
SECTION 220000 - PLUMBING**1.0 GENERAL****1.01 General Conditions:**

- A. Drawings, all Contract Documents, and Division-1 Specifications sections, apply to work of this Section.
- B. Where the term "Contractor" is used it shall mean the Plumbing Contractor.
- C. Contractors bidding on this section are notified that they shall hold a license for Plumbing as issued by the North Carolina State Board of Examiners of Plumbing and Heating Contractors.
- D. Reference shall be made to the Architectural, Structural, Heating and Air-conditioning, and Electrical drawings and specifications for details of building construction and for coordination with other parts of construction.
- E. Contractor shall visit the job site before the submission of a bid and familiarize himself with existing conditions. Submission of a bid will be considered as evidence that the Contractor has visited the site and is familiar with existing conditions.

1.02 Bidding:

See General conditions.

1.03 Scope of the Work:

- A. The work to be done under this contract consists of furnishing all labor, materials, equipment, devices, appliances, tools, transportation, and services as required, and in performing all functions to completion and leave ready for operation the installation of the plumbing work in strict accordance with these specifications and applicable drawings and subject to the terms and conditions of the contract.
- B. Obtain all permits and make all test.

1.04 Intent:

- A. It is the intention of the specifications and drawings to call for finished work, tested, and ready for operation. Work shall be installed in accordance with the drawings and specifications using skilled workmen.
- B. It shall be the responsibility of this Contractor upon discovering any discrepancies in the drawings or specifications or points of conflict therein, to immediately notify the Owner who will clarify such discrepancies or conflicts in writing before the work progresses beyond said point. No extras will be allowed because of failure to properly notify the Owner.

1.05 Codes, Permits and Inspections:

- A. All work under this specification shall comply with all local and state codes, laws, ordinances and regulations. Wherever the drawings and specifications are in excess of such laws, ordinances and regulations, the drawings and specifications shall hold.

- B. Contractor shall obtain permits and arrange all inspections necessary for the installation of this work, paying all fees in connection therewith, and furnishing the Owner with certificates of inspection from all authorities having jurisdiction.
- C. No piping or other construction shall be covered up or concealed until it has been inspected, tested and approved. The Contractor shall furnish all labor, materials, water, fuel, equipment, and apparatus and bear all expenses of such tests as are hereinafter specified for the work under this section of the specifications.

1.06 Drawings and Specifications:

- A. The plumbing drawings show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction will permit.
- B. Plumbing work shall conform to the requirements shown on all the drawings. Architectural and Structural drawings shall take precedence over Plumbing drawings. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions.
- C. The drawings and specifications are complementary each to the other and what is called for by one shall be as binding as if called for by both.
- D. Omission of particular reference to any item necessary for a complete installation and proper operation thereof, shall not relieve the Contractor of the responsibility of furnishing same.

1.07 Coordination of Work:

- A. The Contractor shall coordinate the work with other contractors on the project. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of all piping systems and equipment. Work shall be installed in proper sequence with other trades, and without unnecessary delays.
- B. The layout shown shall be followed as closely as circumstances will permit but the Contractor must lay out his work so as not to conflict with other trades and to avoid any unnecessary cutting of or damage to walls, floors or other parts of his equipment.
- C. Whenever interferences might occur, before installing any of the work in question, the Contractor shall consult with other contractors and shall come to an agreement with them as to the exact location and level of his piping and other parts of his equipment.
- D. Locations of pipes, equipment, and appurtenances shall be adjusted to accommodate the work to interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe prior to fabrication. Lines, which pitch, shall have right of way over those which do not pitch. Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed.
- E. Offsets and changes in direction in pipes shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all accessories as required to affect these offsets and changes in direction.

1.08 Equipment and Materials:

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- A. Catalog numbers and trade names in these specifications and noted on the drawings are intended to describe the material, devices or apparatus wanted. Similar materials, devices or apparatus of other manufacturers, if of equal quality, capacity and character, may be substituted on the written approval of the Owner. If the Contractor fails to comply with the provisions of this paragraph, he shall be required to furnish all materials and equipment as specified.
 - B. All materials shall be new and bear the manufacturer's name, trade name and the UL Label in every case where a standard has been established for the particular material. The equipment to be furnished shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be the manufacturer's latest approved design.
 - C. Equipment and materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection until installed.
 - D. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
 - E. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Damage or defects developing before acceptance of the work shall be made good at the Contractor's expense.
 - F. Dimensions: It shall be the responsibility of the Contractor to insure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications.

1.09 Equipment Accessories:

- A. The Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work, ready for use, occupancy and operation by the Owner.
- B. Supports: The Contractor shall support plumb, rigid and true to line all work and equipment furnished under this section. The Contractor shall study thoroughly all general, structural, mechanical and electrical drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, etc., are to be supported, mounted or suspended and shall provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support whether or not shown on the drawings.

1.10 Cutting, Patching and Repairing:

- A. In new construction, the General Contractor will provide all openings in wall, floor, and roof construction required by the Plumbing Contractor for installation of his work, provided complete information is furnished to the General Contractor at the time required. Failure to provide necessary information will necessitate provisions of additional required openings, chases, recesses, etc., by Plumbing Contractor at his own expense, and he shall be fully responsible for the proper cutting and patching of such construction as approved and directed by the Owner.
- B. Where pipes or conduit pass through walls, floors, or roofs, sleeves shall be furnished by this Contractor and installed, except as noted otherwise, by the trade furnishing and installing the material in which they are located. Location of sleeves, inserts, and supports shall be as directed by this Contractor who will also insure that they are properly installed. Sleeves shall be neatly sawed, sheared, or cut with wheeled cutters. No flame cutting will be permitted.

- C. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades required because of his fault, error or tardiness or because of any damage done by him.
- D. Under no circumstances shall the Contractor cut any structural beam or support without prior approval and instructions from the Owner.
- E. If Plumbing Contractor installs Plumbing work through exposed finish walls, ceiling or floor after they are in place, the Plumbing Contractor shall close excess openings around his work to match finish surface.

1.11 Shop Drawings and Submittal Data:

- A. The Contractor shall submit to the Owner after the award of the contract, a folder containing catalog cuts and descriptions giving name of manufacturer, trade name, type, catalog number and location in work, of all equipment which he proposes to use in the execution of the contract.
- B. Approval is solely for the purpose of determining suitability and will in no way absolve the Contractor of his responsibility for the correctness of measurements, quantities, or performance. Approval of shop drawings shall not constitute a change in the contract requirements.
- C. Shop drawings must comply with the requirements of all regulatory bodies having jurisdiction.
- D. Contractor shall furnish at least five (5) copies of submittal data. Three (3) copies will be returned to the Contractor. If the Contractor desires the return of more than three (3) copies, additional copies shall be furnished at the time of original submission.

1.12 Workmanship:

The work throughout shall be executed in the best and most thorough manner, under the periodic observation of and to the satisfaction of the Owner and Engineer who will jointly interpret the meaning of the drawings and specification, and shall have the power to reject any work or materials which, in their judgment, are not in full accordance therewith.

1.13 Singular:

In all cases where a device or piece of equipment is referred to herein or on the drawings in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

1.14 Use of the Word "Provide":

Herein, where the word "Provide" is written in these specifications, provide shall be understood to mean provide complete in place, that is, "Furnish and Install".

1.15 Supervision and Superintendence:

The Contractor shall, during the progress of the work, maintain a competent superintendent, who shall not be changed except if he proves unsatisfactory to the Contractor or the Owner. Efficient supervision shall be given to all work under this contract.

2.0 PRODUCTS**2.01 Excavation, Trenching, and Backfill:**

- A. Unless noted otherwise on the drawings, the Plumbing Contractor shall do all excavation and backfill required for his work. Unless otherwise shown, provide separate trenches for each sanitary sewer, storm sewer, and water line. Lay all pipe in open trenches except when the Owner gives written permission for tunneling.
- B. Sheeting, Bracing, and Water Removal: Sheet and brace trenches, and remove water as necessary to fully protect workmen and adjacent structures and permit proper installation of the work. Comply with all local regulations or, in the absence thereof, with the provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. Under no circumstances lay pipe or install appurtenances in water. The trench shall be kept free from water until pipe joint material has hardened. The presence of ground water in the soil or the necessity of sheeting or bracing trenches shall not constitute a condition for which any increase may be made in the contract price. Sheeting shall not be removed until the trench is substantially backfilled.
- C. Rock Excavation: The material to be excavated is assumed to be earth and debris encountered in the project area. If rock should be encountered, an agreed extra compensation will be allowed. Earth shall include all material that can be removed by a 3/4-yard power shovel. Rock is defined as rock, stone, hard shale in original ledge, boulders, masonry and rock fragments over nine (9) cubic feet in volume, and cannot be removed by power shovel or without the use of explosives or drills.
- D. Blasting: The written consent and approval of method from the Owner must be obtained before explosives are used, and if used, all local regulations, laws, and ordinances shall be observed. Cover blasts with heavy timbers or mats and set off no blast within twenty-five (25) feet of pipe already laid in the trench. Protect pipe already laid with earth backfill.

Grading Trench Bottoms: Grade the bottom of trenches evenly to insure uniform bearing for the full length of all pipes. Cut holes as necessary for joints and joint making. Excavate all rock, cemented gravel, or other hard materials to at least four (4) inches below the pipe at all points. Refill to grade with sand or fine gravel firmly compacted.

Backfill trenches only after piping has been inspected, tested and locations of pipe and appurtenances have been recorded. Backfill by hand around pipe and for a depth of one (1) foot above the pipe using earth without rock fragments or large stones, and tamp firmly in layers not exceeding six (6) inches in thickness, taking care not to disturb the pipe or injure the pipe coating. Compact the remainder of the backfill thoroughly with a rammer of suitable weight or with an approved mechanical tamper, in layers not exceeding six (6) inches in thickness. All cinders and rubbish shall be prohibited from all trenches.

All fill within the building shall be compacted to 95 per cent of the maximum standard Proctor density.

2.02 Sanitary, Waste, and Vent Lines:

- A. The following lines and fittings shall be Schedule 40 PVC:

Underfloor and underground waste lines
- B. The following lines and fittings shall be Service Weight Cast Iron:

Above floor sanitary waste lines
Above floor vent lines

C. Installation:

Piping of sizes shown shall be run as indicated on the drawings. All extensions above the roof shall be made according to code and as detailed on the drawings. Soil waste and vent stacks shall be run in partitions and suspended above ceilings where indicated. Vertical vent pipes shall be connected together into one main vent stack or riser above the fixtures and vented as indicated on riser diagrams. Vents and branch vent lines shall be free from drops or sags and be graded and connected so as to drip back into the soil or waste pipe by gravity. Where vent pipes connect to the horizontal soil or waste pipe, the vent branch shall be taken off above the center line of the pipe and the vent pipe extended vertically or at an angle of forty-five (45) degrees to the vertical before off-setting or connecting to branch, main waste or soil vent.

Vents from any fixture or line of fixtures, when connected to a vent line serving other fixtures, shall be extended at least six (6) inches above the flood level rim of the highest of such fixtures to prevent use of the vent line as a waste. Extensions of vent pipes through a roof shall be terminated not less than twelve (12) inches above the roof.

Horizontal drainage piping shall be installed in practical alignment at the grade shown on the drawings, but in no case less than a uniform grade of 1/8 inch per foot for sizes 3" and larger. For sizes 2" and smaller grade shall be not less than 1/4 inch per foot.

Changes in direction in drainage piping shall be made by the appropriate use of forty-five (45) degrees wyes, half-yses, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used when two (2) fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than ninety (90) degrees shall be made. Where different sizes of drainage pipes or pipes and fittings are to be connected, standard increasers and reducers of proper size shall be used. Reduction of the size of drainage piping in the direction of flow is prohibited.

Drilling and tapping of house drains, soil, waste or vent pipes, and the use of saddle hubs and bands are prohibited.

Cross-connections or any fixtures, devices, or construction which will permit backflow connections between a water distribution system and any part of the drainage system shall not be installed.

All piping shall be made permanently gas and water tight. Any fitting or connection which has an enlargement, chamber, or recess with a ledge or shoulder or reduction of the pipe area that offers an obstruction to flow through the pipe shall not be installed. Threaded joints shall be made with a lubricant on the male thread only. All burrs or cutting shall be removed and pipe shall be reamed or filed out to not less than the original diameter.

Floor connections for water closets and other fixtures shall be made by means of an approved brass, or iron flange, caulked, into the drainage pipe. The connection shall be bolted, with an approved gasket or approved setting compound between the fixture base and the connections.

2.03 Water Piping, Cold and Hot:

A. Copper tubing, water, ASTM Specification B-88-55, Type K and Type L.

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- B. Soldered joint fittings, wrought type, American Standard Specification B-16 22-1951. Fittings to be of same manufacturer as copper tubing.
 - C. Silver Solder: 15% silver, 80% copper, 5% phosphorous conforming to ASTM B 260-52T.
 - D. 95/5 Solder: 95% tin, 5% antimony.
 - E. Above-ground Piping: Seamless, type L, hard drawn copper with wrought copper fittings.
 - F. Underground Piping: Piping shall be seamless, type K, soft copper with wrought copper fittings.
 - G. Valves: Valves shall have the name and trademark of the manufacturer and the guaranteed working pressure cast on the body of the valve. All valves shall be of one manufacturer and identified by manufacturer's catalog number stamped on a metal disk located under the valve handle nut. Valves shall be bronze NIBCO S-111 or approved equal.
 - H. Installation:

All piping shall be provided with identification in accordance with ANDI A13.1-1981 standards. Markers shall be located at each wall, floor, and ceiling penetration, and at every 20ft. Markers shall be fully legible from floor level showing medium contained in pipe, and direction of flow.

Contractor shall provide hot and cold water mains with branches and risers complete from point indicated on plans running to all fixtures and other outlets indicated. Mains and branches shall be run generally as shown on the drawings. Contractor shall provide all interior water piping, branches, and risers as shown on the drawing and shall make connections to all plumbing fixtures, hose bibbs, wall hydrants, and other points requiring water under this and other divisions of the specifications.

All water mains and branches shall be pitched at least one (1) inch in twenty-five (25) feet toward fixtures. The piping installation shall be arranged so that the entire system can be drained through fixture supply connections. Unions shall be installed at the connections to each piece of equipment to allow removal of equipment without dismantling connecting piping.

Size of all water piping shall be as shown on the drawings. Sizes for connections to fixtures and equipment shall be not less than shown in the schedules on the drawings.

Plumbing Contractor shall be held responsible for any damage to any work installed by others caused by leaks or improper installation of the piping system. The Contractor shall coordinate his work with that of the Heating Contractor and where interference occurs, shall procure approval from the Owner before installation of the work.

Provide eighteen (18) inch high air chambers at fixtures with flush valves. At other fixtures air chambers shall be eighteen (18) inches high. Pipe size for air chambers shall be same as supply to fixture.

Soldered or Bronzed Joints: Joints 1-1/4 inches and larger shall be made with silver solder. For joints less than 1-1/4 inches and all valves (regardless of size) use 95/5 solder. Also use a non-corrosive paste flux in accordance with manufacturer's instructions. All joints shall be thoroughly cleaned with emory cloth and reamed cut before assembly. Acid core solder will not be permitted.

Pipe penetrations through floor slabs and fire rated walls shall be restored to the slab or fire rated wall's original rating and shall be sealed with impervious non-combustible materials sufficiently tight to prevent

transfer of smoke or combustion gases from one side of the wall or slab to the other in accordance with UL methods.

As appropriate to the penetration size and location, provide firestopping using one of the following:

High-temperature non-shrink grout shall be installed in accordance with recommendations of ACI, CSI and the manufacturer's specifications.

Fill openings with Thermafiber Safing insulation.

Caulk full depth of wall or floor with 3M fire barrier; material - No. 25 caulk or 303 putty.

Penetrations through existing construction shall be neatly drilled or cut, and the opening completely filled around the penetrating pipe with the approved firestopping material. Solid masonry and concrete walls as well as concrete slabs shall be core drilled. Diameter of core drilled holes shall be from 3/4 inch to 1-1/2 inch bigger than the outside diameter of pipe. Pipe shall be secured within 18 inches of the penetration, both sides, from other than the fire wall or slab itself.

2.04 Open Ends:

This Contractor shall keep all ends of piping including those extending above the roof, drains, and fixture branches closed with caps or plugs so as to prevent dirt from building materials from getting into pipes and traps during construction.

2.05 Hangers, Anchors, and Guides:

A. All piping in building shall be rigidly supported from the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place and shall be so arranged as to provide for expansion and contraction.

B. Generally, pipe hangers shall be attached to 1-1/2" x 1- 1/2" x 1/4" angles supported between joists or supported from clamps attached to bar joists. Use trapeze hangers, 1-1/2" x 1-1/2" x 1/4" angles, where possible and lines can be grouped. Trapeze hanger to be supported from joists by beam clamps.

C. Spacing of hangers shall not be greater than the following:

Horizontal soil pipe, 5'-0" on centers.

Copper tubing, 2" size, 10'-0" on centers,

1-1/2" and smaller 6'-0" on centers.

In addition, provide two (2) hangers at each turn in horizontal line approximately two (2) feet from fitting.

D. Hangers shall be adjustable steel clevis, MSS Type 1. Select size of hangers to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle of shield for insulated piping. Provide copper plated hangers and supports for copper piping that do not receive insulation.

E. Hanger rods shall not be less than the following sizes and machine threads:

2" and smaller	3/8" diameter
2-1/2" and 3"	1/2" diameter
3-1/2", 4" and 5"	5/8" diameter

- F. Provide fastening devices, turnbuckles or other leveling devices, locknuts, rods and inserts as required to properly support the piping systems.

2.06 Pipe Insulation:

- A. All hot and cold water piping in building shall be insulated.
- B. Piping shall be insulated with premoulded glass fiber. Jacket shall be factory applied white kraft bonded to aluminum foil, reinforced with fiberglass yarn. Insulation shall be Johns-Manville Flame-Safe with VB jacket or equal by Owens Corning or Certainteed - 1" thick for all piping and all pipe sizes.
- C. Provide 4" sealing strips of jacket for butt joints. Securely fasten jacket at longitudinal laps and sealing strips with adhesive and flare-door type staples 3 to 4 inches on centers. Each staple shall be sealed after installation with adhesive. Adhesive shall be Foster Spark-FAS 85-20. Apply according to manufacturer's recommendations.
- D. At hanger locations, the Contractor shall furnish and install insulation protection saddle between insulation and hanger. Insulation shall pass through hanger unbroken.
- E. All fittings, valve bodies, etc., to be insulated with machined fiberglass fitting covers and PVC ZIP jackets as manufactured by Speed Line Manufacturing Company. Install according to manufacturer's recommendations.
- F. Insulation shall pass through all sleeves and walls unbroken.
- G. All insulation material shall have 25/50 smoke and flame rating.

2.07 Plumbing Fixtures:

- A. The best quality of plumbing fixtures and trimmings shall be provided, fabricated by a manufacturer of established reputation, and all plumbing fixtures shall be of same manufacturer through entire job.
- B. All fixtures shall have the manufacturer's guarantee label or trademark indicating first quality. All enameled ware shall bear the manufacturer's symbol signifying acid resisting enamel.
- C. Quantities: The Contractor is referred to the Architectural and Plumbing drawings for the quantities of fixtures to be furnished under this division of the specifications which shall be deemed to include all plumbing fixtures shown of the type described hereinafter, complete with all necessary trimmings.
- D. All supply fittings to lavatories, urinals, and water closets through wall to valve and to fixture shall be chrome plated brass, complete with chrome plated escutcheon.
- E. The fixtures herein, specifying catalog numbers, show the type and quality of plumbing fixture desired in each instance. Owner approved equal fixtures of the following manufacturers will be acceptable.

Fixtures American-Standard, Kohler, Eljer, Elkay, Just

Trim As for fixtures plus Chicago
Faucet, Sloan, Delta, Symmons, McGuire

Seats	Church, Beneke, Olsonite
Carriers	Josam, Wade, Zurn
Floor Drains	Josam, Wade, Zurn
Cleanouts	As for floor drains
Water Cooler	Halsey Taylor, Elkay, Sunroc
Water Heater	Rudd, State, A.O. Smith

- F. All fixtures shall be white.
- G. Refer to drawings for fixture schedule.

3.0 EXECUTION

3.01 Electrical Connections of Equipment:

- A. Wiring from disconnect switches, junction boxes, panel board circuit breakers, etc. up to mechanical equipment shall be by the electrical contractor. Final electrical connections to plumbing equipment shall be by this contractor.
- B. Control wiring and control connections for plumbing systems is by this Contractor.

3.02 Protection During Construction:

- A. Plumbing fixtures and trim shall be protected against damage or injury due to building materials, acid, tools, equipment, or any causes incidental to construction.
- B. The finished surface of each fixture shall be covered with building paper or similar protection. All fixtures damaged by any cause, and any trim with marred or scratched finish shall be replaced at nocost to the Owner. The fixture and fixture trim protection shall be removed at the completion of construction.

3.03 Tests:

- A. Concealed work shall remain uncovered until required tests have been completed, but if necessary, tests on portions of the work may be made and those portions of the work may be concealed after being proved satisfactory. Repairs of defects that are discovered as a result of inspections or tests shall be made with new materials. Caulking of screwed joints, cracks, or holes will not be accepted. Test shall be repeated after defects have been eliminated.

- B. Drainage System Tests:

A water test shall be applied to all parts of the drainage systems before the pipes are concealed or fixtures set in place. The test may be applied in sections. All openings of each system to be tested shall be tightly closed except the highest opening above roof, and the entire system shall be filled with water up to the overflow point of this highest opening.

All parts of the system shall be subject to not less than ten (10) feet of hydrostatic head except the uppermost ten (10) feet of the piping directly below the opening. The water shall remain in the system for

not less than fifteen (15) minutes after which time no leaks at any joint or lowering of the water level at the overflow shall be visible.

C. Water Supply System:

A water pressure test shall be applied to all parts of the water supply system before the piping is concealed or before the fixtures are connected. A hydrostatic pressure of not less than one hundred twenty-five (125) pounds per square inch shall be applied to the system, and there shall be no leaks at any point in the system at this pressure. An air or gas test is not acceptable.

3.04 Sterilization:

- A. All the new water piping and affected existing water piping, including all valves, fixtures, fittings, and other devices connected hereto, shall be sterilized with a solution containing not less than fifty (50) parts per million of available chlorine. The chlorinating material shall be liquid chlorine gas-water mixture, calcium hypochlorite, sodium hypochlorite, or chlorinated lime and water mixture conforming to the standards of the American Water Works Association and shall be introduced into the system in an approved manner.
- B. The sterilization solution shall be allowed to remain in the system for a minimum period of twenty-four (24) hours, but until pronounced safe and fit for human consumption by the Owner based on samples drawn from the system and tested. During the sterilizing period all valves and outlets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until residual chlorine content is not greater than 0.2 parts per million unless otherwise directed. After the system has been flushed, additional samples will be taken and tests made; if the water is found unsafe for human consumption, the sterilization procedure specified herein before shall be repeated.

3.05 Cleaning and Adjusting:

- A. Upon completion of work, all surplus material and rubbish shall be removed from premises. Fixtures shall be cleaned; all valves adjusted; all escutcheons and plates installed; all floor drains cleaned, and all mortar and foreign matter removed from all exposed plumbing work.
- B. Any stoppage or discoloration or other damage to parts of the building, its finish, or furnishing, due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor without cost to the Owner.

3.06 Emergency Repairs:

The Owner reserves the right to make, or have made, repairs to the plumbing system within the guarantee period as required to keep the equipment in operation when the Plumbing Contractor is not available to make the necessary repairs. These necessary repairs shall in no way void the Contractor's guarantee bond nor relieve the Contractor of his responsibilities during the bonding period.

3.07 Painting:

- A. All factory finished metal surfaces of plumbing equipment installed that are damaged during construction shall be restored to the original condition.
- B. Contractor shall paint all iron and steel, including pipe hangers, that do not have a factory finish or galvanized finish used for support of equipment. Prime with one coat of oil base primer followed by one coat of oil base finish coat.

3.08 Maintenance and Operating Manuals:

At the completion of this project the contractor shall furnish the Owner three (3) operating and maintenance manual s containing a brief description of each system and its various components. Instructions must give full details of the operation of all equipment installed, and shall include manufacturer's printed operating and maintenance instructions, detailed data and bulletins covering all material furnished under the contract giving all necessary illustrations and diagrams and a composite schedule of periodic servicing and lubrication requirements and replacement parts.

3.09 As Built Drawings:

- A. Contractor shall keep and maintain in good order a record of any waste, vent, or water piping that deviates from drawings for any reason. This record shall be made available to the Owner on the date of substantial completion and shall be legible and accurate so as to be directly transferable to an as-built reproducible drawing.
- B. Contractor shall provide to the Owner actual dimensions of all waste and water lines installed on exterior of building, giving dimensions to new and/or existing buildings.

3.10 Guarantee:

The Contractor shall deliver the system to the Owner complete in first-class operating condition in every respect and shall guarantee the material and workmanship for a period of one (1) year from the date of acceptance. If, during that time, any defect should show up due to defective material, negligence, or want of proper care on the part of the Contractor, he shall furnish such new materials as are necessary to repair such defects and place same in working order at his own expense on receipt of notice of such from the Owner or Owners.

END OF SECTION 220000