

Wendell H. Murphy Football Center

Kitchen Renovation

SCO ID# 24-28146-01A

NCSU Project# 202320015

NCSU Building #:135F

NC State University,
4600 Trinity Road Raleigh, NC 27607

Bid Set

June 23, 2025

Architect: CRA Associates
Sports Design/Interiors: HKS, Inc.
Structural: Bennett & Pless
Engineers: Optima Engineering
Food Service: Foodesign



HKS



optima
engineering



WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

NC State University – Project Management

Design Project Manager

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Title: Architect
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Email: apbode@ncsu.edu

Construction Project Manager

Name: Annette Snead
Title: Construction Engineer
Phone: 919.513.0537
Email: lasnead@ncsu.edu

Design Team

Architect

Firm Name
CRA Associates, Inc.

Name: Andrew R. Cruickshank
Title: Architect
Phone: 919.401.8586
Email: andyc@cra-ae.com

Plumbing, Mechanical, and Electrical

Firm Name
Optima Engineering

Name: Morgan Gunter
Title: Principal | Electrical Engineer
Phone: 919.926.2200
Email: mgunter@optimaengineering.com

Name: Drew Landen
Title: Mechanical Engineer
Phone: 919.926.2200
Email: dlanden@optimaengineering.com

Name: Thomas A. Landen
Title: Mechanical Engineer
Phone: 919.926.2200
Email: dlanden@optimaengineering.com

Food Service

Firm Name
Foodesign

Name: Ashley Gaines
Title: Vice President
Phone: 704.545.6151
Email: againes@foodesignassociates.com

Sports Design / Interiors

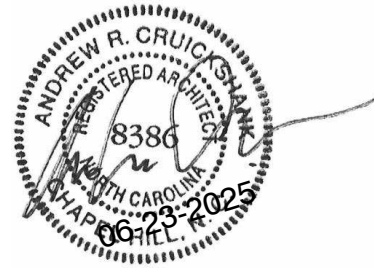
Firm Name
HKS, Inc.

Name: Jessica Conrad
Title: Interiors Associate
Phone: 804.644.8400
Email: jconrad@hksinc.com

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
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SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

ARCHITECT

Name of Person: Andrew Cruickshank
License Number: 8386
Name of Firm: cra associates, inc.
Street Address: 100 Europa Dr #565
City, State, Zip: Chapel Hill, NC 27517
Phone Number: 919-401-8586



FIRE PROTECTION ENGINEER

Name of Person: Daniel A. Revilla
License Number: 043866
Name of Firm: Optima Engineering
Street Address: 434 Fayetteville Street STE 2450
City, State, Zip: Raleigh, NC 27601
Phone Number: 919.926.2200



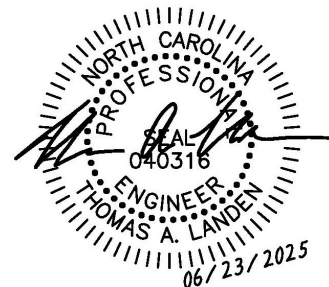
PLUMBING ENGINEER

Name of Person: Daniel A. Revilla
License Number: 043866
Name of Firm: Optima Engineering
Street Address: 434 Fayetteville Street STE 2450
City, State, Zip: Raleigh, NC 27601
Phone Number: 919.926.2200



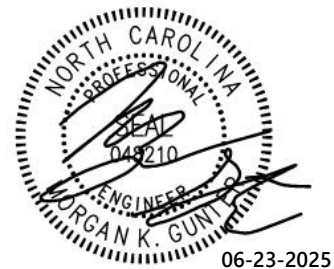
MECHANICAL ENGINEER

Name of Person: Thomas A. Landen
License Number: 040316
Name of Firm: Optima Engineering
Street Address: 434 Fayetteville Street STE 2450
City, State, Zip: Raleigh, NC 27601
Phone Number: 919.926.2200



ELECTRICAL & FIRE ALARM ENGINEER

Name of Person: Morgan K. Gunter
License Number: 048210
Name of Firm: Optima Engineering
Street Address: 434 Fayetteville Street STE 2450
City, State, Zip: Raleigh, NC 27601
Phone Number: 919.926.2200



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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

FOOD SERVICE

Name of Person: John Barja
License Number: 1977
Name of Firm: Foodesign
Street Address: 8303 University Executive Park Dr Suite 410
City, State, Zip: Charlotte, NC 28262
Phone Number: 704.545.6151



TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT & CONTRACTING REQUIREMENTS

000101	Project Title Page	000101-1	
000103	Project Directory.....	000103-1	
000107	Seals Page	000107-1 thru	2
000110	Table of Contents	000110-1 thru	4
000115	List of Drawing Sheets	000115-1 thru	2
002113	Instructions to Bidders (First Half of SCO OC-15).....	002113-1 thru	6
002126	UNC System MB Guidelines & Forms 2024.....	002126-1 thru	16
004100	Proposal Form	004100-1 thru	5
005200	Form of Contract - Single Prime.....	005200-1 thru	11
006000	Project Forms	006000-1 thru	46
007200	General Conditions of the Contract	007200-1 thru	38
007300	Supplemental General Conditions of the Contract	007300-1 thru	2

DIVISION 01 - GENERAL REQUIREMENTS

011000	Summary.....	011000-1 thru	4
011116	Work by Owner	011116-1 thru	2
011400	Work Restrictions	011400-1 thru	5
012200	Unit Prices	012200-1 thru	2
012300	Alternates.....	012300-1 thru	2
012500	Substitution Procedures.....	012500-1 thru	3
012600	Contract Modification procedures.....	012600-1 thru	7
012613	Requests for Interpretation	012613-1 thru	2
012900	Payment Procedures.....	012900-1 thru	8
013100	Project Management and Coordination.....	013100-1 thru	8
013119	Project Meetings	013119-1 thru	8
013200	Construction Progress Documentation.....	013200-1 thru	9
013216	Construction Progress Schedule	013216-1 thru	1
013233	Photographic Documentation	013233-1 thru	3
013300	Submittal Procedures.....	013300-1 thru	4
013523	NCSU Safety Requirements	013523-1 thru	19
014000	Quality Requirements.....	014000-1 thru	11
014200	References.....	014200-1 thru	3
014339	Mockups	014339-1 thru	2
015000	Temporary Facilities and Controls.....	015000-1 thru	6
015500	Vehicular Access & Parking	015500-1 thru	2
015626	Temporary Fencing	015626-1 thru	2
015700	Temporary Controls	015700-1 thru	4
015800	Project Identification	015800-1	
016000	Product Requirements.....	016000-1 thru	5
017300	Execution.....	017300-1 thru	7
017311	Cutting and Patching.....	017311-1 thru	4
017419	Construction Waste Management.....	017419-1 thru	8

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

017700	Closeout Procedures.....	017700-1 thru	5
017823	Operation and Maintenance Data.....	017823-1 thru	8
017839	Project Record Documents.....	017839-1 thru	4
017846	Maintenance Materials.....	017846-1 thru	2
017900	Demonstration and Training.....	017900-1 thru	5

DIVISION 02 – EXISTING CONDITIONS

024119	Selective Demolition.....	024119-1 thru	6
--------	---------------------------	---------------	---

DIVISION 03 – CONCRETE

033000	Cast-in-Place Concrete.....	033000-1 thru	17
--------	-----------------------------	---------------	----

DIVISION 05 – METALS

051200	Structural Steel Framing.....	051200-1 thru	8
055000	Metal Fabrications.....	055000-1 thru	11

DIVISION 06 – WOOD, PLASTICS AND COMPOSITES

061053	Miscellaneous Rough Carpentry.....	061053-1 thru	6
064116	Plastic Laminate Faced Architectural Cabinets.....	064116-1 thru	9

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

072100	Thermal Insulation	072100-1 thru	7
--------	--------------------------	---------------	---

DIVISION 08 – OPENINGS

081113	Hollow Metal Doors & Frames.....	081113-1 thru	11
083800	Impact Traffic Doors.....	083800-1 thru	11
084110	Aluminum-Framed Entrances and Storefronts.....	084110-1 thru	11
084126	All-Glass Entrances and Storefronts.....	084126-1 thru	8
087100	Door Hardware.....	087100-1 thru	19
088000	Glazing.....	088000-1 thru	12
089000	Louvers and Vents.....	089000-1 thru	7

DIVISION 09 – FINISHES

092900	Gypsum Board.....	092900-1 thru	12
093100	Ceramic Tile.....	093100-1 thru	12
095000	Suspended Metal Panel Ceilings.....	095000-1 thru	4
095113	Acoustical Panel Ceiling.....	095113-1 thru	7
095446	Fabric-Wrapped Ceiling Panels.....	095446-1 thru	6

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

095800	Integrated Ceiling Assemblies.....	095110-1 thru	10
096513	Resilient Base and Accessories.....	096513-1 thru	6
096516	Resilient Sheet Flooring.....	096516-1 thru	6
096723	Resinous Flooring.....	096723-1 thru	7
096800	Carpeting.....	096800-1 thru	6
097750	FRP Panel Systems.....	097750-1 thru	4
098000	Custom Aluminum Metal Wall System.....	098000-1 thru	5
099123	Interior Painting.....	099123-1 thru	6

DIVISION 10 – SPECIALTIES

101010	Visual Display Surfaces.....	101010-1 thru	6
102310	Glazed Interior Wall and Door Assemblies.....	102310-1 thru	4
104310	Interior Signage.....	104310-1 thru	7
104413	Fire Protection Cabinets.....	104416-1 thru	10

DIVISION 11 – EQUIPMENT

114000	Food Service Equipment.....	104000-1 thru	32
	Itemized List of Equipment.....	1 thru	224
115213	Projection Screens.....	115213-1 thru	4

DIVISION 12 – FURNISHINGS

122413	Roller Window Shades	122413-1 thru	6
123661	Solid Surfacing Countertops	123661-1 thru	4

DIVISION 21 – FIRE PROTECTION

210100	Fire Suppression Systems.....	210100-1 thru	14
210500	Fire Protection General.....	210500-1 thru	12

DIVISION 22 – PLUMBING

220100	Plumbing General Requirements.....	220100-1 thru	14
220105	Plumbing Submittal Requirements.....	220105-1 thru	3
220529	Hangers and Supports for Plumbing Systems.....	220529-1 thru	5
220532	Firestopping for Plumbing Systems.....	220532-1 thru	3
220548	Vibration Controls for Plumbing Piping and Equipment.....	220548-1 thru	7
220553	Identification for Plumbing Systems.....	220553-1 thru	4
220700	Insulation for Plumbing Systems.....	220700 -1 thru	3
221100	Domestic Water Systems.....	221100-1 thru	9
221300	Sanitary Waste and Vent Systems.....	221300 -1 thru	12

DIVISION 23 –HEATING, VENTILATION AND AIR CONDITIONING

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

230500	Common Work Results for HVAC.....	230500-1 thru	9
230513	Common Motor Requirements for HVAC Equipmet.....	230513-1 thru	3
230523	General Duty Valves for HVAC Piping.....	230523-1 thru	30
230529	Hangers And Supports for HVAC Piping And Equipme.....	230529-1 thru	11
230553	Identification For HVAC Piping and Equipment.....	230553-1 thru	5
230593	Testing, Adjusting and Balancing For HVAC.....	230593-1 thru	29
230700	HVAC Insulation.....	230700-1 thru	31
232113	Hydronic Piping.....	232113-1 thru	18
233113	Metal Ducts.....	233113-1 thru	20
233300	Air Duct Accessories.....	233300-1 thru	18
233423	HVAC Power Ventilators.....	233423-1 thru	9
233600	Air Terminal Units.....	233600-1 thru	5
233713	Diffusers, Registers and Grilles.....	233713-1 thru	5

DIVISION 26 – ELECTRICAL

260500	Common Work Results For Electrical.....	260500-1 thru	5
260519	Low Voltage Electrical Power Conductors and Cable.....	260519-1 thru	7
260523	Control – Voltage Electrical Power Cables.....	260523-1 thru	9
260526	Grounding and Bonding for Electrical Systems.....	260526-1 thru	6
260529	Hangers and Support for Electrical Systems.....	260529-1 thru	6
260533	Raceway and Boxes for Electrical Systems.....	260533-1 thru	12
260553	Identification for Electrical Systems.....	260553-1 thru	7
260573.13	Short Circuit Studies.....	260573.13-1 thru	5
260573.16	Coordination Studies.....	260573.16-1 thru	8
260573.19	Arc-Flash Hazard Analysis.....	260573.19-1 thru	7
262213	Low-Voltage Distribution Transformers.....	262213-1 thru	5
262416	Panelboards.....	262416-1 thru	8
262726	Wiring Devices.....	262726-1 thru	8
262813	Fuses.....	262813-1 thru	3
262816	Enclosed Switches and Circuit Breakers.....	262816-1 thru	6
265116	Lighting.....	265116-1 thru	6
265119	Architectural RGWB Led Backlighting Luminaire – Interior.....	265119-1 thru	5

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

283111	Digital, Addressable Fire-Alarm System.....	283111-1 thru	15
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END TABLE OF CONTENTS

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

LIST OF DRAWING SHEETS

<u>Sheet No.</u>	<u>Sheet Name</u>	<u>Latest Issue</u>	<u>Date of Latest Issue</u>
Insert Volumes as Necessary			
<u>Cover & General</u>			
G0.00	Cover Sheet		
G0.01	Building Code Summary (for reference)		
G0.02	Life Safety Plan - Base Bid		
G0.02A	Life Safety Plan – Alternate#2		
G1.01	ADAAG Diagrams		
G1.02	ADAAG Diagrams		
G2.01	Construction Staging Plan – Base Bid		
G2.02	Construction Staging Plan – Alternate#2		
G2.03	Construction Staging Plan – Alternate#3		
 <u>Life Safety</u>			
G0.02	Life Safety Plan - Base Bid		
G0.02A	Life Safety Plan - Alternate#2		
 <u>Architectural</u>			
A1.01	Demolition Plan - Base Bid		
A1.01A	Demolition Plan - Alternate#2		
A1.02	Demolition RCP - Base Bid		
A1.02A	Demolition RCP - Alternate#2		
A1.03	Demolition RCP - Level 02		
A1.04	Floor Plan - Base Bid		
A1.04A	Floor Plan - Alternate#2		
A1.05	Reflected Ceiling Plan - Base Bid		
A1.05A	Reflected Ceiling Plan - Alternate#2		
A1.06	Finish Plan - Base Bid		
A1.06A	Finish Plan - Alternate#2		
A1.07	Freezer Location - 1st Floor - Alternate#3		
A2.01	Interior Elevations - Base Bid		
A2.01A	Interior Elevations - Alternate#2		
A2.02	Interior Sections		
A2.03	Details		
A2.04	Details		
A2.05	Partition Types		
A2.06	Plan Details - Columns		
A2.06A	Plan Details - Columns - Alternate#2		
A3.01	Casework		
A3.02	Casework		
A3.03	Casework		
A3.04	Casework Details		
A3.05	Casework Details		
A4.00	Door Schedule & Finish Legend		
A4.00A	Door Schedule & Finish Legend - Alternate#2		
A5.00	Signage Plan		

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Equipment (if needed)

FS.01	Foodservice Equipment Plan
FS.02	Foodservice Equipment Schedule
FS.03	Foodservice Equipment Schedule
FS.04	Foodservice Plumbing Plan
FS.05	Foodservice Electrical Plan
FS.06	Foodservice Cold Storage Details
FS.07	Foodservice Exhaust Hood Details
FS.08	Foodservice Equipment Details

Fire Alarm

FA0.01	Fire Alarm Legend and Notes
FA1.01	Level 03 - Fire Alarm Plan - Demolition
FA1.02	Level 03 - Fire Alarm Plan - New Work
FA1.02A	Level 03 - Fire Alarm Plans - Alternate#2

Fire Protection

FP0.01	Fire Protection Legend, Notes, and Details
FP1.01	Level 03 - Fire Protection Plan - Demolition
FP1.02	Level 03 - Fire Protection Plan - New Work
FP1.02A	Level 03 - Fire Protection Plans - Alternate#1

Plumbing

P0.01	Plumbing Legend, Index, and Notes
P1.01	Level 01 - Plumbing Drainage Plan - Demolition
P1.02	Level 01 - Plumbing Drainage Plan - New Work
P1.03	Level 02 - Plumbing Drainage Plan - New Work
P1.04	Level 03 - Plumbing Drainage Plan - Demolition
P1.05	Level 03 - Plumbing Drainage Plan - New Work
P2.01	Level 03 - Plumbing Supply Plan - Demolition
P2.02	Level 03 - Plumbing Supply Plan - New Work
P4.01	Enlarged Kitchen Plumbing Plans - New Work
P5.01	Plumbing Details
P5.02	Waste & Vent Riser Diagrams
P5.03	Domestic Riser Diagrams

Mechanical

M0.01	Mechanical Legend and Notes
M0.02	Mechanical Schedules
M0.03	Level 03 - Thermal Zone Diagram
M1.01	Level 03 - Mechanical Plan - Demolition
M1.02	Level 03 - Mechanical Plan - New Work
M1.02A	Level 03 - Mechanical Plans - Alternate#2
M1.03	Roof - Mechanical Plan - Demolition
M1.04	Roof - Mechanical Plan - New Work
M2.01	Level 03 - Mechanical Piping Plan - Demolition
M2.02	Level 03 - Mechanical Piping Plan - New Work
M5.01	Mechanical Details

Electrical

E0.01	Electrical Legend and Notes
E0.02	Electrical Notes
E1.01A	Level 01 - Power Plan - Alternate#3
E2.01	Level 02 - Power Plan - New Work

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

E3.01	Level 03 - Lighting Plan - Demolition
E3.02	Level 03 - Lighting Plan - New Work
E3.02A	Level 03 - Lighting Plans - Alternate#1/Alternate#2
E3.03	Level 03 - Lighting Photometrics
E3.04	Level 03 - Lighting Elevations
E3.05	Level 03 - Power Plan - Demolition
E3.06	Level 03 - Power Plan - New Work
E3.06A	Level 03 - Power Plans - Alternate#1/Alternate#2
E3.07	Level 03 - Equipment Connections Plan - New Work
E3.08	Level 03 - Special Systems Plan - New Work
E3.08A	Level 03 - Special Systems Plan - Alternate#1
E4.01	Roof - Electrical Plan - Demolition
E4.02	Roof - Electrical Plan - New Work
E5.01	Enlarged Kitchen Power Plan - New Work
E5.02	Kitchen Equipment Schedules
E6.01	Electrical Details
E6.02	Electrical Details
E7.01	Electrical Diagrams
E7.02	Panel Schedules
E7.03	Panel Schedules
E8.01	Electrical Schedules

**Advertisement for Bids
&
Notice of Public Meeting for Proposed Alternate Bids for Preferred Products**

Sealed proposals will be received by NC State University. Attention **Project Manager**, until **(time)** on **(date)** in Conference Room **(room #)**, Administrative Services III Building 2601 Wolf Village Way, Raleigh, NC 27695 and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment for the construction **(OR OTHER DESCRIBED ACTIVITY)** of:

NC State University
(Name of Project)
SCO ID No.: **(Number)**
NC State Project No.: **(Number)**

INSERT A PARAGRAPH DESCRIBING THE PROJECT SCOPE.

Bids will be received for **single prime bid** contracts. All Proposals will be lump sum.

BID OPENING:

Project Name virtual meeting information.

When: **Month Date**, 202**X** at **X:00 am/pm** Eastern Time

This meeting requires advance registration using the link below to attend the meeting. (if applicable)

Virtual Meeting Link

Meeting ID No. (number) (if applicable)

Registrants will receive a calendar invitation via email. (if applicable)

The following General Contractors have been pre-qualified to bid this job:

- **Contractor Name**..... **City, State**

Bid documents are available for examination in the plan rooms:

1. iSQFT; <http://www.isqft.com/start/> handles Associated General Contractors plan room.
2. The local North Carolina offices of Dodge Data and Analytics;
3. The Eastern Regional Offices of CMD Group in Norcross, GA;
4. The offices of the Designer: **(DESIGNER FIRM NAME AND ADDRESS)**;
5. The North Carolina Institute of Minority Economic Development, Inc. (NCIMED) Plan and Resource Center at 114 W. Parrish St., 6th Floor, Durham, NC; 919-956-8889 or 919-287-3036
6. The Hispanic Contractors Association of the Carolinas (HCAC) in Winston-Salem, Charlotte and Raleigh Areas – 877-227-1680;

Complete plans and specifications for this project in electronic format can be obtained from **(DESIGNER'S NAME AND ADDRESS)** during normal office hours after **(DATE)**. Email requests for the electronic documents may be sent to **(DESIGNER EMPLOYEE'S EMAIL ADDRESS.)**

Full printed copies may be obtained by those qualified as prime bidders, upon deposit of **(WRITE OUT DOLLAR VALUE) (\$XXX)** in cash or certified check with a minimum of 48 hours' notice to **(DESIGNER EMPLOYEE'S EMAIL ADDRESS)**. The full plan deposit will be returned to those bidders provided all documents are returned in BOUND, good, usable condition within ten (10) days after the bid date.

Partial or full printed copies of the project documents may be purchased from **(PRINTING COMPANY NAME AND ADDRESS)**. Phone number for ordering is **XXX-XXX-XXXX**. Documents may also be purchased from Document Imaging Systems, Inc. at 231 East Johnson Street, Units E, F, & G, Cary, NC 27513. Phone number for ordering is 919-460-9440.

The State reserves the unqualified right to reject any and all proposals.

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SCO ID# 24-28146-01A, NCSU Project#202320015, NCSU Building# 135F

North Carolina State University has an affirmative policy of fostering, promoting and conducting business with minority owned enterprises. Minority contractors are encouraged to participate in the bidding process.

The bidder must include completed minority business subcontractor documentation form(s) with their proposal or the bid may be considered non-responsive and invalid.

Pre-Bid Meeting

Project Name virtual meeting information. (if applicable)

When: **Month Date**, 202X at X:00 am/pm Eastern Time

This meeting requires advance registration using the link below to attend the meeting. (if applicable)

Virtual Meeting Link

Meeting ID No. (number) (if applicable)

Registrants will receive a calendar invitation via email. (if applicable)

(Option for new building or simple renovation):

A Pre-bid meeting will be held for all interested bidders on **(date and time)** in Room **(Room #)** of Administrative Services III Building at 2701 Sullivan Drive, Raleigh, NC 27695. The meeting will address project specific questions.

(Option for complex renovation)

A Pre-bid meeting and site visit will be held for all interested bidders on two occasions:

(DATE AND TIME), AND **(DATE AND TIME)** in room **(room #)** of **(Name of building and address)**.

ATTENDANCE AT ONE OF THE PRE-BID MEETINGS IS MANDATORY. The meeting will address project specific questions and provide an opportunity for bidders to assess the project's existing conditions.

Notice of Public Meeting for Proposed Alternate Bids for Preferred Products. (if applicable)

Project Name virtual meeting information. (if applicable)

When: **Month Date**, 202X at X:00 am/pm Eastern Time

This meeting requires advance registration using the link below to attend the meeting. (if applicable)

Virtual Meeting Link

Meeting ID No. (number) (if applicable)

Registrants will receive a calendar invitation via email. (if applicable)

An open public meeting will be held on **(DATE AND TIME)** in Room **(room #)** of Administrative Services III Building at 2601 Wolf Village Way, Raleigh, NC 27695. The meeting is to identify preferred brand alternates and their performance standards pertinent to this project.

In accordance with GS133-3, Section 64. (C) and State Construction Office procedures the following preferred brand items are being considered as Alternates by the owner for this project:

(Edit list to specific project requirements)

bike racks, controls, door access system (reader controllers, card readers, electronic door strikes, access cards), fire alarm controls, fire alarm dialers, fire hydrants, exterior lighting fixtures, door hardware (locksets and cylinders, closers, panic hardware and strikes, locks and cores), telecommunications components, chillers, cooling towers less than 1000 tons, steam PRV's, underground chilled water valves, elevator controls, elevator telephone, steam conduit systems, meters (condensate, steam, chilled water, city water, electricity), laboratory exhaust fans, exhaust valves, toilet and bath accessories, generators, and irrigation controls.

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SCO ID# 24-28146-01A, NCSU Project#202320015, NCSU Building# 135F

A copy of pertinent sections of the performance standards may be obtained by contacting the designer at the address or phone number noted above.

Project Manager
NC State University
Capital Project Management
XXXXXXXX@ncsu.edu
919.51X.XXXX

REQUEST FOR GENERAL CONTRACTOR PREQUALIFICATION SUBMITTALS

North Carolina State University is seeking qualification statements from general contractors for improvements to (Project Name), located on (campus location). The project scope includes (Project Description, describing general scope of work and any special or sensitive requirements).

To qualify, the contractor must have a general contractor's license in the State of North Carolina as well as applicable bonding requirements. The contractor must show comparable work experience, both in complexity and dollar value, and preferably in a university campus environment, to the scope of work outlined above.

To be considered, the contractor must obtain an application package from the NC State University Project Manager and submit a fully completed qualification document by (Time), (Date), to (DMPM), project manager, by email only to (DMPM email). **No hard copies will be accepted.** Application packages will be available electronically after (Date). Please contact the project manager via email (preferred) or phone to request a package or download it from the link below.

Application packages must be submitted to the following email address:

DC_Formal_Prequal@ncsu.edu

NOTE: The SCO Prequalification Package has been updated recently. Please use the project-specific form provided by NC State. Submissions on any other form will be considered nonresponsive.

NC State University has an affirmative policy of fostering, promoting, and conducting business with women and minority owned enterprises. Women and minority contractors are encouraged to participate in the prequalification process.

(DMPM)

North Carolina State University
Design & Construction

(DMPM phone number)

Email (questions only): (DMPM email address)

INSTRUCTIONS TO BIDDERS

For a proposal to be considered it must be in accordance with the following instructions:

1. PROPOSALS

Proposals must be made in strict accordance with the Form of Proposal provided therefor, and all blank spaces for bids, alternates, and unit prices applicable to bidder's work shall be properly filled in. When requested alternates are not bid, the proposer shall so indicate by the words "No Bid". Any blanks shall also be interpreted as "No Bid". The bidder agrees that bid on Form of Proposal detached from specifications will be considered and will have the same force and effect as if attached thereto. Photocopied or faxed proposals will not be considered. Numbers shall be stated both in writing and in figures for the base bids and alternates. If figures and writing differ, the written number will supersede the figures.

Any modifications to the Form of Proposal (including alternates and/or unit prices) will disqualify the bid and may cause the bid to be rejected.

The bidder shall fill in the Form of Proposal as follows:

- a. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
- b. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.
- c. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
- d. If the proposal is made by a joint venture, it shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable.
- e. All signatures shall be properly witnessed.
- f. If the contractor's license of a bidder is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the proposal. The title "Licensee" shall appear under his/her signature.

Proposals should be addressed as indicated in the Advertisement for Bids and be delivered, enclosed in an opaque sealed envelope, marked "Proposal" and bearing the title of the work, name of the bidder, and the contractor's license number of the bidder. Bidders should clearly mark on the outside of the bid envelope which contract(s) they are bidding.

Bidder shall identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts or an affidavit indicating work under contract will be self-performed, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid.

For projects bid in the single-prime alternative, the names and license numbers of major subcontractors shall be listed on the proposal form.

It shall be the specific responsibility of the bidder to deliver his bid to the proper official at the selected place and prior to the announced time for the opening of bids. Later delivery of a bid for any reason, including delivery by any delivery service, shall disqualify the bid.

Unit prices quoted in the proposal shall include overhead and profit and shall be the full compensation for the contractor's cost involved in the work. See General Conditions, Article 19c-1.

2. EXAMINATION OF CONDITIONS

It is understood and mutually agreed that by submitting a bid the bidder acknowledges that he has carefully examined all documents pertaining to the work, the location, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site, and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the material to be encountered, the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the work, the general and local conditions, the construction hazards, and all other matters, including, but not limited to, the labor situation which can in any way affect the work under the contract, and including all safety measures required by the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a proposal the bidder acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications and other contract documents for the construction of the work and that he accepts all the terms, conditions and stipulations contained therein; and that he is prepared to work in cooperation with other contractors performing work on the site.

Reference is made to contract documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work which have been relied upon by the designer in preparing the documents. The owner will make copies of all such surveys and reports available to the bidder upon request.

Each bidder may, at his own expense, make such additional surveys and investigations as he may deem necessary to determine his bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the owner. Any reasonable request for access to the site will be honored by the owner.

3. BULLETINS AND ADDENDA

Any addenda to specifications issued during the time of bidding are to be considered covered in the proposal and in closing a contract they will become a part thereof. It shall be the bidder's responsibility to ascertain prior to bid time the addenda issued and to see that his bid includes any changes thereby required.

Should the bidder find discrepancies in, or omission from, the drawings or documents or should he be in doubt as to their meaning, he shall at once notify the designer who will send written instructions in the form of addenda to all bidders. Notification should be no later than seven (7) days prior to the date set for receipt of bids. Neither the owner nor the designer will be responsible for any oral instructions.

All addenda should be acknowledged by the bidder(s) on the Form of Proposal. However, even if not acknowledged, by submitting a bid, the bidder has certified that he has reviewed all issued addenda and has included all costs associated within his bid.

4. BID SECURITY

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the proposal, said deposit to be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law (G.S. 143-129).

Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract. The owner may retain bid securities of any bidder(s) who may have a reasonable chance of award of contract for the full duration of time stated in the Notice to Bidders. Other bid securities may be released sooner, at the discretion of the owner. All bid securities (cash or certified checks) shall be returned to the bidders promptly after award of contracts, and no later than seven (7) days after expiration of the holding period stated in the Notice to Bidders. Standard Form of Bid Bond is included in these specifications and shall be used.

5. RECEIPT OF BIDS

Bids shall be received in strict accordance with requirements of the General Statutes of North Carolina. Bid security shall be required as prescribed by statute. Prior to the closing of the bid, the bidder will be permitted to change or withdraw his bid. Guidelines for opening of public construction bids are available from the State Construction Office.

6. OPENING OF BIDS

Upon opening, all bids shall be read aloud. Once bidding is closed, there shall not be any withdrawal of bids by any bidder and no bids may be returned by the designer to any bidder. After the opening of bids, no bid may be withdrawn, except under the provisions of General Statute 143-129.1, for a period of thirty days unless otherwise specified. Should the successful bidder default and fail to execute a contract, the contract may be awarded to the next lowest and responsible bidder. The owner reserves the unqualified right to reject any and all bids. Reasons for rejection may include, but shall not be limited to, the following:

- a. If the Form of Proposal furnished to the bidder is not used or is altered.
- b. If the bidder fails to insert a price for all bid items, alternate and unit prices requested.
- c. If the bidder adds any provisions reserving the right to accept or reject any award.
- d. If there are unauthorized additions or conditional bids, or irregularities of any kind which tend to make the proposal incomplete, indefinite or ambiguous as to its meaning.
- e. If the bidder fails to complete the proposal form where information is requested so the bid may be properly evaluated by the owner.
- f. If the unit prices contained in the bid schedule are unacceptable to the owner and the State Construction Office.
- g. If the bidder fails to comply with other instructions stated herein.

7. BID EVALUATION

The award of the contract will be made to the lowest responsible bidder as soon as practical. The owner may award on the basis of the base bid and any alternates the owner chooses.

Before awarding a contract, the owner may require the apparent low bidder to qualify himself to be a responsible bidder by furnishing any or all of the following data:

- a. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the owner.
- b. A listing of completed projects of similar size.
- c. Permanent name and address of place of business.
- d. The number of regular employees of the organization and length of time the organization has been in business under present name.
- e. The name and home office address of the surety proposed and the name and address of the responsible local claim agent.
- f. The names of members of the firms who hold appropriate trade licenses, together with license numbers.
- g. If prequalified, contractor info will be reviewed and evaluated comparatively to submitted prequalification package.

Failure or refusal to furnish any of the above information, if requested, shall constitute a basis for disqualification of any bidder.

In determining the lowest responsible, responsive bidder, the owner shall take into consideration the bidder's compliance with the requirements of G.S. 143-128.2(c), the past performance of the bidder on construction contracts for the State with particular concern given to completion times, quality of work, cooperation with other contractors, and cooperation with the designer and owner. Failure of the low bidder to furnish affidavit and/or documentation as required by G.S. 143-128.2(c) shall constitute a basis for disqualification of the bid.

Should the owner adjudge that the apparent low bidder is not the lowest responsible, responsive bidder by virtue of the above information, said apparent low bidder will be so notified and his bid security shall be returned to him.

8. PERFORMANCE BOND

The successful bidder, upon award of contract, shall furnish a performance bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

9. PAYMENT BOND

The successful bidder, upon award of contract, shall furnish a payment bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

10. PAYMENTS

Payments to the successful bidders (contractors) will be made on the basis of monthly estimates. See Article 31, General Conditions.

11. PRE-BID CONFERENCE

Prior to the date set for receiving bids, the Designer may arrange and conduct a Pre-Bid Conference for all prospective bidders. The purpose of this conference is to review project requirements and to respond to questions from prospective bidders and their subcontractors or material suppliers related to the intent of bid documents. Attendance by prospective bidders shall be as required by the "Notice to Bidders".

12. SUBSTITUTIONS

In accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

- a. Name, address, and telephone number of manufacturer and supplier as appropriate.
- b. Trade name, model or catalog designation.
- c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.
- d. Detailed comparison with specified products including performance capabilities, warranties, and test results.
- e. Other pertinent data including data requested by the Designer to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Designer to those specified, all bidders of record will be notified by Addendum.

**GUIDELINES FOR
RECRUITMENT AND SELECTION OF MINORITY BUSINESSES
FOR PARTICIPATION IN THE UNIVERSITY OF NORTH CAROLINA
CONSTRUCTION CONTRACTS**

In accordance with G.S. 116-31.11 and G.S. 143-128.2 these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, design-build, public-private partnership, and alternative contracting methods, on University of North Carolina construction projects in the amount of \$100,000 to \$4,000,000. The legislation provides that the State, including the University of North Carolina System, shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

SECTION A: INTENT

It is the intent of these guidelines that the State through The University of North Carolina, its constituent institutions, and/or affiliates (hereafter The University of North Carolina) as awarding authorities for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper, and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

SECTION B: DEFINITIONS

1. Minority business, minority person, and socially and economically disadvantaged individual - G.S. 143-128 (g) includes the following definitions. Any changes to G.S. 143-128 (g) are incorporated herein upon enactment:
 - (1) The term "minority business" means a business:
 - a. In which at least fifty-one percent (51%) is owned by one or more minority persons or socially and economically disadvantaged individuals, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
 - b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.
 - (2) The term "minority person" means a person who is a citizen or lawful permanent resident of the United States and who is:
 - a. Black, that is, a person having origins in any of the black racial groups in Africa;
 - b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
 - c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, or the Pacific Islands;
 - d. American Indian, that is, a person having origins in any of the original Indian peoples of North America; or
 - e. Female.
 - (3) The term "socially and economically disadvantaged individual" means the same as defined in 15 U.S.C. 637.
2. Public Entity – The State of North Carolina and all public subdivisions and local governmental units.
3. Owner - The State of North Carolina, through the constituent institution named in the contract.

4. Designer – Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.
5. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.
6. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials, or services, including construction, and obligating the buyer to pay for them.
7. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.
8. Subcontractor - A firm under contract with the prime contractor, construction manager at risk, design-builder, or private developer under public-private partnerships for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

SECTION C: RESPONSIBILITIES

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office). The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:
 - a. Identify those areas of work for which there are minority businesses, as requested.
 - b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
 - c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:

- (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
 - (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the University of North Carolina and other public entities.
 - (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
 - (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
 - (5) The HUB Office also oversees the minority business program by:
 - a. Monitoring compliance with the program requirements.
 - b. Assisting in the implementation of training and technical assistance programs.
 - c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
 - d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.
2. The University of North Carolina System Office: The University of North Carolina System Office will be responsible for the following:

- a. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal prior to award of construction contracts within their awarding authority. The State through The University of North Carolina, reserves the right to reject any or all bids and to waive informalities.
 - b. Assisting constituent institutions in monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
 - c. Consulting and advising institutions and affiliates regarding changes in HUB statutes, executive orders, or state procedures.
 - d. Resolving any protest and disputes arising on projects within The University of North Carolina System Office award authority.
3. Constituent Institutions and Affiliates of The University of North Carolina: Before awarding a contract, the constituent institution shall do the following:
- a. Implement The University of North Carolina HUB plan.
 - b. Attend the scheduled prebid conference.
 - c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
 1. A description of the work for which the bid is being solicited.
 2. The date, time, and location where bids are to be submitted.
 3. The name of the individual within the owner's organization who will be available to answer questions about the project.
 4. Where bid documents may be reviewed.
 5. Any special requirements that may exist.
 - d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
 - e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in its efforts to meet the goals.
 - f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the University of North Carolina.
 - g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to University of North Carolina.
 - h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
 - i. Document evidence of implementation of Owner's responsibilities.
4. Designer
Under the single-prime bidding, separate prime bidding, construction manager at risk, design-build, public-private partnership, or alternative contracting method, the designer will:
- a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
 - b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
 - c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
 - d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S.143-128.2(f), including the bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of

work, if the contractor will perform work under contract by its own workforce, prior to recommendation of award.

- e. During construction phase of the project, review “MBE Documentation for Contract Payment” – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner.
- f. Make documentation showing evidence of implementation of Designer’s responsibilities available for review by The University of North Carolina System Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, Design-Builder, Public-Private Partnership developer and Its First-Tier Subcontractors: Under all construction delivery methods contractor(s) will:

- a. Attend the scheduled prebid conference.
- b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
- c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires. The notification will include the following:
 - (1) A description of the work for which the subbid is being solicited.
 - (2) The date, time and location where subbids are to be submitted.
 - (3) The name of the individual within the company who will be available to answer questions about the project.
 - (4) Where bid documents may be reviewed.
 - (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.
- d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
- e. Identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
- f. Make documentation showing evidence of implementation of Subcontractor responsibilities available for review by the University of North Carolina System Office and HUB Office, upon request.
- g. Upon being named the apparent low bidder, the Bidder shall provide **one** of the following: (1) an affidavit (Affidavit B) indicating bidder’s self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f) and has all material and supplies required for the project. Bidder may be asked to provide additional documentation in support of the claim of self-performance and regarding the Good Faith Effort to utilize minority suppliers where possible. (2) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (3) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal (Affidavit D). Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
- h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided for formal contracts (>\$500,000) as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
- i. The contractor(s) on formal contracts (>\$500,000) shall submit with each monthly pay request(s) and final payment(s), “MBE Documentation for Contract Payment” – (Appendix E), for designer’s review. This documentation is also required for contracts under informal bidding, but these projects, typically of shorter duration, may have a single payment request at project completion.
- j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, The University of North Carolina System Office, and the Director of the HUB Office in writing, of the circumstances involved. The prime contractor shall make a

good faith effort to replace a minority business subcontractor with another minority business subcontractor.

- k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
- l. It is the intent that these requirements apply to all contractors and first tier subcontractor under any of the approved construction delivery methods permitted on state projects.

6. Minority Business Responsibilities: While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

SECTION D: DISPUTE PROCEDURES

It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

SECTION E: EFFECTIVE DATE

These guidelines shall apply upon promulgation on university construction projects. Copies of these guidelines may be obtained from The University of North Carolina System Office
website: <https://www.northcarolina.edu/offices-and-services/finance-and-administration/capital-design-and-construction/>.

SECTION F: FORMS

In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing MBE participation in State, through The University of North Carolina, building projects. An explanation of the process follows, titled "MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)" along with relevant forms for its implementation ("Identification of Minority Business Participation" form, Affidavits A, B, C, D, and Appendix E).

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in University of North Carolina Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from The University of North Carolina System Office website: <https://www.northcarolina.edu/offices-and-services/finance-and-administration/capital-design-and-construction/>

MINORITY BUSINESS SUBCONTRACT GOALS:

The minimum goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid (by using the "Identification of Minority Business Participation" form provided in the bid document), the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

Failure to submit these documents is grounds for rejection of the bid. Bid amounts from rejected bids shall not be read aloud at public bid openings.

The lowest responsible, responsive bidder must provide:

Affidavit C, if the portion of work to be performed by minority firms is equal to or greater than 10% of the bidder's total contract price. Affidavit C includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, and lists the participating minority firms with the dollar value of their contracts.

OR

Affidavit D, if the portion of work to be performed by minority firms is less than 10% of the bidder's total contract price. Affidavit D includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, lists the participating minority firms with the dollar value of their contracts, and must include adequate **documentation of Good Faith Effort**.

AND

Affidavit B (with bid), if the bidder does not customarily subcontract work on this type project and has all material and supplies required for the project. Bidder may be asked to provide additional documentation in support of the claim of self-performance and regarding the Good Faith Effort to utilize minority suppliers where possible.

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.

Summary of required submissions: Use check boxes to assist in ensuring that all appropriate forms are submitted.

ALL BIDDERS MUST SUBMIT TWO FORMS WITH THEIR BID:

- ☐ “Identification of Minority Business Participation” form

AND EITHER

- ☐ Affidavit A – “Listing of Good Faith Efforts”

OR

- ☐ Affidavit B – “Intent to Perform Contract with Own Workforce”

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid. Bid amounts from rejected bids shall not be read aloud at public bid openings.

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**IN ADDITION, THE APPARENT LOWEST
RESPONSIVE, RESPONSIBLE BIDDER SUBMITS:**

- ☐ **Affidavit C** – “Portion of the Work to be Performed by Minority Firms” if the percentage of work to be performed by minority firms is 10% or more. This form is to be submitted within 72 calendar hours of notification of being low bidder.

OR

- ☐ **Affidavit D** – “Good Faith Efforts” if the percentage of work to be performed by minority firms is less than 10%. This form is to be submitted within 72 calendar hours of notification of being low bidder.

The above information is mandatory. Failure to submit these documents is grounds for rejection of the bid.

MINIMUM COMPLIANCE REQUIREMENTS:

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State (The University of North Carolina) for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business guidelines shall constitute a breach of the contract. A finding by the State (The University of North Carolina) that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false, or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State (The University of North Carolina) whether to terminate the contract for breach.

In determining whether a contractor has made a Good Faith Effort, the University of North Carolina will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

- (1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government, maintained lists at least 10 days before the bid or proposal date, and notifying them of the nature and scope of the work to be performed.
- (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals were due.
- (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.
- (4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- (5) Attending any prebid meetings scheduled by the public owner.
- (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.
- (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- (9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

Attach to bid

Attach to bid

Attach to bid

Attach to bid

Attach to bid

Identification of HUB Certified/ Minority Business Participation

I, _____, do hereby certify that on
(Name of Bidder)
this project, we will use the following HUB Certified/ minority business as construction subcontractors,
vendors, suppliers, or providers of professional services.

Firm Name, Address and Phone Number	Work Type	*Minority Category	**HUB Certified
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

The total value of minority business contracting will be (\$)_____.

AFFIDAVIT A

Listing of Good Faith Efforts

(The University of North Carolina)

County of _____

Affidavit of _____

(Name of Bidder)

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.
(1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ☐ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

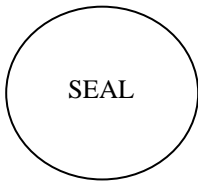
The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____

Name of Authorized Officer: _____

Signature: _____



Title: _____

State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

AFFIDAVIT B
Intent to Perform Contract with Own Workforce
(The University of North Carolina)

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____ contract.

(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

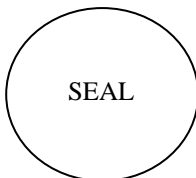
The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____

Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

AFFIDAVIT C**Portion of the Work to be Performed by HUB Certified/Minority Businesses**
(The University of North Carolina)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidder's total contract price, then the bidder must complete this affidavit.

This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

County of _____

Affidavit of _____ I do hereby certify that on the

(Name of Bidder)

_____ contract.

(Name of Project)

Project ID# _____ Amount of Bid \$ _____

I will expend a minimum of _____ % of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified	Work Description	Dollar Value
		Y / N		
		Y / N		
		Y / N		
		Y / N		
		Y / N		
		Y / N		

* Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

** HUB Certification with the State HUB Office is required to be counted toward state participation goals.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

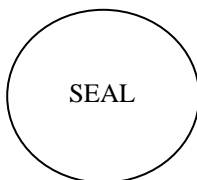
The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____

Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

AFFIDAVIT D

Good Faith Efforts

(The University of North Carolina)

This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

If the goal of 10% participation by HUB Certified/minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

County of _____

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

(Project Name)

Project ID# _____ Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

(Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified	Work Description	Dollar Value
		Y / N		
		Y / N		
		Y / N		
		Y / N		
		Y / N		

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**), American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

** HUB Certification with the State HUB Office required to be counted toward state participation goals.

Examples of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- B. Copies of quotes or responses received from each firm responding to the solicitation.
- C. A telephone log of follow-up calls to each firm sent a solicitation.
- D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- F. Copy of pre-bid roster
- G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

- H. Letter detailing reasons for rejection of minority business due to lack of qualification.
- I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

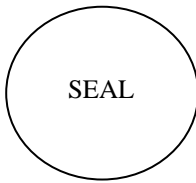
The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____

Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

****THIS DOCUMENT MUST BE SUBMITTED WITH EACH PAY REQUEST & FINAL PAYMENT****

APPENDIX E
MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments to be made to minority business contractors on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

* Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Date: _____

Approved/Certified By: _____

Name

Title

Signature

Signature certifies that any minority firms not previously verified in the bid/award process have been appropriately verified, services have been rendered, and payment is due as processed.

FORM OF PROPOSAL

Murphy Center Kitchen Renovation	Contract:
North Carolina State University	Bidder:
SCO # 24-28146-01A	Date:

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with the State of North Carolina through North Carolina State University in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of

Renovation of the Kitchen, Dining and Position Rooms on the third floor of the Murphy Football Center at Carter-Finley Stadium.

in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the State of North Carolina, North Carolina State University, and CRA Associates, Inc. with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents, for the sum of:

SINGLE PRIME CONTRACT:

Base Bid:

_____ Dollars(\$)

General Subcontractor:

_____ Lic _____

Plumbing Subcontractor:

_____ Lic _____

Mechanical Subcontractor:

_____ Lic _____

Electrical Subcontractor:

_____ Lic _____

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

ALTERNATES:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" or "deducted from" the base bid. (Strike out "Add" or "Deduct" as appropriate.)

GENERAL CONTRACT:

Alternate No. 1 (*New Offices*)

(Add)	Dollars(\$)
-------	-------------

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

UNIT PRICES:

Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the base bid quantity of the work all in accordance with the contract documents.

GENERAL CONTRACT:

No. 1	<i>2'x2' frameless ceiling access panels</i>	<i>Per unit</i>	Unit Price (\$)

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions Article 23. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 23.

MINORITY BUSINESS PARTICIPATION REQUIREMENTS:

Provide with the bid - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

NOTE: A contractor that performs all of the work with its own workforce may submit an Affidavit (**B**) to that effect in lieu of Affidavit (**A**) required above. The MB Participation Form must still be submitted even if there is zero participation.

After the bid opening - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

* OR *

If less than the 10% goal, Affidavit (D) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

Note: Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of _____

(Name of firm or corporation making bid)

WITNESS:

By: _____
Signature

(Proprietorship or Partnership)

Name: _____
Print or type

Title: _____
(Owner/Partner/Pres./V.Pres)

Address _____

ATTEST:

By: _____

License No. _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. _____

Email Address: _____

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5 _____ Addendum No. 6 _____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____ Addendum No. 7 _____

*Note: For Community College projects - Delete "State of North Carolina, through" as owner and use "Trustees of (insert name of community college)"

FORM OF CONSTRUCTION CONTRACT

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the _____ day of _____ in the year of 20__ by and between _____

hereinafter called the Party of the First Part and the *State of North Carolina, through the _____

_____ hereinafter called the Party of the Second Part.

WITNESSETH:

That the Party of the First Part and the Party of the Second Part for the consideration herein named agree as follows:

1. Scope of Work: The Party of the First Part shall furnish and deliver all of the materials, and perform all of the work in the manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part thereof as if fully contained herein: advertisement; Instructions to Bidders; General Conditions; Supplementary General Conditions; specifications; accepted proposal; contract; performance bond; payment bond; power of attorney; workmen's compensation; public liability; property damage and builder's risk insurance certificates; approval of attorney general; certificate by the Office of State Budget and Management, and drawings, titled:

Consisting of the following sheets:

Dated: _____ and the following addenda:

Addendum No. _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____ Addendum No. _____ Dated: _____

Addendum No. _____ Dated: _____ Addendum No. _____ Dated: _____

2. That the Party of the First Part shall commence work to be performed under this agreement on a date to be specified in a written order of the Party of the Second Part and shall fully complete all work hereunder within _____ consecutive calendar days from said date. For each day in excess thereof, liquidated damages shall be as stated in

Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions of the Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

(\$ _____).

Summary of Contract Award:

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in _____ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

Witness:

Contractor: (Trade or Corporate Name)

(Proprietorship or Partnership)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

The State of North Carolina through*

(CORPORATE SEAL)

(Agency, Department or Institution)

Witness:

By: _____

Title: _____

FORM OF PERFORMANCE BOND

Date of Contract: _____

Date of Execution: _____
Name of Principal
(Contractor) _____

Name of Surety: _____

Name of Contracting
Body: _____

Amount of Bond: _____

Project _____

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness: _____

Contractor: (Trade or Corporate Name)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice
Pres. only)

(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

Witness:

Countersigned:

(N.C. Licensed Resident Agent)

Name and Address-Surety Agency

Surety Company Name and N.C.
Regional or Branch Office Address

(Surety Company)

By: _____

Title: _____
(Attorney in Fact)

(Surety Corporate Seal)

FORM OF PAYMENT BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal
(Contractor) _____

Name of Surety: _____

Name of Contracting
Body: _____

Amount of Bond: _____

Project _____

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in _____ counterparts.

Witness:

(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

Witness:

Countersigned:

(N.C. Licensed Resident Agent)

Name and Address-Surety Agency

Surety Company Name and N.C.
Regional or Branch Office Address

Contractor: (Trade or Corporate Name)

By: _____

Title _____
(Owner, Partner, or Corp. Pres. or Vice
Pres. only)

(Surety Company)

By: _____

Title: _____
(Attorney in Fact)

(Surety Corporate Seal)

Sheet for Attaching Power of Attorney

Sheet for Attaching Insurance Certificates

APPROVAL OF THE ATTORNEY GENERAL

**CERTIFICATION BY THE OFFICE OF STATE
BUDGET AND MANAGEMENT**

Provision for the payment of money to fall due and payable by the

under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This _____ day of _____ 20____.

Signed _____
Budget Officer

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

PLACEHOLDER FOR DESIGNER'S DIGITAL / ELECTRONIC DATA PROTOCOL
EXHIBIT

SECTION 006000 – PROJECT FORMS

PART 1 – GENERAL

1.1. GENERAL

- A. Working copies of most Administrative Forms can be provided to Contractor by Owner or Designer upon request.
- B. Related Sections:
 - 1. All HUB Forms for the project can be found in Section 002126 “UNC System MB Guidelines & Forms 2024”.

1.2. FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner / Contractor Agreement and form of the General Conditions shall be used for Project:
 - 1. Form of Construction Contract as shown in Section 005200 “Form of Construction Contract.”
 - 2. The General Conditions for Project are specified in Section 007200 “General Conditions of the Contract.”
 - 3. Supplementary General Conditions are specified in Section 007300 “Supplementary General Conditions.”

1.3. ADMINISTRATIVE FORMS

- A. Copies of AIA standard forms may be obtained from the American Institute of Architects.
- B. Copies of CSI standard forms may be obtained from the Construction Standards Institute.
- C. Preconstruction Forms:
 - 1. Designer Waste Information Form
- D. INFORMATION & MODIFICATION FORMS: Attached at the end of this Section.
 - 1. Subcontractor & Major Material Suppliers List.
 - 2. Requests for Interpretation (RFI).
 - 3. RFI Log.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

4. Submittal Transmittal.
5. Substitution Request.
6. Potential Change Order Form.
7. HUB Change Order Form
8. Field Order
9. Punch List.
10. Request for Designers Pre-Final Inspection Checklist
11. Request for Final Inspection Checklist
12. SCO Beneficial Occupancy Form
13. Final Acceptance Checklist
14. Project Closeout Checklist
15. Bulletin Form or ASI

E. PAYMENT FORMS:

1. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."
2. Sales Tax.
3. Stored Material Summary.
4. CMR HUB Formal Project Data Report

F. OPERATIONS FORMS

1. Method of Procedure Form.
2. Preconstruction Conference Agenda.
3. Designer Monthly Meeting Agenda.
4. Contractor Weekly Meeting Agenda.
5. Crane Lift Plan.
6. C&D Waste and Recycling Tracking Form.
7. Construction & Demolition Salvaged Material Form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 006000

Designer Waste Information Form

Project Name:

Project Designer:

Date:

This form is to be completed by the designer and included with SD documents. Waste Management Plan will be based off of this form.

Waste Type (Condition of waste can determine category. Damaged Universal Waste can become Hazardous Waste)	Present at Site (Y/N)	Comments
Hazardous Waste and Material		
Asbestos		
Chemical Waste (liquid and solid)		
Lead Containing Paint/ Lead Based Paint Chips/ Lead Debris		
PCB containing items (ballasts, caulk, etc.)		
Mercury contaminated debris/ piping/ P-traps		
Broken fluorescent lamps		
Universal Waste		
Mercury containing items (batteries, switches, etc.)		
Batteries (all types)		
Fluorescent Lamps - Intact		
Non-Regulated Waste		
Drywall		
Insulation		
Broad loom carpet		
Vinyl composition tile		
Acoustic ceiling tile		
Treated wood and MDF		
Other Regulated Waste		
Refrigeration equipment		
Tires		
Recyclable		
White goods (lab refrigerators to be disposed of)		
Roofing materials (asphalt, shingles, gravel, metal) non-ACM or lead		
Oil		
Metal (fixtures, piping, ductwork, studs, wiring)		
Cardboard		
Untreated wood		
Aggregate, concrete, brick, asphalt		
Carpet tile		
Non-PCB ballasts		

Email completed form to EH&S Hazardous Waste Program Manager (mdlong3@ncsu.edu) and Waste Diversion Coordinator, ajbensle@ncsu.edu

[illegible]

Email completed form to EH&S Hazardous Waste Program Manager (mdlong3@ncsu.edu) and Waste Diversion Coordinator, ajbensle@ncsu.edu

SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS LIST



PROJECT: _____

FROM (CONTRACTOR): _____

DATE: _____

TO (A/E): _____

A/E PROJECT NUMBER: _____

CONTRACT FOR: _____

LIST SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS PROPOSED FOR USE ON THIS PROJECT AS REQUIRED BY THE CONSTRUCTION DOCUMENTS.
ATTACH SUPPLEMENTAL SHEETS IF NECESSARY.

NUMBER SECTION	SECTION TITLE	FIRM	ADDRESS	PHONE NUMBER	CONTACT

☐ Attachments

SIGNED BY: _____

DATE: _____

COPIES: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

REQUEST FOR INFORMATION



PROJECT: _____ **R.F.I. NUMBER:** _____

_____ **FROM:** _____

TO: _____ **DATE:** _____

_____ **A/E PROJECT NUMBER:** _____

RE: _____ **CONTRACT FOR:** _____

This Clarification Notice is issued for the purpose of clarifying the Contract Documents based on an interpretation reasonably inferable from the Contract Documents, and therefore has no effect on the Contract Sum or Contract Time. Proceeding with Work in accordance with this Clarification Notice indicates acceptance with no change in the Contract Sum or Contract Time.

SPECIFICATION SECTION:	PARAGRAPH:	DRAWING REFERENCE:	DETAIL:
------------------------	------------	--------------------	---------

REQUEST:

SIGNED BY:

DATE:

RESPONSE:

☐ **Attachments**

RESPONSE FROM:	TO:	DATE REC'D:	DATE RET'D:
----------------	-----	-------------	-------------

SIGNED BY:

DATE:

COPIES: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File



A/E PROJECT NUMBER: _____

CONTRACTOR: _____

[illegible]

Project Name: NC State Project Number: SCO Project Number:					Substitution Request Number: _____				
SPECIFICATION TITLE: _____ Section: _____ Page: _____				DESCRIPTION: _____ Article/Paragraph: _____					
PROPOSED SUBSTITUTION: _____									
MANUFACTURER: _____			ADDRESS: _____				PHONE: _____		
TRADE NAME: _____							MODEL NO.: _____		
INSTALLER: _____			ADDRESS: _____				PHONE: _____		
HISTORY :		<input type="radio"/> New Products		<input type="radio"/> 1-4 years old			<input type="radio"/> 5-10 years old		<input type="radio"/> Over 10 years old
DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT: _____ _____ _____ <input type="radio"/> Point-by-point comparison data attached									
REASON FOR NOT PROVIDING SPECIFIED ITEM: _____ _____ _____									
SIMILAR INSTALLATION									
PROJECT: _____ ADDRESS: _____ _____							ARCHITECT: _____ _____ OWNER: _____ _____		
WILL PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK? Yes or No If yes, please explain. _____									

Project Name:
NC State Project Number:
SCO Project Number:

Substitution Request Number: _____

SAVINGS TO OWNER FOR ACCEPTING SUBSTITUTION: _____

WILL PROPOSED SUBSTITUTION CHANGE CONTRACT TIME? Yes or No If yes, please explain.

Supporting data attached

☐ Drawings

☐ Product Data

☐ Samples

☐ Tests

☐ Reports

☐ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____
Signature: _____
Firm: _____
Address: _____
Contact number: _____

A/E's REVIEW AND RECOMMENDATION

- ☐ Approve substitution – Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures
- ☐ Approve substitution as noted – Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures
- ☐ Reject substitution – Use specified materials
- ☐ Substitution Request received too late – Use specified materials

Project Name: NC State Project Number: SCO Project Number:					Substitution Request Number: _____				
Signed by:					Date:				
OWNER'S REVIEW AND ACTION <ul style="list-style-type: none"> <input type="radio"/> Substitution approved – Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures. Prepare change order. <input type="radio"/> Substitution approved as noted - Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures. Prepare change order. <input type="radio"/> Substitution rejected – Use specified materials 									
Signed by:					Date:				
Additional Comments Attached									
<input type="radio"/> Contractor	<input type="radio"/> Subcontractor	<input type="radio"/> Supplier	<input type="radio"/> Manufacturer	<input type="radio"/> A/E					

Change Order Request #		
Contractor's Change Order Request Summary (Sheet "A")		
Item:	Code:	N.C.S.U. Project #
(Project Name)		
<div>Company name Street Address City, State Zip</div>		
(Line 17.) on sheet "B"	C.O.R. Request Total*	\$ -
* Do Not Round Off Numbers		
Signature: _____		Date: _____
Print Name: _____		

|

|

|

|

Contractor Summary - (Sheet "B")**C.O.R. #**Project Name
NCSU Project #
SCO #

Code: Item:

Summary of Contractor's Self Performed Work

(1.) (= line e. from Sheet "C").	Total Material*	\$ -
(2.) (=Line e. from Sheet "D").	Total Labor*	\$ -
(3.) (= line e. from Sheet "E").	Total Equipment*	\$ -

(4.) (=lines 1 + 2 + 3)	Total of Self Performed Work*	\$ -
-------------------------	--------------------------------------	-------------

Summary of Quoted Work (subcontractors)

(5.)	Quote - Subcontractor #1 (company name)	Quote #1 Total* (without General Contractor OH&P)	\$ -
(6.)	Quote - Subcontractor #2 (company name)	Quote #2 Total* (without General Contractor OH&P)	\$ -
(7.)	Quote - Subcontractor #3 (company name)	Quote #3 Total* (without General Contractor OH&P)	\$ -
(8.)	Quote - Subcontractor #4 (company name)	Quote #4 Total* (without General Contractor OH&P)	\$ -

(9.) (lines 5 + 6 + 7 + 8)	Subtotal - Quoted (subcontract) Work* (w/o Gen Contractor OH&P)	\$ -
----------------------------	---	-------------

(10.) (on line 9.)	5% max (or as negotiated)	<input type="text"/> %OH&P	\$ -
--------------------	---------------------------	----------------------------	-------------

(11.) (lines 9 + 10)	Total Quoted (subcontractor) Work (with Gen Contractor OH&P)	\$ -
----------------------	---	-------------

(13.) (lines 4 + 11)	Total All Work* (without bond and ins)	\$ -
----------------------	---	-------------

(14.) (on line 13.)	<input type="text"/> %Bond*	\$ -
---------------------	-----------------------------	-------------

(15.) (on line 13)	<input type="text"/> % Ins.*	\$ -
--------------------	------------------------------	-------------

(16.) (lines 14 + 15)	Bonds & Insurance*	\$ -
-----------------------	-------------------------------	-------------

(17.) (lines 13 + 16)	Grand Total All Work*	\$ -
-----------------------	------------------------------	-------------

* **Do Not** Round Off Numbers

Material Break Down - (Sheet "C")

Material Description	Quantity		Price		Extension*
		Unit		Unit	
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		ea.	@ \$ -	/ ea.	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		lin. feet	@ \$ -	/ lin. foot	= \$ -
		sq. yds	@ \$ -	/ sq. yd	= \$ -
		sq. yds	@ \$ -	/ sq. yd	= \$ -
		sq. yds	@ \$ -	/ sq. yd	= \$ -
		sq. yds	@ \$ -	/ sq. yd	= \$ -
		cu. yds.	@ \$ -	/ cu. yd.	= \$ -
		cu. yds.	@ \$ -	/ cu. yd.	= \$ -
		cu. yds.	@ \$ -	/ cu. yd.	= \$ -
		tons	@ \$ -	/ ton	= \$ -
		tons	@ \$ -	/ ton	= \$ -
		gals	@ \$ -	/ gal	= \$ -
		gals	@ \$ -	/ gal	= \$ -
		gals	@ \$ -	/ gal	= \$ -
	a.	Total Materials*		\$	-
(on line a.)	b.		%	Sales Tax	\$ -
(lines a. + b.)	c.	Subtotal*		\$	-
(on line c.) - max 10% (or as negotiated)	d.		%	O.H.&P.	\$ -
(lines c. + d.)	e.	Total Material*		\$	-

* Do Not Round Off Numbers

Labor Break Down (Sheet "D")

Labor Description	Time	Unit	Cost	Unit	Extension*
Foreman	_____	/hr	@ \$ -	/hr	= \$ -
Tradesman	_____	/hr	@ \$ -	/hr	= \$ -
Tradesman	_____	/hr	@ \$ -	/hr	= \$ -
Tradesman	_____	/hr	@ \$ -	/hr	= \$ -
Tradesman	_____	/hr	@ \$ -	/hr	= \$ -
Tradesman	_____	/hr	@ \$ -	/hr	= \$ -
Journey Man	_____	/hr	@ \$ -	/hr	= \$ -
Journey Man	_____	/hr	@ \$ -	/hr	= \$ -
Journey Man	_____	/hr	@ \$ -	/hr	= \$ -
Journey Man	_____	/hr	@ \$ -	/hr	= \$ -
Journey Man	_____	/hr	@ \$ -	/hr	= \$ -
Laborer	_____	/hr	@ \$ -	/hr	= \$ -
Laborer	_____	/hr	@ \$ -	/hr	= \$ -
Laborer	_____	/hr	@ \$ -	/hr	= \$ -
Laborer	_____	/hr	@ \$ -	/hr	= \$ -
Apprentice	_____	/hr	@ \$ -	/hr	= \$ -
Apprentice	_____	/hr	@ \$ -	/hr	= \$ -
Apprentice	_____	/hr	@ \$ -	/hr	= \$ -
Apprentice	_____	/hr	@ \$ -	/hr	= \$ -
(a.) Subtotal Labor*				\$	-
(on Line a.) max 30%	(b.)	%	Burden	\$	-
(lines a. + b.)	(c.)		Subtotal*	\$	-
(on Line c.) max 10% (or as negotiated)	(d.)	%	O.H.&P.	\$	-
(lines c. + d.)	(e.)		Total Labor	\$	-

* **Do Not** Round Off Numbers

Equipment Break Down (Sheet "E")

Equipment Type	Rental Per Hour			Rental Per Day			Rental Per Week			Extension*
	# Hour(s)		Charge	# Day(s)		Charge	# Week(s)		Charge	
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
	hr(s)	@	\$ - /hr	day(s)	@	\$ - /day	wk(s)	@	\$ - /wk(s)	\$ -
a. Subtotal Equipment*										\$ -
(No sales tax charge on contractor owned equipment)				(on line a.)		b. % Sales Tax \$ -				
				(lines a. + b.)		c. Subtotal* \$ -				
maximun 10% (or as negotiated)				(on Line c.)		d. % O.H.&P. \$ -				
				(lines c. + d.)		e. Total Equipment* \$ -				

* **Do Not** Round Off Numbers

Change Order Minority Participation	
Code /Item:	Code: XXXXX Item:XXX
NCSU Project #:	072044
Contractor:	XXXXXXXXXXXXXX
C.O. Number	G-X
C.O. Scope of Work:	XXXXXXXXXXXXXX
C.O. Cost:	

HUB Subcontractor	Minority Category ¹	Contractor Trade ²	C.O. Dollar Value	Revised Contract Total
	N/A	N/A	N/A	N/A

¹ Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Economically& SociallY Disadvantaged (D)

² Contractor Trade - Select number (i.e. "2" for General - Demolition)

Contractor Trades			
1. Div 1 – General Contractor	55. Div 6 – Wood & Plastics – Architectural Woodwork	5. Div 10 – Specialties – Fire Extinguishers and Cabinets	24. Div 15A – Plumbing – Pipe & Pipe Fittings
2. Div 1 – General – Demolition	56. Div 6 – Wood & Plastics – Carpentry	6. Div 10 – Specialties – Identification Devices (Signage, etc.)	25. Div 15A – Plumbing – Pipe Insulation
3. Div 1 – General – Cleaning	57. Div 7 – Thermal/Moisture Protection – Building Insulation	7. Div 10 – Specialties – Toilet Accessories	26. Div 15B – Mechanical – Controls Work
4. Div 1 – General – Temp Facilities (fencing, trailers, etc)	58. Div 7 – Thermal/Moisture Protection – Fireproofing	8. Div 10 – Specialties – Toilet Partitions	27. Div 15B – Mechanical – Ductwork
40. Div 2 – Site Work – Grading	59. Div 7 – Thermal/Moisture Protection – Joint Sealing/Caulking	9. Div 11 – Equipment – Audio-visual (Projectors, Screens, etc.)	28. Div 15B – Mechanical – Mechanical Equipment
41. Div 2 – Site Work – Hauling	60. Div 7 – Thermal/Moisture Protection – Roofing	10. Div 11 – Equipment – Food Service	29. Div 15B – Mechanical – Pipe Duct Insulation
42. Div 2 – Site Work – Landscaping (seeding, planting, etc.)	61. Div 7 – Thermal/Moisture Protection – Waterproofing	11. Div 11 – Equipment – Residential	30. Div 15B – Mechanical – Pipe & Pipe Fittings
43. Div 2 – Site Work – Paving	62. Div 8 – Doors/Windows – Doors	12. Div 12 – Furnishings – Floor Mats	31. Div 15B – Mechanical/HVAC General
44. Div 2 – Site Work – Soil/Sediment Erosion & Control	63. Div 8 – Doors/Windows – Finish Hardware	13. Div 12 – Furnishings – Systems Furniture	32. Div 16 – Electrical – High/Medium Voltage (Transformers, Switches, etc.)
45. Div 2 – Site Work – Water/Sewer System	64. Div 8 – Doors/Windows – Glass & Glazing	14. Div 12 – Furnishings – Window Treatments	33. Div 16 – Electrical – Conduit
46. Div 3 – Concrete – Plain Concrete (sidewalks, curb & gutter, etc.)	65. Div 8 – Doors/Windows – Windows	15. Div 13 – Special Construction – Fire Protection (Sprinklers, etc.)	34. Div 16 – Electrical – Fire Alarm & Smoke Detection Systems
47. Div 3 – Concrete – Pre-cast Concrete	66. Div 9 – Finishes – Acoustic Panel Ceilings	16. Div 13 – Special Construction – Hazardous Materials Abatement	35. Div 16 – Electrical – General
48. Div 3 – Concrete – Structural Concrete	67. Div 9 – Finishes – Carpet	17. Div 13 – Special Construction – Security Systems	36. Div 16 – Electrical – Lighting Fixtures
49. Div 4 – Masonry – General	68. Div 9 – Finishes – Gypsum Drywall	18. Div 14 – Conveying Systems – Elevators	37. Div 16 – Electrical – Site Lighting
50. Div 4 – Masonry – Labor Only	69. Div 9 – Finishes – Hard Flooring (tiles, slate, etc.)	19. Div 14 – Conveying Systems – Escalators	38. Div 16 – Electrical – Telecommunications Systems
51. Div 5 – Metals – Architectural Metal (railings, etc.)	70. Div 9 – Finishes – Painting/Wallcoverings	20. Div 15A – Plumbing – Exterior Work	39. Div 16 - Electrical – Wiring & Wiring Devices
52. Div 5 – Metals – Light Gauge Metal (decking, etc.)	71. Div 9 – Finishes – Plaster	21. Div 15A – Plumbing – Fixtures	
53. Div 5 – Metals – Structural Steel	72. Div 9 – Finishes – Soft tile Flooring	22. Div 15A – Plumbing – Fuel Gas Piping & Equipment	
54. Div 5 – Metals – Structural Steel Erection	73. Div 9 – Finishes – Wood Flooring	23. Div 15A – Plumbing – General	

State Construction Office

Field Order # _____

Project: _____ Location: _____ Project ID: _____

Description of Change: _____

Justification of Change: _____

CONTRACTOR:

A total cost change not to exceed a lump sum cost is \$ _____ or a unit cost of _____ extended using estimated quantities to not exceed is \$ _____. The contractor will need a maximum number of _____ days time extension to the contract. The actual cost, not to exceed stated cost, shall be based on a realistic estimate based on current acceptable market values submitted with change order for approval by designer, owner, and State Construction Office.

DESIGNER:

The quoted price and need for the change are in the best interests of the owner to have the work accomplished. A formal change order will be prepared for contractor's signature within seven (7) days.

OWNING AGENCY:

The owning agency agrees to the change as being in the owner's best interest. Adequate funds are available to pay the cost for the change.

STATE CONSTRUCTION OFFICE:

The State Construction Office approves the request for the change.

SIGNATURES:

Contractor: _____ Date: _____

Designer: _____ Date: _____

Owning Agency: _____ Date: _____

State Construction Office: _____ Date: _____

Request for Designers Pre-Final Inspection Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

All items must be complete and verified by the Designer. Once items are verified as complete, Designer shall note the date complete and initial the line. If items are not applicable to the project, Designer shall note "N/A" in the date line.

Item	Date	Initials
Contractors Statement of Completion with Request for Designers Inspection, include Contractors Completion List		
Initial Submission of the TAB Report		
Pre-Functional Testing Report		
Operation & Maintenance Submittal Log showing all required O&M's have been approved		
Schedule of Owner Trainings		
Certification all Fire Extinguishers have been installed or delivered to N.C. State		
Demonstration of the operation of fire pumps to the N.C. State Fire Marshall		
Final Clean is Complete		
Laboratory Hood Certification by Contractors 3rd Party Inspector (if applicable)		
Roof & Window Water Test Reports (if applicable)		

Designers Approval: _____
Name Signature Date

Request for Final Inspection Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

All items must be complete and verified by the Designer. Once items are verified as complete, Designer shall note the date complete and initial the line. If items are not applicable to the project, Designer shall note "N/A" in the date line.

_____(Designer of Record) provides information to the Owner and the State Construction Office that the project has been evaluated and field inspected to assure Life Safety Construction involving Fire Protection Systems (Fire Alarm, Sprinkler, etc.), egress, fire rated walls, and egress travel distances are constructed in accordance with the Contract Documents for Final Inspection to allow occupancy by the Owner.

Designer's Representative

Item	Date	Initials
Contractors Statement of Completion with Request for Designers Inspection, include Contractors Completion List		
Designer's Pre-Final Punch List Inspection		
SCO Final Inspection Scheduled for _____		
SCO Electrical Inspection (Certificate of Electrical Completion)		
Installer's Fire Alarm System Record of Completion (Certification) as required by NFPA 72		
Installers Sprinkler System Material & Test Reports:		
NFPA 13 (Sprinkler Systems)		
NFPA 14 (Standpipe & Hose Systems)		
NFPA 20 (Centrifugal Fire Pumps)		
NFPA 22 (Water Tanks for Private Fire Protection)		
NFPA 24 (Private Fire Service Mains)		
SCO Approval Letter for Sprinkler System		
Engineer's Approval of Battery Powered Emergency Devices		
Engineer's Approval Emergency and Standby Generator NFPA 110 Tests		
Engineer's Approval Electrical Service Ground Test Report		
Department of Labor Approval for Elevator		
Department of Labor Approval for Boiler & Pressure Vessels		
Department of Agriculture Approval for Fuel Tanks		

Item	Date	Initials
Health Department Inspection and Acceptance for Use		
Domestic Water Test Report and Acceptance for Use		
Laboratory Hood Certification by Contractors 3 rd Party Inspector		
Laboratory Hood Certification by N.C. State EH&S		
Engineers Approval of Test & Balance Report		
Engineers Verification Letter of Fire Damper Operation		
Backflow Preventer Certification		
Designers Approval of Stair / Ramp Survey		
Metal Building Manufacturer's Warranty		
Roofing Manufacturer's Warranty		
Commissioning Agents Approval		
Lightning Protection UL Master Label		
Special Inspectors Final Report / Resolutions		
Designer's Approval of Site Survey		

Designers Approval: _____

Name	Signature	Date
------	-----------	------

NCSU Approval: _____

Name	Signature	Date
------	-----------	------



North Carolina
State Construction Office

PROJECT APPROVAL AUTHORIZATION
PARTIAL UTILIZATION: (BENEFICIAL OCCUPANCY)

Project: _____

SCO Identification Number: _____ Contract Completion Date: _____

Project Owning Agency: _____

Owning Agency's Requester: _____ Date: _____

Designer's Statement:

_____ (Designer's Firm Name) provides information to the owner and the State Construction Office that the project has been evaluated and field inspected to assure that construction meets contract requirements for partial utilization and/or occupancy by the owning agency.

Designer's Representative Name

Project Description: _____

Project Partial Utilization Description: _____

BACK-UP DATA:
CONTRACTOR'S APPROVAL DOCUMENTS:

General Construction Contractor's Approval:	Date _____	N/A <input type="checkbox"/>
Electrical Construction Contractor's Approval:	Date _____	N/A <input type="checkbox"/>
Mechanical Construction Contractor's Approval:	Date _____	N/A <input type="checkbox"/>
Plumbing Construction Contractor's Approval:	Date _____	N/A <input type="checkbox"/>
Sprinkler Installation Contractor's Approval:	Date _____	N/A <input type="checkbox"/>
Asbestos Removal Contractor's Approval:	Date _____	N/A <input type="checkbox"/>
Other: _____	Date _____	N/A <input type="checkbox"/>
Other: _____	Date _____	N/A <input type="checkbox"/>
Other: _____	Date _____	N/A <input type="checkbox"/>
Certificate of Occupancy by Local Authority Having Jurisdiction (Community College):	Date _____	N/A <input type="checkbox"/>



**North Carolina
State Construction Office**

Beneficial Occupancy Inspection:	Date _____	N/A <input type="checkbox"/>
Beneficial Occupancy Punch List to be completed:	Date _____	N/A <input type="checkbox"/>
Owner's Assumption of Responsibility for Maintenance, Heat, Utilities, and Insurance:		
Comments: _____	Date _____	N/A <input type="checkbox"/>

Established Date for Guarantees and Warranties.		
Comments: _____	Date _____	N/A <input type="checkbox"/>

Consent of Surety:	Date _____	N/A <input type="checkbox"/>
Insurance Company Permitting Occupancy:	Date _____	N/A <input type="checkbox"/>
SCO Electrical Inspection (Certificate of Electrical Completion):	Date _____	N/A <input type="checkbox"/>
Installer's Fire Alarm System Record of Completion (Certification) as required by NFPA 72:	Date _____	N/A <input type="checkbox"/>
Installer's Sprinkler System Material and Test Reports as required by:		
NFPA 13-(Sprinkler Systems)	Date _____	N/A <input type="checkbox"/>
NFPA 14-(Standpipe and Hose Systems)	Date _____	N/A <input type="checkbox"/>
NFPA 20-(Centrifugal Fire Pumps)	Date _____	N/A <input type="checkbox"/>
NFPA 22-(Water Tanks for Private Fire Protection)	Date _____	N/A <input type="checkbox"/>
NFPA 24-(Private Fire Service Mains)	Date _____	N/A <input type="checkbox"/>
Other: SCO Approval Letter Sprinkler System	Date _____	N/A <input type="checkbox"/>
Engineer's Approval of Battery Powered Emergency Devices:	Date _____	N/A <input type="checkbox"/>
Engineer's Approval Emergency and Standby Generator NFPA 110 Tests:	Date _____	N/A <input type="checkbox"/>
Engineer's Approval Electrical Serv Ground Test Report:	Date _____	N/A <input type="checkbox"/>
Dept. of Labor Approval for Elevator:	Date _____	N/A <input type="checkbox"/>
Dept. of Labor Approval for Boiler & Pressure Vessels:	Date _____	N/A <input type="checkbox"/>
Dept. of Agriculture Approval for Fuel Tanks:	Date _____	N/A <input type="checkbox"/>
Health Dept. Inspection and Acceptance for Use:	Date _____	N/A <input type="checkbox"/>



**North Carolina
State Construction Office**

Domestic Water Test Report and Acceptance for Use:	Date _____	N/A <input type="checkbox"/>
Laboratory Hood Certification:	Date _____	N/A <input type="checkbox"/>
Engineer's Approval of Test and Balance Report:	Date _____	N/A <input type="checkbox"/>
Engr's. Verification Letter Fire Damper Operation:	Date _____	N/A <input type="checkbox"/>
Agreement & Means for Separation of Owner Occupied Area from Construction Work Area:	Date _____	N/A <input type="checkbox"/>
Designer's Inspection to Assure Life Safety Construction involving Fire Protection Systems (Fire Alarm, Sprinkler, etc.), egress, fire rated walls and egress travel distances are constructed in accordance with contract documents:	Date _____	N/A <input type="checkbox"/>
Backflow Preventer Certification:	Date _____	N/A <input type="checkbox"/>
Engineer's Approval Stair/Ramp Survey:	Date _____	N/A <input type="checkbox"/>
Engineer's Approval Site Survey (DENR):	Date _____	N/A <input type="checkbox"/>
Metal Building Manufacturer's Warranty:	Date _____	N/A <input type="checkbox"/>
Roofing Manufacturer's Warranty:	Date _____	N/A <input type="checkbox"/>
Commissioning Engineer's Approval:	Date _____	N/A <input type="checkbox"/>
Lightning Protection UL Master Label:	Date _____	N/A <input type="checkbox"/>
Special Inspector's Final Report/Resolutions:	Date _____	N/A <input type="checkbox"/>

Designer's Approval:	Date: _____	Printed Name: _____
Owning Agency Approval:	Date: _____	Printed Name: _____
SCO Approval:	Date: _____	Printed Name: _____

Final Acceptance Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

Item	Date	Initials
Signed Request for Final Inspection Checklist		
SCO Beneficial Occupancy Form(s) for Project's Phases		
Designer's statement to Owner the Designer's Punch List has been Completed		
SCO Final Acceptance Inspection		
SCO Final Acceptance Punch List Issued		
Contractors Work Plan for SCO Final Acceptance Punch List		
Owner's Assumption of Responsibility for Maintenance, Heat, Utilities, and Insurance		
Cancellation of Contractors Insurance Carriers Public Liability, Property Damage, and Builders Risk		
Established Date for Guarantees and Warranties		
Insurance Company Permitting Occupancy		
Record of Owner's Trainings: Plumbing HVAC/Controls Electrical Fire Alarm		
NCSU Fire Marshall's inspection of life safety systems (FAS, Sprinkler System, Emergency Generator, Fire Pumps etc)		
NCSU Lock Shop to installed permanent lock cores on Project's doors		

Date of Project's Final Acceptance: _____

Designers Approval: _____
Name Signature Date

NCSU Approval: _____
Name Signature Date

SCO Approval: _____
Name Signature Date

Project Closeout Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

Item	Date	Initials
Signed Request for Final Inspection Checklist		
Signed Final Acceptance Checklist		
Contractors Final Payment Application		
Contractors Affidavit of Release of Leins		
Contractors Affidavit of Payment of Debts & Claims		
Consent of Surety to Final Payment		
Certificates of Compliance – by each Designer who sealed documents		
Certificate of Completion – by Lead Designer		
Complete Tax Statement Form		
MBE Appendix E Form		
Survey of New & Existing Sub-surface Utilities		
All Contractors Keys Returned to Lock Shop		
NCSU Stormwater Program Manager Approval		
SCO Punch List Complete		
List of Contractors & Subcontractors		
As-Builts & Record Documents		

Designers Approval: _____
Name Signature Date

NCSU Approval: _____
Name Signature Date

SCO Approval: _____
Name Signature Date

STATE OF NORTH CAROLINA
COUNTY SALES AND USE TAX REPORT
SUMMARY TOTALS AND CERTIFICATION

CONTRACTOR: _____

Page _____ of _____

PROJECT: _____

FOR PERIOD: _____

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR							
SUBCONTRACTOR(S)*							
COUNTY TOTAL							

* Attach subcontractor(s) report(s)

** Must balance with Detail Sheet(s)

I certify that the above figures do not include any tax paid on supplies, tools and equipment which were used to perform this contract and only includes those building materials, supplies, fixtures and equipment which actually became a part of or annexed to the building or structure. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the _____ day of _____, 19____

Signed

Notary Public

My Commission Expires: _____

Print or Type Name of Above

Seal

NOTE:

This certified statement may be subject to audit

STATE OF NORTH CAROLINA
SALES AND USE TAX REPORT DETAIL

CONTRACTOR: _____

Page _____ of _____

SUBCONTRACTOR _____

FOR PERIOD: _____

PROJECT: _____

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	COUNTY TAX PAID	COUNTY OF SALE *
				\$	\$	
				TOTAL:	\$	

* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.

STORED MATERIAL SUMMARY

NC STATE UNIVERSITY

PROJECT: _____

APPLICATION PERIOD: _____

OWNER: _____

APPLICATION NUMBER: _____

A/E PROJECT NUMBER: _____

APPLICATION DATE: _____

[illegible]



FACILITIES DIVISION

REQUEST FOR UTILITY INTERRUPTION WORK SHEET

REQUESTOR

NAME : _____

DATE : _____

DEPT : _____

PHONE : _____

WORK REQ #: _____ ACCT #: _____

CAMPUS BOX : _____

BUILDING INFORMATION / DATE & TIME

BUILDING(s): _____ ENTIRE BLDG or
SPECIFIC ROOM : _____

BEGIN DATE : _____ END DATE : _____

BEGIN TIME : _____ END TIME: _____

DISCONNECT INFORMATION

POWER

Primary ☐

Secondary ☐

RUNNING WATER

Hot ☐

Cold ☐

Distilled ☐

FIRE ALARM

Disconnect ☐

Testing ☐

Sprinkler Operational Yes / No

HEATING ☐

STEAM SYSTEMS ☐

AIR CONDITIONING ☐
(Chilled Water)

PROPANE/NATURAL GAS ☐

OTHER : _____

For all Fire Alarm / Sprinkler Disconnects or Testing, please first obtain approval from the Electronics Shop: <http://facilities.ofa.ncsu.edu/fire-alarm-disconnect/> (separate form).

REASON FOR INTERRUPTION (Scope of Work):

Shop Supervisor Signature: _____ Date: _____

Addtl. Supervisor (s) Signature: _____

POLICY # 806 – ROUTINE UTILITY INTERRUPTION REQUEST – ADV NOTIFICATION PERIODS

Primary (Total Building) Power – 10 working days

Secondary Power Feeders – 4 working days

Cold/Hot Water Interruption – 4 working days

A/C/Heat Interruption – 4 working days

*Fire Alarm Disconnect/Testing – 3 working days

Distilled Water Interruption – 3 working days

Steam Interruption – 5 working days

Gas Interruption – 5 working days

Lab Air Interruption – 4 working days

Sanitary/Storm Sewer – 3 working days

PLEASE NOTE: The Customer Service Center will make notifications for the disconnect if it is submitted within the appropriate number of days. The CSC will also make notifications for Emergency disconnects. If it is not submitted within the appropriate number of days, it is the Requestor's responsibility to make the notifications to all personnel.

Method of Procedure

Requested Start Date: DD/MM/YYYY

Requested Work Window: XX hours or YY days

Backup Dates:

1.0 **Purpose / Scope of Work**

1.1 The purpose of this procedure is to [description of the work to be performed].

2.0 **Personnel**

2.1 **Contractors Personnel**

2.1.1 [List Name, Title, and Contact Information for the Contractors Personnel]

2.2 **NC State Personnel**

2.2.1 [List Name, Title, and Contact Information for the Contractors Personnel]

2.3 **Other Personnel**

2.3.1 [List Name, Title, and Contact Information for the Contractors Personnel]

3.0 **Planned Impact to Environment / Equipment**

3.1 [Describe the intended impact of the work].

4.0 **Risks & Potential Hazards**

4.1 [List the risks and potential hazards associated with the work]

5.0 **Stakeholders Impacted**

5.1 [List the stakeholders impacted by the work]

6.0 **Contingency Plan**

6.1 [Describe the contingencies planned by the contractor to mitigate risks associated with the work not going according to plan.]

7.0 **Attachments & References**

7.1 [List the attachments associated with the MOP.]

7.2 [List the reference documents & details associated with the MOP.]

8.0 **Prerequisites**

8.1 [Description of Prerequisite #1.]

Prerequisite #1 is complete.

[ENTITY]:

Signature

Print Name

Date

8.2 [Description of Prerequisite #2.]

9.0 Prerequisite #2 is complete.

[ENTITY]:

Signature

Print Name

Date

10.0 **Procedure**

10.1 [Step 1]

10.2 [Step 2]

10.3 [Step 3]

PRECONSTRUCTION MEETING AGENDA

Project Name: _____

Project number: _____ Code: _____ Item: _____ SCO ID #: _____

Date and location of Meeting: _____

Attendees:

1.) Introductions

2.) Correspondence Protocol:

- a. All correspondence shall have the NCSU Project Name and Number as indicated on SCO's letter of award.
- b. Owner and Contractor will endeavor to direct all communications through the Design Representative.
- c. Correspondence from Designer to Owner will be addressed to the NCSU Project Manager.
- d. Correspondence between Designer and Contractor requires copy to the NCSU Project Manager.
- e. Correspondence from Owner and Contractor to Designer will be addressed to the Design Representative.

3.) Schedule

- a. Bar chart, Network plots. Project schedule, signed by all major subcontractors, is due to the designer within 30 calendar days of the notice to proceed. A Schedule of Values shall be submitted within 30 calendar days of the notice to proceed.
- b. Monthly schedule updates, signed by all major subcontractors, shall be required with each payment application.
- c. Milestones:

Notice to Proceed Date: _____

Project Start Date: _____

Duration: _____

Project Completion Date: _____

Adjustment(s) to the completion of a project will only be allowed by a justifiable change order approved by the designer, the owning agency and the State Construction Office.

One copy of the approved schedule is to be posted at the project site and marked daily showing actual progress of the work.

The submission of an approved schedule and schedule of values to the designer shall occur prior to submitting the first request for payment. The schedule of Values shall include dollar value of each subcontractor and shall identify MBE subcontract work.

A list of subcontractors and material suppliers are to be provided to the designer with a copy for the State Construction Office within 14 days of the notice to proceed in accordance with article 16 of the general conditions.

- d. Weather Delays: The general conditions states the contractual method by which the contractors were to use to establish the expected number of weather days to include in the contract(s). For weather impact greater than what is in the contract, the contract is due to be adjusted. The contractors' project administrators should develop a daily log on construction events covering construction progress and daily weather conditions that affect the construction progress. Copies of the logs should be directed to the designer's representative on a weekly basis for his initial. Copies of the logs should be turned in to the designer on a monthly basis with a request for weather time extensions if justifiable. The requests will be evaluated and approved by the designer, owning agency and State Construction Office if deemed valid. The designer shall keep a running total of time of weather relating delays for granting one change order per prime contract at the end of the project for contract adjustment to the date of completion of the project.
- e. Liquidated Damages: The contract contains a clause allowing an assessment of a sum of _____dollars per day as liquidated damages for each calendar day the project construction is delayed beyond the adjusted scheduled completion date.
- f. It is important all prime contractors become familiar with the general and the supplementary general conditions of the contract(s).

4.) **Progress Meetings**

- a. SCO/Owner's/Designer's Regular monthly progress meetings will be held on:

Location: _____

Time: _____

Prime contractors shall be represented by office and project representatives having the authority to make bindings contractual decisions on the contract. The meetings are open to subcontractors, material suppliers and others that may contribute to the progress toward project completion. The meetings are to enhance coordination, to enhance cooperation, to assist the support of the project schedule, to facilitate in the resolution of problems, and to review pending changed conditions.

- b. Contractor's regular weekly progress meetings will be held on:

Location: _____

Time: _____

Meeting Agenda. A sample agenda for these meetings is included in the Project Manual.

5.) **Change Orders**

For Changes in the Work - follow General Conditions Article 19 and see Attachment 2:

- a. Provide breakdown of materials, labor rates, and correct OH&P

- b. Each request will be identified as "change proposal" or "change request" and will be number consecutively.
- c. Designer will prepare field orders to the Contract on State Construction Office forms.
- d. Owner and Designer will prepare change orders to the Contract on State Construction Office forms or using SCO Interscope Website to process electronically.
- e. Designer shall maintain a change order log.
- f. ***Time extension requests must be supported by a marked-up schedule showing the impact of the delay(s) on the critical path.***
- g. The University requires 6 original change orders for processing.
- h. Only the designer has the authority to issue change orders to change the work of Contractor
- i. All User or other departmental requests for changes in the work will be channeled through the N.C.S.U. Project Manager to the designer as necessary.

6.) Pay Applications/Schedule of Values:

- a. Shall be submitted on *AIA G702 forms*. Applications submitted on any different format will be returned *NOT APPROVED*. The University requires three originals only.
- b. A copy of *NC Sales Tax Report* shall be included with each pay application.
- c. Contractor will submit pay applications to the Designer for approval.
- d. Submittal date to designer will be: _____.
- e. Schedule of values *must be approved by Designer and Owner* prior to first pay application.
- f. Pay applications must clearly identify the type of contract (general, mechanical, plumbing, electrical, etc.). Project name, code and item number, NCSU project number, and SCO ID number must be shown.
- g. All Pay Applications must be accompanied by a *Consent of Surety* and up to date *MBE (HUB) Form*.
- h. Contractor's pay applications are due at Capital Project Management by the fifth of each month.
- i. A copy of the payment application will be submitted to the SCO Project Monitor.

7.) Project Close-Out:

The following must all be complete and included:

- a. As-Builts, including registered survey and certification of stairs.
- b. O&M Manuals
- c. Special Inspections Report
- d. Consent of Surety
- e. Affidavit of Payment of Debts and Claims and Lien waivers
- f. Special warranties/bonds, certificates of completion and compliance
- g. Certification of equipment demonstrations and training for Owner personnel.
- h. Commissioning of building systems if required
- i. Contractor and Designer evaluations

8.) Personnel Conduct

- a. Zero tolerance for harassment of any sort of any member of the University community.
- b. Smoking Policy - No smoking inside of existing facility or addition.
- c. Protection/Safety
 - 1.) OSHA Regulations:
 - a) Fire control
 - b) Barricades - work areas, excavation, pedestrian access, etc.
 - c) Housekeeping - keep site clean, keep mud off streets daily
 - 2.) Working in and around occupied facilities - must be sensitive to the needs of occupants. Coordinate with Project Manager. Noise hours.
 - 3.) Scheduling of cutting of floors in occupied spaces. Precaution to protect activities in floors below
 - 4.) Hot Work Permits: Fire Marshals Office: 515-2568
 - 5.) Contractors shall familiarize themselves with article 11 of the general conditions. The requirements are a mandatory part of the contract.
- d. Accident Reports - Owner requires copy of First Report of Injury.
- e. It is illegal for any person to have firearms at the project site, any type of alcoholic beverages, or drugs other than prescribed by a physician. Everyone at the project site is expected to exhibit proper behavior. Indecent language, acts or dress will not be accepted. Anyone in violation of proper behavior will be ejected from the construction site by the proper authorities.

9.) Temporary Services and Facilities:

- 1.) Sanitary:
- 2.) Water:
- 3.) Power:
- 4.) Heat:
- 5.) Telephone:
- 6.) Trailers:
- 7.) Job Sign:
- 8.) Parking:
- 9.) Waste Disposal Dumpster:
- 10.) Restroom facilities are to be:
- b. Service Continuity:
 - 1.) All interruption of services will be coordinated through the NCSU project manager
 - 2.) Contractor will not interrupt existing services, i.e., Owner will throw switches, turn valves, etc.
 - 3.) 5 days minimum notice, longer for major utility outages, up to 10 days for high voltage or building electricity interruptions.
- c. Cleaning of Streets - any mud, debris, etc., will be removed by Contractor daily.

- d. Site Considerations:
 - 1.) Project limits and staging - see drawings.
 - 2.) Store materials properly.
 - 3.) Erosion control.
 - 4.) Tree protection.
 - 5.) Concrete wash-down areas - keep clean - do not wash out near trees, storm drain inlets.
 - 6.) Pre-Excavation Process:
 - a) The Contractor shall lay out excavations.
 - b) The Contractor shall be responsible for having existing utilities located.
 - c) The Contractor may start excavation only when all known utilities have been located or verified as per the specifications.

10.) Special Requirements of the Owner:

- a. Asbestos:
 - 1.) If applicable, Owner will survey for, and deal with asbestos removal prior to work on this contract commencing.
 - 2.) If the Contractor encounters any material that is suspected to be asbestos, work will cease immediately in the area, and the area will be barricaded, etc.
 - 3.) Owner shall be notified immediately if the presence of asbestos is suspected.
- b. Submittals:
 - 1.) Submit ____ copies to Designer. NCSU requires one full set of approved submittals at the end of the project.
 - 2.) Submittals to be numbered consecutively and specification section will be referenced.
 - 3.) Contractor approval stamp required prior to submission to the Designer.
 - 4.) Designer shall maintain submittal log.
 - 5.) *See Attachment 3 for a list of Submittals to be reviewed by the owner.*
- c. Requests For Information:
 - 1.) Contractor is responsible for thoroughly reviewing contract documents prior to request for information.
 - 2.) Designer shall maintain a RFI (request for information) log.
- d. Normal working Hours: _____

11.) Final Inspections:

- a. State Inspections must be complete and approved. (SCO Electrical, NFPA Testing, and DOL: elevator, boilers, pressure vessels, etc.)
- b. Satisfactory review of project completeness by the Designer.
- c. The designer shall coordinate and notify all parties of the time and date of the formal final inspection.

- d. Upon correction by the contractor and verification by the designer that the work has been completed, a formal final inspection shall be coordinated and performed by the designer in cooperation with the contractor in the presence of the owning agency and the State Construction Office.

12.) As-Built Drawing:

- a. Contractor to keep record set of drawings on site for record drawing purposes exclusively.
- b. Designer and Owner will review the record drawings once a month at construction meeting.

13.) State Construction Office Requirements: Show project SCO ID on all correspondence. Provide a copy of all designers' weekly inspection reports to the project monitor.

MONTHLY MEETING AGENDA

Project Name: _____

Project number: _____ Code: _____ Item: _____ SCO ID #: _____

Date and location of Meeting: _____

Attendees:

- 1.) Review previous minutes of the meeting and resolve any corrections.
- 2.) Work performed in the last 30 days.
- 3.) Work to be performed in the next 30 days.
 - a. Review Project Schedule Summary and attach to the meeting minutes.
 - b. Review updated schedule and attach to the meeting minutes.
 - c. Review Monthly Progress Summary and attach to the meeting minutes.
- 4.) Requests for Proposals.
- 5.) Review Pending Change Orders. Attach an updated Change Order Log to the meeting minutes.
- 6.) Review Requests for Information. Attach an updated RFI log to the meeting minutes.
- 7.) Review Submittals. Attach an updated Submittal Log to the meeting minutes.
- 8.) Discuss Coordination Issues.
- 9.) Designer Weekly Inspection Reports.
- 10.) Erosion Control & Tree Protection Review.
- 11.) Site Cleanliness.
- 12.) Safety.
- 13.) Open Discussion.
- 14.) Attach photos of work progress, taken within two days of the meeting, to the meeting minutes.

PROJECT SCHEDULE SUMMARY

Notice to Proceed Date	_____
Contract Completion Date	_____
Contract Calendar Days	_____
Number of Contract Calendar Days Expended to Date Thru __/__/__	_____
Percentage of Contract Time Expended to Date Thru __/__/__(Days Expended/Contract Duration)	_____
Previous Percentage of Contract Time Expended to Date	_____
Pending Time Extensions (Weather – Calendar Days)	_____
Pending Time Extensions (Scope – Calendar Days)	_____
Approved Time Extensions (Weather – Calendar Days)	_____
Approved Time Extensions (Scope – Calendar Days)	_____
Completion Date per Updated Schedule	_____
Actual Percentage Complete (Work in Place less stored Materials) thru __/__/__	_____ _____
Previous Percentage Complete	_____

MONTHLY CONSTRUCTION PROGRESS REPORT

Designer		Address	
Location		Date	
Job Title		Starting Date	
SCO ID#			

PERCENT COMPLETION

	% Previous Month	% This Month	% Total to Date	% Scheduled	Completion Date
General Contract					
Plumbing Contract					
Mechanical Contract					
Electrical Contract					

Change Orders Since Last Report:

Change Order Number	Amount	Purpose

Insurance up to Date: Yes ____ No ____
 Explanation (if no):

Financial Status:	Previously Authorized	Authorized This Month	Total Contract Inc. Extras	% of Total Authorization
General				
Plumbing				
Mechanical				
Electrical				
Totals				

If work is behind schedule, what action has been taken?

WEEKLY MEETING AGENDA

Project Name: _____

Project number: _____ Code: _____ Item: _____ SCO ID #: _____

Date and location of Meeting: _____

Attendees:

- 1.) Contractor's Construction Schedule:
 - a. Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review schedule for the upcoming two-week period.
 - c. Discuss long-term schedule needs as necessary.
- 2.) Safety, hazards and risks.
- 3.) Change Order Requests and Change Orders.
- 4.) Request for Information.
- 5.) Submittals.
- 6.) Designer Inspection Reports.
- 7.) Erosion & Sedimentation Update (if applicable).
- 8.) Review condition of tree protection (if applicable).
- 9.) Progress cleaning and site cleanliness.
- 10.) Changes to Site Logistics or Emergency Action Plan.
- 11.) Sequence of operations.
- 12.) Resolution of BIM component conflicts.
- 13.) Status of upcoming samples and/or mockups, and location for review.
- 14.) Deliveries.
- 15.) Off-site fabrication.
- 16.) Access.
- 17.) Site utilization.

- 18.) Temporary facilities and controls.
- 19.) Atypical work hours.
- 20.) Quality and work standards.
- 21.) Pending changes
- 22.) Pending claims and disputes.
- 23.) Documentation of information for payment requests.
- 24.) Testing and inspection requirements.
- 25.) Other business relating to the Work.

NC State University Lift Plan Approval Request

Date Submitted: _____

Submitted by: _____

NCSU Group Leading Project: _____

Lift Date: _____

-
- The identity of the controlling entity, meaning the employer with the overall responsibility for construction operations associated with the crane lift.
 - Identify a lift director (i.e. primary signal person) and method of communication (hand signals, radio, etc.).
 - Contractors conducting crane operations are required to obtain required FAA permits according to 14.CFR Part 77; to be submitted with the lift plan.
 - Equipment positioning locations, including load staging and movement and paths to and from the working position
 - Equipment specifications including load and reach capacities
 - Current qualifications, certifications, and licenses of operator(s) and rigger(s)
 - For lifts involving more than one crane, the lift plan shall encompass all cranes.
 - Fall Zone: The contractor shall identify the Fall Zone. The Fall Zone is the area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall. Spaces within the Fall Zone (including buildings, foot traffic, vehicle traffic, etc.) shall be barricaded to control access. The Fall Zone shall be cleared of personnel not participating in the lift.
 - Wind limitations
 - Ground and subsurface stability at crane and load placement locations. The contractor must ensure a qualified person evaluates the crane set-up location to ensure ground conditions are sufficient.
 - Other conditions or factors that may affect the safety of the lift
 - A pre-lift meeting must be completed immediately before the lift and shall include all personnel involved with the lift and a thorough review of the elements and specifics of the lift plan and personnel assignments.
 - Specify distance to closest energized lines and applicable minimum approach distance of any lift component.
 - Where items positioned by a crane lift are rigged at heights above easy reach height, the lift plan shall include safe attachment and de-attachment procedures and the control of exposure to fall hazards
 - The contractor must provide documentation of annual and monthly inspections for the previous 3 months. 1926.1412(f) & .1412(e)

Reviewed by: _____

Review Date _____

- **Approved**
- **More Information Needed**
- **Denied**



C&D WASTE AND RECYCLING TRACKING FORM

The University requires 75% of the waste produced from each project be diverted from the landfill

Project Name & ID: _____

Name of Contractor: _____

Project Manager Name: _____

Contractor Phone #: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

Name of Person Completing Form: _____

It is required to attach weight tickets and/or invoices to this form.

Please check one: ☐ Weight tickets attached ☐ Weight tickets not attached. Provide explanation: _____

Date	Waste Hauler/Contractor Name	Material Description	Weight (lbs or tons)	Estimate Weight if no Ticket	Recycling or Landfill Facility hauled to

Project Totals (Contractor to Calculate)

Total Weight Landfill: _____ Total Weight Diverted (Recycled + Salvaged) _____ Percent of Project Waste Diverted from Landfill
(Total Weight Diverted / Total Project Weight) x 100

Total Weight Recycled: _____ Total Project Weight (Recycled + Salvaged + Landfilled): _____ %

Instructions for completing this form

1. NCSU project manager to provide info.
2. Contractor to provide this information, including name of person completing this form.
3. Check a box indicating whether weight tickets are attached to this form. If they are not, provide an explanation.
4. Complete one line for each instance of hauling.

A. List the date material was hauled.

B. Provide name of waste hauler or contractor who disposed or recycled the material.

C. List the type of material disposed of or recycled. Ex. Mixed C&D waste, scrap metal, concrete, asphalt shingles, etc.

D. List the actual weight of the material, in pounds or tons, as recorded by a scale.

E. If material is not weighed by a scale, provide an estimate of the weight in pounds or tons (keep units consistent throughout).

F. List the facility the material was delivered to.
5.

A. Provide the total weight of all materials that went to a landfill. *Note:* For Waste Industries Raleigh View Road C&D Processing Facility *only* - 20% of each load is recycled. Multiply the weight recorded at this facility by .80 to get the weight landfilled by Waste Industries.

B. Provide the total weight of materials that were recycled. *Note:* For Waste Industries Raleigh View Road C&D Processing Facility *only* - 20% of each load is recycled. Multiply the weight recorded at this facility by .20 to get the weight recycled by Waste Industries.

C. Total weight recycled (B) plus total weight salvaged (*#8 on Salvaged Material form*).

D. Total weight of all material generated by the project (A+B+C).

E. Divide the total weight diverted by the total project weight, then multiply by 100 to get the diversion rate as a percent ((C/D) x 100).



C&D WASTE AND RECYCLING TRACKING FORM

The University requires 75% of the waste produced from each project be diverted from the landfill

1. Project Name & ID: _____

Project Manager Name: _____

2. Name of Contractor: _____

Contractor Phone #: _____

Name of Person Completing Form: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

It is required to attach weight tickets and/or invoices to this form.

3. Please check one: ☐ Weight tickets attached ☐ Weight tickets not attached. Provide explanation: _____

4.

Date	Waste Hauler/Contractor Name	Material Description	Weight (lbs or tons)	Estimate Weight if no Ticket	Recycling or Landfill Facility Hauled to
A	B	C	D	E	F

Project Totals (Contractor to Calculate)

5. Total Weight Landfill: **A** Total Weight Diverted (Recycled + Salvaged): **C** Percent of Project Waste Diverted from Landfill (Total Weight Diverted / Total Project Weight) x 100

Total Weight Recycled: **B** Total Project Weight (Recycled + Salvaged + Landfilled): **D** **E** %

Description Of Program: The University has established a program to salvage building materials, parts and furnishings that would otherwise be considered construction and demolition waste. Prior to the beginning of construction and renovations projects on campus, Facilities Operations and other Donees will have an opportunity to reclaim C&D materials for reuse.

Facilities Operations Trade shops will have first priority in the invitation to salvage materials from construction and renovation projects. Other donees, such as Habitat for Humanity may receive donation of reusable materials. The following conditions and procedure must be met in order to participate in the salvaged material/ reuse program.

Criteria:

Clear understanding of the purpose of the salvaged material/ reuse program.

Tracking the salvaged materials is extremely important to protect all participants from possible liability claims or false acquisition of materials by shops or donees.

Shop or donee is responsible for removal and transportation of materials.

Shop or donee has adequate second use or storage for the materials.

Shop or donee takes responsibility for the timely and lawful surplus or disposal of materials if an adequate reuse is not identified in an appropriate amount of time.

Questions? Contact WRR at 919.515.9421 or recycling@ncsu.edu

Return completed form to Waste Reduction and Recycling. Campus Box 7516 or recycling@ncsu.edu



CONSTRUCTION & DEMOLITION SALVAGED MATERIAL FORM

Project Name & ID: _____

Project Manager Name: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

Date	Material Description	Quantity	Weight Each Item (lbs or tons)	Estimated Donation Value	Released By (NCSU)	Released To & Phone #

Total Salvaged Material Weight: _____

Instructions for completing this form

6. NCSU project manager to provide info.
7. Complete one line for each item salvaged for reuse.

A. List the date salvaged material was turned over to the receiving party.

B. Describe the material being salvaged for reuse.

C. Quantity of a particular item was salvaged.

D. Weight of each item, either actual or estimated.

E. Estimate the value of the material. If you are unsure, leave this blank.

F. List the name of the person at NCSU who is releasing the material.

G. List the name and phone number of the person who is receiving the material.
8. Add up the total weight of material salvaged. Keep the units (tons or pounds) consistent with those used on C&D waste tracking form, as this number will be used in the diversion rate equation.



CONSTRUCTION & DEMOLITION SALVAGED MATERIAL FORM

6.

Project Name & ID: _____

Project Manager Name: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

7.

Date	Material Description	Quantity	Weight Each Item (lbs or tons)	Estimated Donation Value	Released By (NCSU)	Released To & Phone #
A	B	C	D	E	F	G

8.

Total Salvaged Material Weight: _____



Field Memo / Project Instructions

date Month/Date/Year

project **Wendell H. Murphy Football Center, Kitchen Renovation**
NC State University
Raleigh, NC 27607

cra project # 2308

sent to

from

field memo # **FM**

Please provide a cost proposal for any change in your respective scopes of work as outlined in the field memo documents described below and as attached. Also please notify the Designer in writing if there is no effect by this field memo on your scope of work. Please contact the Designer if you have any questions regarding this field memo.

The following is a list of changes made:

1.

CC:

page 1 of 1

This Field Memo/Project Instruction does not constitute approval of any additional cost or time which a Contractor feels he may be due as a result of this communication from the Designer. All requests for additional monies or time must be submitted and approved per the Contract Documents for the project referenced above.

GENERAL CONDITIONS OF THE CONTRACT

STANDARD FORM FOR CONSTRUCTION MANAGER-AT-RISK PROJECTS

NORTH CAROLINA

DEPARTMENT OF ADMINISTRATION

STATE CONSTRUCTION OFFICE

Form OC-15CM

This document is intended for use on State capital construction projects and shall not be used on any project that is not reviewed and approved by the State Construction Office. Extensive modification to the General Conditions by means of “Supplementary General Conditions” is strongly discouraged. State agencies and institutions may include special requirements in “Division 1 – General Requirements” of the specifications, where they do not conflict with the General Conditions.

Second Edition January 2013

Revision 1 – May 2024: Article 23.b

GENERAL CONDITIONS OF THE CONTRACT

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of the State of North Carolina, and is distributed by, through and at the discretion of the State Construction Office, Raleigh, North Carolina, for that distinct and sole purpose.

TABLE OF CONTENTS

ARTICLE	TITLE	PAGE
1	Definitions	4
2	Intent and Execution of Documents.....	5
3	Clarifications and Detail Drawings.....	6
4	Copies of Drawings and Specifications	7
5	Shop Drawings, Submittals, Samples, Data.....	7
6	Working Drawings and Specifications at the Job Site.....	7
7	Ownership of Drawings and Specifications.....	7
8	Materials, Equipment, Employees	8
9	Royalties, Licenses and Patent.....	9
10	Permits, Inspections, Fees, Regulations	9
11	Protection of Work, Property and the Public	9
12	Sedimentation Pollution Control Act of 1973.....	10
13	Inspection of the Work.....	11
14	Construction Supervision and Schedule.....	12
15	{NOT USED}	13
16	Principal Trade and Specialty Contracts & Contractors	13
17	Construction Manager and Subcontractor Relationships	14
18	Designer's Status	15
19	Changes in the Work.....	16
20	Claims for Extra Cost.....	18
21	Minor Changes in the Work.....	20
22	Uncorrected Faulty Work.....	20
23	Time of Completion, Delays, Extension of Time	20
24	Partial Utilization: Beneficial Occupancy.....	21
25	Final Inspection, Acceptance, and Project Closeout	21
26	Correction of Work Before Final Payment	22
27	Correction of Work After Final Payment.....	22
28	Owner's Right to Do Work.....	23
29	Annulment of Contract.....	23
30	Construction Manager's Right to Stop Work or Terminate the Contract	24
31	Request for Payment	24
32	Certificates of Payment and Final Payment	25
33	Payments Withheld	26
34	Minimum Insurance Requirements	27
35	Performance Bond and Payment Bond	28
36	Contractor's Affidavit.....	28
37	Assignments	29
38	Use of Premises.....	29
39	Cutting, Patching and Digging.....	29
40	Utilities, Structures, Signs.....	29

41	Cleaning Up	31
42	Guarantee	31
43	Codes and Standards	32
44	Indemnification	32
45	Taxes	32
46	Equal Opportunity Clause	33
47	Employment of the Handicapped	33
48	Asbestos-Containing Materials (ACM)	33
49	Minority Business Participation	33
50	Contractor Evaluation	34
51	Gifts	34
52	Auditing Access to Persons and Records	36
53	North Carolina False Claims Act	37
54	Termination for Convenience	38

ARTICLE 1 - DEFINITIONS

- a. The **contract documents** consist of the Request for Proposal (RFP); Construction Manager's formal response to the RFP; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the drawing and specifications, including all bulletins, addenda or other modifications of the drawings and specifications incorporated into the documents prior to their execution; the contract; the performance bond; the payment bond; insurance certificates; the approval of the attorney general; and the certificate of the Office of State Budget and Management. All of these items together form the contract.
- b. The **Owner** is the State of North Carolina by and through the agency or institution named in the contract..
- c. The **designer** or **project designer** means the firm or firms of architects or engineers or both (and their consultants) which have undertaken to design the project pursuant to a contract with the Owner, (hereinafter, the "design contract").
- d. The **Construction Manager-at-Risk (CM)** **accepts a relationship of trust and confidence between himself and the Owner and undertakes to act as the Owner's fiduciary in the handling and opening of bids in accordance with the provisions of North Carolina General Statute (N.C.G.S.) 143-128.1.** The CM agrees to furnish his best skills and his best judgment to cooperate with the Owner and Designer for undertaking all necessary action contemplated under the contract documents to (a) establish during the design phase a Guaranteed Maximum Price (GMP) to construct the project and (b) ensure timely and quality completion of the project at a cost within the GMP. Construction Manager or CM as used in the contract documents means Construction Manager-at-Risk (CM at Risk).
- e. A **subcontractor**, as the term is used herein, shall be in the case of a principal trade contractor, a general, mechanical, electrical or plumbing contractor or in the case of a specialty contractor, a trade contractor who is not a principal trade contractor, who has entered into a direct contract with a CM, and includes one who furnishes materials worked to a special design in accordance with plans and specifications covered by the contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.
- f. **Written notice** shall be defined as notice in writing delivered in person to the contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization by registered mail.
- g. **Work**, as used herein as a noun, is intended to include materials, labor, and workmanship of the appropriate contractor as supervised by the CM.
- h. The **project** is the total construction work to be performed under the contract documents.
- i. **Construction Management Fee** shall be an all inclusive lump sum management fee which will include all Construction Manager-at-Risk home office, project site and project related costs including all Construction Manager-at-Risk overhead costs and profit.
- j. **Change order**, as used herein, shall mean a written order to the CM subsequent to the signing of the contract authorizing a change in the GMP contract. The change order shall be signed by the CM, designer and the Owner, and approved by the State Construction Office, in that order (Article 19).

- k. **Field Order**, as used herein, shall mean a written approval for the CM to proceed with the work requested by Owner prior to issuance of a formal Change Order. The field order shall be signed by the CM, designer, Owner, and State Construction Office (SCO).
- l. **Field Change**, as used herein shall mean a written approval from the Owner for the CM to proceed with work requested by the Owner to be paid for from the CM Contingency or Owner's Project Reserve within the GMP.
- m. **Time of Completion**, as stated in the contract documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article 23).
- n. **Liquidated damages**, as stated in the contract documents, is an amount reasonably estimated in advance to cover the consequential damages associated with the Owner's economic loss in not being able to use the Project for its intended purposes at the end of the contract's completion date as amended by change order, if any, by reason of failure of the CM to complete the work within the time specified. Liquidated damages does not include the Owner's extended contract administration costs (including but not limited to additional fees for architectural and engineering services, testing services, inspection services, commissioning services, etc.), such other damages directly resulting from delays caused solely by the CM, or consequential damages that the Owner identified in the bid documents that may be impacted by any delay caused solely by the CM (e.g., if a multi-phased project-subsequent phases, delays in start of other projects that are dependent on the completion of this Project, extension of leases and/or maintenance agreements for other facilities).
- o. **Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the CM, and which engages to be responsible for the CM and his acceptable performance of the work.
- p. **Routine written communications between the Designer and the Construction Manager** are any communication other than a "request for information" provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, or facsimile. Such communications cannot be identified as "request for information".
- q. **Clarification or Request for information (RFI)** is a request from the CM seeking an interpretation or clarification by the Designer relative to the contract documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the CM's interpretation or understanding of the contract documents requirements in question, along with reasons for such an understanding.
- r. **Approval** means written or imprinted acknowledgement that materials, equipment or methods of construction are acceptable for use in the work.
- s. **Inspection** shall mean examination or observation of work completed or in progress to determine its compliance with contract documents.
- t. **"Equal to" or "approved equal"** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the bidder in all characteristics (physical, functional, and aesthetic) to those specified in the contract documents. Acceptance of equal is subject to approval of the designer and owner.

- u. **“Substitution” or “substitute”** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified, but which in the opinion of the bidder would improve competition and/or enhance the finished installation. Acceptance of substitution is subject to the approval of the designer and owner.
- v. **Provide** shall mean furnish and install complete in place, new, clean, operational, and ready for use.
- w. **Indicated and shown** shall mean provide as detailed, or called for, and reasonably implied in the contract documents.
- x. **Special inspector** is one who inspects materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the approved construction documents and referenced standards.
- y. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance to the owner’s project requirements and the project design documents.
- z. **Designer Final Inspection** is the inspection performed by the design team to determine the completeness of the project in accordance with approved plans and specifications. This inspection occurs prior to SCO final inspection.
- aa. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with NC Building Codes and approved plans and specifications.
- bb. **Beneficial Occupancy** is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed as determined by the State Construction Office. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.
- cc. **Final Acceptance** is the date in which the State Construction Office accepts the construction as totally complete. This includes the SCO Final Inspection and certification by the designer that all punch lists are completed.

ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

- a. The drawings and specifications are complementary, one to the other. That which is shown on the drawings or called for in the specifications shall be as binding as if it were both called for and shown. The intent of the drawings and specifications is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a complete job. In case of discrepancy or disagreement in the contract documents, the order of precedence shall be: Form of Contract, specifications, large-scale detail drawings, small-scale drawings.
- b. The wording of the specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.

- c. The CM shall execute each copy of the response to RFP, contract, performance bond and payment bond as follows:
 1. If the documents are executed by a sole Owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
 2. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.
 3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
 4. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole Owner, partnership or corporation, whichever form is applicable to each particular member.
 5. All signatures shall be properly witnessed.
 6. If the construction manager's license is held by a person other than an Owner, partner or officer of a firm, then the licensee shall also sign and be a party to the contract. The title "Licensee" shall appear under his/her signature.
 7. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.
 8. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.
 9. The seal of the bonding company shall be impressed on each signature page of the bonds.
 10. The CM's signature on the performance bond and the payment bond shall correspond with that on the contract.

ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS

- a. In such cases where the nature of the work requires clarification by the designer, such clarification shall be furnished by the designer with reasonable promptness by means of written instructions or detail drawings, or both. Clarifications and drawings shall be consistent with the intent of contract documents, and shall become a part thereof.
- b. The CM and the Designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the work. The Designer shall furnish drawings or clarifications in accordance with that schedule. The CM shall not proceed with the work without such detail drawings and/or written clarifications.

ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS

The Designer or owner shall furnish free of charge to the CM electronic copies of plans and specifications. If requested by the CM, up to 30 paper copies of plans and specifications will be

provide free of charge,, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the CM shall clearly and legibly record all work-in-place that is at variance with the contract documents. Additional sets shall be furnished at cost, including mailing, to the CM at the request of the CM.

ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA

- a. Within fifteen (15) consecutive calendar days of the notice to proceed, a schedule for anticipated submission of all shop drawings, product data, samples, and similar submittals shall be prepared by the CM and provided to the designer. This schedule shall indicate the items, relevant specification sections, other related submittal data, and the date when these items will be furnished to the designer.
- b. The CM shall review, approve and submit to the Designer all Shop Drawings, Coordination Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Required Submittals shall bear the CM's stamp of approval, any exceptions to the Contract Documents shall be noted on the submittals, and copies of all submittals shall be of sufficient quantity for the Designer to retain up to three (3) copies of each submittal for his own use plus additional copies as may be required by the CM. Submittals shall be presented to the Designer in accordance with the schedule submitted in paragraph (a). so as to cause no delay in the activities of the Owner.
- c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining three (3) copies (1 for the Designer, 1 for the owner and 1 for SCO) for his use. The remaining copies of each submittal shall be returned to the CM not later than twenty (20) days from the date of receipt by the Designer, for the CM's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittals.
- d. Approval of shop drawings by the designer shall not be construed as relieving the CM from responsibility for compliance with the design or terms of the contract documents nor from responsibility of errors of any sort in the shop drawings, unless such error has been called to the attention of the designer in writing by the CM.

ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE

- a. The CM shall maintain, in readable condition at his job office, one complete set of working drawings and specifications for his work including all shop drawings. Such drawings and specifications shall be available for use by the Designer or his authorized representative, owner or State Construction Office.
- b. The CM shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the contract documents. Such variations shall be fully noted on project drawings by the CM and submitted to the designer upon project completion and no later than thirty (30) days after acceptance of the project.
- c. The contractor shall maintain at the job office a record of all required tests that have been performed, clearly indicating the scope of work inspected and the date of approval or rejection.

ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS

All drawings and specifications are instruments of service and remain the property of the Owner. The use of these instruments on work other than this contract without permission of the Owner is prohibited. All copies of drawings and specifications other than contract copies shall be returned to the Owner upon request after completion of the work.

ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES

- a. The CM shall, unless otherwise specified, supply & pay for all lighting, power, heat, sanitary facilities & water and shall require the Principal Trade and Specialty Contractors to, supply and pay for all labor, transportation, materials, tools, apparatus, scaffolding and incidentals necessary for the completion of his work, and to install, maintain and remove all equipment of the construction, other utensils or things, and be responsible for the safe, proper and lawful construction, maintenance and use of same. The CM shall construct in the best and most workmanlike manner, a complete job and everything incidental thereto, as shown on the plans, stated in the specifications, or reasonably implied there from, all in accordance with the contract documents.
- b. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the specifications.
- c. Upon notice, the CM shall furnish evidence from the the Principal Trade and Specialty Contractors as to quality of materials.
- d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the CM through the Principal Trade or Specialty Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the CM through the Principal Trade or Specialty Contractor has the option of using any product and manufacturer combination listed. However, the CM through the Principal Trade or Specialty Contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. The CM shall be responsible for reviewing all substitution requests from Principal Trade or Specialty Contractors prior to submission to the Project Designer and Owner and shall track & monitor all such requests. Requests for substitution of materials, items, or equipment shall be submitted to the Project Designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and the owner approves.
- e. The CM shall obtain written approval from the designer for the use of products, materials, equipment, assemblies or installation methods claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered.

- f. The Designer is the judge of equality for proposed substitution of products, materials or equipment.
- g. If at any time during the construction and completion of the work covered by these contract documents, the conduct of any workman of the various crafts be adjudged a nuisance to the Owner or Designer, or if any workman be considered detrimental to the work, the CM shall order such parties removed immediately from grounds.

ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS

It is the intention of the contract documents that the work covered herein will not constitute in any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The CM shall protect and save harmless the Owner against suit on account of alleged or actual infringement. The CM shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS

- a. The CM shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work under this contract. If the CM observes that the drawings and specifications are at variance therewith, he shall promptly notify the Designer in writing. Any necessary changes required after contract award shall be made by change order in accordance with Article 19. If the CM performs any work or authorizes any work to be performed knowing it to be contrary to such laws, ordinances, codes, rules and regulations, and without such notice to the designer, he shall bear all cost arising there from. Additional requirements implemented after bidding will be subject to equitable negotiations.
- b. All work under this contract shall conform to the North Carolina State Building Code and other State, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the CM unless otherwise specified.
- c. Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to inspection by any county or municipal authorities and are not subject to county or municipal building codes. The CM shall, however, cooperate with the county or municipal authorities by obtaining building permits. Permits shall be obtained at no cost.
- d. Projects involving local funding (Community Colleges) are also subject to county and municipal building codes and inspection by local authorities. The CM shall pay the cost of these permits and inspections unless otherwise specified.

ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

- a. The CM shall be responsible for the entire site and the building or construction of the same and provide all the necessary protections, as required by the Owner or designer, and by laws or ordinances governing such conditions. The CM shall be responsible for any damage to the Owner's property or of that of others on the job, by them, their personnel, or their subcontractors, and shall make good such damages. The CM shall be responsible for and pay for any damages caused to the Owner. The CM shall have access to the project at all times.

- b. The CM shall be responsible to cover and protect all portions of the structure when the work is not in progress, provide and set all temporary roofs, covers for doorways, sash and windows, and all other materials necessary to protect all the work on the building. Any work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the Owner.
- c. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the Designer.
- d. The CM shall ensure that all trees and shrubs designated to remain in the vicinity of the construction operations are protected in accordance with the requirements of the plans and specifications. All walks, roads, etc., shall be barricaded as directed by the designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the work shall be well barricaded and properly lighted at night.
- e. The CM shall develop and implement a project safety plan that provides all necessary safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the work. The CM shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. The CM shall insure that protection is provided against damage or injury resulting from falling materials and that all protective devices and signs be maintained throughout the progress of the work.
- f. The CM shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by N.C.G.S. 95-126 through 155.
- g. The CM shall designate a responsible person of his organization as safety officer/inspector to inspect the project site for unsafe health and safety hazards, to report these hazards to the contractor for correction, and whose duties also include accident prevention on the project, and to provide other safety and health measures on the project site as required by the terms and conditions of the contract. The name of the safety inspector shall be made known to the designer and owner at the time of the preconstruction conference and in all cases prior to any work starting on the project.
- h. In the event of an emergency affecting the safety of life, the protection of work, or the safety of adjoining properties, the CM is hereby authorized to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage. Any compensation claimed by the CM on account of such action shall be determined as provided for under Article 19(b).
- i. Any and all costs associated with correcting damage caused to adjacent properties of the construction site or staging area shall be borne by the contractor. These costs shall include but not be limited to flooding, mud, sand, stone, debris, and discharging of waste products.

ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973

- a. Any land-disturbing activity performed by the CM or any Principal Trade or Specialty Contractor in connection with the project shall comply with all erosion control measures set

forth in the contract documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).

- b. Upon receipt of notice that a land-disturbing activity is in violation of said act, the CM shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said act are promptly taken.
- c. The CM shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this article.
- d. To the fullest extent permitted by law, the CM shall indemnify and hold harmless the Owner, the designer and the agents, consultants and employees of the Owner and designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article.

ARTICLE 13 - INSPECTION OF THE WORK

- a. It is a condition of this contract that the work shall be subject to inspection during normal working hours by the designer, designated official representatives of the Owner, State Construction Office and those persons required by state law to test special work for official approval. The CM shall therefore provide safe access to the work at all times for such inspections.
- b. All instructions to the CM will be made only by or through the designer or his designated project representative. Observations made by official representatives of the Owner shall be conveyed to the designer for review and coordination prior to issuance to the CM.
- c. The CM shall perform quality control inspections on the work of Principal Trade and Specialty Contractors to guard the Owner against defects and deficiencies in the work and shall coordinate this activity with the on-site duties of the Project Designer. The CM shall advise the Project Designer of any apparent variation and/or deviation from the intent of the Contract Documents and shall take the necessary action to correct such variations and deviations.
- d. All work shall be inspected by designer, special inspector and/or State Construction Office prior to being covered by the contractor. The CM shall give a minimum two weeks notice unless otherwise agreed to by all parties. If inspection fails, after the first re-inspection all costs associated with additional re-inspections shall be borne by the CM.
- e. Where special inspection or testing is required by virtue of any state laws, instructions of the designer, specifications or codes, the CM shall give adequate notice to the Project Designer of the time set for such inspection or test, if the inspection or test will be conducted by a party other than the Project Designer. Such special tests or inspections will be made in the presence of the Project Designer, or his authorized representative, and it shall be the CM's responsibility to serve ample notice of such tests.

- f. All laboratory tests shall be paid by the Owner unless provided otherwise in the contract documents except the CM shall pay for laboratory tests to establish design mix for concrete and for additional tests to prove compliance with contract documents where materials have tested deficient except when the testing laboratory did not follow the appropriate ASTM testing procedures.
- g. Should any work be covered up or concealed prior to inspection and approval by the Project Designer and/or (SCO) such work shall be uncovered or exposed for inspection, if so requested by the Project Designer or SCO in writing. Inspection of the work will be made promptly upon notice from the CM. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition, the work that has been covered or concealed will be paid by the CM.

ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE

- a. On-site representatives of the CM shall manage the work of the Principal Trade and Specialty Contractors and coordinate the work with the activities of the Owner and Project Designer to complete the project with the Owner's objectives of cost, time and quality. Throughout the progress of the work, the CM shall maintain a competent and adequate full-time staff approved by the Owner and Project Designer. It is understood that the designated and approved on-site representative of the CM will remain on the job and in responsible charge as long as those persons remain employed by the CM unless otherwise requested or agreed to by the Owner. The CM shall establish an on-site organization with appropriate lines of authority to act on behalf of the CM. Instructions, directions or notices given to the designated on-site authority shall be as binding as if given to the CM. However, directions, instructions, and notices shall be confirmed in writing.
- b. The CM shall examine and study the drawings and specifications and fully understand the project design, and shall provide constant and efficient supervision to the work. Should he discover any discrepancies of any sort in the drawings or specifications, he shall report them to the designer without delay. He will not be held responsible for discrepancies in the drawings and/or specifications, but shall be held responsible to report them should they become known to him.
- c. The CM shall call and preside over monthly job site progress conferences. All Principal Trade and Specialty Contractors shall be represented at these job progress conferences by both home office and project personnel. The CM shall require attendance from other subcontractors and material suppliers who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the project on schedule and to complete the project within the specified contract time. The CM shall be prepared to assess progress of the work and to recommend remedial measures for correction of progress as may be appropriate. The CM with assistance from the Designer shall be the coordinator of the conferences and shall preside as chairman. The CM shall turn over a copy of his daily reports to the Designer and Owner at the job site progress conference. Owner will determine daily report format.
- d. The CM shall employ an engineer or a land surveyor licensed in the State of North Carolina to lay out the work and to establish a bench mark nearby in a location where same will not be disturbed and where direct instruments sights may be taken.

- e. Prior to bidding, it shall be the responsibility of the CM to prepare an electronic and paper copy of a preliminary critical path method (CPM) schedule and submit such schedule to the Project Designer for his review and comment in sufficient time to allow revisions prior to inserting said schedule into the Principal Trade and Specialty Contractors' bid packages. After contract award but prior to thirty (30) days from the date of the notice to proceed, the CM shall obtain from the Principal Trade and Specialty Contractors their respective work activities and integrate them into a project construction schedule in CPM form. The resulting CPM schedule shall show all salient features of the work required for construction of the project from start to finish within the time allotted by the contract. The time in days between the CM's early completion date and the contractual completion date is project float time and shall be used as such by the CM unless amended by change order. The CM shall submit to the Project Designer an electronic and paper copy of the final CPM schedule after contracts are executed but within fifteen (15) days prior to the written notice to proceed. The Project Designer after reviewing and commenting on the project CPM schedule shall submit it to the Owner for approval. No application for payment will be processed until the project CPM schedule is approved by the Owner. No monthly application for payment will be processed without the submission of an electronic and paper copy of the CPM schedule attached.
- f. The CPM schedule shall be a complete computer generated network analysis showing the complete sequence of construction activities, identifying the work of separate stages and other logically grouped activities, indicating early and late start and early and late finish dates, float duration and a complete logic. Monthly updates will show the estimated completion of each activity.
- g. The CM shall distribute to the principal trade and specialty contractors the approved project CPM schedule and shall display same at the job site.
- h. The CM shall maintain the project CPM schedule, making monthly adjustments, updates, corrections, etc., which are necessary to finish the project within the time allotted by the contract. In doing so, the CM shall keep the designer as well as all Principal Trade and Specialty Contractors fully informed as to all changes and updates to the schedule. The CM shall submit to the Project Designer a monthly report of the status of all work activities. The monthly status report shall show the actual work completed to date in comparison with the original amount of work scheduled. If the work is behind schedule, the CM must indicate in writing what measures are being taken to bring the work back on schedule and ensure that the contract completion date is not exceeded. If the work is greater than thirty (30) days behind schedule and no legitimate requests for time extensions are in process, then the CM shall prepare and submit to the Project Designer a recovery schedule for review and approval. Failure of the CM to abide by the directives in this paragraph will give the Owner cause to exercise the remedies set forth in Article 29 of the General Conditions and pursue any other legal remedies allowed it by law.

ARTICLE 15 – {NOT USED}

ARTICLE 16 - PRINCIPAL TRADE AND SPECIALTY CONTRACTS AND CONTRACTORS

- a. Principal Trade and Specialty Contractors shall be pre-qualified by the CM. The prequalification criteria shall be determined by the Owner and CM to address quality, performance, the time specified in the bids for performance of the contract, the cost of construction oversight, time for completion, capacity to perform, and any other factors deemed appropriate by the Owner and/or CM. Basic qualification information from Principal Trade and Specialty Contractors shall be requested on the standard State of North Carolina

Prequalification Form approved by the State Building Commission. Only pre-qualified contractors are allowed to bid to and contract with the CM on a project.

- b. All bids for Principal Trade and Specialty Contracts shall be publically advertised and shall be opened publically in a public venue, and once opened, shall be public records under N.C.G.S. 132. The CM shall award the contract to the lowest responsible, responsive bidder, taking into consideration quality, performance, the time specified in the bids for performance of the contract, the time for completion, compliance with N.C.G.S. 143-128.2, and other factors deemed appropriate by the Owner and advertised as part of the bid solicitation. When contracts are awarded pursuant to this section, the Owner shall provide for a dispute resolution procedure as provided by N.C.G.S. 143-128(f1). Once Principal Trade and Specialty Contractors are in place, the CM shall provide copies of the contracts to the Project Designer and also provide a list of equipment and material suppliers.
- c. A CM may perform a portion of the work only if (a) bidding produces no responsible, responsive bidder for that portion of the work, or (b) the lowest responsible, responsive bidder will not execute a contract for the bid portion of the work, or the Principal Trade or Specialty Contractor defaults and a prequalified replacement cannot be obtained in a timely manner, and (c) the Owner approves performance of the work by the CM.
- d. The Designer will furnish to any Principal Trade or Specialty Contractor, upon request, evidence regarding amounts of money paid to the CM on account of the work of the Principal Trade or Specialty Contractor.
- e. The CM is and remains fully responsible for his own acts or omissions as well as those of any Principal Trade or Specialty Contractor or of any employee of either. The CM agrees that no contractual relationship exists between the Principal Trade and Specialty Contractors and the Owner in regard to the contract, and that the Principal Trade and Specialty Contractors act on this work as an agent or employee of the CM.

ARTICLE 17 - CONSTRUCTION MANAGER AND SUBCONTRACTOR RELATIONSHIPS

The CM agrees that the terms of these contract documents shall apply equally to each Principal Trade and Specialty Contractor as to the CM, and the CM agrees to take such action as may be necessary to bind each Principal Trade and Specialty Contractor to these terms. The CM further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to CM-subcontractor relationships, and that payments to Principal Trade and Specialty Contractors shall be made in accordance with the provisions of N.C.G.S. 143-134.1 titled "Interest on final payments due to prime contractors: payments to subcontractors".

- a. On all public construction contracts which are let by a board or governing body of the state government or any political subdivision thereof, except contracts let by the Department of Transportation pursuant to N.C. G.S. 136-28.1, the balance due the CM shall be paid in full within 45 days after respective prime contracts of the project have been accepted by the Owner, certified by the architect, engineer or designer to be completed in accordance with terms of the plans and specifications, or occupied by the Owner and used for the purpose for which the project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting engineer in charge of the project determines that delay in completion of the project in accordance with terms of the plans and specifications is the fault of the CM, the project may be occupied and used for the purposes for which it was constructed without payment of any interest on amounts withheld past the 45 day limit. Should final

payment to the CM beyond the date such contracts have been certified to be completed by the Project Designer, accepted by the Owner, or occupied by the Owner and used for the purposes for which the project was constructed, be delayed by more than 45 days, said CM shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due the CM during construction shall be paid in accordance with the payment provisions of the contract documents or said CM shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the contract. Funds for payment of such interest on state-owned projects shall be obtained from the current budget of the owning department, institution or agency. Where a conditional acceptance of a contract exists, and where the Owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

- b. Within seven days of receipt by the CM of each periodic or final payment, the CM shall pay the Principal Trade and Specialty Contractors based on work completed or service provided under their contract with the CM. Should any periodic or final payment to a Principal Trade or Specialty Contractor be delayed by more than seven days after receipt of periodic or final payment by the CM, the CM shall pay the Principal Trade or Specialty Contractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.
- c. The percentage of retainage on payments made by the CM to the Principal Trade and Specialty Contractors shall not exceed the percentage of retainage on payments made by the Owner to the CM. Any percentage of retainage on payments made by the CM to the Principal Trade or Specialty Contractors that exceeds the percentage of retainage on payments made by the Owner to the CM shall be subject to interest to be paid by the CM to the Principal Trade or Specialty Contractor at the rate of one percent (1%) per month or fraction thereof.
- d. Nothing in this section shall prevent the CM at the time of application and certification to the Owner from withholding application and certification to the Owner for payment to a Principal Trade or Specialty Contractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of the Principal Trade or Specialty Contractor to make timely payments for labor, equipment and materials; damage to CM or another subcontractor; reasonable evidence that a Principal Trade or Specialty Contract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by Owner.

ARTICLE 18 - DESIGNER'S STATUS

- a. The Project Designer shall provide liaison and necessary inspection of the work to ensure compliance with plans and specifications. He is the agent of the Owner only for the purpose of constructing this work and to the extent stipulated in the contract documents. He has authority to stop work or to order work removed, or to order corrections of faulty work where such action may be necessary to assure successful completion of the work.
- b. The Project Designer is the impartial interpreter of the contract documents, and, as such, he shall exercise his powers under the contract to enforce faithful performance by both the Owner and the CM, taking sides with neither.

- c. Should the Project Designer cease to be employed on the work for any reason whatsoever, then the Owner shall employ a competent replacement who shall assume the status of the former Project Designer.
- d. The Project Designer will make periodic inspections of the project at intervals appropriate to the stage of construction. He will inspect the progress, the quality and the quantity of the work.
- e. The Project Designer and the Owner shall have access to the work whenever it is in preparation and progress during normal working hours. The CM shall provide facilities for such access so the Designer may perform his functions under the contract documents.
- f. Based on the Project Designer's inspections and evaluations of the project, the Project Designer shall issue interpretations, directives and decisions as may be necessary to assist the CM in the administration of the project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the contract. The CM's decisions, however, relating to means and methods, and administration of the contracts the CM holds are final.

ARTICLE 19 - CHANGES IN THE WORK

- a. The Owner may have changes made in the work covered by the contract. These changes will not invalidate and will not relieve or release the CM from any guarantee given by him pertinent to the contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the surety or sureties of said bond. All extra work shall be executed under conditions of the original contract.
- b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of approved change order or written field order from the designer, countersigned by the owner and the state construction office authorizing such change. No claim for adjustments of the contract price shall be valid unless this procedure is followed.

A field order, transmitted by fax or hand-delivered, may be used where the change involved impacts the critical path of the work. A formal change order shall be issued as expeditiously as possible.

The CM may be requested to make a change to the work by the Project Designer and Owner where such work is to be funded by the CM Contingency or Project Reserve that is part of the GMP contract. Such a change must be documented in the same manner as a Change Order and must be authorized in writing by the Project Designer and Owner by a Field Change document.

In the event of emergency endangering life or property, the CM may be directed to proceed on a time and material basis whereupon the CM shall proceed and keep accurately on such form as may be required, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the work the change order will be prepared as outlined under either Method "c(1)" or Method "c(2)" or both.

- c. In determining the values of changes, either additive or deductive, the CM and Principal Trade and Specialty Contractors are restricted to the use of the following methods:
 - 1. Where the extra work involved is covered by unit prices quoted in the proposal, the value of the change shall be computed by application of unit prices based on quantities,

estimated or actual as agreed of the items involved, except in such cases where a quantity exceeds the estimated quantity allowance in the contract by one hundred percent (100%) or more. In such cases, either party may elect to proceed under subparagraph c2 herein. If neither party elects to proceed under c2, then unit prices shall apply.

2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the change order, and the change order shall stipulate the corresponding lump sum adjustment to the contract price.
- d. Under Paragraph "b" and Methods "c(2)" above, the allowances for overhead and profit combined for a Principal Trade or Specialty Contractor and all multi-tier subcontractors shall not exceed fifteen percent (15%) of **net cost** of the work. No allowance for overhead and profit will be allowed for the CM until the change orders aggregate to a sum in excess of five percent (5%) of the Cost of the Work portion of the GMP. Once this threshold is met the CM may add an overhead & profit allowance not to exceed four percent (4%) of the net cost of the change order. Change orders to the GMP which authorize additional phases of a project without a change in scope of the originally intended project will not be considered in establishing the threshold for additional CM overhead & profit. Under Method "c (1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.
- e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:
 1. The actual costs of materials and supplies incorporated or consumed as part of the project;
 2. The actual costs of labor expended on the project site;
 3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker's compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;
 4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the project;
 5. The actual costs of premiums for bonds, insurance, permit fees and sales or use taxes related to the project.

Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the Owner.
- f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods.

All change orders shall be supported by a breakdown showing method of arriving at net cost as defined above.

- g. In all change orders, the procedure will be for the Project Designer to request proposals for the change order work in writing. The CM will require the Principal Trade and Specialty Contractors to provide such proposals and supporting data in suitable format and will review and approve such change orders prior to submission to the designer. The Project Designer shall verify correctness. Within fourteen (14) days after receipt of the CM's proposal, the Project Designer shall prepare the change order and forward to the CM for his signature or otherwise respond, in writing, to the CM's proposal. Within seven (7) days after receipt of the change order executed by the CM, the Project Designer shall, certify the change order by his signature, and forward the change order and all supporting data to the Owner for the Owner's signature. The Owner shall execute the change order and forward to the State Construction Office for final approval, within seven (7) days of receipt. The State Construction Office shall act on the change order within seven (7) days. Upon approval by the State Construction Office, one copy remains with the State Construction Office, and the remaining copies are sent to the Project Designer for distribution to the Owner(s), CM and the surety. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or field orders approved by all parties, then shall be substantiated in writing as outlined under normal procedure.
- h. At the time of signing a change order, the CM shall be required to certify as follows:

"I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety."
- i. A change order, when issued, shall be full compensation, or credit, for the work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the project as a result of the change in the work.
- j. If, during the progress of the work, the Owner requests a change order and the CM's terms are unacceptable, the Owner, with the approval of the State Construction Office, may require the CM to perform such work on a time and material basis in accordance with paragraph "b" above. Without prejudice, nothing in this paragraph shall preclude the Owner from performing or to have performed that portion of the work requested in the change order.

ARTICLE 20 - CLAIMS FOR EXTRA COST

- a. Should the CM consider that as a result of any instructions given in any form by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days without delay. The written notice shall clearly state that a claim for extra cost is being made and shall provide a detailed justification for the extra cost. The CM shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation will be considered unless the claim is so made. The Designer shall render a written decision within seven (7) days of receipt of claim.
- b. The CM shall not act on instructions received by him from persons other than the Project Designer, and any claims for extra compensation or extension of time on account of such instruction will not be honored. The Project Designer will not be responsible for misunderstandings claimed by the CM of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the

contract documents unless such instruction is confirmed in writing and supported by a properly authorized change order.

- c. Should a claim for extra compensation that complies with the requirements of (a) above by the CM be denied by the Project Designer or Owner, and cannot be resolved by a representative of the State Construction Office, the CM may request a mediation in connection with N.C.G.S. 143-128(f1) in the dispute resolution rules adopted by the State Building Commission (1 N.C.A.C. 30H .0101 through .1001). If the CM is unable to resolve its claims as a result of mediation, then the CM may pursue his claim in accordance with the provisions of N.C.G.S. 143-135.3, or G.S. 143-135.6 where Community Colleges are the owner, and the following:
 1. A CM who has not completed a contract with a state agency or institution for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the Director of the State Construction Office of the Department of Administration for the amount the CM claims is due. The Director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under N.C.G.S. Chapter 150B.
 2. (a) A CM who has completed a contract with a State agency or institution for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the Director of the State Construction Office of the Department of Administration for the amount the CM claims is due. The claim shall be submitted within sixty (60) days after the CM receives a final statement of the board's disposition of his claim and shall state the factual basis for the claim.
 - (b) The Director shall investigate a submitted claim within ninety (90) days of receiving the claim, or within any longer time period upon which the Director and the CM agree. The CM may appear before the Director, either in person or through counsel, to present facts and arguments in support of his claim. The Director may allow, deny or compromise the claim, in whole or in part. The Director shall give the CM a written statement of the Director's decision on the CM's claim.
 - (c) A CM who is dissatisfied with the Director's decision on a claim submitted under this subsection may commence a contested case on the claim under Chapter 150B of the General Statutes. The contested case shall be commenced within sixty (60) days of receiving the Director's written statement of the decision.
 - (d) As to any portion of a claim that is denied by the Director, the CM may, in lieu of the procedures set forth in the preceding subsection of this section, within six (6) months of receipt of the Director's final decision, institute a civil action for the sum he claims to be entitled to under the contract by filing a verified complaint and the issuance of a summons in the Superior Court of Wake County or in the superior court of any county where the work under the contract was performed. The procedure shall be the same as in all civil actions except that all issues shall be tried by the judge, without a jury.

ARTICLE 21 - MINOR CHANGES IN THE WORK

The Project Designer will have the authority to order minor changes in the work not involving an adjustment in the contract sum or time for completion, and not inconsistent with the intent of the contract documents. Such changes shall be effected by written order, copied to the State Construction Office, and shall be binding on the Owner and the CM.

ARTICLE 22 - UNCORRECTED FAULTY WORK

Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the Owner and the Project Designer, the Owner shall be reimbursed by the CM. A change order will be issued to reflect a reduction in the contract sum.

ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME

- a. The final completion date will be as determined by the Owner, Designer and CM during the pre-construction phase of the project and will be incorporated into the contract for construction services between the Owner and the CM.
- b. The CM shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed from the Project Designer and shall fully complete all work hereunder within the time of completion specified. For each day in excess of the above number of days, the CM shall pay the Owner the sum stated as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of the CM to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof. Should the work be delayed by both the owner and contractor, liquidated damages shall be apportioned to reflect the delays of each party. In the case of concurrent delays, contractor caused delays shall be accounted for before owner and designer caused delays.
- c. If the CM is delayed at any time in the progress of his work by any act or negligence of the Owner or the Project Designer, or by any employee of either; by changes ordered in the work; by labor disputes at the project site; by abnormal weather conditions not reasonably anticipated for the locality where the work is performed; by unavoidable casualties; by any causes beyond the contractor's control; or by any other causes which the designer and Owner determine may justify the delay, then the contract time may be extended by change order for the time which the designer and Owner may determine is reasonable.

Time extensions will not be granted for rain, wind, snow or other natural phenomena of normal intensity for the locality where work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climatic range during the same time interval based on the National Oceanic and Atmospheric Administration National Weather Service statistics for the locality where work is performed and on daily weather logs kept on the job site by the CM reflecting the effect of the weather on progress of the work and initialed by the designer's representative. No weather delays shall be considered after the building is dried in unless work claimed to be delayed is on the critical path of the baseline schedule or approved updated schedule. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents. Contractor caused delays shall be accounted for before owner or designer caused delays in the case of concurrent delays.

- d. Request for extension of time shall be made in writing to the designer, copies to the owner and SCO, within twenty (20) days following cause of delay. In case of continuing cause for delay, the CM shall notify the designer copies to the owner and SCO, of the delay within twenty (20) days of the beginning of the delay and only one claim is necessary.
- e. The CM shall notify his surety in writing of extension of time granted.
- f. No claim shall be allowed on account of failure of the Project Designer to furnish drawings or instructions until twenty (20) days after demand for such drawings and/or instructions. See Article 5c. Demand must be in written form clearly stating the potential for delay unless the drawings or instructions are provided. Any delay granted will begin after the twenty (20) day demand period is concluded.

ARTICLE 24 - PARTIAL UTILIZATION/BENEFICIAL OCCUPANCY

- a. The Owner may desire to occupy or utilize all or a portion of the project when the work is substantially complete.
- b. Should the owner request a utilization of a building or portion thereof, the designer shall perform a designer final inspection of area after being notified by the contractor that the area is ready for such. After the contractor has completed designer final inspection punch list and the designer has verified, then the designer shall schedule a beneficial occupancy inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office. If beneficial occupancy is granted by the State Construction Office, in such areas the following will be established:
 - 1. The beginning of guarantees and warranties period for the equipment necessary to support. in the area.
 - 2. The owner assumes all responsibilities for utility costs for entire building.
 - 3. Contractor will obtain consent of surety.
 - 4. Contractor will obtain endorsement from insurance company permitting beneficial occupancy.
- c. The Owner shall have the right to exclude the CM from any part of the project which the Project Designer has so certified to be substantially complete, but the Owner will allow the CM reasonable access to complete or correct work to bring it into compliance with the contract.
- d. Occupancy by the Owner under this article will in no way relieve the CM from his contractual requirement to complete the project within the specified time. The contractor will not be relieved of liquidated damages because of beneficial occupancy. The designer may prorate liquidated damages based on the percentage of project occupied.

ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT

- a. Upon notification from the CM that the project is complete and ready for inspection, the Project Designer shall make a designer final inspection to verify that the project is complete and ready for SCO final inspection. Prior to SCO final inspection, the CM shall ensure that all items requiring corrective measures noted at the designer final inspection are complete.

The Project Designer shall schedule an SCO final inspection at a time and date acceptable to the Owner, the CM and the State Construction Office.

- b. At the SCO final inspection, the designer and his consultants shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the contract documents. At the conclusion of the SCO final inspection, the designer and State Construction Office representative shall make the following determinations:
 - 1. That the project is completed and accepted.
 - 2. That the project is accepted subject to the correction of the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of SCO final inspection or the Owner may invoke Article 28, Owner's Right to Do Work.
 - 3. That the project is not complete and another date for a final inspection will be established.
- c. Within fourteen (14) days of acceptance per Paragraph c1 or within fourteen (14) days after completion of punch list per Paragraph c2 above, the Project Designer shall certify the work and issue applicable certificate(s) of compliance.
- d. Any discrepancies listed or discovered after the date of SCO final inspection and acceptance under Paragraphs c1 or c2 above shall be handled in accordance with Article 42.
- e. The date of acceptance will establish the following:
 - 1. The beginning of guarantees and warranties period.
 - 2. The date on which the CM's insurance coverage for public liability, property damage and builder's risk may be terminated.
 - 3. That no liquidated damages (if applicable) shall be assessed after this date.
 - 4. The termination date of utility cost to the CM (if applicable).
- f. **Prior to issuance of final acceptance date, the contractor shall have his authorized representatives visit the project and give full instructions to the designated personnel regarding operating, maintenance, care, and adjustment of all equipment and special construction elements. In addition, the contractor shall provide to the owner a complete instructional video (media format acceptable to the owner) on the operation, maintenance, care and adjustment of all equipment and special construction elements.**

ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT

- a. Any work, materials, fabricated items or other parts of the work which have been condemned or declared not in accordance with the contract by the designer shall be promptly removed from the work site by the CM, and shall be immediately replaced by new work in accordance with the contract at no additional cost to the Owner. Work or property of the Owner, damaged or destroyed by virtue of such faulty work, shall be made good at the expense of the CM.
- b. Correction of condemned work described above shall commence within twenty-four (24) hours after receipt of notice from the Project Designer, and shall make satisfactory progress until completed.

- c. Should the CM fail to proceed with the required corrections, then the Owner may complete the work in accordance with the provisions of Article 28.

ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT

See Article 35, Performance Bond and Payment Bond, and Article 42, Guarantee. Neither the final certificate, final payment, occupancy of the premises by the Owner, nor any provision of the contract, nor any other act or instrument of the Owner, nor the Project Designer, shall relieve the CM from responsibility for negligence, or faulty material or workmanship, or failure to comply with the drawings and specifications. The CM shall correct or make good any defects due thereto and repair any damage resulting therefrom, which may appear during the guarantee period following final acceptance of the work except as stated otherwise under Article 42, Guarantee. The Owner will report any defects as they may appear to the CM and establish a time limit for completion of corrections by the CM. The Owner will be the judge as to the responsibility for correction of defects.

ARTICLE 28 - OWNER'S RIGHT TO DO WORK

If, during the progress of the work or during the period of guarantee, the CM fails to prosecute the work properly or to perform any provision of the contract, the Owner, after seven (7) days written notice sent by certified mail, return receipt requested, to the CM from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the CM, such action and cost of same having been first approved by the Project Designer. Should the cost of such action of the Owner exceed the amount due or to become due the CM, then the CM or his surety, or both, shall be liable for and shall pay to the Owner the amount of said excess.

ARTICLE 29 - ANNULMENT OF CONTRACT

If the CM fails to begin the work under the contract within the time specified or fails to establish a GMP or obtain bids from or enter into contracts with qualified Principal Trade or Specialty Contractors within the GMP, or the progress of the work is not maintained on schedule, or the work is not completed within the time above specified, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said work, or shall perform the work unsuitably or shall discontinue the prosecution of the work, or if the CM shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the work in an acceptable manner, the Owner may give notice in writing, sent by certified mail, return receipt requested, to the CM and his surety of such delay, neglect or default, specifying the same, and if the CM within a period of seven(7) days after such notice shall not proceed in accordance therewith, then the Owner shall, declare this contract in default, and, thereupon, the surety shall promptly take over the work and complete the performance of this contract in the manner and within the time frame specified. In the event the surety shall fail to take over the work to be done under this contract within seven(7) days after being so notified and notify the Owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the Owner shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of said CM, to appropriate or use any or all contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said contract according to the terms and provisions thereof or use such other methods as in his opinion shall be required for the completion of said contract in an acceptable manner. All costs and charges incurred by the Owner, together with the costs of completing the

work under contract, shall be deducted from any monies due or which may become due said CM and surety. In case the expense so incurred by the Owner shall be less than the sum which would have been payable under the contract, if it had been completed by said CM, then the said CM and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the CM and the surety shall be liable and shall pay to the Owner the amount of said excess.

ARTICLE 30 – CONSTRUCTION MANAGER’S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT

- a. Should the work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three months, due to cause beyond the fault or control of the CM, or if the Owner should fail or refuse to make payment on account of a certificate issued by the designer within forty-five (45) days after receipt of same, then the CM, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the Owner and the designer, may suspend operations on the work or terminate the contract.
- b. The Owner shall be liable to the CM for the cost of all materials delivered and work performed on this contract plus ten (10) percent overhead and profit and shall make such payment. The designer shall be the judge as to the correctness of such payment.

ARTICLE 31 - REQUEST FOR PAYMENT

- a. Not later than the fifth day of the month, the CM shall submit to the designer a request for payment for work done during the previous month. The request shall be in the form agreed upon between the CM and the designer, but shall show substantially the value of work done and materials delivered to the site during the period since the last payment, and shall sum up the financial status of the contract with the following information:
 1. Total of contract including change orders.
 2. Value of work completed to date.
 3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the CM's work has been satisfactorily completed on schedule, with approval of the owner and the State Construction Office and written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule.
 4. Less previous payments.
 5. Current amount due.
- b. Prior to submitting the first payment request, the CM shall prepare a schedule showing a breakdown of the contract price into values of the various parts of the GMP contract. The Cost of the Work breakdown will be arranged so as to facilitate payments to the Principal Trade and Specialty Contractors in accordance with Article 17. The combined CM Construction Management Fee, Bonds & Insurance, CM Contingency, and Project Reserve (if any) will be shown on the Schedule of values as separate lines. The values for the CM Contingency and Project Reserve (if any) will move to appropriate lines within the Cost of the Work as those funds are committed and expended. This schedule of values will be submitted to & approved by the designer and Owner within 30 days of the Notice to Proceed.

The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the designer and Owner may require.

- c. Applications for payment shall be in a form agreed upon by the CM, designer and Owner and shall be prepared and supported by such data to substantiate the accuracy of the request as the designer may require.
- d. Subject to other provisions of the contract documents, the amount of each progress payment shall be computed as follows:
 - 1. Take that portion of the GMP properly allocable to completed work as determined by multiplying the percentage completion of each portion Cost of the Work by the share of the GMP allocated to that portion of the work in the schedule of values.
 - 2. Add that portion of the GMP properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the work or if approved in advance by the Owner, suitably stored off site at a location agreed upon in writing.
 - 3. Subtract the aggregate of previous payments made by the Owner.
 - 4. Subtract the amount, in any, by which the CM has been previously overpaid, as evidenced by the Owner's review of the CM's documentation.
 - 5. Subtract amounts, if any, for which the Project Designer has withheld or nullified a certificate of payment.
 - 6. Subtract retainage as per paragraph (h) below.
 - 7. Add the amount due for the CM Construction Management Fee calculated on the basis the percentage completion of the project or on a schedule of payment negotiated with the Owner less fifteen percent (15%) and less previous payments for CM Construction Management Fee.
- e. Payment allocated to Principal Trade and Specialty Contractors shall be subject to five percent (5%) retainage, provided, however that after fifty percent (50%) of the Cost of the Work has been satisfactorily completed on schedule, with the approval of the Owner and the State Construction Office and with written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule. The balance of the CM Construction Management Fee shall be held by the Owner until satisfactory completion and close out of the project. Satisfactory completion and close out of the project means that the Owner and Project Designer are satisfied that the project has been completed in accordance with the plans and specifications and within the GMP, all general conditions of the contract pertaining to close out have been satisfied, and all Principal Trade and Specialty Contractors have satisfactorily completed their respective contracts. No retainage will be held for the cost of Bonds and Insurance
- f. When payment is made on account of stored materials and equipment, such materials must be stored on the owner's property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the owner's title to such materials and equipment. Such payments will be made only for materials that have been customized or fabricated specifically for this project. Raw materials or commodity products including but not limited to piping, conduit, CMU, metal studs and gypsum board may not be submitted. Responsibility for such stored materials and equipment shall remain with the CM regardless

of ownership title. Such stored materials and equipment shall not be removed from the owner's property. Should the space for storage on-site be limited, the CM, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the CM desire to include any such materials or equipment in his application for payment, they must be stored in the name of the owner in an independent, licensed, bonded warehouse approved by the designer, owner and the State Construction Office and located as close to the site as possible. The warehouse selected must be approved by the CM's bonding and insurance companies; the material to be paid for shall be assigned to the owner and shall be inspected by the designer. Upon approval by the designer, owner and SCO of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the CM. Such stored materials and equipment shall not be moved except for transportation to the project site. Under certain conditions, the designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the designer, the owner and the State Construction Office prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the State absolute right to possession of the materials at anytime. Bond, security and insurance protection shall continue to be the responsibility of the CM.

- g. In the event of beneficial occupancy, retainage of funds due the CM may be reduced with the approval of the State Construction Office to an equitable amount to cover the list of items to be completed or corrected. Retainage may not be reduced to less than two and one-half (2 1/2) times the estimated value of the work to be completed or corrected. Reduction of retainage must be with the consent and approval of the CM's bonding company.

ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT

- a. Within five (5) days from receipt of request for payment from the CM, the designer shall issue and forward to the Owner a certificate for payment. This certificate shall indicate the amount requested or as approved by the designer. If the certificate is not approved by the designer, he shall state in writing to the CM and the Owner his reasons for withholding payment.
- b. No certificate issued or payment made shall constitute an acceptance of the work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the Owner except:
 - 1. Claims arising from unsettled liens or claims against the CM.
 - 2. Faulty work or materials appearing after final payment.
 - 3. Failure of the contractor to perform the work in accordance with drawings and specifications, such failure appearing after payment.
 - 4. As conditioned in the performance bond and payment bond.
- c. The making and acceptance of final payment shall constitute a waiver of all claims by the CM except those claims previously made and remaining unsettled (Article 20(c)).
- d. Prior to submitting request for final payment to the designer for approval, the CM shall fully comply with all requirements specified in the "project closeout" section of the specifications. These requirements include but not limited to the following:
 - 1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, As-Built Drawings, Certificates of Inspection or Approval

from agencies having jurisdiction. (The designer must approve the Manuals prior to delivery to the Owner).

2. Transfer of required attic stock material and all keys in an organized manner.
 3. Record of Owner's training.
 4. Resolution of any final inspection discrepancies.
 5. Granting access to Contractor's records, if Owner's internal auditors have made a request for such access pursuant to Article 52.
- e. The CM shall forward to the designer, the final application for payment along with the following documents:
1. List of minority business subcontractors and material suppliers showing breakdown of contracts amounts and total actual payments to subcontractors and material suppliers.
 2. Affidavit of Release of Liens.
 3. Affidavit from CM of payment to material suppliers and subcontractors. (See Article 36).
 4. Consent of Surety to Final Payment.
 5. Certificates of state agencies required by state law.
- f. The designer will not authorize final payment until the work under contract has been certified by Project Designer, certificates of compliance issued, and the CM has complied with the closeout requirements. The designer shall forward the CM's final application for payment to the Owner along with respective certificate(s) of compliance required by law.

ARTICLE 33 - PAYMENTS WITHHELD

- a. The designer with the approval of the State Construction Office may withhold payment for the following reasons:
1. Faulty work not corrected.
 2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.
 3. To provide for sufficient contract balance to cover liquidated damages that will be assessed against the CM.
- b. The Secretary of the Department of Administration may authorize the withholding of payment for the following reasons:
1. Claims filed against the CM or evidence that a claim will be filed.
 2. Evidence that Principal Trade or Specialty Contractors have not been paid.

- c. The Owner may withhold all or a portion of CM's Project Management Fee costs set forth in the approved schedule of values, if CM has failed to comply with: (1) a request to access its records by Owner's internal auditors pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14.j or provide The Owner; (3) a request to provide an electronic copies of Contractor's baseline schedule, updates with all logic used to create the schedules in the original format of the scheduling software; and (4) Contractor's failure to have its Superintendent on the Project full-time.
- d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the CM without cause will make owner liable for payment of interest to the CM in accordance with G.S. 143-134.1. As provided in G.S.143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third-party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS

The work under this contract shall not commence until the CM has verified to the Owner that all required insurance and verifying certificates of insurance have been obtained and approved in writing by the Owner. These certificates shall contain a provision that coverage's afforded under the policies will not be cancelled, reduced in amount or coverage's eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the Owner of such alteration or cancellation.

a. Worker's Compensation and Employer's Liability

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall provide and maintain, during the life of the contract, workmen's compensation insurance, as required by law, as well as employer's liability coverage with minimum limits of \$100,000.

b. Public Liability and Property Damage

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall provide and maintain, during the life of the contract, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

Bodily Injury:	\$500,000 per occurrence
Property Damage:	\$100,000 per occurrence / \$300,000 aggregate

In lieu of limits listed above, a \$500,000 combined single limit shall satisfy both conditions.

Such coverage for completed operations must be maintained for at least two (2) years following final acceptance of the work performed under the contract.

c. Property Insurance (Builder's Risk/Installation Floater)

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall purchase and maintain property insurance during the life of this contract, upon the entire work at the

site to the full insurable value thereof. This insurance shall include the interests of the Owner, the CM, and subcontractors in the work and shall insure against the perils of fire, extended coverage, and vandalism and malicious mischief. If the Owner is damaged by failure of the CM to purchase or maintain such insurance, then the CM shall bear all reasonable costs properly attributable thereto; the CM shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions.

d. Deductible

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the CM and/or the Principal Trade or Specialty Contractor as applicable.

e. Other Insurance

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall obtain such additional insurance as may be required by the Owner or by the General Statutes of North Carolina including motor vehicle insurance, in amounts not less than the statutory limits.

f. Proof of Carriage

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall furnish the Owner with satisfactory proof of carriage of the insurance required before written approval is granted by the Owner.

ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND

- a. The CM shall furnish a performance bond and payment bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount, which shall be in the amount of the GMP for the entire project. Bonds shall be executed in the form bound with the specifications
- b. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

ARTICLE 36 - CONTRACTOR'S AFFIDAVIT

The final payment of retained amount due the CM on account of the contract shall not become due until the CM has furnished to the Owner through the designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted work to Principal Trade and Specialty Contractors in connection with his contract have been satisfied, and that no claims or liens exist against the CM in connection with this contract. In the event that the CM cannot obtain similar affidavits from the Principal Trade and Specialty Contractors to protect the CM and the Owner from possible liens or claims against the subcontractor, the CM shall state in his affidavit that no claims or liens exist against any subcontractor to the best of his (the CM's) knowledge, and if any appear afterward, the CM shall save the Owner harmless.

ARTICLE 37 - ASSIGNMENTS

The CM shall not assign any portion of this contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the CM under the contract may be assigned.

ARTICLE 38 - USE OF PREMISES

- a. The CM shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the designer and shall not exceed those established limits in his operations.
- b. The CM shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.
- c. The CM shall enforce the designer's and owner's instructions regarding signs, advertisements, fires and smoking.
- d. No firearms, any type of alcoholic beverages or drugs (other than those prescribed by a physician) will be permitted at the job site.

ARTICLE 39 - CUTTING, PATCHING AND DIGGING

- a. The CM shall ensure that all cutting, fitting or patching that may be required to make the work come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the drawings and specifications for the completed structure, as the designer may direct.
- b. Any cost brought about by defective or ill-timed work shall be borne by the party responsible therefor.
- c. No Principal Trade or Specialty Contractor shall endanger any work of another such contractor by cutting, digging or other means, nor shall he cut or alter the work of any other such contractor without the consent of the designer and the affected contractor(s).

ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS

- a. The CM shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer, and other utility services, which may be necessary and required for completion of the project. If the Owner specifies that the CM is to pay all utilities, any permanent meters installed shall be listed in the CM's name until his work is fully accepted by the Owner. As stipulated in the Supplementary General Conditions, the Owner may: (1) pay utilities cost directly, (2) require the CM to pay all utilities cost, (3) or reimburse the CM for the actual cost of utilities. The Owner or CM, as applicable, may recover actual costs of metered utilities from the responsible party should delays occur in project completion. Coordination of the work of the utility companies during construction is the sole responsibility of the CM.
- b. If applicable Meters shall be relisted in the Owner's name on the day following completion and acceptance of the CM's work, and the Owner shall pay for services used after that date.
- c. Prior to the operation of permanent systems, the CM will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.
- d. The CM shall ensure that the permanent building systems are in sufficient readiness for furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishes of the building. A building shall be considered enclosed and secured when windows, doorways (exterior, mechanical, and

electrical equipment rooms), and hardware are installed; and other openings have protection, which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the CM and the designer. Use of the equipment in this manner shall in no way affect the warranty requirements of the CM.

- e. The CM shall coordinate the work so that the building's permanent power wiring distribution system shall be in sufficient readiness to provide power as required by the HVAC contractor for temporary climatic control.
- f. The CM shall coordinate the work so that the building's permanent lighting system shall be ready at the time interior painting and finishing begins and shall provide adequate lighting in those areas where interior painting and finishing is being performed.
- g. The CM shall be responsible for his permanently fixed service facilities and systems in use during progress of the work. The following procedures shall be strictly adhered to:
 - 1. Prior to acceptance of work by the State Construction Office, the CM shall coordinate the removal and replacement of any parts of the permanent building systems damaged through use during construction.
 - 2. Temporary filters as recommended by the equipment manufacturer in order to keep the equipment and ductwork clean and free of dust and debris shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the Owner's acceptance of the work.
 - 3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and site work operations are creating dust in excess of what would be considered normal if the building were occupied.
 - 4. It shall be understood that any warranty on equipment presented to the Owner shall extend from the day of final acceptance by the Owner. The cost of warranting the equipment during operation in the finishing stages of construction shall be borne by the contractor whose system is utilized.
 - 5. The CM shall ensure that all lamps are in proper working condition at the time of final project acceptance.
- h. The CM shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.
- i. The CM shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, should the designer so direct.
- j. On multi-story construction projects, the CM shall either provide or ensure that temporary elevators, lifts, or other necessary special equipment is available for the general use of all contractors. The cost for such elevators, lifts or other special equipment and the operation thereof shall either be included in the CM Construction Management Fee or specified as part of the work of a Principal Trade or Specialty Contractor and paid for as a part of the Cost of the Work.

- k. The CM will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the CM's name, and the name of the designer and consultants. Directional signs may be erected on the Owner's property subject to approval of the Owner with respect to size, style and location of such directional signs. Such signs may bear the name of the contractor and a directional symbol. No other signs will be permitted except by permission of the Owner.

ARTICLE 41 - CLEANING UP

- a. The CM shall ensure that the building and surrounding area is reasonably free from rubbish at all times, and shall remove debris from the site on a timely basis or when directed to do so by the designer. The CM shall provide an on-site refuse container(s) for the use of all Principal Trade and Specialty Contractors. The CM shall ensure that each Principal Trade and Specialty Contractor removes their rubbish and debris from the building on a daily basis. The CM shall ensure that the building is broom cleaned as required to minimize dust and dirt accumulation.
- b. The CM shall provide and maintain suitable all-weather access to the building.
- c. Before final inspection and acceptance of the building, the CM shall ensure that all portions of the work are clean, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the Owner, with no cleaning required by the Owner.

ARTICLE 42 - GUARANTEE

- a. The CM shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the work or beneficial occupancy and shall replace such defective materials or workmanship without cost to the Owner.
- b. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The CM shall replace such defective equipment or materials, without cost to the Owner, within the manufacturer's warranty period.
- c. Additionally, the Owner may bring an action for latent defects caused by the negligence of the CM, which is hidden or not readily apparent to the Owner at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.
- d. Guarantees for roof, equipment, materials, and supplies shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

ARTICLE 43 - CODES AND STANDARDS

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina State Building Codes, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

ARTICLE 44 - INDEMNIFICATION

To the fullest extent permitted by law, the CM shall indemnify and hold harmless the Owner, the designer and the agents, consultants and employees of the Owner and designer, from and against all claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance or failure of performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any negligent act or omission of the CM, the CM's subcontractor, or the agents of either the CM or the CM's subcontractor. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this article.

ARTICLE 45 - TAXES

- a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).
- b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).
- c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.
- d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal from Principal Trade and specialty Contractors and contract sum.
- e. Accounting Procedures for Refund of County Sales & Use Tax

Amount of county sales and use tax paid per CM's statements:

CM's performing contracts for state agencies shall ensure that the Principal Trade and Specialty Contractors provide information to allow the CM to give the state agency for whose project the materials, supplies, fixtures and/or equipment was purchased a signed statement containing the information listed in N.C.G.S. 105-164.14(e).

The Department of Revenue has agreed that in lieu of obtaining copies of sales receipts from contractors, an agency may obtain a certified statement from the contractors setting forth the date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered should be listed. The contractor should also be notified that the certified statement may be subject to audit.

In the event the contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.

Such statement must also include the cost of any tangible personal property withdrawn from the contractor's warehouse stock and the amount of county sales or use tax paid thereon by the CM.

Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the building or structure.

ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the Secretary of Labor, are incorporated herein.

ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES

The CM agrees not to discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant is qualified. The CM agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices.

ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)

The State of North Carolina has attempted to address all asbestos-containing materials that are to be disturbed in the project. However, there may be other asbestos-containing materials in the work areas that are not to be disturbed and do not create an exposure hazard. Construction Managers are reminded of the requirements of instructions under General Conditions of the Contract, titled Examination of Conditions. Statute 130A, Article 19, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos Abatement* from the State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

ARTICLE 49 - MINORITY BUSINESS PARTICIPATION

N.C.G.S. 143-128.2 establishes a ten percent (10%) goal for participation by minority businesses in total value of work for each State building project and requires documentation of good faith efforts for meeting that goal. The document, *Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts* including Affidavits and Appendix F are hereby incorporated into and made a part of this contract.

The CM shall identify and define contract packages (the value of which shall total to at least ten percent (10%) of the GMP) that remove barriers to participation commonly experienced by Historically Underutilized Businesses and Minority Business Enterprises as those terms are defined in North Carolina General Statute 143-128.2, hereinafter referred to as Reduced Barrier Packages (RBP). Such contract packages will be submitted to the Owner for review. As an example, RBP's may require no performance or payment bond, or may offer the participation of the CM as a guarantor or surety in the financing of material purchases by the Principal Trade and/or Specialty Contractors, provided that the CM may condition such financing participation upon the

issuance of joint checks or other similar arrangements to allow the CM to verify that timely payments are made to suppliers furnishing credit. The CM may propose other and/or additional provisions for reducing barriers to participation.

The Owner shall require the CM to submit a plan for compliance with N.C.G.S.143-128.2 by approval by the Owner prior to soliciting bids for the Principal Trade and Specialty Contracts. The CM and Principal Trade and Specialty Contractors shall make a good faith effort to recruit and select minority businesses for participation in contracts pursuant to N.C.G.S. 143-128.2.

ARTICLE 50 – CONTRACTOR EVALUATION

The CM's overall work performance on the project shall be fairly evaluated in accordance with the State Building Commission policy and procedures, for determining qualifications to compete for future capital improvement projects for institutions and agencies of the State of North Carolina. In addition to final evaluation, interim evaluation may be prepared during the progress of project. The document, Construction Manager Evaluation Procedures, is hereby incorporated and made a part of this contract. The Owner may request the CM's comments to evaluate the designer.

ARTICLE 51 – GIFTS

Pursuant to N.C. Gen. Stat. § 133-32, it is unlawful for any vendor or contractor (i.e. architect, bidder, contractor, construction manager, design professional, engineer, subcontractor, supplier, vendor, etc.), to make gifts or to give favors to any State employee. This prohibition covers those vendors and contractors who: (1) have a contract with a governmental agency; or (2) have performed under such a contract within the past year; or (3) anticipate bidding on such a contract in the future. For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review G.S. Sec. 133-32.

During the construction of the Project, the Contractor is prohibited from making gifts to any of the Owner's employees, Owner's project representatives (architect, engineers, construction manager and their employees), employees of the State Construction Office and/or any other State employee that may have any involvement, influence, responsibilities, oversight, management and/or duties that pertain to and/or relate to the contract administration, financial administration and/or disposition of claims arising from and/or relating to the Contract and/or Project.

ARTICLE 52 – AUDITING-ACCESS TO PERSONS AND RECORDS

In accordance with N.C. General Statute 147-64.7, the State Auditor shall have access to Contractor's officers, employees, agents and/or other persons in control of and/or responsible for the Contractor's records that relate to this Contracts for purposes of conducting audits under the referenced statute. The Owner's internal auditors shall also have the right to access and copy the Contractor's records relating to the Contract and Project during the term of the Contract and within two years following the completion of the Project/close-out of the Contract to verify accounts, accuracy, information, calculations and/or data affecting and/or relating to Contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost

escalation, pass-through claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from Owner and/or its project representatives.

ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT

The North Carolina False Claims Act (“NCFCA”), N.C Gen. Stat. § 1-605 through 1-618, applies to this Contract. The Contractor should familiarize itself with the entire NCFCA and should seek the assistance of an attorney if it has any questions regarding the NCFCA and its applicability to any requests, demands and/or claims for payment its submits to the State through the contracting state agency, institution, university or community college.

The purpose of the NCFCA “is to deter persons from knowingly causing or assisting in causing the State to pay claims that are false or fraudulent and to provide remedies in the form of treble damages and civil penalties when money is obtained from the State by reason of a false or fraudulent claim.” (Section 1-605(b).) A contractor’s liability under the NCFCA may arise from, but is not limited to: requests for payment, invoices, billing, claims for extra work, requests for change orders, requests for time extensions, claims for delay damages/extended general conditions costs, claims for loss productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, documentation used to support any of the foregoing requests or claims, and/or any other request for payment from the State through the contracting state agency, institution, university or community college. The parts of the NCFCA that are most likely to be enforced with respect to this type of contract are as follows:

- A “claim” is “[a]ny request or demand, whether under a contract or otherwise, for money or property and whether or not the State has title to the money or property that (i) is presented to an officer, employee, or agent of the State or (ii) is made to a contractor ... if the money or property is to be spent or used on the State's behalf or to advance a State program or interest and if the State government: (a) provides or has provided any portion of the money or property that is requested or demanded; or (b) will reimburse such contractor ... for any portion of the money or property which is requested or demanded.” (Section 1-606(2).)
- "Knowing" and "knowingly." – Whenever a person, with respect to information, does any of the following: (a) Has actual knowledge of the information; (b) Acts in deliberate ignorance of the truth or falsity of the information; and/or (c) Acts in reckless disregard of the truth or falsity of the information. (Section 1-606(4).) Proof of specific intent to defraud is not required. (Section 1-606(4).)
- "Material" means having a natural tendency to influence, or be capable of influencing, the payment or receipt of money or property. (Section 1-606(4).)
- Liability. – “Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:] ... (1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or

approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) ...” (Section 1-607(a)(1), (2).)

- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. § 3729, et seq., and any subsequent amendments to that act. (Section 1-616(c).)

Finally, the contracting state agency, institution, university or community college may refer any suspected violation of the NCFCA by the Contractor to the Attorney General’s Office for investigation. Under Section 1-608(a), the Attorney General is responsible for investigating any violation of NCFCA, and may bring a civil action against the Contractor under the NCFCA. The Attorney General’s investigation and any civil action relating thereto are independent and not subject to any dispute resolution provision set forth in this Contract. (See Section 1-608(a).)

ARTICLE 54 – TERMINATION FOR CONVENIENCE

- a. Owner may at any time and for any reason terminate CM’s services and work at Owner's convenience. Upon receipt of such notice, CM shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.
- b. Upon such termination, CM shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by CM as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to CM prior to the date of the termination of this Agreement. CM shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment.

SECTION 007300 – SUPPLEMENTARY GENERAL CONDITIONS (Construction Manager at Risk)

North Carolina Department of Administration's State Construction Office Form OC-15CM, in its entirety, shall constitute the General Conditions of the Contract for Construction (the "General Conditions"). These Supplementary General Conditions of the Contract for Construction ("Supplementary Conditions") are attached to, and made a part of, the Contract Documents and are intended to modify and/or supplement the General Conditions. Capitalized terms used herein but not defined herein shall have the same meanings as in the General Conditions.

ARTICLE 1 – DEFINITIONS

1.1. Subparagraph b.: Revise the first sentence to read as follows:

The owner is the State of North Carolina through North Carolina State University.

1.2. Subparagraph v.: Revise the first sentence to read as follows:

Provide shall mean purchase, deliver, and install, new, clean, and completely operations, fully tested and ready for use.

ARTICLE 23 – TIME OF COMPLETION, DELAYS, EXTENSION OF TIME

1.3. Subparagraph a.: Revise the paragraph to read as follows:

Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Final Acceptance of the entire work not later than 238 calendar days from the date provided on the Notice to Proceed issued by the Designer. Contractor, upon notice of award of contract, shall prepare a construction schedule to complete the project within this time as required by Article 14.

1.4. Subparagraph b.: Revise the second sentence to read as follows:

For each day in excess of the above number of days, the Contractor shall pay the owner, as liquidated damages and not as a penalty, a sum of \$1,000 dollars per day by which the actual date of Final Acceptance exceeds the Contract Time.

ARTICLE 31 – REQUEST FOR PAYMENT

1.5. Subparagraph d.: Revise the paragraph and its subparagraphs to read as follows:

Subject to other provisions of the contract documents, the amount of each progress payment shall be computed as follows:

1. Take that portion of the GMP properly allocable to completed work as determined by multiplying the percentage completion of each portion Cost of the Work by the share of the GMP allocated to that portion of the work in the schedule of values.
2. Add that portion of the GMP properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the work or if approved in advance by the Owner, suitably stored off site at a location agreed upon in writing.
3. Subtract the aggregate of previous payments made by the Owner.

4. Subtract the amount, if any, by which the CM has been previously overpaid, as evidenced by the Owner's review of the CM's documentation.
5. Subtract amounts, if any, for which the Project Designer has withheld or nullified a certificate of payment.
6. Add the amount due for the CM Construction Management Fee calculated on the basis the percentage completion of the project or on a schedule of payment negotiated with the Owner. Method of calculation shall be established prior to the first Payment Application being submitted.
7. Subtract retainage as per paragraph (e) below.

1.6. Subparagraph e: revise the second sentence of the paragraph as follows:

Payment allocated to Principal Trade and Specialty Contractors shall be subject to five percent (5%) retainage, provided, however that after fifty percent (50%) of the Cost of the Work has been satisfactorily completed on schedule, with the approval of the Owner and the State Construction Office and with written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule. Payment allocated to CM Construction Fee shall be subject to five percent (5%) retainage and this retainage shall be held in full by the Owner until satisfactory completion and close out of the project. Satisfactory completion and close out of the project means that the Owner and Project Designer are satisfied that the project has been completed in accordance with the plans and specifications and within the GMP, all general conditions of the contract pertaining to close out have been satisfied, and all Principal Trade and Specialty Contractors have satisfactorily completed their respective contracts. No retainage will be held for the cost of Bonds and Insurance

ARTICLE 38 – USE OF PREMISES

1.7. Subparagraph d.: Add a second sentence to read as follows:

Contractor shall post a sign indicating Firearms are prohibited on the construction site.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Coordination with occupants.
 - 5. Work restrictions.
 - 6. Specification and drawing conventions.
 - 7. Miscellaneous provisions.

- B. Related Requirements:

- 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Wendell H. Murphy Football Center – Kitchen Renovation

- 1. Project Location: 4600 Trinity Rd, Raleigh, North Carolina.

- B. Owner: North Carolina State University (NCSU).

- 1. Owner's Representative: Owner's project representative will be assigned by the NCSU Design and Construction Services Department.

- C. Architect: Corley Redfoot Architects 100 Europa Dr, Chapel Hill, North Carolina 27517.

- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

- 1. Electrical and Plumbing Design: Optima Engineers, 150 Fayetteville Street, STE 520, Raleigh, North Carolina 27601.

2. Structural Design: Bennett & Pless, 5430 Wade Park Boulevard, STE 400, Raleigh, NC27601
3. Food Service,: Foodesign, 220 N Ames St., Suite 101 Matthews, NC 28105

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 1. Base Bid Work: Selective demolition of paving and site amenities. Re-face existing columns and add new vestibules to North and South entry. Add new brick paving, stage and site amenities.
- B. Type of Contract:
 1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used

- facilities without written permission from Owner and approval of authorities having jurisdiction.
- 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Compliance for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with restrictions on construction operations described in the following documents, which are included in this Project Manual.
 - a. "NC State Design and Construction Guidelines: 1100 – NC State's Requirements."
 - b. "NC State Design and Construction Guidelines: 1300 – Contractor Safety Requirements."
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, unless otherwise indicated.
 - 1. Hours for Core Drilling: Coordinate with Owner to determine time that will have minimum impact on owner operations.
 - 2. Hours for Concrete Slab Cutting: Coordinate with Owner to determine time that will have minimum impact on owner operations.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than 14 days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.

- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 011116 – WORK BY OWNER

PART 1 – GENERAL

1.1. SUMMARY

A. Section Includes:

1. Owner Furnished equipment for Contractor Installation (OFCI).
2. Owner Furnished and Owner Installed equipment (OFOI).
3. Owner performed work.

1.2. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3. INSURANCE AND SAFETY

- A. Work performed by Owner and/or Owner's Contractors must abide by the Contractor's insurance and safety requirements. Owner and Contractor shall coordinate logistics and schedule to ensure the safe installation of OFOI work.

PART 2 – PRODUCTS

2.1. OWNER FURNISHED EQUIPMENT FOR CONTRACTOR INSTALLATION

- A. Refer to Kitchen Equipment schedule for owner furnished equipment.
- B. Division 06 – Miscellaneous Carpentry
1. All blocking to support the OFCI equipment listed herein is by the Contractor.

2.2. OWNER FURNISHED AND OWNER INSTALLED EQUIPMENT

- A. Refer to Kitchen Equipment schedule for owner installed equipment.

PART 3 - EXECUTION

3.1. OWNER PERFORMED WORK

- A. Division 01 – General Requirements
1. All existing valves and circuits must be operated by NC State personnel.
- B. Division 27 – Telecommunications
1. Owner to provide telecom devices and make connections.
- C. Division 27 – Audiovisual
1. Owner to provide Audiovisual equipment and make connections.
- D. Division 28 – Security & Access Control
1. Owner to provide Security and Access Control devices and make connections.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

END OF SECTION 011116

SECTION 011400 – WORK RESTRICTIONS

PART 1 – GENERAL

1.1. SUMMARY

A. This Section Includes:

1. Owner's Representative.
2. Employee Screening.
3. Behavior Policy.
4. Working Hours.
5. Use of Premises.
6. Utility Interruptions.
7. Fire Alarm Shutdowns.
8. Hot Work Permits
9. Miscellaneous restrictions.

B. Related Sections include the following:

1. Section 006000 "Project Forms" for the Outage Request Form and Method of Procedure Form to be submitted by the Contractor when requesting Utility Interruptions.
2. Section 015500 "Vehicular Access & Parking" for additional requirements on access and parking.

1.2. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3. OWNER'S REPRESENTATIVE

- A. NC State has designated a Project Manager to act as the Owner's Representative in all matters pertaining to construction contracts. All official contacts, decisions, directions, problem resolution, coordination and other liaison activities required from NC State will be through the Project Manager. This requirement does not modify the responsibilities of the Designer as stated in the General Conditions of the Contract. The Project Manager for this project is listed in the Project Directory.

1.4. EMPLOYEE SCREENING

- A. At any time in NC State's sole discretion, NC State may require Contractor, at NC State's expense at cost without markups, to conduct a background check for any or all of its employees, as well as for the employees of its subcontractors, who will perform any function or activity under this Agreement. NC State may withhold consent for any of Contractor's employees, or any of its subcontractors employees to be placed on a NC State assignment at its sole discretion.

1.5. BEHAVIOR POLICY

- A. All construction personnel shall be respectful of all members of the NC State community.

- B. Any incidents of disrespect, verbal abuse, threatening statements, unwelcome comments, unwelcome interaction or any form of harassment from any construction personnel toward any member of NC State community is strictly prohibited. Any such act shall constitute sufficient cause for NC State to remove any individual permanently from the project and all NC State property.
- C. Any of the Contractor(s) project personnel who ignore or refuse to take action on any requirements of the contract documents or ignore or refuse to take immediate action to correct any endangerment to the health and safety of the public (as solely determined by NC State) shall be permanently removed from the project and NC State property.
- D. If in the sole determination of NC State, it is in the best interest of the project and NC State to have any of the Contractor(s) personnel removed from the project, then the Contractor shall do so upon request by NC State. Such actions taken by NC State shall not constitute grounds for a delay claim. NC State will not be responsible for any delays caused to the project due to any individual being removed from the project by NC State.

1.6. WORKING HOURS

- A. The Contractor may establish a work schedule of his own choosing. There are no restrictions regarding work hours, except as noted herein. The Contractor shall submit to NC State and to the Designer his regular daily work schedule and shall notify NC State in writing one week in advance of any deviations from the schedule.
- B. Contractor shall coordinate weekly with Football Operations to coordinate noisy or disruptive activities, which may require the contractor to modify their schedule of those activities at no additional cost or delay to the project.
- C. NC State reserves the right to limit the Contractor's activities when they conflict with NC State operations at no additional cost or delay to the project. During times in which construction operations conflict with NC State operation, NC State may require the Contractor to cease all construction activities, limit activities to on-site only, modify working hours, make accommodations for access, restrict noise-making activities, or other limitations as determined by NC State. Instances in which construction operations may conflict with NC State operations include, but are not limited to, the following:
 - 1. Study and Examination periods;
 - 2. Graduation;
 - 3. Athletic or Special events;
 - 4. Student move in/move out days.

1.7. USE OF PREMISES

- A. Parking & Staging Areas
 - 1. Parking is extremely limited at NC State. Parking for personal vehicles on campus is not provided by NC State and is the responsibility of the Contractor. Contractors must limit parking of company vehicles and storage of materials to within the limits of the construction site and staging area.
 - 2. The Contractor is required to follow NC State Transportation's Contractor Parking Policies as described online at: <https://transportation.ncsu.edu/construction-parking-information/>

3. Reserved Spaces & Staging Areas must be approved in advance by NC State's Project Manager and NC State Transportation. A current logistics plan must be submitted by the Contractor to NC State in order for any reserved spaces or staging areas to be approved.

B. Traffic Movement & Interruptions

1. The Contractor shall make requests for approval for any street, alley, driveway or any access way to be closed at least fifteen (15) workdays prior to the date for the desired closing.
 - a. The request shall be accompanied by a proposed traffic control plan prepared by the Contractor detailing all signage and detour routes in accordance with MUTCD current revision requirements.
 - b. The plan must be reviewed and approved by Designer and NC State.
2. The Contractor shall close no street, alley, driveway or access-way without prior approval by NC State. Contractor shall only install a blockage after NC State has provided written approval of the proposed blockage.
 - a. All blockages and detours shall be planned, subject to approval by NC State, considering handicapped access.
3. The Contractor shall install warning signs, barricades, and detour information signs to maintain traffic flow as directed by NC State, and in accordance with MUTCD requirements. If required, flagmen provided by the Contractor shall direct traffic around the construction area or detour area.
 - a. At all times, pedestrian and vehicle traffic wayfinding around the construction limits must be maintained in a clean and safe condition.
4. NC State is a handicap accessible campus. All barricades, temporary walkways, excavations, and stockpiled materials shall be placed and/or constructed in such a manner as to accommodate, adequately warn, and protect all members of the campus community, as well as the general public. Contractor shall not block accessible pathways without providing suitable alternative accessible pathways as agreed upon by Designer and NC State. Owner reserves the right to reject or modify Contractor's Site Logistics Plan as necessary to ensure handicap accessibility throughout campus.
5. No excavations shall take place prior to placing proper barricades, lighting, and other devices as shall be required.

1.8. UTILITY INTERRUPTIONS

- A. The Contractor shall ensure all campus utilities and other campus services are maintained throughout the Project, except for scheduled interruptions.
- B. The Contractor shall submit an Outage Request to NC State's Project Manager at least fourteen (14) calendar days in advance for minor outages and thirty (30) calendar days in advance for major outages. While the Outage Request Form provided in Section 006000 "Project Forms" lists shorter durations, the durations listed herein are required so all communication, collaboration, and coordination can occur to ensure a successful Outage.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

1. No utility interruption, regardless of the advance notice given, shall be undertaken without written approval from NC State.
2. All Outage Requests for a utility interruption must include an Outage Request Form and a Method of Procedure (MOP) describing the sequence of operations for the work to be performed by the Contractor during the outage. Incomplete Outage Requests will not be processed.
3. Upon receipt of the Outage Request Form and MOP, NC State will notify the Contractor that the Contractor can schedule a coordination meeting with NC State's Project Manager and appropriate personnel from the NC State Zone Shop or Department, and other interested parties, to discuss the Outage Request and the MOP.
 - a. No outage will be scheduled without a coordination meeting.
4. NC State may determine the utility service cannot be interrupted for the length of time or frequency requested by the Contractor.
5. NC State will determine if an outage is considered major or minor.
6. Examples of major outages include, but are not limited to, outages impacting:
 - a. An entire building;
 - b. An entire floor of a building;
 - c. All or parts of several buildings;
 - d. All or parts of an area;
 - e. Any high voltage outage.
- C. If requested by NC State, utility outages shall be performed after hours and/or at night, or over the weekend, or during holidays. No extra payment will be made for such work. Anticipated off hour outages on the project are as follows:
- D. Certain activities of utility outages must be performed by NC State and cannot be performed by the Contractor. Examples of activities to be performed by NC State include, but are not limited to:
 1. Operating existing electrical switches;
 2. Turning existing water, chilled water, and steam valves;
 3. Placing existing building systems back in operation;
 4. Operating existing fire alarm systems.
- E. While NC State will provide reasonable support to the Project at no cost to the Contractor, when the Contractor requires an additional or extra outage to complete their work because of a shortage of or improper materials, shortage of labor, poor coordination, failure to finish the work during the outage scheduled length of time, the Contractor will pay all expenses incurred for NC State's services for an additional outage(s) via deductive Change Order.
- F. Signs and barricades (if applicable) for utility outage notice shall be written and placed as directed by NC State seven (7) workdays prior to the outage. No outage shall take place until signs and barricades (if applicable) are in place to notify and/or protect the public. Signs and barricades (if applicable) must be maintained throughout the outage.
 1. Signs shall be neat and legible, hand-made signs are not acceptable.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- G. The Contractor shall include in his base bid provisions for temporary utility equipment and services for the duration of the outage(s) required to complete the Project.

1.9. FIRE ALARM SHUTDOWNS

- A. The Contractor shall schedule all fire alarm shutdowns to support the Project with NC State's Project Manager at least five (5) workdays in advance. Fire Alarm shutdowns must be conducted by NC State.
- B. If at any time the fire alarm system is not in operation after normal working hours then the Contractor shall be required to employ a Fire Watch for the unprotected portion of the building, using a Fire Watch company approved by NC State's Fire Marshal.

1.10. HOT WORK PERMITS

- A. When the Contractor is performing work that produces heat, flame, or sparks on or in an existing building or other structure the Contractor is required to obtain a "hot work" permit from NC State Environmental Health and Public Safety, Fire Protection Department. The department's requirements for the hot work program and permit can be found at the web link on the first page of this document. The EH&PS Hot Work Policy (rev. May 1, 2022) is appended to the end of this section.
- B. <https://fls.epsi.ncsu.edu/forms/hot-work-permit-request/>

1.11. MISCELLANEOUS RESTRICTIONS

- A. Controlled Substances: Use of tobacco products and other controlled substances on NC State's campus is not permitted.
 - 1. Exception: Controlled substances as prescribed by a doctor are allowable provided appropriate documentation that does not violate HIPPA requirements is available.
- B. Firearms are prohibited on all university property.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011400

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Sections include the following:
 - 1. Section 012100 "Quantity Allowances" for procedures for using unit prices to adjust quantity allowances.
 - 2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of the Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent entity acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3 of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

A. Unit Price 1:

1. Description: 2'x2' frameless ceiling access panels.
2. Unit of Measurement: per panel

END OF SECTION 012200

SECTION 012200 – ALTERNATES

PART 1 – GENERAL

1.1. SUMMARY

- A. Section includes administrative and procedural requirements for alternates.
- B. Related Sections include the following:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3. DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4. PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 SCHEDULE OF PREFERRED BRAND ALTERNATES

- A. PB-1 Electrified Door Hardware (Specification Section) - **NOT USED**

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

B. PB-2 Mechanical Door Hardware (Specification Section)

1. Base Bid:
2. Preferred Brand Alternate Bid: NCSU Campus Standard Mechanical Door Hardware Components.
 - a. Mortise Locks, Keys and Cylindrical Deadbolts by one of the following: Best, 45H DTA0 OR Schlage 9050/9070/9080
 - b. Manual Door Closers by LCN
 - c. Panic Hardware and Strikes by Von Duprin 98/99 (rim, vertical rod and mortise)
 - d. Fire Rated Exit Devices by one of the following: Von Duprin (rim, vertical rod and mortise)
 - e. Key Blanks 7 pin by one of the following: Schlage OR Best
 - f. Cores, small format interchangeable, 7 pin, by one of the following: Schlage OR Best
 - g. Power Operators by LCN 4630/4640/6440 Compact
 - h. Power Operators by LCN Senior Swing 9542/9531/9553
 - i. ADA Operator Power Supply by Von Duprin PS 902/904 4RL

3.2. SCHEDULE OF ALTERNATES

- A. Alternate #1: **NOT USED**
- B. Alternate #2:
 1. Base Bid: Renovate Kitchen, Dining, and Position Rooms.
 2. Alternate Bid: In addition to the Base Bid scope of work, add Offices in the Player's Lounge.
- C. Alternate#3:
 1. Base Bid: Renovate Kitchen, Dining, and Position Rooms.
 2. Alternate Bid: In addition to the Base Bid scope of work, add Outdoor Freezer on the First Floor.
- D. Alternate#4:
 1. Base Bid: Renovate Kitchen, Dining, and Position Rooms.
 2. Alternate Bid: In addition to the Base Bid scope of work, add kitchen equipment and installation.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012300 "Alternates" for products selected under an alternate.
 - 2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES – CM at Risk Projects

PART 1 – GENERAL

1.1. SUMMARY

A. This section includes:

1. Minor Changes in the Work
2. Owner Initiated Proposal Requests
3. Unit Price Change Orders (General Conditions Article 19 "Method c(1)")
4. Equitable Value Change Orders (General Conditions Article 19 "Method c(2)")
5. Change Order Procedures
6. Field Orders
7. Weather Delays

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 012900 "Payment Procedures" for administrative procedures for submitting and processing payment applications.

1.2. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3. DEFINITIONS

- A. Overhead: Contractors cost to perform the General Conditions of the Contract and all general requirements detailed in Division 01 of the Specifications, including, but not limited to: project management, scheduling, home office expense, engineering and layout, reproduction expenses, shop drawing processing and coordination, supervision, coordination, small tools, all vehicle expenses, temporary facilities, safety provisions, as built drawings, estimating, and general overhead.

- B. Labor Burden: actual costs of labor burden, limited to including the following. Labor Burden shall not exceed thirty percent (30%) of the actual costs of labor.

1. Actual costs of Social Security (FICA) and Medicare/Medicaid taxes;
2. Unemployment insurance;
3. Health, dental, and vision insurance premiums;
4. Paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of thirty (30) days per year;
5. Retirement contributions;
6. Worker's compensation insurance premiums;
7. Costs of general liability insurance when premiums are computed on payroll amounts

C. Weather Delays:

1. Weather Delays can only be logged in accordance with Paragraph 1.11 of this Section for days in which the performance of Work activities on the critical path are impacted in the following manners:

- a. Any day that rain exceeds one tenth of one inch (0.1").
- b. Precipitation that prevents work on the critical path from being performed for more than four (4) hours in a given day;
- c. Project Site conditions, as a result of precipitation (regardless of whether such precipitation occurred on that day or a prior day), such as mud, pooling of water, ice, standing snow, or wet building component surfaces to the extent such site conditions prevent the performance of Work activities on the critical path;
- d. Wind speeds, as measured by a project site gauge, exceeding those permissible to use equipment or to perform certain tasks safely (such as not being able to safely use or operate cranes or other aerial equipment) that prevent the performance of Work on the critical path;
- e. Installation of temporary protection measures and/or dismantling of equipment necessary to prepare the Project Site for extreme weather events, such as named storms and flooding; removal of temporary protections, clean-up, and restoration of Project Site that prevent the performance of critical path activities.

1.4. MINOR CHANGES IN THE WORK

- A. Designer may issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on "Bulletin" form included in Section 006000 "Project Forms."

1.5. OWNER INITIATED PROPOSAL REQUESTS:

- A. Designer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time on "Proposal Request" form included in Section 006000 "Project Forms". If necessary, the description will include supplemental or revised Drawings and Specifications.
 1. Bulletins with "Designers Request for Contractor's Proposal" indicated, issued by Designer are not instructions either to stop work in progress or to execute the proposed change.
- B. Within seven (7) calendar days after receipt of Bulletin, or within a duration mutually agreed upon in writing by Owner, Designer, and Contractor, the Contractor shall submit a written proposal to Owner estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
- C. Owner Initiated Proposal Request Format:
 1. Use "Change Order Request" Form included in Section 006000 "Project Forms" or similar form approved by Designer and Owner as a cover page for the Change Order Request.
 2. Backup to support the Change Order Request conforming to the requirements of Unit Price Change Orders or Equitable Value Change Orders as described herein.
 3. Complete "HUB Change Order Form" included in Section 006000 "Project Forms".
 4. Contractor's Schedule Update Report conforming to the requirements of Section 013216 "Construction Progress Schedule". In the narrative portion of the Schedule Update Report, describe the effect of the changes requested, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 5. Completed "HUB Utilization Form" as included in Section 002126 "Guidelines for Recruitment and Selection of Minority Businesses for Participation in the University of North Carolina Construction Contracts".

6. Surety Certification: In the Change Order Request, Contractor shall include a signed statement that states: "I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this Change Order, and that a copy of the approved Change Order will be mailed upon receipt by me to my surety." Contractor shall only notify Surety of change in contract value after a Change Order has been issued, but shall include the statement in each Change Order Request.

1.6. CONTRACTOR INITIATED PROPOSALS:

- A. If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a Change Order Request to Designer and Owner. Claims must be submitted by the Contractor to NC State and Designer within seven (7) calendar days in accordance with Article 20 of the General Conditions.
 1. Use "Change Order Request" Form included in Section 006000 "Project Forms" or similar form approved by Designer and Owner as a cover page for the Change Order Request.
 2. A written description outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 3. Backup to support the Change Order Request conforming to the requirements of Unit Price Change Orders or Equitable Value Change Orders as described herein.
 4. Complete "HUB Change Order Form" included in Section 006000 "Project Forms".
 5. Contractor's Schedule Update Report conforming to the requirements of Section 013216 "Construction Progress Schedule". In the narrative portion of the Schedule Update Report, describe the effect of the changes requested, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Completed "HUB Utilization Form" as included in Section 002126 "Guidelines for Recruitment and Selection of Minority Businesses for Participation in the University of North Carolina Construction Contracts".
 7. Surety Certification: In the Change Order Request, Contractor shall include a signed statement that states: "I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this Change Order, and that a copy of the approved Change Order will be mailed upon receipt by me to my surety." Contractor shall only notify Surety of change in contract value after a Change Order has been issued, but shall include the statement in each Change Order Request.
 8. If the Contractor is requesting to use Contractor Controlled Contingency to fund the change, include a "CM Contingency Request" Form included in Section 006000 "Project Forms".
 9. If the Contractor is requesting to use Reserve Contingency (also referred to as "Bid Savings") to fund the change, include a "Reserve Contingency Request" Form included in Section 006000 "Project Forms".
 10. If the Contractor is requesting to use Owners Contingency to fund the change, include a "Owners Contingency Request" Form included in Section 006000 "Project Forms".

1.7. UNIT PRICE CHANGE ORDERS - Article 19 of the General Conditions, Method c(1)

- A. Description and estimated quantities of unit prices for the project are specified in Section 012200 "Unit Prices". The value of each unit price is indicated on the Form of Proposal incorporated into the Contract Documents.

- B. Value of the change shall be computed by the application of unit prices based on mutually agreed upon quantities.
 - 1. If the mutually agreed upon quantities exceed the estimated quantity allowance described in Section 012200 "Unit Prices", then either party may elect to proceed with an Equitable Value Change Order in lieu of a Unit Price Change Order. If neither party elects to proceed with an Equitable Value Change Order, then the unit prices shall apply.
 - 2. No Additional markups for Overhead and Profit shall be included in Unit Price Change Orders, as the value of the Unit Prices already includes Contractors Overhead and Profit.
- 1.8. EQUITABLE VALUE CHANGE ORDERS – Article 19 of the General Conditions, Method c(2)
 - A. When the method of determining the value of a change order is considered to be an equitable value for the work instead of being controlled by predetermined unit prices, the Contractor, Designer, and Owner shall negotiate and agree upon the equitable value of the change prior to issuance of the Change Order.
 - B. The change order cost breakdown shall differentiate between work performed by the General Contractor and work performed by Subcontractors.
 - C. The Change Order shall be organized in a manner consistent with the Schedule of Values of the contract, as detailed in Paragraph 1.5.B of Section "012900" Payment Procedures".
 - D. The change order cost breakdown shall include the following items:
 - 1. Labor
 - a. Number of hours worked
 - b. Unburdened Labor Rate for each worker
 - c. Actual cost of Labor Burden (not to exceed 30%)
 - d. Overtime, or extra pay for holidays or weekends, may only be a cost item if approved by Owner.
 - 2. Material
 - a. Quantity
 - b. Unit cost of materials, including supporting invoices from material suppliers for all materials being submitted for
 - c. Sales tax
 - 3. Tools & Equipment
 - a. Quantity
 - b. Unit prices for rental for tools (excluding hand tools), equipment, machinery, fuel (if required) and temporary facilities required for the work, including supporting invoices from tool & equipment suppliers for all tools & equipment being submitted for.
 - c. Equipment already on site for the project, and owned by a contractor on site, can not be billed for in a change order.
 - 4. Bonds, Insurance, & Permitting
 - a. Actual costs of premiums for bonds, insurance, and permit fees.

5. Markups for Overhead & Profit
 - a. All allowance for overhead and profit combined for Construction Manager, prime subcontractors, and all multi-tier subcontractors shall not exceed fifteen percent (15%) of the net cost of the work.
 - b. No allowance for overhead and profit (hereafter referred to as “fee”) will be allowed for the Construction Manager until the Change Orders aggregate to a sum in excess of five percent (5%) of the Cost of the Work portion of the GMP. Once this threshold is met, the Construction Manager may add fee not to exceed four percent (4%) of the net cost of the change order. Change Orders to the GMP which authorize additional phases of a project without a change in scope of the originally intended project will not be considered in establishing the threshold for additional Construction Manager fee. In the case of deductible change orders, the Construction Manager shall include no less than five percent (5%) fee.
6. Net Cost
 - a. The actual costs of materials and supplies incorporated or consumed as part of the project;
 - b. The actual costs of labor expended on the project site;
 - c. Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker’s compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;
 - d. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the project;
 - e. The actual costs of premiums for bonds, insurance, permit fees and sales or use taxes related to the project;
 - f. Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the Owner.
7. Time
 - a. In the event that the Change Order Request includes a change to the project duration, the Change Order Request shall include the revised project duration and revised dates of Substantial Completion and Final Acceptance.
 - b. Not all time extensions are compensatory. Extended General Conditions for the Contractor will only be allowed in specific circumstances as described in Section 007200 “General Conditions” Article 23.
- E. Subcontractors pricing and backup shall conform to the “Change Order Request” Form included in Section 006000 “Project Forms” or similar form approved by Designer and Owner, with the inclusion of the Subcontractors letterhead.
- F. For change orders that delete any part of the work within the change order and/or contain deductive costs, the back up shall show the original material and labor for the deleted work or costs.
- G. If the change order contains both adds and deducts for the same type of work then the material unit and labor unit costs shown on the back up for the deleted work and the added work shall be the same and the net difference shown.

- H. Deductive change orders shall show the proper reduction in OH&P and the bond.
- I. Failure by the Contractor to provide the information requested in this paragraph shall result in rejection of the change order by the designer and a request for re-submittal. Delay in the processing of the change order due to lack of proper submittal by the Contractor in accordance with this paragraph, or due to errors in the change order calculations shall not constitute grounds for a time extension or basis for a claim.

1.9. CHANGE ORDER PROCEDURES

A. Submission of Change Order Request

- 1. The Contractor shall prepare a Change Order Request conforming to the requirements herein for either an Owner Requested Proposal Request or a Contractor Initiated Proposal and submit the Change Order Request to the Designer for review.

B. Review of Change Order Request

- 1. The designer shall review the Change Order Request to verify correctness and determine if the Contractor's proposed costs are equitable.
- 2. If the Designer determines the Change Order Request is correct and agrees to its accuracy, the Designer will forward the Change Order Request to NC State for their review.
- 3. If NC State determines that the cost is equitable then NC State shall notify the Designer of their acceptance.
- 4. If either the Designer or NC State determines the Change Order Request is incorrect, or the cost has not been agreed upon by the designer and NC State then the Designer shall notify the Contractor that the proposal is rejected and the proposal shall be resubmitted.

C. Interscope / Issuance of Change Order

- 1. Once Change Order Requests have been reviewed and approved by the Contractor, Designer and NC State, the Designer shall initiate a Change Order in the State Construction Office (SCO) web-based Interscope program to incorporate the, or multiple, Change Order Request(s) into the Contract Documents. All Change Orders shall be processed for signatures electronically through Interscope. Directions for using Interscope shall be provided at the Preconstruction Conference.

1.10. FIELD ORDER

- A. Designer may issue a Field Order on "Field Order" Form included in Section 006000 "Project Forms".
- B. Field Order instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Field Order contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- C. Contractor shall maintain detailed records on a time and material basis of work required by the Field Order. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.11. WEATHER DELAYS

- A. Based on the Five Year Climatic Average, using the statistics kept by the National Weather Service at Raleigh-Durham International Airport, the Project Schedule accounts for **Zero [0]** of calendar days.
- B. The Contractors Superintendent shall maintain Daily Weather Logs kept at the jobsite showing the effect of the weather on the progress of the critical path work and the critical path schedule, both initialed by the designer's project representative. All contract time extension requests must incorporate these work logs.
- C. The Contractor may only be entitled to an extension of the contract period for the number of rain days that exceed the normal number of rain days for any given month.
- D. For the purpose of determining extent of delay attributable to unusual weather, a determination shall be made by comparing the Five Year Climatic Average attachment of this Section to the Daily Weather Logs prepared by the Contractor.
- E. Time extensions for weather delays do not entitle the Contractor to "extended overhead" recovery and are in all other ways non-compensable.
- F. Not all rain days above the normal number of rain days will warrant a contract time extension. Justification for the request for rain related contract time extensions must also be based on the effect of the rain on critical path work activity in progress during the period of the request and additionally be predicated on the Contractor's diligent prosecution of the work.
 - 1. No additional rain days shall be granted for building projects after the building has been "dried-in" as determined by the designer.
- G. Requests for contract time extensions based on rain days must be received by the designer on or before the 20th day of the month immediately following the month in which the rain occurred. The request must include all required documentation. All parties to this contract agree that the Contractor has no right to claim a contract time extension if the request is not received by the designer in strict accordance with the procedure set forth in this paragraph.
- H. For other types of weather delays, the Contractor is granted one (1) day of contract extension for each day NC State is closed due to weather, however no additional General Conditions will be granted to the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 012600

SECTION 012613 – REQUEST FOR INTERPRETATION (RFI)

PART 1 – GENERAL

1.1. REQUEST(S) FOR INTERPRETATION (RFI)

- A. General: A Request for Interpretation (RFI) is a Contractor initiated, Owner or Designer formatted, written instrument related to the execution of the Work that is addressed to the Designer. The RFI shall be used by the Contractor as the means for it to ask questions related to the Work; subject to the conditions contained within this article.
 - 1. An RFI which fails to conform to the requirements stated herein, (i.e. is incomplete or contains numerous errors) shall be returned to the Contractor for its completion/rectification without benefit of the Designer's response, in addition, no adjustments for Contract Time or Contract Sum shall be granted for an RFI failing to conform to the requirements stated herein.
 - 2. Each RFI shall be submitted with such promptness as to cause no delay in the Contractor's own work and in that of any subcontractor. No adjustments of Contract Time or Contract Sum will be granted because of failure to have an RFI submitted with sufficient time to allow for the orderly processing of a response by the Designer.
- B. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in a prompt manner to avoid delays in Contractor's work or the work of its Subcontractors.
- C. Authorship:
 - 1. Each RFI shall originate solely from the Contractor. An RFI submitted to the Designer by an entity, or individual, other than the Contractor (i.e. a Subcontractor) shall be returned to the Contractor.
- D. Prohibitions: RFIs shall not be used for the following:
 - 1. To solicit consideration by the Designer of a "substitution."
 - 2. To request an adjustment of the Contract time.
 - 3. To request an adjustment of the Contract sum.
 - 4. To solicit comment clarification(s) of any required submittal or shop drawing review that was transmitted by the Designer to the Contractor, unless the comments provided conflict with the Contract Documents.
 - 5. RFIs shall not be used to transfer coordination responsibility from the Contractor to the Owner or the Designer.
- E. Procedure:
 - 1. The Contractor shall submit all RFIs on the form supplied in Section 006000 "Project Forms" or on a form approve by the Designer and Owner.
 - 2. Each blank on the RFI form shall be filled in.
 - 3. Each RFI shall be typewritten and shall be forwarded to the Designer electronically.
 - 4. Each RFI shall address one subject.
 - 5. Each RFI shall contain specific reference to the drawing number(s), detail number(s), schedule type(s), bulletin number(s), specification section(s) and paragraph number(s), or other related document(s) which is (are) pertinent to the Contractor's question. The date of each referenced drawing number, bulletin, specification section or other related document shall be identified. In preparing each RFI verify the applicable dimension(s), field conditions, drawing requirements (small through large

scale details), and/or specification section requirements pertaining thereto. Prior to submission of the RFI coordinate the nature of the inquiry with the requirements of other sections or trades as related thereto and responses to previous RFIs. Where supplementary sketches are required to clarify an inquiry the Contractor shall attach supplementary sketches, at large scale, illustrative of the inquiry. Sketches shall include sufficient detail, materials, dimensions, thicknesses, assembly, attachments, relation to adjoining work, structural grid references, and all other pertinent data and information for the Designer to make an informed response.

- a. The Contractor is encouraged to suggest solution(s) to its inquiries, if applicable. Should the Contractor's solution(s) have an impact on Contract Sum or Contract time it shall be so stated within the RFI.
 6. Each RFI shall be dated and sequentially numbered.
 7. Each RFI shall be reviewed, and signed, by the RFI Manager prior to transmitting to the Designer.
 8. Duration of RFI Response Upon Receipt: Seven (7) calendar days, pending complete information.
 - a. If Contractor requires a response within seven (7) calendar days due to the RFI impacting work on the critical path of the project, Contractor shall make all reasonable efforts to submit the RFI in a timely manner, note on the RFI that the RFI impacts work on the critical path and identify the deadline for a response, and verbally communicate (i.e. in person, or over the phone) with the Designer that the specific RFI needs to be expedited. This exception should only be utilized as necessary to ensure the timely completion of the project. Contractor shall not frequently rely on this exception to ensure timely completion of the project.
 9. RFIs rejected for incomplete information shall not be logged, or shall be logged separately and clearly identified from outstanding RFIs with complete information.
 10. RFIs that contain content on the prohibitions list shall be excluded from RFI logs, and be resubmitted properly or tracked in a manner applicable to the request.
 11. RFIs received by Designer after 1:00 p.m. will be considered as received the following working day.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by RFI Number. Submit RFI Log to Designer and Owner weekly. Use RFI Log Form included in Section 006000 "Project Forms", or similar form approved by Designer and Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 012613

SECTION 012900 – PAYMENT PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Section 006000 "Project Forms" for miscellaneous forms required to be submitted with each Payment Application.
 - 2. Section 002126 "UNC System MB Guidelines & Forms 2024" for HUB forms required to be submitted with Payment Applications.
 - 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 4. Section 013100 "Project Management & Coordination" for administrative procedures for the requirements of the Subcontractor and Vendor list.
 - 5. Section 013216 "Construction Progress Schedule" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule.
 - 6. Section 013233 "Photographic Documentation" for administrative requirements governing preparation and submittal of Construction Photographs.
 - 7. Section 013523 "NCSU Safety Requirements" for administrative requirements governing the preparation and submittal of the Monthly Safety Report.
 - 8. Section 014400 "Quality Requirements" for administrative requirements governing the Schedule of Tests and Inspections.
 - 9. Section 015000 "Temporary Facilities & Controls" for administrative requirements governing the preparation of the Site Logistics Plan, Erosion-and Sedimentation-Control Plan, Fire-Safety Program, Moisture-Protection Plan, Dust-and HVAC Control Plans, and Vibration Control Plan, as required by project scope of work.
 - 10. Section 017419 "Construction Waste Management & Disposal" for administrative requirements governing the preparation of Construction Waste Management Plan to be submitted by Contractor with Initial Application for Payment.
 - 11. Section 017700 "Closeout Procedures" for the administration requirements for Final Acceptance and the Final Payment Checklist.

1.2. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3. DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4. PAYMENTWORKS

- A. N.C. State uses PaymentWorks, a third-party onboarding platform that eliminates the risk of business payments fraud and ensures regulatory compliance by automating the complex payee management process.

- B. Prior to any payment being made from N.C. State to the Contractor, Contractor must complete the PaymentWorks supplier registration process.

1.5. SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Items required to be indicated as separate activities in Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Owner and Designer at earliest possible date but no later than fifteen working days before the date scheduled for submittal of initial Applications for Payment.
 - a. Initial format of Schedule of Values must be approved by the Owner and Designer prior to submission of the initial Application for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. NC State Project Name and location.
 - b. NC State Project Number, Code & Item, and State Construction Office Project Number.
 - c. Designer's name and address.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Schedule of Values Organization:
 - a. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents.
 - b. Provide at least one line item for each Specification Section listed in the Table of Contents, except for Divisions 00 and 01.
 - 1) The following sections shall be used for Contractors Division 00 and 01 costs:
 - i. General Conditions.
 - ii. Cleaning.
 - iii. Temporary Facilities.
 - iv. Builders Risk Insurance.
 - v. Bonding.
 - vi. Insurance Programs separate from Builders Risk.
 - vii. Project Closeout.
 - viii. Fee.

- c. When the work of a Specification Section is to be performed by multiple Subcontractors, at least one line item for each Subcontractor shall be provided.
 - d. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
 - e. Break down principal subcontract amounts into separate labor and materials items.
 - f. Breakdown of subcontractor's schedule of values must be true and accurate.
 - g. For line items associated with the minority business subcontractor or supplier as identified in Contractor's Affidavit C "Portion of the Work to be Performed by HUB Certified/Minority Businesses".
- 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 4. Schedule of Values Updating: Update and resubmit the Schedule of Values no less than seven (7) calendar days before the next Application for Payment when a Change Order(s) results in a change in the Contract Sum for either the Contractor or one of its Subcontractors. Format each change order as described throughout paragraph 1.5.B of this Section. Organize the Schedule of Values so that Change Order(s) are grouped together.

1.6. APPLICATIONS FOR PAYMENT

- A. Each Application for Payment package shall be organized as follows, with each section meeting all the requirements described in subsequent paragraphs herein:
 - 1. Signed cover letter on Contractor's letterhead describing the Payment request including, but not limited to, the NC State Project Number, Code & Item, State Construction Office Project Identification Number, the date of the request, month covered in the application and the number of the application, amount of the request, and a list of included documents.
 - 2. Payment Application Forms.
 - 3. A Consent of Surety Letter that includes the surety's consent to the progress payment and the amount of the payment.
 - 4. Sales Tax Forms, organized by Contractor's summary with Subcontractor backup.
 - 5. Updated Schedule Report, as described in Section 013216, "Construction Progress Schedule".
 - 6. MBE Appendix "E" Form with accurate subcontract amounts and amounts paid.
 - 7. CMR HUB Formal Project Data Report
 - 8. Stored Materials (if applicable), organized by Contractor's summary with Subcontractor backup.
 - 9. Waivers of Mechanic's Lien.
 - 10. Supplemental Information.
- B. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Designer and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- C. Payment Application Transmission & Times: Not later than the fifth day of the month, the Contractor shall electronically submit a signed and notarized copy of each Application for Payment to Designer.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- D. Payment Application Forms: Use AIA Document G702 (Application & Certificate for Payment) and AIA Document G703 (Continuation Sheet) as form for Applications for Payment.
- E. Application Preparation: Complete every entry on the form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Designer will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders issued before the last day of construction period covered by application.
 - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration, if any.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
 - 1. The following requirements apply for Stored Materials:
 - a. Differentiate between items stored on-site and off-site.
 - b. Materials must be customized or fabricated specifically for the project. No raw materials (including, but not limited to piping, conduit, CMU, metal studs and gypsum board, etc.) may be billed as stored materials.
 - c. Contractor is responsible for stored materials and equipment shall remain with the Contractor regardless of ownership title.
 - d. For items stored off-site, the following conditions apply.
 - 1) Material must be stored in an independent, licensed, and bonded warehouse approved by Designer, Owner, State Construction Office, Contractors Insurance Company, and Contractors Surety.
 - 2) Material stored must be clearly identified as NC State property.
 - 3) The warehouse shall be located as close to the project site as possible.
 - 4) Designer must verify that material is stored in compliance with Stored Materials requirements herein.
 - 2. The Stored Materials backup to be included in the Payment Application is as follows:
 - a. Stored Material Summary. Using the standard form provided in Section 006000, provide summary documentation for stored materials indicating the following:
 - 1) Materials previously stored and included in previous Applications for Payment.
 - 2) Work completed for this Application utilizing previously stored materials.
 - 3) Additional materials stored with this application.
 - 4) Total materials remaining stored, including materials with this application.
 - b. Designer's verification of materials.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- c. Provide description of item(s) being stored.
 - d. Location of the warehouse(s) where materials or equipment is stored, and warehouse approval letters from each of: Designer, Owner, State Construction Office, Contractor's Insurance Company, and Contractor's Surety.
 - e. Bill of sale made to Owner stating there will be no additional cost for transportation and delivery of the stored item(s).
 - f. Statement certifying that item, or any part thereof, will not be installed in any construction other than Work under this Contract.
 - g. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials (separate from consent of surety to overall payment application).
 - h. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit notarized waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit a current Subcontracts and Vendor List.
 - 2. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
 - 3. When an application shows completion of an item, submit final or full waivers.
 - 4. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 5. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 6. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- H. Supplemental Information: With each Application for Payment, but as separate files,, submit the following reports, logs, and submittals:
 - 1. Submittals Schedule updated the same day of the application. After 50% complete on the contract duration, include closeout submittals in a separate Closeout Submittal Schedule.
 - 2. Construction Photographs taken within 2 days of the application for payment documenting progress in the areas under construction.
 - 3. Change Order Log showing issued change orders and potential change orders updated the same day of the application.
 - 4. RFI Log updated the same day of the application.
 - 5. Daily Construction Reports for each work day during the application period.
 - 6. Meeting minutes for meetings conducted by the Contractor during the application period.
 - 7. Monthly Safety Report.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors, principal suppliers and fabricators.
 - 2. Products list (preliminary if not final).
 - 3. Schedule of unit prices.
 - 4. List of Contractor's staff assignments and principal consultants.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

5. Copies of permits submitted by Contractor (if any).
 6. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 7. Certificates of insurance and insurance policies.
 8. Performance & payment bonds.
 9. Preconstruction Photographs.
 10. Submittal Schedule
 11. Construction waste management program.
 12. Site logistics & temporary security plans.
 13. Erosion- and Sedimentation Control Plan (if project scope involves site work).
 14. Fire-Safety Program.
 15. Moisture Protection Plan.
 16. Dust and HVAC Control Plan.
 17. Site Specific Safety Plan.
 18. Contractors Site Specific Quality Control Plan.
 19. Noise & Vibration Control Plan
 20. Schedule of Tests & Inspections
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Contractor's Affidavit for Release of Liens.
 2. Contractor's Affidavit of Payment of Debts and Claims.
 3. Consent of Surety for Final Payment.
 4. Certificate of Compliance (Completed by Designer)
 5. Certificate of Completion (Completed by Designer)
 6. Completed Tax Statement and Form.
 7. MBE Appendix "E" Form with accurate subcontract amounts and amounts paid.
 8. Survey of New and Existing Sub-Surface Utilities.
 9. Warranties & Guarantees required by the Contract Documents.
 10. Evidence of completion of Project closeout requirements, including, but not limited to:
 - a. Transmittal of required Project Record Documents to Owner.
 - b. Evidence of completion of demonstration and training.
 - c. Transmittal of Attic Stock.
 - d. Reconciliation of Allowances.
 11. Builders Risk Insurance Cancellation Notice.
 12. Certificates of State Agencies required by State Law.
 13. Certification all keys issued to Contractor have been returned to N.C. State Lock Shop.
 14. Certification of no outstanding utility bills.
 15. Final Completion Construction Photographs.
- 1.7. REVIEW OF APPLICATION FOR PAYMENT
- A. Draft Copy: Submit draft (pencil) copy of the Application for Payment ten days prior to due date for review by Designer.
 - B. Draft Copy Review Meeting: The Owner, Designer and Contractor shall meet prior to payment application due date to review the draft (pencil) copy of the Application for Payment. Questions resulting from this review shall be answered by the Contractor and clarified prior to receipt of the official copy of the Application for Payment.

- C. Upon receipt of the official Application for Payment and other documentation as required by the Designer and Owner, the Designer shall review the documents received to determine if they correspond to the agreements reached during the draft copy review meeting. If necessary, the Contractor shall revise the Application for Payment to correspond to the agreements reached, execute the Certificate for Payment, and forward the executed copies to the Owner.
- D. The Owner and Designer will rely on the accuracy and completeness of the information furnished by the Contractor. Issuance of a Certificate of Payment, and subsequent payment thereof will not be deemed to represent that the Owner or Designer performed audits of the supporting data, and does not waive Owners right to audit the project.

1.8. INSPECTION & AUDIT

- A. Contractor's "records" shall upon reasonable notice be open to inspection and subject to audit and/or reproduction during normal business working hours. An NC State representative or an outside representative engaged by NC State may perform such audits. NC State or its designee may conduct such audits or inspections throughout the term of this contract and for a period of three years after final payment or longer if required by law.
- B. Contractor's records as referred to in this contract shall include any and all information, materials and data of every kind and character, including without limitation the following:
 - 1. Records
 - 2. Books
 - 3. Documents
 - 4. Subscriptions
 - 5. Recordings
 - 6. Agreements
 - 7. Purchase Orders
 - 8. Leases
 - 9. Contracts
 - 10. Commitments
 - 11. Arrangements
 - 12. Notes
 - 13. Daily diaries
 - 14. Superintendent reports
 - 15. Drawings
 - 16. Receipts
 - 17. Vouchers and memoranda, and
 - 18. Any and all other agreements, sources of information and matters that may in NC State's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document.
- C. Such records shall include (hard copy, as well as computer readable data if it can be made available):
 - 1. written policies and procedures;
 - 2. time sheets;
 - 3. payroll registers;
 - 4. payroll records;
 - 5. cancelled payroll checks;
 - 6. subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.);
 - 7. original estimates;
 - 8. estimating work sheets;

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

9. correspondence;
10. change order files (including documentation covering negotiated settlements);
11. back charge logs and supporting documentation;
12. invoices and related payment documentation;
13. general ledger entries detailing cash and trade discounts earned;
14. insurance rebates and dividends; and
15. any other Contractor records which may have a bearing on matters of interest to NC State in connection with the Contractor's dealings with NC State (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of:
 - a. Contractor compliance with contract requirements,
 - b. Compliance with NC State's business ethics policies, and
 - c. Compliance with provisions for pricing change orders, invoices or claims submitted by the Contractor or any of his payees.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.

- f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
 - 1. Identification of related Minor Change in the Work, Field Order, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013119 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for meetings regarding the Project including, but not limited to, the following:
 - 1. General Meeting Requirements
 - 2. Preconstruction Conference
 - 3. Prescheduling Conference
 - 4. Monthly Progress Meeting
 - 5. Weekly Progress Meeting
 - 6. Preinstallation Conferences
 - 7. Pay Application Review Meeting
 - 8. Project Closeout Conference
 - 9. Sustainable Design Coordination Conference
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 013100 "Project Management and Coordination" for preparing and submitting the Subcontractor List.
 - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule and schedule reports
 - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 4. Section 017700 "Closeout Procedures" for coordinating Contract closeout.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 GENERAL MEETING REQUIREMENTS

- A. Schedule and physically conduct meetings at Project site or within a safe meeting space in close proximity to the Project, unless otherwise indicated.
 - 1. Use of virtual meetings is allowable, but at least one representative from each entity invited to the meeting should be in person to facilitate discussion and item resolution.
- B. Requirements herein apply to all meetings, regardless of the meeting organizer.
 - 1. Attendees: Meeting organizer shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
 - a. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Meeting organizer shall prepare the meeting agenda and distribute the agenda to all invited attendees no less than three (3) calendar days prior to the meeting.

3. Minutes: Meeting organizer shall designate a note taker for the meeting. Record significant discussions and agreements achieved. Meeting organizer shall distribute the meeting minutes to all meeting invitees within three (3) calendar days of the meeting.
4. Notification: Inform participants three (3) calendar days prior to meetings not regularly scheduled.

1.4 PRECONSTRUCTION CONFERENCE

- A. Designer shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, State Construction (if applicable) and Contractor, but no later than fifteen (15) calendar days after execution of the Agreement.
 1. Attendees:
 - a. Authorized representatives of Owner
 - b. Owner's Commissioning Authority
 - c. Designer, and their consultants;
 - d. Contractor and its superintendent;
 - e. major subcontractors;
 - f. manufacturers;
 - g. suppliers;
 - h. testing laboratory representatives;
 - i. Other concerned parties shall attend the conference.
 2. Agenda: Use the State Construction Office Preconstruction Conference Agenda included in Section 006000 "Project Forms" as a basis for creating the agenda for the Preconstruction Meeting. Do not change the formatting or contents of items 1 through 12 of the State Construction Office Preconstruction Conference Agenda. Beginning with new note 13, discuss items of significance from the list below that could affect progress, including the following:
 - a. Review Subcontract List;
 - b. Requirements in individual Specification Sections for preconstruction responsibilities;
 - c. Attach a full Construction Schedule Report from the Contractor to the meeting notes;
 - d. Project coordination;
 - e. Site Logistics Plan;
 - f. Contractors Quality Control Plan;
 - g. Erosion & Sedimentation Control Plan;
 - h. Fire Safety Program;
 - i. Moisture-Protection Plan;
 - j. Dust and HVAC Control Plan;
 - k. Phasing;
 - l. Hazardous Material Remediation Plan;
 - m. Critical work sequencing and long-lead items.
 - n. Designation of key personnel and their duties.
 - o. Lines of communication.
 - p. Procedures for processing Requests for Interpretation (RFIs.)
 - q. Procedures for processing Bulletins and Architects Supplemental Instructions (ASI's) and the difference between the two.
 - r. Procedures for processing submittals, including electronic photography requirements and sample submittal review procedures.
 - s. Procedures for processing substitution requests.

- t. Procedures for testing and inspecting.
- u. Distribution of the Contract Documents.
- v. Preparation of Record Documents.
- w. Use of the premises.
- x. Work restrictions.
- y. Working hours.
- z. Owner's occupancy requirements.
- aa. Responsibility for temporary facilities and controls.
- bb. Procedures for disruptions and shutdowns.
- cc. Construction waste management and recycling.
- dd. Office, work, and storage areas.
- ee. Equipment deliveries and priorities.
- ff. First aid.
- gg. Security.
- hh. Progress cleaning.

1.5 SCHEDULING CONFERENCE

- A. Construction Manager shall schedule and conduct a Scheduling Conference prior to mobilization to the site.
- B. Attendees:
 - 1. Contractor's Preconstruction Manager, Project Manager, and Superintendent
 - 2. Contractor's Scheduler or Scheduling Consultant
 - 3. Authorized Representatives of the Owner (Optional)
 - 4. Designer, and their consultants (Optional)
- C. Contractor and all its subcontractors shall include a minimum of five (5) full work days in their base bid to attend the Scheduling Conference.
- D. Agenda:
 - 1. Develop the Project Schedule that conforms to the contract time.
 - 2. Review methods and procedures related to Contractor's Construction Schedule, including, but not limited to, the following:
 - a. Review software limitations and content and format for reports.
 - b. Verify availability of qualified personnel needed to develop and update schedule.
 - c. Discuss constraints, including phasing work stages and interim milestones.
 - d. Review delivery dates for Owner-furnished products
 - e. Review schedule for work of Owner's separate contracts.
 - f. Review submittal requirements and procedures.
 - g. Review time required for review of submittals and resubmittals.
 - h. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - i. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - j. Review and finalize list of construction activities to be included in schedule.
 - k. Review procedures for updating schedule.
- E. At the end of the Prescheduling Conference, the Contractor shall deliver to Owner and Designer a Project Schedule, signed by the Contractor's Project Manager and

Superintendent, and each Project Manager and Superintendent for each of Contractor's Subcontractors, as identified on the Subcontract List.

1. No application for payment will be processed until this schedule is accepted by the Designer and Owner.
2. The signed original copy of the Project Schedule resulting from the Prescheduling Conference shall be displayed at the jobsite.

1.6 MONTHLY PROGRESS MEETING

A. Designer shall conduct progress meetings at monthly intervals.

1. Attendees:
 - a. Designer
 - b. Designer Consultants whose discipline is under active construction or will begin within the next month
 - c. Owner
 - d. State Construction Monitor
 - e. Contractor's Project Manager and Superintendent
 - f. The meeting is open to the following optional attendees: subcontractors, material suppliers, and any others who contribute to the progress of the project.
2. Agenda:
 - a. Use Monthly Meeting Agenda included in Section 006000 "Project Forms" as a basis for the Monthly Meeting. Items should remain on the agenda until all actions associated with the note are complete.
 - b. Review and correct or approve minutes of previous progress meeting.
 - c. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - d. Review Designer's Logs and discuss issues, Information, Instructions, Proposals and Modifications.
 - e. Review any pending change orders or field orders.
 - f. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
3. Reporting:
 - a. Designer shall distribute minutes of the meeting to each party present and to parties who should have been present within three (3) calendar days of the meeting.
 - b. Designer shall upload a copy of the meeting minutes into the State Construction Office InterSCOPE database as Package Documents.

1.7 WEEKLY PROGRESS MEETINGS

- A. Contractor shall conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees:
 - a. Representatives of Owner;
 - b. Owner's Commissioning Authority;
 - c. Designer;
 - d. Contractor's Project Manager and Superintendent;
 - e. Contractor may invite their subcontractors, suppliers, and/or other entities concerned with current progress or involved in planning, coordination, or performance of future activities.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule:
 - 1) Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 2) Review schedule for the upcoming two-week period.
 - 3) Discuss long-term schedule needs as necessary.
 - 4) Review Upcoming Work Summary report, as described in Section 013216 "Construction Progress Schedule".
 - b. Review present and future needs of each entity present, including the following:
 - 1) Safety, hazards and risks.
 - 2) Change Order Requests and Change Orders.
 - 3) Request for Information.
 - 4) Submittals.
 - 5) Designer Inspection Reports.
 - 6) Erosion & Sedimentation Update (if applicable).
 - 7) Review condition of tree protection (if applicable).
 - 8) Progress cleaning and site cleanliness.
 - 9) Changes to Site Logistics or Emergency Action Plan.
 - 10) Sequence of operations.
 - 11) Resolution of BIM component conflicts.
 - 12) Status of upcoming samples and/or mockups, and location for review.
 - 13) Deliveries.
 - 14) Off-site fabrication.
 - 15) Access.
 - 16) Site utilization.
 - 17) Temporary facilities and controls.
 - 18) Atypical work hours.
 - 19) Quality and work standards.

- 20) Pending changes
 - 21) Pending claims and disputes.
 - 22) Documentation of information for payment requests.
 - 23) Testing and inspection requirements.
 - 24) Other business relating to the Work.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.8 PREINSTALLATION CONFERENCES

- A. Conduct all preinstallation conferences at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Contractor, Subcontractor responsible for the work being discussed at the conference, Designer (architect at a minimum, consultant responsible for the design of the work to also be in attendance), NC State's Project Manager, Commission Agent (if required) and other interested and/or impacted parties within NC State.
 - 2. Agenda: Contractor shall prepare the meeting agenda and distribute the agenda to all invited attendees at least three (3) workdays prior to the meeting. Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFI.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.

3. Minutes: Contractor shall record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Contractor shall distribute minutes of the meeting to each party present and to other parties requiring information within three (3) workdays of the meeting.
4. Notification: Conference shall occur no less than ten (10) workdays prior to activity beginning.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

B. The following preinstallation conferences are required by NC State. Additional preinstallation conferences may be specified by the Designer within specific Specification Sections within the Contract Documents.

1. Demolition;
2. Grading, installation of construction fence, underground utility services;
3. Waterproofing, damp-proofing;
4. Face brick installation;
5. Window, Storefront, Curtain wall and other glazing installations;
6. Landscape;
7. Roofing installation;
8. Flooring installation;
9. Structural Concrete;
10. Structural Steel;
11. Casework/Fumehoods;
12. Fire Alarm-Sprinkler System;
13. Card reader/Security, Door Hardware;
14. Audio/Visual;
15. Replacement and New Installation of Transformers, Switches, etc.

1.9 PAYMENT APPLICATION MEETING

A. Contractor shall conduct a payment application meeting at monthly intervals.

1. Meeting shall occur between submission of the pencil copy of the payment application to the Designer on the 25th day of the month and the last day of the month.
2. Attendees:
 - a. Owners Project Manager
 - b. Designer;
 - c. Contractor's Project Manager.
3. Agenda: Review and correct pencil copy of payment application.

1.10 PROJECT CLOSEOUT CONFERENCE

A. Contractor shall schedule and conduct a project closeout conference, at a time convenient to Owner, State Construction, and Designer, but no later than 80% completion of the Contract Duration, or 90 days prior to the scheduled date of Final Acceptance, whichever is earlier.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees:

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- a. Authorized representatives of Owner,
 - b. Owner's Commissioning Authority,
 - c. Designer, and their consultants;
 - d. Contractor and its superintendent;
 - e. Major subcontractors;
 - f. Suppliers;
 - g. Other concerned parties shall attend the meeting.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Review Completion Schedule.
 - b. Review Final Acceptance Checklist, as included in Section 006000 "Project Forms".
 - c. Preparation of record documents.
 - d. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - e. Submittal of written warranties.
 - f. Requirements for preparing operations and maintenance data.
 - g. Requirements for delivery of material samples, attic stock, and spare parts.
 - h. Requirements for demonstration and training.
 - i. Preparation of Contractor's punch list.
 - j. Requirements prior to the preparation of the Designer's punch list.
 - k. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - l. Submittal procedures for closeout documents.
 - m. Owner's partial occupancy requirements.
 - n. Installation of Owner's furniture, fixtures, and equipment.
 - o. Responsibility for removing temporary facilities and controls.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013119

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
 - 5. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.

- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.

- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Special Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 14 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.

5. Acceptance: Indicate completion in advance of date established for Acceptance, and allow time for Architect's administrative procedures necessary for certification of Acceptance.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.
 - k. Startup and placement into final use and operation.
 4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of plumbing installation.
 - e. Completion of electrical installation.
 - f. Acceptance.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Acceptance, and final completion, and the following interim milestones:
1. Work under each Alternate accepted.

- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.
- F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 15 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Field Orders received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Applications for Partial Utilization authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Definitions.
 - 2. Reports.
 - 3. Quality Assurance.
 - 4. Coordination.
 - 5. Work Breakdown Structure Overview (WBS).
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 012900 "Payment Procedures" for submitting the Schedule of Values.
 - 2. Section 013100 "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
 - 3. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 4. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.
 - 5. Section 017700 "Closeout" for administrative requirements about Contractor's Statement of Completion with Request for Designers Inspection, Substantial Completion, and Final Acceptance.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activities are activities on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity is an activity that must be completed before a given activity can be started.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest continuous chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- G. Major Area: A story of construction, a separate building, a separate wing, a major department, or a similar significant construction element.
- H. Milestone: A key or critical point in time for reference or measurement.
- I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity Relationships.
- J. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.
- K. Work Breakdown Structure (WBS): A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project, with each descending level of the WBS representing an increasingly detailed definition of the project work.

1.4 REPORTS

- A. Format for Submittals: Submit required submittals in the following format, unless indicated otherwise:
1. Working electronic copy of schedule file in contractor's scheduling software utilized.
 2. PDF electronic file.
- B. Contractor's Initial Construction Schedule: Initial project construction schedule conforming to the requirements herein, submitted within fifteen (15) calendar days of Notice to Proceed. No Applications for Payment will be processed without an approved Initial Construction Schedule. Once approved, this schedule becomes the "Baseline" schedule.
1. Submit a working electronic copy of schedule, exported to Microsoft Project (.mpp) format (regardless of the software used to generate the schedule), and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. Construction Finish Schedule: At 80 percent project completion (determined by duration not value of work in place), submit a schedule illustrating tasks remaining to complete the project.
- D. Construction Schedule Update Report:
1. Submit, with each Application for Payment, an electronic copy of the Construction Schedule Update Report in .pdf format containing all requirements herein as well as a working electronic copy of the schedule in Microsoft Project (.mpp) format.
 2. Cover Letter: Cover letter shall describe the contents of the report including the following:

- a. Project Name and NC State Project Number,
 - b. SCO Project ID Number,
 - c. Date of Report,
 - d. Contents of the Report,
 - e. Schedule compliance update and status of recovery schedule (if applicable)
 - f. Signed by the Contractor's Project Manager.
3. Signature Page: A signature page (or pages if necessary) must be included in the Update Report, so that in addition to the Contractor's signature representing the accuracy of the updated Schedule, the Project Manager for each Subcontractor (as identified in the Subcontract List submittal) can sign to document their agreement to the updated schedule.
 - a. If a Subcontractor does not agree to the updated schedule, they shall write "Exceptions Taken" in the signature line for their company and submit to Contractor a separate written summary of their exceptions and/or inaccuracies on Subcontractors letterhead. Contractor shall include the Subcontractor's written summary, and responses to the exceptions in the Narrative section of the Schedule Update Report.
4. Narrative: Contractor shall include, separate from the Cover Letter, a Narrative that describes what activity changes happened on the project, including the following:
 - a. Summary of work completed since the last report,
 - b. Missing data,
 - c. Recent and upcoming changes,
 - d. Documented delays,
 - e. Potential delays, and
 - f. Other facts.
5. CPM Activity Report:
 - a. Formatting:
 - 1) Plotted to an 11x17 page with landscape orientation,
 - 2) List of all activities sorted by WBS, activity number, and then early start date, or actual start date if known.
 - 3) Include the Gantt chart in the report, scaled so all information below and the chart fit on one page width.
 - b. Each activity line in the report shall contain the following:
 - 1) Activity number,
 - 2) Activity description,
 - 3) Original duration,
 - 4) Remaining duration,
 - 5) Early start date,
 - 6) Early finish date,
 - 7) Late start date,
 - 8) Late finish date,
 - 9) Predecessor & Successor Activity Numbers, and
 - 10) Total float in working days.
6. Critical Path Report: Using the same format of the CPM Activity Report, generate a report showing only items on the Critical Path of the Project.

7. Total Float Report:
 - a. Format: 8-1/2x11, portrait orientation
 - b. List of all activities sorted by total float, Criticality (Critical: 0 days float, Near Critical: 1 to 10 days of float, and Not Critical: 11+ days of Float), WBS, then activity number.
 - c. Each activity line in the report shall contain the following:
 - 1) Activity number,
 - 2) Activity description,
 - 3) Original duration,
 - 4) Remaining duration,
 - 5) Early start date,
 - 6) Early finish date,
 - 7) Total float in working days.
 8. Change Report, as described in Paragraph 2.2.G. of this Section.
 9. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment in tabular and chart format.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered RFI.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.

F.

1.5 QUALITY ASSURANCE

- A. Contractors Scheduler, or Scheduling Consultant, Qualifications: Contractor shall employ, or contract with, an experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Designer's or Owner's request.
1. Qualification Data: Submit the resume and/or qualifications for Contractors Scheduler or the Contractors scheduling consultant. Owner reserves the right to approve, reject, or change the Contractors Scheduler as necessary to ensure the project stays on schedule without incurring additional costs.
- B. Conduct Prescheduling conference at Project site to comply with requirements in Section 013119 "Project Meetings."

1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from parties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
- C. Coordinate Contractor's construction schedule with Owner's construction schedule for Owner's own forces. Revise Contractor's construction schedule, if necessary, after a joint review and mutual agreement. The construction schedule shall then constitute the schedule to be used by Contractor, separate contractors, and Owner until subsequently revised.

1.7 WORK BREAKDOWN STRUCTURE (WBS) OVERVIEW

- A. All schedules prepared by the contractor shall generally conform to the following Work Breakdown Structure (WBS). Additional details for each WBS are included in subsequent paragraphs in this Section.
 1. Milestones.
 2. Inspections & Outages.
 3. Preconstruction.
 4. Construction.
 5. Closeout.
- B. Milestones
 1. Include, at a minimum, the following milestones in the schedule, within the following structure:
 - a. Contract Dates (if project includes multiple phases, include the following for each phase)
 - 1) Contract Execution
 - 2) Notice to Proceed
 - 3) 15 Days after NTP (due date for various submittals)
 - 4) 30 Days after NTP (due date for various submittals)
 - 5) 80% Duration Complete
 - 6) Final Acceptance
 - b. Coordination Effort
 - 1) MEPFP Coordination Drawings Ready for Review (can be multiple milestones if required by the project)
 - 2) Casework & Fume Hood Submittals & Shop Drawings Ready for Review, if necessary (due within 30 calendar days from Notice to Proceed)
 - c. SCO Monthly Meeting Dates
 - d. Progress Milestones
 - 1) Chilled Water Complete.
 - 2) Footings Complete.
 - 3) Structure Complete.
 - 4) Roof Complete.
 - 5) Envelope Complete / Dry-in.
 - 6) Sitework Complete.
 - 7) Contractor's Statement of Completion with Request for Designer's Inspection

C. Tests, Inspections & Outages

1. Contractor Tests & Inspections:
 - a. Stair & Ramp Survey (if required)
 - b. Moisture Testing for Flooring
 - c. Contractors Pre-Final Punch List
 - d. Testing, Adjusting, and Balancing
 - e. Pre-Functional Testing
2. Designer Tests & Inspections:
 - a. Backflow Preventer Test (if not by Contractor)
 - b. Designer Punch List
 - c. Designer Pre-Electrical Inspection
3. Designer and NC State Tests & Inspections:
 - a. In-wall Inspections
 - b. Above Ceiling Inspections
 - c. Generator Load Test
 - d. Fire Pump Test
 - e. Fire Sprinkler Main Drain Tests
 - f. Pre-Final Inspections
 - g. 100% Test of the fire detection and alarm system
 - h. Third Party materials testing / special inspections / commissioning
 - i. Piping Pressure Testing
 - j. Telecom/Data Wiring Tests & As-Builts
 - k. Final Inspection for Project Acceptance
4. Include, at a minimum, the following tests & inspections, conducted by AHJ
 - a. NFPA, DOI, and DOL Tests
 - b. Beneficial Occupancy
 - c. Final Inspections
5. Include Utility Outages on the schedule, scheduled in accordance with the requirements described in Section 011400 "Work Restrictions".
6. General Requirements
 - a. The Contractor should include a reasonable corrective work period after each inspection so that Contractor has time to work off deficient items identified during each inspection. However, since the duration shown for each corrective work period will be at the Contractor's discretion, and the amount of corrective work needed will be relative to Contractor's quality of work, if the corrective work period takes longer than the time identified on the schedule, it does not alleviate Contractor's requirement to achieve the Contract Milestone dates.

D. Preconstruction

1. Include, at a minimum, the following preconstruction items:
 - a. Procurement & Submittals (General) - repeat for each item with a procurement duration longer than six (6) weeks.

- 1) Prepare Submittal
 - 2) A/E Review Submittal (20 calendar days)
 - 3) Fabricate / Deliver Material
 - b. Procurement & Submittals (Sprinkler)
 - 1) Prepare Submittal
 - 2) A/E Review Submittal (20 calendar days)
 - 3) North Carolina State Construction Office Review (approx. 30 calendar days)
 - 4) Fabricate / Deliver Material
 - c. BIM Coordination
 - d. Safety
 - 1) NCSU Review of Activities (Refer to Paragraph 4.0 of NCSU Safety Manual)
 - 2) NCSU Lift Plan Review (50 calendar days)
 - e. Mockups
- E. Construction
 1. Work by Contractor – Organized at Contractor's discretion, conforming to reasonably accepted construction standards and coordinated with the Schedule of Values.
 2. Work by Owner - coordinate with Section 011116, "Work by Owner"
 3. Acceptance Phase - Include a section that shows an Acceptance Phase showing all activities preparing for Final Acceptance.
 - a. This Acceptance Phase shall include all activities by Contractor, Designer, Owner, and Inspectors required to complete the project. Coordinate activities with Section 017700 "Closeout".
- F. Closeout
 1. Include, at a minimum, the following activities in the closeout section:
 - a. Preparation of O&M's (listed by Division)
 - b. Review & Approval of O&M's (listed by Division)
 - c. Preparation of Warranties
 - d. Review & Approval of Warranties
 - e. Training & Demonstration activities
 - f. Attic Stock Transfer

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Activity Duration: Define Construction Activities so no activity is longer than fourteen (14) working days, unless specifically allowed by Owner and Designer.
 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 30 working days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Include selection process activities for finishes and products specified by allowances or specified to be selected during the sample review process. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 4. Startup and Testing Time: Include not less than 15 days for startup and testing.
 5. Final Acceptance: Indicate completion in advance of date established for Final Acceptance and allow time for Designer's administrative procedures necessary for Final Acceptance.
 6. Punch List and Final Completion: Include not more than 60 days for completion of punch list items and final completion.
 7. Demonstration and Training: Training of Owner's personnel as indicated in Section 017700 "Closeout Procedures."
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected. No constraints, aside from those specifically listed in the Contract Documents, are allowed.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work under More Than One Contract: Include a separate activity for each contract.
 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011116 "Work by Owner". Delivery dates indicated stipulate the earliest possible delivery date.
 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with other construction projects.
 - b. Examination periods.
 - c. Graduation.
 - d. Athletic Events (if applicable to the project).
 - e. Student Move-in & move-out (if applicable to the project).
 - f. Utility Outages.
 - g. Uninterruptible services.
 - h. Use of premises restrictions.
 - i. Provisions for future construction.
 - j. Seasonal variations or limitations.
 - k. Environmental control.
 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.

- e. Fabrication.
- f. Sample testing.
- g. Deliveries.
- h. Installation.
- i. Tests and inspections.
- j. Adjusting.
- k. Curing.
- l. Startup and placement into final use and operation.

7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the milestones listed in Paragraph 1.7.B. of this Section.

D. Plan of Action and Recovery Schedule:

- 1. A Plan of Action and Recovery Schedule shall be prepared by the Contractor when any of the following occur:
 - a. The Contractor's report indicated delays that would prevent the Contractor's ability to complete the project within the Contract Duration.
 - b. The updated construction schedule is thirty (30) days behind schedule.
 - c. The Contractor desires to make changes to the sequence of work that are, in the opinion of the Owner or Design, major in nature.
- 2. The Plan of Action is due from the Contractor within two (2) calendar days of Owners written demand.
- 3. Recovery schedules are due from the Contractor within five (5) calendar days of Owners written demand.

E. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules. Coordinate with Designer regarding which project management software will be used on the Project. Contractor to provide Owner two (2) licensed copies of the scheduling software for the duration of the Project.

- 1. Allowable scheduling software's include Microsoft Project, Primavera P6, or another software approved by the Owner.
- 2. Smartsheets, Google Sheets, Microsoft Excel, or similar products shall not be used to prepare or update the project schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Designer's approval of the schedule.
 2. All activities, except for "Project Start" and "Project Finish", must have at least one predecessor activity and at least one successor activity.
 3. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 4. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 5. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing [and commissioning].
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Principal events of activity.
 - 4. Immediately preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the Schedule of Values).
- G. Schedule Updating: Concurrent with revising the schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
 - 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 - 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 - 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 - 4. Prepare list for ease of comparison with payment requests, coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled monthly progress meeting.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, or as requested by Owner, the Contractor shall update the project schedule to reflect actual construction progress and activities. Issue schedule three (3) calendar days before each regularly scheduled progress meeting.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Actual Completion percentage for each activity.
 4. Notify Owner and Designer a minimum of one week prior to issuance of updated schedule of all anticipated significant revisions to the Construction Schedule.
- B. Distribution: Distribute copies of approved schedule to Designer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post electronic copies of the updated project schedule on the project website.
 2. Post copies in Project meeting rooms and temporary field offices.
 3. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.
 4. Provide Owner electronic copy of updated schedule in Contractor's scheduling software format.

END OF SECTION 013216

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Utility Photographs.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Construction photographs may not be used for Contractor's marketing materials or social media unless approved by Owner.

1.4 INFORMATIONAL SUBMITTALS

- A. Key Plan: Fifteen (15) days after Notice to Proceed, submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos by uploading to web-based project software site and email to Designer & NC State Project Manager. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in web-based project software site:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Designer.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

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SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date, Project area and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer & Quality: Construction photographs shall be taken by a member of the Contractors Supervisory team and shall not be blurry. In the event that drone photography is to be used, Contractor shall engage with, or retain, a qualified drone operator. All drone photography must be approved in advance with N.C. State.
- B. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of excavation or demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner or Designer.
 - 1. Flag excavation or demolition areas before taking construction photographs.
 - 2. Take a reasonably sufficient quantity of photographs to reasonably show existing conditions within and adjacent to project before starting the Work.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
 - 4. Failure to submit preconstruction photographs may result in delayed processing of the initial payment application.
- D. Post-Demolition Photographs: After completion of demolition, but before any new construction activities, take photographs of Project site and surrounding areas.
- E. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- F. Periodic Construction Photographs: Take a reasonably sufficient quantity of photographs coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- G. Final Completion Construction Photographs: Take a reasonably sufficient quantity

of photographs prior to Final Acceptance for submission as Project Record Documents. Owner and Designer will inform photographer of desired vantage points.

1.7 UTILITY PHOTOGRAPHS

- A. In conjunction with survey's required for as-builts, as required by Section 017700 "Closeout Requirements", the following photographs need to be submitted by the Contractor to Owner within two weeks of the backfilling of utilities or completion of the associated construction task. Failure to take appropriate photographs will result in Contractor excavating the work at no addition cost to the Owner so that all photographs can be taken.
- B. The following outline lists the utilities to be located and the data to be collected. Photographs shall be at a minimum resolution of 2200 x 1700. Digital photographs can be submitted in TIFF, JPG, or RAW file formats. File naming shall be all lower case text. File naming shall be as follows: bldg#_ncsu project number_util_photo#.file extention. For example: 135_201300001_util_1.jpg
 - 1. Steam Tunnel and Lines
 - a. Provide digital photographs of the tunnel, piping and expansions areas.
 - 2. Water Lines - (Domestic, Fire Main, Chilled, Hot Water, & Reuse Waterlines)
 - a. Provide digital photographs of bends and valves.
 - 3. Electric and Communication Duct Banks and Direct Buried Conduit
 - a. Provide digital photographs of the tunnel and conduit configuration.
 - 4. Storm and Sanitary Sewer
 - a. Provide digital photographs of structures.
 - 5. Existing Utilities
 - a. Provide digital photographs of any crossings or conflict between new utilities and existing utilities.
 - 6. Deliverables for Surveys
 - a. The subsurface location data and platting shall be continuous throughout the project.
 - b. All data and plats are due to NC State within two-weeks of the backfilling of utilities or completion of the associated construction task.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit within 14 days of date established for commencement of the Work. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will[**not**] be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD 2010.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.

- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals

shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

- j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.
4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
- a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.
 - 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.
 - 10) Category and type of submittal.
 - 11) Submittal purpose and description.
 - 12) Specification Section number and title.
 - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 14) Drawing number and detail references, as appropriate.
 - 15) Indication of full or partial submittal.
 - 16) Transmittal number, numbered consecutively.
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
- 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Action Submittals: Submit Six paper copies of each submittal unless otherwise indicated. Architect will return three copies.
 - 3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 - 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - b. Six paper copies of Product Data unless otherwise indicated. Architect will return three copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
 3. Submit Shop Drawings in the following format:
 - a. Six opaque copies of each submittal. Architect will retain three copies; remainder will be returned.

- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit four sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
 - b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 013523 – NCSU SAFETY REQUIREMENTS

1.0 Purpose

- A. The purpose of this guideline is to define NC State contractor safety requirements. This guideline is intended to be a supplement to the General Conditions of the contract.
- B. The Designer or Construction Manager shall incorporate this document into the Project Manual in its entirety.
- C. Contractors and subcontractors are responsible for the safety of their employees and all persons on and around a work site. Contractors are solely responsible for the development and implementation of their safety programs. This document does not relieve the duty and responsibility of contractors, subcontractors, their agents, employees, and other persons performing portions of the work on a project to comply with federal, state, and/or local laws or regulations that relate to work site safety.

2.0 Scope

- A. This document provides contractors with the University's specific requirements that must be incorporated into the contractor's Site-Specific Safety Plan. This document is not designed or intended to replace the contractor's safety program, nor to address every possible safety, environmental, or health hazard associated with the contractor's work. In the event that the contractor's safety program includes a requirement or practice that is more stringent than set forth herein, the more stringent shall be followed. This document does not relieve the contractor of this obligation to: (1) control the means and methods by which its employees and any subcontractors perform work, and (2) independently ascertain what health and safety practices are necessary for the performance of the work.
- B. No specific requirements herein shall be construed to limit, replace, or supersede applicable provisions of federal, state, or local laws or regulations. [Occupational Safety and Health Administration \(OSHA\) Regulations; Standard Number 29 CFR 1926](#) are the foundation of these Guidelines.
- C. Deliverables
 - 1. Competent Person Designation (see attached form) (4.0/C)
 - 2. Verification of OSHA 30 or OSHA 10 compliance, based on project requirements. (4.0/D/1/b)
 - 3. Contractor Site Specific Safety Plan (SSSP). (4.0/I)
 - 4. Summary of the Daily Safety Inspections documented as part of regular project meeting minutes. For projects bid through Construction Services summaries of Daily Safety Inspections will be documented as agreed upon at the pre-construction meeting. (4.0/F/1)
 - 5. Regular (min. monthly) Safety Reports. (4.0/F/2)
 - 6. Traffic Control Plans (when impact exists) (4.0/QQ/1)

3.0 Reference Materials

- A. The following reference materials are required to be available upon request at every job site:
1. OSHA Regulations published by NC Department of Labor (DOL) (Available at (800) NC-LABOR, <http://www.nclabor.com/pubs.htm>).
 2. Safety Data Sheets (SDS) for all chemical products the contractor has brought to the worksite.
 3. The written Safety Plan of the Contractor or Subcontractor.
 4. Site inspection documentation.
 5. Worksite employee training records.
 6. Mishap reports and investigations.

4.0 General Responsibilities

- A. The contractor must notify the NC State Project Manager in writing at least 10 days prior to:
1. Utilizing powder-actuated tools
 2. Starting operations that will produce excessive odor, dust, and noise affecting occupied buildings or work near air intakes
 3. Using a combustion engine indoors
 4. Using a mobile crane or tower crane (50-day notice is required)
 5. Breaking ground for an excavation or trench
 6. Using a laser
 7. Using any source of radioactive material
 8. Working with lead or asbestos-containing materials
 9. Performing energized electrical work
 10. Working on or near active underground utility infrastructure (steam, chilled water, natural gas, water, etc.)
 11. Entering electrical distribution assets

Violation of any safety, security, or environmental requirement may result in the permanent removal of the contractor or their employees from the NC State premises.

- B. Construction Management
1. The contractor is responsible for compliance with all federal, state, and local laws, regulations, standards, executive orders, etc. applicable in part or whole pertaining to the scope of work.
 2. Contractors are responsible for compliance with all applicable NC State safety practices, procedures, policies, standards, and requirements.
 3. Contractors are responsible for providing qualified and competent personnel to perform activities under the scope of work. Contractors must provide documentation of training prior to beginning work on-site.
 4. Contractors are responsible for ensuring that subcontractors, their agents,

employees, visitors, and other persons performing portions of the work on a project comply with federal, state, and/or local laws or regulations that relate to work site safety.

5. Contractors are responsible for ensuring that subcontractors are informed of and comply with all applicable requirements within the scope of work.

C. Competent Person Designation

1. Contractors shall designate a competent person for activities as specified in OSHA 29 CFR 1926. Such activities include, but are not limited to, the following activities, as applicable to the job:

- a. general provisions
- b. ionizing/non-ionizing radiation
- c. gases, vapors, fumes, mists, dust
- d. ventilation
- e. hazard communication
- f. lead
- g. asbestos
- h. personal protective equipment
- i. hearing conservation
- j. respiratory protection
- k. rigging and material handling equipment
- l. welding, cutting, brazing
- m. electrical
- n. scaffold
- o. fall protection
- p. cranes (overhead and mobile)
- q. motor vehicles and equipment
- r. excavations
- s. concrete and masonry
- t. steel erection
- u. demolition
- v. stairways and ladders
- w. toxic and hazardous substances.

2. OSHA 29 CFR 1926.32(f) "Competent person" means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

D. Contractor Safety Personnel

1. Safety Representative
 - a. For all projects contractors must designate a Safety Representative prior to the start of the project. The Safety Representative may be the Project Superintendent and is responsible for all safety concerns related to the construction operations.
 - b. For formally contracted projects (>\$500k), the Safety Representative must have completed, at a minimum, an OSHA 30-hour Construction

Safety Course. For informally contracted projects (<\$500k), the Safety Representative must have completed, at a minimum, an OSHA 10-hour Construction Safety Course.

- c. The Safety Representative must actively monitor the job site for safety issues on a daily basis. The Safety Representative may have additional site duties outside the scope of safety; when the safety representative is not on the project site, a competent designee must be assigned to monitor safety on the site.

2. Safety Professional

- a. **When appropriate, the contractor shall provide a full-time safety professional assigned to the project. The duties of the full-time safety professional must be strictly limited to safety-related activities, with no additional job site duties.**
- b. Safety professionals must have one or more of the following credentials: a professional certification (beyond an OSHA 30-hour course), a college or professional degree related to safety and health, or significant previous experience and skills necessary to thoroughly understand the health and safety hazard and controls relevant to the project. The designation and adequacy of qualifications of the full-time safety professional shall be reviewed and accepted by the University prior to the commencement of the work.
- c. Project-specific requirements for a full-time safety professional will be addressed in the contract documents and discussed during the Pre-Bid Meeting.

E. Daily Pre-Job Meetings

- 1. A pre-job meeting (i.e. “Tailgate” or “toolbox” meeting) shall be held at the beginning of each work period (normally in the morning before leaving the yard or work staging area). The pre-job meeting should include a discussion of the scope of work to be completed, associated hazards, and means and methods to mitigate the hazards. The pre-job meeting must be led by the supervisor or other competent person.

F. Safety Inspections

- 1. Daily Inspections: The Contractor shall perform daily job inspections and correct any unsafe conditions or actions. A summary of these inspections will be reviewed as a portion of and captured in the minutes of the weekly Owner, Designer, and Contractor job meetings.
- 2. Monthly Inspections: For projects with a duration of more than one calendar month (4 weeks), the safety inspection must be documented and include, at a minimum, the name of the person performing the inspection, the date, a checklist of items observed, any identified safety concerns, and actions taken to address identified concerns.
- 3. University Project Visits: The NC State Project Manager, or another owner representative, may perform unscheduled visits to project sites to address adherence to the Contractor Safety Requirements or Site-Specific Safety

Plans. Any safety concerns identified will be reported to the responsible contractor for prompt mitigation.

- G. Mishap Reporting: All mishaps occurring on the project site must be investigated to determine causes and actions must be taken to prevent recurrence. Mishaps resulting in a recordable injury requiring medical treatment or damage to NC State property must be reported in writing to the NC State Project Manager as soon as possible but no later than 24 hours from occurrence; the Project Manager shall be notified immediately of mishaps resulting in life-threatening injury.
- H. The Contractor shall address safety concerns at regularly scheduled meetings with subcontractors.
 - 1. Contractor Site-Specific Safety Plan (SSSP) - The Contractor must develop and implement an SSSP. The SSSP is a comprehensive safety plan for his or her employees, which covers all aspects of onsite construction operations and activities associated with the contract. This plan must comply with all applicable health and safety regulations and any project-specific requirements. The SSSP must be submitted to, reviewed, and accepted by NC State before beginning any on-site work activities.
 - 2. As applicable to the project, these items must be included in the SSSP:
 - a. Scope of Work
 - b. Emergency Procedures
 - c. 24-hour emergency points of contact
 - d. Identification of Designated Competent On-Site Personnel (per OSHA requirements)
 - e. Designated On-Site Safety Personnel
 - f. Safety orientation program
 - g. Site logistics Plan: address public (student, faculty, staff, visitor) safety, traffic plan, equipment and lay-down areas, site security, dust containment, etc.
 - h. Minimum PPE requirements
 - i. Hazard Assessment (for defined project tasks) - include hazard identification and mitigation
 - j. Mishap reporting and investigation procedures
 - k. Safety inspection/audit procedures
 - l. Sub-contractor requirements

5.0 General Requirements

- A. Asbestos - If asbestos-containing materials are uncovered during construction, NC State must be notified immediately. Do not attempt to remove the material. Contractors shall comply with provisions of the [State Construction Office Asbestos Abatement Guidelines and Policies](#) and the [NC State Asbestos Management Plan](#).
 - 1. If asbestos-containing material is present in any building material and is in good condition (i.e. non-friable) and will not be disturbed during construction, the material may be left in place. If asbestos-containing material is disturbed during construction activities, then it shall be removed; removal shall be performed by appropriately qualified and accredited personnel and in accordance with federal, state, and local regulations.

- B. Compressed Gas Cylinders
 - 1. Compressed gas cylinders shall be properly used, stored, and maintained as per federal, state, and local requirements.
 - 2. Cylinders shall not be stored in a location in which they are subject to mobile equipment traffic (including vehicles) unless adequately protected.
- C. Confined Space Entry
 - 1. Contractors required to enter a confined space at NC State must have and implement a written confined space entry program in accordance with OSHA 1926 Subpart AA Confined Spaces in Construction or OSHA 1910.146 permit required confined spaces, as applicable.
 - 2. Controlling contractors (those with overall responsibility for construction at the work site) must ensure space entry coordination when more than one entity enters the space.
 - 3. Each contractor must have a competent person who will identify confined spaces associated with the scope of their work. Before entry into a permit-required confined space, contractors must obtain the following information from the controlling contractor (when there is no controlling contractor, the contractor will obtain the information from the NC State Project Manager):
 - a. The location of each known permit space associated with the project scope;
 - b. The known hazards or potential hazards that make it a permit space;
 - c. Any precautions needed to be taken based on the known hazards or potential hazards.
 - 4. Each contractor performing work in a permit space must perform a hazard assessment specific to the work to be performed and establish corresponding hazard controls.
 - 5. A competent person from each contractor performing work in a permit space must complete and sign [Appendix F](#) to the [NC State Confined Space Entry Program](#).
- D. Contaminated Soil - If soil or any materials appear to be contaminated, the NC State Project Manager must be notified immediately. The NC State Project Manager will contact NC State EHS for assistance at (919) 515-7915.
- E. Electrical Power Lines (Overhead) - The contractor shall have a trained and knowledgeable observer (signal person) within sight of the operator and the overhead lines that will effectively provide guidance and clearance information to the operator as the equipment may approach the minimum approach distances. Advising the operator shall be the signal person's one and only task. When conducting any work with a crane, derrick, or hoist in the vicinity of any overhead electric power transmission or distribution line, the contractor shall observe all clearance requirements dictated by all applicable OSHA rules, as specifically contained within 29 CFR 1910 - Standards for General Industry, CFR 1926 - Standards for Construction, IEEE C2 - NEC, NFPA 70 - NEC, the NCSBC, ANSI standards, and other applicable NC State safety guidelines and requirements. Further, no crane, derrick, or hoist operator or contractor shall conduct any operation at any distance closer than 20 feet to any electric power line lower than 200 kV or closer than 35 feet to any electric power transmission line at voltages higher than 200 kV and lower than 250 kV, unless the requirements of OSHA 1926 Sub CC for preventing encroachment/electrocution are strictly followed.
- F. Elevators/Material Hoists
 - 1. Any persons operating elevators/hoists must be trained to do so. Documentation

- shall be kept onsite.
- 2. No elevator/hoist with a defect shall be used.
- 3. Elevator/hoist safety devices shall not be overridden or made inoperable.
- G. Emergency Equipment- The following shall not be moved, blocked, disabled, or rendered inaccessible unless authorized by NC State:
 - 1. Fire equipment
 - 2. First aid equipment, fire blankets, stretchers, eyewash fountains, and safety showers
 - 3. Fire protection, hydrants, and detection systems
- H. Emergency Medical Treatment - To receive immediate assistance for emergency medical treatment call 911.
- I. Environmental and Chemical Requirements
 - 1. Contractors must provide NC State with a list of all chemicals to be used on NC State property and maintain a copy on-site of the SDS for each chemical prior to being brought on-site. Each chemical container must be labeled clearly with the identity of the chemical and any associated hazards in accordance with the OSHA Hazard Communication Standard (1910.1200).
 - 2. Contractors must follow the safety procedures recommended by the manufacturer or seller of any chemicals, tools, equipment, or other materials. Contractors are to remove all empty containers, excess chemicals, and chemical waste from NC State property.
 - 3. For all chemical incidents, contractors shall call 911 and also notify the NC State Project Manager.
- J. Excavation and Trenches - Before doing any excavation work, the Contractor must locate all utilities by calling the local utility locator service and NC State.
- K. Excavations
 - 1. Underground Facilities Locate. Contractors shall ensure underground installations and facilities are identified by calling 811 (Call Before You Dig) before performing any excavating activity. Note: excavation includes movement or removal of earth, rock, or other materials in or on the ground by use of manual or mechanized equipment. This is required for any project with earth-moving activities before you dig so that underground facilities can be identified and avoided. Detailed instructions and requirements can be found at nc811.org.
 - 2. Competent Person. Trench and excavation work must be performed under the direction of a competent person. Responsibilities include: classifying soil, inspecting protective systems, monitoring water removal, and conducting site inspections.
 - 3. Cave-In Protective Systems. A protective system is required by OSHA-1926 Subpart P for trenches and excavations that are 5 feet or more in-depth OR if the competent person has examined the ground and finds an indication of a potential cave-in. Protective systems typically include sloping/benching, shoring, or shielding. To determine what protective systems are appropriate, the competent person must first determine the soil type: Stable Rock, Type A, Type B, or Type C soil. Type C soil is the least cohesive and therefore, the least stable. No work shall be permitted in excavations where water has accumulated unless the integrity of the excavation has been protected.
 - 4. Excavations >20 feet in depth or that cannot comply with OSHA requirements require written approval by a Registered Professional Engineer (RPE).
 - 5. A ladder, stairway, ramp, or other means of access must be provided within the excavation when excavations are >4 feet in depth.

6. Barricades (stop-logs) shall be provided where vehicles or mobile equipment are used near or adjacent to excavations.
 7. Spoil piles must be placed a minimum of 2 feet from the edge of the excavation.
 8. Air monitoring must be performed if the excavation is >4 feet in depth and there is a potential for a hazardous atmosphere to exist.
- L. Exit Routes
1. Exit routes must be maintained at all times during construction.
 2. Lighting and marking must be adequate and appropriate.
 3. Exit routes must be kept free of explosive or highly flammable furnishings.
 4. Exit routes must be free and unobstructed. No materials or equipment may be placed, either permanently or temporarily, within the exit route. The exit access must not go through a room that can be locked, such as a bathroom, to reach an exit or exit discharge, nor may it lead into a dead-end corridor. Stairs or a ramp must be provided where the exit route is not substantially level. No materials shall be stored in a stairwell.
- M. Explosives: Blasting on university property is prohibited.
- N. Fall Prevention. A fall hazard is any condition on a walking-working surface that exposes an employee to a risk of a fall on the same level or to a lower level. Examples of fall hazards include, but are not limited to: floor openings, hoist areas, roofs, leading edges, scaffolding, ramps, etc.
1. Preventing or protecting falls from height may be necessary at any height given the circumstances, but is required when an employee is at a height of 6 feet or more above a lower level.
 2. Contractor work generally falls within construction industry applications, where acceptable methods depend on the type of work being performed: unprotected sides or edges, roof work, leading edge, etc. In all cases, contractors shall comply with the respective OSHA standards.
 3. Contractors shall ensure that every employee required to work at unprotected heights (greater than 6 feet) is trained in fall hazard recognition and prevention.
 4. **Guardrail System.** A guardrail system provides the highest level of protection and is always preferred. The system must be capable of supporting 200 lbs. in any direction and still maintain its integrity. The individual heights of the components must conform to the following minimum standards:
 - a. The top rail of the system must be at a height of 42" (+ or – 3");
 - b. the mid rail must be at a height of 21" with a 3" variation possible;
 - c. the toe board must have a minimum vertical height of 3.5".Note: The building code has more stringent requirements for permanent installations.
5. **Personal Fall Protection Systems.** At times, it is necessary to work in areas where guardrails cannot be constructed; in these instances, a personal fall protection system must be used. Personal Fall Protection Systems are systems (including all components) that provide protection from falling or that safely arrest a fall. Examples include travel restraint and personal fall arrest. All components of this system shall meet the applicable design requirements as specified in OSHA 1910, 1926, or ANSI Z359. All components shall be inspected by the wearer prior to each use and at least annually by a competent person. No employee may use a personal fall protection system without proper training and an understanding of proper use and safe application of the system.
- a. **Travel Restraint System.** A travel restraint system is a combination of an

anchorage, anchorage connector, lanyard (or other means of connection), and body support that the wearer uses to eliminate the possibility of going over the edge of a walking-working surface. Anchorages for travel restraint systems shall have a strength capable of sustaining static loads of at least 1,000 lbs. (per person) or two times the foreseeable forces for certified anchorages. Anchorage connectors, lanyards (or other means of connection), and body support devices shall be used in accordance with the manufacturer's requirements. The system shall be installed so that a fall cannot occur; therefore, a rescue plan is not required.

- b. **Personal Fall Arrest System.** A personal fall arrest system is a system used to safely arrest a user in a fall from a walking-working surface. It includes an anchorage, anchorage connector, and a full-body harness. The means of connection may include a lanyard, deceleration device, lifeline, or a suitable combination of these. Equipment must be worn and used in accordance with the manufacturer's requirements. Anchorages for personal fall arrest systems shall have a strength capable of sustaining static loads of at least 5,000 lbs. (per person) or two times the maximum arresting force for certified anchorages. The system shall be installed so that should a fall occur, the wearer will not contact the lower level or any other obstruction. Since there is a potential for a fall to occur, a rescue plan written by a qualified person is required.
- c. **Warning Line System.** A warning line may be used for construction roofing work when closer to the fall hazard than 15ft, but no closer than 6ft and in conjunction with one of the following: a guardrail system, a safety net system, a personal fall protection system, or a safety monitoring system. A warning line system shall conform to regulatory requirements and enclose all authorized employees conducting work protected by the Warning Line System. Refer to OSHA 1926.502(f).

O. Fire Protection and Prevention

- 1. The contractor shall be responsible for the development and maintenance of an effective fire protection and prevention program at the job site throughout all phases of the construction. Contractors shall perform inspections on fire extinguishers monthly. Contractors shall immediately replace fire extinguishers that do not pass inspection.
- 2. Fire cutoffs shall be retained in buildings undergoing alterations or demolition until operations necessitate their removal.
- 3. If work requires the disabling of Fire Protection Devices, then the Contractor must request a Fire Alarm Disconnect; through the appropriate NC State process; beginning with the Project Manager. No alarm shall be disabled at any time by the Contractor.

P. Hand and Power Tools

- 1. All hand and power tools and similar equipment, whether furnished by the employer or the employee, shall be maintained in a safe condition. Any tool found not in proper working order, or that develops a defect during use, shall be immediately removed from service and not used until properly repaired.
- 2. All tools shall be used, operated, and maintained in accordance with OSHA and manufacturer requirements.

Q. Hot Work Permits - A Hot Work Permit is required when any indoor or outdoor work will involve hot work, defined as operations including cutting, welding, thermite welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of

torch-applied roof systems or other similar activities. Requirements for Contractors performing this work are contained in the NC State Hot Work Permit Program which is a part of the specifications package and can also be found in the [Hot Work Permit Form](#).

R. Housekeeping

1. The Contractor must maintain a clean and orderly project job site. The Contractor shall maintain NC State's pathways free of rocks, mud, and other miscellaneous construction debris. The Contractor shall prevent the accumulation of dirt, dust, and/or other debris on NC State's roadways. The Contractor shall clean the travelways on a daily basis. (Refer to project specifications for requirements.)
2. Waste material and debris must be removed from the work and access areas at least once a day. Waste material and debris should not be thrown from one level to another but should be carried down, lowered in containers, or deposited in a disposal chute.
3. Materials must be neatly piled, stacked, or otherwise stored to prevent tipping or collapsing. Materials must be carefully stacked and located so they do not block aisles, doors, fire extinguishers, safety showers, eyewash stations, fixed ladders, or stairways.
4. Material to be lifted by crane or other hoisting devices must not be stored under overhead power lines.
5. No materials may be stored on penthouses, roofs, or other areas until a specific area is assigned by NC State for a specific project.
6. Adverse Weather: If NC State becomes aware of an adverse weather event, the NC State Project Manager shall notify the construction superintendent, and the contractor shall perform a job site review to ensure any debris or construction materials are secured and protected from the elements.

S. Illumination - Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lit to not less than the minimum illumination intensities required by OSHA.

T. Ladders - All ladders must meet OSHA requirements.

U. Lasers

1. Lasers must comply with the OSHA Construction Industry Standards.
2. Lasers must be low-power (<5mw) devices with visible beams. Lasers to be used must bear a label indicating this maximum power output. Lasers that do not bear this label shall not be used.
3. "Laser in use" signs shall be posted according to OSHA requirements.
4. Lasers must be used in a manner that will not risk exposure to others.

V. Lead

1. Lead may be found in certain painted surfaces. A check for lead presence should be conducted prior to certain activities such as grinding, sanding, or burning over painted surfaces. If lead-containing paint is disturbed or a material is questionable the NC State Project Manager must be notified immediately. Do not attempt to remove the material.
2. Hot Work over lead-painted surfaces is generally not permitted.

W. Lock Out/Tag Out

1. All contractors that work on energized equipment with any hazardous energy source are required to have a hazardous energy control (i.e. lockout tagout) program. The program shall specify policies and procedures for de-energizing, verifying de-energizing, and securing the source potential using energy isolating devices and applying locks/tags or implementing other forms of hazardous

energy control as specified in OSHA standards. Types of potential energy sources include, but are not limited to:

- a. Electrical (refer to the section of these requirements titled “Electrical”)
 - b. Pneumatic
 - c. Hydraulic
 - d. Thermal
 - e. Kinetic (motion)
 - f. Hazardous gas, liquid, air
 - g. Radiation
 - h. Lasers
2. When multiple contractors are performing work on the same project, hazardous energy control procedures shall be coordinated by the controlling entity which includes establishing device standardization.
 3. Contractors shall ensure site personnel are trained on the hazardous energy control program.
 4. Central [Utility Plant \(CUP\) - Lockout Tagout Procedure](#)
 - a. Contractors with the need to perform LOTO operations within the operating CUP shall be trained in accordance with the procedure and comply with applicable sections of the procedure. The contractor is responsible for providing this training; a copy of this procedure will be provided to the contractor.
 - b. Contractor management shall ensure that authorized personnel are assigned to perform work in which they are qualified.
 - c. Contractor management shall comply with applicable sections of the procedure.
- X. Mobile Cranes, Tower Cranes, etc. (Reference OSHA 1926 Subpart CC).
1. Prior to the setup or operation of any crane on university property, the NC State Project Manager (or another point of contact) shall be notified; notification must be made with as much lead time as possible, but no fewer than fifty (50) working days
 2. Cranes shall be set up and operated in compliance with the manufacturer and applicable OSHA requirements.
 3. Contractors are responsible for ensuring ground conditions are capable of supporting the equipment and load, which will include performing underground facilities/utilities location (i.e. 811 calls) as well as factual confirmation of necessary compaction capacities. This confirmation is to be by third-party inspection services, at the expense of the contractor.
 4. No lifts may occur over occupied spaces unless a registered structural engineer evaluates and certifies that the building can withstand the impact of a load being dropped on the building as a worst-case scenario. If it is determined that the building cannot withstand the impact without compromising the structure, areas of the building within the load fall zone must be evacuated during the duration of the lift. This evacuation process must be a part of the lift plan and managed by the contractor.
 5. The crane contractor shall provide equipment documentation, including the annual inspection and the last monthly inspection. Documentation must be signed.
 6. Crane operators shall be certified by an Accredited Crane Operator Certification Agency for the type of equipment operated. Examples of such agencies, include, but are not limited to:

- a. National Commission for the Certification of Crane Operators (NCCCO)
- b. National Center for Construction Education and Research (NCCER)
- c. Operating Engineers Certification Program (OECF)
- d. Electrical Industry Certifications Association (EICA)

Additionally, the crane operator's employer must attest that the operator was evaluated to verify the operator demonstrates skills and knowledge to safely operate the equipment as well as the ability to recognize and avert risk, as required under 29 CFR 1926.1427 (f).

- 7. All rigging personnel and signal persons shall be qualified in accordance with OSHA 1926 Subpart CC.
- 8. Crane Lift Plan. A lift plan is required for any lift in a location not under the exclusive control of the contractor, including lifts affecting NC State property, structures, employees, students, or visitors. Each lift plan must be developed by a qualified person and include at least the following:
 - a. The identity of the controlling entity, meaning the employer with the overall responsibility for construction operations associated with the crane lift.
 - b. Identify a lift director (i.e. primary signal person) and method of communication (hand signals, radio, etc.).
 - c. Contractors conducting crane operations are required to obtain required FAA permits according to 14 CFR Part 77; to be submitted with the lift plan.
 - d. Equipment positioning locations, including load staging and movement and paths to and from the working position.
 - e. Equipment specifications including load and reach capacities.
 - f. Current qualifications, certifications, and licenses of operators and riggers.
 - g. For lifts involving more than one crane, the lift plan shall encompass all cranes.
 - h. Fall Zone: The contractor shall identify the Fall Zone. The Fall Zone is the area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall. Spaces within the Fall Zone (including buildings, foot traffic, vehicle traffic, etc.) shall be barricaded to control access. The Fall Zone shall be cleared of personnel not participating in the lift.
 - i. Wind limitations.
 - j. Ground and subsurface stability at crane and load placement locations. The contractor must ensure a qualified person evaluates the crane set-up location to ensure ground conditions are sufficient. (See X., 3. above).
 - k. Other conditions or factors that may affect the safety of the lift.
 - l. A pre-lift meeting must be completed immediately before the lift and shall include all personnel involved with the lift and a thorough review of the elements and specifics of the lift plan and personnel assignments.
 - m. Specify the distance to the closest energized lines and the applicable minimum approach distance of any lift component.
 - n. Where items positioned by a crane lift are rigged at heights above easy reach height, the lift plan shall include safe attachment and de-attachment

procedures and the control of exposure to fall hazards.

- o. The contractor must provide documentation of annual and monthly inspections for the previous 3 months. 1926.1412(f) & .1412(e).

Y. Electrical

1. Electrical Contractor shall ensure that their personnel using electrically powered equipment are trained to recognize electrical hazards, inspect and maintain electrically powered equipment, and on safe work procedures to prevent exposure to electric shock.
2. Premises Electrical Equipment. All electrical installations must comply with the National Electrical Code® (NEC®). Work associated with electrical equipment installed in accordance with the NEC® will be conducted in accordance with the NFPA 70E® Standard for Electrical Safety in the Workplace. NC State's goal is to minimize exposure to shock and arc flash hazards during the installation, repair, maintenance, and operation of electrical equipment, components, and systems.
 - a. Electrical power sources shall be de-energized, verified, and locked out prior to working on electrical equipment except when de-energization creates a greater hazard and a properly executed Energized Electrical Work Permit (EWP) has been completed.
 - b. Contractors performing electrical work must have their own energized electrical work program that includes a permit process.
3. Power Generation & Distribution: Work by Qualified Persons and Unqualified Persons working on or near power generation or distribution equipment is addressed in OSHA 29CFR1910.269. It includes work on or directly associated with installations used for the generation, control, transformation, transmission, and distribution of electricity. Any work involving the NC State distribution system shall be coordinated by the NC State Project Manager (or other university contact person) in collaboration with the Facilities Division Power Systems group.
 - a. Work involving the NC State electrical distribution system shall only be performed after authorization by the Facilities Division Power Systems group in accordance with the Power Systems Switching Procedure.
 - b. System Check-In/Out: Prior to entering any primary enclosure (substation, transformer, manhole, switch, switching station, etc.) of the NC State Power System the NC State Project Manager or other designated person shall send a text or email to group-powersystementry@ncsu.edu with the work location and brief description of the tasks to be performed (photos are welcomed). When exiting the enclosure, check out with NC State Power Systems using the same method. This is only for unescorted access. For example, if you're with a member of the Power Systems team there's no need to check in/out, but if that team member has to leave your work site, you're expected to check in and check out.
4. The contractor will follow all requirements as noted in NFPA 70E.

Z. Mobile Elevating Work Platforms (MEWPs)

1. General Requirements.
 - a. MEWPs shall be operated in accordance with the manufacturer's requirements and specifications.
 - b. Employees must always stand firmly on the floor of the MEWP and must not sit or climb on the edge of guardrails, or use planks, ladders, or other devices for a work position. The guardrail system of the platform must not

- be used to support materials, other work platforms, or employees.
 - c. A personal fall arrest/restraint system shall be used in accordance with the manufacturer's requirements. A scissor lift with approved guardrails may be used without a personal fall arrest system when specified by the manufacturer, however, if there are designated anchor points, the use of a fall arrest/restraint system is required.
 - d. The MEWP must be used only in accordance with the manufacturer's operating instructions and safety rules.
 - e. The designed rated capacity for a given angle of elevation must not be exceeded.
 - f. At least 10 ft distance must be maintained away from overhead power lines with a nominal voltage of 50kV or less; 20 ft for power lines over 50kV (or if the voltage is unknown). Note: qualified workers using appropriately insulated MEWPs may approach closer than 10 ft when following provisions specified in OSHA 1910.268, 1910.269, and 1926 Subpart V, as applicable.
 - g. The manufacturer's rated load capacity must not be exceeded. The load and its distribution on the platform must be in accordance with the manufacturer's specifications. The rated load capacity must not be exceeded when loads are transferred to the platform at elevated heights. Only employees, their tools, and necessary materials must be on or in the platform.
 - h. A trained spotter with no other job duties is required when a MEWP is driven; the spotter will assess conditions that could pose a hazard to the operation (for example, drop-offs, holes, slopes, inadequate surface and support, obstructions, pedestrians, vehicles, debris, electric lines, etc.) and stop operations and alert the operator. The operator shall halt operations until hazards are adequately controlled.
2. Training
- a. Only personnel who have received training to operate the specific type(s) of MEWPs are authorized to operate them on NC State property.
 - b. Training must include inspection, application, and operation of MEWPs (including recognition and avoiding hazards associated with their operation). Operators are only authorized to use MEWPs of the specific model for which they are trained and evaluated.
 - c. Training must be provided by a person who has knowledge regarding the laws, regulations, safe use practices, manufacturer's requirements, and recognition and avoidance of hazards, and is familiar with the specific type(s) of MEWPs. Note: Personnel may not operate rented equipment unless qualified to operate the specific equipment; the rental provider or other authorized evaluator must provide familiarization training to satisfy this requirement.
3. Inspection, Maintenance, and Testing
- a. Each MEWP must be inspected, maintained, repaired, and kept in proper working condition in accordance with the manufacturer's operating or maintenance and repair manual or manuals. Maintenance inspections shall be completed at intervals no less frequent than annually.
 - b. Before use, visual equipment inspections and a functional check must be performed before each shift in accordance with the manufacturer's operating manual. Any MEWP found not to be in a safe operating

condition must be removed from service until repaired. All repairs must be made by an authorized person in accordance with the manufacturer's operating or maintenance and repair manual or manuals.

- c. Before and during use, visual worksite inspections must be performed and include workplace risk assessment. The workplace risk assessment includes identifying and evaluating hazards (for example, drop-offs, holes, slopes, inadequate surface and support, obstructions, pedestrians, vehicles, debris, electric lines, etc.) and establishing effective control measures. Uncontrolled hazardous situations must be corrected prior to the initial or continued use of the MEWP.

AA. Noise/Vibration

1. Noise-producing equipment, such as power drills, jackhammers, welders, etc., can create sound levels of 80dB(A) or greater in and around a construction area. Notify the NC State Project Manager in advance to determine the appropriate times to operate high noise/vibration equipment for that project's location.
2. Appropriate personal protective equipment shall be used when working around high-noise/vibration equipment.

BB. Overhead Work

1. Work must not be performed above other personnel, including other contractor employees. Affected areas must be roped off or barricaded and marked to prohibit traffic.
2. Contractors must not climb on the heating and air-conditioning ductwork, plumbing steam piping, sprinkler piping, electrical cable trays, fixtures, or furniture or use as work platforms.
3. Contractors are expected to comply with OSHA fall protection requirements.

CC. Paints and Solvents - Contractors must provide the following safeguards:

1. Adequate ventilation must be maintained at all times when paints or solvents are being used. Refer to [NC State Odor Prevention and Dust Control in Occupied Buildings](#) for additional information.
2. Contractor personnel must use proper respiratory protection and protective clothing when the toxicity of the material requires such protection.
3. Flammable solvents and materials must be used with extreme caution when possible sources of ignition exist.
4. Flammable paints and solvents must be stored in an approved flammable liquid storage cabinet when storage is required inside buildings. Acids and flammables must never be stored together. If an approved flammable liquid storage cabinet is not available, flammable paints and solvents must be removed from the building.
5. Flammable liquids must be dispensed in a safety can with a flash screen bearing a Factory Mutual or Underwriters Laboratory (UL) approval.

DD. Personal Protective Clothing and Equipment - The contractor shall determine this minimum level of protective equipment to be worn on the job site (example: hard hat, eye protection, safety vest, gloves, and safety shoes); NC State expects contractors to conform to industry accepted minimum PPE standards, for example, hard hats, safety glasses, and protective toe footwear. Any additional safety equipment required by a specific activity shall also be worn and shall meet or exceed OSHA standards. This applies to ALL persons entering the job site.

EE. Powder-Actuated Tools

1. Powder-actuated tools are not to be used on NC State property unless specific approval is obtained from NC State prior to usage.
2. If approved, powder-actuated tools must be used in accordance with OSHA and

manufacturer regulations.

FF. Power Vehicle Equipment

1. Only trained operators are allowed to use power vehicles on NC State property. Contractor management will be expected to provide proof of training if requested.
2. Generally, LP gas-powered trucks are not to be used inside NC State buildings. Prior approval from NC State is required.
3. The design of the LP gas-fueled industrial truck for use within NC State buildings must comply with the following:
 - a. LP gas-fueled industrial trucks must comply with NFPA 505-1982.
 - b. If trucks are in continuous use in a populated area, they must be equipped with a catalytic converter.
 - c. LP gas containers must not exceed the nominal 45 pounds of LP gas.
4. The following conditions and requirements will govern the use of LP gas-fueled vehicles inside the confines of NC State buildings and structures:
 - a. LP gas-fueled trucks must be removed from the building and parked at the end of each workday and not left unattended while in use. When the job requiring the vehicle is complete, the vehicle must be removed from the job site.
 - b. Trucks and tanks must not be refueled inside buildings.
 - c. All areas where LP gas-fueled trucks are used must be well ventilated.
5. All LP cylinders must be stored outside and secured by a chain in an upright position.

GG. Roof Safety

1. The contractor shall request authorization from NC State prior to accessing a roof.
2. During all rooftop operations, the contractor must provide fall protection measures in accordance with OSHA.
3. A Hot Work Permit and at least two appropriate fire extinguishers of the correct ABC type are required when performing hot work on roofs. Other persons acting as a Fire Watch shall be in place on the roof and on the floor(s) directly below the operation.

HH. Sanitation

1. Drinking Water - An adequate supply of water, meeting the U.S. Public Health Service Drinking Water Standards, shall be provided.
2. Washing Facilities
 - a. The contractor shall provide adequate washing facilities for employees engaged in the application of paints, coating, herbicides, or insecticides, or in other operations where contaminants may be harmful to the employees. Such facilities shall be close to the work site and shall be so equipped as to enable employees to remove such substances.
 - b. Hand soap or similar cleansing agents shall be provided.
 - c. Individual hand towels, cloth or paper, warm air blowers, or clean individual sections of continuous cloth toweling, shall be provided.
3. Toilet facilities shall be provided for employees according to OSHA requirements.

II. Scaffolding

1. The contractor shall erect, use, and dismantle scaffolding in accordance with OSHA and manufacturer regulations.
2. Competent Person. Scaffolds must be erected and dismantled under the direction of a competent person. Responsibilities include, but are not limited to:
 - a. supervise and direct scaffold erection, moving, dismantling, or alteration.

- b. determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds. Employers are required to provide fall protection for employees erecting or dismantling supported scaffolds where the installation and use of such protection is feasible and does not create a greater hazard.
 - c. inspect scaffold and scaffold components for visible defects before each work shift and after any occurrence that could affect a scaffold's structural integrity and ensure identified deficiencies are corrected,
 - d. determine if it is safe for employees to work on scaffolds during storms or high winds.
 - 3. Access. When scaffold platforms are more than 2 feet (0.6 m) above or below a point of access, portable ladders, hook-on ladders, attachable ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface shall be used. Cross Braces shall not be used as a means of access.
 - 4. Fall Protection. Each employee on a scaffold more than 10 feet (3.1 m) above a lower level shall be protected from falling to that lower level; each employee on a suspended scaffold shall be protected by a personal fall arrest system attached to an independent anchorage.
 - 5. Falling Object Protection. Where the potential for tools, materials, or other equipment could fall from a scaffold, the area below must be barricaded, and personnel not permitted to enter the area OR effective means shall be implemented to prevent objects from falling.
- JJ. Signs, Tags, and Barricades (references 1926 Sub G and ANSI Z535)
 - 1. Signs and Tags: Each sign and tag must include a signal word, symbol, and text.
 - a. Signal words:
 - (1) DANGER = the hazard will most likely result in serious injury or death;
 - (2) WARNING = the hazard could result in serious injury or death;
 - (3) CAUTION = the hazard would not likely result in serious injury or death;
 - (4) NOTICE = indicates important information, but is not directly hazard-related.Symbols or graphics are used to bridge language barriers and draw attention to the message.
 - b. Text is used to convey the safety message in a clear, concise manner.
 - 2. Barricades. Barricades must be installed for situations where a physical obstruction is necessary to deter the passage of people, vehicles, or equipment. When used, barricades must be installed at all points of access.
 - a. Barricades associated with traffic control in a public roadway must comply with the Federal Manual of Uniform Traffic Control Devices and the North Carolina Supplement. Coordinate with the NC State Transportation Office.
 - b. Barricades may take many forms on construction sites, but when used, they must clearly indicate the intent of the barricade. All barricades are required to include a sign that includes the name of the person responsible for the barricaded area, method for contacting the responsible person (ex. phone number), and clear and concise text describing the purpose of the barricade.

(1) CAUTION Tape Barricades should be used when the hazardous condition is not likely to cause serious physical harm but could result in injury. Standard CAUTION Tape must be used, which includes yellow tape with the word “CAUTION” in black letters. Personnel may enter the barricaded area only when implementing precautions to address the identified hazard.

(2) DANGER Tape Barricades are used when a serious or imminent danger may exist. Standard DANGER Tape must be used, which includes red tape with the word “DANGER” in black letters. Only personnel specifically authorized by the person responsible for the barricaded area may enter the barricaded area.

- KK. Silica (Respirable Crystalline Silica) – The following requirements apply to all operations involving exposure to respirable crystalline silica. Examples of such operations include: cutting, grinding, drilling, or crushing brick, block, concrete, stone, rock, mortar, and other materials that contain crystalline silica.
1. Contractors shall comply with OSHA standard 29 CFR 1926.1153 including taking all necessary steps to comply with the established exposure limits.
 2. Contractors must have a written Exposure Control Plan specific to their operations in accordance with 29 CFR 1926.1153 that includes specific details for controlling exposure to NC State personnel and the public. A copy of this plan shall be made available to NC State EHS and/or the university Project Manager upon request.
 3. Tasks performed indoors or in an enclosed area shall have effective exhaust ventilation to minimize the accumulation of visible airborne dust. In situations where ventilation is exhausted in an area with the potential to expose people to dust must incorporate effective HEPA filtration; such areas include but are not limited to, inside a building or outside where people may be present.
 4. When a building ventilation system services an area where work with the potential for generating respirable crystalline silica exists, the building air returns shall be blanked or closed while such work is in progress. Contractors must coordinate this with the university project manager.
 5. Contractors must establish a “Temporary Restricted Area” for tasks that require the use of respiratory protection in accordance with 29 CFR 1926.1153.
 - a. A *Temporary Restricted Area* is an area demarcated by the employer where an employee is required to wear respiratory protection.
 - b. *Temporary Restricted Areas* must be designated with signs, barriers, or other effective means that will ensure unauthorized persons do not enter.

If such work is performed in *occupied* buildings, dust barriers shall be installed as necessary to isolate the restricted area. Refer to [NC State Odor Prevention and Dust Control in Occupied Buildings](#) for additional information.

- LL. Smoking and Open Flames
1. Smoking is not allowed in any NC State buildings, including roofs, penthouses, electrical/mechanical rooms, and basements or within 25 feet of any building entrance or exit.
 2. The use of open flames is strictly prohibited in areas where flammable liquids, gasses, or highly combustible materials are stored, handled, or processed.
 3. The use of open flames, where allowed, requires a Hot Work Permit.

- MM. Tarpaulins - When tarpaulins are required for the deflection of hot slag, dust, paint drippings, etc., or as a security barrier, they must be flame resistant and in good condition, free of holes and worn edges.
- NN. Tar Pots (tar kettles) - Tar Pots are not allowed on roofs. The contractor must notify the NC State Project Manager prior to using tar pots and obtain a Hot Work permit.
- OO. Temporary Heating - When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation to ensure proper combustion, maintain the health and safety of workmen, and limit temperature rise in the area.
- PP. Temporary Lighting - The contractor shall submit a lighting plan for night work, underground work, and any other worksites without adequate lighting.
- QQ. Temporary Traffic Control
 - 1. All traffic control shall be approved by NC State and meet the Institute for Transportation Research and Education (ITRE) Work Zone Safety Guidelines for Construction, Maintenance, and Utility Operations. A traffic control plan shall be provided by the contractor and approved prior to commencement.
 - 2. The contractor shall provide warning signs, barriers, barricades, etc., in accordance with the construction plans and specifications or whenever such protection is needed.
 - 3. Where signs and barricades do not provide adequate protection, particularly along a road, walkway, or main aisle, flagmen shall be used.
 - 4. Review with the crew, each person's responsibility regarding the traffic control set-up (e.g. sign installation, lane closure setup, etc.).
 - 5. Review traffic control devices to be used at the site. Assure that traffic control set-up is properly installed. The installer shall document what traffic control set-up was used (including the sign types and sign locations) and how it was installed.
- RR. Vehicle Operation
 - 1. All equipment shall have operational backup alarms. Equipment shall not be utilized until such device is functioning properly.
 - 2. All vehicles shall be operated in accordance with OSHA and manufacturer regulations.
- SS. Vertical Lifts - All contractors' platforms or vertical lifts must meet OSHA and manufacturer requirements.

SECTION 014000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Designer, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Sections:
 - 1. Section 013100 "Project Management & Coordination" for requirements on the Construction Management Software that the Contractor will be utilizing to implement the Site-Specific Quality Program.
 - 2. Section 014339 "Mockups" for specific mockup requirements.
 - 3. Section 017300 "Execution" for repair and restoration of construction disturbed by testing and inspecting activities.
 - 4. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Designer.
- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- J. Professional Engineer: Engineer currently licensed to practice in the State of North Carolina.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Designer for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Designer for a decision before proceeding.

1.5 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.6 INFORMATIONAL SUBMITTALS

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- A. Site-Specific Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- E. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- G. Testing Agency and Inspection Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Ambient conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.

- H. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
- I. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- J. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S SITE-SPECIFIC QUALITY PROGRAM

- A. Definitions:
 - 1. Quality Assurance: The part of Quality Management focused on providing confidence that quality requirements will be fulfilled.
 - 2. Quality Control: The part of Quality Management focuses on fulfilling quality requirements. While quality assurance relates to how a process is performed, quality control is more the inspection aspect of quality management.
- B. General:
 - 1. Submit Contractors Site-Specific Quality Program including all components herein not less than five days prior to preconstruction conference. Submit in format acceptable to Designer and Owner. . Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
 - 2. Contractors Site-Specific Quality Program must be specifically tailored to the work of the project. While a corporate Quality Manual may be submitted to supplement, or as a reference to, the Site-Specific Quality Program, the submission of a corporate Quality Manual without specific tailoring to the needs of the project will be rejected.
- C. Quality Assurance:

1. Goals & Objectives, including key milestones for the project.
2. Roles & Responsibilities of Project Personnel, including an Organization Chart and Resumes of individuals.
3. Description of the Project Management / Document Control Software / Quality Control Software(s) to be utilized on the project.
4. Define the Projects Definable Features of Work (DFOW).
 - a. Contractor is encouraged to define additional DFOW's as they see fit to ensure that the quality requirements of the Project Documents is successfully delivered.
5. Describe the BIM coordination process to be followed.
6. Describe the Preconstruction / Bidding process.
7. Describe procedures for ensuring compliance with requirements through review and management of submittal process.

D. Quality Control:

1. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
2. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
3. Inspections & Testing: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - a. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include the following:
 - 1) Tests and inspections required in the Contract Documents.
 - 2) Contractor-elected tests and inspections (i.e. first-in-kind installations, material delivery inspections, weekly jobsite walks, etc.)
 - 3) Mockups
 - b. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - c. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
4. Describe the process for Correction of Deficiencies.
5. Submit Documentation Templates to be used by the Contractor during the Project to ensure quality requirements are being met. Include at a minimum, the following:
 - a. Daily Reports Template.
 - b. Inspection & Testing Report Forms.
 - c. Inspection checklist templates.
 - d. Material receiving reports.
6. Describe the process for the control of Quality Records.

- a. Maintain testing and inspection reports including log of approved and rejected results. Include work Designer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.
- 7. Describe the startup process for equipment, include relevant forms to ensure work is complete prior to attempting startup.
- 8. Describe the Contractor's Commissioning plan, including identifying personnel responsible for coordinating with Owner's Commissioning Party.
- E. Closeout & Project Acceptance:
 - 1. Describe the process for completing the following items as part of the Closeout & Project Acceptance Phase. Provide draft checklists as applicable.
 - a. Contractors Completion List
 - b. Designer & Owner Punch List
 - c. Owner's Training
 - d. O&M Manuals
 - e. Attic Stock
 - f. NC State Final Acceptance Checklist
 - g. SCO Final Inspection Checklist
 - h. Warranty Phase

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Fabricator Qualifications: A firm experienced and expert in producing products similar to those indicated for this Project and with a three-year record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a three-year record of successful in-service performance.
- E. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a five-year record of successful in-service performance.
- F. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- G. Professional Engineer Qualifications: A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as

those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

- H. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- I. Testing Agency Qualifications: An NRTL, an NVLAP-accredited, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 7. Provide quality assurance and control services required due to changes in the Work proposed by or made by the Contractor.
 8. Provide quality control services for Work done contrary to the Contract Documents, without prior notice, when so specified, or without proper supervision.
 9. Overtime expenses and schedule delays accruing as a result of executing quality control services shall be the Contractor's responsibility and shall not be charged to the Owner.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents. Designer retains the right to require the use of a different testing agency for retesting and reinspecting.
- F. Testing Agency Responsibilities: Cooperate with Designer, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Designer, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
 7. Attend Project progress meetings as requested by Designer.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field-curing of test samples.
 5. Delivery of samples to testing agencies or arranging for pick-up of test samples after normal business hours.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents[as a component of Contractor's quality-control plan]. Coordinate and submit schedule concurrently with Contractor's Construction Schedule as specified in Section 013200 "Construction Progress Documentation."
1. Distribution: Distribute schedule to Owner, Designer, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Designer.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Designer's, Commissioning Authority's, reference during normal working hours.

1.11 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for Section 017300 "Execution."
 2. Protect construction exposed by or for quality-control service activities.
 3. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the space in which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
2. ANSI - American National Standards Institute; www.ansi.org.
3. ASSE - American Society of Safety Engineers (The); www.asse.org.
4. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
5. AWI - Architectural Woodwork Institute; www.awinet.org.
6. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
7. CPA - Composite Panel Association; www.pbmdf.com.
8. CSI - Construction Specifications Institute (The); www.csinet.org.
9. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
10. ICC - International Code Council; www.iccsafe.org.
11. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
12. LMA - Laminating Materials Association; (See CPA).
13. MPI - Master Painters Institute; www.paintinfo.com.
14. NECA - National Electrical Contractors Association; www.necanet.org.
15. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
16. NEMA - National Electrical Manufacturers Association; www.nema.org.
17. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
18. NLGA - National Lumber Grades Authority; www.nlga.org.
19. UL - Underwriters Laboratories Inc.; www.ul.com.
20. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
21. WWPA - Western Wood Products Association; www.wwpa.org.

- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
2. EPA - Environmental Protection Agency; www.epa.gov.
3. OSHA - Occupational Safety & Health Administration; www.osha.gov.

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office;
www.gpo.gov/fdsys.
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. SCO – State of North Carolina; Department of Administration; State Construction Office;
www.nc-sco.com.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014339 – MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for mockups of the following types:
 - 1. As required by Specification Sections and/or Drawings.
- B. Related Requirements: Refer to applicable sections of the Specifications for materials, products and components to be included in mockups.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 DEFINITIONS

- A. Mockups: Full-size physical assemblies that are constructed on-site, unless indicated otherwise. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged..

1.4 QUALITY ASSURANCE

- A. Mockups, General: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish shown in the Drawings and specified in individual Sections, to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Designer.
 - 2. Notify Designer seven (7) calendar days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction of the Work.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Designer's and NC State University Architect's Office approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed, unless otherwise indicated.
- B. Preinstallation Conference: Conduct conference at Project site.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

1. Review requirements for construction of mockups, and for protecting and maintaining mockups.
2. Review procedures for reviewing, changing, and approval of mockups.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014339

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

- B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
 - 1. Connect temporary service to Owner's existing power source, as directed by Owner.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Owner's acceptance. Personnel remaining after Owner's acceptance will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- F. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- D. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
 1. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

- a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 4. Protect air-handling equipment.
 5. Provide walk-off mats at each entrance through temporary partition.
- E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Owner's acceptance.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Owner's acceptance. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Owner's acceptance, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

END OF SECTION 015000

SECTION 015500 – VEHICULAR ACCESS & PARKING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for vehicular access and parking.
- B. Related Sections include the following:
 - 1. Section 015000 "Temporary Facilities" for requirements associated with temporary facilities.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUPPORT FACILITIES INSTALLATION

- A. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- B. Temporary Use of Permanent Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- D. Pedestrian Detours: Sidewalks shall remain open and accessible during construction. Should sidewalks require closure, an accessible and safe temporary (concrete, asphalt or plywood) pedestrian path around construction shall be required if an alternative accessible route is not close by. Temporary paths shall be shown on the contract documents clearly showing path and type of construction.

END OF SECTION 015500

SECTION 015626 - TEMPORARY FENCING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements temporary fencing.
 - 1. Provide and maintain all temporary fencing necessary for the performance of the Work.
- B. Related Sections include the following:
 - 1. Section 015000 "Temporary Facilities" for requirements associated with temporary facilities.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials suitable for use intended.
- B. Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8 inch OD line posts and 2-7/8 inch OD corner and pull posts, with 1-5/8-inch-OD continuous top and bottom rails. Provide one of the following bases for supporting posts.
 - 1. Water Filled Jersey Barriers
 - 2. Concrete Jersey Barriers
 - 3. Fence Panels with feet that need to be weighted down with concrete or sand.
 - 4. Poured concrete footings
- C. Wind Screening: An integral visual barrier or shading type material applied and maintained for the duration of the project. Wind Screening is only allowed on fences with poured concrete footings.

PART 3 - EXECUTION

3.1 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Site Enclosure Fence: Prior to commencing earthwork, install site enclosure fence as shown on plans with lockable entrance swing gates. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
 3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- C. Locks: Locks for all gates or enclosures shall be interlocked with a padlock provided by NCSU in order to allow access by NCSU or other emergency personnel in case of emergency.

END OF SECTION 015626

SECTION 015700 - TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for support facilities, and security and protection facilities.
 - 1. Provide and maintain all temporary facilities and controls necessary for the performance of the Work. Locate and install all facilities and controls where acceptable to the local authorities having jurisdiction and utility owner and remove same and terminate, in a manner suitable to the utility owner, at completion of the Work or when otherwise directed. Pay all costs associated with the provision and maintenance of temporary facilities and controls including power, water, and fuel (if any) consumed until Substantial Completion.
 - 2. Notwithstanding these specifications for Temporary Facilities and Controls, the incorporation of all temporary facilities and controls into the Project shall be subject to the Owner's approval.
- B. Related Sections include the following:
 - 1. Section 013300 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 2. Section 015100 "Temporary Utilities" for requirements associated with temporary utilities.
 - 3. Section 313116 "Termite Control" for pest control.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 INFORMATIONAL SUBMITTALS

- A. Erosion- and Sedimentation-Control Reports: Weekly, Contractor shall submit reports showing compliance with the requirements of the Project Documents, North Carolina Department Environmental Quality, or NC State Stormwater Management, whichever is more stringent.
- B. Moisture-Protection Plan: Not less than five (5) working days prior to preconstruction conference, Contractor shall submit a Moisture Protection plan Describing procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, bathroom waterproofing testing, and terrazzo grinding, and describe plans for dealing with water from these operations.

Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

- C. Dust- and HVAC-Control Plan: Not less than five (5) working days prior to preconstruction conference, submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.
- D. Noise & Vibration Control Plan: Not less than five (5) working days prior to preconstruction conference, submit a Noise & Vibration Control Plan describing procedures and controls for protecting adjacent classrooms, laboratories, dormitories, common areas, and food service areas from excess noise and vibration. Pay special attention to exam and graduation periods. Include a description of how the Contractor will mitigate the following:
 - 1. Vibration resulting from site preparation activities that could impact active experiments or student learning.
 - 2. Noise resulting from shooting hangers, drywall tracks, or other components into floor below active classrooms.
 - 3. Saw cutting and grinding activities.
 - 4. Equipment noise.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SUPPORT FACILITIES INSTALLATION

- A. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction and in applicable Division 31 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
 - 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
 - 3. Remove snow and ice as required to minimize accumulations.

3.2 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
 - 1. Verify that flows of water redirected from construction areas or generated

by construction activity do not enter or cross tree- or plant- protection zones.

2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

- B. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

3.3 PEST CONTROL:

- A. Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Final Acceptance. Perform control operations lawfully, using environmentally safe materials.

3.4 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Designer.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

END OF SECTION 015700

SECTION 015800 – PROJECT IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for project identification.
- B. Related Sections include the following:
 - 1. Section 015000 “Temporary Facilities” for requirements associated with temporary utilities.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROJECT SIGNS

- A. Project Signs: Project signs are not allowed. Directional signs for material deliveries are allowed within the construction area, if required, and shall be 4' wide x 2' high maximum, black and white only. The NCSU Project Manager shall approve the design of the sign and the sign text.

END OF SECTION 015800

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.

2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Installation of the Work.
 - 2. Cutting and patching.
 - 3. Progress cleaning.
 - 4. Starting and adjusting.
 - 5. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for final cleaning.
 - 3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

- a. Fire separation assemblies.
 - b. Air or smoke barriers.
 - c. Fire-suppression systems.
 - d. Mechanical systems piping and ducts.
 - e. Control systems.
 - f. Communication systems.
 - g. Fire-detection and -alarm systems.
 - h. Electrical wiring systems.
 2. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Piping, ductwork, vessels, and equipment.
 3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate

and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.

- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Acceptance.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017311 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 2. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-suppression systems.
 - 4. Mechanical systems piping and ducts.
 - 5. Control systems.
 - 6. Communication systems.
 - 7. Conveying systems.
 - 8. Electrical wiring systems.

9. Operating systems of special construction in Division 13 Sections.

- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.

- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017311

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging, Recycling, and Disposal of nonhazardous demolition and construction waste.
 - 2. Handling and disposing of hazardous demolition and construction waste.
- B. Related Sections include the following:
 - 1. Section 006000 "Project Forms" for the Designer Waste Information Form for the project and Non-Hazardous Waste Tracking Forms.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging and waste materials (i.e. brick, concrete, asphalt, and aggregate).
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Special Waste: Solid wastes that require special handling and management.
- D. Hazardous Waste: Any solid waste that is ignitable, corrosive, reactive, or toxic; a listed hazardous material or containing a listed hazardous material per Title 40 Code of Federal Regulations Parts 260-270.
- E. Universal Waste: Hazardous wastes that have been provided specific exemptions (40 CFR 273) to encourage recycling. Universal wastes are limited to recalled or cancelled pesticides and intact batteries, lamps, and mercury containing devices. State regulations prohibit the crushing of fluorescent lamps.
- F. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- H. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- I. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For waste management coordinator.

1.5 CLOSEOUT SUBMITTALS

- A. Hazardous Waste Disposal Certificates: Contractor shall provide NC State with a copy of all hazardous, universal, and special waste disposal certifications and/or manifest for all waste shipped.
- B. Construction & Demolition Waste and Recycling Tracking Forms: All reuse, recycling, and landfilled materials are to be tracked and compiled on NC State's "Construction & Demolition Waste & Recycling Tracking Form", which is included in Section 006000 "Project Forms".
- C. Construction & Demolition Salvaged Material Form: All salvaged materials are to be tracked and compiled on NC State's "Construction & Demolition Salvaged Material Form" which is included in Section 006000 "Project Forms".

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: The plan shall include details on how the hazardous and non-hazardous generated waste will be managed in accordance with local, state, and federal regulations. Contractor must also provide all materials, personnel, and protective equipment necessary to remove and store wastes in accordance with the plan. The Contractor must coordinate salvage or reuse efforts identified on the Designer Waste Information Form with NC State and/or the non-profit entity.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
- D. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

1.8 PERFORMANCE GOALS & REQUIREMENTS

- A. All hazardous and non-hazardous generated waste shall be managed in accordance with local, state, and federal regulations.
- B. Seventy-five percent (75%) of a project's non-hazardous waste must be diverted from landfill disposal through reuse and recycling.
- C. One hundred percent (100%) of yard waste must be diverted from landfill disposal through reuse and recycling.
- D. The Designer must complete the Designer Waste Information Form (<http://go.ncsu.edu/wasteinfoform>) and identify regulated wastes, as well as materials, fixtures, and equipment that are to be salvaged for reuse or recycled. The location of the staging area as well as the responsible party for removal, delivery, and/or pick up must also be included.
 1. The completed Designer Waste Information Form has been included in Section 006000 "Project Forms".

1.9 MANAGEMENT OF HAZARDOUS, UNIVERSAL, AND SPECIAL WASTES

- A. Hazardous, universal, and special wastes must be managed separately from other C&D wastes.
- B. Disposal must be coordinated with NC State Environmental Health & Safety.
- C. Special wastes include:
 1. Paints, varnish, solvents, sealers, thinners, resins, roofing cement, adhesives, lubricants, and caulk, or drums and containers that once held these materials.
 2. Treated wood including lumber, posts, ties, decks, and utility poles (creosote, arsenic, chromium, pentachlorophenol).
 3. Asbestos, PCBs, mercury, or lead containing materials
 4. Used oil
 5. Lead acid batteries
 6. Medical wastes
- D. Waste disposal responsibility falls to one of two parties: the Contractor or NC State, as defined in the NC State Environmental Health and Safety's document: Management of Building Demolition Debris available at: <http://go.ncsu.edu/demodebris>
 1. Containers used for waste storage must be United States Department of Transportation approved. The Contractor must supply bins, tanks or tank

- trucks. Containers must remain closed at all times except when material is being added. NC State will provide containers for items collected by NC State.
2. Hazardous waste containers must have labels that clearly identify waste streams. Different waste streams cannot be combined in a shared container. The Contractor must identify the initial accumulation date on the hazardous waste label when waste is first placed in the container.
 3. Waste containers must be stored in a secured, covered, and well identified area of the construction site. Hazardous waste cannot be stored for more than 90 days. Any waste stored for more than six days must be inspected, and the inspection documented, weekly.
 4. Spill response supplies must be on-site and adequate to contain 110% of any accumulated waste. Portable fire extinguishers must also be readily available. If a spill occurs, Contractor must contact NC State immediately and proceed with spill containment and clean up.
 5. The Contractor must provide NC State with a copy of all hazardous, universal, and special waste disposal certifications and/or manifests for all waste shipped.

1.10 MANAGEMENT OF NON-HAZARDOUS WASTE

A. Priority 1 - Salvage of Construction and Demolition Waste for Reuse

1. Salvaged materials should first be evaluated for use in University construction projects. NC State Surplus Property Services should be considered if there are reusable materials that have resale value and are no longer needed by the University. Contact Waste Reduction and Recycling (recycle@ncsu.edu) for assistance with disposition. Examples of Salvageable material include:
 - a) Furniture and electronics
 - b) Cabinets and shelves that are not built-in
 - c) Sinks and water fountains
 - d) Paper towel dispensers
 - e) Newer light fixtures
 - f) Dry erase boards, chalkboards, and cork boards
 - g) Solid wood panel doors
 - h) Brick pavers
2. Contact vendors about take-back programs to recycle materials their company provides. These materials include, but are not limited to ceiling tiles, carpet tiles, and cubicle walls.
3. Coordinate with the Project Manager to utilize the NC State Construction Shop for the careful removal of salvageable items prior to contractor demolition. An estimate for the Construction Shop's work must be received during design and must be initiated prior to the project going out to bid.

B. Priority 2 - Recycling of Construction and Demolition Waste

1. If materials are not a salvageable for reuse, they must be source separated to the greatest extent possible and recycled.
2. Common source separated materials for recycling include:
 - a) Cardboard
 - b) Bottles and cans
 - c) Scrap metal and wire
 - d) Rigid plastics
 - e) Untreated/unpainted dimensional lumber

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- f) Gypsum board (unpainted)
- g) Concrete
- h) Asphalt (pavement and shingles)
- i) Aggregate
- j) Brick and CMU
- k) Carpet and Pad

3. 100% of the following materials must be recycled:

- a) Paper
- b) Cardboard
- c) Bottles and cans
- d) Scrap metal and wire
- e) Concrete
- f) Asphalt (pavement and shingles)
- g) Aggregate
- h) Brick and CMU
- i) Plastic sheet and film
- j) Polystyrene packaging
- k) Wood crates
- l) wood pallets
- m) plastic pails

C. Priority 3 - Disposal of Construction and Demolition Waste

- 1. If material/s cannot be salvaged for reuse or source separated and recycled, they must be sent to a C&D recycling and reclamation facility. Materials are not to be sent directly to a landfill or a facility that does not sort and recycle.
- 2. Regardless of salvage/recycle goal indicated in "General" paragraph above, salvage or recycle 100% of the following construction office waste materials:

- a) Paper
- b) Aluminum cans
- c) glass containers

D. All solid waste management facilities must be permitted to operate by NCDEQ in accordance with 15A NCAC 13B .0201.

1.11 DUMPSTER SERVICES

- A. Contractor is responsible for providing the dumpster for the project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

- 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 2. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 3. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 4. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 5. Store components off the ground and protect from the weather.
 - 6. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Clean and stack undamaged, whole masonry units on wood pallets.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- H. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- J. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.4 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
- 3.5 DISPOSAL OF WASTE
- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

PART 4 - END OF SECTION 017419

SECTION 017700 - CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 006000 "Project Forms" for Completion Checklists and Project Acceptance forms.
 - 2. Section 012900 "Payment Procedures" for Payment at Final Acceptance .
 - 3. Section 013100 "Project Management & Coordination" for information regarding the Project Website used for the Punch List(s).
 - 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 5. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 6. Section 017846 "Maintenance Materials" for submitting maintenance materials requirements.
 - 7. Section 017900 "Demonstration & Training" for completing training and submitting documentation of completed training.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents used during Final Clean.
- B. Contractor's Pre-Final Punch List: Submitted no later than thirty (30) calendar days prior to Final Acceptance.
- C. Final Inspection Punch List: Submitted at Final Acceptance. All work must be complete within thirty (30) calendar days of the Final Inspection.

1.4 CLOSEOUT SUBMITTALS

- A. As listed in the checklists referenced in Paragraph 1.5 of this Section, and as itemized in the various Specification Sections of this Project Manual.
- B. Closeout Submittal Log: Contractor shall, at 50% complete, as determined by the project schedule, submit to Designer a log of schedule of all Closeout Submittals required by the Project Documents.

1.5 FINAL ACCEPTANCE PROCEDURES

- A. The checklists and timelines listed herein are organized in a manner to prepare the Project Team for SCO's Inspection for Beneficial Occupancy (if applicable) and SCO's Final Inspection for Final Acceptance. The checklists provided herein are required to be

completed in the timelines provided herein in their entirety, but the checklists do not replace the SCO Forms for Beneficial Occupancy and Final Acceptance, both of which are included in Section 006000 "Project Forms" and will be uploaded by the Designer to Interscope after the milestone is achieved.

- B. Request for Designers Pre-Final Inspection: No less than ten (10) working days prior to Designer's Pre-Final Inspection, Contractor shall submit to Designer, in an organized .zip folder, the items shown on the Request for Designers Pre-Final Inspection Checklist, as included in Section 006000 "Project Forms".
 - C. Request for Final Inspection: No less than ten (10) working days prior to the SCO Final Inspection, Contractor shall submit to Designer, in an organized .zip folder, the items shown on the Request for Final Inspection Checklist, as included in Section 006000 "Project Forms".
 - 1. If the project has a phase that requires Beneficial Occupancy, as noted in Article 23 of the Supplemental General Conditions, use the Request for Final Inspection Checklist to prepare for Beneficial Occupancy.
 - D. Final Inspection: To achieve Final Acceptance, all items on the Final Acceptance Checklist must be complete. Contractor shall submit to Designer, in an organized .zip folder, all items shown on the Final Acceptance Checklist. Once all items on the Final Acceptance Checklist are complete, the Project has achieved Final Acceptance.
 - E. Project Closeout: Prior to Final Payment, Contractor must submit all items on the Project Closeout Checklist as included in Section 006000 "Project Forms".
- 1.6 LIST OF INCOMPLETE ITEMS (CONTRACTORS COMPLETION / DESIGNER PUNCH LIST)
- A. Preparation: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, proceeding from lowest floor to highest floor.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. NC State Project Name and location.
 - b. NC State Project Number, Code & Item, and State Construction Office Project Number.
 - c. Date.
 - d. Name of Designer.
 - e. Name of Contractor.
 - f. Page number.
 - B. Submit list of incomplete items in electronic tracking system format. Designer will utilize agreed upon electronic tracking system (Project Website). Access shall be provided by the contractor.
 - 1. Required Functions of Electronic Tracking System:

- a. Ability to download and sync tasks with Apple iPad over non-persistent wireless internet connection.
 - b. Drawing markup and viewing, for location identification of incomplete items.
 - c. Authorship tracking of each comment and subsequent action, including timestamps.
 - d. Sortable, filterable, itemized listing of incomplete items, by at a minimum unique issue number, date, location, issue author and responsible party.
 - e. Ability to append photos and markups on photos for the purpose of identifying incomplete items and demonstrating completeness of items.
 - f. Ability to incorporate Designer's provided list of pre-generated comments.
- C. Designer will direct all incomplete items to the attention of the Contractor, who shall identify responsible subcontractors.
- D. Contractor shall verify all items for completion prior to forwarding to Designer for action. To the maximum extent feasible, items shall be documented for closeout with clear photographs in the software, taken with context to identify the specific issue is resolved.

1.7 PROJECT RECORD DOCUMENTS

- A. Provide Project Record Documents as specified in Section 017839 "Project Record Documentation".

1.8 OPERATION AND MAINTENANCE MANUALS

- A. Assemble and provide complete set of operation and maintenance data as specified in Section 017823 "Operation & Maintenance Data".

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Submit written warranties as specified in Section 017823 "Operation & Maintenance Data".

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning.

Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting Designers Pre-Final Inspection:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including plenums, shafts, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Remove labels that are not meant to be permanent.
 - k. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - n. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in lighting fixtures to comply with requirements for new fixtures.
 - p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for

CLOSEOUT

017700 - 4

determination of Substantial Completion.

- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - b. Do not paint over labels for fire resistive joints.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
 - 2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the

Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so

that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Power failure.
3. System, subsystem, or equipment failure.

- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Operating standards.
 - 3. Operating procedures.
 - 4. Operating logs.
 - 5. Wiring diagrams.
 - 6. Control diagrams.
 - 7. Precautions against improper use.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Engineering data and tests.
 - 8. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent,

and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record prints.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Revisions to routing of piping and conduits.
 - d. Revisions to electrical circuitry.
 - e. Actual equipment locations.
 - f. Duct size and routing.
 - g. Locations of concealed internal utilities.
 - h. Changes made by Change Order.
 - i. Changes made following Architect's written orders.
 - j. Details not on the original Contract Drawings.
 - k. Field records for variable and concealed conditions.
 - l. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as paper copy.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as paper copy.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017846 – MAINTENANCE MATERIALS AND ATTIC STOCK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for maintenance materials (commonly referred to as “attic stock”).

1.2 RELATED DOCUMENTS

- A. Section 017700 “Closeout” for closeout requirements.
- B. Section 017823 “Operation and Maintenance Data” for operation and maintenance manual requirements.
- C. Section 017839 “Project Record Documents” for submitting record Drawings, record Specifications, and record Product Data.

1.3 CLOSEOUT SUBMITTALS

- A. Schedule of Maintenance Material and Attic Stock Items: For maintenance material submittal items listed below and as specified in other Sections. Contractor shall submit the following a minimum of 5 days prior to requesting an inspection for determining date of Final Acceptance for the Work or a designated portion thereof.
 - 1. Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Label with manufacturer's name and model number where applicable. Obtain Designer's signature for receipt of submittal.
- B. Maintenance Material and Attic Stock Transmittal: Prior to Final Acceptance, Contractor shall turn over all items on the Schedule of Maintenance Material Items to N.C. State. Contractor shall obtain N.C. State's recipients signature for each item received by each recipient.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide Maintenance Materials per individual Specification Section requirements.
- B. Division 21 Fire Protection (if applicable)
 - 1. Concealed sprinkler cover plates equal to number installed.
- C. Division 23 Campus Automation (if applicable)
 - 1. Sensors provide one (1) of each type (hydronic, air supply and humidity)
 - 2. Zone thermostats provide two (2).
- D. Division 26 Fire Alarm systems (if applicable)

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A

1. Fuses provide two (2) of each size installed.
2. MPS with monitor modules provide a minimum of one (1) or 2% of total installed.
3. Audio-visual devices provide a minimum of one (1) or 4% of total installed.
4. Indoor strobe only devices, provide a minimum of one (1) or 4% of total installed.
5. Exterior indicating devices, provide a minimum of one (1) or 2% of total installed.
6. Spot Smoke Detectors provide a minimum of one (1) or 6% of total installed.
7. Spot heat/thermal detectors provide a minimum of one (1) or 6% of total installed.
8. Spot detector bases provide a minimum of one (1) or 2% of total installed.
9. Spot detector sounder bases provide a minimum of one (1) or 6% of total installed.
10. Relay modules provide a minimum of one (1) or 4% of total installed.
11. Monitor modules provide a minimum of one (1) or 4% of total installed.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017846

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Operating standards.
 - c. Regulatory requirements.
 - d. Equipment function.
 - e. Operating characteristics.
 - f. Limiting conditions.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.

- d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 4. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.
- B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- C. Predemolition Photographs or Video: Submit before Work begins.
- D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Division 01, Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 01, Section "Special Inspections" for inspections of structural steel framing.
 - 3. Division 02, Section "Earthwork" for drainage fill under slabs-on-grade.
 - 4. Division 03, Section "Concrete Pavement" for concrete pavement and walks.

1.2 SUBMITTALS

- A. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Submit in accordance with ACI 318.99, Section 5.3.
- B. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Form materials and form-release agents.
 - 3. Steel reinforcement and reinforcement accessories.
 - 4. Fiber reinforcement.
 - 5. Admixtures.
 - 6. Waterstops.
 - 7. Curing materials.
 - 8. Vapor barriers.
- E. Cold Weather Concreting: Submit description of planned protective measures.
- F. Hot Weather Concreting: Submit description of planned protective measures.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Owner will engage a qualified independent testing and inspection agency for field quality control.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 318, "Building Code Requirements for Structural Concrete."
 - 4. ACI 305R 91, "Hot Weather Concreting".
 - 5. ACI 306R 88, "Cold Weather Concreting".
 - 6. ACI 347, "Recommended Practice for Concrete Formwork".

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths, and other data corresponding to information shown on placement drawings.
 - 1. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- C. Reinforcing Accessories:
 - 1. Tie wire: Black annealed type, 16 1/2 gage or heavier.
 - 2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice".
 - a. Class 1 (plastic protected) at all formed surfaces which will be exposed to weather.
 - b. Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather.
 - c. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

2.3 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
 - b. Conseal CS-231; Concrete Sealants Inc.
 - c. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.
 - d. Hydrotite; Greenstreak.
 - e. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
 - f. Adeka Ultra Seal; Mitsubishi International Corporation.
 - g. Superstop; Progress Unlimited Inc.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 1. Fly Ash: ASTM C 618, Class C or F.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 1. Class: Moderate weathering region, but not less than 3M.
 2. Nominal Maximum Aggregate Size: as noted.
- C. Lightweight Aggregate: ASTM C330, 3/4-inch nominal maximum aggregate size
- D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 VAPOR BARRIER

- A. Vapor Barrier
 1. Vapor barrier must have all of the following qualities:
 - a. Permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with ASTM E 1745 Section 7.1.
 - b. Other performance criteria:
 - 1). Strength: ASTM E 1745 Class A.

- 2). Thickness: 15 mils
- c. Manufactured from prime virgin resins.
- 2. Manufacturers:
 - a. Stego Wrap, (877) 464-7834.
 - b. Griffolyn T-85 by Reef Industries, (800) 231-6075.
 - c. Moistop Ultra A by Fortifiber Industries, (800) 773-4777.
 - d. Vapor Mat, W.R. Meadows Inc.
- 3. Seam Tape and Penetration Tape:
 - a. Manufacturer's recommended tape.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.8 RELATED MATERIALS

- A. Joint-Filler Strips: 100% recycled rubber meeting ASTM D 1751 and ASTM D 1752.
- B. Bond Breaker: Felt Underlayment: Type II, asphalt-saturated organic felt, complying with ASTM D 226 (No. 30) or ASTM D 4869.
- C. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
- F. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- G. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1, ACI 301, and ACI 318.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Cementitious Materials: Percentage, by weight, of cementitious materials other than portland cement in concrete shall be as noted.
- D. Footings: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3,000 psi.
 - 2. Nominal Maximum Aggregate Size: 3/4 inch.
 - 3. Combined Fly Ash and Pozzolan: Not more than 25 percent.
 - 4. Maximum Slump: 4 inches.
 - 5. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.
 - 6. Air Content: Less than 3 percent (no air entrainment).

- E. Walls, Grade Beams and Piers: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4,000 psi.
 - 2. Nominal Maximum Aggregate Size: 1 inch.
 - 3. Combined Fly Ash and Pozzolan: Not more than 25 percent.
 - 4. Maximum Slump: 4 inches.
 - 5. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.
 - 6. Air Content: Less than 3 percent.
- F. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3,000 psi.
 - 2. Nominal Maximum Aggregate Size: 3/4 inch.
 - 3. Combined Fly Ash and Pozzolan: Not more than 25 percent.
 - 4. Maximum Slump: 3 inches prior to addition of water-reducing admixture; 8 inches after addition of water-reducing admixture.
 - 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- G. Suspended Slabs on Composite Steel Deck: Proportion structural lightweight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days.
 - 2. Maximum aggregate size: 3/4 inch.
 - 3. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C567.
 - 4. Slump Limit: 4 inches, plus or minus 1 inch.
 - 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- H. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- I. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 CONCRETE FORM PREPARATION

- A. General: Comply with requirements of ACI 301 for formwork, and as herein specified. The contractor is responsible for design, engineering, and construction of formwork, and for its timely removal.
- B. Earth Forms: Hand trim bottoms and sides of earth forms to profiles indicated on the drawings. Remove loose dirt before placing concrete.
- C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch, at all floors.
 2. Class B, 1/4 inch, at all other work.
- E. Construct forms tight enough to prevent loss of concrete mortar.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 1. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. At least 70 percent of 28-day design compressive strength.
 - 2. Determine compressive strength of in-place concrete by testing representative field-cured test specimens according to ACI 301.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR BARRIERS

- A. Vapor Barriers: Place, protect, and repair vapor-barrier sheets according to ASTM E 1643 and manufacturer's written instructions. Seal seams and tears with vapor barrier seam tape. Tape perimeter of all vapor barrier penetrations.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07, Section "Joint Protection," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 2. Do not apply rubbed finish to smooth-formed finish.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
 2. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot- long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - a. 1/8 inch.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated, to surfaces to receive resinous flooring, and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTION AND CURING

A. General:

1. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.

B. Normal Curing Period:

1. Not less than 7 days for standard cements and mixes.
2. Not less than 4 days for high early strength concrete using Type III cement.

C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.

1. Keep wooden or metal forms moist when exposed to heat of the sun.
2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.

D. Surfaces Not in Contact with Forms:

1. Start initial curing as soon as free water has disappeared, but before surface is dry.
2. Keep continuously moist for not less than 7 days by uninterrupted use of any of the following:
 - a. Water ponding.
 - b. Water-saturated sand.
 - c. Water-fog spray.
 - d. Saturated burlap: Provide 4-inch minimum overlap at joints.
3. Begin final curing procedures immediately following initial curing and before concrete has dried.
 - a. Moisture-retaining cover: Lap not less than 3 inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.
 - 1). Extend covering past slab edges at least twice the thickness of slab.
 - 2). Do not use plastic sheeting on surfaces which will be exposed to view when in service.
 - b. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain.
 - c. Curing and sealing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain. Apply additional coat near substantial completion to act as sealer.
 - d. Use curing compounds only in locations permitted or required, and where use will not interfere with other finishes, coatings, or coverings to be applied.

- 4. Continue final curing to end of curing period.
- E. Avoid rapid drying at end of curing period.
- F. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Progressively adjust protective measures to provide uniform temperature changes over entire concrete surface.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will employ and pay for a qualified independent testing and inspecting agency to sample materials, perform tests, perform inspections and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
 - a. Two cylinders shall be broken at 7 and 28 days. The fifth cylinder shall be held in reserve and broken at the direction of the structural engineer.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural shapes.
 - 2. Channels and angles.
 - 3. Hollow structural sections.
 - 4. Structural pipe.
 - 5. Structural plates and bars.
 - 6. Fasteners, connectors, and anchors.
 - 7. Base plate grout.
- B. Related Sections:
 - 1. Section 052100 - Steel Joists.
 - 2. Section 053100 - Steel Decking.

1.2 REFERENCES

- A. American Institute of Steel Construction:
 - 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
 - 2. AISC Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
 - 3. AISC Load and Resistance Factor Design Specification for Single-Angle Members.
 - 4. AISC Seismic Provisions for Structural Steel Buildings.
 - 5. AISC Specification for Allowable Stress Design of Single-Angle Members.
 - 6. AISC Specification for the Design of Steel Hollow Structural Sections.
 - 7. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.
- B. American Society of Civil Engineers:
 - 1. ASCE 19 - Standard Applications of Steel Cables for Buildings.
- C. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 5. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. ASTM A193/A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
7. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
8. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
10. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.
11. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
15. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
16. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
17. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM A588/A588M - Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
19. ASTM A618 - Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing.
20. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
21. ASTM A847 - Standard Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance.
22. ASTM A852/A852M - Standard Specification for Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick.
23. ASTM A913/A913M - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
24. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.
25. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
26. ASTM E94 - Standard Guide for Radiographic Examination.
27. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments.
28. ASTM E165 - Standard Test Method for Liquid Penetrant Examination.
29. ASTM E709 - Standard Guide for Magnetic Particle Examination.
30. ASTM F436 - Standard Specification for Hardened Steel Washers.
31. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

- 32. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- 33. ASTM F1852 - Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- D. American Welding Society:
 - 1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - 2. AWS D1.1 - Structural Welding Code - Steel.
- E. Research Council on Structural Connections:
 - 1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts.
- F. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.
 - 2. SSPC Paint 15 - Steel Joist Shop Paint.
 - 3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).
 - 4. SSPC SP 3 - Power Tool Cleaning.
 - 5. SSPC SP 6 - Commercial Blast Cleaning.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, location of structural members, openings, attachments and fasteners.
 - 2. Connections. Engage a fabricator who utilizes a North Carolina registered Professional Engineer to prepare calculations, shop drawings and other structural data for structural steel connections.
 - 3. Cambers.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Mill Test Reports: Submit indicating structural strength, destructive and non-destructive test analysis.
- D. Manufacturer's Mill Certificate: Certify products meet or exceed specified requirements.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
 - 2. AISC Code of Standard Practice for Steel Buildings and Bridges. Section 10.

3. AISC Seismic Provisions for Structural Steel Buildings.
4. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design.

1.5 QUALIFICATIONS

- A. Fabricator: Company specializing in performing Work of this section with minimum 5 years experience with the following current AISC Certification:
 1. Standard Steel Building Structures (STD).
- B. Erector: Company specializing in performing Work of this section with minimum 5 years experience.
- C. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.

1.6 COORDINATION

- A. Section 014000 - Quality Requirements.
- B. Coordinate work with the following:
 1. Section 052100, 053100.
 2. Section 055000 for miscellaneous steel supports other than structural steel.
 3. Section 078110 for finishes on structural steel receiving fireproofing.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

- A. Structural W-Shapes: ASTM A992.
- B. Structural M-Shapes: ASTM A36.
- C. Structural T-Shapes: Cut from structural W-shapes.
- D. Channels and Angles: ASTM A36.
- E. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.
- F. Structural Pipe: ASTM A53, Grade B.
- G. Structural Plates and Bars: ASTM A36.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
 1. Finish, Interior Framing: Plain, uncoated.
 2. Finish, Exterior Framing: Mechanically deposited zinc coating, ASTM B 695, Class 50.

- B. Nuts: ASTM A563 heavy hex type.
 - 1. Finish: Unfinished.
- C. Washers: ASTM F436; Type 1, circular
 - 1. Finish: Unfinished.
- D. Shear Connectors: ASTM A108; Grade 1015 or 1020, headed, unfinished and in accordance with AWS D1.1; Type B.
- E. Threaded Anchor Rods: ASTM F 1554, Grade 36 or Grade 55, as indicated on Drawings.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 5. Finish, Interior Framing: Plain.
 - 6. Finish, Exterior Framing: Hot-dip zinc coating, ASTM A 153/A 153M, Class C or mechanically deposited zinc coating, ASTM B 695, Class 50.
- F. Forged Structural Steel Hardware:
 - 1. Clevises and Turnbuckles: ASTM A108; Grade 1085.
 - 2. Eye Nuts and Eye Bolts: ASTM A108; Grade 1030.
 - 3. Sleeve Nuts: ASTM A108; Grade 1018.
 - 4. Rod Ends, Yoke Ends and Pins, Cotter Pins, and Coupling Nuts: Carbon steel.

2.3 WELDING MATERIALS

- A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ACCESSORIES

- A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days.
- B. Shop and Touch-Up Primer:
 - 1. Concealed Structural Steel: Fabricators dark color rust-inhibiting primer.
 - 2. Exposed Structural Steel: Series 90-97 Tneme-Zinc . DFT 2.5 to 3.n mils.

2.5 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- B. Fabricate connections for bolt, nut, and washer connectors.
- C. Develop required camber for members.

2.6 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 3 "Power Tool Cleaning" for all concealed work and SSPC SP 6 "Commercial Blast Cleaning" for all work exposed to view.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded or in contact with concrete.
- C. Galvanizing for Structural Steel Members: ASTM A123; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.
- D. Galvanizing for Fasteners, Connectors, and Anchors:
 - 1. Hot-Dipped Galvanizing: ASTM A153.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Shop test bolted and welded connections as specified for field quality control tests.
- C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify bearing surfaces are at correct elevation.
- B. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

- A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field weld components and shear connectors indicated on Drawings.

- C. Field connect members with threaded fasteners; tighten to snug tight for bearing type connections.
- D. Do not field cut or alter structural members without approval of Architect/Engineer.
- E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

- A. Shim bearing plates and equipment supports to proper elevation, snug tighten anchor bolts.
- B. Fill void under bearing surface with grout. Install and pack grout to remove airpockets.
- C. Moist cure grout.
- D. Remove forms after grout is set. Trim grout edges to form smooth surface, splayed 45 degrees.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested work complied with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements at no additional cost to the Owner.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Direct-tension indicator gaps will be verified to comply with ASTM F 592, Table 2.
- E. In addition to visual inspection, field welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 - 1. Liquid Penetrant Inspection: ASTM E165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
 - 4. Ultrasonic inspection: ASTM E 164.

F. Contractor shall furnish all necessary staging, platforms, ladders, or other items necessary to facilitate the testing laboratory in testing and inspecting the work.

G. The testing laboratory shall inspect 50% of the fillet welds and spot check gauge and length of all welds.

3.6 CLEANING

A. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

B. Touch up all hot dipped galvanized steel with high zinc dust content paint.

1. For re-galvanizing welds and steel, comply with SSPC-Paint 20.

END OF SECTION 051200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for overhead doors and grilles
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
5. Steel framing and supports for mechanical and electrical equipment.
6. Elevator hoist beams and divider beams.
7. Steel shapes for supporting elevator door sills.
8. Shelf angles.
9. Metal ladders.
10. Ladder safety cages.
11. Metal floor plate and supports.
12. Miscellaneous steel trim including steel angle corner guards and loading-dock edge angles.
13. Metal bollards.
14. Cast-iron wheel guards.
15. Pipe and downspout guards.
16. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

- C. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.

2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Metal Stairs."
5. Division 05 Section "Pipe and Tube Railings."
6. Division 05 Section "Metal Gratings."
7. Division 05 Section "Decorative Metal Railings."

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
 2. Prefabricated building columns.
 3. Metal nosings and treads.
 4. Paint products.
 5. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).

2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230); 0.0528-inch (1.35-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

- H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy **Group 1 (A1)** stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a

minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3 unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:

1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
2. Space siderails of elevator pit ladders 12 inches (300 mm) apart.
3. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
4. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
6. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
7. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) IKG Industries, a division of Harsco Corporation; Mebac.
 - 2) SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.
 - 3) Ross Technology Corp.; Algrip.
8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
9. Galvanize ladders, including brackets and fasteners.

2.9 METAL FLOOR PLATE

- A. Fabricate from abrasive-surface floor plate of thickness indicated below:
1. Thickness: As indicated.
- B. Provide grating sections where indicated fabricated from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch (12 mm).
- C. Provide steel angle supports as indicated.
- D. Include steel angle stiffeners, and fixed and removable sections as indicated.
- E. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

- C. Galvanize exterior miscellaneous steel trim.

2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.

2.12 CAST-IRON WHEEL GUARDS

- A. Provide wheel guards made from cast iron, 3/4 inch (19 mm) thick, hollow-core construction, of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.
- B. Prime cast iron wheel guards with zinc-rich primer.

2.13 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.14 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.15 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.16 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.17 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer [primers specified in Division 09 painting Sections] unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

- B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- D. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLING CAST-IRON WHEEL GUARDS

- A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

3.5 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Wood blocking and nailers.
 - 2. Plywood backing panels.

- B. Related Requirements:

- 1. Division 31 Section "Soil Treatment" for site application of borate treatment to wood framing.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.

1.6 QUALITY ASSURANCE

- ### A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- ### A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- #### A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- #### B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less, no limit for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- E. Comply with AWP M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

- G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 061053

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 2. Section 123661 "Solid Surfacing Countertops".
 - 3. Section 093100 "Ceramic Tile"

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, fire-retardant-treated materials, and cabinet hardware and accessories.

- 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- B. Sustainable Design Submittals:

- 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
 4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
1. Show details full size.
 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- D. Samples for Initial Selection:
1. PVC edge material.
 2. Thermoset decorative panels.
- E. Samples for Verification:
1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 2. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
 3. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For the following:
1. Composite wood and agrifiber products.
 2. Thermoset decorative panels.
 3. Adhesives.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- B. Installer Qualifications: .
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical plastic-laminate cabinets as directed by the Architect.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. Regional Materials: Wood products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- E. Type of Construction: Frameless.
- F. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- G. Reveal Dimension: 1/2 inch, unless otherwise indicated on the Drawings.
- H. High-Pressure Decorative Laminate (Types PL01, and PL02): NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, for PL01 provide Formica and for PL02 provide Stylite or a comparable product by one of the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Pionite: a Panolam Industries International, Inc. brand.
 - e. Wilsonart International Holdings, Inc.
- I. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade VGS.
 - 3. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - 4. Pattern Direction: As indicated, or if not indicated, vertically for drawer fronts, doors, and fixed panels.

J. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding, matching panel facing in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

K. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

L. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

M. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

N. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations indicated on the Drawing "FINISH LEGEND."

O. Treated wood composite panel: Basis of design

1. Basis-of-Design Product: Subject to compliance with requirements provide the Extira JELD-WEN, inc., or a comparable product of one of the following:
 - a. Tricoya, ACCSYS Technologies.
 - b. Armorite, Roseburg Forest Products.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.
- C. Composite Wood Products: Products shall be made without urea formaldehyde.
1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 2. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Panel Source International, Inc.; Pyroblock Platinum.
 - b. SierraPine; Medite FR.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening.
- C. Back-Mounted Pulls: BHMA A156.9, B02011; as indicated on the Drawings, or if not indicated, as follows:
 - 1. Basis of Design Product: Hafele; “Model No. 124.02.220.”
- D. Catches: Magnetic catches, BHMA A156.9, B03141.
- E. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- F. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For drawers 6 inches high or less and not more than 24 inches wide, provide Grade 1HD-100.
 - 3. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 4. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- G. Door Locks: BHMA A156.11, E07121.
- H. Drawer Locks: BHMA A156.11, E07041.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 INSTALLATION MATERIALS

- A. Hanger Clips: Aluminum concealed panel anchors, consisting of continuous substrate Z-shaped support channel and individual Z-shaped clips anchored to the back surface of panel products.
 - 1. Basis of Design Product; Provide Monarch “Z” Clip, Model MF-375 or a comparable product of an approved manufacturer complying with the following:
 - a. Projection from Substrate Surface: 1/4-inch projection.
 - b. Minimum Lift-Off Clearance at Top of Cabinet: 3/8 inch.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with continuous hanging clips.
 - a. Channels: Install wall-mounted channel at top and bottom of each wall cabinet, and not more than 48 inches on center between. Locate bottom of bottom channel not less than 3 inches above lower cabinet edge.
 - b. Install “Z”-clips on back side of cabinets spaced to align with continuous wall-mounted support channels. Provide clips at 24 inches on center, but no less than 2 clips per channel. Locate center of clip 4 inches from vertical edges of cabinets.
- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Glass-fiber board insulation.
5. Mineral-wool blanket insulation.
6. Mineral-wool board insulation.

- B. Related Requirements:

1. Section 093100 " Ceramic Tile" for substrate for solid surface.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Glass-fiber board insulation.
5. Mineral-wool blanket insulation.
6. Mineral-wool board insulation.

- B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
 - 1. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. MBCI.
 - d. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

- B. Extruded Polystyrene Board Insulation, Type VI: ASTM C578, Type VI, 40-psi (276-kPa) minimum compressive strength.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation Limited.
 - d. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas EPS; a Division of Atlas Roofing Corporation.
 - b. Atlas Roofing Corporation.
 - c. Carlisle Coatings & Waterproofing Inc.
 - d. Dow Chemical Company (The).
 - e. Firestone Building Products.
 - f. Hunter Panels.
 - g. Johns Manville; a Berkshire Hathaway company.
 - h. Rmax, Inc.
 - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway Company.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.4 GLASS-FIBER BOARD INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Glass-Fiber Board Insulation, Unfaced: ASTM C612, Type IA; unfaced, passing ASTM E136 for combustion characteristics.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway Company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Nominal Density: 3 lb/cu. ft. (48 kg/cu. m) or 4.25 lb/cu. ft. (68 kg/cu. m).
 5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 6. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.5 MINERAL-WOOL BLANKET INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.
- C. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.6 MINERAL-WOOL BOARD INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.
- C. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
 2. Nominal Density: 4 lb/cu. ft. (64 kg/cu. m).
 3. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
 4. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.7 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Standard hollow-metal steel doors.
- 2. Standard hollow-metal steel frames.
- 3. Standard hollow metal louvered doors

- B. Related Sections include the following:

- 1. Division 4 Section "Unit Masonry Assemblies" for building anchors into and grouting standard steel frames in masonry construction.
- 2. Division 8 Section "Fiber-Reinforced Plastic (FRP) Doors and Frames" for exterior FRP doors in standard steel frames.
- 3. Division 8 Section "Glazing" for glazed lites in standard steel doors and frames.
- 4. Division 8 Sections for door hardware for standard steel doors.
- 5. Division 9 painting Sections for field painting standard steel doors and frames.
- 6. Division 10 Section "Louvers" for louvers to be mounted above steel frames.
- 7. Division 13 Section "Access Control System" for wiring to be run inside exterior steel frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.
- B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details.

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Standard hollow-metal steel doors.
 - 2. Standard hollow-metal steel frames.
 - 3. Standard hollow metal louvered doors
- B. Related Sections include the following:
 - 1. Division 8 Section "Glazing" for glazed lites in standard steel doors and frames.
 - 2. Division 8 Sections for door hardware for standard steel doors.
 - 3. Division 9 painting Sections for field painting standard steel doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.
- B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details.
 - 3. Frame details for each frame type, including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Details of glazing frames and stops showing glazing.
 - 8. Details of conduit and preparations for electrified door hardware and controls.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
- D. Qualification Data: For Installer.
- E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amweld Building Products, LLC.
 2. Benchmark Doors; a division of General Products Co., Inc.
 3. Ceco Door Products; an ASSA ABLOY Group Company.
 4. CURRIES Company; an ASSA ABLOY Group Company.
 5. Deansteel Manufacturing, Inc.
 6. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
 7. Kewanee Corporation (The).
 8. Mesker Door Inc.
 9. Pioneer Industries, Inc.
 10. Republic Builders Products Company.
 11. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- E. Grout: Comply with Division 4 Section "Unit Masonry Assemblies."
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- G. Glazing: Comply with requirements in Division 8 Section "Glazing."
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.
 - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- C. Exterior Heavy-Duty Doors: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: Hollow Metal.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - f. Core: Kraft-paper honeycomb with vertical steel stiffener.
- D. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
 - 1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
 - 2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.

3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
 2. Frames for Hollow Metal Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
 2. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 3. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
 2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
 3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.
- E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- F. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

- G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- H. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.

2.5 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.6 ACCESSORIES

- A. Louvers: Provide louvers for exterior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 22 gauge thick, cold-rolled steel sheet set into 20 gauge thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

2.7 FABRICATION

- A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Standard Steel Doors:
 - 1. Glazed Lites: Factory cut openings in doors.
- C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) in height.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) in height.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 120 inches (3048 mm) in height.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) in height.
 - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
 - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
 - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
 2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of doors and frames.
 - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.8 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish standard steel door and frames after assembly.
- B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint, as needed, specified below to comply with ASTM A 780.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Standard Steel Frames: Install standard steel frames for doors, sidelights, borrowed lights and other openings, of size and profile indicated. Comply with SDI 105.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

- a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Standard Steel Doors:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.
- 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 081113

SECTION 083800 – IMPACT TRAFFIC DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithically (one piece) formed, insulated, high impact door systems
2. Spring bumpers and windows
3. Hardware and accessories

B. Related Sections:

1. Section 05500 - Metal Fabrications: Prepared opening with steel channel jambs and header.

1.2 SUBMITTALS

- A. Reference Section 01330 - Submittal Procedures; submit the following items:
1. Product information in print or electronic format.
 2. Shop Drawings: Show fabrication details.
Include door elevations, head, jamb and meeting stile details including full or partial gaskets.
 3. Samples: Full range of manufacturer's standard color selections for panel.
 4. Quality Assurance/Control Submittals:
 - a. Manufacturer's Installation Instructions.
 5. Closeout Submittals:
 - a. Cleaning and Maintenance instructions
 - b. Warranty

1.3 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer Qualifications: Minimum 5 years experience in producing doors of the type specified.

1.4 DELIVERY STORAGE AND HANDLING

- A. Section 01660 - Product Storage and Handling Requirements: Transport, handle, store and protect Products.
- B. Deliver product in manufacturer's original unopened packages with label legible and intact.
- C. Examine doors upon delivery for damage. Verify doors were shipped on edge or in upright position as indicated on packaging by manufacturer.
 - 1. Note specific doors shipped in other than on edge or upright position on bill of lading and contact manufacturer.
- D. Store doors at project site on edge or in upright position and under cover following manufacturer's instructions printed on carton.

1.5 PROJECT/SITE CONDITIONS

- A. Existing Conditions: Frames installed, under other sections, shall be level and plumb.

1.6. WARRANTY

- A. 730 days from the date of installation or 760 days from the date of shipment, whichever comes first.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Durulite Standard by Chase Industries, Inc.
 - 1. Substitutions will be considered.

2.2 DOOR COMPONENTS

- A. Door Panel: shall be a monolithic, one piece, hollow shell of high impact, rotationally molded polyethylene with minimum wall thickness of 1/4", overall panel thickness of 1-7/8" and textured finish. Bottom, leading and back edges have molded in keyways to accept gaskets.
- B. Door Panel Core: shall be of high density, foamed-in-place, non-CFC urethane bonded to interior of the cross linked polyethylene shell providing an insulating R factor of 10.83.
- C. Standard Hinge System: consists of the following components:
 - 1. Upper hinge: self closing "V" cam design; [1-3/8" standard rise, 3/4" low rise, 180°, spring assist]. The roller assembly design shall allow up and down and back and forth adjustments to the door. Upper hinge seal shall be black PVC with a flexible nylon reinforced vinyl skirt.
 - 2. Lower hinge: shall be pillow block design of zinc plated ductile iron [optional stainless steel pillow block] with UHMW sleeve and solid cast aluminum lower hinge adapter which has provision for mounting an optional spring assist.
 - 3. Hinge Shaft: 1-5/16" (33mm) diameter inserted with screws through tubular steel spine which is foamed -in -place during fabrication and runs full length of door.
- D. Vision Panel: Window glazing shall be 1/8" thick polycarbonate with black ABS frame [double pane shall be black aluminum frame pane] recessed a minimum of 1/8" from the face of the panel. Double pane window glazing shall be 1/8" thick Minimum height from finish floor to the bottom of the viewing area shall not exceed 48 inches.

[panel size	window size
24"	10 ½" x 22 ½"
34"	18 ½" x 22 ½"
27, 30"	14 ½" X 22 ½"
32"	16 ½" X 22 ½"
36, 42, 48"	20 ½" X 22 ½"
54, 60"	22 ½" X 22 ½"]

E. Gaskets: Gaskets shall be 60 to 80 durometer extruded black santoprene fitted into matching, pre-formed gasket key and held by friction. Gaskets have wings which seal against rounded edges of the door.

1. [Fully Gasketed: Leading edge shall be [blade-type for a double door or bulb-type for a single panel]. Bulb type gasket is used on the bottom and between the back of the door and jamb. Top seal is a coextruded PVC extrusion with flexible PVC gasket]

2.3 ACCESSORIES

- A. Polyethylene Spring Bumpers with 4" projection, [6", 12", 18", 24", 36" or 42" heights}. Color to be determined by Architect from manufacturer's standard selection.
- B. Lower Hinge Guards
- C. Double Pane View Windows (*for use when ambient temperature between areas is 30° or more. Not to be used on freezer doors*)
- D. Limiting Posts, architecture to select from manufacturer's standard selection.

2.4 FABRICATION

- A. Appropriate size panel is roto-molded with back edge steel and gasket extrusions in place. Panel is then foamed-in-place with non-CFC urethane. The panel is then trimmed, drilled, fit with hardware, vision panel, gasketing and required options installed. Completed door is serialized and packaged with hinge mounting hardware kit.
- B. Complete unit to be assembled at factory, neat in appearance, free from defects and warping.

2.5 SOURCE QUALITY CONTROL

- A. Tolerances: Width and height of each panel: +/-1/4 inch. Maximum allowable deflection shall meet industry standards of a 1/4" per 36.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that openings are ready to receive work and opening dimensions and clearances are as indicated on drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory conditions.
- C. Commencement of work by installer is acceptance of opening conditions.

3.2 INSTALLATION

- A. Follow manufacturer's instructions. Coordinate sequence of installation with other work to avoid delays.
- B. Install doors accurately in their respective frames with clearances, necessary anchors, hardware and accessories according to the manufacturer's data and as specified.

3.3 ADJUSTING

- A. Follow manufacturer's instructions as required to:
 - 1. Clean and lubricate operating parts.
 - 2. Adjust to open and close smoothly and freely without binding
 - 3. Check seals for proper fit.

3.4 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

END OF SECTION 083800

SECTION 084110 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior storefront framing.
 - 2. Storefront framing for window walls.
 - 3. Storefront framing for punched openings.
 - 4. Exterior and interior manual-swing entrance doors and door-frame units.
- B. Related Sections:
 - 1. Division 08 Section "Glazing".

1.3 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 - 2. Dimensional tolerances of building frame and other adjacent construction.
 - 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.

- f. Sealant failure.
- g. Failure of operating units.

B. Structural Loads:

- 1. Wind Loads:
 - a. Basic Wind Speed: 90 mph (40 m/s).
 - b. Importance Factor: 1.15.
 - c. Exposure Category: C.
- 2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:

- 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
- 2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

- 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
- 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
- 3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

- 1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures.

Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
- I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
 1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Isometric Drawing: In lieu of fabrication sample in preceding paragraph, an isometric drawing included in Shop Drawings, at no less than half full-scale, is acceptable

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- D. Source quality-control reports.
- E. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- G. Preinstallation Conference: Conduct conference at Project site.

1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water leakage through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Two years from date of Acceptance.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 20 years from date of Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Trifab VG 451T by Kawneer North America or comparable product by one of the following:
1. EFCO Corporation.
 2. Tubelite.
 3. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
 4. YKK AP America Inc.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM B 308/B 308M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
 - 1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: 2- to 2-1/4-inch (50.8- to 57.2-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: As indicated.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

- a. Provide nonremovable glazing stops on outside of door.

- B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.6 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing from exterior.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Entrance Door Frames: Provide steel reinforcing for all aluminum frames at jambs and headers to support loads imposed by door operation and for installing entrance door hardware.
 1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Division 08 Section "Glazing."

- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

- F. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION 084110

SECTION 084126 - ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior swinging all-glass entrance doors.
 - 2. Interior all-glass storefronts.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for overhead-steel support for all-glass systems.
 - 2. Section 087110 "Door Hardware" for cylinders.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. System schematic.
 - b. Point-to-point wiring diagram.
 - c. Riser diagram.
 - d. Elevation of each door.
 - 2. Detail interface between electrified door hardware and fire alarm system, the access control system, and the-security system.

- C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
 - a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - 1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
- D. Samples for Initial Selection: For each type of exposed finish indicated.
- E. Samples for Verification: For each type of exposed finish indicated, prepared on Samples of size indicated below.
1. Metal Finishes: 6-inch- (150-mm-) long sections of patch fittings and rail fittings, accessory fittings, and other items.
 2. Glass: 6 inches (150 mm) square, showing exposed-edge finish.
 3. Door Hardware: For exposed door hardware of each type, in specified finish, full size.
- F. Delegated-Design Submittal: For all-glass systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For all-glass systems, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For all-glass systems to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Supplier Qualifications: Door hardware supplier with office and warehousing facilities within 100 miles of Project's site and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Electrified Door Hardware Supplier Qualifications: An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
 - a. Engineering Responsibility: Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- D. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 - 1. Electrified Door Hardware Qualifications: Experienced in providing consulting services for electrified door hardware installations.
- E. Regulatory Requirements: Comply with provisions of the following:
 - 1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," as follows:

- a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.
 2. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
 - c. Thresholds: Not more than 1/2 inch (13 mm) high.
 3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 2. Review sequence of operation for each type of electrified door hardware.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review required testing, inspecting, and certifying procedures.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - b. Failure of operating components.
 - 2. Warranty Period: Two years from date of Final Acceptance, except as follows:]
 - a. Concealed Floor Closers: Five years from date of Final Acceptance.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design all-glass entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of all-glass entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 MANUFACTURERS

- A. Provide All-Glass Entrance and Storefront System from one of the following: Basis of Design: C.R. Laurence Co., Inc; CRL Cascade Series Frameless Glass Wall Office System or Equal by Blumcraft, Oldcastle Building Envelope, Virginia Glass, Vistawall or Vitro America

2.3 METAL COMPONENTS

- A. Fitting Configuration:
 - 1. Manual-Swinging, All-Glass Entrance Doors: Patch fittings at head and sill on pivot side, and for lock at sill of swing side.
 - 2. All-Glass Storefronts: Recessed glazing channel at top and bottom.

- B. Patch Fittings: Aluminum.
- C. Rail Fittings:
 - 1. Material: Aluminum.
 - 2. Height:
 - a. Top Rail: 2 inches.
 - b. Bottom Rail: 2 inches.
 - 3. Profile: As indicated.
 - 4. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
- D. Accessory Fittings: Match patch-fitting metal and finish for the following:
 - 1. Overhead doorstop.
 - 2. Center-housing lock.
 - 3. Glass-support-fin brackets.
- E. Anchors and Fastenings: Concealed.
- F. Materials:
 - 1. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5.
 - a. Color: As selected by Architect from full range of industry colors and color densities.

2.4 GLASS

- A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.
 - 1. Class 1: Clear monolithic.
 - a. Thickness: 1/2 inch.
 - b. Locations: As indicated.

2.5 ENTRANCE DOOR HARDWARE

- A. General: Heavy-duty entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of patch fittings.
- B. Concealed Floor Closers and Top Pivots: Center hung; BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.

1. Swing: Single acting.
 - a. Positive Dead Stop: Coordinated with hold-open angle if any, or at angle selected.
 2. Hold Open: No hold-open feature to be provided.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion.
 - b. Accessible Interior Swinging Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Concealed Overhead Holder: BHMA A156.8, Grade 1, with dead-stop setting coordinated with concealed floor closer.
- D. Exit Device Basis of Design: Blumcraft 2000 Series
- E. Electric Strike Basis of Design: Folger Adams 310-1
- F. Push-Pull Set Basis of Design: Blumcraft DB-130-F, Handle Style F.
- G. Power Supply Basis of Design: Secuitron BPS 12-24V
- H. Single-Door and Active-Leaf Locksets: Center-housing deadbolt with pulls.
 1. Deadbolt operated by key outside and key inside.
- I. Cylinders: As specified in Section 087100 "Door Hardware."
- J. Threshold: Not more than 1/2 inch (13 mm) high.
- 2.6 FABRICATION
- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
 1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.
- C. Furnish and install all required components for security hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install all-glass systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts according to manufacturer's written instructions.
- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
- F. Install butt-joint sealants according to manufacturer's instructions and as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

3.3 ADJUSTING AND CLEANING

- A. Adjust all-glass entrance doors and hardware to produce smooth operation and tight fit at contact points and weather stripping.
 - 1. For all-glass entrance doors accessible to people with disabilities, adjust closers to provide a three-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.
- B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 084126

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:

- 1. Mechanical and electrified door hardware for:
 - a. Swinging doors.
 - b. Sliding doors.
- 2. Electronic access control system components, including:
 - a. Electronic access control devices.

- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors

- C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
- 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
- 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
- 4. Division 13 Section "Radiation Protection" for requirements for lead-lining for door hardware at openings indicated to receive radiation protection.
- 5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
- 6. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

- A. UL - Underwriters Laboratories

- 1. UL 10B - Fire Test of Door Assemblies

2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
 - a. Door Index; include door number, heading number, and Architects hardware set number.

- b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
- c. Type, style, function, size, and finish of each hardware item.
- d. Name and manufacturer of each item.
- e. Fastenings and other pertinent information.
- f. Location of each hardware set cross-referenced to indications on Drawings.
- g. Explanation of all abbreviations, symbols, and codes contained in schedule.
- h. Mounting locations for hardware.
- i. Door and frame sizes and materials.
- j. Name and phone number for local manufacturer's representative for each product.
- k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).
Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
 - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

- a. All keying shall be provided by NCSU Lockshop

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

- 1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
- 2. Product Certificates for electrified door hardware, signed by manufacturer:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- 3. Certificates of Compliance:
 - a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
 - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
 - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
- 4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
- 5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

- 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

- a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
- b. Catalog pages for each product.
- c. Name, address, and phone number of local representative for each manufacturer.
- d. Parts list for each product.
- e. Copies of floor plans with keying nomenclature
- f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- g. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
 1. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 1. Warehousing Facilities: In Project's vicinity.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
 - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
 2. Can provide installation and technical data to Architect and other related subcontractors.
 3. Can inspect and verify components are in working order upon completion of installation.
 4. Capable of producing wiring diagrams.
 5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
 2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- I. Keying Conference:
1. Owner to conduct keying conference inviting required attendees as needed.
- J. Pre-installation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 4. Review sequence of operation for each type of electrified door hardware.
 5. Review required testing, inspecting, and certifying procedures.
- K. Coordination Conferences:
1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
 - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
 - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Architect and Contractor.
 - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
 - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
 - 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
 - 1. Promptly replace products damaged during shipping.
 - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
 - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Final Acceptance, for durations indicated.
 - a. Closers:
 - 1) Mechanical: 30 years.
 - b. Exit Devices:
 - 1) Mechanical: 3 years.
 - 2) Electrified: 1 year.
 - c. Locksets:
 - 1) Mechanical: 10 years.
 - 2) Electrified: 1 year.
 - d. Continuous Hinges: Lifetime warranty.
 - e. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents in quantities as determined by Owner.

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Heavy weight, steel, 4-1/2 inches (114 mm) high
4. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins

- e. Interior Non-lockable Doors: Non-rising pins
- 7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.

2.04 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:

- a. Scheduled Manufacturer: Ives.
- b. Acceptable Manufacturers: Select, Stanley.

2. Requirements:

- a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
- b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
- c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
- d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Install hinges with fasteners supplied by manufacturer.
- g. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

- a. Scheduled Manufacturer: Von Duprin EPT-10
- b. Acceptable Manufacturers: ABH PT1000, Securitron CEPT-10

B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.

C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

- 1. Scheduled Manufacturer: Ives

2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

2.08 MORTISE LOCKS

A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: Best 45H Series
2. Acceptable Manufacturers and Products: Corbin-Russwin ML2000 series, Schlage L 9000 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

- a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.09 EXIT DEVICES

A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: Von Duprin 98 series
2. Acceptable Manufacturers and Products: Detex Advantex 10 series, Precision Apex series.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.
10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

- a. Lever Style: Match lever style of locksets

12. Provide UL labeled fire exit hardware for fire rated openings.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Provide devices with all control inputs – door position input, external inhibit input, fire alarm input; auxiliary locking; nuisance alarm and internal horn; and, remote signaling output self-contained in the device assembly.

2.10 POWER SUPPLIES

A. Manufacturers and Products:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
2. Acceptable Manufacturers and Products: Precision ELR series, Dynalock 5000 series.

B. Requirements:

1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Options:
 - a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
 - b. Provide sealed batteries for battery back-up at each power supply where specified.
 - c. Provide keyed power supply cabinet.
 - d. Provide Fire Alarm relay board where power supplies are provided for fail safe applications.
5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

2.11 CYLINDERS

A. Manufacturers:

1. Owner Preferred Manufacturer: Schlage R134 7-Pin

B. Requirements:

1. Provide small format interchangeable core (SFIC) cylinders/cores zero bitted with uncut key blanks to match Owner's existing Schlage key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.
 - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - 1) 3 construction control keys
 - 2) 12 construction change (day) keys.
 - b. Provide and install construction cores for electronic wireless locks supplied by Security Contractor.
 - c. Provide permanent cores, zero bitted, to Owner as directed.
 - d. Owner will replace temporary construction cores with permanent cores.

2.12 KEYING

A. Keying to be performed by Owner.

1. Provide Uncut keys with the following features:
 - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - b. Patent Protection: Keys and blanks protected by one or more utility patent(s) the year, 2029.
2. Quantity: Furnish in the following quantities.
 - a. 3 per cylinder/core.

2.13 DOOR CLOSERS

A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: LCN 4010/4110 series
2. Acceptable Manufacturers and Products: Sargent 281/281P10 series factory assembled (without PRV), Norton 9500/PR9500 series (without PRV).

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges, with countersunk screw holes as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
 - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
 - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.

3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Reese

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
 - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
 - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.19 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.20 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide coat hooks as specified.

2.21 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing door and frame for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Provide construction cores for any lock provided by security provider.
 - 2. Furnish permanent cores to Owner for installation.

- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed on door and system headend details.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.
 - 2. Owner will inspect door hardware and provide final punch list prior to Building Occupancy inspection.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to

operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Final Acceptance, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Final Acceptance.

3.07 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.08 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- B. Hardware Sets:









WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Hardware Group No. 01

For use on Door #(s):

308

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	RX-LC-98-EO		⚡ 626	VON
1	EA	WIRELESS EXIT DEVICE TRIM	AD-400-993R-70 BATTERY OPERATED (SUPPLIED AND INSTALLED BY OWNER)		⚡ 626	SCE
1	EA	SFIC CORE	80-036		626	SCH
1	EA	SURFACE CLOSER	4111 EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

DOOR TO BE PREPPED FOR OWNER SUPPLIED LOCK. COORDINATE WITH ELECTRICAL AND SECURITY.

ENTRY BY CREDENTIAL OR KEY OVERRIDE. PRESENTING VALID CREDENTIAL TO CARD

READER LOCK WILL MOMENTARILY UNLOCK PANIC LEVER TRIM AND ALLOW ENTRY.

UPON LOSS OF POWER DOOR IS LOCKED.

DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.









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 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Hardware Group No. 02

For use on Door #(s):

310A 312 314 310 316 316A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	WIRELESS LOCK	AD-400-MS-70 BATTERY OPERATED (SUPPLIED AND INSTALLED BY OWNER)	 ⚡	626	SCE
1	EA	SFIC CORE	80-036		626	SCH
1	EA	SURFACE CLOSER	4011 REGARM		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP/HOLDER	WS40		626	IVE
1	EA	GASKETING	8144SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	369AA3-Z49-PULL-OUT		AA	ZER

DOOR TO BE PREPPED FOR OWNER SUPPLIED LOCK. COORDINATE WITH ELECTRICAL AND SECURITY.

ENTRY BY CREDENTIAL OR KEY OVERRIDE. PRESENTING VALID CREDENTIAL TO CARD READER LOCK WILL MOMENTARILY UNLOCK LOCK LEVER TRIM AND ALLOW ENTRY.

UPON LOSS OF POWER DOOR IS LOCKED.

DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.







DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

Hardware Group No. 03

For use on Door #(s):

318E 318F

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB458		626	IVE
1	EA	DUST PROOF STRIKE	DP2		626	IVE
1	EA	STOREROOM LOCK	45H-7-D-15H		626	BES
1	EA	SFIC CORE	80-036		626	SCH
2	EA	OH STOP & HOLDER	90H		630	GLY
2	EA	SILENCER	SR64		GRY	IVE





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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Hardware Group No. 04

For use on Door #(s):

318H

Provide each SGL door(s) with the following:





QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	45H-7-R-15H		626	BES
1	EA	SFIC CORE	80-036		626	SCH
1	EA	OH STOP & HOLDER	90H		630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE

Hardware Group No. 05

For use on Door #(s):

318J

Provide each SGL door(s) with the following:


QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	45H-7-D-15H		626	BES
1	EA	SFIC CORE	80-036		626	SCH
1	EA	WALL STOP	WS406/407CVX		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 06

For use on Door #(s):

318K 318L

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	SFIC CORE	80-036		626	SCH
1	EA	BALANCE OF HARDWARE	HARDWARE BY MANUFACTURER			

COORDINATE CYLINDER CORE REQUIREMENT WITH GLASS DOOR HARDWARE
MANUFACTURER'S TUBULAR PANIC DEVICE.

ALL DOOR HARDWARE PROVIDED BY FRAMELESS GLAZED INTERIOR WALL AND DOOR
SYSTEM SUPPLIER.

DOOR CLOSERS TO INCLUDE HOLD OPEN OPTION.

LOCKING HARDWARE TO INCLUDE TUBULAR PANIC DEVICES WITH DOGGING OPTION.

LOCKING DEVICE TO INCLUDE CYLINDER HOUSING COMPATIBLE WITH NCSU PERMANENT
CORE REQUIREMENTS.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Hardware Group No. 07

For use on Door #(s):

318A 318B

Provide each SL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
EA	HARDWARE BY MANUFACTURER	HARDWARE BY MANUFACTURER		

ALL DOOR HARDWARE PROVIDED BY FRAMELESS GLAZED INTERIOR WALL AND DOOR
SYSTEM SUPPLIER.

SLIDING DOOR SYSTEM TO INCLUDE BACK-TO-BACK MOUNTED TUBULAR LADDER PULLS; 60
INCHES OA LENGTH.

Hardware Group No. 08

For use on Door #(s):

302

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY DOOR MANUFACTURER		

End of Section

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Storefront framing.
 - 2. Glazed entrances.
- B. Related Sections:
 - 1. Division 08 Section "Aluminum Framed Entrances and Storefronts".
 - 2. Division 08 Section "Flush Wood Doors".

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

- a. Wind Design Data: As indicated on Drawings.
- 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
- 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
- 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
- C. Glazing Accessory Samples: For gaskets and colored spacers, in 12-inch (300-mm) lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers, manufacturers of insulating-glass units with sputter-coated, low-e coatings and glass testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass.
- D. Preconstruction adhesion and compatibility test report.
- E. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Source Limitations for Glass: Obtain coated float glass and insulating glass from single source from single manufacturer for each glass type.
- E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Division 08 Section "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
- I. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

- 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

- 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

- 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

- 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance

Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Uncoated Monolithic Glass as manufactured by Viracon, Inc., or comparable product by one of the following:
 - a. Guardian Industries Corp.
 - b. PPG Industries, Inc.
 2. Tint Color: Clear.
 3. Visible Light Transmittance: 47 percent minimum.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. EPDM complying with ASTM C 864.
 2. Silicone complying with ASTM C 1115.
 3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; OmniPlus.
 - b. Bostik, Inc.; Chem-Calk 1200.
 - c. Dow Corning Corporation; 999-A.
 - d. GE Advanced Materials - Silicones; Contractors SCS1000 or Construction SCS1200.
 - e. May National Associates, Inc.; Sil 100 GC, Sil 100 GP, or Sil 100 WF.
 - f. Pecora Corporation; 860.
 - g. Polymeric Systems, Inc.; PSI-601.
 - h. Schnee-Morehead, Inc., an ITW company; SM5732 Polyglaze.
 - i. Tremco Incorporated; Proglaze.

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer

rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.8 MONOLITHIC-GLASS TYPES

- A. Glass Type GL-1: Clear fully tempered float glass.
1. Thickness: 6.0 mm.

2. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08800

SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.
- B. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
 - 2. Division 08 Section "Flush Wood Doors" for louvers in flush wood doors.
 - 3. Division 23 Sections for louvers that are a part of mechanical equipment.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.

- B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project is 0.23g.
 - 2. Component Importance Factor is 1.0.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
 - 3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of metal finish required.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.

- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- G. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Storm-Resistant Louver:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide C/S 7” Storm Resistant Fixed Horizontal Louver Model RS-7705 by Construction Specialties, Inc., or comparable product by one of the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Air Flow Company, Inc.
 - c. Airolite Company, LLC (The).
 - d. All-Lite Architectural Products.
 - e. American Warming and Ventilating, Inc.; a Mestek company.
 - f. Arrow United Industries; a division of Mestek, Inc.
 - g. Greenheck Fan Corporation.
 - h. Industrial Louvers, Inc.
 - i. NCA Manufacturing, Inc.
 - j. Nystrom Building Products.
 - k. Reliable Products, Inc.
 - l. Ruskin Company; Tomkins PLC.
 - m. United Enertech Corp.
 - 2. Louver Depth: 7 inches (175 mm).
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Air Performance: Not more than 0.225-inch wg (55.9-Pa) static pressure drop at 900-fpm (4.57-m/s) free-area intake velocity.
 - c. Wind-Driven Rain Performance: Not less than 80 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of 483 fpm (2.5 m/s).

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 1. Screen Location for Fixed Louvers: Interior face.
 2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Mill finish unless otherwise indicated.
 3. Type: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 1. Bird Screening: Flattened, expanded aluminum, 5/8 by 0.050 inch (15.9 by 1.27 mm) thick.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Tile backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. Lafarge North America Inc.
 - 5. National Gypsum Company.
 - 6. Temple-Inland.
 - 7. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch (12.7 mm).
 2. Long Edges: Tapered.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch (15.9 mm).
 2. Long Edges: Tapered.
- D. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
1. Thickness: 1/4 inch (6.4 mm).
 2. Long Edges: Tapered.
- E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Thickness: 1/2 inch (12.7 mm).
 2. Long Edges: Tapered.
- F. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 1.
1. Core: 5/8 inch (15.9 mm), Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- G. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch (15.9 mm), Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; Firebloc Type C.
 - b. CertainTeed Corp.; ProRoc Type C.
 - c. Georgia-Pacific Gypsum LLC; Fireguard C.
 - d. Lafarge North America Inc.; Firecheck Type C.
 - e. National Gypsum Company; Gold Bond Fire-Shield C.
 - f. Temple-Inland; Type TG-C.
 - g. USG Corporation; Firecode C Core.
 2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 3. Long Edges: Tapered.

- B. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Georgia-Pacific Gypsum LLC; DensArmour Plus.
 - 2. Core: As indicated.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. National Gypsum Company; Sound Break.
 - b. Quiet Solution, Quiet Rock.
 - 2. Core: 5/8 inch (15.9 mm), regular type.
 - 3. Long Edges: Tapered.

2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; GlasRoc Sheathing.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond, e(2)XP.
 - d. USG Corporation; Securock Glass Mat Sheathing.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
- B. Cellulose Fiber-Reinforced Gypsum Sheathing Board: ASTM C 1278/C 1278M, gypsum sheathing, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. USG Corporation; Fiberock Aqua-Tough.
 - 2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
 - 3. Size: 48 by 96 inches (1219 by 2438 mm).

2.6 TILE BACKING PANELS

- A. Contractor's Option: Unless otherwise indicated, provide either of the following types of backing panels:
- B. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; GlasRoc Tile Backer.
 - b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
 - 2. Core: 5/8 inch (15.9 mm), Type X.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C-Cure; C-Cure Board 990.
 - b. CertainTeed Corp.; FiberCement BackerBoard.
 - c. Custom Building Products; EasyBoard.
 - d. FinPan, Inc.; ProTEC.
 - e. James Hardie Building Products, Inc.; Hardiebacker 500.
 - f. National Gypsum Company, Permabase Cement Board.
 - g. USG Corporation; DUROCK Cement Board.
 - 2. Thickness: 1/2 inch (12.7 mm).
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.7 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. L-Bead: L-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.
- B. Exterior Trim: ASTM C 1047.
 - 1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
 - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.8 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
- D. Joint Compound for Exterior Applications:
 - 1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
 - 2. Cellulose Fiber-Reinforced Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.9 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR or AIS-919.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings.
 - 2. Type X: Vertical surfaces unless otherwise indicated.
 - 3. Flexible Type: Apply in double layer at curved assemblies.
 - 4. Ceiling Type: Ceiling surfaces.
 - 5. Abuse-Resistant Type: As indicated on Drawings.
 - 6. Moisture- and Mold-Resistant Type: As indicated on Drawings.
 - 7. Type C: Where required for specific fire-resistance-rated assembly indicated.
 - 8. Glass-Mat Interior Type: As indicated on Drawings.
 - 9. Acoustically Enhanced Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring

- member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 2. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
- 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
 - 2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
- 1. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. L-Bead: Use where indicated.

D. Exterior Trim: Install in the following locations:

1. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Section 099123 "Interior Painting." Level 5 is suitable for surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting. It is considered a high-quality gypsum board finish.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093100 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Solid polymer thresholds installed as part of tile installations.
 - 2. Waterproof membrane for tile installations.
 - 3. Crack-suppression membrane for thin-set tile installations.
- B. Related Sections include the following:
 - 1. Division 1 Section "Construction Waste Management" for waste reduction reporting requirements.
 - 2. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
 - 3. Division 9 Section "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
- E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- F. Product Certificates: For each type of product, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Material Test Reports: For each tile-setting and -grouting product.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Waterproofing.
 - 2. Joint sealants.
 - 3. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid latexes in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
- F. Waste Management:
 - 1. Separate and recycle offcuts and waste materials in accordance with the Waste Management Plan and to the maximum extent economically feasible.
 - 2. Use the least toxic sealants, adhesives, sealers, cleaning agents and finishes necessary to comply with the requirements of this Section.
 - 3. Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature.
 - 4. Place used sealant tubes and other containers in areas designated for hazardous materials.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
3. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 1. As indicated by manufacturer's designations.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

- A. Tile T01:
 1. Basis-of-Design Product: Subject to compliance with requirements provide the product indicated in Finish Legend on Drawings, or a comparable product of one of the following:
 - a. American Marazzi Tile, Inc.
 - b. American Olean; Div. of Dal-Tile International, Inc.

- c. Dal-Tile International, Inc.
 - 2. Provide coordinating base indicated in Finish Legend on Drawings.
- B. Tile T02:
- 1. Basis-of-Design Product: Subject to compliance with requirements provide the product indicated in Finish Legend on Drawings, or a comparable product of one of the following:
 - a. American Marazzi Tile, Inc.
 - b. American Olean; Div. of Dal-Tile International, Inc.
 - c. Dal-Tile International, Inc.
- C. Tile T03:
- 1. Basis-of-Design Product: Subject to compliance with requirements provide the product indicated in Finish Legend on Drawings, or a comparable product of one of the following:
 - a. American Marazzi Tile, Inc.
 - b. American Olean; Div. of Dal-Tile International, Inc.
 - c. Dal-Tile International, Inc.

2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.
- B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.
 - 1. Available Products:
 - a. Custom Building Products; RedGard Waterproofing and Anti-Fracture Membrane.
 - b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
 - c. MAPEI Corporation; PRP M19.
 - d. Summitville Tiles, Inc.; S-9000 Crack isolation/Waterproof Membrane.

2.5 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:

1. Atlas Minerals & Chemicals, Inc.
2. Boiardi Products Corporation.
3. Bonsal American/an Oldcastle Company.
4. Bostik.
5. C-Cure.
6. Custom Building Products.
7. DAP, Inc.
8. Jamo Inc.
9. LATICRETE International Inc.
10. MAPEI Corporation.
11. Southern Grouts & Mortars, Inc.
12. Summitville Tiles, Inc.
13. TEC Specialty Products Inc.

B. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:

1. Latex Additive: Manufacturer's standard acrylic resin water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
2. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.

1. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.
 - b. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.

2.6 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 - 1. Available Products:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - d. Tremco, Inc.; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
 - 1. Available Products:
 - a. Bostik; Chem-Calk 550.
 - b. Mameco International, Inc.; Vulkem 245.
 - c. Pecora Corporation; NR-200 Urexpan.
 - d. Tremco, Inc.; THC-900.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated by one of the following:
 - a. Blanke Corporation.
 - b. Ceramic Tool Company, Inc.

- c. Profilitec SpA
 - d. Schluter Systems L.P.
- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
 - 1. Available Products:
 - a. Bonsal, W. R., Company; Grout Sealer.
 - b. Bostik; CeramaSeal Grout Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; TileLab SurfaceGard Penetrating Sealer.
 - e. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
 - f. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
 - g. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
 - h. TEC Specialty Products Inc.; Guard All Invisible Penetrating Sealer.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- G. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
 - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
 - a. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
- B. Joint Widths: Install tile on floors with the following joint widths:
 - 1. Paver Tile: 1/4 inch (6.35 mm).
- C. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces

END OF SECTION 09310

SECTION 095000 - SUSPENDED METAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and General Conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Suspended Metal Panel Ceilings
2. Cable hangers and fasteners

B. Related Sections:

1. Division 23 (15) Sections - HVAC
2. Division 26 (16) Sections – Electrical
3. Section 09 54 00 Specialty Ceilings
4. Section 09 53 00 (09500) – Acoustical Ceiling Suspension Assemblies

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
2. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide panels and method of attachment by a single manufacturer.

B. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store the metal ceiling panels in an interior location and keep in cartons prior to installation to avoid damage and where they will be protected against damage from moisture, direct sunlight, surface contamination, etc.

B. Exercise care in moving and opening cartons to prevent damage to the panel face.

C. Handle panels carefully to avoid damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure:

Building areas to receive panels shall be free of construction dust and debris. Products can be installed up to 100°F (38°C) with humidity not exceeding 90% RH. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the panels. Following installation, conditions must be maintained below 70% RH or near those intended for final occupancy.

1.7 WARRANTY

A. Metal Panels: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

1. Panels: Manufacturing defects.
2. Attachment devices: Rusting and manufacturing defects.

B. Warranty Period:

1. Panels: One (1) year from date of substantial completion.
2. Attachment devices: One (1) year from date of substantial completion.

C. Warranty Language:

Manufacturer's products are expressly warranted for a period of one (1) year from purchase to be free from defects in material and workmanship, when installed according to manufacturer's published installation procedures. During the warranty period manufacturer will repair or at its option replace the products that are proven to be defective. Manufacturer is NOT responsible for any intentional or accidental abuse, misuse, or neglect incurred on the original warranted product, and shall as determined by manufacturer, void the warranty.

PART 2 - PRODUCTS

A.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Arktura Vapor Gradient or a comparable product of one of the following:

- a. Armstrong World Industries, Inc.
- b. Chicago Metallic Corporation
- c. USG Interiors, Inc.

B. Suspension System for Custom Perforated Ceiling Panels:

1. Armstrong (or equal)
 - 7301TS - Prelude XL 12' HD Main Beam slotted for torsion spring
 - XL7328 - Prelude XL 2' Cross Tee
 - 7147 WH - Torsion spring perimeter trim (extruded)
 - 7871 WH - (alternate trim) W Mold
 - 7131 WH - Torsion spring perimeter trim -2 part (must use when adjacent to Arktura wall channel mount system)
 - 7126 - Spreader hold down clip

2.2 PANEL UNITS

A. Panels:

1. Surface Texture: Smooth [see Section 2.3]
2. Composition: 0.06 Aluminum 5052

3. Color: Color from RAL System
4. Size: Approximately 2' x 4'
5. Perforation: custom algorithmically generated pattern by Arktura with varying sizes and shapes. Perforated pattern to be continuous across panelized system (panel edge to panel edge). Smooth inside cut faces.
6. Recycled Content: 30% [up to 60% recycled content upon request]

2.3 SURFACE FINISH

- A. Application of surface finish to be applied in compliance with the following standard operating procedure:

1. Inspect raw material for obvious defects.
2. Pre-treat raw material with 3-6% iron phosphate rust inhibitor solution via pressure spray at 10-20 psi and 110-130 °F.
4. Pre-heat raw material for 3-6 minutes at 400°F to dry.
5. Electrostatically apply Triglycidyl Isocyanurate (TGIC) polyester powder primer (Dupont or equivalent) to entire surface of part at approximately 2.0-3.0 mils.
6. Cure part per manufacturer's specifications.

- B. Surface finish, when complete, must meet the reference standards as listed below:

American Society for Testing and Materials (ASTM):

1. ASTM D3359 Standard Test Methods for Measuring Adhesion, Method B
2. ASTM D3363 Standard Test Method for Film Hardness by Pencil Test
3. ASTM D2794 [modified] Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
4. ASTM D522 [modified] Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
5. ASTM D4060 [modified] Standard Test Method for Abrasion Resistance

- C. Durability of surface finish must meet the reference standards as listed below:

American Society for Testing and Materials (ASTM):

1. ASTM B117 - 09 Standard Practice for Operating Salt Spray (Fog) Apparatus

2.4 ATTACHMENT SYSTEM

- A. Installation Hardware:

The custom engineered, prefabricated panels will be designed for an Armstrong Metalworks torsion spring grid suspension structure. The perimeter trim and other main tees in the suspension grid are part of the Armstrong Metalworks torsion spring system. The torsion springs themselves are supplied by Arktura with the custom perforated metal panels.

PART 3 - EXECUTION

3.1 PREPARATION [by others]

- A. To field verify each ceiling area as-built and establish coordinated layout of panels. Arkura to supply standard diagrams and instructions needed for panel installation. Panel sub-structure shall be level and plumb. Panel substructure shall be structurally sound as determined by an engineer. Panel substructure shall be free of defects detrimental to work and erected in accordance with established building tolerances.
- B. to coordinate panel layout and openings with mechanical, electrical and sprinkler fixtures as necessary.
- C. to coordinate delivery of such items to project site.

3.2 INSTALLATION [by Others]

- A. Install panels in accordance with Manufacturer's instructions and in compliance with the authorities having jurisdiction.
- B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.
- C. Erect panels' level and plumb, in proper alignment in relation to substructure framing and established lines.
- D. Panel anchorage shall be structurally sound and per engineering recommendations.
- E. Locate and place ceiling panels' level, plumb, and at indicated alignment with adjacent work.

3.3 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Proper maintenance and regular servicing of the coated surfaces are both prerequisites for the claims of any guarantee and require regular cleaning at least once each year. For severe environmental pollution, for example in regions with increased salt contamination and/or chemical exhausts, meaning in a direct area of influence or within the vicinity of an industrial or chemical enterprise, or in the immediate vicinity of a sea coast or within a defined chemical/radioactive precipitation zone, the building must be cleaned more often. In this way possible damage can be made subject to timely recognition and remedied on time by suitable measures.
- C. If a coated component is soiled during transport, through storage or assembly, the cleaning of this component must take place immediately with clear, cold or lukewarm water. Neutral or a weak alkaline detergent can be used against severe soiling.
- D. Protect ceiling panel assemblies from damage during construction. Use temporary protective coverings where needed as approved by the ceiling panel manufacturer.

END OF SECTION 095000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Related Requirements:
 - 1. Section 095423 "Linear Metal Ceilings" for ceilings consisting of linear metal-pan units with exposed and concealed suspension systems.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For products having recycled content, submit documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating cost for each product having recycled content.
 - 2. Product Data: For ceiling products indicating compliance with General Emissions evaluation.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Perimeter moldings.
 - 7. Minimum Drawing Scale: 1/4 inch = 1 foot (1:48).
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Ceilings, Walls, and Thermal Insulation: Shall comply with requirements of California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 450 or less.

2.3 ACOUSTICAL PANELS, ACT-01

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Lyra Concealed, or comparable product by one of the following:
 - 1. Celotex Corporation; Architectural Ceilings Marketing Dept.
 - 2. USG Interiors, Inc.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

1. Type and Form: Smooth texture. Fiberglass.
- D. Color: Custom red to match owner's sample.
- E. Noise Reduction Coefficient (NRC): 0.90.
- F. Edge/Joint Detail: Beveled concealed.
- G. Thickness: 7/8 inch.
- H. Modular Size: 48" by 48"

2.4 ACOUSTICAL PANELS, ACT-02

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Calla Health Zone Tegular, or comparable product by one of the following:
 1. Celotex Corporation; Architectural Ceilings Marketing Dept.
 2. USG Interiors, Inc.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 1. Type and Form: Smooth texture. Mineral Fiber.
- D. Color: Black.
- E. Noise Reduction Coefficient (NRC): 0.80.
- F. Edge/Joint Detail: Square Tegular.
- G. Thickness: 1 inch.
- H. Modular Size: 24" by 24"
- I. Metal Suspension System:
 1. Basis of Design: Suprafine XL 9/16" Black or comparable product by one of the following:
 - a. Celotex Corporation; Architectural Ceilings Marketing Dept.
 - b. USG Interiors, Inc.

2.5 ACOUSTICAL PANELS, ACT-03

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Clean Room VL unperforated, or comparable product by one of the following:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

1. Celotex Corporation; Architectural Ceilings Marketing Dept.
 2. USG Interiors, Inc.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
1. Type and Form: Smooth texture. Mineral Fiber.
- D. Color: White.
- E. Edge/Joint Detail: Square Lay-in.
- F. Thickness: 5/8 inch.
- G. Modular Size: 24" by 24"
- H. Metal Suspension System:
1. Basis of Design: Co-Extruded 5/16" Clean Room or comparable product by one of the following:
 - a. Celotex Corporation; Architectural Ceilings Marketing Dept.
 - b. USG Interiors, Inc.

2.6 ACOUSTICAL PANELS, ACT-04

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; Optima Tegular, or comparable product by one of the following:
1. Celotex Corporation; Architectural Ceilings Marketing Dept.
 2. USG Interiors, Inc.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
1. Type and Form: Smooth texture. Fiberglass.
- D. Color: White
- E. Edge/Joint Detail: Square Tegular.
- F. Thickness: 1 inch.
- G. Modular Size: 24" by 24"
- H. Metal Suspension System:

1. Basis of Design: Suprafine XL 9/16" Exposed Tee or comparable product by one of the following:
 - a. Celotex Corporation; Architectural Ceilings Marketing Dept.
 - b. USG Interiors, Inc.

I.

2.7 METAL SUSPENSION SYSTEM

- A. Basis of Design: Armstrong World Industries, Inc.: Prelude XL Heavy Duty 15/16" Exposed Tee, or comparable product by one of the following:
 - a. Chicago Metallic Corporation; Matrix.
 - b. USG Interiors, Inc.; Donn Brand DX.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
 1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) type.
 3. Face Design: Flat, flush.
 4. Cap Material: Cold-rolled steel.
 5. Cap Finish: Painted white.

2.8 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.9 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Celotex Corporation; Architectural Ceilings Marketing Dept.
 - 3. USG Interiors, Inc.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.10 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 3. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 - a. Hold-Down Clips: Space 24 inches (610 mm) o.c. on all cross runners.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION - 095446 FABRIC-WRAPPED CEILING PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

a) Section Includes:

1. Non-Woven layered and formed Polyester felt fiber ceiling panels
2. Wire hangers, fasteners, main runners, cross tees, wall angle moldings and accessories.

b) Related Sections:

1. Section 09 20 00 - Plaster and Gypsum Board
2. Section 09 22 16 - Non-Structural Metal Framing

c) Alternates

1. Prior Approval: Unless otherwise provided for in the Contract documents, submit proposed product substitutions no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review and acceptance. Approved products will be set forth by the Addenda. If a substitution is included in a Bid and is not approved by an Addendum, the specified products shall be provided as in place of the substitute without additional compensation.
2. Submittals, which do not provide adequate data for the product evaluation, will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); panel design, size, composition, color, and finish; suspension system component profiles and sizes; compliance with the referenced standards.

1.3 REFERENCES

a) American Society for Testing and Materials (ASTM):

1. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E580 Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.

4. ASTM C423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. ASTM E795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests
6. International Building Code
7. ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality
8. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.2 2017
9. California Green Building Standards Code Cal Green Title 24
10. NFPA 70 National Electrical Code
11. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
12. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
13. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings
14. Underwriters Laboratories Green Guard
15. International Living Building Challenge

1.4 SUBMITTALS

- a) **Shop Drawings:** Provide layout including panel type and components used in the assembly of the ceiling. Show locations of items that are to be coordinated with the ceiling.
- b) **Installation Instructions:** Submit manufacturer's installation instructions as referenced in Part three, Installation.
- c) **Samples:** Minimum 6 inch x 6 inch sample of the colors selected in the ceiling design, include manufacturer sample of suspension components.
- d) **Product Data:** Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
- e) **Certifications:** Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- f) **Non-Conformance:** All products not conforming to the requirements of this specification and or the manufacturer's published values are to be disposed. The Contractor performing the work will replace with approved product at their expense.

1.5 QUALITY ASSURANCE

- a) Single-Source Responsibility: Provide ceiling panel units and suspension components by a single manufacturer.
- b) Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with Class A products.
 - i. Flame Spread: 25 or less
 - ii. Smoke Developed: 450 or less
- c) Fire Sprinklers: Ceiling systems may obstruct or Skew the planned water distribution pattern of fire sprinkler. In addition to creating a possible delaying or accelerating the activation of the sprinkler of fire detection system. Consult with a fire protection engineer for guidance.
- d) Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

- a) Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- b) Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- c) White gloves recommended for handling to avoid marring, especially on light color panels.

1.7 PROJECT CONDITIONS

- a) Space Enclosure:
 - I. HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

1.8 WARRANTY

- a) Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period.
- b) Warranty Period:

- I. Acoustical panels and Suspension: One (1) year from date of substantial completion
- c) The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 SUSTAINABLE MATERIALS

- a) The GREENGUARD Certification Program gives assurance that products designed for use in indoor spaces meet strict chemical emissions limits, which contribute to the creation of healthier interiors. GREENGUARD Certified products meet stringent chemical emissions requirements, such as being screened for more than 10,000 volatile organic compounds (VOCs).
- b) Health Product Declaration. The end use product has a published, complete Health Product Declaration with disclosure at a minimum of 1000ppm of known hazards in compliance with the Health Product Declaration open Standard.
- c) Declare Label. The end use product has a published Declare label by the International Living Future Institute with disclosure of 100 ppm with a designation of Red List Free or Compliant (less than 1% proprietary ingredients).
- d) Low Emitting products with VOC emissions data. Preference will also be given to manufacturers that can provide emissions data showing their products meet CDHP Standard Method v1.2 (Section 01350).
- e) Life cycle analysis. Products that have communicated lifecycle data through Environmental Product Declarations (EPDs) will be preferred.
- f) Products meeting LEED V4 requirements.

1.10 MAINTENANCE

- a) Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Ceiling Units: Furnish quality of full-size units equal to 2.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 1.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- a) Basis of Design: Subject to compliance with requirements, provide Acoufelt; Truss Ceiling Baffles, Premier Collection or comparable product of one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Celotex Corporation; Architectural Ceilings Marketing Dept.

3. USG Interiors, Inc.

b) Suspension Systems:

1. Armstrong World Industries, Inc. (or equal)

2.2.0 CEILING UNITS

a) Ceiling Panel:

1. Surface Texture: Soft
2. Color: Grey
3. Edge Profile: Square
4. Fire Tests: ASTM E84-17a Class A
5. Flame spread index: 15
6. Smoke developed index: 200
7. Energy: Generated using 40% solar energy
8. Indoor Air Quality: VOC less than/equal to 0.5mg/m³
9. Water Sorption: ASTM C1104-2019 (A Modified), Water sorbed by weight: 0.20% (based on a 12mm thick panel)
10. Colorfastness ISO 105-B02, 6-7
11. Certifications: SCS Global Indoor Advantage Gold
12. Material: FilaSorb™ polyester felt (100% polyester)
13. Recycled Content: 60% minimum
14. Sizes:
 1. Height 4"
 2. Depth 2"
 3. Thickness 1/2"
15. NRC Rating: 0.75, up to 1.65 based on dimension and spacing.

2.2.1 SUSPENSION SYSTEMS

A. Basis of Design: Armstrong World Industries, Inc.; Item 8230 – 96" Suspension Bar for 3/8" FeltWorks Blades connector holes on both ends or comparable product by one of the following:

- a. Chicago Metallic Corporation; Matrix.
- b. USG Interiors, Inc.; Donn Brand DX.

PART 3 - EXECUTION

3.1 EXAMINATION

- a) Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.
- b) Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.2 PREPARATION

- a) Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

- a) Install suspension system and blades in compliance with the approval of the authorities having jurisdiction, and in accordance with the manufacturer's FELTWORKS Blades Installation Instructions.

3.4 ADJUSTING AND CLEANING

- a) Replace damaged and broken panels.
- b) Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

END OF SECTION 095446

SECTION 095800 - INTEGRATED CEILING ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes suspended linear metal ceiling system with integrated linear LED decorative luminaires and suspension system.
- B. Related Requirements:
 - 1. Division 21 Sections for fire suppression penetrations through ceiling.
 - 2. Division 23 Sections for HVAC penetrations through ceiling.
 - 3. Division 26 Sections for electrical service rough-ins, conduit, devices, wiring, low-voltage wiring work, and connections to electrical power system.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meetings: Conduct at project site.
- B. Coordination: Coordinate with fire suppression, HVAC, electrical, and other work as required to accommodate those systems and prevent interferences with required clearances.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include driver and dimming protocol.
- B. Shop Drawings: Include the following:
 - 1. Layout and attachment details.
 - 2. Locations and details of items which penetrate, are to be coordinated with, or supported by the ceilings.
 - 3. Ceiling perimeter detail.
 - 4. Diagrams for power and control wiring including points of connection.
- C. Samples: For each exposed product and for each color and finish specified.
- D. Samples for Verification: For each type of exposed finish.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Certificates: Manufacturer's certifications that integrated ceiling assembly complies with specified requirements.
 - 1. Submit certification from the luminaire, driver, or dimmer switch manufacturer that ensures compatibility and operability between devices without flickering and to specified dimming levels.

- B. Product Test Reports: For integrated ceiling assembly, for acoustic performance, FDA, and fire-resistance tests performed by manufacturer and witnessed by a qualified testing agency a qualified testing agency.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 5 years experience under current organizational structure.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver integrated ceiling assembly components to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Handle integrated ceiling assembly components carefully to avoid damage.

1.08 FIELD CONDITIONS

- A. Do not install integrated ceiling assemblies until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.09 WARRANTY

- A. Manufacturer's Standard Ceiling System Warranty: Manufacturer and Installer agree to repair or replace components of integrated ceiling assemblies that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Rusting or corrosion.
 - 2. Excessive sagging or deflection.
 - 3. Warranty Period: One year from date of Substantial Completion.
- B. Manufacturer's Standard Lighting System Warranty: Manufacturer and Installer agree to repair or replace components of LED luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty shall include:
 - a. All LED drivers and integral control equipment.
 - b. Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.
 - c. [Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) show a color shift greater than 0.003 delta u'v' from the zero hour measurement stated in the ANSI/IES LM-79 Test Report.]
 - 2. Failures include, but are not limited to, the following:
 - a. Finish failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading.
 - 3. LED Luminaire Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide BARZ® + BRILLIANCE™ by USG® Ceilings Plus®.
 - 1. Substitutions will be considered.
- B. Single-Source Responsibility: Provide integrated ceiling assemblies and suspension components through one source from a single manufacturer.

2.02 PERFORMANCE CRITERIA

- A. Seismic Performance: Comply with IBC Section 1613.
- B. Surface-Burning Characteristics: ASTM E84; Class A. Identify products with appropriate markings of applicable testing agency.
- C. Regulatory Requirements:
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 INTEGRATED CEILING ASSEMBLY DESCRIPTION

- A. Integrated ceiling assemblies consist of a linear metal ceiling system comprised of formed aluminum perforated and insulated bars factory-finished and attached to metal slats for suspending from a direct-hung ceiling suspension system with linear LED luminaire fixtures set into bars in a decorative yet functional pattern.

2.04 CASSETTE ASSEMBLIES

- 1. Aluminum Bars/Baffles: 0.05 inch thick aluminum sheet formed into rectangular profiles of 4 inch wide by 134.5 inch nominal length, high size vary with integral top return; punched for attachment to backslats.
- 2. End Caps: Metal matching bars; fabricated to fit and conceal exposed ends of bars.
- 3. Suspension: Custom direct attached to field installed U-Channels.
- 4. Aluminum Bar Finish: Pre-finished custom red.

2.05 INTEGRAL LUMINAIRES, GENERAL

- A. Provide complete system with LED drivers and light sources clearly marked for operation of specific light sources and LED drivers.
- B. LED driver and light source package, array, or module shall be accessible for service or replacement without removal or destruction of luminaire.
- C. LED Drivers: Provide LED drivers that are electronic, UL Class 1 or Class 2, constant-current type and that comply with the following requirements:
 - 1. The combined driver and LED light source system shall not exceed the minimum luminaire efficacy values as listed in the luminaire schedule provided.

2. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.
 3. Maximum Total Harmonic Distortion (THD) less than 20 percent at full input power and across specified dimming range.
 4. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
 5. Withstands Category A surges of 2 kV without impairment of performance. Provide surge protection that is integral to the driver.
 6. Integral thermal protection that reduces the output power to protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.
 7. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Non-Consumer (Class A) for EMI/RFI (conducted and radiated) per 47 CFR 15.
 8. Class A sound rating.
 9. Restriction of Hazardous Substances (RoHS) compliant per EU Directive 2011/65/EU.
 10. Provide dimming capability as indicated in the luminaire schedule on Drawings.
 11. Provide remote LED Drivers that are UL listed for dry locations typical of interior installations. Provide LED driver in junction box or housing with mounting plate. Housing shall allow for field connections to occur inside the housing or shall contain mechanical connections.
 12. LED drivers shall have clear markings indicating dimming type and indicate proper terminals for the various outputs.
- D. Wall Box Dimmers: Dimmers shall provide flicker-free, continuously variable light output throughout the dimming range of 5 percent to 100 percent. Devices shall be capable of operating at their full rated capacity regardless of being single or ganged-mounted, and be compatible with three-way and four-way switching scenarios. Provide wall-box dimmers that meet the following requirements:
1. Device operates as part of a lighting control system.
 2. Device operates with the use of a vertical slider, paddle, rotary, button, or toggle with adjacent vertical slider.
 3. Finish of device matches switches and outlets in the same area.
 4. Back box in wall has sufficient depth to accommodate body of switch and wiring.
 5. Dimmer is capable of controlling LED drivers. Dimmers and the drivers they control shall be provided from the same manufacturer or tested and certified as compatible for use together.
 6. Radio frequency interference suppression is integral to device.

2.06 INTEGRAL LUMINAIRES

- A. Recessed Fixtures: LED tape lights in extruded aluminum channel-shaped housing with white frosted lens.
1. Brilliance™ LED Linear Fixture.
 2. Housing: Extruded aluminum.
 - a. Finish: Silver anodized.
 3. LEDs: Single binned LEDs +/- 30-70 CCT, MacAdam 3 SDCM.
 4. Lens: Frosted polycarbonate or poly(methyl methacrylate) (PMMA).
 5. Length: 134.5 inch.
 6. Mounting: Clip-mounted inside bars/baffles where indicated.

7. Electrical Characteristics:
 - a. Watts per Foot: 5.9.
 - b. IC (Insulator Container) Rating: < 30 Celsius.
 - c. IP (Ingress Protection) Rating: IP20 dry.
 - d. Input Voltage: 24V DC.
 - e. Power Supply: 120-277 VAC.
 - f. Total Harmonic Distortion: <20%
8. Light Output Characteristics:
 - a. Lumen depreciation after 36,000 hours: >90 percent
 - b. Beam Spread: 109° typical with frosted lens.
 - c. Lumen Output: 420 lumens/foot.

- B. Controls: Contact USG for additional product data
 1. Power Supplies: Dimmable type.
 - a. Product: Universal 0-10V Flicker Free Dimmable .

2.07 MATERIALS

- A. Aluminum Sheet: ASTM B209, stretcher leveled.
 1. Recycled Content: Up to 85 percent.
- B. Electrical components (wiring, connectors, etc.) shall comply with Division 26 Sections.

2.08 FABRICATION

- A. Cut integrated ceiling assembly bars to size at perimeter edges and to accommodate penetrating fire suppression, mechanical, and electrical items. Bars/Baffles with integrated lights shall not be field cut.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 1. Examine areas and conditions, including structural framing and substrates to which integrated ceiling assemblies attach or abut, with installer present, for compliance with requirements for installation tolerances, clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
 2. Verify that layout of hangers will not interfere with other work.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of integrated ceiling assemblies to balance border widths at opposite edges of each ceiling. Avoid use of less than half width or length cassettes at borders, and comply with reflected ceiling plans.
- B. Coordinate integrated ceiling assembly layout with fire suppression work, mechanical work, and other suspended or permanent construction that penetrates the ceiling.

3.03 LED DRIVERS

- A. Locate remote LED drivers within the maximum distance allowed to minimize voltage drop. Do not locate remote LED drivers further from the light source than specified by the manufacturer. Locate remote LED drivers in dry, well-ventilated, and accessible location, above accessible ceilings or behind a removable wall or ceiling panel. Mount housing or junction box so that it is rigidly and securely fastened in place. Install LED drivers such that components are not in contact with combustible materials unless listed for such condition. Ground remote LED drivers per NFPA 70.
- B. Provide separate compartments for Class 2 wiring connections and for Class 1 wiring connections. Separation shall be barrier-type within the same box or separate boxes with close connector conduit fittings. Field connections shall be inside housing or junction box or secured by a quick disconnect wire connector.

3.04 CLEANING

- A. Clean exposed surfaces of integrated ceiling assemblies, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.
- B. Replace damaged components.

END OF SECTION 095800

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Final acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

2.2 THERMOPLASTIC-RUBBER BASE (B)

- A. Resilient Base:
 - 1. Refer to the Finish Legend for each Basis of Design product selection details.
 - 2. B-3 in 8ft lengths, mitered inside and outside corners.
 - 3. B-5 in rolls or 4ft lengths.
- B. Subject to compliance with requirements, provide the product listed in the Finish Legend in the Drawings or product by one of the following:
 - 1. Allstate Rubber Corp.
 - 2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 3. Johnsonite; A Tarkett Company.
 - 4. Roppe Corporation, USA.
- C. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Straight: Provide in areas with carpet.
 - b. Cove: Provide in areas with resilient flooring.
 - c. Butt to: Provide in areas indicated.
- D. Thickness: 0.125 inch.
- E. Height: As indicated on Drawings.
- F. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- G. Outside Corners: Preformed.
- H. Inside Corners: Job formed.
- I. Colors: As selected by Architect from full range of industry colors.

2.3 RUBBER MOLDING ACCESSORY

- A. Resilient Moldings:
 - 1. Refer to the Finish Legend Notes for each Basis of Design product selection details.
- B. Subject to compliance with requirements, provide the product listed in the Finish Legend in the Drawings or product by one of the following:
 - 1. Allstate Rubber Corp.
 - 2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 3. Johnsonite; A Tarkett Company.
 - 4. Roppe Corporation, USA.
- C. Description: Rubber carpet edge for glue-down applications nosing for carpet reducer strip, for resilient flooring joiner, for tile and carpet and transition strips.
- D. Profile and Dimensions: As indicated.

- E. Locations: Provide rubber molding accessories in transitions indicated.
- F. Colors and Patterns: As selected by Architect from full range of industry colors.
 - 1. Unless indicated otherwise, match resilient accessory to adjacent higher surface material.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

- a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
 - 1. Apply two coat(s).
- E. Cover resilient products subject to wear and foot traffic until Final acceptance.

END OF SECTION

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

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SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes rubber sheet flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of resilient sheet flooring required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For resilient sheet flooring.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Final acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Resilient sheet flooring shall comply with requirements of FloorScore certification.

2.2 UNBACKED RUBBER SHEET FLOORING

- A. Sheet Resilient Flooring RF1 through RF__:
 - 1. Refer to the Finish Legend for each Basis of Design product selection details.
- B. Subject to compliance with requirements, provide the product listed in the Finish Legend in the Drawings or product by one of the following:
 - 1. AB; American Biltrite;
 - 2. Flexco.
 - 3. Nora Systems, Inc.
 - 4. PRF USA, Inc.
 - 5. R.C.A. Rubber Company (The) .
 - 6. VPI, LLC, Floor Products Division.
- C. Product Standard: ASTM F 1859.
- D. Wearing Surface: Textured.
- E. Sheet Width: As standard with manufacturer.

- F. Seamless-Installation Method: Heat welded.
- G. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: As selected by Architect from manufacturer's full range to contrast with flooring.
 - 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
 - 2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
 - 3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range

- on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
- 4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
 2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 1. Remove adhesive and other blemishes from surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish in accordance with Manufacturer's written instructions.
- E. Cover resilient sheet flooring until Final acceptance.

END OF SECTION

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

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SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes resinous flooring systems.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: For each resinous flooring component, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

- B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Apply full-thickness mockups on 96-inchesquare floor area selected by Architect.
 - a. Include 96-inchlength of integral cove base with inside corner.
 - 2. Simulate finished lighting conditions for Architect's review of mockups.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 1. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flammability: Self-extinguishing according to ASTM D 635.

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
1. BASF Corporation-Construction Systems.
 2. DUDICK Inc.
 3. Sika Corporation, USA.
 4. Tennant Company.
 5. Tnemec Company, Inc.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

2.3 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, stain-, ultraviolet- and chemical-resistant, epoxy-based monolithic floor surfacing system designed to produce a seamless floor and integral cove base.
1. System Characteristics:
 - a. Color and Pattern: As indicated on the Drawing "FINISH LEGEND" by reference to manufacturer's product designation.
 - b. Wearing Surface: Manufacturer's standard wearing surface.
 - c. Overall System Thickness: 80 to 100 mils (2 mm) DFT.
 - d. Revise "Federal Agency Approvals" Subparagraph below to suit Project; delete if not required.
 - e. Federal Agency Approvals: USDA approved for food-processing environments.
 2. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
 - a. Formulation Description: Two-component, penetrating moisture-tolerant urethane.
 - b. Application: Squeegee and roller.
 3. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
 4. Body Coats:
 - a. Resin: Epoxy, two-component resin and curing agent.
 - b. Formulation Description: 100 percent solids.
 - c. Application Method: Self-leveling slurry with broadcast aggregates, spread with squeegee and rolled.
 - d. Number of Coats: One.
 - e. Aggregates: Manufacturer's standard stainable quartz (ceramic-coated silica).
 5. Stain: Single-component, translucent waterborne stain.

- a. Application Method: Sprayed.
6. Topcoats: Sealing or finish coats.
- a. Resin: Two-component, ultraviolet-resistant epoxy.
 - b. Formulation Description: 100 percent solids.
 - c. Type: Clear.
 - d. Application Method: Squeegee and roller.
 - e. Number of Coats: One.
 - f. Finish: Matte.
7. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
- a. Tensile Strength: 1600 psi minimum according to ASTM D 638.
 - b. Flexural Strength: 4000 psi minimum according to ASTM D 790.
 - c. Flexural Modulus of Elasticity: 1.0×10^6 psiminimum according to ASTM D 790.
 - d. Impact Resistance: Not less than 160 in./lbs. per ASTM D 2794. No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation according to MIL-D-3134J.
 - e. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) according to MIL-D-3134J.
 - f. Abrasion Resistance: 0.03 grams maximum weight loss according to ASTM D 4060.
 - g. Coefficient of Friction (Dry): Not less than 1.0 according to ASTM F 1679.
 - h. Slip Resistance Index (Wet): Not less than 0.7 according to ASTM F 1679.
 - i. Flammability: Class I according to ASTM E 648.
 - j. Critical Radiant Flux: 0.45 W/sq. cm or greater according to NFPA 253.

2.4 ACCESSORIES

- A. Multicomponent, Nonsag, Traffic-Grade, Polyurethane Joint Sealant: General purpose sealant recommended by manufacturer of primary flooring materials, chemically resistant to same materials as adjacent flooring, complying with ASTM C 920, Type M, Grade NS, Class 25, for Use T.
1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following:
- a. Sika: “Sikaflex 2CNS.”
 - b. Physical Properties: Comply with the following:
 - 1) Hardness: 50, Shore D per ASTM D 2240.
 - 2) Tensile Strength: 250 psi, per ASTM C 307.
 - 3) Percent Elongation: 450 percent.
 - 4) Joint Movement: 25 percent plus or minus.
 - c. Use: Floor expansion or movement joints.

- B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- C. Wall Base Edge Trim: L-shaped metal edge strips with top surface of same depth as finish face of coved resinous base, to provide an edge strip or a transition between resinous base and adjacent wall finishes, satin anodized aluminum, exposed-edge material.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Prepare concrete substrates as recommended by resinous flooring manufacturer, complying with ICRI Standard CSP-3 minimum.
 - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 - 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
 - b. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
 - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

3.2 APPLICATION

- A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 1. Integral Cove Base: As indicated on the Drawings, or if not indicated, 12 inches high.
- D. Troweled or Screeded Base Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When base coats are cured, remove trowel marks and roughness using method recommended by manufacturer.
- E. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

3.3 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
 - 1. Owner reserves the right to engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.
- B. Core Sampling: Owner reserves the right to direct its testing agency to take take core samples at locations designated by Owner of resinous flooring to verify thickness. For each sample that fails to comply with requirements, two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.4 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tufted carpet.
 - 2. Carpet Tile.
- B. Related Requirements:
 - 1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:
 - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Locations where dye lot changes occur.
 - 4. Seam locations, types, and methods.
 - 5. Type of subfloor.
 - 6. Type of installation.
 - 7. Pattern type, repeat size, location, direction, and starting point.
 - 8. Pile direction.
 - 9. Type, color, and location of insets and borders.
 - 10. Type, color, and location of edge, transition, and other accessory strips.
 - 11. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 30cm (12-inch)- square Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
 - 3. Carpet Seam: 6-inch Sample.
 - 4. Mitered Carpet Border Seam: 12-inch-square Sample. Show carpet pattern alignment.

- D. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 8 sqm (10 sq. yd).

1.7 QUALITY ASSURANCE

- A. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups at locations and in sizes shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Final acceptance.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
 - 3. Warranty Period: 10 years from date of Final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Sheet Carpet Basis-of-Design Product: Refer to the Finish Legend in the Drawings. Subject to compliance with requirements, provide product indicated on Finish Legend or comparable product by one of the following:
 - 1. Atlas Carpet Mills, Inc.
 - 2. Bentley Prince Street, Inc.
 - 3. Interface, LLC.
 - 4. J&J Invision; J&J Industries, Inc.
 - 5. Mannington Mills, Inc.
 - 6. Milliken & Company.
 - 7. Mohawk Group (The); Mohawk Carpet, LLC.
 - 8. Shaw Contract Group; a Berkshire Hathaway company.
 - 9. Tandus; a Tarkett company
- B. Carpet Tile Basis-of-Design Product: Refer to the Finish Legend in the Drawings. Subject to compliance with requirements, provide product indicated on Finish Legend or comparable product by one of the following:
 - 1. Atlas Carpet Mills, Inc.
 - 2. Bentley Prince Street, Inc.
 - 3. Interface, LLC.
 - 4. J&J Invision; J&J Industries, Inc.
 - 5. Mannington Mills, Inc.
 - 6. Milliken & Company.
 - 7. Mohawk Group (The); Mohawk Carpet, LLC.
 - 8. Shaw Contract Group; a Berkshire Hathaway company.
 - 9. Tandus; a Tarkett company

2.2 SHEET CARPET

- A. Sheet Carpets CPT2:
 - 1. Refer to the Finish Legend for each Basis of Design product selection details.

2.3 CARPET TILE

- A. Carpet Tile CPT1, CPT 3, CPT4:
 - 1. Refer to the Finish Legend for each Basis of Design product selection details.

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- D. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. For wood subfloors, verify the following:
 - 1. Underlayment over subfloor complies with requirements specified in Section 06 10 00 "Rough Carpentry."
 - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 3mm (1/8 inch wide or wider, and protrusions more than 0.7mm (1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. General: Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
 - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
 - 2. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for glue-down installation.
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Carpet Tile Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- H. Maintain dye lot integrity. Do not mix dye lots in same area.
- I. Install in pattern indicated on Drawings. Install pattern and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

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SECTION 097750: FRP PANEL SYSTEMS

PART 1: GENERAL

1.01 WORK INCLUDED

Section Includes: Laminated panels and attachment systems for use as interior cladding.

1.02 SYSTEM DESCRIPTION

A. Interior wall system, non-loadbearing, as indicated on the Drawings, including all installation attachments.

B. Prefinished interior sanitary wall panel material.

C. Plastic extrusions, fasteners, and sealant necessary to maintain wall system integrity and airtight installation.

D. Panel composite assembly shall conform to ASTM E84, Flame Spread Resistance, Class A.

1.03 QUALITY ASSURANCE

A. Panel Manufacturer: Manufacturer shall have a minimum of ten (10) years experience in the manufacture of composite architectural wall systems and have ISO 9001:2000 Certification.

B. Panel Installer: Installer shall be experienced in performing work of this section and be specialized in the installation of similar work required on this project.

C. Field Measurements: Measurements shall be taken prior to the completion of shop manufacturing and assembly.

1.04 SUBMITTALS

A. Samples:

Panel: Two samples of each type of assembly.

Color Standards: Two 3" x 5" samples of each color of finish selected.

B. Shop Drawings: Indicate thickness and dimension of parts, fastening and anchoring methods, detail and location of joints, including joints necessary to accommodate thermal movement.

C. Material Certification: Two (2) copies certifying that material meets the requirements specified.

D. Manufacturer's Literature: Two (2) copies of manufacturer's literature for panel material.

1.07 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirements Section.

B. Deliver, store and handle panels and other components so they will not be damaged or deformed. Package all panels for protection against transportation damage.

C. Storage and Protection: Stack materials on platforms or pallets, covered with suitable ventilated covering. Do not store panels to accumulate water or be in contact with other materials that might cause staining, denting or other surface damage.

1.08 WARRANTY

A. Manufacturer's Warranty: Furnish panel manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of other rights Owner may have under the Contract Documents.

B. Panel Lamination Warranty: One (1) year commencing on Date of Substantial Completion.

C. Finish Warranty:

{Fiberglass Reinforced Plastic (FRP): One (1) year}

PART 2: PRODUCTS

2.01 INTERIOR WALL PANELS & SYSTEMS

A. Approved Manufacturer:

Citadel Architectural Products, Inc.

B. EnviroGuard™ HDP

Sanitary Wall Panels

1. Panel Composition:

a. Face Skin:

{.035" fiberglass reinforced plastic (FRP)}

b. Core: 4mm high density polypropylene

2. Panel Tolerances:

a. Thickness: $\pm 1/32$ "

b. Length and Width: +0, -1/8"

c. Squareness: 1/64" per lineal foot

3. Attachment System:

PVC moldings

2.03 FINISH

A. Exposed Finish:

Fiberglass Reinforced Plastic (FRP)

B. Color: White.

2.04 ACCESSORIES

A. Fasteners and moldings as required for panel system's design by panel system manufacturer.
Fasteners shall be coated or stainless steel.

PART 3: EXECUTION

3.01 EXAMINATION

A. Examine and verify substrate surfaces to receive composite metal panel system and associated work and condition which work will be installed.

B. Maximum deviation from vertical and horizontal alignment of substrate shall be no more than 1/4" in 20'-0".

C. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Starting work within a particular area will be construed as installer's acceptance of surface conditions.

3.02 PREPARATION

A. Comply with manufacturer's product data including product technical bulletins, product catalog installation instructions, and product carton instructions.

B. Surfaces to receive panels shall be even, smooth, sound, clean, and free from defects detrimental to panel installation.

C. Field measure and verify dimensions as required.

D. Protect adjacent areas or surfaces from damage as a result of the Work of this Section.

3.03 INSTALLATION

A. Erect panels level and true to intended plane.

B. Maximum deviation from vertical and horizontal alignment of erected panels shall be no more than 1/4" in 20'-0".

C. Maximum deviation in panel flatness shall be 0.6% of the assembled units.

D. Conform to panel manufacturer's instructions for attachment systems.

E. Weather seal all joints as required using methods and materials as recommended by the panel manufacturer.

3.04 CLEANING

A. Remove temporary coverings and protection to adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

B. Remove and legally dispose of construction debris from project site.

END OF SECTION 097750

SECTION 098000 - CUSTOM ALUMINUM METAL WALL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and General Conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Custom decorative metal wall panels
2. Attachments and fasteners

B. Related Items:

1. Wall Framing/Substrate

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B209 - 07 Standard Specifications for Aluminum and Aluminum-Alloy Sheet and Plate
2. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Drawings: For interior screen panel assemblies and accessories. Include plans, elevations; sections and details describing complete assembly, including support framing channels. (for graphic perf® scale elevation for artwork and custom generated perforated pattern.

B. Samples for initial selections:

1. Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
2. One 8" x 11" sample of custom algorithmically generated perforated metal panel of the same material, hole size, and finish representing final product.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide panels and method of attachment by a single manufacturer.

B. Coordination of Work: installers to coordinate panel system per the standard installation manual. Also to coordinate with related work including, but not limited to building structure, light fixtures, mechanical systems, electrical systems, and other substrates.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store the metal panels, attachment/structure in an interior location and keep in cartons/crates prior to installation to avoid damage.
- B. Exercise care in moving and opening cartons/crates to prevent damage to the panel face.
- C. Handle panels carefully with manufacturer's recommendations to avoid damaging parts in any way.

1.7 PROJECT CONDITIONS

- A. Space Enclosure:
Building areas to receive panels shall be free of construction dust and debris. Products can be installed up to 100°F (38°C) with humidity not exceeding 90% RH. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact. Following installation, conditions must be maintained below 70% RH.

1.8 WARRANTY

- A. Metal Panels: Submit a written warranty from the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Panels: Manufacturing defects.
 - 2. Attachment devices: Rusting and manufacturing defects.
- B. Warranty Period:
 - 1. Panels: One (1) year from date of substantial completion.
 - 2. Attachment devices: One (1) year from date of substantial completion.
- C. Warranty Language:
Manufacturer's products are expressly warranted for a period of one (1) year from purchase to be free from defects in material and workmanship, when installed according to manufacturer's published installation procedures. During the warranty period manufacturer will repair or at its option replace the products that are proven to be defective.
Manufacturer is NOT responsible for any intentional or accidental abuse, misuse, or neglect incurred on the original warranted product, and shall as determined by manufacturer, void the warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Arktura Vapor® Graphic Perf® :
 - 1. Substitutions will be considered.

2.2 PANEL UNITS

- A. Samples for initial selections:

- 1.Surface Texture: Smooth [see Section 2.3]
- 2.Composition: Panels and Channels - Typically .060” to .125” Aluminum Alloy: 5052
- 3.Color: RAL powder coated finish
- 4.Custom Algorithmically Generated Perforation Pattern: Constantly varying hole sizes in multiples of .01”. Holes/openings to vary from .25” min to 1.25” max unique diameters.
- 5.Pattern Constraints: Custom modified perforation pattern at all panel edges to accommodate pattern transitions and necessary material borders for material integrity.
- 6.All cuts/perforations 90 Deg to surface face
- 7.All metal bending and forming to be formed within a .03” bending tolerance
- 8.No depressions or deformations at perforation edges
- 9.Recycled Content: 25% [up to 60% recycled content upon request]

2.3 SURFACE FINISH

- A. Application of surface finish to be applied in compliance with the following standard operating procedure:

- 1.Inspect raw material for obvious defects. Finish to 180 grit.
2. 5-stage anti-corrosion pretreatment.
3. Electrostatically apply Triglycidyl Isocyanurate (TGIC) polyester powder (IGP Dura Xal or equivalent) to entire surface of part at approximately 2.0-3.0 mils. Exterior Architectural grade powder coating.
4. Cure part per manufacturer’s specifications.

- B. Surface finish, when complete, must meet the reference standards as listed below:

American Society for Testing and Materials (ASTM):

1. ASTM D3359 Standard Test Methods for Measuring Adhesion, Method B
2. ASTM D3363 Standard Test Method for Film Hardness by Pencil Test
3. ASTM D2794 [modified] Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
4. ASTM D522 [modified] Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
5. ASTM D4060 [modified] Standard Test Method for Abrasion Resistance

C. Durability of surface finish must meet the reference standards as listed below:

American Society for Testing and Materials (ASTM):

1. ASTM B117 - 09 Standard Practice for Operating Salt Spray (Fog) Apparatus
2. AAMA 2604 – 5 Year South Florida Exposure (American Architectural Manufacturers Association, AAMA)

2.4 ATTACHMENT SYSTEM

A. System: Vertika™ System for Arktura panels

Aluminum channels designed to work with Arktura panels. Designed and Engineered by manufacturer.

B. Installation:

The pre-engineered, prefabricated Vapor® panels will be designed with slotted holes to align aesthetically with hooks on the Vertika® support framing beyond. Install is sequential with the top panel requiring a set screw or capture channel in exterior applications. metal channels will be coated to match color of the panels unless otherwise specified.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field verify each wall area and establish layout of panels. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation. Panel substructure shall be level and plumb. Panel substructure attachment to base building shall be structurally sound as determined by that subcontractor's engineer. Panel substructure shall be free of defects detrimental to work and erected in accordance with established building tolerances.
- B. Coordinate panel layout with mechanical, electrical and sprinkler fixtures as required.
- C. Coordinate delivery of such items to project site.

3.2 INSTALLATION [by Others]

- A. Install panels in accordance with the manufacturer's instructions and in compliance with the authorities having jurisdiction.
- B. Erect panels' level and plumb, in proper alignment in relation to substructure framing and established lines.
- C. Panel anchorage shall be structurally sound and per engineering recommendations.
- D. Locate and place wall panels' level, plumb, and at indicated alignment with adjacent work.

3.3 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Proper maintenance and regular servicing of the coated surfaces are both prerequisites for the claims of any guarantee and require regular cleaning at least once each year. For severe environmental pollution, for example in regions with increased salt contamination and/or chemical exhausts, meaning in a direct area of influence or within the vicinity of an industrial or chemical enterprise, or in the immediate vicinity of a sea coast or within a

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defined chemical/radioactive precipitation zone, the building must be cleaned more often.

In this way possible damage can be made subject to timely recognition and remedied on time by suitable measures.

- C. If a coated component is soiled during transport, through storage or assembly, the cleaning of this component must take place immediately with clear, cold or lukewarm water. Neutral or a weak alkaline detergent can be used against severe soiling.
- D. Protect wall panel assemblies from damage during construction. Use temporary protective coverings where needed as approved by the wall panel manufacturer.

END OF SECTION 098000

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Bennette Paint Manufacturing Company, Inc.
 - 4. BLP Mobile Paint Manufacturing.
 - 5. Color Wheel Paints & Coatings.
 - 6. Coronado Paint.
 - 7. Devoe High Performance Coatings.
 - 8. Duron, Inc.
 - 9. Envirocoatings Canada Inc.
 - 10. Farrell-Calhoun.
 - 11. Glidden Professional.
 - 12. ICI Paints.
 - 13. Insl-x.
 - 14. M.A.B. Paints.
 - 15. PPG Architectural Finishes, Inc.
 - 16. Pratt & Lambert.
 - 17. Sherwin-Williams Company (The).
 - 18. Southern Diversified Products, LLC.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

D. Colors: As selected by Architect from manufacturer's full range.

1. 10 percent of surface area will be painted with deep tones.

2.3 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50 or MPI #50 X-Green.
- B. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149 or MPI #149 X-Green.

2.4 METAL PRIMERS

- A. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

2.5 WATER-BASED PAINTS

- A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143 or MPI #143 X-Green.
- B. Latex, Interior, High Performance Architectural, (Gloss Level 3): MPI #139 or MPI #139 X-Green.
- C. Latex, Interior, High Performance Architectural, Semi-Gloss (Gloss Level 5): MPI #141 or MPI #141 X-Green.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" and "MPI Maintenance Repainting Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Other items as directed by Architect.
 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

- 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer, alkyd, quick dry, for metal.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5).

B. Gypsum Board Substrates:

- 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1).
- 2. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer sealer, latex, interior.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, (Gloss Level 3).
- 3. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer sealer, latex, interior.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (Gloss Level 5).

END OF SECTION 099123

SECTION 101010 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Markerboards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show location of panel joints.
 - 2. Include sections of typical trim members.
- C. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
 - 1. Actual sections of porcelain-enamel face sheet and tack assembly.
 - 2. Samples of accessories involving color selection.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of fabrics.
- E. Maintenance Data: For visual display surfaces to include in maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefabricate components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display units vertically with packing materials between each unit.

1.6 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces become slick or shiny.
 - c. Surfaces exhibit crazing, cracking, or flaking.
 - 2. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
 1. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.
- B. Hardboard: AHA A135.4, tempered.
- C. Particleboard: ANSI A208.1, Grade 1-M-1, made with binder containing no urea formaldehyde.
- D. Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
- E. Cork Sheet: MS MIL-C-15116-C, Type II.
- F. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

2.3 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and porcelain-enamel face sheet with matte finish.
 1. Manufacturers:
 - a. AARCO Products, Inc.
 - b. ADP/Lemco, Inc.
 - c. Bangor Cork Company, Inc.
 - d. Best-Rite Manufacturing.
 - e. Claridge Products & Equipment, Inc.
 - f. Egan Visual Inc.
 - g. Ghent Manufacturing Inc.
 - h. Marsh Industries, Inc.
 - i. Platinum Visual Systems; a division of ABC School Equipment, Inc.
 - j. PolyVision Corporation.
 2. Particleboard Core: 3/8 inch (9.5 mm) thick, aluminum sheet backing.
 3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.
 4. Projection Capability: markerboard shall be compatible with projection equipment and provide adequate surface for legible projection.

2.4 MARKERBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.
 - 1. Factory-Applied Trim: Manufacturer's standard.
- B. Chalktray: Manufacturer's standard, continuous.
 - 1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
- C. Map Rail: Provide the following accessories:
 - 1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
 - 2. End Stops: Located at each end of map rail.
 - 3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1220 mm) of map rail or fraction thereof.

2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assemble visual display boards, unless otherwise indicated.
 - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
 - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
 - 2. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
 - 3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.6 ALUMINUM FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
- B. Examine walls and partitions for proper backing for visual display surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.
 1. Seal wall surfaces indicated to receive visual display fabric.
- C. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level,

and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalktray.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
 1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 12 inches (300 mm) o.c.

3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101010

SECTION 102310

GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Frameless glazed interior wall and door assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2011e1.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
- G. WDMA I.S.1-A - Architectural Wood Flush Doors; Window and Door Manufacturers Association; 2011.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
 - 1. Require attendance by representatives of installer, other entities directly affecting, or affected by, construction activities of this section.
 - 2. Notify Architect four calendar days in advance of scheduled meeting date.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in partition assembly.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
 - 1. Include field measurements of openings.
 - 2. Include Elevations Showing:
 - a. Locations and identification of manufacturer-supplied door hardware and fittings.
 - b. Locations and sizes of cut-outs and drilled holes for other door hardware.
 - 3. Include Details Showing:
 - a. Requirements for support and bracing of overhead track.
 - b. Installation details.
 - c. Appearance of manufacturer-supplied door hardware and fittings.
- D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.
- E. Verification Samples: Two samples, minimum size 2 by 3 inches (50 by 75 mm), representing actual material and finish of exposed metal.

- F. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.
- G. Certificates: Contractor to certify that installer of partition assemblies meets specified qualifications.
- H. Operation and Maintenance Data: For manufacturer-supplied operating hardware.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Specimen Warranty.
- K. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum three years of experience designing, assembling, and installing partition assemblies similar to those specified in this section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of metal finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - Frameless Glazed Interior Wall and Door Assemblies:
 - 1. C.R. Laurence Co., Inc; CRL Cascade Series Frameless Glass Wall Office System: www.crl-arch.com. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Kawneer North America; an Alcoa company.
 - 3. YKK AP America Inc

2.02 FRAMELESS GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

- A. Frameless Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of full-width and height glass panels fastened with U-channel fittings on top and bottom edge of glass wall.
 - 1. Configuration: As indicated on drawings.
 - 2. U-Channel Fittings: Extruded aluminum, satin anodized finish, dry glazed, and with matching end caps.
 - a. Top channel is 1-1/2 inch (38 mm) high by 1 inch (25.4 mm) deep.
 - b. Bottom channel is 1 inch (25.4 mm) high by 1 inch (25.4 mm) deep.
 - 3. Glass Thickness: 1/2 inch (12.7 mm), tempered.
 - 4. Designed to withstand normal operation without damage, racking, sagging, or deflection.
 - 5. Coordinate wall and door assembly preparation and provide hardware as necessary for fully operable installation.
 - 6. Finished metal surfaces protected with strippable film.
 - 7. Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.
- B. Pivoting Glass Doors: Dry glazed patch fittings.
 - 1. Door Configuration: As indicated on drawings.

2. Height: 2 inch (51 mm).
 3. Length: 6-7/16 inch (164 mm).
 4. Cladding Finish: Satin anodized.
 5. Glass Thickness: 1/2 inch (12.7 mm), tempered.
 6. Door Hardware: Patch bottom fitting, brushed stainless steel.
 7. Provide accessories as required for complete installation.
 8. Basis of Design: C.R. Laurence Co., Inc; CRL Commercial Patch Hardware, Catalog No. PH20AA (Top), PH10CA (Bottom): www.crl-arch.com.
- C. Sliding Glass Doors: Top supported without holes required in glass.
1. Door Configuration: As indicated on drawings.
 2. Door Weight: 264 lbs (120 kgs), maximum.
 3. Track Size: 2-7/16 inch (62 mm) high by 2-7/16 inch (62 mm) deep with end caps.
 - a. Overhead track size for single slider.
 4. Track Finish: Satin anodized.
 5. Glass Thickness: 1/2 inch (12.7 mm), tempered.
 6. Door Hardware: Center locks, brushed stainless steel.
 7. Provide accessories as required for complete installation.
 8. Basis of Design: C.R. Laurence Co., Inc; CRL290 Series Top Hung Sliding Door System: www.crl-arch.com.
- D. Sliding Flush Wood Doors: Top supported from track with hanger assembly mortised into top edge of door.
1. Door Configuration: Single sliding door, wall mounted.
 2. Door Weight: 275 lbs (125 kgs), maximum.
 3. Track Size: 1-5/8 inch (41 mm) high by 1-9/16 inch (39 mm) deep with end caps.
 4. Track and Cover Length: 118 inch (3 m), maximum.
 5. Track Cover Finish: Satin anodized.
 6. Flush Wood Doors: Comply with WDMA I.S.1-A standards, Premium Grade, with AA Grade veneer faces.
 - a. Width: As scheduled.
 - b. Door Height: As scheduled.
 - c. Door Thickness: 1-3/4 inch (44.5 mm), maximum.
 - 1) Wall mounted, with track shined out from face of wall to accommodate door thickness.
 - d. Veneer: Rotary cut, white birch.
 - e. Veneer Match: Book Running Match.
 - f. Veneer Finish: Field finished.
 - g. Vision Lites: As indicated on drawings.
 7. Door Hardware: Refer to the Section 08 7100.
 8. Provide mounting brackets, floor guide and other accessories as required for complete installation.
 9. Basis of Design: C.R. Laurence Co., Inc; CRL70 Series Wood Door Kits: www.crl-arch.com.
- E. Other Manufacturers: Not permitted; provide the product identified as "Basis of Design".

2.03 FITTINGS AND HARDWARE

- A. Operable Panel Hardware: Coordinate with additional requirements as specified in Section 08 7100.

2.04 MATERIALS

- A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Class 2 - Tinted, Quality Q3, fully tempered in accordance with ASTM C1048, Kind FT, and as follows:
1. Thickness: As indicated.

- 2. Color: Grey tint; low iron.
- 5. Prepare glazing panels for indicated fittings and hardware before tempering.
- 6. Polish edges that will be exposed in finished work to bright flat polish.
- 7. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.
- B. Aluminum Components: Conforming to ASTM B221 (ASTM B221M), Alloy 6063, T5 Temper.
- C. Sealant: One-part silicone sealant, conforming to ASTM C920, clear.

2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that track supports are properly braced, level within 1/4 inch (6 mm) of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.
- D. Do not begin installation until supports and adjacent substrates have been properly prepared.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean substrates thoroughly prior to installation.
- B. Prepare substrates using the methods recommended by the manufacturer for achieving acceptable result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with glazed interior wall and door assembly manufacturer's instructions.
- B. Fit and align glazed interior wall and door assembly level and plumb.

3.04 ADJUSTING

- A. Adjust glazed interior wall and door assembly to operate smoothly from sliding or pivoting positions.
- B. Adjust swing door hardware for smooth operation.

3.05 CLEANING

- A. Clean installed work to like-new condition.
- B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Demonstrate operation of glazed interior wall and door assembly and identify potential operational problems.

3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before date of Substantial Completion.

END OF SECTION

SECTION 104310 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Room signs.
 - 2. Miscellaneous signs.
- B. Related Sections include the following:
 - 1. Division 1 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
 - 2. Division 14 Section "Gearless Traction Elevators" for code-required elevator signage.
 - 3. Division 15 Section "Mechanical" for labels, tags, and nameplates for mechanical equipment.
 - 4. Division 16 Section "Electrical" for labels, tags, and nameplates for electrical equipment.
 - 5. Division 16 Section "Electrical" for illuminated Exit signs.

1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 - 1. Aluminum.
 - 2. Acrylic sheet.
 - 3. Polycarbonate sheet.
 - 4. Fiberglass sheet.
 - 5. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
 - 1. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).
 - 2. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
 - 3. Polycarbonate Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
 - 4. Fiberglass Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
 - 5. Panel Signs: Not less than 12 inches (305 mm) square.
 - 6. Accessories: Manufacturer's full-size unit.
- E. Sign Schedule: Use same designations indicated on Drawings.
- F. Qualification Data: For fabricator.
- G. Maintenance Data: For signs to include in maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and the North Carolina Accessibility Code.
- E. University Requirements: Comply with applicable provisions of the East Carolina University Exterior and Interior Signage Standards attached to this specification for information.

1.6 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

1.7 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
- B. Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi (103 MPa) when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi (207 MPa) when tested according to ASTM D 790.
- C. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- D. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 PANEL SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allenite Signs; Allen Marking Products, Inc.
 2. APCO Graphics, Inc.
 3. ASI-Modulex, Inc.
 4. Best Sign Systems Inc.
 5. Mohawk Sign Systems.
 6. Supersine Company (The)
- B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
1. Aluminum Sheet: 0.080 inch (2.03 mm) thick.
 2. Acrylic Sheet: 0.060 inch (1.52 mm) thick.
 3. Edge Condition: Square cut.
 4. Corner Condition: Square.
 5. Mounting: Unframed.
 - a. Wall mounted with two-face tape.
 - b. Manufacturer's standard anchors for substrates encountered.
 6. Custom Paint Colors: Match Pantone color matching system.
 7. Color: As selected by Architect from manufacturer's full range.
 8. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.
- C. Exterior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
1. Fiberglass Sheet: 0.125-inch thick sheet.
 2. Edge Condition: Square cut.
 3. Corner Condition: Square.
 4. Mounting: Unframed.
 - a. Wall mounted.
 - b. Manufacturer's standard noncorroding anchors for substrates encountered.
 5. Custom Paint Colors: Match Pantone color matching system.
 6. Color: As selected by Architect from manufacturer's full range.
- D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
1. Panel Material: Photopolymer.
 2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

- E. Subsurface Copy: Apply minimum 4-mil- (0.10-mm-) thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.
- F. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
 - 1. Custom Paint Colors: Match Pantone color matching system.
 - 2. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
 - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
 - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
 - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

2.7 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 - 1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 - 2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
 - 3. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.4 INTERIOR SIGN SCHEDULE

END OF SECTION 104310

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.
 - b. Portable fire extinguisher and fire-hose valve.
 - c. Portable fire extinguisher, fire hose, rack, and fire-hose valve.
 - d. Fire-hose valve.
 - e. Fire hose, rack, and fire-hose valve.

- B. Related Requirements:

- 1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets
- 2. Section 211200 "Fire-Suppression Standpipes" for fire-hose connections.

1.3 ALLOWANCES

- A. Fire-protection cabinets are part of **<Insert name of allowance>**.

1.4 UNIT PRICES

- A. Work of this Section is affected by **<Insert name of unit price>**.

1.5 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at **[Project site]** **<Insert location>**.

- 1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
 - 2. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire-protection cabinets.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on samples **6 by 6 inches** (150 by 150 mm) square.
- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. [**Use same designations indicated on Drawings.**]

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.8 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of [**fire extinguishers**] [**fire hoses, hose valves, and hose racks**] indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET <Insert drawing designation>

- A. Cabinet Type: Suitable for fire [**extinguisher**] [**extinguisher and hose valve**] [**hose, rack, valve, and extinguisher**] [**hose, rack, and valve**] [**-hose valve**].
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Cabinet Construction: [**Nonrated**] [**One-hour fire rated**] [**Two-hour fire rated**].
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from **0.043-inch- (1.09-mm-)** thick cold-rolled steel sheet lined with minimum **5/8-inch- (16-mm-)** thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: [**Cold-rolled steel sheet**] [**Aluminum sheet**] [**Stainless steel sheet**].
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box, to act as [**plaster stop**] [**drywall bead**].
 - 2. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
 - 3. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: **1-1/4- to 1-1/2-inch (32- to 38-mm)** backbend depth.
 - 2. Rolled-Edge Trim: [**2-1/2-inch (64-mm)**] [**4-inch (102-mm)**] [**4-1/2-inch (114-mm)**] **<Insert dimension>** backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: [**Steel sheet**] [**Aluminum sheet**] [**Extruded-aluminum shapes**] [**Stainless steel sheet**] [**Copper-alloy brass sheet**] [**Copper-alloy bronze sheet**] [**Same material and finish as door**].
- H. Door Material: [**Steel sheet**] [**Aluminum sheet**] [**Extruded-aluminum shapes**] [**Stainless steel sheet**] [**Copper-alloy brass sheet**] [**Copper-alloy bronze sheet**].

- I. Door Style: [**Fully glazed, frameless, backless, acrylic panel**] [**Fully glazed panel with frame**] [**Full acrylic bubble, frameless**] [**Full acrylic bubble with frame**] [**Full acrylic bubble with frameless, rotating turntable**] [**Horizontal duo panel with frame**] [**Vertical duo panel with frame**] [**Center glass panel with frame**] [**Solid opaque panel with frame**] [**Flush opaque panel, frameless, with no exposed hinges**].
- J. Door Glazing: [**Clear float glass**] [**Tempered float glass (clear)**] [**Tempered float glass (bronze tint)**] [**Break glass**] [**Tempered break glass**] [**Wire glass**] [**Acrylic sheet**] [**Break acrylic bubble**] [**Molded acrylic bubble**].
 - 1. Acrylic Sheet Color: [**Clear**] [**Bronze**] transparent acrylic sheet.
 - 2. Acrylic Sheet Color: Clear transparent acrylic sheet painted [**white**] [**red**] [**black**] on unexposed side.
 - 3. Acrylic Bubble Color: [**Clear**] [**Bronze**] [**Red**], transparent.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide [**projecting lever handle with cam-action latch**] [**projecting door pull and friction latch**] [**recessed door pull and friction latch**] [**manufacturer's standard**].
 - 2. Provide [**continuous hinge, of same material and finish as trim,**] [**concealed hinge**] [**pivot hinge**] [**manufacturer's standard hinge**], permitting door to open 180 degrees.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - 3. Break-Glass Door Handle: Manufacturer's standard, integral to glass with the words "PULL TO BREAK GLASS" applied to handle.
 - 4. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 5. Door Lock: [**Cam lock that allows door to be opened during emergency by pulling sharply on door handle**] [**Cylinder lock, keyed alike to other cabinets**].
 - 6. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate [**as indicated**] [**as directed by Architect**] <Insert location>.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "[**FIRE EXTINGUISHER**] <Insert identification>."
 - 1) Location: Applied to [**cabinet door**] [**cabinet glazing**] [**location indicated on Drawings**].
 - 2) Application Process: [**Silk-screened**] [**Engraved**] [**Etched**] [**Decals**] [**Pressure-sensitive vinyl letters**].
 - 3) Lettering Color: [**Red**] [**Black**] [**White**].
 - 4) Orientation: [**Vertical**] [**Horizontal**] [**As indicated on Drawings**].

7. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by **[batteries]** **[low voltage, complete with transformer]**.

M. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: **[Factory primed for field painting]** **[Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603]**.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: **[Match Architect's sample]** **[As selected by Architect from manufacturer's full range]** **<Insert color>**.
2. Aluminum: **ASTM B221** **(ASTM B221M)** for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
 - a. Finish: **[Clear anodic]** **[Color anodic]** **[Baked enamel or powder coat]**.
 - b. Color: **[Light bronze]** **[Medium bronze]** **[Dark bronze]** **[Match Architect's sample]** **[As selected by Architect from full range of industry colors and color densities]** **<Insert color>**.
3. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: **[ASTM A480/A480M No. 4 directional satin finish,]** **[ASTM A480/A480M No. 8 mirrorlike reflective, nondirectional polish]** **<Insert finish>**.
4. Copper Alloy, Brass: ASTM B36/B36M alloy **[as standard with manufacturer]** **<Insert requirements>**.
 - a. Finish: **[Polished]** **[Satin]** **[As selected by Architect from full range of industry finishes]** **<Insert finish>**.
5. Copper Alloy, Bronze: ASTM B36/B36M alloy **[as standard with manufacturer]** **<Insert requirements>**.
 - a. Finish: **[Mirror polish]** **[Satin polish]** **[Satin oxidized oil rub]** **[Clear baked enamel]** **[Match Architect's sample]** **[As selected by Architect from full range of industry finishes]** **<Insert finish>**.
6. Clear Float Glass: ASTM C1036, Type I, Class 1, Quality q3, **[3]** **[6]** mm thick.
7. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, **[Class 1 (clear)]** **[Class 2 (tinted, heat absorbing, and light reducing), bronze tint]**.
8. Break Glass: Clear annealed float glass, ASTM C1036, Type I, Class 1, Quality q3, 1.5 mm thick, single strength.
9. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

10. Wire Glass: ASTM C1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
11. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), [1.5] [3] [6] mm thick, with [**Finish 1 (smooth or polished)**] [**Finish 2 (patterned, textured)**].

2.4 SECURITY FIRE-PROTECTION CABINET <Insert drawing designation>

- A. Cabinet Type: Suitable for fire [extinguisher] [extinguisher and hose valve] [hose, rack, valve, and extinguisher] [hose, rack, and valve] [hose valve].
 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Cabinet Construction: [Nonrated] [One-hour fire rated] [Two-hour fire rated].
 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls lined with minimum **5/8-inch- (16-mm-)** thick fire-barrier material.
- C. Cabinet Material: [**0.068-inch- (1.72-mm-)** thick steel sheet] [**0.097-inch- (2.45-mm-)** thick steel sheet] [**0.078-inch- (1.98-mm-)** thick stainless steel sheet].
 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 1. Square-Edge Trim: **1-1/4- to 1-1/2-inch (32- to 38-mm)** backbend depth.
 2. Rolled-Edge Trim: **2-1/2-inch (64-mm)** backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: [Steel sheet] [Stainless steel sheet] [Same material and finish as door].
- H. Door Material: [**0.097-inch- (2.45-mm-)** thick steel] [**0.078-inch- (1.98-mm-)** thick stainless steel] [**0.109-inch- (2.78-mm-)** thick stainless steel] sheet.
- I. Door Style: Solid opaque panel with frame.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated, and as follows:
 1. Recessed door pull.

2. Continuous Hinge: Same material and finish as trim, permitting door to open 180 degrees.
3. Mechanical Deadlock: Lockbolt retracted and extended by five-tumbler **[paracentric]** **[mogul]** cylinder; keyed one side.
 - a. Lockbolt: **1-1/2 inches high by 3/4 inch (38 mm high by 19 mm)** thick; **5/8-inch (16-mm)** throw.
4. Mechanical Deadlock: As specified in Section 087163 "Detention Door Hardware."
5. Mechanical Snaplatch: Automatic snaplatch when closed; latchbolt retracted by five-tumbler **[paracentric]** **[mogul]** cylinder; keyed one side.
 - a. Lockbolt: **1 inch high by 7/16 inch (25 mm high by 11 mm)** thick; **5/16-inch (8-mm)** throw.
6. Mechanical Snaplatch: As specified in Section 087163 "Detention Door Hardware."

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate **[as indicated]** **[as directed by Architect]** **<Insert location>**.
 - a. Identify fire extinguisher in security fire-protection cabinet with the words "[**FIRE EXTINGUISHER**]" **<Insert identification>**.
 - 1) Location: Applied to **[cabinet door]** **[location indicated on Drawings]**.
 - 2) Application Process: **[Silk-screened]** **[Engraved]** **[Etched]** **[Decals]** **[Pressure-sensitive vinyl letters]**.
 - 3) Lettering Color: **[Red]** **[Black]** **[White]**.
 - 4) Orientation: **[Vertical]** **[Horizontal]** **[As indicated on Drawings]**.
3. Keys: Three per door lock.

L. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: **[Factory primed for field painting]** **[Baked enamel or powder coat]**.
 - b. Color: **[Match Architect's sample]** **[As selected by Architect from full range of industry colors]** **<Insert color>**.
2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: **[ASTM A480/A480M No. 4 directional satin finish]** **[ASTM A480/A480M No. 8 mirrorlike reflective, nondirectional polish]** **<Insert finish>**.

2.5 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Miter corners and grind smooth.
 - 3. Provide factory-drilled mounting holes.
 - 4. Prepare doors and frames to receive locks.
 - 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch (13 mm)** thick.
 - 2. Fabricate door frames of one-piece construction with edges flanged.
 - 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose **[valves]** **[racks]** and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where **[recessed]** **[and]** **[semirecessed]** cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for [**recessed**] [**and**] [**semirecessed**] fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated[**or, if not indicated, at height indicated below:**][**or, if not indicated, at heights acceptable to authorities having jurisdiction.**]
 - 1. Fire-Protection Cabinets: [**42 inches (1067 mm)**] <Insert dimension> above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 4. Fire-Rated [**Hose and Valve**] [**Hose-Valve**] Cabinets:
 - a. Install cabinet with not more than **1/16-inch (1.6-mm)** tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."
- C. Identification:
 - 1. Apply [**decals**] [**vinyl lettering**] at locations indicated.
 - 2. Apply [**decals**] [**vinyl lettering**] on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 01 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract including general and supplementary conditions and general requirements apply to the work specified in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Plumbing: Refer to Division 22, including:
 - 1. Rough-in piping for gas and water supply and waste lines.
 - 2. Piping for supply and waste lines.
 - 3. Traps, grease traps, line strainers, tail pieces, valves, stops, shut offs and miscellaneous fittings required for complete installation.
 - 4. Final connections.
 - 5. Indirect drains for sink compartments.
 - 6. Disconnect existing equipment.
- B. Mechanical: Refer to Division 23, including:
 - 1. Roof mounted fans and connecting ductwork not shown as part of the kitchen equipment.
 - 2. Final connections, including approved welded duct connections to hoods.
 - 3. Disconnect existing equipment.
- C. Electrical: Refer to Division 26, including:
 - 1. Rough-in conduit, wiring, line and disconnect switches, safety cut-offs and fittings, control panels, fuses, boxes, and fittings required for complete installation.
 - 2. Final connections, including mounting and wiring of switches furnished as part of the food service equipment (unless otherwise indicated on the drawings).
 - 3. Disconnect existing equipment.
- D. Mechanical Work:
 - 1. Provide exhaust hoods with connection collars ready for final connection by HVAC Section.
 - 2. Provide stainless steel exposed ducts to ceiling for dishmachine.
- E. Existing Equipment:
 - 1. Contractor shall remove and store existing equipment at his expense in a controlled environment storage facility until such time as job site is ready for reinstallation.

2. Relocate those items of existing equipment noted as being reset to new positions shown on plan drawings. Coordinate resetting to minimize disruptions of operation of kitchen operations.
3. Remove remaining existing equipment from premises.
4. All piping, traps, etc. for reset equipment shall be new.

1.3 WORK INCLUDED THIS SECTION:

- A. Furnish and install all food service equipment as specified herein, including that which is reasonably inferred, with all related items necessary to complete work shown on contract drawings and/or required by these specifications.
- B. Electrical Work:
 1. Interwiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box as is applicable, ready for final connection.
 2. Voltages shall be as indicated on contract drawings. Any differences in electrical characteristics at job site from those shown on contract documents must be submitted to Architect for consideration prior to ordering equipment.
- C. Plumbing Work:
 1. Furnish all equipment with faucets, sink waste assemblies, and trim as specified in this section.
 2. Other than sink compartments, extend all indirect waste lines to nearest floor receptor. All such drain lines to be properly sized. Drain shall terminate with proper air gap above flood rim of floor receptor. Drain lines to be copper with silver paint unless specified otherwise. Drain lines in public areas to be chrome plated where exposed to public view.
- D. Mechanical Work:
 1. Provide exhaust hoods with connection collars ready for final connection by Division 23.

1.4 QUALITY ASSURANCE

- A. It is required that all custom fabricated equipment such as food serving units, tables, sinks, counter tops, etc., be manufactured by a food service equipment fabricator who has the plant, personnel and engineering equipment required. Such manufacturer shall be subject to approval of Architect. All work in the above category shall be manufactured by one manufacturer and shall be of uniform design and finish.
- B. Manufacturer of this equipment must be able to show that they are now and for the past five years have been engaged in manufacture or distribution of equipment, as required under this contract, as their principal product.

- C. Manufacturer of equipment herein specified shall be a recognized distributor for items of equipment specified herein which are of other manufacture than their own.
- D. Only manufacturers who can meet the foregoing qualifications will be acceptable.
- E. All work shall be done in an approved professional manner, to the complete satisfaction of the Owner.

1.5 SUBMITTALS

- A. Submit shop drawings as required by General Conditions. All shop drawings and rough-in drawings shall be CAD drafted and must be submitted in .DWF or .PDF electronic format. Multiple hard copies are not acceptable.
- B. Shop drawings and bound brochures covering manufactured or "buy-out" items covering all work and equipment included in this contract shall be submitted to Architect as soon as possible after award of contract. After approval, Food Service Equipment Contractor shall furnish to Architect electronic files of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproduction and submission shall be part of the contract. Bound brochure and cut sheet submittals must be copied to Owner for review and comment.
- C. Provide fully dimensioned rough-in plans at 1/4" scale, consisting of a separate drawing for each discipline. Each drawing shall show equipment shaded down 50%. Rough-in set shall include all required mechanical, electrical, plumbing, services for equipment and dimensioned rough-in location for same. Rough-in locations shown shall make allowances for required traps, switches, etc., thereby not requiring interpretation or adjustment on the part of other Contractors.
The Food Service Equipment Contractor shall visit the site to verify all rough-in and sleeve locations prior to installation of finished floors and shall cooperate with other Contractors involved in proper location of same. The Food Service Equipment Contractor shall be responsible for any required relocations of rough-in due to errors or inaccuracies on those rough-in plans which they prepare.
- D. Rough-in plans shall include all required services which relate to equipment, but which may not directly connect thereto, such as convenience outlets at walls, hose stations, floor drains, etc.
- E. Rough-in plans shall also include all required outlet services for equipment which is designated on the drawing schedule, even though such equipment may not be included in this contract. Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment.
- F. Fully dimensioned and detailed shop drawings of custom fabricated equipment items shall be submitted, drawn at 3/4" and 1 - 1/2" scale for plans, elevations, and sections respectively.
Drawings shall show all details of construction, installation, and relation to adjoining and related work where cutting or close fitting is required. Drawings shall show all

reinforcements, anchorage, and other work required for complete installation of all fixtures.

- G. Do not begin fabrication of custom manufactured equipment until approvals of shop drawings have been received and until field measurements have been taken by Food Service Equipment Contractor, where such measurements are necessary to assure proper conformance with intent of contract drawings and specifications.
- H. Make field measurements, giving due consideration to any architectural, mechanical, or structural discrepancies which may occur during construction of building. No extra compensation will be allowed for any difference between actual measurements secured at job site and dimensions indicated on contract drawings. Any differences which may be found at job site during field measurements shall be submitted to Architect for consideration before proceeding with fabrication of equipment.
- I. Submit illustrative brochures for manufactured or "buy-out" equipment items, complete with illustrations, specifications, line drawings, rough-in requirements, and list of accessories or other specified additional requirements. Brochures shall be bound and shall include data on all equipment which is to be provided, arranged in numerical sequence which conforms to item numbers of specifications. Omission of data does not reduce obligation to provide items as specified.
- J. Approval of shop schedules and brochures will be in general and shall be understood to mean that Architect has no objection to use of materials or processes shown. Approval does not relieve Food Service Equipment Contractor from responsibility for errors, omissions, or deviations from their contract requirements.

1.6 SUBSTITUTIONS - STANDARDS

- A. Refer to Instructions to Bidders and Division 01 for requirements.
- B. All unspecified substitutions after bid must be submitted to Owner for written approval prior to acceptance.

1.7 DRAWINGS

- A. Drawings which constitute part of contract documents indicate general arrangement of piping and location of equipment. Should it be necessary to deviate from arrangement indicated to meet structural conditions, make such deviations without expense to Owner.
- B. Specifications and drawings are reasonably exact, but their extreme accuracy is not guaranteed. Drawings and specifications are for assistance and guidance of Contractor, and exact locations, distances and levels shall be governed by the building.

1.8 MANUFACTURER'S DIRECTIONS

- A. Follow manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on drawings or specifications.

1.9 INDUSTRY STANDARDS

- A. Electric operated and/or heated equipment, fabricated or otherwise, shall conform to the latest standards of National Electric Manufacturers Association and of Underwriters Laboratories, Inc., and shall bear the U.L. label.
- B. Cooking and hot food holding equipment shall meet minimum construction standards as noted by NSF #4.
- C. Refrigeration equipment shall meet minimum construction standards as noted by NSF #7.
- D. Items of food service equipment furnished shall bear the N.S.F. seal.
- E. Food service equipment shall be installed in accord with N.S.F. standards.
- F. Work and materials shall comply with requirements of applicable codes, ordinances, and regulations, including but not limited to those of Occupational Safety and Health Act (OSHA), National Fire Protection Association, State Fire Marshal, State Accident Commission, U.S. Public Health Service, State Board of Health, local health codes, etc.
- G. No extra charge will be paid for furnishing items required by regulations, even though such may not be shown on drawings or called for in these specifications.
- H. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

- A. All like types of equipment such as all refrigerated and heated cabinets, all ovens, and all mixers shall be by the same manufacturer.
- B. Except as may be specified otherwise under individual item specifications in "Equipment Schedule", all items of standard manufactured equipment shall be complete in accord with manufacturer's standard specification for specific unit or model called for, including finishes, components, attachments, appurtenances, etc., except as follows:
 - 1. All items of standard equipment shall be that manufacturer's latest model at time of delivery.
 - 2. Substitutions for manufactured equipment specified will be accorded consideration under terms set forth in "Substitutions - Standards".

2.2 FABRICATED EQUIPMENT

- A. Stainless steel shall be U.S. standard gauges as called for, 18-8, Type 302, Type 304, No. 4 finish.
- B. Galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth, and where galvanizing has been burned off, touched up with high grade aluminum bronze.
- C. Legs and crossrails shall be continuously welded, unless otherwise noted, and ground smooth.
- D. Bottom of legs at floor shall be fitted with sanitary stainless-steel bullet type foot, with not less than 2" adjustment.
- E. Legs shall be fastened to equipment as follows:
 - 1. To sinks by means of closed gussets. Gussets shall be stainless steel, reinforced with bushing, having set screws for securing legs.
 - 2. To tables and drainboards with closed gussets which shall be welded to stainless steel hat sections or channels, 14 gauge or heavier, exposed hat sections having closed ends. Bracing shall be welded to the underside of tops.
- F. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.
- G. Sinks, unless otherwise specified, shall be furnished with rotary type waste outlets, without connected overflows: Atlantic Brass Works Model 772-RB; Fisher Brass Foundry Model 250A; T&S; or approved equal. Where exposed, furnish wastes chromium plated.
- H. Rolls shall be 1 1/2" diameter, except as detailed contrary, with corners bullnosed, ground and polished.
- I. Seams and joints shall be shop welded. Welds to be ground smooth and polished to match original finish. Materials 18 gauge or heavier shall be welded.
- J. Metal tops shall be one-piece welded construction, unless specified otherwise, reinforced on underside with stainless steel hat sections or channels welded in place. Crossbracing to be not more than 30" on centers.
- K. Drawers to be 18-gauge stainless steel channel type housing and drawer cradle, both housing and cradle being reinforced and welded at corners, housing being secured to underside of table top, and both housing and cradle being sized for and fitted with 18-gauge 20" x 20" x 5" deep stainless-steel drawer insert having coved corners. Drawer insert shall be easily removable from cradle without tools or having to remove entire drawer. Drawers to have stainless steel fronts. Provide with recessed flush type stainless steel pulls.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- L. Support drawer on fabricated 14-gauge stainless steel interlocking channel solid delrin ball bearing wheels. Support slides shall be load rated at 200 lb. per pair. Slides to be Component Hardware S52 Series.
- M. Enclosed cabinet type bases shall be made of formed steel sheets reinforced with formed steel sections to create a rigid structure. Steel shall be 18-gauge or heavier. Base shall be welded construction throughout with front rails, mullions, etc., welded to appear as one-piece construction. All exposed sections of interior and exterior shall be stainless steel, and unexposed sections shall be galvanized steel, unless specified contrary.
- N. Hardware shall be solid materials and except where unexposed or specified contrary, of cast brass, chrome plated. Stampings are not acceptable. Identify all hardware with the manufacturer's name and number so that broken or worn parts may be ordered and replaced.
- O. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Front of multiple compartment sinks to be continuous on exterior. Bottoms shall be creased to drain.
- P. Ends of all fixtures, splashbacks, shelves, etc., shall be finished flush to walls or adjoining fixtures.
- Q. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Front of multiple compartment sinks to be continuous on exterior. Bottoms shall be creased to drain.
- R. Ends of all fixtures, splashbacks, shelves, etc., shall be finished flush to walls or adjoining fixtures.
- S. Dishtables, draintables, splashbacks and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.
- T. Rounded and coved corners or radius bends shall be 1/2" radius or longer.
- U. Shelves in fixtures with enclosed bases shall be turned up on back and sides and feathered slightly to insure tight fit to enclosure panels. Bottom shelves shall be made for easy removal unless otherwise noted.
- V. Undersides of tops to be coated with heavy-bodied resinous material compounded for permanent, non-flaking adhesion to metal, 1/8" thick, applied after reinforcing members have been installed, drying without dirt-catching crevices.
- W. Metal components, unless specified or noted otherwise, to be the following gauges:

Counter and table tops	14 ga. Stainless Steel
Wall shelves	16 ga. Stainless Steel
Pipe leg undershelves	16 ga. Stainless Steel
Drawer fronts	16 ga. Stainless Steel
Enclosed cabinet bases	18 ga. Stainless Steel

Sinks and drainboards	14 ga.	Stainless Steel
Exhaust hoods	18 ga.	Stainless Steel
Legs 1 - 5/8" diameter	16 ga.	Stainless Steel
Doors (outer pan)	18 ga.	Stainless Steel
Doors (inner pan)	20 ga.	Stainless Steel

- X. Products fabricated by Savannah Industrial Solutions, John Boos, Premier Stainless, Eagle Group, Advance Tabco, or approved equal, modified to comply with specifications, are acceptable.

2.3 HEATING EQUIPMENT

- A. Wherever electric heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment item or details.
 All such equipment shall be designed and installed to be easily cleaned or to be easily removed for cleaning.
- B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown contrary.

2.4 SWITCHES AND CONTROLS

- A. Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch of proper type in accord with Underwriter's Code.
- B. All internal wiring for fabricated equipment items included, all electrical devices, wiring, controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed by Food Service Equipment Contractor in their factory or building site with all items complete to junction box for final connection to building lines by Electrical Contractor.
- C. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles, similar to No. 5262, for all equipment items powered by plugging into 110-120 volts, single phase AC. Also, provide suitable length 3-wire cord for equipment.

2.5 CONNECTION TERMINALS

- A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified otherwise.

2.6 LOCKS

- A. Fit all doors for reach-in refrigerated compartments with locking type latches. Provide master keys.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work under this contract and covered under this section of specifications includes but is not limited to:
 - 1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc. as required to coordinate installation of food service equipment with work of other Contractors on project.
 - 2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required hereinbefore under "Submittals".
 - 3. Repair of all damage to premises as result of this installation, and removal of all debris left by those engaged in this installation.
 - 4. Having all food service equipment fixtures completely cleaned and ready for operation when building is turned over to Owner.

3.2 INSTALLATION PROCEDURES

- A. Food Service Equipment Contractor shall make arrangements for receiving their custom fabricated and "buy out" equipment and shall make delivery into building as requisitioned by their installation superintendent. They shall not consign any of their equipment to Owner or to any other Contractor unless they have written acceptance from them and have made satisfactory arrangements for the payment of all freight and handling charges.
- B. Food Service Equipment Contractor shall deliver all their custom fabricated and "buy out" equipment temporarily in its final location, permitting Trades to make necessary arrangements for connection of service lines; they shall then move equipment sufficiently to permit installation of service lines, after which they shall realign their equipment level and plumb, making final erection as shown on contract drawings.
- C. All portable or counter mounted equipment weighing more than 25 pounds shall be mounted on 4" stainless steel adjustable legs.
- D. This Contractor shall coordinate their work and cooperate with other trades working at site toward the orderly progress of the project.
- E. Architect or Owner's Agent shall always have access to plant or shop in which custom fabricated equipment is being manufactured, from time contract is let until equipment is shipped, in order that progress of work can be checked, as well as any technical problem which may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after complete installation.
- F. Food Service Equipment Contractor shall assist Architect, Owner, and/or Owner's Agent in making any desired tests during or prior to final inspection of equipment; they shall remove immediately any work or equipment rejected by Architect, Owner, and/or Owner's Agent, replacing same with work conforming with contract requirements, and shall

reimburse mechanical and/or other contractors involved for extra work made necessary by such replacement.

- G. This Contractor shall keep premises free from accumulation of their waste material and rubbish, and at completion of their work shall remove their rubbish and implements, leaving areas of their work broom clean.
- H. This Contractor shall provide and maintain coverings or other approved protection for finished surfaces and other parts of their equipment subject to damage during and after erection. After removal of protective coverings, all field joints shall be grounded, polished and entire work shall be thoroughly cleaned and polished.

3.3 TRIMMING AND SEALING EQUIPMENT

- A. Seal completely spaces between all units to walls, ceilings, floors, and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material best suited to nature of equipment and adjoining surface material.
- B. Close ends of all hollow sections.
- C. Equipment butting against walls, ceilings, floor surfaces and corners to fit tightly against same; backsplashes or risers which fit against wall to be neatly scribed and sealed to wall with Dow Corning # 732 RTV or General Electric clear silicone sealant, wiping excess sealant out of joint to fillet radius. Where required to prevent shifting of equipment and breaking wall seal, anchor item to floor or wall.
- D. Treat enclosed spaces (inaccessible after equipment installation) for vermin prevention in accord with industry practice.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

- A. After completion of installation, all equipment using water, gas, and electricity shall be performance inspected and tested by a factory certified service agent, including wet test of hood fire suppression systems, if so required. Food Service Equipment Contractor shall document that these inspections have been performed prior to scheduling demonstrations and Owner acceptance of equipment.
- B. Food Service Equipment Contractor shall arrange to have all manufactured, mechanically operated equipment furnished under this contract demonstrated by authorized representatives of equipment manufacturers, these representatives to instruct Owner's designated personnel in use, care and maintenance of all items of equipment after same are in working order. Demonstration and instruction shall be held on dates designated by Owner.
- C. Food Service Equipment Contractor shall provide a competent service representative to be present when installation is put into operation.

3.5 EQUIPMENT HANDLING AND STORAGE

- A. Deliver equipment to site, properly crated and protected, and store in safe place, protected from damage until time for installation.

3.6 GUARANTEE

- A. Special Project Warranty: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. This warranty shall be in addition to, and not limitation of, the rights the Owner may have against the Contractor under the Contract Documents.
- B. Warranty Period:
1 year minimum from date of Substantial Completion, all new equipment furnished.
5-year warranty period on refrigeration compressors.
10-year warranty period on walk-in panels.

3.7 OPERATING AND MAINTENANCE MANUALS

- A. After completion of installation, Food Service Equipment Contractor shall present to Owner three sets of all operating and maintenance manuals, covering all mechanically operated equipment furnished under this contract, each set being neatly bound in loose-leaf binder having durable cover.
- B. Include in each binder a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of equipment furnished under this contract.

PART 4 – FOOD SERVICE EQUIPMENT

ITEM 01 COLD STORAGE ASSEMBLY EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 02 OVERHEAD CONVEYOR QUANTITY AS SCHEDULED

Ferris wheel design conveyor to be custom fabricated in accordance with General Requirements of specifications and with plan and detail drawings by Bi-Line or approved fabricator.

ITEM 03 SOILED DISHTABLE QUANTITY AS SCHEDULED

This item to be custom fabricated in accordance with General Requirements of specifications and with plan and detail drawings by Titan Stainless or approved fabricator.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

ITEM 04 PRE-RINSE FAUCET ASSEMBLY QUANTITY AS SCHEDULED

Provide pre-rinse unit with the following features:

- A. Wall mount faucet with riser wall bracket
- B. 8" centers
- C. Quarter-turn Eterna cartridges with spring checks
- D. Lever handles with color-coded indexes
- E. 18" Easy install riser
- F. 44" Flexible stainless steel hose with heat-resistant gray handle & hold down ring
- G. Polished chrome-plated brass faucet body
- H. 1.15 GPM spray valve, finger hook
- I. 6" Wall bracket

Faucet Assembly to be as manufactured by T&S Brass, Model B-0133, Chicago Faucet, or Fisher.

ITEM 05 DISHWASHER, CONVEYOR TYPE QUANTITY AS SCHEDULED

Provide single-tank rack conveyor type dishmachine, having the following features:

- A. Tall chamber opening
- B. Insulated hinged access doors, see hinging as shown on Plan
- C. 202 racks/hour, .62 gallon/rack
- D. Stainless steel enclosure panels
- E. Touch screen controls with diagnostics
- F. Energy efficiency, energy recovery
- G. Automatic soil remover
- H. Voltage as scheduled, dual point direct connection
- I. Electric tank heat 15kW, with internal hot water 18 kW electric booster
- J. Drain water tempering kit
- K. Left-to-right operation
- L. Table limit switch
- M. Extended hood vents with stainless steel ductwork to ceiling by F.S.E.C.

Dishmachine to be as manufactured by Hobart, Model CL44EN-ADV+BUILDUP, Jackson, or CMA Dishmachines.

ITEM 06 CLEAN DISHTABLE QUANTITY AS SCHEDULED

Provide clean dishtable with the following features:

- A. Straight design, 84"W
- B. Left to right operation
- C. 14/300 Stainless steel top
- D. Stainless steel H- frame legs
- E. Bullet feet
- F. Table limit switch provision
- G. Sound deadening

Clean dishtable to be as manufactured by Titan Stainless, Model 7CDT-R-14, John Boos, or Eagle.

ITEM 07 DISHTABLE SORTING SHELF QUANTITY AS SCHEDULED

Provide sorting shelf with the following features:

- A. 63"W x 18"D x 12-1/4"H
- B. Wall mounted

C. Slanted, tubular
D. Includes brackets
E. 16/300 Stainless steel
Dishtable sorting shelf to be as manufactured by John Boos Model No. BHS1863-TS, Eagle, or Titan Stainless.

Provide mobile soak sink with the following features:

- Mobile soak sink to be as manufactured by John Boos, Model PB-SS-208, Eagle, or Titan Stainless.

Provide wall mounted hand sink with the following features:

- Hand sink to be as manufactured by Advance Tabco, Model No. 7-PS-51, or Eagle, or John Boos.

ITEM 11 THREE COMPARTMENT SINK EXISTING, RESET

ITEM 12 POT RACK EXISTING, RESET

ITEM 13 UTILITY CART EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

Provide wire shelving unit with the following features:

- A. 60"W x 24"D x 63"H
- B. (4) Wire shelves
- C. (4) Posts

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

D. Epoxy-coated corrosion-resistant finish with antimicrobial protection
Shelving unit to be as manufactured by Metro, Model No. A566K3, Quantum, or Cambro.

ITEM 15 MOP SINK CABINET QUANTITY AS SCHEDULED

Provide janitor cabinet with the following features:

- A. 30"W x 30"D x 84"H overall size
- B. Enclosed cabinet with open back for plumbing
- C. (2) Lockable louvered swing doors
- D. Includes 24" x 24" x 12" deep mop sink with drain
- E. Overhead shelf
- F. Rear-mounted mop holder with (3) locking cams
- G. Service faucet with vacuum breaker and 120" hose
- H. 18/300 stainless steel

Mop sink cabinet to be as manufactured by John Boos, Model No. PBJC-303084, Eagle Group, or Advance Tabco.

ITEM 16 ICE MAKER, WITH BIN EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 17 TILTING SKILLET BRAISING PAN EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 17A FLOOR TROUGH QUANTITY AS SCHEDULED

Provide floor trough with the following features:

- A. 36"W x 18"D, 6" deep receptacle
- B. (1) 4" OD tailpiece
- C. Stainless steel beehive strainer
- D. 14/304 Stainless steel
- E. Brushed satin finish
- F. Pultruded fiberglass grating

Floor trough to be as manufactured by IMC/Teddy, Model ASFT-1836-PFG, Eagle Group, or John Boos.

ITEM 18 COMBI-OVEN, DOUBLE STACKED EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 19A EXHAUST HOOD QUANTITY AS SCHEDULED

Provide single bank wall-mount type canopy exhaust hood of size, shape and content as shown on detail drawings, having the following features:

- A. All exposed surfaces of 18-gauge 304 Series, 18-8 stainless steel construction.
- B. N.F.P.A. 96 construction, including all joints and seams welded externally, continuous, and liquid tight.
- C. 5/8" diameter hanger rods to structural ceiling, approximately 96" on center.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- D. Stainless steel high-efficiency baffle type U.L. classified grease extracting filters, with handles.
- E. Integral grease gutter sloped to drain to grease receptacle.
- F. Vapor-proof U.L. listed recessed LED light fixtures.
- G. Coordinated installation of fire suppression system as specified for Item 19B.
- H. Integral make-up air plenum along front as shown.
- I. Stainless steel wall panel, full length of hood
- J. Removable stainless-steel perimeter trim and/or closure panels from top of hood to ceiling.
- K. Food Service Equipment Contractor shall provide and install any secondary supporting members required to suspend exhaust hoods. Hood supports shall include seismic bracing, if required, installed in accord with SMACNA guidelines.
- L. Fire suppression cabinet with pre-wire control package and switches with variable speed control fan.

Exhaust hood to be as manufactured by Captive-Aire, Model ND2-PSP, Gaylord, or Avtec.

ITEM 19B FIRE SUPPRESSION SYSTEM QUANTITY AS SCHEDULED

Provide automatic wet chemical fire suppression system as required to protect exhaust hood, Items 19A, and the cooking equipment located under this hood, and having the following features:

- A. All tanks, control heads, piping, relays, cable, fusible links, nozzles, elbows, etc., as required for complete system.
- B. Brass nozzles and chrome plated or sleeved exposed piping.
- C. Manual strike mechanism in an accessible location.
- D. Installation in accord with N.F.P.A. 17A code requirements and coordinate with exhaust hood construction and installation.
- E. Four contacts for use by E.C., one contact for alarm, one for supply fan shut-off, one for shunt trip actuation, and one spare.
- F. Provide mechanical gas solenoid valve loose for installation by plumber.

Fire suppression system to be as manufactured by Ansul, Model R-102, Range Guard, or Pyrochem.

ITEMS 20-21 NOT USED

ITEM 22 WORKTABLE, WITH SINK EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 23 HEATED HOLDING CABINET EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 24 WORKTABLE, CASTER MOUNTED EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 25 ROLL-IN REFRIGERATOR QUANTITY AS SCHEDULED

Provide refrigerator with the following features:

- A. Roll-in

- B. Two-section
- C. Self-contained refrigeration
- D. Stainless steel exterior, aluminum interior
- E. Standard depth cabinet
- F. Full-height solid doors, hinged left & right
- G. Cylinder locks
- H. Electronic control with digital display
- I. Hi-low alarm
- J. R290 Hydrocarbon refrigerant
- K. Removable stainless steel ramp
- L. Voltage as scheduled, cord and plug
- M. Stainless steel case back including rear grill & concealed drain

Roll-in refrigerator to be as manufactured by Continental Refrigerator, Model No. D2RINSA-E, Beverage Aire, or True.

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

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ITEM 31	WALL MOUNTED SHELVING	QUANTITY AS SCHEDULED
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- A. 108"W x 16"D
- B. 2" Rear up turn
- C. 16/300 Stainless steel construction
- D. Wall mounted at 5'-4" AFF

Shelf to be as manufactured by Titan Stainless, Model No. 9WMS-16, Eagle Group, or John Boos.

Provide work top freezer with the following features:

- A. 27"W
- B. 7.4 Cu ft capacity
- C. One-section
- D. Stainless steel top with 5-1/2"H backsplash
- E. (1) Field rehingeable door, hinged right

- F. Stainless steel front & end panels
- G. Aluminum interior
- H. Rear-mounted self-contained refrigeration
- I. R290 Hydrocarbon refrigerant
- J. Voltage as scheduled, cord and plug
- K. 5" Casters

Worktop freezer to be as manufactured by Continental Refrigerator, Model No. SWF27NBS, Beverage Air, or True.

- A. Countertop
- B. Electric
- C. Ceramic heating elements
- D. Incandescent lights
- E. Pre-set thermostatically controlled heated base
- F. NO backstop included
- G. Stainless steel construction
- H. Voltage as scheduled, cord and plug
- I. Dimensions: 24.63(h) x 21.63(w) x 23.25(d)

- A. Reach-in, 28-1/2"W
- B. One-section
- C. Self-contained refrigeration, R290 hydrocarbon refrigerant
- D. Stainless steel exterior, aluminum interior
- E. Standard depth
- F. Half-height solid doors, hinged right
- G. Cylinder locks
- H. Electronic control with digital display
- I. Hi-low alarm
- J. Electric condensate evaporator
- K. 5" Casters
- L. Voltage as scheduled, cord and plug

A. Electric, countertop
B. MDD-1001 Open kitchen bundle

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- C. 21.1" Wide
 - D. Fully insulated cook chamber
 - E. Ventless
 - F. Stores over 1,000 recipes
 - G. Internal catalytic converter
 - H. One-touch controls
 - I. Smart voltage sensor technology
 - J. Removable rack and grease collection pan
 - K. Bottom jet plate
 - L. Pull down door with ergonomic handle
 - M. Stainless steel front, top & sides, side handle grips
 - N. Stacking kit
 - O. 24" Cart, caster mounted
 - O. Voltage as scheduled, cord and plug
- Rapid cook oven to be as manufactured by TurboChef, Model No. BULLET.

ITEM 37 EQUIPMENT STAND, FREEZER BASE QUANTITY AS SCHEDULED

Provide freezer griddle stand with the following features:

- A. One-section
- B. (2) Drawers - four drawers accommodates (2) 12" x 20" x 6"
- C. Stainless steel top with drip guard marine edge
- D. Stainless steel exterior & interior
- E. Electronic control with digital display
- F. Hi-low alarm, high/low temperature alarm
- G. Self-contained refrigeration
- H. Automatic hot gas condensate evaporator
- I. R290 hydrocarbon refrigerant
- J. 4" Casters
- K. Condensing unit on left
- L. Voltage as scheduled, cord and plug

Equipment stand to be as manufactured by Continental Refrigerator, Model No. D48GFN, Beverage Air, or True.

ITEM 38 EQUIPMENT STAND, REFRIGERATED QUANTITY AS SCHEDULED

Provide refrigerated griddle stand with the following features:

- A. Two-section
- B. (4) Drawers - four drawers accommodates (2) 12" x 20" x 6"
- C. Stainless steel top with drip guard marine edge
- D. Stainless steel exterior & interior
- E. Electronic control with digital display
- F. Hi-low alarm, high/low temperature alarm
- G. Self-contained refrigeration
- H. R290 hydrocarbon refrigerant
- J. 4" Casters
- K. Condensing unit on left
- L. Voltage as scheduled, cord and plug

Equipment stand to be as manufactured by Continental Refrigerator, Model No. D84GN, Beverage Air, or True.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

ITEM 39 GRIDDLE, COUNTERTOP EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 40 NOT USED

ITEM 41 CHARBROILER, COUNTERTOP QUANTITY AS SCHEDULED

Provide charbroiler with the following features:

- A. Countertop
- B. Electric
- C. 4" High legs
- D. Cast iron grate
- E. 36" Wide
- F. Stainless steel construction
- G. With grease pan and scraper/brush
- H. Voltage as scheduled, cord and plug

Countertop charbroiler to be as manufactured by Wells, Model No. B-50, Garland, or Royal.

ITEM 42 INDUCTION RANGE, COUNTERTOP QUANTITY AS SCHEDULED

Provide heavy-duty induction range with the following features:

- A. Countertop
- B. 12"W x 30"D x 13-5/8"H
- C. (2) Hob
- D. Digital controls
- E. (100) Power settings
- F. 100°-400°F Temperature range
- G. Timer function
- H. Voltage as scheduled, cord and plug

Countertop induction range to be as manufactured by Vollrath Model No. 912HIDC, Garland, or Hatco.

ITEM 43 INDUCTION RANGE, COUNTERTOP QUANTITY AS SCHEDULED

Provide heavy-duty induction range with the following features:

- A. Countertop
- B. 24"W x 30"D x 13-5/8"H
- C. (4) Hob
- D. Digital controls
- E. (100) Power settings
- F. 100°-400°F Temperature range
- G. Timer function
- H. Voltage as scheduled, cord and plug

Countertop induction range to be as manufactured by Vollrath Model No. 924HIDC, Garland, or Hatco.

ITEM 44 EXHAUST HOOD EXISTING, RESET

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 45	FIRE SUPPRESSION SYSTEM	EXISTING, RESET
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This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEMS 46-50 NOT USED

ITEM 51	PASS-THRU REFRIGERATOR	QUANTITY AS SCHEDULED
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Provide pass-thru refrigerator with the following features:

- A. One-section
- B. 29-1/4"W
- C. 23 cu. ft. capacity
- D. (3) Adjustable epoxy coated wire shelves
- E. Digital controller with LED display
- F. 33°F to 54°F temperature range (35°F preset)
- G. Auto defrost
- H. Audible overheat protection alarm for compressor & condenser coil
- I. LED interior lighting
- J. Self-maintaining condensate drain pan
- K. (2) Reversible right hinged self-closing (front glass & rear solid) locking doors
- L. Stainless steel interior & exterior, galvanized top & bottom
- M. Self-contained refrigeration, R290 Hydrocarbon refrigerant
- N. Top-mounted compressor
- O. 5" swivel casters
- P. Voltage as scheduled, cord and plug

Pass-thru refrigerator to be as manufactured by Everest Refrigeration, Model No. ESPT-1G-1S, Beverage Air, or Continental.

ITEM 52A	DROP-IN COLD FOOD WELL	QUANTITY AS SCHEDULED
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Provide slimline drop-in cold food pan with the following features:

- A. 48-3/4"W x 17-3/8"D x 25"H
- B. Accommodates (2) 6" deep 12" x 20" pans
- C. 300 Series stainless steel top with overhang & locking tabs
- D. 10" Deep 300 series stainless steel interior liner steel exterior housing
- E. Remote mounted on/off switch with SS face plate (2-3/16"W x 4-1/8"H cutout required)
- F. Air-cooled condensing unit, R448a
- G. (1) Adapter bar included, 1" brass drain & plug
- H. Voltage as scheduled, cord and plug
- I. 47-3/4"W x 16-3/4"D cutout required for unit

Drop-in cold food well to be as manufactured by Duke Manufacturing, Model No. ADI-2MDSL-N7, LTI, or Delfield.

ITEM 52B	DROP-IN COLD FOOD WELL	QUANTITY AS SCHEDULED
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Provide slimline drop-in cold food pan with the following features:

- A. 70-3/4"W x 17-3/8"D x 25"H
B. Accommodates (3) 6" deep 12" x 20" pans

- C. 300 Series stainless steel top with overhang & locking tabs
- D. 10" Deep 300 series stainless steel interior liner steel exterior housing
- E. Remote mounted on/off switch with SS face plate (2-3/16"W x 4-1/8"H cutout required)
- F. Air-cooled condensing unit, R448a
- G. (2) Adapter bars included, 1" brass drain & plug
- H. Voltage as scheduled, cord and plug
- I. 47-3/4"W x 16-3/4"D cutout required for unit

Drop-in cold food well to be as manufactured by Duke Manufacturing, Model No. ADI-3MDSL-N7, LTI, or Delfield.

Provide drop-in hand sink with the following features:

- Drop-in sink to be as manufactured by Eagle Group Model No. HWB-E, John Boos, or Eagle.

Provide fixed self-service sneeze guard with the following features:

- | | | |
|----------|--------------------------|-----------------------|
| ITEM 54B | SNEEZE GUARD, STATIONARY | QUANTITY AS SCHEDULED |
|----------|--------------------------|-----------------------|

Provide fixed self-service sneeze guard with the following features:

- | | | |
|----------|--------------------------|-----------------------|
| ITEM 54C | SNEEZE GUARD, STATIONARY | QUANTITY AS SCHEDULED |
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Provide fixed self-service sneeze guard with the following features:

- 114000 - 21

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- C. Fixed end panels
 - D. 1/2" Vertical glass supports
 - E. Sneeze guard section sizes and content as shown on plan and detailed drawings
- Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. TMUS-96, Versa-Guard, or BSI.

ITEM 55 UNDERCOUNTER REFRIGERATOR QUANTITY AS SCHEDULED

Provide undercounter refrigerator with the following features:

- A. 27"W, 7.4 Cu ft capacity
- B. One-section
- C. (1) Field rehingeable door, hinged right
- D. Stainless steel front, top & end panels, aluminum interior
- E. 1-3/8" Diameter plate casters
- F. Front breathing
- G. Rear-mounted self-contained refrigeration
- H. R290 Hydrocarbon refrigerant
- I. Voltage as scheduled, cord and plug

Undercounter refrigerator to be as manufactured by Continental Refrigerator, Model No. SW27N-U, True, or Beverage Air.

ITEM 56 UNDERCOUNTER REFRIGERATOR QUANTITY AS SCHEDULED

Provide undercounter refrigerator with the following features:

- A. 36"W, 10.3 Cu ft capacity
- B. Two-section
- C. (2) Field rehingeable doors, hinged left & right
- D. Stainless steel front, top & end panels, aluminum interior
- E. 1-3/8" Diameter plate casters
- F. Front breathing
- G. Rear-mounted self-contained refrigeration
- H. R290 Hydrocarbon refrigerant
- I. Voltage as scheduled, cord and plug.

Undercounter refrigerator to be as manufactured by Continental Refrigerator, Model No. SW36N-U, True, or Beverage Air.

ITEM 57 DROP-IN HOT/COLD FOOD WELL QUANTITY AS SCHEDULED

Provide drop-in food well with the following features:

- A. Heated & refrigerated
- B. 65" Long
- C. (4) 12" x 20" Individual pans
- D. 300 Series stainless steel top rim
- E. 5" Deep 300 series stainless steel interior liners, steel exterior housing
- F. Individual wired remote digital controls for hot or cold operation
- G. Air-cooled condensing unit
- H. Individual drains manifolded to a valve
- I. Voltage as scheduled, 6' cord & plug

Drop-in food wells to be as manufactured by Duke Manufacturing, Model No. HCF-4, LTI, or Delfield.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

ITEM 58A SNEEZE GUARD, STATIONARY QUANTITY AS SCHEDULED

Provide fixed self-service sneeze guard with the following features:

- A. Single sided guard without top shelf
 - B. Tempered glass with polished edges
 - C. Fixed end panels
 - D. 1/2" Vertical glass supports
 - E. Sneeze guard section sizes and content as shown on plan and detailed drawings
- Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. TMU1-36, Versa-Guard, or BSI.

ITEM 58B SNEEZE GUARD, STATIONARY QUANTITY AS SCHEDULED

Provide fixed self-service sneeze guard with the following features:

- A. Single sided guard without top shelf
 - B. Tempered glass with polished edges
 - C. Fixed end panels
 - D. 1/2" Vertical glass supports
 - E. Sneeze guard section sizes and content as shown on plan and detailed drawings
- Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. TMU1-72, Versa-Guard, or BSI.

ITEM 59 CARVING STATION QUANTITY AS SCHEDULED

Provide decorative carving station with two heat lamps having the following features:

- A. Telescoping clearance 14"-26"
 - B. 30° Shade pivot
 - C. Heated base with thermostatic control
 - D. 36"x24" Cutting board with meat juice containment
 - E. Verify finishes with Interior/Architect
 - F. Voltage as scheduled, cord and plug
- Decorative carving shelf to be as manufactured by Hatco, Model No. DCSB400-3624-2, Alto-Shaam, or Cres Cor.

ITEM 60 NOT USED

ITEM 61 CABINET, COOK / HOLD / OVEN QUANTITY AS SCHEDULED

Provide holding oven with the following features:

- A. Electric
- B. Low temperature
- C. 100 Lb. capacity
- D. (6) 12" x 20" x 4" or (10) 12" x 20" x 2-1/2" pans
- E. (3) Stainless steel wire shelves
- F. Simple controls
- G. Heavy-duty stainless-steel construction
- H. Caster mounted
- I. Voltage as scheduled, cord and plug
- J. Probe cooking and holding

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- K. Programmable recipes
 - L. Solid door, hinged right
 - M. Voltage as scheduled, single point direct connection
- Heated holding cabinet to be as manufactured by Alto-Shaam, Model No. 750-TH, Metro, or Blodgett.

ITEM 62 DROP-IN INDUCTION RANGE QUANTITY AS SCHEDULED

Provide built-in cooking system with the following features:

- A. (3) 2600 Watt ranges
- B. (2) Induction air filter system
- C. Integrated power management system
- D. 20 Cook modes
- E. Temperature range 100°F to 400°F
- F. Stainless steel construction
- G. Voltage as scheduled, cord and plug

Induction range to be as manufactured by Spring USA, Model No. ICB348-26, Southbend, or Garland.

ITEM 63 PIZZA PREP REFRIGERATOR QUANTITY AS SCHEDULED

Provide refrigerated prep table with the following features:

- A. Two-section
- B. (1) 27" Door
- C. Stainless steel top with reduced height raised pan rail with 2" pan recess
- D. ABS Interior sides, stainless steel floor
- E. Unfinished ends & back
- F. Side-mounted self-contained refrigeration
- G. Nom. 6" adjustable stainless steel legs
- H. R290 Hydrocarbon refrigerant
- I. Voltage as scheduled, cord and plug

Pizza preparation refrigerator to be as manufactured by Delfield, Model No. F18RC47P, Continental, or Beverage Air.

ITEM 64 REACH-IN FREEZER QUANTITY AS SCHEDULED

Provide extra-wide reach-in freezer with the following features:

- A. Reach-in, 28-1/2"W
- B. One-section
- C. Self-contained refrigeration, R290 hydrocarbon refrigerant
- D. Stainless steel exterior, aluminum interior
- E. Shallow depth
- F. Full-height solid door, hinged right
- G. Cylinder locks
- H. Electronic control with digital display
- I. Unit can be adjusted to operate as low as -10°F
- J. Hi-low alarm
- K. Electric condensate evaporator
- L. 5" Casters
- M. Voltage as scheduled, cord and plug

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Freezer to be as manufactured by Continental Refrigerator, Model No. 1FESNSA, Beverage Air, or True.

ITEM 65A SNEEZE GUARD, STATIONARY QUANTITY AS SCHEDULED

Provide fixed full-service sneeze guard with the following features:

- A. Single sided guard without top shelf
 - B. Tempered glass with polished edges
 - C. Straight front
 - D. End panels
 - D. Front mount
 - E. 1" OD round stainless support posts
 - F. Sneeze guard section sizes and content as shown on plan and detailed drawings
- Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. FM1V-52, Versa-Guard, or BSI.

ITEM 65B SNEEZE GUARD, STATIONARY QUANTITY AS SCHEDULED

Provide fixed full-service sneeze guard with the following features:

- A. Single sided guard without top shelf
 - B. Tempered glass with polished edges
 - C. Straight front
 - D. End panels
 - D. Front mount
 - E. 1" OD round stainless support posts
 - F. Sneeze guard section sizes and content as shown on plan and detailed drawings
- Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. FM1V-64, Versa-Guard, or BSI.

ITEM 66 NOT USED

ITEM 67 DROP-IN HOT FOOD WELL QUANTITY AS SCHEDULED

Provided drop-in hot food well with the following features:

- A. Electric
 - B. (1) 12" x 20" Hot food well
 - C. 18-1/4" Long, 12-3/4" high
 - D. Stainless steel top & interior liner
 - E. Steel exterior housing
 - F. Remote control panel
 - G. Sealed wells with drains
 - H. Voltage as scheduled, cord and plug
- Drop-in hot food well to be as manufactured by Duke Manufacturing, Model No. ADI-1E-SW, LTI, or Delfield.

ITEM 68 BATTER DISPENSER EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 69 MEGA-TOP REFRIGERATED COUNTER QUANTITY AS SCHEDULED

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Provide refrigerated sandwich unit with the following features:

- A. 48"W
- B. Two-section
- C. (18) 1/6 Size x 4" deep pans with 8" cutting board
- D. (2) Field rehingeable doors, hinged left & right
- E. Stainless steel top, front, sides & interior
- F. Electronic control with digital display
- G. Hi-low alarm
- H. 6" Adjustable legs
- I. Rear mounted self-contained refrigeration
- J. Automatic hot gas condensate evaporator
- K. R290 hydrocarbon refrigerant
- L. Stainless steel flat cover, without hinges
- M. Voltage as scheduled, cord and plug

Mega-top sandwich refrigerated prep unit to be as manufactured by Continental Refrigerator, Model No. D48N18M, Beverage Air, or True.

ITEM 70

NOT USED

ITEM 71 DROP-IN HOT/COLD FOOD WELL

QUANTITY AS SCHEDULED

Provide drop-in food well with the following features:

- A. Heated & refrigerated
- B. 49" Long
- C. (3) 12" x 20" Individual pans
- D. 300 Series stainless steel top rim
- E. 5" Deep 300 series stainless steel interior liners, steel exterior housing
- F. Individual wired remote digital controls for hot or cold operation
- G. Air-cooled condensing unit
- H. Individual drains manifolded to a valve
- I. Voltage as scheduled, 6' cord & plug

Drop-in food wells to be as manufactured by Duke Manufacturing, Model No. HCF-3, LTI, or Delfield.

ITEM 72 SNEEZE GUARD, STATIONARY

QUANTITY AS SCHEDULED

Provide fixed self-service sneeze guard with the following features:

- A. Single sided guard with top shelf
 - B. Tempered glass with polished edges
 - C. Fixed end panels
 - D. 1/2" Vertical glass supports
 - E. Sneeze guard section sizes and content as shown on plan and detailed drawings
- Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. TMUS-54, Versa-Guard, or BSI.

ITEM 73 ELECTRIC GRIDDLE, FLOOR MODEL

QUANTITY AS SCHEDULED

Provide full metal surround cooking station with the following features:

- A. Electric

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- B. 48"W x 24"D Rectangular steel cooktop surrounded with black granite
 - C. Self-contained ventilation
 - D. Multi-stage filtration system
 - E. Integrated fire suppression system
 - F. 100° F to 550° F (38° C to 288° C) temperature range
 - G. Touch panel display
 - H. Includes: cleaning kit, (2) stainless steel spatulas, (1) stainless steel scraper
 - I. Caster mounted
 - J. Voltage as scheduled, cord and plug
- Griddle to be as manufactured by Evo America, LLC (Middleby), Model No. 10-0148-EVT, or approved equal.

ITEM 74 REACH-IN UNDERCOUNTER FREEZER QUANTITY AS SCHEDULED

Provide undercounter freezer with the following features:

- A. 27"W
 - B. 7.4 Cu ft capacity
 - C. One-section
 - D. (1) Rehingeable door, hinged right
 - E. Stainless steel front, top & end panels
 - F. Aluminum interior
 - G. 1-3/8" Casters
 - I. Front breathing
 - J. Rear-mounted self-contained refrigeration
 - K. R290 Hydrocarbon refrigerant
 - L. Voltage as scheduled, cord and plug
- Undercounter freezer to be as manufactured by Continental Refrigerator, Model No. SWF27N-U, Beverage Air, or True.

ITEM 75 MICROWAVE / IMPINGEMENT OVEN QUANTITY AS SCHEDULED

Provide rapid cook oven with the following features:

- A. Electric
- B. Nom. 28" Wide
- C. Ventless
- D. Countertop
- E. Fully insulated cook chamber
- F. Stores up to 200 recipes
- G. Internal catalytic converter
- H. Smart voltage sensor technology
- I. Digital display
- J. Removable rack and grease collection pan
- K. Top and bottom jet plates
- L. Pull down door with ergonomic handle
- M. Multi-speed impingement blower
- N. 13 1/2" x 14 1/4"
- O. (2) Solid PTFE baskets
- P. Cleaner and guard starter kit
- Q. (1) Standard rack
- R. Side hand grips

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- S. Stainless steel front, top & sides
 - T. Voltage as scheduled, cord and plug
- Microwave oven to be as manufactured by TurboChef, Model No. I5, APW, or Merrychef.

ITEM 76 PANINI GRILL QUANTITY AS SCHEDULED

Provide panini grill with the following features:

- A. Electric, double
- B. 14-1/2" x 11" Cooking surface
- C. Hinged auto-balancing top plate with heat resistant handles
- D. Ribbed top & flat bottom grill
- E. Adjustable thermostats 570°F (300°C)
- F. Indicator lights
- G. Brushed stainless steel body & removable drip tray
- H. Voltage as scheduled, cord and plug

Panini grill to be as manufactured by Waring, Model No. WDG250, Hatco, or Globe.

ITEM 77 TRASH CAN, INDOOR QUANTITY AS SCHEDULED

Provide slim undercounter trash receptacle with the following features:

- A. 23-gallon capacity
- B. Nom. 15" x 22" x 30"H
- C. Rectangular with large, angled opening
- D. Integrated venting channels
- E. Bag cinches
- F. Rim and base handles, reinforced rim
- G. High-quality resin

Undercounter trash can to be as manufactured by Rubbermaid Commercial Products, Model No. 2026721, or approved equal.

ITEM 78 SOFT SERVE MACHINE QUANTITY AS SCHEDULED

Provide floor model soft-serve freezer with the following features:

- A. Nom. 19"W x 37"D x 68"H
- B. Air cooled
- C. Front opening refrigerated cabinet
- D. (2) Flavors with twist
- E. (2) 5-1/2 Gallon hoppers
- F. (2) 1 Gallon freezing cylinders
- G. Smart control
- H. Self-closing spigot
- I. Stainless steel exterior
- J. Caster mounted
- K. Stainless steel bag adaptor
- L. Voltage as scheduled, cord and plug

Soft-serve machine to be as manufactured by Stoelting Model No. O431-38I2F, Silver King, or Carpigiani.

ITEM 79 WAFFLE MAKER QUANTITY AS SCHEDULED

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
 NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
 SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Provide waffle baker with the following features:

- A. 7" Round Belgian plate
- B. LED display, on/off
- C. Timer/temperature toggle
- D. Heavy duty stainless steel construction
- E. Teflon® coated aluminum plates
- F. Voltage as scheduled, cord and plug

Waffle maker to be as manufactured by Hatco, Model No. FWM-1B, Globe, or Star.

ITEM 80 NOT USED

ITEM 81 MILK DISPENSER EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 82 DRY PRODUCTS DISPENSER EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 83 POP-UP TOASTER QUANTITY AS SCHEDULED

Provide toaster with the following features:

- A. Stainless steel finish
- B. (4) 1-1/4" Wide self-centering slots
- C. Individual manual controls
- D. Removable crumb tray
- E. Stainless steel construction
- F. Voltage as scheduled, cord and plug

Pop-up toaster to be as manufactured by Hatco, Model No. TPT-120, Cadco, or Waring.

ITEM 84 COUNTERTOP PASTRY CASE QUANTITY AS SCHEDULED

Provide countertop display case with the following features:

- A. Nom. 13"Wx21"Dx24"H
- B. 4-Tier
- C. Self-serve
- D. Knock-down type, slant front, front door
- E. (4) 13" x 18" Trays

Pastry display case to be as manufactured by Cal-Mil, Model No. 1012-S, or approved equal.

ITEM 85 ICE AND BEVERAGE DISPENSER EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 86 JUICE DISPENSER EXISTING, RESET

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 87 COFFEE BREWER EXISTING, RESET

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

This item is to be reset from Owner's existing facility by Food Service Equipment Contractor.

ITEM 88 COFFEE GRINDER QUANTITY AS SCHEDULED

Provide bulk grinder with the following features:

- A. 3 lb. Hopper capacity
 - B. Turbo action
 - C. Bag switch
 - D. Black decor
 - E. Voltage as scheduled, cord and plug
- Coffee grinder to be as manufactured by BUNN, Model No. 22100.0000, Curtis, or approved equal.

ITEM 89 OUTDOOR FREEZER ASSEMBLY QUANTITY AS SCHEDULED

Provide prefabricated outdoor freezer assembly of size and shape shown on plan and detail drawings. Exact overall size to be field verified prior to fabrication.

- A. Insulation:
Panels shall be insulated with 4" thick urethane, foamed or poured in place using HCPC (no CFC) blowing agent. Foam shall be 2.25 lb. density, 95% closed cell. Panels shall meet STME-84 (UL-723) and be listed by Underwriters laboratories. Panels shall have a maximum flame spread of 25, maximum smoke developed of 450 minimum. Flash ignition of 600 degrees and minimum self-ignition of 800 degrees F.
- B. Coved corners:
Assembly shall be constructed so that all interior wall, floor, and ceiling intersections shall comply with N.S.F. requirements.
- C. Cam lock fasteners:
All panel intersections and wall, floor and ceiling intersections shall be secured by cam-lock fasteners connected with 2" wide metal straps set in and surrounded by insulation.
- D. Finishes:
Exterior and interior finishes shall be as shown in the drawings.
- E. Doors:
Door size and finish shall be as shown on drawings, and shall be furnished complete with sill wiper gasket, and a minimum of 3 spring loaded lift type hinges. Doors to be Super doors with a reinforced 14 ga. U-Channel steel frame, backed with additional 1/8" steel plate drilled and tapped where all hardware is mounted. 3/16" backing on all doors larger than 42" wide.
Exterior door to be equipped with automatic door closer. Cooler and Freezer doors to be equipped with perimeter heat. All doors to be equipped with heavy duty padlocking pull-handle lever, with inside safety release.
- F. Thermometers:
Each compartment to be provided with exterior flush mounted thermometer mounted at eye level to each door. Provide remote read-out for freezer compartment at exterior cooler door.
- G. Lights:
Each compartment to be furnished complete with manufacturer's standard light fixtures, having protective cover, mounted and pre-wired to switch with pilot light in door section. Extra light fixtures as needed to provide 30-foot candles 30" above floor. Lights to be furnished and installed by this section.
- H. Ceiling panels to be one piece, self-supporting and span full width of assembly when available.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- I. Floor:
Recessed insulated floor by Food Service Equipment Contractor with .100 diamond tread aluminum with exterior aluminum ramp.
Reinforced floor panels to support minimum 1200 pounds per square foot.
The floor and ceiling shall have maximum length panels to span full length of box, if possible, otherwise stagger joints so there are no common "four corner" intersections and no joints occurring in doorways.
- J. Refrigeration System:
Shall be furnished by manufacturer as part of cold storage room assembly, provide each compartment with complete refrigeration system sized to maintain appropriate temperature.
Provide temperature alarm system with remote read-out and recording capability.
Condensing units to be air-cooled, remote. Units to have performance and wiring characteristics as scheduled on drawings. Refrigeration systems to be designed for use with R448 refrigerant. Condensing units to be provided with painted galvanized steel all-weather housing, controls, and crankcase heaters, all suitable for outdoor conditions, and located as shown on drawings. Evaporators to be low-silhouette type with adaptive defrost control equal to a Bally SmartVap+controller. Evaporators to be equipped with 2speed EC motors, running full speed while refrigeration is engaged, and running at 1/3 speed while system is pumped down; mounted at locations shown on drawings. Performance and wiring characteristics to be as scheduled on drawings. Condensing units shall be provided with 2 speed EC fan motors, running full speed while refrigeration is engaged and 1/2" speed while ambient temp is below 60 degrees Fahrenheit. Also, the crank case heater will be turned off at an ambience above 60 degrees Fahrenheit.
The evaporator drain lines are to be provided by this section and extended to floor receptors outside assembly.
Freezer drain lines to be wrapped with heater cable and insulated with pre-molded foamed plastic insulation suitable for the application. Thickness as recommended by the manufacturer.
Refrigerant lines over 75 feet must be field verified.
Refrigerant piping to be ACR copper tubing, hard temper, with wrought fittings and silver solder joints. Insulate suction lines with pre-molded foamed plastic insulation, thickness as recommended by manufacturer for temperature and application.
Refrigeration systems to be provided with all required refrigerant piping, insulation, sight glass vibration eliminator, solenoid(s), dryer, suction line filter, expansion valve(s), thermostat(s), heat exchangers, and defrost timers, etc. as necessary for complete installation. Provide pump control circuit consisting of thermostat and solenoid valve. All components including piping and insulation to be installed using accepted industry standards, manufacturer's instructions, and first-class workmanship.
- K. Miscellaneous:
Assembly to be installed on depressed building slab. See detail drawing.
Provide 1/8" diamond tread wainscot along exposed front exterior of assembly mounted from floor to 48" A.F.F.
Provide trim strips, closure panels, etc., as necessary to trim assembly to adjacent building surfaces.
Provide removable top closure panels with "C" channel rails. Lift-out panel sections to have turn-down edges for strength and are not to exceed 4'-0" in length.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

Provide plastic strip curtains at door locations, transparent vinyl overlapping strips, aluminum bar hanging rod and bracket, suitable for low temperature application, as manufactured by Curtron, Flexstrip Products, Inc., or equal. Size to suit openings.

Provide heated pressure relief port in freezer.

Provide sleeves properly located for utility entrance, drain lines, and refrigeration lines, and after lines are installed, fill sleeves with spray foam compound, suitable for use in refrigerated spaces. Trim excess foam away and cover with stainless steel escutcheon. Cold storage room shall be erected by factory trained, or factory approved installers or shall be supervised by factory personnel. Shop drawing submittal shall indicate who the installer is, and a letter of approval shall accompany the submittal indicating the manufacturer's acceptance of the installers.

Refrigeration systems shall be furnished by cold storage room manufacturer and installed by factory approved personnel.

This specification does not constitute a complete description of cold storage assembly, also see plan and detail drawings.

Cold storage room assembly to be as manufactured by Bally, Arctic, Norlake, American Panel, Imperial/Brown, or Masterbilt complying with specifications and drawings.

ITEM 90

NOT USED

END OF SECTION 114000



Specifications

02/24/2025

Project
NCSU Football
United States

From
Foodesign Associates, Inc.
John Barja
220 N. Ames Street
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Matthews , NC 28105
United States
(704)545-6151
(704)545-6151 (Contact)

ITEM 01 - WALK IN COMBINATION COOLER FREEZER, REMOTE (1 REQ'D)

Imperial Brown Model CUSTOM EXISTING

update refrigeration systems as needed.

ITEM 02 - CONVEYOR (1 REQ'D)

Bi-Line Model ACCUMULATOR CUSTOM

Ferris Wheel design: Overhead Model
Custom Assembly with Soiled Scrapping Table
Trough with center mount disposer connection
rack roller system
L shaped feed to dishwasher
pre-rinse spray units, 2 ea.
undermount hose reel

ITEM 03 - DISHTABLE, SOILED "L" SHAPED (1 REQ'D)

Titan Stainless Model 10SDT-L-14 -CUSTOM Dimensions: 43(h) x 120(w) x 30(d)

Soiled Dishtable, CUSTOM corner design, 120" end to corner, 72" corner to machine, L-shaped, left to right operation, landing ledge, CUSTOM 20" x 20" x 12"D pre-rinse sink, 14/300 stainless steel top, stainless steel H-frame legs, NSF

- 1 ea Model RS Rack Slide, 16/300 stainless steel construction
- 1 ea Model SB Scrap Basket, small, 19-1/2"W x 19-1/2"D x 6"H, 16/300 stainless steel construction
- 1 ea Model LDB Lever Drain Bracket
- 1 ea Model STI Scrap Trough Inlet
- 1 ft Model TST Tapered Scrap Trough, 5"W
- 1 ea Model BF-S Bullet Foot, stainless steel
- 1 ft Model SD Sound Deadening (priced per linear foot)

ITEM 04 - PRE-RINSE FAUCET ASSEMBLY (1 REQ'D)

T&S Brass Model B-0133

EasyInstall Pre-Rinse Unit, wall mount mixing faucet with 8" adjustable centers, quarter-turn Eterna cartridges with spring checks, lever handles with color-coded indexes, 18" EasyInstall riser, 44" flexible stainless steel hose with heat-resistant gray handle & hold down ring, 1.15 GPM spray valve (B-0107), finger hook, polished chrome-plated brass faucet body, 1/2" NPT female inlets, CSA

- 1 ea Model B-0109-01 Wall Bracket, 6"



WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

ITEM 05 - DISHWASHER, CONVEYOR TYPE (1 REQ'D)**Champion Model 44 PRO**

Pro Series, 44"W rack conveyor dishwasher, Proportional Rinse, Progressive anti-jam drive system, top mounted Prodigy series HMI user interface, Proactive maintenance software, 100 gallons per hour with energy sentinel (idle pump shut-off), (209) racks per hour, single-piece hood design, single-piece stainless steel upper & lower wash arms manifolds, internal removable scrap basket, dual-piece scrap screens, 20" standard vertical clearance which accommodate 18" x 26" sheet pans, full 180° opening leak proof insulated hinged access doors, automatic tank fill, door safety switches, leak-proof ball valve drains, lower front & side enclosure panels, stainless steel heavy gauge construction including base & legs, electric tank heat, 2 HP wash pump, single point machine & booster connection, vent fan control, stainless steel rear manifolds, includes: (1) 20" x 20" peg rack & (1) 20" x 20" flat rack, NSF Pot & Pan mode, cULus, ENERGY STAR®, Made in USA



- 1 ea 1 year parts & labor warranty, standard
- 1 ea Complimentary factory authorized performance test included, upon equipment start-up. Consult local Champion sales representative for coordination of the start-up. If customer is beyond 60 miles from Champion authorized service agent, consult factory.
- 1 ea Direction of operation to be specified
- 1 ea Note: For water of 3-grains of hardness or more, Champion recommends adding a water treatment device.
- 1 ea 208v/60/3-ph
- 1 ea Electric tank heat, standard
- 1 ea Electric booster, 70° rise, 21kW, built-in
- 1 ea Extended stainless steel vent cowl with 7" stack & locking damper (set)
- 1 ea 24" Vertical clearance through machine
- 1 ea Model 407400 Table Limit Switch (Whisker Style) Table limit switch, includes: 12 ft. pre-wired cord standard (unmounted) (recommended on all conveyor models)

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									2		
2	208	60	3								

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"								

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	1-1/2"	

ITEM 06 - CLEAN DISHTABLE (1 REQ'D)**Titan Stainless Model 7CDT-R-14 Dimensions: 43(h) x 84(w) x 30(d)**

Clean Dishtable, straight design, 84"W, left to right operation, 14/300 stainless steel top, stainless steel H-frame legs, NSF

- 1 ea Model BF-S Bullet Foot, stainless steel
- 1 ea Model LS-P Limit Switch Provision (Limit switch provided and installed by others)
- 1 ft Model SD Sound Deadening (priced per linear foot)

ITEM 07 - DISHTABLE SORTING SHELF (1 REQ'D)
John Boos Model BHS1863-TS Dimensions: 12.25(h) x 63(w) x 18(d)

Dishrack Sorting Shelf, 63"W x 18"D x 12-1/4"H, wall mounted, slanted, tubular, includes brackets, 16/300 stainless steel, NSF



ITEM 08 - SOAK SINK (1 REQ'D)
John Boos Model PB-SS-208 Dimensions: 21.75(h) x 27(w) x 27(d)

Soak Sink, mobile, 27"W x 27"D x 21-3/4"H overall size, (1) 20"W x 20"W x 8" deep compartment, 3-1/2" die-stamped drain opening, twist lever waste, no drip edge, 16/300 stainless steel construction, 5" swivel casters with locks



WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

PLUMBING 1 REMARKS
3-1/2" drain opening

ITEM 09 - HAND SINK (3 REQ'D)
Advance Tabco Model 7-PS-51 Dimensions: 13(h) x 17.25(w) x 15.25(d)

Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, electronic faucet (battery & 110v options both supplied), lever drain with overflow, P-trap, wall bracket, NSF, cCSAus



ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	110	60	1								

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	1/2"			1/2"					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		1-1/2"

PLUMBING 1 REMARKS
(1) set of 1" faucet holes, 4" OC, splash mount

ITEM 10 - SPARE NO.

ITEM 11 - THREE (3) COMPARTMENT SINK (1 REQ'D)

Eagle Group Model EXISTING CUSTOM Dimensions: 44.5(h) x 126(w) x 31(d)

Spec-Master® FN Series Sink, three compartment, 120"W x 31"D, 14/304 stainless steel top, coved corners, 20" x 24" x 14" deep compartments, 30" drainboards on left & right, 9-1/2"H backsplash with 1" upturn & tile edge, (2) sets of 8" OC splash mount faucet holes, rolled edges on front & sides, includes LEVER DRAINS, stainless steel crossbracing on all sides, stainless steel legs & adjustable bullet feet, NSF
TWO SWING SPOUT FAUCETS
EXISTING CUSTOM



WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	(3) 1-1/2"	

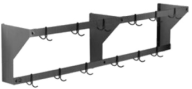
PLUMBING 1 REMARKS

(2) sets of 1-1/8" faucet holes, 8" O.C.

ITEM 12 - POT RACK (1 REQ'D)

Eagle Group Model EXISTING Dimensions: 16(h) x 120(w) x 12(d)

Pot Rack, wall mount, 120"W x 12"D x 16"H, double-bar design, constructed of 3/16" x 2" stainless steel flat bar, includes (20) double-pronged pot hooks, NSF



ITEM 13 - CART, UTILITY/BUSSING (2 REQ'D)

Lakeside Manufacturing Model EXISTING Dimensions: 37.13(h) x 38.63(w) x 22.38(d)

Utility Cart, open, (3) shelf, shelf size 33" x 21", U-shaped frame, all-welded stainless steel construction, 700 lb. capacity, (2) 5" swivel & (2) 8" fixed casters, Made in USA
2 ea Casters, (2) 5", swivel, (2) 8", fixed cushion tread, standard



ITEM 14 - WIRE SHELVING UNIT (3 REQ'D)

Metro Model A566K3 Dimensions: 63(h) x 60(w) x 24(d)

Super Adjustable Super Erecta® Starter Shelving Unit, 60"W x 24"D x 63"H, (4) wire shelves, (4) posts, Metroseal 3™ epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, KD, NSF



ITEM 15 - MOP SINK CABINET (1 REQ'D)

John Boos Model PBJC-303084 Dimensions: 84(h) x 30(w) x 30(d)

Janitor Cabinet, 30"W x 30"D x 84"H overall size, enclosed cabinet with open back for plumbing, (2) lockable louvered swing doors, includes 24" x 24" x 12" deep mop sink with drain, overhead shelf, rear-mounted mop holder with (3) locking cams, service faucet with vacuum breaker and 120" hose, 18/300 stainless steel, NSF



WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

PLUMBING 1 REMARKS

3-1/2" drain opening

ITEM 16 - ICE MAKER, CUBE-STYLE (1 REQ'D)**Hoshizaki Model KM-1301SAJ EXISTING Dimensions: 27.38(h) x 48(w) x 27.38(d)**

Ice Maker, Cube-Style, 48"W, air-cooled, self-contained condenser, production capacity up to 1365 lb/24 hours at 70°/50° (1301 lb AHRI certified at 90°/70°), crescent cube style, stainless steel exterior, R-404A refrigerant, 208-230v/60/1-ph, 12.4 amps, NSF, UL



- 1 ea Model B-900SF EXISTING Ice Bin, 52"W, top-hinged front-opening door, 900-lb ice storage capacity, for top-mounted ice makers, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208-230	60	1				12.4				

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									
2				1/2"					
3									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	3/8"	
2	3/4"	
3	3/4"	

PLUMBING 1 REMARKS

Dew Drain

PLUMBING 2 REMARKS

Ice Maker Drain

ITEM 17 - TILTING SKILLET BRAISING PAN, ELECTRIC (1 REQ'D)**Crown (Middleby) Model VULCAN EXISTING Dimensions: 40(h) x 36(w) x 41.63(d)**

(QUICK SHIP) Tilting Skillet, electric, 30 gallon capacity, manual tilt, spring assisted cover, removable lip strainer, etched interior markings, stainless steel construction, open frame, adjustable flanged feet, 12.0kW, cCSAus, NSF (maximum quantity = 2 per order)

- 1 ea 208v/50/60/3-ph, 33.3 amps

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1								12.0			
2	208	50/60	3				33.3				

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1	3/8"			3/8"					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

PLUMBING 1 REMARKS

(Connections for optional faucet)

ITEM 17A - FLOOR TROUGH (1 REQ'D)**IMC/Teddy Model ASFT-1836-PFG Dimensions: 12.25(h) x 36(w) x 18(d)**

ASFT Anti-Spill Floor Trough, 36"W x 18"D, 6" deep receptacle, (1) 4" OD tailpiece, stainless steel beehive strainer, 14/304 stainless steel, brushed satin finish, (PFG) pultruded fiberglass grating, grey, NSF, Made in USA



WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		4"

ITEM 18 - COMBI OVEN, ELECTRIC DBL. STACKED (2 REQ'D)**RATIONAL Model ICC 6-FULL E (2X) EXISTING Dimensions: 29.6(h) x 42.25(w) x 38.4(d)**

(CC2ERRA.0000255) iCombi Classic® 6-Full Size Combi Oven, electric, (6) 18" x 26" sheet pan or (12) 12" x 20" steam pan or (6) 2/1 GN pan capacity, (3) stainless steel grids included, digital color display screen with push button control, (3) manual operating modes: steam, convection & combination, 85° to 572°F temperature range, (100) program slots, core temperature probe, retractable hand shower, 5-speed fan, (4) automatic cleaning programs, integrated care system, 208/240v/60/3-ph, 22.4 kW, CE, IPX5, UL, cULus, NSF, ENERGY STAR®



TWO UNITS STACKED

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208/240	60	3	Direct			62.2/53.9	22.4			

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/4" GHT					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	2"	

PLUMBING 1 REMARKS

1/2" ID

ITEM 19A - EXHAUST HOOD (1 REQ'D)**Captive-Aire Model ND2**

wall canopy hood group

ITEM 19B - FIRE SUPPRESSION SYSTEM (1 REQ'D)**Ansul Fire Protection Model R-102**

FIRE SUPPRESSION SYSTEM, WET CHEMICAL

ITEM 20 - SPARE NO.

ITEM 22 - WORKTABLE, 30X72 WITH SINK (2 REQ'D)**Eagle Group Model T3072-CUSTOM-EXISTING Dimensions: 39.63(h) x 72(w) x 30(d)**

Spec-Master® Marine Series Work Table, 72"W x 30"D, 14/300 series stainless steel top, box marine edge on front & sides,
 CUSTOM 10" H BACKSPLASH
 24"X24"X12"D SINK WITH 4 SUPPORT LEGS
 WELDED UNDERSHELF
 EXISTING

**ITEM 23 - HEATED HOLDING PROOFING CABINET, MOBILE (1 REQ'D)****Winston Foodservice Model HL4522-SS EXISTING Dimensions: 73.1(h) x 27.6(w) x 34.5(d)**

CVap® Proofing/Holding Cabinet, mobile, full-size, insulated, with fan, adjustable universal wire slides, 3-1/2" OC, adjustable on 1-3/4" increments, accommodates (14) 18" x 26" or (28) 12" x 20" or (14) 2/1 GN pans, 90°F to 180°F temperature range, (2) hinged solid dutch doors with magnetic latch, electronic differential controls, manual water fill, stainless steel construction, CE, UL EPH ANSI/NSF4, cUL, UL-Sanitation

1 ea 120v/60/1-ph, 1730 watts, 14.4 amps, (US) NEMA 5-15P

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-15P	14.4	1.73		15	

ITEM 24 - WORK TABLE, STAINLESS STEEL TOP (2 REQ'D)**Eagle Group Model T3060SE EXISTING Dimensions: 36.13(h) x 60(w) x 30(d)**

Spec-Master® Series Work Table, 60"W x 30"D, 14/300 series stainless steel top, rolled edge on front & back, adjustable 18/300 series stainless steel undershelf with marine edge, Uni-Lok® gusset system, (4) stainless steel legs & adjustable bullet feet, NSF
 CUSTOM WITH 20X20 DWR AND CASTERS

2 st Model CA4-SB Table Casters, set of (4), 4" diameter, (2) swivel & (2) swivel/brake, 115 lbs. capacity per caster, zinc with resilient tread, NSF

**ITEM 25 - ROLL-IN REFRIGERATOR (1 REQ'D)****Continental Refrigerator Model D2RINSA-E Dimensions: 92(h) x 68.5(w) x 35.38(d)**

Designer Line Extra-High Refrigerator, roll-in, two-section, self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth cabinet, full-height solid doors, cylinder locks, electronic control with digital display, hi-low alarm, removable stainless steel ramps, R290 hydrocarbon refrigerant, 1/2 HP, cETLus, NSF

- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 10.3 amps, cord & plug, standard
- 1 ea Left Door hinged on left & right door hinged on right, standard
- 1 ea Stainless steel case back including rear grill & concealed drain

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/2		
2	115	60	1	Cord & Plug			10.3				

ITEM 26 - MOBILE MIXER STAND (1 REQ'D)**Eagle Group Model MS3030S EXISTING Dimensions: 24(h) x 30(w) x 30(d)**

Mixer Stand, 30"W x 30"D x 24"H, 16/300 series stainless steel top with 600 lbs. capacity, rolled front edge, stainless steel adjustable undershelf with 150 lbs. capacity, Uni-Lok® gusset system, stainless steel legs with CASTERS, NSF
WITH UTENSIL TREE
EXISTING

**ITEM 27 - PLANETARY MIXER (1 REQ'D)****Hobart Model HL200-1 EXISTING**

100-120/50/60/1; Bench type mixer; without attachments; US/EXP configuration - Legacy Planetary Mixer - Unit Only, Bench, 20 quart, (3) fixed speeds plus stir speed, gear-driven transmission, 15-minute SmartTimer™, #12 taper hub, manual bowl lift, stainless steel bowl guard, 1/2 hp, cord with plug

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1				Cord & Plug							

ITEM 28 - EQUIPMENT STAND, MOBILE (1 REQ'D)**Eagle Group Model MMT3030 EXISTING Dimensions: 34.5(h) x 30(w) x 30(d)**

Mixer Stand, mobile, 30"W x 30"D, 14/300 series stainless steel top with marine edge, 400 lbs capacity, pan rack slides for (6) 18" x 26" pans, Uni-Lok® gusset (2) swivel & (2) swivel/brake 4" casters
STAINLESS STEEL
EXISTING

**ITEM 29 - BUN / SHEET PAN RACK (1 REQ'D)****Eagle Group Model EXISTING Dimensions: 73(h) x 21.5(w) x 26(d)**

EXISTING PAN RACKS VARIOUS

**ITEM 30 - SPARE NO.****ITEM 31 - SHELVING, WALL MOUNTED (3 REQ'D)****Titan Stainless Model 9WMS-16 Dimensions: 14(h) x 108(w) x 16(d)**

Shelf, wall mounted, 108"W x 16"D, 2" rear up turn, 16/300 stainless steel construction, NSF

ITEM 32 - WORKTOP FREEZER (1 REQ'D)**Continental Refrigerator Model SWF27NBS Dimensions: 40.75(h) x 27.5(w) x 31.56(d)**

Work Top Freezer, 27"W, 7.4 cu ft capacity, one-section, stainless steel top with 5-1/2"H backsplash, (1) field rehingable door, stainless steel front & end panels, aluminum interior, rear mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF

- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 4.8 amps, cord, NEMA 5-15P, standard
- 1 ea Door hinged on right, standard
- 1 ea Casters, 5" standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/4		
2	115	60	1	Cord & Plug		5-15P	4.8				

ITEM 33 - FRENCH FRY WARMER (1 REQ'D)**Hatco Model GRFHS-PT16 Dimensions: 24.63(h) x 21.63(w) x 23.25(d)**

Glo-Ray® Pass-Thru Fry Holding Station, countertop, electric, ceramic heating elements, incandescent lights, pre-set thermostatically controlled heated base, NO backstop included, stainless steel construction, 1090 watts, NSF, CE, cULus, Made in USA

- 1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- 1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 1 ea One year on-site parts & labor warranty, plus one additional year parts only warranty on all Glo-Ray ceramic elements
- 1 ea 120v/60/1-ph, 1090 watts, 9.1 amps, NEMA 5-15P (domestic voltage), standard
- 1 ea Toggle switch, standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-15P	9.1	1.09			

ITEM 34 - ELECTRIC FRYER, BATTERY (1 REQ'D)**Vulcan Model 2ER50CF EXISTING Dimensions: 36.25(h) x 31(w) x 34.38(d)**

Fryer, electric, 31" W, (2) battery, 50 lbs. capacity per vat, programmable computer control with melt cycles, (10) countdown timers, KleenScreen PLUS® filtration system, twin baskets, stainless steel cabinet & fry tank, (4) adjustable legs, CSAus, NSF, ENERGY STAR®

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea 10 year limited fry tank warranty, standard
- 1 ea (2) 208v/60/3-ph (add -1 suffix), 17kW, 52.0 amps each, standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208	60	3				52.0	17.0			
2	208	60	3				52.0	17.0			

ELECTRICAL 1 REMARKS

Connection 1

ELECTRICAL 2 REMARKS

Connection 2

ITEM 35 - REACH-IN REFRIGERATOR (1 REQ'D)**Continental Refrigerator Model 1RENSAHD Dimensions: 82.25(h) x 28.5(w) x 35.38(d)**

Extra-Wide Refrigerator, reach-in, 28-1/2"W, one-section, self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth, half-height solid doors, cylinder locks, electronic control with digital display, hi-low alarm, electric condensate evaporator, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF, ENERGY STAR®



- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 5.2 amps, cord, NEMA 5-15P, standard
- 1 ea Door hinged on right, standard
- 1 ea 5" Casters, standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/4		
2	115	60	1	Cord & Plug		5-15P	5.2				

ITEM 36 - COMBI OVEN, ELECTRIC (2 REQ'D)**RATIONAL Model ICC 6-FULL E 208/240V 3 PH (LM200CE) Dimensions: 29.6(h) x 42.25(w) x 38.4(d)**

(CC2ERRA.0000255) iCombi Classic® 6-Full Size Combi Oven, electric, (6) 18" x 26" sheet pan or (12) 12" x 20" steam pan or (6) 2/1 GN pan capacity, (3) stainless steel grids included, digital color display screen with push button control, (3) manual operating modes: steam, convection & combination, 85° to 572°F temperature range, (100) program slots, core temperature probe, retractable hand shower, 5-speed fan, (4) automatic cleaning programs, integrated care system, 208/240v/60/3-ph, 22.4 kW, CE, IPX5, UL, cULus, NSF, ENERGY STAR®



- 2 ea NOTE: All discounts subject to approval by manufacturer
- 2 ea 2 years parts and labor, 5 years steam generator warranty
- 2 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 1 ea Model 1900.1158US Water Filtration Double Cartridge System, for full-size Combi-Duos or if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
- 2 ea NOTE: The RATIONAL Water Filtration Systems helps provide consistent high quality water to your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines and chlorine while providing the required flow rates
- 2 ea Model 60.76.178 UltraVent® Plus Ventless Recirculating Condensation Hood, with HEPA filter for smoke capture, filters smoke, for single or Combi-Duo, for 6- and 10-full size (electric), 120v/50/60/1-ph, 170 watts, 6' cord, NEMA 5-15P
- 1 kt Model 60.74.725 Combi-Duo Stacking Kit for iCombi 6-full size (electric or gas) on iCombi 6- or 10-full size (electric only)
- 2 ea When selecting a Stacking Kit, a Mobile Combi-Duo Kit or Stand I is required.

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208/240	60	3	Direct			62.2/53.9	22.4			
2	120	50/60	1	Cord & Plug		5-15P	1.6	.17			

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/4" GHT					
2				3/4" GHT					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	2"	
2		

PLUMBING 1 REMARKS

1/2" ID

ITEM 37 - EQUIPMENT STAND, FREEZER BASE (1 REQ'D)**Continental Refrigerator Model D48GFN Dimensions: 26.38(h) x 48(w) x 34.75(d)**

Freezer Griddle Stand, one-section, (2) drawers, accommodates (2) 12" x 20" x 6", stainless steel top with drip guard marine edge, stainless steel exterior & interior, electronic control with digital display, hi-low alarm, high/low temperature alarm, self-contained refrigeration, automatic hot gas condensate evaporator, R290 hydrocarbon refrigerant, 1/3 HP, 10' cord, cETLus, CE, NSF



- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 5.9 amps, cord, NEMA 5-15P, standard
- 1 ea Condensing unit on the left
- 1 ea Casters, 3" diameter, 4"H overall, standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/3		
2	115	60	1	Cord & Plug		5-15P	5.9				

ITEM 38 - EQUIPMENT STAND, REFRIGERATED BASE (1 REQ'D)**Continental Refrigerator Model D84GN Dimensions: 26.38(h) x 84(w) x 34.75(d)**

Refrigerator Griddle Stand, two-section, (4) drawers - four drawers accommodates (2) 12" x 20" x 6", stainless steel top with drip guard marine edge, stainless steel exterior & interior, electronic control with digital display, hi-low alarm, self-contained refrigeration, R290 hydrocarbon refrigerant, 1/4 HP, 10' cord, cETLus, NSF, ENERGY STAR®



- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 4.2 amps, cord, NEMA 5-15P, standard
- 1 ea Condensing unit on the left
- 1 ea Casters, 3" diameter, 4"H overall, standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/4		
2	115	60	1	Cord & Plug		5-15P	4.2				

ITEM 39 - GRIDDLE, ELECTRIC, COUNTERTOP (1 REQ'D)**Vulcan Model HEG48E EXISTING Dimensions: 15.3(h) x 48(w) x 31.5(d)**

Heavy Duty Griddle, electric, countertop, 48" W x 24" D cooking surface, 1/2" thick polished steel griddle plate, bottom mounted snap action thermostat every 12", low profile, stainless steel front, sides, front top ledge with "Cool Bullnose", front grease trough, 4" back & tapered side splashes, 4" adjustable legs, cCSAus, NSF



- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea 208v/60/3-ph, 21.6 kW, 67.4 amps

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208	60	3	Direct			67.4	21.6			

ITEM 40 - SPARE NO.**ITEM 41 - CHARBROILER, ELECTRIC, COUNTERTOP (1 REQ'D)****Wells (Middleby) Model B-50 Dimensions: 15.38(h) x 36.5(w) x 29.5(d)**

Charbroiler, countertop, electric, 4" high legs, cast iron grate, 36" wide, stainless steel construction, with grease pan and scraper/brush, UL, CE



- 1 ea Note: Must specify voltage and phase
- 1 ea One year warranty on cast iron grates, burners & burner shields, standard
- 1 ea 208v/60/3-ph, 10.8 kW, 30.0 amps, standard

ITEM 42 - INDUCTION RANGE, COUNTERTOP (1 REQ'D)**Vollrath Model 912HIDC Dimensions: 13.63(h) x 12(w) x 30(d)**

Cayenne Heavy-Duty Induction Range, countertop, 12"W x 30"D x 13-5/8"H, (2) hob, digital controls, (100) power settings, 100°-400°F temperature range, 1-180 minute timer function, 2500-2900 watts per hob (5000-5800 watts total), 208-240v/50/60/1ph, 24 amps, cord with NEMA 6-30P, NSF, UL, CUL, FCC (Refer to vollrathfoodservice.com for full warranty policy)

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208-240	50/60	1	Cord & Plug		6-30P	24	5.8			

ITEM 43 - INDUCTION RANGE, COUNTERTOP (1 REQ'D)**Vollrath Model 924HIDC Dimensions: 13.63(h) x 24(w) x 30(d)**

Cayenne Heavy-Duty Induction Range, countertop, 24"W x 30"D x 13-5/8"H, (4) hob, digital controls, (100) power settings, 100°-400°F temperature range, 1-180 minute timer function, 2500-2900 watts per hob (5000-5800 watts total), (2) 208-240v/50/60/1ph, (2) 24 amps, (2) cords with NEMA 6-30P, NSF, UL, CUL, FCC (Refer to vollrathfoodservice.com for full warranty policy)



NCSU Football
ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208-240	50/60	1	Cord & Plug		6-30p	24	2.88			
2	208-240	50/60	1	Cord & Plug		6-30p	24	2.88			

ITEM 44 - EXHAUST HOOD (1 REQ'D)
Captive-Aire Model EXISTING
wall canopy hood group

ITEM 45 - FIRE SUPPRESSION SYSTEM (1 REQ'D)
Ansul Fire Protection Model R-102
FIRE SUPPRESSION SYSTEM, WET CHEMICAL

ITEM 46 - SPARE NO.

ITEM 47 - DROP-IN SINK (1 REQ'D)
Advance Tabco Model DI-1-25 Dimensions: 5(h) x 12(w) x 14(d)

Drop-In Bar Hand Sink, 12"W x 14"D overall, 9"W x 9"D front-to-back x 5" deep bowl, 20/304 stainless steel, includes: K-52 deck mounted gooseneck faucet, 1-1/2" basket drain, NSF (cutout size 11-1/4"W x 13-1/4"D)
1 ea Model K-614A Removable 3-sided splash for counter-mount drop in sink, 8" tall, includes posts to be installed in countertop, for DI-1-25 & DI-1-9 (drop in sink-for sinks welded into stainless counters use TA-56)



WATER										WASTE	
	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE	INDIRECT SIZE	DIRECT SIZE
1											1-1/2"

PLUMBING 1 REMARKS
(1) set of 1/2" faucet holes, 4" OC

ITEM 48 - SPARE NO.

ITEM 49 - SPARE NO.

ITEM 50 - SPARE NO.

ITEM 51 - PASS-THRU REFRIGERATOR (2 REQ'D)**Everest Refrigeration Model ESPT-1G-1S Dimensions: 74.25(h) x 29.25(w) x 33.71(d)**

Pass-Thru Refrigerator, one-section, 29-1/4"W, 23 cu. ft. capacity, (3) adjustable epoxy coated wire shelves, digital controller with LED display, 33°F to 54°F temperature range (35°F preset), auto defrost, audible overheat protection alarm for compressor & condenser coil, LED interior lighting, self maintaining condensate drain pan, (2) reversible right hinged self closing (front glass & rear solid) locking doors, stainless steel interior & exterior, galvanized top & bottom, self contained refrigeration, top-mounted compressor, (4) 5" swivel casters (2 locking), R290 Hydrocarbon refrigerant, 1/4+ HP, 115v/60/1-ph, 4.0 amps, cord, NEMA 5-15P, NSF, cETLus, ETL-Sanitation

- 2 ea Parts and labor: 3 years from ship date
- 2 ea Electrical components: 5 years from ship date
- 2 ea Compressor: 10 years from ship date
- 2 ea Door hinged on right, standard
- 2 ea Model CASA5-01 5" Overall Height Casters Set of 4, (front 2 locking), standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1	Cord & Plug		5-15P	4				

ITEM 52A - COLD FOOD WELL UNIT, DROP-IN, REFRIGERATED (2 REQ'D)**Duke Manufacturing Model ADI-2MDSL-N7 Dimensions: 25(h) x 48.75(w) x 17.38(d)**

Slimline Drop-In Cold Food Pan, refrigerated, 48-3/4"W x 17-3/8"D x 25"H, accommodates (2) 6" deep 12" x 20" pans, 300 series stainless steel top with overhang & locking tabs, 10" deep 300 series stainless steel interior liner, steel exterior housing, remote mounted on/off switch with stainless steel face plate (2-3/16"W x 4-1/8"H cutout required), air-cooled condensing unit, (1) adapter bar included, 1" brass drain & plug, R448a, cULus, UL EPH Classified, NSF (47-3/4"W x 16-3/4"D cutout required for unit)

- 2 ea Do not fully enclose compressor area. Two unrestricted openings of no less than (200) square inches required in cabinet for proper cooling.
- 2 ea 120v/60/1-ph, 4.26 amps, 1/4 HP, NEMA 5-15P

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1				Cord & Plug							
2	120	60	1	Cord & Plug		5-15P	4.26		1/4		

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	1"	

ITEM 52B - COLD FOOD WELL UNIT, DROP-IN, REFRIGERATED (2 REQ'D)**Duke Manufacturing Model ADI-3MDSL-N7 Dimensions: 25(h) x 70.75(w) x 17.38(d)**

Slimline Drop-In Cold Food Pan, refrigerated, 70-3/4"W x 17-3/8"D x 25"H, accommodates (3) 6" deep 12" x 20" pans, 300 series stainless steel top with overhang & locking tabs, 10" deep 300 series stainless steel interior liner, steel exterior housing, remote mounted on/off switch with stainless steel face plate (2-3/16"W x 4-1/8"H cutout required), air-cooled condensing unit, (2) adapter bars included, 1" brass drain & plug, R448a, cULus, UL EPH Classified, NSF (69-3/4"W x 16-3/4"D cutout required for unit)

2 ea Do not fully enclose compressor area. Two unrestricted openings of no less than (200) square inches required in cabinet for proper cooling.

2 ea 120v/60/1-ph, 4.26 amps, 1/4 HP, NEMA 5-15P



ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1				Cord & Plug							
2	120	60	1	Cord & Plug		5-15P	4.26		1/4		

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1									

WASTE

	INDIRECT SIZE	DIRECT SIZE
1	1"	

ITEM 53 - DROP-IN SINK (2 REQ'D)**Eagle Group Model HWB-E Dimensions: 17.25(h) x 16.5(w) x 17.5(d)**

Drop-In Hand Sink, one compartment, 17-1/2" x 16-1/2" x 17-1/4"H, type 304 stainless steel welded construction, 9-1/4" x 11-1/2" x 6" bowl, bullnose front edge, Encore deck mount gooseneck faucet, basket drain, soap on rear deck, C-fold towel dispenser, hinged door with pull handle & magnetic catch, NSF

**ITEM 54A - SNEEZE GUARD, STATIONARY (1 REQ'D)****Premier Metal & Glass Model TMUS-60 Dimensions: 20.69(h) x 22(d)**

Infinity UV Bonded Fixed Self-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, fixed end panels, 1/2" vertical glass supports, NSF listed (Contact Premier Sales Department for Pricing)

84" LONG

**ITEM 54B - SNEEZE GUARD, STATIONARY (2 REQ'D)****Premier Metal & Glass Model TMUS-78 Dimensions: 20.69(h) x 22(d)**

Infinity UV Bonded Fixed Self-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, fixed end panels, 1/2" vertical glass supports, NSF listed (Contact Premier Sales Department for Pricing)

78" LONG



ITEM 54C - SNEEZE GUARD, STATIONARY (2 REQ'D)**Premier Metal & Glass Model TMUS-96 Dimensions: 20.69(h) x 22(d)**

Infinity UV Bonded Fixed Self-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, fixed end panels, 1/2" vertical glass supports, NSF listed (Contact Premier Sales Department for Pricing)



84" LONG

ITEM 55 - UNDERCOUNTER REFRIGERATOR (2 REQ'D)**Continental Refrigerator Model SW27N-U Dimensions: 31.81(h) x 27.5(w) x 31.56(d)**

Undercounter Refrigerator, 27"W, 7.4 cu ft capacity, one-section, (1) field rehingeable door, stainless steel front, top & end panels, aluminum interior, 1-3/8" diameter plate casters, front breathing, rear-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/5 hp, cETLus, NSF, ENERGY STAR®

- 2 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 2 ea 115v/60/1-ph, 2.46 amps, cord, NEMA 5-15P, standard
- 2 ea Door hinged on right, standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/5		
2	115	60	1	Cord & Plug		5-15P	2.46				

ITEM 56 - UNDERCOUNTER REFRIGERATOR (3 REQ'D)**Continental Refrigerator Model SW36N-U Dimensions: 31.81(h) x 36(w) x 31.56(d)**

Undercounter Refrigerator, 36"W, 10.3 cu ft capacity, two-section, (2) field rehingeable door, stainless steel front, top & end panels, aluminum interior, 1-3/8" diameter plate casters, front breathing, rear-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/5 hp, cETLus, ENERGY STAR®

- 3 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 3 ea 115v/60/1-ph, 2.46 amps, cord, NEMA 5-15P, standard
- 3 ea Left Door hinged on left & right door hinged on right, standard

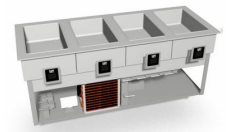
**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/5		
2	115	60	1	Cord & Plug		5-15P	2.46				

ITEM 57 - HOT / COLD FOOD WELL UNIT, DROP-IN, ELECTRIC (4 REQ'D)**Duke Manufacturing Model HCF-4 Dimensions: 25.94(h) x 64.5(w) x 25.5(d)**

Hot/Cold/Freeze Drop-In Food Well Unit, heated & refrigerated, 65" long, (4) 12" x 20" individual pans, 300 series stainless steel top rim, 5" deep 300 series stainless steel interior liners, steel exterior housing, individual wired remote digital controls for hot or cold operation, air-cooled condensing unit, individual drains manifolded to a valve, 6' cord & plug, UL, cULus, NSF #4 & 7

- 4 ea Model HCF-4-208 120/208v/60/1-ph, 16.0 amps, NEMA L14-20P

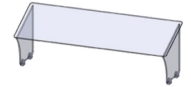


ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120/208/240	60	1	Cord & Plug		L5-30P/L14-20P	21/16	2.52/1.92	1/2		
2	120/208	60	1			L14-20P	16	1.92			

ITEM 58A - SNEEZE GUARD, STATIONARY (5 REQ'D)**Premier Metal & Glass Model TMU1-36 Dimensions: 21(h) x 20.5(d)**

Infinity UV Bonded Fixed Self-Service Sneeze Guard, single sided guard without top shelf, tempered glass with polished edges, fixed end panels, 1/2" vertical glass supports, NSF listed (Contact Premier Sales Department for Pricing)



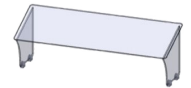
72" LONG

5 ea Specify Length: _____36_____

5 ea NOTE: Certain finishes/tubing combos not recommended, Contact Premier Sales Department for samples and details

ITEM 58B - SNEEZE GUARD, STATIONARY (5 REQ'D)**Premier Metal & Glass Model TMU1-72 Dimensions: 21(h) x 20.5(d)**

Infinity UV Bonded Fixed Self-Service Sneeze Guard, single sided guard without top shelf, tempered glass with polished edges, fixed end panels, 1/2" vertical glass supports, NSF listed (Contact Premier Sales Department for Pricing)



72" LONG

5 ea Specify Length: _____72_____

5 ea NOTE: Certain finishes/tubing combos not recommended, Contact Premier Sales Department for samples and details

ITEM 59 - CARVING STATION / SHELF (1 REQ'D)**Hatco Model DCSB400-3624-2 Dimensions: 46(h) x 36(w) x 24(d)**

Decorative Carving Station with Two Heat Lamps (clear bulbs included), telescoping clearance (bottom of shade to top of cutting board) 14" - 26", 30° shade pivot, heated Swanstone® base with thermostatic control, includes one 36"x24" cutting board with meat juice containment, specify finish, CE, cULus, UL EPH Classified, Made in USA



1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details

1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350

1 ea One year parts & labor warranty (excludes sneeze guard & light bulbs), standard

1 ea One year warranty for burnouts on all ceramic heating elements

1 ea 120v/60/1-ph, 1300 watt, NEMA 5-15P, standard

1 ea Model SPECIFY MUST SPECIFY designer color selected from list of standard colors & indicated on order (available at time of purchase only)

1 ea Model SPECIFY MUST SPECIFY designer color selected from list of standard colors & indicated on order (available at time of purchase only)

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-15P		1.3			

ITEM 60 - SPARE NO.

ITEM 61 - CABINET, COOK / HOLD / OVEN (3 REQ'D)**Alto-Shaam Model 750-TH Dimensions: 33.3(h) x 25.7(w) x 33.5(d)**

Halo Heat® Cook & Hold Oven, electric, low temperature, 100 lb. capacity - (6) 12" x 20" x 4" or (10) 12" x 20" x 2-1/2" pans, simple or deluxe controls, probe, programmable recipes, SureTemp™ heat recovery system, heavy-duty stainless steel exterior, stainless steel side racks, (3) stainless steel wire shelves, 3-1/2" casters (2 rigid, 2 swivel with brakes), EcoSmart®, cULus, UL EPH Classified, CE, IPX4, TUV NORD, EAC, N11942



- 3 ea NOTE: Subject to Manufacturer's Terms & Conditions. See Documents Section
- 3 ea 120v/60/1-ph, 14.0 amps, 1.7 kW, 9 ft. cord, NEMA 5-20P
- 3 ea Simple controls, standard
- 3 ea Model PR-46999 Single point, standard
- 3 ea Solid Door, hinged on right, standard
- 3 ea Stainless steel exterior, standard
- 3 ea Casters, 2-1/2", not available with bumper

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-20P	14	1.7			

ITEM 62 - INDUCTION RANGE, BUILT-IN / DROP-IN (2 REQ'D)**Spring USA Model ICB348-26 Dimensions: 37.3(h) x 48(w) x 24.8(d)**

MAX Induction™ Cooking System, built-in, (3) 2600 watt MAX Induction® ranges (SM-261R), (2) induction air filter systems (AF-350), integrated power management system (PM-2221), 20 cook modes, temperature range 100°F to 400°F, individual SmartScan® controls, stainless steel, 208-240v/60/1-ph, 35.4 amps, 8.5kW, NEMA 14-50P, ETL, UL-STD 197, NSF-ANSI STD 4, UL-ANSI/NSF No. 2, FCC, cETL (custom product) (6-8 week lead time)



- 2 ea 1 year parts & labor warranty (excluding filters), standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208-240	60	1	Cord & Plug		14-50P	35.0	8.5			

ITEM 63 - SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)**Continental Refrigerator Model SW32N8-FB Dimensions: 40.88(h) x 32(w) x 31.44(d)**

Sandwich Unit, Front Breather, 32"W, 9.0 cu ft capacity, one-section, (8) 1/6 size x 4" deep pans with 12" cutting board, (1) field rehingeable door, stainless steel top, front & end panels, aluminum back & interior, 3-3/4" casters, rear mounted self-contained refrigeration, automatic hot gas condensate evaporator, R290 hydrocarbon refrigerant, 1/5 hp, cETLus, NSF



- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 2.46 amps, cord, NEMA 5-15P, standard
- 1 ea Door hinged on right, standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/5		
2	115	60	1	Cord & Plug		5-15P	2.46				

ITEM 64 - REACH-IN FREEZER (1 REQ'D)**Continental Refrigerator Model 1FESNSA Dimensions: 82.25(h) x 28.5(w) x 29.25(d)**

Extra-Wide Freezer, reach-in, 28-1/2"W, one-section, self-contained refrigeration, stainless steel exterior, aluminum interior, shallow depth, full-height solid door, cylinder lock, electronic control with digital display, unit can be adjusted to operate as low as -10°F, hi-low alarm, electric condensate evaporator, R290 Hydrocarbon refrigerant, 1/2 HP, cETLus, NSF

- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 7.6 amps, cord, NEMA 5-15P, standard
- 1 ea Door hinged on right, standard
- 1 ea 5" Casters, standard



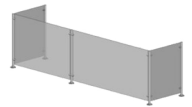
ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/2		
2	115	60	1	Cord & Plug		5-15P	7.6				

ITEM 65A - SNEEZE GUARD, STATIONARY (2 REQ'D)**Premier Metal & Glass Model FM1V- 52 Dimensions: 24(h) x 19.75(d)**

1Guard™ Fixed Full-Service Sneeze Guard, single sided guard without top shelf, straight front, tempered glass with polished edges, end panels, front mount, 1" OD round stainless support posts, NSF & UL (Contact Premier Sales Department for Pricing)

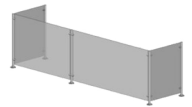
52" LONG

**ITEM 65B - SNEEZE GUARD, STATIONARY (1 REQ'D)****Premier Metal & Glass Model FM1V-64 Dimensions: 24(h) x 19.75(d)**

1Guard™ Fixed Full-Service Sneeze Guard, single sided guard without top shelf, straight front, tempered glass with polished edges, end panels, front mount, 1" OD round stainless support posts, NSF & UL (Contact Premier Sales Department for Pricing)

64" LONG

- 1 ea Specify Length: 64
- 1 ea NOTE: Certain finishes/tubing combos not recommended, Contact Premier Sales Department for samples and details

**ITEM 66 - SPARE NO.**

ITEM 67 - HOT FOOD WELL UNIT, DROP-IN, ELECTRIC (1 REQ'D)**Duke Manufacturing Model ADI-1E-SW Dimensions: 12.75(h) x 18.25(w) x 24.25(d)**

Hot Food Drop-In Unit, electric, with (1) 12" x 20" hot food well, 18-1/4" long, 12-3/4" high, stainless steel top & interior liner, steel exterior housing, with remote control panel, sealed wells with drains, cULus, UL EPH Classified

1 ea 120v/60/1-ph, 6.3 amps, 750 watts

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1				6.3	.75			

ITEM 68 - BATTER DISPENSER (1 REQ'D)**Waring Model WBD2G**

Batter Dispenser, 2 gallon capacity, with base, dishwasher safe, removable stainless steel drip saucer, Tomlinson® Spigot, non-skid feet, 304 stainless steel (available November 15, 2020)

**ITEM 69 - MEGA TOP SANDWICH / SALAD PREPARATION REFRIGERATOR (1 REQ'D)****Continental Refrigerator Model D48N18M Dimensions: 43.25(h) x 48(w) x 35(d)**

Designer Line Mighty Top Sandwich Unit, 48"W, two-section, (18) 1/6 size x 4" deep pans with 8" cutting board, (2) field rehingeable doors, stainless steel top, front, sides & interior, electronic control with digital display, hi-low alarm, 6" adjustable legs, rear mounted self-contained refrigeration, automatic hot gas condensate evaporator, R290 hydrocarbon refrigerant, 1/4 hp, cETLus, NSF

- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 4.5 amps, cord, NEMA 5-15P, standard
- 1 ea Left Door hinged on left & right door hinged on right, standard
- 1 ea (00FL) Stainless steel flat cover - without hinges

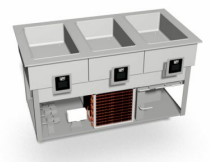
**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/4		
2	115	60	1	Cord & Plug		5-15P	4.5				

ITEM 70 - SPARE NO.**ITEM 71 - HOT / COLD FOOD WELL UNIT, DROP-IN, ELECTRIC (2 REQ'D)****Duke Manufacturing Model HCF-3 Dimensions: 25.94(h) x 48.82(w) x 25.5(d)**

Hot/Cold/Freeze Drop-In Food Well Unit, heated & refrigerated, 49" long, (3) 12" x 20" individual pans, 300 series stainless steel top rim, 5" deep 300 series stainless steel interior liners, steel exterior housing, individual wired remote digital controls for hot or cold operation, air-cooled condensing unit, individual drains manifolded to a valve, 6' cord & plug, UL, cULus, NSF #4 & 7

- 2 ea Model HCF-3-208 120/208v/60/1-ph, 11.0 amps, NEMA L14-20P



ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120/208/240	60	1	Cord & Plug		5-15P/L14-20P	16/11	1.92/1.32	1/2		
2	120/208	60	1			L14-20P	11	1.32			

ITEM 72 - SNEEZE GUARD, STATIONARY (2 REQ'D)**Premier Metal & Glass Model TMUS-54 Dimensions: 20.69(h) x 22(d)**

Infinity UV Bonded Fixed Self-Service Sneeze Guard, single sided guard with top shelf, tempered glass with polished edges, fixed end panels, 1/2" vertical glass supports, NSF listed (Contact Premier Sales Department for Pricing)



54" LONG

ITEM 73 - GRIDDLE, ELECTRIC, FLOOR MODEL (1 REQ'D)**Evo America, LLC (Middleby) Model 10-0148-EVT Dimensions: 36(h) x 59.14(w) x 39.5(d)**

Evo® EVent® 48E Full Metal Surround Cooking Station, electric, 48"W x 24"D rectangular steel cooktop surrounded with black granite, self-contained ventilation, multi-stage filtration system, integrated fire suppression system, 100° F to 550° F (38° C to 288° C) temperature range, touch panel display, includes: cleaning kit, (2) stainless steel spatulas, (1) stainless steel scraper, UL, UL EPH Classified, Made in USA



1 ea OWNER RESPONSIBILITY: Before any Evo EVent Electric Cooktop with Ventless Recirculating Ventilation System can be powered up for the first time, the factory installed UL300 Buckeye fire suppression system must be armed, commissioned, and tagged by a certified and locally licensed BUCKEYE Fire Suppression contractor. This commissioning is also the commencement of an agreement between the Buckeye agent and the owner and cannot be altered by Evo, Inc., its agents, dealers, or service agencies. Cost will vary by individual Buckeye agent and are paid by the customer, not by Evo.

1 ea NOTE: Before purchasing and installing this equipment, Evo, Inc. recommends that operators apply for permits as required by local jurisdictional authorities. Required permits vary by jurisdiction and may include Electrical, Fire, Mechanical and Food Service. Permits are the responsibility of the operator and/ or its contractors.

1 ea INTERNATIONAL ORDERS: For any orders outside the United States or Canada, it is recommended that a Spare Parts Kit, 20-EVT-1000 is purchased and shipped with every unit.

Evo, Inc. requires all equipment purchased for shipment outside the countries of US & Canada must complete an Electrical Questionnaire form. This form helps ensure that all equipment is to the correct specification of the site & country. You can download the form at <http://www.evoamerica.com/wp-content/uploads/2020/05/ElectricalQuestionnaire.pdf>. Any questions please contact our factory by phone 866-626-1802 or email international@evoamerica.com.

1 ea 1 year parts & labor warranty (contact factory for details)

1 ea 208v/60/1-ph, 32.0 amps, 6.7 kW, 8-foot cord, NEMA 6-50P

1 ea Model 10-0150-EVT-FMS Customization for 10-0148-EVT: Metal surround, stainless steel enclosure

1 ea Model 10-0150-EVT-36 Caster Kit, for 36" working height, standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208	60	1	Cord & Plug		6-50P	32	6.7			

ITEM 74 - REACH-IN UNDERCOUNTER FREEZER (1 REQ'D)**Continental Refrigerator Model SWF27N-U Dimensions: 31.81(h) x 27.5(w) x 31.56(d)**

Undercounter Freezer, 27"W, 7.4 cu ft capacity, one-section, (1) field rehingeable door, stainless steel front, top & end panels, aluminum interior, 1-3/8" diameter plate casters, front breathing, rear-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF

- 1 ea Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
- 1 ea 115v/60/1-ph, 4.8 amps, cord, NEMA 5-15P, standard
- 1 ea Door hinged on right, standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1									1/4		
2	115	60	1	Cord & Plug		5-15P	4.8				

ITEM 75 - MICROWAVE/IMPINGEMENT OVEN (2 REQ'D)**TurboChef (Middleby) Model I5 Dimensions: 24.3(h) x 28.1(w) x 28.25(d)**

i5-9500-1, I5™ Microwave/Impingement Oven, Rapid Cook, electric, 28.1" wide, ventless, countertop, fully insulated cook chamber, stores up to 200 recipes, internal catalytic converter, smart voltage sensor technology (US only), digital display, removable rack and grease collection pan, top and bottom jet plates, pull down door with ergonomic handle, multi-speed impingement blower, 13 1/2" x 14 1/4, (2) solid PTFE baskets, TurboChef Cleaner and Guard Starter Kit, includes (1) cleaner packet, (1) 24oz bottle, (1) Guard bottle and (2) foamer trigger, (1) standard rack, side hand grips, stainless steel front, top & sides, cULus, CE, UL EPH Classified, ANSI/NSF 4, TUV



- 1 ea Model MDD-1001 Open Kitchen bundle, includes - 1 x ConnectWare module, 1 x Secure Access Point (SAP), 3 year subscription for Open Kitchen (NET price displays when item is added to quote)
- 2 ea All items FOB: Carrollton, Texas: Consumable/accessory orders less than \$5,000 will incur a handling fee. Orders shipping standard ground will incur a \$15.00 handling fee. Orders shipping other than standard ground will incur \$25.00 handling fee
- 2 ea One year parts and labor warranty
- 2 ea 208/240v/60/1-ph, 48.0amps, 9.5-11.5kw, 6 foot cord (nominal), NEMA 6-50P, standard

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208/240	60	1	Cord & Plug		6-50P	48	9.5-11.5			

ITEM 76 - PANINI GRILL (2 REQ'D)**Waring Model WDG250 Dimensions: 13.75(h) x 20.38(w) x 21.5(d)**

Dual Surface Panini Grill, electric, double, 14-1/2" x 11" cooking surface, hinged auto-balancing top plate with heat resistant handles, ribbed top & flat bottom grill, adjustable thermostats 570°F (300°C), indicator lights, brushed stainless steel body & removable drip tray, 120v, 15amps, UL, NSF

- 2 ea 1 year limited warranty, standard



For Customer Care & Product Service, please contact:

(800) 269-6640

waring_service@conair.com

Waring Customer Care

314 Ella T. Grasso Ave

Torrington, CT 06790

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120						15.0				

ITEM 77 - TRASH RECEPTACLE, INDOOR (4 REQ'D)**Rubbermaid Commercial Products Model 2026721 Dimensions: 30(h) x 15.8(w) x 22.06(d)**

Slim Jim® Container, under-counter, 23-gallon capacity, 15-4/5" x 22" x 30"H, rectangular, large angled opening, integrated venting channels, bag cinches, rim and base handles, reinforced rim, injection-molded, high-quality resin, gray, Made in USA

**ITEM 78 - SOFT SERVE MACHINE (1 REQ'D)****Stoelting Model O431-38I2F Dimensions: 68.38(h) x 19.13(w) x 37.5(d)**

Soft-Serve Freezer, floor model, 19-1/8"W x 37-1/2"D x 68-3/8"H, air cooled, front opening refrigerated cabinet, (2) flavors with twist, (2) 5-1/2 gallon hoppers, (2) 1 gallon freezing cylinders, IntelliTec2™ controls, self-closing spigot, stainless steel exterior, casters, 15,000 BTU/hour Scroll™ compressor, (2) 3/4 hp motors, 208-240v/60/1-ph, 23 amps, cord with NEMA L6-30P, cULus, NSF



- 1 ea 1 year parts & labor warranty, standard (North America Only)
- 1 ea 5 year warranty on compressor, evaporator/hopper assembly, drive motor, speed reducer, auger shaft & auger flights (against breakage) standard
- 1 ea Model O431-38I2F/START-UP FEE Factory Start-up Fee, for O431-38I2F (net)
- 1 ea Model 2208100 Bag adaptor, stainless steel

ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	208-240	60	1	Cord & Plug		L6-30P	23		(2) 3/4		

ITEM 79 - WAFFLE MAKER / BAKER (2 REQ'D)**Hatco Model FWM-1B Dimensions: 11.58(h) x 11.58(w) x 22.78(d)**

Hatco/Suntec Flip Waffle Maker, 7" round Belgian plate, LED display, on/off, timer/temperature toggle, heavy duty stainless steel construction with Teflon® coated aluminum plates, CE, cULus, UL EPH Classified

- 1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- 1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350 (US & Canada Only)
- 2 ea One year parts & labor warranty, standard
- 2 ea 120v/60/1-ph, 11.3 amps, 1.35 kW, NEMA 5-15P (domestic voltage), standard



ELECTRICAL

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-15P	11.3	1.35			

ITEM 80 - SPARE NO.

ITEM 81 - MILK DISPENSER (1 REQ'D)**Silver King Model EXISTING Dimensions: 39.5(h) x 26.93(w) x 17.06(d)**

Majestic Series Milk Dispenser, refrigerated, double valve - spring loaded, 12 gallon capacity, (accommodates 3, 5, or 6 gallon bags), includes (2) crates, stainless steel interior & exterior with galvanized bottom, shipboard legs, bottom-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/10 HP, 115v/60/1-ph, 1.5 amps, NEMA 5-15P, cETLus, ETL-Sanitation

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1	Cord & Plug		5-15P	1.4		1/10		

ITEM 82 - DISPENSER, DRY PRODUCTS (2 REQ'D)**Cal-Mil Model EXISTING Dimensions: 26.5(h) x 11(w) x 8.75(d)**

Madera Cereal Dispenser, (2) 4.5L capacity cylinders, 11"W x 8-3/4"D x 26-1/2"H, turn & serve mechanism, removable crumb catcher, plastic cylinders, rustic pine base

**ITEM 83 - POP-UP TOASTER (2 REQ'D)****Hatco Model TPT-120 Dimensions: 8.13(h) x 13.63(w) x 12.38(d)**

Pop-Up Toaster, (4) 1-1/4" wide self centering slots, individual manual controls, removable crumb tray, stainless steel construction, cULus, UL EPH Classified

- 1 ea NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- 1 ea NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 2 ea One year replacement warranty, contact Hatco service team for details
- 2 ea 120v/60/1-ph, 1800w, 15.0 amps, 6' cord with NEMA 5-15P
- 2 ea Stainless steel finish, standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-15P	15.0	1.8			

ITEM 84 - DISPLAY CASE, PASTRY, COUNTERTOP (1 REQ'D)**Cal-Mil Model 22116-13 Dimensions: 26.75(h) x 26.5(w) x 17(d)**

Monterey Display Case, 26-1/2"W x 17"D, 26-3/4"H, 3-tier, countertop, dual hinged doors with handles, (3) white composite shelves, acrylic & steel



ITEM 85 - SODA ICE & BEVERAGE DISPENSER (1 REQ'D)**Cornelius Model EXISTING Dimensions: 35.63(h) x 22(w) x 30(d)**

Enduro 150 Ice & Post-Mix Beverage Dispenser, countertop, (6) UFB-1™ push-button valves, 150 lbs. ice capacity, built-in drip tray, timed ice agitation, key switch, TotalFlex™ beverage manifold, 10" cup clearance, generic graphics, stainless steel cabinet, 115v/60/1-ph, 3.0 amps, cULus, NSF, CE

1 ea 2 year limited parts & 1 year limited labor warranty (USA), standard

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	115	60	1				3.0				

ITEM 86 - JUICE DISPENSER, ELECTRIC (2 REQ'D)**BUNN Model EXISTING Dimensions: 33.4(h) x 15.7(w) x 27.5(d)**

37300.0000 JDF-4S Silver Series® 4-Flavor Cold Beverage System, (3) 12 oz. drinks/min capacity, 2-modular dispense decks, 18 lb. ice bank, 7" cup clearance, dispense 1.0 to 1.5 ounces per second flow rate, pumps & mixes 2+1 to 11+1 concentrated beverages, 4+1 high viscosity & 5+1 juices, dispenses frozen and ambient products, High Intensity™ mixing technology, push button and portion control, door lock, juice display, 120v/60/1-ph, 6 amps, NEMA 5-15P, NSF, ETL

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1	120	60	1	Cord & Plug		5-15P	6				

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/8"					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

ITEM 87 - COFFEE BREWER (1 REQ'D)**BUNN Model EXISTING Dimensions: 26.8(h) x 10.2(w) x 22.1(d)**

53300.0100 ICB-DV Infusion Series® Platinum Edition Coffee Brewer, single, plumbed, pre-infusion & pulse brew functions, brews into 2.5 to 3.8 liter airpots or 3.8 to 5.7 liter baseless Thermofresh servers (not included), electronic funnel lock, 4.3" color touchscreen, wireless interface, energy saver mode, SmartWAVE sprayhead technology, brew counter, USB programming, stainless steel funnel & finish, 120v/60/1-ph, 1700 watts, 14 amps, cord, NEMA 5-15P (field convertible to 120/208v/60/1-ph, 2900 watts, 14 amps (direct wired) or 120/240v/60/1-ph, 4050 watts, 17 amps (direct wired)), UL, NSF

**ELECTRICAL**

	VOLTS	CYCLE	PHASE	CONN	AFF	NEMA	AMPS	KW	HP	MCA	MOCP
1											

ELECTRICAL 1 REMARKS

120v/60/1-ph, 1700 watts, 14 amps, NEMA 5-15P (field convertible to 120/208v/60/1-ph, 2900 watts, 14 amps (direct wired) or 120/240v/60/1-ph, 4050 watts, 17 amps (direct wired))

WATER

	HOT SIZE	HOT AFF	HOT GPH	COLD SIZE	COLD AFF	FILTERED SIZE	FILTERED AFF	CONDENSER INLET SIZE	CONDENSER OUTLET SIZE
1				3/8"					

WASTE

	INDIRECT SIZE	DIRECT SIZE
1		

ITEM 88 - SPARE NO.

ITEM 89 - WALK-IN FREEZER, OUTDOOR (1 REQ'D)
Bally Refrigerated Boxes Model CUSTOM

ITEM 90 - SPARE NO.

MAKING YOUR WALK-INS COOL SINCE 1970





Project _____
 Item No. _____
 Quantity _____

Accumulators

RTP – Projection Style

RTS – Slim Line Style

VA – Vertical Accumulator

STANDARD FEATURES

- Manufactured in USA
- **Exclusive Maintenance Free Chain**
- 2-5 tier capacity
- Heavy duty construction – Accumulator frame constructed from 12 gauge stainless steel
- All 304 stainless steel construction with a #4 finish
- Carriers removable without tools
- Custom wireform basket designs with optional stainless steel liners
- TEFC Drive Motor accessible without removing carriers
- Photo eye safety switch
- Adjustable speed control in NEMA 4 control cabinet with programmable AC inverter
- Stainless steel 304 window frame and lights
- Stainless steel 304 table at drop off window
- Unit supported on 1-5/8" diameter 16 gauge wall polished stainless steel tubular legs with *fully welded* 1-5/8" cross bracing
- Frame is enclosed with 16-gauge stainless steel #4 finish panels with no visible attaching hardware at drop off window
- Simple bolt up installation
- Load-carry of Carriers is 100lbs. each
- **Tray or Tray-less application**



MAINTENANCE FREE CHAIN DESIGN

Our rotary accumulator is a SPROCKETLESS design that is virtually maintenance free. This exclusive maintenance free chain never has to be adjusted in order to maintain operation. A heavy-duty low friction conveyor chain, consisting of load bearing and guiding wheels, rides in a heavy-duty stainless steel enclosed track on the straight and curve sections.

SPECIFIER STATEMENT

Every system is designed, built and tested by the same team to ensure the highest of quality. The Bi-Line Accumulator utilizes Caterpillar stainless steel chain supported in a thick stainless steel tube that will prevent stretching therefore not needing maintenance and carries a standard 5 year warranty. Standard drop off table and sight and sound barrier make the accumulator pleasing and quiet from the cafeteria. A variable speed control is standard in the NEMA 4 rated control panel.

Bi-Line • 3765 Champion Blvd., Winston-Salem, NC 27105
 Tel: 336/661-1556 Fax: 336/661-1979

2674 N. Service Rd., Jordan Station, Ontario, Canada L0R 1S0
 Tel: 800/263-5798 Fax: 905/562-4618

(1M) 1/13 Printed in U.S.A.

Champion®
 INTEGRATED SYSTEMS

www.bilineconveyors.com





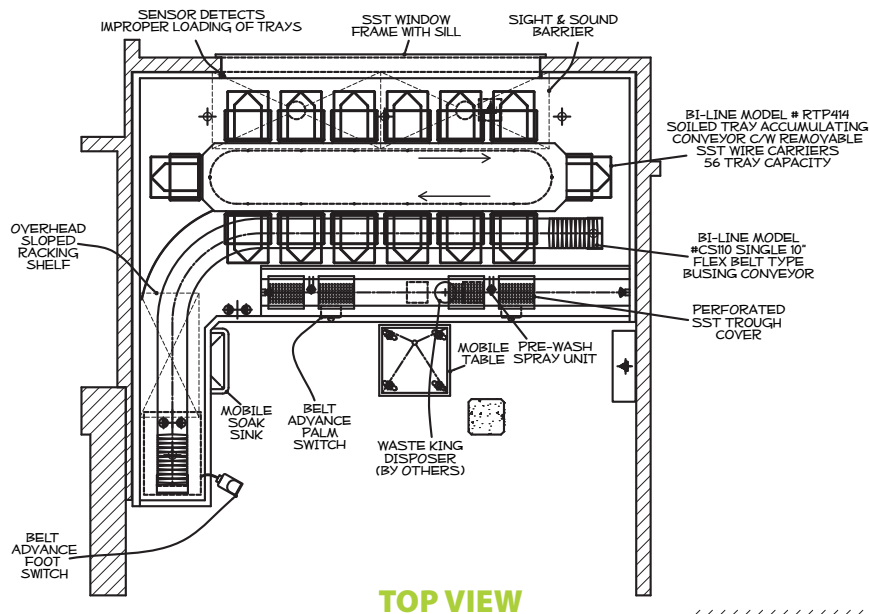
Accumulators

RTP – Projection Style

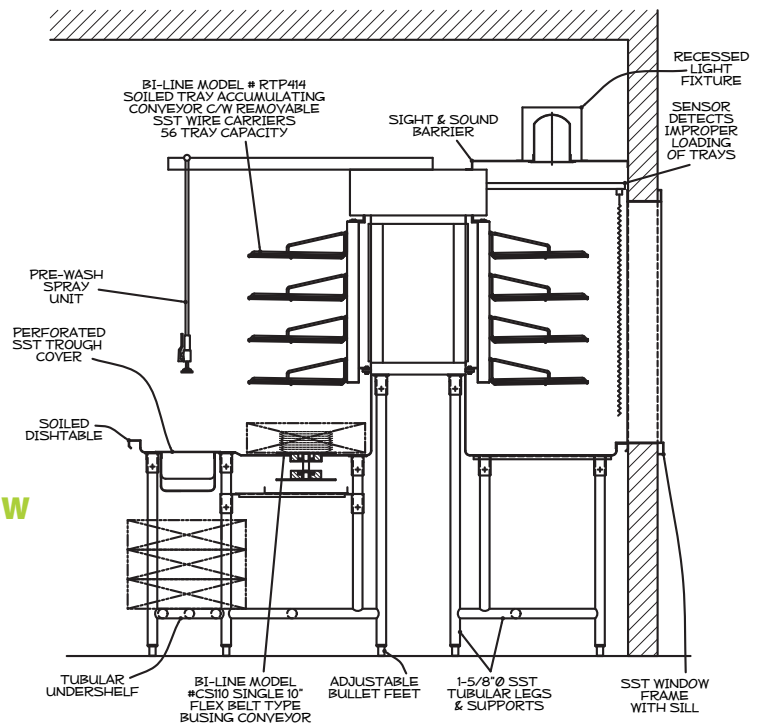
RTS – Slim Line Style

VA – Vertical Accumulator

RTP – PROJECTIONS STYLE



SIDE VIEW



Champion[®]
INTEGRATED SYSTEMS

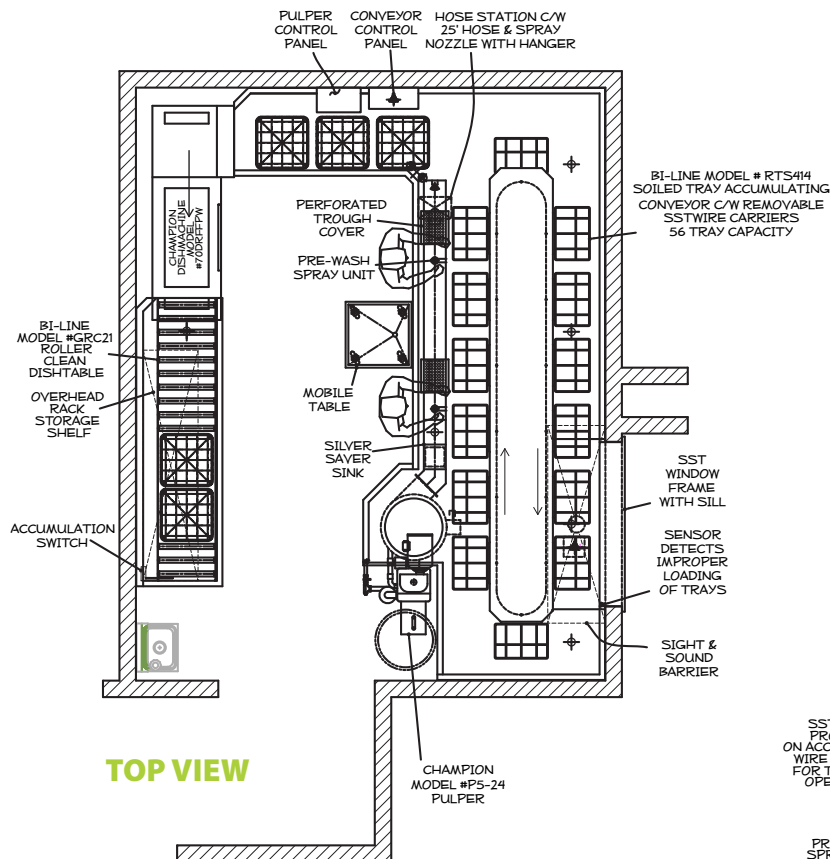
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Accumulators

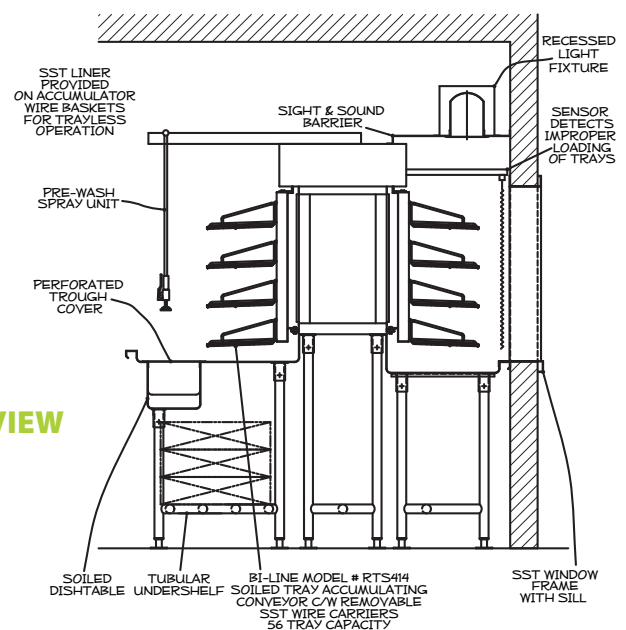
RTP – Projection Style
RTS – Slim Line Style
VA – Vertical Accumulator

RTS – SLIM LINE STYLE



TOP VIEW

SIDE VIEW



Champion
INTEGRATED SYSTEMS

www.bilineconveyors.com

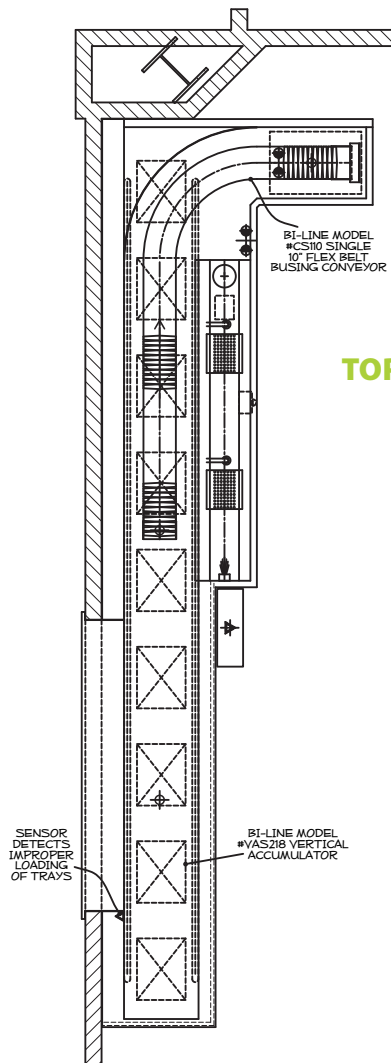




Accumulators

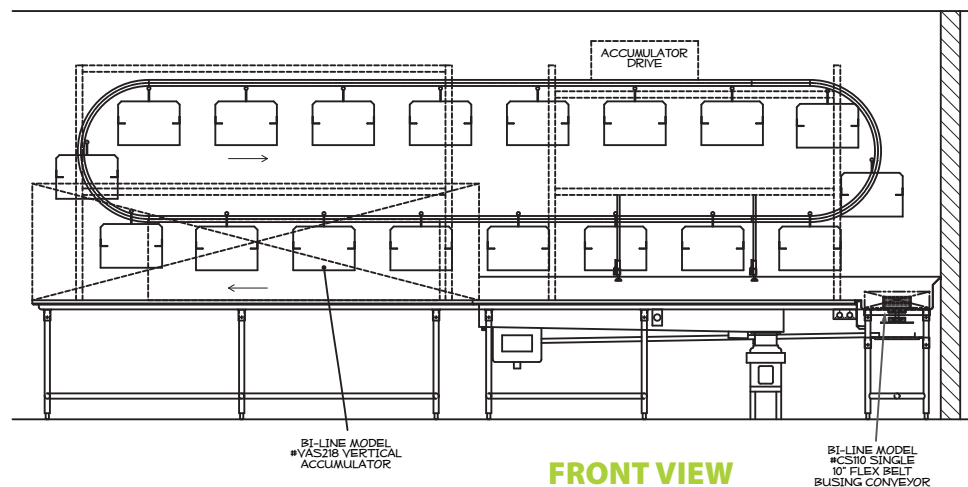
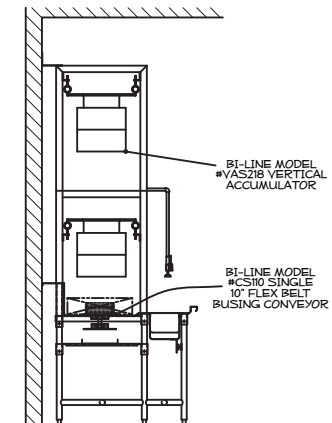
RTP – Projection Style
RTS – Slim Line Style
VA – Vertical Accumulator

VA – VERTICAL ACCUMULATOR



TOP VIEW

SIDE VIEW



FRONT VIEW



Champion[®]
INTEGRATED SYSTEMS

www.bilineconveyors.com





Accumulators

RTP – Projection Style

RTS – Slim Line Style

VA – Vertical Accumulator

OPTIONS & ACCESSORIES

- ☐ Custom size and shape per plan
- ☐ Select the number of carriers (minimum 8 carriers)
- ☐ 1, 2, 3, 4, or 5 tiers for carries
- ☐ Stainless steel liners for each tier (tray-less operation)
- ☐ Slim or projection style operation
- ☐ Obstruction free pre-rinse sprays
- ☐ Integral trough
- ☐ Mobile tables
- ☐ Sliding work shelves
- ☐ Seismic bolt down feet
- ☐ Gushers at drop off window
- ☐ Mobile soak sink
- ☐ Full tabling at drop off window
- ☐ Perforated pan at drop off window
- ☐ Skate wheels (for trough)
- ☐ Wash down hose with reel
- ☐ Trough magnets
- ☐ Trough bridges
- ☐ Disposer cover for trough



Pre-rinse spray



Stainless steel liners



Control panel



Champion
INTEGRATED SYSTEMS

www.bilineconveyors.com



TITAN STAINLESS

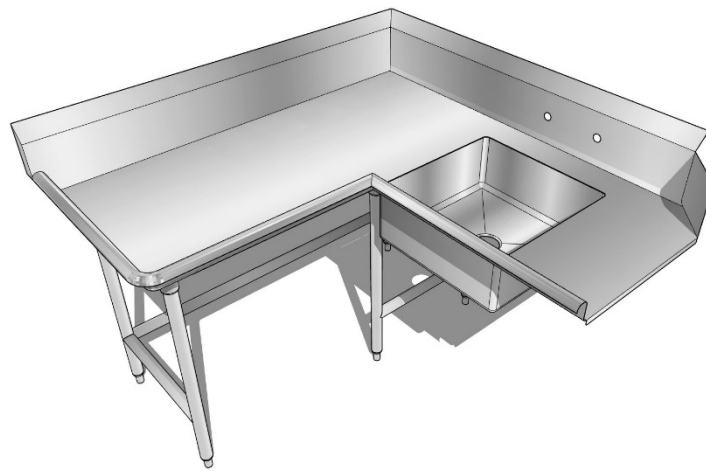
CUSTOM FOODSERVICE FABRICATION

502 Usher Street · Pageland, SC · 704-243-8717 · www.titan-stainless.com



SOILED DISHTABLE – CORNER STYLE – LEFT SIDE OF MACHINE

TITAN STAINLESS Dishtables are made using all-welded heavy gauge stainless steel construction. Assembly is not required; however, equipment can be disassembled for convenience. The backs of the tables are formed into a 9" tall x 2" thick backsplash with angled top; all other edges feature our standard 3"H raised rolled edge. Dishmachine opening is 20-3/4" standard. Reinforcing channels are applied to the underside of the top and sealed with double-sided sound dampening tape. A 20" x 20" x 8" pre-rinse sink bowl is provided along with 8" O.C. faucet holes in the backsplash (plumbing components are not provided). 1-5/8" diameter tubing is fitted into stainless steel leg sockets, which are welded to reinforcement below, preventing surface imperfections. Legs are removable, and furnished with adjustable stainless steel bullet feet. 1-5/8" diameter cross-rails are welded to the table legs. All welds are ground and polished to a smooth finish.

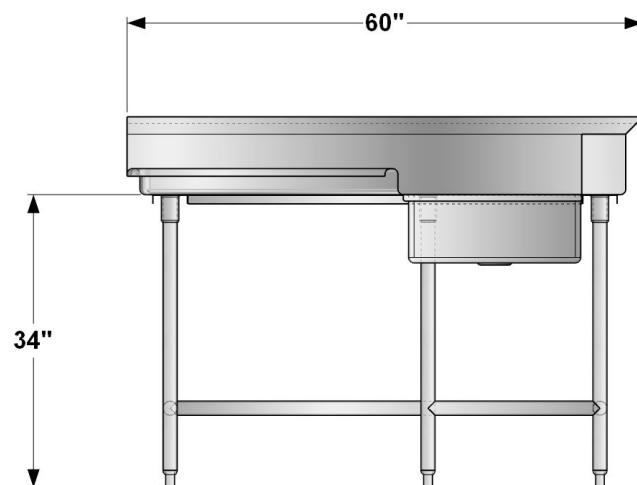
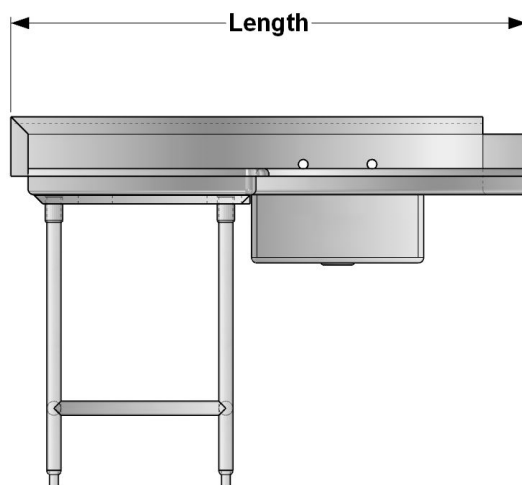


MODEL NUMBER SELECTION / INFORMATION

(Example #: 5SDT-L-CS)

Corner-style dishtables are available in standard lengths from 3'-0" to 10'-0", in 1-foot increments, at the *dishmachine* side of the table—the other length of the table is 60" standard. Standard width is 30" to accommodate standard commercial dishmachines. Additional legs may be added as required, as dictated by the length.

- See **AutoQuotes™** for full list of model numbers and pricing, along with all additional accessories
- Custom sizes and configurations are available upon request



TITAN STAINLESS

502 Usher Street · PO Box 8 · Pageland, SC 29728
Contact: 704-243-8717 · quotes@titan-stainless.com · www.titan-stainless.com





T&S BRASS AND BRONZE WORKS, INC.

2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

Model No.

B-0133

Item No.

This Space for Architect/Engineer Approval

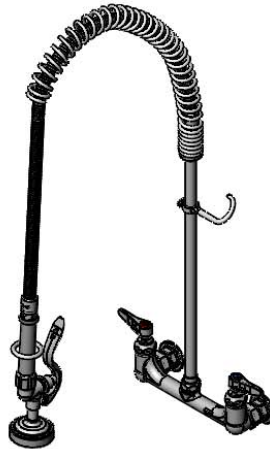
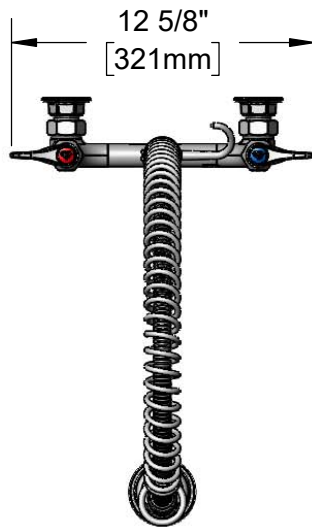
Job Name _____ Date _____

Model Specified _____ Quantity _____

Customer/Wholesaler _____

Contractor _____

Architect/Engineer _____



44" Flexible Stainless Steel Hose w/ Spring & Spray Valve

Items Not Shown for Clarity

Finger Hook

3/8" NPT x 18" Riser

Quarter-Turn Eterna Cartridges w/ Spring Checks & Lever Handles w/ Color Coded Indexes

Ø 2" [51mm] Flanges w/ 1/2" NPT Female Inlets

EasyInstall Lock Nut & Bushing

3 11/16" [94mm]

8" [203mm]

Adjustable From 7 3/4" to 8 1/4" [197mm to 210mm]

3 3/4" [95mm]

B-0107 1.15 GPM Spray Valve

14 1/16" [357mm]

2 3/8" [61mm]

Mounting Surface

33 3/8" [848mm]

Product Specifications:

Pre-Rinse Unit: EasyInstall 8" Wall Mount Mixing Faucet, Quarter-Turn Eterna Cartridges w/ Spring Checks, Lever Handles, 44" Flexible Stainless Steel Hose, 1.15 GPM Spray Valve & 1/2" NPT Female Inlets

Product Compliance:

ASME A112.18.1 / CSA B125.1
NSF 61 - Section 9
NSF 372 (Low Lead Content)
2019 DOE PRSV - Class II

Drawn: MRC Checked: JRM Approved: JHB Date: 06/18/20

Scale: 1:8 Sheet: 1 of 2



T&S BRASS AND BRONZE WORKS, INC.

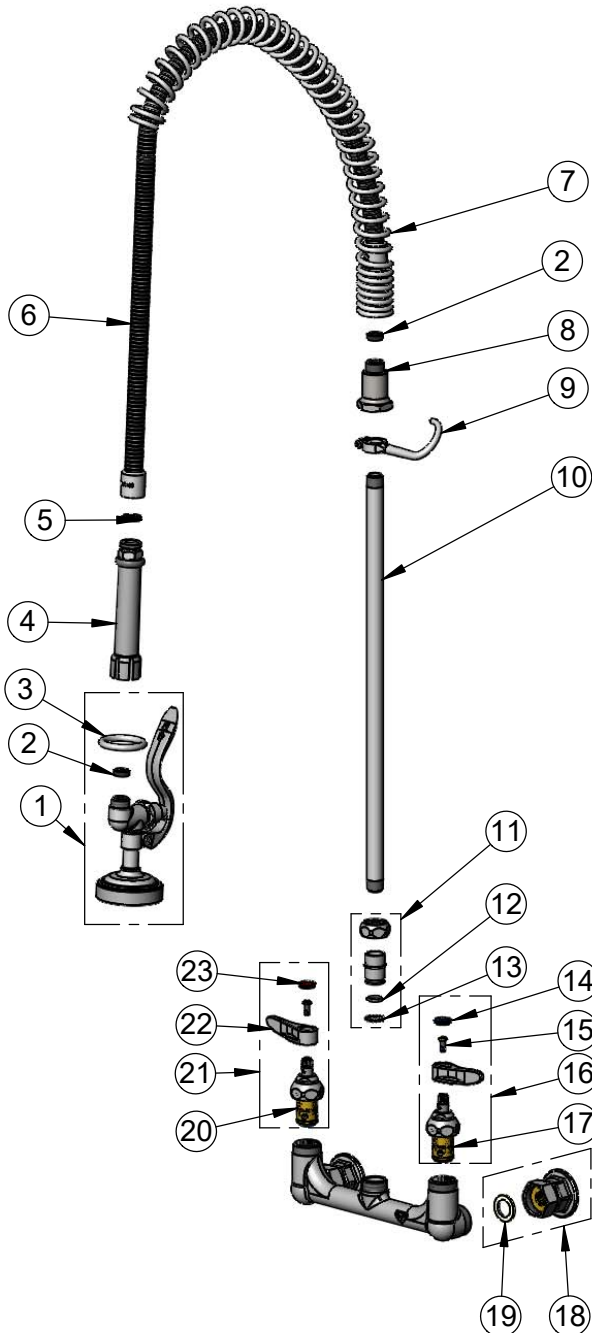
2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690

Model No.

B-0133

Item No.

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com



ITEM NO.	SALES NO.	DESCRIPTION
1	B-0107	1.15 GPM Spray Valve
2	010476-45	#27 Washer
3	000907-45	Spray Valve Hold Down Ring
4	002987-40	Grip Handle
5	001014-45	Washer, B-0100 Hose Barrel
6	B-0044-H2A	44\" Stainless Steel Flexible Hose, Less Handle
7	000888-45	EasyInstall Overhead Spring
8	000821-40	Spring Body
9	004R	Finger Hook
10	000369-40	3/8\" NPT x 18\" Riser
11	EZ-K	EasyInstall Kit
12	001065-45	O-Ring
13	014200-45	Star Washer, Anti-Rotation
14	018506-19NS	Blue Button Index, Press-in
15	000925-45	Lab Handle Screw
16	002711-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, Handle, Blue Index & Screw, LTC
17	012442-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, LTC
18	00AA	1/2\" NPT Female Eccentric Flange
19	001019-45	Coupling Nut Washer
20	012443-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, RTC
21	002712-40NS	Quarter-Turn Eterna Cartridge w/ Spring Check, Handle, Red Index & Screw, RTC
22	001638-45NS	Lever Handle (New Style)
23	001193-19NS	Red Button Index, Press-in

Product Specifications:

Pre-Rinse Unit: EasyInstall 8\" Wall Mount Mixing Faucet, Quarter-Turn Eterna Cartridges w/ Spring Checks, Lever Handles, 44\" Flexible Stainless Steel Hose, 1.15 GPM Spray Valve & 1/2\" NPT Female Inlets

Product Compliance:

ASME A112.18.1 / CSA B125.1
NSF 61 - Section 9
NSF 372 (Low Lead Content)
2019 DOE PRSV - Class II


T&S BRASS AND BRONZE WORKS, INC.

 2 Saddleback Cove / P.O. Box 1088
 Travelers Rest, SC 29690

Model No.

B-0109-01

Item No.

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This Space for Architect/Engineer Approval

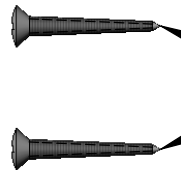
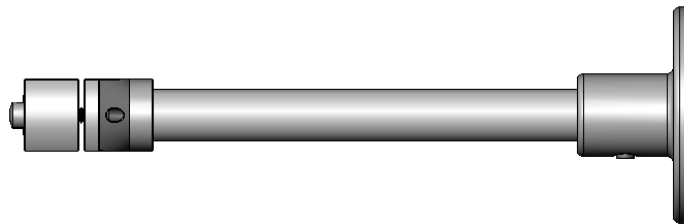
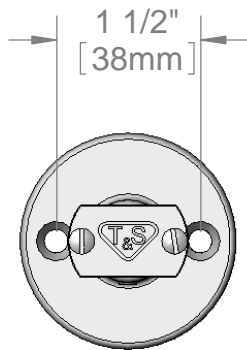
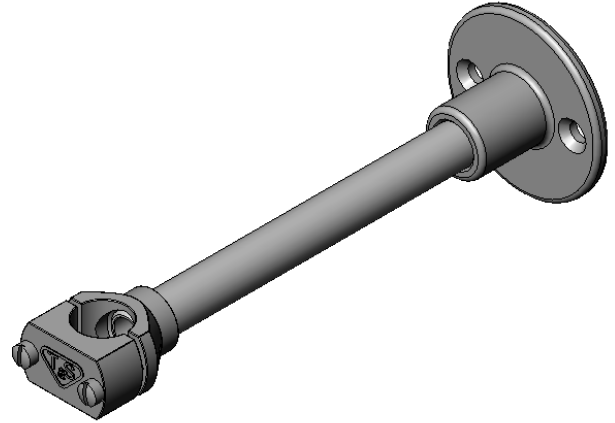
Job Name _____ Date _____

Model Specified _____ Quantity _____

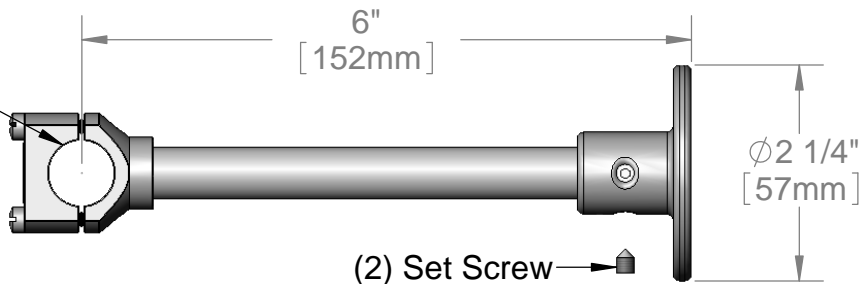
Customer/Wholesaler _____

Contractor _____

Architect/Engineer _____


 Chrome Plated Brass Wood Screws
 for Wall Mounting (Included)

Fits 3/8" Pipe


Product Specifications:
**6" Wall Bracket Assembly for 3/8" Pipe
 w/ Mounting Hardware**

Drawn

JRM

Checked

KJG

Approved

JHB

Scale:

1:2

Date:

06/02/14

Sheet: 1 of 1



PROJECT: _____
 ITEM # _____ QTY: _____
 MODEL # _____
 AIA # _____ SIS # _____

44 PRO-E

HIGH TEMPERATURE ELECTRIC RACK CONVEYOR



Rendered image is for general visual representation only. Please refer to specifications for the latest detailed product information.

STANDARD FEATURES

- **Perpetual Rack Advance System**
with digital jam monitoring, and mechanical drive protection
- **Automated Delime Function**
with user-customizable alert intervals
- **209 Racks Per Hour**
- **0.48 Gallons/Rack With Energy Sentinel** (idle pump shut-off)
- **Advanced Touchscreen Display**
intuitive condition alerts, with user friendly cleaning and operation visual guidance, multi-lingual
- **Enhanced Visual On-board Diagnostics**
quickly identify machine faults for rapid resolution and less downtime
- **Automatic Tank Fill**
- **Programmable Machine Dwell**
pauses rack in wash zone for extended cleaning, NSF Certified Pot & Pan Mode
- **Automatic Drain Valve**
- **Single-Piece Hood Design**
- **Single-Piece Scrap Screen**
more robust and faster cleaning
- **Single-Piece Stainless Steel Upper And Lower Wash Arm Manifolds**
- **Single-Point Electrical Connection**
- **20" Standard Vertical Clearance**
accommodates 18" x 26" sheet pans
- **Fully Insulated Doors**
open a full 180° for unrestricted cleaning access
- **All Stainless Steel Heavy Gauge Construction**
including base, legs and feet
- **Enclosure Panels** (front and sides)
- **2 HP Pump Motor** with stainless steel impeller
- **Factory Authorized Start-Up**
- **Vent Fan Control**
- **ENERGY STAR® Certified**
- **Made in America**



SPECIFIER STATEMENT

Specified unit will be Champion model 44 PRO Series high temperature rack conveyor dishwashing machine. Features top mounted prodigy HMI user interface controls with proactive maintenance software, proportional rinse, using only 100 GPH, optional built-in 21kW booster, progressive anti-jam drive system, energy sentinel (idle pump shut-off), 209 racks per hour, single-piece hood design, single-piece stainless steel upper & lower wash arms manifolds, full 180° opening leak proof insulated hinged access doors.

1 Year parts and labor warranty.

In the USA:

3765 Champion Blvd, Winston-Salem, NC 27105
 Tel: (336) 661-1556 Fax: (336) 661-1979
www.championindustries.com

In Canada:

2674 N. Service Rd., Jordan Station, Ontario, Canada L0R1S0
 Tel: (905) 562-4195 Fax: (905) 562-4618
www.championindustries.com/1canada

Champion®

The Dishwashing Machine Specialists

44 PRO-E

HIGH TEMPERATURE ELECTRIC RACK CONVEYOR

ACCESSORIES

- ☐ Drain water tempering kit (unmounted)
- ☐ Table limit switch, unmounted (recommended on all rack conveyor installations) (unmounted)
 - o WHISKER STYLE
 - o BUTTON STYLE
- ☐ Vent cowl, stainless steel with 7" stacks & locking dampers
- ☐ Extended vent cowl, with 7" stacks, locking dampers & external curtain
- ☐ Flanged feet (unmounted)
- ☐ Water hammer kit (unmounted)
- ☐ Chemical pump kit (detergent and rinse aid, mounted and interwired)
- ☐ Water pressure regulating valve (unmounted; standard with booster)
- ☐ ION scale prevention device (unmounted)
- ☐ Water softening system (manufactured, warrantied and serviced by Kinetico)
- ☐ Dish racks:
 - o PEG RACK
 - o FLAT RACK
 - o SHEET PAN RACK
- ☐ Splash shields
- ☐ Cantilever sideloader (without hood) for 90° load operation
 - o 24" SIDELOAD
 - o 30" SIDELOAD (ACCEPTS SHEET PANS)
- ☐ Model PRO-90B unloader (90° corner conveyor table)
- ☐ Model PRO-90B loader (90° corner conveyor table)
- ☐ Model RCT 64 or RCT 84 roller conveyor table (see factory for custom length)
- ☐ Stainless steel rear enclosure panels
- ☐ Correctional package (contact factory)

OPTIONS

- ☐ Two-point electrical connection, separate for machine and booster (field convertible)
- ☐ 33" Blower dryer – electric
- ☐ Booster heaters (completely interplumbed, controls are interwired)
 - o 40°F RISE (BUILT-IN) (FIELD CONVERTED)
 - o 70°F RISE (BUILT-IN)
- ☐ Direct link connectivity solution
- ☐ Direct link plus+ connectivity solution

**Cantilever
Sideloader**
(no hood)



PRO-90B
90° Corner Conveyor
table loader and
unloader available



Model RCT 64 or RCT 84
Roller conveyor table



In the USA: 3765 Champion Blvd, Winston-Salem, NC 27105 | Tel: (336) 661-1556 Fax: (336) 661-1979 | www.championindustries.com

In Canada: 2674 N. Service Rd., Jordan Station, Ontario, Canada L0R1S0 | Tel: (905) 562-4195 Fax: (905) 562-4618 | www.championindustries.com/1canada



44 PRO-E

HIGH TEMPERATURE ELECTRIC RACK CONVEYOR

UTILITIES

1	Electrical Connections Machine electrical connection and booster electrical connection
2	Hot Water Machine with built-in booster Main connection 1/2" NPT 110° incoming water
4	Hot Water Machine with no booster Main water connection 1/2" NPT 180° incoming water
5A	Drain Connection 1-1/4" NPT Drain Max Flow Rate (g/min) 15
8	Vents A Stack connection – load end 200 CFM @ 1/4" static pressure B Stack connection – unload end 400 CFM @ 1/4" static pressure

Warning: Plumbing and electrical connections should be made by qualified personnel who will observe all the applicable plumbing, sanitary, and safety codes and the National Electrical Code.

Note: Water Hammer Arrestor (meeting ASSE-1010 standard or equivalent) to be supplied (by others) in common water supply line at service connection.

Plumbing Notes: Because of the variation in house-supplied steam and water pressures, steam and water pressure regulating valves (PRVs) may be needed. (Water PRV is standard on machines with booster.) The PRVs can either be purchased from Champion or obtained locally.

Water hardness of 3 grains/US Gal (0.83 Imp Gal) – 5.3 Mg/L or less

Venting Notes: Fabricated duct size: 3-7/8" x 15-7/8" (outside dimensions)

Optional Drain Tempering: 1/2" NPT cold water connection required. 1/2" NPT drain connection from back flow preventer to house drain. (FIELD INSTALLED and PLUMBED).

SPECIFICATIONS

Capacity	
Racks per hr (NSF rated)	209
Wash tank (US gal.)	17
Conveyor speed (ft/min)	5.8
Conveyor speed Pot/Pan Mode (ft/min) (only one rack at a time in pot/pan)	4.5
Motor Horsepower	
Drive	1/6
Wash	2
Water Consumption	
US Gal. per hr (max. use)	100
US Gal. per rack	0.48
Heating	
Tank Heat, electric (kW)	15
Electric booster (built-in) (kW supplied for 40°F rise)	12
Electric booster (built-in) (kW supplied for 70°F rise)	21
Booster heaters completely inter plumbed, controls are interwired.	
Venting	
Load end (minimum CFM)	200
Unload end (minimum CFM)	400
Standard 20"x 20" Rack Complement	
Peg	1
Flat	1

Single Tank PRO Rack Machine and Booster Ratings

The tables below give the ratings for each model. The ratings include the requirements of the 12 and 21 kW booster heaters when they are in use.

Machines with a single point electrical connection:

44 PRO Electric Tank Heat, 21 kW 70° Booster			
Elec. Specs	Rated Amps	Minimum Supply Ckt. Conductor Ampacity	Maximum Overcurrent Protective Device
208/60/3	111	150	150
240/60/3	96	125	125
480/60/3	47	60	60
575/60/3	40	50	50

44 PRO Electric Tank Heat, 12 kW 40° Booster			
Elec. Specs	Rated Amps	Minimum Supply Ckt. Conductor Ampacity	Maximum Overcurrent Protective Device
208/60/3	85	110	110
240/60/3	74	100	100
480/60/3	36	50	50
575/60/3	31	40	40

44 PRO Electric Tank Heat, No Booster			
Elec. Specs	Rated Amps	Minimum Supply Ckt. Conductor Ampacity	Maximum Overcurrent Protective Device
208/60/3	52	70	70
240/60/3	45	60	60
480/60/3	22	30	30
575/60/3	19	25	25

Machines with a dual point electrical connection:

44 PRO Electric, 21 kW Booster Only			
Elec. Specs	Rated Amps	Minimum Supply Ckt. Conductor Ampacity	Maximum Overcurrent Protective Device
208/60/3	59	80	80
240/60/3	51	70	70
480/60/3	26	35	35
575/60/3	22	30	30

44 PRO Electric, 12 kW Booster Only			
Elec. Specs	Rated Amps	Minimum Supply Ckt. Conductor Ampacity	Maximum Overcurrent Protective Device
208/60/3	34	45	45
240/60/3	29	40	40
480/60/3	15	20	20
575/60/3	12	15	15

Note:

Machine ships as a single point electrical connection standard. Easily converted to a dual point connection by a qualified electrician.

In the USA: 3765 Champion Blvd, Winston-Salem, NC 27105 | Tel: (336) 661-1556 Fax: (336) 661-1979 | www.championindustries.com

In Canada: 2674 N. Service Rd., Jordan Station, Ontario, Canada L0R1S0 | Tel: (905) 562-4195 Fax: (905) 562-4618 | www.championindustries.com/Canada

Champion®
The Dishwashing Machine Specialists

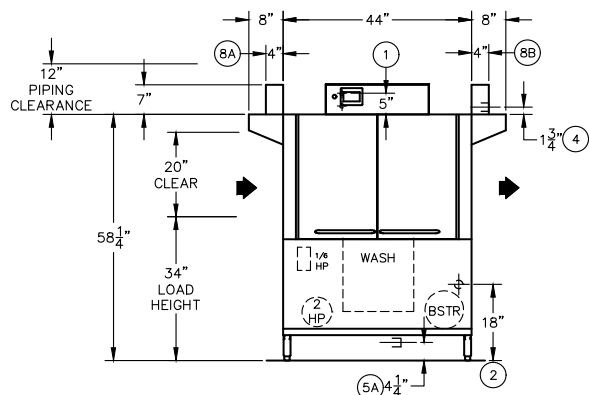
44 PRO-E

HIGH TEMPERATURE ELECTRIC RACK CONVEYOR

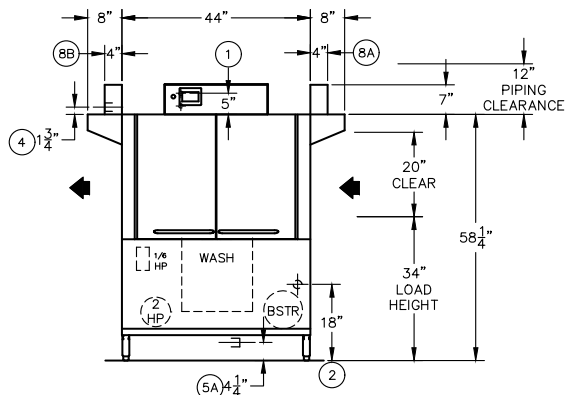
Shipping weight crated: 600 lbs. Dimensions shown in inches

Front View

Left to Right Model

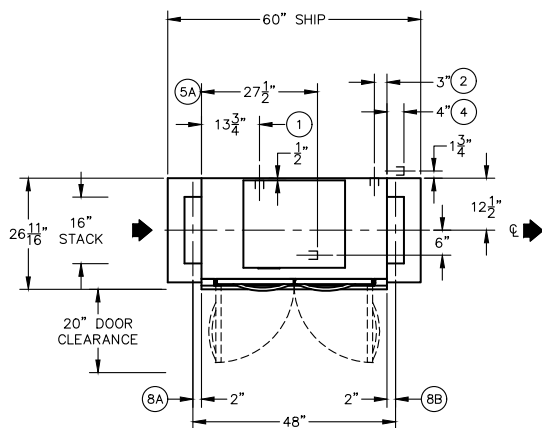


Right to Left Model

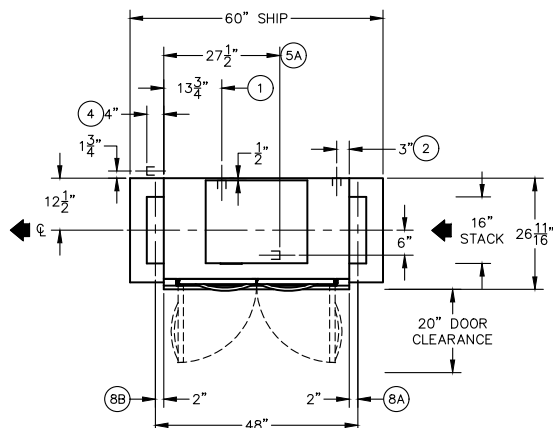


Plan View

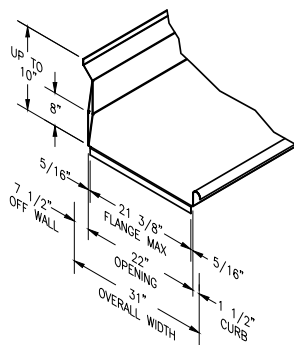
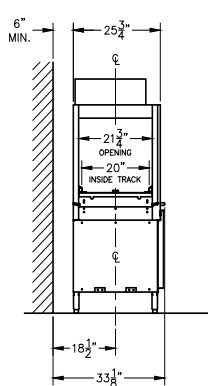
Left to Right Model



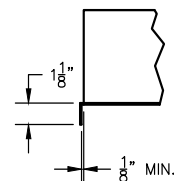
Right to Left Model



End View



Suggested Table Construction



Flange Details

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In Canada: 2674 N. Service Rd., Jordan Station, Ontario, Canada LORISO | Tel: (905) 562-4195 Fax: (905) 562-4618 | www.championindustries.com/1canada

Rev. 08/2024 Printed in U.S.A.

Due to an ongoing value analysis program at Champion, specifications contained in this catalog are subject to change without notice.

TITAN STAINLESS

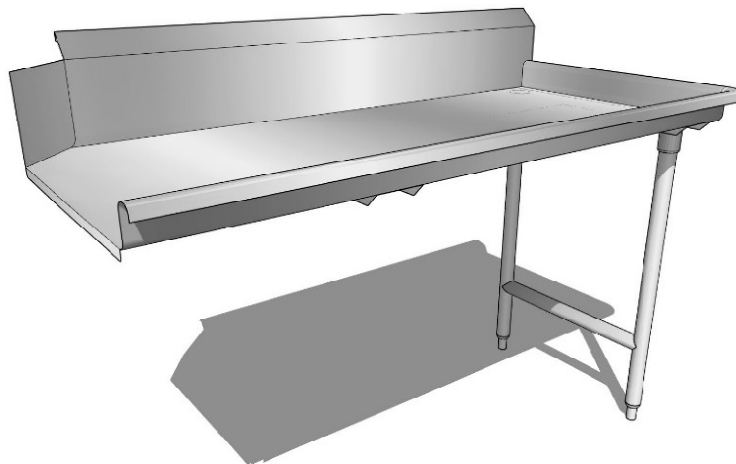
CUSTOM FOODSERVICE FABRICATION

502 Usher Street · Pageland, SC · 704-243-8717 · www.titan-stainless.com



CLEAN DISHTABLE – RIGHT SIDE OF MACHINE

TITAN STAINLESS Dishtables are made using all-welded heavy gauge stainless steel construction. Assembly is not required; however, equipment can be disassembled for convenience. The backs of the tables are formed into a 9" tall x 2" thick backsplash with angled top; all other edges feature our standard 3"H raised rolled edge. Dishmachine opening is 20-3/4" standard. Reinforcing channels are applied to the underside of the top and sealed with double-sided sound dampening tape. 1-5/8" diameter tubing is fitted into stainless steel leg sockets, which are welded to reinforcement below, preventing surface imperfections. Legs are removable, and furnished with adjustable stainless steel bullet feet. 1-5/8" diameter cross-rails are welded to the table legs. All welds are ground and polished to a smooth finish.

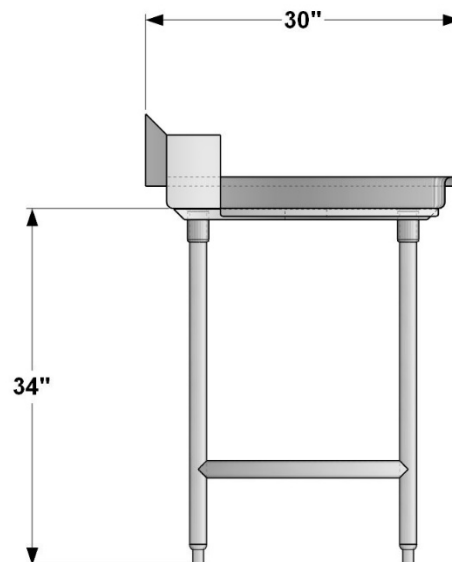
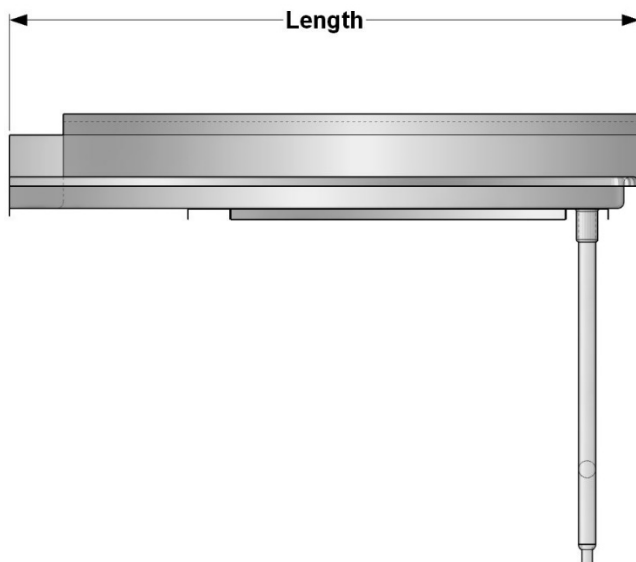


MODEL NUMBER SELECTION / INFORMATION

(Example #: 5CDT-R)

Dishtables are available in standard lengths from 3'-0" to 10'-0", in 1-foot increments. Standard width is 30" to accommodate standard commercial dishmachines. Units over 6'-0" long will be furnished with an additional set of legs.

- See **AutoQuotes™** for full list of model numbers and pricing, along with all additional accessories
- Custom sizes and configurations are available upon request



TITAN STAINLESS

502 Usher Street · PO Box 8 · Pageland, SC 29728
Contact: 704-243-8717 · quotes@titan-stainless.com · www.titan-stainless.com





SPEC SHEET

"BHS-TS" SORTING SHELVES

Tubular Construction, Wall Mount

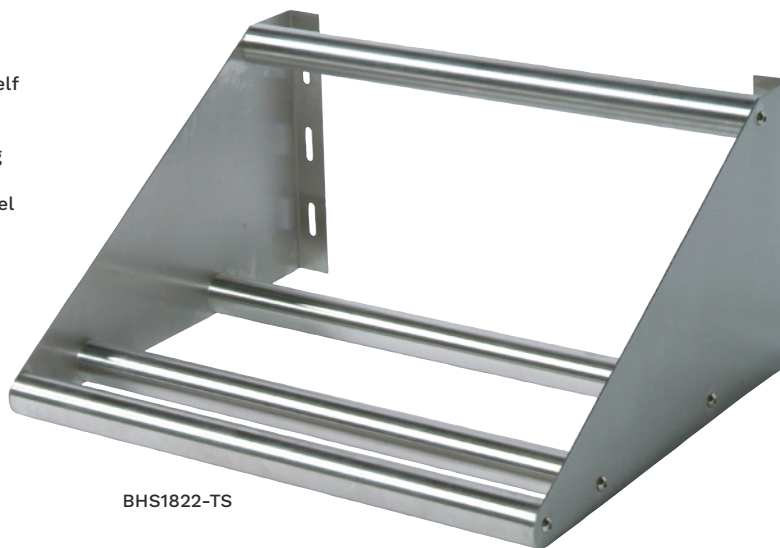
FEATURES:

- Dual Purpose Open Design, Wall Mounted Sorting Shelf

SPECIFICATIONS:

- Unit Is Shipped With Assembly Hardware, No Welding
- Brackets: 16GA Type 300 Stainless Steel
- Tubing: 1-5/8" Diameter 16GA Type 300 Stainless Steel

CERTIFICATIONS:



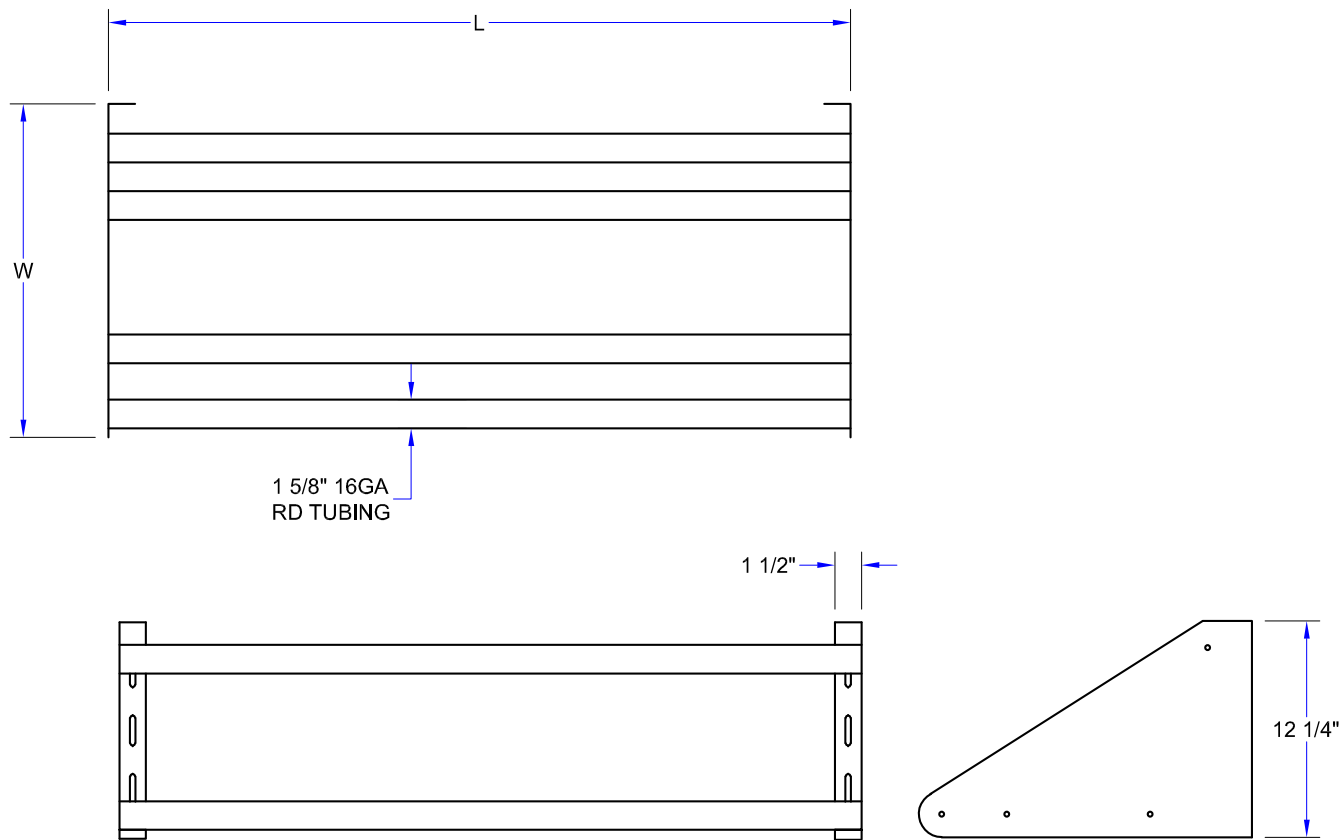
BHS1822-TS

"BHS-TS" SORTING SHELVES

MODEL	SIZE (L X W X H)	WEIGHT (LBS)
BHS1822-TS	22"x 18"x 12-1/4"	20
BHS1842-TS	42"x 18"x 12-1/4"	23
BHS1863-TS	63"x 18"x 12-1/4"	35
BHS1882-TS	82"x 18"x 12-1/4"	38

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

DETAILED SPECIFICATIONS



"BHS-TS" SORTING SHELVES

MODEL	SIZE (L X W X H)	WEIGHT (LBS)
BHS1822-TS	22"x 18"x 12-1/4"	20
BHS1842-TS	42"x 18"x 12-1/4"	23
BHS1863-TS	63"x 18"x 12-1/4"	35
BHS1882-TS	82"x 18"x 12-1/4"	38

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.



**John
BOOS**
Since 1887

ITEM #: _____ QTY: _____

MODEL #: _____

PROJECT NAME: _____

07302018

3601 S. Banker St. Effingham, IL 62401 • P.O. BOX 609 • Ph: (888) 431-2667 • Fax: (800) 433-2667

"PB-SS" MOBILE SOAK SINK

FEATURES:

- STANDARD 16 GAUGE STAINLESS STEEL CONSTRUCTION
- TYPE 300 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- ALL CORNERS, BOTH VERTICAL AND HORIZONTAL, COVED AT 5/8" RADIUS
- BOTTOMS OF BOWLS FORMED FOR DRAINAGE TO 3-1/2"
- DIAMETER DIE STAMPED OPENING
- TOP IS FINISHED W/ A 1-1/2" X 1" **NO-DRIP EDGE** W/ A 2"
- TURN DOWN ON ALL SIDES
- STANDARD LEGS 1-5/8" DIAMETER, 16GA STAINLESS STEEL, TYPE 300 STAINLESS STEEL W/ #4 POLISH, SATIN FINISH
- TWIST LEVER WASTE FOR EASY CLEAN IN REMOTE OPERATIONS
- OPTIONAL REMOVABLE CHUTE: SILVER - 16GA STAINLESS STEEL (PB-SS-CHUTE)

CONSTRUCTION:

- TOP: STAINLESS STEEL SINKS ARE TIG WELDED, EXPOSED WELDS ARE POLISHED TO MATCH ADJACENT SURFACE
- BASE: STAINLESS STEEL BASES ARE MIG WELDED

MATERIAL:

- BOWLS & TOP: 16GA TYPE 300 STAINLESS STEEL WITH #4 POLISH, SATIN FINISH
- LEGS: 1-5/8" ROUND O.D. STAINLESS STEEL
- BRACING: 1-1/4" ROUND O.D. STAINLESS STEEL
- GUSSETS: STAINLESS STEEL
- CASTER: 5" SWIVEL



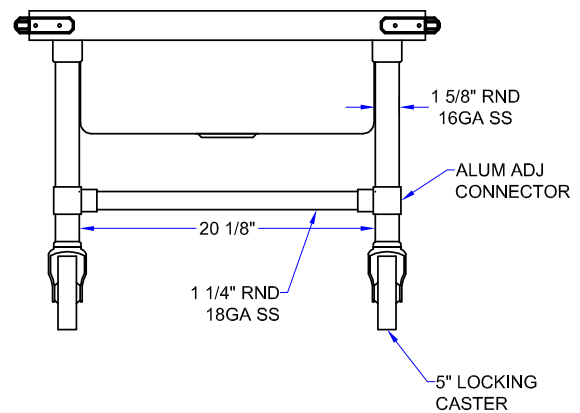
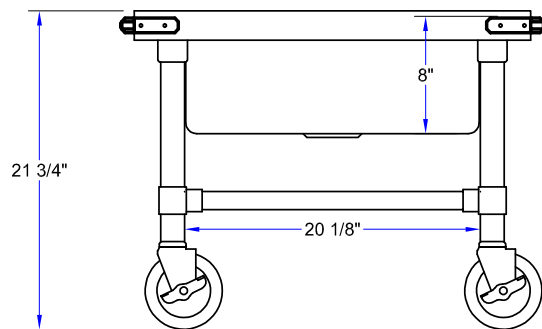
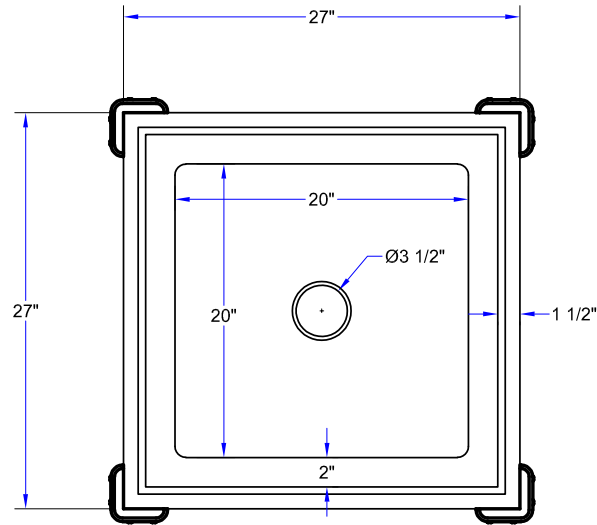
MOBILE SOAK SINK

MODEL	QTY
PB-SS-208	

OPTIONAL ACCESSORIES

DESCRIPTION	QTY
CHUTE	

DETAILED SPECIFICATIONS



MOBILE SOAK SINK

MODEL	BOWL SIZE	DIMENSIONS	WT. (LBS)
PB-SS-208	20" X 20" X 8"	27" X 27" X 21-3/4"	35

SOME UNITS SHIP UNASSEMBLED FOR REDUCED SHIPPING COST. ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500"

John Boos & Co. is constantly engaged in a program of improving products and therefore reserves the right to change specifications without prior notice.



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07302018

603



STAINLESS STEEL

HAND SINKS**ELECTRONIC OPERATED FAUCETS**

Conforms To NSF 61/9 Lead Free Requirements



Space Saver Sink With Side
Splashes Also Available
Click Here!

SPACE SAVER

7-PS-53



7-PS-51



7-PS-61



7-PS-52



7-PS-81



7-PS-91

TOUCHLESS
SOAP DISPENSER



7-PS-131

Item #: _____ Qty #: _____

Model #: _____

Project #: _____

FEATURES:

One piece **Deep Drawn** sink bowl design.

Sink bowl is 10"x14"x5" (Excludes 7-PS-53. Unit has 9"x9"x5" bowl).

"Hands Free" Electronic Faucet makes use of infrared technology to sense the user's presence and immediately turn on water supply that is pre-mixed to desired temp.

Electronic gooseneck faucet is splash mounted and comes complete with AC/DC control module, sensor, 4 "AA" batteries and spout.

All sink bowls have a large liberal radii with a minimum dimension of 2" and are rectangular in design for increased capacity.

Stainless steel basket drain 1 1/2" IPS.

Additional Features:

7-PS-51 & 7-PS-81 lever operated drain and built-in overflow with plastic overflow tube and spring clamps. P-Trap is 1 1/2".

7-PS-81 towel dispenser with hinged towel box. Unit uses standard C-fold towels. Liquid Soap dispenser.

7-PS-52 towel dispenser with hinged towel box. Unit uses standard C-fold towels. Liquid soap dispenser. (Unit does not include overflow, lever drain & P-trap).

7-PS-91 pedestal skirt.

7-PS-131 K-175 electronic faucet, splash mount touchless liquid soap dispenser. 7-3/4" Side Splashes.

CONSTRUCTION:

All TIG welded.

Welded areas blended to match adjacent surfaces & to a satin finish.

Die formed Countertop Edge with a 3/8" No-Drip offset.

One sheet of stainless steel - No Seams.

MATERIAL:

Heavy gauge type 304 series stainless steel.

Electronic Faucet solid brass, chrome plated.

Wall mounting bracket is stainless steel and of offset design.

All fittings are brass / chrome plated unless otherwise indicated.

MECHANICAL:

Electronic faucet is 1/2" male IPS thread.

K-175 Replacement Electronic Operated Faucet.

Faucet Flow Rate: 2.2 GPM/8.3 LPM aerator. 60 PSI.



7-PS-104

HANDS-FREE TOUCHLESS SOAP DISPENSER UPGRADE

- Wall Mounted
 - A/C or Battery Powered (Requires 4 "AA" Batteries. Not Included)
 - Low Soap Indicator Window
 - Includes Wall Bracket & Hardware
 - Uses Liquid Soap
- (Excludes 7-PS-131)



WARNING: Equipment that includes a faucet may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info., visit www.p65warnings.ca.gov.



Customer Service Available To Assist You **1-800-645-3166** 8:30 am - 7:00 pm E.S.T.

For Orders & Customer Service:

Email: customer@advancetabco.com or Fax: 631-242-6900

For Smart Fabrication™ Quotes:

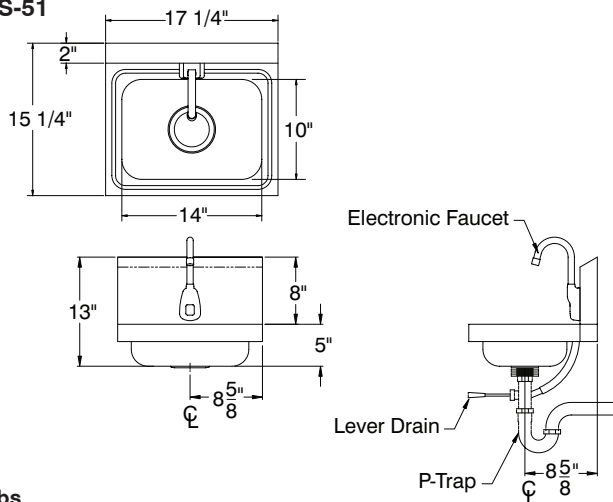
Email: smartfab@advancetabco.com or Fax: 631-586-2933

DIMENSIONS and SPECIFICATIONS

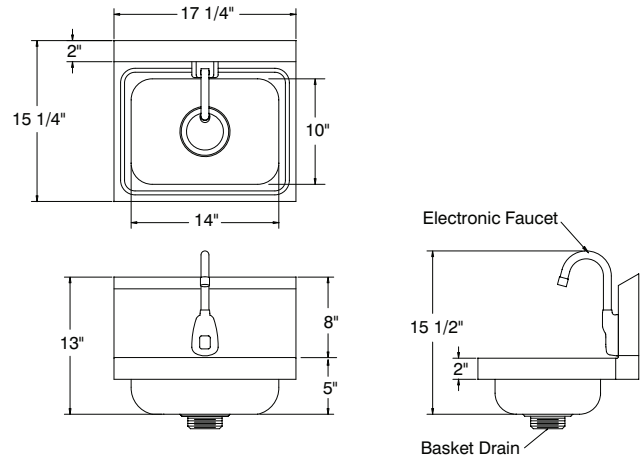
TOL Overall: $\pm .500"$ Interior: $\pm .250"$

FITTINGS SUPPLIED AS SHOWN

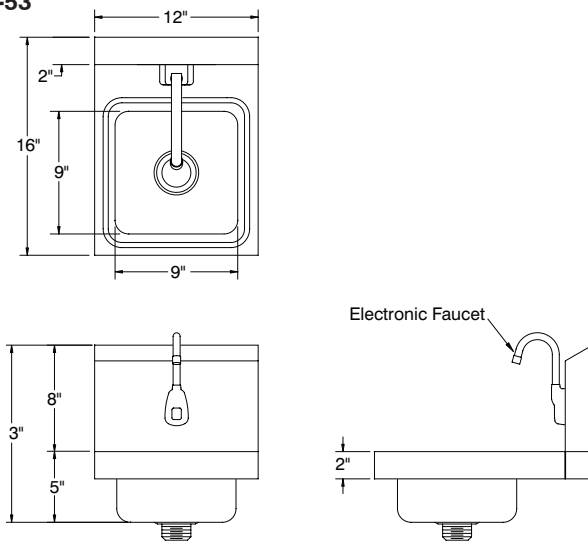
ALL DIMENSIONS ARE TYPICAL

7-PS-51

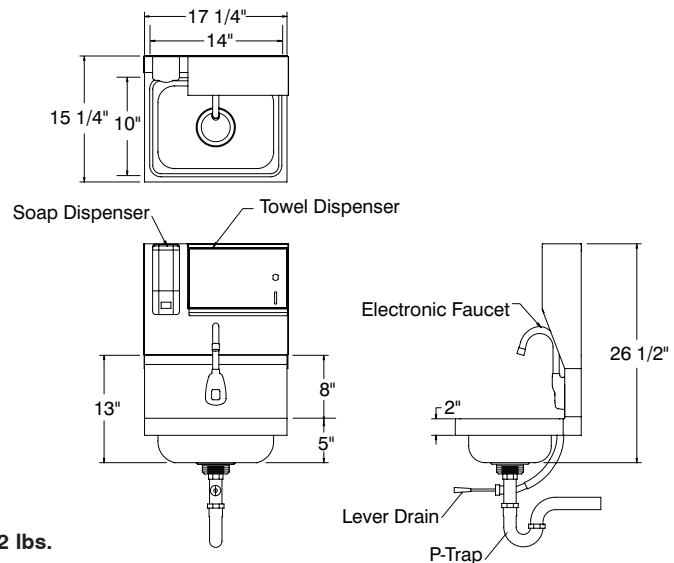
21 lbs.

7-PS-61

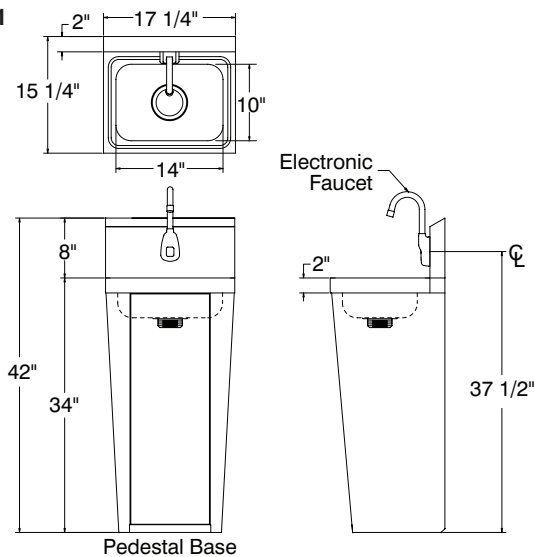
19 lbs.

7-PS-53

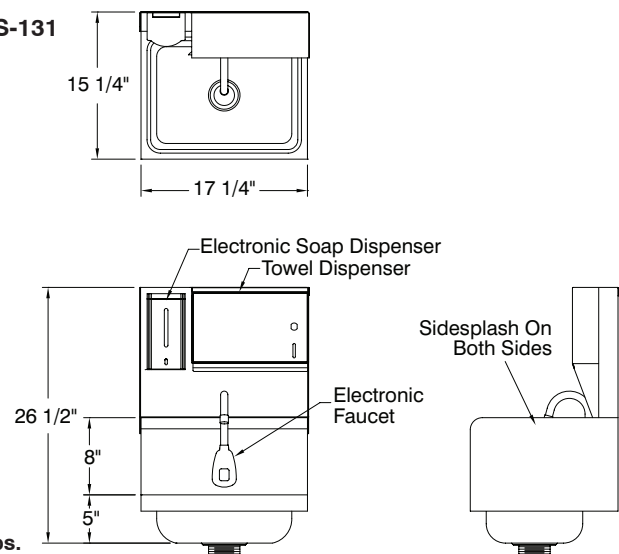
12 lbs.

7-PS-81/7-PS-52 (7-PS-52 Excludes P-Trap, lever Drain & Overflow)

32 lbs.

7-PS-91

41 lbs.

7-PS-131

30 lbs.





Profit from the Eagle Advantage®

Specification Sheet

Short Form Specifications

Eagle Spec-Master® Three-Compartment Sinks, model _____, Unit constructed of 14 gauge 300 series, 18-8 stainless steel throughout. Sink bowls coved with a full $\frac{5}{8}$ " radius, and shall have a 14" water level. Drainboards, when required, shall be "V" creased for positive drainage. 9 $\frac{1}{2}$ " high backsplash with 1" upturn and tile edge. Legs to be 1 $\frac{1}{2}$ " O.D., stainless steel, with stainless steel gussets, stainless steel crossbracing and adjustable stainless steel bullet feet.



3-compartment sink
(faucets not included)

Options / Accessories

- | | |
|--|--|
| <input type="checkbox"/> Lever drain | <input type="checkbox"/> Faucets |
| <input type="checkbox"/> Lever drain with overflow | <input type="checkbox"/> Polyboard sink covers |
| <input type="checkbox"/> Twist handle drains | <input type="checkbox"/> Stainless steel sink covers |
| <input type="checkbox"/> Overflow hole | <input type="checkbox"/> Skirted front panel |
| <input type="checkbox"/> Sink kits | |

Assembly:

- Entire assembly is fuse-welded and planished, providing a one-piece seamless sink unit.
- Welded areas are high-speed belt blended to match adjacent surfaces with continuity of satin finish.
- All outside corners of assembly are bullnosed to provide safe, clean edges.
- Water supply is $\frac{1}{2}$ " (13mm) NPS for hot and cold lines.

EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Item No.: _____
Project No.: _____
S.I.S. No.: _____

Spec-Master® FN Series Coved Corner Three-Compartment Sinks

MODELS:

- | | |
|-------------------------------------|-------------------------------------|
| <input type="checkbox"/> FN2048-3-* | <input type="checkbox"/> FN2472-3-* |
| <input type="checkbox"/> FN2054-3-* | <input type="checkbox"/> FN2860-3-* |
| <input type="checkbox"/> FN2060-3-* | |

* See table on back for complete model numbers.

Top:

- Drainboards, backsplash and rolled rims are 14 gauge 300 series stainless steel.
- Drainboards, when provided, are integrally welded.
- All rolled edges are highlighted for enhanced appearance.
- 9 $\frac{1}{2}$ " high backsplash with 1" upturn and tile edge.
- 1 $\frac{1}{2}$ " (29mm) faucet holes* punched on 8" (203mm) centers.

Base:

- Legs: 1 $\frac{1}{2}$ " (41mm)-diameter stainless steel tubing with stainless steel gussets and fully adjustable stainless steel bullet feet.
- Crossbracing: Adjustable, 1 $\frac{1}{4}$ " (32mm)-diameter stainless steel; running left-to-right and front-to-back.
- Leg locations fall directly under sink bowls**, providing increased stability and maximum weight support.
- Leg gussets welded to a die-cut heavy-gauge stainless steel reinforcing corner plate.
- Legs are crossbraced on all sides for increased stability.

Sink Bowls:

- 14 gauge 300 series stainless steel.
- 14" (356mm) water level, 17" (432mm) flood level.
- Sink compartments are coved on a full $\frac{5}{8}$ " (41mm) radius and constructed using state-of-the-art seamless welding techniques.
- Basket-type waste drain fits sink bowls' 3 $\frac{1}{2}$ " (89mm) opening and features 1 $\frac{1}{2}$ " (38mm) outlet.

* Three-compartment sinks with 20" x 16" (508 x 406mm) bowls have one set of faucet holes. All others feature two sets of faucet holes.

** On sinks with drainboard(s) 30" or longer, legs are located underneath the outer end of drainboard(s).

Certifications / Approvals



AutoQuotes



Spec sheets available for viewing, printing or downloading from our online literature library at www.eaglegrp.com

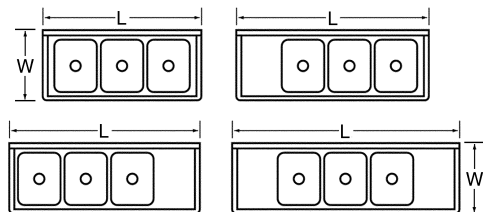
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Profit from the Eagle Advantage®

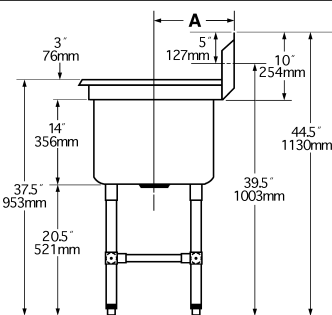
Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

Spec-Master® FN Series Coved Corner Three-Compartment Sinks



Drain location for rough-in

bowl width	bowl length	Dimension A	
in.	mm	in.	mm
20"	508	16"	406
20"	508	18"	457
20"	508	20"	508
24"	610	16"	406
28"	711	20"	508



model #	BOWL DIMENSIONS				DRAINBOARD			OVERALL DIMENSIONS				weight	
	width		length		quantity	length		width		length		lbs.	kg
	in.	mm	in.	mm		in.	mm	in.	mm	in.	mm		
FN2048-3-14/3	20"	508	16"	406	0	-	-	27"	686	57"	1448	99	44.9
FN2048-3-18R or L-14/3	20"	508	16"	406	1	18"	457	27"	686	73½"	1867	118	53.5
FN2048-3-18-14/3	20"	508	16"	406	2	18"	457	27"	686	90"	2286	137	61.7
FN2048-3-24R or L-14/3	20"	508	16"	406	1	24"	610	27"	686	79½"	2019	124	56.2
FN2048-3-24-14/3	20"	508	16"	406	2	24"	610	27"	686	102"	2591	149	67.6
FN2048-3-30R or L-14/3	20"	508	16"	406	1	30"	762	27"	686	85½"	2172	129	58.5
FN2048-3-30-14/3	20"	508	16"	406	2	30"	762	27"	686	114"	2896	159	72.1
FN2048-3-36R or L-14/3	20"	508	16"	406	1	36"	914	27"	686	91½"	2324	134	60.8
FN2048-3-36-14/3	20"	508	16"	406	2	36"	914	27"	686	126"	3200	169	76.7
FN2054-3-14/3 *	20"	508	18"	457	0	-	-	27"	686	63"	1600	102	46.3
FN2054-3-18R or L-14/3 *	20"	508	18"	457	1	18"	457	27"	686	79½"	2019	121	54.9
FN2054-3-18-14/3 *	20"	508	18"	457	2	18"	457	27"	686	96"	2438	140	63.5
FN2054-3-24R or L-14/3 *	20"	508	18"	457	1	24"	610	27"	686	85½"	2172	127	57.6
FN2054-3-24-14/3 *	20"	508	18"	457	2	24"	610	27"	686	108"	2743	158	71.6
FN2054-3-30R or L-14/3 *	20"	508	18"	457	1	30"	762	27"	686	91½"	2324	132	59.9
FN2054-3-30-14/3 *	20"	508	18"	457	2	30"	762	27"	686	120"	3048	162	73.5
FN2054-3-36R or L-14/3 *	20"	508	18"	457	1	36"	914	27"	686	97½"	2477	137	62.1
FN2054-3-36-14/3 *	20"	508	18"	457	2	36"	914	27"	686	132"	3358	172	78.0
FN2060-3-14/3 *	20"	508	20"	508	0	-	-	27"	686	69"	1753	114	51.7
FN2060-3-18R or L-14/3 *	20"	508	20"	508	1	18"	457	27"	686	85½"	2172	133	60.3
FN2060-3-18-14/3 *	20"	508	20"	508	2	18"	457	27"	686	102"	2591	152	68.9
FN2060-3-24R or L-14/3 *	20"	508	20"	508	1	24"	610	27"	686	91½"	2324	139	63.1
FN2060-3-24-14/3 *	20"	508	20"	508	2	24"	610	27"	686	114"	2896	164	74.4
FN2060-3-30R or L-14/3 *	20"	508	20"	508	1	30"	762	27"	686	97½"	2477	144	65.3
FN2060-3-30-14/3 *	20"	508	20"	508	2	30"	762	27"	686	126"	3200	174	78.9
FN2060-3-36R or L-14/3 *	20"	508	20"	508	1	36"	914	27"	686	103½"	2629	149	67.6
FN2060-3-36-14/3 *	20"	508	20"	508	2	36"	914	27"	686	138"	3505	184	83.5
FN2472-3-14/3 *	24"	610	24"	610	0	-	-	31"	787	81"	2057	127	57.6
FN2472-3-18R or L-14/3 *	24"	610	24"	610	1	18"	457	31"	787	97½"	2477	146	66.2
FN2472-3-18-14/3 *	24"	610	24"	610	2	18"	457	31"	787	114"	2896	165	74.8
FN2472-3-24R or L-14/3 *	24"	610	24"	610	1	24"	610	31"	787	103½"	2629	152	68.9
FN2472-3-24-14/3 *	24"	610	24"	610	2	24"	610	31"	787	126"	3200	177	80.3
FN2472-3-30R or L-14/3 *	24"	610	24"	610	1	30"	762	31"	787	109½"	2769	157	71.2
FN2472-3-30-14/3 *	24"	610	24"	610	2	30"	762	31"	787	138"	3505	187	84.8
FN2472-3-36R or L-14/3 *	24"	610	24"	610	1	36"	914	31"	787	115½"	2934	162	73.5
FN2472-3-36-14/3 *	24"	610	24"	610	2	36"	914	31"	787	150"	3810	197	89.4
FN2860-3-14/3 *	28"	711	20"	508	0	-	-	35"	889	69"	1753	130	59.0
FN2860-3-18R or L-14/3 *	28"	711	20"	508	1	18"	457	35"	889	85½"	2172	149	67.6
FN2860-3-18-14/3 *	28"	711	20"	508	2	18"	457	35"	889	102"	2591	168	76.2
FN2860-3-24R or L-14/3 *	28"	711	20"	508	1	24"	610	35"	889	91½"	2324	155	70.3
FN2860-3-24-14/3 *	28"	711	20"	508	2	24"	610	35"	889	114"	2896	180	81.6
FN2860-3-30R or L-14/3 *	28"	711	20"	508	1	30"	762	35"	889	97½"	2477	160	72.6
FN2860-3-30-14/3 *	28"	711	20"	508	2	30"	762	35"	889	126"	3200	190	86.2
FN2860-3-36R or L-14/3 *	28"	711	20"	508	1	36"	914	35"	889	103½"	2629	165	74.8
FN2860-3-36-14/3 *	28"	711	20"	508	2	36"	914	35"	889	138"	3505	200	90.7

* Features two sets of faucet holes.

EAGLE GROUP

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www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

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Printed in U.S.A.

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Rev. 02/18

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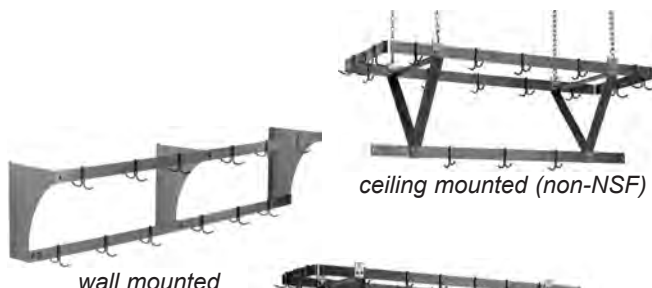
Specification Sheet

Short Form Specifications

Eagle Table Mounted Rack, model _____.
Constructed of $\frac{3}{8}$ " x 2" (aluminum or stainless steel) flat bar, bolted together. Triple bar construction, furnished with one stainless steel double prong sliding pot hook every 12". 1 $\frac{1}{2}$ " O.D. stainless steel tubular supports extend through table and are secured to adjustable undershelf. Available with optional 12" wide 16/304 stainless steel shelf.

Eagle Ceiling Mounted Rack, model _____.
Constructed of $\frac{3}{8}$ " x 2" (aluminum or stainless steel) flat bar, bolted together. Triple bar construction, furnished with one stainless steel double prong sliding pot hook every 12". Provided with plated chain hangers for ceiling suspension.

Eagle Wall Mounted Rack, model _____.
Constructed of $\frac{3}{8}$ " x 2" (aluminum or stainless steel) flat bar bolted together. Furnished with one stainless steel double prong sliding pot hook every 12", and provided with stainless steel mounting brackets.



ceiling mounted (non-NSF)

wall mounted



table mounted

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For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-3091 • e-mail: specfab@eaglegrp.com

Item No.: _____
Project No.: _____
S.I.S. No.: _____

Racks

MODELS:

<input type="checkbox"/> CM36*	<input type="checkbox"/> TM36*	<input type="checkbox"/> WM36*
<input type="checkbox"/> CM48*	<input type="checkbox"/> TM48*	<input type="checkbox"/> WM48*
<input type="checkbox"/> CM60*	<input type="checkbox"/> TM60*	<input type="checkbox"/> WM60*
<input type="checkbox"/> CM72*	<input type="checkbox"/> TM72*	<input type="checkbox"/> WM72*
<input type="checkbox"/> CM84*	<input type="checkbox"/> TM84*	<input type="checkbox"/> WM84*
<input type="checkbox"/> CM96*	<input type="checkbox"/> TM96*	<input type="checkbox"/> WM96*
<input type="checkbox"/> CM108*	<input type="checkbox"/> TM108*	<input type="checkbox"/> WM108*
<input type="checkbox"/> CM120*	<input type="checkbox"/> TM120*	<input type="checkbox"/> WM120*
<input type="checkbox"/> CM132*	<input type="checkbox"/> TM132*	<input type="checkbox"/> WM132*
<input type="checkbox"/> CM144*	<input type="checkbox"/> TM144*	<input type="checkbox"/> WM144*

* See charts on back for full model numbers.

Ceiling mounted (non-NSF)

- Racks are triple-bar construction.
- Supported with plated chain hangers supplied.
- Available in stainless steel or aluminum.
- Provided with double-pronged pot hooks.

Wall Mounted

- Racks are double-bar construction.
- Supplied with die-formed stainless steel brackets.
- Available in stainless steel or aluminum.
- Provided with double-pronged pot hooks.

Table Mounted

- Racks are triple-bar construction.
- Front-to-back adjustable crossbracing, plus adjustable undershelf.
- 1 $\frac{1}{2}$ " (41mm) tubular stainless steel supports extend through tabletop and are secured to adjustable undershelf. Units 108" (2743mm) and longer have three supports.
- Provided with double-pronged pot hooks.
- Available in stainless steel or aluminum.

Options / Accessories

- ☐ Additional sliding hooks
- ☐ All-welded construction
- ☐ 12"-wide adjustable shelves (for Table Mounted Racks)

Certifications / Approvals



AUTOQUOTES



EG10.12 Rev. 06/14

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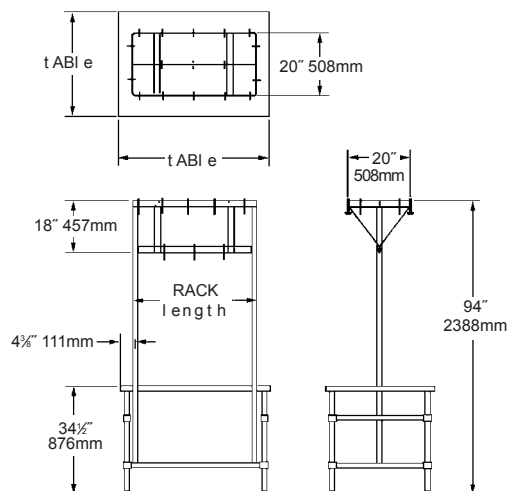
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Item No.: _____
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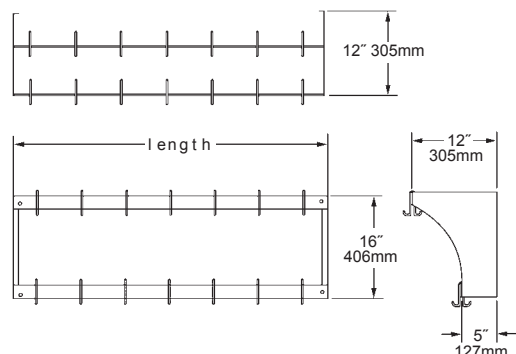
Table Mounted Racks



ALUMINUM			STAINLESS STEEL			rack length		fits table length	
model #	weight lbs. kg		model #	weight lbs. kg		in.	mm	in.	mm
TM36APR	38	17.2	TM36PR	50	22.7	28"	711	36"	914
TM48APR	42	19.1	TM48PR	57	25.9	40"	1016	48"	1219
TM60APR	46	20.9	TM60PR	64	29.0	52"	1321	60"	1524
TM72APR	50	22.7	TM72PR	70	31.8	64"	1626	72"	1829
TM84APR	54	24.5	TM84PR	77	34.9	76"	1930	84"	2134
TM96APR	58	26.3	TM96PR	83	37.6	88"	2235	96"	2438
TM108APR*	62	28.1	TM108PR*	89	40.4	100"	2540	108"	2743
TM120APR*	66	29.9	TM120PR*	95	43.1	112"	2845	120"	3048
TM132APR*	71	32.2	TM132PR*	102	46.3	124"	3150	132"	3353
TM144APR*	76	34.5	TM144PR*	109	49.4	136"	3454	144"	3658

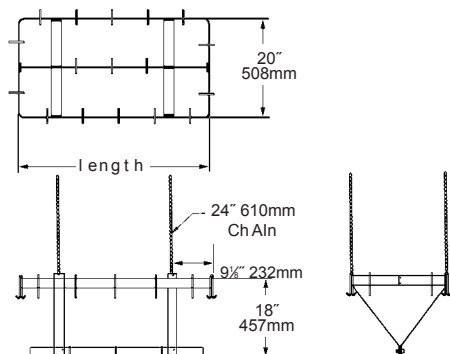
* These racks include center tubular support.

Wall Mounted Racks



ALUMINUM			STAINLESS STEEL			rack length	
model #	weight lbs. kg		model #	weight lbs. kg		in.	mm
WM36APR	13	5.8	WM36PR	18	8.2	36"	914
WM48APR	15	6.8	WM48PR	22	10.0	48"	1219
WM60APR	17	7.7	WM60PR	26	11.8	60"	1524
WM72APR	19	8.6	WM72PR	29	13.2	72"	1829
WM84APR	21	9.5	WM84PR	33	15.0	84"	2134
WM96APR	23	10.4	WM96PR	37	16.8	96"	2438
WM108APR	25	11.3	WM108PR	41	18.6	108"	2743
WM120APR	28	12.7	WM120PR	45	20.4	120"	3048
WM132APR	31	14.1	WM132PR	50	22.7	132"	3353
WM144APR	34	15.4	WM144PR	55	24.9	144"	3658

Ceiling Mounted Racks



ALUMINUM			STAINLESS STEEL			rack length	
model #	weight lbs. kg		model #	weight lbs. kg		in.	mm
CM36APR	28	12.7	CM36PR	41	18.6	28"	711
CM48APR	32	14.5	CM48PR	48	21.8	40"	1016
CM60APR	36	16.3	CM60PR	54	24.5	52"	1321
CM72APR	40	18.1	CM72PR	60	27.2	64"	1626
CM84APR	44	20.0	CM84PR	67	30.4	76"	1930
CM96APR	48	21.8	CM96PR	74	33.6	88"	2235
CM108APR	53	24.0	CM108PR	81	36.7	100"	2540
CM120APR	58	26.3	CM120PR	87	39.5	112"	2845
CM132APR	63	28.6	CM132PR	94	42.6	124"	3150
CM144APR	68	30.8	CM144PR	101	45.8	136"	3454

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Item # _____

Quantity _____

Stainless Steel Utility Carts

Heavy Duty - 700 Lb Capacity



Model 744

Models

710, 711, 721, 722, 743, 744, 758, 759
510, 511, 521, 522, 543, 544, 558, 559

“U” Shaped Angled Frame Provides The Strength Needed For Heavy-duty Jobs

- 700 lb. (300 kg) capacity is ideal for continuous moving of heavy loads over various standard floor surfaces
- Rugged 18 gauge reinforced stainless steel shelves are stain and rust resistant. Electronically welded for added strength.
- Easy to clean and sanitize, simply wipe down or steam clean
- Leg and handle bumpers protect walls and furniture
- NSF listed models available

Specifications

Unit shall be of fully welded stainless steel construction. Legs and frame shall be of U-frame design, eliminating the need for corner reinforcements. Leg/frame shall be .120 x 1" x 1" angle stainless steel. Shelves shall be of 18-gauge stainless steel and shall be welded to vertical leg frames. Shelves shall be double hemmed on all four edges for extra rigidity. Unit shall have two each 5" (127 mm) diameter extra-load swivel casters with 1-1/4" (32 mm) wide non-marking polyurethane wheels, and two each 8" diameter extra-load wheels mounted to a fixed axle. Swivel casters shall be plate type and shall be bolted to an 18-gauge 5" (127 mm) wide stainless steel cross member with a galvanized reinforcement. Unit shall have push handle made of 18 gauge 1" O.D. stainless steel tubing. Handle mounting brackets shall be welded to vertical leg frame. Unit shall have two each bumpers mounted to handle ends and two each 6" (152 mm) vertical bumpers riveted to front legs.

Lakeside Manufacturing, Inc.

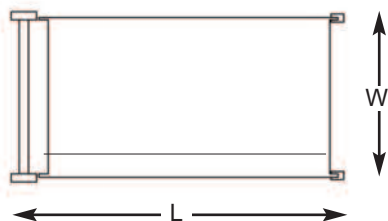
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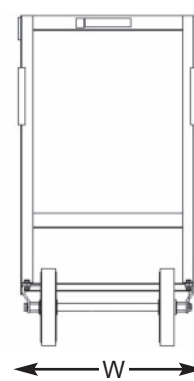
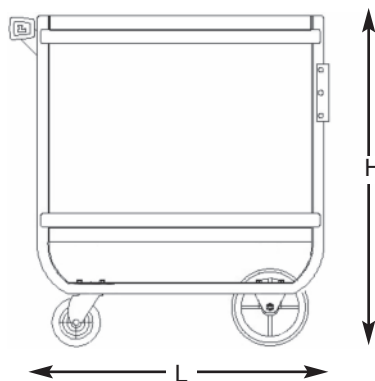
Stainless Steel Utility Carts

Heavy Duty - 700 Lb Capacity

Top View



AutoCAD drawings available through KCL CADalog



Model Information

Model	NSF Model	# of	Shelf Description		Overall Size			Case Weight	
			Size	Clearance	L	W	H	lbs.	(kg.)
710	510	2	15-1/2" x 24" (394 x 610)	19" (483)	30" (762)	16-1/4" (413)	34-1/4" (870)	49	(22.2)
711	511	3	15-1/2" x 24" (394 x 610)	10" (254)	30" (762)	16-1/4" (413)	34-1/4" (870)	57	(25.9)
721	521	2	18" x 27" (457 x 686)	19" (483)	32-5/8" (829)	19-3/8" (492)	34-1/2" (876)	53	(24)
722	522	3	18" x 27" (457 x 686)	10" (254)	32-5/8" (829)	19-3/8" (492)	34-1/2" (876)	63	(28.6)
743	543	2	21" x 33" (533 x 838)	21" (533)	38-5/8" (981)	22-3/8" (568)	37-1/8" (943)	64	(29)
744	544	3	21" x 33" (533 x 838)	11-3/8" (289)	38-5/8" (981)	22-3/8" (568)	37-1/8" (943)	78	(35.4)
758	558	2	21" x 49" (533 x 1245)	21" (533)	54-5/8" (1387)	22-3/8" (568)	37" (940)	87	(39.5)
759	559	3	21" x 49" (533 x 1245)	11-3/8" (289)	54-5/8" (1387)	22-3/8" (568)	37" (940)	108	(49)

Measurements in () denote metric millimeters, unless otherwise specified.

Optional Accessories

- ☐ Extended perimeter bumper
- ☐ All 5" swivel casters
- ☐ Set of 2 ea. 5" brake casters



Lakeside Manufacturing, Inc.

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SPEC SHEET

"PBJC" JANITOR CABINET 16GA Sink Bowl

FEATURES:

- Type 300 Stainless Steel With #4 Polish Satin Finish
- All Exposed Hardware Is Tamper Proof
- Includes Overhead Shelf For Chemical Storage
- (2) Swing Lockable Louvered Doors
- (1) Oversized Mop Sink
- Bottoms Of Bowls Formed For Drainage To 3-1/2" Diameter Die Stamped Opening
- Includes (1) Heavy Duty Service Faucet (PBF-S-6)
- Includes (1) 10" Service Faucet Hose (PB-HOSE-120)
- (2) Shelf Mounted Mop Holders With Locking Cams
- Mounting Location Of Service Faucet Can Be Specified By Kitchen Equipment Contractor
- 3-1/2" Drain Accepts 2" Male Drain Pipe

SPECIFICATIONS:

- Cabinet: Stainless Steel Cabinets TIG Welded, Exposed Edges Are Polished To Match Adjacent Surface
- Cabinet: 18GA Type 300 Stainless Steel With #4 Polish, Satin Finish
- 18GA Type 300 Cabinet
- 16GA Type 300 Sink Bowl And Deck

CERTIFICATIONS:



PBF-SS-6



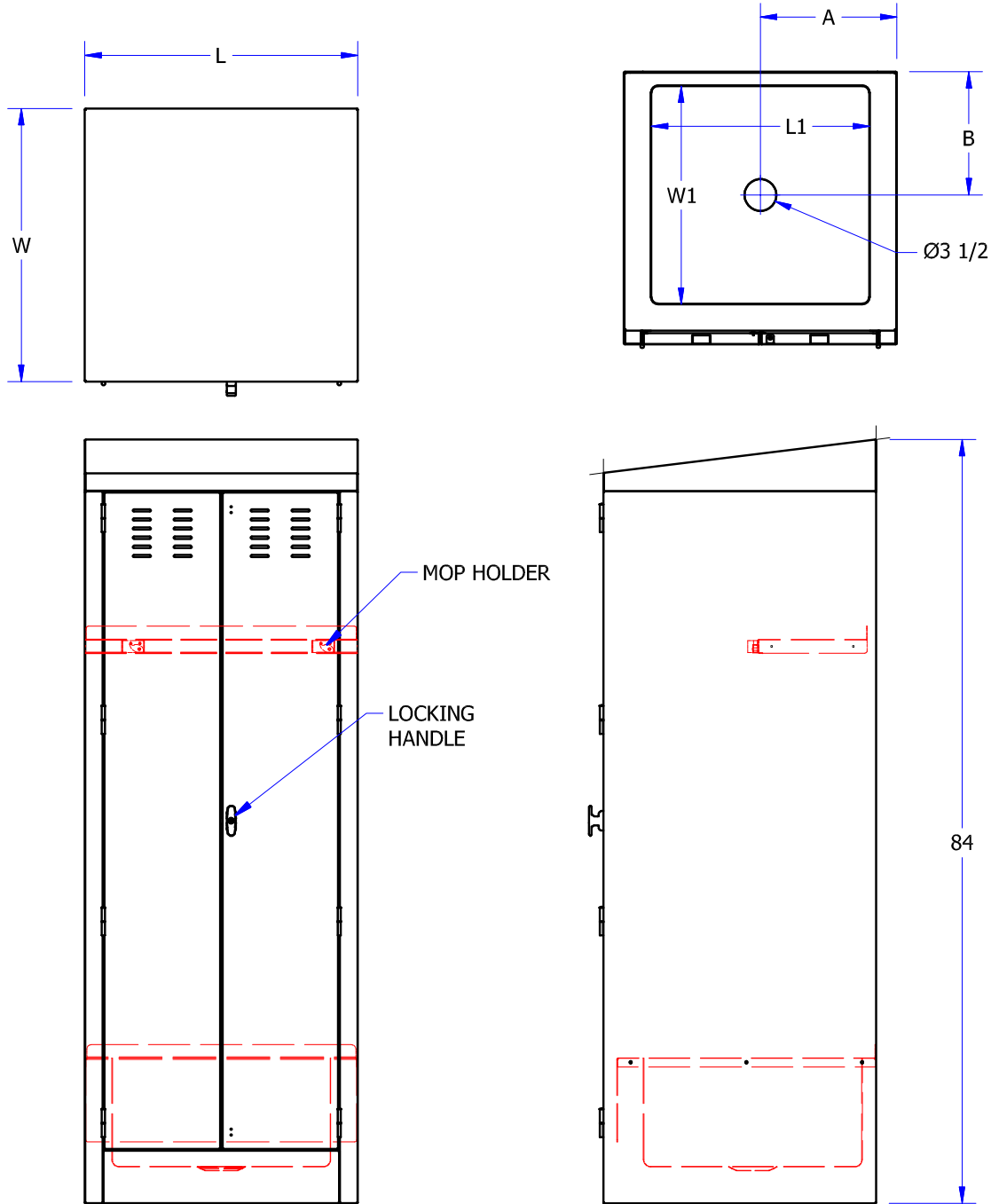
PB-HOSE-120

"PBJC" JANITOR CABINET

MODEL	SIZE (L X W X H)	MOP SINK SIZE (L' X W' X DEPTH)	A	B	WEIGHT (LBS)
PBJC-222584	25"x22-1/2"x84"	16"x20"x12"	12-1/2"	9-9/16"	169
PBJC-303084	30"x30"x84"	24"x24"x12"	15"	13-9/16"	213

ALL DIMENSIONS ARE TYPICAL. TOLERANCE +/- .500". JOHN BOOS & CO. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

DETAILED SPECIFICATIONS



"PBJC" JANITOR CABINET

MODEL	SIZE (L X W X H)	MOP SINK SIZE (L' X W' X DEPTH)	A	B	WEIGHT (LBS)
PBJC-222584	25"x22-1/2"x84"	16"x20"x12"	12-1/2"	9-9/16"	169
PBJC-303084	30"x30"x84"	24"x24"x12"	15"	13-9/16"	213

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Hoshizaki

KM-1301SAJ EXISTING

Item#: 16


KM-1301S_J(Z)(3)
07/02/24
Item # 1356


KM-1301S_J(Z)(3)

STACKABLE ICE CUBER

W x D x H
48" x 27³/₈" x 27³/₈"**KM|EDGE™****KM-1301SAJ**
Air-Cooled 1 Phase**KM-1301SWJ**
Water-Cooled 1 Phase
Shown on optional bin B-900**KM-1301SRJZ**
Remote Air-Cooled 1 Phase**KM-1301SAJ3 ★**
Air-Cooled 3 Phase**KM-1301SWJ3**
Water-Cooled 3 Phase**KM-1301SRJZ3 ★**
Remote Air-Cooled 3 PhaseItem #: _____
Project: _____
Qty: _____
AIA#: _____

Features

- ▶ Individual crescent cube
- ▶ Stainless steel evaporator
- ▶ CycleSaver™ design 

- Up to 1433 lbs. of ice production per 24 hours
- Stackable for 2866 lbs. per 24 hours ice production in the same floor space
- Durable stainless steel exterior
- EverCheck™ alert system 
- Removable air filters (Air-cooled model only)
- R-404A Refrigerant

Available on Bins:

B-800 B-1150SS B-1500SS Top kit may be required.
B-900 B-1300SS B-1650SS See Bin Spec Sheets.

Warranty:

3 Year Parts & Labor on entire machine. 5 Year Parts & Labor on Evaporator. 5 Year Parts on Compressor; air-cooled condenser coil. Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.

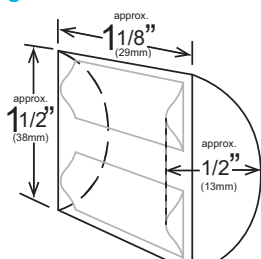
Shipping: (LxWxH) 51.75" x 33" X 33" Volume: 32.61ft³

			ICE PRODUCTION		WATER USAGE			ELECTRICAL						
Condenser		Model	Air / Water Temp Lbs. per 24 hours 70°/ 50°F 90°/ 70°F		Potable Gal. per 100 lbs. 90°/ 70°F	Condenser Gal. per 100 lbs. 90°/ 70°F	kWh Used per 100 lbs. 90°/ 70°F	Min. Circuit/ Max. Fuse Size	Amperage	Voltage	Circuit Wires (including ground)	Heat Rejection BTU/hr.	Refrigerant Charge Amount	Net / Ship Weight (lbs.)
1 Phase	Air	KM-1301SAJ	1365	1301	21.0	N/A	4.27	20A	12.4A	208-230V/60/1	3	19,400	4 lbs. 3 oz.	298 / 338
	Water	KM-1301SWJ	1247	1230	21.0	89	3.76	20A	8.2A	208-230V/60/1	3	20,900	2 lbs. 2.4 oz.	295 / 335
	Remote	KM-1301SRJZ	1400	1260	14.0	N/A	4.28	20A	13.5A	208-230V/60/1	3	18,900	5 lbs. 15.2 oz. 10 lbs. 5.8 oz. ¹	295 / 335
3 Phase	Air	KM-1301SAJ3	1427	1350	15.6	N/A	3.95	20A	9.5A	208-230V/60/3	4	18,400	4 lbs. 3 oz.	298 / 338
	Water	KM-1301SWJ3	1360	1355	16.0	95	3.25	20A	6.1A	208-230V/60/3	4	20,100	2 lbs. 2.4 oz.	295 / 335
	Remote	KM-1301SRJZ3	1433	1330	14.0	N/A	3.83	20A	10.7A	208-230V/60/3	4	18,800	5 lbs. 15.2 oz. 10 lbs. 5.8 oz. ¹	285 / 335

¹with condenser

Power cord not included

KMEdge™ Cube Dimensions*



* approximate size in inches, image not to scale

Operating Limits

- Ambient Temp Range 45 - 100°F
- Water Temp Range 45 - 90°F
- Water Pressure 10 - 113 PSIG
- Voltage Range 187 - 253V
- If GFCI is required, a GFCI breaker MUST be used in lieu of GFCI receptacle

Service

- Panels easily removed and all components accessible for service.
- Allow 6" (15cm) clearance at rear, sides, and top for proper air circulation and ease of maintenance/ service.

Plumbing

- Ice maker Water Supply Line: Min. 3/8" Nominal ID Copper Water Tubing or Equivalent
- Ice maker Drain Line: Min. 3/4" Nominal ID Hard Pipe or Equivalent
- Water-Cooled Model (Lines Must Be Independent of Ice maker)
- Condenser Water Supply Line: Min. 3/8" Nominal ID Copper Water Tubing or Equivalent
- Condenser Drain/Return Line: Min. 3/8" Nominal ID Hard Pipe (open drain system) or Copper Water Tubing (closed loop system) or Equivalent

Water Filter

Please refer to water filter spec sheet for recommended configurations.

Hoshizaki reserves the right to change specifications without notice.



Hoshizaki

KM-1301SAJ EXISTING

Item#: 16

KM-1301S_J(Z)(3)

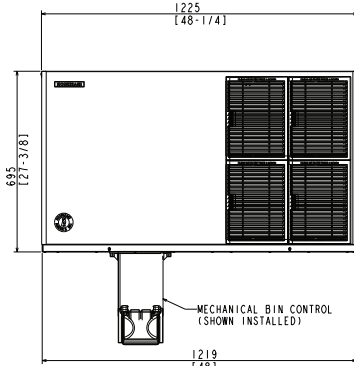
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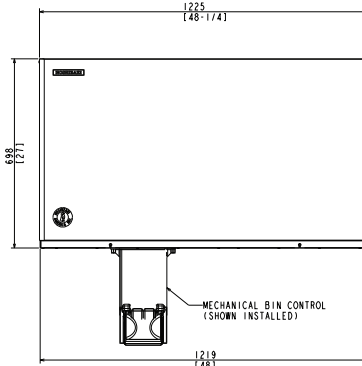
KM-1301S_J(Z)(3)

STACKABLE ICE CUBER

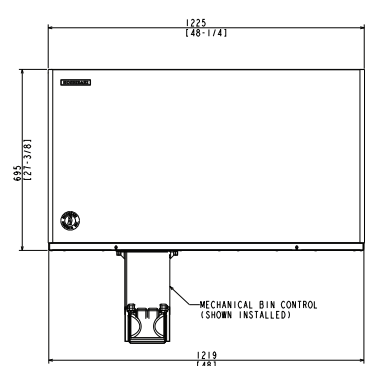
FRONT VIEW



AIR-COOLED

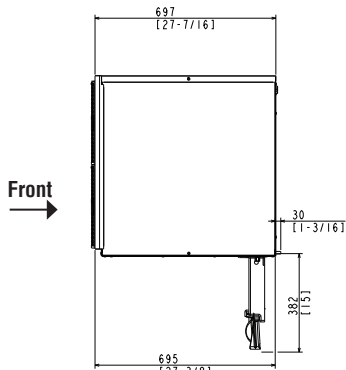


WATER-COOLED

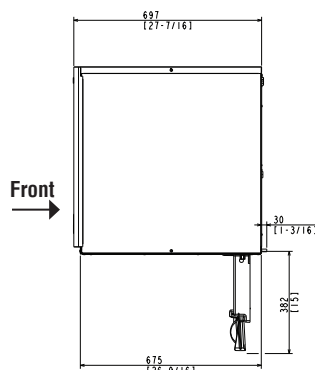


REMOTE AIR-COOLED

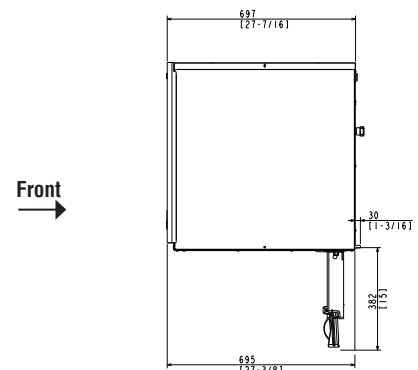
SIDE VIEW



AIR-COOLED

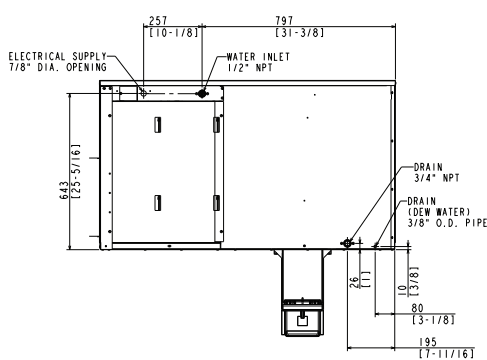


WATER-COOLED

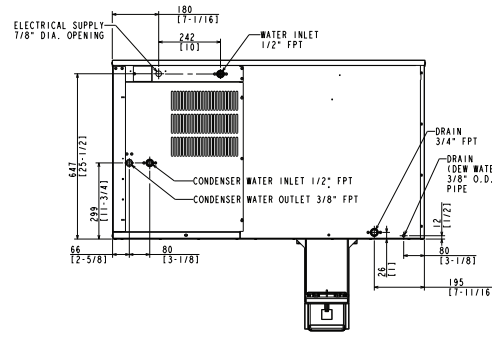


REMOTE AIR-COOLED

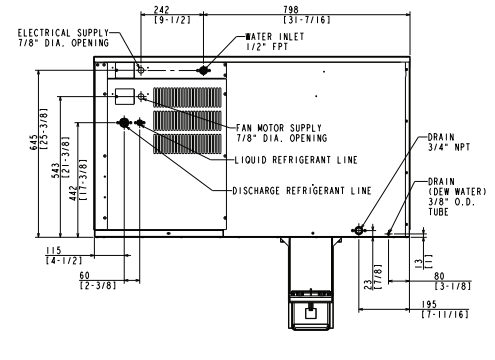
BACK VIEW



AIR-COOLED

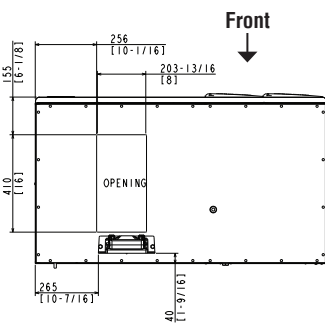


WATER-COOLED

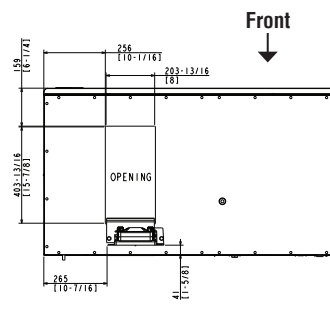


REMOTE AIR-COOLED

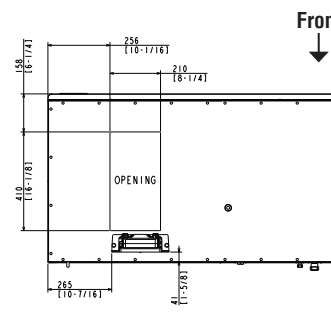
BOTTOM VIEW



AIR-COOLED

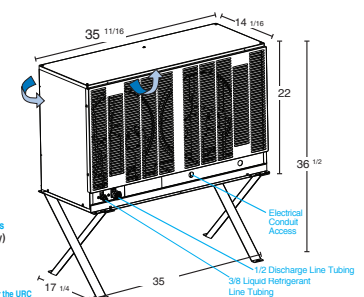


WATER-COOLED



REMOTE AIR-COOLED

URC-14FZ Remote Condenser (Sold Separately)
(W x D x H) 35 11/16 x 14 1/16 x 36 1/2
For Use with KM-1301SRJZ(3)



Brazed Line Sets
(Sold Separately)
25' HS-6604
35' HS-6605
55' HS-6606

Voltage supply for the URC
Remote Condenser is supplied
from the Ice Maker. No additional
circuit is required.



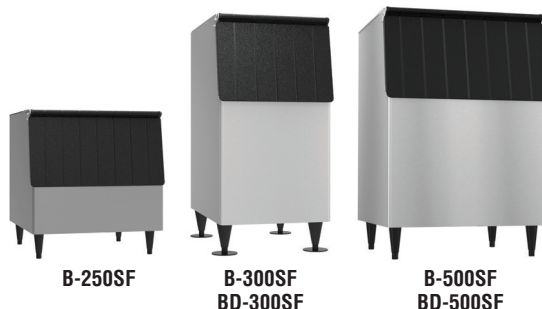
SF Bins

ICE STORAGE BIN SERIES



SF Bins
07/02/24
Item # 13163

SF - Stainless Steel Finish



Item #: _____
Project: _____
Qty: _____
AIA#: _____

Features

- ▶ Polyethylene bin liner for sanitary storage
- ▶ Sturdy construction for side-by-side or stacked ice machine installation

- Ice storage capacity from 250 lbs. up to 900 lbs.
- Both surfaces are designed for easy cleaning
- Long lasting attractive appearance
- Foamed-in-place polyurethane insulation, in all bin walls and bottom, provides dependable ice storage
- H-GUARD Plus Antimicrobial adds extra protection to the ice scoop (included)

SF - Stainless Steel Finish

BD Bins

- Fit 24" - 24 1/2" deep ice machine without top kit extension

Warranty:

2 Year Parts & Labor (Production prior to January 2012)

3 Year Parts & Labor (Production January 2012 and after)

Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.

Model Number	Exterior Dimensions W x D x H*	Interior Dimensions W x D x H	Application Storage Capacity†	Cubic Volume	Shipping Dimensions L x W x H	Shipping Weight (lbs.)
B-250SF	30" x 32.3" x 33.4"	27" x 27.7" x 23.7"	250 lbs.	10.30 ft³	35" x 32" x 32"	—
B-300SF	22" x 32.3" x 46"	19" x 27.7" x 37.6"	300 lbs.	11.51 ft³	35" x 24" x 45"	125
BD-300SF	22" x 32.3" x 46"	19" x 27.7" x 37.6"	300 lbs.	11.51 ft³	35" x 24" x 45"	130
B-500SF	30" x 32.3" x 46"	27" x 27.7" x 37.6"	500 lbs.	16.33 ft³	35" x 32" x 45"	140
BD-500SF	30" x 32.3" x 46"	27" x 27.7" x 37.6"	500 lbs.	16.33 ft³	35" x 32" x 45"	140
B-700SF	44" x 32.3" x 46"	41" x 27.7" x 37.6"	700 lbs.	24.77 ft³	46" x 35" x 45"	175
B-800SF	48" x 32.3" x 46"	45" x 27.7" x 37.6"	800 lbs.	26.90 ft³	50.25" x 35" x 45"	185
B-900SF	52" x 32.3" x 46"	49" x 27.7" x 37.6"	900 lbs.	29.59 ft³	54.5" x 35" x 45"	195

*Height includes 6" legs

† Capacity based on volume x 30 lb/ft³ average density of ice.

Hoshizaki reserves the right to change specifications without notice.



SF Bins

ICE STORAGE BIN SERIES



SF Bins
07/02/24
Item # 13163

Ice Machine Model Application

	22" Width	22" Width	30" Width	30" Width	44" Width	44" Width	48" Width
	KM-350M KM-520M KM-660M F-450M F-801M F-1002M	KMD-410M [†] KMS-822M FD-650M-C [†] FD-1002M-C	KM-901M KM-1340M KM-1601M KML Series KMD-505M KMD-705M F-1501M F-2001	KMD-460M [‡] KMD-530M [‡] KMD-860M [‡] KMS-1402M [*] KMS-2000M [*]	2 KM-350M 2 KM-520M 2 KM-660M IM-500S 2 F-450M 2 F-801M 2 F-1002M	2 KMD-410M 2 FD-650M-C 2 FD-1002M-C	KM-1301S KM-1400S KM-1601S KM-1900S KM-2200S KM-2600S
Bins B-300SF DB-130H	—	NEED HS-2153 HS-5424 (KMD-410 on B-300 only)	N/A	N/A	N/A	N/A	N/A
Bins B-250SF B-500SF	NEED HS-2033	NEED HS-2033 & HS-2129	—	NEED HS-2129	N/A	N/A	N/A
Bins B-700SF	NEED HS-2035	NEED HS-2035 & HS-2130	NEED HS-2034	NEED HS-2130 & HS-2034	—	NEED HS-2130 (KMD-410 does not apply)	N/A
Bins B-800SF	NEED HS-2035 & HS-2032	NEED HS-2035, HS-2032 & HS-2131	NEED HS-2034 & HS-2032	NEED HS-2131, HS-2034 & 2032	NEED HS-2032	NEED HS-2032 & HS-2131	—
Bins B-900SF	NEED HS-2035 & HS-2033	NEED HS-2035, HS-2033 & HS-2132	NEED HS-2035	NEED HS-2132 & HS-2035	NEED HS-2033	NEED HS-2033 & HS-2132	NEED HS-2032
Bins DB-200H DM-200B	NEED HS-2036 (KM units only)	N/A	— (KML Series only) NEED HS-2148 (KMD Series on DB-200H only)	N/A	N/A	N/A	N/A

— No top kit necessary | N/A Combination of ice maker and bin is not possible

BD Bins fit 24" - 24 1/2" deep ice machine without Top Kit extension.

[†]**BD-300SF:** KMD-410M, KMS-822M, FD-650M-C, FD-1002M-C

[‡]**BD-500SF:** KMD-460M, KMD-530M, KMD-860M, KMD-505M, KMD-705M

Top Kits:

HS-2032 - 4" ABS Top Kit

HS-2033 - 8" ABS Top Kit

HS-2034 - 14" ABS Top Kit

HS-2035 - 22" ABS Top Kit

HS-2036 - (2) 4" ABS Top Kits

HS-2066 - Seismic Kit for SD 500 Stands

HS-2071 - Anchored Leg Kit SD 500 Stands

HS-2111 - 11.3" x 26.2" Stainless

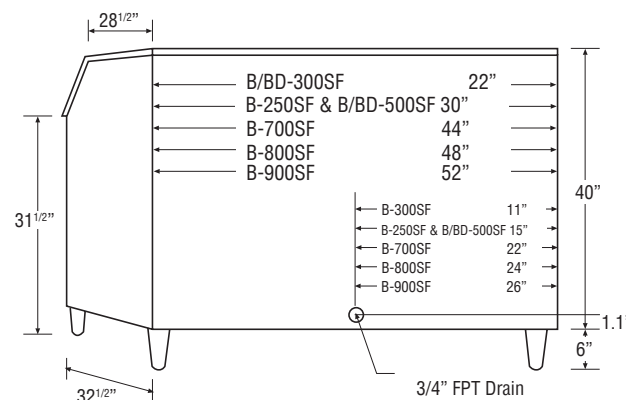
Cover/Separator

HS-2148 - 30" x 3.1" Stainless Cover

HS-2153 - KMD-410 on B-300 bin

HS-2160 - 2 KM-901M

B-250SF



Ice Drop Area



B Bins



BD Bins



Bin Flanged Legs:
B/BD-300SF



Bin Legs:
B-250SF, B/BD-500SF
B-700SF, B-800SF
B-900SF



Job: _____ Item#: _____

ES



ELECTRIC TILTING SKILLET with Manual Tilt



Model ES-40

☐ ES-30☐ ES-40

OPERATION SHALL BE BY:

Electric heating elements equipped for operation on:

- ☐ 208 VAC, 1 phase, 50/60 Hz
- ☐ 208 VAC, 3 phase, 50/60 Hz
- ☐ 220 VAC, 1 phase, 50/60 Hz
- ☐ 220 VAC, 3 phase, 50/60 Hz
- ☐ 240 VAC, 1 phase, 50/60 Hz
- ☐ 240 VAC, 3 phase, 50/60 Hz
- ☐ 380/220 VAC, 3 phase, 50/60 Hz
- ☐ 415/240 VAC, 3 phase, 50/60 Hz

OPTIONS & ACCESSORIES AT ADDITIONAL COST

- | | | |
|--|---|---|
| <input type="checkbox"/> 380 VAC, 3 phase, 50/60 Hz | <input type="checkbox"/> Correctional Package | <input type="checkbox"/> Single pantry faucet & bracket with 60" pot filler (SP-KF) |
| <input type="checkbox"/> 415 VAC, 3 phase, 50/60 Hz | <input type="checkbox"/> Sliding drain pan (S-SDP-2) | <input type="checkbox"/> Double pantry faucet & bracket with 60" pot filler (DP-KF) |
| <input type="checkbox"/> 480 VAC, 3 phase, 50/60 Hz | <input type="checkbox"/> Pan carrier (PC-3) | <input type="checkbox"/> Half size pan carrier for ES-30 when TVT ordered (PC-HP) |
| <input type="checkbox"/> 600 VAC, 3 phase, 50/60 Hz | <input type="checkbox"/> Steam pan insert (SPI-30, SPI-40) | <input type="checkbox"/> Faucet bracket (FB) |
| <input type="checkbox"/> Etched liter markings (LMS-30, LMS-40) | <input type="checkbox"/> 12" Single pantry faucet with swing spout (SF-12) | |
| <input type="checkbox"/> 2" draw off valve with strainer (TVT-2) | <input type="checkbox"/> 12" Double pantry faucet with swing spout (DF-12) | |
| <input type="checkbox"/> 3" draw off valve with strainer (TVT-3) | <input type="checkbox"/> 3" Stainless steel faucet plumbing enclosure (SPE-1) | |

STANDARD CONSTRUCTION SPECIFICATIONS

Shall be a Crown model ES-30 or ES-40, electrically heated skillet with manual tilt, c-CSA-us and NSF certified.

The unit shall have a spring assisted stainless steel cover, with full width handle, no drip condensate guide, etched gallon markings, and vent port with swing cover.

The pan shall have a sloped front and be front hinged for easy tilting pour control and comes complete with a removable pour strainer.

Pan is formed from 10 gauge 304 stainless steel with a #4 finish exterior and polished interior with coved corners for easy cleaning.

Heating shall be accomplished by electric elements cast embedded in a full 1-3/8" (35 mm) thick aluminum casting bolted to the underside of the pan for even heat distribution across the entire surface.

The pan shall be mounted on a heavy duty welded frame with stainless steel exterior supported by an all welded 1-5/8" (41 mm) stainless steel pipe frame with adjustable bullet feet and rear legs fitted with flange adjustable feet for securing to the floor.

Unit shall have a permanently lubricated, self-contained gear box tilt mechanism to allow the pan to tilt forward for complete emptying of contents.

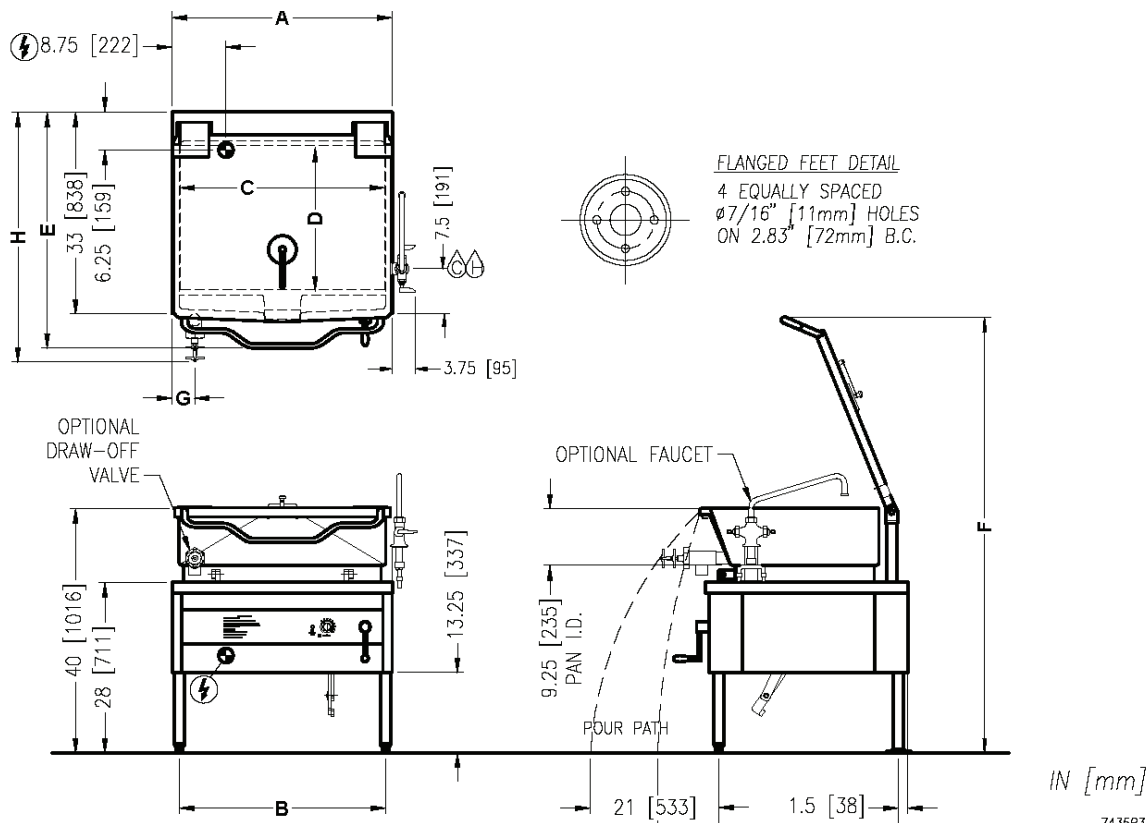
The controls enclosure shall be designed to meet NEMA-2 and provide a degree of protection against dripping and light splashing and shall include a thermostat with OFF position and a range of 160°F - 445°F (71°C - 229°C) a thermostat indicator light, pan tilt switch that shuts elements off if tilted more than 5°, and high temperature cut-off set at 536°F (280°C).



Approval Notes: _____

Models: ☐ ES-30 ☐ ES-40

ES



WATER: Optional faucets require 3/8" (10mm) outside-diameter tubing connection to base of each faucet.

DIMENSIONS

MODEL	CAPACITY	A	B	C	D	E	F	G	H	
									Ø2	Ø3
ES-30	30 Gallons (114 liters)	36" (914)	33.63" (854)	33.5" (851)	23.5" (597)	38.88" (987)	71.38" (1813)	3.75" (95)	41.13" (1045 mm)	46.75" (1187 mm)
ES-40	40 Gallons (152 liters)	48" (1219)	45.63" (1159)	43.5" (1105)	23" (584)	39.38" (1000)	70.88" (1800)	4.75" (121)	41.63" (1057 mm)	46.13" (1172 mm)

ELECTRICAL CHARACTERISTIC

AMPS PER LINE									
MODEL	KW	PHASE	208V	220V	240V	380V	415V	480V	600V
ES-30	12	1	57.7 A	54.5 A	50.0 A	N/A	N/A	N/A	N/A
		3	33.3 A	31.5 A	28.9 A	18.2 A	16.7 A	14.4 A	11.5 A
ES-40	18	1	86.5 A	81.8 A	75.0 A	N/A	N/A	N/A	N/A
		3	50.0 A	47.2 A	43.3 A	27.3 A	25.0 A	21.7 A	17.3 A

SPECIFICATIONS

MODEL	CAPACITY		
	KW	GALLON	LITER
ES-30	12	30	114
ES-40	18	40	152

MODEL	SHIPPING WEIGHT	MINIMUM CLEARANCE *	
ES-30	545 lbs. [247 kg]	Sides	0
ES-40	710 lbs. [322 kg]	Back	0

**INTENDED FOR COMMERCIAL USE ONLY.
NOT FOR HOUSEHOLD USE.**





ASFT

Anti-Spill Floor Trough

General Information

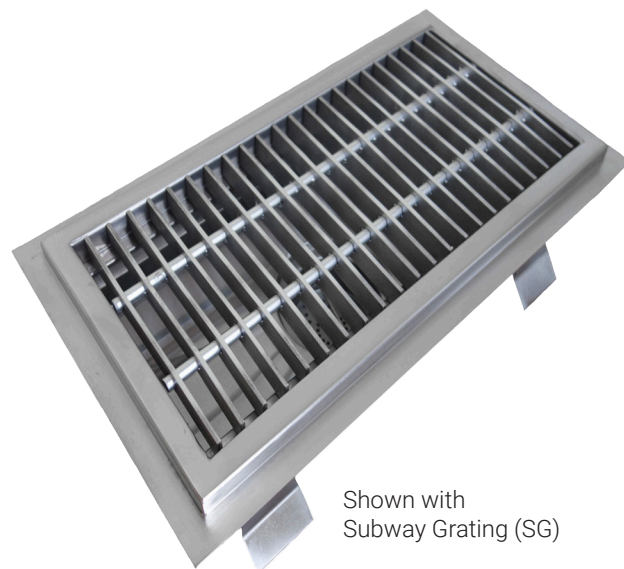
Project Name: _____

Consultant: _____

Item #: _____

Model #: _____

Quantity: _____



Shown with
Subway Grating (SG)



Specifications

ASFT Floor Troughs are 14GA type 300 series stainless steel. Horizontal corners are coved and the trough is integrally pitched toward a waste outlet with a stainless steel beehive strainer and a 4" OD tailpiece.

Anti-Spill features are built into the trough, which is 6" deep.

Recessed flange and 1" deep ledge for IMC grating are integral with the unit.

Joints are TIG welded and leak-proof. Exposed surfaces finished brush satin.

Product Guide

Use in Commercial and Institutional Buildings or large food prep facilities for high volume, rapid discharge application.

Anti-Spill feature directs splashing waste water to inside corners of the trough away from the equipment.

Recessed outer flange supports floor tile and provides a grout pocket.

Setting frame for waterproof membrane and/or integral seepage flange with "weep" holes can be added for wet floor areas.

Extension arms and intersections available for multiple equipment layout.

Options*

- ☐ **DOD** - 3", 3½", 5", 6", 8" OD Tube (circle one)
- ☐ **WTO** - Waste Tube over 3" Long
- ☐ **AW** - Additional Wastes
- ☐ **WCP** - Waste Cup Strainers
- ☐ **BH** - Beehive Strainers (Each)
- ☐ **OCW** - Off Center Waste (Each)
- ☐ **ST12** - Scrap Tray Up to 18" Wide
- ☐ **PWT** - Perforated Waste Pipe
- ☐ **SF-2** - Special Size Setting Flange 2" Deep
- ☐ **SF-4** - Special Size Setting Flange 2" to 4" Deep
- ☐ **OWT** - Oversize Waste Tube
- ☐ **FSG** - Seepage Flange w/ Weep Holes
- ☐ **ST20** - Scrap Tray 20" Long
- ☐ **DSE** - Drain on the End
- ☐ **ROD** - Rim on Drain
- ☐ **BSPC** - Basket Strainer w/ Handle & Chain
- ☐ **BXD** - Box Type Drain
- ☐ **BSX** - Beehive Strainer for Box Drain
- ☐ **GA-12** - 12GA Upgrade

*See Price List for Complete Options

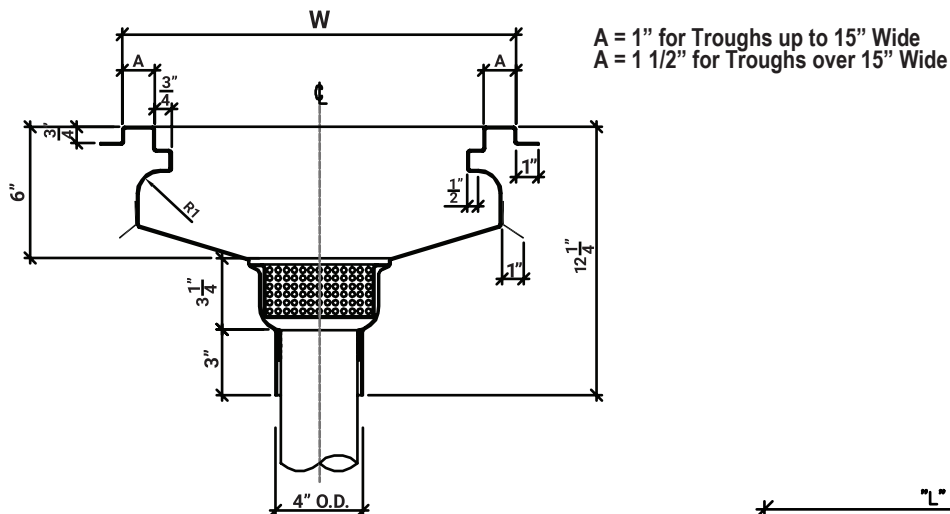
ASFT-90 0321



ASFT

Anti-Spill Floor Trough

DRAWINGS

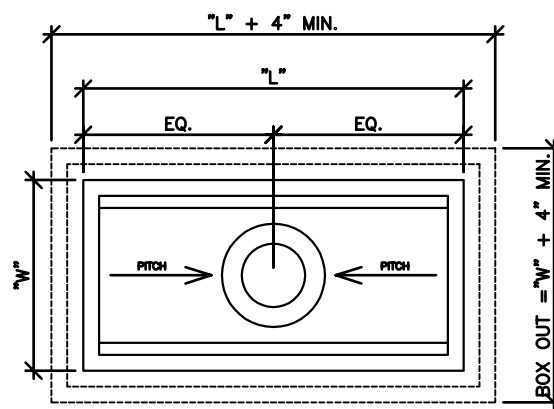


A = 1" for Troughs up to 15" Wide
A = 1 1/2" for Troughs over 15" Wide

Box Out Size

Trough Area

- Width (PIT) = Width ("W") + 4" Minimum
- Length (PIT) = Length ("L") + 4" Minimum
- Depth (PIT) = Depth of Trough + 1/2" + Finish Floor
- Size of Rough-In Hole For Drains 7 1/2" Ø Minimum



ANTI-SPILL FLOOR TROUGHS

Model	Size (W x L)	Model	Size (W x L)	Model	Size (W x L)	Model	Size (W x L)
□ ASFT-1218	12" x 18"	□ ASFT-1824	18" x 24"	□ ASFT-2430	24" x 30"	□ ASFT-3036	30" x 36"
□ ASFT-1224	12" x 24"	□ ASFT-1830	18" x 30"	□ ASFT-2436	24" x 36"	□ ASFT-3048	30" x 48"
□ ASFT-1230	12" x 30"	□ ASFT-1836	18" x 36"	□ ASFT-2448	24" x 48"	□ ASFT-3060	30" x 60"
□ ASFT-1236	12" x 36"	□ ASFT-1848	18" x 48"	□ ASFT-2460	24" x 60"	□ ASFT-3072	30" x 72"
□ ASFT-1248	12" x 48"	□ ASFT-1860	18" x 60"	□ ASFT-2472	24" x 72"	□ ASFT-3084	30" x 84"
□ ASFT-1260	12" x 60"	□ ASFT-1872	18" x 72"	□ ASFT-2484	24" x 84"	□ ASFT-3096	30" x 96"
□ ASFT-1272	12" x 72"	□ ASFT-1884	18" x 84"	□ ASFT-2496	24" x 96"	□ ASFT-30108	30" x 108"
□ ASFT-1284	12" x 84"	□ ASFT-1896	18" x 96"	□ ASFT-24108	24" x 108"	□ ASFT-30120	30" x 120"
□ ASFT-1296	12" x 96"	□ ASFT-18108	18" x 108"	□ ASFT-24120	24" x 120"		
□ ASFT-12108	12" x 108"	□ ASFT-18120	18" x 120"	□ ASFT-3024	30" x 24"		
□ ASFT-12120	12" x 120"	□ ASFT-2424	24" x 24"	□ ASFT-3030	30" x 30"		

Note - Standard troughs up to 96" have one (1) waste at center. Over 96", troughs have two (2) wastes equidistant.

Specifications subject to change without notice.

ASFT-90 0321



Spec sheet

iCombi® Classic 6-full size E/G



Description

- > Combi-steamer in accordance with DIN 18866 for most cooking methods used in commercial kitchens for optional use of steam and convection, individually, one after the other, or combined.

Ventilation approvals: The electrical appliance conforms to the EPA 202 test in accordance with ANSI/NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations" Refer to UL Listing KNLZ.E148536 (America) or KNLZ7.E148536 (Canada).

Unit description and functions

Capacity

- > Six (6) Full-size sheet pans or Twelve (12) Steam table pans or Six (6) 2/1 GN accessories
- > Removable standard hinging rack with 2 5/8 inch rack spacing (68 mm)
- > Large selection of accessories for various cooking procedures, such as grilling, braising or baking
- > For use with 2/1, 1/1, 2/4 GN accessories

Combi-steamer mode

- > Steaming 86 °F - 266 °F
- > Convection 86 °F - 572 °F
- > Combination of steam and convection 86 °F - 572 °F

ClimaPlus

- > Climate management – humidity measurement and control
- > Humidity setting in 10-% increments

Cooking functions

- > ClimaPlus: The active climate management in the cooking cabinet, which constantly measures and controls the humidity and guarantees effective dehumidification, combined with high productivity, cooking quality and low energy consumption. Humidity can be adjusted in increments of 10% and monitored via the digital display for precise manual cooking
- > Dynamic air circulation in the cooking cabinet through reversing high-performance fan propeller with five fan speeds that can be programmed manually. The optimal energy yield results in excellent uniformity and short cooking times.
- > High-performance steam generator for optimal steaming performance even at low temperatures below 212°F
- > Integrated, maintenance-free fat separation system without an additional fat filter
- > Cool-down function for quick cooling of the cooking cabinet via a fan propeller
- > Core temperature measurement via core temperature probe and optional positioning aid (accessories)
- > Delta-T cooking for extremely gentle preparation with minimal cooking losses
- > Digital temperature display, can be set to °C or °F, displays target and actual values
- > Cooking cabinet humidity and time displayed digitally; displays target and actual values
- > Individual programming of up to 100 single or multi-stage cooking programs with up to 12 steps
- > Individual adjustment of the cooking parameters time, temperature and humidity for a program step during ongoing operation
- > Easy transfer of cooking programs to other cooking systems via USB stick.
- > Integrated hand shower with automatic retraction and switchable spray/jet function
- > Energy-saving, long-lasting LED lighting in the cooking cabinet, with excellent color fidelity to allow quick determination of cooking progress
- > No-charge 4-hour RATIONAL certified chef assistance program

Occupational and operating safety

- > Electronic safety temperature limiter for steam generator and convection heating
- > Integrated fan wheel brake
- > Use of Active Green cleaning tabs and Care tabs (solid cleaning agent) for ideal occupational safety levels
- > HACCP data memory and output via USB
- > Tested according to national and international standards for unsupervised operation
- > Maximum tray height must not exceed 63 inch when using a RATIONAL stand
- > Ergonomic door handle with right- / left-handed door opening and swing-shut function

Networking

- > Integrated, IP-protected USB interface for local data exchange
- > Optional integrated IP-protected Ethernet interface
- > Optional integrated Wi-Fi interface (incl. Ethernet interface)

Cleaning and care

- > Automatic, water pressure-independent cleaning and maintenance system for cooking cabinet and steam generator
- > Care system: Automatic cleaning and descaling of the steam generator
- > 4 cleaning programs of varying degrees for unsupervised cleaning, even overnight
- > Easy and intuitive operation of the cleaning programs: Display of the selected cleaning program, the recommended quantity of tabs and the remaining cleaning time
- > Safe ending of the cleaning in the event of a power failure with no cleaning agent left in the cooking cabinet
- > Use of phosphate and phosphorous-free Active Green cleaner tabs and care tabs
- > Hygienic setup flush with the counter without feet for easy and safe cleaning
- > Unit door with rear-ventilated double glass panel and hinged inner pane for easy cleaning

- > Inside and outside material: stainless steel DIN 1.4301, seamless hygienic cooking cabinet with rounded corners and optimized air flow
- > Glass and stainless steel surfaces allow easy, safe external cleaning; IPX5-class protection against spraying water in all directions

Operation

- > 4.3 inch TFT color display and softkeys for easy and intuitive operation. Operating modes and functions are visually highlighted
- > Easy operation and exact settings through a central dial with push function
- > Acoustic prompts and visual messages when user action is required
- > Recirculating hoods (accessories) with situational adjustment of extraction power and service message transmission.

Installation, maintenance and environment

- > Professional installation by RATIONAL-certified technicians recommended
- > Rear in-direct floor drain with air gap is required, and should be supplied in alignment with local code.
- > Adaptation to the installation site (height above sea level) through automatic calibration
- > Operation without water softener and without additional manual descaling possible
- > Installation flush with the floor and wall through connection in the base area *
- > Double-pane glass door with heat reflective special coating for minimal energy losses
- > Service diagnostic system with automatic service message display
- > Regular maintenance is recommended. Maintenance according to manufacturer recommendations available from RATIONAL service partners
- > Energy efficiency in accordance with ENERGY STAR tested and passed. Published at www.energystar.gov
- > 2-year RATIONAL warranty including parts, labor, and travel and 5-year steam generator warranty**
- > * See the installation or planner manual for details
- > ** Terms and conditions apply, see manufacturer warranty statement at www.rational-online.com

Options

- > Cooking cabinet door, left-hinged
- > MarineLine – ship version
- > SecurityLine – prison / security version
- > MobilityLine - mobile version (available to order as a separate accessory)
- > HeavyDutyLine – particularly resilient version
- > Integrated fat drain
- > Mobile oven rack package
- > Safety door lock
- > Protection for control panel
- > Lockable control panel
- > Integrated, IP-protected Ethernet interface
- > Integrated Wi-Fi interface (incl. Ethernet interface)

Technical specifications

Dimensions and weights

Dimensions (W x H x D)	
Cooking system (body)	42 1/4 x 29 5/8 x 38 3/8 inches
Cooking system (total)	42 1/4 x 31 5/8 x 41 inches
Cooking system with packaging	46 1/4 x 37 3/4 x 45 1/2 inches
Maximum working height of top level*	≤ 5 ft. 2 7/8 inches

*when using a corresponding RATIONAL stand

Weights	
Maximum load size per level	66 lb
Maximum total load capacity	132 lb
Weight - electric unit without packaging	282 lb
Weight - electric unit with packaging	344 lb
Weight - gas unit without packaging	324 lb
Weight - gas unit with packaging	388 lb

Electrical connection conditions

Voltage 3 ph 208 V / 240 V	
Connected loads - electric	22.4 kW
Steam power	18 kW
Convection power	21.6 kW
Breaker	70 A
Connection impedance	0.09 Ω
Running AMPS	62.2 A (208 V) / 53.9 A (240 V)
Cable diameter	AWG 3 140°F
Voltage 3 ph 440 V / 480 V	
Connected loads - electric	22.4 kW
Steam power	18 kW
Convection power	21.6 kW
Breaker	35 A
Connection impedance	0.09 Ω
Running AMPS	29.4 A (440 V) / 26.9 A (480 V)
Cable diameter	AWG 8 140°F

Not supplied with cable connection

Connected loads - gas

Natural gas G20	
Nominal heat load, total	106500 BTU
Nominal heat load, Steam mode	80000 BTU
Nominal heat load, Hot Air mode	106500 BTU
Required connection flow pressure	6.5 – 10 inch w.c.
Liquid gas	
Nominal heat load, total	104000 BTU
Nominal heat load, Steam mode	78000 BTU
Nominal heat load, Hot Air mode	104000 BTU
Required connection flow pressure	10 – 15 inch w.c.

3/4" NPT with 3/4" gas shut off

Additional gas types and voltages available on request

Connected loads - gas

Voltage 1 ph 208 V	
Connected loads - gas	0.9 kW

Breaker	15 A
Running AMPS	4.3 A

All gas units are supplied with a 6 ft cord.

Connection conditions water

Water inlet (pressure hose), each	3/4"
Water pressure (flow pressure), each	14.5-87.0 psi
Maximum flow rate per cooking system	3 gal/min
Water drain, each	2" OD
Max short-term amount of wastewater	0.11 gal/sec

Use only high-temperature resistant drain pipe

Water quality requirements

Untreated water can be 0 to 24.5 gr/gal (0 to 420ppm) hardness. We do not recommend treated water hardness < 5 gr/gal (86ppm) because the water could be corrosive. Sodium ion exchangers are not recommended; H+ Ion exchange systems are recommended. Water that does not meet the following minimum standards will require the proper conditioning

Contaminant	Water Requirements	If > than recommended
Sand / Particles	< 15 µm	Particle filter
Chlorine (Cl ₂)	< 0.012 gr/gal (0.2 ppm)	Active carbon filter
Chloride (Cl ⁻)	< 4.68 gr/gal (80 ppm)	RO

Connected loads - exhaust air and thermal load

Latent heat load	3269 BTU
Sensible heat emission	4344 BTU
Sound level (electric)	56 dBA
Sound level (gas)	61 dBA

Connection loads - data

LAN data interface	RJ45
WiFi data interface	IEEE 802.11 a/g/n

Minimum distances at installation

Clearance Requirements

To facilitate servicing, we recommend leaving a 20" (500 mm) gap on the left-hand side of the unit. If there is not 20" (500 mm) left side clearance available, provisions for moving the unit to the left for service access must be made. Such provisions include, but are not limited to, having quick connections (water, gas, etc.) and lengthened electrical connections with flexible cords.

If there are no external heat sources acting on the unit, there should be at least 2" (50 mm) of clearance on either side of the unit. On the back, single units and electric Combi-Duo vent pipe can be mounted flush with the wall. 2" rear clearance from the gas Combi-Duo exhaust gas box.

If a high temperature heat source is on the left or right side of the unit, clearance of at least 14" (350 mm) must be maintained on the respective side. This clearance may be reduced to 2" (50 mm) if a heat shield is used (see accessories).

Recommended clearance from unobstructed rear exhaust pipes and any surface collecting grease or flammable material; 16" (400 mm) gas, 10" (254 mm) electric. It is recommended to have a hood overhang of 6" (150 mm) to 18" (450 mm) at the front of the unit and 6" (150 mm) on the sides if installed at the end of the cooking line. Please refer to the Installation Manual for additional technical data and for instructions on installation and setup.

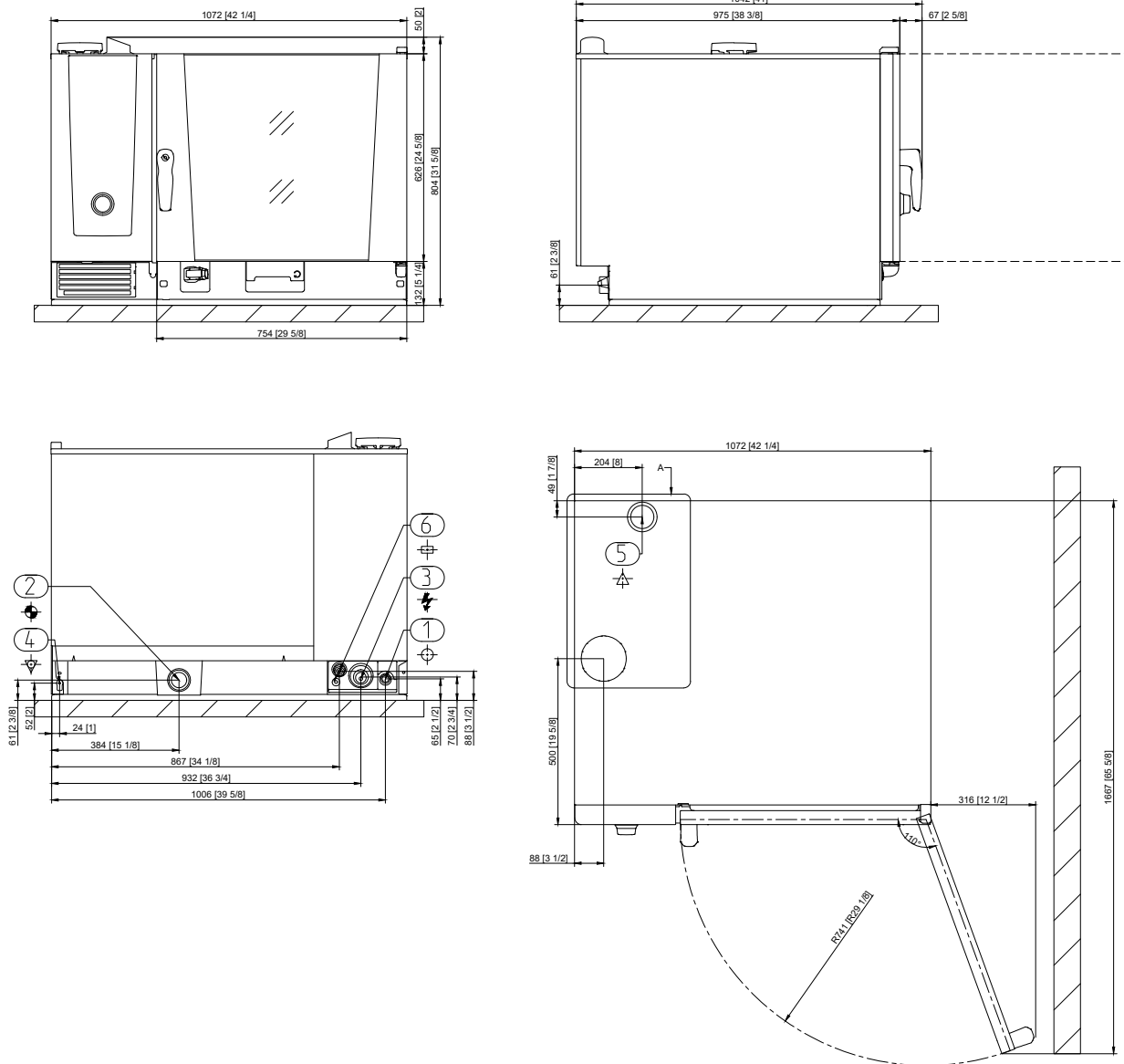
Installation conditions

- > Observe all local and country-specific standards and regulations regarding the installation and operation of industrial cooking appliances. The local standards and regulations for interior ventilation systems must also be taken into account.

Approvals**NSF Certification**

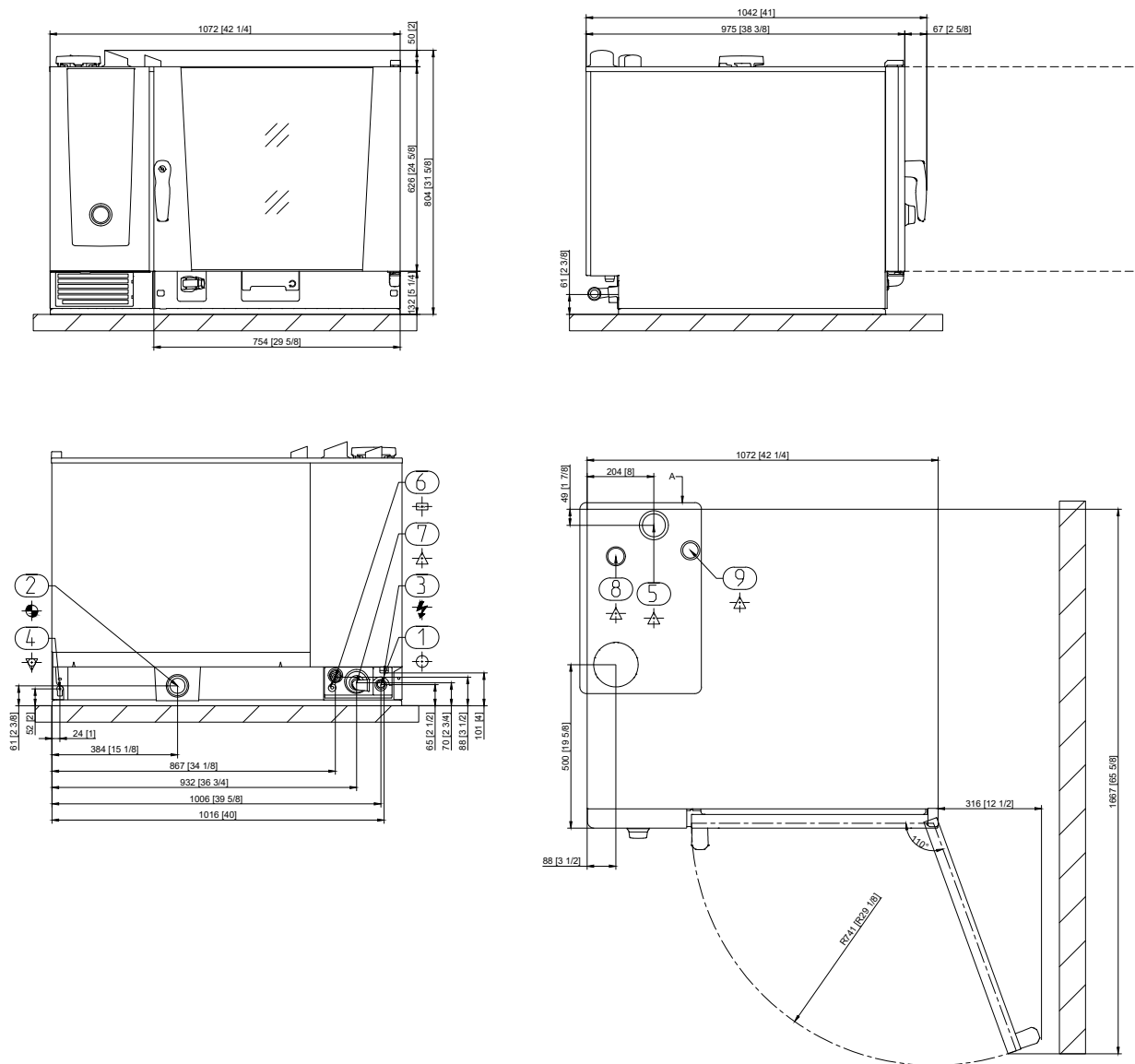
iCombi Pro (LM100) and iCombi Classic (LM200) are NSF-certified, shown on the NSF list.

Technical drawing, electrical



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface

Technical drawing, gas



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface
7	Gas connection
8	Exhaust pipe gas (steam)
9	Exhaust pipe gas (convection)

Accessories

> 3 full size stainless steel grids included with delivery of the cooking system

Accessories	Item number
RATIONAL Active Green cleaning agent tabs – guarantee the best cleaning performance	Item no. 56.01.535
RATIONAL Care tabs – effectively prevent limescale deposits	Item no. 56.00.562
Condensation breaker – diverts steam and vapors to an existing exhaust air system Sizes 6-half size, 10-half size, 6-full size and 10-full size	Item no. 60.72.592
Run-in rail for mobile rack and mobile plate rack Size 6-full size, 10-full size	Item no. 60.74.650
Finishing system for banquets Size 6-full size, 34 plates	Item no. 60.62.196
Full size sheet pan adapter	Item no. 60.12.156
Mobile oven rack and mobile plate oven rack – for simple loading outside the cooking system	See Cooking Systems and Accessories catalog
Hinging racks - Size 6-full size	Item no. 7 racks 60.62.168
	Item no. 5 racks 60.62.171
Heat shield – for installing a unit near a heat source, e.g. a grill - Size 6-full size	Item no. left side 60.75.769
	Item no. right side 60.75.768
Mobile catering stand - especially for heavy mobile catering usage	Item no. 60.31.165
Stackable Combi-Duo kit - Size 6-full size E/G on Size 6-full size E or Size 10-full size E	Item no. 60.74.725
Stackable Combi-Duo kit - Size 6-full size E/G on Size 6-full size G	Item no. right-side hinges 60.75.752
	Item no. left-side hinges 60.75.754
Transport trolley for mobile rack and mobile plate rack - height-adjustable - Sizes 6-full size, 10-full size	Item no. 60.75.605
Transport trolley for mobile rack and mobile plate rack - standard - Sizes 6-full size, 10-full size	Item no. 60.73.999
UltraVent recirculating hood - for Size 6-full size, 10-full size electric units only	Item no. 60.76.180
UltraVent Plus recirculating hood - for Size 6-full size, 10-full size electric units only	Item no. 60.07.178
Stands are available in various versions - standard, with casters, or with anchorable stainless steel feet	See Cooking Systems and Accessories catalog
RATIONAL USB stick – to securely transfer cooking programs and HACCP data	Item no. 42.00.162
RATIONAL Double Water Filter - for Combi Duo 6-full size/6-full size and 6-full size/10-full size or if used for more than 2 units	Item no. 1900.1150US

We offer a wide range of cooking accessories to help you achieve ideal cooking results; for more information, please consult our accessories brochure, ask your dealer, or visit www.rational-online.com

Planner	RATIONAL AG
	1701 Golf Road, Suite C-120, Commerce Rolling Meadows, IL 60008 Toll Free: 888-320-7274 Fax: 847-755-9583 Email: info@rational-online.com Visit us on the internet: www.rational-online.com



ND-2 Series

Exhaust Only Hood

CaptiveAire's Premier Canopy

The ND-2 Series is a Type I, Wall Canopy Hood for use over 450°F, 600°F and 700°F cooking surface temperatures. The aerodynamic design includes a mechanical baffle and performance enhancing lip for exceptional capture and containment.

Fully Integrated Package

CaptiveAire sells this hood as a stand-alone appliance to be integrated into a kitchen ventilation application, or provided as part of a FULLY INTEGRATED PACKAGE designed by CaptiveAire and pre-engineered for optimum performance. The package consists of the hood, an integral utility cabinet, factory pre-wired electrical controls, and a listed fire suppression system. Other options include a listed exhaust fan, a listed make-up air unit and listed, factory-built ductwork.

Advantages

- ▶ **Exhaust Flow Rates:** Superior exhaust flow rates. A 4' Hood can operate at 150 CFM/ft or 600 total CFM. Available in single or back-to-back configurations.
- ▶ **ETL Listed:** ETL Listed for use over 450°F, 600°F and 700°F cooking surface temperatures, which provides flexibility in designing kitchen ventilation systems. ETL Listed to US and Canadian safety standards, ETL Sanitation Listed and built in accordance with NFPA 96.
- ▶ **Capture and Containment:** Insulated, double-wall rigid front has aerodynamic design that reduces radiant heat into kitchen, prevents condensation and provides exceptional capture and containment of cooking vapors. This is accomplished with the signature ND-2 "mechanical baffle" on the front of the hood's capture area and the "C-shaped" design of the hood's capture area. Mechanical baffle provides a built-in wiring chase for optimal positioning of electrical controls and outlets on the front face of the hood without penetrating capture area or requiring external chase way.
- ▶ **Convenient Design:** Factory pre-wired lighting to illuminate the cooking surface is accessible from the bottom of the hood. Fitted with UL Listed, pre-wired, incandescent light fixtures and tempered glass globes to hold up to a standard 100 watt bulb. Pre-punched hanging angles on each end of hood and additional set provided for hoods longer than 12'.
- ▶ **Construction:** Polished stainless steel on the interior and exterior of the front enhance aesthetics. Fully welded and polished front corners. Fabricated from
- ▶ **Grease Extraction:** All hoods come standard with stainless steel baffle filters and a deep grease trough which allows for easy cleaning. Captrate Combo® and Captrate Solo® filters are optional. Grease drain system with removable 1/2 pint cup for easy cleaning. Standard filter stops eliminate gaps between filters.
- ▶ **Reduced Lead Times and Shipping Costs:** Produced on a high volume assembly line at one of six manufacturing facilities to reduce lead times and shipping costs.
- ▶ **Clearance to Combustibles:** Standard built in 3" rear standoff to meet NFPA 96 requirements, when installed in a wall application.
- ▶ **Controls:** Hoods can be equipped with modular utility cabinets and end standoffs. Optional listed light and fan control switches flush mounted and pre-wired through electrical chase way.
- ▶ **Optional Make-Up Air:** Make-up air can be supplied through optional front and/or side plenums (ND-2 Series with PSP or AC-PSP Accessory).
- ▶ **Optional Self Cleaning Technology:** The Self Cleaning Hood option adds a spray bar that extends the full length of the hood immediately behind the filters. The system cleans grease from the plenum and portion of the duct with the daily hot water spray cycle.
- ▶ **Optional CORE Protection:** The CORE Fire Protection System is an automatic, pre-engineered fire suppression system which is ETL listed to UL Standard

Type 430 stainless steel with option of Type 304 available.

- ▶ **Channels:** Hood comes standard with structural channels on top and wrapper channels on the bottom.
- ▶ **Reduced Weight:** Rigid single wall end panels reduce weight.

300. The CORE Protection System is designed to provide primary coverage for ventilating equipment including hoods, ducts, plenum and filters.

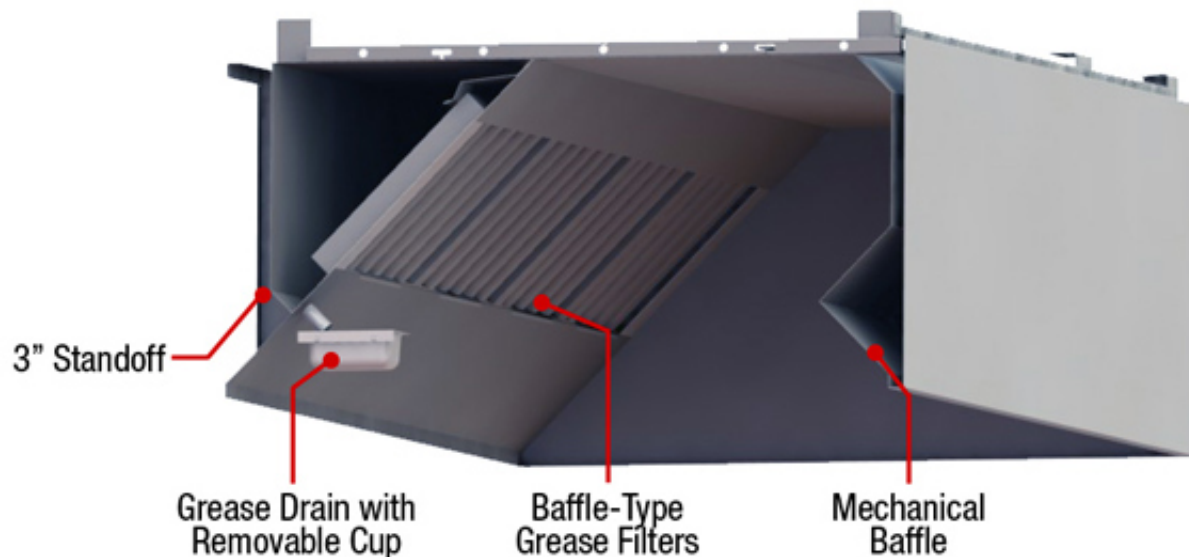
- ▶ **Optional Heat Recovery Coil:** This option is available for hoods with CORE Protection. A listed coil accessory can be added to the hood plenum to recover heat from the exhaust stream. Warm air in the exhaust stream passes over the coil and heats the cold water in the coil, acting as a preheater on the hot water supply line for the restaurant or facility.

Performance

AVG. COOKING SURFACE TEMP. (°F)	CONFIGURATION	MIN. EXHAUST CFM / FT.
450°F	Single Wall Hood 2 Wall Hoods Back-to-Back	150 300
600°F	Single Wall Hood 2 Wall Hoods Back-to-Back	200 400
700°F	Single Wall Hood 2 Wall Hoods Back-to-Back	250 500

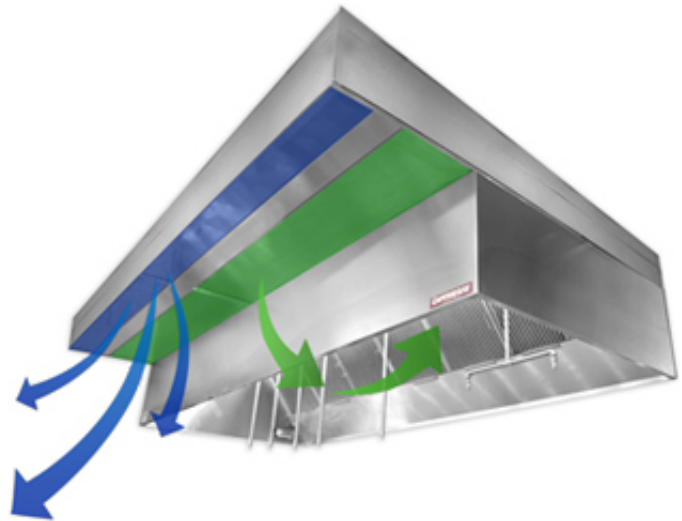
Recommended Duct Sizing: Exhaust - Based on 1500 FPM

Features



Optional Make-Up Air Accessory

- Provides the required make-up air for your kitchen system
- Delivers AC where it is needed most
- AC air does not interfere with the hoods capture and containment
- Convenient termination for AC ductwork in kitchen
- Stainless steel construction to match the ventilation hoods
- Insulated to prevent condensation
- Make-up plenum is located nearest the hood; the air conditioned plenum is away from the hood
- Make-up air stream and the air conditioned air stream are not permitted to mix until leaving the dual plenum
- Perforated, stainless steel diffuser plates provide even air distribution
- Optional LED Lights



Make-up air is evenly distributed along the length of the hood through the first plenum and **conditioned air** is delivered through the outer plenum.

Optional Vertical End Panels (VEP & WVEP)

Energy Savings

- VEPs provide improved capture and containment by directing effluents into the hood and blocking cross drafts
- Allows exhaust CFM reductions up to 18%
- Equivalent reduction in makeup air
- This saves on fan energy, make-up air heating/cooling energy
- Possible equipment downsizing, reduces upfront cost

Design

- Stainless steel matches hood finish
- Gas chase allows appliance lines to run between wall and end panel
- Double-wall insulated construction
- Adjustable feet
- May allow for a reduction in required side overhangs

Safety

- Encloses the hood area, preventing flames or embers from escaping
- Ensures equipment is not accidentally moved outside of the hood area
- Stainless steel construction for sanitation and longevity
- Legs raise bottom of panel off floor to allow room for cleaning

- Hemmed edges prevent sharp surfaces
 - Wide Vertical End Panels (WVEPs) provide an increased level of heat containment and fire protection, especially useful for high radiant load appliances such as solid fuel
-

Options

Utility Cabinet: Listed for integral side mount and fabricated of same material as hood. Cabinet can house listed fire suppression system and listed, pre-wired electrical controls.

Front Perforated Supply Plenum: Provides low velocity make-up air for the kitchen and is discharged in front of the hood. Perforated diffuser plates allow for even air distribution and supply riser includes a volume damper for easy balancing. Side Perforated Supply Plenums can be added to optimize the air flow if necessary.

Enclosure Panels: Constructed of stainless steel. Sized to extend from hood top to ceiling, enclosing pipe and hanging parts.

End Panels: Should be used to maximize hood performance and eliminate the effects of cross drafts in kitchen. units constructed of stainless steel and sized according to hood width and cooking equipment. Exposed edges hemmed for safety and rigidity.

Roof Top Package: Combination ETL Listed exhaust/supply air unit with factory prewired and mounted motors, trunkline and curb vented on exhaust side.

Separate Exhaust and/or Make-Up Air Fans: ETL Listed single exhaust fans and supply-air fans and curbs available.

Fire Suppression System: UL 300 fire suppression system.

Lighting: Recessed Incandescent, Recessed Fluorescent, Compact Fluorescent, Recessed LED, Halogen

DATA SHEET



R-102 Restaurant Fire Suppression Systems

Features

- Low pH Agent
- Proven Design
- Reliable Gas Cartridge Operation
- Aesthetically Appealing
- UL Listed – Meets Requirements of UL 300
- ULC Listed – Meets Requirements of ULC/ORD-C1254.6
- CE Marked

Application

The ANSUL® R-102 Restaurant Fire Suppression System is an automatic, pre-engineered, fire suppression system designed to protect areas associated with ventilating equipment including hoods, ducts, plenums, and filters. The system also protects auxiliary grease extraction equipment and cooking equipment such as fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite, or gas-radiant char-broilers; and woks.

The system is ideally suitable for use in restaurants, hospitals, nursing homes, hotels, schools, airports, and other similar facilities.

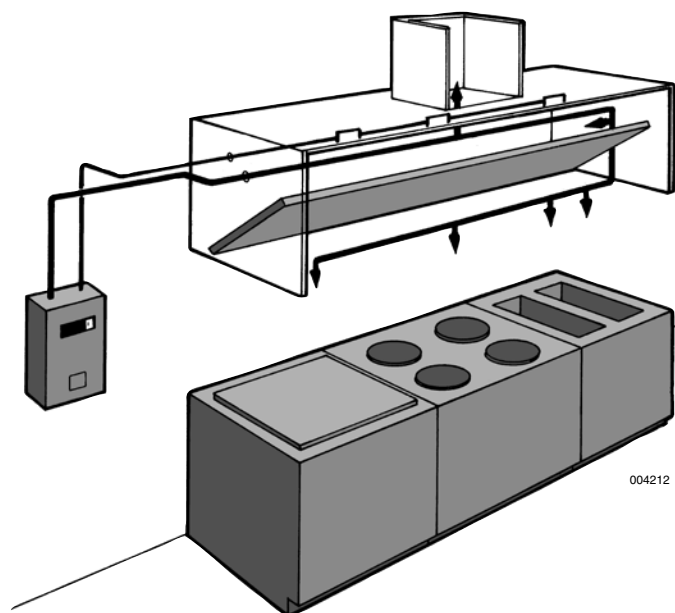
Use of the R-102 system is limited to indoor applications or locations that provide weatherproof protection within tested temperature limitations. The regulated release and tank assemblies must be mounted in an area where the air temperature will not fall below 32 °F (0 °C) or exceed 130 °F (54 °C). The system must be designed and installed within the guidelines of the UL/ULC Listed Design, Installation, Recharge, and Maintenance Manual.

System Description

The restaurant fire suppression system is a pre-engineered, wet chemical, cartridge-operated, regulated pressure type with a fixed nozzle agent distribution network. It is listed with Underwriters Laboratories, Inc. (UL/ULC).



004215



004212

The system is capable of automatic detection and actuation as well as remote manual actuation. Additional equipment is available for building fire alarm panel connections, electrical shutdown and/or interface, and mechanical or electrical gas line shut-off applications.

The detection portion of the fire suppression system allows for automatic detection by means of specific temperature-rated alloy type fusible links, which separate when the temperature exceeds the rating of the link, allowing the regulated release to actuate.

A system owner's guide is available containing basic information pertaining to system operation and maintenance. A detailed technical manual, including system description, design, installation, recharge and resetting instructions, and maintenance procedures, is available to qualified individuals.

The system is installed and serviced by authorized distributors that are trained by the manufacturer.

The basic system consists of an AUTOMAN regulated release assembly which includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles with blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows are supplied in separate packages in the quantities needed for fire suppression system arrangements.

Additional equipment includes a remote manual pull station(s), mechanical and electrical gas valves, and electrical switches for automatic equipment and gas line shut-off. Accessories can be added such as alarms, warning lights, etc., to installations where required.

Additional tanks and corresponding equipment can be used in multiple arrangements to allow for larger hazard coverage. Each tank is limited to a listed maximum amount of flow numbers.



Component Description

Wet Chemical Agent – The extinguishing agent is a mixture of organic salts designed for rapid flame knockdown and foam securement of grease related fires. It is available in plastic containers with instructions for wet chemical handling and usage.

Agent Tank – The agent tank is installed in a stainless steel enclosure or wall bracket. The tank is constructed of stainless steel.

Tanks are available in two sizes: 1.5 gallon (5.7 L) and 3.0 gallon (11.4 L). The tanks have a working pressure of 110 psi (7.6 bar), a test pressure of 330 psi (22.8 bar), and a minimum burst pressure of 660 psi (45.5 bar).

The tank includes an adaptor/tube assembly. The adaptor assembly includes a chrome-plated steel adaptor with a 1/4 in. NPT female gas inlet, a 3/8 in. NPT female agent outlet, and a stainless steel agent pick-up tube. The adaptor also contains a bursting disc seal which helps to prevent the siphoning of agent up the pipe during extreme temperature variations.

Regulated Release Mechanism – The regulated release mechanism is a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one, two, or three agent tanks depending on the capacity of the gas cartridge used. It contains a factory installed regulator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). It has automatic actuation capabilities by a fusible link detection system and remote manual actuation by a mechanical pull station.

The regulated release mechanism contains a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure contains knock-outs for 1/2 in. conduit. The cover contains an opening for a visual status indicator.

It is compatible with mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch and manual reset relay, it is compatible with electric gas line or appliance shut-off devices.

Regulated Actuator Assembly – When more than two agent tanks (or three 3.0 gallon (11.4 L) tanks in certain applications) are required, the regulated actuator is available to provide expellant gas for additional tanks. It is connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge. It contains a regulated actuator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). It has automatic actuation capabilities using pressure from the regulated release mechanism cartridge.

The regulated actuator assembly contains an actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure contains knockouts to permit installation of the expellant gas line.

Discharge Nozzles – Each discharge nozzle is tested and listed with the R-102 system for a specific application. Nozzle tips are stamped with the flow number designation (1/2, 1, 2, or 3). Each nozzle must have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.

Agent Distribution Hose – Kitchen appliances manufactured with or resting on casters (wheels/rollers) may include an agent distribution hose as a component of the suppression system. This allows the appliance to be moved for cleaning purposes without disconnecting the appliance fire suppression protection. The hose assembly includes a restraining cable kit to limit the appliance movement within the range (length) of the flexible hose.

Flexible Conduit – Flexible conduit allows for quicker installations and the convenience of being able to route the cable over, under and around obstacles. Flexible conduit can be used as a substitute for standard EMT conduit or can be used with EMT conduit.

Flexible conduit can be used only with the Molded Remote Manual Pull Station.

Pull Station Assembly – The remote manual pull station is made out of a molded red composite material. The red color makes the pull station more readily identifiable as the manual means for fire suppression system operation.

The pull station is compatible with the ANSUL Flexible Conduit.

Approvals

- UL/ULC Listed
- CE Marked
- New York City Department of Buildings
- LPCB
- TFRI
- Marine Equipment Directive (MED)
- DNV
- ABS
- Lloyd's Register
- Meets requirements of NFPA 96 (Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment)
- Meets requirements of NFPA 17A (Standard on Wet Chemical Extinguishing Systems)

Ordering Information

Order all system components through your local authorized ANSUL Distributor.

Specifications

An ANSUL R-102 Fire Suppression System shall be furnished. The system shall be capable of protecting all hazard areas associated with cooking equipment.

1.0 GENERAL

1.1 References

- 1.1.1 Underwriters Laboratories, Inc. (UL)
 - 1.1.1.1 UL Standard 1254
 - 1.1.1.2 UL Standard 300
- 1.1.2 Underwriters Laboratories of Canada (ULC)
 - 1.1.2.1 ULC/ORD-C 1254.6
- 1.1.3 National Fire Protection Association (NFPA)
 - 1.1.3.1 NFPA 96
 - 1.1.3.2 NFPA 17A

1.2 Submittals

- 1.2.1 Submit two sets of manufacturer's data sheets
- 1.2.2 Submit two sets of piping design drawings

1.3 System Description

- 1.3.1 The system shall be an automatic fire suppression system using a wet chemical agent for cooking grease related fires.
- 1.3.2 The system shall be capable of suppressing fires in the areas associated with ventilating equipment including hoods, ducts, plenums, and filters as well as auxiliary grease extraction equipment. The system shall also be capable of suppressing fires in areas associated with cooking equipment, such as fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite or gas-radiant char-broilers; and woks.
- 1.3.3 The system shall be the pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories (UL/ULC).
- 1.3.4 The system shall be installed and serviced by personnel trained by the manufacturer.
- 1.3.5 The system shall be capable of protecting cooking appliances by utilizing either dedicated appliance protection and/or overlapping appliance protection.

1.4 Quality Control

- 1.4.1 Manufacturer: The R-102 Restaurant Fire Suppression System shall be manufactured by a company with at least forty years experience in the design and manufacture of pre-engineered fire suppression systems. The manufacturer shall be ISO 9001 registered.
- 1.4.2 Certificates: The wet agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease-related fires.

1.5 Warranty, Disclaimer, and Limitations

- 1.5.1 The pre-engineered restaurant fire suppression system components shall be warranted for five years from date of delivery against defects in workmanship and material.

1.6 Delivery

- 1.6.1 Packaging: All system components shall be securely packaged to provide protection during shipment.

1.7 Environmental Conditions

- 1.7.1 The R-102 system shall be capable of operating within a temperature range of 32 °F to 130 °F (0 °C to 54 °C).

2.0 PRODUCT

2.1 Manufacturer

- 2.1.1 Tyco Fire Protection Products, One Stanton Street, Marinette, Wisconsin 54143-2542, Telephone (715) 735-7411.

2.2 Components

- 2.2.1 The basic system shall consist of an AUTOMAN regulated release assembly which includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles, blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows shall be supplied in separate packages in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station, mechanical and electrical gas valves, and electrical switches for automatic equipment and gas line shut-off, and building fire alarm control panel interface.
- 2.2.2 Wet Chemical Agent: The extinguishing agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease related fires.
- 2.2.3 Agent Tank: The agent tank shall be installed in a stainless steel enclosure or wall bracket. The tank shall be constructed of stainless steel. Tanks shall be available in two sizes; 1.5 gallon (5.7 L) and 3.0 gal (11.4 L). The tank shall have a working pressure of 110 psi (7.6 bar), a test pressure of 330 psi (22.8 bar), and a minimum burst pressure of 660 psi (45.5 bar). The tank shall include an adaptor/tube assembly containing a burst disc union.
- 2.2.4 Regulated Release Mechanism: The regulated release mechanism shall be a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one or two agent tanks depending on the capacity of the gas cartridge used or three 3.0 gallon (11.4 L) agent storage tanks in certain applications. It shall contain a factory installed regulator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar).

It shall have the following actuation capabilities: automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station.

The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure shall contain knock-outs for 1/2 in. conduit. The cover shall contain an opening for a visual status indicator.

It shall be compatible with mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch(es), it shall be compatible with electric gas line or appliance shut-off devices, or connections to a building fire alarm control panel.

Specifications (Continued)

- 2.2.5 Regulated Actuator Assembly: When more than two agent tanks or three agent tanks in certain applications are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge. The regulator shall be deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). The regulated actuator assembly shall contain an actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.
- 2.2.6 Discharge Nozzles: Each discharge nozzle shall be tested and listed with the R-102 system for a specific application. Nozzles tips shall be stamped with the flow number designation (1/2, 1, 2, or 3). Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.
- 2.2.7 Distribution Piping: Distribution piping shall be Schedule 40 black iron, chrome-plated, or stainless steel conforming to ASTM A120, A53, or A106.
- 2.2.8 Detectors: The detectors shall be the fusible link style designed to separate at a specific temperature.
- 2.2.9 Cartridges: The cartridge shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.
- 2.2.10 Agent Distribution Hose: An optional agent distribution hose shall be available for kitchen appliances manufactured with or resting on casters (wheels/rollers). This shall allow the appliance to be moved for cleaning purposes without disconnecting the appliance fire suppression protection. Hose assembly shall include a restraining cable kit to limit the appliance movement within the range (length) of the flexible hose.
- 2.2.11 Flexible Conduit: The manufacturer supplying the Restaurant Fire Suppression System shall offer flexible conduit as an option to rigid EMT conduit for the installation of pull stations and/or mechanical gas valves. The flexible conduit shall be UL Listed and include all approved components for proper installation.
- 2.2.12 Pull Station Assembly: The Fire Suppression System shall include a remote pull station for manual system actuation. The pull station shall be designed to include a built-in guard to protect the pull handle. The pull station shall also be designed with a pull handle to allow for three finger operation and shall be red in color for quick visibility.

3.0 IMPLEMENTATION

3.1 Installation

- 3.1.1 The R-102 fire suppression system shall be designed, installed, inspected, maintained, and recharged in accordance with the manufacturer's listed instruction manual.

3.2 Training

- 3.2.1 Training shall be conducted by representatives of the manufacturer.

ANSUL, R-102, and the product names listed in this material are marks and/or registered marks. Unauthorized use is strictly prohibited.



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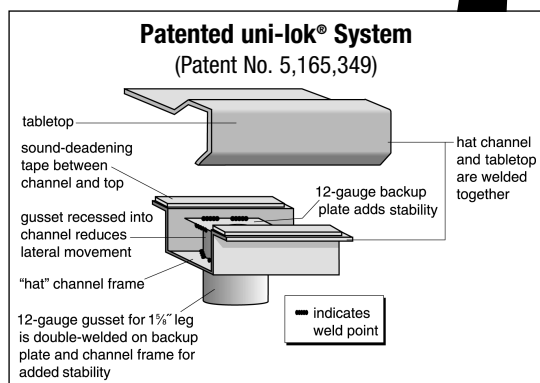
Specification Sheet

Short Form Specifications

Eagle worktables, Spec-Master® Marine series, model _____ . Top constructed of 14 gauge 300 series stainless steel, with 2½" marine counter style edging on all four sides and 4½" backsplash. Adjustable undershelf constructed of 18 gauge 300 series stainless steel with marine edge. Top reinforced with stainless steel hat channels and sound deadened. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. 1½"-diameter stainless steel legs, with stainless steel gussets and 1" stainless steel adjustable bullet feet.



worktable with backsplash
and adjustable undershelf



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Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

Worktables with Backsplash and Stainless Steel Base with Undershelf —Spec-Master® Marine Series

MODELS:

- | | | | |
|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| <input type="checkbox"/> T2424SEM-BS | <input type="checkbox"/> T24108SEM-BS | <input type="checkbox"/> T3072SEM-BS | <input type="checkbox"/> T3660SEM-BS |
| <input type="checkbox"/> T2430SEM-BS | <input type="checkbox"/> T24120SEM-BS | <input type="checkbox"/> T3084SEM-BS | <input type="checkbox"/> T3672SEM-BS |
| <input type="checkbox"/> T2436SEM-BS | <input type="checkbox"/> T24132SEM-BS | <input type="checkbox"/> T3096SEM-BS | <input type="checkbox"/> T3684SEM-BS |
| <input type="checkbox"/> T2448SEM-BS | <input type="checkbox"/> T24144SEM-BS | <input type="checkbox"/> T30108SEM-BS | <input type="checkbox"/> T3696SEM-BS |
| <input type="checkbox"/> T2460SEM-BS | <input type="checkbox"/> T3030SEM-BS | <input type="checkbox"/> T30120SEM-BS | <input type="checkbox"/> T36108SEM-BS |
| <input type="checkbox"/> T2472SEM-BS | <input type="checkbox"/> T3036SEM-BS | <input type="checkbox"/> T30132SEM-BS | <input type="checkbox"/> T36120SEM-BS |
| <input type="checkbox"/> T2484SEM-BS | <input type="checkbox"/> T3048SEM-BS | <input type="checkbox"/> T30144SEM-BS | <input type="checkbox"/> T36132SEM-BS |
| <input type="checkbox"/> T2496SEM-BS | <input type="checkbox"/> T3060SEM-BS | <input type="checkbox"/> T3648SEM-BS | <input type="checkbox"/> T36144SEM-BS |

Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Top reinforced with welded-on hat channel.
- Sound-deadened between top and channels.
- 4½" (114mm)-high 90° backsplash with 1" (25mm) turn at 90°.
- Marine counter edge on front and ends.
- 14 gauge 300 series polished stainless steel.

Adjustable Undershelf

- Heavy gauge stainless steel.
- Gusset welded to each corner.
- Heavy duty marine edge design.

Legs—1½" (41mm)-diameter

- Tables 96" (2438mm) and longer come with six legs or more.
- Heavy gauge stainless steel.
- 1" (25mm) adjustable stainless steel feet.

Options / Accessories

- | | |
|--|--|
| <input type="checkbox"/> Drawer | <input type="checkbox"/> Duplex receptacles |
| <input type="checkbox"/> Lock | <input type="checkbox"/> Pot rack |
| <input type="checkbox"/> Casters | <input type="checkbox"/> Sink |
| <input type="checkbox"/> Overshelves | <input type="checkbox"/> Additional undershelf |
| <input type="checkbox"/> Power strip (for material handling) | <input type="checkbox"/> Stabilizer Bar (for 30"- and 36"-wide tables) |
| <input type="checkbox"/> Knockdown Welded Base (see back page) | |

Certifications / Approvals



AutoQuotes



Spec sheets available for viewing, printing or downloading from our online literature library at our websites

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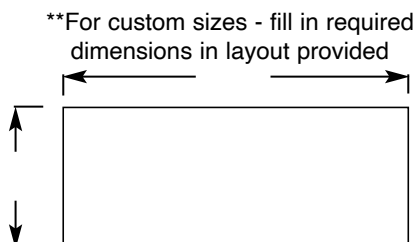
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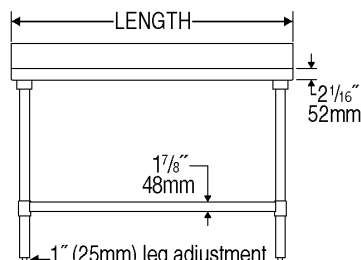
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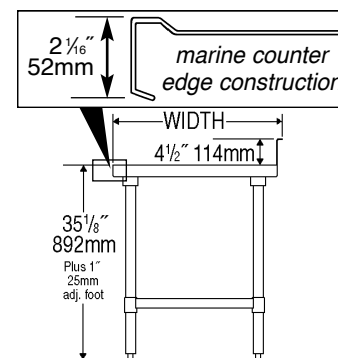
Worktables with Backsplash and Stainless Steel Base with Undershelf—Spec-Master® Marine Series



TOP VIEW



FRONT VIEW



SIDE VIEW

model #	# of legs	width		length		weight	
		in.	mm	in.	mm	lbs.	kg
T2424SEM-BS	4	24"	610	24"	610	44	20.0
T2430SEM-BS	4	24"	610	30"	762	51	23.1
T2436SEM-BS	4	24"	610	36"	914	53	24.0
T2448SEM-BS	4	24"	610	48"	1219	67	30.4
T2460SEM-BS	4	24"	610	60"	1524	79	35.8
T2472SEM-BS	4	24"	610	72"	1829	94	42.6
T2484SEM-BS	4	24"	610	84"	2134	132	59.9
T2496SEM-BS	6	24"	610	96"	2438	137	62.1
T24108SEM-BS	6	24"	610	108"	2743	142	64.4
T24120SEM-BS	6	24"	610	120"	3048	154	69.9
T24132SEM-BS	8	24"	610	132"	3353	177	80.3
T24144SEM-BS	8	24"	610	144"	3658	234	106.1
T3030SEM-BS	4	30"	762	30"	762	55	25.0
T3036SEM-BS	4	30"	762	36"	914	62	28.2
T3048SEM-BS	4	30"	762	48"	1219	77	34.9
T3060SEM-BS	4	30"	762	60"	1524	87	39.5
T3072SEM-BS	4	30"	762	72"	1829	105	47.6
T3084SEM-BS	4	30"	762	84"	2134	132	59.9
T3096SEM-BS	6	30"	762	96"	2438	169	76.7
T30108SEM-BS	6	30"	762	108"	2743	176	79.8
T30120SEM-BS	6	30"	762	120"	3048	182	82.6
T30132SEM-BS	8	30"	762	132"	3353	225	102.0
T30144SEM-BS	8	30"	762	144"	3658	238	237.6
T3648SEM-BS	4	36"	914	48"	1219	84	38.1
T3660SEM-BS	4	36"	914	60"	1524	99	44.9
T3672SEM-BS	4	36"	914	72"	1829	114	51.7
T3684SEM-BS	4	36"	914	84"	2134	183	83.0
T3696SEM-BS	6	36"	914	96"	2438	203	92.0
T36108SEM-BS	6	36"	914	108"	2743	207	93.9
T36120SEM-BS	6	36"	914	120"	3048	211	95.7
T36132SEM-BS	8	36"	914	132"	3353	234	106.1
T36144SEM-BS	8	36"	914	144"	3658	241	109.3

NEW Option for Worktables with Stainless Steel Base: Knockdown Welded Base

PATENT PENDING



worktable shown with base knocked down



worktable assembled

- Precision machined stainless steel threaded inserts pressed into 16 gauge 1 5/8"-diameter leg sections for knockdown construction
- Marine edge stainless steel undershelf welded to lower leg sections

Add suffix **"-KDWB"** to worktable model number (ex: T2436SEM-BS-KDWB). See EG8217 for more info.

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HL4522-SS

CVap® Holding Cabinet

SPECIFICATIONS

Short Form Specs

Winston CVap Holding Cabinet, model HL4522 with electronic A-Series differential controls to provide precise food temperature from 90 to 180°F (32 to 82°C) and maintain food texture with settings labeled proof, very moist, firm moist, and crisp. Utilizes Controlled Vapor Technology (patent #5,494,690) as a method and apparatus for holding hot foods, consisting of an air heater and water heater to establish ideal water vapor content that is in relation with the moistness characteristics of the food. Utilizes circulating fan to assist heat recovery.

Construction

Control	Electronic differential control with dials labeled Food Temperature and Food Texture.
Capacity	14 Sheet Pan (18" x 26" x 1.25") 28 Steam Table Pan (12" x 20" x 2.5") 14 Gastronorm Pan 2/1
Weight Tolerance	65 lbs. (29.25 kg) per rack.
Electrical	Supplied with 84" (2,134 mm) (minimum) power cord and plug.
Shelving	Adjustable, wire racks (standard 3.5" (89 mm) centers (OC) adjustable to 1.75"). Rack supports accommodate wire racks, sheet pans, gastronorm, or steam table pans.
Materials	To be commercial and institutional grade stainless steel interior and exterior to provide ease of cleaning and long service life with reasonable use and care. Full-perimeter insulation.
Doors	Fully insulated stainless steel. Magnetic door latch.
Casters	Includes two locking, two non-locking, heavy duty, non-marking.
Water Fill	Operated manually. Low mineral potable water is recommended, otherwise use deionizer/demineralizer to minimize corrosive damage.
Installation Requirements	Allow at least 2" (51 mm) clearance on sides, particularly around ventilation holes. Allow at least 18" (457 mm) clearance from heat producing equipment, such as ovens or fryers. Generally this equipment does not need to be installed under a mechanical ventilation system (vent hood). Check local health and fire codes for requirements specific to your location. Unit must be installed at level.



HL4522-SS

CVAP HOLDING CABINET
Electronic Differential Control

**FULL SIZE MODEL, WITH FAN,
STAINLESS STEEL (SHOWN)**



CVap® Holding Cabinets are designed for high quality holding of a wide variety of menu items for extended times. They can be used for proofing, holding, and serving.



WINSTON FOODSERVICE

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winstonfoodservice.com | 800.234.5286 | +1.502.495.5400

Specifications subject to change without notice.

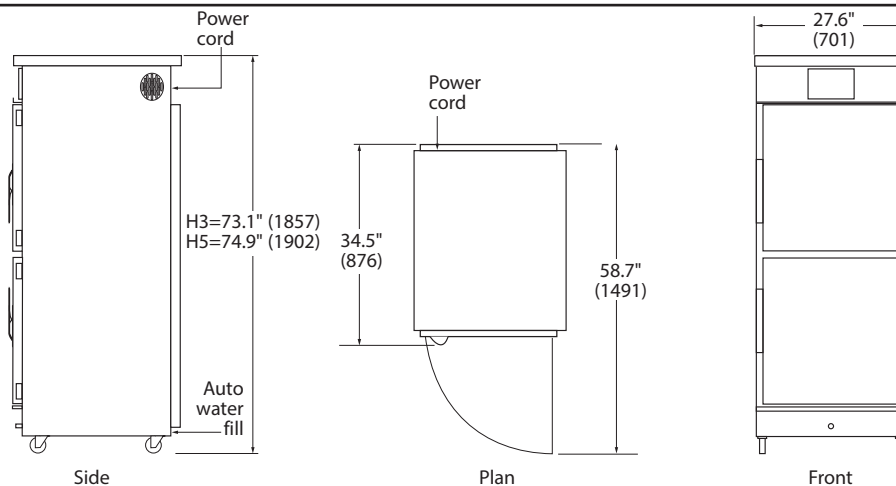
JOB

ITEM#



HL4522-SS

CVap® Holding Cabinet | Full Size Model



Drawings not to scale

Drawings Not to Scale

capacity	size in (mm)	volts	hertz	ph	amps	watts	nema	ship wt. lb (kg)	ship cube	
14 SP 28 STP 14 GP 2/1	H3= 73.1" (1857)	120	60	1	14.4	1730	US / CANADA		420 (191)	C3,5=60.0 (1.7) CT=73.9 (2.1)
	H5= 74.9" (1902)						US 5-15P			
	HT= 75.7" (1923)						CAN 5-20P			
	W= 27.6" (701)									
	WT= 29.5" (749)									
						INTERNATIONAL				
	D= 34.5" (876)						Not available for international market at this time			
	DT= 37.6" (955)									

SP= Sheet Pan (18" x 26" x 1.25") • STP= Steam Table Pan (12" x 20" x 2.5") • GP= Gastronorm Pan • H3= Height w/3" casters • H5= Height w/5" casters
HT= Height w/transport or bumper guards • WT= Width w/transport or bumper guard • DT= Depth w/transport bumper guard

CONTROLLED VAPOR TECHNOLOGY Exclusive Controlled Vapor technology (U.S. patent # 5,494,690) establishes that the water vapor content in the cabinet is the same as that of the food. This unique process controls moisture evaporation and saturation, so crisp foods stay crisp, and moist foods stay moist.

EASY-TO-USE CONTROLS Electronic differential controls are easy to understand and reliable. Never requires field calibration.
FOOD TEMP DIAL allows precise control of food temperature from 90 to 180°F (32 to 82°C).
FOOD TEXTURE DIAL maintains just-cooked texture with settings labeled proof, very moist, firm moist, and crisp. No guesswork required.

BUILT TO LAST WITH QUALITY CRAFTSMANSHIP, high grade stainless steel construction, and full insulation on top, sides, and doors. Features perimeter door gaskets, magnetic door latches, removable side racks, and digital readout for water temperature.

ALLOWS FOR BETTER CONTROL OF FOOD QUALITY, hold your menu items at just-cooked quality and precise serving temperatures for extended times.

INDUSTRY COMPLIANT, CVap equipment complies with domestic and international requirements such as UL, C-UL, UL Sanitation, CE, and others.

WARRANTY. Limited one year warranty. Warranty disclaimer for failure to clean. Ask for complete warranty disclosure.

SPECIFY THE FOLLOWING WHEN ORDERING:

Standard (No additional cost):

1. Voltage: 120V
*Inquire about additional international voltages available.
2. Hinge preference: Left or right
3. Casters: 3" (76") casters

Optional (Additional cost):

1. 5" (127 mm) casters
2. 6" (152 mm) legs
3. Window: Window in doors
4. Locking handle
5. Cord wrap
6. Drain ball valve
7. Control cover
8. Bumper guard
9. Transport package
10. Solid rack supports: Solid stainless steel rack supports (replaces standard wire rack supports)
11. Automatic water fill system
12. Extended warranty

Accessories & Supplies (Additional cost):

- PS2206-4 Wire rack, chrome (Qty 4)
- PS2206-5 Wire rack, chrome (Qty 5)
- PS2938-4 Wire rack, SS (Qty 4)
- PS2938-5 Wire rack, SS (Qty 5)
- PS2553 8.5" (216 mm) Top cover extension
- PS2351 11" (279 mm) Top cover extension
- PS2696 Mobile water removal system
- PS2429 External water filter (auto water fill units only)

FOR WINSTON SERVICE PARTS, ACCESSORIES, AND SUPPLIES ONLINE!
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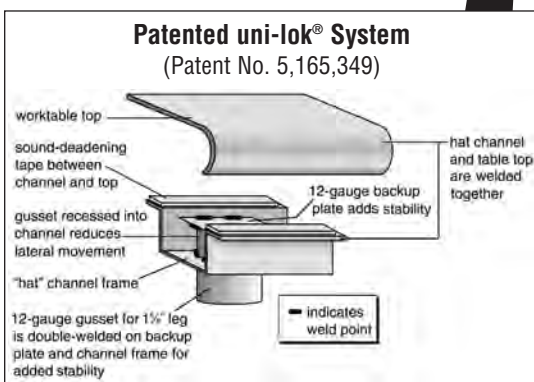


Profit from the Eagle Advantage®

Specification Sheet

Short Form Specifications

Eagle worktables, Spec-Master® series, model _____. Top constructed of 14 gauge 300 series stainless steel, with 1½" roll on front and rear, and sides turned down 90°. Undershelf is adjustable and constructed of 18 gauge 300 series stainless steel with marine edge. Top reinforced with stainless steel hat channels and sound deadened. Constructed with uni-lok® patented gusset system with the gussets recessed into the hat channels to reduce lateral movement. Legs are 1½" O.D., stainless steel, with stainless steel gussets and 1" stainless steel adjustable bullet feet.



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MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

Worktables with Flat Top and Stainless Steel Base with Undershelf—Spec-Master® Series

MODELS:

<input type="checkbox"/> T2424SE	<input type="checkbox"/> T24144SE	<input type="checkbox"/> T30132SE	<input type="checkbox"/> T36144SE
<input type="checkbox"/> T2430SE	<input type="checkbox"/> T3030SE	<input type="checkbox"/> T30144SE	<input type="checkbox"/> T4848SE
<input type="checkbox"/> T2436SE	<input type="checkbox"/> T3036SE	<input type="checkbox"/> T3648SE	<input type="checkbox"/> T4860SE
<input type="checkbox"/> T2448SE	<input type="checkbox"/> T3048SE	<input type="checkbox"/> T3660SE	<input type="checkbox"/> T4872SE
<input type="checkbox"/> T2460SE	<input type="checkbox"/> T3060SE	<input type="checkbox"/> T3672SE	<input type="checkbox"/> T4884SE
<input type="checkbox"/> T2472SE	<input type="checkbox"/> T3072SE	<input type="checkbox"/> T3684SE	<input type="checkbox"/> T4896SE
<input type="checkbox"/> T2484SE	<input type="checkbox"/> T3084SE	<input type="checkbox"/> T3696SE	<input type="checkbox"/> T48108SE
<input type="checkbox"/> T2496SE	<input type="checkbox"/> T3096SE	<input type="checkbox"/> T36108SE	<input type="checkbox"/> T48120SE
<input type="checkbox"/> T24108SE	<input type="checkbox"/> T30108SE	<input type="checkbox"/> T36120SE	<input type="checkbox"/> T48132SE
<input type="checkbox"/> T24120SE	<input type="checkbox"/> T30120SE	<input type="checkbox"/> T36132SE	<input type="checkbox"/> T48144SE
<input type="checkbox"/> T24132SE			

Tabletop

- Patented uni-lok® gusset system (patent #5,165,349): gussets are recessed into hat channel, reducing lateral movement.
- Top reinforced with welded-on hat channel.
- Sound-deadened between top and channels.
- 1½" (38mm)-diameter 180° rolled edges on front and rear. Ends are turned down 90° providing for flush installations when required.
- 14 gauge 300 series polished stainless steel.

Adjustable Undershelf

- 18 gauge 300 series stainless steel.
- Gusset welded to each corner.
- Heavy duty marine edge design.

Legs—1½" (41mm)-diameter

- 24" to 36" (610 to 914mm)-wide units that are 96" (2438mm) and longer come with six legs or more. 48" (1219mm)-wide units that are 72" (1829mm) and longer come with six legs or more.
- Heavy gauge stainless steel.
- 1" (25mm) adjustable stainless steel feet.

Options / Accessories

- | | |
|--|--|
| <input type="checkbox"/> Drawer | <input type="checkbox"/> Duplex receptacles |
| <input type="checkbox"/> Lock | <input type="checkbox"/> Pot rack |
| <input type="checkbox"/> Casters | <input type="checkbox"/> Sink |
| <input type="checkbox"/> Stainless steel bullet feet | <input type="checkbox"/> Additional undershelf |
| <input type="checkbox"/> Overshelves | <input type="checkbox"/> Stabilizer Bar (for 30"- and 36"-wide tables) |

Certifications / Approvals



AUTOQUOTES



EG10.41C Rev. 09/15

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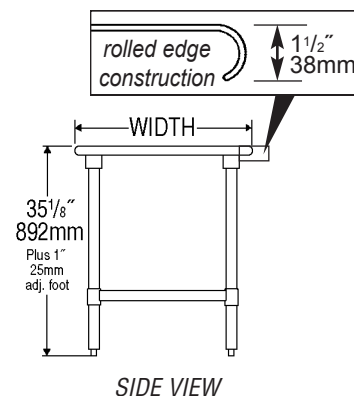
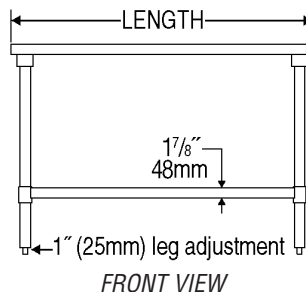
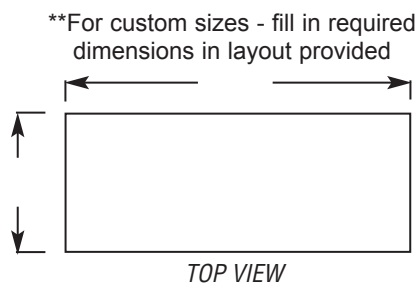
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Profit from the Eagle Advantage®

Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

Worktables with Flat Top and Stainless Steel Base with Undershelf—Spec-Master® Series



model #	# of legs	width		length		weight	
		in.	mm	in.	mm	lbs.	kg
T2424SE	4	24"	610	24"	610	46	20.9
T2430SE	4	24"	610	30"	762	50	22.7
T2436SE	4	24"	610	36"	914	55	24.9
T2448SE	4	24"	610	48"	1219	67	30.4
T2460SE	4	24"	610	60"	1524	78	35.4
T2472SE	4	24"	610	72"	1829	90	40.8
T2484SE	4	24"	610	84"	2134	103	46.3
T2496SE	6	24"	610	96"	2438	125	56.7
T24108SE	6	24"	610	108"	2743	144	65.3
T24120SE	6	24"	610	120"	3048	163	73.9
T24132SE	8	24"	610	132"	3353	186	84.4
T24144SE	8	24"	610	144"	3658	200	90.7
T3030SE	4	30"	762	30"	762	54	24.5
T3036SE	4	30"	762	36"	914	57	25.9
T3048SE	4	30"	762	48"	1219	75	34.0
T3060SE	4	30"	762	60"	1524	87	39.5
T3072SE	4	30"	762	72"	1829	101	45.8
T3084SE	4	30"	762	84"	2134	116	52.6
T3096SE	6	30"	762	96"	2438	139	63.1
T30108SE	6	30"	762	108"	2743	161	73.0
T30120SE	6	30"	762	120"	3048	182	82.6
T30132SE	8	30"	762	132"	3353	204	92.5
T30144SE	8	30"	762	144"	3658	224	101.6
T3648SE	4	36"	914	48"	1219	83	37.6
T3660SE	4	36"	914	60"	1524	97	44.0
T3672SE	4	36"	914	72"	1829	114	51.7
T3684SE	4	36"	914	84"	2134	132	59.9
T3696SE	6	36"	914	96"	2438	153	69.4
T36108SE	6	36"	914	108"	2743	180	81.6
T36120SE	6	36"	914	120"	3048	207	93.9
T36132SE	8	36"	914	132"	3353	234	106.1
T36144SE	8	36"	914	144"	3658	261	118.4
T4848SE	4	48"	1219	48"	1219	136	61.7
T4860SE	4	48"	1219	60"	1524	161	73.0
T4872SE	6	48"	1219	72"	1829	188	85.3
T4884SE	6	48"	1219	84"	2134	217	98.4
T4896SE	8	48"	1219	96"	2438	265	120.2
T48108SE	8	48"	1219	108"	2743	306	138.8
T48120SE	8	48"	1219	120"	3048	348	157.9
T48132SE	8	48"	1219	132"	3353	388	176.0
T48144SE	8	48"	1219	144"	3658	430	195.0

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Profit from the Eagle Advantage®

Specification Sheet



spice bin

stabilizer bars

power strip

zinc casters

worktable with extra undershelf

Casters (NSF) — chart on back page

- Offered in sets of four, six, and eight casters.
- Available in zinc with resilient or poly tread, or polymer cart washable with polymer tread.

Extra Undershelves** — chart on back page

- For tables with uni-lok® hat channel frame.
- Designed for storage of shorter, smaller items under worktable where only one undershelf might not suffice.
- Adjustable, available in galvanized or stainless steel.

** Stabilizer Bars and Extra Undershelves will not work together.

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Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

Table Accessories

MODELS:

- ☐ 24*GADJUS ☐ CA*-SB
☐ 24*SADJUS* ☐ PS*
☐ 30*GADJUS ☐ SB-1
☐ 30*SADJUS* ☐ W TSA30

* See charts for complete model numbers.

Spice Bin

- Designed for either overshelf or wall shelf applications.
- 22 gauge stainless steel with fully covered deep-drawn construction.
- Complete with label holders.

model #	width		length		height*		weight	
	in.	mm	in.	mm	in.	mm	lbs.	kg
SB-1	6½"	165	5½"	140	6"	156	1.5	0.7

* Must allow 7¾" (197mm) space. Bin slides on stainless steel angle supports secured to underside of shelf.

Power Strips for Stainless Steel Tables with Backsplash

- Mounts onto backsplash via two stainless steel clips—no tools required.
- Brushed aluminum finish.
- 15' (4572mm)-long cord and plug.
- ON-OFF toggle switch and reset button.

model #	length		number of outlets
	in.	mm	
PS2408	24"	610	8
PS3612	36"	914	12
PS4816	48"	1219	16
PS6020	60"	1524	20

Stabilizer Bars (pair)**

- Fits standard 30" and 36" (762 and 914mm)-wide worktables.
- Positioned at an angle to add maximum stability to table.
- 12 gauge Valu-Master® epoxy coated gussets welded onto ends of each 12 gauge galvanized angle bar.
- Stands 19½" (495mm) when mounted to table.

model # (pair): W TSA30

AUTOQUOTES


EG10.59 Rev. 05/11

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Profit from the Eagle Advantage®

Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

Table Accessories

Casters

set of	caster diameter in. mm		ZINC WITH RESILIENT TREAD			ZINC WITH POLY TREAD			POLY CART WASHABLE WITH POLY TREAD		
			model #	wt. cap. per caster lbs. kg		model #	wt. cap. per caster lbs. kg		model #	wt. cap. per caster lbs. kg	
4 swivel (2 with brake)	4"	102	CA4-SB	115	52.2	n/a			n/a		
6 swivel (3 with brake)	4"	102	CA6-SB	115	52.2	n/a			n/a		
8 swivel (4 with brake)	4"	102	CA8-SB	115	52.2	n/a			n/a		
4 swivel (2 with brake)	5"	127	CAH4-SB	200	90.7	CAHP4-SB	250	113.4	CAHW4-SB	250	113.4
6 swivel (3 with brake)	5"	127	CAH6-SB	200	90.7	CAHP6-SB	250	113.4	CAHW6-SB	250	113.4
8 swivel (4 with brake)	5"	127	CAH8-SB	200	90.7	CAHP8-SB	250	113.4	CAHW8-SB	250	113.4

Extra Undershelves

Note: When ordering an extra or replacement undershelf, *please order per the size of your tabletop*. Please note the "for table size" column in chart below.

GALVANIZED		STAINLESS STEEL		for table size *				weight lbs. kg	
model #		model #	model #	width in. mm	length in. mm				
2424GADJUS	2424SADJUS-18/4	2424SADJUS-18/3		24"	610	24"	610	15	6.6
2430GADJUS	2430SADJUS-18/4	2430SADJUS-18/3		24"	610	30"	762	18	8.2
2436GADJUS	2436SADJUS-18/4	2436SADJUS-18/3		24"	610	36"	914	21	9.6
2448GADJUS	2448SADJUS-18/4	2448SADJUS-18/3		24"	610	48"	1219	27	12.2
2460GADJUS	2460SADJUS-18/4	2460SADJUS-18/3		24"	610	60"	1524	33	15.0
2472GADJUS	2472SADJUS-18/4	2472SADJUS-18/3		24"	610	72"	1829	39	17.6
2484GADJUS	2484SADJUS-18/4	2484SADJUS-18/3		24"	610	84"	2134	45	20.4
2496GADJUS	2496SADJUS-18/4	2496SADJUS-18/3		24"	610	96"	2438	51	23.1
24108GADJUS	24108SADJUS-18/4	24108SADJUS-18/3		24"	610	108"	2743	57	25.9
24120GADJUS	24120SADJUS-18/4	24120SADJUS-18/3		24"	610	120"	3048	63	28.6
24132GADJUS	24132SADJUS-18/4	24132SADJUS-18/3		24"	610	132"	3353	69	31.3
24144GADJUS	24144SADJUS-18/4	24144SADJUS-18/3		24"	610	144"	3658	75	34.0
3024GADJUS	3024SADJUS-18/4	3024SADJUS-18/3		30"	762	24"	610	17	7.5
3030GADJUS	3030SADJUS-18/4	3030SADJUS-18/3		30"	762	30"	762	21	9.5
3036GADJUS	3036SADJUS-18/4	3036SADJUS-18/3		30"	762	36"	914	24	10.7
3048GADJUS	3048SADJUS-18/4	3048SADJUS-18/3		30"	762	48"	1219	30	13.6
3060GADJUS	3060SADJUS-18/4	3060SADJUS-18/3		30"	762	60"	1524	36	16.3
3072GADJUS	3072SADJUS-18/4	3072SADJUS-18/3		30"	762	72"	1829	42	19.1
3084GADJUS	3084SADJUS-18/4	3084SADJUS-18/3		30"	762	84"	2134	48	21.8
3096GADJUS	3096SADJUS-18/4	3096SADJUS-18/3		30"	762	96"	2438	54	24.5
30108GADJUS	30108SADJUS-18/4	30108SADJUS-18/3		30"	762	108"	2743	60	27.2
30120GADJUS	30120SADJUS-18/4	30120SADJUS-18/3		30"	762	120"	3048	66	29.9
30132GADJUS	30132SADJUS-18/4	30132SADJUS-18/3		30"	762	132"	3353	72	32.7
30144GADJUS	30144SADJUS-18/4	30144SADJUS-18/3		30"	762	144"	3658	78	35.4

* Undershelves for 30" (762mm)-wide tables listed above also fit 36" (915mm)-wide tables.

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DESIGNER LINE ROLL-IN REFRIGERATOR

Model: D2RIN-E

Natural Refrigerant R-290 Model

Designer line

2-Section Extra-High Roll-In Refrigerator with 72" Cart Capacity

D2RIN-E - Stainless steel front, aluminum end panels and interior

D2RINSA-E - Stainless steel exterior, aluminum interior

D2RINSS-E - Stainless steel exterior and interior



Options and Accessories

(upcharge and lead times may apply)

Epoxy coated steel shelves	Special electrical req. (consult factory)
Chrome or stainless steel shelves	Correctional Facility Options
Rehinging of doors (consult factory)	<ul style="list-style-type: none"> One way security screws
Custom laminates	<ul style="list-style-type: none"> Locking hasp (lock not included)
Half doors	<ul style="list-style-type: none"> Stainless steel mesh cover
Stainless steel back	<ul style="list-style-type: none"> Coverless hinges

Consult factory for other model configurations, options and accessories.

Continental
Refrigerator



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Self contained, performance rated "plug" refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Refrigeration system is readily accessible on top of cabinet, separate from the "food zone"

Automatic, hot gas condensate evaporator

Expansion valve system

CABINET ARCHITECTURE

3" non-CFC polyurethane foam insulation

Smooth, polished chrome workflow door handles

Cam action, lift off hinges

Magnetic snap in Santoprene™ door gaskets

Cylinder lock in each door

Self-closing doors

72 1/2" high door opening (72"H rack capacity*)

MODEL FEATURES

Electronic control, off cycle defrost

LED interior lighting

Top and side air distribution ducts

Cabinet upper side panels and refrigeration "plug" system can be removed and reinstalled at job site

Removable stainless steel rack guides

Removable stainless steel ramps

Reinforced stainless steel floor

* Rack not supplied

IMPORTANT NOTE: ¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	68 (1926 cu l)
Width, Overall (inches)	68 1/2 (1740 mm)
Depth, Overall (inches) (including handles)	35 3/8 (899 mm)
Depth (inches) (less doors)	32 (813 mm)
Depth (inches) (doors open 90°)	65 (1651 mm)
Clear Door Width (inches)	27 3/8 (695 mm)
Clear Full Door Height (inches)	72 1/2 (1842 mm)
Height, Overall (inches)	92 (2337 mm)
Number of Door(s)	2
Rack Capacity**	2

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/2+
Capacity (BTU per hour)*	4010

* Rating @ +25°F evaporator, 90°F ambient

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	9.4 (4.2)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Height - Crated (inches)	97 (2464 mm)
Width - Crated (inches)	77 (1956 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	176 (4984 cu l)
Weight Std - Crated (pounds)	730 (331 kg)
Weight SS - Crated (pounds)	890 (404 kg)

* Rating @ +25°F evaporator, 90°F ambient

** Maximum rack size including wheels - 27"W x 29"D x 72"H

Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

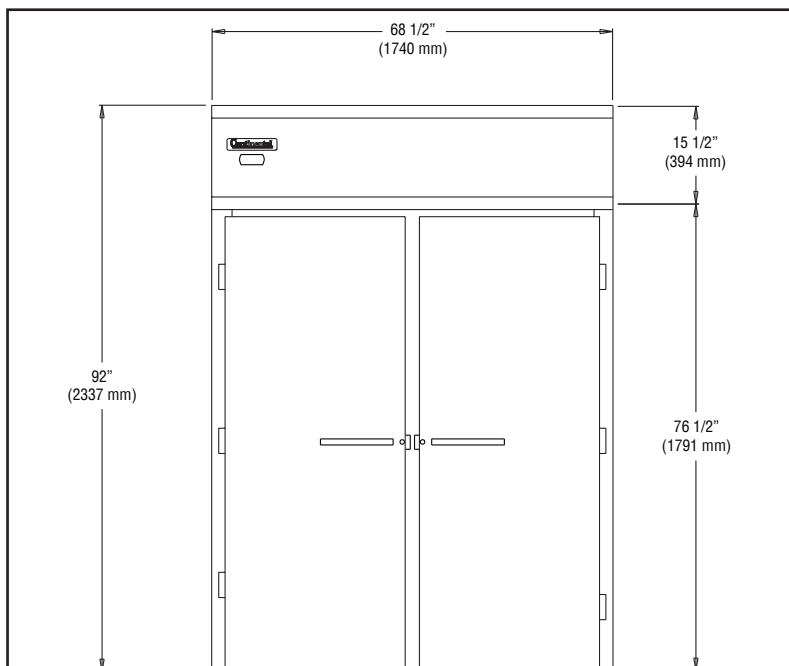
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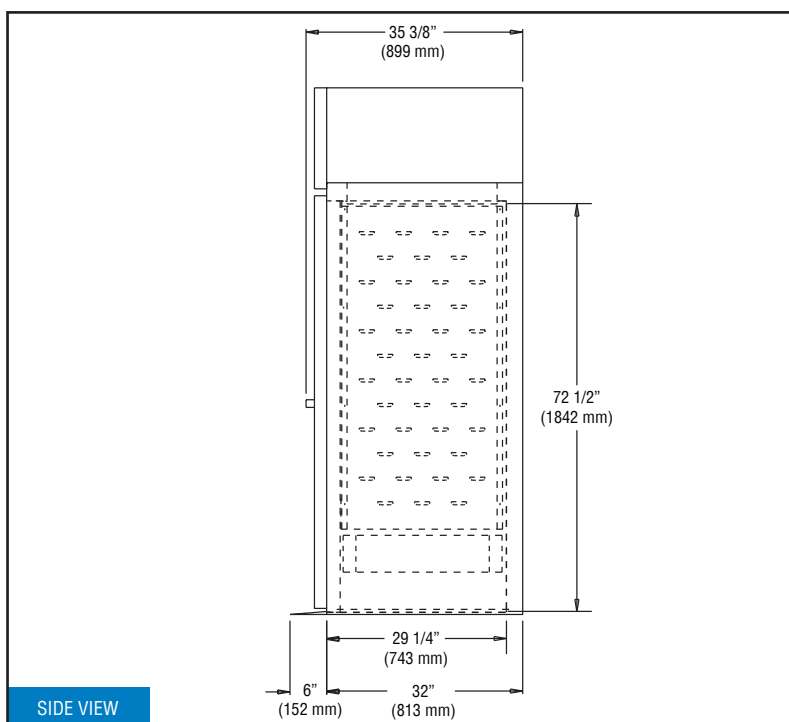
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Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.

REVISED: 5/04/2024



Profit from the Eagle Advantage®

Specification Sheet

Short Form Specifications

Eagle Mixer Stand, model _____. Top to be 16 gauge 300 series stainless steel with rolled edges on all sides. 24" O.A. working height. Constructed with uni-lok® patented gusset system, with the gussets recessed into the hat channels to reduce lateral movement.

- **Units with undershelf:** Heavy gauge galvanized or stainless steel adjustable undershelf. 1½" O.D. galvanized or stainless steel tubular legs with adjustable bullet feet.
- **Units with tubular base:** 1½" O.D. galvanized or stainless steel adjustable tubular legs with 1¼" O.D. galvanized or stainless steel tubular cross rails, and adjustable bullet feet.

Eagle Utensil Rack, model UR-501, for mixer stands. 1½"-diameter stainless steel rod with five ⅝" stainless steel rods, approximately 5" long, for utensils.



mixer stand shown with optional utensil rack

Options / Accessories

- ☐ Drawers
- ☐ Casters
- ☐ Utensil rack

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Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

Mixer Stands

MODELS:

- | | | | |
|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| <input type="checkbox"/> MS2424 | <input type="checkbox"/> MS3036 | <input type="checkbox"/> TMS3024 | <input type="checkbox"/> TMS3636 |
| <input type="checkbox"/> MS2424S | <input type="checkbox"/> MS3036S | <input type="checkbox"/> TMS3024S | <input type="checkbox"/> TMS3636S |
| <input type="checkbox"/> MS3024 | <input type="checkbox"/> MS3636 | <input type="checkbox"/> TMS3030 | <input type="checkbox"/> CA4-SB |
| <input type="checkbox"/> MS3024S | <input type="checkbox"/> MS3636S | <input type="checkbox"/> TMS3030S | <input type="checkbox"/> CA6-SB |
| <input type="checkbox"/> MS3030 | <input type="checkbox"/> TMS2424 | <input type="checkbox"/> TMS3036 | <input type="checkbox"/> CAH4-SB |
| <input type="checkbox"/> MS3030S | <input type="checkbox"/> TMS2424S | <input type="checkbox"/> TMS3036S | <input type="checkbox"/> CAH6-SB |
| | | | <input type="checkbox"/> UR-501 |

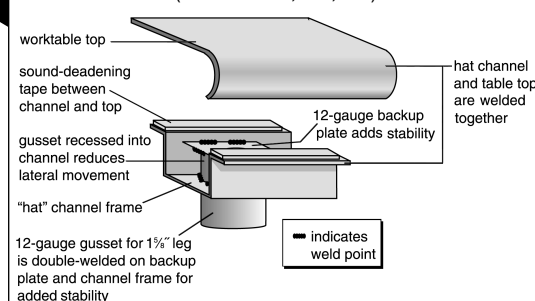
Mixer Stands

- Highly-polished die-formed 16 gauge 300 series stainless steel tabletop, with rolled front edge and ends turned down at 90°.
- Uni-lok® gusset system (patent #5,165,349): gusset is recessed into hat channel underside tabletop, reducing lateral movement.
- Galvanized or stainless steel base available with adjustable undershelf or adjustable tubular frame.
- 1½" (41mm)-diameter legs are galvanized with adjustable non-marking plastic bullet feet, or stainless steel with stainless steel adjustable bullet feet.
- Tabletop weight capacity: 600 lbs. (272.2 kg).
- Undershelf weight capacity: 150 lbs. (68.0 kg).

Optional Utensil Rack—#UR-501

- Five ⅝" (8mm)-diameter stainless steel utility rods approximately 5" (127mm) in length.
- 1½" (41mm)-diameter stainless steel tubular support, 54" (1371mm) height.

Patented uni-lok® System (Patent No. 5,165,349)



Certifications / Approvals



AUTOQUOTES



EG10.26A Rev. 09/21

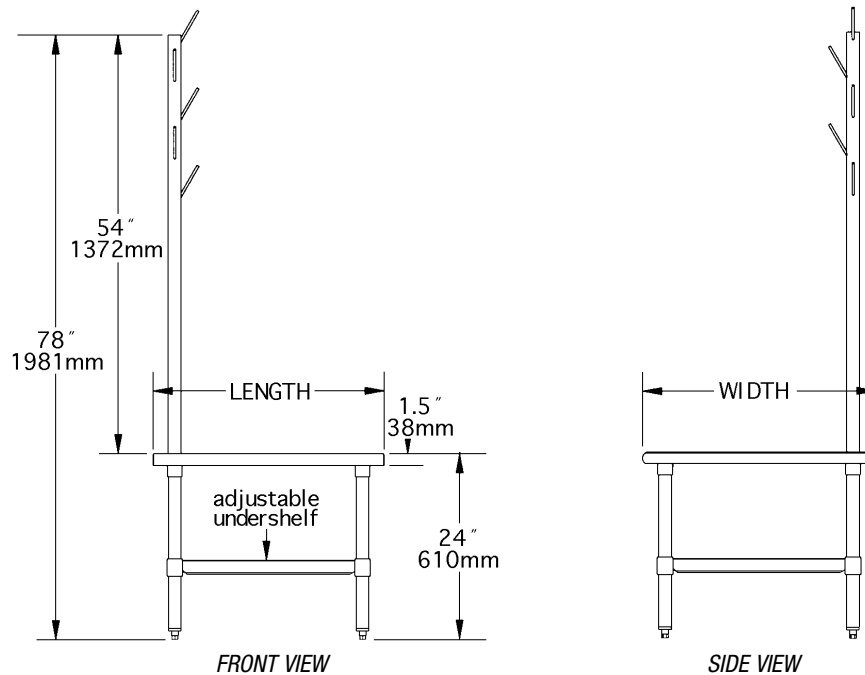
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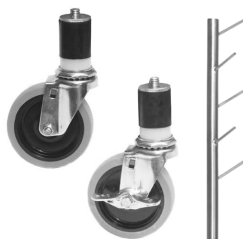
Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

Mixer Stands



(mixer stand with optional utensil rack)

width		length		weight		...WITH UNDERSHELF		...WITH TUBULAR BASE	
						with	with stainless	with	with stainless
in.	mm	in.	mm	lbs.	kg	galvanized legs	steel legs	galvanized legs	steel legs
						model #	model #	model #	model #
24"	610	24"	610	42	19.1	MS2424	MS2424S	TMS2424	TMS2424S
30"	762	24"	610	47	21.3	MS3024	MS3024S	TMS3024	TMS3024S
30"	762	30"	762	49	22.2	MS3030	MS3030S	TMS3030	TMS3030S
30"	762	36"	914	51	23.1	MS3036	MS3036S	TMS3036	TMS3036S
36"	914	36"	914	53	24.0	MS3636	MS3636S	TMS3636	TMS3636S



Optional Casters

description	weight cap. per caster		model #
	lbs.	kg	
4" (102mm)-dia., set of four (two swivel, two w/brake)	115	52.2	CA4-SB
4" (102mm)-dia., set of six (three swivel, three w/brake)	115	52.2	CA6-SB
5" (127mm)-dia., set of four (two swivel, two w/brake)	200	90.7	CAH4-SB
5" (127mm)-dia., set of six (three swivel, three w/brake)	200	90.7	CAH6-SB

Optional Utensil Rack

weight		model #
lbs.	kg	
23	10.4	UR-501

EAGLE GROUP

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Phone: 302-653-3000 or 800-441-8440 • Fax: 302-653-2065

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Project _____
 AIA # _____ SIS # _____
 Item # _____ Quantity _____ C.S.I. Section 114000



HL200 LEGACY+ 20-Quart Maximum Heavy-Duty Mixer



SPECIFIER STATEMENT

Specified mixer will be an NSF rated 20-quart maximum heavy-duty, all-purpose mixer with Hobart PLUS System, three fixed speeds plus a stir speed. Mixer has ½ HP output at the planetary shaft and all-gear transmission. Features include automatic time recall, swing-out bowl, Shift-on-the-Fly™ controls and manual bowl lift. Mixer finished with a metallic gray hybrid powder coat and has a stainless steel bowl guard.

MODEL

- ☐ **HL200** 20-Quart Maximum Heavy-Duty Countertop Mixer
- ☐ **HL200-10STD** 20-Quart Maximum Heavy-Duty Floor Mixer
- ☐ **HL200C** 20-Quart Maximum Heavy-Duty Mixer with Maximum Security Correctional Package

STANDARD FEATURES

Features in bold are exclusive to Hobart

- + **PLUS System**
 - **VFDadvantage** variable frequency drive
 - **Maximum capacity** overheat protection
 - **Reinforced planetary shaft system**
- + **Triple interlock system with MagnaLock technology**
- + Heavy-duty ½ HP motor
- + Gear transmission
- + Three fixed speeds, plus stir speed
- + **Shift-on-the-Fly™ controls**
- + Soft start agitation technology
- + **15-minute SmartTimer™**
- + Automatic time recall
- + Large, easy-to-reach controls
- + **Single point bowl installation**
- + **Ergonomic swing-out bowl**
- + #12 taper attachment hub
- + Open base
- + Metallic gray hybrid powder coat finish
- + Stainless steel removable bowl guard

ACCESSORY PACKAGE

Featuring Hobart Quick Release™ Agitators

- ☐ HL200-1STD Standard Accessory Package includes:
 - + 20-quart stainless steel bowl
 - + 20-quart "B" beater
 - + 20-quart "D" wire whip
 - + 20-quart "ED" dough hook

HL200 LEGACY+ 20-QUART MAXIMUM HEAVY-DUTY MIXER

Approved by _____ Date _____ Approved by _____ Date _____



HL200 LEGACY+ 20-Quart Maximum Heavy-Duty Mixer

SOLUTIONS/BENEFITS

PERFORMANCE

VFDadvantage Variable Frequency Drive

- + All-gear, direct drive system
- + Ensures superior mixing consistency, motor protection and long life

Quick Release™ Agitators

- + Eliminates the up/down play of bayonet-style agitators
- + Consistent agitator-to-bowl ratio delivers superior mixing performance

Four Mixing Speeds

- + Can handle virtually any mixing job
- + Includes stir speed

Reinforced Planetary Shaft System

- + Rugged durability under the most challenging mixing conditions

Maximum Capacity Overheat Protection

- + Extreme-duty wiring and connections handle more power, reducing thermal cycling impact

EASE OF USE

Ergonomic Swing-Out Bowl

- + Easily swing bowl to the side to remove/add ingredients
- + Adds convenience and saves time

Single-Point Bowl Installation

- + Easy-to-mount bowl uses only one point to install
- + Reduces risk of spills, speeds up mixing process

Bowl Lift

- + Ergonomic, smoothly moves bowl into mixing position

Shift-on-the-Fly™ Controls

- + Allows safe, convenient speed changes while the motor is running
- + Pulse and jog as needed

15-Minute SmartTimer™

- + Automatic recall of time and speed

SANITATION & CLEANING

Stainless Steel Removable Bowl Guard

- + Easy to remove without tools for cleaning
- + Dishwasher-safe for easy cleaning and sanitizing

Soft Start Agitation Technology

- + Gradually delivers electricity to the mixer
- + Minimizes the risk of ingredient splash out

OPERATOR ASSURANCE

Triple Interlock System with MagnaLock Technology

- + Prevents mixer from operating unless the bowl is fully up and locked in place and the bowl guard is secured

HL200 MIXER CAPACITY CHART

Recommended Maximum Capacities – dough capacities based on 70°F water and 12% flour moisture.

Product	Agitators Suitable for Operation	HL200
Capacity of Bowl (Qt. Liquid)		20
Egg Whites	D	1 qt.
Mashed Potatoes	B & C	15 lb.
Whipped Cream	D or C	4 qt.
Cakes	B	21 lb.
Cookies, Sugar		15 lb.
Dough, Bread or Roll ★ (Lt.-Med.) 60% AR	ED	25 lb. ●
Dough, Heavy Bread 55% AR ★	ED	15 lb. ●
Dough, Thin Pizza 40% AR ★ (max. mix time 5 min.)	ED	9 lb. ●
Dough, Thick Pizza 60% AR ★	ED	20 lb. ●
Dough, Whole Wheat 70% AR	ED	20 lb. ●
Icing, Fondant	B	12 lb.
Icing, Marshmallow	C or I	2 lb.
Pasta, Basic Egg Noodle (max. mix time 5 min.)	ED	5 lb. ●

Note: % AR (% Absorption Ratio) – Water weight divided by flour weight. Capacity depends on moisture content of dough. Above capacities based on 12% flour moisture at 70°F water temperature.

● 1st Speed

■ 2nd Speed

▲ 3rd Speed

★ If high gluten flour is used, reduce above dough batch size by 10%.

2nd speed should never be used on 50% AR or lower products.

Use of ice requires a 10% reduction in batch size.

1 gallon of water weighs 8.33 lbs.

Note: Attachment hub should not be used while mixing.



HL200 LEGACY+ 20-Quart Maximum Heavy-Duty Mixer

SPECIFICATIONS

Motor: ½ HP high torque, 3-phase motor.

100-120/50/60/1 – 8.0 Amps

200-240/50/60/1 – 5.0 Amps

Electrical: 100-120/50/60/1, 200-240/50/60/1 – UL Listed.

Controls: Magnetic contactor and thermal overload protection. Internally sealed “Start-Stop” push buttons. A 15-minute SmartTimer™ is standard. SmartTimer™ includes:

- **Automatic Time Recall**, which remembers the last time set for each speed.
- **Transmission:** Gear-driven. Gears are constant mesh heat-treated hardened alloy steel along with anti-friction ball bearings. Grease lubricants furnished to all gears and shafts.

Speeds	Agitator (RPM)	Attachment (RPM)
Stir	59	33
First (Low)	107	61
Second (Intermediate)	198	113
Third (High)	365	207

Bowl Guard: Heavy-duty stainless steel wire front and solid rear portion. Front portion of guard rotates easily to add ingredients and install or remove agitator. It detaches in seconds for cleaning in dishwasher or sink. Rear portion of guard can be quickly cleaned in position. Guard must be in closed position before mixer will operate. Bowl support interlock provides further protection.

Bowl Lift: Ergonomic style, manual operated, self-locking in top and bottom position.

Finish: Metallic gray hybrid powder coat finish.

Attachment Hub: Comes with front-mounted Hobart standard #12 taper attachment hub for use with Hobart #12 size attachments.

Warranty: Unit has full one-year warranty on parts, labor and mileage against manufacturer's defects. Service contracts are available.

Attachments and Accessories:

The following are available at extra cost:

Attachment / Accessory	Device #
Stainless Steel Bowl	BOWL-HL20P
“B” Flat Beater	BBEATER-HL20
“C” Wing Whip	CWHIP-HL20
“D” Wire Whip	DWHIP-HL20
“E” Dough Hook	DOUGH-HL20
“ED” Dough Hook	EDDOUGH-HL20
“P” Pastry Knife	PPASTRY-HL20
Mixer Table	TABLEHW-HL2012
Bowl Splash Cover (lexan)	SPLASH-LEX020
Bowl Scraper	SCRAPER-HL20
Ingredient Chute	CHUTE-HL20
9" Vegetable Slicer	VS9
Meat Chopper Attachment	12TIN-C/EPAN
Attachment Tray Support	TRAY-HL2012
12 Quart Accessories	See HL120 spec sheet

Plugs and Receptacles:

Dependent on local power codes

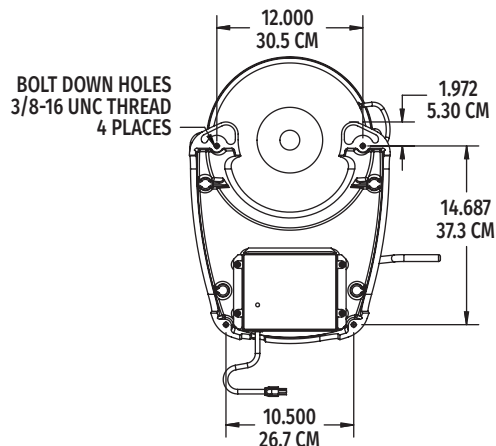
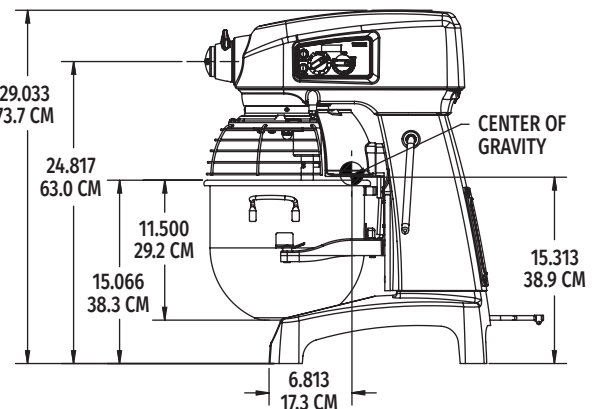
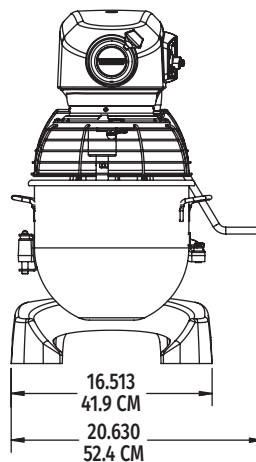
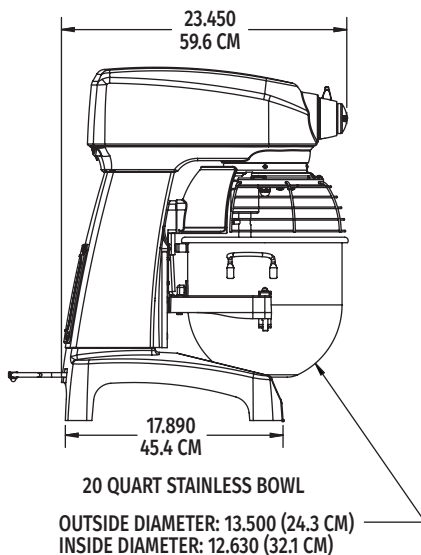
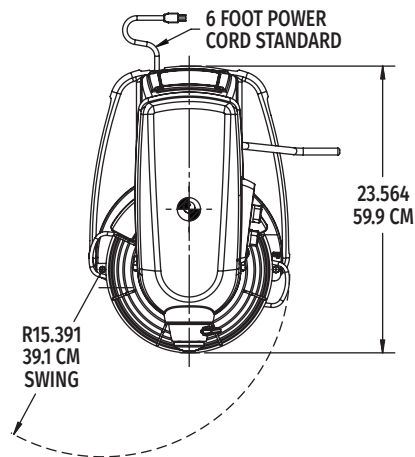
Machine Voltages		
HL200	120/60/1	230/60/1
Service Current Requirement if Plug Connected	120/60/1	230/60/1
	15 Amp.	15 Amp.
Terminal Designation of Plug	2 Pole 3 Wire Grounding	2 Pole 3 Wire Grounding
NEMA Plug Configuration	5-15P	6-15P
Plug Configuration		
Molded Plug on Cord	Yes	Yes
Plug - Straight/Angle	Straight	Straight
NEMA Receptable or Connector Configuration	5-15R	6-15R
Power Cord Included	Yes	Yes



HL200 LEGACY+ 20-Quart Maximum Heavy-Duty Mixer

DETAILS AND DIMENSIONS

HL200



WARNING: Electrical and grounding connections must comply with the applicable portions of the National Electrical Code and/or other codes in force.

NOTE:

Machine Weight (Less Bowl): 189 lbs. (85.7 kg)

Shipping Weight: 204 lbs. (92.5 kg)

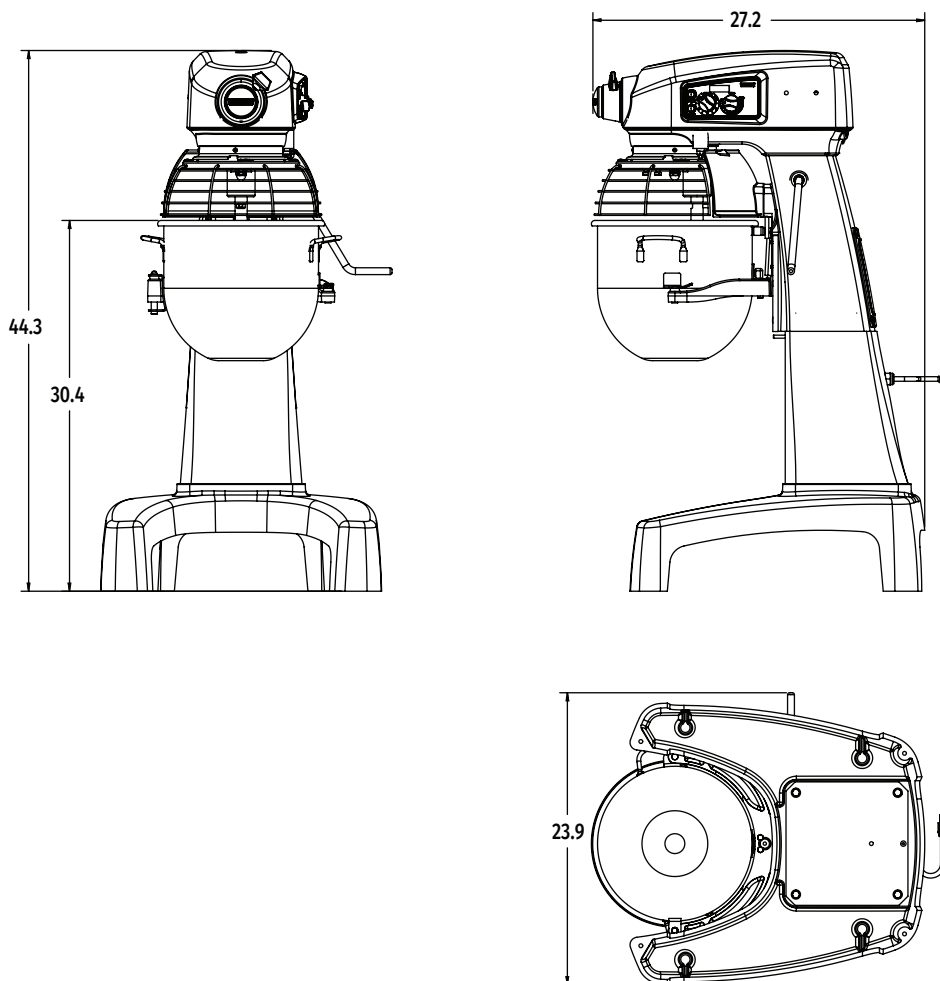
Bowl Weight: 9 lbs. (4.1 kg)



HL200 LEGACY+ 20-Quart Maximum Heavy-Duty Mixer

DETAILS AND DIMENSIONS

HL200-10STD

**NOTE:****Machine Weight (Less Bowl):** 320 lbs. (145.2 kg)**Shipping Weight:** 337 lbs. (152.9 kg)**Bowl Weight:** 9 lbs. (4.1 kg)



Profit from the Eagle Advantage®

Specification Sheet

Short Form Specifications

Eagle Mobile Mixer Stand, model _____. Top to be 14 gauge 300 series stainless steel with no-drip counter top edge. Constructed with uni-lok® patented gusset system, with the gussets recessed into the hat channels to reduce lateral movement. Stainless steel pan rack slides hold six 18" x 26" bun pans. Galvanized or stainless steel tubular base: 1½" O.D. tubular legs with 1¼" O.D. tubular cross rails, and 4" swivel casters—two with brake.

Eagle Mobile Equipment Stand, model MET2430S. Top to be 14 gauge 300 series stainless steel with no-drip counter top edge. Constructed with uni-lok® patented gusset system, with the gussets recessed into the hat channels to reduce lateral movement. Heavy gauge stainless steel adjustable undershelf, 1" diameter stainless steel handle welded to brackets and stand. 1½" O.D. stainless steel tubular legs and two 4" casters with brake.



mobile mixer stand



mobile equipment stand

Options / Accessories

☐ Drawers

Item No.:	_____
Project No.:	_____
S.I.S. No.:	_____

Mobile Mixer/Equipment Stands

MODELS:

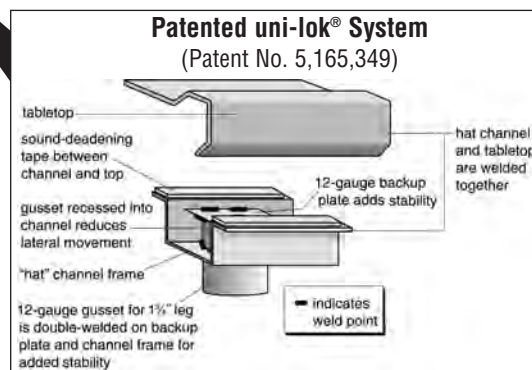
☐ MMT3030G ☐ MMT3036G ☐ MET2430S
☐ MMT3030S ☐ MMT3036S

Mobile Mixer Stands

- Uni-lok® gusset system (patent #5,165,349): gusset is recessed into hat channel underside tabletop, reducing lateral movement.
- Highly-polished 14 gauge 300 series stainless steel top with no-drip countertop edge.
- Stainless steel crossbracing on three sides.
- 1½" (41mm)-diameter legs with four 4" (102mm) casters, two with brake.
- Pan rack slides hold six 18" x 26" (457 x 660mm) pans.
- 400 lb. (181.4 kg) total weight capacity - evenly distributed static load.

Mobile Equipment Stand

- Uni-lok® gusset system (patent #5,165,349): gusset is recessed into hat channel underside tabletop, reducing lateral movement.
- Highly-polished 14 gauge 300 series stainless steel top with no-drip countertop edge.
- Stainless steel undershelf.
- 1½" (41mm)-diameter legs with two 4" (102mm) casters with brake.
- 1" (25mm)-diameter stainless steel handle is welded to heavy duty brackets and stand.



EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

AUTOQUOTES



EG10.26B Rev. 05/15

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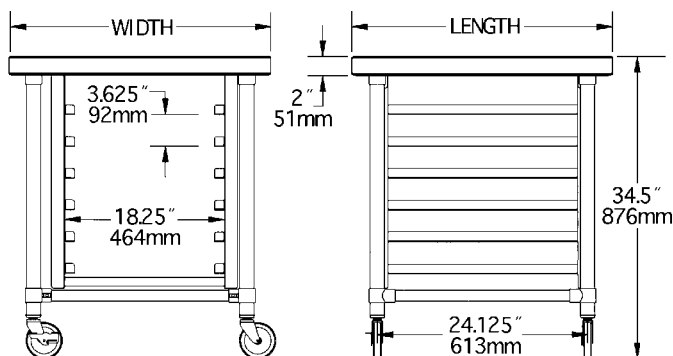


Profit from the Eagle Advantage®

Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

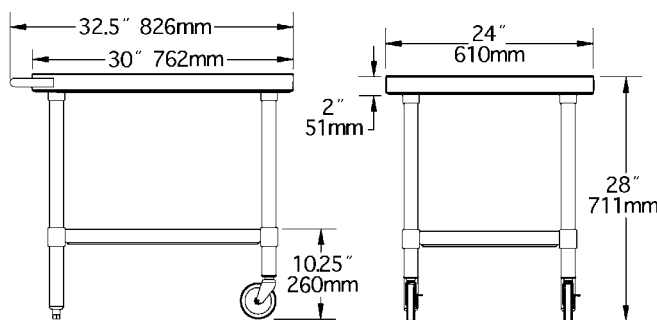
Mobile Mixer/Equipment Stands

Mobile Mixer Stands



galvanized model #	stainless steel model #	weight		width		length	
		lbs.	kg	in.	mm	in.	mm
MMT3030G	MMT3030S	55	24.9	30"	762	30"	762
MMT3036G	MMT3036S	60	27.2	30"	762	36"	914

Mobile Equipment Stand



model #	weight		width		length	
	lbs.	kg	in.	mm	in.	mm
MET2430S	47	21.3	24"	610	30"	762

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Profit from the Eagle Advantage®

Specification Sheet

Short Form Specifications

Eagle LIFETIME Series Bun Pan Rack, model _____.
Constructed of heavy duty 6063-T5 aluminum alloy. Fully welded frame. 1" square tubular crossbracing. Base consists of 1½" x 1½" square aluminum tubing with pretapped caster plates welded inside. 3¼" wide angle slides welded to uprights. Heavy duty 6" x 2" non-marking swivel plate casters.



LIFETIME Series bun pan rack

Options / Accessories

- ☐ Caster upgrade
- ☐ Caster locks
- ☐ Corner bumpers
- ☐ Solid base*
- ☐ Perimeter bumpers*
- ☐ Pan stop*
- ☐ Vertical bumpers

* Factory installation required.

EAGLE GROUP

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For custom configuration or fabrication needs, contact our **SpecFAB® Division**.
Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Item No.: _____
Project No.: _____
S.I.S. No.: _____

LIFETIME Series Bun Pan Racks

MODELS:

- ☐ 4330
- ☐ 4331
- ☐ 4333

Design and Construction Features

- LIFETIME GUARANTEE against:
 - rust and corrosion
 - material defects and workmanship
- Durable and long-lasting—withstands years of rough use.
- All heavy duty 6063-T5 alloy aluminum type construction.
- Fully-welded frame features 1½" x 1¼" (38 x 45mm) "D"-shaped tubing.
- Crossbracing consists of 1" (25mm) square tubing.
- 1½" (38mm) square tube base features heavy duty 6" x 2" (152 x 51mm) non-marking swivel plate casters.
- 2" (51mm)-wide aluminum angle slides are welded to frame.
- These racks accommodate 18" x 26" (457 x 660mm) sheet pans.
- Three welds per angle connection.

Certifications / Approvals



AutoQuotes



EG60.31 Rev. 11/22

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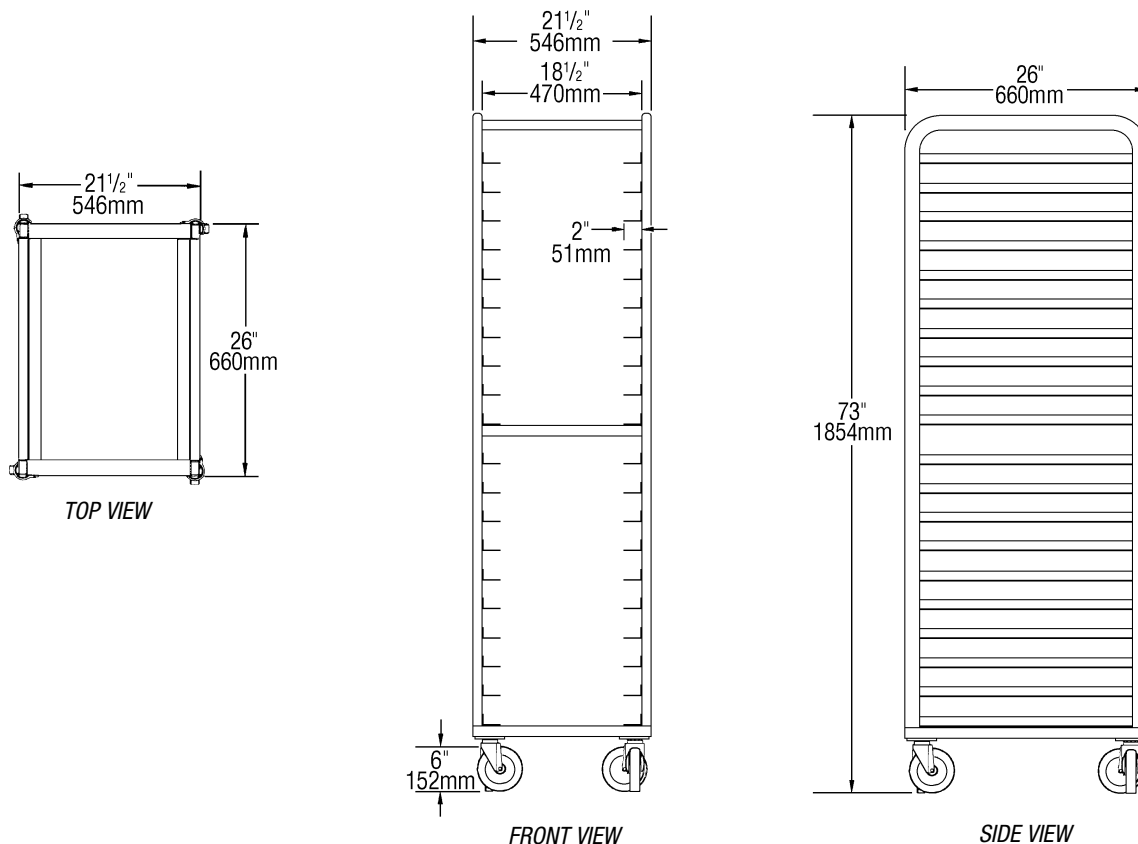
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Profit from the Eagle Advantage®

Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

LIFETIME Series Bun Pan Racks



model #	overall dimensions						weight		slide spacing		pan capacity
	width	depth	height	width	depth	height					
	in.	mm	in.	mm	in.	mm	lbs.	kg	in.	mm	
4330	21½"	546	26"	660	73"	1854	99	44.9	2"	51	30
4331	21½"	546	26"	660	73"	1854	99	44.9	3"	76	20
4333	21½"	546	26"	660	73"	1854	99	44.9	5"	127	12

EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 or 800-441-8440 • Fax: 302-653-2065

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WORKTOP FREEZER (0°F)

Model: SWF27NBS

Natural Refrigerant R-290 Model

27" Worktop Freezer with Solid Door and 5½" Backsplash

Stainless steel front, top and end panels, aluminum back and interior.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Different caster sizes
Stainless steel back	Adjustable legs
Additional epoxy coated steel shelves	Door locks
Stainless steel shelves	Drawers in lieu of door (consult factory)**
Overshelves (single or double)	Special electrical requirements (consult factory)

**Two tier: (1) 12 x 20 x 6 pan per drawer

Consult factory for other model configurations, options and accessories.



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

2" non-CFC polyurethane foam insulation

Smooth, polished chrome door handle

Spring loaded, self closing door

Magnetic snap in Santoprene™ door gasket

Heavy duty, epoxy coated steel shelf

Completely enclosed, vented and removable case back

5" casters

MODEL FEATURES

Field rehingeable door

Electronic control, automatic electric defrost

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	7.4 (210 cu l)
Width, Overall (inches)	27 1/2 (699 mm)
Depth, Overall (inches) (including handle & bumpers)	32 3/16 (818 mm)
Height, Overall (inches) (including 5" casters)	40 3/4 (1035 mm)
Shelf Area (square feet)	3.5 (0.3 sq m)
Number of Shelves	1
Number of Doors	1
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	24 1/2 (622 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4
Capacity (BTU per hour)*	1572

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	4.0 (2.8)
Defrost Amps (International)	4.8 (2.4)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	200 (91 kg)
Height - Crated (inches)	48 3/4 (1238 mm)
Width - Crated (inches)	35 1/2 (902 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

* Rating @ -15°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

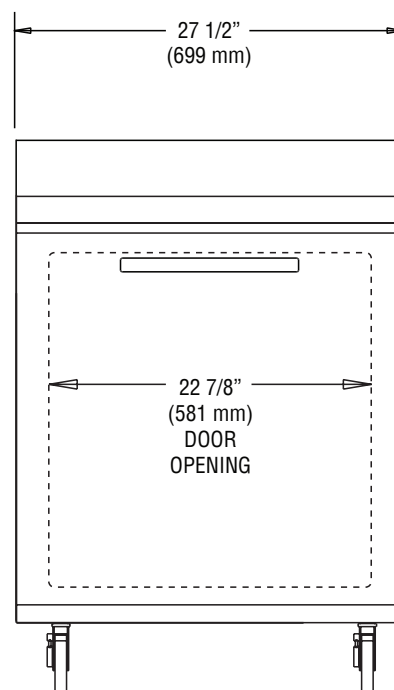
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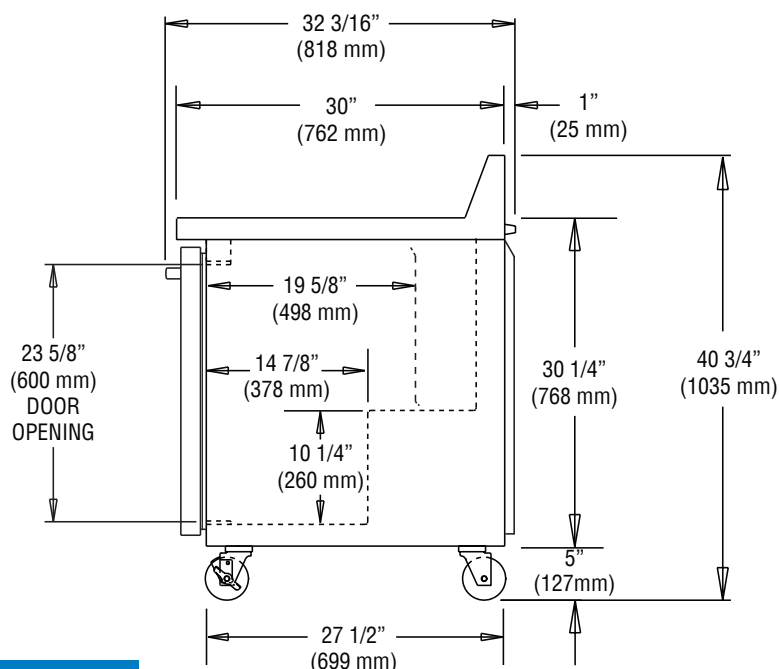
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Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall, a minimum clearance of 3" is required on sides, front and rear.

REVISED: 4/2/24



Glo-Ray® Fry Holding Stations

Models: GRFHS-16, -21, -22, -26

GRFHS-PT16, -PT26,

GRFHS-PTT16, -PTT21

Hatco offers convenient Glo-Ray® Fry Holding Stations that can be placed where they are most needed - next to a fryer! Glo-Ray heat technology offers you the ability to keep fried foods at optimum temperatures, ready to serve, without cooking or drying them out.

Standard features

- Ceramic heating elements above, allowing ample space between the warmer and food bin to empty baskets
- Pre-Set Heated base provides an envelope of heat around your product
- Various hardcoated fry ribbons stage boxed or bagged products for quick service areas
- PT and PTT models are pass-through style
- Pass-thru tunnel is available with models GRFHS-PTT16 and -PTT21
- Sectional divider permits holding of multiple products
- Models have 16.75", 18", or 20" (425, 457, or 508 mm) clearances
- Bottom trivet lifts food off the bottom of the station promoting air movement and reduces the build up of moisture

Project _____

Item # _____

Quantity _____



Options (available at time of purchase only)

- ☐ Halogen Bulb in lieu of Standard Display Light (60 watt) – 120V only
- ☐ Left or Right side Cutout (GRFHS-16, -21, and -26) – Adds 1.7" (43 mm) to width of unit)
- ☐ 6" (15 mm) deep pan (GRFHS-PT26)
- ☐ Infinite Control (metal sheathed GRFS models only)

Accessories

- ☐ 4-Pleat Hardcoated Fry Box Ribbon (All models)
- ☐ 5-Pleat Hardcoated Fry Bag Ribbon (All models)
- ☐ 5-Pleat Hardcoated Fry Box Ribbon (GRFHS-21, -PTT16, -PTT21, PT26)
- ☐ 6-Pleat Hardcoated Fry Bag Ribbon (GRFHS-21, -PTT16, -PTT21, PT26)
- ☐ 6-Pleat Hardcoated Fry Box/Bag Ribbon (GRFHS-21, -PTT16, -PTT21, PT26)
- ☐ 7-Pleat Hardcoated Fry Bag Ribbon (GRFHS-21, -PTT21, PT26)
- ☐ 10-Pleat Hardcoated Hashbrown Ribbon (GRFHS-PTT16)
- ☐ 5" (127 mm) side-by-side bag holder (GRFHS-21)
- ☐ Scoop Holder - adds 1.25" (32 mm) to overall product width for each scoop holder (one standard on GRFHS-PT26, -PTT16, & -PTT21) (not available for the GRFHS-22) (-PTT16 has two additional locations that can be adjusted in field)
- ☐ Additional Sectional Dividers (one standard on GRFHS-PT26, -PTT16, & -PTT21 models, not available for GRFHS-22)
- ☐ Food Pans (not available for the GRFHS-22)
- ☐ Wire Trivet (not available for the GRFHS-22)
- ☐ Chef LED Bulb in lieu of Standard Display Light – bulb must be rotated down 120V
 - ☐ 2700K Similar to warm incandescent light
 - ☐ 3000K Similar to warm halogen light
 - ☐ 4000K Similar to cool fluorescent light
- ☐ 230V – CE for input voltages above 200V
 - ☐ 2700K Similar to warm incandescent light
 - ☐ 3000K Similar to warm halogen light
 - ☐ 4000K Similar to cool fluorescent light



For operation, location and safety information, please refer to the Installation and Operating Manual.



HATCO CORPORATION

P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (414) 671-6350



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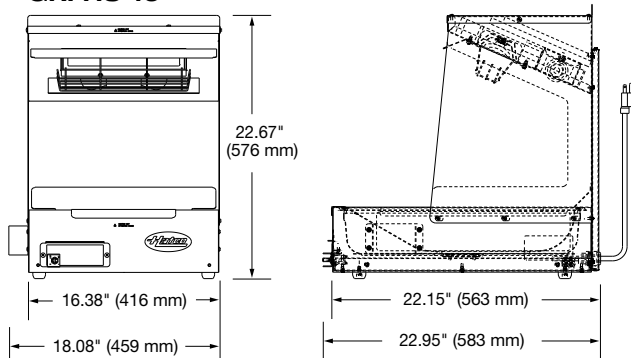
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Glo-Ray® Fry Holding Stations

Models: GRFHS-16, -21, -22, -26, -PT16, -PT26, -PTT16, -PTT21

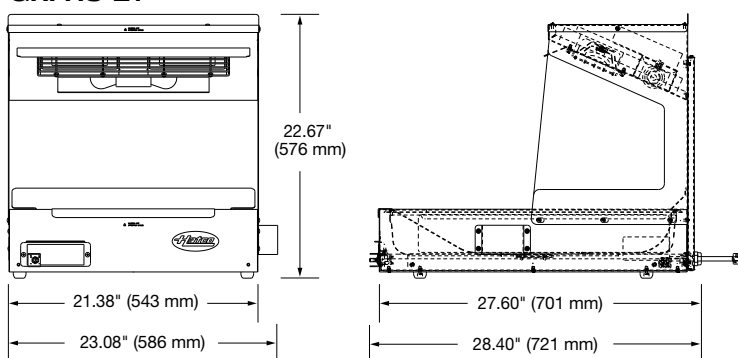
GRFHS-16



FRONT VIEW

SIDE VIEW

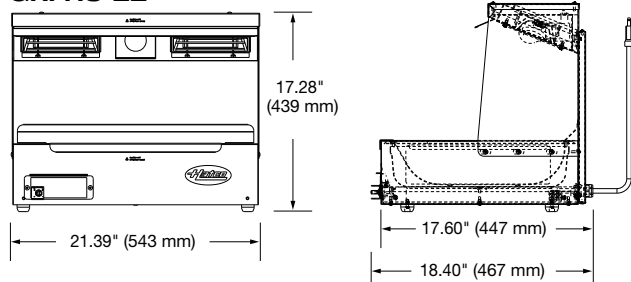
GRFHS-21



FRONT VIEW

SIDE VIEW

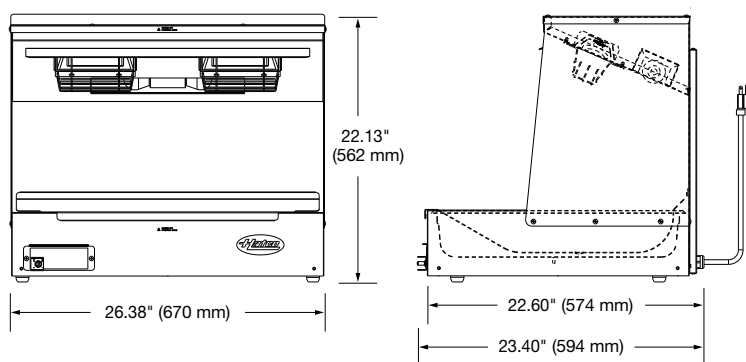
GRFHS-22



FRONT VIEW

SIDE VIEW

GRFHS-26



FRONT VIEW

SIDE VIEW

SPECIFICATIONS

Glo-Ray® Portable Fry Holding Stations

The shaded areas contain electrical information for International models

Model	Dimensions (W x D x H)	Volts (Single Phase)	Watts	Amps	Plug	Approx. Ship Weight
GRFHS-16*	18.08" x 22.95" x 22.67" (459 x 583 x 576 mm)	100	878	8.8	JIS C 8303	51 lbs. (24 kg)
		120	1090	9.1	NEMA 5-15P	
		220⚡	1057	4.8	BS-1363	
		220-230 (CE)	1057-1155	4.8-5.0	CEE 7/7 Schuko	
		230-240 (CE)	1019-1110	4.4-4.6	BS-1363	
GRFHS-21*	23.08" x 28.40" x 22.67" (586 x 721 x 576 mm)	100	1007	10.1	JIS C 8303	63 lbs. (29 kg)
		120	1200	10.0	NEMA 5-15P	
		220⚡	1218	5.5	BS-1363	
		220-230 (CE)	1218-1332	5.5-5.8	CEE 7/7 Schuko	
		230-240 (CE)	1102-1200	4.8-5.0	BS-1363	
GRFHS-22	21.39" x 18.40" x 17.28" (543 x 467 x 439 mm)	100	847	8.5	JIS C 8303	44 lbs. (20 kg)
		120	1030	8.6	NEMA 5-15P	
		220⚡	1076	4.9	BS-1363	
		220-230 (CE)	1076-1176	4.9-5.1	CEE 7/7 Schuko	
		230-240 (CE)	1176-1280	5.1-5.3	BS-1363	
GRFHS-26**	26.38" x 23.40" x 22.13" (670 x 594 x 562 mm)	100	1007	10.1	JIS C 8303	66 lbs. (30 kg)
		120	1200	10.0	NEMA 5-15P	
		220⚡	1243	5.7	BS-1363	
		220-230 (CE)	1243-1359	5.7-5.9	CEE 7/7 Schuko	
		230-240 (CE)	1128-1229	4.9-5.1	BS-1363	

* Add 1 3/4" to width if ordering Scoop Holder

** Add 1.75" (44.45 mm) to width if ordering Scoop Holder

⚡ 60 Hz

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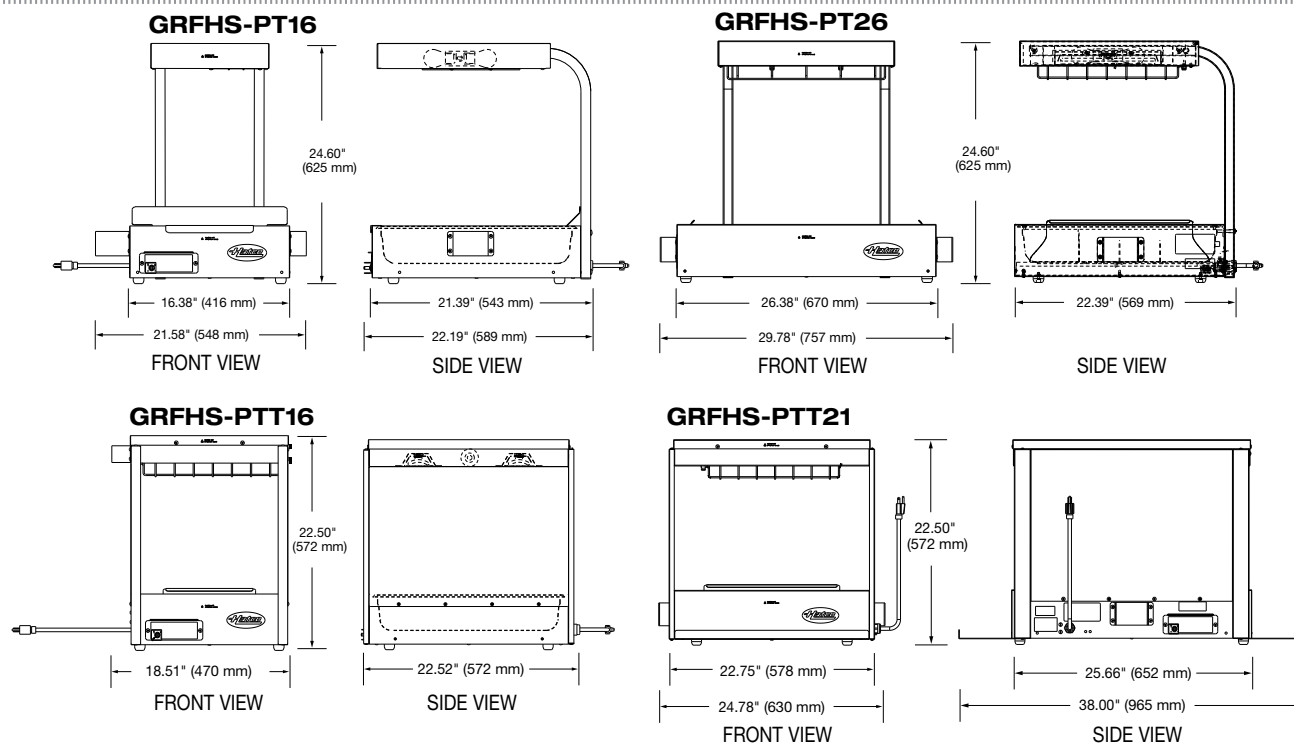
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Glo-Ray® Fry Holding Stations

Models: GRFHS-16, -21, -22, -26, -PT16, -PT26, -PTT16, -PTT21



SPECIFICATIONS

Glo-Ray® Portable Fry Holding Stations - Pass Through

The shaded areas contain electrical information for International models

Model	Dimensions (W x D x H)	Volts (Single Phase)	Watts	Amps	Plug	Approx. Ship Weight
GRFHS-PT16	21.58" x 23.95" x 24.875" (548 x 608 x 632 mm)	100	861	8.6	JIS C 8303	60 lbs. (27 kg)
		120	1090	9.1	NEMA 5-15P	
		220	1057	4.8	BS-1363	
		220-230 (CE)	1057-1155	4.8 - 5.0	CEE 7/7 Schuko	
		230-240 (CE)	1019-1110	4.4 - 4.6	BS-1363	
GRFHS-PT26	29.4" x 22.71" x 24.71" (747 x 577 x 628 mm) - OR - 29.4" x 22.71" x 26.71"♣ (747 x 577 x 678 mm)	100	1208	12.1	JIS C 8303	64 lbs (29 kg)
		120	1440	12.0	NEMA 5-15P	
		220	1233	5.6	BS-1363	
		220-230 (CE)	1233-1347	5.6-5.9	CEE 7/7 Schuko	
		230-240 (CE)	1347-1468	5.9-6.1	BS-1363	
GRFHS-PTT16	16.7" x 22.5" x 22.5" (423 x 572 x 572 mm)	120	1300	10.8	NEMA 5-15P	65 lbs (29 kg)
GRFHS-PTT21	22.63" x 38" x 22.64" (575 x 965 x 575 mm)	100	1347	13.5	JIS C 8303	100 lbs. (46 kg)
		120	1740	14.5	NEMA 5-15P*	
		220	1486	6.8	BS-1363	
		220-230 (CE)	1486-1624	6.8-7.1	CEE 7/7 Schuko	
		230-240 (CE)	1624-1768	7.1-7.4	BS-1363	

♣ Canada model uses NEMA 5-20P. * 60 Hz

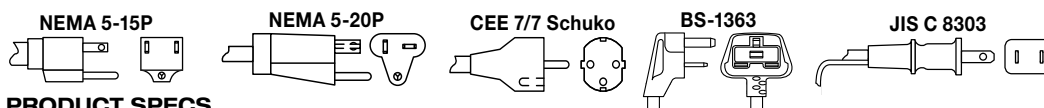
♣ Includes a built-in 6" deep heated food holding base (4" is standard on all other models).

CORD LOCATION

GRFHS-16, -21, -26, -PT26: Back side, lower right corner.

GRFHS-PTT16, -PTT21: Lower right-hand side.

PLUG CONFIGURATIONS



PRODUCT SPECS

Glo-Ray® Fry Holding Stations

The Fry Holding Station shall be a Glo-Ray® manufactured by the Hatco Corporation, Milwaukee, WI 53234 U.S.A.

The Fry Holding Station shall be rated at ... watts, ... volts, and be ... inches (millimeters) in overall width. It shall consist of either a stainless steel housing or an aluminum housing with ceramic. Pre-Set Heated base provides heat around product. Portable warmer features wire guards, shatter-resistant incandescent

display lights, a lighted on-off switch, and 6' (1829 mm) cord and plug. Options: Halogen Bulb, Left or Right side Cutout, 6" (15 mm) deep pan, Infinite Control. Accessories: various Pleated Hardcoated Fry Box Ribbons and Bags, side-by-side bag holder, Scoop Holder, additional Sectional Dividers, Food Pans, Wire Trivet, Chef LED Bulbs.

Warranty consists of 24/7 parts and service assistance (U.S. and Canada only).

HATCO CORPORATION

P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (414) 671-6350



www.hatcocorp.com

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F R Y E R S

VULCAN**1ER50 SERIES
FREE STANDING ELECTRIC FRYERS****Model 1ER50D**

Shown with caster accessory

**SPECIFICATIONS**

Electric deep fat fryer, Vulcan Model No. (1ER50A) (1ER50D) (1ER50C) temperature controls are adjustable from 200°F to 390°F and multiple fat melt cycles and high limit control. Stainless steel cabinet with four 6" adjustable legs. 16 gauge stainless steel fry tank holds 50 lbs. of frying compound. 1¼" full port ball type drain valve. 17kW low watt density ribbon style heating elements. Twin fry baskets. Power supply is 208 volt, 50/60 Hz, 3 phase.

Overall Dimensions:

15½"w x 34¾"d x 39⅞"h. working height is 35¾".

NSF listed. CSA design certified.

Specify voltage when ordering.

- ☐ **1ER50A** Solid state analog knob control.
- ☐ **1ER50D** Solid state digital controls.
- ☐ **1ER50C** Programmable computer controls.

STANDARD FEATURES

- Stainless steel cabinet.
- Set of four 6" adjustable legs.
- 16 gauge stainless steel fry tank, 50 lb. capacity.
- Ten year limited fry tank warranty.
- 1¼" full port ball type drain valve.
- 17 kW low watt density ribbon style heating elements.
- Multiple fat melt modes.
- High limit control.
- Twin fry baskets with plastic coated handles.
- 208 volt, 3 phase.
- One year limited parts and labor warranty.

CONTROLS

- 1ER50A** Solid state knob control. Accurate temperature control 200°F to 390°F within +/- 2°. Multiple fat melt modes, fast recovery.
- 1ER50D** Solid state digital read temperature control. Accurate temperature control 200°F to 390°F within +/- 2°. Multiple fat melt modes, fast recovery and boil out mode and two countdown timers.
- 1ER50C** Computer control digital read temperature control. Accurate temperature control 200°F to 390°F within +/- 2°. Multiple fat melt modes, fast recovery and boil out mode. Ten programmable product keys and ten countdown timers. Secondary and advanced programming options.

OPTIONAL FEATURES (Factory Installed)

- ☐ 480 volt, 3 phase. (Separate 120 volt, 20 amp electric supply required.)
- ☐ Second year extended limited parts and labor warranty.

ACCESSORIES (Packaged & Sold Separately)

- ☐ Stainless Steel Tank Cover – doubles as a work surface top
- ☐ Set of four 6" adjustable casters (2 locking)
- ☐ Extra set of Twin Fry Baskets – 6½"w x 13¼"d x 6"h
- ☐ Large Single Fry Basket – 13"w x 13¼"d x 5½"h
- ☐ Frymate™ VX15S Dump Station
- ☐ Connecting Kit(s) – connect two fryers together (banking strip, brackets and hardware)
- ☐ 10" high stainless steel removable splash guard

VULCAN

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

F R Y E R S



ER KLEENSCREEN PLUS® FILTRATION SYSTEM

BUILT-IN FILTRATION SYSTEM FOR 2ERF, 3ERF & 4ERF FRYERS



Model 2ER85CF
Shown on casters (Accessory)



SPECIFICATIONS

Built-in filter system, Vulcan Model No. (# of fryers – 2, 3 or 4) ER50 (control type A, D, or C) F (add suffix -F to fryer battery Model No., i.e. 2ER50DF). Filter system accommodates a maximum of four cabinets. Drawer style filter pan assembly holds 70 lbs. shortening capacity. Filter vessel constructed of drawn (seamless) 18 gauge stainless steel. The 2ER50F filter pan weighs only 12.2 lbs. 1/3 H.P. motor and pump circulates hot frying compound at the rate of 8 gallons per minute, activated by a one touch push button switch. System provided standard with stainless steel mesh filter screen. Optional KleenScreen PLUS® envelopes filter out particulate down to .5 microns. Standard equipment comes on legs, has a tank brush and cleanout rod. Hands free oil return line connection. Drain valve interlock switch turns fryer's heating elements off when drain valve is opened. Power supply is 208 volt, 60 Hz, 3 phase.

CSA design certified. NSF listed.

STANDARD FEATURES

- Filter system accommodates maximum of four fryer cabinets.
- Boil Out ByPass™ easily removes boil out solution from fry tank without contact of drain manifold, filter pan or motor/pump.
- Drain valve interlock switch (DVI). Turns off heating elements automatically when draining oil or lifting heating elements during cleaning.
- Drawn (seamless) 18 gauge stainless steel filter pan. 70 lbs. frying compound capacity.
- 6" adjustable legs.
- Stainless steel mesh 2-sided filter screen – surface area 270 sq. in.
- 1/3 H.P. motor and pump circulates frying compound at a rate of 8.0 gallons per minute.
- One touch push button switch to engage pump and motor (solid state controls).
- Tank brush and clean-out rod.
- One year limited parts and labor warranty.
- 6' High Temperature Discard Hose.
- 10 year fry tank limited warranty.

ACCESSORIES (Packaged & Sold Separately)

- ☐ Stainless steel tank cover – doubles as a work surface top.
- ☐ Micro-Filtration Fabric Envelopes – 6 filters/per package.
- ☐ Casters, adjustable (2 locking, 2 non-locking).
- ☐ "Add-On" Frymate™ – VX15.
- ☐ Rear oil reclamation discard connection (factory installed).
- ☐ Prison Security Package (factory installed).
- ☐ Single Basket Lift (factory installed).

OPTIONS

- ☐ 480 volt, 3 phase (NEMA 5-15P). (Separate 120 volt, 20 amp electric supply required.)
- ☐ Second year extended limited parts and labor warranty.

REFERENCE MATERIALS

- See 1ER50 Spec Sheet F32900 for electrical specs.
- See 1ERF Spec Sheet F32969 for single unit KleenScreen PLUS®.



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F R Y E R S



ER KLEENSCREEN *PLUS*® FILTRATION SYSTEM

BUILT-IN FILTRATION SYSTEM FOR 2ERF, 3ERF & 4ERF FRYERS

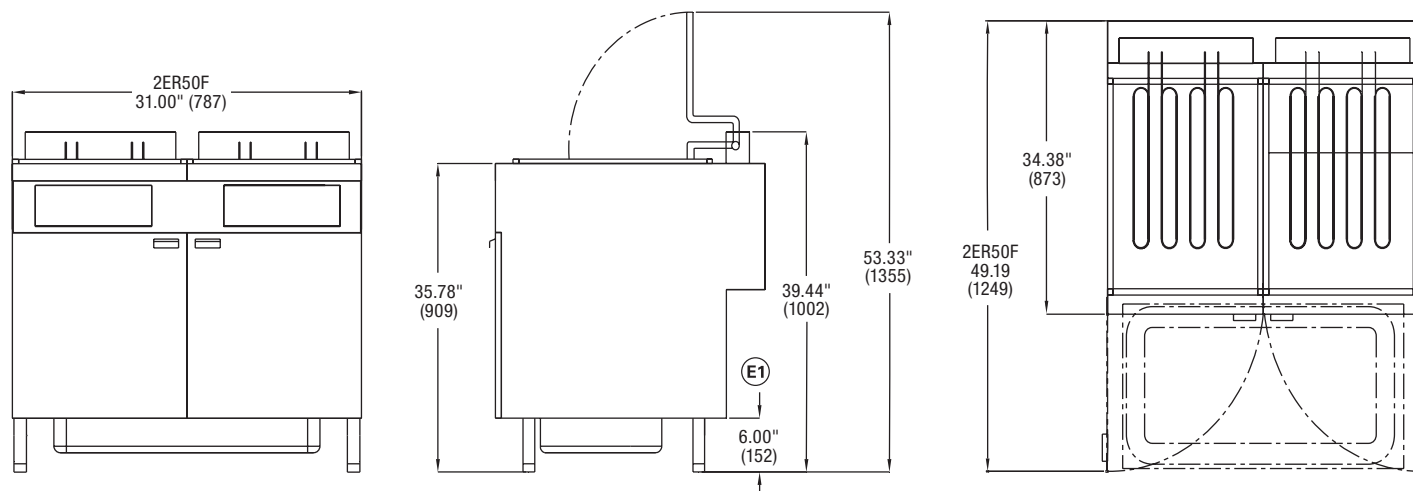
INSTALLATION INSTRUCTIONS

1. An adequate ventilation system is required for Commercial Cooking Equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. When writing refer to NFPA No. 96.
2. All models require a 6" clearance at both sides and rear adjacent to combustible construction.
3. All models require a 16" (407 mm) minimum clearance to adjacent open top burner units.
4. This appliance is manufactured for commercial installation only and is not intended for home use.

SERVICE CONNECTIONS:

- Ⓔ 480 volt ER KleenScreen *PLUS*® require a separate 120 V, 60Hz, 1 phase (NEMA 5-15P) electrical power connection to operate the filter motor/pump and digital controls, (not supplied with the fryer).

NOTE: In line with its policy to continually improve its product, Vulcan reserves the right to change materials and specifications without notice.



FILTER SYSTEM SPECIFICATION:

Screen = 270 sq.
Micro Filtration Fabric Envelope = 350 sq. in

MOTOR/PUMP SPECIFICATIONS:

480V = 1/3 HP 1750 RPM 8.0 gal./min 120V / 5.0A 50/60Hz 1 Ph.
208V = 1/3 HP 1750 RPM 8.0 gal./min 208V / 3.6A 50/60Hz 1 Ph.

Model	Filter Pan Capacity	Electrical	Battery Dimensions (Widths)		
			2 Fryers	3 Fryers	4 Fryers
2ER50F	70 lbs.	17kW Refer to spec. sheet F32900	31"	46½"	62"
3ER50F					
4ER50F					

NOTE: Fryer in battery with fuses (master) must add 5 amps for the motor / pump. Remaining fryers (slave) use amps per spec. sheet.

This appliance is manufactured for commercial use only and is not intended for home use.



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REACH-IN REFRIGERATOR

Model: 1RENHD

Natural Refrigerant R-290 Model

1-Section Extra-Wide Reach-In Refrigerator with Half Doors



ENERGY STAR® Qualified Commercial Refrigerator

1RENHD - Stainless steel front, aluminum end panels and interior

1RENSAHD - Stainless steel exterior, aluminum interior

1RENSSHD - Stainless steel exterior and interior

Designed to maintain NSF-7 temperatures in 100°F ambient.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel case back	Shallow depth (consult factory)
Additional epoxy coated steel shelves	Hinged glass door (consult factory)
Chrome or stainless steel shelves	Full door
Heavy duty pilaster strips	Rehinging of doors (consult factory)
Wine rack	Pass thru (consult factory)
Adjustable legs	Correctional Facility Options
Custom laminates	• One way security screws
Universal pan slides	• Locking hasp (lock not included)
Expansion valve	• Stainless steel mesh cover
Special electrical requirements (consult factory)	• Coverless hinges

Consult factory for other model configurations, options and accessories.

Continental
Refrigerator



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Self contained, performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, electric condensate evaporator

CABINET ARCHITECTURE

3" non-CFC polyurethane foam insulation

Smooth, polished chrome workflow door handles

Cam action, lift off hinges

Self-closing doors

Magnetic snap in Santoprene™ door gaskets

Cylinder lock in each door

Heavy duty, epoxy coated steel shelves

5" casters

MODEL FEATURES

LED interior lighting

Electronic control, off-cycle defrost

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	21 (595 cu l)
Width, Overall (inches)	28 1/2 (724 mm)
Depth, Overall (inches) (including handles)	35 3/8 (899 mm)
Depth (inches) (less doors)	32 (813 mm)
Depth (inches) (doors open 90°)	58 (1473 mm)
Clear Door Width (inches)	21 7/8 (556 mm)
Clear Half Door Height (inches)	27 1/2 (699 mm)
Height, Overall (inches) (including 5" casters)	82 1/4 (2089 mm)
Number of Doors	2
Number of Shelves	3
Shelf Area (square feet)	20.4 (1.9 sq m)
Tray Slide Capacity (per half section) 2" centers	11

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4+
Capacity (BTU per hour)*	1940

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	5.9 (3.9)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

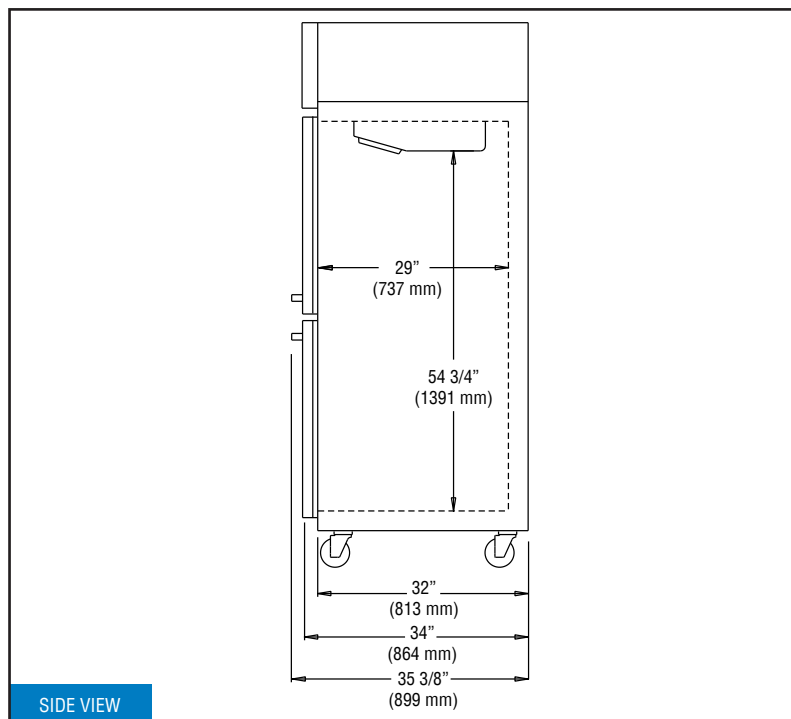
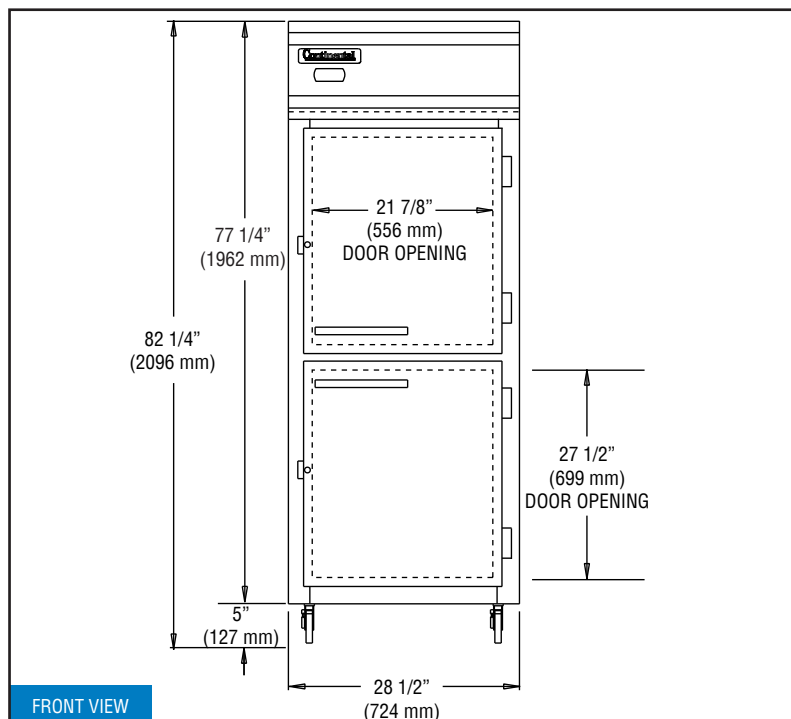
Height - Crated (inches)	85 1/2 (2172 mm)
Width - Crated (inches)	31 5/8 (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (lbs.)	315 (143 kg)
Weight SS - Crated (lbs.)	379 (172 kg)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Model Plan Views



IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.



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IN THE U.S.A.

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REVISED: 2/21/24



Spec sheet

iCombi® Classic 6-full size E/G



Description

- > Combi-steamer in accordance with DIN 18866 for most cooking methods used in commercial kitchens for optional use of steam and convection, individually, one after the other, or combined.

Ventilation approvals: The electrical appliance conforms to the EPA 202 test in accordance with ANSI/NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations" Refer to UL Listing KNLZ.E148536 (America) or KNLZ7.E148536 (Canada).

Unit description and functions

Capacity

- > Six (6) Full-size sheet pans or Twelve (12) Steam table pans or Six (6) 2/1 GN accessories
- > Removable standard hinging rack with 2 5/8 inch rack spacing (68 mm)
- > Large selection of accessories for various cooking procedures, such as grilling, braising or baking
- > For use with 2/1, 1/1, 2/4 GN accessories

Combi-steamer mode

- > Steaming 86 °F - 266 °F
- > Convection 86 °F - 572 °F
- > Combination of steam and convection 86 °F - 572 °F

ClimaPlus

- > Climate management – humidity measurement and control
- > Humidity setting in 10-% increments

Cooking functions

- > ClimaPlus: The active climate management in the cooking cabinet, which constantly measures and controls the humidity and guarantees effective dehumidification, combined with high productivity, cooking quality and low energy consumption. Humidity can be adjusted in increments of 10% and monitored via the digital display for precise manual cooking
- > Dynamic air circulation in the cooking cabinet through reversing high-performance fan propeller with five fan speeds that can be programmed manually. The optimal energy yield results in excellent uniformity and short cooking times.
- > High-performance steam generator for optimal steaming performance even at low temperatures below 212°F
- > Integrated, maintenance-free fat separation system without an additional fat filter
- > Cool-down function for quick cooling of the cooking cabinet via a fan propeller
- > Core temperature measurement via core temperature probe and optional positioning aid (accessories)
- > Delta-T cooking for extremely gentle preparation with minimal cooking losses
- > Digital temperature display, can be set to °C or °F, displays target and actual values
- > Cooking cabinet humidity and time displayed digitally; displays target and actual values
- > Individual programming of up to 100 single or multi-stage cooking programs with up to 12 steps
- > Individual adjustment of the cooking parameters time, temperature and humidity for a program step during ongoing operation
- > Easy transfer of cooking programs to other cooking systems via USB stick.
- > Integrated hand shower with automatic retraction and switchable spray/jet function
- > Energy-saving, long-lasting LED lighting in the cooking cabinet, with excellent color fidelity to allow quick determination of cooking progress
- > No-charge 4-hour RATIONAL certified chef assistance program

Occupational and operating safety

- > Electronic safety temperature limiter for steam generator and convection heating
- > Integrated fan wheel brake
- > Use of Active Green cleaning tabs and Care tabs (solid cleaning agent) for ideal occupational safety levels
- > HACCP data memory and output via USB
- > Tested according to national and international standards for unsupervised operation
- > Maximum tray height must not exceed 63 inch when using a RATIONAL stand
- > Ergonomic door handle with right- / left-handed door opening and swing-shut function

Networking

- > Integrated, IP-protected USB interface for local data exchange
- > Optional integrated IP-protected Ethernet interface
- > Optional integrated Wi-Fi interface (incl. Ethernet interface)

Cleaning and care

- > Automatic, water pressure-independent cleaning and maintenance system for cooking cabinet and steam generator
- > Care system: Automatic cleaning and descaling of the steam generator
- > 4 cleaning programs of varying degrees for unsupervised cleaning, even overnight
- > Easy and intuitive operation of the cleaning programs: Display of the selected cleaning program, the recommended quantity of tabs and the remaining cleaning time
- > Safe ending of the cleaning in the event of a power failure with no cleaning agent left in the cooking cabinet
- > Use of phosphate and phosphorous-free Active Green cleaner tabs and care tabs
- > Hygienic setup flush with the counter without feet for easy and safe cleaning
- > Unit door with rear-ventilated double glass panel and hinged inner pane for easy cleaning

- > Inside and outside material: stainless steel DIN 1.4301, seamless hygienic cooking cabinet with rounded corners and optimized air flow
- > Glass and stainless steel surfaces allow easy, safe external cleaning; IPX5-class protection against spraying water in all directions

Operation

- > 4.3 inch TFT color display and softkeys for easy and intuitive operation. Operating modes and functions are visually highlighted
- > Easy operation and exact settings through a central dial with push function
- > Acoustic prompts and visual messages when user action is required
- > Recirculating hoods (accessories) with situational adjustment of extraction power and service message transmission.

Installation, maintenance and environment

- > Professional installation by RATIONAL-certified technicians recommended
- > Rear in-direct floor drain with air gap is required, and should be supplied in alignment with local code.
- > Adaptation to the installation site (height above sea level) through automatic calibration
- > Operation without water softener and without additional manual descaling possible
- > Installation flush with the floor and wall through connection in the base area *
- > Double-pane glass door with heat reflective special coating for minimal energy losses
- > Service diagnostic system with automatic service message display
- > Regular maintenance is recommended. Maintenance according to manufacturer recommendations available from RATIONAL service partners
- > Energy efficiency in accordance with ENERGY STAR tested and passed. Published at www.energystar.gov
- > 2-year RATIONAL warranty including parts, labor, and travel and 5-year steam generator warranty**
- > * See the installation or planner manual for details
- > ** Terms and conditions apply, see manufacturer warranty statement at www.rational-online.com

Options

- > Cooking cabinet door, left-hinged
- > MarineLine – ship version
- > SecurityLine – prison / security version
- > MobilityLine - mobile version (available to order as a separate accessory)
- > HeavyDutyLine – particularly resilient version
- > Integrated fat drain
- > Mobile oven rack package
- > Safety door lock
- > Protection for control panel
- > Lockable control panel
- > Integrated, IP-protected Ethernet interface
- > Integrated Wi-Fi interface (incl. Ethernet interface)

Technical specifications

Dimensions and weights

Dimensions (W x H x D)	
Cooking system (body)	42 1/4 x 29 5/8 x 38 3/8 inches
Cooking system (total)	42 1/4 x 31 5/8 x 41 inches
Cooking system with packaging	46 1/4 x 37 3/4 x 45 1/2 inches
Maximum working height of top level*	≤ 5 ft. 2 7/8 inches

*when using a corresponding RATIONAL stand

Weights	
Maximum load size per level	66 lb
Maximum total load capacity	132 lb
Weight - electric unit without packaging	282 lb
Weight - electric unit with packaging	344 lb
Weight - gas unit without packaging	324 lb
Weight - gas unit with packaging	388 lb

Electrical connection conditions

Voltage 3 ph 208 V / 240 V	
Connected loads - electric	22.4 kW
Steam power	18 kW
Convection power	21.6 kW
Breaker	70 A
Connection impedance	0.09 Ω
Running AMPS	62.2 A (208 V) / 53.9 A (240 V)
Cable diameter	AWG 3 140°F
Voltage 3 ph 440 V / 480 V	
Connected loads - electric	22.4 kW
Steam power	18 kW
Convection power	21.6 kW
Breaker	35 A
Connection impedance	0.09 Ω
Running AMPS	29.4 A (440 V) / 26.9 A (480 V)
Cable diameter	AWG 8 140°F

Not supplied with cable connection

Connected loads - gas

Natural gas G20	
Nominal heat load, total	106500 BTU
Nominal heat load, Steam mode	80000 BTU
Nominal heat load, Hot Air mode	106500 BTU
Required connection flow pressure	6.5 – 10 inch w.c.
Liquid gas	
Nominal heat load, total	104000 BTU
Nominal heat load, Steam mode	78000 BTU
Nominal heat load, Hot Air mode	104000 BTU
Required connection flow pressure	10 – 15 inch w.c.

3/4" NPT with 3/4" gas shut off

Additional gas types and voltages available on request

Connected loads - gas

Voltage 1 ph 208 V	
Connected loads - gas	0.9 kW

Breaker	15 A
Running AMPS	4.3 A

All gas units are supplied with a 6 ft cord.

Connection conditions water

Water inlet (pressure hose), each	3/4"
Water pressure (flow pressure), each	14.5-87.0 psi
Maximum flow rate per cooking system	3 gal/min
Water drain, each	2" OD
Max short-term amount of wastewater	0.11 gal/sec

Use only high-temperature resistant drain pipe

Water quality requirements

Untreated water can be 0 to 24.5 gr/gal (0 to 420ppm) hardness. We do not recommend treated water hardness < 5 gr/gal (86ppm) because the water could be corrosive. Sodium ion exchangers are not recommended; H+ Ion exchange systems are recommended. Water that does not meet the following minimum standards will require the proper conditioning

Contaminant	Water Requirements	If > than recommended
Sand / Particles	< 15 µm	Particle filter
Chlorine (Cl ₂)	< 0.012 gr/gal (0.2 ppm)	Active carbon filter
Chloride (Cl ⁻)	< 4.68 gr/gal (80 ppm)	RO

Connected loads - exhaust air and thermal load

Latent heat load	3269 BTU
Sensible heat emission	4344 BTU
Sound level (electric)	56 dBA
Sound level (gas)	61 dBA

Connection loads - data

LAN data interface	RJ45
WiFi data interface	IEEE 802.11 a/g/n

Minimum distances at installation

Clearance Requirements

To facilitate servicing, we recommend leaving a 20" (500 mm) gap on the left-hand side of the unit. If there is not 20" (500 mm) left side clearance available, provisions for moving the unit to the left for service access must be made. Such provisions include, but are not limited to, having quick connections (water, gas, etc.) and lengthened electrical connections with flexible cords.

If there are no external heat sources acting on the unit, there should be at least 2" (50 mm) of clearance on either side of the unit. On the back, single units and electric Combi-Duo vent pipe can be mounted flush with the wall. 2" rear clearance from the gas Combi-Duo exhaust gas box. If a high temperature heat source is on the left or right side of the unit, clearance of at least 14" (350 mm) must be maintained on the respective side. This clearance may be reduced to 2" (50 mm) if a heat shield is used (see accessories).

Recommended clearance from unobstructed rear exhaust pipes and any surface collecting grease or flammable material; 16" (400 mm) gas, 10" (254 mm) electric. It is recommended to have a hood overhang of 6" (150 mm) to 18" (450 mm) at the front of the unit and 6" (150 mm) on the sides if installed at the end of the cooking line. Please refer to the Installation Manual for additional technical data and for instructions on installation and setup.

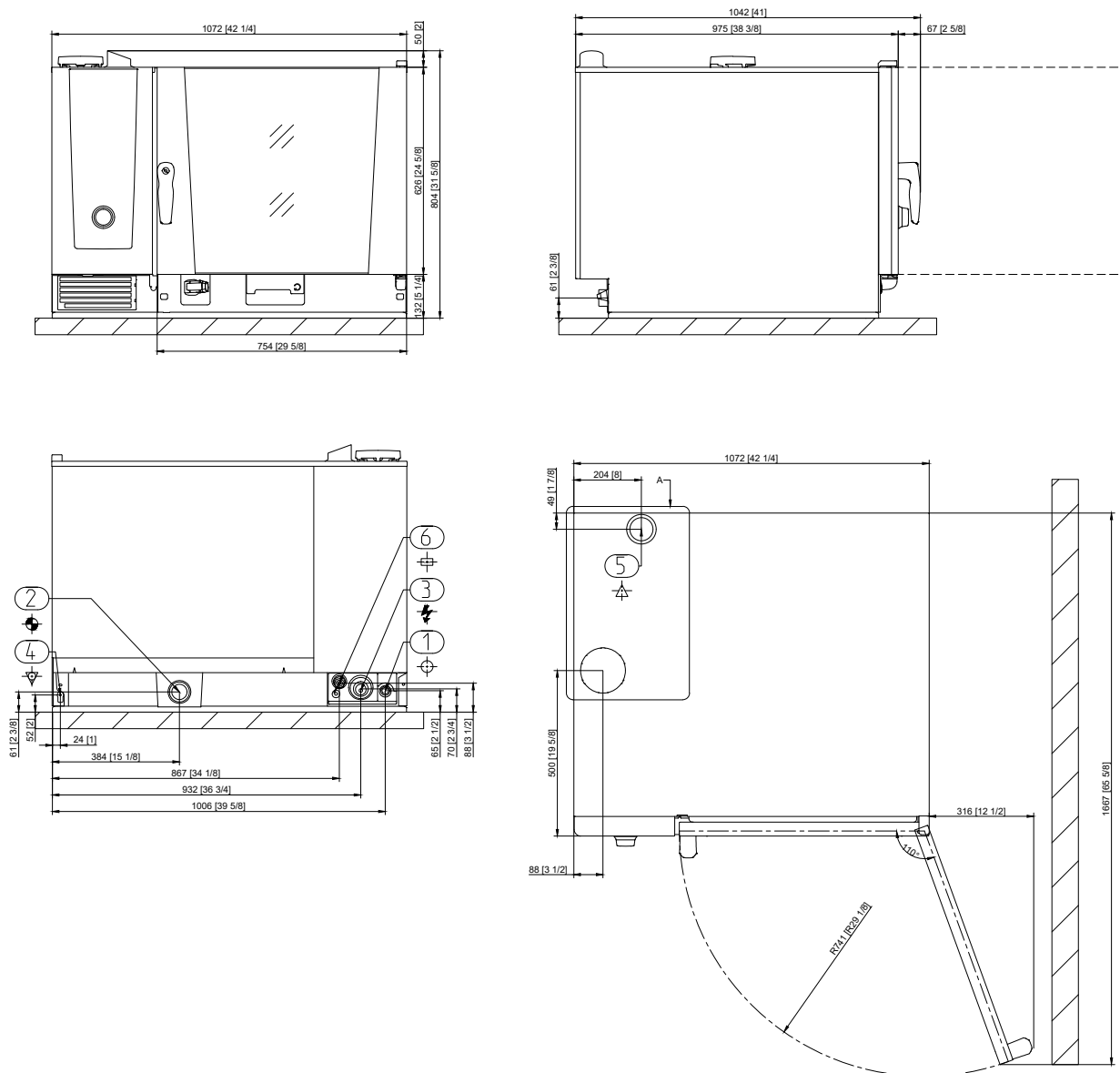
Installation conditions

- > Observe all local and country-specific standards and regulations regarding the installation and operation of industrial cooking appliances. The local standards and regulations for interior ventilation systems must also be taken into account.

Approvals**NSF Certification**

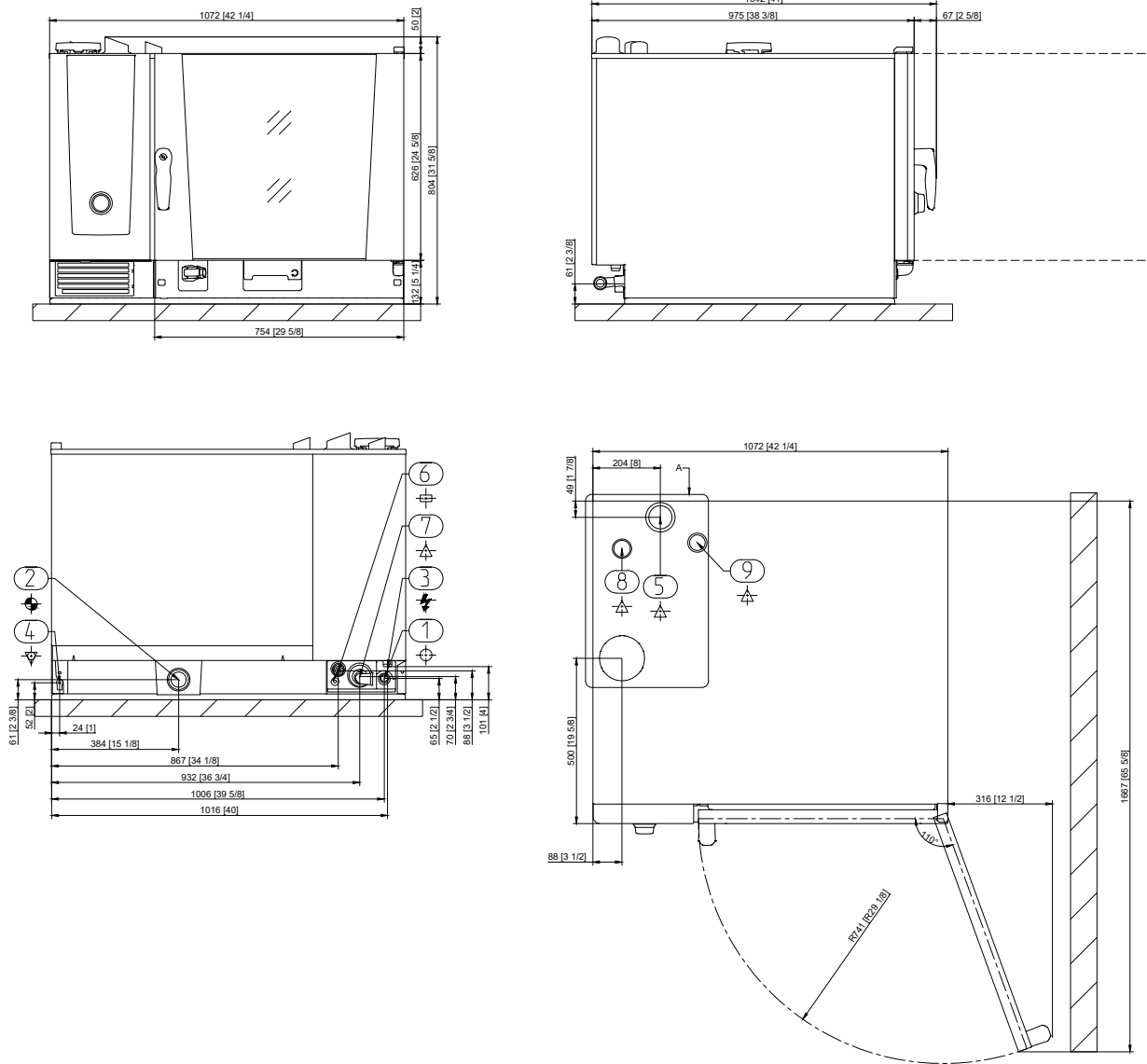
iCombi Pro (LM100) and iCombi Classic (LM200) are NSF-certified, shown on the NSF list.

Technical drawing, electrical



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface

Technical drawing, gas



1	Water inlet
2	Water drain
3	Electrical connection
4	Equipotential bonding
5	Ventilation pipe
6	Ethernet interface
7	Gas connection
8	Exhaust pipe gas (steam)
9	Exhaust pipe gas (convection)

Accessories

> 3 full size stainless steel grids included with delivery of the cooking system

Accessories	Item number
RATIONAL Active Green cleaning agent tabs – guarantee the best cleaning performance	Item no. 56.01.535
RATIONAL Care tabs – effectively prevent limescale deposits	Item no. 56.00.562
Condensation breaker – diverts steam and vapors to an existing exhaust air system Sizes 6-half size, 10-half size, 6-full size and 10-full size	Item no. 60.72.592
Run-in rail for mobile rack and mobile plate rack Size 6-full size, 10-full size	Item no. 60.74.650
Finishing system for banquets Size 6-full size, 34 plates	Item no. 60.62.196
Full size sheet pan adapter	Item no. 60.12.156
Mobile oven rack and mobile plate oven rack – for simple loading outside the cooking system	See Cooking Systems and Accessories catalog
Hinging racks - Size 6-full size	Item no. 7 racks 60.62.168
	Item no. 5 racks 60.62.171
Heat shield – for installing a unit near a heat source, e.g. a grill - Size 6-full size	Item no. left side 60.75.769
	Item no. right side 60.75.768
Mobile catering stand - especially for heavy mobile catering usage	Item no. 60.31.165
Stackable Combi-Duo kit - Size 6-full size E/G on Size 6-full size E or Size 10-full size E	Item no. 60.74.725
Stackable Combi-Duo kit - Size 6-full size E/G on Size 6-full size G	Item no. right-side hinges 60.75.752
	Item no. left-side hinges 60.75.754
Transport trolley for mobile rack and mobile plate rack - height-adjustable - Sizes 6-full size, 10-full size	Item no. 60.75.605
Transport trolley for mobile rack and mobile plate rack - standard - Sizes 6-full size, 10-full size	Item no. 60.73.999
UltraVent recirculating hood - for Size 6-full size, 10-full size electric units only	Item no. 60.76.180
UltraVent Plus recirculating hood - for Size 6-full size, 10-full size electric units only	Item no. 60.07.178
Stands are available in various versions - standard, with casters, or with anchorable stainless steel feet	See Cooking Systems and Accessories catalog
RATIONAL USB stick – to securely transfer cooking programs and HACCP data	Item no. 42.00.162
RATIONAL Double Water Filter - for Combi Duo 6-full size/6-full size and 6-full size/10-full size or if used for more than 2 units	Item no. 1900.1150US

We offer a wide range of cooking accessories to help you achieve ideal cooking results; for more information, please consult our accessories brochure, ask your dealer, or visit www.rational-online.com

Planner	RATIONAL AG
	1701 Golf Road, Suite C-120, Commerce Rolling Meadows, IL 60008 Toll Free: 888-320-7274 Fax: 847-755-9583 Email: info@rational-online.com Visit us on the internet: www.rational-online.com

Water Filtration Products.

R295-CLX



R295-CLX

RATIONAL Water Filtration Products Model R295-CLX water filtration system helps provide consistent high quality water for your RATIONAL combi by reducing the effects of sediment, chloramines, chlorine, taste & odor while providing required flow rates for Combi-Duo models 6-full size/6-full size, 6-full size/10-full-size or if used for more than 2 units. For each additional unit add one additional head and cartridge.

Product Benefits

- › Carbon block technology effectively reduces chloramines, chlorine, taste & odor for better equipment protection.
- › NSF Standard 42 and FDA CFR-21 compliant materials.
- › Sanitary Quick Change (SQC) encapsulated cartridge design allows for fast and easy cartridge change-outs with 1/4" turn.
- › 3/4" MNPT horizontal inlet and outlet ports allow direct or easily adaptable connections to existing plumbing lines.

Model Number	Article No.	Reduction Claims	Nominal Micron Rating	Capacity	Replacement Cartridge	Service Flow Rate
R295-CLX	1900.1158US	Chlorine, Taste and Odor Chloramine	5.0 ¹	108,000 gallons (408,824 liters)	R295-CLX (Qty 2) 1900.1155US	10 gpm (37.85 lpm) 3 gpm (11.36 lpm)

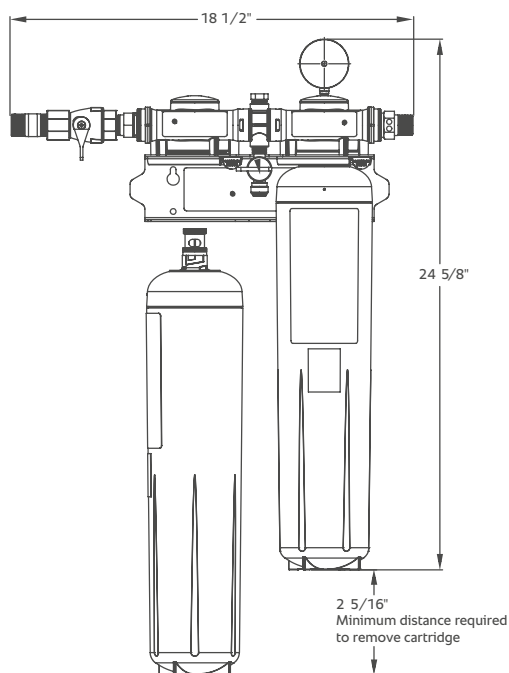
¹ NSF Certified for Particulate Reduction



Visit www.nsf.org for the claims associated with products that are NSF listed.

Water Filtration Products.

R295-CLX



Warning

To reduce the risk associated with the ingestion of contaminants: Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.

RATIONAL recommends regularly scheduled maintenance and replacement of the filter cartridge(s) in order for the product to perform as advertised/sold. RATIONAL shall not be liable for system failures due to improper maintenance.

Application Guide

- › 6-full size/6-full size or 6-full size/10-full-size.
Add up to 2 additional units with extra heads and cartridges.

Important: Installation Tips

These installation tips are for informational purposes only and are not intended to be used as actual installation instructions. CAUTION: To reduce the risk associated with property damage due to water leakage:

- › Read and follow Use Instructions before installation and use of this system.
- › Installation and use **must** comply with all state and local plumbing codes.
- › Protect from freezing, remove filter cartridge when temperatures are expected to drop below 40 °F (4.4 °C).
- › Do not install on hot water supply lines. The maximum operating water temperature of this filter system is 100 °F (37.8 °C).
- › Water pressure range- minimum 25 to maximum 80 psi (172-552 kPa). If your water pressure exceeds 80 psi (552 kPa), you must install a pressure limiting valve. Contact a plumbing professional if you are uncertain how to check your water pressure.
- › Do not install where water hammer conditions may occur. If water hammer conditions exist you must install a water hammer arrester. Contact a plumbing professional if you are uncertain how to check for this condition.
- › The disposable filter cartridge **must** be replaced every 12 months, at the rated capacity or sooner if a noticeable reduction in flow rate occurs.

Limited Warranty

RATIONAL warrants this Product will be free from defects in material and manufacture for five (5) years from the date of purchase: The filter cartridge or filter membrane is warranted to be free from defects in material and manufacture for one (1) year. This warranty does not cover failures resulting from abuse, misuse, alteration or damage not caused by RATIONAL Water Filters or failure to follow installation and use instructions. No warranty is given as to the service life of any filter cartridge or membrane as it will vary with local water conditions and water consumption. RATIONAL MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOMER OR USAGE OF TRADE. If the Product fails to satisfy this Limited Warranty during the warranty period, RATIONAL will replace the Product or refund your Product purchase price. This warranty does not cover labor. The remedy stated in this paragraph is Customer's sole remedy and RATIONAL exclusive obligation. For additional information, see the entire Limited Warranty located in the product Installation and Operating Instruction Manual.

Limitation of Liability. RATIONAL will not be liable for any loss or damage arising from this RATIONAL product, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability. Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

RATIONAL USA

1701 Golf Road
Suite C-120, Commerce
Rolling Meadows, IL 60008

Tel. 888-320-7274 (Toll Free)
Fax 847-755-9583

info@rational-online.us
rationalusa.com

Specification/Datasheet

UltraVent Plus Types 6-full size, 10-full size



Article number

60.76.178

Description

The UltraVent Plus gets rid of the steam emitted with its condensation technology. No connection to the outside or extension of an existing exhaust system is necessary with this air recirculation hood.

It is also equipped with special filter technology which reduces lingering smoke, which can be created with fatty/oily products at high temperature.

Intended use

This product is intended exclusively for professional use, such as in restaurant kitchens or catering operations for schools, hospitals, or delis. Any other use runs counter to its intended purpose, and could be dangerous. RATIONAL AG assumes no liability for consequences of improper use.

Features

- Intelligent control with automatic, continuously variable adjustment of the capture power to the quantity of steam produced
- Automatically boosts extraction rate when cooking cabinet door is opened
- Reduces lingering steam and vapors. These are captured and condensed in the hood
- Wastewater discharged by the device - no additional discharge line needed
- Easy to install and retrofit
- Issue of service notifications on the display of the iCombi Pro and iCombi Classic
- Easy to clean stainless steel grease baffles, dishwasher safe
- Special filter technology with a replacable HEPA H13 main filter to reduce smoke
- Connects to both cooking systems in a Combi-Duo

Technical specifications

Supplied with an 8 ft 2 in (2.5 m) power cable with 5-15 P-connector

Connection:	120 V - 1 ph
Frequency:	60 Hz
Connected load:	180 W
Running Amps (A):	1.6 A
Extraction capacity:	415 ft ³ /min
Operating noise level:	50-65 dB(A)

Dimensions and weights

Width (W):	42 3/8 in
Height (H):	16 in
Depth (D):	42 3/4 in
Weight:	196.2 lb

Material

Stainless steel (CNS 1.4301/AISI 304)

Equipment/Scope of delivery

- The condensation hood includes an adapter kit for optional installation on a Combi-Duo

Specification/Datasheet

UltraVent Plus Types 6-full size, 10-full size



Note

- To install an UltraVent or UltraVent Plus on a SelfCookingCenter (from 04/2004) or CombiMaster Plus, a corresponding adapter kit is required
- The local standards and regulations for ventilation systems must be adhered to
- Only permitted for installation on electrical units
- We recommend maintaining an overhead clearance of at least 18" (450 mm) for all cooking systems and Combi-Duos using an UltraVent or an UltraVent Plus
- In individual cases involving Model 10-half size or smaller tabletop cooking systems, this clearance can be reduced to a minimum of 10" (250 mm) following expert evaluation of local framework conditions
- Not to be used with VarioSmoker

Approvals

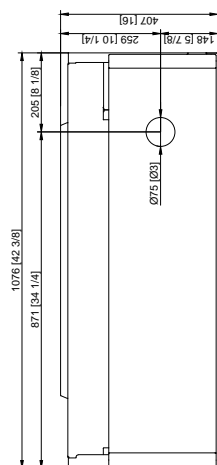


Specification/Datasheet

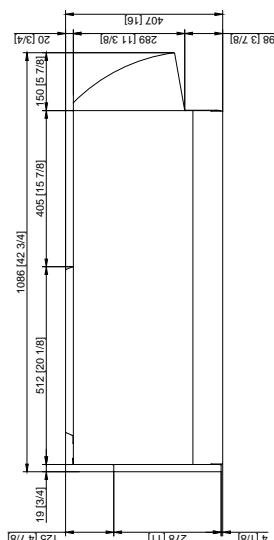
UltraVent Plus Types 6-full size, 10-full size



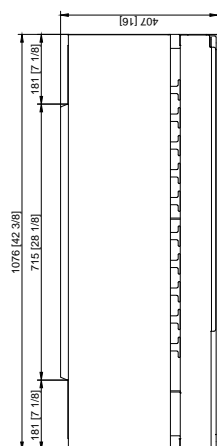
Rückansicht
Back view
Vue arrière



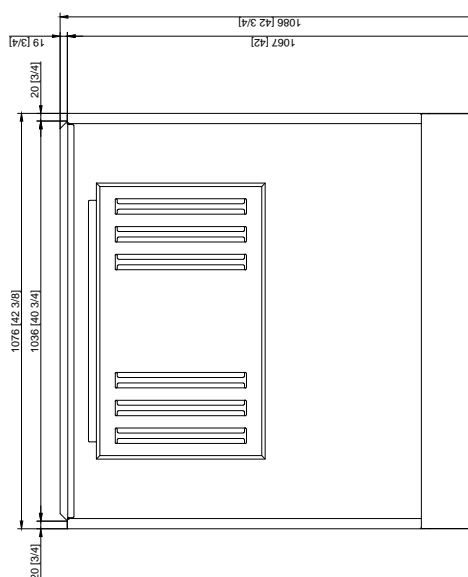
Seitenansicht
Side view
Vue de côté



Vorderansicht
Front view
Vue de face



Draufsicht
Top view
Vue de dessus



Information/Information/Information		Anschlussplan/Connection diagram/Plan de connexion	
Zachungsausschnitt unterliegt nicht dem Änderungsdiens!		UltraVent Plus (CP-CC 6-21 and 90-21 (master view))	
Printed drawing is not automatically updated!		Date/Date/Date	
Le mise à jour n'est pas assurée sur les plans papier!		30.05.2019	
RATIONAL AG 2019		RATIONAL AG 2019	
Revision/Reviser/Revision		Esterbauer/Scale/Échelle	
Index/Date/Date/Date		1:1	
Name/Name/Name		Abmessungen/Dimensions/Dimensions (mm/inch)	
1		Nr./No./Beschreibung/Description	
2		1	
3		2	
4		3	
5		4	
6		5	
7		6	
8		7	

GRIDDLE STAND FREEZER (0°F)

Model: D48GFN

Natural Refrigerant R-290 Model

48" Griddle Stand Freezer



ENERGY STAR® Qualified Commercial Freezer

Stainless steel exterior and interior, reinforced stainless steel work top with drip guard marine edge and stainless steel case back.



Options and Accessories

(upcharge and lead times may apply)

Flat top in lieu of marine edge	Integral heat shield top
16 gauge stainless steel top (flat or marine)	Cylinder locks
Top extensions (flat or marine edge)	Doors in lieu of drawers
Condensing unit on left (standard on right)	Special electrical requirements (consult factory)

Consult factory for other model configurations, options and accessories.

Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Expansion valve system

Easily serviceable, front slide outcondensing unit

CABINET ARCHITECTURE

High density, non-CFC polyurethane foamed-in-place insulation

Easy glide, fully extendable drawers designed to hold 6" deep pans side-by-side

Smooth, polished chrome drawer handles

One-piece, snap in magnetic Santoprene™ drawer gaskets

Heavy duty drawer track with built in drawer safety clips

Drawers designed to hold 250 lb. capacity

(2) drawer pan divider bars*

4" casters on support plates

* Pans supplied by others

MODEL FEATURES

Electronic control, automatic electric defrost

Front breathing

¹ R-290 refrigerant meets all federal and state regulatory requirements.

Continental
Refrigerator



APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	9.0 (255 cu l)
Width, Overall (inches)	48 (1219 mm)
Depth, Overall (inches) (including handles)	35 5/16 (897 mm)
Height, Overall (inches) (including 4" casters)	26 3/8 (670 mm)
Number of Drawers	2

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/3+
Capacity (BTU per hour)*	1250

* Rating @ -15°F evaporator, 90°F ambient

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	5.9 (3.1)
Defrost Amps (International)	4.0 (2.2)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	475 (215 kg)
Height - Crated (inches)	30 (762 mm)
Width - Crated (inches)	64 (1626 mm)
Depth - Crated (inches)	39 (991 mm)

DRAWER PAN DIVIDERS (supplied with model)

CM2-0764 2 (one per drawer)

See drawer pan configurations on right (**pans not supplied**). For other drawer pan configurations, consult factory.

TOP WEIGHT CAPACITY

Max. Top Weight Capacity (pounds) 775 (352 kg)

Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

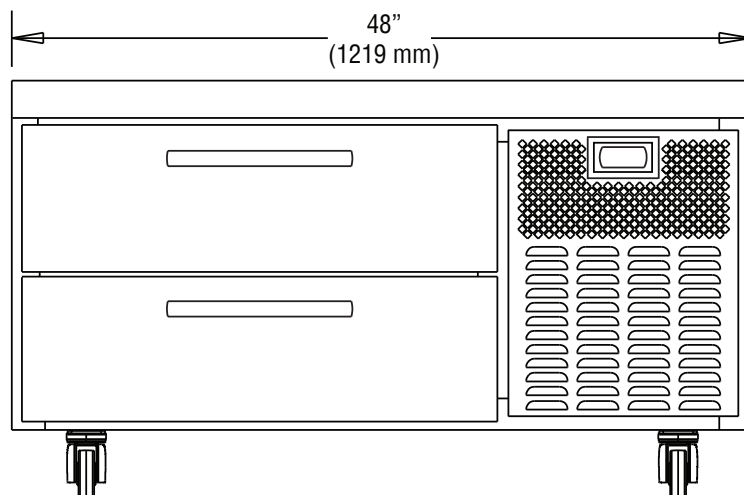
Due to our continued efforts in developing innovative products, specifications subject to change without notice.



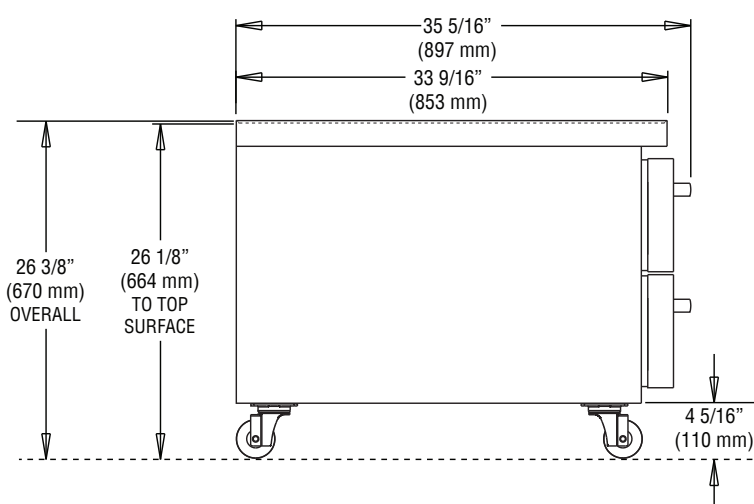
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Model Plan Views

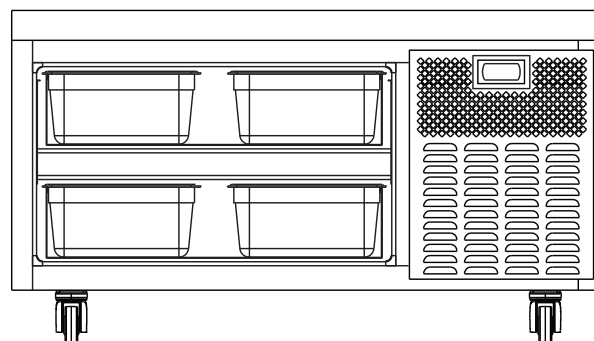


FRONT VIEW



SIDE VIEW

Shown with (4) 12 x 20 x 6 pans (**not supplied**).



DRAWER PAN CONFIGURATION

REVISED: 2/9/24

GRIDDLE STAND REFRIGERATOR

Model: D84GN

Natural Refrigerant R-290 Model

84" Griddle Stand Refrigerator



ENERGY STAR® Qualified Commercial Refrigerator

Stainless steel exterior and interior, reinforced stainless steel work top with drip guard marine edge and stainless steel case back.



Options and Accessories

(upcharge and lead times may apply)

Flat top in lieu of marine edge	Integral heat shield top
16 gauge stainless steel top (flat or marine)	Cylinder locks
Top extensions (flat or marine edge)	Doors in lieu of drawers
Condensing unit on left (standard on right)	Special electrical requirements (consult factory)

Consult factory for other model configurations, options and accessories.

Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Expansion valve system

Easily serviceable, front slide outcondensing unit

CABINET ARCHITECTURE

High density, non-CFC polyurethane foamed-in-place insulation

Easy glide, fully extendable drawers designed to hold 6" deep pans side-by-side

Smooth, polished chrome drawer handles

One-piece, snap in magnetic Santoprene™ drawer gaskets

Heavy duty drawer track with built in drawer safety clips

Drawers designed to hold 250 lb. capacity

(4) drawer pan divider bars*

4" casters on support plates

* Pans supplied by others

MODEL FEATURES

Electronic control, off-cycle defrost

Front breathing

¹ R-290 refrigerant meets all federal and state regulatory requirements.

Continental
Refrigerator



APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	20.0 (566 cu l)
Width, Overall (inches)	84 (2134 mm)
Depth, Overall (inches) (including handles)	35 (897 mm)
Height, Overall (inches) (including 4" casters)	26 (670 mm)
Number of Drawers	4

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4+
Capacity (BTU per hour)*	2610

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	4.2 (2.2)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	605 (274 kg)
Height - Crated (inches)	30 (762 mm)
Width - Crated (inches)	109 (2769 mm)
Depth - Crated (inches)	39 (991 mm)

DRAWER PAN DIVIDERS (supplied with model)

CM2-0764	4 (one per drawer)
----------	--------------------

See drawer pan configurations on right (**pans not supplied**). For other drawer pan configurations, consult factory.

TOP WEIGHT CAPACITY

Max. Top Weight Capacity (pounds)	1400 (635 kg)
-----------------------------------	---------------

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
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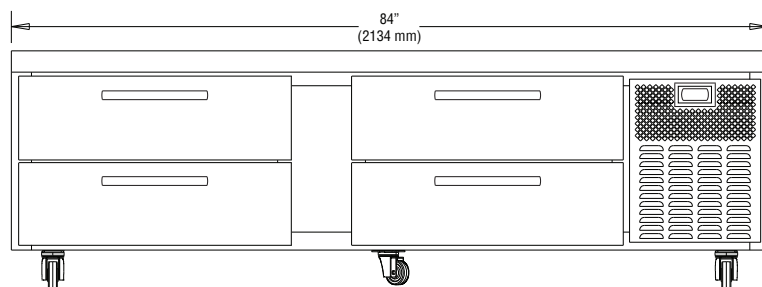
Due to our continued efforts in developing innovative products, specifications subject to change without notice.



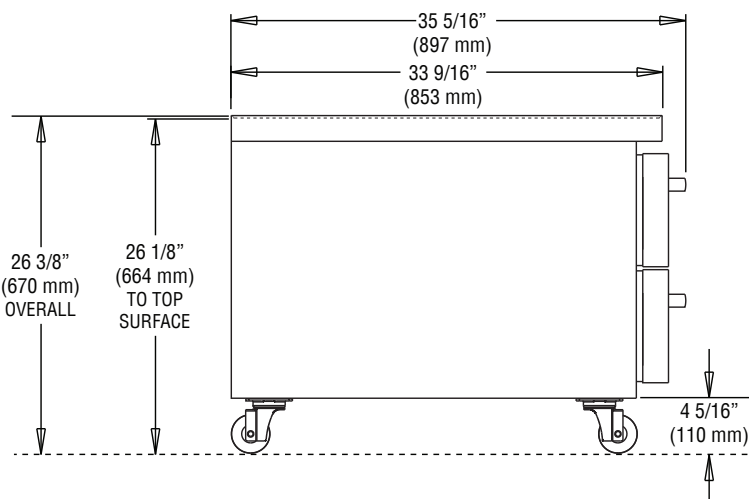
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Model Plan Views

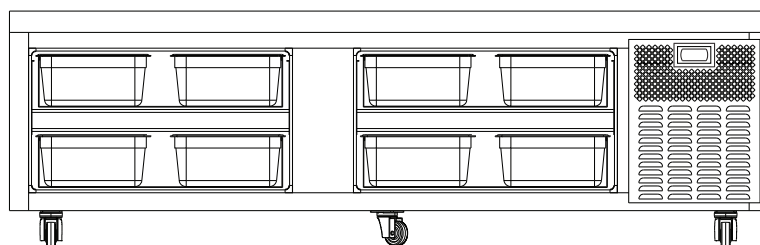


FRONT VIEW



SIDE VIEW

Shown with (8) 12 x 20 x 6 pans (**not supplied**).



DRAWER PAN CONFIGURATION

REVISED: 2/8/24

GRIDDLES & BROILERS

VULCAN**HEG-E SERIES
HEAVY DUTY ELECTRIC GRIDDLE**

Model HEG36E

For 24", 36" & 48"
unitsFor 60" & 72"
units**SPECIFICATIONS**

Heavy duty electric griddle, Vulcan Model No. _____. Stainless steel front and sides. 11" cooking height on 4" adjustable legs. 1/2" steel plate for 24", 36" and 48" units; 3/4" steel plate for 60" and 72" units. Tubular incoloy elements and one snap action thermostat for every 12" of griddle width. Thermostats adjust from 200° to 450° F. Stainless steel 4" back and tapered side splashes. 3 1/2" wide front grease trough empties into large capacity grease drawer. Available in 208V, 240V 50/60 Hz, 1 or 3 phase. 480V 50/60 Hz 3 phase.

NSF Certified.

SPECIFY VOLTAGE WHEN ORDERING.

- ☐ **HEG24E** 24" w x 24" d griddle plate
- ☐ **HEG36E** 36" w x 24" d griddle plate
- ☐ **HEG48E** 48" w x 24" d griddle plate
- ☐ **HEG60E** 60" w x 24" d griddle plate
- ☐ **HEG72E** 72" w x 24" d griddle plate

STANDARD FEATURES

- Stainless steel front, sides and 4" adjustable legs.
- 1/2" steel plate for 24", 36" and 48" units; 3/4" steel plate for 60" and 72" units.
- 11" cooking height on 4" adjustable legs.
- Two solid sheathed tubular incoloy heating elements, one snap action thermostat and cycling light per each 12" griddle width. Thermostats adjust from 200° to 450° F.
- Heavy duty chromed thermostat knob guards
- Stainless steel 4" back and tapered side splashes.
- 3 1/2" wide front grease trough empties into a large capacity grease drawer. 60" and 72" models have two grease drawers.
- Available in 208V or 240V, 50/60 Hz, 1 or 3 phase power supply. 480V, 50/60 Hz 3 phase power supply.
- One year limited parts and labor warranty.

OPTIONS

- ☐ Stainless steel stand with marine edges and casters.
- ☐ Cutting board, condiment rail, plate rail and banking strip accessories.

VULCAN

a division of ITW Food Equipment Group LLC

P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

GRIDDLES & BROILERS



HEG-E SERIES

HEAVY DUTY ELECTRIC GRIDDLE

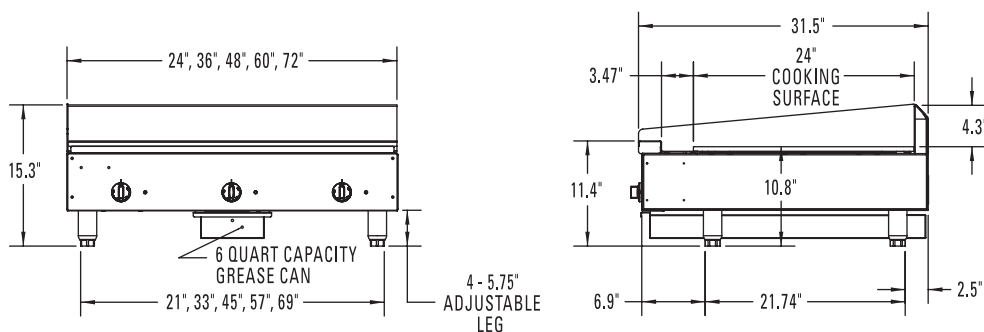
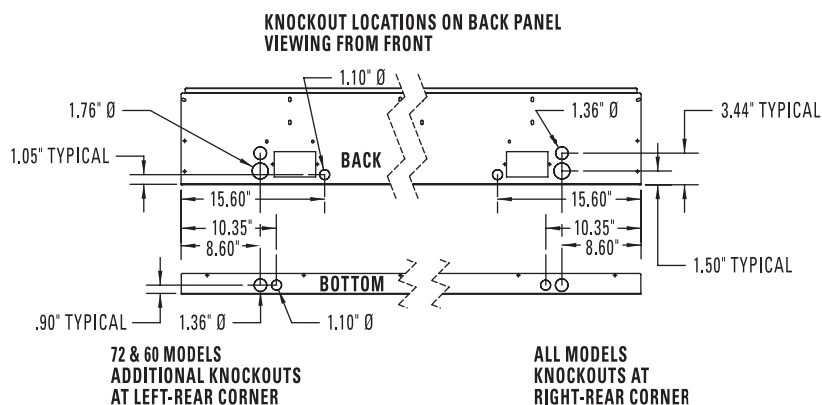
ELECTRICAL CHARACTERISTICS

STANDARD VOLTAGES – 208 VOLTS OR 240 VOLTS 50/60 Hz. – SINGLE OR THREE PHASE 480 VOLTS 50/60 Hz. – THREE PHASE ONLY																
MODEL NO.	TOTAL CONN. KW	TOTAL KW PER CONN	3 PHASE LOADING KW PER PHASE PER CONN.*			NOMINAL AMPS PER LINE WIRE CONN.*										
						3 PHASE									1 PHASE	
			X-Y	Y-Z	X-Z	208 VOLT			240 VOLT			480 VOLT			208	240
						X	Y	Z	X	Y	Z	X	Y	Z	VOLT	VOLT
HEG24E	10.8	10.8	5.4	5.4	0.0	22.5	45.0	22.5	19.5	39.0	19.5	9.7	19.5	9.7	51.9	45.0
HEG36E	16.2	16.2	5.4	5.4	5.4	45.0	45.0	45.0	39.0	39.0	39.0	19.5	19.5	19.5	77.9	67.5
HEG48E	21.6	21.6	10.8	5.4	5.4	67.4	67.4	45.0	58.5	58.5	39.0	29.2	29.2	19.5	103.8	90.0
HEG60E*	27.0	16.2	5.4	5.4	5.4	45.0	45.0	45.0	39.0	39.0	39.0	19.5	19.5	19.5	77.9	67.5
		10.8	5.4	0.0	5.4	45.0	22.5	22.5	39.0	19.5	19.5	19.5	9.7	9.7	51.9	45.0
HEG72E*	32.4	16.2	5.4	5.4	5.4	45.0	45.0	45.0	39.0	39.0	39.0	19.5	19.5	19.5	77.9	67.5
		16.2	5.4	5.4	5.4	45.0	45.0	45.0	39.0	39.0	39.0	19.5	19.5	19.5	77.9	67.5

*Model HEG60E and HEG72E require two separate electrical connections and services.

INSTALLATION CLEARANCES:

Sides and rear must be 1" from nearest combustible construction and 0" from non-combustible construction. Bottom must be 4" from combustible or non-combustible construction. This appliance is manufactured for commercial installation only and is not intended for home use.



MODEL NO.	OVERALL DIMENSIONS			COOKING SURFACE DEPTH	GREASE DRAWER CAPACITY (Gals.)	APPROX. SHIP WT.
	WIDTH	DEPTH	HEIGHT*			
HEG24E	24" (610)	31.5" (800)	15.3" (389)	24" (610)	1.5	230 lbs / 104 kg
HEG36E	36" (914)				1.5	310 lbs / 141 kg
HEG48E	48" (1219)				1.5	400 lbs / 181 kg
HEG60E	60" (1524)				2 x 1.5	535 lbs / 243 kg
HEG72E	72" (1821)				2 x 1.5	610 lbs / 277 kg

(Dimensions in parenthesis are in millimeters)



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P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

B-50 CHAR BROILER

B-50 CHAR BROILER



Wells B-50 Countertop Broiler has a stainless steel top and sides that make this broiler one of the most durable in the industry. Self-cleaning elements are protected by heavy-duty cast-iron grates and provide two heat zones for flexibility in broiling.

Specifications

Overall Dimensions:	Inches	MM
Width	36 1/2	927
Depth	29 9/16	751
Height (incl. 4" legs)	15 3/8	391
Grid Surface Dimensions:		
Width	32	813
Depth	20	508
Area	640 in ²	0.41 m ²
Temperature Settings:	OFF/LO to HI	
Number of Controls:	2	
Pre-Heat Time to 600° F:	10 minutes	
Typical Production	Per Load	Per Hour
Hamburgers	50	700
Steaks	18	160
Weights:	Lbs.	KG
Installed	151	68
Shipping	159	72

Export

The following model is available for export and meets the standards for CE:

- B-50EU, 380-415V, 3Ø, 10800 watts

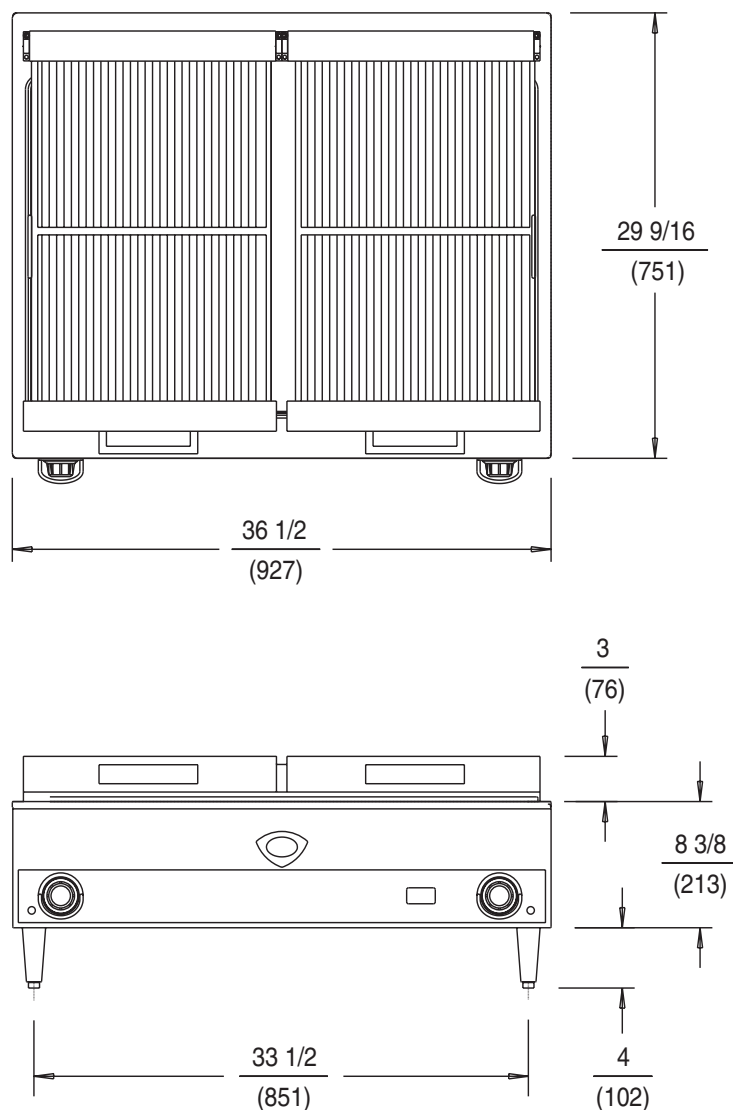
Features

- **Each self-cleaning element** is positioned between the broiler grate ribs to protect against direct food contact and spatula abrasion. The elements also provide dual heating action (conductive and radiant).
- **Temperature** is regulated by infinite controls that have a positive-off position and signal lights to indicate a power-on condition.
- **Element frame** has a spring-loaded support rod to secure element when in a raised position.
- **Lift-out, drawn drip pans with handles** and removable **cast iron grates** allow fast and easy cleaning.
- **Individual controls** regulate one half of the grid surface area for cooking versatility and are mounted with a protective guard ring to help prevent accidental temperature changes.
- **A terminal block** is provided for field connection to the main power supply.
- Each unit is provided with a **grate scraper/brush and 4" adjustable metal legs**.
- **The B-50 Broiler** is Underwriters Laboratories, Inc. LISTED and meets NSF International standards.
- **A one-year warranty** against defects covers parts and labor.



WELLS MANUFACTURINGLISTED
E6070

STD.4

EXPORT
MODELS
ONLY**MODEL
B-50
CHAR BROILER****DIMENSIONS:**INCH
(MM)MINIMUM CLEARANCE REQUIRED FROM UNIT
TO THE NEAREST COMBUSTIBLE OBJECT.

BACK	SIDE	BOTTOM	TOP
$\frac{6}{16}$ (152)	$\frac{7}{16}$ (178)	$\frac{4}{16}$ (102)	$\frac{30}{16}$ (762)

B-50 ELECTRICAL SPECIFICATIONS:

MODELS	VOLTS	WATTS	AMPS PER LINE PHASE 3				AMPS SINGLE PHASE	POWER SUPPLY CORD
			L1	L2	L3	N		
B-50	208	10800	30.0	30.0	30.0	—	—	NONE
B-50	240	10800	26.0	26.0	26.0	—	45.0	NONE
Ⓢ B-50EU	380-415	10800	15.0	15.0	15.0	—	—	NONE

Ⓢ Denotes export (EU) products.

NOTE: Specifications are subject to change without notice.

WELLS MANUFACTURING COMPANY

2 ERIK CIRCLE, PO BOX 280, VERDI, NV 89439 U.S.A. • USA PHONE: (775) 689-5700 • FAX: (775) 689-5972

FOR ORDERS ONLY: (888) 356-5362 • FAX: (800) 356-5142 • www.wellsbloomfield.com

2001 WELLS MANUFACTURING • PRINTED IN THE U.S.A. • 2/01 • REV(F) • PART NO. 37088





Project:

Item Number:

Quantity:

CAYENNE® HEAVY-DUTY INDUCTION RANGES



912HIMC



912HIDC



924HIMC



924HIDC

DESCRIPTION

These high-efficiency, heavy-duty, commercial, bench top induction ranges are designed for use in commercial kitchens. They provide sensitive low-end control for cooking sauces, milks and chocolates as well as fast, high temperature cooking.

The induction ranges come complete with one or two 30 amp power cords with plugs (see Specifications). The case is made from 18-gauge stainless steel with a vitro ceramic top. The ceramic top is easily cleaned with a mild cleaner.

The induction range is equipped with a variety of safety features including:

- Over-heat protection
- Small-article detection
- Pan auto-detection function
- Empty-pan shut-off

AGENCY LISTINGS



This device complies
with Part 18 FCC Rules.

ITEMS

912HIMC Dual Hob, Manual Control (US/Canada)

912HIDC Dual Hob, Digital Control (US/Canada)

924HIMC Four Hob, Manual Control (US/Canada)

924HIDC Four Hob, Digital Control (US/Canada)

FEATURES

- Proprietary, high performance induction technology
- Stainless steel framed hobs
- Dual commercial, high-flow fans for extra durability
- 90% efficiency rating
- Low 100°F temperature setting for holding applications
- Same look and operating height as Cayenne® charbroilers and griddles
- FCC Part 18 approved
- Adjustable legs for leveling
- One year parts and labor warranty

Manual Control Models

- Knob control, from Low to High (1% to 100% power)
- Knob guards

Digital Control Models

- Multi-sensor solid-state controls with digital display
- Smooth power control from 1% to 100% of output power and temperature control settings (100° - 400° F) in Fahrenheit only
- Touch controls for easy cleaning
- 1 to 180 minute timer

WARRANTY

All models shown come with Vollrath's standard warranty against defects in materials and workmanship. For full warranty details, please refer to www.Vollrath.com.

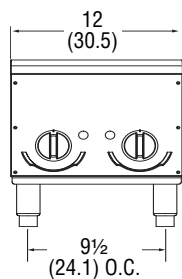
CLEARANCE AND ENVIRONMENT REQUIREMENTS

- This appliance is intended for use with induction-ready cookware. It is not intended to be used with aluminum pans with a metal disc on the bottom.
- All models require a minimum ½" clearance between the induction range and any adjacent hot equipment, such as charbroilers or griddles (do not install flush). Unit draws air from below. Do not install in areas where other equipment can exhaust directly into the induction range.
- The maximum intake temperature must not exceed 110°F (43°C). Temperatures are measured in ambient air while all appliances in the kitchen are in operation.

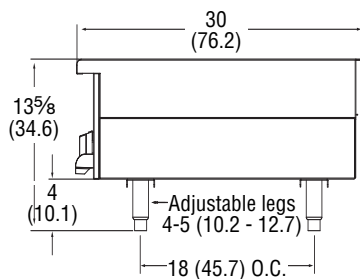
Due to continued product improvement, please consult www.vollrath.com for current product specifications.

Approvals	Date

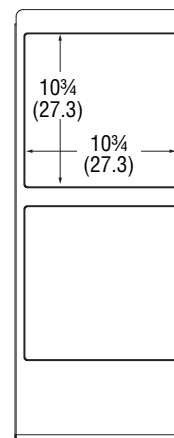


CAYENNE® HEAVY-DUTY INDUCTION RANGES**DIMENSIONS** (Shown in inches (cm))**Dual Hob 912HIMC / 912HIDC**

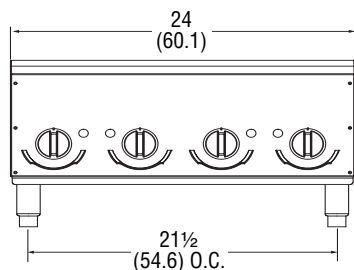
Front View



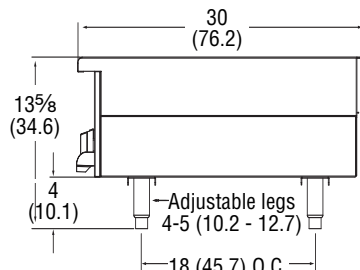
Side View



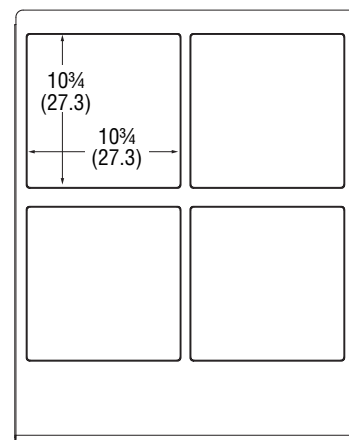
Top View

Four Hob 924HIMC / 924HIDC

Front View



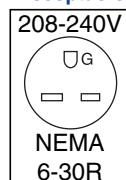
Side View



Top View

SPECIFICATIONS

Item No.	Description	Volts	HZ	Amps	Watts per Hob	Net Weight lb (kg)	Plug
912HIMC	Dual Hob, Manual Control	208-240	50/60	24	2500-2900	47 (21.3)	NEMA 6-30P
912HIDC	Dual Hob, Digital Control						
924HIMC	Four Hob, Manual Control			2 x 24		86 (39)	NEMA 2 x 6-30P
924HIDC	Four Hob, Digital Control						
Dual hob units feature one power cord and require a single receptacle with a dedicated circuit.							
Four hob units feature two power cords and require two outlets, each with a dedicated circuit.							

Receptacle
www.vollrathfoodservice.com
The Vollrath Company, L.L.C.

1236 North 18th Street
Sheboygan, WI 53081-3201 U.S.A.
Main Tel: 800.624.2051 or 920.457.4851
Main Fax: 800.752.5620 or 920.459.6573
Customer Service: 800.628.0830
Canada Customer Service: 800.695.8560

Technical Services
techservicereps@vollrathco.com
Induction Products: 800.825.6036
Countertop Warming Products: 800.354.1970
All Other Products: 800.628.0832



Project:

Item Number:

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CAYENNE® HEAVY-DUTY INDUCTION RANGES



912HIMC



912HIDC



924HIMC



924HIDC

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- Small-article detection
- Pan auto-detection function
- Empty-pan shut-off

AGENCY LISTINGS



This device complies
with Part 18 FCC Rules.

ITEMS

- | | |
|----------------|--|
| 912HIMC | Dual Hob, Manual Control (US/Canada) |
| 912HIDC | Dual Hob, Digital Control (US/Canada) |
| 924HIMC | Four Hob, Manual Control (US/Canada) |
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- Stainless steel framed hobs
- Dual commercial, high-flow fans for extra durability
- 90% efficiency rating
- Low 100°F temperature setting for holding applications
- Same look and operating height as Cayenne® charbroilers and griddles
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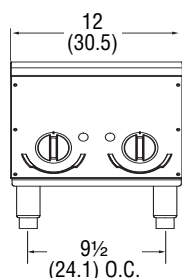
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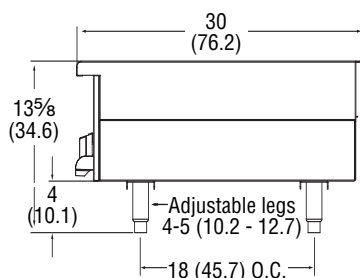
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Approvals	Date

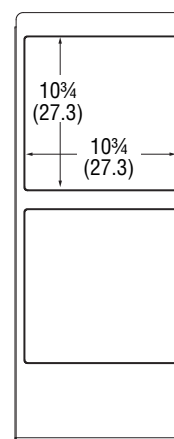


CAYENNE® HEAVY-DUTY INDUCTION RANGES**DIMENSIONS** (Shown in inches (cm))**Dual Hob 912HIMC / 912HIDC**

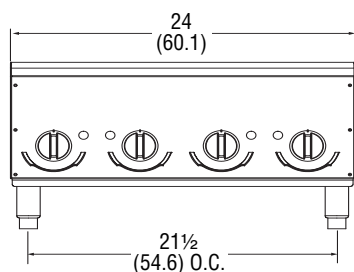
Front View



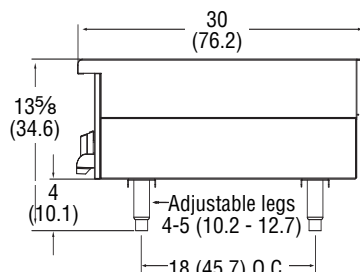
Side View



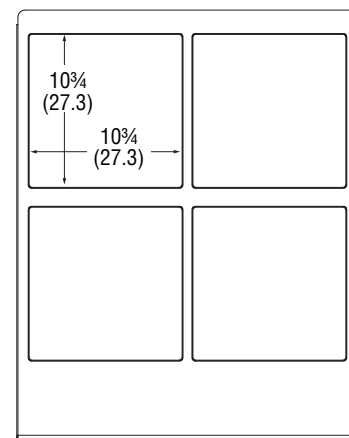
Top View

Four Hob 924HIMC / 924HIDC

Front View



Side View

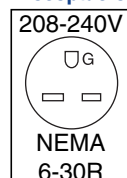


Top View

SPECIFICATIONS

Item No.	Description	Volts	HZ	Amps	Watts per Hob	Net Weight lb (kg)	Plug
912HIMC	Dual Hob, Manual Control	208-240	50/60	24	2500-2900	47 (21.3)	NEMA 6-30P
912HIDC	Dual Hob, Digital Control			24			
924HIMC	Four Hob, Manual Control			2 x 24		86 (39)	NEMA 2 x 6-30P
924HIDC	Four Hob, Digital Control			2 x 24			

Dual hob units feature one power cord and require a single receptacle with a dedicated circuit.
Four hob units feature two power cords and require two outlets, each with a dedicated circuit.

Receptacle
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Main Tel: 800.624.2051 or 920.457.4851
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Technical Services
techservicereps@vollrathco.com
Induction Products: 800.825.6036
Countertop Warming Products: 800.354.1970
All Other Products: 800.628.0832



ND-2 Series

Exhaust Only Hood

CaptiveAire's Premier Canopy

The ND-2 Series is a Type I, Wall Canopy Hood for use over 450°F, 600°F and 700°F cooking surface temperatures. The aerodynamic design includes a mechanical baffle and performance enhancing lip for exceptional capture and containment.

Fully Integrated Package

CaptiveAire sells this hood as a stand-alone appliance to be integrated into a kitchen ventilation application, or provided as part of a FULLY INTEGRATED PACKAGE designed by CaptiveAire and pre-engineered for optimum performance. The package consists of the hood, an integral utility cabinet, factory pre-wired electrical controls, and a listed fire suppression system. Other options include a listed exhaust fan, a listed make-up air unit and listed, factory-built ductwork.

Advantages

- ▶ **Exhaust Flow Rates:** Superior exhaust flow rates. A 4' Hood can operate at 150 CFM/ft or 600 total CFM. Available in single or back-to-back configurations.
- ▶ **ETL Listed:** ETL Listed for use over 450°F, 600°F and 700°F cooking surface temperatures, which provides flexibility in designing kitchen ventilation systems. ETL Listed to US and Canadian safety standards, ETL Sanitation Listed and built in accordance with NFPA 96.
- ▶ **Capture and Containment:** Insulated, double-wall rigid front has aerodynamic design that reduces radiant heat into kitchen, prevents condensation and provides exceptional capture and containment of cooking vapors. This is accomplished with the signature ND-2 "mechanical baffle" on the front of the hood's capture area and the "C-shaped" design of the hood's capture area. Mechanical baffle provides a built-in wiring chase for optimal positioning of electrical controls and outlets on the front face of the hood without penetrating capture area or requiring external chase way.
- ▶ **Convenient Design:** Factory pre-wired lighting to illuminate the cooking surface is accessible from the bottom of the hood. Fitted with UL Listed, pre-wired, incandescent light fixtures and tempered glass globes to hold up to a standard 100 watt bulb. Pre-punched hanging angles on each end of hood and additional set provided for hoods longer than 12'.
- ▶ **Construction:** Polished stainless steel on the interior and exterior of the front enhance aesthetics. Fully welded and polished front corners. Fabricated from
- ▶ **Grease Extraction:** All hoods come standard with stainless steel baffle filters and a deep grease trough which allows for easy cleaning. Captrate Combo® and Captrate Solo® filters are optional. Grease drain system with removable 1/2 pint cup for easy cleaning. Standard filter stops eliminate gaps between filters.
- ▶ **Reduced Lead Times and Shipping Costs:** Produced on a high volume assembly line at one of six manufacturing facilities to reduce lead times and shipping costs.
- ▶ **Clearance to Combustibles:** Standard built in 3" rear standoff to meet NFPA 96 requirements, when installed in a wall application.
- ▶ **Controls:** Hoods can be equipped with modular utility cabinets and end standoffs. Optional listed light and fan control switches flush mounted and pre-wired through electrical chase way.
- ▶ **Optional Make-Up Air:** Make-up air can be supplied through optional front and/or side plenums (ND-2 Series with PSP or AC-PSP Accessory).
- ▶ **Optional Self Cleaning Technology:** The Self Cleaning Hood option adds a spray bar that extends the full length of the hood immediately behind the filters. The system cleans grease from the plenum and portion of the duct with the daily hot water spray cycle.
- ▶ **Optional CORE Protection:** The CORE Fire Protection System is an automatic, pre-engineered fire suppression system which is ETL listed to UL Standard

Type 430 stainless steel with option of Type 304 available.

- ▶ **Channels:** Hood comes standard with structural channels on top and wrapper channels on the bottom.
- ▶ **Reduced Weight:** Rigid single wall end panels reduce weight.

300. The CORE Protection System is designed to provide primary coverage for ventilating equipment including hoods, ducts, plenum and filters.

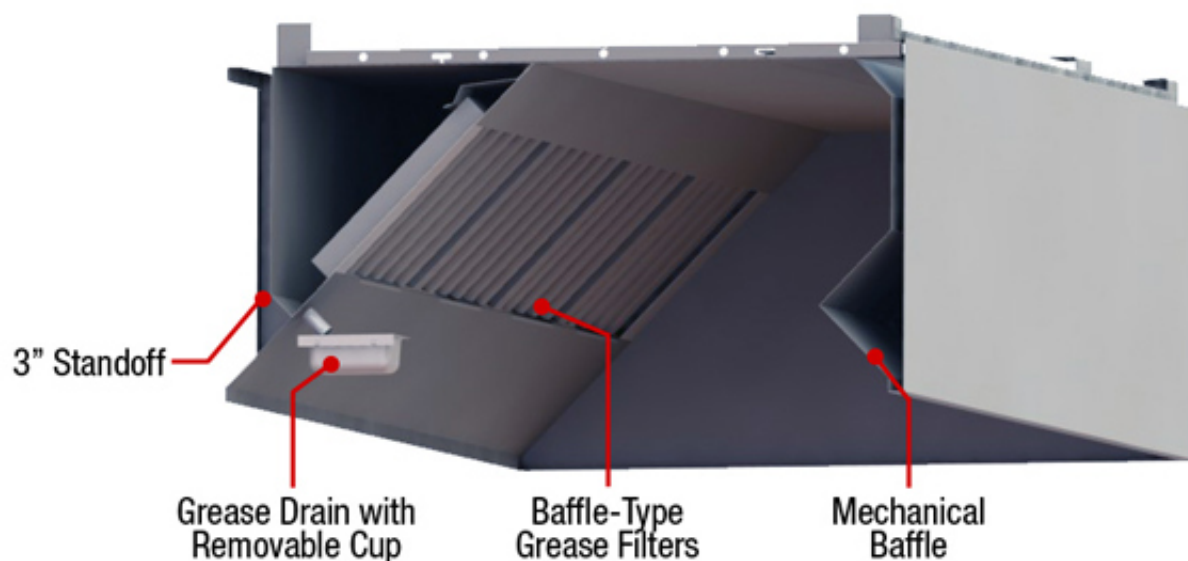
- ▶ **Optional Heat Recovery Coil:** This option is available for hoods with CORE Protection. A listed coil accessory can be added to the hood plenum to recover heat from the exhaust stream. Warm air in the exhaust stream passes over the coil and heats the cold water in the coil, acting as a preheater on the hot water supply line for the restaurant or facility.

Performance

AVG. COOKING SURFACE TEMP. (°F)	CONFIGURATION	MIN. EXHAUST CFM / FT.
450°F	Single Wall Hood 2 Wall Hoods Back-to-Back	150 300
600°F	Single Wall Hood 2 Wall Hoods Back-to-Back	200 400
700°F	Single Wall Hood 2 Wall Hoods Back-to-Back	250 500

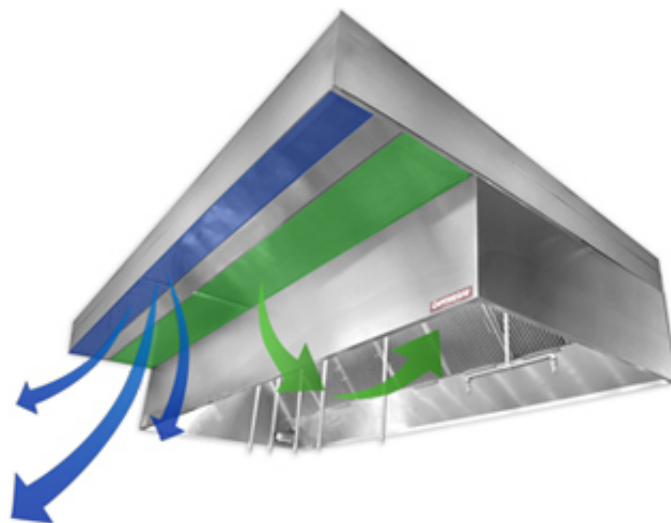
Recommended Duct Sizing: Exhaust - Based on 1500 FPM

Features



Optional Make-Up Air Accessory

- Provides the required make-up air for your kitchen system
- Delivers AC where it is needed most
- AC air does not interfere with the hoods capture and containment
- Convenient termination for AC ductwork in kitchen
- Stainless steel construction to match the ventilation hoods
- Insulated to prevent condensation
- Make-up plenum is located nearest the hood; the air conditioned plenum is away from the hood
- Make-up air stream and the air conditioned air stream are not permitted to mix until leaving the dual plenum
- Perforated, stainless steel diffuser plates provide even air distribution
- Optional LED Lights



Make-up air is evenly distributed along the length of the hood through the first plenum and **conditioned air** is delivered through the outer plenum.

Optional Vertical End Panels (VEP & WVEP)

Energy Savings

- VEPs provide improved capture and containment by directing effluents into the hood and blocking cross drafts
- Allows exhaust CFM reductions up to 18%
- Equivalent reduction in makeup air
- This saves on fan energy, make-up air heating/cooling energy
- Possible equipment downsizing, reduces upfront cost

Design

- Stainless steel matches hood finish
- Gas chase allows appliance lines to run between wall and end panel
- Double-wall insulated construction
- Adjustable feet
- May allow for a reduction in required side overhangs

Safety

- Encloses the hood area, preventing flames or embers from escaping
- Ensures equipment is not accidentally moved outside of the hood area
- Stainless steel construction for sanitation and longevity
- Legs raise bottom of panel off floor to allow room for cleaning

- Hemmed edges prevent sharp surfaces
 - Wide Vertical End Panels (WVEPs) provide an increased level of heat containment and fire protection, especially useful for high radiant load appliances such as solid fuel
-

Options

Utility Cabinet: Listed for integral side mount and fabricated of same material as hood. Cabinet can house listed fire suppression system and listed, pre-wired electrical controls.

Front Perforated Supply Plenum: Provides low velocity make-up air for the kitchen and is discharged in front of the hood. Perforated diffuser plates allow for even air distribution and supply riser includes a volume damper for easy balancing. Side Perforated Supply Plenums can be added to optimize the air flow if necessary.

Enclosure Panels: Constructed of stainless steel. Sized to extend from hood top to ceiling, enclosing pipe and hanging parts.

End Panels: Should be used to maximize hood performance and eliminate the effects of cross drafts in kitchen. units constructed of stainless steel and sized according to hood width and cooking equipment. Exposed edges hemmed for safety and rigidity.

Roof Top Package: Combination ETL Listed exhaust/supply air unit with factory prewired and mounted motors, trunkline and curb vented on exhaust side.

Separate Exhaust and/or Make-Up Air Fans: ETL Listed single exhaust fans and supply-air fans and curbs available.

Fire Suppression System: UL 300 fire suppression system.

Lighting: Recessed Incandescent, Recessed Fluorescent, Compact Fluorescent, Recessed LED, Halogen

DATA SHEET



R-102 Restaurant Fire Suppression Systems

Features

- Low pH Agent
- Proven Design
- Reliable Gas Cartridge Operation
- Aesthetically Appealing
- UL Listed – Meets Requirements of UL 300
- ULC Listed – Meets Requirements of ULC/ORD-C1254.6
- CE Marked

Application

The ANSUL® R-102 Restaurant Fire Suppression System is an automatic, pre-engineered, fire suppression system designed to protect areas associated with ventilating equipment including hoods, ducts, plenums, and filters. The system also protects auxiliary grease extraction equipment and cooking equipment such as fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite, or gas-radiant char-broilers; and woks.

The system is ideally suitable for use in restaurants, hospitals, nursing homes, hotels, schools, airports, and other similar facilities.

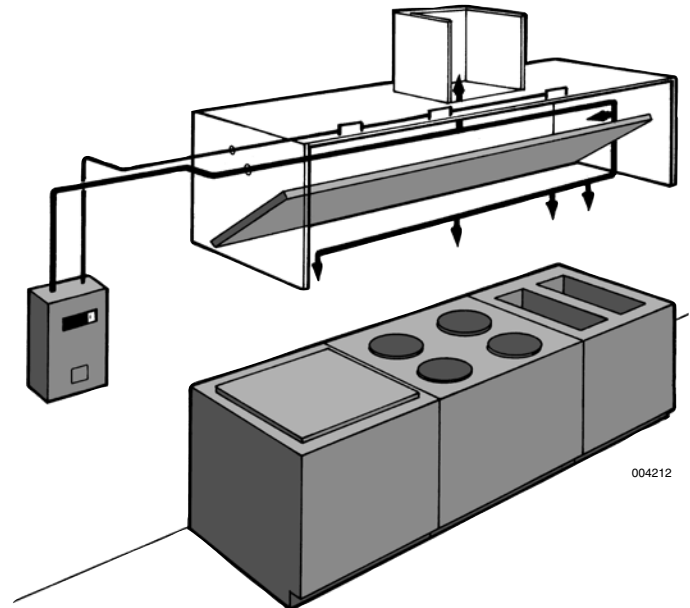
Use of the R-102 system is limited to indoor applications or locations that provide weatherproof protection within tested temperature limitations. The regulated release and tank assemblies must be mounted in an area where the air temperature will not fall below 32 °F (0 °C) or exceed 130 °F (54 °C). The system must be designed and installed within the guidelines of the UL/ULC Listed Design, Installation, Recharge, and Maintenance Manual.

System Description

The restaurant fire suppression system is a pre-engineered, wet chemical, cartridge-operated, regulated pressure type with a fixed nozzle agent distribution network. It is listed with Underwriters Laboratories, Inc. (UL/ULC).



004215



004212

The system is capable of automatic detection and actuation as well as remote manual actuation. Additional equipment is available for building fire alarm panel connections, electrical shutdown and/or interface, and mechanical or electrical gas line shut-off applications.

The detection portion of the fire suppression system allows for automatic detection by means of specific temperature-rated alloy type fusible links, which separate when the temperature exceeds the rating of the link, allowing the regulated release to actuate.

A system owner's guide is available containing basic information pertaining to system operation and maintenance. A detailed technical manual, including system description, design, installation, recharge and resetting instructions, and maintenance procedures, is available to qualified individuals.

The system is installed and serviced by authorized distributors that are trained by the manufacturer.

The basic system consists of an AUTOMAN regulated release assembly which includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles with blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows are supplied in separate packages in the quantities needed for fire suppression system arrangements.

Additional equipment includes a remote manual pull station(s), mechanical and electrical gas valves, and electrical switches for automatic equipment and gas line shut-off. Accessories can be added such as alarms, warning lights, etc., to installations where required.

Additional tanks and corresponding equipment can be used in multiple arrangements to allow for larger hazard coverage. Each tank is limited to a listed maximum amount of flow numbers.



Component Description

Wet Chemical Agent – The extinguishing agent is a mixture of organic salts designed for rapid flame knockdown and foam securement of grease related fires. It is available in plastic containers with instructions for wet chemical handling and usage.

Agent Tank – The agent tank is installed in a stainless steel enclosure or wall bracket. The tank is constructed of stainless steel.

Tanks are available in two sizes: 1.5 gallon (5.7 L) and 3.0 gallon (11.4 L). The tanks have a working pressure of 110 psi (7.6 bar), a test pressure of 330 psi (22.8 bar), and a minimum burst pressure of 660 psi (45.5 bar).

The tank includes an adaptor/tube assembly. The adaptor assembly includes a chrome-plated steel adaptor with a 1/4 in. NPT female gas inlet, a 3/8 in. NPT female agent outlet, and a stainless steel agent pick-up tube. The adaptor also contains a bursting disc seal which helps to prevent the siphoning of agent up the pipe during extreme temperature variations.

Regulated Release Mechanism – The regulated release mechanism is a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one, two, or three agent tanks depending on the capacity of the gas cartridge used. It contains a factory installed regulator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). It has automatic actuation capabilities by a fusible link detection system and remote manual actuation by a mechanical pull station.

The regulated release mechanism contains a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure contains knock-outs for 1/2 in. conduit. The cover contains an opening for a visual status indicator.

It is compatible with mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch and manual reset relay, it is compatible with electric gas line or appliance shut-off devices.

Regulated Actuator Assembly – When more than two agent tanks (or three 3.0 gallon (11.4 L) tanks in certain applications) are required, the regulated actuator is available to provide expellant gas for additional tanks. It is connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge. It contains a regulated actuator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). It has automatic actuation capabilities using pressure from the regulated release mechanism cartridge.

The regulated actuator assembly contains an actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure contains knockouts to permit installation of the expellant gas line.

Discharge Nozzles – Each discharge nozzle is tested and listed with the R-102 system for a specific application. Nozzle tips are stamped with the flow number designation (1/2, 1, 2, or 3). Each nozzle must have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.

Agent Distribution Hose – Kitchen appliances manufactured with or resting on casters (wheels/rollers) may include an agent distribution hose as a component of the suppression system. This allows the appliance to be moved for cleaning purposes without disconnecting the appliance fire suppression protection. The hose assembly includes a restraining cable kit to limit the appliance movement within the range (length) of the flexible hose.

Flexible Conduit – Flexible conduit allows for quicker installations and the convenience of being able to route the cable over, under and around obstacles. Flexible conduit can be used as a substitute for standard EMT conduit or can be used with EMT conduit.

Flexible conduit can be used only with the Molded Remote Manual Pull Station.

Pull Station Assembly – The remote manual pull station is made out of a molded red composite material. The red color makes the pull station more readily identifiable as the manual means for fire suppression system operation.

The pull station is compatible with the ANSUL Flexible Conduit.

Approvals

- UL/ULC Listed
- CE Marked
- New York City Department of Buildings
- LPCB
- TFRI
- Marine Equipment Directive (MED)
- DNV
- ABS
- Lloyd's Register
- Meets requirements of NFPA 96 (Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment)
- Meets requirements of NFPA 17A (Standard on Wet Chemical Extinguishing Systems)

Ordering Information

Order all system components through your local authorized ANSUL Distributor.

Specifications

An ANSUL R-102 Fire Suppression System shall be furnished. The system shall be capable of protecting all hazard areas associated with cooking equipment.

1.0 GENERAL

1.1 References

- 1.1.1 Underwriters Laboratories, Inc. (UL)
 - 1.1.1.1 UL Standard 1254
 - 1.1.1.2 UL Standard 300
- 1.1.2 Underwriters Laboratories of Canada (ULC)
 - 1.1.2.1 ULC/ORD-C 1254.6
- 1.1.3 National Fire Protection Association (NFPA)
 - 1.1.3.1 NFPA 96
 - 1.1.3.2 NFPA 17A

1.2 Submittals

- 1.2.1 Submit two sets of manufacturer's data sheets
- 1.2.2 Submit two sets of piping design drawings

1.3 System Description

- 1.3.1 The system shall be an automatic fire suppression system using a wet chemical agent for cooking grease related fires.
- 1.3.2 The system shall be capable of suppressing fires in the areas associated with ventilating equipment including hoods, ducts, plenums, and filters as well as auxiliary grease extraction equipment. The system shall also be capable of suppressing fires in areas associated with cooking equipment, such as fryers; griddles and range tops; upright, natural charcoal, or chain-type broilers; electric, lava rock, mesquite or gas-radiant char-broilers; and woks.
- 1.3.3 The system shall be the pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories (UL/ULC).
- 1.3.4 The system shall be installed and serviced by personnel trained by the manufacturer.
- 1.3.5 The system shall be capable of protecting cooking appliances by utilizing either dedicated appliance protection and/or overlapping appliance protection.

1.4 Quality Control

- 1.4.1 Manufacturer: The R-102 Restaurant Fire Suppression System shall be manufactured by a company with at least forty years experience in the design and manufacture of pre-engineered fire suppression systems. The manufacturer shall be ISO 9001 registered.
- 1.4.2 Certificates: The wet agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease-related fires.

1.5 Warranty, Disclaimer, and Limitations

- 1.5.1 The pre-engineered restaurant fire suppression system components shall be warranted for five years from date of delivery against defects in workmanship and material.

1.6 Delivery

- 1.6.1 Packaging: All system components shall be securely packaged to provide protection during shipment.

1.7 Environmental Conditions

- 1.7.1 The R-102 system shall be capable of operating within a temperature range of 32 °F to 130 °F (0 °C to 54 °C).

2.0 PRODUCT

2.1 Manufacturer

- 2.1.1 Tyco Fire Protection Products, One Stanton Street, Marinette, Wisconsin 54143-2542, Telephone (715) 735-7411.

2.2 Components

- 2.2.1 The basic system shall consist of an AUTOMAN regulated release assembly which includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles, blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows shall be supplied in separate packages in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station, mechanical and electrical gas valves, and electrical switches for automatic equipment and gas line shut-off, and building fire alarm control panel interface.
- 2.2.2 Wet Chemical Agent: The extinguishing agent shall be a specially formulated, aqueous solution of organic salts with a pH range between 7.7 – 8.7, designed for flame knockdown and foam securement of grease related fires.
- 2.2.3 Agent Tank: The agent tank shall be installed in a stainless steel enclosure or wall bracket. The tank shall be constructed of stainless steel. Tanks shall be available in two sizes; 1.5 gallon (5.7 L) and 3.0 gal (11.4 L). The tank shall have a working pressure of 110 psi (7.6 bar), a test pressure of 330 psi (22.8 bar), and a minimum burst pressure of 660 psi (45.5 bar). The tank shall include an adaptor/tube assembly containing a burst disc union.
- 2.2.4 Regulated Release Mechanism: The regulated release mechanism shall be a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to one or two agent tanks depending on the capacity of the gas cartridge used or three 3.0 gallon (11.4 L) agent storage tanks in certain applications. It shall contain a factory installed regulator deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar).
It shall have the following actuation capabilities: automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station.
The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure shall contain knock-outs for 1/2 in. conduit. The cover shall contain an opening for a visual status indicator.
It shall be compatible with mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch(es), it shall be compatible with electric gas line or appliance shut-off devices, or connections to a building fire alarm control panel.

Specifications (Continued)

- 2.2.5 Regulated Actuator Assembly: When more than two agent tanks or three agent tanks in certain applications are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver outlet of the regulated release mechanism providing simultaneous agent discharge. The regulator shall be deadset at 110 psi (7.6 bar) with an external relief of approximately 180 psi (12.4 bar). The regulated actuator assembly shall contain an actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.
- 2.2.6 Discharge Nozzles: Each discharge nozzle shall be tested and listed with the R-102 system for a specific application. Nozzles tips shall be stamped with the flow number designation (1/2, 1, 2, or 3). Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.
- 2.2.7 Distribution Piping: Distribution piping shall be Schedule 40 black iron, chrome-plated, or stainless steel conforming to ASTM A120, A53, or A106.
- 2.2.8 Detectors: The detectors shall be the fusible link style designed to separate at a specific temperature.
- 2.2.9 Cartridges: The cartridge shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.
- 2.2.10 Agent Distribution Hose: An optional agent distribution hose shall be available for kitchen appliances manufactured with or resting on casters (wheels/rollers). This shall allow the appliance to be moved for cleaning purposes without disconnecting the appliance fire suppression protection. Hose assembly shall include a restraining cable kit to limit the appliance movement within the range (length) of the flexible hose.
- 2.2.11 Flexible Conduit: The manufacturer supplying the Restaurant Fire Suppression System shall offer flexible conduit as an option to rigid EMT conduit for the installation of pull stations and/or mechanical gas valves. The flexible conduit shall be UL Listed and include all approved components for proper installation.
- 2.2.12 Pull Station Assembly: The Fire Suppression System shall include a remote pull station for manual system actuation. The pull station shall be designed to include a built-in guard to protect the pull handle. The pull station shall also be designed with a pull handle to allow for three finger operation and shall be red in color for quick visibility.

3.0 IMPLEMENTATION

3.1 Installation

- 3.1.1 The R-102 fire suppression system shall be designed, installed, inspected, maintained, and recharged in accordance with the manufacturer's listed instruction manual.

3.2 Training

- 3.2.1 Training shall be conducted by representatives of the manufacturer.

ANSUL, R-102, and the product names listed in this material are marks and/or registered marks. Unauthorized use is strictly prohibited.



STAINLESS STEEL
DROP-IN SINKS
 One Compartment - FOR HAND SINK USE

Sinks Include Gooseneck Faucet & Drain



Item #: _____ Qty #: _____

Model #: _____

Project #: _____

FEATURES:

One piece seamless **Deep Drawn** sink bowl design.

All sink bowls have a large liberal radii with a minimum dimension of 2" and are rectangular in design for increased capacity.

Self-Rim Design. Mounting clips provided accommodates all thicknesses of counter. (Quantity supplied varies based on drop in sink ordered).

Includes 4" O.C. **K-52** faucet.

Includes 3" Drain Basket Drain*.

***DI-1-25** Includes 2" Drain with Strainer Plate.

CONSTRUCTION:

Unit fabricated from one sheet of stainless steel.

All bowls are Sound Deadened.

Units feature Advance Tabco's **Smart Finish™**.

MECHANICAL:

Faucet supply is 1/2" IPS male thread.

Deck mounted faucet is furnished with aerator and 4" O.C.

MATERIAL:

20 gauge type 304 series stainless steel.

Faucets are brass-nickel plated.

Drains are 1-1/2" IPS.



DI-1-5



DI-1-25



DI-1-5SP



DI-1-10



STANDARD MOUNTING CLIPS

For countertops over 7/8" and up to 2" thick.

Replacement # **K-28** (Per Sink)

**New 6"
Rear & Side
Splash**



DI-1-10SP



DI-1-35

Available Faucets & Accessories	Model #	Qty
Deck Mounted 3 1/2" Gooseneck. 4" O.C.	K-52	
Deck Mounted 8 1/2" Gooseneck. 4" O.C.	K-55	
Deck Mounted Swing w/Spray. 8" O.C.*	K-58	
Deck Mtd. X.H.D. 3 1/2" Gooseneck. 4" O.C.	K-62	
Mounting Clips (Bag of 4).	K-28	

*REQUIRES **K-472** FAUCET HOLE REVISION



WARNING: Faucets on this page may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info., visit www.p65warnings.ca.gov.



Customer Service Available To Assist You 1-800-645-3166 8:30 am - 8:00 pm E.S.T.

For Orders & Customer Service:

Email: customer@advancetabco.com or Fax: 631-242-6900

For Smart Fabrication™ Quotes:

Email: smartfab@advancetabco.com or Fax: 631-586-2933

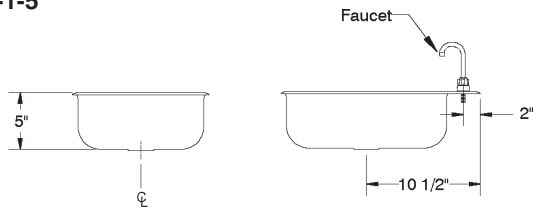
DIMENSIONS and SPECIFICATIONS

TOL $\pm .125"$

Supplied with K-52 Faucet

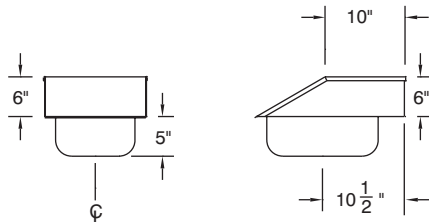
ALL DIMENSIONS ARE TYPICAL

DI-1-5



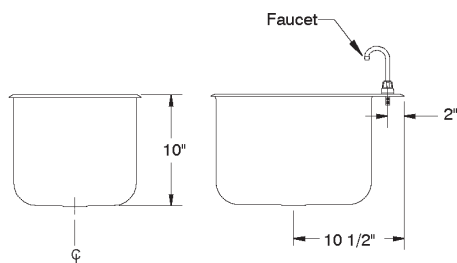
Approx. Wt. 12 lbs.

DI-1-5SP



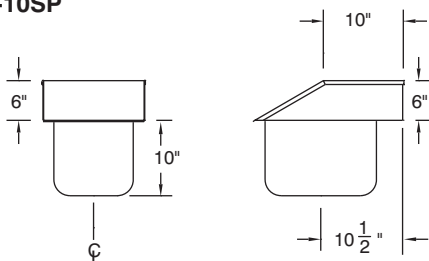
Approx. Wt. 16 lbs.

DI-1-10



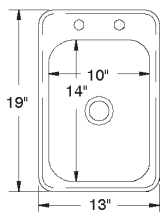
Approx. Wt. 14 lbs.

DI-1-10SP



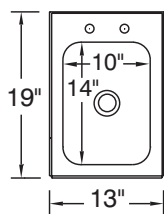
Approx. Wt. 18 lbs.

TOP VIEW FOR DI-1-5 & DI-1-10

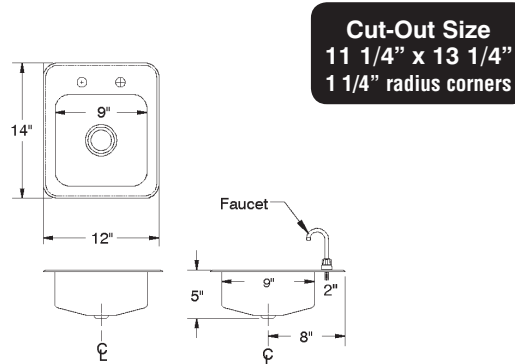


Cut-Out Size
12 1/4" x 18 1/4"
1 1/4" radius corners

TOP VIEW FOR DI-1-5SP & DI-1-10SP

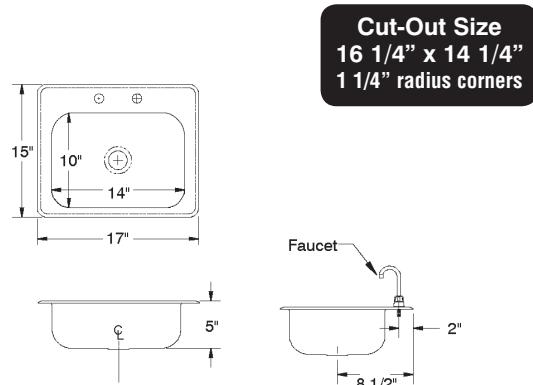


DI-1-25



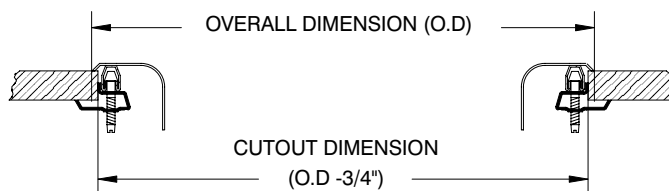
Approx. Wt. 8 lbs.

DI-1-35



Approx. Wt. 10 lbs.

TYPICAL INSTALLATION



Cut-Out Size = L to R x F to B

Standard Mounting Clips Fit Countertops
Over 7/8" & Up To 2" Thick.





STAINLESS STEEL

REMOVABLE 8" SPLASH WRAP FOR EXISTING DROP-IN SINKS



Item #: _____ Qty #: _____

Model #: _____

Project #: _____

FEATURES:

Adapts easily to any existing Drop-In Sink (Must specify Drop-In Sink Model).
Mounting hardware provided.

MATERIALS:

16 Gauge, Type 304 Series Stainless steel.
Plastic hardware included.

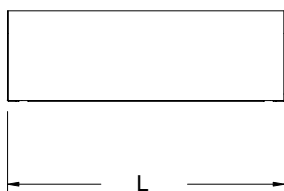
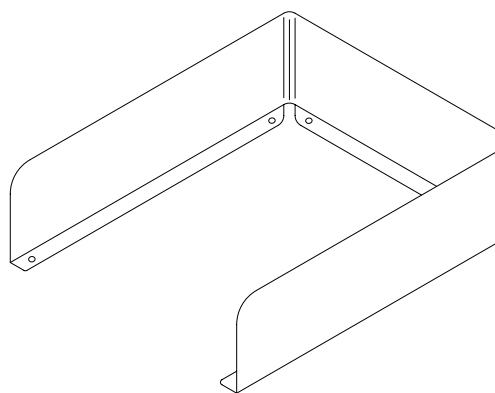
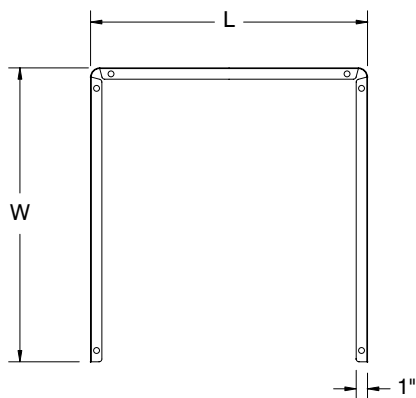
	K-614A	K-614B	K-614C	K-614D	K-614E	K-614F	K-614G
	L x W	L x W	L x W	L x W	L x W	L x W	L x W
SPLASH O.A.	14 1/2" x 15" 1/4"	15 1/2" x 20" 1/4"	17 1/2" x 16 1/4"	19 1/2" x 16 1/4"	21 1/2" x 20 1/4"	25 1/2" x 22 1/4"	33 1/2" x 26 1/4"
FITS SINK MODEL:	DI-1-25	DI-1-5, DI-1-10	DI-1-1515	DI-1-35	DI-1-168	DI-1-208, DI-1-2012	DI-1-2812

DIMENSIONS and SPECIFICATIONS

TOL $\pm .125"$

ALL DIMENSIONS ARE TYPICAL

K-614



NOTE: Specify model of Drop-In Sink (See Above). For sinks not listed, must specify overall dimensions from outside of sink flanges (Edge of bowl opening for undermount sinks)

UPRIGHT REACH-IN PASS-THRU REFRIGERATOR

GLASS FRONT/SOLID REAR

TOP MOUNTED CONDENSING UNIT



ESPT-1G-1S

ES Series



Refrigeration System

- Top mounted, self-contained and fully detachable Blizzard R290 condensing unit uses environmentally friendly, EPA-compliant R290 refrigerant with zero (0) Ozone Depletion Potential (ODP) and three (3) Global Warming Potential (GWP). Blizzard R290 is easily replaceable and requires no on-site brazing.
- Electronically commutated (ECM) fan motors achieve rapid cooling with less energy consumption.
- Full-length air duct and airflow guard ensure optimal cold air circulation.
- Time-initiated and temperature-terminated auto defrost cycle for seamless operation.
- Large capacity, corrosion-resistant condenser and evaporator coils.
- Self-maintaining, energy-efficient condensate drain pan requires no external drains or electric heaters.
- High performance, auto-reverse condenser fan motor supports compressor ventilation and condenser coil cleaning.
- Pressure relief devices allow rapid cabinet re-entry.
- Pre-wired and ready to plug, 115V/60Hz/1Ph, NEMA 5-15P.

Cabinet Construction

- Pass-through design allows seamless access from both front and back entry points.
- Open spaced interior with no walls between compartments.
- Heavy duty stainless steel interior / exterior with rounded corners for a hazard-free workspace.
- Galvanized steel top and bottom.
- 2.5" thick high density polyurethane insulation.
- Four 5" swivel casters with locks on front set. Leg stabilizers standard.

Lighting

- Energy efficient silicone coated and shatter-proof LED lighting provides bright, high color illumination with low heat output.

Doors

- Front glass door has low emissivity double glass panes that reflect UV rays for efficient cooling. Rear solid door has stainless steel exterior/interior.
- 2.5" thick high density polyurethane insulation.
- Frame heaters prevent exterior moisture build up.
- Self-closing with adjustable torsion system for a positive seal.
- Snap-in magnetic door gasket make cleaning and replacement an easy process.
- High strength, recessed door handles.
- Pre-installed door locks keep your items safe from theft.
- Field reversible.

Shelving

- Three epoxy coated, steel wire shelves per section.
- Height adjustable stainless steel clips.

Temperature Control

- Multi-function digital controller with easy to read LED display.
- Factory preset temperature, 35°F. Temperature setting range from 33°F to 54°F.
- Audible overheat protection alarm for compressor and condenser coil.

Options

- Additional shelving.
- 3" swivel casters with locks.
- 3.5" – 6" height-adjustable and interchangeable legs.
- Left hinged door.



Type	Doors	Capacity Cu. Ft.	Shelves	Refrigerant	HP	Power V-Hz-Ph	Amps	Crated Weight	Exterior Dimensions		
									L	D	H*
REF	2	23	3	R-290	1/4+	115-60-1	4	364 lbs	29.25"	33.71"	74.25"

(†)Based on evaporating temperature of 23°F (-5°C) & condensing temperature of 131°F (55°C). (P) Product capacity is calculated based on standard industry figures. (*) Reference plan view for clarification on caster/unit height. If dimensions and capacity are critical, please contact Everest Refrigeration. Blizzard R290 replacement is at the sole discretion of Everest Refrigeration. Specifications subject to change without notice.

UPRIGHT REACH-IN PASS-THRU REFRIGERATOR

GLASS FRONT/SOLID REAR

TOP MOUNTED CONDENSING UNIT



ESPT-1G-1S

ES Series

DIMENSIONAL DATA

External Dims.	L	29.25 in.
	D	33.71 in.
	H*	74.25 in.
Crated Weight		364 lbs.
Doors/Drawers/Lids		2
Max Weight Support		-

STORAGE DATA

Net Capacity Cu. Ft. [†]	23
Shelves	3
Barrels	-
20 oz. Bottles	-
12 oz. Bottles	-
12 oz. Cans	-
8" Mugs	-
# of Pans (Top)	-
# of Pans (Drawer)	-
Dividers	-
Trays	-

ELECTRICAL DATA

Voltage	115-60-1
Full Load Amperage	4A
Feed Wires w/ Ground	3
Cord Length	9ft
NEMA Plug Type	NEMA 5-15P

REFRIGERATION DATA

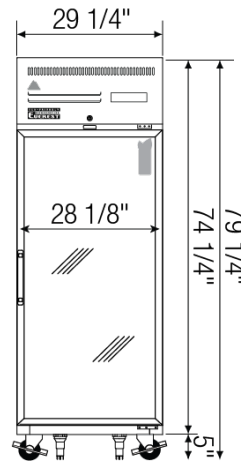
Compressor	Top
Refrigerant	R-290
Compressor HP	1/4+
BTU/HR [†]	1926

KEY

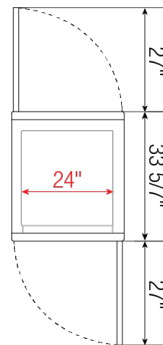
D	Door	R	Refrigerator
L	Lid	REF	Refrigerator
H	Half Door	F	Freezer
FD	Full Door	FRZ	Freezer
SD	Solid Door	DUAL	REF/FRZ Combo
GD	Glass Door	DR	Drawer

	Elevation	Right	Plan	3D	Back

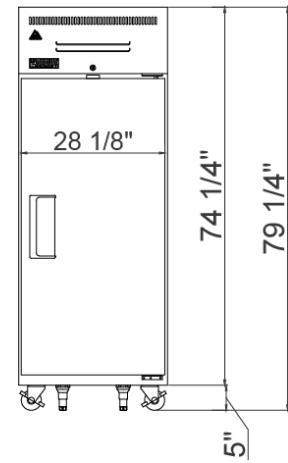
PLAN VIEW



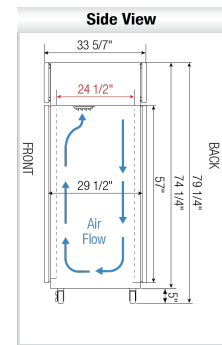
FRONT



TOP



REAR



SIDE

ACCESSORIES & OPTIONS

- ☐ Additional Shelving - Contact Everest Refrigeration for more information.
- ☐ AJL03-00 - Interchangeable Leg for Caster (Optional)
- ☐ CASA3-01 - 3" Overall Height Caster Assembly - (2) Front (2) Rear

([†])Based on evaporating temperature of 23°F (-5°C) & condensing temperature of 131°F (55°C). ([‡]) Product capacity is calculated based on standard industry figures. (*) Reference plan view for clarification on caster/unit height. If dimensions and capacity are critical, please contact Everest Refrigeration. Blizzard R290 replacement is at the sole discretion of Everest Refrigeration. Specifications subject to change without notice.



Your Solutions Partner

Specifications

F.O.B. Sedalia, Missouri 65301

**ADI-3MDSL-N7**

(optional louvered grille shown)

OPTIONS:

- Hot food style top
- Sectional false bottom
- Globe valve and drain line
- Designer Foodshields
- Adapter panels
- Adapter bars

AGENCY LISTING:



DUKE MANUFACTURING CO.

2305 N. Broadway

St. Louis, MO 63102

800.735.3853 Toll Free

314.231.5074 Fax

www.dukemfg.com

Specification subject to change



WARNING for CA residents: go to
www.dukemfg.com/prop65 for prop 65 warning

Approval Stamp(s):

PRODUCT INFORMATION:

PROJECT: _____

ITEM: _____

QUANTITY: _____

MODEL:

Drop-Ins - Slimline - Cold Pan**Mechanically Cooled - 10" Deep Liner****Meets NSF Standard 7**

- ☐ ADI-2MDSL-N7 (2) 6" Deep 12" x 20" pan
- ☐ ADI-3MDSL-N7 (3) 6" Deep 12" x 20" pan

TOP RIM:

- Heavy gauge, 300 Series stainless steel
- Overhang on all four sides w/locking tabs
- Reinforced with heavy gauge steel angle
- Vinyl foam gasket as sealant

LINER:

- 300 Series stainless steel cold pan
- 10" deep, 13-5/8" front to back
- 1" cast brass drain and plug
- Adapter bars for full size pans included
- Products recessed 3" below top
- Removable stainless steel brackets 3" below top

REFRIGERATION:

- Copper coils attached to sides of liner - R448A refrigerant
- Air cooled condensing unit, in center of unit - 120 volt
- Open angle iron suspended compressor compartment
- Remote mounted on/off switch with stainless steel face plate
- 6' cord and plug - NEMA 5-15
- Five year warranty on compressor motor

EXTERIOR HOUSING

- Heavy gauge paint grip steel body

DROP-IN - SLIMLINE - COLD PAN - MECHANICALLY - 10" DEEP LINER - N7

Catalog No. ADI-SLIMNECH10N7

A.I.A. File No. 35-C-13

Drop-Ins - Slimline - Cold Pan

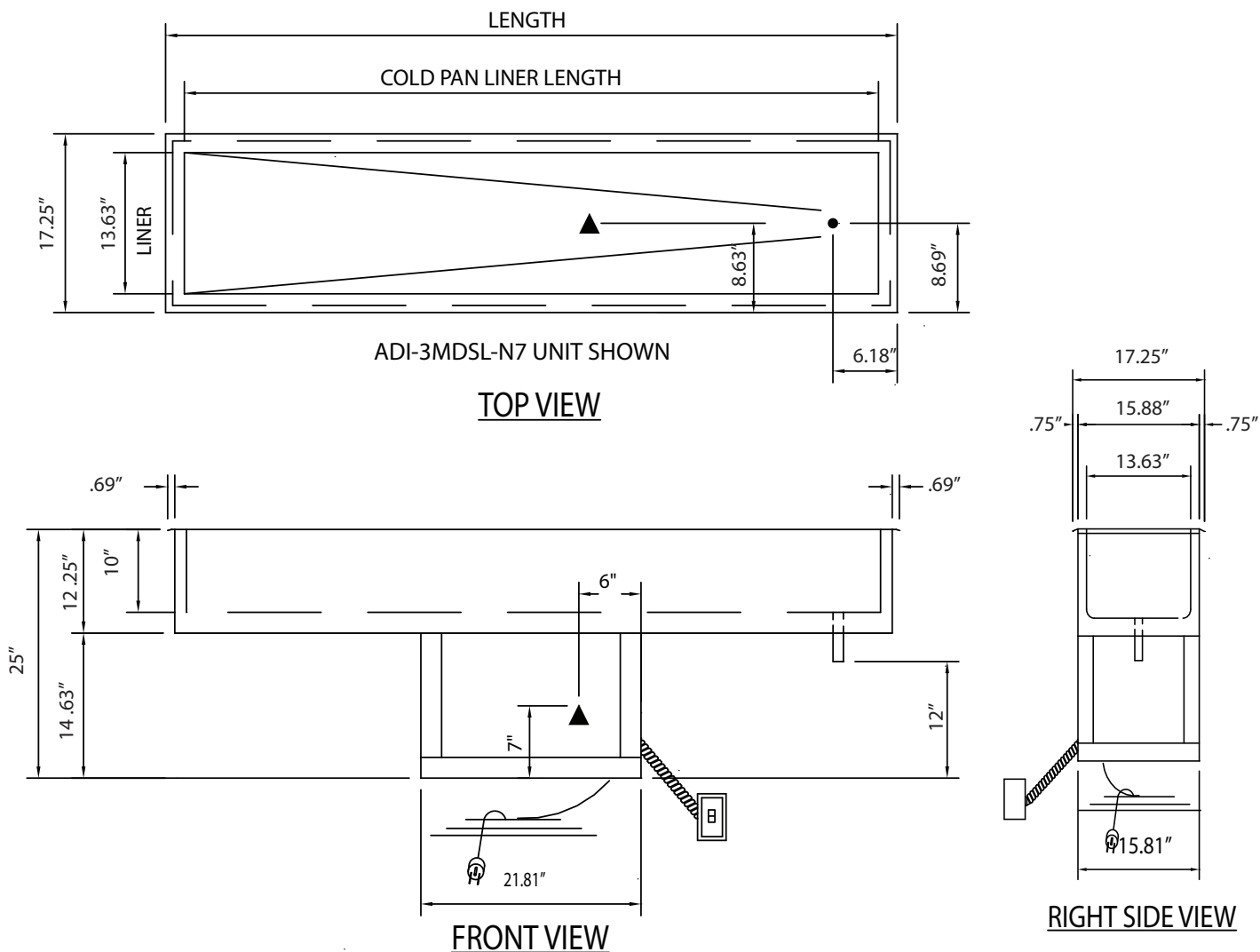
Mechanically Cooled- 10" Deep Liner

Meets NSF Standard 7

A.I.A. File No. 35-C-13

Catalog No. ADI-SLIMMECH10N7

DROP-INS - SLIMLINE - COLD PAN - MECHANICALLY COOLED ICE - 10" DEEP LINER - N7



ELECTRICAL:

Model	120 Volt	
	Amps	HP
ADI-2MSL-N7	4.26	1/4
ADI-3MSL-N7	4.26	1/4

LEGEND	
▲	ELECTRICAL CONNECTION
●	DRAIN CONNECTION

DIMENSIONS - Liners are 13-5/8" (34.7 cm) W; cutouts 16-3/4" (42.5 cm) W**FREIGHT CLASS: 100**

Model	Length		Width		Height		Cube ft crated	Adapter Bars	Weight		Cold Pan - L		Cutout - L	
	in.	cm	in	cm	in	cm			lbs	kg	in	cm	in	cm
ADI-2MDSL-N7	48 3/4	123.8	17-3/8	44.2	25	61.0	20.2	1	165	75	45-1/8	114.3	47 3/4	121.9
ADI-3MDSL-N7	70 3/4	179.7	17-3/8	44.2	25	61.0	28.4	2	225	102.3	67-1/8	170.2	69 3/4	177.8

REMOTE CONTROL CUTOUT IS 4-1/8" H X 2-3/16" W



Duke Manufacturing Co.
2305 N. Broadway
St. Louis, MO 63102

Phone: 314-231-1130
Toll Free: 1-800-735-3853
Fax: 314-231-5074

www.dukemfg.com

Printed in U.S.A
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Your Solutions Partner

Specifications

F.O.B. Sedalia, Missouri 65301



ADI-3MDSL-N7

(optional louvered grille shown)

OPTIONS:

- Hot food style top
- Sectional false bottom
- Globe valve and drain line
- Designer Foodshields
- Adapter panels
- Adapter bars

AGENCY LISTING:



DUKE MANUFACTURING CO.

2305 N. Broadway

St. Louis, MO 63102

800.735.3853 Toll Free

314.231.5074 Fax

www.dukemfg.com

Specification subject to change



WARNING for CA residents: go to
www.dukemfg.com/prop65 for prop 65 warning

Approval Stamp(s):

PRODUCT INFORMATION:

PROJECT: _____

ITEM: _____

QUANTITY: _____

MODEL:

Drop-Ins - Slimline - Cold Pan

Mechanically Cooled - 10" Deep Liner

Meets NSF Standard 7

- ☐ ADI-2MDSL-N7 (2) 6" Deep 12" x 20" pan
- ☐ ADI-3MDSL-N7 (3) 6" Deep 12" x 20" pan

TOP RIM:

- Heavy gauge, 300 Series stainless steel
- Overhang on all four sides w/locking tabs
- Reinforced with heavy gauge steel angle
- Vinyl foam gasket as sealant

LINER:

- 300 Series stainless steel cold pan
- 10" deep, 13-5/8" front to back
- 1" cast brass drain and plug
- Adapter bars for full size pans included
- Products recessed 3" below top
- Removable stainless steel brackets 3" below top

REFRIGERATION:

- Copper coils attached to sides of liner - R448A refrigerant
- Air cooled condensing unit, in center of unit- 120 volt
- Open angle iron suspended compressor compartment
- Remote mounted on/off switch with stainless steel face plate
- 6' cord and plug - NEMA 5-15
- Five year warranty on compressor motor

EXTERIOR HOUSING

- Heavy gauge paint grip steel body

DROP-IN - SLIMLINE - COLD PAN - MECHANICALLY - 10" DEEP LINER - N7

Catalog No. ADI-SLIMNECH10N7

A.I.A. File No. 35-C-13

Drop-Ins - Slimline - Cold Pan

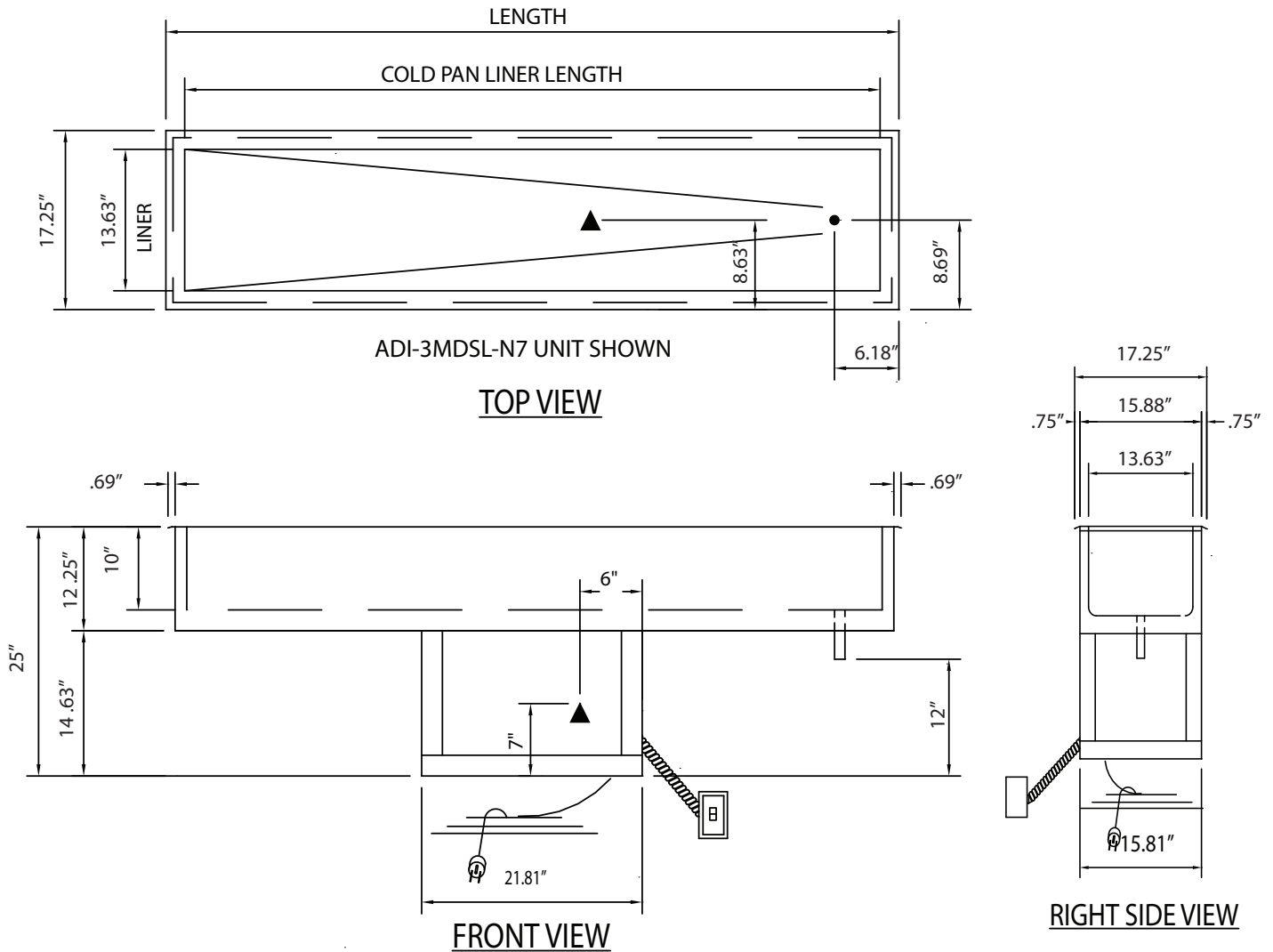
Mechanically Cooled- 10" Deep Liner

Meets NSF Standard 7

A.I.A. File No. 35-C-13

Catalog No. ADI-SLIMMECH10N7

DROP-INS - SLIMLINE - COLD PAN - MECHANICALLY COOLED ICE - 10" DEEP LINER - N7



ELECTRICAL:

Model	120 Volt	
	Amps	HP
ADI-2MSL-N7	4.26	1/4
ADI-3MSL-N7	4.26	1/4

LEGEND	
▲	ELECTRICAL CONNECTION
●	DRAIN CONNECTION

DIMENSIONS - Liners are 13-5/8" (34.7 cm) W; cutouts 16-3/4" (42.5 cm) W**FREIGHT CLASS: 100**

Model	Length		Width		Height		Cube ft crated	Adapter Bars	Weight		Cold Pan - L		Cutout - L	
	in.	cm	in	cm	in	cm			lbs	kg	in	cm	in	cm
ADI-2MDSL-N7	48 3/4	123.8	17-3/8	44.2	25	61.0	20.2	1	165	75	45-1/8	114.3	47 3/4	121.9
ADI-3MDSL-N7	70 3/4	179.7	17-3/8	44.2	25	61.0	28.4	2	225	102.3	67-1/8	170.2	69 3/4	177.8

REMOTE CONTROL CUTOUT IS 4-1/8" H X 2-3/16" W



Duke Manufacturing Co.
2305 N. Broadway
St. Louis, MO 63102

Phone: 314-231-1130
Toll Free: 1-800-735-3853
Fax: 314-231-5074

www.dukemfg.com

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Profit from the Eagle Advantage®

Specification Sheet

Short Form Specifications

Eagle Space-Saver Hand Wash Sink, model HWC-E. Constructed of type 304 stainless steel with 9¼" x 11½" x 6" deep stainless steel sink, basket drain, hinged door with magnetic catch, built-in C-fold towel dispenser, deck mounted soap dispenser, and deck mounted gooseneck faucet. Note: For T&S faucet, use model HWC-T.

Eagle Drop-In Hand Wash Sink, model HWB-E. Constructed of type 304 stainless steel with 9¼" x 11½" x 6" deep stainless steel sink, basket drain, hinged door with magnetic catch, built-in C-fold towel dispenser, deck mounted soap dispenser, and deck mounted gooseneck faucet. Note: For T&S faucet, use model HWB-T.



#HWC-E



#HWB-E

Hand Wash Sinks

MODELS:

- ☐ HWC-E
- ☐ HWC-T
- ☐ HWB-E
- ☐ HWB-T

Design and Construction Features

- All heavy gauge type 304 stainless steel all-welded construction.
- 1½" (38mm) bullnose front edge.
- Bowl is 9¼" x 11½" x 6" (235 x 292 x 152mm).
- Hinged door with pull handle secured by magnetic catch.
- Pump action soap dispenser in rear deck.
- Built-in C-fold towel dispenser located in front of sink bowl.
- Deck mount faucet.
- 1½" (38mm) stainless steel basket drain and crumb cup.
- Wall-mountable "Space-Saver" models and drop-in models available.

EAGLE GROUP

100 Industrial Boulevard, Clayton, DE 19938-8903 USA

Phone: 302-653-3000 • Fax: 302-653-2065

www.eaglegrp.com

Foodservice Division: Phone 800-441-8440

MHC/Retail Display Divisions: Phone 800-637-5100

For custom configuration or fabrication needs, contact our SpecFAB® Division.

Phone: 302-653-3000 • Fax: 302-653-2065 • e-mail: quotes@eaglegrp.com

Certifications / Approvals



AUTOQUOTES



EG20.47 Rev. 08/14

Spec sheets available for viewing, printing or downloading from our online literature library at www.eaglegrp.com

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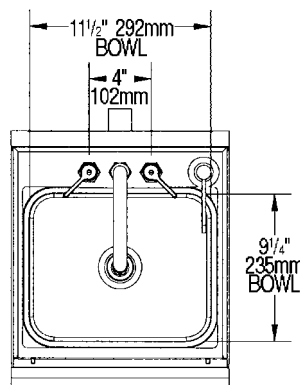


Profit from the Eagle Advantage®

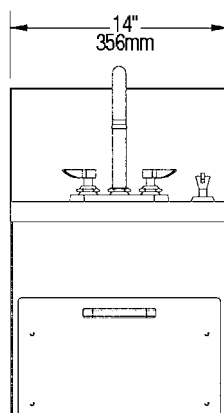
Item No.: _____
 Project No.: _____
 S.I.S. No.: _____

Wall-Mountable "Space Saver" Hand Wash Sinks

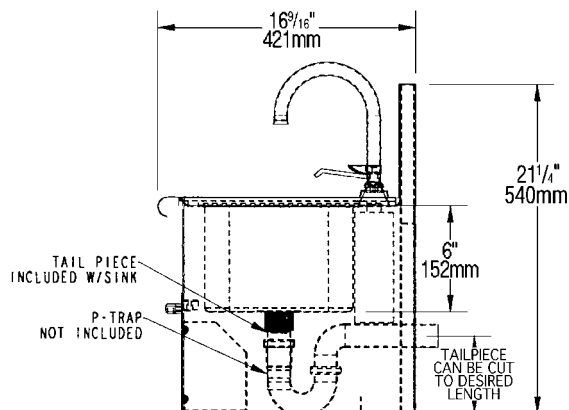
Furnished with Z-clips to secure to wall.



TOP VIEW



FRONT VIEW

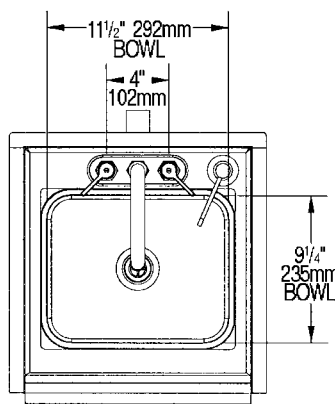


SIDE VIEW

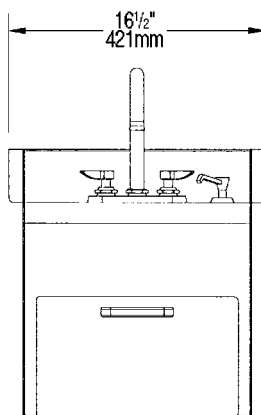
(model # HWC-T unit shown with T&S faucet)

inside bowl dimensions				overall size				WITH ENCORE FAUCET				WITH T&S FAUCET			
width x length x depth				width x length x height				weight				weight			
in. mm				in. mm				lbs.	kg	model #		lbs.	kg	model #	
9 1/4" x 11 1/2" x 6"	235 x 292 x 152			16 9/16" x 14" x 21 1/4"	421 x 356 x 540			36	16.3	HWC-E		37	16.8	HWC-T	

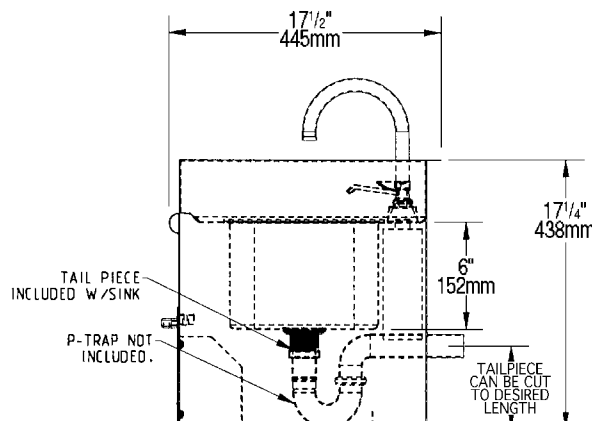
Drop-In Hand Wash Sinks



TOP VIEW



FRONT VIEW



SIDE VIEW

(model # HWB-T unit shown with T&S faucet)

inside bowl dimensions				overall size				cutout dimensions				WITH ENCORE FAUCET				WITH T&S FAUCET			
width x length x depth				width x length x height				width x length				weight				weight			
in. mm				in. mm				in. mm				lbs.	kg	model #		lbs.	kg	model #	
9 1/4" x 11 1/2" x 6"	235 x 292 x 152			17 1/2" x 16 1/2" x 17 1/4"	445 x 419 x 438			16" x 14 3/8"	406 x 378			32	14.5	HWB-E		33	15.0	HWB-T	

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INFINITY™

INFINITY™ Support:

- ☐ 1/2" Clear Tempered Glass
Contact factory for additional options

Glass:

- ☐ 3/8" Glass - 72" max. Span
☐ 1/2" Glass - 96" max. Span
Contact factory for spans exceeding max.

Mounting Options:

Some mounting options may not be available on some cantilevered/counter substrate combinations. Refer to mounting cut-sheet or contact factory for additional information.

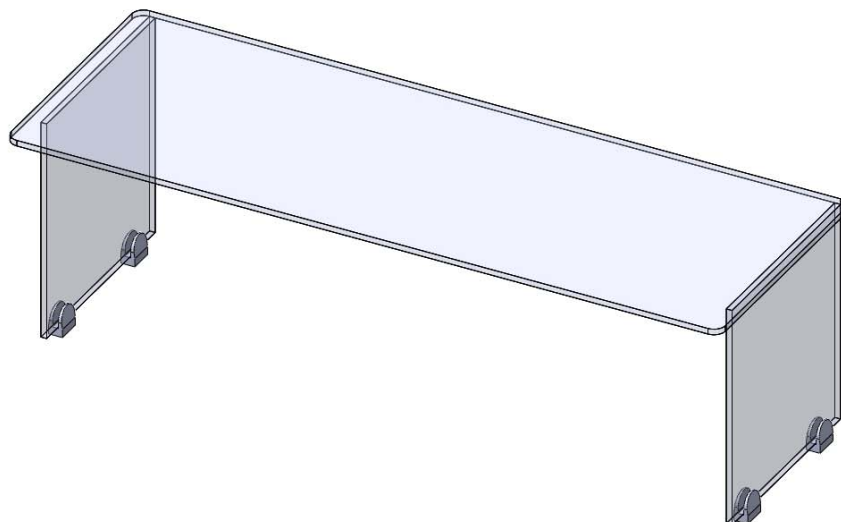
- ☐ 640-Z Above Counter Surface Mount (Standard)
☐ 640-FB Above Counter Surface Mount with Stainless Flat Bar

End Panels:

NSF 2008 standards for side end panels require:

5.35.6 A vertical barrier (end shield) shall be provided at each end of a foodshield. The vertical barrier shall be a minimum of 18" deep (front to back) beginning at the bottom leading edge of the foodshield. The minimum height of the vertical barrier shall be equal to the overall height of the foodshield.

5.35.6.1 A foodshield intended to be installed a maximum of 3" from a building wall perpendicular to the foodshield is exempt from the requirements of 5.35.6 provided that the height of the building wall is not lower than the overall height of the foodshield.



Model:

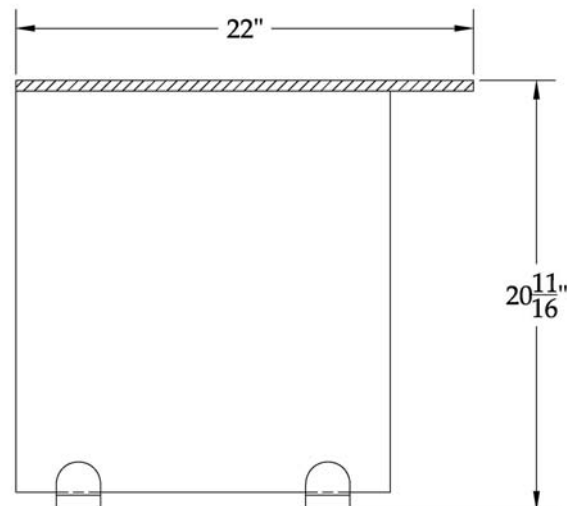
TMUS

Project Name:

Item Number:

Quantity:

Length:



Advise Counter
Thickness and Material

UV BONDED GUARDS

Specifications for reference only and may be changed without notice. All orders require approved shop drawings prior to release to production. Products are drawn & built to meet NSF Standard 2. It is the responsibility of the customer to ensure product meets local health board standards.

Web: www.premierbrass.com
Email: info@premierbrass.com
Phone: 1-800-251-5800
Fax: 1-800-251-2515



NSF Standard No. 2
77 MF



2012



LISTED
CUSTOM-BUILT FOOD SERVICE EQUIPMENT
4MK4

Printed in the USA (04/2013)
Premier1Source, Inc.
255 Ottley Drive, N.E.
Atlanta, Ga 30324


INFINITY™

INFINITY™ Support:

- ☐ 1/2" Clear Tempered Glass
Contact factory for additional options

Glass:

- ☐ 3/8" Glass - 72" max. Span
☐ 1/2" Glass - 96" max. Span
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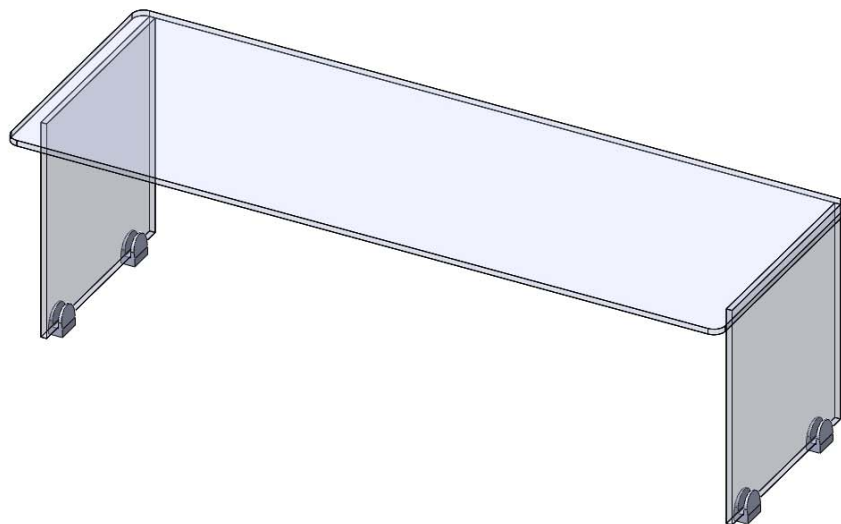
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Model:

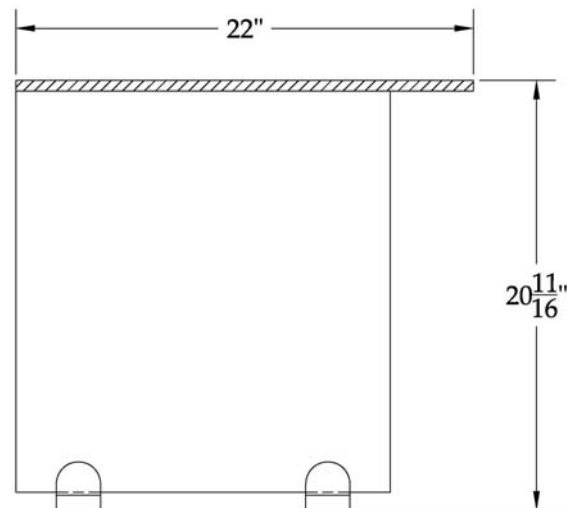
TMUS

Project Name:

Item Number:

Quantity:

Length:



Advise Counter
Thickness and Material

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NSF Standard No. 2
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Printed in the USA (04/2013)
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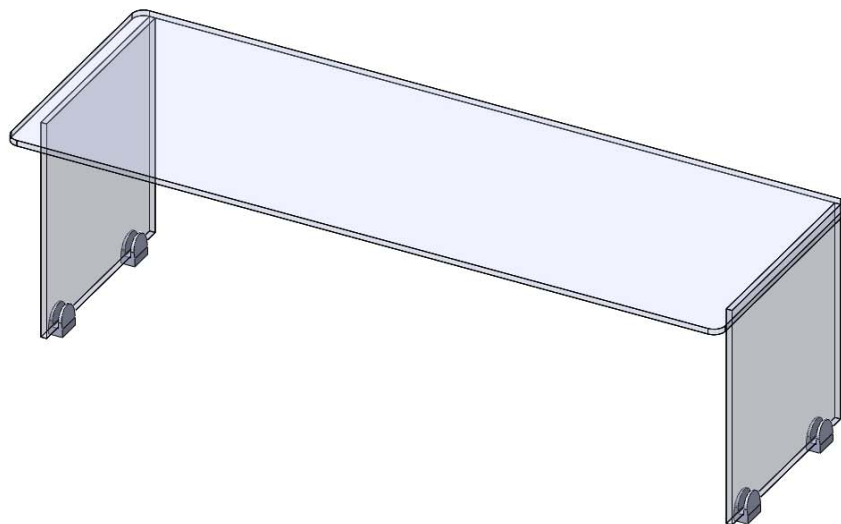
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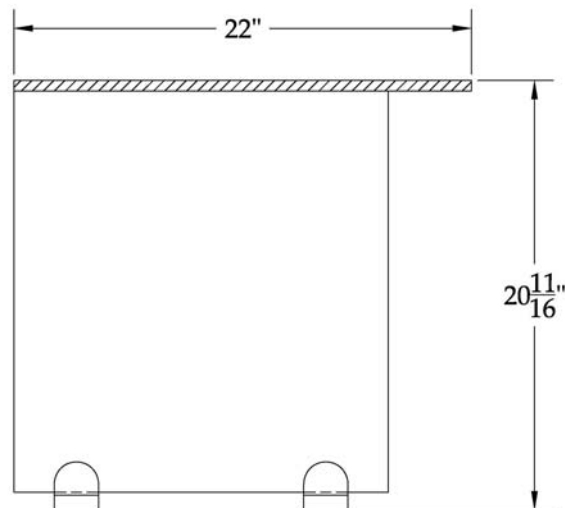
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Item Number:

Quantity:

Length:



Advise Counter
Thickness and Material

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NSF Standard No. 2
77 MF



2012



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Premier1Source, Inc.
255 Ottley Drive, N.E.
Atlanta, Ga 30324

UNDERCOUNTER REFRIGERATOR

Model: SW27N-U

Natural Refrigerant R-290 Model

27" Undercounter Refrigerator with Solid Door



ENERGY STAR® Qualified Commercial Refrigerator

Stainless steel front, top and end panels, aluminum back and interior.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Additional epoxy coated steel shelves
Stainless steel back	Stainless steel shelves
Stacking collar	Door locks
Drawers in lieu of doors (consult factory)**	Special electrical requirements (consult factory)

**Two tier: (1) 12 x 20 x 6 pan per drawer

Consult factory for other model configurations, options and accessories.



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

2" non-CFC polyurethane foam insulation

Smooth, polished chrome door handle

Spring loaded, self closing door

Magnetic snap in Santoprene™ door gasket

Heavy duty, epoxy coated steel shelf

Completely enclosed, vented and removable case back

1 3/8" diameter plate casters (factory installed)

MODEL FEATURES

Field rehingeable door

Electronic control, off cycle defrost

2" high, bottom mounted front breather air divider

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	7.4 (210 cu l)
Width, Overall (inches)	27 1/2 (699 mm)
Depth, Overall (inches) (including handle & bumpers)	32 3/16 (818 mm)
Height, Overall (inches) (including 1 3/8" plate casters)	31 13/16 (808 mm)
Shelf Area (square feet)	3.5 (0.3 sq m)
No. of Shelves	1
No. of Doors	1
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	24 1/2 (622 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/5
Capacity (BTU per hour)*	1625

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	2.5 (2.2)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

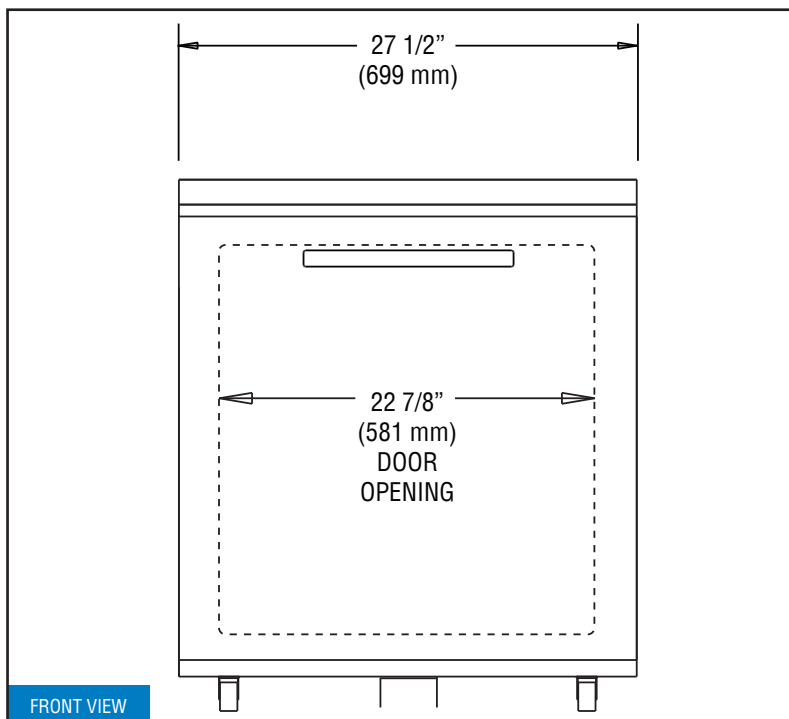
Weight (pounds)	200 (91 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	35 1/2 (902 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

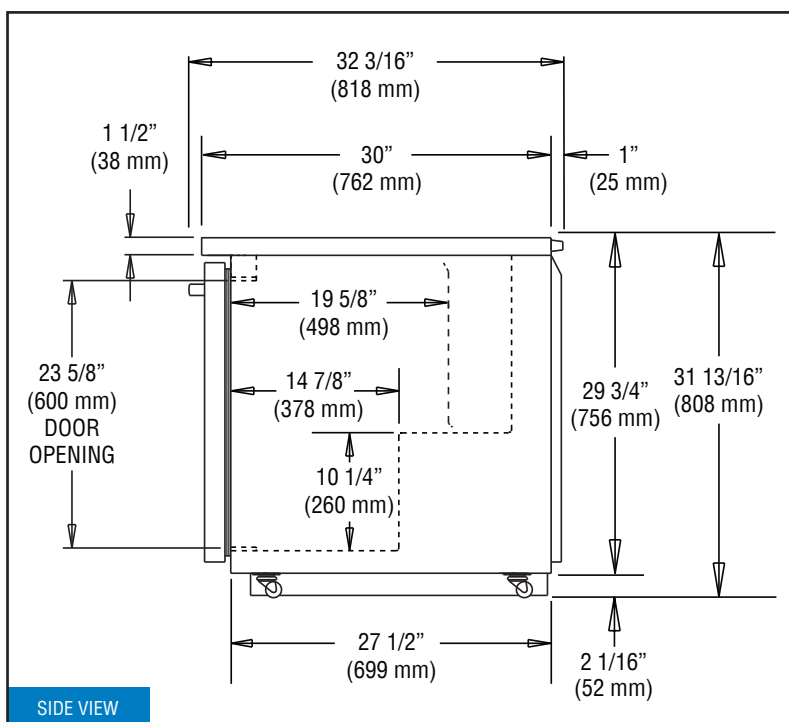


Equipped with one NEMA-5-15P Plug
(varies by country)

Model Plan Views



FRONT VIEW



SIDE VIEW

NOTE: For proper operation, the area under and in front of the cabinet **must** not be obstructed in any way.

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.



PROUDLY
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REVISED: 4/3/24

UNDERCOUNTER REFRIGERATOR

Model: SW36N-U

Natural Refrigerant R-290 Model

36" Undercounter Refrigerator with Solid Doors



ENERGY STAR® Qualified Commercial Refrigerator

Stainless steel front, top and end panels, aluminum back and interior.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Additional epoxy coated steel shelves
Stainless steel back	Stainless steel shelves
Special electrical requirements (consult factory)	Door locks

Consult factory for other model configurations, options and accessories.



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

2" non-CFC polyurethane foam insulation

Smooth, polished chrome door handles

Spring loaded, self closing doors

Magnetic snap in Santoprene™ door gaskets

Heavy duty, epoxy coated steel shelves

Completely enclosed, vented and removable case back

1 3/8" diameter plate casters (factory installed)

MODEL FEATURES

Field rehingeable doors

Electronic control, off cycle defrost

2" high, bottom mounted front breather air divider

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	10.3 (292 cu l)
Width, Overall (inches)	36 (914 mm)
Depth, Overall (inches) (including handles & bumpers)	32 3/16 (818 mm)
Height, Overall (inches) (including 1 3/8" plate casters)	31 13/16 (808 mm)
Shelf Area (square feet)	4.6 (0.4 sq m)
No. of Shelves	2
No. of Doors	2
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	32 (813 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/5
Capacity (BTU per hour)*	1625

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	2.5 (2.2)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	235 (107 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	44 (1118 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
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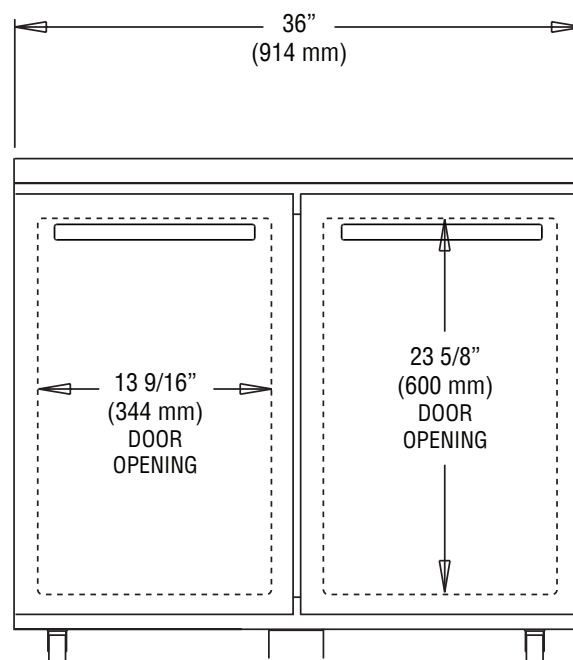


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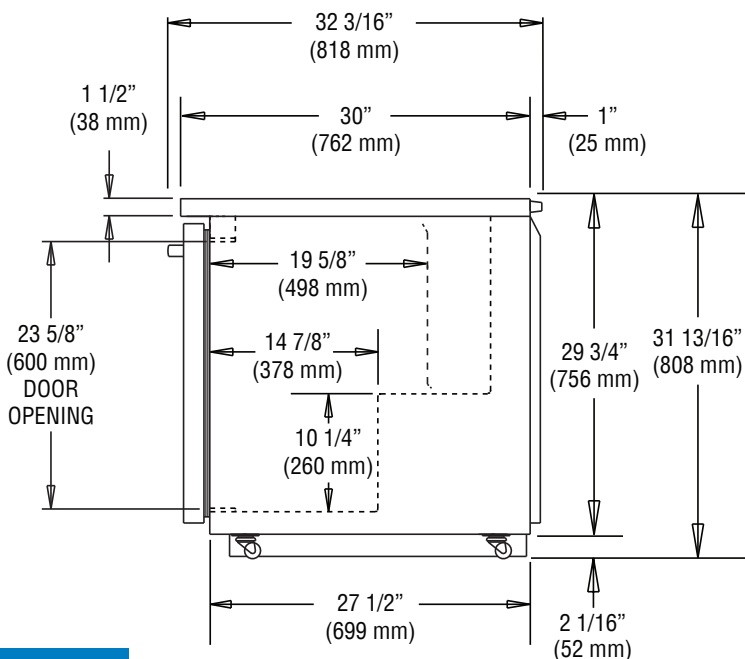
Intertek

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Model Plan Views



FRONT VIEW



SIDE VIEW

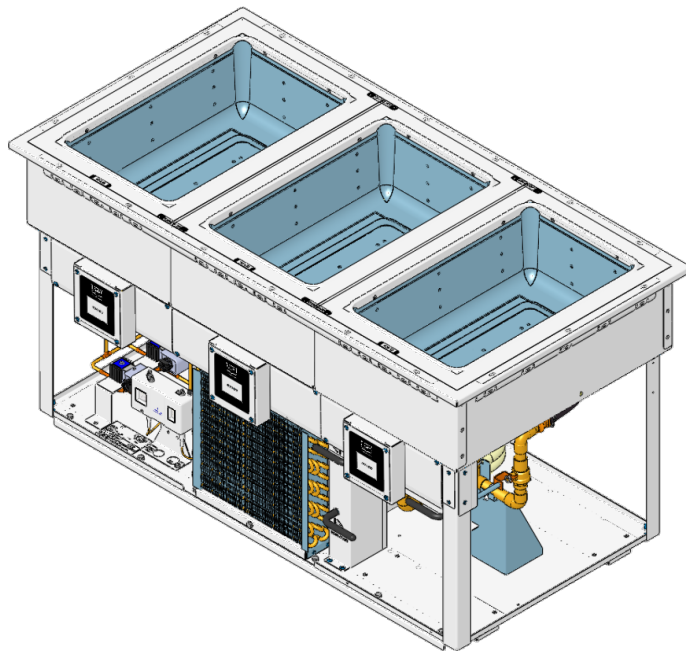
NOTE: For proper operation, the area under and in front of the cabinet **must** not be obstructed in any way.

REVISED: 4/3/24

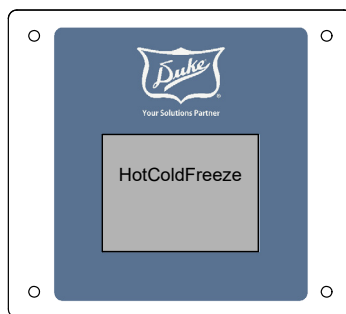


Specifications

F.O.B. Sedalia, Missouri 65301



Model HCF-3 Shown



**Touch Screen Control
can be mounted in cabinet body**

OPTIONS:

- ☐ No drain, dry heat only with removeable non-stick liner

DUKE MANUFACTURING CO.

2305 N. Broadway

St. Louis, MO 63102

800.735.3853 Toll Free

314.231.5074 Fax

www.dukemfg.com

SS-1100 Duke HotColdFreeze

Specification subject to change



WARNING For CA residents: go to
www.dukemfg.com/prop65 for prop 65 warning

Approval Stamp(s):

PRODUCT INFORMATION:

PROJECT: _____

ITEM: _____

QUANTITY: _____

MODEL:

Duke HotColdFreeze™

- | | |
|--------------------------------|---------|
| <input type="checkbox"/> HCF-1 | 1 Wells |
| <input type="checkbox"/> HCF-2 | 2 Wells |
| <input type="checkbox"/> HCF-3 | 3 Wells |
| <input type="checkbox"/> HCF-4 | 4 Wells |
| <input type="checkbox"/> HCF-5 | 5 Wells |

BODY:

- Top Mount with flush mount pans
- Stainless Steel - formed, welded, and polished to high finish
- Sealing gasket
- Drains at each well

CAPACITIES:

- Standard 12" x 20" steam table pans
- 2-1/2", 4" and 6" deep

CONTROLS:

- Intuitive, easy to use touch screen control changes mode of operation
- 3 wet heat, 3 dry heat, 3 refrigerated and 1 freeze mode.
- 1 control per food well
- Controls have a built-in Wifi modem and redundant controls capabilities for future activation.
- Unit shipped with 10" cable installed between control and touchscreen. Six foot cord is supplied if needed.
- Complies with part 15 of the FCC rules.

Refrigeration:

- 5 Year compressor replacement
- R448a Refrigerant
- Compressor slides out 15.375" for easy service.

Serviceability:

- Unit can be serviced in counter, no need to remove.
- Six foot Cord and plug supplied

CERTIFICATIONS:



ANSI/ NSF 169

REV L 09/03/2024

PRODUCT HOLDING UNIT - Duke HotColdFreeze™

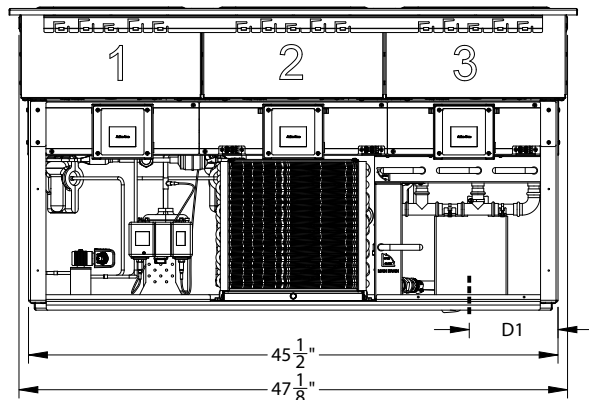
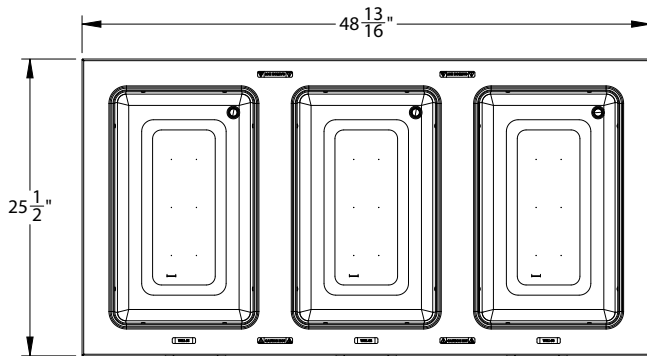
Catalog No. Duke HotColdFreeze™

A.I.A. File No. 35-C-13

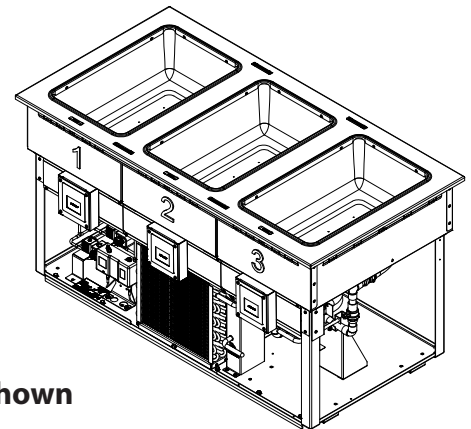
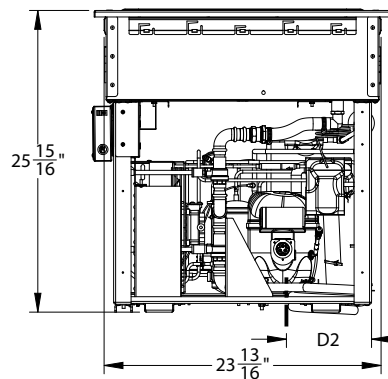
Duke HOTCOLDFREEZE™

A.I.A. File No. 35-C-13

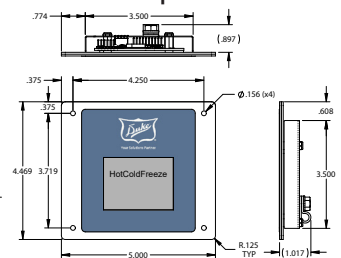
Catalog No. Duke HotColdFreeze™



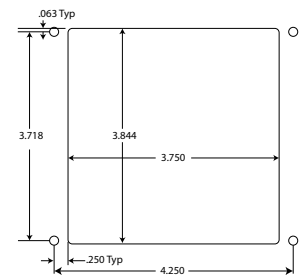
Model HCF-3 Shown



Control Specifications



Control Cutout



Note: Controls can be mounted in cabinet body

ELECTRICAL SPECIFICATIONS:

Model	120V/60Hz			120 / 208V 60Hz			120 / 240V 60Hz			Refrigeration				
	Watts	Amps	NEMA	Watts	Amps	NEMA	Watts	Amps	NEMA		HP	Refrig.	OZ	Grams
HCF-1	660	5.5	5-15P	660	5.5	L14-20P	660	5.5	L14-20P		1/3	448a	15.0	466.6
HCF-2	1260	10.5	5-15P	1260	10.5	L14-20P	1260	10.5	L14-20P		1/3	448a	19.5	606.5
HCF-3	1920	16	5-20P	1320	11	L14-20P	1320	11	L14-20P		1/2	448a	30.0	933.1
HCF-4	2520	21	L5-30P	1920	16	L14-20P	1920	16	L14-20P		1/2	448a	38.0	1181.9
HCF-5	3360	28	5-50P	2064	17.2	L14-30P	2064	17.2	L14-30P	Sys-1	1/3	448a	19.5	606.5
HCF-5 +	4800	40	5-50P	2736	22.8	L14-30P	2736	22.8	L14-30P	Sys-2	1/2	448A	30.0	933.1
										Sys-1	1/3	448a	19.5	606.5
										Sys-2	1/2	448A	30.0	933.1

+ = Provided with one 120V, 15A general use convenience receptacle

DIMENSIONS:

FREIGHT CLASS: 100

Model	Unit dimensions								Drain Location				Cutout Dimentions				Cube ft. Crated		
	Length		Depth		Height		Liner Widths		D1		D2		Length		Width			Weight	
	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm		lbs	kg
HCF-1	17.50	44.45	25.5	64.77	25.94	65.89	23.82	60.50	2.81	7.14	2.94	7.47	16.00	40.64	24.00	60.96	12.5	95	43
HCF-2	33.19	79.22	25.5	64.77	25.94	65.89	23.82	60.50	22.44	57.0	2.94	7.47	31.69	80.50	24.00	60.96	21.0	145	65.8
HCF-3	48.82	124.00	25.5	64.77	25.94	65.89	23.82	60.50	7.63	19.38	7.94	20.17	47.38	120.35	24.00	60.96	28.9	198	89.8
HCF-4	64.50	163.82	25.5	64.77	25.94	65.89	23.82	60.50	23.0	58.42	7.63	19.38	63.00	160.02	24.00	60.96	38.0	287	130.2
HCF-5	80.19	203.68	25.5	64.77	25.94	65.89	23.82	60.50	7.63	19.38	7.94	20.17	79.00	200.66	24.00	60.96	45.0	340	154.2



Duke Manufacturing Co.

2305 N. Broadway
St. Louis, MO 63102

Phone: 314-231-1130

Toll Free: 1-800-735-3853

Fax: 314-231-5074

www.dukemfg.com

Printed in U.S.A.

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INFINITY™

INFINITY™ Support:

- ☐ 1/2" Clear Tempered Glass
Contact factory for additional options

Glass:

- ☐ 3/8" Glass - 72" max. Span
☐ 1/2" Glass - 96" max. Span
Contact factory for spans exceeding max.

Mounting Options:

Some mounting options may not be available on some cantilevered/counter substrate combinations. Refer to mounting cut-sheet or contact factory for additional information.

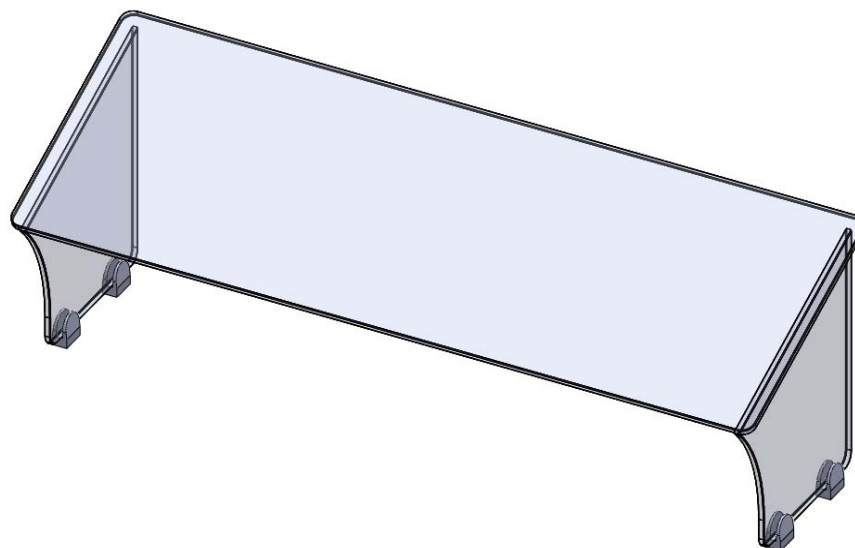
- ☐ 640-Z Above Counter Surface Mount (Standard)
☐ 640-FB Above Counter Surface Mount with Stainless Flat Bar

End Panels:

NSF 2008 standards for side end panels require:

5.35.6 A vertical barrier (end shield) shall be provided at each end of a foodshield. The vertical barrier shall be a minimum of 18" deep (front to back) beginning at the bottom leading edge of the foodshield. The minimum height of the vertical barrier shall be equal to the overall height of the foodshield.

5.35.6.1 A foodshield intended to be installed a maximum of 3" from a building wall perpendicular to the foodshield is exempt from the requirements of 5.35.6 provided that the height of the building wall is not lower than the overall height of the foodshield.



Model:

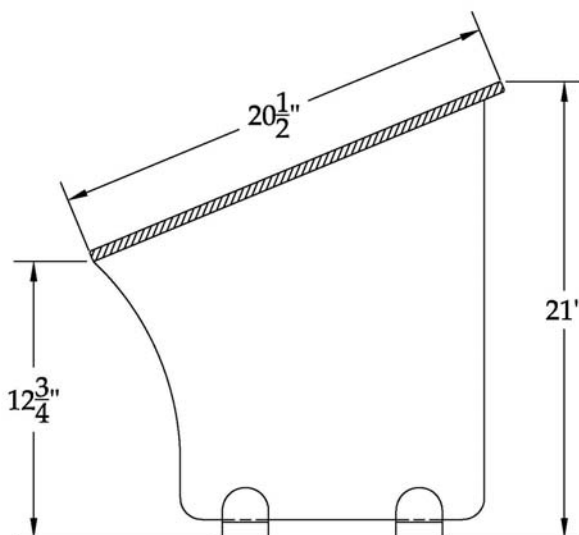
TMU1

Project Name:

Item Number:

Quantity:

Length:



Advise Counter
Thickness and Material

UV BONDED GUARDS

Specifications for reference only and may be changed without notice. All orders require approved shop drawings prior to release to production. Products are drawn & built to meet NSF Standard 2. It is the responsibility of the customer to ensure product meets local health board standards.

Web: www.premierbrass.com
Email: info@premierbrass.com
Phone: 1-800-251-5800
Fax: 1-800-251-2515



CUSTOM-BUILT FOOD SERVICE EQUIPMENT
4MKA

Printed in the USA (04/2013)
Premier1Source, Inc.
255 Ottley Drive, N.E.
Atlanta, Ga 30324


INFINITY™

INFINITY™ Support:

- ☐ 1/2" Clear Tempered Glass
Contact factory for additional options

Glass:

- ☐ 3/8" Glass - 72" max. Span
☐ 1/2" Glass - 96" max. Span
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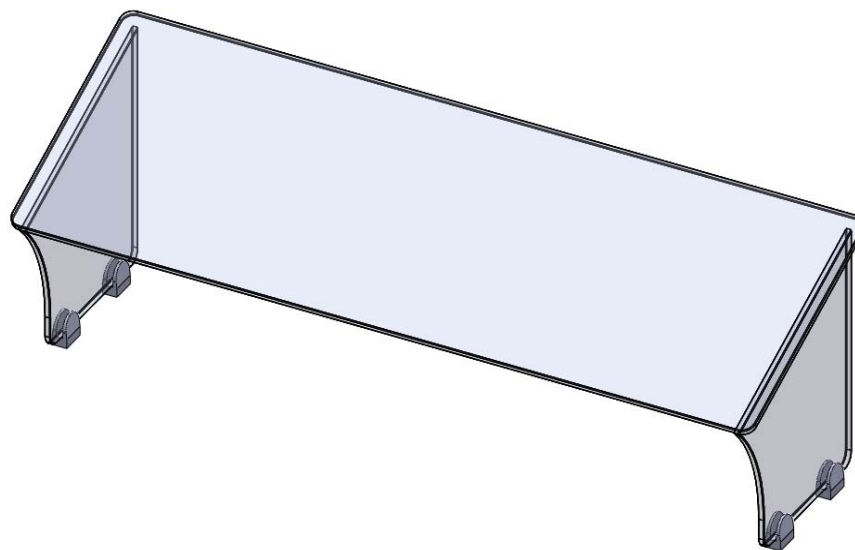
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Model:

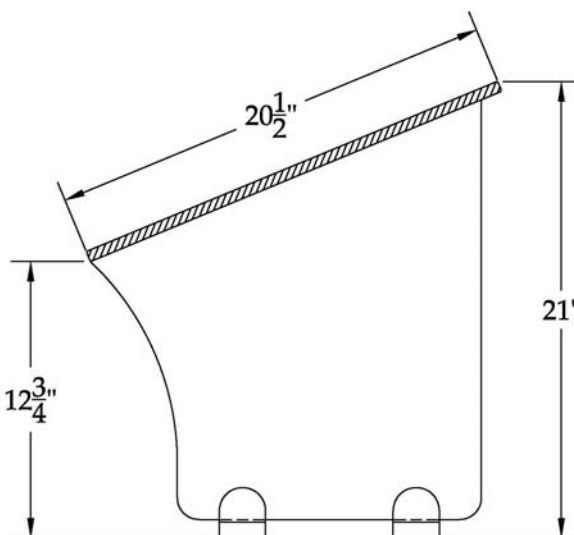
TMU1

Project Name:

Item Number:

Quantity:

Length:



Advise Counter
Thickness and Material

UV BONDED GUARDS

Specifications for reference only and may be changed without notice. All orders require approved shop drawings prior to release to production. Products are drawn & built to meet NSF Standard 2. It is the responsibility of the customer to ensure product meets local health board standards.

Web: www.premierbrass.com
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Fax: 1-800-251-2515



NSF Standard No. 2
77 MF



2012



4MK4

Printed in the USA (04/2013)
Premier1Source, Inc.
255 Ottley Drive, N.E.
Atlanta, Ga 30324



Decorative Carving Stations

Models: DCS400-1

DCS400-1CM

DCSB400-R24-1

DCSB400-2420-1

DCSB400-3624-2

Providing proper food serving temperatures, the Decorative Carving Station combines the Hatco Decorative Heat Lamp with the Swanstone® Heated Base to create an attractive carving display. These warmers are perfect for chef stations in restaurants, hotels, country clubs, casinos and catered events.

Standard features

- Available as Post Mount, Counter Mount or Freestanding with a round or rectangular heated stone base
- Patented telescoping adjustable post pivots 30° to put the heat and light where it is needed
- Height can be adjusted from from the bottom of lamp to top of the cutting board:
14" to 26" (356 to 660 mm) for DCSB400-R24-1, -2420-1, -3624-2
16" to 28" (406 to 711 mm) for DCS400-1
16" to 28" (406 to 711 mm) for DCS400-1CM
- DCS400-1 includes a black base for stability and to minimize the risk of tipping
- DCS400-1CM is designed to be permanently mounted to a counter or stable shelf
- Heated base is controlled by an adjustable thermostat and power switch (excludes DCS400-1 and DCS400-1CM)
- Heated stone bases, post bases and cutting boards are made of foodsafe materials
- Sneeze guard is 5" (127 mm) above base for easy accessibility (excludes DCS400-1 and DCS400-1CM)
- Swanstone cutting board matches color of base (excludes DCS400-1 and DCS400-1CM)
- Clear coated, 250 watt bulb(s) included
- Comes with 6' (1829 mm) cord and plug attached
- DCSB400-R24-1, -2420-1, -3624-2 Sneeze guard is removable for easy cleaning

Project _____

Item # _____

Quantity _____



Options (available at time of purchase only)

Post and Lamp Shades Plated Finishes:

- ☐ Bright Brass ☐ Bright Nickel (standard) ☐ Bright Copper
☐ Antique Brass ☐ Antique Bronze

Heated Stone Base, Trim Ring (DCS400-1CM only) and Cutting Board

Swanstone® Decorative Stone Color:

- ☐ Gray Granite ☐ Bermuda Sand ☐ Night Sky (standard)

Accessories

- ☐ Coated Red Bulb, 250 Watt (clear coat is standard)



For operation, location and safety information, please refer to the Installation and Operating Manual.



HATCO CORPORATION

P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (800) 558-0607 | (414) 671-6350



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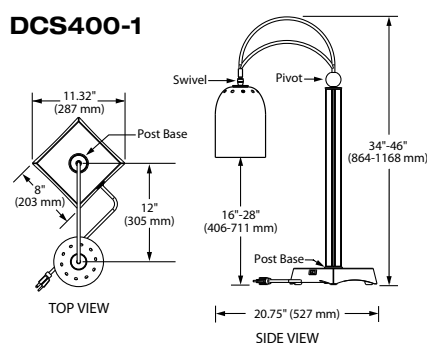
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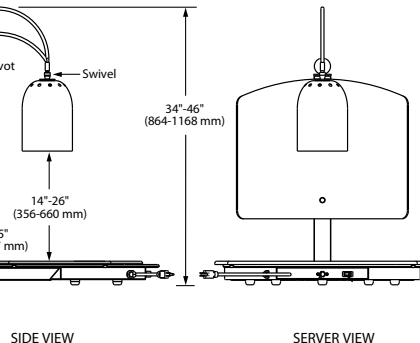
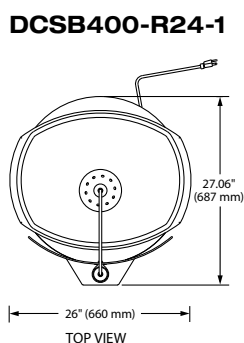
Decorative Carving Stations

Models: DCS400-1, DCS400-1CM, DCSB400-R24-1, DCSB400-2420-1, DCSB400-3624-2

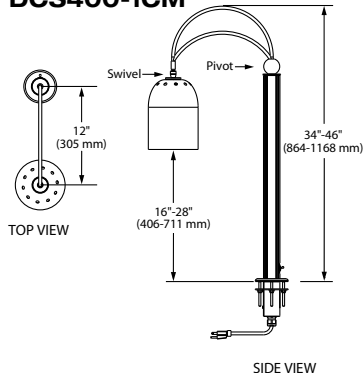
DCS400-1



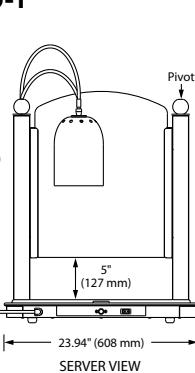
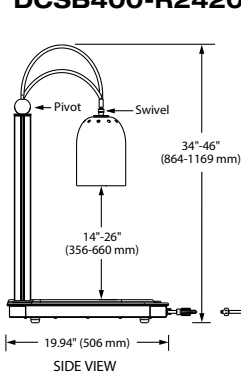
DCSB400-R24-1



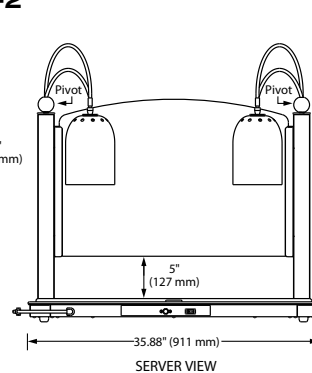
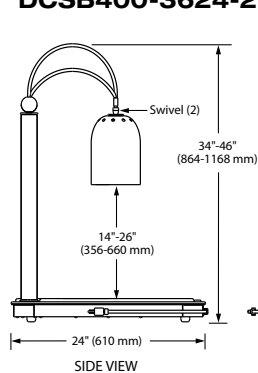
DCS400-1CM



DCSB400-R2420-1



DCSB400-3624-2



SPECIFICATIONS

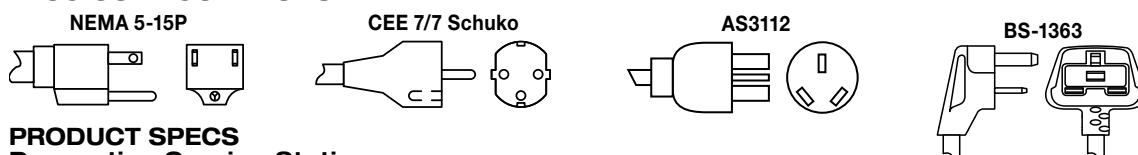
Decorative Carving Stations - All Single Phase

The shaded areas contain electrical information for International models only

Model	Dimensions (W x D x H)	Heated Base Surface (W x D)	Voltage	Watts	Amps	Plug	Cord Location	Ship Weight*
DCS400-1	8" x 20.75" x 34"-46" (203 x 527 x 864-1168 mm)	————	120	250	2.1	NEMA 5-15P	Server side center, base of unit	32 lbs. (15 kg)
			220 (CE)	210	1.0	CEE 7/7 Schuko, AS3112, BS-1363		
			230 (CE)	230				
			240 (CE)	250				
DCS400-1CM	6.125" x 20.75" x 34"-46" (156 x 527 x 864-1168 mm)	————	120	250	2.1	NEMA 5-15P	Bottom of unit	18 lbs. (9 kg)
			220 (CE)	210	1.0	CEE 7/7 Schuko, AS3112, BS-1363		
			230 (CE)	230				
			240 (CE)	250				
DCSB400-R24-1	26"W x 27.06"D x 34"-46"H (660 x 687 x 864-1168 mm)	Diameter: 24" (609 mm)	120	600	5.0	NEMA 5-15P	Server side on left, base of unit	75 lbs. (34 kg)
			220 (CE)	530	2.4	CEE 7/7 Schuko, AS3112, BS-1363		
			230 (CE)	580	2.5			
			240 (CE)	631	2.6			
DCSB400-2420-1	23.94" x 19.94" x 34"-46" (608 x 506 x 864-1168 mm)	24" x 20" (609 x 508 mm)	120	750	6.3	NEMA 5-15P	Server side on left, base of unit	82 lbs. (38 kg)
			220 (CE)	667	3.0	CEE 7/7 Schuko, AS3112, BS-1363		
			230 (CE)	730	3.2			
			240 (CE)	794	3.3			
DCSB400-3624-2	35.88" x 24" x 34"-46" (911 x 610 x 864-1168 mm)	36" x 24" (914 x 609 mm)	120	1300	10.8	NEMA 5-15P	Server side on left, base of unit	128 lbs. (60 kg)
			220 (CE)	1152	5.2	CEE 7/7 Schuko, AS3112, BS-1363		
			230 (CE)	1259	5.5			
			240 (CE)	1371	5.7			

* Shipping weight includes packaging.

PLUG CONFIGURATIONS



PRODUCT SPECS

Decorative Carving Stations

The Foodwarmer shall be a Decorative Carving Station manufactured by the Hatco Corporation, Milwaukee, WI 53234 U.S.A.

The Decorative Carving Station shall be rated at ... watts, ... volts, single phase, and be ... inches (millimeters) in overall width.

The foodwarmer shall be factory-assembled ready for electrical installation with cutting

board and 6' (1829 mm) cord and plug. Heated base units shall be thermostatically controlled. Options: Post and lamp Plated Finishes, Heated Stone Base colors. Accessories: Coated red 250 Watt Bulb.

Warranty consists of 24/7 parts and service assistance (U.S. and Canada only).

HATCO CORPORATION

P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (800) 558-0607 | (414) 671-6350



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Cook & Hold Oven

Model 750-TH

Original Cook & Hold Ovens produce better food quality and higher yields with built-in savings.

Gentle, radiant Halo Heat® technology evenly surrounds food without the use of extremely hot elements, added humidity or fans. This controlled, uniform heat maintains precise temperatures throughout the cooking and holding process—improving food quality and extending hold times.

Cook by time or probe with Simple or Deluxe controls. Probes sense internal product temperature and automatically convert the oven from cook mode to hold mode once set parameters have been reached.

Labor-free, overnight cooking and effortless operation reduces labor costs and increases productivity.

Place anywhere with a ventless, waterless design. Lower costs with energy efficient operation and no water hookups or traditional kitchen hood required. All Alto-Shaam Cook & Hold Ovens are EPA 202 Certified ventless.

Advanced controls – designed intentionally simple – feature an intuitive, user-friendly interface and programmable recipes to ensure consistency with each cook.

ChefLinc™, cloud-based remote oven management software, streamlines processes and maximizes profits with data-driven insights [Deluxe model only].

ISO 9001:2015-certified

Standard Features

- Casters [two (2) rigid, two (2) swivel with brake]
- Single-point, straight removable probe
- Drip tray and drip pan with drain
- Programmable, touchscreen control on Deluxe model
- HACCP data collection on Deluxe model
- Programmable control on Simple model
- Easy recipe upload/download via USB port
- SureTemp™ heat recovery on Deluxe model
- Two (2) stainless steel side racks with ten (10) pan positions spaced 1-3/8" [35mm] on centers
- Removable exterior drip tray



10 Full-size pans — 20" x 12" x 2-1/2" on wire shelves
GN 1/1 — 530mm x 325mm x 65mm

20 Half-size pans — 10" x 12" x 2-1/2" on wire shelves
GN 1/2 — 265mm x 325mm x 65mm

Weight maximum: 100 lbs. [45 kg]

Volume maximum: 75 quarts [71 liters]

Four (4) shelves included.



ALTO-SHAAM



Shown with Deluxe control



Shown with Simple control

750-TH

Configurations (select one each)

Models

- ☐ Simple
 - ☐ HACCP option
- ☐ Deluxe
 - ☐ Ethernet option [5032090]

Door Choice

- ☐ Right hinged, solid door, standard
- ☐ Right hinged, window door
- ☐ Left hinged, solid door
- ☐ Left hinged, window door

Electrical

- ☐ 120V, 1Ph
- ☐ 208-240V, 1Ph

Casters and Legs

- ☐ 2-1/2" [64mm] casters, two (2) rigid two (2) swivel with brake, option [5027134] – not available with bumper
- ☐ 2-1/2" [64mm] caster, swivel with brake, option [CS-39969, 4 required] – not available with bumper
- ☐ 3-1/2" [89mm] casters, two (2) rigid two (2) swivel with brake, standard [5027133]
- ☐ 3-1/2" [89mm] caster, swivel with brake, option [CS-39971, 4 required]
- ☐ 5" [127mm] casters, two (2) rigid two (2) swivel with brake, option, [5027112]
- ☐ 5" [127mm] caster, swivel with brake, option [CS-39973, 4 required]
- ☐ 6" [152mm] legs, set of four [4] [5032092]
- ☐ 6" [152mm] seismic legs, set of four [4] [5032093]

Optional Accessories (select all that apply)

Bumper and Handles

- ☐ Full perimeter bumper
- ☐ Push/Pull handle

Additional Probes

- ☐ Sous vide probe [PR-36576]
- ☐ T-handle probe, up to six (6) with Deluxe [PR-46998]
- ☐ Straight probe, up to six (6) with Deluxe (qty one [1] included with oven) [PR-46999]

Drip Pans, Shelves, Holders

- ☐ Drip pan with drain [5027713]
- ☐ Drip pan, without drain [1034370]
- ☐ Increased capacity exterior drip pan [5030664]
- ☐ Shelf, stainless steel [SH-2324]
- ☐ Carving holder, prime rib [HL-2635]
- ☐ Carving holder, steamship [cafeteria round] [4459]

Cleaners

- ☐ Alto-Shaam, non-caustic cleaner one (1) 32-ounce bottle [CE-46828]
- ☐ Alto-Shaam, non-caustic cleaner six (6) 32-ounce bottles [CE-46829]

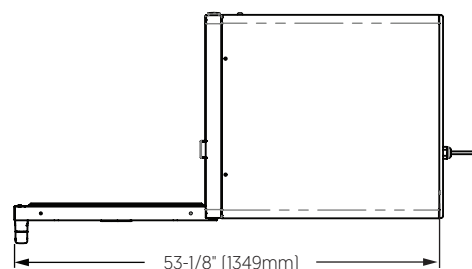
Accessories, misc.

- ☐ Stacking kit, 750-TH over 750-TH [5032041]
- ☐ Door lock with key [5028755]

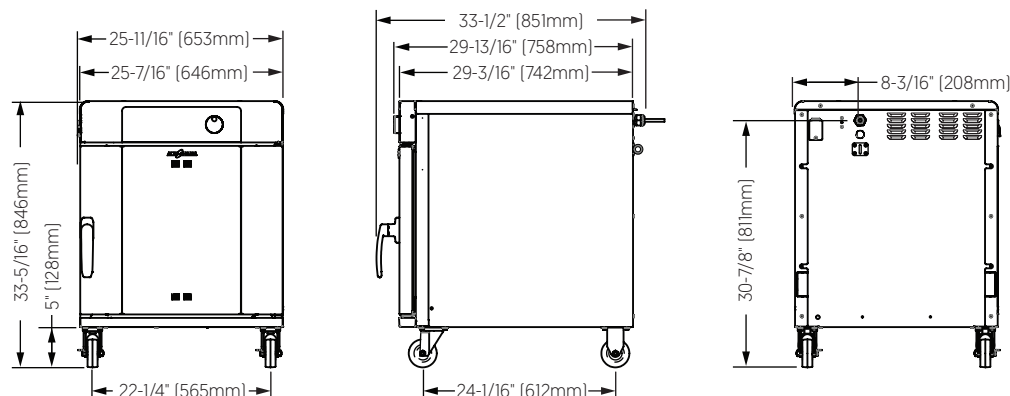
Cook & Hold Oven

Model 750-TH

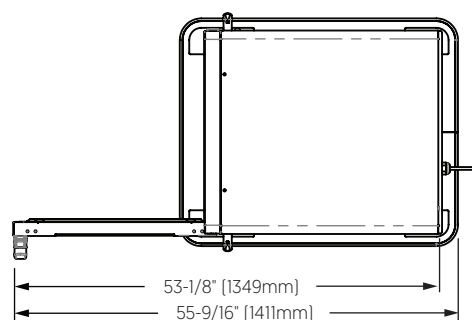
ALTO-SHAAM

DIMENSIONS


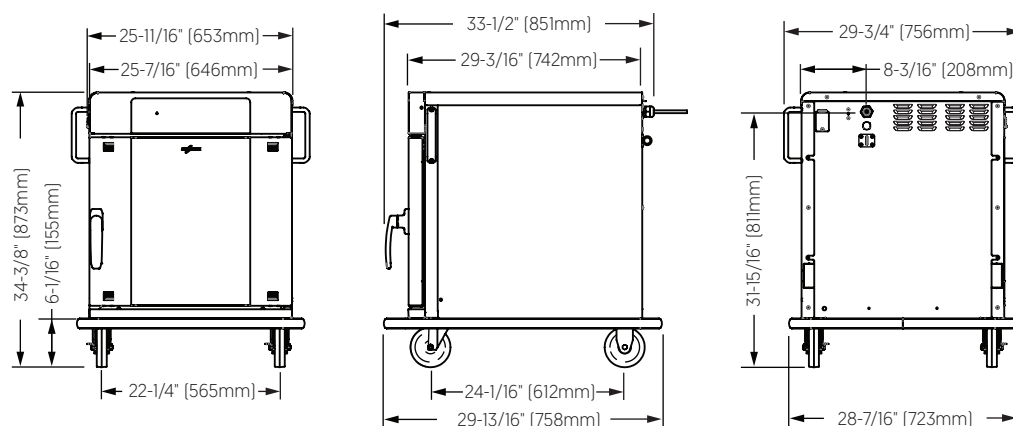
Shown with Simple control
and 3-1/2" casters



OVERALL HEIGHT: 750-TH		
Accessory	in	mm
5" caster	34-3/8"	873
3-1/2" caster	33-5/16"	846
2-1/2" caster	31-3/4"	805
6" leg (min)	32-1/4"	818
6" leg (max)	34-1/2"	875
6" seismic leg (min)	33-3/16"	842
6" seismic leg (max)	35-5/8"	904



Shown with Deluxe control,
5" casters, bumper, and handles



Interior (H x W x D)	Net Weight	Ship Dimensions (L x W x H)	Ship Weight
20-1/16" x 22" x 26-1/2" [510mm x 559mm x 673mm]	225 lbs. [102 kg]	35" x 35" x 42" [889mm x 889mm x 1067mm]	290 lbs. [131 kg]

Cook & Hold Oven

Model 750-TH


**CLEARANCE**

Top:..... 2" [51mm]

Left: 2" [51mm]

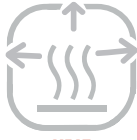
Right:..... 2" [51mm]

Back: 3" [76mm]

**CHECK FIRST**

The oven must be installed level.

The oven must not be installed in any area where it may be affected by steam, grease, dripping water, high temperatures, or any other severely adverse conditions.

**HEAT****Heat of rejection**

750-TH	Heat Gain qs, BTU/hr	Heat Gain qs, kW
	851	0.25










**TEMPERATURE****Cooking temperature range:**

200°F–325°F [94°C–163°C]

Holding temperature range:

85°F–205°F [29°C–96°C]

**ELECTRIC**

750-TH	V	Ph	Hz	Awg	IEC	A	Breaker [A]	kW	Plug Configuration	Certification
120V	120	1	60	10	—	14	20	1.7	Alto-Shaam offers a number of readily available cord and plug configurations. Contact factory for options.	 
208–240V**	208	1	50/60	10	—	15	20 UL 30 CSA	3.1		 
	240	1	50/60	10	—	17	20 UL 30 CSA	4.2		 
230V	230	1	50/60	10	—	17	32	3.8		  
		1	50/60	10	—	11	20	2.6*		

Electrical connections must meet all applicable federal, state, and local codes.

*Reduced wattage configuration.

**Dedicated circuit required.

CONTACT US

W164 N9221 Water Street | Menomonee Falls, Wisconsin 53051 | U.S.A.
 Phone: 262.251.3800 | 800.558.8744 U.S.A./Canada | Fax: 262.251.7067 | alto-shaam.com



Project _____

Model # _____ Quantity _____



Induction Cooking Station (Built-In)

(Model Shown: ICB234-26)

Models:

Model #	Number of Ranges	Number of Air Filter Systems	Number of Power Management Systems	Range Voltage	Range Peak Power
ICB234-18	2	1	1	110-120	1800 W
ICB234-26	2	1	1	208-240	2600 W
ICB348-18	3	2	1	110-120	1800 W
ICB348-26	3	2	1	208-240	2600 W

Description:

Spring USA's Induction Cooking Station is a unit that provides high-speed heating with quiet, efficient air filtering that removes grease laden vapor and odors all within a stainless steel housing that is ready for easy installation in a display cooking or cabinet base. Each unit offers flush mounted induction ranges with LED power/temp display, a downdraft air filter system with easy access to filters, and an integrated power source that powers the entire unit.

Standard Warranty:

- One year, parts & labor (excluding filters)

Agency Listings:

- ETL (Induction Ranges & Power Management System)
- UL STD 197 (Induction Ranges, Air Filter System & Power Management System)
- NSF/ANSI STD 4 (Induction Ranges & Air Filter System)
- UL ANSI/NSF No. 2 (Air Filter System)
- FCC (Induction Ranges)
- CETL (Induction Ranges & Air Filter System)



Project _____

Model # _____ Quantity _____

Induction Cooking Station (Built-in)

Construction & Performance Features:

Housing

- Choice of 34" width (for two ranges) or 48" width (for three ranges)
- Heavy duty, easy to clean, stainless steel work top
- Sturdy support frame with full back panel

Induction Ranges (*Model #SM-181R or SM-261R*)

- Choice of 1800 watts or 2600 watts of power
- Easy to clean, 5 mm thick, tempered glass cooktop
- Black, tempered glass faceplate
- Power on/off with power on/pan present indicator light
- SmartScan technology
- Solid state controls with over/under voltage protection
- Cook/Temp mode touch pad with indicator lights
- Knob-set thermostat control with digital LED display
- Cook mode levels 1-20 and temp mode range from 100°F-400°F

Air Filter System (*Model #AF-350*)

- Cabinet mounted downdraft filtration system
- Stainless steel, counter-level, capture flue(s)
- Easy-service drawer slide for filter access
- Washable pre-filter, primary cell filter, and carbon absorption filter
- 96.7% capture of 1-3 micron particulate
- Quiet running 350-watt blower

Power Management System (*Model #PM2221, PM2231, or PM2251*)

- Mounted to housing for single point power connection
- Stainless steel enclosure and hardware
- 6 ft. power cord with NEMA 14-50P plug
- Includes NEMA 14-50R receptacle
- All outlets are surge protected



(Solid surface top not included)





Project _____

Model # _____ Quantity _____

Induction Cooking Station (Built-in)

Available Accessories/Alternative Configurations:

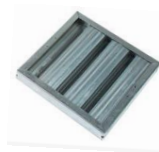
- Replacement filters
 - High Efficiency Primer Filter (Item #AF98710)
 - Carbon Final Filter (Item #AF98711)
 - Galvanized Baffle Filter (Item #AF9879)
- Induction ready Cookware (See Spring USA catalog)



Item #AF98710



Item #AF98711



Item #AF9879

Electric Requirements:

Each Induction Cooking Station comes with its own Power Management System, powering the entire unit with a single receptacle, eliminating the need for multiple receptacles at various voltages. The Power Management System includes five receptacles and can combine 120 volt and 240 volt power into one central power source of 240 volt. This simplifies the electrical requirements of each unit.

Below are the requirements of the Power Management system per the specific Induction Cooking Station model.

Model #	Voltage	Phase	Hertz	kW	Amps	Plug
ICB234-18	208-240	1	60	4.0	32.9	NEMA 14-50P
ICB234-26	208-240	1	60	5.6	23.1	NEMA 14-50P
ICB348-18	208-240	1	60	6.1	27.0	NEMA 14-50P
ICB348-26	208-240	1	60	8.5	35.4	NEMA 14-50P

For requirements of the individual components (induction ranges or air filter system) please see their corresponding specification sheets.



Project _____
 Model # _____ Quantity _____

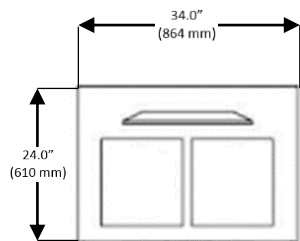
Induction Cooking Station (Built-in)

Key Dimensions:

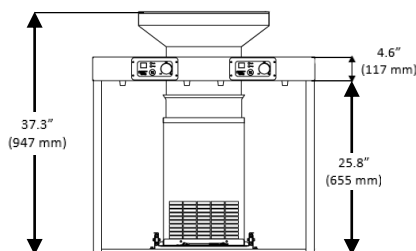


ICB234-18 & ICB234-26

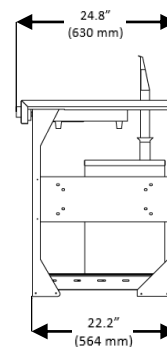
TOP VIEW



FRONT VIEW

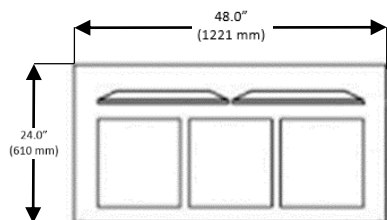


SIDE VIEW

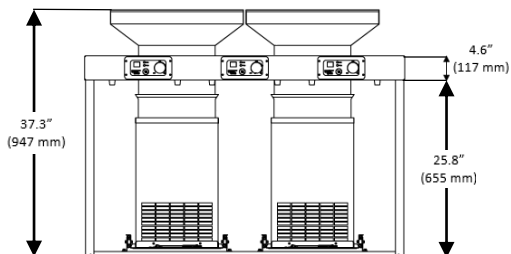


ICB348-18 & ICB348-26

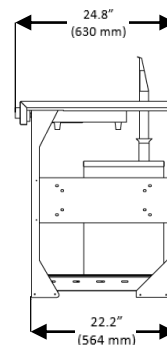
TOP VIEW



FRONT VIEW



SIDE VIEW





Project _____

Model # _____ Quantity _____

Induction Cooking Station (Built-in)

Shipping Dimensions:

Single Unit Shipping Carton				
Model #	Length	Width	Height	Weight
ICB234-18	72" (1829 mm)	38" (965 mm)	47" (1194 mm)	220 lb. (100 kg)
ICB234-26				
ICB348-18	72" (1829 mm)	38" (965 mm)	47" (1194 mm)	298 lb. (135 kg)
ICB348-26				

Notes & Conditions:

1. The Induction Cooking Station (Built-in) unit must be installed in a base cabinet or display cooking pedestal by a qualified contractor.
2. Ensure that you have dedicated power wherever you are planning to use your Induction Cooking Station. Refer to the manual for detailed instructions regarding operation.
3. Ensure the unit has proper ventilation at all times so it does not overheat.
4. The air filtration system is design exclusively for use with built-in induction ranges and cannot be used as a stand alone device or with other heating devices.
5. Induction ranges require use of ferrous metal, induction-ready cookware.
6. Spring USA Induction Servers and Induction Warmers/Ranges are designed to work together as a system. Optimal performance is achieved by using Spring USA components in conjunction with each other. As the first to offer such induction systems, Spring USA cannot warranty the performance of facsimile products offered by other companies.
7. Refer to individual specification sheets for the induction ranges, air filter system, or power management system for detailed information.

SANDWICH UNIT REFRIGERATOR

Model: SW32N8-FB

Natural Refrigerant R-290 Model

32" Standard Top Sandwich Unit Refrigerator with Solid Door - 8 Pans Front Breathing

Stainless steel front, top and end panels, aluminum back and interior.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Flat lid
Stainless steel back	Vision panel lid
Additional epoxy coated steel shelves	Rear mounted cutting board
Stainless steel shelves	Composite cutting board
Overshelves (single or double)	Crumb catcher
Door locks	Modified pan opening
Drawers in lieu of door*	

Consult factory for other model configurations, options and accessories.

*Drawers hold (1) 12x20x6 pan OR (1) 1/2 & (2) 1/3 pans per drawer

Continental
Refrigerator



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Unique air flow distribution allows pan product to maintain 33° - 41°F

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

2" non-CFC polyurethane foam insulation

Smooth, polished chrome door handle

Spring loaded, self closing door

Magnetic snap in Santoprene™ door gasket

Heavy duty, epoxy coated steel shelf

12" deep, full length nylon cutting board

Insulated lid

Completely enclosed, vented and removable case back

3 3/4" casters

MODEL FEATURES

(8) 1/6 size recessed pans, 4" deep

Removable interior tub below pans

Electronic control, off-cycle defrost

Field rehingeable door

¹ R-290 refrigerant meets all federal and state regulatory requirements.

Front breathers are a unique, field assembled, bottom mounted ventilation system designed to allow cabinets to be flush against a wall or built into a counter to conserve space. For proper operation, the area under and in front of the cabinet must not be obstructed in any way.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	9.0 (253 cu l)
1/6 Size Pans (4" deep)	8
Width, Overall (inches)	32 (813 mm)
Depth, Overall (inches) (including handle & bumpers)	32 3/16 (818 mm)
Depth, Cutting Board (inches)	12 (305 mm)
Height, Overall (inches) (including 3 3/4" casters)	41 (1041 mm)
Shelf Area (square feet)	3.9 (0.4 sq m)
Number of Shelves	1
Number of Doors	1
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	28 (711 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/5
Capacity (BTU per hour)*	1625

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	2.46 (1.85)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	275 (125 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	40 (1016 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunkserry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

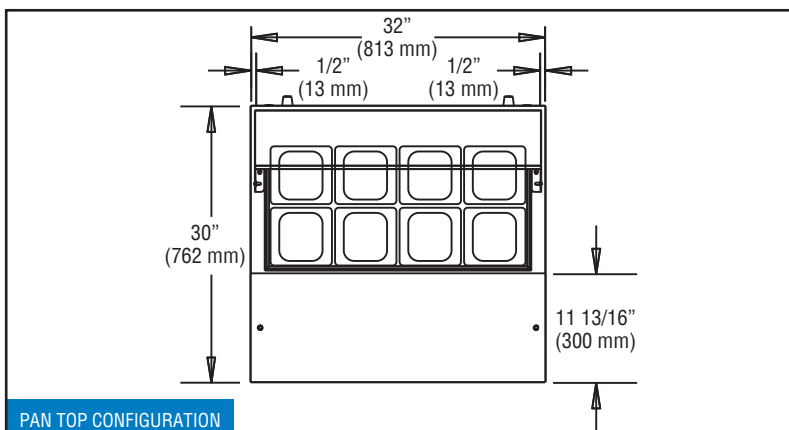
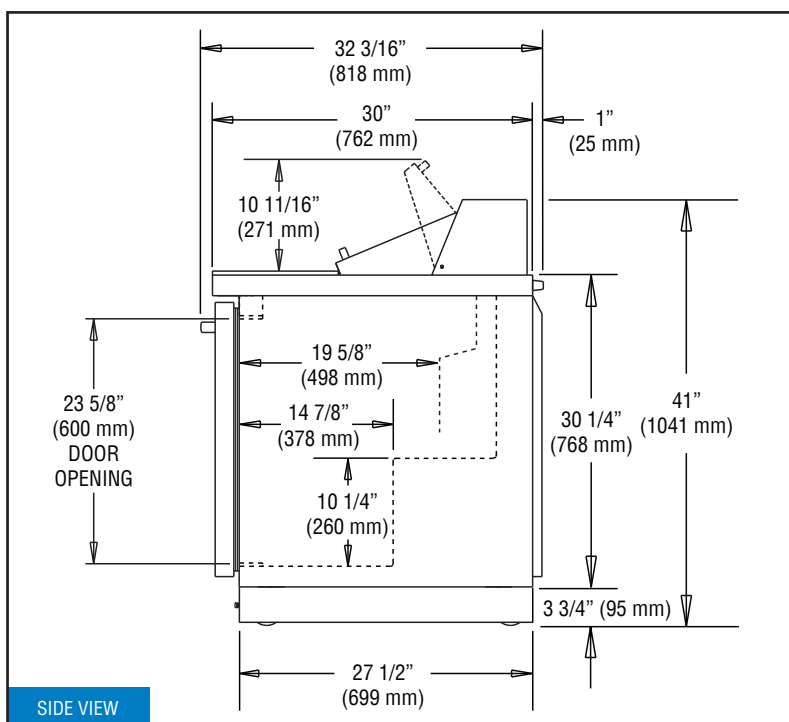
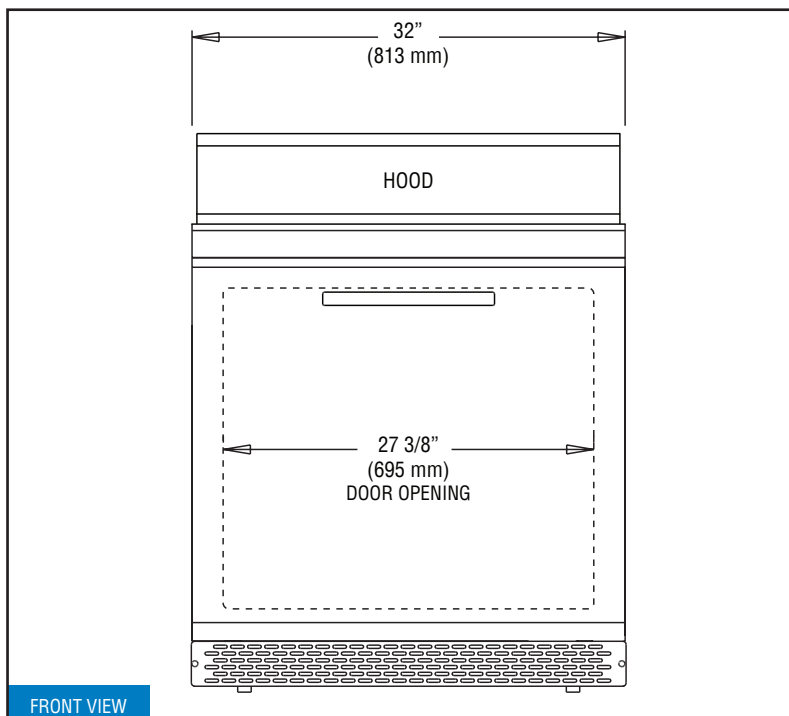
Due to our continued efforts in developing innovative products, specifications subject to change without notice.



PROUDLY
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IN THE U.S.A.

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Model Plan Views



REVISED: 3/12/24

REACH-IN FREEZER (0°F)

Model: 1FESN

Natural Refrigerant R-290 Model

1-Section Extra-Wide Reach-In Freezer - Shallow Depth

1FESN - Stainless steel front, aluminum end panels and interior

1FESNSA - Stainless steel exterior, aluminum interior

1FESNSS - Stainless steel exterior and interior



Options and Accessories

(upcharge and lead times may apply)

Stainless steel case back	Standard depth (consult factory)
Additional epoxy coated steel shelves	Hinged glass doors (consult factory)
Chrome or stainless steel shelves	Half doors
Heavy duty pilaster strips	Correctional Facility Options
Wine rack	<ul style="list-style-type: none"> One way security screws
Adjustable legs	<ul style="list-style-type: none"> Locking hasp (lock not included)
Custom laminates	<ul style="list-style-type: none"> Stainless steel mesh cover
Special electrical requirements (consult factory)	<ul style="list-style-type: none"> Coverless hinges

Consult factory for other model configurations, options and accessories.



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Self contained, performance rated refrigeration system

Natural, environmentally safe, high efficiency R-290 refrigerant¹

Automatic, electric condensate evaporator

Expansion valve system

Standard operating temperature is 0 to -5°F and can be adjusted to operate as low as -10°F in a 90°F ambient.

CABINET ARCHITECTURE

3" non-CFC polyurethane foam insulation

Smooth, polished chrome workflow door handle

Cam action, lift off hinges

Self-closing door

Magnetic snap in Santoprene® door gasket

Cylinder lock in door

Heavy duty, epoxy coated steel shelves

5" casters

MODEL FEATURES

LED interior lighting

Electronic control, automatic electric defrost

Rehinging of doors (in the field)

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	18 (510 cu l)
Width, Overall (inches)	28 1/2 (724 mm)
Depth, Overall (inches) (including handle)	29 1/4 (743 mm)
Depth (inches) (less door)	25 7/8 (657 mm)
Depth (inches) (door open 90°)	51 7/8 (1318 mm)
Clear Door Width (inches)	21 7/8 (556 mm)
Clear Door Height (inches)	58 5/8 (1489 mm)
Height, Overall (inches) (including 5" casters)	82 1/4 (2089 mm)
Number of Doors	1
Number of Shelves	3
Shelf Area (square feet)	20.4 (1.9 sq m)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/2
Capacity (BTU per hour)*	1590

* Rating @ -15°F evaporator, 90°F ambient

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	7.6 (4.2)
Defrost Amps (International)	3.7 (2.0)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Height - Crated (inches)	85 1/2 (2172 mm)
Width - Crated (inches)	31 5/8 (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (pounds)	290 (132 kg)
Weight SS - Crated (pounds)	348 (158 kg)

Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
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www.continentalrefrigerator.com

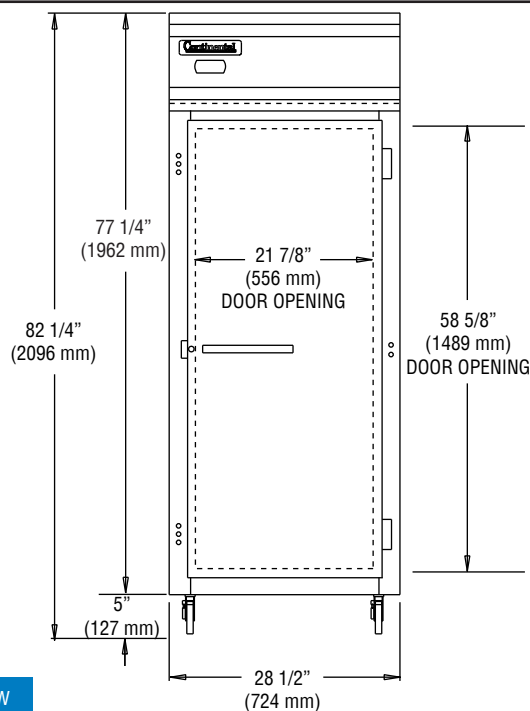
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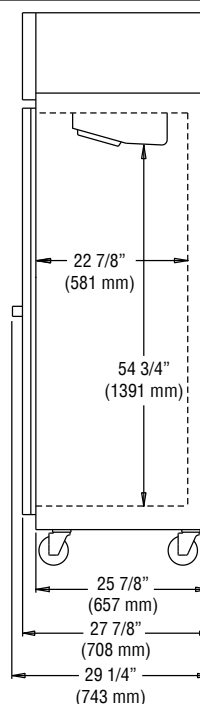
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Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.



Model: **FM1V**

Project Name: _____
 Item Number: _____
 Quantity: _____
 Length: _____

1GUARD™



CHOICE™ Support:

- ☐ 1" OD Stainless Steel
 Contact factory for additional tubing options

NSF Listed Finishes:

- ☐ Brushed (#4)
☐ Polished (#8) Stainless
☐ Flat Black
☐ Wrinkle Black
☐ Unlimited Powder Coats, specify:
 RAL#: _____ or PMS#: _____

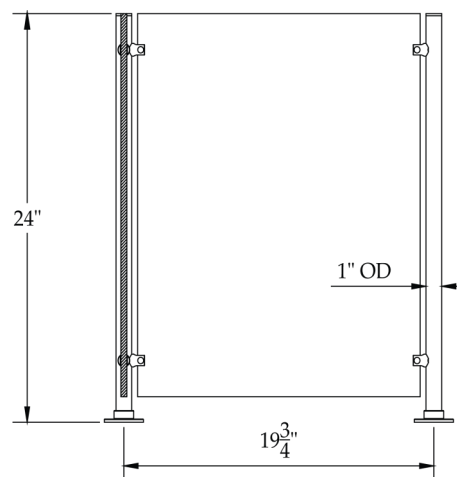
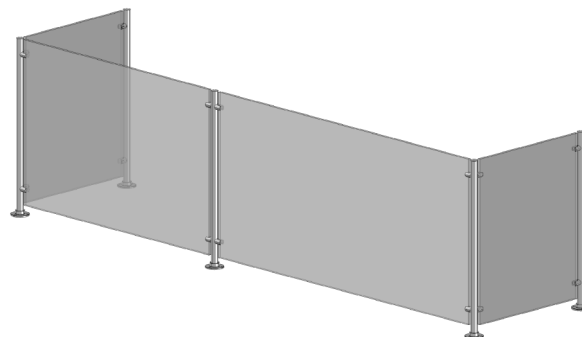
Glass:

- ☐ 1/4" Glass - 48" max. Span
☐ 3/8" Glass - 60" max. Span
 Contact factory for spans exceeding max.

End Panels:

- ☐ Both (Std.) ☐ Right Only
☐ None ☐ Left Only

As required by current NSF / ANSI 2 standards, all food shields will be quoted with side end panels unless customer requests otherwise. Standards available upon request.



Advise Counter
 Thickness and Material

Mounting Options:

Some mounting options may not be available on some cantilevered/counter substrate combinations. Refer to mounting cut-sheet or contact factory for additional information.

- ☐ 641-1 Above Counter Surface Mount
- ☐ 640B-2/1 Above Counter Surface Mount with Stainless Flange Cover
- ☐ 644B-3/1 Narrow Above Counter Surface Mount with Stainless Flange Cover
- ☐ 223 Through Counter Mount (Standard when rear legs are not possible)
- ☐ Other: _____

Electrical Components:

Lights Only

- ☐ Ultra-Slim™ Fluorescent 4100CCT* (Std.)
☐ Ultra-Slim™ LED Display Light
 (ideal over refrigerated product areas)

Heat Strip Only

- ☐ Hatco GRNM Narrow Heat Strip (Std.)
 (Other Hatco heat strips available)

Heat / Light Combo

- ☐ Hatco GRNM Narrow Heat Strip and
 Ultra-Slim™ Fluorescent 4100CCT* (Std.)
 (Other Hatco heat/combo units available)

Please see electrical cut sheet for additional options and wiring diagram.

Specifications for reference only and may be changed without notice. All orders require approved shop drawings prior to release to production. Products are drawn & built to meet NSF Standard 2. It is the responsibility of the customer to ensure product meets local health board standards.

Web: www.pmg-inc.com
 Email: info@pmg-inc.com
 Phone: 1-800-251-5800
 Fax: 1-800-251-2515



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 Premier Metal & Glass Ventures, Inc.
 1835 MacArthur Blvd., NW
 Atlanta, Ga 30318



Model: **FM1V**

Project Name: _____
 Item Number: _____
 Quantity: _____
 Length: _____

1GUARD™



CHOICE™ Support:

- ☐ 1" OD Stainless Steel
 Contact factory for additional tubing options

NSF Listed Finishes:

- ☐ Brushed (#4)
☐ Polished (#8) Stainless
☐ Flat Black
☐ Wrinkle Black
☐ Unlimited Powder Coats, specify:
 RAL#: _____ or PMS#: _____

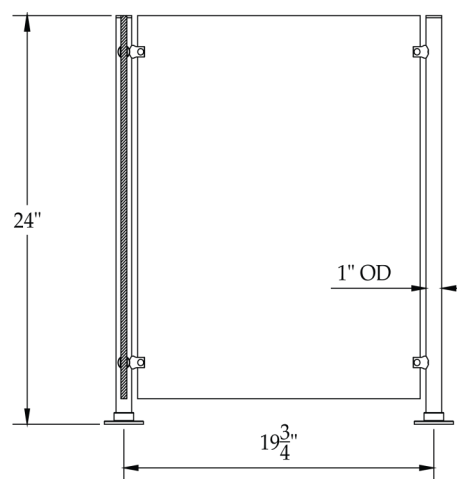
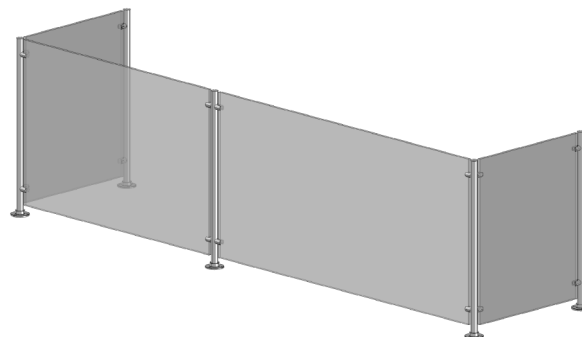
Glass:

- ☐ 1/4" Glass - 48" max. Span
☐ 3/8" Glass - 60" max. Span
 Contact factory for spans exceeding max.

End Panels:

- ☐ Both (Std.) ☐ Right Only
☐ None ☐ Left Only

As required by current NSF / ANSI 2 standards, all food shields will be quoted with side end panels unless customer requests otherwise. Standards available upon request.



Advise Counter
 Thickness and Material

Mounting Options:

Some mounting options may not be available on some cantilevered/counter substrate combinations. Refer to mounting cut-sheet or contact factory for additional information.

- ☐ 641-1 Above Counter Surface Mount
- ☐ 640B-2/1 Above Counter Surface Mount with Stainless Flange Cover
- ☐ 644B-3/1 Narrow Above Counter Surface Mount with Stainless Flange Cover
- ☐ 223 Through Counter Mount (Standard when rear legs are not possible)
- ☐ Other: _____

Electrical Components:

Lights Only

- ☐ Ultra-Slim™ Fluorescent 4100CCT* (Std.)
☐ Ultra-Slim™ LED Display Light
 (ideal over refrigerated product areas)

Heat Strip Only

- ☐ Hatco GRNM Narrow Heat Strip (Std.)
 (Other Hatco heat strips available)

Heat / Light Combo

- ☐ Hatco GRNM Narrow Heat Strip and
 Ultra-Slim™ Fluorescent 4100CCT* (Std.)
 (Other Hatco heat/combo units available)

Please see electrical cut sheet for additional options and wiring diagram.

Specifications for reference only and may be changed without notice. All orders require approved shop drawings prior to release to production. Products are drawn & built to meet NSF Standard 2. It is the responsibility of the customer to ensure product meets local health board standards.

Web: www.pmg-inc.com
 Email: info@pmg-inc.com
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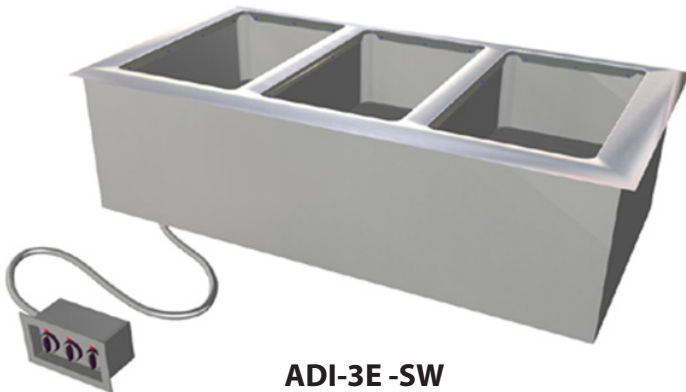
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 Premier Metal & Glass Ventures, Inc.
 1835 MacArthur Blvd., NW
 Atlanta, Ga 30318



Your Solutions Partner

Specifications

F.O.B. Sedalia, Missouri 65301

**ADI-3E -SW****OPTIONS:**

- ☐ 3 phase wiring (except ADI-1E-SW)
- ☐ Individual valves
- ☐ Manifold drains
- ☐ Master valve
- ☐ Designer Foodshields
- ☐ Telescope covers
- ☐ Removable S/S carving station
- ☐ Adapter Plates
- ☐ Adapter Bars

Agency Listings:

DUKE MANUFACTURING CO.
 2305 N. Broadway
 St. Louis, MO 63102
 800.735.3853 Toll Free
 314.231.5074 Fax
 www.dukemfg.com
 SS-1127 Drop In Elec-Sealed Well

Specification subject to change



WARNING For CA residents: go to
www.dukemfg.com/prop65 for prop 65 warning

Approval Stamp(s):**PRODUCT INFORMATION:**

PROJECT: _____

ITEM: _____

QUANTITY: _____

MODEL:
**Drop-Ins - Hot Food
 Electric - Sealed Well**

- | | |
|------------------------------------|--------------------------------|
| <input type="checkbox"/> ADI-1E-SW | 18 1/4"L x 24 1/4"W x 12 3/4"H |
| <input type="checkbox"/> ADI-2E-SW | 32 1/4"L x 24 1/4"W x 12 3/4"H |
| <input type="checkbox"/> ADI-3E-SW | 46 1/4"L x 24 1/4"W x 12 3/4"H |
| <input type="checkbox"/> ADI-4E-SW | 60 1/4"L x 24 1/4"W x 12 3/4"H |
| <input type="checkbox"/> ADI-5E-SW | 74 1/4"L x 24 1/4"W x 12 3/4"H |
| <input type="checkbox"/> ADI-6E-SW | 88 1/4"L x 24 1/4"W x 12 3/4"H |

TOP RIM:

- Heavy gauge, 300 Series stainless steel
- Overhang on front, back and ends w/locking tabs
- Vinyl foam gasket as sealant
- Die-stamped openings - 12-1/16" x 20-1/16"

HEAT COMPARTMENTS:

- ☐ 6-1/4" deep stainless steel liner, wet or dry operation
- ☐ Sealed element in each compartment
 - ☐ 750 watt, 120 Volt/1 Ph
 - ☐ 900 watt, 208 Volt/1 Ph
 - ☐ 1200 watt, 240 Volt/1 Ph
- Individual open drains

CONTROL PANEL:

- Stainless steel face plate, plastic knobs
- Infinite switch controls in remote box
- 2 panels on units with 4, 5 or 6 wells
- UL approved

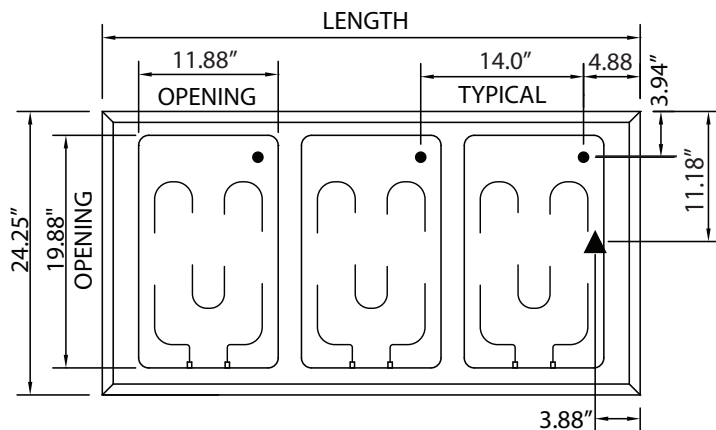
EXTERIOR HOUSING

- Heavy gauge paint grip steel

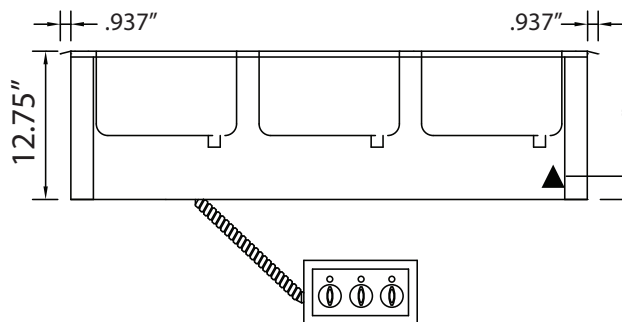
Drop-Ins - Hot Food Electric - Sealed Well

A.I.A. File No. 35-C-13

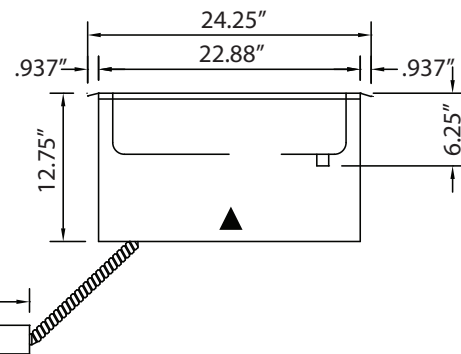
Catalog No. ADI-ELECHFSW



TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW

Dimensions:**Freight Class 100**

Model	Length		Width		Height		Top Openings	Cutout Width		Cutout Length		Control Panels	Cube ft. Crated	Weight	
	in	cm	in	cm	in	cm		in	cm	in	cm			lbs	kg
ADI-1E-SW	18 1/4	46.4	24 1/4	61.6	12 3/4	32.4	1	23.125	58.74	17.25	43.82	1	8.2	43	19.6
ADI-2E-SW	32 1/4	81.9	24 1/4	61.6	12 3/4	32.4	2	23.125	58.74	31.25	79.375	1	13.0	75	34.1
ADI-3E-SW	46 1/4	117.5	24 1/4	61.6	12 3/4	32.4	3	23.125	58.74	45.25	114.94	1	17.7	90	40.9
ADI-4E-SW	60 1/4	153.0	24 1/4	61.6	12 3/4	32.4	4	23.125	58.74	59.25	150.50	2	22.5	115	52.3
ADI-5E-SW	74 1/4	188.6	24 1/4	61.6	12 3/4	32.4	5	23.125	58.74	73.25	186.06	2	27.2	140	63.6
ADI-6E-SW	88 1/4	224.2	24 1/4	61.6	12 3/4	32.4	6	23.125	58.74	87.25	221.62	2	32.0	220	100.0

REMOTE CONTROL CUTOUT IS 9" X 4-3/8"**Electrical Specifications:**

(Consult factory for 3-phase electrical requirements and other options)

Model	120 Volt		208 Volt		240 Volt	
	watts	amps	watts	amps	watts	amps
ADI-1E-SW	750	6.3	900	4.3	1200	5.0
ADI-2E-SW	1500	12.5	1800	8.7	2400	10.0
ADI-3E-SW	2250	18.8	2700	13.0	3600	15.0
ADI-4E-SW	3000	25.0	3600	17.3	4800	20.0
ADI-5E-SW	3750	31.3	4500	21.6	6000	25.0
ADI-6E-SW	n/a	n/a	5400	26.0	7200	30.0

**Duke Manufacturing Co.**2305 N. Broadway
St. Louis, MO 63102

Phone: 314-231-1130

Toll Free: 1-800-735-3853

Fax: 314-231-5074

www.dukemfg.com

Printed in U.S.A

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WBD2G

2-Gallon Batter Dispenser



2-Gallon Batter Dispenser



MAIN FEATURES

- Industry-approved Tomlinson® spigot*
- 304 stainless steel housing and cover
- Fits up to 2 gallons of batter
- Spigot is removable for easy cleaning
- Stainless steel drip saucer is removable for easy cleaning
- Container removes from the base
- Base features nonskid feet for safe and stable operation
- All parts are dishwasher-safe
- Built for use with waffle, pancake and crepe batters
- Limited 90-Day Warranty

*Tomlinson® is a registered trademark of the Meyer Company, Cleveland, OH.

SALES FEATURES

With fresh-made waffles in high demand, your operation needs an easy way to dispense waffle batter. Perfect for front- and back-of-the-house usage, this 2-gallon batter dispenser is efficient and low maintenance. A removable Tomlinson® spigot releases batter with an even pour. Built to last, the stainless steel container sits in a sturdy base and features a removable top for easy filling. A stainless steel drip saucer prevents mess.



@waringcommercial

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314 Ella T. Grasso Avenue, Torrington, CT 06790
Tel. 800-492-7464 • Fax 860-496-9008

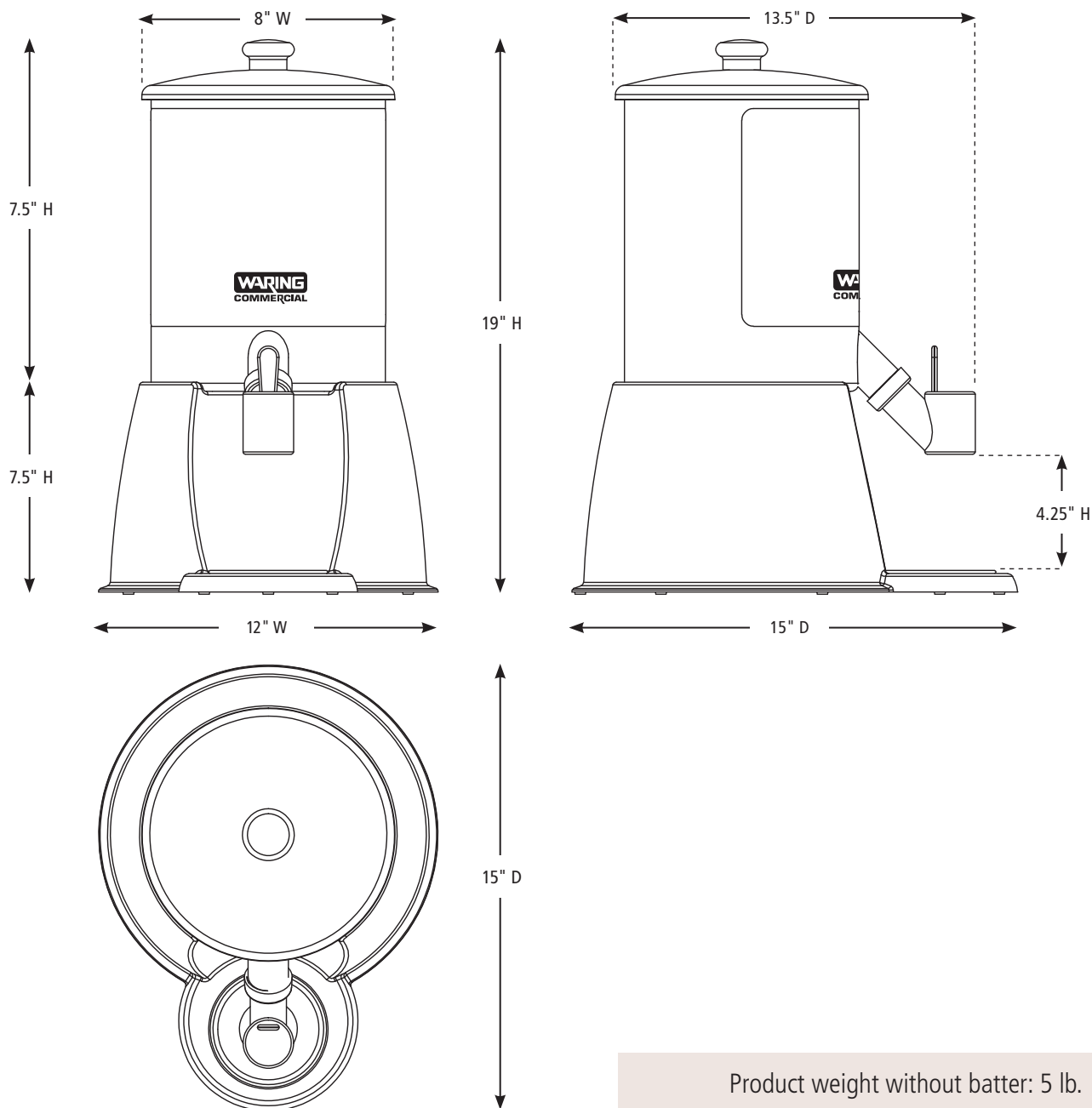
waringcommercialproducts.com

WBD2G



2-Gallon Batter Dispenser WBD2G

DIMENSIONS



Product weight without batter: 5 lb.

ORDERING INFORMATION	#STD. PKG.	GIFTBOX WEIGHT	CUBIC FEET	BOX DIMENSIONS D X W X H	UPC	CASE PKG.	MC WEIGHT	MC DIMENSIONS D X W X H	MBC
WBD2G – 2-Gallon Batter Dispenser	1	7.03	1.279	16.375" x 12.750" x 17.750"	040072091377	1	7.03	16.375" x 12.750" x 17.750"	10040072091374



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20WC074577 / REV 10/20

DESIGNER LINE SANDWICH UNIT

Model: D48N18M

Natural Refrigerant R-290 Model

Designer line

48" Mighty Top Sandwich Unit Refrigerator with Solid Door - 18 Pans

Stainless steel front, top and end panels and interior.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel back	Casters
Overshelves (single or double)	Rear mounted cutting board
Additional epoxy coated steel shelves	Composite cutting board
Stainless steel shelves	Flat insulated night cover
Door lock	Vision panel lid
Crumb catcher	Modified pan openings
Drawers in lieu of doors**	Front breathing

Consult factory for other model configurations, options and accessories.

**Two-Tier Drawers Accommodate: (1) 12 x 18 x 6 pan per drawer OR

(1) 1/2 x 6 AND (1) 1/3 x 6 pans per drawer

Continental
Refrigerator



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe,
high efficiency R-290 refrigerant¹

Unique air flow distribution allows
pan product to maintain 33° - 41°F

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Expansion valve system

Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

2" non-CFC polyurethane foam insulation

Smooth, polished chrome door handles

Spring loaded, self closing doors

Magnetic snap in Santoprene™ door gaskets

Heavy duty, epoxy coated steel shelves

8" deep, full length nylon cutting board

Insulated lid

Completely enclosed, vented and removable case back

6" adjustable, stainless steel legs

MODEL FEATURES

Electronic control, off cycle defrost

(18) 1/2 size recessed pans, 4" deep

Removable interior tub below pans

Field rehingeable doors

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	13.4 (379 cu l)
1/6 Size Pans (4" deep)	18
Width, Overall (inches)	48 (1219 mm)
Depth, Overall (inches) (including bumpers)	35 (890 mm)
Depth, Cutting Board (inches)	8 (203 mm)
Height, Overall (inches) (including 6" legs)	43 1/4 (1099 mm)
Shelf Area (square feet)	6.8 (0.6 sq m)
Number of Shelves	2
Number of Doors	2
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	44 (1118 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4
Capacity (BTU per hour)*	1940

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	4.8 (2.7)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	325 (148 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	56 (1422 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

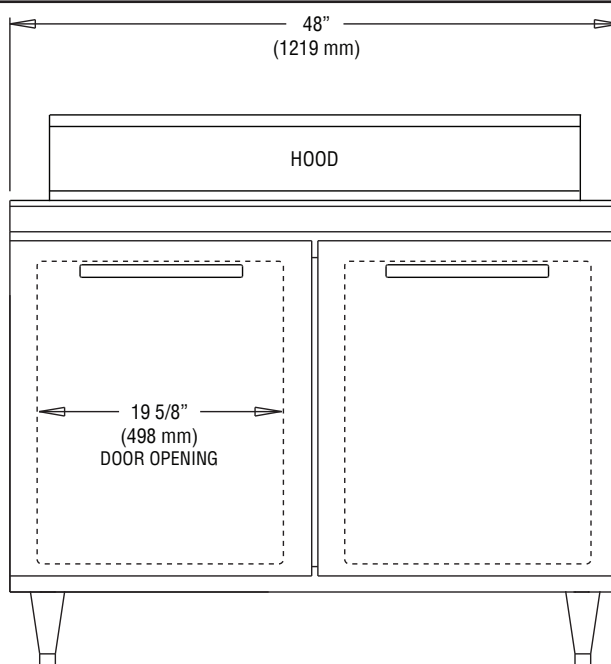
Due to our continued efforts in developing innovative products, specifications subject to change without notice.



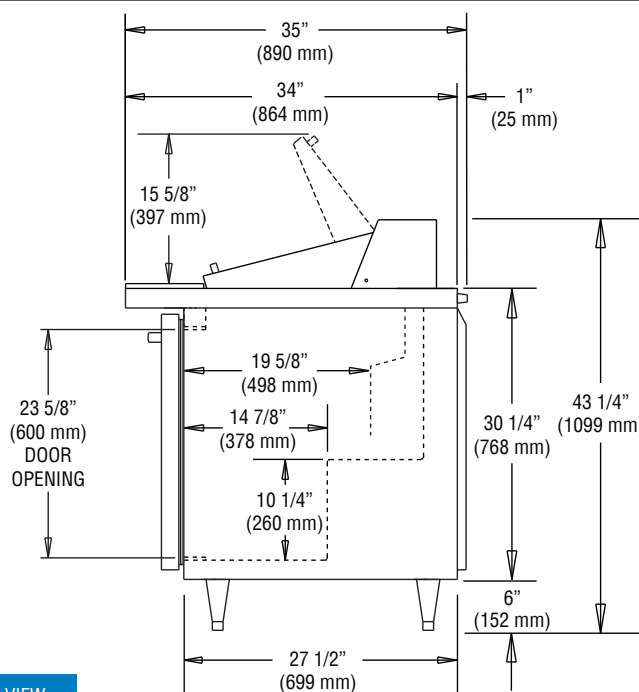
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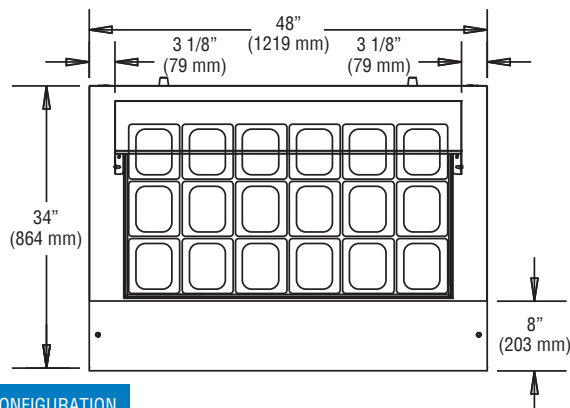
Model Plan Views



FRONT VIEW

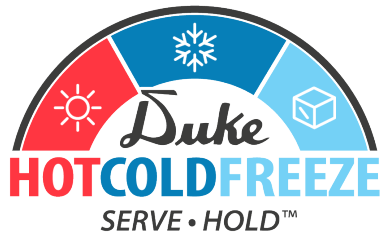


SIDE VIEW



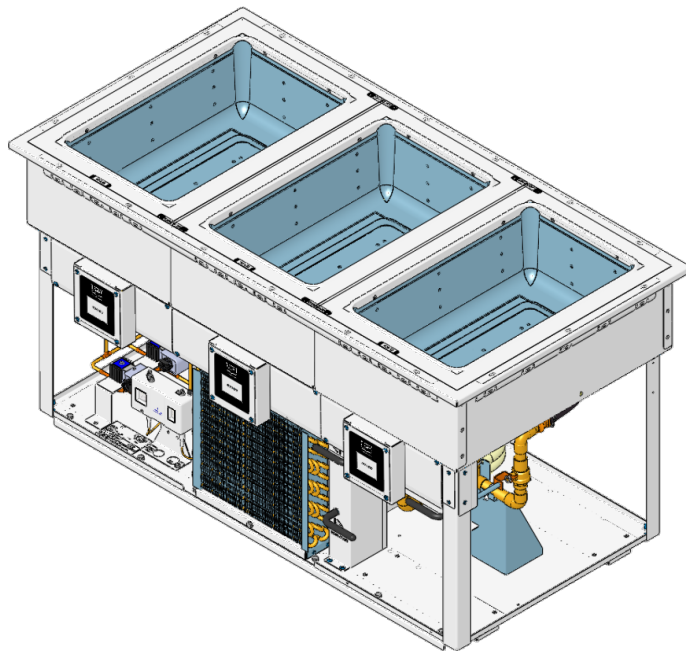
PAN TOP CONFIGURATION

REVISED: 6/9/2024

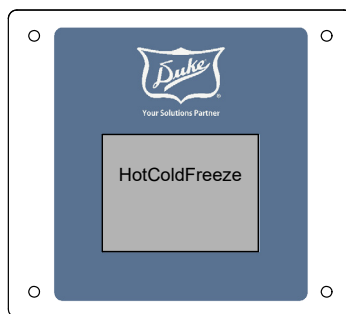


Specifications

F.O.B. Sedalia, Missouri 65301



Model HCF-3 Shown



Touch Screen Control
can be mounted in cabinet body

OPTIONS:

- ☐ No drain, dry heat only with removeable non-stick liner

DUKE MANUFACTURING CO.
2305 N. Broadway
St. Louis, MO 63102
800.735.3853 Toll Free
314.231.5074 Fax
www.dukemfg.com
SS-1100 Duke HotColdFreeze

Approval Stamp(s):

PRODUCT INFORMATION:

PROJECT: _____

ITEM: _____

QUANTITY: _____

MODEL:

Duke HotColdFreeze™

- | | |
|--------------------------------|---------|
| <input type="checkbox"/> HCF-1 | 1 Wells |
| <input type="checkbox"/> HCF-2 | 2 Wells |
| <input type="checkbox"/> HCF-3 | 3 Wells |
| <input type="checkbox"/> HCF-4 | 4 Wells |
| <input type="checkbox"/> HCF-5 | 5 Wells |

BODY:

- Top Mount with flush mount pans
- Stainless Steel - formed, welded, and polished to high finish
- Sealing gasket
- Drains at each well

CAPACITIES:

- Standard 12" x 20" steam table pans
- 2-1/2", 4" and 6" deep

CONTROLS:

- Intuitive, easy to use touch screen control changes mode of operation
- 3 wet heat, 3 dry heat, 3 refrigerated and 1 freeze mode.
- 1 control per food well
- Controls have a built-in Wifi modem and redundant controls capabilities for future activation.
- Unit shipped with 10" cable installed between control and touchscreen. Six foot cord is supplied if needed.
- Complies with part 15 of the FCC rules.

Refrigeration:

- 5 Year compressor replacement
- R448a Refrigerant
- Compressor slides out 15.375" for easy service.

Serviceability:

- Unit can be serviced in counter, no need to remove.
- Six foot Cord and plug supplied

CERTIFICATIONS:



ANSI/ NSF 169

REV L 09/03/2024

Specification subject to change



WARNING For CA residents: go to
www.dukemfg.com/prop65 for prop 65 warning

PRODUCT HOLDING UNIT - Duke HotColdFreeze™

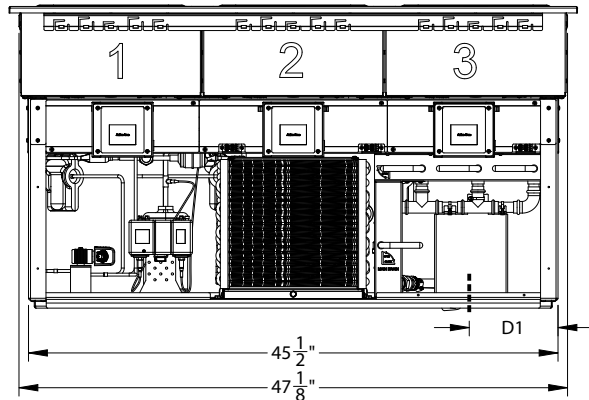
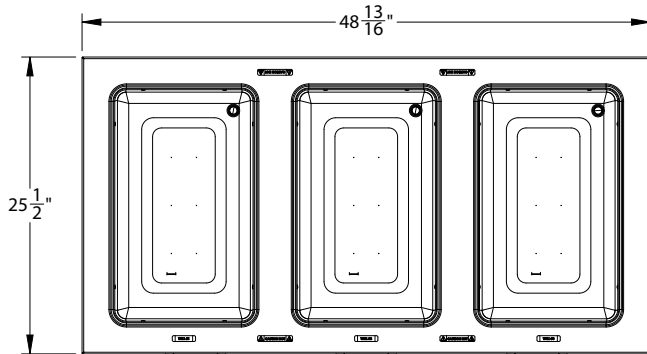
Catalog No. Duke HotColdFreeze™

A.I.A. File No. 35-C-13

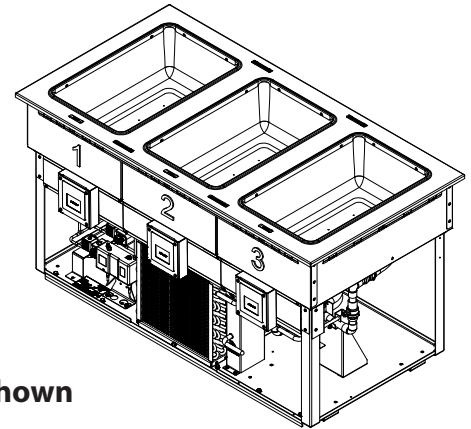
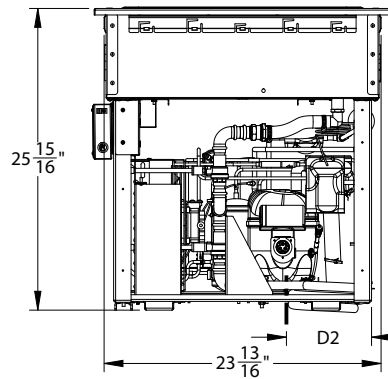
Duke HOTCOLDFREEZE™

A.I.A. File No. 35-C-13

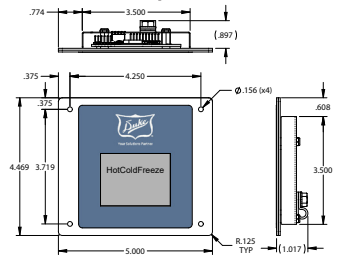
Catalog No. Duke HotColdFreeze™



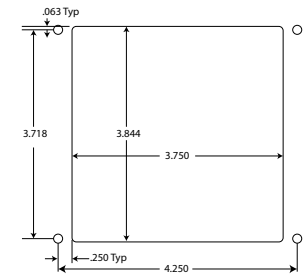
Model HCF-3 Shown



Control Specifications



Control Cutout



Note: Controls can be mounted in cabinet body

ELECTRICAL SPECIFICATIONS:

Model	120V/60Hz			120 / 208V 60Hz			120 / 240V 60Hz			Refrigeration				
	Watts	Amps	NEMA	Watts	Amps	NEMA	Watts	Amps	NEMA		HP	Refrig.	OZ	Grams
HCF-1	660	5.5	5-15P	660	5.5	L14-20P	660	5.5	L14-20P		1/3	448a	15.0	466.6
HCF-2	1260	10.5	5-15P	1260	10.5	L14-20P	1260	10.5	L14-20P		1/3	448a	19.5	606.5
HCF-3	1920	16	5-20P	1320	11	L14-20P	1320	11	L14-20P		1/2	448a	30.0	933.1
HCF-4	2520	21	L5-30P	1920	16	L14-20P	1920	16	L14-20P		1/2	448a	38.0	1181.9
HCF-5	3360	28	5-50P	2064	17.2	L14-30P	2064	17.2	L14-30P	Sys-1	1/3	448a	19.5	606.5
HCF-5 +	4800	40	5-50P	2736	22.8	L14-30P	2736	22.8	L14-30P	Sys-2	1/2	448A	30.0	933.1
										Sys-1	1/3	448a	19.5	606.5
										Sys-2	1/2	448A	30.0	933.1

+ = Provided with one 120V, 15A general use convenience receptacle

DIMENSIONS:

FREIGHT CLASS: 100

Model	Unit dimensions								Drain Location				Cutout Dimentions				Cube ft. Crated		
	Length		Depth		Height		Liner Widths		D1		D2		Length		Width			Weight	
	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm	in	cm		lbs	kg
HCF-1	17.50	44.45	25.5	64.77	25.94	65.89	23.82	60.50	2.81	7.14	2.94	7.47	16.00	40.64	24.00	60.96	12.5	95	43
HCF-2	33.19	79.22	25.5	64.77	25.94	65.89	23.82	60.50	22.44	57.0	2.94	7.47	31.69	80.50	24.00	60.96	21.0	145	65.8
HCF-3	48.82	124.00	25.5	64.77	25.94	65.89	23.82	60.50	7.63	19.38	7.94	20.17	47.38	120.35	24.00	60.96	28.9	198	89.8
HCF-4	64.50	163.82	25.5	64.77	25.94	65.89	23.82	60.50	23.0	58.42	7.63	19.38	63.00	160.02	24.00	60.96	38.0	287	130.2
HCF-5	80.19	203.68	25.5	64.77	25.94	65.89	23.82	60.50	7.63	19.38	7.94	20.17	79.00	200.66	24.00	60.96	45.0	340	154.2



Duke Manufacturing Co.

2305 N. Broadway
St. Louis, MO 63102

Phone: 314-231-1130

Toll Free: 1-800-735-3853

Fax: 314-231-5074

www.dukemfg.com

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INFINITY™

INFINITY™ Support:

- ☐ 1/2" Clear Tempered Glass
Contact factory for additional options

Glass:

- ☐ 3/8" Glass - 72" max. Span
☐ 1/2" Glass - 96" max. Span
Contact factory for spans exceeding max.

Mounting Options:

Some mounting options may not be available on some cantilevered/counter substrate combinations. Refer to mounting cut-sheet or contact factory for additional information.

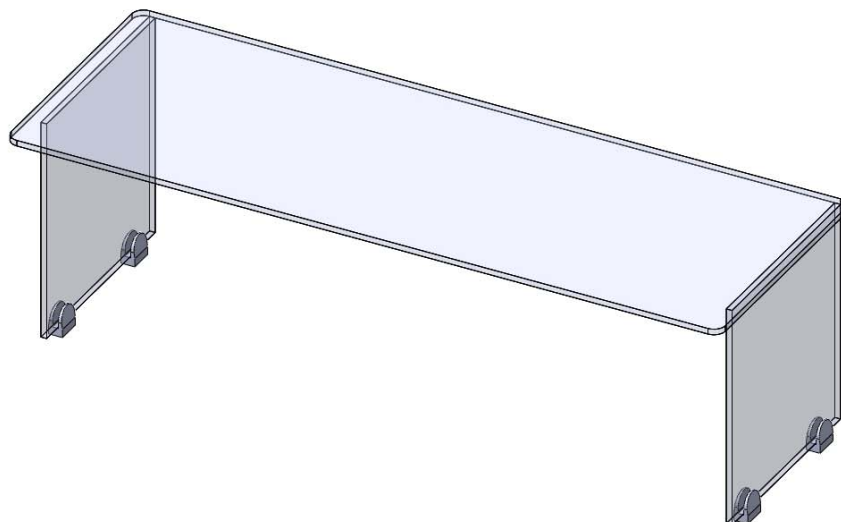
- ☐ 640-Z Above Counter Surface Mount (Standard)
☐ 640-FB Above Counter Surface Mount with Stainless Flat Bar

End Panels:

NSF 2008 standards for side end panels require:

5.35.6 A vertical barrier (end shield) shall be provided at each end of a foodshield. The vertical barrier shall be a minimum of 18" deep (front to back) beginning at the bottom leading edge of the foodshield. The minimum height of the vertical barrier shall be equal to the overall height of the foodshield.

5.35.6.1 A foodshield intended to be installed a maximum of 3" from a building wall perpendicular to the foodshield is exempt from the requirements of 5.35.6 provided that the height of the building wall is not lower than the overall height of the foodshield.



Model:

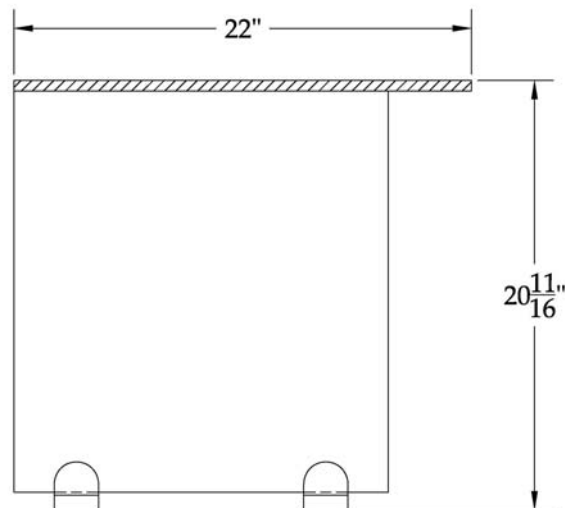
TMUS

Project Name:

Item Number:

Quantity:

Length:



Advise Counter
Thickness and Material

UV BONDED GUARDS

Specifications for reference only and may be changed without notice. All orders require approved shop drawings prior to release to production. Products are drawn & built to meet NSF Standard 2. It is the responsibility of the customer to ensure product meets local health board standards.

Web: www.premierbrass.com
Email: info@premierbrass.com
Phone: 1-800-251-5800
Fax: 1-800-251-2515



NSF Standard No. 2
77 MF



2012



CUSTOM-BUILT FOOD SERVICE EQUIPMENT
4MKA

Printed in the USA (04/2013)
Premier1Source, Inc.
255 Ottley Drive, N.E.
Atlanta, Ga 30324



Project: _____ Item #: _____ Config #: _____

Evo® EVent® 48E - Electric Cooktop in Ventless Recirculating Ventilation System

Model #: 10-0148-EVT



Model 10-0148-EVT
w/ 36" Casters Shown

DESCRIPTION

The Evo EVent® 48E is an electrically controlled 48" x 24" (1219mm x 610mm) rectangular steel cooktop in an integrated ventless recirculating ventilation unit. Evo EEvents four combined heaters heat a static cooking zone with variable temperatures ranging from 100°F to 550°F (38°C to 288°C). A high velocity CFM ventless system provides containment and capture from the intake aperture located on the chef-side adjacent the cooking surface, and a discharge duct on the chef-side returns clean filtered air. The duct system is fully welded stainless steel and utilizes a 4-stage filtration system including a washable stainless steel grease baffle filter, mesh particulate filter, electrostatic precipitator, and a replaceable activated charcoal filter. Factory installed fire suppression system with dry contact fire alarm micro switch and cross-pattern nozzles provide a continuous zone of fire protection.

SPECIFICATIONS

FILTRATION - Completely self-contained 4-stage filtration process reduces grease emissions below that are allowed in NFPA 96 and ANSI UL710B using the EPA 202 test method. The self-contained 4-stage filtration system includes a washable stainless steel grease baffle filter, mesh particulate filter, electrostatic precipitator (ESP) and replaceable activated charcoal filter. All filters are easily removable with the included 8 MM hex key. Airflow sensors continually monitor airflow and grease removal while an interlock system will not allow unit to operate if filters are missing, clogged or in the event of a fire.

FIRE PROTECTION - Factory installed Buckeye® Kitchen Mister system includes BFR-5 tank, 2 - nitrogen cartridges, SRM control head, piping, flex cable, fusible link, nozzles and manual pull station. Manual pull is located on the chef side (front) of the unit. BFR-5 tank comes pre-filled (charged) with fire suppression chemical. Fire protection system meets NFPA 96 Chapter 13 and was tested to UL300 standards. **Fire protection system must be armed and certified by Buckeye® Authorized distributor after installation and before first use (operators responsibility).**

EXHAUST AND AIR FLOW - Exhaust air is horizontal discharge. A minimum of 70 cubic feet (CFM) of fresh air per minute is required both in and out of cooking area to ensure the dilution of cooking aromas. Dedicated Make-up Air unit is not required. Please consult your HVAC contractor.

COOKING APPLIANCE - The 48E unit includes a 48" x 24" (1219mm x 610mm) flat rectangular steel cook surface with Evo® patented intelligent heating technology that provides a 24" x 17" heated cooking area. Each unit also includes a resistive touchscreen display that provides feedback on the operation of the unit.

STANDARD FEATURES

- 48" x 24" (1219mm x 610mm) flat rectangular steel cook surface
- Variable temperatures 100°F to 550°F (38°C to 288°C)
- Completely self-contained, 4-stage filtration system
- Resistive interactive touchscreen display that provides instant status of filters, grease drawers and control of temperature presets
- Stainless steel and aluminum construction for durability, strength and ease of cleaning
- Can be factory configured for 36" or 34" overall counter height
- Large removable grease collection tray
- Self-contained filtration process reduces emissions below that allowed in NFPA 96 and ANSI UL710B using the EPA 202 test method
- Pre-engineered factory installed fire protection system
- Fire protection system includes a dry contact micro switch for connection to a central fire alarm system (operators responsibility)
- Low noise with only 70 dBA average
- Evo EEvents are semi-mobile, making them easy to roll out for housekeeping and maintenance
- Chef-side accessible washable stainless steel grease baffle filter, mesh particulate filter, electrostatic precipitator (ESP) and disposable activated charcoal filter
- Charcoal filter recommended replacement interval - 2 weeks
- Available in 208 or 240 V, 1-phase (Must be specified at order)
- 8-foot cord and molded NEMA 6-50P
- Units ship with one complete set of 4 filters, grill surface cleaning kit, 2 stainless steel spatulas, grill scraper, and owner's manual
- Limited one-year parts and labor warranty

AVAILABLE PARTS

- 10-0150-EVT-34 34" Caster Kit - ADA Compliant
- 10-0150-EVT-36 36" Caster Kit - Standard
- 10-0150-EVT-FMS Stainless Steel Surround
- 13-0200-EVT Electrostatic Precipitator (ESP)
- 13-0210-EVT Stainless Steel Grease Baffle Filter
- 13-0220-EVT Aluminum Mesh Pre-Filter
- 13-0230-EVT Replaceable Charcoal Filter
- 20-EVT-1000 Recommended Spare Parts Kit

CERTIFICATIONS



UL710B LISTED



Evo America, LLC 20360 SW Avery Ct., Tualatin, OR 97062

Ph 503-626-1802 • Fax 503-213-5869 • evoamerica.com • sales@evoamerica.com

Evo is protected under U.S. Patents 9,897,328, 9,869,474, 10,139,113, 9,903,595, 10,842,540, 7,825,353 and U.S. Patents Pending.

NOTE: Due to ongoing product improvement, specifications are subject to change without notice and are not intended for installation purposes.

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Evo® EVent® 48E - Electric Cooktop in Ventless Recirculating Ventilation System

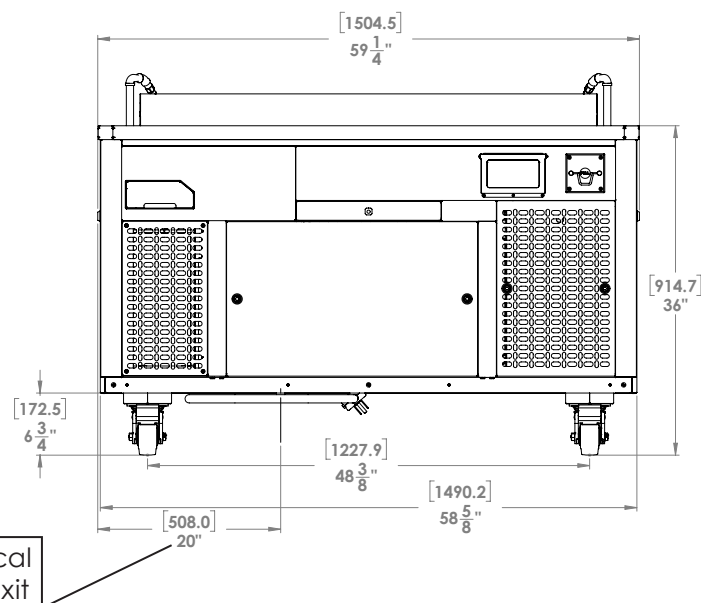
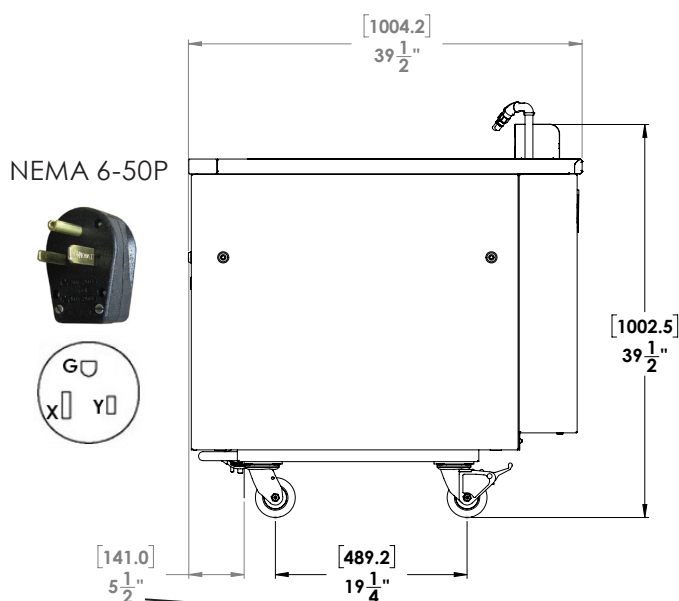
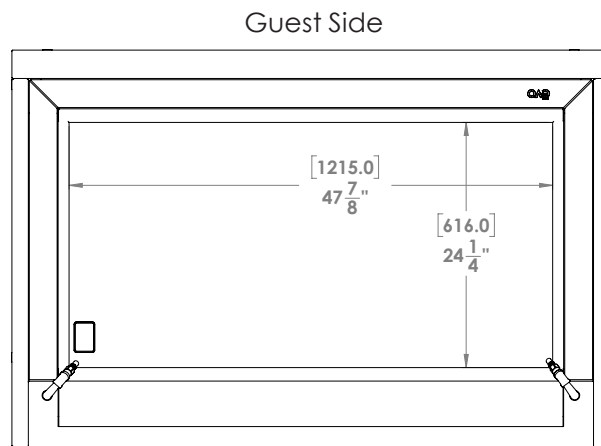
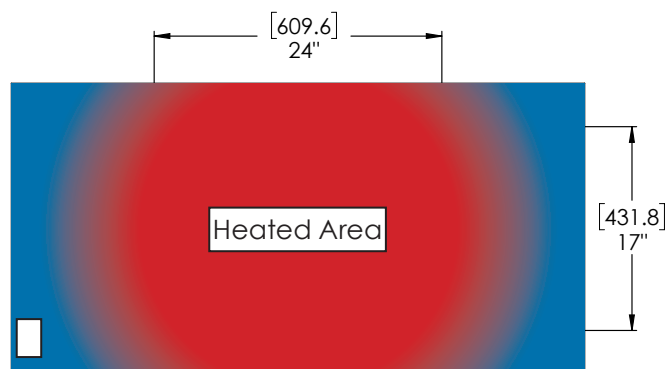
Model #: 10-0148-EVT

NOTE: Specifications are subject to change without notice.

ENVIRONMENTAL SPECIAL NOTICE: The ventilation system is designed to eliminate grease laden vapor & smoke and reduce odor but not eliminate odors. Air exchange at the installation site must comply with requirements of the local jurisdictional authority. To ensure dilution of odor buildup, minimum recommendation is 70 to 140 cubic feet (CFM) of fresh air per minute both in and out of the cooking area.

MINIMUM CLEARANCE FROM UNIT TO NEAREST COMBUSTIBLE SURFACE (UNIT MUST BE SERVICEABLE FROM ALL SIDES)

	Back (Guest)	Side	Front (Chef)	Top (Minimum Ceiling)
Inches	0"	0"	36" recommended 24" minimum	96" minimum ceiling height A.F.F (Above Finish Floor)
(MM)	(0)	(0)	(914) recommended (610) minimum	(2438) minimum ceiling height A.F.F (Above Finish Floor)



Model	Cooking Surface	Chassis Dimensions			Voltage & Phase	AMP Draw	Max Breaker	Plug Type	Weight (Ship)
		H	W	D					
10-0148-EVT	1152 Square Inches	36" or 34" 914mm 864mm	59.25" 1504mm	39.5" 1004mm	208 or 240V 1 Phase 60 Hz	32 AMPS	40 AMP (Dedicated)	NEMA 6-50P	857 lbs 388 kg (1235 lbs) (560 kg)

Evo America, LLC 20360 SW Avery Ct., Tualatin, OR 97062

Ph 503-626-1802 • Fax 503-213-5869 • evoamerica.com • sales@evoamerica.com

Evo is protected under U.S. Patents 9,897,328, 9,869,474, 10,139,113, 9,903,595, 10,842,540, 7,825,353 and U.S. Patents Pending.

Due to periodic changes in design, procedures, methods, regulations and policies, the specifications contained in this sheet are subject to change without notice. While Evo exercises good faith efforts to provide accurate information, we are not responsible for errors or omissions in information provided or conclusions reached as a result of using the specifications. By using the information provided, the user assumes all risks in connection with such use.

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Evo® EVent® 48E - Electric Cooktop in Ventless Recirculating Ventilation System

Model #: 10-0148-EVT

> DESIGN & INSTALLATION CONSIDERATIONS

Positioning the Unit – Clearance

- Evo EVent® arrives palletized & strapped in a heavy corrugated shipping carton. Once unpacked, it is important to have adequate clearance to move and position the unit in place. Allow minimum of 42" (1066.8mm) opening into the space or building to place unit inside. If not possible, unit can be rigged, lifted off its casters and rolled to its back side (Guest Side, see page 2). All loose components and large access panels removed to allow for smaller door clearances.
- If EVent® is installed into a cart or cabinet, the chef's side (touchscreen control, fire pull station, inlet aperture) should be facing out, accessible to cooking staff and unobstructed.

Electrical Outlet & Fire Alarm Placement Clearances

- Unit is equipped with factory installed cord and plug. If final electrical connection is located on floor, the receptacle needs to be flush with the final floor finish to allow unit to roll easily over plug. If unit is hard wired, flexible conduit with adequate length will need to be installed to allow for housekeeping.
- If building fire alarm is required, the above considerations apply.

Sneeze Guard Installation

- Allow a minimum 1" (25.4mm) air space from counter to bottom of glass for creation of an "air curtain". 4" (101.6mm) additional clearance from wall to unit if guest side is installed against wall.

Ventilation Considerations

- The HVAC system plays a large part in the efficiency of the Evo EVent® unit. The HVAC system should be designed to allow adequate cooling load for the dining space, while minimizing the velocity of air exiting the diffusers.
- If velocity is unavoidable, diffusers should be positioned to direct air away from the Evo EVent® cooking surface. Air blowing across the cooking surface will inhibit the designed capture of smoke and grease laden vapor.
- A minimum of 70 cubic feet of fresh air per minute is required both in and out of cooking area to ensure the dilution of cooking aromas. Dedicated Make-up Air unit not required. Please consult your HVAC contractor.

Acoustic Considerations – Dining Space

- Although Evo EVent® with its integrated ventilation system brings customers closer to the cooking experience by eliminating the need for noisy ventilation hoods, certain surfaces can reflect, rather than absorb ambient noise. If hard surface finishes (i.e. stone, glass) are used throughout the space, softer surfaces may need to be introduced to absorb reflecting sounds and noise.


Evo America, LLC 20360 SW Avery Ct., Tualatin, OR 97062

Ph 503-626-1802 • Fax 503-213-5869 • evoamerica.com • sales@evoamerica.com

Evo is protected under U.S. Patents 9,897,328, 9,869,474, 10,139,113, 9,903,595, 10,842,540, 7,825,353 and U.S. Patents Pending.

Due to periodic changes in design, procedures, methods, regulations and policies, the specifications contained in this sheet are subject to change without notice. While Evo exercises good faith efforts to provide accurate information, we are not responsible for errors or omissions in information provided or conclusions reached as a result of using the specifications. By using the information provided, the user assumes all risks in connection with such use.

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 Evo, Inc. 8140 SW Nimbus Ave., Bldg 5 Beaverton, OR 97008 P 503-626-1802 • F 503-213-5869 www.evoamerica.com	Project: _____ Location: _____ Item #: _____ Qty: _____ Model #: _____	AIA # _____ SIS# _____	10-0148-EVT
	Model# 10-0148-EVT		
Evo® EVent™ 48E			



EVent™ 48E
 Shown with
 Wood Dining Tabletop & Trim
 10-0148-EVT
 10-0150-EVT-STD



EVent™ 48E
 Shown with
 Metal Surround & 36" Casters
 10-0148-EVT
 10-0150-EVT-FMS
 10-0150-36

SHORT FORM SPECIFICATIONS:

The Evo EVent™ 48E is an electrically controlled 24" (610mm) x 48" (1219mm) rectangular steel teppan style cooktop in an integrated downdraft ventilation base. Four independent heaters heat a programmable cooking zone with variable temperatures ranging from 100°F to 550°F (38°C to 288°C). A stainless steel high velocity CFM downdraft filtration system provides full containment and capture from the intake aperture located on the chef-side adjacent the cooking surface, and a discharge duct on the chef-side returns clean filtered air. The filtration system is fully welded stainless steel and utilizes a washable stainless steel grease pre-filter, a washable electrostatic precipitator filter cartridge, and a final stage replaceable activated charcoal filter. A self-contained fire suppression system with cross-pattern nozzles provide a continuous zone of fire protection.

Base Model Data

Model	Cook Surface	Voltage	Amps	Average AMP Draw
10-0148-EVT	24" x 48" 1152 square Inches	208V-220V 60Hz, 1-Phase	40 AMP	32 AMPS Maximum

Customization

Model #	Description
10-0148-EVT	Base Unit - Teppan Style Cooktop with Integrated Downdraft Ventilation and fire suppression (31" H)
Customization:	
10-0150-EVT-STD	Wood Dining Tabletop & Base Trim - Beech with Walnut Stain 17" Corner Radius
10-0150-EVT-FMS	Metal Surround - Stainless Steel Enclosure
10-0150-EVT-34	34" Height - Casters to Adjust Base Height to 34"
10-0150-EVT-36	36" Height - Casters to Adjust Base Height to 36"

Due to ongoing product improvement, specifications are subject to change without notice.

Electric Cooktop in Ductless Downdraft Ventilation Table

INDOOR USE

- 24" (610mm) x 48" (1219mm) rectangular steel Teppan style cooking surface surrounded with black granite counter top.
- Customize with wood dining table or metal surround.
- Resistive touch screen display controls cook temperature presets and filter condition monitoring.
- Variable temperatures 100°F to 550°F (38°C to 288°C).
- Electric: 208V - 220V, 40AMP, 1-Phase.
- Low noise, high efficiency CFM downdraft ventilation system with chef-side intake aperture and discharge duct.
- Chef-side accessible washable stainless steel pre-filter and washable electrostatic precipitator filter, with replaceable activated charcoal post-filter.
- Self-contained fire suppression system with nozzles in cross-pattern arrangement provide a continuous zone of protection.

Designed For Table Seating in Teppan Concept Restaurants

- Install in teppanyaki style restaurants where theatrical cooking with a self-contained ventilation cooking station is required.
- Caster wheel mounted chassis allows easy setup and placement.

Easy Operation, Easy Maintenance, Easy Cleanup

- Food service staff skill level: Intermediate.
- Cooking techniques: teppanyaki grill, flattop plancha-style grilling, sauté, sear, stir-fry, toast.
- Cook surface is durable and easy to clean.
- Ventilation filters are accessible and easy to clean with periodic maintenance schedule.
- Sealed electric heaters and electronic controls.



Approvals:

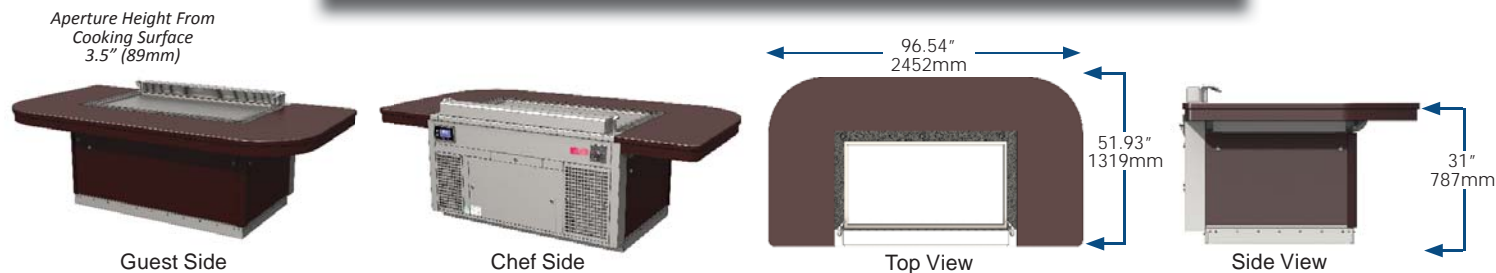




Model# 10-0148-EVT

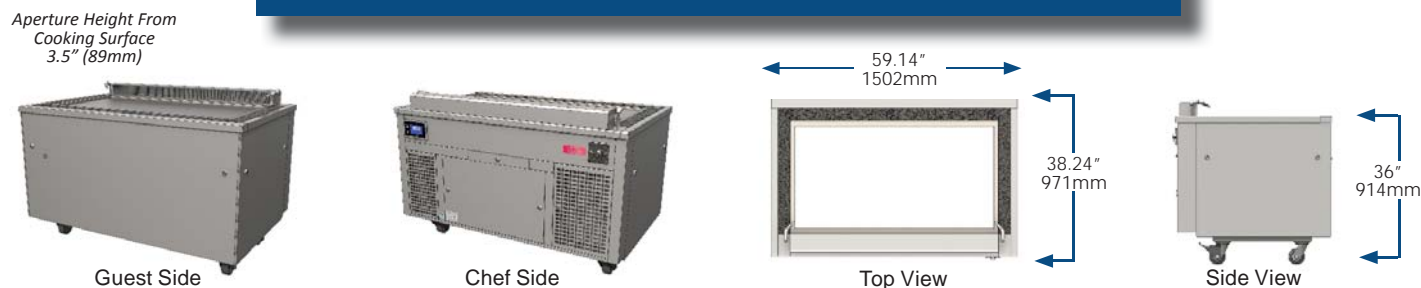
Evo® EVent™ 48E

Base Model with Wood Dining Tabletop & Trim:



Model #s For this Configuration	Cook Surface	Dimensions			Voltage	Amps	Average AMP Draw	Net Weight	Ship Weight
		H	W	D					
10-0148-EVT 10-0150-EVT-STD	24" x 48" 1152 square Inches	31" 787mm	96.54" 2452mm	51.93" 1319mm	208V 60Hz, 1-Phase	40 AMP	32 AMPS Maximum	869 lbs 394 kg	1119 lbs 507 kg

Base Model with Metal Surround & 36" Casters:



Model #s For this Configuration	Cook Surface	Chassis Base Dimensions			Voltage	Amps	Average AMP Draw	Net Weight	Ship Weight
		H	W	D					
10-0148-EVT 10-0150-EVT-FMS 10-0150-EVT-36	24" x 48" 1152 square Inches	36" 914mm	59.14" 1502mm	38.24" 971mm	208V 60Hz, 1-Phase	40 AMP	32 AMPS Maximum	857 lbs 388 kg	1107 lbs 502 kg

INSTALLATION REQUIREMENTS

208V-220V, 40AMP, 1-Phase electrical service. Must be installed level.

ELECTRICAL CONNECTION

VOLTAGE

208V-220VAC
60Hz, 1-Phase

AMPS

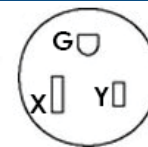
40AMP Dedicated Circuit

CONNECTION

Cord: 600V 3/C 8AWG FT-2, 8ft
Plug: NEMA 6-50P

CONNECTION LOCATION

Bottom Right (from guest side)



ACCESSORIES INCLUDED

- Professional grill surface cleaning kit (3M brand) - Includes handle cooksurface cleaning pad and screen.
- 2 stainless steel spatulas, 1 stainless steel scraper, stainless steel cleaner and protectant.
- Owner's Manual & Use and Care Instructions.

REPLACEMENT FILTER ITEM NUMBERS

- Ships with one of each filter installed. Filter replacements:
- 13-0200-EVT Electrostatic Precipitator (ESP) Cell Filter
 - 13-0210-EVT Stainless Steel Grease Filter
 - 13-0220-EVT Aluminum Pre-Filter
 - 13-0230-EVT Disposable Charcoal Filter

Evo, Inc. 8140 SW Nimbus Ave., Bldg. 5, Beaverton Oregon 97008
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Evo® is protected under U.S. Patents 6,189,530 and 6,488,022, and U.S. Patents Pending

UNDERCOUNTER FREEZER (0°F)

Model: SWF27N-U

Natural Refrigerant R-290 Model

27" Undercounter Freezer with Solid Door

Stainless steel front, top and end panels, aluminum back and interior.



Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Additional epoxy coated steel shelves
Stainless steel back	Stainless steel shelves
Drawers in lieu of doors (consult factory)**	Door locks
	Special electrical requirements (consult factory)

**Two tier: (1) 12 x 20 x 6 pan per drawer

Consult factory for other model configurations, options and accessories.



Project Name:

Model Specified:

Location:

Item No:

Quantity:

AIA #:

SIS #:

Standard Model Features

REFRIGERATION SYSTEM

Performance rated refrigeration system

Natural, environmentally safe,
high efficiency R-290 refrigerant¹

Automatic, hot gas condensate evaporator

Non-corrosive, plasticized fin evaporator coil

Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

2" non-CFC polyurethane foam insulation

Smooth, polished chrome door handle

Spring loaded, self closing door

Magnetic snap in Santoprene™ door gasket

Heavy duty, epoxy coated steel shelf

Completely enclosed, vented and removable case back

1 3/8" diameter plate casters (factory installed)

MODEL FEATURES

Field rehingeable door

Electronic control, automatic electric defrost

2" high, bottom mounted front breather air divider

¹ R-290 refrigerant meets all federal and state regulatory requirements.

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	7.4 (210 cu l)
Width, Overall (inches)	27 1/2 (699 mm)
Depth, Overall (inches) (including handle & bumpers)	32 3/16 (818 mm)
Height, Overall (inches) (including 1 3/8" plate casters)	31 13/16 (808 mm)
Shelf Area (square feet)	3.5 (0.3 sq m)
Number of Shelves	1
Number of Doors	1
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	24 1/2 (622 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4
Capacity (BTU per hour)*	1572

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	4.0 (2.8)
Defrost Amps (International)	4.8 (2.4)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	200 (91 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	35 1/2 (902 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

* Rating @ -15°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Continental
Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunkserry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

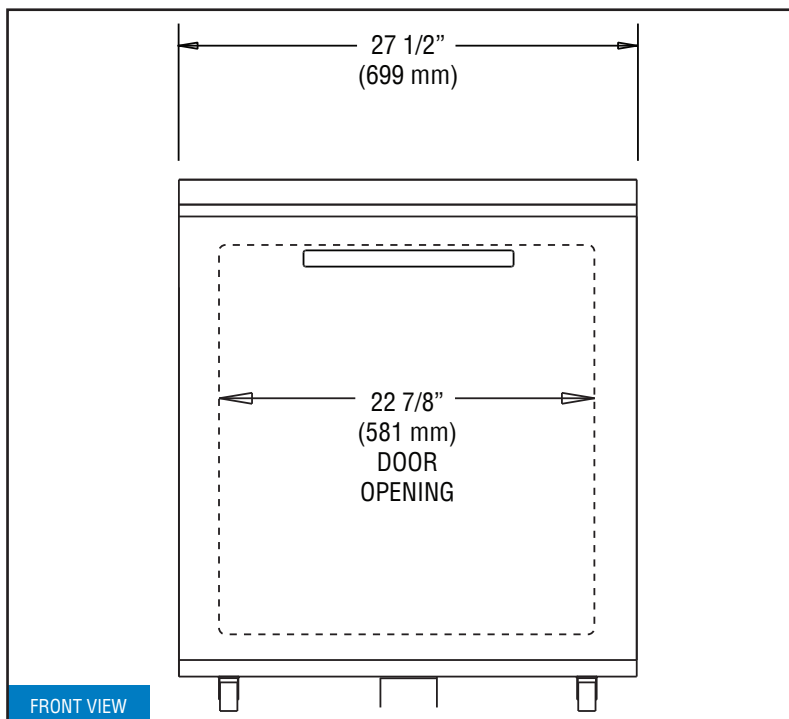
Due to our continued efforts in developing innovative products, specifications subject to change without notice.



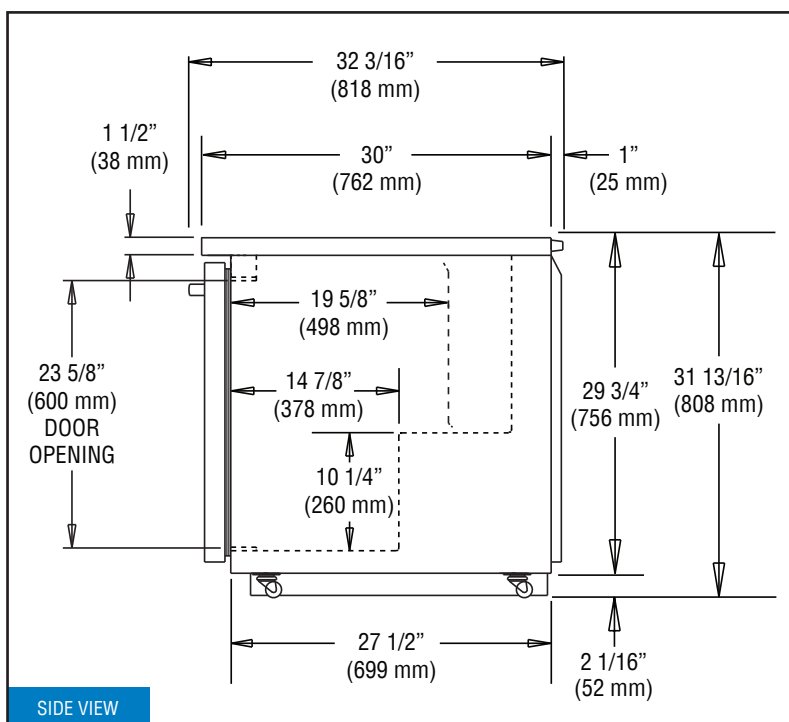
PROUDLY
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IN THE U.S.A.

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Model Plan Views



FRONT VIEW



SIDE VIEW

NOTE: For proper operation, the area under and in front of the cabinet **must** not be obstructed in any way.

REVISED: 5/16/2022



THE i5™

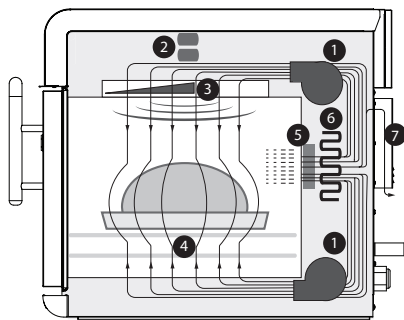


PERFORMANCE

Utilizing TurboChef's patented technology to rapidly cook food without compromising quality, the i5 oven maximizes versatility with its large cavity size and ability to cook with most any metal pan.

VENTILATION

- UL (KNLZ) listed for ventless operation.[†]
- EPA 202 test (8 hr):
 - Product: Pepperoni Pizzas
 - Results: 2.80 mg/m³
 - Ventless Requirement: <5.00 mg/m³
- Internal catalytic filtration to limit smoke, grease, and odor emissions.



1. Blower Motors
2. Microwave System
3. Stirred Impinged Air (Top) and Microwave
4. Impinged Air (Bottom)
5. Catalytic Converter
6. Impingement Heater
7. Vent Tube Catalyst

Project _____

Item No. _____

Quantity _____

EXTERIOR CONSTRUCTION

- Two-tone stainless steel front, top and sides
- 304 stainless steel removable grease collection pan
- Ergonomic door handle
- Rubber seal for surface mounting
- Side hand grips for lifting

INTERIOR CONSTRUCTION

- 304 stainless steel
- Fully insulated cook chamber
- Removable rack with dual setting option
- Top and bottom jetplates

STANDARD FEATURES

- Integral recirculating catalytic converter for UL (KNLZ) listed ventless operation
- Independently-controlled dual motors for vertically-recirculated air impingement
- Top-launched microwave system
- Stirrer to help ensure even distribution of air and microwave
- Variable rack positioning
- External air filtration
- Smart menu system capable of storing up to 200 recipes
- Flash software updates via smart card
- Single or multiple-temperature interface
- Smart Voltage Sensor Technology* (U.S. only)
- Vent catalyst to further limit emissions
- Built-in self-diagnostics for monitoring oven components and performance
- Stackable (requires stacking stand)
- Field-configurable for single or 3-phase operation
- Includes plug and cord (6 ft. nominal)
- Warranty – 1 year parts and labor

COMES WITH STANDARD ACCESSORIES

- 1 Aluminum Paddle (NGC-1478)
- 1 Bottle Oven Cleaner (103180)
- 1 Bottle Oven Guard (103181)
- 2 Trigger Sprayers (103182)
- 2 PTFE Baskets (NGC-1331)



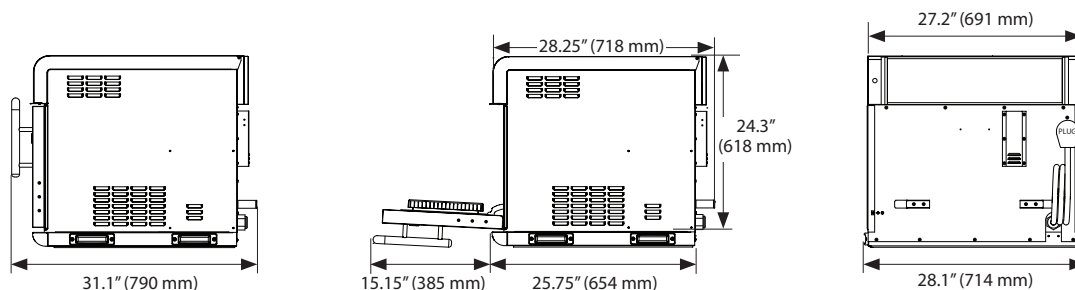
This product conforms to the ventilation recommendations set forth by NFPA96 using EPA202 test method.

* Smart Voltage Sensor Technology does not compensate for lack of or over voltage situations. It is the responsibility of the owner to supply voltage to the unit according to the specifications on the back of this sheet.

[†] Ventless certification is for all food items except for foods classified as "fatty raw proteins." Such foods include bone-in, skin-on chicken, raw hamburger meat, raw bacon, raw sausage, steaks, etc. If cooking these types of foods, consult local HVAC codes and authorities to ensure compliance with ventilation requirements.

Ultimate ventless allowance is dependent upon AHJ approval, as some jurisdictions may not recognize the UL certification or application. If you have questions regarding ventless certifications or local codes please email ventless.help@turbochef.com


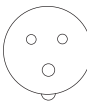
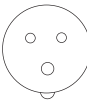
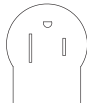

TurboChef reserves the right to make substitutions of components or change specifications without prior notice.



DIMENSIONS

Single Units		
Height	24.3"	618 mm
Width	28.1"	714 mm
Depth	28.25"	718 mm
Weight	275 lbs.	125 kg
Cook Chamber		
Height	10"	254 mm
Width	24"	610 mm
Depth (Door Open / Closed)	16" / 14"	406 mm / 356 mm
Volume	2.2 cu.ft.	62 liters
Wall Clearance (Oven not intended for built-in installation)		
Top	19"	483 mm
Sides	2"	51 mm

ELECTRICAL SPECIFICATIONS-SINGLE PHASE









i5 US Model (I5-9500-1) - United States		 NEMA 6-50P
Voltage	208/240 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	48 amp (50 amp)	
Max Input	9500/11 500 watts	
i5 UK Model (I5-9500-2-UK) - United Kingdom		 IEC 309, 3-pin
Voltage	230 VAC	
Frequency	50 Hz	
Current (Max Circuit Requirement)	48 amp (60 amp)	
Max Input	10000 watts	
i5 BK Model (I5-9500-6-BK) - Brazil		 IEC 309, 3-pin
Voltage	220 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	48 amp (50 amp)	
Max Input	10000 watts	
i5 LA Model (I5-9500-7-LA) - Latin America		 NEMA 6-50P
Voltage	220 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	48 amp (50 amp)	
Max Input	10000 watts	
i5 JK Model - 50 Hz (I5-9500-8-JK) - Japan 60 Hz (I5-9500-10-JK) - Japan		 NEMA L6-50, PSE, 3-blade
Voltage	200 VAC	
Frequency	50 Hz or 60 Hz	
Current (Max Circuit Requirement)	46 amp (50 amp)	
Max Input	9000 watts	

ELECTRICAL SPECIFICATIONS-MULTI PHASE

i5 DL Model (I5-9500-14-DL) - United States		
Voltage	208/240 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	30 amp (30 amp)	
Max Input	9500/11500 watts	

TurboChef recommends installing a type D circuit breaker for all installations.

TurboChef reserves the right to substitute components or change specifications without notice.

i5 ED Model (I5-9500-3-ED) - International		 IEC 309, 4-pin
Voltage	230 VAC	
Frequency	50 Hz	
Current (Max Circuit Requirement)	28 amp (32 amp)	
Max Input	10000 watts	
i5 EW Model (I5-9500-4-EW) - International		 IEC 309, 5-pin
Voltage	400 VAC	
Frequency	50 Hz	
Current (Max Circuit Requirement)	19 amp (20 amp)	
Max Input	10000 watts	
i5 AU Model (I5-9500-5-AU) - Australia		 Clipsal, 5-pin
Voltage	400 VAC	
Frequency	50 Hz	
Current (Max Circuit Requirement)	19 amp (20 amp)	
Max Input	10000 watts	
i5 JD Model - 50 Hz (I5-9500-9-JD) - Japan 60 Hz (I5-9500-11-JD) - Japan		 NEMA L6-50, PSE 4-blade
Voltage	200 VAC	
Frequency	50 Hz or 60 Hz	
Current (Max Circuit Requirement)	25 amp (30 amp)	
Max Input	10000 watts	
i5 KW Model (I5-9500-12-KW) - Middle East & Korea		 IEC 309, 5-pin
Voltage	400 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	19 amp (20 amp)	
Max Input	10000 watts	
i5 SD Model (I5-9500-13-SD) - Middle East & Korea		 IEC 309, 4-pin
Voltage	230 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	28 amp (30 amp)	
Max Input	10000 watts	
i5 LD Model (I5-9500-15-LD) - Latin America		 NEMA 15-30P
Voltage	220 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	28 amp (30 amp)	
Max Input	10000 watts	
i5 BD Model (i5-9500-16-BD) - Brazil		 IEC 309, 4-pin
Voltage	220 VAC	
Frequency	60 Hz	
Current (Max Circuit Requirement)	28 amp (30 amp)	
Max Input	10000 watts	

SHIPPING INFORMATION

U.S.: All ovens shipped within the U.S. are packaged in a double-wall corrugated box banded to a wooden skid.

International: All International ovens shipped via Air or Less than Container Loads are packaged in wooden crates.

Box size: 31" x 32" x 33" (787 mm x 813 mm x 838 mm)

Crate size: 40"x 36" x 35" (1016 mm x 914 mm x 889 mm)

Item class: 110 NMFC #26710 HS code 8419.81

Appx. boxed weight: 330 lb. (150 kg) / Appx. crated weight: 410 lb. (186 kg)

Minimum entry clearance required for box: 31.5" (800 mm)

Minimum entry clearance required for crate: 35.5" (902 mm)

WARING® COMMERCIAL PANINI GRILLS**Features**

- Combination flat and ribbed cast-iron plates
- Brushed stainless steel body and removable drip tray
- Hinged, auto-balancing top plate to suit foods up to 3" thick
- Adjustable thermostat to 570°F
- Power and ready indicator lights
- Heat-resistant handles
- Limited One Year Warranty



Italian-Style Dual Surface Panini Grills

WDG250/WDG250C/WDG300**WDG300****WDG250 & WDG250C**



Italian-Style Dual Surface Panini Grills



WDG250/WDG250C/WDG300

Specifications

Item	Electrical	Plug-Type	Listings	Dimensions (H" x W" x D")	Cooking Surface	Warranty
WDG250	120 Volt, 15A	NEMA 5-15P 	UL, NSF	9.5" x 17.5" x 16"	14.5" x 11"	Limited 1 Year
WDG250C	120 Volt, 15A	NEMA 5-20P 	cUL, NSF	9.5" x 17.5" x 16"	14.5" x 11"	Limited 1 Year
WDG300	240 Volt, 13A	NEMA 6-20P 	UL, NSF	9.25" x 15.5" x 18.75"	17" x 9.25"	Limited 1 Year

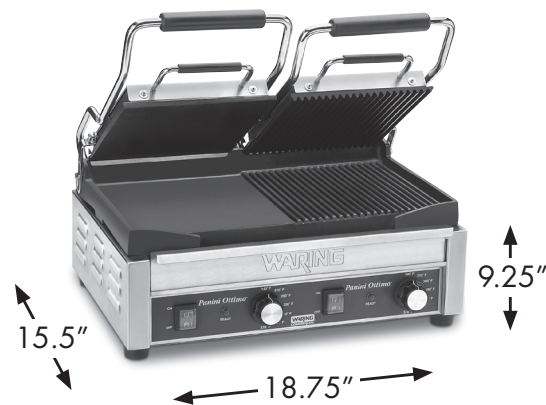
Ordering Information

Description	Catalog #	Std Pkg.	Ship Wt. (lbs.)	Cubic Feet	UPC Code
Ribbed Top Plate/Flat Bottom Plate Grill	WDG250	1	76.7 lbs.	3.74	040072008269
Ribbed Top Plate/Flat Bottom Plate Grill	WDG250C	1	76.7 lbs.	3.74	040072009129
Half Flat Plates/Half Ribbed Plates Grill	WDG300	1	90 lbs.	3.56	040072008276

WDG250 & WDG250C



WDG300



Waring Commercial • 314 Ella T. Grasso Ave. • Torrington • Connecticut 06790
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07WC30098
PG-21425



SlimJim®

Slim Jim® Under-Counter Containers are a purpose-built solution for space-efficient waste disposal under the counter.

Features and Benefits:

- Large angled opening provides 2x more access under the counter than traditional slim containers*
- Integrated venting channels make removing liners 80% easier, improving productivity and reducing the risk of worker injury
- Bag cinches secure liners around the rim of the container and allow for quick, knot-free liner changes
- Rim and base handles improve grip and control while lifting and emptying full containers
- Reinforced rim maintains structural integrity to resist crushing

Colors available:

Gray, Black, Brown, Beige, Blue, Green

Material Composition:

Injection-molded with high-quality resin

Compatibility:

13-Gallon Slim Jim® Under-Counter Containers:

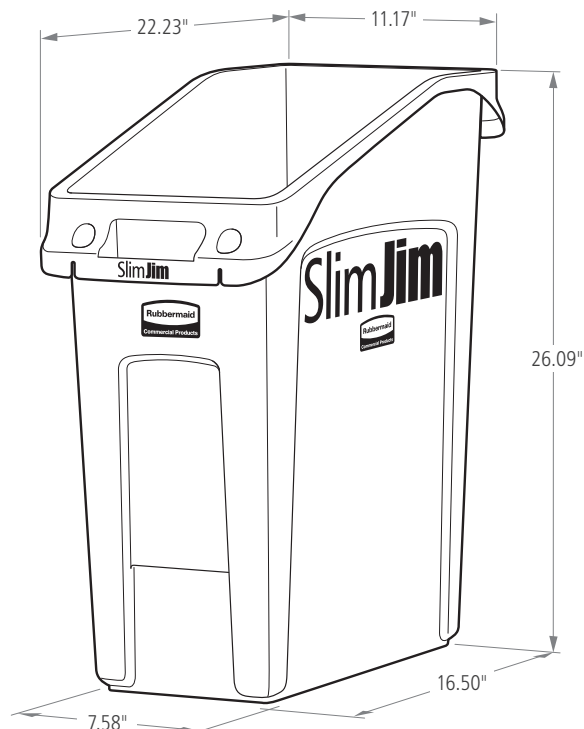
- Slim Jim® Stainless Steel Dollies
- Intuitive Recycling Label Kit – 2018391

23-Gallon Slim Jim® Under-Counter Containers:

- Intuitive Recycling Label Kit – 197789

*Compared to 23-Gallon Vented Slim Jim® containers

SLIM JIM® UNDER-COUNTER CONTAINERS



13-Gallon Slim Jim® Under-Counter Container



23-Gallon Slim Jim® Under-Counter Container

SLIM JIM® UNDER-COUNTER CONTAINERS

SKU #	DESCRIPTION	COLOR	CAPACITY		LENGTH		WIDTH		HEIGHT		PACK SIZE
			GAL	L	IN	MM	IN	MM	IN	MM	
2026695	SLIM JIM® UNDER-COUNTER CONTAINER	GRAY	13	49	22.23	564.59	11.17	283.69	26.09	662.76	4
2026696	SLIM JIM® UNDER-COUNTER CONTAINER	BLACK	13	49	22.23	564.59	11.17	283.69	26.09	662.76	4
2026697	SLIM JIM® UNDER-COUNTER CONTAINER	BROWN	13	49	22.23	564.59	11.17	283.69	26.09	662.76	4
2026698	SLIM JIM® UNDER-COUNTER CONTAINER	BEIGE	13	49	22.23	564.59	11.17	283.69	26.09	662.76	4
2026699	SLIM JIM® UNDER-COUNTER CONTAINER	BLUE	13	49	22.23	564.59	11.17	283.69	26.09	662.76	4
2026700	SLIM JIM® UNDER-COUNTER CONTAINER	GREEN	13	49	22.23	564.59	11.17	283.69	26.09	662.76	4
2026721	SLIM JIM® UNDER-COUNTER CONTAINER	GRAY	23	87	22.06	560.22	15.80	401.22	30.00	762.00	4
2026722	SLIM JIM® UNDER-COUNTER CONTAINER	BLACK	23	87	22.06	560.22	15.80	401.22	30.00	762.00	4
2026723	SLIM JIM® UNDER-COUNTER CONTAINER	BROWN	23	87	22.06	560.22	15.80	401.22	30.00	762.00	4
2026724	SLIM JIM® UNDER-COUNTER CONTAINER	BEIGE	23	87	22.06	560.22	15.80	401.22	30.00	762.00	4
2026725	SLIM JIM® UNDER-COUNTER CONTAINER	BLUE	23	87	22.06	560.22	15.80	401.22	30.00	762.00	4
2026726	SLIM JIM® UNDER-COUNTER CONTAINER	GREEN	23	87	22.06	560.22	15.80	401.22	30.00	762.00	4



Project:

Item Number:

Quantity:

O431-12F SOFT SERVE PRESSURE-FED TWIN TWIST FLOOR MACHINES



DESCRIPTION

Slim, twin twist, floor model soft serve/frozen yogurt pressure freezer with mix storage refrigerated cabinet. Maintains high production capacity in high temperature conditions. Ideal choice for locations where space is an issue.



Every machine includes Stoelting's White Glove Service. One call does it all – customer service, technical service, parts or warranty information, installation, startup, sales, on-site service dispatch and much more. Available 24 hours a day, seven days a week year-round.

Continuous research leads to ongoing product improvements; therefore, these specifications are subject to change without notice and should not be used as installation specifications.

ITEMS

- ☐ **O431-38I2F** Air cooled, single phase
- ☐ **O431-309I2F** Air cooled, three phase
- ☐ **O431-18I2F** Water cooled, single phase
- ☐ **O431-109I2F** Water cooled, three phase

ACCESSORIES & OPTIONS

- ☐ **2208100** Stainless Steel Bag Adapter

FEATURES

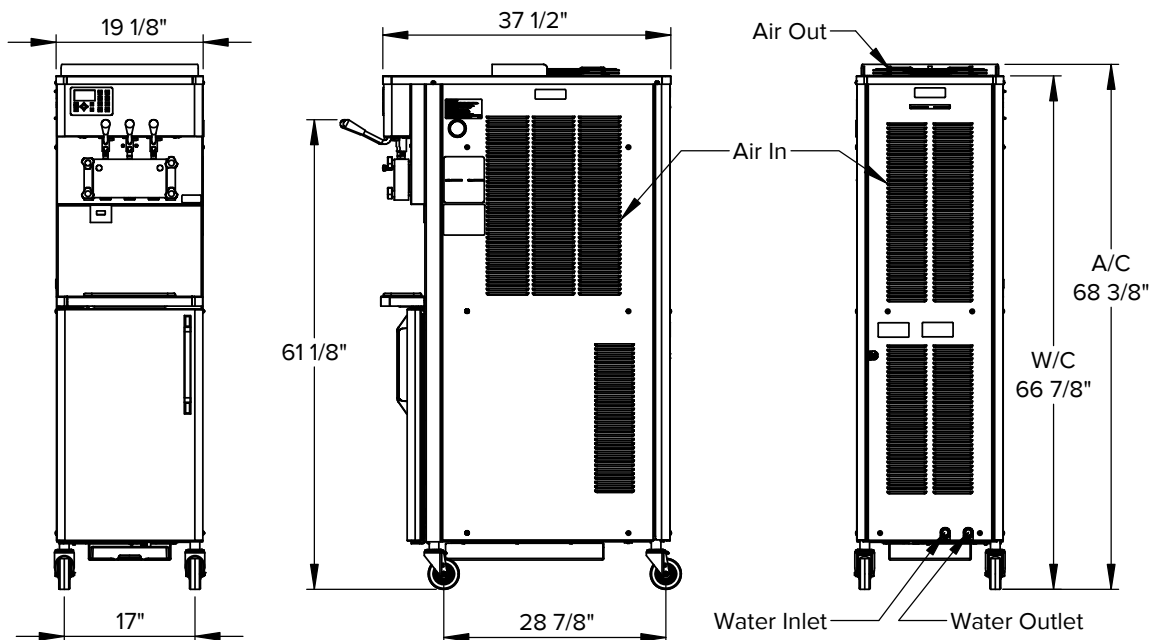
- NSF approved food grade plastic blades provide quiet operation and superior durability.
- Simplified design for quick assembly after cleaning.
- Adjust the dispense rate to meet your requirements.
- Clear door displays circulating product for merchandising appeal.
- Efficient freezing cylinder and auger design delivers a consistent uniform product with small ice crystals and a quick recovery time.
- Highly efficient auger design gently folds the entire contents of the freezing cylinder, delivering a thick, smooth, and creamy product.
- Self-closing spigot eliminates waste and ensures precise portion control.
- Pump approved for clean-in-place, reducing cleaning time and labor requirements.
- Compact floor unit design saves valuable floor space.
- Mix containers in the refrigerated storage cabinet safely hold up to 11 gallons of mix, providing enough product during peak times and reducing the frequent refills.
- Long-wearing parts offer lower preventative maintenance costs.

IntelliTec2™ Control

- Programmable and configurable through multi-line graphics display.
- Upload firmware and download statistics through a USB connection.
- Performance and error logs provide data to maximize profitability.
- Senses product consistency or temperature to customize for a wide variety of mixes.
- Standby and sleep modes conserve energy and automatically defrost product, maintaining small ice crystals and delivering a superior mouthfeel.

Approvals

Date

O431-I2F SOFT SERVE PRESSURE-FED TWIN TWIST FLOOR MACHINES**DIMENSIONS**Height dimensions may vary $\pm 1"$ due to casters**GENERAL SPECIFICATIONS**

Model	Freezing Cylinder				Cabinet				Drive Motor (hp)	Weight lb (kg)	Crated Weight lb (kg)
	Capacity gallon (L)	Btu/hr	Refrigerant	Charge (oz)	Capacity gallon (L)	Btu/hr	Refrigerant	Charge (oz)			
O431-I2F	Two 1 (3.8)	15,000	R-448A	A/C: 38 W/C: 28	Two 5.5 (20.8)	1,300	R-134A	8	Two 2	500 (226.8)	770 (349.3)

- Indoor use only.
- Maximum ambient temperature: 100°F (37.8°C).
- Requires one dedicated electrical circuit per barrel.
- Power cord provided.
- Air cooled units require: 3" (7.6 cm) air space at the back and sides.
- Water cooled units require: 1/2" N.P.T. water and drain fittings. Maximum water pressure of 130 psi. Minimum water flow rate of 3 GPM per barrel. Ideal EWT of 50°-70°F.
- Details on CAD Revit Symbols Libraries are available on stoelting.kclcad.com

ITEM NUMBER SPECIFICATIONS

Model Number	Cooling	Phase	Volts	Hz	Running Amps	Cord with Plug (Included)
O431-38I2F	Air	1	208-240	60	23	NEMA L6-30P
O431-309I2F		3			19	NEMA L15-30P
O431-18I2F	Water	1	208-240	60	22	NEMA L6-30P
O431-109I2F		3			18	NEMA L15-30P



Service Information
 800-319-9549 (U.S. Toll Free)
 920-894-2293 (Outside the U.S.)
www.stoeltingfoodservice.com
www.vollrath.com

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L36089 12/10/20
 Printed in USA



Hatco®/Suntec Flip Waffle Makers

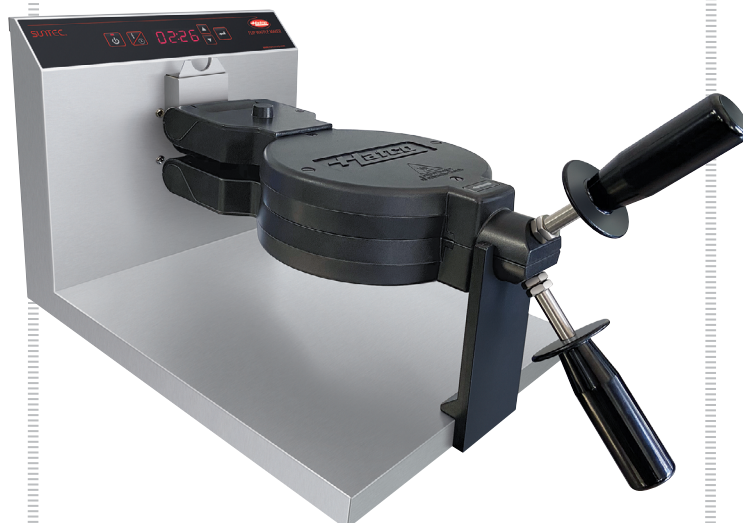
Model: FWM-1B

Hatco®/Suntec Flip Waffle Makers produce excellent, authentic 1¼" (32 mm) thick, round Belgian waffles. Their unique heating elements and 180° swivel mechanism ensure even cooking, while a thermostatic control and a programmable timer deliver consistent, repeatable results. Adjustments to temperature and time can be made to suit any batter and the unit is memory retentive so you may only have to program it once.

Standard features

- Commercial food service quality – designed for many hours of continuous use, every day
- Heavy duty stainless steel construction with Teflon® coated aluminum plates
- Simple push-button control panel features a stand-by on/off, timer/temperature toggle, higher/lower selection, and start
- Easy to see bright red LED display shows settings and countdown when cooking
- Timer starts automatically when waffle maker is closed and resets when opened, while a beeper signals the end of a cooking cycle
- Fast initial heat up time, excellent heat retention and recovery delivers high productivity
- Models shipped with NEMA 5-15P plug and cord (attached)

Project _____
Item # _____
Quantity _____



FWM-1B

*Standard Round
Belgian Plate
7" (178 mm)
diameter*



*Mini Round Waffle
Plate available as
accessory
Four 3⁵/₃₂ (80 mm)
diameter*



Accessories

- ☐ Waffle Brush - For easy cleaning
- ☐ Waffle Fork
- ☐ Mini Waffle Plate



For operation, location and safety information, please refer to the Installation and Operating Manual.



HATCO CORPORATION | P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (800) 558-0607 | (414) 671-6350



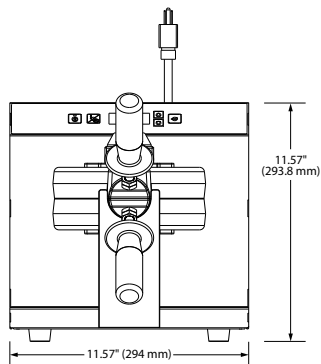
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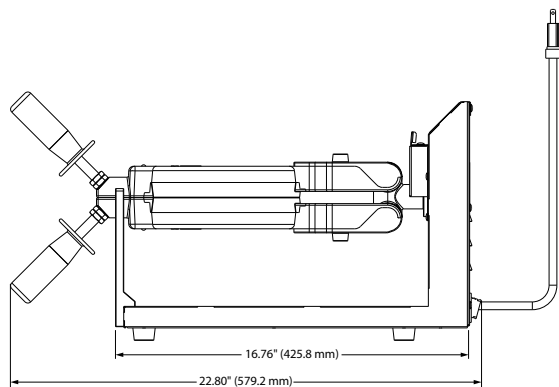
Hatco®/Suntec Flip Waffle Maker

Models: FWM-1B

FWM-1B



FRONT VIEW



SIDE VIEW

SPECIFICATIONS Flip Waffle Maker

Model	Item No.	Description	Dimensions (W x D x H)	Voltage	Watts	Amps	HZ	Plug	Ship Weight*
FWM-1B	FWM1B.515	single, round	11.57" x 22.80" x 11.57" (294 x 579 x 294 mm)	120	1350	11.3	50-60	NEMA 5-15P	26.5 lbs. (12 kg)
				100	1350	13.5	50-60		
				220-240	1235-1470	5.7-6.2	50-60		
				220	1235	5.7	60		

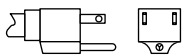
* Shipping weight includes packaging.

CORD LOCATION

Bottom center of unit.

PLUG CONFIGURATION

NEMA 5-15P



PRODUCT SPECS Waffle Makers

The Waffle Makers shall be Model ... as distributed by the Hatco Corporation, Milwaukee, WI 53234 U.S.A.

The Waffle Maker shall be rated at ... watts, ... volts, and be ... inches (millimeters) in overall width.

It shall consist of stainless steel frame and cast iron waffle plates. Waffle Makers

feature removable cast iron waffle plate for Belgian waffles. Also, an adjustable Temperature Control and a power indicator. All units are equipped with a factory attached 6' (1829 mm) power cord and plug.

Accessories shall include a waffle brush, waffle fork and mini waffle plate.

Warranty consists of 24/7 parts and service assistance (US and Canada only).

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Dairy Dispensers

Milk Dispenser 2 Valve

SKMAJ2

Specification Sheet

Features

Eco-Friendly Refrigerant

R290 refrigerant with a global warming potential (GWP) of 3

Quick-Load Milk Crates

Loading product is simple with the auto-align connector slot that ensures correct positioning — an additional platform accessory is available to accommodate bag-in-box

Minimal Waste

Angled milk crate design pushes product toward the dispense point to maximize yield

Made to Last

Stainless steel exterior with galvanized bottom reduces the risk of corrosion

Long-Lasting, Removable Gaskets

Santoprene™ gaskets last four times longer than standard gaskets

High-Density Insulation

Foamed-in-place, CFC-free polyurethane insulation provides maximum strength, rigidity, and insulation

High-Capacity

Each milk crate can hold a 3-gallon, 5-gallon, or 6-gallon bag — also accommodates a bag-in-box and manual-fill stainless steel can

Double Valve Dripless Dispense

Spring-loaded lift valves ensure dripless dispense for optimal sanitation, reduced waste, and convenient one-handed operation

Easy to Clean

The stainless steel interior with coved corners, finished edges, removable door gasket, and elevated legs make cleaning simple

Heavy-Duty, Locking Door

High-strength door with heavy-duty hinges ensure lasting performance — latch can accommodate locks and security tags



MARMON
Foodservice
Technologies

A BERKSHIRE HATHAWAY COMPANY

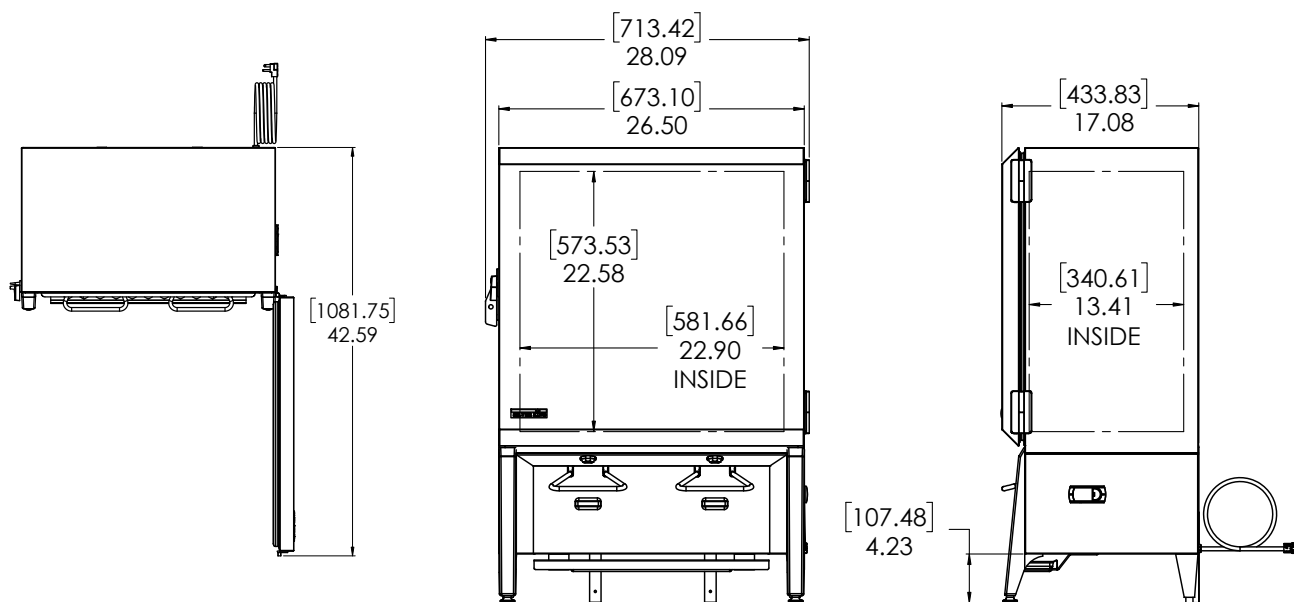


Dairy Dispensers

Milk Dispenser 2 Valve

SKMAJ2

Specification Sheet



Technical Specifications

Electrical Requirements	115v/60hz/1ph/1.6A/NEMA 5-15P Plug
Product Dimensions	17.09"W x 28.09"H x 39.48"D (43.38cm x 71.35cm x 100.28cm)
Product Weight	150lbs (68.04kg)
Shipping Dimensions	26"W x 36"H x 48"D (66.04cm x 91.44cm x 121.92cm)
Shipping Weight	160lbs (72.57kg)
Shipping Cubic Dimensions	26ft ³ (0.74Cu.M)
Temperature Range	38 to 40°F (3.3 to 4.4°C)
Refrigerant	R290
Insulation	Foamed-in-place, CFC-free polyurethane

Exterior Construction	Stainless steel exterior with galvanized bottom
Interior Construction	Stainless steel interior with coved corners and finished edges
Doors	One (1) right-hand swing with lockable latch
Valves	Two (2) spring-loaded lift valves
Crates	Two (2) milk crates (each accommodates a 3-gallon, 5-gallon, or 6-gallon bag)
Internal Capacity	12-gallons
Door Gasket	Long-lasting, removeable Santoprene™ gasket
Legs	Adjustable standard legs or adjustable shipboard legs
Certifications	ETL SAFETY, ETL SANITATION NSF 7
Warranty	1-year parts and labor, 5-year compressor (part only)

Model Number	Description
SKMAJ2-ESUS3	Majestic Milk Dispenser, 115v/60hz/1ph/1.6A, 2 valve, (2) 6-gallon crates, shipboard legs, NEMA 5-15P
SKMAJ2-ESUS4	Majestic Milk Dispenser, 115v/60hz/1ph/1.6A, 2 valve, (2) 6-gallon crates, adjustable legs, NEMA 5-15P

Accessories	Description
35904	Milk Crate for 3-Gallon, 5-Gallon, or 6-Gallon Bags
62642	3-Gallon Milk Can
60224	5-Gallon Milk Can
63959	Platform Adaptor for Bag-in-Box
20323	Milk Tubes
10314-96	Shipboard Legs

To learn more about **Silver King Milk Dispenser**, visit silverking.com



Project _____

Item # _____

Quantity _____

Pop-Up Toasters

Models: TPT-120, -208, -240, -230-4

The Hatco Pop-Up Toasters are economical, fast, dependable and versatile. These toasters are perfect for self-serve buffet areas and lighter volume restaurants, diners and cafes.

Standard features

- Evenly toasts a variety of bread products including bagels, Texas toast, waffles and English muffins
- All models have four self-centering 1.25" (32 mm) extra wide slots.
- Durable stainless steel construction
- Individual progressive color controls
- Removable crumb trays for easy cleaning
- A selector switch for single (or double) sided toasting (excluding TPT-120)
- Unit comes with 6' (1829 mm) cord with plug



Gloss Finishes – Non-standard colors are non-returnable
 – Stainless Steel standard – (TPT-120 only)
☐ Radiant Red ☐ Bold Black



IFS anti-microbial coatings use naturally-occurring, environmentally sustainable, silver ions to help inhibit the growth of microbes on the powder coated surface. See www.hatcocorp.com/antimicrobial-paint for more information.



For operation, location and safety information, please refer to the Installation and Operating Manual.



TPT-120, -208, -240



TPT-230-4 only

HATCO CORPORATION

P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (414) 671-6350



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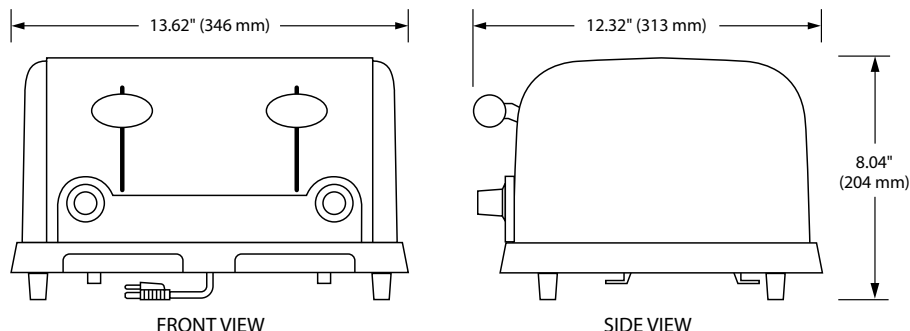
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Pop-Up Toasters

Models: TPT-120, -208, -240, -230-4



SPECIFICATIONS Pop-Up Toasters

The shaded areas contain electrical information for International models

Model	Dimensions (Width x Depth x Height)	Volts	Phase	Watts	Amps	Plug	Ship Weight*
TPT-120 (US)	13.62" x 12.32" x 8.04" (346 x 313 x 204 mm) Slot Opening: 1.25" x 5.5" x 4.5" (32 x 140 x 114 mm)	120	Single	1800	15.0	NEMA 5-15P	14 lbs. (7 kg)
TPT-120 (CAN)				1440	12.0		
TPT-208		208		2600	12.5	NEMA 6-15P†	16 lbs. (8 kg)
TPT-240		240			10.9	NEMA 6-15P	
TPT-230-4		230 (CE)			10.4	CEE 7/7 Schuko AS 3112	

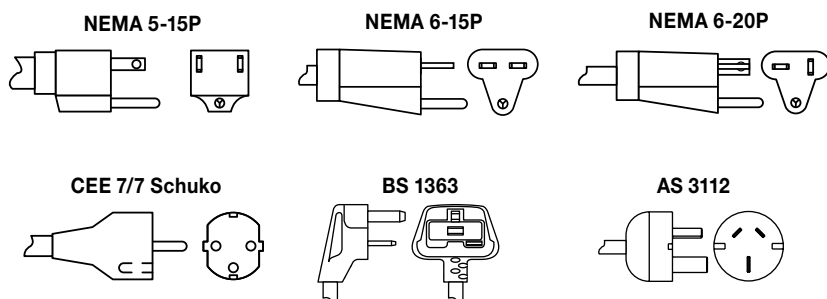
*Shipping weight includes packaging.

† Canadian models use NEMA 6-20P.

CORD LOCATION

Bottom, back center.

PLUG CONFIGURATIONS



PRODUCT SPECS Pop-Up Toasters

The Pop-Up Toaster shall be Model ... rated at ... volts, and ... watts, single phase, by the Hatco Corporation, Milwaukee, WI 53234 U.S.A.

The Toaster shall consist of a rugged stainless steel body with 4 slot openings,

removable crumb trays, resistance wire elements, and a 6' (1829 mm) cord with plug attached.

Warranty consists of 24/7 parts and service assistance (US and Canada only).

HATCO CORPORATION

P.O. Box 340500 Milwaukee, WI 53234-0500 U.S.A. | (414) 671-6350



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ENDURO 150

POST-MIX ICE DRINK DISPENSER



FEATURES

Large ice capacity - 150 lb ice capacity

Choices - Available with 6 UFB-1™ sanitary lever or push button valves

Merchandising - Highly efficient LED illuminated merchandiser utilizing a brighter, longer lasting bulb, providing a high impact visual display

Ice - Gravity ice dispensing with positive shut-off provides excellent ice targeting
Ice used to cool cold plate is separate from ice dispensed into cups

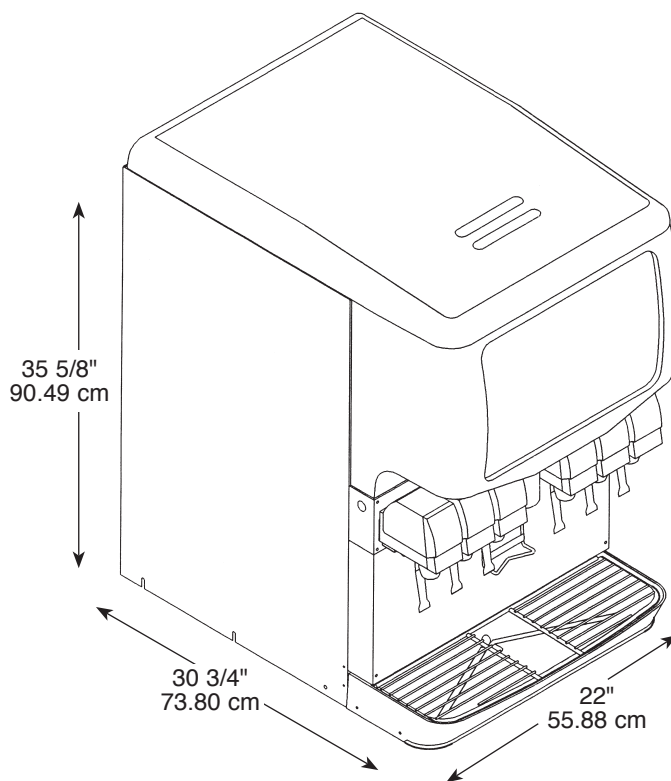
Durable - One piece ABS thermoformed plastic ice storage hopper (Durabide™ design) provides durability and ensures all ice in the hopper is dispensable

Flexible - Unit readily accepts top mount cubers with manual ice fill capability

Quality - Stainless steel cabinet

Ease of Use - Modular design allows for easy component access from the front of the unit

TotalFlex™ – easily changes from carbonated to non-carbonated



PART NUMBER	DESCRIPTION
621053405	Enduro 150 Ice Drink Dispenser with 6 UFB-1™ 2-4 oz Sanitary Lever Valves
621053404	Enduro 150 Ice Drink Dispenser with 6 UFB-1™ 2-4 oz Push Button Valve
3472	Enduro 150 Dispenser Stand - Stainless Steel: 30"H x 22"W x 30"D

* If top mounting an ice maker, an ice maker adapter kit is required. Order separately.

TECHNICAL SPECIFICATIONS

ICE STORAGE CAPACITY..... 150 lb (68.04 kg)

BEVERAGE MANIFOLDING TotalFlex

CUP CLEARANCE..... 10" (25.4 cm)

COOLING CAPACITY 10-12 oz drinks /
min @ 75°F

DRAIN CONNECTION..... 0.75" PVC (NPT) or
1" ID flexible tubing

GRAPHIC SIZE Overall:
11.4"H x 16.6"W
Viewable:
10.608"H x 16.3"W

STANDARD FEATURES..... Beverage key switch,
timed ice agitation
and 4" legs

ELECTRICAL REQUIREMENTS .. 115 V / 60 Hz / 3 Amps

SHIPPING WEIGHT..... 240 lb (108.86 kg)

AGENCY LISTINGS.....



City of Los Angeles



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IN THE U.S.A.
Ph: 800.238.3600
Fax: 800.258.0255

OUTSIDE THE U.S.A.
Ph: 763.488.8200
Email: webmaster@cornelius.com

101 Broadway Street West
Osseo, MN 55369
www.cornelius-usa.com

For more information or to place an order, contact your sales representative or authorized distributor.

JDF®-4S

Height: 33.4" Width: 15.7" Depth: 27.5"
(84.8cm) (39.9cm) (69.9cm)



- Patented High Intensity Mixing System delivers consistent quality beverages in the cup - cup after cup, from the top of the cup to the bottom of the cup
- 7" (17.8cm) cup clearance accommodates most juice containers
- Both push and hold dispense and optional single size portion control dispense available in the same dispenser
- Quick dispense with 1.0 to 1.5oz (29.6 to 44.4ml) per second flow rate
- One dispenser delivers both frozen and ambient concentrate products to maximize profitability by providing greater flexibility in product offerings
- Door lock standard
- Service friendly design makes set up and maintenance simple
- Burst Capacity: At rate of three 12 oz drink/min, 145 drinks before exceeding 41°F (75°F ambient and 75°F incoming water temp)
- Pumps and Mixes most 2+1 to 11+1 concentrates accurately and consistently, including 4+1 and 5+1 high viscosity concentrates

Agency:



Specifications

Product #: 37300.0000

Flavors: 4 Flavors

Finish: Black

Door: Un-Lit

Refrigerant: R-134A

Ice Bank: 18.00 lbs (8.165 kgs)

Dispense: Push Button

Legs: 4" Black Legs

Additional Features

Electrical & Capacity

Volts*	Amps	Watts	Cord Attached	Plug Type	8oz cups/hr 236ml cups/hr	Input H ₂ O Temp.	Phase	# Wires plus Ground	Hertz
120	6	720	Yes	NEMA 5-15P	-	60°F (15.5°C)	1	2	60

*When a BUNN is machine rated 120/208-240V, 120/208V or 120/240V, the higher voltage is the supply voltage needed to power the machine. The 120V is there to supply power to some components rated 120V in the machine, but it is not the supply voltage and would not power the machine if the machine is marked with the before mentioned ratings.

Plumbing Requirements

PSI	kPa	Fitting Supplied	Water Flow Required (GPM)
20-100	138-689	3/8" Male Flare Fitting	-

CAD Drawings

2D	Revit	KLC
●		

WARNING: This product can expose you to chemicals including Bisphenol A (BPA), which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov



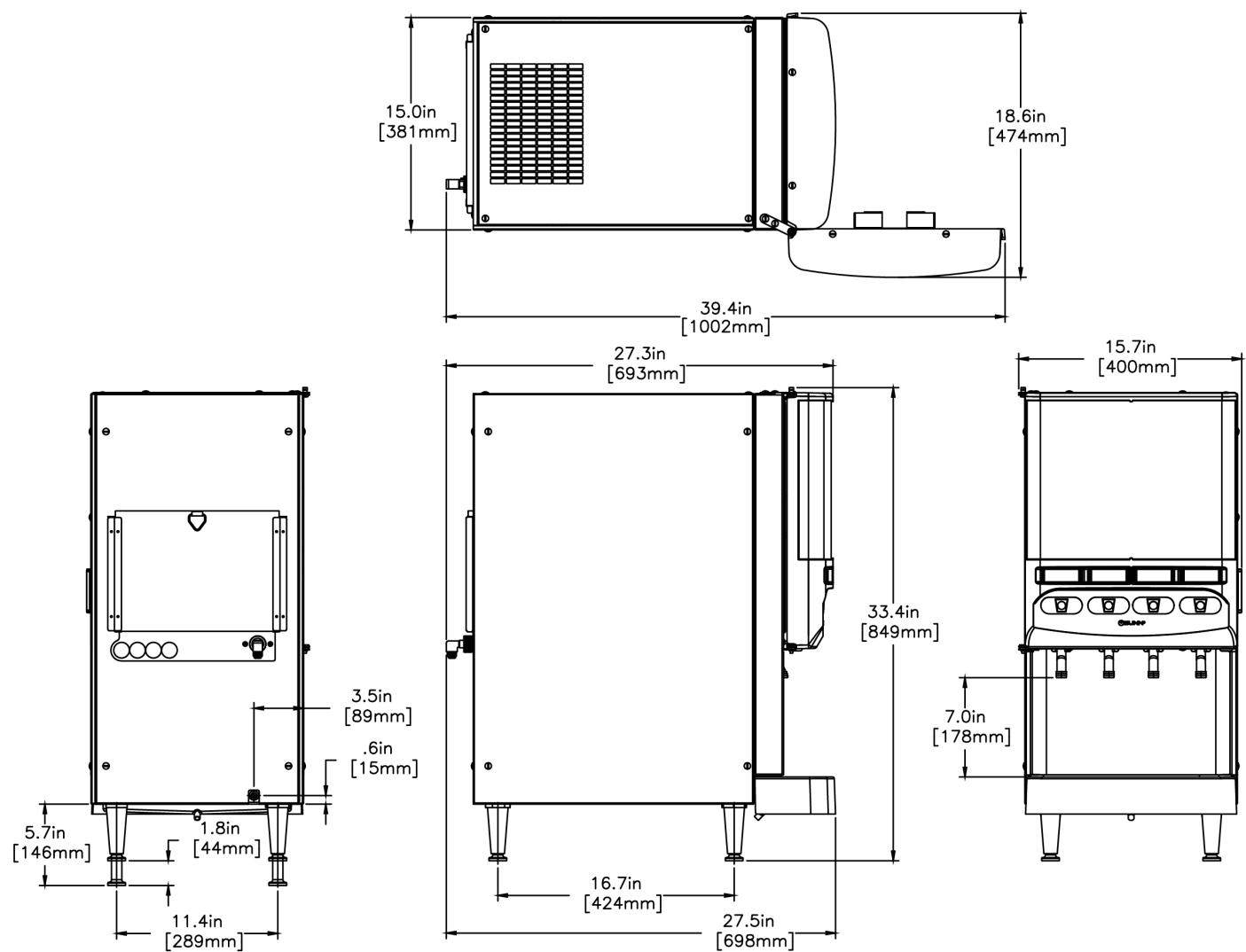
NCSU Football

BUNN® reserves the right to change specifications and product design without notice. Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment. For most current specifications and other info visit bunn.com

Foodesign Associates, Inc.

Last Updated:
04/26/2024

Page: 212



Unit				Shipping				
	Height	Width	Depth	Height	Width	Depth	Weight	Volume
English	33.4 in.	15.7 in.	27.5 in.	43.7 in.	22.8 in.	30.5 in.	142.750 lbs	17.543 ft³
Metric	84.8 cm	39.9 cm	69.9 cm	111.0 cm	57.8 cm	77.5 cm	64.751 kgs	0.497 m³

Related Products & Accessories: JDF®-4S(37300.0000)

KIT, AMBIENT CONC
CVRSN JDF-4

Product #: 33699.0001



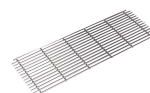
WATER FILTER,
EQHP-10

Product #: 39000.0004



CONTAINER ASSY,
REFILLABLE

Product #: 39302.0000



WIRE GRILL, DRIP TRAY
(JDF-4S)

Product #: 39613.0000

KIT, HOSE ASSY-PUMP
JDF-2S/4S

Product #: 39690.0000



TRAY, EXTENDED DRIP
JDF-4S

Product #: 40789.1000



KIT, TST 4 VALVE MECH
SWITCH

Product #: 45541.1004



KIT, TST 4 VALVE OVAL
OVERLAY

Product #: 45541.1006



SYSTEM, WQ-55(2)5

Product #: 56000.0004



SYSTEM, WEQ-10(1.5)5

Product #: 56000.0027



CARTRIDGE, WQ-55(2)5

Product #: 56000.0104



CARTRIDGE, WEQ-10
(1.5)5

Product #: 56000.0122

Serving & Holding Options: JDF®-4S(37300.0000)

Serving and Holding selections are currently unavailable. Please contact your sales representative to find out more information.



NCSU Football

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Foodesign Associates, Inc.

Last Updated:
04/26/2024


Page: 215

ICB-DV Platinum Edition, 120V

Height: 26.8" Width: 10.2" Depth: 22.1"
(68.1cm) (25.9cm) (56.1cm)



- Produce fresh cold brew in minutes with the new Cold Brew mode, enabling operators to brew an on-demand batch of concentrate or ready-to-drink cold brew quickly and consistently with operational ease
- Add Bubble Tea to the menu with the new Bubble Tea Kit (54165.1018)
- 4.3" Color Touchscreen aides in customizing recipes, brewing options and control
- The Infusion Series® Platinum Edition relies on the powerful duo of the Peak Extraction Sprayhead and SmartWAVE® technology to further enhance the uniformity of extraction and resistance to limescale buildup.
- Brews into 2.5 to 3.8L (84 to 128 oz) airpots and 3.8 to 5.7L (1 to 1.5 gallon) baseless Thermofresh servers
- BUNN Infusion Series technology allows for multiple recipes from one footprint
- Energy-saver mode reduces tank temperature during idle periods
- Electronic funnel lock prevents removal of the brew funnel until drip- through is complete
- Brew counter keeps track of how many batches are brewed
- Pre-infusion and pulse brew for maximum flavor extraction. Cold brew lockout & digital temperature control further ensure top-notch brewing
- Dual voltage adaptable (Can operate at 120V/15 amp or 120/208-240V/20 amp)
- Optional BUNNlink® remote monitoring support (kit required)

 Server(s) sold separately

Agency:



Specifications

Product #: 53300.0100

Funnel: Stainless Steel

Water Access: Plumbed

Interface: Wireless

Finish: Stainless

Additional Features

BrewWISE

Electrical & Capacity

Volts*	Amps	Watts	Cord Attached	Plug Type	8oz cups/hr 236ml cups/hr	Input H ₂ O Temp.	Phase	# Wires plus Ground	Hertz
120	14	1700	Yes	NEMA 5-15P	82	60°F (15.5°C)	1	2	60
120/208	14	2900	-	N/A	136	60°F (15.5°C)	1	3	60
120/240	17	4050	-	N/A	181	60°F (15.5°C)	1	3	60


*When a BUNN is machine rated 120/208-240V, 120/208V or 120/240V, the higher voltage is the supply voltage needed to power the machine. The 120V is there to supply power to some components rated 120V in the machine, but it is not the supply voltage and would not power the machine if the machine is marked with the before mentioned ratings.

Plumbing Requirements

PSI	kPa	Fitting Supplied	Water Flow Required (GPM)
20-90	138-621	3/8" Male Flare Fitting	1.00

CAD Drawings

2D	Revit	KLC
●		

 **WARNING:** This product can expose you to chemicals including Bisphenol A (BPA), which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov



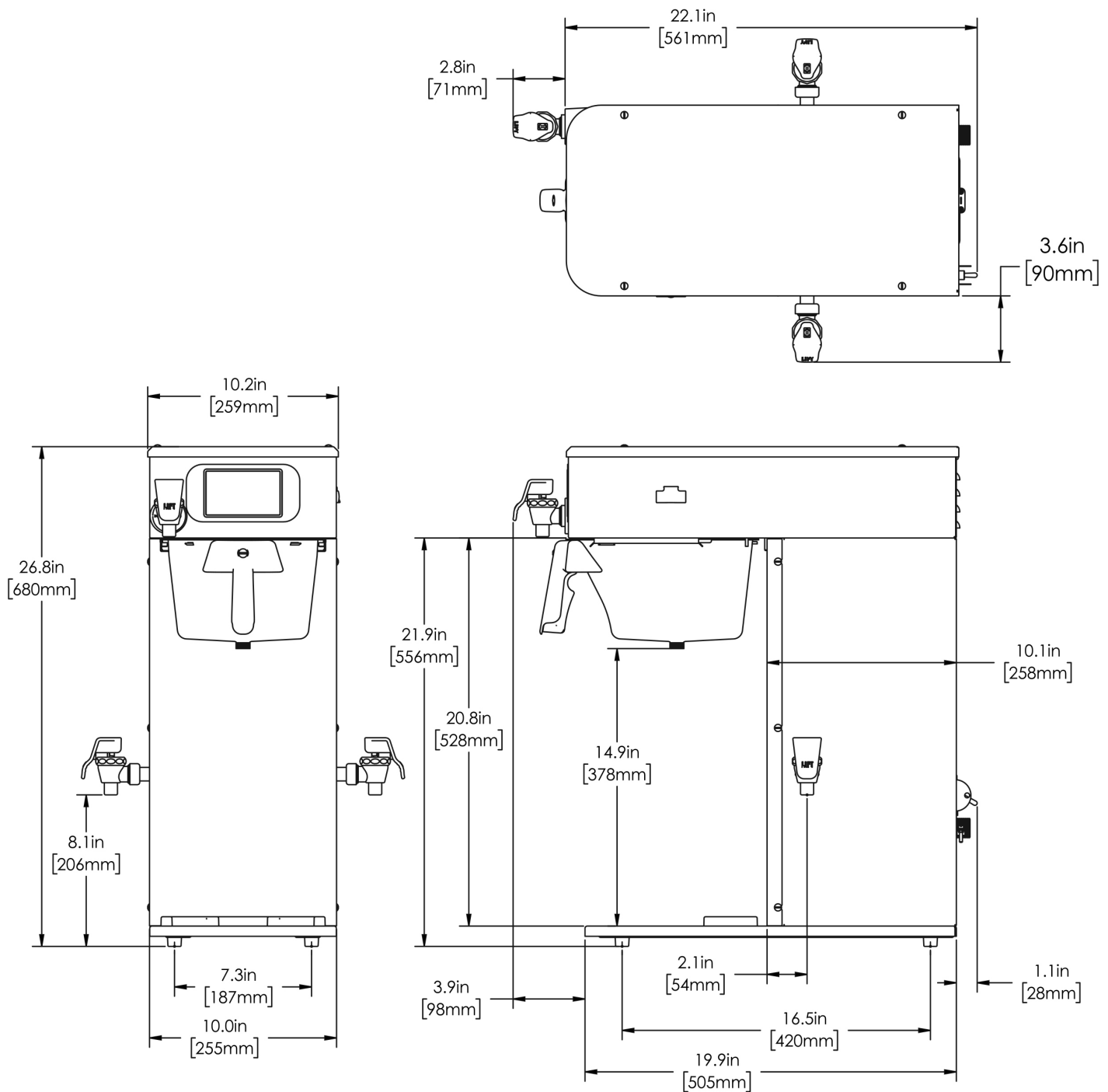
NCSU Football

BUNN® reserves the right to change specifications and product design without notice. Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment. For most current specifications and other info visit bunn.com

Foodesign Associates, Inc.

Last Updated:
04/07/2023

Page: 216



Unit				Shipping				
	Height	Width	Depth	Height	Width	Depth	Weight	Volume
English	26.8 in.	10.2 in.	22.1 in.	34.9 in.	13.3 in.	27.4 in.	53.750 lbs	7.321 ft ³
Metric	68.1 cm	25.9 cm	56.1 cm	88.6 cm	33.7 cm	69.5 cm	24.381 kgs	0.207 m ³

Related Products & Accessories: ICB-DV Platinum Edition, 120V(53300.0100)



FILTERS, GOURMET 500
500/1 50/CL

Product #: 20138.1000



WATER FILTER,
EQHP-10L

Product #: 39000.0001



WATER FILTER,
EQHP-10

Product #: 39000.0004

FUNNEL ASSY, SST
INFUSION COFFEE

Product #: 54675.0001

FUNNEL ASSY, SST
INFUSION COFFEE

Product #: 54675.0008



SYSTEM, WQ-55(2)5L

Product #: 56000.0001



SYSTEM, WQ-55(2)5

Product #: 56000.0004



SYSTEM, WEQ-10(1.5)5L

Product #: 56000.0024



SYSTEM, WEQ-10(1.5)5

Product #: 56000.0027



CARTRIDGE, WQ-55(2)5L

Product #: 56000.0101



CARTRIDGE, WQ-55(2)5

Product #: 56000.0104



CARTRIDGE, WEQ-10
(1.5)5L

Product #: 56000.0121



CARTRIDGE, WEQ-10
(1.5)5

Product #: 56000.0122

Serving & Holding Options: ICB-DV Platinum Edition, 120V(53300.0100)



AIRPOT, 2.5L GL PB
SINGLE PK

Product #:13041.0001



AIRPOT, 2.5L GL PB 6/
CASE

Product #:13041.0101



AIRPOT, 2.5L SST LA
SINGLE PK

Product #:32125.0000



AIRPOT, 2.5L SST LA 6/
CASE

Product #:32125.0100



AIRPOT, 3.0L SST LA
SINGLE PK

Product #:32130.0000



AIRPOT, 3.0L SST LA 6/
CASE

Product #:32130.0100



AIRPOT, 3.8L SST LA
SINGLE PK

Product #:36725.0000



AIRPOT, 3.8L SST LA 6/
CASE

Product #:36725.0100



STAND ASSY, TF
SERVER

Product #:39795.0003



TF SERVER, DSG2 1G
SST NOBASE

Product #:42700.0050



TF SERVER, DSG2 1G
BLK NOBASE

Product #:42700.0051



TF SERVER, 1G DSG
GEN3 NOBASE

Product #:42700.0250



TF SERVER, DSG2 1.5G
SST NOBAS

Product #:42750.0050



TF SERVER, 1G/3.8L
MECH NOBASE

Product #:44000.0050



TF SERVER, 1G/3.8L
MECH BLK NOBASE

Product #:44000.0051



TF SERVER, 1G MECH
GEN3 NOBASE

Product #:44000.0250



STAND ASSY KIT, TF
SERVER

Product #:54473.1000



Sectional Walk-In Coolers & Freezers

*A guide to design specifications,
options, & refrigeration equipment.*



1-800-24BALLY
www.ballyrefboxes.com

Proven Dependable



INDEX

Sectional Walk-In Coolers & Freezers

Design Specifications _____	2
Standard Exterior Dimensions _____	2
The Bally Speed-Lok _____	2
Bally Door Section _____	3
Door Options & Accessories _____	4
Options & Accessories _____	5

Refrigeration Equipment

Evaporators

BLP-Line, Low Profile Evaporators _____	6
BTL-Line, Center-Mount Two Way Evaporators _____	8
SmartVap II, Evaporator Control _____	8

Condensing Units

BEH-Line, Indoor/Outdoor Air-Cooled Hermetic Condensing Units _____	9
BEZ-Line, Indoor/Outdoor Air-Cooled Scroll Condensing Units _____	10
BES-Line, Outdoor Air-Cooled Semi-Hermetic Condensing Units _____	11
BQZ "Quiet" Line, Outdoor Air-Cooled Scroll Condensing Units _____	12

Packaged Refrigeration Units

PRO3 Packaged Refrigeration System _____	14
BEC-Line and BF-Line _____	15

DESIGN SPECIFICATIONS

PANEL CONSTRUCTION: Panels shall consist of foamed-in-place urethane insulation, sandwiched between interior and exterior metal skins. Edges of panels shall be tongue and groove, with Speed-Lok fastening devices foamed-in-place at the time of fabrication. Insulation shall be of non-ozone depleting urethane, U.L. Class I system, with a flame spread rating of 25 or less, with a Factory Mutual panel assembly rating. A PVC gasket located on the tongue side of panels forms an air tight seal.

PANEL SIZES: Panels are available in 4", 5" and 6" thicknesses. Vertical panel sizes are 12" x 12" corners, 11½", 17¼", 23", 34½" and 46" widths. Ceiling and floor panels are available in 23½" end panels, 11½", 17¼", 34½" and 46" widths. Panel heights are 5'10" thru 10'10"; 11'4" thru 19'4"; and 19'8" thru 27'8" in one foot increments. The maximum length for ceiling and floor panels is 11'6" for multi-span and 17'4" for indoor single span ceilings.

PANEL FINISHES: Stucco-embossed Galvalume™ steel, Stainless steel, Stucco-embossed stainless steel, Stucco-embossed aluminum, Smooth white aluminum, Smooth white galvanized steel, Stucco-embossed white galvanized steel, Stucco-embossed sand-tan galvanized steel. **FLOOR FINISHES:** Rigidized Aluminum diamond tread, Aluminum diamond tread, Rigidized stainless steel diamond tread, Galvanized steel (if floor is to be covered with tile or concrete).

FLOOR CONSTRUCTION: Standard floors support 600 pounds per square foot of evenly distributed stationary loads. Floor construction options include 4" insulated floor panels on slab, floor panels recessed (with or without tile), built-in insulated floor (with or without floor screeds). Reinforced floor panels designed for cart or pallet truck usage are available.

Standard Exterior Dimensions

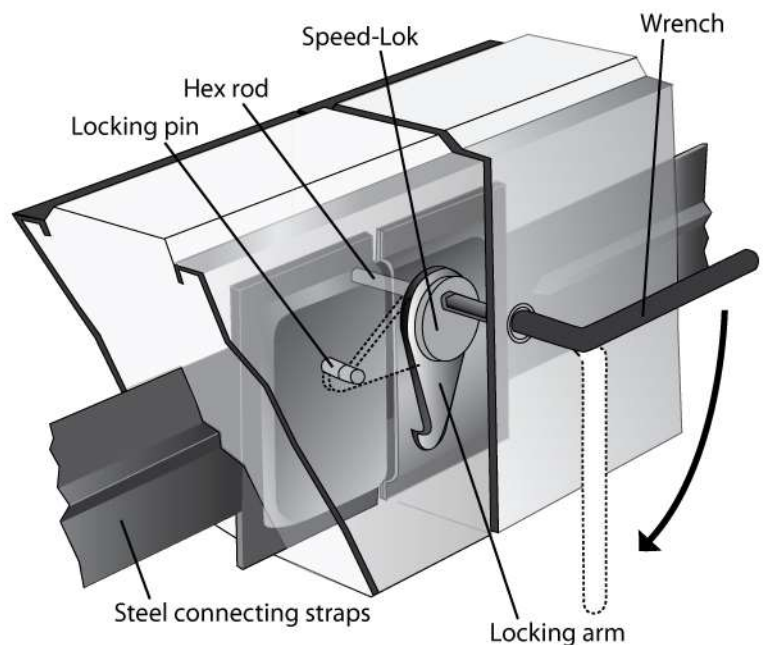
Nominal	Actual	Nominal	Actual	Nominal	Actual	Nominal	Actual	Nominal	Actual	Nominal	Actual
6'0"	5'10"	11'0"	10'7 1/2"	16'0"	15'5"	21'0"	20'2 1/2"	25'6"	24'6 1/4"	30'6"	29'3 3/4"
6'6"	6'3 3/4"	11'6"	11'1 1/4"	16'6"	15'10 3/4"	21'6"	20'8 1/4"	26'0"	25'0"	31'0"	29'9 1/2"
7'0"	6'9 1/2"	12'0"	11'7"	17'0"	16'4 1/2"	22'0"	21'2"	26'6"	25'5 3/4"	31'6"	30'3 1/4"
7'6"	7'3 1/4"	12'6"	12'3/4"	17'6"	16'10 1/4"	22'6"	21'7 3/4"	27'0"	25'11 1/2"	32'0"	30'9"
8'0"	7'9"	13'0"	12'6 1/2"	18'0"	17'4"	23'0"	22'7 1/2"	27'6"	26'5 1/4"	32'6"	31'2 3/4"
8'6"	8'2 3/4"	14'0"	13'6"	18'6"	17'10 1/4"	23'6"	22'7 1/4"	28'0"	26'11"	33'0"	31'8 1/2"
9'0"	8'8 1/2"	14'6"	13'11 3/4"	19'0"	18'3 1/2"	24'0"	23'1"	28'6"	27'4 3/4"	33'6"	32'2 1/4"
9'6"	9'2 1/4"	15'0"	14'5 1/2"	19'6"	18'9 1/4"	24'6"	23'6 3/4"	29'0"	27'10 1/2"	34'0"	32'8"
10'0"	9'8"	15'6"	14'11 1/4"	20'0"	19'3"	25'0"	24'1 1/2"	29'6"	28'4 1/4"	34'6"	33'1 3/4"
10'6"	10'1 3/4"			20'6"	19'8 3/4"			30'0"	28'10"		

DIAPHRAGMATIC JOINING SYSTEM

The heart of a rugged, versatile Walk-In is its joining system. Bally's diaphragmatic system, based on our patented Speed-Lok is proven dependable.

A steel strap is welded to the pocket and foamed into the panel, forming a lock-to-lock connection for strength.

The Bally Speed-Lok, is operated by a hex wrench and consists of only two simple assemblies. First, the Locking pin. This steel rod is precisely positioned so the locking arm engages it tightly. Second, the Locking arm is cam-mounted with a hooked end. When the hex wrench turns the arm, the eccentric movement of the cam first enables the hook to engage the pin and draws the panels tightly together.

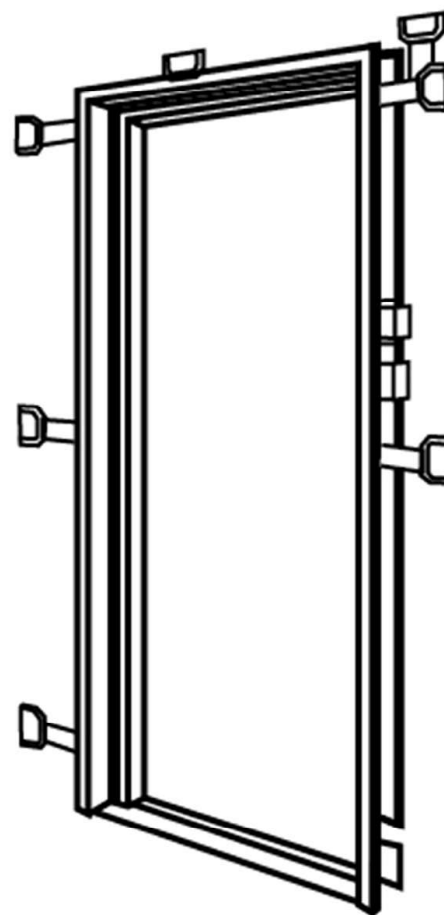


THE BALLY DOOR - *The best in the business*

Bally Walk-Ins can be equipped with a variety of door types and sizes to fill every user's requirements. Hinged doors are available in 24", 30", 36", 42", 48" and 60" widths and 66", 78" and 84" heights; with left or right hand swings. (Swing determined when facing outside). All doors furnished with:

- Thermostatically controlled heater wires around frame to protect against condensation or frost formation on door edge. (Doorcap heaters are available on request)
- 2" dial thermometer (field-mounted on 60" doors)
- Glow in the dark inside safety release
- Self-closing hinges and door closers on doors up to 42" wide; Strap-hinges on 48" and 60" wide doors; Touch latch with cylinder lock on doors up to 42"; and a positive latch on 48" and 60" doors
- Removable magnetic gaskets
- Vapor-proof fluorescent light
- Freezer doors furnished with a pressure relief port

Every Bally entrance door has a unitized structural steel frame with thermal breaker, with additional 1/8" thick steel reinforcement plates welded to the frame for hardware support, and hinge and latch supports foamed into the door caps. For heavy-duty support choose the Bally Super door.



Super Door



Adapt-A-Door

SUPER DOORS - 1/8" thick aluminum diamond tread kickplates on the exterior door frame, and a third hinge added for support.

ADAPT-A-DOORS - Replacement hinged doors to retrofit any existing Walk-In cooler or freezer door. Available in widths from 30" to 60" and in heights from 66" to 84". Finishes are:

- Stainless steel
- Stucco embossed Galvalume™
- Stucco embossed white galvanized steel
- Stucco embossed aluminum

DOOR OPTIONS AND ACCESSORIES

OBSERVATION WINDOWS - 14" x 24" and 14" x 14" viewports with heated glass.

STRIP CURTAINS- Clear thermoplastic strip curtains to be installed behind the door.

STRIP DOORS- A two-piece hinged double-acting PVC curtain installed in the door opening.

ALARMS and THERMOMETERS- Solar thermometers, digital thermometers, TM166 digital alarm thermometer, Modularm 75 audio-visual alarms, and Weiss XWA audio-visual alarms.

LOCKING BARS- A two-piece stainless-steel locking bar provides added security.

DEADBOLT LOCK- A deadbolt handle latch using cylinder lock or padlock

ENTRANCE DOOR RAMPS- When you need a Walk-In that can handle light duty, wheeling carts and it is impossible to recess the floor, interior or exterior ramps are available.

Interior Ramps- of reinforced stainless steel, cut into the threshold area of the door.

Exterior Ramps- Reinforced aluminum diamond tread ramps secured to a special flanged step-plate mounted on the threshold allows the door to swing freely.

GLASS DISPLAY DOORS- A wide selection of glass display doors is available in hinged or sliding doors. Doors are complete with shelving and lighting. Doors have built-in heaters to prevent condensation.

SLIDING DOORS- These doors are available in both single and bi-parting types. Sizes range from 36" to 120" wide and heights from 78" to 120" both manual and electric.



14" x 24" Observation Window



Deadbolt Lock



Hinged glass display doors

SECTION 115213 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Electrically operated, front-projection screens.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for metal support framing for front-projection screens.
 - 2. Section 061053 "Rough Carpentry" for wood backing for screen installation.

1.3 DEFINITIONS

- A. ALR: Ambient-light rejection; for specular reflective viewing surfaces, measured as the percentage of ambient light striking the viewing surface that has equal angles of incidence and reflection.
- B. Gain: Ratio of light reflected from viewing-surface material to that reflected perpendicularly from a magnesium carbonate surface as determined in accordance with SMPTE RP 94.
- C. Half-Gain Angle: The angle, measured from the axis of the viewing surface to the most central position on a perpendicular plane through the horizontal centerline of the viewing surface, where the gain is half of the peak gain.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:
 - 1. Drop heights.
 - 2. Anchorage details, including connection to supporting structure for suspended units.
 - 3. Details of juncture of screen case or trim with adjacent finishes.
 - 4. For electrically operated units, wiring diagrams and location of wiring connections.
 - 5. Accessories.

- C. Samples for Initial Selection: For each type of exposed finish.
- D. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
- E. Product Schedule: For front-projection screens. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Environmental Limitations: Do not deliver front-projection screens until spaces are enclosed and weathertight, wet-work in installation spaces is complete and dry, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions planned for building occupants during the remainder of the construction period.
- B. Store front-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.7 COORDINATION

- A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC system components, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain viewing surfaces and accessories, including mounting hardware, from screen manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Viewing-Surface and Masking Materials:
 - 1. Mildew-Resistance Rating: Zero or 1 when tested in accordance with ASTM G21.
 - 2. Flame Resistance: Passes NFPA 701.

2.3 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

- A. General Requirements: Manufacturer's standard units, consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by Underwriters Laboratories Inc. (UL) or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a metal rod, with ends of rod protected by plastic caps.
- B. Suspended, Electrically Operated Screen, PS: Unit designed and fabricated for suspended mounting.
 - 1. Basis-of-Design Product: Subject to requirements, provide Draper, Inc.; Access V, or comparable product by one of the following:
 - a. BEI Audio-Visual Products.
 - b. Legrand AV Inc. (Da-Lite).
 - c. Stewart Filmscreen Corporation.
 - 2. Motor in Roller: Instant-reversing motor of size and capacity recommended in writing by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
 - 3. Wiring Compartment: Metal or metal lined.
 - 4. Controls: Remote three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 - a. Provide with one control switch.
 - b. Provide power supply for low-voltage systems if required.
 - c. Provide radio-frequency remote control, consisting of battery-powered transmitter and receiver.
 - d. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.
 - 5. Screen Case: Metal.
 - a. Ceiling Aperture: With closure, hinged to automatically open when screen is lowered and automatically close when screen is fully raised.
 - 1) Provide screen case with trim flange to receive ceiling finish.
 - b. Finish on Exposed Surfaces: Manufacturer's standard.

6. Tab-Tensioned, ALR Viewing Surface: Minimum peak gain of 1.0, 82 percent ALR, and 20-degree minimum half-gain angle. Provide viewing surface without seams.
 - a. Tab Tensioning: Durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of entire height of screen by tabs, to pull viewing surface flat horizontally.
7. Size of Viewing Surface: 87-1/2 by 140 inches (2223 by 3556 mm).
8. Extra Drop Height: As needed at top of screen for bottom of screen to be 48 inches (1200 mm) above floor.
 - a. Color: Black.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install front-projection screens at locations indicated on Drawings to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor them to supporting substrate in a manner that produces a smoothly operating screen that, when lowered, has flat viewing surface and plumb vertical edges.
 1. Install low-voltage controls in accordance with NFPA 70 and complying with manufacturer's written instructions.
 - a. Wiring Method: Install wiring in raceway, except in accessible ceiling spaces and in gypsum board partitions, where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables, except in unfinished spaces.
 2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
 3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

END OF SECTION 115213

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Manually operated roller shades with single rollers.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. 10 inches Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
 - 2. Installation Accessories: Full-size unit, not less than 10 inches long.
- D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than five units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. Lutron Electronics Co., Inc.
 - 4. MechoShade Systems, Inc.
 - 5. Nysan Solar Control Inc.; Hunter Douglas Company.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Nickel-plated metal.
 - a. Loop Length: As indicated on the Drawings, or if not indicated, extend to within not less than 36 inches above finish floor.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted or mounted on vertical window mullion, as applicable.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of inside face of shade, unless otherwise indicated on Drawings.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands: Complying with NFPA 701.
 - 1. Shadeband Material: Light-filtering fabric or light-blocking fabric, at locations indicated.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
- F. Installation Accessories:
 - 1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 6 inches.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel.
 - 2. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 - 3. Wall-Mount Angle Support Angles: Manufacturer's standard design for support of concealed roller window shade operating mechanism to be installed above finish ceiling as indicated on the Drawings.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Type: PVC-coated polyester, unless otherwise indicated in the Drawing "FINISH LEGEND."
 - 3. Weave: Basketweave, unless otherwise indicated in the Drawing "FINISH LEGEND."
 - 4. Roll Width: Maximum available by manufacturer, but not less than 84 inches.
 - 5. Openness Factor: 3 percent, unless otherwise indicated in the Drawing "FINISH LEGEND."
 - 6. Colors: As indicated in the Drawing "FINISH LEGEND," or if not indicated, as selected by the Architect from manufacturer's full range of available fabrics.
- C. Fabric for Custom Graphic: Opaque fabric, stain and fade resistant.
 - 1. Source: Roller-shade manufacturer.
 - 2. Type: Polyester with foamed-acrylic backing.
 - 3. Roll Width: Full width of roller.

4. Color: As indicated in the Drawing “FINISH LEGEND,” or if not indicated, as selected by the Architect from manufacturer’s full range of available fabrics
5. Custom Graphic: Image to be provided by the Owner on electronic media, in format requested by shade manufacturer.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 2. Custom Graphic Shadeband: Seams are not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives and sealants indicating compliance with General Emissions evaluation and VOC content requirements.
 - 2. Product Data: For composite wood products indicating compliance with Composite Wood Evaluation.
- C. Shop Drawings: For countertops. Show materials, finishes, and methods of joining.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- D. Samples for Initial Selection: For each type of material exposed to view.
- E. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches (150 mm) square.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements Wilsonart “Luminous White” or a comparable product of one of the following:
 - a. Aristech Surfaces, LLC; Avonite Surfaces.
 - b. E.I. DuPont de Nemours, Inc.
 - c. Durasein.
 - d. Formica Corporation.
 - e. Halstead.
 - f. Hanex Solid Surfaces.
 - g. LG Hausys.
 - 2. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Low-emitting requirements – Composite Wood:

1. Composite Wood Evaluation - Composite wood, as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, shall be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

C. MDF: Waterproof exterior grade treated composite panel.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Solid Surface Material
2. Backsplash: None.
3. End Splash: None.

C. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

E. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.

1. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. VOC Content Requirements for Wet Applied Products: All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, amended October 26, 2017, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.
2. Do not use adhesives that contain urea formaldehyde.

- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 210100 - FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.
- B. See Division 28 Section "Digital Addressable Fire Alarm Systems" for alarm devices not specified in this Section.

1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).
- B. Fire-suppression sprinkler system design shall comply with procedures outlined in 2014 SCO guidelines for shop drawing approval. The sprinkler contractor must submit "working plans" and hydraulic calculations to Sigma Engineered Solutions for review, prior to any fabrication or installation work. After their review, Sigma Engineered Solutions will forward the shop drawings, hydraulic calculations and material submittals to North Carolina Department of Administration, State Construction Office for their review and comments. No fabrication and or installation shall begin without approved submittals from Sigma Engineered Solutions and the North Carolina Department of Administration, State Construction Office.
- C. Margin of Safety for Available Water Flow and Pressure: 10 percent flow and 10 psi for static and residual pressure, including losses through water-service piping, valves, and backflow preventers.
 - 1. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.
 - b. Office and Public Areas: Light Hazard.
 - 2. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Ordinary Hazard, Group 1: 0.15 gpm/sq.ft., over 1500 sq. ft. (6.1 over L/min. per sq. m over 139sq.m or 6.1 mm/min. over 139 sq. m).
 - b. Light Hazard Occupancy: 0.10 gpm/sq.ft., over 1500 sq. ft. (6.1 over L/min. per sq. m over 139sq.m or 6.1 mm/min. over 139 sq. m).

3. Maximum Protection Area per Sprinkler:
 - a. Office Spaces and meeting : 225 sq. ft. (11.1 sq. m).
 - b. Storage and Auxiliary spaces
 - c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m)
 - d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m)
 - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
4. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 GPM for 60 to 90 minutes.
 - b. Ordinary Group I Occupancies: 250 GPM for 60 to 90 minutes.
5. Calculations start at the water main connection at the street and must include the backflow preventer and all valves and fittings. Include a 500gpm hose stream allowance if water supplies permit. Limit water velocity to 25fps, except use 18fps for any segment with a vane type waterflow switch (to comply with UL listing).
6. Sprinkler system shall be designed under the following standards in lieu of standing SCO design guidelines:
 - a. 10% reduction in flow, as measured by the flow hydrant in accordance with NFPA 24
 - b. 10psi reduction of static and residual pressure, as measured by the test and flow hydrant in accordance with NFPA 24

1.4 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Field test reports and certificates.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 1. NFPA 13, "Installation of Sprinkler Systems."
 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- B. Plain-End, Standard-Weight Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe where indicated.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- C. Grooved-End, Standard-Weight Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.
1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Ductilic, Inc.
 - 4) JDH Pacific, Inc.
 - 5) National Fittings, Inc.
 - 6) Shurjoint Piping Products, Inc.
 - 7) Southwestern Pipe, Inc.
 - 8) Star Pipe Products; Star Fittings Div.
 - 9) Victaulic Co. of America.
 - 10) Ward Manufacturing.

- b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
 - D. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10, hot-dip galvanized where indicated in NPS 5 (DN 125) and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250).
 - 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 - 2. Steel Flanges and Flanged Fittings: ASME B16.5.
 - E. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10, hot-dip galvanized where indicated in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250); with factory- or field-formed, roll-grooved ends.
 - 1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Central Sprinkler Corp.
 - 3) Ductilic, Inc.
 - 4) JDH Pacific, Inc.
 - 5) National Fittings, Inc.
 - 6) Shurjoint Piping Products, Inc.
 - 7) Southwestern Pipe, Inc.
 - 8) Star Pipe Products; Star Fittings Div.
 - 9) Victaulic Co. of America.
 - 10) Ward Manufacturing.
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.3 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping.
- B. Outlet Specialty Fittings:
 - 1. Manufacturers:
 - a. Anvil International, Inc.

- b. Central Sprinkler Corp.
 - c. Ductilic, Inc.
 - d. JDH Pacific, Inc.
 - e. National Fittings, Inc.
 - f. Shurjoint Piping Products, Inc.
 - g. Southwestern Pipe, Inc.
 - h. Star Pipe Products; Star Fittings Div.
 - i. Victaulic Co. of America.
 - j. Ward Manufacturing.
- 1) Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
- C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufacturers:
 - a. Central Sprinkler Corp.
 - b. Fire-End and Croker Corp.
 - c. Viking Corp.
 - d. Victaulic Co. of America.
- D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
 - 1. Manufacturers:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire-End and Croker Corp.
 - c. Potter-Roemer; Fire-Protection Div.
- E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
 - 1. Manufacturers:
 - a. AGF Manufacturing Co.
 - b. Central Sprinkler Corp.
 - c. G/J Innovations, Inc.
 - d. Triple R Specialty of Ajax, Inc.
- F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
 - 1. Manufacturers:
 - a. CECA, LLC.
 - b. Merit.
 - c. Star Pipe Products; Star Fittings Div.

2.4 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating.
- B. Butterfly Valves: UL 1091.
 - 1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company
 - 3) NIBCO.
 - 2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Global Safety Products, Inc.
 - 3) McWane, Inc.; Kennedy Valve Div.
 - 4) Mueller Company.
 - 5) NIBCO.
 - 6) Pratt, Henry Company.
 - 7) Victaulic Co. of America.
- C. Check Valves NPS 2 (DN 50) and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. American Cast Iron Pipe Co.; Waterous Co.
 - c. Central Sprinkler Corp.
 - d. Clow Valve Co.
 - e. Crane Co.; Crane Valve Group; Crane Valves.
 - f. Crane Co.; Crane Valve Group; Jenkins Valves.
 - g. Firematic Sprinkler Devices, Inc.
 - h. Globe Fire Sprinkler Corporation.
 - i. Grinnell Fire Protection.
 - j. Hammond Valve.
 - k. Matco-Norca, Inc.
 - l. McWane, Inc.; Kennedy Valve Div.
 - m. Mueller Company.
 - n. NIBCO.
 - o. Potter-Roemer; Fire Protection Div.
 - p. Reliable Automatic Sprinkler Co., Inc.
 - q. Star Sprinkler Inc.
 - r. Stockham.

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- s. United Brass Works, Inc.
- t. Venus Fire Protection, Ltd.
- u. Victaulic Co. of America.
- v. Watts Industries, Inc.; Water Products Div.

D. Gate Valves: UL 262, OS&Y type.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.
 - 2) Hammond Valve.
 - 3) NIBCO.
 - 4) United Brass Works, Inc.
2. NPS 2-1/2 (DN 65) and Larger: Cast-iron body with flanged ends.
 - a. Manufacturers:
 - 1) Clow Valve Co.
 - 2) Crane Co.; Crane Valve Group; Crane Valves.
 - 3) Crane Co.; Crane Valve Group; Jenkins Valves.
 - 4) Hammond Valve.
 - 5) Milwaukee Valve Company.
 - 6) Mueller Company.
 - 7) NIBCO.
 - 8) Red-White Valve Corp.
 - 9) United Brass Works, Inc.

E. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
2. NPS 2 (DN 50) and Smaller: Ball or butterfly valve with bronze body and threaded ends.
 - a. Manufacturers:
 - 1) Milwaukee Valve Company.
 - 2) NIBCO.
 - 3) Victaulic Co. of America.
3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) Grinnell Fire Protection.
 - 3) McWane, Inc.; Kennedy Valve Div.
 - 4) Milwaukee Valve Company.
 - 5) NIBCO.
 - 6) Victaulic Co. of America.

2.5 UNLISTED GENERAL-DUTY VALVES

- A. Check Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- B. Gate Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- C. Globe Valves NPS 2 (DN 50) and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.6 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig (1200-kPa) minimum pressure rating.
 - 1. Manufacturers:
 - a. AFAC Inc.
 - b. Central Sprinkler Corp.
 - c. Firematic Sprinkler Devices, Inc.
 - d. Globe Fire Sprinkler Corporation.
 - e. Grinnell Fire Protection.
 - f. Reliable Automatic Sprinkler Co., Inc.
 - g. Star Sprinkler Inc.
 - h. Venus Fire Protection, Ltd.
 - i. Victaulic Co. of America.
 - j. Viking Corp.
- B. Automatic Drain Valves: UL 1726, NPS 3/4 (DN 20), ball-check device with threaded ends.

2.7 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating.
- B. Manufacturers:
 - 1. AFAC Inc.
 - 2. Central Sprinkler Corp.
 - 3. Firematic Sprinkler Devices, Inc.
 - 4. Globe Fire Sprinkler Corporation.
 - 5. Grinnell Fire Protection.
 - 6. Reliable Automatic Sprinkler Co., Inc.
 - 7. Star Sprinkler Inc.
 - 8. Venus Fire Protection, Ltd.
 - 9. Victaulic Co. of America.
 - 10. Viking Corp.

- C. Automatic Sprinklers: With heat-responsive element complying with the following:
 - 1. UL 1767, for early-suppression, fast-response applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows: sprinkler heads installed in rooms with existing heads shall match the same response rating.
 - 1. Concealed ceiling sprinklers, including cover plate, where indicated.
 - 2. Quick-response pendent sprinklers.
 - 3. Quick-response extended coverage pendent sprinklers.
 - 4. Quick-response dry sidewall sprinklers.
 - 5. Quick-response sidewall sprinklers.
 - 6. Quick-response upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and factory painted.
- G. Special Coatings: None.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, 1 piece, with 1-inch (25-mm) vertical adjustment.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig (1725-kPa) pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 1. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller
 - d. Potter Electric Signal Company.
 - e. System Sensor.
 - f. Viking Corp.
 - g. Watts Industries, Inc.; Water Products Div.

- C. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 - 1. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. System Sensor.
- D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
 - 1. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Potter Electric Signal Company.
 - c. System Sensor.
 - d. Viking Corp.
- E. Electrically Operated Alarm: UL 464, with 10-inch- (250-mm-) diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. System Sensor.
 - c. Edwards Signaling.

2.9 PRESSURE GAGES

- A. Manufacturers:
 - 1. AGF Manufacturing Co.
 - 2. AMETEK, Inc.; U.S. Gauge.
 - 3. Brecco Corporation.
 - 4. Dresser Equipment Group; Instrument Div.
 - 5. Marsh Bellofram.
 - 6. WIKA Instrument Corporation.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch (90- to 115-mm-) diameter, dial pressure gage with range of 0 to 250 psig (0 to 1725 kPa) minimum.
 - 1. Water System Piping: Include caption "WATER" on dial face.

2.10 SPRINKLER CABINETS:

- A. Finished steel cabinet and hinged cover, with space for minimum of 6 spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and 1 wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on project.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.2 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, black or galvanized standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
- B. NPS 2 (DN 50) and Larger: Threaded-end, black or galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
- C. NPS 2 (DN 50) and Larger: Grooved-end, black or galvanized schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- D. Where steel pipe is used in dry-pipe system, piping material shall be limited to internally galvanized steel pipe.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use butterfly or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use butterfly or gate valves.
 - b. Throttling Duty: Use globe valves.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 21 Section "Basic Methods and Materials for Fire Suppression Systems" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - 2. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

3.5 PIPING INSTALLATION

- A. Refer to Division 21 Section "Basic Methods and Materials for Fire Suppression Systems" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install drain valves on standpipes.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 - 1. Install sprinkler system piping according to NFPA 13.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft

metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

- N. Fill wet-pipe sprinkler system piping with water, flush and refill
- O. Drain dry-pipe sprinkler piping.
- P. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices and air compressors.

3.6 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

3.7 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
 - 1. Rooms without Ceilings: Upright sprinklers with wire guard where indicated.
 - 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers, as indicated.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated
 - 5. Sprinkler Finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
 - b. Concealed Sprinklers: Smooth brass, with factory-painted white cover plate.
 - c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 - d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.8 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.

- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect water-supply piping to fire-suppression piping.
- D. Connect piping to specialty valves, hose valves, specialties, and accessories.
- E. Electrical Connections: Power wiring is specified in Division 26.
- F. Connect alarm devices to fire alarm.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding."
- H. Connect wiring according to Division 26 Section "Power Conductors and Cables."

3.10 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.11 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
 - 4. Coordinate with fire alarm tests. Operate as required.
- B. Prior to making request for Beneficial Occupancy, the contractor shall submit written test reports and certificates as required by NFPA 13 and 24. Submittals shall include acceptance form approved by NFPA only, no other forms shall be considered.

END OF SECTION 210100

SECTION 210500 - FIRE PROTECTION SYSTEM GENERAL

PART 1 - GENERAL

1.1 SCOPE

- A. Design, fabricate, install, and secure required approvals for a complete fire protection automatic sprinkler [and standpipe] system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation in accordance with pertinent requirements of NFPA 13 and local governmental agencies having jurisdiction.
- B. Work includes providing design services; furnishing all labor, material, equipment and installation as necessary and reasonably incidental to the proper completion and proper operation of the fire protection systems. The work shall consist of but shall not necessarily be limited to the following:
 - 1. Automatic wet-pipe sprinkler system as specified in Section 21 13 13.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 (General Requirements) sections of the Project Manual apply to this Section.
- B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 21 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 21 specifications contain statements more definitive or more restrictive.

1.3 DEFINITIONS

- A. Words and phrases used throughout the Contract Documents shall be interpreted as indicated below:
 - 1. Construction Documents – the basis for the work. It includes both the Drawings (plans) and Project Manual (specifications).
 - 2. Contractor – The person or organization awarded the contract for fire protection design and construction services.

In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for fire protection design and construction work.

The terms “Fire Protection Contractor” and “Sprinkler Contractor” may be used interchangeably with the term Contractor.
 - 3. Provide – To furnish and install materials, equipment or systems.

4. Submittals – Submittals shall include Manufacturer’s Catalog Data, Shop Drawings, Calculations, Certificates of Compliance, Testing Reports, Samples, and Operation and Maintenance Manuals.
5. Professional – The Architect and/or Engineer of record.
6. Work By Others – Work provided by a person or organization other than the Contractor.

1.4 CODES, REFERENCES, AND STANDARDS

- A. The Contractor shall comply with all laws, ordinances, and regulations of all Authorities Having Jurisdiction, including those of all applicable City, County, State, Federal and Public Utility entities. All licenses, permits, fees, connection fees, tapping fees, inspection fees, etc., shall be obtained by the Contractor and the cost shall be included in the Contract price.
- B. The minimum standard of work under this contract shall be in accordance with the following model building codes and standards:
 1. International Code Council (ICC)
 - a. International Building Code with North Carolina Amendments
 - b. International Fire Prevention Code with North Carolina Amendments
 2. National Fire Protection Association
 - a. NFPA 13 – Standard for the Installation of Sprinkler Systems
- C. Other publications listed throughout Division 22 form a part of this specification to the extent referenced. All publications shall be the latest edition as adopted by the Authority Having Jurisdiction. The publications are referred to in the text by basic designation only.

1.5 QUALITY ASSURANCE, WORKMANSHIP AND COORDINATION

- A. The Contractor must coordinate his work with that of the other trades so that all work will be performed in an orderly manner and with the least possible interference. Where coordination with other trades is required, the Professional shall make the final decision regarding changes to be made in the work.
- B. The Contractor must thoroughly familiarize himself with all specifications and drawings for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor must plan and perform his work to permit the use of the building as soon as possible.
 1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- C. The Contractor shall guarantee the workmanship, materials and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of final acceptance. Defective workmanship shall be construed as meaning defective materials and

unsatisfactory installation and not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by defective workmanship as construed herein within the period covered by the Guarantee, including all incidental work required to correct the deficiency.

- D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance and adjustments of the equipment.
- E. The Contractor will be held responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the Contract Documents.
 - 1. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 2. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
- F. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

1.6 PROJECT RECORD DRAWINGS

- A. Deviations from the Contractor's approved Design and Fabrication Drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of Authorities Having Jurisdiction shall be made only after obtaining written permission from the Professional.
- B. The Contractor shall keep a record of construction changes and deviations from the original Design and Fabrication Drawings. All changes shall be recorded on a separate set of prints which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include:
 - 1. changes in pipe routing location
 - 2. valve locations
 - 3. Equipment locations, etc.
 - 4. actual capacities and values of equipment provided as indicated in equipment schedules
- C. The marked-up record set of drawings shall be submitted to the Professional for review and approval before final acceptance of the Fire Protection Contract work.

1.7 FIELD MEASUREMENTS

- A. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site and shall be held responsible for the correctness of same.

- B. No extra compensation will be allowed because differences between actual dimensions and measurements and those indicated on the Contractor's drawings.

1.8 PROTECTION OF SERVICES AND EQUIPMENT

- A. The Contractor, at his own expense, shall repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior or exterior) damaged, broken, or otherwise rendered inoperative during construction due to activities on the part of the Contractor. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Professional.
- B. The Contractor shall protect, at his own expense, such of his work, materials or equipment that is subject to damage during the project duration. All openings into any piping, ducts or equipment must be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor shall be held responsible for all damage so done until his work is fully and finally accepted.
- C. It shall be the responsibility of the Contractor to protect motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.

1.9 INTERRUPTION OF SERVICES

- A. The Contractor shall schedule his work to avoid any major interruption of any utility services.
- B. Existing utilities serving facilities occupied and used by the Owner or others shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions shall occur only after acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days notice to the Professional and receive written notice to proceed before interrupting any utility.

1.10 CLEANUP

- A. The Contractor shall maintain buildings, grounds, and public properties free from accumulations of waste materials, debris and rubbish. At reasonable intervals during the progress of work, and when directed by the Owner's Authorized Representative, the site and public properties shall be cleaned and waste materials, debris and rubbish shall be disposed of in appropriate manner. The Contractor shall provide containers for collection of waste materials, debris and rubbish. Waste materials, debris and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris or rubbish on project site shall not be permitted.
- B. At the completion of the Project, remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed fire protection fixtures and equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed fire protection fixtures and equipment. Broom clean paved and concrete surfaces; rake clean other ground surfaces. Repair, patch and touch up marred surfaces to specified finish or to match adjacent surfaces.

1.11 SUBMITTALS

A. Submittals shall be in accordance with Division 01 of the Project Manual.

B. General

1. The Contractor shall provide to the Professional for review six (6) copies of required submittals, unless noted otherwise. All Catalog Data, Shop Drawings, Design (hydraulic) Calculations, and Certificates of Compliance shall be submitted as a single package. All delays to the job resulting from the Contractor's failure to provide submittals at one time will be the responsibility of the Contractor. Four (4) copies will be returned to the Contractor.
2. Submittals provided for review shall clearly and completely describe the specific product(s) they represent. Where differences exist between the item specified and that submitted for review, the submittal shall be highlighted.
3. Shop Drawings shall be prepared by a Certified NICET Level III technician. The plans should bear the signature, stamp and certificate number of the technician.
4. Submittals shall bear the review stamp of the Contractor. The review stamp of the Contractor shall be affixed to shop drawings to indicate:
 - a. The Contractor has coordinated the electrical characteristics of the equipment.
 - b. The Contractor has verified that the equipment submitted will physically fit into the space allocated with adequate clearances for maintenance, access, and egress requirements.
 - c. The Contractor shall bear all associated costs that may accrue due to failure to completely represent a given product.
5. Material and equipment shown on the drawings or specified herein shall not be incorporated in the work of this Contract until shop drawings, hydraulic calculations, engineering data and catalog information have been reviewed and accepted by the Professional.
6. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

C. Operation and Maintenance Manuals

1. Submit one electronic pdf sixty (60) days prior to operator training/pre-final inspection for review by the Professional.
2. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS – FIRE PROTECTION SYSTEMS", title of project, and subject matter of binder when multiple binders are required.
3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified type on thirty (30) pound white paper.
 - a. Part 1: Directory, listing names, addresses, and telephone numbers of Contractor, Subcontractors, and equipment suppliers.

- b. Part 2: Operation and maintenance instructions arranged by system or process flow and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - 1) Significant design criteria.
 - 2) List of equipment.
 - 3) Parts list for each component.
 - 4) Maintenance instructions for equipment and systems.
 - 5) Maintenance instructions for finishes, including recommended cleaning methods and materials and operating instructions.
 - 6) Special precautions identifying detrimental agents.
 - 7) Special Requirements of other sections of this specification noted to be included in the operating and maintenance manual.
 - 8) Original copy (reproductions will not be accepted) of NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
 - c. Part 3: Project documents and certificates, including the following:
 - 1) All approved Submittals
 - 2) Shop Drawings
 - 3) Hydraulic Calculations
 - 4) Certificates of Compliance
 - 5) Photocopies of warranties and bonds
 - 6) Material safety data sheets
5. Submit two (2) copies of completed volumes in final form fifteen (15) days prior to owner training. These copies will include Professional's previous review comments.

1.12 CONCRETE

- A. Concrete shall comply with Division 3 of the Project Manual.
- B. Reinforcing shall conform to ASTM A-615, Grade 60. Concrete exposed to freezing and thawing, salts, sulfates and corrosion shall comply with International Building Code with North Carolina amendments.
- C. All concrete shall be of minimum 3000 pounds per square inch (psi) strength in 28 (twenty-eight) days. All concrete shall be mixed by machine. No wet or moistened mixture containing cement shall remain unplaced for a period exceeding 30 (thirty) minutes and shall not be used after its initial set. Retempering after initial set is prohibited. Exposed surfaces shall be protected from drying for at least 7 (seven) days. All forms shall be built true and rigid. Form removal shall not injure the concrete.
- D. All concrete is to be finished with a hard, smooth troweled finish and is to be faced smooth with rounded corners.

1.13 INSPECTION AND TESTING

A. General

1. New fire protection systems shall be tested to disclose leaks and defects.
2. The Contractor shall notify the Professional a minimum of 5 (five) working days prior to testing to coordinate the testing and inspection procedures.
3. If the Professional determines that the fire protection systems do not pass the prescribed tests, then the Contractor shall be required to make the necessary repairs, at his own expense, and the Contractor shall re-inspect and re-test the systems. Repairing, inspection and testing shall be continued until all systems pass as determined by the Professional.
4. All new, altered, extended or replaced fire protection shall be left uncovered and unconcealed until it has been inspected, tested and accepted by the Professional. Where such work has been covered or concealed before it has been inspected, tested and accepted, it shall be uncovered by the Contractor, at his own expense as directed by the Professional.
5. All equipment, material, labor, etc., required for testing the fire protection systems shall be furnished by the Contractor.

1.14 INSTRUCTION OF THE OWNER

- A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.
- B. The Contractor shall provide the Owner with two weeks' notice before the instruction session.

1.15 CHASES AND OPENINGS

- A. All chases and openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time (1 (one) week minimum) for coordination of all chases and openings. The contractor shall be responsible for all work required to cut and patch the required openings. The work shall be performed to the satisfaction of the Professional.
- B. Penetrations made in fire rated chases, partitions, floors, etc., shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.
- C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of work in chases and openings.

1.16 PAINTING

- A. Painting shall be in accordance with Division 09.

1.17 RELATED WORK

- A. All work related to providing complete fire protection systems and equipment shall be the responsibility of the Contractor. The following related work shall be provided as indicated in other specification Divisions, unless noted otherwise, but shall remain the responsibility of the Contractor for workmanship and completeness:

1. General Contractor
 - a. Installation of access panels.
 - b. Concrete housekeeping pads for fire protection equipment.
 - c. Removal of existing concrete housekeeping pads.
2. Food Service Equipment Contractor
 - a. Kitchen hood fire extinguishing systems.

1.18 MISCELLANEOUS STEEL AND ACCESSORIES

- A. The contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etc., as shown on plans, as specified, or as may be required for complete and proper installation of sprinkler piping, systems and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

1.19 ACCESS PANELS

- A. The Contractor shall furnish access doors to the General Contractor for installation in ceilings, walls, partitions and floors for access to valve and other appurtenances.
- B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be 12-inches by 16-inches.
- C. Access door locations shall be as determined by field conditions for optimum access to equipment, and shall be reviewed by the Professional before final installation
- D. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions and floors.
- E. Frame and panel access doors in restrooms, kitchens and as indicated shall be stainless steel.
- F. Access doors with UL Listing shall be provided in rated construction assemblies. Access doors shall be "B-Label" and shall have a UL one and one-half (1-1/2) hour rating at 250 degrees F rating for both door and frame. Maximum size shall be 20" x 20" or 400 square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be twenty (20) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation and self-latching cylinder locks.
- G. Access doors without UL label shall be provided in all non-rated construction assemblies: Frame shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), concealed spring type hinges and flush-face type lock with key operation and self-latching cylinder locks. Door shall open 175 degrees (minimum).
- H. All access doors shall be keyed alike.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials used on fire protection systems shall meet the requirements of applicable codes, standards, and requirements of Local Authorities Having Jurisdiction and the Owner's Insurance Carrier.

2.2 SPRINKLER PIPING, ABOVE GROUND

- A. Piping: black steel meeting ASTM A53, ASTM A135, or ASTM A795.
1. Piping 2-½" and larger shall be Schedule 10 with roll-grooved, flanged or welded connections.
 2. Piping 2" and smaller shall be Schedule 40 with threaded or welded connections.
 3. Piping shall be hot-dipped galvanized where specified herein or noted on the drawings.
- B. Fittings: UL-listed, standard weight suitable for pressures up to 250 psig, cast iron meeting ASTM A126 or malleable iron meeting ASTM A197. Threaded cast iron fittings shall meet ANSI B16.4; flanged cast iron fittings shall meet ANSI B16.1. Threaded malleable iron fittings shall meet ANSI B16.3. Grooved fittings and couplings shall be UL-listed and shall be of ductile iron meeting ASTM A536, utilizing an EDPM gasket. Fittings shall be short pattern, with flow equal to standard pattern fittings. Plain-end fittings and couplings, or welded-segmented fittings shall not be used. Changes in pipe diameter shall be made using tapered reducing fittings. Bushings or grooved-end reducing couplings shall not be used unless standard reducing fittings are not regularly available.
1. Grooved joint couplings shall be:
 - a. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.)
 - 1) 1-½" through 4": Installation-Ready, for direct stab installation without field disassembly.
 - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications.

2. Gaskets:

Fire Protection Service	Temp. Range	Gasket Recommendation
Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

2.3 VALVES FOR FIRE PROTECTION SYSTEMS

- A. Gates Valves: Class 125, comply with MSS SP-80, bronze body, screwed bonnet, rising stem, solid wedge. 3" and larger; comply with MSS SP-70, iron body, bronze trim, rising stem, hand wheel, OS&Y, flanged or grooved ends.
- B. Butterfly Valves:

1. Comply with MSS SP-67, lug type, cast or ductile iron body, chrome plated ductile iron disk, EPDM seat, extended neck, handwheel and gear drive and integral indicating device, built-in tamper proof switch, 200 PSI rating.
 2. Grooved end type with ductile iron body, EPDM coated ductile iron disk with integrally cast stem, handwheel and gear drive and integral indicating devices, with weatherproof actuator and supervisory switches, 300 PSI rating.
- C. Spring-Actuated Check Valves: 250 PSI rating, grooved end ductile iron one-piece body, stainless steel spring and shaft, suitable for vertical or horizontal installations.
- D. Check Valves: Class 125, comply with MSS SP-80 bronze body, screwed cap. "Y" pattern swing, bronze disc. 3" and larger, comply with MSS SP-71, class 125, iron body, bronze mounted, horizontal swing, cast iron disc.

2.4 DRAIN VALVES

- A. Provide bronze compression stop with hose thread nipple and cap.

PART 3 - EXECUTION

3.1 GENERAL

- A. All materials and equipment used shall be installed in strict accordance with the Standards under which the materials are accepted and approved, and in strict accordance with the manufacturer's instructions.
- B. The Contractor's Drawings shall indicate every bend, offset, change in direction and appurtenance required to provide a complete and workable system.
- C. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

3.2 INSTALLATION OF EQUIPMENT

- A. Aboveground Pipe
1. Run pipe parallel to column centerlines. Install pipe as high as possible in unfinished areas to maintain maximum headroom. Piping shall bear evenly on hangers and supports.
 2. Provide means to drain entire piping system. Pitch dry pipe system branch lines and mains to drain in accordance with NFPA 13.

3. Threads on fittings and bolts shall be fully engaged. Pipe threads shall be made up using joint compound or Teflon tape.
4. Pipe drains and discharges from relief valves and automatic ball drip valves to spill directly over the nearest floor drain or outside the building. Pipe main drain and test connections to discharge at a safe point outside the building unless indicated otherwise on the Drawings.
5. Torch cutting and field welding are not permitted in sprinkler systems.
6. System layout shall follow the layout and minimum sizes indicated on the Drawings. Provide additional fittings and offsets as required to coordinate with other trades.
7. Piping shall not be supported from ductwork or other equipment.

B. Control Valves and Accessories

1. Install gate valves with stems pointing at or above the pipe centerline.

C. Alarm and Supervisory Devices

1. Tamper switches shall not interfere with valve operation and shall be adjusted to initiate a signal before the valve stem moves more than 20% of its total travel or two handwheel revolutions from its normal position. Valves shall be monitored in the normally open positions unless indicated as normally closed on the Drawings.
2. Adjust retard mechanisms of vane-type water flow switches for a 20-second delay.
3. Provide an inspector's test connection with site glass, orifice, and shutoff valve for each water flow switch in each system.

D. Accessories

1. Install sprinkler cabinet near the sprinkler water entrance or as directed by the Owner.
2. Install valve identification signs as required by NFPA 13. Install hydraulic nameplates on system risers. Record all hydraulic data on each nameplate as required by NFPA 13.

3.3 SEISMIC RESTRAINTS

- A. The Sprinkler Contractor shall coordinate with the General Contractor to determine site classification and seismic requirements for this project. Where required, the Sprinkler Contractor shall be responsible for providing restraints to resist the earthquake effects on the Sprinkler system(s). The requirements for these restraints are found in the 2009 North Carolina Building Code.
- B. The Sprinkler Contractor shall refer to the latest edition of the "Seismic Restraint Manual Guidelines for Mechanical Systems" published by SMACNA for guidelines to determine the correct restraints for piping.

- C. The Sprinkler Contractor shall include shop drawings of the specific methods of seismic restraint to be used for this project before installation of piping, ductwork, and equipment.
- D. Any required anchorage of the equipment and materials for this project shall be an integral part of the design and specification of such equipment and materials. Manufacturers of all equipment shall provide anchorage details, isolators, seismic mounts and restraints, etc. necessary to comply with Code requirements.
- E. The Sprinkler Contractor shall retain the services of a Professional Structural Engineer licensed in the State of North Carolina to design seismic restraint elements required for this project. The engineer's computations, bearing his professional seal, shall accompany shop drawings which show Code compliance. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment, systems and assemblies.
- F. Internal seismic restraint elements of manufactured equipment shall be certified by a Professional Engineer retained by the manufacturer. Such certificate applies only to internal elements of the equipment. All equipment anchorage requirements shall be coordinated with the building structure and shall be compatible thereto. All such anchorage shall be reviewed by the project's structural engineer.
- G. The professional engineer retained by the Sprinkler Contractor for seismic restraint calculations shall visit the job site upon completion of the seismic restraint installation. This Engineer shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's professional seal. Job site inspection by other than this Engineer is not acceptable. This engineer shall also be responsible for any required special inspections and associated documentation.
- H. Review of the seismic design and shop drawings by the Engineer/Architect or his agent shall not relieve the Sprinkler Contractor of his responsibility to comply with the seismic or any other requirements of the International Building Code.

END OF SECTION 210500

SECTION 220100 - PLUMBING GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. General provisions of the contract documents including general and supplementary conditions apply to all work in this division.
- B. The general conditions shall be carefully examined before proposals for any work are submitted. Division twenty-two shall not be interpreted as waiving or overruling any requirements expressed in the general conditions unless division twenty-two specifications contain statements more definitive or more restrictive.
- C. Nothing herein contained shall be so construed as to relieve the contractor from performing their work according to the true intent and meaning of the contract drawings and specifications. The contractor will be held responsible to provide all materials and equipment and shall provide all labor necessary for the complete, prompt, and satisfactory execution of the work. The contractor is also responsible for the proper coordination of their work with all other trades.
- D. The contractor shall bear all expenses incidental to the satisfactory completion of the work contained in the contract drawings and specifications.

1.2 DEFINITIONS

- A. Where words and phrases used throughout the contract documents are not specifically defined below or in the reference standards, they shall be interpreted by the meanings given to them in the latest edition of the Merriam-Webster dictionary.
- B. Words and phrases used throughout the contract documents shall be interpreted as indicated below:
 - 1. Contractor: The person or organization awarded the contract for construction services. In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the contractor holding a prime contract for plumbing construction work.
 - 2. Others: A person or organization other than the contractor, owner, or professional.
 - 3. Owner: The person or organization that awards the construction contract, or their designated representative.
 - 4. Professional: The engineer of record.
 - 5. Provide: To furnish and install materials, equipment, or systems.
 - 6. Submittals: Industry standards, manufacturer's data, manufacturer's warranties, operation and maintenance instructions, shop drawings, and test reports.
 - 7. Work: All labor, materials, equipment, and services necessary and reasonably incidental to the proper completion and proper operation of the plumbing systems.

1.3 REFERENCES

- A. The contractor shall comply with all laws, ordinances, and regulations of all authorities having jurisdiction, including those of all applicable city, county, state, federal, and public utility entities. The contractor shall obtain all licenses, permits, etc. and shall pay all associated connection fees, tapping fees, inspection fees, etc. These costs shall be included in the contract price.
- B. The publications listed below form a part of this specification. All publications shall be the latest edition as adopted by the authority having jurisdiction at the date of bid advertisement. The minimum standard of work under this contract shall be in accordance with the following model building codes or standards:
 - 1. ASTM International:
 - a. ASTM C33 – Standard Specification for Concrete Aggregates.
 - b. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
 - c. ASTM C150 – Standard Specification for Portland Cement.
 - d. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - e. ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.
 - f. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
 - g. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 2. International Building Code (IBC) with North Carolina Amendments:
 - a. North Carolina Building Code.
 - b. North Carolina Energy Conservation Code.
 - c. North Carolina Fire Prevention Code.
 - d. North Carolina Fuel Gas Code.
 - e. North Carolina Mechanical Code.
 - f. North Carolina Plumbing Code.
 - 3. National Fire Protection Association:
 - a. NFPA 70 – National Electric Code.

1.4 SCOPE

- A. Domestic water systems: The domestic water systems shall be extended to all equipment and accessories, including those provided by others as determined in the construction contract. For systems with piping outside of the building, the systems shall be extended from a point five (5) feet beyond the exterior face of the building. Final installation at the point of utility connection shall be made by the contractor.
- B. Sanitary waste systems: The sanitary waste systems shall be extended to all equipment and accessories including those provided by others as determined in the construction

contract. For systems with piping outside of the building, the systems shall be extended from a point five (5) feet beyond the exterior face of the building. Final installation at the point of utility connection shall be made by the contractor.

- C. Fuel gas systems: The fuel gas systems shall be extended to all equipment and accessories, including those provided by others as determined in the construction contract. For systems with piping outside of the building, the systems shall be extended from a point five (5) feet beyond the exterior face of the building. Final installation at the point of utility connection shall be made by the contractor.

1.5 RELATED WORK

- A. All work related to providing complete plumbing systems and equipment shall be the responsibility of the contractor. The following related work shall be provided as indicated in other specification divisions:

- 1. General contractor:

- a. Downspouts and gutters.
- b. New catch basins and foundation drains.
- c. The contractor shall furnish access panels to the general contractor for installation.
- d. The contractor shall make all final connections to owner supplied equipment. The contractor shall be responsible for coordination of plumbing services with the equipment.
- e. The contractor shall furnish and/or install casework mounted fixtures and equipment where not furnished and/or installed by others. Where fixtures and equipment are furnished by others, the contractor shall install these items in accordance with the contract drawings and specifications. Rough-in plumbing work shall be in accordance with rough-in drawings provided by others. The contractor shall make the final connections to all fixtures and equipment. The contractor shall be responsible for coordination of plumbing services with the fixtures and equipment.
- f. Concrete housekeeping and structural pads for equipment.
- g. Cast-in-place concrete sumps, interceptors, and receivers.
- h. Cutting and patching: The general contractor shall perform cutting and patching of floors, exterior walls, and roofs when necessary for the installation of the work.
- i. The general contractor shall provide final painting of walls, floors, and ceilings where the surfaces are new, refinished, and remodeled under the general contract. The general contractor shall perform all required painting of piping provided by the contractor.

- 2. Electrical contractor:

- a. Verification of the proper rotation of three-phase equipment, and any modifications required to correct improper rotation.
- b. Installation of all combination starters/disconnects and overload protectors.

- c. Installation of all line side junction boxes and/or receptacles servicing low voltage control transformers.
- 3. HVAC contractor:
 - a. HVAC makeup water connections downstream of contractor provided backflow prevention devices.
 - b. Condensate drain piping associated with HVAC equipment.
 - c. The contractor shall install pipeline mounted metering and control devices furnished by the HVAC contractor for connection to the building automation system, or similar monitoring system(s), located in systems provided by the contractor. All control wiring shall be provided by the HVAC contractor.

1.6 QUALITY ASSURANCE

- A. The contractor shall become thoroughly familiarized with all specifications and drawings for the project such that they clearly understand their responsibility in relationship to the work to be performed. The contractor shall plan and perform their work so as to permit the use of the building at the earliest possible date.
- B. The contractor shall coordinate their work with that of the other trades. Where interference with other trades occurs, the contractor shall present their solution to the professional. The professional shall make the final decision regarding changes to be made in the work.
- C. The contractor is responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the contract documents.
- D. The contractor shall expressly and completely follow the manufacturer's instructions required for validation of the manufacturer's warranty, including but not limited to service, maintenance, and adjustment of the equipment.
- E. The contractor shall guarantee all work, materials, and equipment furnished against defects, leaks, performance, and nonoperation for a period of one (1) year after the date of the owner's final acceptance, or as indicated in the general conditions. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to fix the deficiency.

1.7 MATERIALS

- A. Each length of pipe and each pipe fitting, trap, fixture, material, and device utilized in all plumbing systems shall bear the identification of the manufacturer and the applicable standard to which it was manufactured.
- B. All plumbing products and materials shall comply with the referenced standards, specifications, and performance criteria of the contract documents. Where required, plumbing products and materials shall either be tested by an approved third-party testing agency or certified by an approved third-party certification agency.

- C. All piping materials exposed within plenums shall comply with the provisions of the North Carolina Mechanical Code.
- D. Equipment efficiencies shall be in accordance with the North Carolina Energy Conservation Code.
- E. Solders with lead content exceeding two-tenths (0.2) percent are prohibited. Brass and bronze materials with lead content two (2) percent or greater are prohibited.
- F. Provide products requiring electrical connections listed and classified by Underwriters Laboratories, Inc. (UL), as suitable for the purpose specified and indicated.

1.8 FIELD MEASUREMENTS

- A. The contractor is responsible to verify the location of any and all existing underground utilities in the vicinity of their work. When it has been indicated that these utilities are to remain in place, the contractor shall provide adequate means of support and protection during excavation operations.
- B. Before ordering any equipment and material or performing any work, the contractor shall verify all measurements and dimensions at the job site. The contractor is responsible for the correctness of this information.
- C. Any difference identified by the contractor shall be submitted to the professional for consideration before proceeding with the work.
- D. No extra compensation will be considered based on differences between actual dimensions or measurements and those indicated on the drawings.

1.9 PROTECTION OF UTILITIES

- A. All existing service utilities shall remain active during construction. Any service underground, aboveground, interior, or exterior that is damaged, broken, or otherwise rendered inoperative during the course of construction due to activities on the part of the contractor shall be properly repaired by the contractor at their own expense. The method used in repairing, replacing, or maintaining the services shall be submitted to the professional for review and approval.
- B. Ashes, cinders or rags; flammable, poisonous or explosive liquids or gases; oil, grease or any other insoluble material capable of obstructing, damaging or overloading the building drainage or sewer system, or capable of interfering with the normal operation of the sewage treatment process or private disposal system, shall not be deposited into such systems.

1.10 INTERRUPTION OF UTILITIES

- A. The contractor shall schedule their work to avoid interruption of any utility services.
- B. Existing utilities serving occupied facilities shall not be interrupted, except when such interruptions have been authorized by the owner and the professional. Interruptions may occur only after acceptable temporary utility services have been provided. The contractor shall provide a minimum of ten (10) working days' notice to the owner and receive written notice to proceed before interrupting any utility.

1.11 STRUCTURAL SAFETY

- A. The work shall be installed with due regard to preservation of the strength of structural members and prevention of damage to wall and other surfaces through fixture usage.
- B. In the process of installing or repairing any part of a plumbing system, the finished floors, walls, ceilings, tile work, or any other part of the building or premises that must be changed or replaced shall be left in a safe structural condition in accordance with the North Carolina Building Code.
- C. The cutting, notching, and boring of holes in structural steel framing members shall be as prescribed by the structural engineer.
- D. Flanges and lips of load-bearing cold-formed steel framing members shall not be cut or notched. Holes in webs of load-bearing cold-formed steel framing members shall be permitted along the centerline of the web of the framing member and shall not exceed the dimensional limitations, penetration spacing, or minimum hole edge distance as prescribed by the structural engineer. Cutting, notching, and boring holes of steel floor or roof decking shall be as prescribed by the structural engineer.
- E. Flanges and lips of nonstructural cold-formed steel wall studs shall not be cut or notched. Holes in webs of nonstructural cold-formed steel wall studs shall be permitted along the centerline of the web of the framing member, shall not exceed one-and-one-half (1-1/2) inches in width or four (4) inches in length, and the holes shall not be spaced less than twenty-four (24) inches center to center from another hole or less than ten (10) inches from the bearing end.
- F. Truss members and components shall not be cut, drilled, notched, spliced, or otherwise altered in any way without written concurrence and approval of the structural engineer. Alterations resulting in the addition of loads to any member shall not be permitted without verification that the truss is capable of supporting such additional loading.
- G. Trenches installed parallel to footings shall not extend below the forty-five (45) degree bearing plane of the footing or wall.

1.12 RODENTPROOFING

- A. All strainer plates on drain inlets shall be designed and installed so that all openings are not greater than one-half (1/2) inch in least dimension.
- B. Where openings have been made in walls, floors, or ceilings for the passage of pipes, such openings shall be closed and protected by the installation of approved metal collars or other approved materials that are securely fastened to the adjoining structure.
- C. Annular spaces around pipes, electric cables, conduits, or other openings in the foundation or exterior walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry, silicone caulking, or noncorrosive metal.

1.13 PROTECTION OF WORK

- A. Plumbing systems shall not be located in an elevator shaft or in an elevator equipment room. Floor drains, sumps, and sump pumps shall be permitted at the base of an elevator shaft when intended for the specific purpose of dewatering and are installed in accordance with the North Carolina Department of Labor requirements.

- B. Pipes passing through or under walls shall be protected from breakage.
- C. Piping shall be installed so as to prevent strains and stresses that exceed the structural strength of the pipe. Where necessary, provisions shall be made to protect piping from damage resulting from expansion, contraction, and structural settlement.
- D. Any pipe that passes within twelve (12) inches under a footing or through a foundation wall shall be provided with a relieving arch, or a pipe sleeve pipe shall be built into the foundation wall. The sleeve shall be two (2) pipe sizes greater than the pipe passing through the wall. Piping shall not be run under pier footings.
- E. The top of water pipes, installed below grade outside the building, shall be below the frost line or a minimum of twelve (12) inches below finished grade, whichever is greater. Water pipes installed in a wall exposed to the exterior shall be installed on the heated side of the wall insulation. Water piping installed in an unconditioned space shall have insulation with a minimum R-factor of six-and-one-half (6.5) determined at seventy-five (75) degrees Fahrenheit in accordance with ASTM C177.
- F. No traps of soil or waste pipe shall be installed or permitted outside of a building, or concealed in outside walls, or in any place where they may be subjected to freezing temperatures, unless adequate provision is made to protect them from freezing. Waste and soil piping leaving the building shall have a minimum cover of three (3) inches.
- G. In concealed locations where piping, other than cast iron or galvanized steel, is installed through holes or notches in studs, joists, rafters, or similar members less than one-and-one-half (1-1/2) inches from the nearest edge of the member, the pipe shall be protected by steel shield plates. Such shield plates shall have a thickness of not less than sixteen (16) gauge. Such plates shall cover the area of the pipe where the member is notched or bored and shall extend a minimum of two (2) inches above sole plates and below top plates.
- H. Components of plumbing systems installed along alleyways, driveways, parking garages, or other locations exposed to damage shall be recessed into the wall or otherwise protected in an approved manner.
- I. At their own expense, the contractor shall protect their work, materials, or equipment that is subject to damage during the project duration. All openings into any piping, ducts, or equipment shall be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The contractor is responsible for all damage until their work is fully and finally accepted.
- J. The use of plumbing fixtures prior to final acceptance by the owner is prohibited.

1.14 CHASES AND OPENINGS

- A. All chases and openings required for the installation of the work shall be coordinated with the work of other trades. The contractor shall provide the other trades with sufficient time for coordination of all chases and openings. The contractor shall be responsible for cutting and patching all openings in walls and ceilings necessary for their work.
- B. The contractor shall provide all sleeves, hangers, and anchors required for installation of the work in chases and openings.
- C. Pipes passing through concrete or cinder walls and floors or other corrosive material shall be protected against external corrosion by a protective sheathing or wrapping or other

means that will withstand any reaction from the lime and acid of concrete, cinder, or other corrosive material. Sheathing or wrapping shall allow for movement including expansion and contraction of piping. Minimum wall thickness of material shall be twenty-five-one-thousandths (0.025) inch.

- D. Annular spaces between sleeves and pipes shall be filled in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be firestopped in accordance with specification section 22 05 32.
- E. Joints at the roof and around vent pipes, shall be made water-tight by the use of lead, copper, galvanized steel, aluminum, plastic, or other approved flashings or flashing material. Exterior wall openings shall be made water tight.

1.15 MISCELLANEOUS STEEL AND ACCESSORIES

- A. The contractor shall provide all necessary steel angles, channels, pipes, rods, nuts, bolts, etc. as shown on plans, as specified, or as may be required for the complete and proper installation of plumbing fixtures, systems, and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

1.16 CROSS CONNECTION CONTROL

- A. The contractor shall coordinate water service requirements in accordance with the local water utility regulations, including required permits, backflow preventers, meters, piping, valves, bypasses, supports, and other accessories.
- B. Where these services are provided by others, the contractor shall verify that they are complete and have been inspected prior to making final connection(s).

1.17 CLEANUP

- A. The contractor shall provide containers for collection of waste materials, debris, and rubbish. Waste materials, debris, and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris, or rubbish on project site is not permitted.
- B. The contractor shall maintain buildings, grounds, and public properties free from accumulations of waste materials, debris, and rubbish. At reasonable intervals during the progress of work, and when directed by the owner, the site and public properties shall be cleaned and waste materials, debris, and rubbish disposed of in an appropriate manner.
- C. At the completion of the project, the contractor shall remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed plumbing fixtures and equipment; remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed plumbing fixtures and equipment; broom clean paved and concrete surfaces; rake clean other ground surfaces; repair, patch, and touch-up marred surfaces to the specified finish or to match adjacent surfaces.

1.18 PROJECT CLOSEOUT DOCUMENTATION

- A. Changes from the contract documents necessary to coordinate the work with other trades, to conform to the building conditions, or to conform to the rules and regulations of authorities having jurisdiction shall be made only after obtaining written permission from the professional.

- B. The contractor shall keep a record of construction changes and deviations from the original contract documents. All changes shall be recorded on a separate set of prints, which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include:
 - 1. Location and elevation of new utility lines.
 - 2. Changes in pipe size and routing location.
 - 3. Valve locations.
 - 4. Equipment locations.
 - 5. Actual capacities and values of equipment provided as indicated in equipment schedules or specifications.
- C. The marked-up record set of construction documents shall be delivered to the professional before final acceptance of the work.
- D. The contractor shall deliver operation and maintenance manuals per section 22 01 05 to the professional before instruction of the owner and after final acceptance of the work.

1.19 INSTRUCTION OF THE OWNER

- A. After acceptance of the project, the contractor shall provide the services of personnel thoroughly familiar with the completed installation to instruct the owner in the proper operation and maintenance of all equipment and appurtenances provided.
- B. The contractor shall provide the owner with ten (10) business days' advance notice before the instruction session(s).

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. The contractor shall furnish access doors to the general contractor for installation in ceilings, walls, partitions, and floors for access to valves, traps, fittings, and all appurtenances.
- B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be twelve (12) by sixteen (16) inches.
- C. Access door locations shall be as determined by field conditions for optimum access to equipment and shall be reviewed by the owner before final installation. Access door locations shall be subject to the following:
 - 1. Bottom of access doors shall not be lower than the top of the partition base, or a minimum of six (6) inches above floor.
 - 2. Tops and/or sides of access panels shall be a minimum of six (6) inches from the ceiling or opening of from the edge of a wall.
- D. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions, and floors.
- E. Frame and panel access doors in restrooms, kitchens, and as indicated shall be stainless steel.

- F. Access doors with UL listing shall be provided in fire-rated construction assemblies. Access doors shall be “B-Label” and shall have a UL rating for both door and frame matching that of the wall in which it is installed. Maximum size shall be twenty (20) inches by twenty (20) inches or four hundred (400) square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be twenty (20) gauge minimum steel.
- G. Access doors without UL label shall be provided in all non-fire-rated construction assemblies. Frames shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel.
- H. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation, and self-latching cylinder locks.
- I. Door shall open one-hundred-seventy-five (175) degrees minimum.
- J. All access doors shall be keyed alike.

PART 3 - EXECUTION

3.1 GENERAL

- A. The contract documents are diagrammatic and are indicative of the work to be performed. It is not intended that they show every pipe, fitting, offset, change in direction, or appurtenance required for a complete installation.
- B. All materials used shall be installed in strict accordance with the standards under which the materials are accepted and approved. In the absence of such installation procedures, the manufacturer’s installation instructions shall be followed.

3.2 EXCAVATION, BACKFILLING, COMPACTION, AND RESURFACING

- A. General:
 - 1. The contractor shall notify “ONE CALL” prior to any work.
 - 2. The contractor shall perform all excavation, backfilling, compaction, and necessary finishing for all piping, equipment, and accessories. Piping installation shall be in accordance with local water, sewer, and gas utility regulations and applicable state and local codes.
 - 3. The contractor shall provide all bracing, sheathing, and shoring necessary to perform and protect their excavations. The contractor shall provide safety rails, lights, signs, etc. as necessary or required for safety, or as required to conform to governing codes and laws.
 - 4. The contractor shall provide, maintain, and operate pumping equipment of sufficient capacity to ensure that all their excavations and trenches are kept free of water at all times.
 - 5. The contractor shall protect existing structures, utilities, sidewalks, pavements, and other facilities not indicated for removal from damage caused by settlement, lateral movement, undermining, washout, and other hazards from excavation operations.
 - 6. Existing utility lines shown on the contract documents do not indicate the exact location of the lines. The location and depth of all utilities shall be marked and

recorded prior to any excavation. Should uncharted or incorrectly charted piping or other utilities be uncovered during excavation, the contractor shall contact the professional for directions before proceeding further with work in this area.

7. All surfaces of streets, walkways, seeded areas, or finished grade areas disturbed by the excavation shall be restored to their original condition and/or as indicated in the contract documents.
8. The presence of explosives on the project site or the use of explosives in the execution of the work under this contract is prohibited.
9. Buried piping shall be supported throughout its entire length.

B. Trenching and bedding:

1. All plumbing excavation is unclassified.
2. If trench excavation operations are performed when the atmospheric temperature is less than thirty-five (35) degrees Fahrenheit, the contractor shall provide cold weather protection as required to protect excavated trench bottoms from freezing. Piping shall not be placed in a trench containing water or on a subgrade containing frost.
3. Take up and relay pipe that is not laid true to required alignment or grade. Pipe that has had its joints disturbed after installation shall be taken up and relayed. Deviation from the required lines and grades will not be permitted unless approved by the professional.
4. Trenches shall be dug to uniform width not less than twelve (12) inches and not more than sixteen (16) inches wider than the bell diameter of the piping. Trench sides shall be vertical. Carry depth of trenches for piping as required to establish required slopes and invert elevations. Beyond building perimeter, keep bottom of trenches sufficiently below finished grade to protect against frost. The bottom of trenches shall be accurately graded to provide uniform and smooth flow throughout.
5. Where trenches are excavated such that the bottom of the trench forms the bed for the pipe, solid and continuous load-bearing support shall be provided between joints. Bell holes, hub holes, and coupling holes shall be provided at points where piping is joined. Such pipe shall not be supported on blocks to grade.
6. Where trenches are excavated below the installation level of the pipe such that the bottom of the trench does not form the bed for the pipe, the trench shall be backfilled to the installation level of the bottom of the pipe with sand or fine gravel placed in layers of six (6) inches maximum depth and such backfill shall be compacted after each placement.
7. Where rock is encountered in trenching, the rock shall be removed to a minimum of three (3) inches below the installation level of the bottom of the pipe, and the trench shall be backfilled to the installation level of the bottom of the pipe with sand tamped in place so as to provide uniform load-bearing support for the pipe between joints. The pipe, including joints, shall not rest on rock at any point.
8. If soft materials of poor load-bearing quality are found at the bottom of the trench, stabilization shall be achieved by over-excavating a minimum of two (2) pipe diameters and backfilling to the installation level of the bottom of the pipe

with fine gravel, crushed stone, or a concrete foundation. The concrete foundation shall be bedded with sand tamped into place so as to provide uniform load-bearing support for the pipe between joints.

9. All underground piping shall be laid on first class granular bedding. The bedding shall be a minimum depth of six (6) inches or one-fourth (1/4) the pipe diameter, whichever is greater. The bedding shall provide uniform longitudinal support to the pipe and shall be laid to provide the grade and line as shown on the drawings or as directed by the professional. Hand-tamp the embedment materials under the haunches and around the pipe to the spring-line of the pipe to a compaction density of ninety-five (95) percent. Final embedment for ferrous pipe materials shall extend from the spring-line of the pipe to a depth of six (6) inches minimum above the top of the pipe. Final embedment for nonmetallic pipe shall extend from the spring-line of the pipe to a depth of eighteen (18) inches minimum above the top of the pipe.

C. Backfilling:

1. Backfilling shall not be undertaken until all tests and inspections have been made.
2. When the type of backfill, material is not indicated on the plans or is not specified, the excavated material may be used, provided that such material consists of loam, clay, sand, gravel, or other material that is suited for backfilling. From one (1) foot above the top of the pipe to subgrade, material containing stones greater than three (3) inches in their greatest dimension may not be used.
3. Backfill shall be free from discarded construction material and debris. Loose earth free from rocks, broken concrete, and frozen chunks shall be placed in the trench in six (6) inch layers and tamped in place until the crown of the pipe is covered by twelve (12) inches of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned.
4. Backfill trenches to a depth of twelve (12) inches above the top of the outside barrel of the pipe. Continue thereafter with the backfill in twelve (12) inch lifts.

D. Compaction:

1. Compaction shall be accomplished by approved equipment suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.
2. Compacting of this backfill by puddling or jetting will not be permitted. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than ninety-five (95) percent of the maximum density obtained at optimum moisture content, in accordance with ASTM D1557, method D and ASTM D1556, sand cone method.
3. The use of specialty equipment for compaction of backfill is prohibited.

E. Resurfacing:

1. All trenches backfill shall be brought to subgrade, ready for base material or topsoil. After the initial aggregate backfill, layer has been placed, refill the remainder of the trench using backfill materials as follows:
 - a. Lawns: Successive six (6) inch layers of clean earth backfill material shall be deposited after initial aggregate backfill. This backfill shall consist of excavated material free from large clods of earth and stone. If stones greater than three (3) inches are encountered, remove stones from the site and haul in clean earth backfill. The entire trench shall be uniformly tamped after each successive layer is deposited. Replace topsoil to its original depth and crown to such height as required.
 - b. Walks and parking areas: Clean earth backfill compacted in six (6) inch layers to a depth of eight (8) inches below the adjacent existing surfaces. Refill the remaining eight (8) inches with compacted stone and replace walk or paving as required.
 - c. Paved areas: When working within the right-of-way limits of all state highways, backfilling must be in accordance with the requirements of the State Department of Transportation. Trenches located within the areas described above shall be backfilled with aggregate material from the top of the pipe bedding to the bottom elevation of the pavement structure and must be spread and compacted in layers not to exceed four (4) inches when using a mechanical damper. The contractor is to understand that payment for special backfilling material shall not be made unless specifically provided in the form of a proposal.

3.3 INSPECTION AND TESTING

A. General:

1. New plumbing systems and parts of existing systems, which have been altered, extended, or repaired, shall be tested to disclose leaks and defects.
2. The contractor shall notify the professional a minimum of five (5) working days prior to testing to coordinate the testing and inspection procedures.
3. The contractor shall provide all equipment, material, labor, etc. required for testing the plumbing systems.
4. All new, altered, extended, or replaced plumbing systems shall be left uncovered and unconcealed until it has been inspected, tested, and accepted by the professional. Where such work has been covered or concealed before it has been inspected, tested, and accepted, it shall be uncovered by the contractor at their own expense as directed by the professional.
5. If the professional determines that the plumbing systems do not pass the prescribed tests, the contractor shall be required to make the necessary repairs at their own expense. The contractor shall inspect and retest the systems. Repairing, inspection, and testing shall be continued until all systems pass as determined by the professional.

B. Test gauges:

1. Tests requiring a pressure of ten (10) psi or less shall utilize a testing gauge having increments of one-tenth (0.1) psi or less.
2. Tests requiring a pressure of greater than ten (10) psi but less than or equal to one hundred (100) psi shall utilize a testing gauge having increments of one (1) psi or less.
3. Tests requiring a pressure of greater than one hundred (100) psi shall utilize a testing gauge having increments of two (2) psi or less.

END OF SECTION 220100

SECTION 220105 - PLUMBING SUBMITTAL REQUIREMENTS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. General provisions of the contract documents including general and supplementary conditions apply to all work in this division.
- B. Submittals shall be made in separate packages containing all the required documentation indicated in each specification section. Only one (1) submittal package shall be made for each specification section. Partial submissions will not be addressed.
- C. Failure of the contractor to provide a complete submittal package may result in delay in processing time. All such delays to the project resulting from the contractor's failure to provide submittals in a timely fashion will be the responsibility of the contractor.

1.2 DEFINITIONS

- A. Industry standard: Printed copies of the current standards recognized in the industry. Current means the latest issue as of the date of these specifications; within the text of these specifications the date suffix frequently shown with identification numbers has been omitted.
- B. Manufacturer's data: Product manufacturer's standard printed product information, including promotional brochures, product specifications, installation instructions and diagrams, statements of compliance with standard performance charts or curves, and similar information concerning the standard portions of manufacturer's products.
- C. Manufacturer's warranty: Manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the purchaser or owner by the manufacturer, when and if the product fails within certain operational conditions and time limits.
- D. Operation and maintenance instructions: The written instructions by the manufacturer, fabricator, or installer of equipment or systems, detailing the procedures to be followed by the owner in operation, control, and shutdown of each operating item of the equipment.
- E. Shop drawings: Project shop drawings and other data prepared specifically for fulfillment of the project requirements. Shop drawings include fabrication, layout, setting, installation, coordination, and similar drawings and diagrams, and include performance data associate therewith, including weights, capacities, speeds, outputs, consumption, efficiencies, voltages, amperages, cycles, phases, noise levels, operating ranges, and similar information.
- F. Test reports: Specific reports prepared by independent testing laboratories and others, showing the results of specified testing on either the material or equipment provided or on identical material or equipment.

1.3 SUBSTITUTIONS

- A. Submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name or by catalog reference, the contractor shall select for use any of those so specified.

- B. Should the contractor desire to substitute another manufacturer's equipment for one specified by name, the contractor shall apply in writing at least ten (10) business days prior to bid date for such permission. The contractor shall provide supporting data for the professional's consideration. No substitution shall be made for any material, article, or process under the contract unless approved by the professional.
- C. Any time that is required by the professional for a request to review submittals for substitute equipment after the award of bids will be billed to the contractor at the professional's current hourly billing rate. The professional's review time will be billed to the contractor whether the proposed substitution is accepted or rejected.

1.4 SUBMITTAL FORM AND PROCEDURES

- A. Submittals shall be assembled as single file electronic submittals. Transmittals shall be included within the file as the first page.
- B. Submittals shall be made in separate packages containing all the required documentation indicated in each specification section. A separate submittal package shall be made for each specification section.
- C. Submittals shall be complete and clearly identified and cross-referenced to the appropriate specification section defining the submitted item.
- D. After checking and verifying all field measurements, the contractor shall submit copies of all submittals to the professional for review. The data shown on the submittals shall be complete with respect to dimensions, design criteria, materials of construction, and the like to enable the professional to review the information as required.
- E. The contractor shall stamp the submittals and verify by signature that the submittals have been checked for compliance with the contract documents and appropriate means have been taken to ensure that the material or equipment will fit into the space available.
- F. At the time of each submission, the contractor shall in writing call the professional's attention to any deviations that the submittal may have from the requirements of the contract documents.
- G. The submittals shall be clearly marked indicating which specific options are being considered and with all related information.
- H. The professional's review of submittals is for general conformance with design concept only. Corrections or comments made on the submittals during review do not relieve the contractor from compliance with requirements of the contract documents.
- I. The contractor is responsible for all quantities, dimensions, and coordination of the work of all trades. The contractor is responsible for selecting fabrication processes and techniques of construction and for performing all work in a safe and satisfactory manner.
- J. No work requiring a submittal shall be commenced until the submittal has been reviewed by the professional.
- K. A copy of each approved submittal shall be kept in good order by the contractor and shall be made available at the site.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Submit after final inspection for review by the professional.

- B. The contents of the submittal shall be prepared as follows:
 - 1. Table of contents.
 - 2. A directory listing names, addresses, and telephone number of professional, contractor, subcontractors, and equipment suppliers.
 - 3. Project documents and certificates:
 - a. Certificates of compliance.
 - b. Photocopies of warranties and bonds.
 - c. Material safety data sheets (MSDS).
 - 4. Operation and maintenance instructions subdivided by specification section. For each item, identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Maintenance instructions for equipment and systems.
 - e. Maintenance instructions for finishes including recommended cleaning methods and materials and operating instructions.
 - f. Special precautions identifying detrimental agents.
 - g. Special requirements of other sections of this specification noted to be included in the operation and maintenance manual.
- C. Submit five (5) copies for review by the owner ten (10) business days prior to owner training.

END OF SECTION 220105

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Pipe hangers and supports.
 - 2. Inserts.
 - 3. Flashing.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.

1.2 REFERENCES

- A. Manufacturers Standardization Society:
 - 1. MSS SP 58 – Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

1.3 SUBMITTALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data for the following:
 - 1. Pipe hangers and supports.
 - 2. Inserts.
 - 3. Flashing.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data, manufacturer's warranties, and operation and maintenance instructions for the following:
 - 1. Pipe hangers and supports.
 - 2. Inserts.
 - 3. Flashing.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Conform to applicable portions of MSS SP 58.
- B. Provide copper or copper-plated supports for copper piping.
- C. Design hangers for pipe movement without disengagement of supported pipe.
- D. Obtain permission from the professional before using powder-actuated anchors.
- E. Suspended supports:
 - 1. Two (2) inches or less: Carbon steel, adjustable swivel, split ring.
 - 2. Two (2) to four (4) inches: Carbon steel, adjustable, clevis.
 - 3. Trapeze hangers: Steel channels with welded supports or spacers and hanger rods.
- F. Wall supports:
 - 1. Three (3) inches or less: Cast iron hooks.
 - 2. Four (4) inches to six (6) inches: Welded steel bracket and wrought steel clamps.
- G. Floor supports:
 - 1. Four (4) inches or less: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- H. Vertical supports: Steel riser clamp.
- I. Hanger rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.
- J. Hangers, anchors, and supports shall support the piping and the contents of the piping. Hangers and strapping material shall be of approved material that will not promote galvanic action.

2.2 INSERTS

- A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.3 FLASHING

- A. Metal flashing: twenty-six (26) gauge galvanized steel.
- B. Metal counter-flashing: twenty-two (22) gauge galvanized steel.
- C. Lead flashing:
 - 1. Waterproofing: five (5) lb/ft² sheet lead.
 - 2. Soundproofing: one (1) lb/ft² sheet lead.
- D. Flexible flashing: forty-seven (47) mil sheet butyl; compatible with roofing.
- E. Caps: twenty-two (22) gauge steel; sixteen (16) gauge at fire-rated assemblies.

2.4 SLEEVES

- A. Non-fire-rated floors: Eighteen (18) gauge galvanized steel.
- B. Non-fire-rated beams, walls, footings, and potentially wet floors: Steel pipe or eighteen (18) gauge galvanized steel.
- C. Sealant: Acrylic.

2.5 MECHANICAL SLEEVE SEALS

- A. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 EXECUTION

3.1 PIPE HANGER AND SUPPORT INSTALLATION

- A. Conform to applicable portions of MSS SP 58.
- B. Hangers and anchors shall be attached to the building construction in an approved manner.
- C. Bases of stacks shall be supported by the building structure, virgin or compacted earth, or other material suitable to support the weight of the piping.
- D. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- E. Use hangers with one-and-one-half (1-1/2) inch minimum vertical adjustment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to specification section 22 07 00.
- G. Install hangers with minimum one-half (1/2) inch space between finished covering and adjacent work.
- H. Place hangers within twelve (12) inches of each horizontal elbow.
- I. Where piping is installed in parallel and at same elevation, provide trapeze hangers.
- J. Support vertical piping independently of connected horizontal piping.
- K. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- L. Piping shall be supported in accordance with the following:

PIPING MATERIAL	MAXIMUM HORIZONTAL SPACING (ft)	MAXIMUM VERTICAL SPACING (ft)
Cast Iron Pipe	5 ^[1]	15
Copper or Copper-Alloy Pipe	12	10
Copper or Copper-Alloy Tubing (less than 1-1/2")	6	10

Copper or Copper-Alloy Tubing (more than 1-1/4")	10	10
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1. The maximum horizontal spacing of cast iron pipe hangers shall be increased to ten (10) feet where ten (10) foot lengths of pipe are installed.

3.2 INSERT INSTALLATION

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe four (4) inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 FLASHING INSTALLATION

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting three (3) inches minimum above finished roof surface with lead worked one (1) inch minimum into hub, eight (8) inches minimum clear on sides with twenty-four (24) by twenty-four (24) inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, ten (10) inches clear on sides with minimum thirty-six (36) by thirty-six (36) inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.

3.4 SLEEVE INSTALLATION

- A. Verify openings are ready to receive sleeves.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of sealant material.
- C. Install backing or damming materials to arrest liquid material leakage.
- D. Exterior watertight entries: Seal with mechanical sleeve seals.
- E. Set sleeves in position in forms. Provide reinforcing around sleeves.
- F. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- G. Extend sleeves through floors two (2) inches above finished floor level. Caulk sleeves.
- H. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- I. Install chrome-plated steel escutcheons at finished surfaces.

END OF SECTION 220529

SECTION 220532 - FIRESTOPPING FOR PLUMBING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Firestopping relating to plumbing work.
 - 2. Firestopping accessories.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E814 – Test Method of Fire Tests of Through Penetration Firestops.
- B. Underwriters Laboratories, Inc.:
 - 1. UL 723 – Tests for Surface Burning Characteristics of Building Materials.
 - 2. UL 1479 – Fire Tests of Through-Penetration Firestops.

1.3 DEFINITIONS

- A. Firestopping (through-penetration protection system): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire-rated construction.

1.4 SUBMITTALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data for the following:
 - 1. Firestopping relating to plumbing work.
 - 2. Firestopping accessories.
- C. Submit a schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- D. Submit manufacturer's preparation and installation instructions for each listed design number.

1.5 QUALITY ASSURANCE

- A. Through-penetration firestopping of fire-rated assemblies: UL 1479, ASTM E814; with one-tenth (0.1) inch water gauge minimum positive pressure differential to achieve fire F-ratings and temperature T-ratings as indicated on life safety drawings, but not less than 1-hour.
- B. Surface burning characteristics: Flame spread index of twenty-five (25) and smoke developed index of fifty (50) when tested in accordance with UL 723 or ASTM E84.

- C. Perform work in accordance with the latest edition of the North Carolina Fire Prevention Code and any local codes, ordinances, or construction standards.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply firestopping materials when temperature of substrate material and ambient air is below sixty (60) degrees Fahrenheit.
- B. Maintain this minimum temperature before, during, and for minimum three (3) days after installation of firestopping materials.
- C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

- A. Product description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone/elastomeric firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam firestopping compounds: Single component foam compound.
 - 3. Formulated firestopping compound of incombustible fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 4. Fiber stuffing and sealant firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 5. Intumescent firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
- B. Color: As selected from manufacturer's full range of colors to match adjacent surfaces.

2.2 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Installation accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- C. General:
 - 1. Furnish UL listed products.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verify openings are ready to receive firestopping.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

- C. Remove incompatible materials affecting bond.
- D. Install backing or damming materials to arrest liquid material leakage.

3.2 INSTALLATION

- A. Install material at fire-rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.

END OF SECTION 220532

SECTION 220548 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Elastomeric hangers.
 - 5. Snubbers.
 - 6. Restraints - rigid type.
 - 7. Restraints - cable type.
 - 8. Restraint accessories.
 - 9. Post-installed concrete anchors.
 - 10. Concrete inserts.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. OSHPD: Office of Statewide Health Planning and Development (for the State of California).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Include load rating for each wind-load-restraint fitting and assembly.
 - 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device component.
 - 4. Annotate to indicate application of each product submitted and compliance with requirements.
 - 5. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Consequential Damage: Provide additional restraints for suspended fire-suppression system components or anchorage of floor-, roof-, or wall-mounted fire-suppression system components as indicated in ASCE/SEI 7-10 so that failure of a non-essential or essential fire-suppression system component will not cause the failure of any other essential architectural, mechanical, or electrical building component.
- B. Fire/Smoke Resistance: All devices and components that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.
- C. Component Supports:
 - 1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
 - 2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-10 Section 13.6.

2.2 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads:
 - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 2. Size: Factory or field cut to match requirements of supported equipment.
 - 3. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
 - 4. Surface Pattern: Smooth, ribbed, or waffle pattern.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
2. Elastomeric Material: Molded, oil and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.

2.6 SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 17 for 2015 or 2018 IBC.
2. Preset Concrete Inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
3. Anchors in Masonry: Design in accordance with TMS 402.
4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
5. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.7 RESTRAINTS - RIGID TYPE

- A. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.8 RESTRAINTS - CABLE TYPE

- A. Seismic-Restraint Cables: ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.
- B. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.9 RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Non-metallic stiffeners are unacceptable.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.10 POST-INSTALLED CONCRETE ANCHORS

- A. Mechanical Anchor Bolts:
 - 1. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.
- B. Adhesive Anchor Bolts:
 - 1. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for

exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.

- C. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-10, Ch. 13.
 - 1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - 2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

2.11 CONCRETE INSERTS

- A. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.
- B. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to high wind forces.
- C. Strength of Support and Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and wind load within specified loading limits.

3.3 INSTALLATION OF VIBRATION-CONTROL DEVICES

- A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Fire-Suppression Vibration Isolation Schedule, where indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

- C. Installation of vibration isolators must not cause any stresses, misalignment, or change of position of equipment or piping.
- D. Equipment Restraints:
 - 1. Install snubbers on fire-suppression equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- E. Piping Restraints:
 - 1. Comply with all requirements in NFPA 13.
 - 2. Design piping sway bracing according to NFPA 13.
 - a. Maximum spacing of all sway bracing to be no greater than indicated in NFPA 13.
 - b. Design loading of all sway bracing not to exceed values indicated in NFPA 13.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Post-Installed Concrete Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL STRUCTURAL MOTION

- A. Install flexible connections in piping where they cross structural construction joints and other points where differential movement may occur, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 ADJUSTING

- A. Adjust isolators after system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at no fewer than four of each type and size of installed anchors and fasteners.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Units will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 210548

SECTION 220553 - IDENTIFICATION FOR PLUMBING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Pipe identification.
 - 2. Valve tags.
 - 3. Ceiling tacks.
 - 4. Nameplates.
 - 5. Labels.
 - 6. Lockout devices.

1.2 REFERENCES

- A. ASME International:
 - 1. ASME A13.1 – Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data for the following:
 - 1. Pipe identification.
 - 2. Valve tags.
 - 3. Ceiling tacks.
 - 4. Nameplates.
 - 5. Labels.
 - 6. Lockout devices.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data, manufacturer's warranties, and operation and maintenance instructions for the following:
 - 1. Pipe identification.
 - 2. Valve tags.
 - 3. Ceiling tacks.
 - 4. Nameplates.

5. Labels.
6. Lockout devices.

PART 2 PRODUCTS

2.1 PIPE IDENTIFICATION

- A. Font and symbols conforming to ASME A13.1.
- B. Colors shall match owner's standard.
- C. With clean cut symbols and letters of following size:
 1. Outside diameter two (2) inches or less: one-half (1/2) inch.
 2. Outside diameter two-and-one-half (2-1/2) to six (6) inches: one (1) inch.
- D. Plastic pipe markers:
 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- E. Plastic underground pipe tape:
 1. Bright colored continuously printed plastic ribbon tape manufactured for direct burial service, minimum six (6) inches wide by four (4) mil.

2.2 VALVE TAGS

- A. Font size conforming to ASME A13.1.
- B. Colors shall match owner's standard.
- C. Metal:
 1. Brass with stamped letters, minimum one-and-one-half (1-1/2) inches diameter with finished edges.
- D. Tag chart:
 1. Typewritten list of applied tags and locations in anodized aluminum frame with polycarbonate cover.

2.3 CEILING TACKS

- A. Font size conforming to ASME A13.1.
- B. Colors shall match owner's standard.
- C. Three-quarters (3/4) inch steel.
- D. Adhesive attachment is prohibited.

2.4 NAMEPLATES

- A. Font size conforming to ASME A13.1.
- B. Colors shall match owner's standard.
- C. Laminated three (3) layer plastic with engraved letters on contrasting background color.

2.5 LABELS

- A. Font size conforming to ASME A13.1.
- B. Colors shall match owner's standard.
- C. Laminated Mylar adhesive backed with printed identification.
- D. Two (2) by three-quarters (3/4) inches.

2.6 LOCKOUT DEVICES

- A. Hasps:
 - 1. Anodized aluminum hasp with erasable label surface.
 - 2. Seven (7) by three (3) inches.
- B. Valves:
 - 1. Steel device preventing operation with lock-accepting shackle.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Install identifying devices after completion of coverings and painting.

3.2 PIPE IDENTIFICATION INSTALLATION

- A. Identify all piping with plastic pipe markers.
- B. Identify service, flow direction, and pressure.
- C. Install in clear view and align with axis of piping.
- D. Locate identification as follows:
 - 1. On every straight run, including risers and drops.
 - 2. Every twenty (20) feet on straight runs.
 - 3. Adjacent to each valve and tee.
 - 4. At each side of wall and floor penetrations.
 - 5. At the underside of roof penetrations.
 - 6. Not less than once in each room.
- E. Install underground plastic pipe markers six (6) inches below finished grade, directly above buried pipe.

3.3 VALVE TAG INSTALLATION

- A. Identify valves in main and branch piping with valve tags.
- B. Install valve tags using corrosion resistant chain.
- C. Number tags consecutively by location.

3.4 CEILING TACK INSTALLATION

- A. Provide ceiling tacks to locate valves above T-bar type panel ceilings.
- B. Locate in corner of ceiling panel closest to equipment.

3.5 NAMEPLATE INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- B. Identify all equipment with plastic nameplates.
- C. Identify all disconnects provided by the contractor with nameplates.

3.6 LABEL INSTALLATION

- A. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
- B. Identify inline specialties and other small devices with labels.

3.7 LOCKOUT DEVICE INSTALLATION

- A. Install lockout devices on all disconnects.
- B. Install lockout devices on all circuit breakers when used as the primary disconnect.
- C. Install lockout devices on all service valves to equipment.

END OF SECTION 220553

SECTION 220700 - INSULATION FOR PLUMBING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Pipe insulation.
 - 2. Pipe insulation jackets.
 - 3. Pipe insulation shields and inserts.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.

1.3 SUBMITTALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data for the following:
 - 1. Pipe insulation.
 - 2. Pipe insulation jackets.
 - 3. Pipe insulation shields and inserts.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data, manufacturer's warranties, and operation and maintenance instructions for the following:
 - 1. Pipe insulation.
 - 2. Pipe insulation jackets.
 - 3. Pipe insulation shields and inserts.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation and related products when ambient temperatures and conditions do not meet manufacturer's requirements.
- B. Maintain required temperature and humidity before, during, and after installation for at least twenty-four (24) hours.

PART 2 PRODUCTS

2.1 PIPE INSULATION

- A. Mineral fiber: ASTM C547; rigid molded, noncombustible, formaldehyde free.
 - 1. K-factor: Twenty-seven-one-hundredths (0.27) at seventy-five (75) degrees Fahrenheit.

2. Maximum service temperature: Eight hundred (800) degrees Fahrenheit.
3. Vapor retarder jacket: Kraft paper with glass fiber yarn and bonded to all-service jacket, secured with self-sealing longitudinal laps and butt strips or with outward clinch expanding staples and vapor retarder mastic.

2.2 PIPE INSULATION JACKETS

- A. Polyvinyl chloride (PVC) plastic:
 1. One-piece molded type fitting covers and sheet material.
 2. Ten (10) mil with brush on welding adhesive.
- B. Canvas:
 1. Underwriters Laboratories, Inc. listed fabric.
 2. Six (6) ounces per square yard, plain weave cotton treated with dilute fire-retardant lagging adhesive.

2.3 PIPE INSULATION SHIELDS AND INSERTS

- A. Shields:
 1. Twenty-two (22) gauge galvanized steel.
- B. Inserts:
 1. Cork or other high density insulating material, not less than six (6) inches long.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verify piping and equipment has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.
- C. Neatly finish insulation at supports, protrusions, and interruptions.
- D. Locate insulation and cover seams in least visible locations where not specified below.
- E. Insulate complete systems conveying fluids below ambient temperature, including fittings, valves, unions, flanges, strainers, flexible connections, etc. Provide vapor barrier jackets for mineral fiber insulation.
- F. Insulate complete systems conveying fluids above ambient temperature, including fittings, valves, unions, flanges, strainers, flexible connections, etc. Insulate flanges and unions with removable sections and jackets.

3.2 PIPING INSULATION INSTALLATION

- A. Continue insulation vapor barrier through penetrations.
- B. For exposed piping, finish with canvas jacket sized for finish painting. Provide PVC jacket and fitting covers in exposed locations in kitchens and mechanical rooms.
- C. For buried piping, insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel, or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one (1) mil aluminum foil sandwiched between

three (3) layers of bituminous compound. Outer surface shall be faced with polyester film.

- D. Insulate piping systems in accordance with the following:

PIPING SYSTEM	PIPE SIZE RANGE	INSULATION SIZE
Domestic Cold-Water Supply	½" – 1¼"	½"
Domestic Cold-Water Supply	1½" – 4"	1"
Domestic Hot Water Supply	½" – 1¼"	1"
Domestic Hot Water Supply	1½" – 4"	1½"
Domestic Hot Water Return	½" – 1¼"	1"
Domestic Hot Water Return	1½" – 4"	1½"

3.3 PIPE INSULATION SHIELD AND INSERT INSTALLATION

- A. Provide shields on piping or equipment one-and-one-half (1-1/2) inches diameter or larger.
- B. Install inserts on piping two (2) inches diameter or larger. Install between support shield and piping and under finish jacket.

END OF SECTION 220700

SECTION 221100 - DOMESTIC WATER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Piping.
 - 2. Valves.
 - 3. Strainers.
 - 4. Pressure gauges.
 - 5. Thermometers.
 - 6. Hydrants.
 - 7. Recessed valve boxes.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI Z21.22 – Relief Valves for Hot Water Supply Systems.
- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME B16.15 – Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
 - 2. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 4. ASME B40.1 – Pressure Gauges and Gauge Attachments.
- C. ASSE International:
 - 1. ASSE 1003 – Performance Requirements for Water Pressure Reducing Valves.
 - 2. ASSE 1017 – Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
- D. ASTM International:
 - 1. ASTM E1 – Standard Specification for Liquid-in-Glass Thermometers.
- E. American Water Works Association (AWWA):
 - 1. AWWA C651 – Disinfecting Water Mains.
- F. Manufacturer’s Standardization Society of the Valves and Fittings Industry (MSS):
 - 1. MSS SP 67 – Butterfly Valves.
 - 2. MSS SP 71 – Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - 3. MSS SP 80 – Bronze Gate, Globe, Angle, and Check Valves.
 - 4. MSS SP 110 – Ball Valves Threaded, Socket Welding, Solder Joint, Grooved, and Flared Ends.

G. NSF International:

1. NSF 61 – Drinking Water System Components – Health Effects.

1.3 SUBMITTALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data for the following:
 1. Piping.
 2. Valves.
 3. Strainers.
 4. Pressure gauges.
 5. Thermometers.
 6. Hydrants.
 7. Recessed valve boxes.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data, manufacturer's product warranties, and operation and maintenance instructions for the following:
 1. Piping.
 2. Valves.
 3. Strainers.
 4. Pressure gauges.
 5. Thermometers.
 6. Hydrants.
 7. Recessed valve boxes.

PART 2 PRODUCTS

2.1 PIPING

- A. Copper Tubing: ASTM B88, Type L, drawn-temper (hard).
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Press Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper and performance criteria of ASME b16.51, with EPDM rubber O-rings at each end.
 3. Joints shall be one of the following:
 - a. Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
 - b. Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

- c. Pressure-Seal-Joints, lead free, minimum 200-psig working pressure rating at 250 degrees F.
- B. Water distribution pipe shall conform to NSF 61. All water distribution pipe and tubing shall have a minimum pressure rating of one hundred (100) psi at one-hundred-eighty (180) degrees Fahrenheit.
- C. Pipe fittings shall be approved for installation with the piping material installed. All pipe fittings utilized in water supply systems shall also comply with NSF 61. The fittings shall not have ledges, shoulders, or reductions capable of retarding or obstructing flow in the piping.

2.2 VALVES

- A. Ball:
 - 1. Four (4) inches or less: MSS SP 110; 600 psi CWP; two-piece cast brass body; replaceable Teflon seats; full port; blowout proof stems; chrome-plated brass ball; threaded, soldered, or compression ends; locking lever handle operated.
 - 2. Provide extended stems for valves in insulated piping.
- B. Swing check:
 - 1. Two (2) inches or less: MSS SP 80; class 125; 200 psi CWP; cast bronze body and cap; threaded, soldered or compression ends; Y-pattern swing type nitrile rubber disc.
 - 2. Two-and-one-half (2-1/2) inches or more: MSS SP 71; class 125; 200 psi CWP; cast iron body, bronze mounted, and bolted bonnet; flanged or threaded ends; swing type nitrile rubber disc; nonasbestos gasket.
- C. Spring-loaded check:
 - 1. Two (2) inches or less: MSS SP 80; class 125; 200 psi CWP; cast bronze body and cap; threaded, soldered or compression ends; inline spring lift check; silent closing nitrile rubber disc; integral seat.
 - 2. Two-and-one-half (2-1/2) inches or more: MSS SP 71; class 125; 200 psi CWP; cast iron body, bronze mounted, and bolted bonnet; flanged or threaded ends; wafer style; center guided bronze disc; stainless steel springs and screws.
- D. Flow control:
 - 1. Construction: Class 125; bronze body; union on inlet and outlet; temperature and pressure test plug on inlet and outlet; combination blow-down drain.
 - 2. Calibration: Control flow within five (5) percent of selected rating; over operating pressure range of ten (10) times minimum pressure required for control; maximum minimum pressure five (5) psi.
- E. Pressure relief:
 - 1. ANSI Z21.22; bronze body; Teflon seat; stainless steel stem and springs; automatic; direct pressure actuated.
- F. Temperature and pressure relief:

1. ANSI Z21.22; bronze body; Teflon seat; stainless steel stem and springs; automatic; direct pressure actuated; temperature relief maximum 210 degrees F; capacity ASME certified and labeled.
- G. Master thermostatic mixing valves.
 1. Valve: Chrome-plated cast brass body; programmable digital controller with integral pressure and temperature sensors, with connections to building automation system for monitoring and control; fully factory piped and assembled on a wall-mount rack frame, including test connections and valves.
 2. Capacity: As specified in thermostatic mixing valve schedule on drawings.
 3. Temperature actuated mixing valves, which are installed to reduce water temperatures to defined limits, shall comply with ASSE 1017.
- H. All valves shall be of an approved type and compatible with the type of piping material installed in the system. Ball valves, gate valves, globe valves, and plug valves intended to supply drinking water shall meet the requirements of NSF 61.

2.3 STRAINERS

- A. Two (2) inches or less: Class 150; 300 psi CWP; bronze body; Y-pattern with 1/32 inch stainless steel perforated screen; threaded, soldered or compression ends.
- B. Two-and-one-half (2-1/2) inches to four (4) inches: Class 125; 200 psi CWP; cast iron body, bronze fitted; Y-pattern with 1/16-inch stainless steel perforated screen; flanged or threaded ends.

2.4 PRESSURE GAUGES

- A. Gauge: ASME B40.1; with bourdon tube; rotary brass movement; brass socket; front calibration adjustment; black scale on white background.
 1. Case: Cast aluminum.
 2. Bourdon tube: Brass.
 3. Dial size: four (4) inches diameter.
 4. Mid-scale accuracy: One (1) percent.
 5. Scale: Psi.
 6. Pressure gauge taps:
 - a. Needle valve: Brass, 1/4-inch NPT for 300 psi.
 - b. Pulsation damper: Pressure snubber, brass with 1/4-inch NPT connections.

2.5 THERMOMETERS

- A. Thermometer: ASTM E1; adjustable angle; red appearing mercury; lens front tube; cast aluminum case with enamel finish; cast aluminum adjustable joint with positive locking device.
 1. Size: 7-inch scale.
 2. Window: Clear Lexan plastic.
 3. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.

4. Accuracy: Two (2) percent.

5. Calibration: Degrees F.

2.6 HYDRANTS

A. As specified in plumbing fixture schedule on drawings.

2.7 RECESSED VALVE BOXES

A. As specified in plumbing fixture schedule on drawings.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

- A. Piping shall be neatly arranged – straight, parallel, or at right angles to walls – and cut accurately to established measurements.
- B. Group piping whenever practical at common elevations.
- C. Pipes shall be worked into place without springing or forcing.
- D. Sufficient headroom shall be provided to enable the clearing of light fixtures, ductwork, sprinklers, aisles, passageways, windows, doors, and other openings.
- E. Pipes shall not interfere with access to maintain equipment.
- F. Pipes shall be clean, free of cuttings and foreign matter inside, and exposed ends shall be covered during site storage and installation. Split, bent, flattened, or otherwise damaged pipe or tubing shall not be used.
- G. Sufficient clearance shall be provided from walls, ceilings, and floors to permit the welding, soldering, or connecting of joints and valves. No less than six (6) inches of clearance shall be provided.
- H. Installation of pipe inside electrical equipment rooms, telecommunications or data rooms, elevator machine rooms, elevator hoistways, and stairwells is prohibited.
- I. Piping systems shall not interfere with the proper operation and maintenance of safety or relief valves.
- J. Means of draining the entire facility water distribution system shall be provided. A hose thread hydrant with vacuum breaker shall be placed at each low point in the system for this purpose. Constant grades to the low points shall be maintained for proper drainage. Piping shall be free of pockets due to changes in elevations.
- K. Install brass male adapters each side of valves in copper piped system.
- L. Install unions downstream of valves and at equipment or apparatus connections.
- M. Provide access doors where union, valves, or similar inline pipe accessories are not accessible. Refer to section 22 01 00.
- N. Sleeve pipes passing through partitions, walls, and floors. Refer to section 22 05 29.
- O. Install firestopping at fire-rated construction perimeters and openings containing penetrating sleeves and piping. Refer to section 22 05 32.
- P. Prepare exposed, unfinished pipe and fittings for finish painting. Refer to section 22 05 53.

- Q. Water service pipe and the building sewer shall be separated by five (5) feet of undisturbed or compacted earth.
 - 1. Exceptions:
 - a. The required separation distance shall not apply where the bottom of the water service pipe within five (5) feet of the sewer is a minimum of twelve (12) inches above the top of the highest point of the sewer and the pipe materials conform to Table 702.3 of the North Carolina Plumbing Code.
 - b. Water service pipe is permitted to be located in the same trench with a building sewer, provided such sewer is constructed of materials listed in Table 702.2 of the North Carolina Plumbing Code.
 - c. The required separation distance shall not apply where a water service pipe crosses a sewer pipe, provided the water service pipe is sleeved at least five (5) feet horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials listed in Table 605.3, 702.2, or 702.3 of the North Carolina Plumbing Code.
- R. Potable water service pipes shall not be located in, under, or above cesspools, septic tanks, septic tank drainage fields, or seepage pits.
- S. The installation of a water service or water distribution pipe shall be prohibited in soil and ground water contaminated with solvents, fuels, organic compounds, or other detrimental materials causing permeation, corrosion, degradation, or structural failure of the piping material. Where detrimental conditions are suspected, a chemical analysis of the soil and ground water conditions shall be required to ascertain the acceptability of the water service or water distribution piping material for the specific installation. Where detrimental conditions exist, approved alternative materials or routing shall be required.
- T. Joints between copper or copper-alloy pipe or fittings shall comply with the following:
 - 1. Soldered joints: Soldered joints shall be made in accordance with the methods of ASTM B828. All cut tube ends shall be reamed to the full inside diameter of the tube end. All joint surfaces shall be cleaned. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32. The joining of water supply piping shall be made with lead-free solders and fluxes. "Lead-free" shall mean a chemical composition equal to or less than 0.2-percent lead.
 - 2. Threaded joints: Threads shall conform to ASME B1.20.1. Pipe-joint compound or tape shall be applied on the male threads only.

3.2 VALVE INSTALLATION

- A. Provide temporary protective coating on cast iron and steel valves.
- B. Install valves with stems upright or horizontal, not inverted.
- C. Provide ball valves adjacent to equipment when functioning to isolate equipment.
- D. Provide spring loaded check valves on discharge of water pumps.
- E. Where water pressure within a building exceeds eighty (80) psi static, an approved water pressure reducing valve conforming to ASSE 1003 with strainer shall be installed to

reduce the pressure in the building water distribution piping to eighty (80) psi static or less.

1. The pressure-reducing valve shall be designed to remain open to permit uninterrupted water flow in case of valve failure.
2. All water-pressure reducing valves, regulators, and strainers shall be so constructed and installed as to permit repair or removal of parts without breaking a pipeline or removing the valve and strainer from the pipeline.

F. Full open valves shall be installed in the following locations:

1. A full open valve shall be located either outside the building within five (5) feet of the foundation wall in a readily accessible valve box, in the crawlspace within three (3) feet of the crawlspace access door or within the building in a location where it may be accessed without the use of a ladder or a tool.
2. On the base of every water riser pipe.
3. On the water supply pipe to a pressurized water tank.
4. On the water supply pipe to every water heater.

G. Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture other than bathtubs and showers.
2. On the water supply to each appliance or mechanical equipment.
3. Each supply branch line serving more than one fixture shall have a shutoff valve installed so as to isolate all fixtures and all pieces of equipment supplied by the branch line. The shutoff valve shall be labeled and located as close to the connection to the supply main and riser as practical.

H. Access shall be provided to all full open valves and shutoff valves.

I. Service valves shall be identified. All other valves installed in locations that are not adjacent to the fixture or appliance shall be identified, indicating the fixture or appliance served. Refer to specification section 22 05 53.

3.3 STRAINER INSTALLATION

- A. Strainers shall be installed such that the blowdown is perpendicular to the floor, wall, or ceiling through which access to the strainer is obtained.
- B. Access shall be provided to all strainers.

3.4 PRESSURE GAUGE INSTALLATION

- A. Install one pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump.
- B. Install gauge taps in piping.
- C. Install pressure gauges with pulsation dampers. Provide needle valve to isolate each gauge.
- D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

- E. Install gauges in locations where they are easily read from normal operating level. Install vertical to forty-five (45) degrees off vertical.
- F. Adjust gauges to final angle, clean windows, and lenses, and calibrate to zero.

3.5 THERMOMETER INSTALLATION

- A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than two-and-one-half (2-1/2) inches for installation of thermometer sockets. Allow clearance from insulation.
- B. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- C. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- D. Adjust thermometers to final angle, clean windows, and lenses, and calibrate to zero.

3.6 HYDRANT INSTALLATION

- A. Install at mounting heights indicated in plumbing fixture schedule on drawings.
- B. Coordinate installation of exterior wall hydrants with the general contractor so that each hydrant occupies space within a single course of masonry units.

3.7 PROTECTION OF THE POTABLE WATER SUPPLY

- A. Chemicals and other substances that produce either toxic conditions, taste, odor, or discoloration in a potable water system shall not be introduced into, or utilized in, such systems.
- B. Piping that has been utilized for any purpose other than conveying potable water shall not be utilized for conveying potable water.
- C. The interior surface of a potable water tank shall not be lined, painted, or repaired with any material that changes the taste, odor, color, or potability of the water supply when the tank is placed in, or returned to, service.
- D. Water pumps, filters, softeners, tanks, and all other devices that handle or treat potable water shall be protected against contamination.

3.8 INSPECTION AND TESTING

- A. Refer to specification section 22 01 00 for general inspection and testing requirements and performance requirements of test gauges.
- B. Upon completion of a section of or the entire water supply system, the system, or portion completed, shall be tested and proved tight under a water pressure of not less than the working pressure of the system; or an air test of not less than one hundred (100) psi. This pressure shall be held for at least fifteen (15) minutes. The water utilized for tests shall be obtained from a potable source of supply.

3.9 STERILIZATION OF THE DOMESTIC WATER SYSTEM

- A. Permitted new or repaired potable water systems shall be purged of deleterious matter prior to neutralization.

- B. After the system has been tested and approved, the entire new system, including valves and accessories, shall be chlorinated. Disinfecting shall be in accordance with AWWA C651.
- C. Chlorine may be applied in any of the following forms:
 - 1. Liquid chlorine gas-water mixture.
 - a. Chlorine gas-water mixture shall be applied by a solution feed chlorinating device.
 - 2. Calcium hypochlorite and water mixture.
 - a. A solution consisting of five (5) percent powder to ninety-five (95) percent water by weight shall be prepared. The calcium hypochlorite and water mixture shall first be made into a paste, then thinned into slurry, and injected or pumped into the system.
- D. The system or any part thereof shall be filled with a water-chlorine solution containing a chlorine concentration and shall stand in the system for a duration from either of the following:
 - 1. Chlorine concentration of at least fifty (50) parts per million and a duration of twenty-four (24) hours.
 - 2. Chlorine concentration of at least two hundred (200) parts per million and a duration of three (3) hours.
- E. During the chlorination process all valves and accessories shall be independently and manually operated at least twice.
- F. After the chlorination process, the chlorine shall be flushed from the system until the system water is equal in chemical and bacteriological composition to those of the permanent source of water supply. Spent chlorinated water shall be disposed of in an environmentally responsible procedure.
- G. Water supply shall not be placed into service until bacteriological test results are found to be satisfactory and the water meets Environmental Protection Agency quality standards for drinking water.
- H. The contractor shall submit samples of the system water to a competent laboratory for analysis. Laboratory tests of the water shall be paid for by the contractor. The water test report shall be submitted to the professional for review and approval.
- I. After acceptance by the professional, the water test report shall be submitted by the contractor to the owner and authority having jurisdiction prior to sending a request for final acceptance and occupancy permit.

END OF SECTION 221100

SECTION 221300 - SANITARY WASTE AND VENT SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Underground sanitary waste and vent piping.
2. Underground grease waste and vent piping.
3. Aboveground sanitary waste and vent piping.
4. Aboveground grease waste and vent piping.
5. Indirect waste piping for kitchen equipment.
6. Valves.
7. Floor drains.
8. Floor sinks.
9. Cleanouts.
10. Interceptors.

1.2 REFERENCES

A. ASTM International:

1. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A888 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
3. ASTM B152 – Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar.
4. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
5. ASTM C1540 – Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
6. ASTM C1563 – Standard Test Method for Gaskets for Use in Connection with Hub and Spigot Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, Vent, and Storm Piping Applications.
7. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
8. ASTM D2564 – Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems.
9. ASTM D2665 – Standard Specification for Polyvinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
10. ASTM D2855 – Standard Practice for Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

11. ASTM F656 – Standard Specification for Primers for Use in Solvent Cement Joints of Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
- B. Cast Iron Soil Pipe Institute (CISPI):
 1. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 2. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data for the following:
 1. Underground sanitary waste and vent piping.
 2. Underground grease waste and vent piping.
 3. Aboveground sanitary waste and vent piping.
 4. Aboveground grease waste and vent piping.
 5. Indirect waste piping for kitchen equipment.
 6. Valves.
 7. Floor drains.
 8. Floor sinks.
 9. Cleanouts.
 10. Interceptors.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Refer to specification section 22 01 05 for submittal requirements, definitions, and procedures.
- B. Submit manufacturer's data, manufacturer's warranties, and operation and maintenance instructions for the following:
 1. Underground sanitary waste and vent piping.
 2. Underground grease waste and vent piping.
 3. Aboveground sanitary waste and vent piping.
 4. Aboveground grease waste and vent piping.
 5. Indirect waste piping for kitchen equipment.
 6. Valves.
 7. Floor drains.
 8. Floor sinks.

9. Cleanouts.
10. Interceptors.

PART 2 PRODUCTS

2.1 UNDERGROUND SANITARY WASTE AND VENT PIPING

- A. Polyvinyl Chloride (PVC) Pipe:
 1. Pipe:
 - a. ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.
 2. Fittings:
 - a. ASTM D2466, Schedule 40, PVC.
 3. Joints:
 - a. ASTM D2855, solvent weld with ASTM D2564 Solvent cement.
- B. Pipe fittings shall not have ledges, shoulders, or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.
- C. The following types of joints and connections shall be prohibited.
 1. Cement or concrete joints.
 2. Mastic or hot pour bituminous joints.
 3. Joints made with fittings not approved for the specific installation.
 4. Joints between different diameter pipes made with elastomeric O-rings.
 5. Solvent cement joints between different types of plastic pipe.
 6. Saddle type fittings.

2.2 UNDERGROUND GREASE WASTE AND VENT PIPING

- A. Cast iron pipe:
 1. Pipe:
 - a. Hub and spigot: ASTM A74.
 2. Fittings:
 - a. Hub and spigot: ASTM A74.
 3. Joints:
 - a. Hub and spigot:
 - 1) Compression gasket: ASTM C564, ASTM C1563.
- B. Pipe fittings shall not have ledges, shoulders, or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.
- C. The following types of joints and connections shall be prohibited.
 1. Cement or concrete joints.

2. Mastic or hot pour bituminous joints.
3. Joints made with fittings not approved for the specific installation.
4. Joints between different diameter pipes made with elastomeric O-rings.
5. Solvent cement joints between different types of plastic pipe.
6. Saddle type fittings.

2.3 ABOVEGROUND SANITARY WASTE AND VENT PIPING

- A. Cast iron pipe:
 1. Pipe:
 - a. Hubless: ASTM A888, CISPI 301.
 2. Fittings:
 - a. Hubless: ASTM A888, CISPI 301.
 3. Joints:
 - a. Hubless shielded couplings: ASTM C564, CISPI 310.
 - 1) Heavy duty: ASTM C1540.
- B. Polyvinyl Chloride (PVC) Pipe:
 1. Pipe:
 - a. ASTM D2665, Schedule 40, PVC.
 2. Fittings:
 - a. ASTM D2665, Schedule 40, PVC.
 3. Joints:
 - a. ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- C. Pipe fittings shall not have ledges, shoulders, or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.
- D. The following types of joints and connections shall be prohibited.
 1. Cement or concrete joints.
 2. Mastic or hot pour bituminous joints.
 3. Joints made with fittings not approved for the specific installation.
 4. Joints between different diameter pipes made with elastomeric O-rings.
 5. Solvent cement joints between different types of plastic pipe.
 6. Saddle type fittings.

2.4 ABOVEGROUND GREASE WASTE AND VENT PIPING

- A. Cast iron pipe:
 1. Pipe:

- a. Hub and spigot: ASTM A74.
- 2. Fittings:
 - a. Hub and spigot: ASTM A74.
- 3. Joints:
 - a. Hub and spigot:
 - 1) Compression gasket: ASTM C564, ASTM C1563.
- B. Pipe fittings shall not have ledges, shoulders, or reductions capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.
- C. The following types of joints and connections shall be prohibited.
 - 1. Cement or concrete joints.
 - 2. Mastic or hot pour bituminous joints.
 - 3. Joints made with fittings not approved for the specific installation.
 - 4. Joints between different diameter pipes made with elastomeric O-rings.
 - 5. Solvent cement joints between different types of plastic pipe.
 - 6. Saddle type fittings.

2.5 INDIRECT WASTE PIPING FOR KITCHEN EQUIPMENT

- A. Polyvinyl chloride (PVC) plastic pipe: ASTM D2665.
 - 1. Fittings:
 - a. Socketed: ASTM D2665, ASTM F1866.
 - 2. Joints:
 - a. Socketed:
 - 1) Primer: ASTM F656.
 - 2) Solvent cement: ASTM D2564.
- B. Pipe fittings shall not have ledges, shoulders, or reductions capable of retarding or obstructing flow in the piping.
- C. The following types of joints and connections shall be prohibited.
 - 1. Cement or concrete joints.
 - 2. Mastic or hot pour bituminous joints.
 - 3. Joints made with fittings not approved for the specific installation.
 - 4. Joints between different diameter pipes made with elastomeric O-rings.
 - 5. Solvent cement joints between different types of plastic pipe.
 - 6. Saddle type fittings.

2.6 FLOOR DRAINS

- A. As specified in plumbing fixture schedule on drawings.

2.7 FLOOR SINKS

- A. As specified in plumbing fixture schedule on drawings.

2.8 CLEANOUTS

- A. Cleanout plugs shall be brass or plastic, or other approved materials. Brass cleanout plugs shall be utilized with metallic drain, waste, and vent piping only, and shall conform to ASTM A74. Cleanouts with plate-style access covers shall be fitted with corrosion-resistant fasteners.
- B. As specified in plumbing fixture schedule on drawings.

2.9 INTERCEPTORS

- A. Grease Interceptors: Precast concrete complying with ASTM C 913. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
- B. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 15-mil minimum thickness applied to all exterior and interior concrete surfaces.
- C. Structural Design Loads:
 - 1. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
- D. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
- E. Steps: FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.
- F. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
- G. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch diameter cover.
 - 1. Ductile Iron: ASTM A 536, Grade 60-40-1.
 - 2. Include indented top design with lettering cast into cover, using wording equivalent to "INTERCEPTOR."

PART 3 EXECUTION

3.1 PIPING INSTALLATION

- A. Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with the following table. Change in direction by combination fittings, side inlets, or increasers shall be installed in accordance with the following table based on the pattern of flow created by the fitting.

TYPE OF FITTING PATTERN	CHANGE IN DIRECTION		
	HORIZONTAL TO VERTICAL	VERTICAL TO HORIZONTAL	HORIZONTAL TO HORIZONTAL
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	X ^[3,5]	X ^[4]
Short sweep	X	X ^[2]	X ^[1]
Long sweep	X	X	X
Sanitary tee	X		
Wye	X	X	X
Combination wye and eighth bend	X	X	X

1. The fittings shall only be permitted for a two (2) inch or smaller sink or lavatory fixture drain.
 2. Two (2) inches and larger.
 3. May be used only within twelve (12) inches below water closet flange measured to centerline of the quarter bend.
 4. This fitting shall only be permitted to be used as the first fitting directly behind the fixture for drains two (2) inches and smaller, except clothes washers.
 5. The heel inlet connection of a quarter bend may be used as a wet or dry vent if the heel inlet connection of the quarter bend is located in the vertical position. The heel or side inlet connection may be used as a wet vent if the quarter bend is located directly below a water closet or other fixture with one integral trap.
- B. Heel inlet quarter bends shall be an acceptable means of connection, except where the quarter bend serves a water closet. A low heel inlet shall not be used as a wet vented connection. Side inlet quarter bends shall be an acceptable means of connection for drainage, wet venting, and stack venting arrangements.
- C. Direct connection of a steam exhaust, blowoff, or drip pipe shall not be made with the building drainage system. Wastewater when discharged into the building drainage system shall be at a temperature not higher than 140 °F. When higher temperatures exist, approved cooling methods shall be provided.
- D. Exposed soil or waste piping shall not be installed above any working, storage, or eating surfaces in food service establishments.
- E. Water service pipe and the building sewer shall be separated by five (5) feet of undisturbed or compacted earth.

1. Exceptions:
 - a. The required separation distance shall not apply where the bottom of the water service pipe within five (5) feet of the sewer is a minimum of twelve (12) inches above the top of the highest point of the sewer and the pipe materials conform to Table 702.3 of the North Carolina Plumbing Code.
 - b. Water service pipe is permitted to be located in the same trench with a building sewer, provided such sewer is constructed of materials listed in Table 702.2 of the North Carolina Plumbing Code.
 - c. The required separation distance shall not apply where a water service pipe crosses a sewer pipe, provided the water service pipe is sleeved at least five (5) feet horizontally from the sewer pipe centerline on both sides of such crossing with pipe materials listed in Table 605.3, 702.2, or 702.3 of the North Carolina Plumbing Code.
- F. Horizontal drainage piping shall be installed in uniform alignment at uniform slopes. The minimum slope of a horizontal drainage pipe shall be in accordance with the following:
 1. Pipes sized two-and-one-half (2-1/2) inches or less: one-quarter (1/4) inch per foot.
 2. Pipes sized (3) three to six (6) inches: one-eighth (1/8) inch per foot.
 3. Slope all grease waste piping at one-quarter (1/4) inch per foot.
- G. The size of drainage piping shall not be reduced in size in the direction of flow.
- H. Horizontal branches shall connect to the bases of stacks at a point located not less than ten (10) times the diameter of the drainage stack downstream from the stack. Horizontal branches shall connect to horizontal stack offsets at a point located not less than ten (10) times the diameter of the drainage stack downstream of the upper stack.
- I. In the installation or removal of any part of a drainage system, dead ends shall be prohibited. Cleanout extensions and approved future fixture drainage piping shall not be considered as dead ends.
- J. Joints between cast iron pipe or fittings shall comply with the following:
 1. Compression gasket joints: Compression gaskets for hub and spigot pipe and fittings shall conform to ASTM C564 and shall be tested to ASTM C1563. Gaskets shall be compressed when the pipe is fully inserted.
 2. Mechanical joint couplings: Mechanical joint couplings for hubless pipe and fittings shall comply with CISPI 310, ASTM C1277, or ASTM C1540. The elastomeric sealing sleeve shall conform to ASTM C564 and shall be provided with a center stop. Mechanical joint couplings shall be installed in accordance with the manufacturer's instructions.
- K. Joints between polyvinyl chloride (PVC) plastic pipe or fittings shall comply with the following:
 1. Solvent cementing: Joint surfaces shall be clean and free of moisture. A purple primer or an ultraviolet purple primer that conforms to ASTM F656 shall be applied. When an ultraviolet primer is used, the installer shall provide an

ultraviolet light to the inspector to be used during the inspection. Solvent cement not purple in color and conforming to ASTM D2564 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D2855. Solvent cement joints shall be permitted above or below ground.

L. Outdoor vent extensions shall comply with the following:

1. Every building in which plumbing is installed shall have at least one (1) stack the size of which is not less than one-half (1/2) of the required diameter of the building drain, and not less than two (2) inches in diameter. Such stack shall run undiminished in size and as directly as possible from the building drain through to the open air or to a vent header that extends to the open air.
2. Vent stacks or stack vents shall extend outdoors and terminate to open air.

M. Vent terminals shall comply with the following:

1. All open vent pipes that extend through a roof shall be terminated at least six (6) inches above the roof, except that where a roof is used by the public or tenants for any purpose, the vent extensions shall be run at least seven (7) feet above the roof.
2. The juncture of each vent pipe with the roof line shall be made water-tight by an approved flashing.
 - a. Sheet copper for vent pipe flashing shall conform to ASTM B152 and shall weigh not less than eight (8) ounces per square foot.
 - b. Sheet lead for vent pipe flashings shall weight not less than three (3) pounds per square foot for field-constructed flashings and not less than two-and-one-half (2.5) pounds per square foot for prefabricated flashings.
3. Vent terminals shall not be used a flag pole or to support flag poles, television aerials, or similar items, except when the piping has been anchored in an approved manner.
4. An open vent terminal from a drainage system shall not be located directly beneath any door, operable window, or other air intake opening of the building or of an adjacent building or property line, and any such vent terminal shall not be within ten (10) feet horizontally of such an opening unless it is at least two (2) feet above the top of such opening.

N. Vent connections shall comply with the following:

1. All individual, branch, and circuit vents shall connect to a vent stack, stack vent, air admittance valve, or extend to the open air.
2. All vent and branch vent pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.
3. Every dry vent connecting to a horizontal drain shall connect above the centerline of the horizontal drain pipe.
4. Every dry vent shall rise vertically to a minimum of six (6) inches above the flood level rim of the highest trap or trapped fixture being vented.

- a. Exception: When vents for interceptors and isolated floor drains are not located near an adjacent wall, the vent must rise six (6) inches vertically before turning horizontally and continuing to the nearest wall. A cleanout the same size as the vent shall be provided.
- 5. A connection between a vent pipe and a vent stack or stack vent shall be made at least six (6) inches above the flood level rim of the highest fixture served by the vent. Horizontal vent pipes forming branch vents, relief vents, or loop vents shall be at least six (6) inches above the flood level rim of the highest fixture served.
- O. Fixture vents shall comply with the following:
 - 1. Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are as indicated in Table 906.1 of the North Carolina Plumbing Code.
 - 2. The total fall in a fixture drain due to pipe slope shall not exceed the diameter of the fixture drain, nor shall the vent connection to a fixture drain, except for water closets, be below the weir of the trap.
 - 3. A vent shall not be installed within two (2) pipe diameters of the trap weir.
- P. Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the fixture drain of the trap or trapped fixture being vented.

3.2 FLOOR DRAIN INSTALLATION

- A. Coordinate the final location of all floor drains dedicated to serving equipment with the equipment provider prior to installation.
- B. Floor drains shall be installed with tops and strainers level with the floor slab.

3.3 FLOOR SINK INSTALLATION

- A. Coordinate the final location of all floor sinks dedicated to serving equipment with the equipment provider prior to installation.
- B. Floor sinks shall be installed with tops and strainers level with the floor slab.

3.4 CLEANOUT INSTALLATION

- A. Plugs shall have raised square or countersunk square heads. Countersunk heads shall be installed where raised heads are a trip hazard.
- B. Cleanouts shall be located in accordance with the following:
 - 1. All horizontal drains shall be provided with cleanouts located not more than one-hundred (100) feet apart.
 - 2. One cleanout shall be required for every four (4) horizontal forty-five (45) degree changes located in series. A long sweep bend is equivalent to two (2) forty-five (45) degree bends.
 - 3. A cleanout shall be provided at the base of each waste or soil stack.
 - 4. There shall be a cleanout at the junction of the building drain and the building sewer. The cleanout shall be outside the building wall and shall be brought up to

the finished ground level. An approved two-way cleanout is allowed to be used at this location to serve as a required cleanout for both the building drain and building sewer.

- a. The cleanout at the junction of the building drain and building sewer shall not be required if the cleanout on a three (3) inch or larger diameter waste stack is located within a developed length of not more than fifteen (15) feet from the building drain and building sewer connections and is extended to the outside of the building.
- C. Cleanout plugs shall not be covered with cement, plaster, or any other permanent finish material. Where it is necessary to conceal a cleanout or to terminate a cleanout in an area subject to vehicular traffic, the covering plate, access door, or cleanout shall be of an approved type designed and installed for this purpose.
- D. Every cleanout shall be installed to open to allow cleaning in the direction of flow of the drainage piping or at right angles thereto.
- E. Cleanouts shall be the same nominal size of the pipe they serve up to four (4) inches. For pipes larger than four (4) inches nominal size, the minimum size of the cleanout shall be four (4) inches.
- F. Cleanouts on six (6) inch and smaller pipes shall be provided with a clearance of not less than eighteen (18) inches for rodding.
- G. Access shall be provided to all cleanouts.
- H. Each horizontal drainage pipe shall be provided with a clean out at the upstream end of the pipe.
 1. The following plumbing arrangements are acceptable in lieu of the upstream cleanout:
 - a. P-traps connected to the drainage piping with slip joints or ground joint connections.
 - b. P-traps into which floor drains, shower drains, or tub drains with removable strainers discharge.
 - c. P-traps into which straight through type waste and overflow discharge with the overflow connecting to the top of the tee.
 - d. P-traps into which residential washing machines discharge.
 - e. Test tees or cleanouts in a vertical pipe.
 - f. Cleanout near the junction of the building drain and the building sewer which may be rodded in both directions.
 - g. Water closets for the water closet fixture drain only.
 - h. Cast iron cleanout sizing shall be in accordance with ASTM A74 for hub and spigot fittings or CISPI 301 for hubless fittings.

3.5 INSPECTION AND TESTING

- A. Refer to specification section 22 01 00 for general inspection and testing requirements and performance requirements of test gauges.

B. Drainage and vent water test:

1. A water test shall be applied to the drainage system within the building either in its entirety or in sections.
2. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow.
3. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than a ten (10) foot head of water.
4. In testing successive sections, at least the upper ten (10) feet of the next preceding section shall be tested so that no joint or pipe in the building, except the uppermost ten (10) feet of the system shall have been submitted to a test of less than a ten (10) foot head of water.
5. This pressure shall be held for at least fifteen (15) minutes. Then system shall then be tight at all points.

C. Drainage and vent final test:

1. The final test of the completed drainage and vent systems shall be visual and in sufficient detail to determine compliance with the provisions of the contract documents.

END OF SECTION 221300

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED PROVISIONS

- a. The requirements of the general conditions and of Division 01 apply to that portion of the work specified in this section.
- b. These specifications and the accompanying drawings shall include the furnishing of all labor, tools, materials, fixtures, transportation, appurtenances and service necessary and incidental to the installation of a complete and operative system as indicated and intended on the Drawings and as herein specified.
- c. Contractor shall coordinate the work and equipment of this division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, etc., which is required by the work of this Division of the Specifications, shall be provided by this Division unless otherwise indicated.
- d. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.2 DESCRIPTION OF THE WORK

- a. Work included under this Division includes installation of a new cooling and heating system and associated electrical system and controls system. The systems shall be installed complete, with boilers, piping, chiller, pumps and auxiliaries as hereinafter called for. Miscellaneous items including conduits, concrete slab, etc., are to be provided as indicated.
- b. It shall be the responsibility of the Contractor to provide a complete and operating system according to the true intent and meaning of the plans and specifications and all pipe, controls and equipment, etc.

1.3 DEFINITION

- a. The word "Contractor" as used in this Section of the Specifications refers to the HVAC Contractor unless specifically noted otherwise. The word "provide" means furnish, fabricate, complete, install, erect, including labor and incidental materials, necessary to complete in place and ready for operation or use the items referred to or described herein, and/or as shown or referred to on the Contract Drawings.

1.4 HVAC CONTRACTOR'S QUALIFICATIONS

- a. It is assumed that the contractor has had sufficient general knowledge and experience to anticipate the needs for a construction of this nature. The contractor shall furnish all items required to complete the construction in accordance with

reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by Code, law or regulations shall be provided whether or not specified or specifically shown.

- b. All work must be done by first class and experienced mechanics properly supervised, and it is understood that the Engineer has the right to stop any work that is not being properly done and has the right to demand that any incompetent workman be removed from the job and a competent workman be substituted therefor.
- c. All work must be done in strict accordance with standards of AME, ASHRAE and the building laws of all character in force in the locality where the apparatus is being installed. All work must also be in accordance with rules and regulations of the National Board of Fire Underwriters.

1.5 DUTIES OF CONTRACTOR

- a. Contractor is responsible for familiarizing himself with the details of the construction of the building. Work under these specifications installed improperly or which requires changing due to improper reading or interpretation of building plans shall be corrected and changed as directed by Engineer without additional cost to the Owner.
- b. Contractor shall leave the premises in a clean and orderly manner upon completion of work, and shall remove from premises all debris that has accumulated during the progress of the work. The HVAC Contractor shall have the permanent HVAC systems in sufficient readiness for furnishing temporary climatic control at the time the building is enclosed. The HVAC systems control shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishers of the building. A building shall be considered enclosed when it has windows installed and when doorways and other openings have protection which will provide reasonable climatic control. The appropriate climatic condition shall be jointly determined by the Contractor and the Architect. Use of the equipment in this manner shall in no way affect the warranty requirements of the Contractor.

1.6 CODES, RULES, PERMITS AND FEES

- a. The contractor shall give all necessary notices, obtain all permits and pay all government sales taxes, fees and other costs including utility connections or extension, in connection with his work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates for inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.
- b. The contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, ordinances, rules and regulations as required to complete the project in accordance with the intent of the drawings.
- c. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of all governmental departments having jurisdiction.

1.7 SURVEYS AND MEASUREMENTS

- a. The contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check correctness of same as related to the work.
- b. Should the contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and Specifications, he shall notify the Architect and shall not proceed with his work until he has received instructions from the Architect.

1.8 PLANS

- a. Except where dimensions are shown, mechanical plans are diagrammatic; see Architectural drawings for building dimensions and locations of windows, doors, ceiling diffusers, lights, etc. The plans are not intended to show each and every fitting, valve, pipe or pipe hanger, or a complete detail of all the work to be done, but are for the purpose of illustrating the type of system, pipe and duct sizes, etc. and special conditions considered necessary for the experienced mechanic to take off his material and lay out his work. Contractor shall be responsible for taking such measurements as may be necessary at the job, and adapting his work to the local conditions.

1.9 DRAWINGS AND SPECIFICATIONS

- a. Plans are diagrammatic, and it sometimes occurs that conditions exist in buildings which require certain changes in drawings and specifications. In event that such changes are necessary, the same are to be made by Contractor without expense to the Owner, provided however, that such changes, do not require furnishing more material or performing more labor than the true intent of the drawings and specifications demand.
- b. It is understood that while the drawings are to be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear on the drawings or in the specifications will be fully explained if application is made to the Engineer. Should however, conditions arise where in the judgment of the Contractor certain changes would be advisable. Contractor will communicate with Engineer and secure approval of the changes before going ahead with the work.
- c. The electrical and mechanical systems for this job have been designed on the basis of the mechanical equipment listed or data given herein or on the drawings. It shall be the responsibility of the Contractor to determine that the electrical service outlets, wiring, conduit and all overcurrent protective and safety devices furnished are adequate to meet Code Requirements for the equipment which he proposes to use. Changes required in the electrical system to accommodate the proposed mechanical equipment shall be worked out and the details submitted for approval. The cost of

making the necessary changes to the electrical system shall be the responsibility of the Contractor.

1.10 SHOP DRAWINGS

- a. Refer to Division 01.
- b. All items submitted to Architect for review shall bear stamp or notation indicating contractor's prior review and approval.
- c. Any Electrical or other changes required by substituted equipment to be made at no change in contract price.
- d. Submit manufacturer's certified performance data for all equipment.
- e. Coordinate installation drawings with other parts of the work, whether specified in this Division or other Divisions.
- f. Approval of shop drawings by the Engineer shall not relieve the Contractor from his obligation to provide equipment, control, and operation to the true intent of plans and specifications.
- g. The Contractor shall submit to the Engineer, within ten (10) days after approval of bids by the owner, a list indicating the manufacturer of all equipment and materials which he proposes to use. After that date, no substitution will be approved and all items shall be as specified.

1.11 SCAFFOLDING, RIGGING, HOISTING

- a. This contractor shall furnish all scaffolding rigging, hoisting, and services necessary to erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

1.12 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS

- a. Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract.

1.13 SLEEVES AND OPENINGS

- a. Contractor must have an experienced mechanic on the job before concrete slab floors or concrete masonry walls are poured or built into place, whose duty it shall be to locate exact positions of any and all holes necessary for future installation of his pipe work, ducts or equipment. Where pipes pass through concrete or masonry walls or floors, steel pipe sleeves shall be furnished. These shall be the same length as wall thickness and shall extend 1/2" above finished floors. Pipe sleeves in equipment room floors shall extend 3" above refinished floor. Pipe sleeves in equipment room floors shall extend 3" above finished floor. Sleeves shall be placed in position by this Contractor.

- b. This Contractor shall arrange for proper openings in the building to admit his equipment. If it becomes necessary to cut any portion of building to admit his equipment, portions cut must be restored to their former condition by this Contractor.
- c. This Contractor will provide duct openings or chases in masonry or concrete; however, it is this Contractor's responsibility to advise exact dimensions, shape and locations of openings required in sufficient time for the Contractor to make necessary provisions. This Contractor shall be responsible for correct size and location of each opening for his equipment through these openings.
- d. Wall openings that require a fire or smoke damper shall be made as nearly possible to the damper or duct size so that an angle frame can close the opening entirely.
- e. Where pipes or ducts penetrate floors or partitions which are fire or smoke barriers, the integrity of the barrier shall not be compromised by such penetration.

1.14 CUTTING AND PATCHING

- a. The Contractor shall do all cutting, fitting and patching as required to install piping and equipment except openings through the roof shall be provided by the General Contractor. Patching shall be done by mechanics skilled in the various trades and work shall match the existing work.
- b. All exposed openings in walls and floors for piping shall be core drilled. Cutting of holes by hand will not be allowed.
- c. Provide all required protection including but not limited to, welding blankets, dust covers, shoring bracing and supports to maintaining structural integrity, safety and cleanliness of the work.

1.15 EXCAVATION AND BACKFILLING

- a. All excavation and backfilling, puddling and tamping required to properly install work under this contract shall be done by this Contractor.
- b. Backfill shall be clear of rocks and trash. Backfilling shall be water tamped so as to provide firm footing for finish work, and shall be maintained at proper level for duration of the Contract. No backfilling shall be done until work to be covered has been inspected. Excessive excavation material shall be deposited on site and leveled as directed by the engineer.

1.16 POURED IN PLACE CONCRETE WORK

- a. Furnish and install all concrete work required for the construction of anchors, guide bases and elsewhere as indicated on the Drawings. Refer to appropriate Section in Division 3 for specification requirements.

1.18 STORAGE OF MATERIALS

- a. Equipment, ductwork, piping, and other equipment stored on site shall be protected from mud, dust, debris, weather, vermin, and construction traffic.
- b. Equipment, ductwork, piping, and other equipment shall be capped or otherwise covered to prevent water, dust, and debris intrusion. Cellophane membrane may be used for duct and equipment with care taken to maintain the seal integrity. Covering shall be replaced if seal is disturbed. Covering shall be removed only when necessary.
- c. Where pipe or ductwork becomes damaged by rust, dirt, dust, mud, or construction debris, it must be thoroughly cleaned and prepared to a like-new condition before installation.
- d. Porous materials such as duct liner and insulation that become saturated with water shall be discarded and replaced.
- e. Any equipment and/or materials affected (including aesthetically) as a result of improper storage shall be cleaned or replaced at contractor expense.

PART 2: PRODUCTS

2.1 MATERIALS

- a. Provide equipment complete with all components and accessories necessary to its satisfactory operation.
- b. Listing of a manufacturer's name in this Division does not infer conformity to all requirements of the Contract Documents, nor waive requirements thereof.

PART 3 - EXECUTION

3.1 BELT DRIVES

- a. V-belt drives shall be rated at not less than 200% of nominal motor horsepower.
- b. Motor sheaves shall be fixed pitch type.
- c. Scheduled fan static pressures are estimated. Provide one extra drive per device as required to allow adjustment to deliver scheduled air quantities against actual system resistance.
- d. Provide guards for all belt drives not enclosed within equipment housings. Provide openings in guard at driving and driven sheaves for use of revolution counter.

3.2 MAINTENANCE AND OPERATING INSTRUCTIONS

- a. Upon completion of all work, the Contractor shall furnish a complete set of operating instructions for all equipment. Such instructions shall be diagrammatic in form on heavy white paper, suitably framed, protected with glass and hung where directed by the owner. A preliminary draft of the instruction sheets shall be submitted to the engineer for approval before making same.
- b. Manufacturer's instruction books, card, etc., (to each individual piece of equipment furnished under this contract) shall be furnished to the owner. These shall contain instructions for the operation and maintenance of all equipment. Where such is not

furnished by the manufacturer, the contractor shall give written instructions to the owner for the maintenance of the equipment involved.

3.3 DUCTS, PLENUM, ETC.

- a. As indicated on drawings, provide a system of ducts for supplying returning and exhausting air from various spaces. All details of the ductwork are not indicated and the necessary bends, offsets and transformations must be furnished whether shown or not.
- b. All sheet metal ducts, casing, plenums, etc., of sizes indicated, shall be constructed from prime galvanized sheet steel, and shall be in accordance with or equal to standards set forth in latest issue of SMACNA low velocity duct manual for gauges of materials, (2" pressure), workmanship, method of fabrication and erection.
- c. All uninsulated panels of ducts over twelve inches (12") wide shall be cross-broken, except on plenums, which shall be braced with angle iron as required to prevent breathing.
- d. All ductwork must present a smooth interior and joints must be airtight. Where there is evidence of undue leakage at the joints in low pressure ducts, they shall be sealed with cement similar to Foster 30-02.
- e. Depending upon space requirements, round or square elbows may be used as required or at the Contractors option in low velocity ducts. All elbows shall be constructed for minimum pressure drop. All elbows with an inside radius less than 3/4 the width of the duct must be fitted with multiple double thickness turning vanes.
- f. No transformations or offsets shall be made with a slope greater than (7 to 1), space conditions permitting.
- g. Where indicated on drawings, ductwork is to be lined with flexible fiberglass acoustics material weighing not less than 1 1/2 lb. per cubic foot and having a flame spread classification of not more than twenty-five (25) as listed under Underwriters Laboratories. Liner shall be applied according to SMACNA duct liner standard. Thickness shall be as indicated on the drawings. Duct sizes on plan are inside clear sizes, increase the actual sheet metal size accordingly in sizing the duct.
- h. The lining shall be secured to the ductwork with a suitable adhesive and with mechanical fasteners center. Liner shall be cut such that adjacent sections of insulation butt together and are sealed with Foster 30-02 joints.
- i. All duct connections to and from all centrifugal fans or cabinets containing fans, shall be made with fabric equal to "Ventfab" as made by Ventfabrics, Inc., not less than four inches (4") long secured by peripheral iron straps holding fabric in galvanized iron, except as otherwise noted.
- j. Vertical ducts shall be supported by means of an angle iron frame riveted to the ductwork on at least two (2) sides. Horizontal runs of ductwork shall be supported on not more than 8'-0" centers as required.

- k. Manual volume and splitter dampers shall be furnished and installed where shown and where necessary for proper regulation of the air distribution. A quadrant and set screw equal to "Ventlock" #641 shall be installed for all dampers which are concealed above plaster or gypsum board ceilings, or behind the masonry construction, furnish and install concealed regulators ("Ventlock" #666) with chrome cover plate.
- l. All ductwork shall operate without chatter and vibration, and shall be free from pulsations.
- m. See section 233113 for metal ductwork requirements.

3.4 ACCESS DOORS OR PANELS

- a. Provide duct access doors of approved construction at any apparatus requiring service and inspection. Doors shall suit finish in which installed.
- b. Access doors in rated walls or assemblies shall be rated as required to maintain rating of assembly. Rated access doors shall bear U.L. Label.

3.5 CLEANING DUCT SYSTEM

- a. Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc., before installing any outlets. After installation of outlets and connections to fans are made, blow out entire systems with all control devices wide open.

3.6 ITEMS OF ELECTRICAL EQUIPMENT

- a. All electrical work shall be done by properly licensed electrical mechanics in accordance with Division 26 of the specifications under supervision of a licensed Electrical Contractor as approved by the Architect.
- b. The Electrical Contractor shall provide all power wiring to motor starter and/or disconnect switch and from starter/disconnect switch to motor. The Mechanical Contractor shall provide all control wiring, low voltage or line voltage, as required for the operation of all mechanical equipment. All control devices such as motor starters, thermostats, switches, etc. shall be provided by the Mechanical Contractor.
- c. All motor starters shall be provided with a "hand-off-auto" switch on the starter cover.
- d. All items of mechanical equipment electrically operated shall be in complete accordance with electrical division of the specifications. Mechanical equipment, other than individually mounted motors, shall be factory prewired so that it will only be necessary to bring connections to a single set of terminals.
- e. Mechanical equipment electrical components shall all be bonded together and connected to electrical system ground.

- f. All mechanical equipment shall be U.L. listed and labeled as a complete package, not through individual components or parts. Provide required 3rd party field UL listing services as required to comply.

3.7 WARRANTY AND SERVICE

- a. Upon completion of all work, the contractor shall check the system out so that all motor bearings are greased as required and have all systems balanced. He shall be responsible for original service, of starting the system up, and providing one set of replacement filters after final acceptance.
- b. Refer to equipment specifications for specific warranty information.

3.8 INSPECTION AND ACCEPTANCE TEST

- a. The project will be checked periodically as construction progresses. The contractor shall be responsible for notifying the Engineer at least 48 hours in advance when any work to be covered up is ready for inspection. No work will be covered up until approved by the Engineer.
- b. Upon completion of erection of all equipment and work specified herein and shown approved shop drawings, and at the time designated by the engineer, the contractor shall start all apparatus, making necessary tests as directed and as specified herein, and make adjustments of all parts of all equipment before acceptance of equipment by the owner. The contractor must demonstrate to the owner, by performance, that all equipment operates as specified and meets the guarantee called for.
- c. Tests shall include satisfactory evidence that all systems operate as called for on the drawings, and that all pieces of equipment operate at specified ratings under specified operating conditions.
- d. The contractor shall furnish all fuel and power required for these purposes, and provide the proper and necessary help required to operate the system while tests are being made.
- e. All drainage piping shall be tested by filling with water to a point 10' above the underground drains or to point of discharge to grade and let stand thus filled for 3 hours.
- f. Tests on all pipe work shall be subject to the inspection of the Engineer. He shall be given 24-hours notice when a section pipe is to be tested and the test shall not be removed until permission is given by the Engineer.

3.9 AS BUILT DRAWINGS

- b. This contractor shall keep on the job at all times, a clean set of contract drawings in blueprint form. As the job progresses, any and all deviations from the arrangements, piping runs, equipment locations, etc., shown on the bid prints shall be marked on this set with red ink. These prints shall not be used for any other purpose than to be marked up as "As-Built" Drawings.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

- 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Iron ball valves.
 - 4. Iron, single-flange butterfly valves.
 - 5. Iron, grooved-end butterfly valves.
 - 6. High-performance butterfly valves.
 - 7. Bronze swing check valves.
 - 8. Iron swing check valves.
 - 9. Iron swing check valves with closure control.
 - 10. Iron, grooved-end swing-check valves.
 - 11. Iron, center-guided check valves.
 - 12. Iron, plate-type check valves.
 - 13. Bronze gate valves.
 - 14. Iron gate valves.
 - 15. Bronze globe valves.
 - 16. Iron globe valves.
 - 17. Lubricated plug valves.
 - 18. Eccentric plug valves.
- B. Related Sections:
 - 1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 ACCEPTABLE MANUFACTURERS

- A. All valves shall be manufactured in the USA.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Valve Co.
 - 2. Cameron
 - 3. Conbraco Industries.
 - 4. Hammond Valve
 - 5. Milwaukee Valve Co.
 - 6. NIBCO Inc.
 - 7. Powell Valves
 - 8. Watts Regulator Co

1.6 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.

- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

- A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 400 psig.
- c. Body Design: One piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded.
- f. Seats: PTFE or TFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

C. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

D. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.

- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Regular.

E. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Brass or bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Regular.

F. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

G. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.

- j. Port: Full.

2.3 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.

B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:

- 1. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Reduced.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

- 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

E. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Regular.

F. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Regular.

G. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.

- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

H. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.4 IRON BALL VALVES

A. Class 150, Iron Ball Valves:

1. Description:

- a. Standard: MSS SP-72.
- b. CWP Rating: 200 psig.
- c. Body Design: Split body.
- d. Body Material: ASTM A 126, gray iron.
- e. Ends: Flanged.
- f. Seats: PTFE or TFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel.
- i. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.

- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

B. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

C. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated or -coated ductile iron.

D. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated or -coated ductile iron.

E. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

F. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

G. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

H. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

I. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated or -coated ductile iron.

J. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated or -coated ductile iron.

K. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

L. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig.
 - c. Body Material: Coated, ductile iron.
 - d. Stem: Two-piece stainless steel.
 - e. Disc: Coated, ductile iron.
 - f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. NPS 8 and Smaller CWP Rating: 300 psig.
 - c. NPS 10 and Larger CWP Rating: 200 psig.
 - d. Body Material: Coated, ductile iron.
 - e. Stem: Two-piece stainless steel.
 - f. Disc: Coated, ductile iron.
 - g. Seal: EPDM.

2.7 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Description:
 - a. Standard: MSS SP-68.
 - b. CWP Rating: 285 psig at 100 deg F.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
 - e. Seat: Reinforced PTFE or metal.
 - f. Stem: Stainless steel; offset from seat plane.
 - g. Disc: Carbon steel.
 - h. Service: Bidirectional.

B. Class 300, Single-Flange, High-Performance Butterfly Valves:

1. Description:
 - a. Standard: MSS SP-68.
 - b. CWP Rating: 720 psig at 100 deg F.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

- d. Body Material: Carbon steel, cast iron, or ductile iron.
- e. Seat: Reinforced PTFE or metal.
- f. Stem: Stainless steel; offset from seat plane.
- g. Disc: Carbon steel.
- h. Service: Bidirectional.

2.8 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: NBR, PTFE, or TFE.

2.9 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:

- a. Standard: MSS SP-80, Type 4.

- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: PTFE or TFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

- 1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

- 1. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.10 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

- 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

- 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.

- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.
- g. Trim: Composition.
- h. Seat Ring: Bronze.
- i. Disc Holder: Bronze.
- j. Disc: PTFE or TFE.
- k. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.
- g. Trim: Bronze.
- h. Gasket: Asbestos free.

2.11 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.
- g. Trim: Bronze.
- h. Gasket: Asbestos free.
- i. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Design: Clear or full waterway.
- e. Body Material: ASTM A 126, gray iron with bolted bonnet.
- f. Ends: Flanged.

- g. Trim: Bronze.
- h. Gasket: Asbestos free.
- i. Closure Control: Factory-installed, exterior lever and weight.

2.12 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

- 1. Description:
 - a. CWP Rating: 300 psig.
 - b. Body Material: ASTM A 536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring operated, ductile iron or stainless steel.

2.13 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

- 1. Description:
 - a. Standard: MSS SP-125.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Style: Compact wafer.
 - f. Seat: Bronze.

B. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

- 1. Description:
 - a. Standard: MSS SP-125.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Style: Globe, spring loaded.
 - f. Ends: Flanged.
 - g. Seat: Bronze.

C. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

- 1. Description:
 - a. Standard: MSS SP-125.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 250 psig.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- e. Style: Compact wafer.
- f. Seat: Bronze.

D. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
- c. NPS 14 to NPS 24, CWP Rating: 250 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Globe, spring loaded.
- f. Ends: Flanged.
- g. Seat: Bronze.

E. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Compact wafer, spring loaded.
- f. Seat: Bronze.

F. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Globe, spring loaded.
- f. Ends: Flanged.
- g. Seat: Bronze.

G. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 400 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Compact wafer, spring loaded.
- f. Seat: Bronze.

H. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 400 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Globe, spring loaded.
- f. Ends: Flanged.
- g. Seat: Bronze.

I. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Compact wafer.
- f. Seat: EPDM or NBR.

J. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Globe, spring loaded.
- f. Ends: Flanged.
- g. Seat: EPDM or NBR.

K. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
- c. NPS 14 to NPS 24, CWP Rating: 250 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Compact wafer.
- f. Seat: EPDM or NBR.

L. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

- c. NPS 14 to NPS 24, CWP Rating: 250 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Globe, spring loaded.
- f. Ends: Flanged.
- g. Seat: EPDM or NBR.

M. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Compact wafer, spring loaded.
- f. Seat: EPDM or NBR.

N. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

a.

2. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron.
- e. Style: Globe, spring loaded.
- f. Ends: Flanged.
- g. Seat: EPDM or NBR.

O. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 400 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Compact wafer, spring loaded.
- f. Seat: EPDM or NBR.

P. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Description:

- a. Standard: MSS SP-125.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 400 psig.
- d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- e. Style: Globe, spring loaded.

- f. Ends: Flanged.
- g. Seat: EPDM or NBR.

2.14 IRON, PLATE-TYPE CHECK VALVES

A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Description:

- a. Standard: API 594.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Design: Wafer, spring-loaded plates.
- e. Body Material: ASTM A 126, gray iron.
- f. Seat: Bronze.

B. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:

1. Description:

- a. Standard: API 594.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
- c. NPS 14 to NPS 24, CWP Rating: 250 psig.
- d. Body Design: Wafer, spring-loaded plates.
- e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- f. Seat: Bronze.

C. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:

1. Description:

- a. Standard: API 594.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Design: Wafer, spring-loaded plates.
- e. Body Material: ASTM A 126, gray iron.
- f. Seat: Bronze.

D. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:

1. Description:

- a. Standard: API 594.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 400 psig.
- d. Body Design: Wafer, spring-loaded plates.
- e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- f. Seat: Bronze.

E. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:

1. Description:
 - a. Standard: API 594.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Design: Wafer, spring-loaded plate.
 - e. Body Material: ASTM A 126, gray iron.
 - f. Seat: EPDM or NBR.

F. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Description:
 - a. Standard: API 594.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Design: Wafer, spring-loaded plates.
 - e. Body Material: ASTM A 126, gray iron.
 - f. Seat: EPDM or NBR.

G. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Description:
 - a. Standard: API 594.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 250 psig.
 - d. Body Design: Wafer, spring-loaded plates.
 - e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - f. Seat: EPDM or NBR.

H. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:

1. Description:
 - a. Standard: API 594.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 300 psig.
 - d. Body Design: Wafer, spring-loaded plate.
 - e. Body Material: ASTM A 126, gray iron.
 - f. Seat: EPDM or NBR.

I. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Description:
 - a. Standard: API 594.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.

- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Design: Wafer, spring-loaded plates.
- e. Body Material: ASTM A 126, gray iron.
- f. Seat: EPDM or NBR.

J. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Description:

- a. Standard: API 594.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 400 psig.
- d. Body Design: Wafer, spring-loaded plates.
- e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
- f. Seat: EPDM or NBR.

2.15 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS Bronze Gate Valves:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, NRS Bronze Gate Valves:

1. Description:

- a. Standard: MSS SP-80, Type 1.

- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

D. Class 150, RS Bronze Gate Valves:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

2.16 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:

1. Description:

- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

2.17 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.

- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, Bronze Globe Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron, bronze, or aluminum.

2.18 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

2.19 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:

- a. Standard: MSS SP-78, Type II.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.

- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Description:

- a. Standard: MSS SP-78, Type II.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Description:

- a. Standard: MSS SP-78, Type IV.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Description:

- a. Standard: MSS SP-78, Type IV.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:

- a. Standard: MSS SP-78, Type II.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.

- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Description:

- a. Standard: MSS SP-78, Type II.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Description:

- a. Standard: MSS SP-78, Type IV.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Description:

- a. Standard: MSS SP-78, Type IV.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
- c. NPS 14 to NPS 24, CWP Rating: 300 psig.
- d. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
- e. Pattern: Regular or short.
- f. Plug: Cast iron or bronze with sealant groove.

2.20 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.

1. Description:

- a. Standard: MSS SP-108.
- b. CWP Rating: 175 psig minimum.

- c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
- d. Bearings: Oil-impregnated bronze or stainless steel.
- e. Ends: Flanged.
- f. Stem-Seal Packing: Asbestos free.
- g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball butterfly gate globe and plug valves NPS 8 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service except Steam: Globe, ball, or butterfly valves.
 - 4. Throttling Service, Steam: Globe or butterfly valves.
 - 5. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 5. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER, CONDENSER WATER AND HOT WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Ball Valves: Three piece, full port, brass or bronze with brass trim.
 - 2. Bronze Swing Check Valves: Class 150, bronze disc.
 - 3. Bronze Gate Valves: Class 150, NRS, bronze.
 - 4. Bronze Globe Valves: Class 150, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
 - 3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, NBR seat, aluminum-bronze disc.

4. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
5. High-Performance Butterfly Valves: Class 150, single flange.
6. Iron Swing Check Valves: Class 125, metal seats.
7. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
8. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
9. Iron, Center-Guided Check Valves: Class 150, compact-wafer, resilient seat.
10. Iron, Plate-Type Check Valves: Class 150; single plate; resilient seat.
11. Iron Gate Valves: Class 125, OS&Y.
12. Iron Globe Valves: Class 125.
13. Lubricated Plug Valves: Class 125, flanged.
14. Eccentric Plug Valves: 175 CWP, resilient seating.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
 - 3. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
 - 4. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
 - 5. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Fiberglass pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Pipe stands. Include Product Data for components.
 - 4. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", AWS D1.3, "Structural Welding Code--Sheet Steel.", AWS D1.4, "Structural Welding Code--Reinforcing Steel." and ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - 5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Material: Carbon Steel
- C. Coating: Galvanized, Hot dipped galvanized
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 1. Base: Plastic.
 - 2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 1. Bases: One or more plastic.
 - 2. Vertical Members: Two or more protective-coated-steel channels.
 - 3. Horizontal Member: Protective-coated-steel channel.
 - 4. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 2”.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.

1.2 SUBMITTAL

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment (Note: Plastic Labels utilized in a return air plenum shall be listed and approved for use in a return air plenum):
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Red.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. (Note: Plastic Labels utilized in a return air plenum shall be listed and approved for use in a return air plenum):
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.
- C. Major mechanical equipment shall include:
- a. VAV Boxes
 - b. Fans

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Chilled-Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
2. Dual Temperature Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
3. Condenser-Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
4. Heating Water Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
5. Refrigerant Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
6. Drain Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; and shutoff valves. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 1. Valve-Tag Size and Shape:
 - a. Chilled Water: 2 inches, round.
 - b. Dual Temperature Water: 2 inches, round.
 - c. Refrigerant: 2 inches, round.

- d. Hot Water: 2 inches, round.
 - e. Gas: 2 inches, round.
- 2. Valve-Tag Color:
 - a. Chilled Water: Natural.
 - b. Dual Temperature Water: Natural.
 - c. Refrigerant: Natural.
 - d. Hot Water: Natural.
 - e. Gas: Natural.
- 3. Letter Color:
 - a. Chilled Water: Black.
 - b. Dual Temperature Water: Black.
 - c. Refrigerant: Black.
 - d. Hot Water: Black.
 - e. Gas: Black.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - b. Dual-duct systems.
 - c. Variable-air-volume systems.
 - d. Multizone systems.
 - e. Induction-unit systems.
 - 2. Hydronic Piping Systems:
 - a. Constant-flow systems.
 - b. Variable-flow systems.
 - c. Primary-secondary systems.
 - 3. HVAC equipment quantitative-performance settings.
 - 4. Kitchen hood airflow balancing.
 - 5. Exhaust hood airflow balancing.
 - 6. Space pressurization testing and adjusting.
 - 7. Existing systems TAB.
 - 8. Verifying that automatic control devices are functioning properly.
 - 9. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- G. RC: Room criteria.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.
- J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.
- K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.
- L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- P. TAB: Testing, adjusting, and balancing.
- Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- R. Test: A procedure to determine quantitative performance of systems or equipment.
- S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.
- B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. The Contract Documents examination report.
 - c. TAB plan.
 - d. Work schedule and Project-site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

- D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.
- G. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 7.2.2 - "Air Balancing."
- H. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.7.2.3 - "System Balancing."

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and

fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- M. Examine strainers for clean screens and proper perforations.
- N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- P. Examine system pumps to ensure absence of entrained air in the suction piping.
- Q. Examine equipment for installation and for properly operating safety interlocks and controls.
- R. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at indicated values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to indicated values.
- S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2007, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's

- recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record the final fan performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance systems similar to constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check expansion tank liquid level.
 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 6. Set system controls so automatic valves are wide open to heat exchangers.
 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

- A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.

2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.12 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.13 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

- A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.
1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.
- B. After balancing is complete, do the following:
1. Measure and record the static pressure at the hood exhaust-duct connection.
 2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.
 3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.
- C. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.

1. Check duct slopes as required.
2. Verify that duct access is installed as required.
3. Verify that point of termination is as required.
4. Verify that duct air velocity is within the range required.
5. Verify that duct is within a fire-rated enclosure.

D. Report deficiencies.

3.14 PROCEDURES FOR EXHAUST HOODS

- A. Measure, adjust, and record the airflow of each exhaust hood. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, explain why, in the report, and explain the test method used.
- B. After balancing is complete, do the following:
 1. Measure and record the static pressure at the hood exhaust-duct connection.
 2. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to achieve optimum results.

3.15 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

- A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.
- B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.
- C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.
 1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
 2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
 3. Test room pressurization first, then zones, and finish with building pressurization.
- D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.
- E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.

1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
 2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test over pressurization and under pressurization, and observe and report on the system's ability to revert to the set point.
 3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.
- F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.
- G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.16 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the refrigerant charge.
 4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check the operation of the drain pan and condensate drain trap.
 7. Check bearings and other lubricated parts for proper lubrication.
 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
4. Air balance each air outlet.

3.17 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.18 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances (code required minimums must meet or exceed rates indicated on plans):
 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Minus 5 to plus 10 percent.
 2. Air Outlets and Inlets: minus 10 to plus 10 percent.
 3. Heating-Water Flow Rate: minus 10 to plus 10 percent.
 4. Cooling-Water Flow Rate: minus 10 to plus 10 percent.

3.19 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to

facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.20 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer, type size, and fittings.
 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Preheat coil static-pressure differential in inches wg.
- g. Cooling coil static-pressure differential in inches wg.
- h. Heating coil static-pressure differential in inches wg.
- i. Outside airflow in cfm.
- j. Return airflow in cfm.
- k. Outside-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outside-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btuh.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and rpm.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Sheave dimensions, center-to-center, and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btuh.
 - i. High-fire fuel input in Btuh.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btuh.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btuh.

I. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btuh.
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.

- h. Airflow rate in cfm.
 - i. Face area in sq. ft..
 - j. Minimum face velocity in fpm.
 - 2. Test Data (Indicated and Actual Values):
 - a. Heat output in Btuh.
 - b. Airflow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- J. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - g. Number of belts, make, and size.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- K. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:

- a. System and air-handling unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..
- g. Indicated airflow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual airflow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

L. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Test apparatus used.
- d. Area served.
- e. Air-terminal-device make.
- f. Air-terminal-device number from system diagram.
- g. Air-terminal-device type and model number.
- h. Air-terminal-device size.
- i. Air-terminal-device effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary airflow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final airflow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

M. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Room or riser served.
- d. Coil make and size.
- e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Entering-water temperature in deg F.

- c. Leaving-water temperature in deg F.
- d. Water pressure drop in feet of head or psig.
- e. Entering-air temperature in deg F.
- f. Leaving-air temperature in deg F.

N. Packaged Chiller Reports:

1. Unit Data:
 - a. Unit identification.
 - b. Make and model number.
 - c. Manufacturer's serial number.
 - d. Refrigerant type and capacity in gal..
 - e. Starter type and size.
 - f. Starter thermal protection size.
 - g. Compressor make and model number.
 - h. Compressor manufacturer's serial number.
2. Water-Cooled Condenser Test Data (Indicated and Actual Values):
 - a. Refrigerant pressure in psig.
 - b. Refrigerant temperature in deg F.
 - c. Entering-water temperature in deg F.
 - d. Leaving-water temperature in deg F.
 - e. Entering-water pressure in feet of head or psig.
 - f. Water pressure differential in feet of head or psig.
3. Air-Cooled Condenser Test Data (Indicated and Actual Values):
 - a. Refrigerant pressure in psig.
 - b. Refrigerant temperature in deg F.
 - c. Entering- and leaving-air temperature in deg F.
4. Evaporator Test Reports (Indicated and Actual Values):
 - a. Refrigerant pressure in psig.
 - b. Refrigerant temperature in deg F.
 - c. Entering-water temperature in deg F.
 - d. Leaving-water temperature in deg F.
 - e. Entering-water pressure in feet of head or psig.
 - f. Water pressure differential in feet of head or psig.
5. Compressor Test Data (Indicated and Actual Values):
 - a. Suction pressure in psig.
 - b. Suction temperature in deg F.
 - c. Discharge pressure in psig.
 - d. Discharge temperature in deg F.
 - e. Oil pressure in psig.
 - f. Oil temperature in deg F.

- g. Voltage at each connection.
 - h. Amperage for each phase.
 - i. Kilowatt input.
 - j. Crankcase heater kilowatt.
 - k. Chilled-water control set point in deg F.
 - l. Condenser-water control set point in deg F.
 - m. Refrigerant low-pressure-cutoff set point in psig.
 - n. Refrigerant high-pressure-cutoff set point in psig.
- 6. Refrigerant Test Data (Indicated and Actual Values):
 - a. Oil level.
 - b. Refrigerant level.
 - c. Relief valve setting in psig.
 - d. Unloader set points in psig.
 - e. Percentage of cylinders unloaded.
 - f. Bearing temperatures in deg F.
 - g. Vane position.
 - h. Low-temperature-cutoff set point in deg F.
- O. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Unit make and model number.
 - d. Compressor make.
 - e. Compressor model and serial numbers.
 - f. Refrigerant weight in lb.
 - g. Low ambient temperature cutoff in deg F.
 - 2. Test Data (Indicated and Actual Values):
 - a. Inlet-duct static pressure in inches wg.
 - b. Outlet-duct static pressure in inches wg.
 - c. Entering-air, dry-bulb temperature in deg F.
 - d. Leaving-air, dry-bulb temperature in deg F.
 - e. Condenser entering-water temperature in deg F.
 - f. Condenser leaving-water temperature in deg F.
 - g. Condenser-water temperature differential in deg F.
 - h. Condenser entering-water pressure in feet of head or psig.
 - i. Condenser leaving-water pressure in feet of head or psig.
 - j. Condenser-water pressure differential in feet of head or psig.
 - k. Control settings.
 - l. Unloader set points.
 - m. Low-pressure-cutout set point in psig.
 - n. High-pressure-cutout set point in psig.

- o. Suction pressure in psig.
 - p. Suction temperature in deg F.
 - q. Condenser refrigerant pressure in psig.
 - r. Condenser refrigerant temperature in deg F.
 - s. Oil pressure in psig.
 - t. Oil temperature in deg F.
 - u. Voltage at each connection.
 - v. Amperage for each phase.
 - w. Kilowatt input.
 - x. Crankcase heater kilowatt.
 - y. Number of fans.
 - z. Condenser fan rpm.
 - aa. Condenser fan airflow rate in cfm.
 - bb. Condenser fan motor make, frame size, rpm, and horsepower.
 - cc. Condenser fan motor voltage at each connection.
 - dd. Condenser fan motor amperage for each phase.
- P. Cooling Tower or Condenser Test Reports: For cooling towers or condensers, include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Make and type.
 - c. Model and serial numbers.
 - d. Nominal cooling capacity in tons.
 - e. Refrigerant type and weight in lb.
 - f. Water-treatment chemical feeder and chemical.
 - g. Number and type of fans.
 - h. Fan motor make, frame size, rpm, and horsepower.
 - i. Fan motor voltage at each connection.
 - j. Sheave make, size in inches, and bore.
 - k. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - l. Number of belts, make, and size.
 - m. Pump make and model number.
 - n. Pump manufacturer's serial number.
 - o. Pump motor make and frame size.
 - p. Pump motor horsepower and rpm.
 - 2. Pump Test Data (Indicated and Actual Values):
 - a. Voltage at each connection.
 - b. Amperage for each phase.
 - c. Water flow rate in gpm.
 - 3. Water Test Data (Indicated and Actual Values):
 - a. Entering-water temperature in deg F.
 - b. Leaving-water temperature in deg F.
 - c. Water temperature differential in deg F.

- d. Entering-water pressure in feet of head or psig.
 - e. Leaving-water pressure in feet of head or psig.
 - f. Water pressure differential in feet of head or psig.
 - g. Water flow rate in gpm.
 - h. Bleed water flow rate in gpm.
4. Air Data (Indicated and Actual Values):
- a. Duct airflow rate in cfm.
 - b. Inlet-duct static pressure in inches wg.
 - c. Outlet-duct static pressure in inches wg.
 - d. Average entering-air, wet-bulb temperature in deg F.
 - e. Average leaving-air, wet-bulb temperature in deg F.
 - f. Ambient wet-bulb temperature in deg F.
- Q. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
- a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model and serial numbers.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

R. Boiler Test Reports:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
 - f. Fuel type and input in Btuh.
 - g. Number of passes.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
2. Test Data (Indicated and Actual Values):
 - a. Operating pressure in psig.
 - b. Operating temperature in deg F.
 - c. Entering-water temperature in deg F.
 - d. Leaving-water temperature in deg F.
 - e. Number of safety valves and sizes in NPS.
 - f. Safety valve settings in psig.
 - g. High-limit setting in psig.
 - h. Operating-control setting.
 - i. High-fire set point.
 - j. Low-fire set point.
 - k. Voltage at each connection.
 - l. Amperage for each phase.
 - m. Draft fan voltage at each connection.
 - n. Draft fan amperage for each phase.
 - o. Manifold pressure in psig.

S. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full load amperage and service factor.

- e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - 3. If fans are an integral part of the unit, include the following for each fan:
 - a. Make and type.
 - b. Arrangement and size.
 - c. Sheave make, size in inches, and bore.
 - d. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - 4. Test Data (Indicated and Actual Values):
 - a. Total exhaust airflow rate in cfm.
 - b. Purge exhaust airflow rate in cfm.
 - c. Outside airflow rate in cfm.
 - d. Total exhaust fan static pressure in inches wg.
 - e. Total outside-air fan static pressure in inches wg.
 - f. Pressure drop on each side of recovery wheel in inches wg.
 - g. Exhaust air temperature entering in deg F.
 - h. Exhaust air temperature leaving in deg F.
 - i. Outside-air temperature entering in deg F.
 - j. Outside-air temperature leaving in deg F.
 - k. Calculate sensible and total heat capacity of each airstream in MBh.
 - T. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.
- 3.21 INSPECTIONS**
- A. Initial Inspection:
 - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
 - 2. Randomly check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Measure sound levels at two locations.
 - e. Measure space pressure of at least 10 percent of locations.

- f. Verify that balancing devices are marked with final balance position.
- g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.22 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Phenolic.
- 2. Fire-rated insulation systems.
- 3. Adhesives.
- 4. Mastics.
- 5. Lagging adhesives.
- 6. Sealants.
- 7. Factory-applied jackets.
- 8. Field-applied fabric-reinforcing mesh.
- 9. Field-applied cloths.
- 10. Field-applied jackets.
- 11. Tapes.
- 12. Securements.
- 13. Corner angles.

- B. Related Sections:

- 1. Division 21 Section "Fire-Suppression Systems Insulation."
- 2. Division 22 Section "Plumbing Insulation."
- 3. Division 23 Section "Metal Ducts" for duct liners.

1.3 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aeroflex
 - 2. Armacell
 - 3. Certain Teed Corp.

4. Johns Manville
5. Knauf Insulation
6. Owens Corning
7. Pittsburg Corning Corp.
8. Dyplast Products

- B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Qualification Data: For qualified Installer.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Block Insulation: ASTM C 552, Type I.
 - 2. Special-Shaped Insulation: ASTM C 552, Type III.
 - 3. Board Insulation: ASTM C 552, Type IV.
 - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
- J. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- K. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
- L. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 2. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- M. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
- N. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal

density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

O. Phenolic:

1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
4. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - a. Preformed Pipe Insulation: ASJ.
 - b. Board for Duct and Plenum Applications: ASJ.
 - c. Board for Equipment Applications: ASJ.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
 - d. Thermal Ceramics; FireMaster Duct Wrap.
 - e. 3M; Fire Barrier Wrap Products.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass, Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 - 2. Service Temperature Range: 0 to 180 deg F.
 - 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 - 4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 - 2. Service Temperature Range: Minus 50 to plus 220 deg F.

3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 200 deg F.
 3. Solids Content: 63 percent by volume and 73 percent by weight.
 4. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
 3. Service Temperature Range: Minus 50 to plus 180 deg F.
 4. Color: White.

2.6 SEALANTS

- A. Joint Sealants: Cellular-Glass, Phenolic Products.
1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Permanently flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 4. Color: White or gray.
 5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: Aluminum.
 5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.

4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
- B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
- C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.

2.9 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: Color-code jackets based on system.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - 4. Factory-fabricated tank heads and tank side panels.
- D. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Finish and thickness are indicated in field-applied jacket schedules.
 - b. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

- F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
- G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
- H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils.
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - 1. Width: 3 inches.
 - 2. Film Thickness: 4 mils.
 - 3. Adhesive Thickness: 1.5 mils.
 - 4. Elongation at Break: 145 percent.
 - 5. Tensile Strength: 55 lbf/inch in width.
- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
 - 1. Width: 3 inches.
 - 2. Film Thickness: 6 mils.
 - 3. Adhesive Thickness: 1.5 mils.
 - 4. Elongation at Break: 145 percent.
 - 5. Tensile Strength: 55 lbf/inch in width.

2.12 SECUREMENTS

- A. Bands:
 - 1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
 - 2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
 - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.

2.13 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the

- wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
1. Provide 1" foam-core insulation on all chilled water pumps. Install pump insulation per foam-core insulation manufacturer's pump insulation installation instructions. Include pump insulation installation instructions with insulation submittals.
 2. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 75 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 75 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface.

Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.10 PHENOLIC INSULATION INSTALLATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- E. Where PVDC jackets are indicated, install as follows:
 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap factory-presize jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presize jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer

- to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.12 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.13 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: Coat exposed outdoor flexible elastomeric insulation with two coats of manufacturer's recommended protective white coating; or cover with aluminum jacketing all exposed outdoor flexible elastomeric insulation, in lieu of paint.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.14 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.15 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return, and outdoor air.
2. Indoor, exposed outdoor air.
3. Indoor, concealed and exposed, Type I, commercial, kitchen hood exhaust.
4. Indoor, concealed and exposed kitchen hood make-up air.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Indoor, exposed supply and return air in air conditioned, occupied spaces
4. Exhaust ductwork, including Type II Kitchen Exhaust and Dishwasher Exhaust
5. Factory-insulated flexible ducts.
6. Factory-insulated plenums and casings.
7. Flexible connectors.
8. Vibration-control devices.
9. Factory-insulated access panels and doors.

3.16 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply-air Ducts, Concealed (installed above ceilings):

1. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0.
- B. Return Air Ducts, Concealed (installed above ceilings):
 1. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0.
- C. Exposed Supply and Return Ductwork in Air Conditioned, Occupied Spaces, and Exhaust Air Ductwork:
 1. None.
- D. Exposed Supply and Return Ductwork exposed in Air Conditioned Utility Spaces (Conditioned Mechanical Rooms or Mechanical Rooms used as Return Air Plenums) and Exposed in Non-Air Conditioned Spaces (Boiler Rooms, et. Al):
 1. Mineral-Fiber Board Insulation: 2 inches thick and installed R-6.0.
- E. Outside-Air Ducts:
 1. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0.
- F. Type-I Commercial Kitchen Hood Exhaust Ducts:
 1. Fire Rated Insulation System as identified in this specification section.
- G. Kitchen Hood Make-Up Air Ducts:
 1. Mineral-Fiber Blanket: 2 inches thick and installed R-6.0.

3.17 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Supply-air, return-air and outside-air duct insulation shall be one of the following:
 1. Mineral-Fiber Blanket: 3 inches and 3-lb/cu. ft. nominal density.
 2. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

3.18 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

3.19 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.20 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate, Cold Water Make-up and Equipment Drain Water:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 3/4 inch thick.
- B. Chilled Water Supply and Return:
 - 1. Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches thick.
 - b. Phenolic: 1-1/2 inch thick.
- C. Heating-Hot-Water Supply and Return:
 - 1. NPS 1-1/2" and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
 - c. Phenolic: 1-1/2 inch thick.
 - 2. NPS 2" and Larger: Insulation shall be the following:
 - a. Cellular Glass: 2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.
 - c. Phenolic: 2 inch thick.
- D. Refrigerant Suction and Hot-Gas Piping:
 - 1. Insulation shall be installed per the manufacturer's recommendations.

3.21 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Chilled Water:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 3 inches thick.
 - b. Flexible Elastomeric: 2 inches thick.
 - c. Phenolic: 1-1/2 inch thick.
- B. Condenser-Water Supply and Return:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 2 inches thick.
 - b. Flexible Elastomeric: 2 inches thick.
 - c. Phenolic: 1 inch thick.
- C. Heating-Hot-Water Supply and Return:
 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 3 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
 - c. Phenolic: 2 inch thick.
- D. Refrigerant Suction and Hot-Gas Piping:
 1. All Pipe Sizes: Insulation shall be as recommended by the manufacturer.

3.22 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.
- B. Chilled Water, All Sizes: Cellular glass, 2 inches thick.
- C. Condenser-Water Supply and Return, All Sizes: Cellular glass, 2 inches thick.
- D. Heating-Hot-Water Supply and Return, All Sizes: Cellular glass, 2 inches thick.

3.23 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts, Plenums, and Piping, Concealed (installed above ceilings) and Exposed in Air Conditioned Occupied Spaces:
 1. None.

- D. Ducts, Plenums, and Piping, Exposed in Air Conditioned Utility Spaces (Conditioned Mechanical Rooms and Mechanical Rooms used as Return Air Plenums):
 - 1. 8 ounce canvas with lagging adhesive.
- E. Ducts, Plenums, and Piping, Exposed in Non-Air Conditioned Spaces (Boiler Rooms, et. al.):
 - 1. PVC: 20 mils thick (N/A if installed in a return air plenum).
 - 2. Aluminum, Smooth: 0.016 inch thick.
- F. Equipment, Concealed (installed above ceilings):
 - 1. None.
- G. Equipment, Exposed (all applications):
 - 1. PVC: 20 mils thick (N/A if installed in a return air plenum)
 - 2. Aluminum, Smooth: 0.016 inch thick.

3.24 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. PVC: 20 mils thick.
 - 2. Aluminum, Smooth: 0.016 inch thick.
- D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.016 inch thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Smooth with: 0.032 inch thick.
- F. Equipment, Concealed:
 - 1. None.
- G. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Painted Aluminum, Smooth: 0.016 inch thick.
- H. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, Smooth with: 0.032 inch thick.
- I. Piping, Concealed:
 1. None.
- J. Piping, Exposed:
 1. PVC, Color-Coded by System: 20 mils thick.
 2. Aluminum, Smooth: 0.016 inch thick.

3.25 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230700

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - 1. Hot-water heating piping.
 - 2. Chilled-water piping.
 - 3. Condenser-water piping.
 - 4. Condensate-drain piping.
 - 5. Blowdown-drain piping.
 - 6. Air-vent piping.
 - 7. Safety-valve-inlet and -outlet piping.
- B. Related Sections include the following:
 - 1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
 - 1. Hot-Water Heating Piping: 150 psig at 200 deg F.
 - 2. Chilled-Water Piping: 150 psig at 200 deg F.
 - 3. Condenser-Water Piping: 150 psig at 150 deg F.
 - 4. Makeup-Water Piping: 80 psig at 150 deg F.
 - 5. Condensate-Drain Piping: 150 deg F.
 - 6. Blowdown-Drain Piping: 200 deg F.
 - 7. Air-Vent Piping: 200 deg F.
 - 8. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 ACCEPTABLE MANUFACTURERS

- A. All piping shall be manufactured in the USA.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Plastic pipe and fittings with solvent cement.
 - 2. Pressure-seal fittings.
 - 3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 4. Air control devices.
 - 5. Chemical treatment.
 - 6. Hydronic specialties.
- B. Welding certificates.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.
- F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.7 EXTRA MATERIALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
- B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- H. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
 - 1. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges:
 - 1. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits:
 - 1. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:

1. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - c. Flow Design Inc.
 - d. Griswold Controls.
 - e. Taco.
 - f. PRO Hydronic Specialties.
 - g. Hays Fluid Controls
4. Body: Bronze, ball or plug type with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
6. Plug: Resin.
7. Seat: PTFE.
8. End Connections: Threaded or socket.
9. Pressure Gage Connections: Integral seals for portable differential pressure meter.
10. Handle Style: Lever, with memory stop to retain set position.
11. CWP Rating: Minimum 125 psig.
12. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - c. Flow Design Inc.
 - d. Griswold Controls.
 - e. Taco.
 - f. PRO Hydronic Specialties.
 - g. Hays Fluid Controls
4. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
6. Stem Seals: EPDM O-rings.
7. Disc: Glass and carbon-filled PTFE.
8. Seat: PTFE.
9. End Connections: Flanged or grooved.
10. Pressure Gage Connections: Integral seals for portable differential pressure meter.
11. Handle Style: Lever, with memory stop to retain set position.
12. CWP Rating: Minimum 125 psig.
13. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - d. Conbraco Industries, Inc.
 - e. Spence Engineering Company, Inc.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - g. American Wheatley
4. Body: Bronze or brass.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

5. Disc: Glass and carbon-filled PTFE.
6. Seat: Brass.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Low inlet-pressure check valve.
10. Inlet Strainer: stainless steel, removable without system shutdown.
11. Valve Seat and Stem: Noncorrosive.
12. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - d. Conbraco Industries, Inc.
 - e. Spence Engineering Company, Inc.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - g. American Wheatley
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: stainless steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Flow Design Inc.
 - b. Griswold Controls.
 - c. PRO Hydronic Specialties
 - d. Hays Fluid Controls
2. Design:
 - a. 2" and under - Brass
 - 1) Threaded or sweat connections

- 2) Minimum of one union and tailpiece incorporated into the design
 - 3) Provide with full-port ball type isolation valve
 - b. 2-1/2" and over – Ductile iron, wafer style
 - 1) Threaded or sweat connections
 - 2) Shall include ANSI Class 150 flanges on both ends
 - 3) Provide with lug style butterfly isolation valve
3. Flow control assembly:
 - a. Provide with either:
 - 1) Elastomeric diaphragm and polyphenylsulfone orifice plate with operating ranges between 8-80 PSID
 - 2) Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable with operating ranges 0-60 PSID
 - b. All wearable surfaces of flow cartridge shall be stainless steel
4. Ports: each valve shall have at least two P/T ports for flow verification.
5. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
6. Combination Assemblies: Include full port bronze or brass-alloy ball valve with stainless steel ball
7. Identification Tag: Marked with zone identification, valve number, and flow rate.
8. Size: Same as pipe in which installed.
9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
10. Minimum CWP Rating: 175 psig.
11. Maximum Operating Temperature: 250 deg F.
12. Extra Materials: Provide additional flow cartridges as required for rebalancing of terminal unit water flows. Provide:
 - a. Additional flow cartridges equal to three (3) each of the following for each cartridge size installed: 1 GPM, 1.5 GPM, 2 GPM, 2.5 GPM, 3 GPM, 5 GPM.
13. Wye-strainers installed upstream of Automatic Flow Control Valves:
 - a. Shall be separate assembly.
 - b. Design:
 - 1) 2" and under:
 - a) The strainer shall be single-body, brass or bronze type wye-design
 - b) Strainer shall include full-port ball valve for isolation
 - c) Strainer shall include integral union nut and tail piece.
 - d) End connections shall be either threaded or sweat.
 - 2) 2-1/2" and up:
 - a) The strainer shall be single-body cast iron wye-design
 - b) Strainer shall include a lug-type butterfly valve for isolation
 - c) Strainer shall be flanged on both ends
 - c. Ports: All strainers shall incorporate at least one P/T port and hose end valve for flushing of system.
 - d. All strainers screens will incorporate a minimum 6:1 ratio between strainer screen area and pipe diameter.
 - e. Construction:
 - 1) Strainer shall have a min. 20 mesh stainless steel screen for maximum protection and minimum pressure loss.
 - 2) Strainer screen shall be stainless steel.
 - f. Operating specifications:
 - 1) 2" and under:

- a) Shall be rated at 600 WOG/CWP
- 2) 2-1/2" and up:
 - a) Body shall be rated at 150 PSIG and include ANSI Class 150 flanges
 - b) Butterfly valve shall be rated at 150 PSIG and suitable for dead-end service.

2.6 AIR CONTROL DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amtrol, Inc.
 - 2. Armstrong Pumps, Inc.
 - 3. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - 4. Taco.
 - 5. Patterson.
- C. Manual Air Vents:
 - 1. Body: Bronze.
 - 2. Internal Parts: Nonferrous.
 - 3. Operator: Screwdriver or thumbscrew.
 - 4. Inlet Connection: NPS 1/2.
 - 5. Discharge Connection: NPS 1/8.
 - 6. CWP Rating: 150 psig.
 - 7. Maximum Operating Temperature: 225 deg F.
- D. Automatic Air Vents:
 - 1. Body: Bronze or cast iron.
 - 2. Internal Parts: Nonferrous.
 - 3. Operator: Noncorrosive metal float.
 - 4. Inlet Connection: NPS 1/2.
 - 5. Discharge Connection: NPS 1/4.
 - 6. CWP Rating: 150 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- E. Expansion Tanks:
 - 1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter.

Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.

3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

F. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

G. Tangential-Type Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

H. Air Purgers:

1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 250 deg F.

2.7 CHEMICAL TREATMENT

- A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.
1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.
5. See Automatic Flow Control Valves for wye-strainers provided as part of coil connection kits.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

D. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

E. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be the following:
 - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be the following:
 - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- E. Condenser-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- F. Condenser-water piping, aboveground, NPS 2-1/2 and larger, shall be the following:
 - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- G. Makeup-water piping installed aboveground shall be the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- H. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints. Do not install PVC piping in return air plenums.
- I. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- J. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- K. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- C. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.

- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 4. Spring hangers to support vertical runs.
 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
 8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
- F. Support vertical runs at roof, at each floor, and at 8-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.
- D. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
- E. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:
1. pH: 9.0 to 10.5.
 2. "P" Alkalinity: 100 to 500 ppm.
 3. Boron: 100 to 200 ppm.
 4. Chemical Oxygen Demand: Maximum 100 ppm.
 5. Corrosion Inhibitor:
 - a. Sodium Nitrate: 1000 to 1500 ppm.
 - b. Molybdate: 200 to 300 ppm.
 - c. Chromate: 200 to 300 ppm.
 - d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
 - e. Chromate Plus Molybdate: 50 to 100 ppm each.
 6. Soluble Copper: Maximum 0.20 ppm.
 7. Tolyriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
 8. Total Suspended Solids: Maximum 10 ppm.
 9. Ammonia: Maximum 20 ppm.
 10. Free Caustic Alkalinity: Maximum 20 ppm.
 11. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maximum 1000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maximum 100 organisms/ml.
 - c. Nitrate Reducers: 100 organisms/ml.
 - d. Sulfate Reducers: Maximum 0 organisms/ml.
 - e. Iron Bacteria: Maximum 0 organisms/ml
- B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 24 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Double-wall round ducts and fittings.
 - 4. Sheet metal materials.
 - 5. Duct liner.
 - 6. Sealants and gaskets.
 - 7. Hangers and supports.
- B. Related Sections:
 - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
 - 2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
 - 3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

1.4 SUBMITTALS

- A. Product Data: For each type of the following products:

- 1. Liners and adhesives.
- 2. Sealants and gaskets.
- 3. Seismic-restraint devices.

- B. Shop Drawings:

- 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
- 2. Factory- and shop-fabricated ducts and fittings.
- 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
- 4. Elevation of top of ducts.
- 5. Dimensions of main duct runs from building grid lines.
- 6. Fittings.
- 7. Reinforcement and spacing.
- 8. Seam and joint construction.
- 9. Penetrations through fire-rated and other partitions.
- 10. Equipment installation based on equipment being used on Project.
- 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
- 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

- C. Delegated-Design Submittal:

- 1. Sheet metal thicknesses.
- 2. Joint and seam construction and sealing.
- 3. Reinforcement details and spacing.
- 4. Materials, fabrication, assembly, and spacing of hangers and supports.
- 5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

- D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
- 2. Suspended ceiling components.
- 3. Structural members to which duct will be attached.
- 4. Size and location of initial access modules for acoustical tile.
- 5. Penetrations of smoke barriers and fire-rated construction.

6. Items penetrating finished ceiling including the following:

- a. Lighting fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

E. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
 - f. Hamlin Sheet Metal
 - g. Turn Key Duct Systems
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Lindab Inc.
 - 2. McGill AirFlow LLC.
 - 3. SEMCO Incorporated.
 - 4. Sheet Metal Connectors, Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - 1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 - 2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
 - 3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

- A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Aeroflex USA Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

- a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.

2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 9. VOC: Maximum 395 g/L.
 10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 11. Service: Indoor or outdoor.
 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.
- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. All medium pressure supply mains from built-up Air Handling Units to the terminal box connections.
 - b. All concealed low pressure supply mains from built up Air Handling Units.
 - c. Low pressure supply ducts (single zone units and supply ductwork downstream of terminal boxes): Test representative duct sections, totaling no less than 10 percent of total installed duct area for each designated pressure class.
 - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 4. Test for leaks before applying external insulation.
 - 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 - 6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.10 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.11 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel unless noted otherwise.
- B. Supply Ducts:
 - 1. Ducts Connected to Indoor Units, Packaged Heat Pumps, and Downstream of Terminal Boxes:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.
 - 2. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.
- C. Return Ducts:
 - 1. Ducts Connected to Indoor Units and Packaged Heat Pumps:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.
 - 2. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.
2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Carbon-steel sheet.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 3-inch wg.
 - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: Per current SMACNA standards based on specified pressure class.
3. Ducts Connected to Dishwasher Hoods:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - d. Welded seams and flanged joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 2-inch wg.
 - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - g. SMACNA Leakage Class: Per current SMACNA standards based on specified pressure class.
4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Indoor Units or Packaged Heat Pumps:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.

- d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.
 - 2. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
 - d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.
- F. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel.
 - 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 - 3. Aluminum Ducts: Aluminum.
- G. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: 1 inch thick.
 - 2. Return Air Ducts: 1 inch thick.
- H. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

- 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- I. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Flexible ducts.
17. Duct security bars.
18. Duct accessory hardware.

- B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Source quality-control reports.
- D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.

2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. American Warming and Ventilating; a division of Mestek, Inc.
 3. Greenheck Fan Corporation.
 4. Nailor Industries Inc.
 5. Pottorff; a division of PCI Industries, Inc.
 6. Ruskin Company.
 7. SEMCO Incorporated.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 1500 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Maximum Leakage: 40" wide, 1% of max. flow.
- F. Frame: 0.09-inch- thick extruded aluminum, with welded corners.
- G. Blades: Multiple single-piece blades, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.
- H. Blade Action: Parallel.
- I. Blade Seals: Extruded vinyl, mechanically locked.
- J. Blade Axles:
 1. Material: Aluminum.
 2. Diameter: 0.20 inch.

- K. Tie Bars and Brackets: Aluminum.
- L. Return Spring: Adjustable tension.
- M. Bearings: Steel ball or synthetic pivot bushings.
- N. Accessories: (as noted on plans or required by installation)
 - 1. Electric actuators.
 - 2. Chain pulls.
 - 3. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 4. Screen Mounting: Rear mounted.
 - 5. Screen Material: Aluminum.
 - 6. Screen Type: Bird or Insect (as noted on drawings)
 - 7. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Pottorff; a division of PCI Industries, Inc.
 - 6. Ruskin Company.
 - 7. SEMCO Incorporated.
- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 1000 fpm..
- D. Maximum System Pressure: 2-inch wg.
- E. Maximum Leakage: 40" wide, 1% of max. flow.
- F. Frame: 0.09-inch- thick extruded aluminum, with welded corners.
- G. Blades:
 - 1. Multiple, 0.025-inch- thick, roll-formed aluminum.
 - 2. Maximum Width: 2 inches.
 - 3. Action: Parallel.
 - 4. Balance: Gravity.

- 5. Eccentrically pivoted.
- H. Blade Seals: Vinyl.
- I. Blade Axles: ½” diameter synthetic
- J. Tie Bars and Brackets:
 - 1. Material: Aluminum.
 - 2. Rattle free with 90-degree stop.
- K. Return Spring: Adjustable tension.
- L. Bearings: Synthetic.
- M. Accessories: (as noted on plans or required by installation)
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Flange on intake.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Ruskin Company.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. Hat-shaped, galvanized-steel channels, 16-gauge minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 16-gauge thick.

5. Blade Axles: Galvanized steel.
6. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
7. Tie Bars and Brackets: Galvanized steel.

2.5 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Greenheck Fan Corporation.
 3. METALAIRE, Inc.
 4. Metal Form Manufacturing, Inc.
 5. Nailor Industries Inc.
 6. Ruskin Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
 1. Hat shaped.
 2. Galvanized-steel channels, 0.064 inch thick.
 3. Mitered and welded corners.
- D. Blades:
 1. Multiple blade with maximum blade width of 8 inches, airfoil design.
 2. Opposed-blade design.
 3. Galvanized steel.
 4. 14-gauge thickness.
 5. Blade Edging: Closed-cell neoprene edging.
 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
 1. Stainless-steel sleeve.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. Greenheck Fan Corporation.
 3. Nailor Industries Inc.
 4. Pottorff; a division of PCI Industries, Inc.
 5. NCA Manufacturing.
 6. Ruskin Company.
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 20-gauge galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

2.7 CEILING DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. METALAIRE, Inc.

3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

2.8 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D. Blades: Roll-formed, horizontal, interlocking, 16-gauge thickness, galvanized sheet steel. Blades shall be true airfoil blades.

E. Leakage: Class I.

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 20-gauge thickness, galvanized sheet steel; length to suit wall or floor application.

H. Damper Motors: two-position action, electric 120V or 24V as noted on the plans.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 120V or 24V as noted on the drawings.
- J. Accessories: (as indicated on the drawings)
1. Auxiliary switches for or position indication.
 2. Momentary test switch, damper mounted.

2.9 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Air Balance Inc.; a division of Mestek, Inc.
 2. Greenheck Fan Corporation.
 3. Nailor Industries Inc.
 4. NCA Manufacturing.
 5. Ruskin Company.
- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).
- G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

- H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Leakage: Class I.
- J. Rated pressure and velocity to exceed design airflow conditions.
- K. Mounting Sleeve: Factory-installed, 20-gauge thickness, galvanized sheet steel; length to suit wall or floor application.
- L. Master control panel for use in dynamic smoke-management systems.
- M. Damper Motors: Modulating or two-position action.
- N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 120V or 24V as noted on the drawings.
- O. Accessories: (as indicated on the drawings)
 - 1. Auxiliary switches for position indication.
 - 2. Momentary test switch, damper mounted.

2.10 CORRIDOR DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.

3. Nailor Industries Inc.
 4. NCA Manufacturing.
 5. Ruskin Company.
- B. General Requirements: Label combination fire and smoke dampers according to UL 555 for 1-1/2-hour rating by an NRTL.
- C. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).
- D. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- E. Frame: Multiple-blade type; fabricated with roll-formed, 16-gauge galvanized steel; with mitered and interlocking corners.
- F. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.
- H. Damper Motors: Modulating or two-position action.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 120V or 24V as noted on the drawings.

2.11 DUCT SILENCERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135F

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel, 0.034 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G60 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
2. Dissipative type with fill material.
 - a. Fill Material: Moisture-proof nonfibrous material.
 - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar bag.
- J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
 1. Lock form and seal or continuously weld joints.
 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 3. Reinforcement: Cross or trapeze angles for rigid suspension.
- K. Source Quality Control: Test according to ASTM E 477.
 1. Testing in accordance with ASTM E-477.
 2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.
- L. Capacities and Characteristics: As indicated on the drawings.

2.12 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 30 inches wide and double wall for larger dimensions.

2.13 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Pottorff; a division of PCI Industries, Inc.
 2. Ventfabrics, Inc.
 3. Young Regulator Company.
 4. Metropolitan.

- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Recessed, 3/4 inches deep.
- F. Wall-Box Cover-Plate Material: Stainless steel.

2.14 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Ductmate Industries, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. McGill AirFlow LLC.
 - 5. Nailor Industries Inc.
 - 6. Pottorff; a division of PCI Industries, Inc.
 - 7. Ruskin
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.
- C. Pressure Relief Access Door:
 - 1. Door and Frame Material: Galvanized sheet steel.
 - 2. Door: Single wall, 12-gauge.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 2" to 10" for positive pressure and -4" to -10" for negative pressure.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.15 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Ventfabrics, Inc.
 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 1. Minimum Weight: 26 oz./sq. yd..
 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 1. Minimum Weight: 24 oz./sq. yd..
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.16 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 2. Maximum Air Velocity: 4000 fpm.
 3. Temperature Range: Minus 20 to plus 250 deg F.
 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.
- D. Flexible Duct Connectors:
 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches, to suit duct size.

2.17 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing and manufacturer's instructions.
- H. Connect ducts to duct silencers with flexible duct connectors.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At duct mounted smoke detectors for inspection.
 - 4. At drain pans and seals.
 - 5. Where noted on plans: Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. Control devices requiring inspection.
 - 8. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts directly or with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place.
- Q. Connect flexible ducts to metal ducts with approved strap and sealant.
- R. Install duct test holes where required for testing and balancing purposes.
- S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. See fan schedule on drawings for additional requirements and specific options required for each fan.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Utility set fans.
 - 2. Centrifugal roof ventilators.
 - 3. Upblast propeller roof exhaust fans.
 - 4. Ceiling-mounting ventilators.
 - 5. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.4 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck
 - 2. Loren Cook Company
 - 3. Penn Ventilation
 - 4. Twin City Fans
- B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.5 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, wiring diagrams, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Operation and Maintenance Data: For power ventilators to include operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

- A. Coordinate size and location of structural-steel support members.

- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

- A. Description: Direct- or Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
- B. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
 - 1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
 - 1. Blade Materials: Steel.
 - 2. Blade Type: Backward inclined (unless noted otherwise on the fan schedule).
- D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L₅₀ of 500,000 hours or L₁₀ of 100,000 hours.
- F. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor Based on Fan Motor Size: 1.5.
 - 2. Motor Pulleys: Adjustable pitch for use with motors through 10 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- G. Accessories: (See drawings for required accessories).
 - 1. Inlet and Outlet: Flanged.
 - 2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - 3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
 - 4. Access Door: Gasketed door in scroll with latch-type handles.
 - 5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
 - 6. Inlet Screens: Removable wire mesh.

7. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
 8. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
 9. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever of same material as housing.
 10. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
 11. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- H. Coatings: As indicated on the drawings.
- I. Capacities and Characteristics: As indicated on the drawings.

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector for UL 762 kitchen hood exhaust fans.
 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 4. Fan and motor isolated from exhaust airstream.
- E. Accessories: (See drawings for required accessories).
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops. Backdraft dampers on all roof mounted supply fans shall be motorized.
- F. Roof Curbs: Galvanized steel; welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Self-flashing without a cant strip, with mounting flange.
 2. Overall Height: 8 inches (unless noted otherwise).
 3. Pitch Mounting: Manufacture curb for roof slope.
 4. Metal Liner: Galvanized steel.
 5. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares (where indicated on the drawings).
 6. Vented Curb: Unlined with louvered vents in vertical sides (where indicated on the drawings).
- G. Capacities and Characteristics: As indicated on the drawings.
- H. Capacities and Characteristics: As indicated on the drawings.

2.3 UPBLAST PROPELLER ROOF EXHAUST FANS

- A. Description: Direct- or belt-driven propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- B. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel, containing butterfly dampers and rain trough, motor and drive assembly, and fan wheel.
1. Damper Rods: Steel with bronze bearings.
 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- C. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to housing; weatherproof housing of same material as fan housing with the following features:
1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 2. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 4. Motor Mount: On outside of fan cabinet, adjustable base for belt tensioning.
- E. Roof Curbs: Galvanized steel; welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 8 inches (unless noted otherwise).
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares Where indicated on the plans).

F. Capacities and Characteristics: As indicated on the drawings.

2.4 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories: (See drawings for required accessories).
 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
 4. Motion Sensor: Motion detector with adjustable shutoff timer.
 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
 6. Filter: Washable aluminum to fit between fan and grille.
 7. Isolation: Rubber-in-shear vibration isolators.
 8. Manufacturer's standard roof jack or wall cap, and transition fittings.
- G. Capacities and Characteristics: As indicated on the drawings.

2.5 IN-LINE CENTRIFUGAL FANS

- A. Description: In-line, direct- or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

- C. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 3. Companion Flanges: For inlet and outlet duct connections.
 - 4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
 - 5. Motor and Drive Cover (Belt Guard): Galvanized steel.
- G. Capacities and Characteristics: As indicated on the drawings.

2.6 MOTORS

- A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed, fan cooled.

2.7 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units using spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
- C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- F. Install units with clearances for service and maintenance.
- G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 1. Verify that shipping, blocking, and bracing are removed.
 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 3. Verify that cleaning and adjusting are complete.
 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fan-powered air terminal units.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Instructions for resetting minimum and maximum air volumes.
 - 2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Enviromental Technologies
 - 2. Nailor Industries
 - 3. Carrier
 - 4. Price Industries
 - 5. Trane
 - 6. Titus
 - 7. Krueger
- B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.6 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 FAN-POWERED AIR TERMINAL UNITS

- A. Configuration: Volume-damper assembly and fan in series or in parallel arrangement, as indicated on Drawings, inside unit casing with control components inside a protective metal shroud.
- B. Casing: 22-gauge steel..
 - 1. Casing Lining: 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
 - 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections.
 - 4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
- C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - 1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.
- D. Fan Section: Galvanized-steel plenum, with direct-drive, forward-curved fan with air filter and backdraft damper.
 - 1. Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.
 - b. Fan-Motor Assembly Isolation: Rubber isolators.
 - 2. Air Filter: 1-inch- thick, fiberglass throwaway, MERV 6 according to ASHRAE 52.2.
- E. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig; and factory installed.
- F. Factory-Mounted and -Wired Controls: Electrical components shall be mounted in control box with removable cover. Incorporate single-point electrical connection to power source.
 - 1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
 - 2. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs shall match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.

- 3. Disconnect Switch: Factory-mounted, fused type.
- G. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.
- H. DDC Controls: Single-package unitary controller and actuator
 - 1. DDC Unit Controller shall be compatible with the existing building controls vendor.
- I. Control Sequence: See Sequence of Operation.

2.2 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.
- B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air terminal units to allow service and maintenance.
- C. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- D. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - b. Verify that controls and control enclosure are accessible.
 - c. Verify that control connections are complete.
 - d. Verify that nameplate and identification tag are visible.
 - e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Round ceiling diffusers.
 - 2. Rectangular and square ceiling diffusers.
 - 3. Perforated diffusers.
 - 4. Louver face diffusers.
 - 5. Linear bar diffusers.
 - 6. Linear slot diffusers.
 - 7. Adjustable Bar Register
 - 8. Fixed face registers.
 - 9. Linear bar grilles.
- B. Related Sections:
 - 1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carnes
 - 2. METALAIRE, Inc.
 - 3. Nailor industries
 - 4. Price
 - 5. Titus
 - 6. Tuttle & Bailey
 - 7. Krueger
- B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a

written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Round Ceiling Diffuser:
 - 1. Devices shall be specifically designed for variable-air-volume flows.
 - 2. Material: Steel or Aluminum as indicated on the drawings.
 - 3. Finish: Baked enamel, white unless noted otherwise.
 - 4. Face Style: Three cone.
 - 5. Mounting: Duct connection.
 - 6. Pattern: Fully adjustable.
 - 7. Dampers: Radial opposed blade.
- B. Rectangular and Square Ceiling Diffusers:
 - 1. Devices shall be specifically designed for variable-air-volume flows.

2. Material: Steel or Aluminum as indicated on the drawings.
3. Finish: Baked enamel, white unless noted otherwise.
4. Face Size: 24 by 24 inches or as indicated on the drawings.
5. Face Style: Four cone.
6. Mounting: As required.
7. Pattern: Fixed.
8. Dampers: Radial opposed blade.

C. Perforated Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel backpan and pattern controllers, with steel or aluminum face as indicated on the drawings.
3. Finish: Baked enamel, white unless noted otherwise.
4. Face Size: 24 by 24 inches or as indicated on the drawings.
5. Duct Inlet: Round or Square as indicated on the drawings.
6. Face Style: Flush.
7. Mounting: T-bar.
8. Pattern Controller: Adjustable with louvered pattern modules at inlet.
9. Dampers: Radial opposed blade.

D. Louver Face Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel or Aluminum as indicated on the drawings.
3. Finish: Baked enamel, white unless noted otherwise.
4. Face Size: As indicated on the drawings.
5. Mounting: As required.
6. Pattern: Four-way core style, unless noted otherwise.
7. Dampers: Radial opposed blade.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Material: Steel or Aluminum as indicated on the drawings.
2. Finish: Baked enamel, white unless noted otherwise.
3. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
4. Core Construction: Integral.
5. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
6. Frame: 1-1/4 inches wide.
7. Mounting: Concealed.
8. Damper Type: Adjustable opposed blade.
9. Accessories:
 - a. Rear-blade gang operator.
 - b. Filter.

B. Fixed Face Register:

1. Material: Steel or Aluminum as indicated on the drawings.
2. Finish: Baked enamel, white unless noted otherwise.
3. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
4. Core Construction: Integral.
5. Frame: 1 inch wide.
6. Mounting: Concealed.
7. Damper Type: Adjustable opposed blade.
8. Accessory: Filter.

C. Linear Bar Grille:

1. Material: Aluminum.
2. Finish: Baked enamel, white unless noted otherwise.
3. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
4. Distribution plenum.
 - a. Internal insulation.
 - b. Inlet damper.
5. Frame: 1-1/4 inches wide.
6. Mounting: Concealed.
7. Damper Type: Adjustable opposed blade.

2.3 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material - Shell: Steel or Aluminum as indicated on the drawings.
3. Material - Pattern Controller and Tees: Aluminum.
4. Finish - Face and Shell: Baked enamel, white exterior with black interior, unless noted otherwise.
5. Finish - Pattern Controller: Baked enamel, black.
6. Finish - Tees: Baked enamel, white.
7. Slot Width: As indicated on the drawings.
8. Number of Slots: as indicated on the drawings.
9. Length: as indicated on the drawings.
10. Accessories:
 - a. End caps in lay-in ceilings.
 - b. End Borders where not installed in lay-in ceilings.
 - c. Insulated plenum: By manufacturer black finish unless otherwise noted.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

1.01 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Conductors serving two separate power systems (i.e. 120/208 V and 277/480 V) shall not be mixed in the same raceway, pull box, or junction box. Exception is where control wiring is a different voltage than the power.
- C. Conductors feeding lighting outlets shall not be combined in the same raceway with conduit serving convenience receptacles. Lighting outlets and convenience receptacles shall not be connected on the same circuit unless specifically intended.
- D. Boxes and devices installed in suspended ceilings are to be supported to the grid with an independent support wire to structure.
- E. All electrical work shall be performed by individuals and/or companies who are properly licensed by the NC State Board of Examiners of Electrical Contractors
- F. Existing Circuits: All existing circuits which are re-used for connection to new or replacement equipment shall be thoroughly inspected for size, condition, and suitability for re-use.
- G. Remediation of Hazardous Materials. Existing facility/building shall be investigated through appropriate testing and/or inspection methods to confirm the presence of any hazardous material that may exist in the electrical system components. If it is determined that remediation is required, then a plan must be implemented rendering the facility free of hazards. This includes but is not limited to Asbestos, Lead, and PCB's.
- H. Abandonment of existing electric system components. Abandoned conduit/boxes shall have all electrical wiring removed completely and not just made "safe." Conduit/boxes shall be removed where practical without creating additional demolition/restitution work for other trades. All existing power supply wiring or vcabling associated with equipment demolished or removed as part of the project scope shall be completely removed back to supply distribution panel and circuits breakers relabeled as "SPARE" or with the new circuit title.
- I. Abandoned existing conduits concealed within floors and walls shall be cut flush with the surface and grouted over. Openings in fire rated assemblies shall be properly fire stopped in accordance with the barrier rating following removal of wiring and conduit.
- J. All electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.

1.02 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
 - 6. Acoustic treatment where acoustical batt is used.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For sleeve seals.

1.05 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. Connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- E. Coordinate acoustical treatments for electrical devices, boxes, conduit, etc. with architectural wall schedule for acoustical details where acoustical batt is present.

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.05 REQUIRED INSPECTIONS

- A. It shall be the responsibility of the electrical contractor to notify the Office of the State Electrical Inspector at the State Construction Office to schedule required inspections including rough-in, above ceiling and final inspections.

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. General Cable Technologies Corporation.
 - 3. Okonite Company (The).
 - 4. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. RoHS compliant.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type USE-2 and Type SE: Comply with UL 854.
 - 2. Type THHN and Type THWN-2: Comply with UL 83.
 - 3. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
 - 4. Dual-rated THHN/THWN or XHHW.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 1/0 AWG; copper for feeders No. 1/0 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway, Type MC Mineral-insulated, Type MI.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- L. Class 2 Control Circuits: Type THHN-THWN, in raceway Power-limited cable, concealed in building finishes Power-limited tray cable, in cable tray.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

WENDELL H. MURPHY FOOTBALL CENTER - KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. 50/125-micrometer, multimode optical fiber cabling.
 - 3. RS-232 cabling.
 - 4. RS-485 cabling.
 - 5. Low-voltage control cabling.
 - 6. Control-circuit conductors.
 - 7. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- E. RCDD: Registered Communications Distribution Designer.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - 1. Vertical and horizontal offsets and transitions.
 - 2. Clearances for access above and to side of cable trays.
 - 3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - 4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- C. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 - 2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install UTP and optical fiber cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.

2.2 BACKBOARDS

- A. Description: Plywood, AC Grade, 2 coats fire retardant paint on all sides, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. CommScope, Inc.

3. Superior Essex Inc.
 4. SYSTIMAX Solutions; a CommScope, Inc. brand.
 5. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, four-pair UTP.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6.
 4. Verified by NRTL to TIA/EIA-568-B.2, TIA/EIA 568-B.2-1 Category 6.
 5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Limited Purpose: Type CMX complying with UL 1581 VW-1
 - b. Communications, General Purpose: Type CM complying with UL 1581 (Vertical Tray)
 - c. Communications, Riser Rated: Type CMR complying with UL 1666
 - d. Communications, Plenum Rated: Type CMP complying with NFPA 262.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Leviton Voice & Data Division.
 2. Nordex/CDT; a subsidiary of Cable Design Technologies.
 3. Panduit Corp.
 4. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 5. Commscope.
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CommScope, Inc.
 2. Superior Essex Inc.
 3. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: Multimode, 50/125-micrometer, 24 fiber, nonconductive, tight buffer, optical fiber cable.
1. Comply with ICEA S-83-596 for mechanical properties.
 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 262 for the following types:
 - a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - b. Riser Rated, Nonconductive: Type OFNR complying with UL 1666.
 - c. Plenum Rated, Conductive: Type OFCP complying with NFPA 262.
 - d. Riser Rated, Conductive: Type OFCR complying with UL 1666.
 5. Conductive cable shall be aluminum-armored type.

6. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 50 700 MHz-km at 850 nm; 500 MHz-km at 1300 nm

C. Jacket:

1. Jacket Color: Aqua for 50/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.6 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Technology Systems Industries, Inc.
 2. Corning Cable Systems.
 3. Dynacom Corporation.
 4. Hubbell Premise Wiring.
 5. Optical Connectivity Solutions Division; Emerson Network Power.
 6. AMP; a Tyco International Ltd. company.
- B. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
1. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
 2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. Polypropylene insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. PVC jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. Plastic insulation.
 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 4. Plastic jacket.
 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM.
1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.

5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 2. Fluorinated ethylene propylene insulation.
 3. Unshielded.
 4. Fluorinated ethylene propylene jacket.
 5. Flame Resistance: NFPA 262, Flame Test.

2.9 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with NFPA 262.
- C. Paired Cable: NFPA 70, Type CMG.
 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 2. Fluorinated ethylene propylene insulation.
 3. Unshielded.
 4. Plastic jacket.
 5. Flame Resistance: NFPA 262, Flame Test.

2.10 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway[power-limited cable, concealed in building finishes complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.11 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:
 1. Brady Corporation.
 2. HellermannTyton.

3. Kroy LLC.
 4. Panduit Corp.
 5. AMP; a Tyco International Ltd. company.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows if possible.
- E. Pathway Installation in Equipment Rooms:
1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
 2. Install cable trays to route cables if conduits cannot be located in these positions.
 3. Secure conduits to backboard if entering room from overhead.
 4. Extend conduits 3 inches above finished floor.
 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- E. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- F. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- G. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 72 inches long shall be neatly coiled not less than 12 inches in diameter below each feed point.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

- a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
- a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
1. Class 1 remote-control and signal circuits, No 14 AWG.
 2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
 3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Grounding arrangements and connections for separately derived systems.
 - 4. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NFPA 70B.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

- A. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - 1. No. 4 AWG minimum, soft-drawn copper.
 - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum, or as indicated on the plans.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in

raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.

- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.
- C. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 3. Fitting and Accessory Materials: Same as channels and angles.
 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Not Allowed.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete (Limited Applications)."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. NBR: Acrylonitrile-butadiene rubber.
- G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C.

- D. **Manufacturer Seismic Qualification Certification:** Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. **Basis for Certification:** Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
 - 2. **Dimensioned Outline Drawings of Equipment Unit:** Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. **Detailed description of equipment anchorage devices** on which the certification is based and their installation requirements.
- E. **Qualification Data:** For professional engineer and testing agency.
- F. **Source quality-control test reports.**

1.5 QUALITY ASSURANCE

- A. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- B. **Rigid Steel Conduit:** ANSI C80.1.
- C. **Aluminum Rigid Conduit:** ANSI C80.5.
- D. **IMC:** ANSI C80.6.

- E. PVC-Coated Steel Conduit: PVC-coated IMC.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- F. EMT: ANSI C80.3.
- G. FMC: Zinc-coated steel.
- H. LFMC: Flexible steel conduit with PVC jacket.
- I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel, compression type. Set-screw or crimp shall not be permitted.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Condux International, Inc.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; a Hubbell Company.
 - 12. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arnco Corporation.
 - 2. Endot Industries Inc.
 - 3. IPEX Inc.
 - 4. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible type, approved for plenum installation.

2.4 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 12, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
 - d. Panduit

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.

6. O-Z/Gedney; a unit of General Signal.
 7. RACO; a Hubbell Company.
 8. Robroy Industries, Inc.; Enclosure Division.
 9. Scott Fetzer Co.; Adalet Division.
 10. Spring City Electrical Manufacturing Company.
 11. Thomas & Betts Corporation.
 12. Walker Systems, Inc.; Wiremold Company (The).
 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic.
- H. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.

2.7 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.8 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by a independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit
 - 2. Concealed Conduit, Aboveground: IMC.
 - 3. Underground Conduit: RNC, Type EPC- 80-PVC, direct buried.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
 - 6. Application of Handholes and Boxes for Underground Wiring:
 - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
 - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.

- c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Comply with the following indoor applications, unless otherwise indicated:
 1. MC cable not permitted.
 2. Exposed, Not Subject to Physical Damage: EMT.
 3. Exposed, Not Subject to Severe Physical Damage: EMT.
 4. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 7. Damp or Wet Locations: IMC.
 8. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
 9. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
 10. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
 11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.

- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from ENT to rigid steel conduit, or IMC before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
 - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
 2. Install backfill as specified in Division 31 Section "Earth Moving."
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Provide a bright colored plastic marker strip reading: "Caution - Electrical Conduits" in each underground conduit trench. Install a maximum of 12" below grade or a minimum of 18" above top of duct bank. All underground markings shall have metallic marking tape.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.

- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.9 AS-BUILT COORDINATION

- A. Provide dimensioned locations for all underground conduits. A minimum of two dimensions from building reference points shall be provided along with bury depth.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.

- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Normal Power = Black; Emergency = Red; UPS = Blue
 - 3. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- C. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength: 50 lb, minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
 - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Exterior concrete and masonry primer.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
 2. Exterior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
 3. Exterior Ferrous Metal:
 - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 4. Exterior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior concrete and masonry primer.
 - 2) Finish Coats: Interior semigloss alkyd enamel.
 6. Interior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 7. Interior Gypsum Board:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior gypsum board primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 8. Interior Ferrous Metal:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

- 1) Primer: Interior ferrous-metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 9. Interior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior zinc-coated metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 100A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
 1. Fire Alarm System: Red.
 2. Fire-Suppression Supervisory and Control System: Red and yellow.
 3. Combined Fire Alarm and Security System: Red and blue.
 4. Security System: Blue and yellow.
 5. Mechanical and Electrical Supervisory System: Green and blue.
 6. Telecommunication System: Green and yellow.
 7. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- I. Instruction Signs:
 - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer or load shedding.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Transformers.
 - e. Electrical substations.
 - f. Emergency system boxes and enclosures.
 - g. Motor-control centers.
 - h. Disconnect switches.
 - i. Enclosed circuit breakers.
 - j. Motor starters.
 - k. Push-button stations.
 - l. Power transfer equipment.
 - m. Contactors.
 - n. Remote-controlled switches, dimmer modules, and control devices.

- o. Battery inverter units.
- p. Battery racks.
- q. Power-generating units.
- r. Voice and data cable terminal equipment.
- s. Master clock and program equipment.
- t. Intercommunication and call system master and staff stations.
- u. Television/audio components, racks, and controls.
- v. Fire-alarm control panel and annunciators.
- w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- x. Monitoring and control equipment.
- y. Uninterruptible power supply equipment.
- z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made.

Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 260553

SECTION 260573.13 - SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 260573.16 "Coordination Studies" and Section 260573.19 "Arc-Flash Hazard Analysis."

1.2 SUMMARY

- A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.
 - a. Short-circuit study input data, including completed computer program input data sheets.
 - b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

- 1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
 2. The following are from the Short-Circuit Study Report:
 - a. Final one-line diagram.
 - b. Final Short-Circuit Study Report.
 - c. Short-circuit study data files.
 - d. Power system data.

1.6 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
 1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. SKM Systems Analysis, Inc.
- B. Comply with IEEE 399 and IEEE 551.
 1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 - 6. Derating factors and environmental conditions.
 - 7. Any revisions to electrical equipment required by the study.
- D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.
- E. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 - 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 - 3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
 - 5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data:
 - 1. One-line diagram of system being studied.
 - 2. Power sources available.
 - 3. Manufacturer, model, and interrupting rating of protective devices.
 - 4. Conductors.
 - 5. Transformer data.
- G. Short-Circuit Study Output Reports:
 - 1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated fault-current magnitude and angle.
 - c. Fault-point X/R ratio.

- d. Equivalent impedance.
2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Calculated asymmetrical fault currents:
 - 1) Based on fault-point X/R ratio.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the study.
 1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
- B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
 1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Obtain electrical power utility impedance at the service.
 3. Power sources and ties.
 4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.2 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
 1. To normal system low-voltage load buses where fault current is 10 kA or less.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 260573.13

SECTION 26 05 73.16 - COORDINATION STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 260573.13 "Short-Circuit Studies" and Section 260573.19 "Arc-Flash Hazard Analysis."

1.2 SUMMARY

- A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.3 DEFINITIONS

- A. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- B. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- C. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- D. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- E. SCCR: Short-circuit current rating.
- F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- G. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. Study and equipment evaluation reports.
 - 3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
 - 1. The following are from the Coordination Study Report:
 - a. Final one-line diagram.
 - b. Final protective device coordination study.
 - c. Coordination study data files.
 - d. List of all protective device settings.
 - e. Time-current coordination curves.
 - f. Power system data.

1.6 QUALITY ASSURANCE

- A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications:
 - 1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. SKM Systems Analysis, Inc.
- B. Comply with IEEE 242 and IEEE 399.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.

- b. Simultaneous faults.
- c. Explicit negative sequence.
- d. Mutual coupling in zero sequence.

2.2 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
 - 6. Any revisions to electrical equipment required by the study.
 - 7. Study Input Data: As described in "Power System Data" Article.
 - a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- D. Protective Device Coordination Study:
 - 1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.
 - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.
 - b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, and ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - 1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.

2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Medium-voltage equipment overcurrent relays.
 - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - f. Cables and conductors damage curves.
 - g. Ground-fault protective devices.
 - h. Motor-starting characteristics and motor damage points.
 - i. Generator short-circuit decrement curve and generator damage point.
 - j. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the overcurrent protective device study.
 1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
- B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be

acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.

- f. Special overcurrent protective device settings or types stipulated by utility company.
- g. Time-current-characteristic curves of devices indicated to be coordinated.
- h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
- k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- H. Motor Protection:
 - 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 - 2. Select protection for motors served at voltages more than 600 V according to IEEE 620.
- I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping

time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

- J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.
- K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.
- L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- M. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short-circuit ratings.
 - 2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
 - 3. Include in the report identification of any protective device applied outside its capacity.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

- A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
 - 1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
 - 2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
 - 3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or that might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 MOTOR-STARTING STUDY

- A. Perform a motor-starting study to analyze the transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of motor starting on the power system stability.
- B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141 and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.6 FIELD ADJUSTING

- A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

3.7 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
 - 1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
 - 2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.

END OF SECTION 260573.16

SECTION 260573.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 260573.13 "Short-Circuit Studies" and Section 260573.16 "Coordination Studies".

1.2 SUMMARY

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

- A. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- B. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- C. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- D. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- E. SCCR: Short-circuit current rating.
- F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- G. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
 - 3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.

2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.6 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. SKM Systems Analysis, Inc.
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:
 1. Protective device designations and ampere ratings.
 2. Conductor types, sizes, and lengths.

3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- G. Arc-Flash Study Output Reports:
 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- H. Incident Energy and Flash Protection Boundary Calculations:
 1. Arcing fault magnitude.
 2. Protective device clearing time.
 3. Duration of arc.
 4. Arc-flash boundary.
 5. Restricted approach boundary.
 6. Limited approach boundary.
 7. Working distance.
 8. Incident energy.
 9. Hazard risk category.
 10. Recommendations for arc-flash energy reduction.
- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.
- B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 1. Location designation.

2. Nominal voltage.
 3. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 4. Available incident energy.
 5. Working distance.
 6. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
 2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- C. Calculate maximum and minimum contributions of fault-current size.
1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
- D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- F. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
 2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from

permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

- G. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
 - 1. When the circuit breaker is in a separate enclosure.
 - 2. When the line terminals of the circuit breaker are separate from the work location.
- H. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the arc-flash hazard analysis.
 - 1. Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Architect's attention.
 - 2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
- B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
 - 1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Obtain electrical power utility impedance or available short circuit current at the service.
 - 3. Power sources and ties.
 - 4. Short-circuit current at each system bus (three phase and line to ground).
 - 5. Full-load current of all loads.
 - 6. Voltage level at each bus.
 - 7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 - 8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
 - 9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
 - 10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
 - 11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
 - 12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.

13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

- A. Apply one arc-flash label on the front cover of each section of the equipment for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
 1. Low-voltage switchboard.
 2. Low voltage transformers.
 3. Panelboards.
 4. Control panel.
 5. Automatic transfer switches.
 6. Fused panelboards.
- C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
 1. Indicate arc-flash energy.
 2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels.

3.6 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 260573.19

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SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of transformer from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.
- B. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by qualified electrical testing laboratory recognized by authorities having jurisdiction.

- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Core volume must allow efficient transformer operation at 10 percent above nominal tap voltage.
 - 3. Grounded to enclosure.
- C. Coils: Continuous windings except for taps.
 - 1. Coil Material: Copper.
 - 2. Internal Coil Connections: Brazed or pressure type.
 - 3. Terminal Connections: Welded.
- D. Encapsulation: Transformers smaller than 30 kVA must have core and coils completely resin encapsulated.
- E. Enclosure: Ventilated.
 - 1. Core and coil must be encapsulated within resin compound to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 4. Environmental Protection:
 - a. Indoor: UL 50E, Type 2.
 - b. Outdoor: UL 50E, Type 3R.
 - 5. Finish Color: Gray weather-resistant enamel.
- F. Taps for Transformers 3 kVA and Smaller: One 5 percent tap above normal full capacity.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.
- J. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of 80 deg C rise above 40 deg C ambient temperature.
- K. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.
 - 1. Unit may not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding indicated insulation class in 40 deg C maximum ambient and 24-hour average ambient of 30 deg C.
 - 2. Indicate value of K-factor on transformer nameplate.
 - 3. Unit must comply with requirements of DOE 2016 efficiency levels when tested in accordance with NEMA TP 2 with K-factor equal to one.
- L. Electrostatic Shielding: Windings must have independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding shield.
- M. Wall Brackets: Wall brackets fabricated from design drawings signed and sealed by qualified structural professional engineer.
- N. Low-Sound-Level Requirements: Maximum sound levels when factory tested in accordance with IEEE C57.12.91, as follows:
 - 1. 9.00 kVA and Less: 40 dB(A-weighted).

2. 9.01 to 30.00 kVA: 5 dB(A-weighted).
3. 30.01 to 50.00 kVA: 45 dB(A-weighted).
4. 50.01 to 150.00 kVA: 50 dB(A-weighted).

2.4 IDENTIFICATION

- A. Nameplates:
 1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Testing Administrator: Engage qualified electrical testing agency to evaluate transformer.
- B. Factory Tests and Inspections: Test and inspect assembled system, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.01 and IEEE C57.12.91 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance on control units.
 1. Resistance measurements of windings at rated voltage connections and at tap connections.
 2. Ratio tests at rated voltage connections and at tap connections.
 3. Phase relation and polarity tests at rated voltage connections.
 4. No load losses, and excitation current and rated voltage at rated voltage connections.
 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
 6. Applied and induced tensile tests.
 7. Regulation and efficiency at rated load and voltage.
 8. Insulation-Resistance Tests:
 - a. Line-side to ground.
 - b. Load-side to ground.
 - c. Line-side to load-side.
 9. Temperature tests.
- C. Nonconforming Work:
 1. System equipment that does not pass tests and inspections will be considered defective.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at location of transformer.
- E. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated design drawings signed and sealed by qualified structural professional engineer.
 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

- B. Install transformers level and plumb on concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base in accordance with manufacturer's published instructions.
- E. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:
 - a. Visual and Mechanical Inspection.
 - 1) Inspect physical and mechanical condition.
 - 2) Inspect anchorage, alignment, and grounding.
 - 3) Verify that resilient mounts are free and that shipping brackets have been removed.
 - 4) Verify that unit is clean.
 - 5) Perform specific inspections and mechanical tests recommended by manufacturer.
 - 6) Verify that as-left tap connections are as specified.
 - 7) Verify presence of surge arresters and that their ratings are as specified.
 - b. Electrical Tests:
 - 1) Measure resistance at windings, taps, and bolted connections.
 - 2) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index may not be less than 1.0.
 - 3) Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
 - 4) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- B. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.

- C. Nonconforming Work:
 - 1. Transformer will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Assemble and submit test and inspection reports.
- E. Manufacturer Services:
 - 1. Engage factory-authorized service representative to support field tests and inspections.

3.5 ADJUSTING

- A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Transient voltage suppression panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces

defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For testing agency.

E. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards.

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Three spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D.

2.2 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - d. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 5. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
 6. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 7. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
1. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 2. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 4. Split Bus: Vertical buses divided into individual vertical sections.
 5. **All bus-bars shall be copper per the SCO Guidelines.**
- D. Conductor Connectors: Suitable for use with conductor material.
1. Main and Neutral Lugs: Compression type.
 2. Ground Lugs and Bus Configured Terminators: Compression type.
 3. Feed-Through Lugs: Compression Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

- B. Main Overcurrent Protective Devices: Circuit breaker or Fused switch, see plans.
- C. Branch Overcurrent Protective Devices:
 - 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 - 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
 - 3. Fused switches.
 - 4. Panels 600 A and less must be equipped with either bolt-on or plug-in type breakers secured in place with 1 or 2 fastening screws.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Plug-in Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity for personnel receptacles, kitchen, EWC, etc; 30-mA trip sensitivity for equipment connections like heat tape, drain line heaters, etc.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."

5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
9. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726 -WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge suppression units.
 - 4. Wall-box motion sensors.
 - 5. Isolated-ground receptacles.
 - 6. Snap switches and wall-box dimmers.
 - 7. Solid-state fan speed controls.
 - 8. Wall-switch and exterior occupancy sensors.
 - 9. Pendant cord-connector devices.
 - 10. Cord and plug sets.
 - 11. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. SPD: Transient voltage surge suppressor, Surge Protection Device.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.

- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.
 - 2. Receptacles shall be tamper resistant per NEC requirements. Catalog numbers listed below are minimum requirements and shall be provided as the tamper resistant version.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
- B. **ALL receptacles shall be Federal Grade per SCO Guidelines, complying with US Federal Specification W-C-596.**

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Hubbell; CR 5253IG.
 - b. Leviton; 5362-IG.
 - c. Pass & Seymour; IG6300.
 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SG.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; 63H.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. GFCI receptacles shall be self-testing type.

2.4 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; IG2310.
 - b. Leviton; 2310-IG.
 2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 2. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.

- b. Hubbell; HBL1557.
- c. Leviton; 1257.
- d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; 1995L.
- b. Hubbell; HBL1557L.
- c. Leviton; 1257L.
- d. Pass & Seymour; 1251L.

2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
 - 1. Continuously adjustable slider,
 - 2. Three-speed adjustable slider, 1.5 A.

2.10 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: See the Plans.
 - 3. Material for Unfinished Spaces: See the plans.
 - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

2.11 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.

- C. Service Plate: See the Plans.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: See the Plans.

2.12 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
 - 3. Square D/ Schneider Electric.
 - 4. Thomas & Betts Corporation.
 - 5. Wiremold Company (The).
- B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
 - 1. Service Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks.
 - 2. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.
 - 3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 - 4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
 - 5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

2.13 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold Company (The).
 - 3. Panduit
 - 4. AMP
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 12 AWG.

2.14 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: See the Plans., unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.

3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Cartridge fuses rated 600 V and less for use in switches panelboards switchboards controllers and motor-control centers.

1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Let-through current curves for fuses with current-limiting characteristics.
 - 3. Time-current curves, coordination charts and tables, and related data.
 - 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**

- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 5 percent of each fuse type and size, but no fewer than 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay J, fast acting J, time delay T, fast acting.
- B. Feeders: Class L, time delay J, time delay RK5, time delay.
- C. Motor Branch Circuits: Class RK5, time delay.
- D. Other Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Enclosures.

1.3 DEFINITIONS

- A. GD: General duty – NOTE: General Duty is NOT ALLOWED
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. UL listing for series rating of installed devices.
 - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports including the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

- A. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**
- B. Comply with NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spare Indicating Lights: Six of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Division.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. Moeller Electric Corporation.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 7. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
 - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Infrared Scanning:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
 - b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
 - c. Instruments, Equipment and Reports:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 265116 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaire supports.

B. Related Requirements:

1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating

E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled luminaires, from manufacturer.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LED LUMINAIRE REQUIREMENTS

- A. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of minimum 80. CCT of 4000 K.
- F. Rated lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: See Light Fixture Schedule on Plans.
 - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.3 LED EXTERIOR LUMINAIRE REQUIREMENTS

- A. **Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third-party testing agency. Third party agencies shall be one of those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment and marked for intended use.**
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.6.
- F. CRI of minimum 80. CCT of 4000 K.
- G. L70 lamp life of 50,000 hours.
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Nominal Operating Voltage: See Light Fixture Schedule on plans.
- J. In-line Fusing: Separate in-line fuse for each luminaire.
- K. Lamp Rating: Lamp marked for outdoor use.
- L. Source Limitations: Obtain luminaires from single source from a single manufacturer.

- M. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.
- N. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- O. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

2.4 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Clear, UV-stabilized acrylic.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.5 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.

- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- D. Install lamps in each luminaire.
- E. Supports: Sized and rated for luminaire weight.
- F. Ceiling-Grid-Mounted Luminaire Supports:
 - 1. Install ceiling support system rods or wire for each luminaire. Locate not more than 6 inches from luminaire corners.
 - 2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
 - 3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 - 4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the luminaire weight at a safety factor of 3.
- G. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- H. Wall-Mounted Luminaire Support:
 - 1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
 - 2. Do not attach luminaires directly to gypsum board.
- I. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- J. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.
- K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265116

SECTION 265119 – ARCHITECTURAL RGBW LED BACKLIGHTING LUMINAIRE - INTERIOR

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. LED lighting fixtures and control systems
 1. Downlights. Arktura RGBW Backlighting
 2. Drivers. Arktura 24V LG-PS1025 LED driver
 3. Control. Pixel Driver Kit AK-BL3007 (3072 pixels (24U)) or AK-BL3008 (12,288 pixels (96U))
 4. Wall Controller kit AK BL3005-1A (Black) or AK-BL3006-1A (White)
 5. User Interface Ark- Touch-Pharos
 - a. TPS 8 User Interface.
 - b. Switch PoE with 4 ports.
 - c. Expert line switch.
 - d. VLC+
 6. NETGEAR 300 series.

1.2 RELATED SECTIONS

- A. Section 26 51 16 – LED Interior Lighting
- B. Section 26 09 23 – Lighting Control Devices
- C. Section 26 09 17 – Programmable Controllers
- D. Section 26 55 59 - Display Lighting
- E. Section 41 67 19 - Plant Safety Equipment. Building integrator shall provide integration of the lighting control system with Building Automation Systems.

1.3 SUBMITTALS

- A. Submit under the provisions of Section 01 30 00.
- B. Product Data:
 1. Manufacturers' data sheets on each product are to be used.
 2. Preparation instructions and recommendations.
 3. Storage and handling requirements and recommendations.
 4. Typical installation methods.
- C. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five years' documented experience.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
- C. Commissioning Qualifications: Company specializing in performing the work of this section with a minimum of five years' documented experience with projects of similar scope and complexity.
- D. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.
- E. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
 - 1. The intention of mock-up is to demonstrate quality of workmanship and visual appearance.
 - 2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
 - 3. Retain mock-ups during construction as a standard for comparison with completed work.
 - 4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.5 PRE-INSTALLATION CONFERENCE

- A. Convene a conference approximately two weeks before the scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. The agenda shall include schedule, responsibilities, critical path items and approvals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and manage strict compliance with manufacturer's written instructions and recommendations.
- B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturers for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

- A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide Arktura LLC.
 - 1. Substitutions will be considered.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. Product Range: RGBW Backlighting LED luminaire architectural lighting system

manufactured by Arktura LLC.

1. RGBW LED Luminaires: Recessed or Surface mount into ceilings or walls solutions.
 - a. Convection cooled with no fans or moving parts.
 - b. Luminaires comply with UL2108 and CSA. ETL Listed.
 - c. Including the following on-board configurable features:
 - 1) Configurable RGBW individual controls up to 128 addresses.
 - 2) 128 pixels of RGBW.
 - d. Dimensions: 2' Width x 4' Length X 4-3/8" height
2. Proprietary Arktura's drivers, hardware, and software.
3. Controllers System features: Depending on the size of the project.
 - a. Option 1 kit.
 - 1) A Pixel Driver Kit: 24U AK-BL3007 (Up to 24 Universe) or 96U AK-BL3008 (Up to 96 universes). Input from a third-party controller conforming to Pixel protocol for individual control of each pixel LED within the luminaire. The kit includes the power supply to power it.
 - 2) A wall controller kit with 6 buttons and Black (AK-BL3005-1A) or White (AK-BL3006-1A) color option. Each button has four standard scenes to choose from. The kit includes the power supply to power it. Non-dim capability.
 - b. Option 2 kit. For project that required less than six universes of operation.
 - 1) A Pixel Driver Kit: 24U AK-BL3007 (Up to 24 Universe). Input from a third-party controller conforming to Pixel protocol for individual control of each pixel LED within the luminaire. The kit includes the power supply to power it.
 - 2) User Interface Ark-Touch Panel 5 is Power-Over-Ethernet. Is a touch interface with an 8" color screen. It can dim-to-dark and create fully customizable scenes with additional color adjustments.
 - 3) DMX and DALI Control Expert Switch.
 - 4) NETGEAR 300 Series
 - c. Option 3. For project that required more than six universes of operation.
 - 1) A Pixel Driver Kit: 24U AK-BL3007 (Up to 24 Universe) or 96U AK-BL3008 (Up to 96 universes). Input from a third-party controller conforming to Pixel protocol for individual control of each pixel LED within the luminaire. The kit includes the power supply to power it.
 - 2) User Interface Ark-Touch Panel 5 is Power-Over-Ethernet. Is a touch interface with an 8" color screen. We are to dim-to-dark and create fully customizable scenes. Dimming capabilities and color adjustments
 - 3) POE Switch with 4 Port, Calss 2, includes power supply.
 - 4) NETGEAR 300 Series
 - 5) Video Lighting controller: VLC + M Ph
4. High Performance LED Emitters:
 - a. CRI: Greater than 90+ for 3500K white pixel.
 - b. White Color Temperature:
 - 1) White (White LED channel only) = 3500K
 - c. Rating: 70 percent output (L70) after 50,000 hours
5. Electrical: Luminaire requires the use of a remote Arktura LG-PS1025 LED driver to power it.
 - 1) Input voltage: 100-277VAC.
 - 2) Outputs: 3 x 96 W, 24VDC outputs.
 - 3) Input power as a system: It includes up to three luminaires per power supply. Each luminaire connects to one of the three outputs of the power supply. At 120VAC input we have the following:
 - a) 220 VA: 3 outputs loaded.
 - b) 148 VA: 2 outputs loaded.

- c) 77 VA: 1 output loaded.
 - 4) Inrush Current: 35A, 50% 1ms@ 120 and 43A, 50%, 1ms@277VAC.
- 6. Scenes and displays:
 - a. It can have up to 24 Standard Scenes programmed: We provide twelve standards scenes.
 - b. Customs displays and scenes are available upon request. Contact manufacturer for details.
- 7. Warranty: Five years' full luminaire coverage.

2.3 LED RGBW Direct luminaire – Arktura RGBW Backlighting Series

- A. Product: AK-BL1025-1A Model: RGBW Backlighting Series as manufactured by Arktura LLC. Controlled via an external, proprietary driver from the Arktura driver range of products.
 - 1. Standards Compliance:
 - a. UL 2108/CSA C22.2 No. 250.13.2020 Ed. 4 + U1, Luminaires.
 - b. Plenum Rated Data wire.
 - c. ETL Listed.
 - 2. Construction:
 - Back tray: Aluminum
 - Front panel: Aluminum
 - 3. Luminaire:
 - a. Rating: IP64. Suitable for indoor use in dry locations.
 - b. Environment: Suitable for Wet, Damp or Dry locations.
 - 4. Base Unit External Dimensions (HxWxD): 24 x 12 x 4-3/8 inch (609.6 x 304.8 x 111.12 mm). Weight: 7.4-lbs (3.36 kg) for Ceiling mount includes RGBW Backlighting of 8 PCBs and mounting tray and 2-lbs (0.91 kg) for wall mount that only includes RGBW 8 PCB kit. There is an additive weight depending on the ceiling panel type.
 - 5. Mounting Accessories: The panels may be installed into the luminaire with these accessory kits.
 - a. Ceiling mount Style: The RGBW Backlighting PCBs gets mounted to the tray. The back-tray then gets fastened to the T-Grid face with three self-tapping screws on each side.
 - b. Wall mount Style: AXONOMETRIC Kit includes (Quantities are specific to each project): Hook plate (4' or 8'), Vertika channel with hook plate (4' (7.2 lbs) or 8' (14.4 lbs), Line channel with hook plate (4' or 8' (9.1 lbs)), Vertika trim 9' (5.2 lbs), Vertika cut trim 9' (4.4 lbs), dome head Rivet, acrylic backer clip (VK-HM1001 or soft sound baker clip (VK-HM1002), Vertika trim bracket (VK-IN1015) and Acrylic and soft sound baker tabs. Vertika Light Bocker between fixtures.
 - 6. Luminaire, LED: RGBW.
 - a. Utilize Eight RGBW LED PCBs to complete one luminaire:
 - 7. Luminaire, RGBW: 192 LED emitters for each color Red, Green, Blue, and White arrays. For a total of 768 LEDs.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until the substrates have been properly constructed and prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

WENDELL H. MURPHY FOOTBALL CENTER – KITCHEN RENOVATION
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A, NCSU Project# 202320015, NCSU Building# 135

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.
- B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.5 CLEANING AND PROTECTION

- A. Clean products in accordance with the manufacturer's recommendations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 265119

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Addressable interface device.

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

B. Shop Drawings: For fire-alarm system.

2. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
3. Include plans, elevations, sections, details, and attachments to other work.
4. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
1. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by NC State University Life Safety and Engineer of Record prior to submitting them to Architect.
1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - a. Licensed or certified by authorities having jurisdiction.

- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer in State of North Carolina responsible for their preparation.
 - 1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 - 3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment.
 - d. Riser diagram.
 - e. Record copy of site-specific software.
 - f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - g. Manufacturer's required maintenance related to system warranty requirements.
 - h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. Retain one of four "NFPA Certification" paragraphs below to require independent system verification.
- D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- E. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- F. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 - 2. Warranty Period: one year from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) NRTL testing agencies.
- E. Provide all components necessary, regardless of whether shown in the contract documents or not. Costs for modifying and programming the existing Fire Alarm Control Unit shall be included in the contract.
- F. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
- G. Circuits:

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A

1. Initiating Device Circuits (IDC): Class A with no "T" taps.
 2. Signal Line Circuits (SLC) within Single Building: Class A with no "T" taps.
 3. Notification Appliance Circuits (NAC): Class B
- H. Spare Capacity is existing:
4. Initiating Device Circuits: Minimum 25 percent spare capacity.
 5. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 6. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- I. The system specified is an addressable system and device designations shall be submitted to the engineer and owner for approval for final programming.
- J. Power Sources:
7. Primary: Dedicated branch circuits of the facility power distribution system.
 8. Secondary: 24-hour battery back up
- K. Spare Parts:
9. Fuses- two (2) of each size used in the installed system.
 10. MPS- w/ monitor modules – Minimum one (1) or 2% of total installation.
 11. Audio-visual devices – Minimum one (1) or 4% of total installation.
 12. Indoor strobe only devices – Minimum one (1) or 4 % of total installation.
 13. Spot Smoke Detectors – Minimum one (1) or 6% of total installation.
 14. Relay modules – Minimum one (1) or 4% of each total installation.
 15. Monitor modules – Minimum one (1) or 4% of total installation.
 16. Isolation modules – Minimum one (1) or 4% of total installation.
- L. Contractor shall conduct mandatory pre-construction meeting with the electrical contractor, electrical engineer, the fire alarm contractor, and NC State University.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Automatic sprinkler system water flow.
 6. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 7. Close fire smoke dampers in air ducts of designated air-conditioning duct systems.

8. Coordinate first subparagraph below with "Elevator Recall" Paragraph in "Fire-Alarm Control Unit" Article.
 9. Recall elevators to primary or alternate recall floors.
 10. Activate elevator power shunt trip.
 11. If supplies are not essential to life safety, retain first subparagraph below for shutoffs installed in supplies that may be hazardous.
 12. Record events in the system memory.
 13. Record event on system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Elevator shunt-trip supervision.
 3. Loss of communication with any panel on the network.
 4. Record event on system printer.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator0
 10. Record event on system printer.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
 2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
 3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
 4. Record event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

- A. Fire Alarm Control unit is existing and is a Honeywell Notifier system.
- B. Contractor shall acknowledge and accept the transfer of responsibility and liability of the existing system prior to start of work with the understanding that the system will be returned to NC State University in the same or better condition.
- C. The system must be equipped with the protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. Use Transtector ACP100BWN3, Ditek DTK-120HW or DTK-120/240CM or Leviton OEM-120 EFI. Install at circuit origination using knockout or supplied "L" bracket, and trim excess lead lengths. Provide coil of six turns in branch conductor to panel at point of connection of surge suppressor and secure with "tie-wrap".

D. Notification-Appliance Circuit:

1. Horn appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

H. Digital communicator is existing.

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell Security & Fire Solutions/Notifier

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.

1. Double-action mechanism requiring two actions to initiate alarm, pull-lever] type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
2. Station Reset: Key locks. Provide (2) keys for each pull station. Allen key type locks are unacceptable.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell Security & Fire Solutions/Notifier

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal
2. In first subparagraph below, retain first option for additions to existing four-wire systems or if detector auxiliary contacts are used for critical control functions such as air-handler shutdowns. Otherwise, retain type based on class of initiating-device circuit. Four-wire detectors have power supply wiring separate from the initiating-device circuit wiring. Both power supply wiring and initiating-device circuit wiring must be supervised.
3. Retain one or both of first two subparagraphs below. If retaining both, indicate detector types on Drawings.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A

5. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 6. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 7. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 8. Magnet test capability.
- C. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- D. Duct Smoke Detectors
- E. Description: Photoelectric-type, duct-mounted smoke detector.
1. General Characteristics:
 - a. Detectors must be **four** -wire type.
 - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
 - c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - d. Integral Visual-Indicating Light: LED type, indicating detector has operated [**and power-on status**].
 - e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
 - f. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
 - 1) Primary status.
 - 2) Device type.
 - 3) Present average value.
 - 4) Present sensitivity selected.
 - 5) Sensor range (normal, dirty, etc.).
 - g. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
 - a. Each sensor must have multiple levels of detection sensitivity.
 - b. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 - a. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 HEAT DETECTORS

A. Combination-Type Heat Detectors:

1. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 521.

b. General Characteristics:

- 1) Temperature sensors must test for and communicate sensitivity range of device.

c. Actuated by fixed temperature of **135 deg F (57 deg C)** or rate of rise that exceeds **15 deg F (8 deg C)** > per minute unless otherwise indicated.

d. Mounting: [Adapter plate for outlet box mounting] [Twist-lock base interchangeable with smoke-detector bases].

e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.

f. Detector must have functional humidity range of **10 to 90** percent relative humidity.

a. Color: **White**.

B. Fixed-Temperature-Type Heat Detectors:

1. Performance Criteria:

a. Regulatory Requirements:

- 1) NFPA 72.
- 2) UL 521.

b. General Characteristics:

- 1) Actuated by temperature that exceeds fixed temperature of **190 deg F (88 deg C)**.

- 2) Mounting: **Twist-lock base interchangeable with smoke-detector bases.**

- 3) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.

- 4) Detector must have functional humidity range of **10 to 90**.

- 1) Color: **White**.

2.7 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell Security & Fire Solutions/Notifier

- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Notification Appliances:
 - 2. Horn/strobe: Provide new.
 - a. Synchronized.
 - b. Candelas as shown on drawings.
 - c. Audible evacuation signal shall sound in a three pulse temporal pattern.
 - 3. Strobe: Provide new.
 - a. Synchronized.
 - b. Candelas as shown on drawings.
 - 4. Exterior horn/strobe:
 - a. Weatherproof accessories.

2.8 Booster power supplies shall be provided with remote.

2.9 ADDRESSABLE INTERFACE DEVICE

- A. General:
 - 1. Include address-setting means on the module.
 - 2. Store an internal identifying code for control panel use to identify the module type.
 - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit-breaker shunt trip for power shutdown.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 - 3. Operate notification devices.
 - 4. Operate solenoids for use in sprinkler service.
- E. Isolation modules:
 - 5. Provided for each 20 devices
 - 6. Provide 3 for new loop, two at the Fire Alarm control unit and one midway through the loop.
 - 7. Provide each floor for multistory buildings.

2.10 AIR HANDLER SHUTDOWN

- A. A supervised "AHU Shutdown Defeat" switch must be provided in/adjacent to the FACP or as a keyoperated function in the Remote Annunciator (if provided). If the FAA option is utilized, provide an informative engraved label at the FACP about this function. The switch must cause a system "trouble" indication when it's placed in the off-normal ("Shutdown Defeated") position.

This is to provide the owner with a convenient means to temporarily resume HVAC operation in the event an unwanted alarm will not clear, prior to arrival of the fire alarm service technician, or for testing purposes.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- B. For projects mixing old and new notification devices it is the responsibility of the fire alarm contractor, before beginning work, to ensure that new and existing devices can produce the same, synchronized audible tone/pulse alarm. If that is not possible, all existing audible devices may need to be replaced.**
- C. Remove existing components indicated and return to owner.
- D. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- E. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- F. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- G. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- H. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.
- I. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
- J. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- K. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

- L. Coordinate "Audible Alarm-Indicating Devices" Paragraph below with Drawings.
- M. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install speakers on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- N. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- O. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- P. System outages for occupied buildings:
 - 1. The Contractor shall notify NC State University prior to any work to contacts/interface with any alarm detection devices (smoke detectors, pull stations, horns, panels, etc.). If any disabling, disconnection, reconnection of fire alarm system equipment is necessary, the Contractor shall notify NC State University at least five (5) working days prior to proposed work. Work cannot proceed until contractor receives written approval from NC State University.
 - 2. Disabling or disconnection shall be limited to one (1) working day per outage. The Contractor shall be liable for any costs, direct or indirect, due to false alarms resulting from Contractor's work.
- Q. In general devices shall be centered in spaces or above other outlets.
- R. Smoke detectors shall not be located closer than three feet to an air conditioning supply or return.
- S. Locate ceiling mounted detectors as high as possible in spaces.
- T. Coordinate any disconnects with NCSU Life Safety at least 72 hours prior to disconnect and provide notification of any interruption of the existing fire alarm system extending beyond 8 hours.

3.2 PATHWAYS

- A. **Fire alarm wiring system shall be run in a "Raceway" without any exceptions per SCO Guidelines.**
- B. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
 - 1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- C. Pathways shall be installed in EMT.
- D. Provide red cover plates for all junction boxes for the fire alarm system.
- E. Initiation or notification circuits shall not be included in raceways containing AC power or AC control wiring.
- F. EMT connectors shall be steel compression type, with insulated throats.
- G. Use terminal blocks for all splices. Twist on splices are not allowed.

- H. For terminations, indicate which conductor leads to the control panel
- I. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
- J. Conductors shall be copper same as specified for electrical system. Initiation circuits shall be number 14 AWG stranded, type THHN or XHHW shall be used.
- K. Addressable loop controller circuits are to be wired with FPL/FPLR/FPLP solid copper, AWG 18 minimum, low capacitance, twisted pair, installed in conduit in lieu of the 14 AWG noted above.
- L. Alarm appliances shall be connected with 14 AWG noted above.
- M. For other circuits the following color code shall apply
 - 1. Initiating circuits (addressable loop)
 - 2. Initiating circuits (smoke detection) (addressable loop)
 - 3. Alarm indicating device circuitsblue and black
 - 4. Door control circuits.....orange

3.3 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated HVAC duct systems.
 - 2. Magnetically held-open doors.
 - 3. Electronically locked doors and access gates.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt-trip breaker.
 - 10. Supervisory connections at fire-extinguisher locations.

3.4 IDENTIFICATION

- A. Junction box covers shall be labeled as to their contents using an electronic labeling system with black letters on white background.
- B. Contractor shall label all wires terminating in junction boxes and riser boxes. These labels shall be self-sticking wire numbers.
- C. All device labels shall be made using an electronic labeling system with black letters on white background. Write-on labels are prohibited. Contractor shall provide a typed legend for all

junction boxes and riser boxes corresponding to these labels. Legend shall be mounted in riser boxes. If system does not have riser boxes, contractor shall provide legend to NC State University at time of NC State University acceptance.

- D. All initiating devices and modules for Intelligent Point Identification Device (P.I.D) systems shall be labeled with their addresses, including loop and point number.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.
- C. Field tests shall be witnessed by Engineer of Record and NCSU Life Safety.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 1. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 2. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 3. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 4. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

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NORTH CAROLINA STATE UNIVERSITY, RALEIGH, NC
SCO ID# 24-28146-01A

- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.
- J. Provided notification to the engineer at least 7 days prior to beginning completion inspections and tests.
- K. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- L. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- M. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- N. Provide all tools, software, and supplies required to accomplish inspection and testing.
- O. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- P. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- Q. Test results shall be provided to the Engineer for inclusion in the project documents.
- R. The contractor must submit the following test documentation:
 - 1. Written verification that this 100% system test was done.
 - 2. Measured sensitivity of each smoke detector.
 - 3. Manufacturer certification of the installing technician and inclusion of a copy of the certification.
- S. After completion of the 100% system test and submission of the above documentation, the contractor will request an inspection. The system must operate for at least two days prior to this inspection.
- T. The system will be inspected and functionally tested by the engineer. Equipment intended for open area protection or releasing device service may be subjected to simulated or actual test fires, in accordance with ANSI/UL guidelines and sound engineering practice, to verify proper response.
- U. After successful completion of inspections and tests, the warranty period begins. In the event malfunctions or excessive nuisance alarms, the contractor must take prompt corrective action. Continued improper performance during the warranty period shall be cause to require the Contractor to replace the system.
- V. Prior to final inspection:
 - 4. Contractor shall demonstrate 100% compliance with plans, submittals, specifications, and NFPA 72 to NC State University.
 - 5. Designer shall provide fully completed NC State University Fire Alarm System Checklist for Addressable Systems to NC State University.

3.6 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Contractor shall provide all software, hardware, interfaces, adapters, and cables required for all programming and maintenance functions.
- C. Contractor shall provide all software required for full system maintenance and upgrades to fire alarm system including any device changes, additions, or deletions.
- D. Contractor shall provide all software updates during the warranty period and upgrades to software following the warranty period that address system operation failures or defects during the life of the system.
- E. Contractor shall provide all levels of password access with documentation.
- F. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for one year.
- G. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.
- B. After completing fire alarm work, test 100% of new devices and devices on same loop plus 10% of existing devices fire alarm system to verify proper operation.**

END OF SECTION 283111