SECTION 18001

GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope: The Contractor shall furnish all labor, materials, equipment and incidentals required to complete the plumbing work as shown and specified. The scope of work for the Plumbing Contract is defined in Section 01010, Summary of Work.

B. Coordination:

1. Review installation procedures under other Sections of these specifications and coordinate the installation of items that must be installed with the site work, building construction work, formwork, walls, partitions and ceilings.

2. Coordinate the plumbing work with the work by others.

3. Specific additional coordination requirements are outlined in Section 01010, Summary of Work.

C. General:

1. Dimensions shown on the Drawings that are related to equipment are based on one manufacturer's equipment. Coordinate the dimensions of the equipment furnished with the space allocated for that equipment.

2. The Drawings show the principal elements of the plumbing installation. They are not intended as detailed working drawings for the plumbing work but as a complement to the Specifications to clarify the principal features of the plumbing systems.

3. It is the intent of this Section that all piping and valves, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment so as to render the installations complete for successful operation,

regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Drawings.

4. Mounting heights of piping and valves noted in the Specifications and on the Drawings are to the center of the device.

5. Review the Contract Drawings for areas of sheeting and excavation specified under other sections of the Contract. Contractor shall schedule their work on underground piping and valves in these areas to run concurrently with that of the site work.

6. The Contractor shall be responsible for excavation, backfilling, bedding, curbing removal and replacement, concrete encasement, and surface restoration, including pavement for underground piping, valve installation and other work related to this Contract that disturbs existing conditions, equipment, improvements and facilities. Truck vehicle access (H-20 loading) shall be maintained on facility roads during construction.

D. Related Work Specified Elsewhere:

1. Division 1, Special Conditions

2. Division 5, Metals

3. Division 9, Finishes

4. Division 15, Mechanical

E. Work Included But Specified Elsewhere:

1. Anchor bolts and other fasteners shall conform to requirements of Division 5, Metals.

2. Shop painting and surface preparation shall conform to requirements of Division 9, Finishes.

F. Temporary Power: Temporary light and power for construction purposes shall be provided in accordance with Division 1, Special Conditions.

1.2 QUALITY ASSURANCE

A. Reference Standards: Plumbing material and equipment shall conform in all respects to the latest approved standards of the following:

1. American Society for Testing and Materials (ASTM).

2. The American National Standards Institute (ANSI).

3. American Water Works Association (AWWA).

4. Occupational Safety and Health Administration (OSHA).

5. Orange County Department of Health.

1.3 SUBMITTALS

A. General: Conform to requirements of the General Specifications and Special Conditions.

B. Shop drawings shall include the following information to the extent applicable to the particular item:

1. Manufacturer's name and product designation or catalog number.

2. Pressure ratings.

3. Conformance to applicable standards or specifications of ANSI, ASTM, AWWA, NFPA, OSHA, UL, or other organizations.

4. Dimensioned plan, section, and elevations showing means for mounting, piping connection and valves.

5. Materials and finish specification, including paints.

6. List of components including manufacturer's names and catalog numbers.

7. Manufacturer's instructions and recommendations for installation, operation, and maintenance.

8. Manufacturer's recommended list of spare parts.

1.4 PROJECT CLOSE-OUT

A. Operation and Maintenance Data: Conform to requirements of Division 1 and the General and Special Conditions.

1.5 PRODUCT DELIVERY

A. Delivery of Materials: Contractor shall instruct the manufacturers and vendors as to the maximum shipping sizes of equipment that can be accommodated at the site.

B. Storage: Plumbing equipment and material shall be stored and protected in accordance with Division 1 and General and Special Conditions.

1.7 PROCEDURES FOR INSTALLATION

A. The Contractor is cautioned to perform their work with due regard to safety and in a manner that will not interfere with the existing equipment or in any way cause interruption of any of the functions of the facility.

B. No existing equipment or piping shall be removed without the specific direction and approval of the Owner, and without clearance by appropriate representatives of the Owner. Whenever such work is contemplated, the Contractor shall submit to the Owner a written request for scheduling such work. Written request must be received 5 working days prior to the date on which the proposed work is to be performed.

+ + END OF SECTION + +

SECTION 18051

BURIED PIPING INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish, install and test all buried piping, fittings, specials and appurtenances. The Work includes, but is not limited to, the following:

   a. All types and sizes of buried piping, except as specified under other Sections. These include, but are not limited to: ductile iron, carbon steel, copper, and thermoplastic.

   b. Supports, restraints, and thrust blocks.

   c. Testing.

   d. Cleaning and disinfecting.

   e. Also included are installation of all jointing and gasketing materials, specials, couplings, flexible couplings, sleeves, tie rods, corrosion protection, and all other Work required to complete buried piping installation.

   f. All valves, specials, sleeves and wall pipes shown or specified shall be incorporated into the piping system as required and as specified in the appropriate section of Division 18.

   g. Unless otherwise shown or specified, buried piping installation includes all buried piping Work required, beginning at the outside face of structure or building foundation.

2. Piping less than 4-inch in diameter is specified in Section 18068, but shall conform to applicable requirements of Section 18051.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work that is related to this Section, including concrete, valves, ventilation and electrical.

2. Section 18051 specifies the installation of all buried piping materials specified in Division 18. Coordinate with these Sections.

C. Related Work Specified Elsewhere:

1. Section 02200 Earthwork.

2. Section 03300, Cast-In-Place Concrete.

3. Section 09900, Painting. (Surface preparation and shop priming are under specific piping sections.)

4. Division 18, Sections on Piping, Valves and Appurtenances.

5. All piping specifically included with equipment.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Comply with applicable requirements of UL and other authorities having jurisdiction.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping.

2. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

3. AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances.

4. AWWA C651, Disinfecting Water Mains.

5. AWWA M23, PVC Pipe - Design and Installation.

6. NFPA 54, National Fuel Gas Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Laying schedules and detailed drawings in plan and profile for all piping.

2. Full details of piping, valves, specials, joints, harnessing and connections to pipes and structures.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test results.

C. Certificate: Submit certificate of compliance with referenced standards.

D. Record Drawings: Submit in accordance with the requirements of Section 01720, Project Record Documents.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off delivery vehicle. Do not otherwise drop, roll or skid pipe. Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved.

B. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.

C. Pipe, fittings and specials shall be unloaded and stored in areas designated on the drawings. Interiors shall be kept completely free from dirt and foreign matter.

D. No material furnished under this specification shall be shipped to the job site until all submittals have been approved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe bedding and backfill in accordance with Section 02200 Earthwork.

B. Pipe materials required are listed in the Piping Schedules at the end of this section. The applicable Sections of Division 18 for detailed materials Specifications apply.

C. Pipe Marking:

1. Each piece of pipe and fitting shall be clearly marked with a designation which shall conform with designations shown on the Shop Drawings.

2. Class designation shall be cast or painted on each piece of pipe or fitting 4 inches in diameter and larger.

3. Piping smaller than 4 inches in diameter shall be clearly marked by manufacturer as to material, type and rating.

2.2 BURIED PIPING SCHEDULE

A. Attached at the end of this Division is the "Buried Piping Schedule." Conform to requirements of the schedule, unless otherwise specified or approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. All piping shall be sloped to avoid high spots and low spots and to facilitate drainage.

2. Proper and suitable tools and appliances for the safe, convenient handling and laying of pipe shall be used.

3. Install piping as shown on the Contract Drawings, specified and as recommended by the manufacturer.

4. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Contract Drawings or Specifications.

5. Pipe, fittings and accessories that are cracked, damaged or in poor condition or with damaged linings will be rejected. At the time of laying, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being laid, it shall be removed and replaced with sound pipe by the contractor at their expense.

6. Minimum cover over buried piping shall be 4 feet unless otherwise shown or approved by Engineer.

7. Earthwork required is specified in Section 02200.

B. Bedding Pipe:

1. Bed pipe with materials as specified below and as shown on the Contract Drawings.

   a. Trenches shall not be excavated below the pipe bottom. All loose and unsuitable material shall be removed from the trench bottom and backfilled with compacted select fill.

   b. Pipe embedment material shall be Select Fill or as defined on the Contract Drawings and placed in accordance with the requirements of Section 02200, Earthwork.

   c. Pipe embedment shall be placed in maximum 6-inch layers and compacted for the full width of the trench. Recesses in the embedment shall be provided around each joint to allow space for making joints and inspection.

2. Carefully and thoroughly compact all pipe bedding and fill.

3. No piping shall be laid until Engineer approves the bedding condition.

4. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.

C. Laying Pipe:

1. Conform to manufacturer's instructions and to AWWA C600, and AWWA M23 where applicable.

2. Install in accordance with the approved drawings unless otherwise approved by Engineer. Remove all pipe accurately to line and grade shown and relay pipes that are not laid correctly.

3. Slope piping uniformly between elevations given.

4. Ensure that water level in trench is at least 6 inches below bottom of pipe. Do not lay pipe in water. Maintain dry trench until jointing and backfilling are complete.

5. Start laying pipe at lowest point and proceed towards the higher elevations, unless otherwise approved by Engineer.

6. Place bell and spigot pipe so that bells face upstream unless otherwise approved by Engineer.

7. Excavate around joints in bedding and lay pipe so that only the barrel receives bearing pressure from the trench bottom.

8. Permissible deflections at joints shall not exceed 75 percent of the amount allowed by manufacturer and in no case exceed AWWA standards.

9. Prior to laying pipe, every precaution shall be taken to ensure that no foreign material enters the piping.

10. All pipe and fittings shall be carefully examined for cracks, damage or other defects while suspended above the trench, before installation. Defective materials shall be immediately removed from site.

11. Interior of all pipe and fittings shall be inspected and all dirt, gravel, sand, debris or other foreign material shall be completely removed from pipe interior before it is moved into the trench. Bell

and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is laid.

12. Every time that pipe laying is not actively in progress the open ends of pipe shall be closed by a watertight plug.

13. Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.

14. Blocking under piping shall not be permitted unless specifically excepted by Engineer for special conditions. If permitted, conform to requirements of AWWA C600.

15. Repair protective coatings and linings in a satisfactory manner prior to backfilling. Refer to specific pipe specifications for coating systems required.

D. Jointing Pipe:

1. Clean completely all jointing surfaces and adjacent areas immediately before making joint.

2. Lubricate and adjust gaskets and "O"-rings as recommended by manufacturer.

3. After "O"-rings are compressed and before pipe is brought fully home, each gasket shall be carefully checked for proper position around full circumference of the joint.

4. Conform to AWWA C111 and to all applicable manufacturer's recommendations pertaining to jointing pipe.

5. For mechanical joints the plain end shall be centered and pushed into the bell and the gasket shall be firmly pressed evenly into the bell. The gland shall be slid to the bell for bolting. All bolts with oiled threads shall be alternately torque tightened 180

degrees opposite to each other to seat the gasket evenly. The maximum torque shall be as follows:

Bolt Size (inches)	Applied Torque (ft-lbs)
5/8	50
3/4	80
1	90
1 1/4	150

All bolts and nuts shall be heavily coated with an approved bituminous or epoxy coating.

6. Solder Joints:

   a. No soldering of water main joints will be allowed on this project.

   b. Replace any existing soldered joints that are required to be connected to with a duo sleeve and retainer glands.

7. Use hexagon head nuts and bolts on all flanged joints. Bolts shall neither project more than 1/4-inch from, nor fall short of the end of the nut.

8. Use ring gaskets unless otherwise specified or approved by Engineer. Maximum gasket thickness shall not exceed 1/8 inch. Gaskets shall be suitable for service intended in accordance with manufacturers ratings and instructions.

9. Clean and lubricate bolt threads and gasket faces for flanged joints.

E. Concrete Trust Blocks:

1. Provide concrete trust blocks as shown, required, or otherwise approved by Engineer.

F. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

G. Closures:

1. Provide all closure pieces shown or required to complete the Work.

2. Locate closures in straight runs of pipe.

H. Backfilling:

1. Conform to applicable requirements of Section 02200 - Earthwork.

2. Backfill by hand until pipe is covered by at least 1 foot of fill.

3.2 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown shall be considered approximate.

2. Contractor is responsible for determining exact location of existing piping to which they must make connections, or which they may disturb during earth moving operations, or which may be affected by their work in any way.

B. Work on Existing Pipelines:

1. Do not take pipelines out of service except where specified or approved by Engineer.

2. Cut or tap pipes as shown or required with machines specifically designed for this work.

3. Install temporary plugs to keep out all mud, dirt, water and debris.

4. Provide all necessary adapters, fittings, pipe and appurtenances required.

5. Refer to Section 02200, Earthwork for additional requirements.

6. The Contractor shall provide a temporary thrust restraint system for existing pipes wherever the installation of new pipes disturbs the existing

pipe's thrust restraint. Upon completion of new pipe installation, the Contractor shall restore the existing pipe thrust restraint system to its condition at the onset of the job.

3.3 TESTING OF PIPING

A. General:

1. Test all piping as specified below except as otherwise authorized by Engineer.

2. Notify Engineer 48 hours in advance of testing

3. Provide all testing apparatus, including pumps, hoses, gauges, and fittings.

4. Unless otherwise noted, pipelines shall hold the specified test pressure for a period of 2 hours.

5. Pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate shall be replaced and retested.

6. Test pressures required are at the lowest elevation of the pipeline section being tested unless otherwise specified.

7. All gas piping shall be tested in accordance with NFPA 54.

8. Unless otherwise approved, conduct all tests in the presence of the Engineer.

9. All pipe shall be tested between valves.

B. Schedule of Pipeline Tests:

1. For pressure test values see "Buried Piping Schedule."

2. Piping not on the schedule shall be tested at 1.5 times the maximum working pressure or 150 psi, whichever is greater.

C. Pressure Test Procedure (Except for Fuel Oil Piping and Gravity Sewer Pipe):

1. Backfill and compaction shall be completed at least to the pipe centerline before testing, unless otherwise required or approved by Engineer. Backfill and compact around all blocking before testing and as required to assure restraint by harnessed joints.

2. Allow concrete for blocking to reach design strength before testing.

3. Fill section to be tested slowly with water and expel all air. Install corporation cocks, if necessary, to remove all air.

4. Test only one section of pipe at a time.

5. Maintain the test pressure for at least 2 hours.

6. Allowable Leakage Rates (in gallons per hour per 1,000 feet per inch diameter) except as otherwise noted:

   a. Buried Ductile iron and PVC - as specified in Table 4A AWWA C600, latest edition.

   b. Exposed Ductile iron and PVC and pipe in tunnels: No leakage.

   c. Copper, steel and Thermoplastic: No leakage.

   d. Sodium hypochlorite and caustic Solution: No leakage.

7. All visible leaks shall be made tight regardless of the amount of leakage or results of the leakage tests. If the pipes tested do not meet the leakage requirements of the leakage tests, they shall be replaced and retested as necessary until the leakage requirement is met.

8. All Work found defective shall be replaced at the expense of the Contractor.

D. Test Procedure for Gravity Sewer Piping:

1. Backfill and compaction shall be completed at least to the pipe centerline before testing, unless otherwise required or approved by the Engineer.

2. After pipe trenches have been satisfactorily backfilled to the required depth, piping shall be checked by the Engineer to determine if any displacement of pipe has occurred. A bright light shall be flashed between manholes. If the illuminated interior of the pipe shows displaced pipe, improper alignment or any other defects, the defect shall be corrected as determined by the Engineer. Upon satisfactory completion of the displacement test, the pipe shall be tested for leakage.

3. The Contractor shall test each section of gravity sewer pipe between manholes for watertightness individually. No continuous sections shall be tested simultaneously.

4. The Contractor shall plug the downstream end of the pipeline under test and all outlets discharging into the upstream manhole.

5. The upstream manhole and the section of pipeline under test shall be filled by the Contractor with water. The elevations to which the manholes shall be filled is a minimum of 2 feet above the crown of the pipe, or at least 2 feet above existing groundwater, whichever is higher.

6. The pipe shall remain filled for an initial 1 hour period to allow for stabilization. Following the stabilization period, water shall be added to the required elevation.

7. Leakage loss shall be measured over a period of 4 hours. After the stabilization period, the Engineer will take 3 readings of the water level in the manhole, and 4 hours later, take 3 more readings. An average of the readings will be used by the Engineer to calculate leakage.

8. If the measured rate of leakage is less than or equal to the allowable leakage rate, the section of pipeline tested is acceptable. If the test fails, the section of pipe must be replaced at the expense of the Contractor, and retested by the same procedures. Regardless of the results of the leakage test, all visible leaks shall be repaired.

9. The maximum allowable leakage rate for any section of pipeline under testing shall not exceed 200 gallons per inch of internal diameter per mile of pipe per day.

10. At the conclusion of the test, clean all pipelines by flushing with water or other means, and remove any debris which may have entered the pipeline during construction.

3.4 CLEANING AND DISINFECTION

A. Pipe cleaning and disinfection shall be in accordance with the requirements of Section 18175.

+ + END OF SECTION + +

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SECTION 18052

EXPOSED PIPING INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish and install and test all exposed piping, fittings, specials, and appurtenances. The Work includes, but is not limited to the following:

   a. All types and sizes of exposed piping, except as specified under other Sections. These include, but are not limited to ductile iron, carbon steel, stainless steel, thermoplastic and copper.

   b. Piping embedded in concrete within a structure or foundation will be considered as exposed and included herein.

   c. Supports, restraints, and thrust blocks.

   d. Testing.

   e. Cleaning and disinfecting.

   f. Installation of all joints, specials, couplings, flexible couplings, flanged adapters, expansion joints, sleeves, tie rods, jointing and gasketing materials and all other Work required to complete installation of exposed piping.

   g. All valves, specials, sleeves, wall pipes and floor pipes shown or specified shall be incorporated into the piping system as required and as specified in the appropriate sections of Division 18.

2. Piping less than 4-inches in diameter is specified in Section 18068, but shall conform to applicable requirements of Section 18052.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work which is related to this Section, including concrete, valves, electric, and ventilation.

2. Section 18052 specifies the installation of all exposed piping materials specified in Division 18. Coordinate with these Sections.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.

2. Section 09900, Painting. (Surface preparation and priming are under specific piping sections.)

3. Division 18, Sections on Piping, Valves and Appurtenances.

4. All piping specifically included with equipment.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Comply with applicable requirements of UL and other authorities having jurisdiction.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASME B16.3, Malleable Iron Threaded Fittings.

2. ASMR B16.4, Gray Iron Threaded Fittings.

3. ASME B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through 24.

4. ASME B16.9, Factory-Made Wrought Buttwelding Fittings.

5. ASME B16.11, Forged Fittings, Socket-Welding and Threaded.

6. ASME B31.1, Power Piping.

7. ASME B31.8, Gas Transmission and Distribution Piping Systems.

8. AWS D1.1, Structural Welding Code.

9. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

10. AWWA C206, Field Welding of Steel Water Pipe.

11. AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances.

12. AWWA C651, Disinfecting Water Mains.

13. AWWA M23, PVC Pipe - Design and Installation.

14. NFPA 54, National Fuel Gas Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Catalog Data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various piping components and accessories. The illustrations shall be of sufficient detail to serve as a guide for assembly and disassembly.

2. Complete layout and installation drawings with clearly marked dimensions. Piece numbers which are coordinated with the tabulated pipe layout schedule shall be clearly marked. Piping layout drawings shall indicate the following information on pipe supports: location, support type, hanger rod size, insert type and the load in pounds.

3. Weight of all component parts.

4. Design calculations where specified.

5. Tabulated pipe layout schedule shall include the following information for all pipe and fittings: service, pipe size, working pressure, wall thickness, piece number and laying length.

6. Interfacing of piping system to equipment and appurtenances.

7. Full details of piping, fittings, specials and connections to equipment in plan and section.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.

C. Certificates: Submit certificates of compliance with referenced standards.

D. Record Drawings: Submit in accordance with the requirements of Section 01720, Project Record Documents.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks. Do not otherwise drop, roll or skid pipe. Materials that are cracked, chipped, gouged, dented or otherwise damaged will not be approved.

B. Store pipe and fittings on heavy wood blocking or platforms so they are not in contact with the ground.

C. Pipe, fittings and specials shall be unloaded as close to the place where they are to be laid as is practical, at a location which has been approved by the Engineer. Interiors shall be kept completely free from dirt and foreign matter.

D. No material furnished under this specification shall be shipped to the job site until all submittals have been approved.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe materials required are listed in the Piping Schedules at the end of this section. The applicable Sections of Division 18 for detailed material Specifications apply.

B. Pipe Marking:

1. Class designation shall be cast or factory painted on each piece of pipe and fitting 3 inches in size and larger.

2. Each piece of pipe and fitting shall be clearly marked with a designation which shall conform with designations shown on the Shop Drawings.

C. Pipe Identification Markers and Arrows: Refer to Section 09900, Painting.

2.2 EXPOSED PIPING SCHEDULE

A. Attached to the end of this Division is the "Exposed Piping Schedule." Conform to the requirements of the schedule, unless otherwise specified or approved by Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install piping as shown on the Contract Drawings, specified and as recommended by the manufacturer.

2. All pipes shall be sloped to avoid high spots and low spots and to facilitate drainage.

3. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Contract Drawings or Specifications.

4. Pipe, fittings and accessories that are cracked, damaged or in poor condition or with damaged linings will be rejected.

5. For specially fabricated piping Contractor shall provide the services of a competent manufacturer's installation specialist when pipe installation begins, unless otherwise approved by Engineer.

6. Conflicts between piping systems and equipment or structures shall be presented to Engineer for determination of corrective measures before proceeding.

7. Install a flange or union at all equipment connections and valves.

B. Piping:

1. Install straight runs true to line and elevation.

2. Install vertical pipe truly plumb in all directions.

3. Install piping parallel or perpendicular to building walls. Piping at angles and 45 degree runs across corners will not be accepted unless specifically shown or approved.

4. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, etc.

5. Install piping so as to leave all corridors, walkways, work areas, and like spaces unobstructed. Unless otherwise approved provide a minimum headroom clearance under all piping of 6 feet 6 inches.

6. Provide temporary caps or plugs over all pipe openings at the end of each days work and when otherwise required or directed by Engineer.

7. Cutting: Cut pipe from measurements taken at site, not from Drawings.

8. Provide flanges for connection to pumps, valves and other flanged equipment.

C. Joints:

1. General:

a. Make joints in accordance with Piping Schedule and the pipe manufacturer's recommendations and the requirements below.

b. Cut piping accurately and squarely and install without forcing or springing.

c. Ream out all pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.

d. Remove all cuttings and foreign matter from the inside of pipes and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before pipe is installed.

2. Threaded Joints: Use standard, right-hand tapered full depth threads on steel piping and apply an approved joint compound to the male threads only, before installation. Leave not more than three pipe threads exposed at each connection.

3. Solder Joints:

a. No soldering of water main joints will be allowed on this project.

b. Replace any existing soldered joints that are required to be connected to with a duo sleeve and retainer glands.

4. Flanged Joints: Assemble flanged joints with approved full-face gaskets and gasket compounds and draw up flange bolts evenly.

5. Plastic Pipe Joints: Make joints in plastic piping in accordance with the manufacturer's recommendations.

6. Use hexagon head nuts and bolts on all flanged joints. Use 1/8 inch thick full face gaskets unless otherwise approved by Engineer. Gaskets shall be suitable for service intended in accordance with manufacturer's ratings and instructions.

D. Unions:

1. Install dielectric unions wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.

2. Provide a union downstream of each valve with screwed connections.

3. Provide screwed, flanged unions or flanged adapters at each piece of equipment, where shown, and where necessary to install or dismantle piping.

E. Eccentric Reducers: Use eccentric reducers where shown and where air or water pockets would otherwise occur in mains because of a reduction in pipe size.

F. Valves and Accessories:

1. Provide supports for large valves, and other heavy items.

2. Position valve operators as shown. When the position is not shown, install the valve so that it can be conveniently operated and as approved by Engineer. Avoid placing operators at angles to the floors or walls.

G. Wall Sleeves:

1. Provide sleeves wherever pipes pass through walls, partitions, floors and roofs unless otherwise shown. Sleeves through wall shall be flush with wall face. Sleeves shall be as specified in Section 18096.

2. Anchor sleeves to concrete walls and structural steel as shown or otherwise approved.

3. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.

4. Do not install sleeves and pipes through structural members unless specifically shown and approved by Engineer.

H. Transitions from One Type of Pipe to Another: Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

I. Additional Requirements for Copper Tubing:

1. Joints shall be made with clean bright ends, properly fluxed, using 95 percent tin, 5 percent antimony solder. Solder containing lead will not be allowed.

2. Runs shall contain unions at connections to equipment and at reasonable distances along the lengths of runs to permit convenient disassembly of piping and removal of equipment.

3. All horizontal lines shall be pitched to facilitate draining. Unless otherwise shown and/or specified, all pipe runs shall be tapped at low points and fitted with minimum 1/2" NPT plugs. Drain lines shall not have a pitch less than 1/8-inch per foot.

J. Additional Requirements for Thermoplastic Piping:

1. All valves shall be supported independently of the piping system.

2. Wide band supports as recommended by manufacturer and approved by Engineer shall be used to minimize localized stresses. Inert plastic shields shall be placed where plastic piping makes contact with steel and/or concrete.

3. Piping passing through walls shall be provided with a sleeve of wearing material to prevent abrasion damage to piping.

4. When anchors are required at locations other than equipment they shall be placed at elbows, valve locations and at bends in pipe line.

5. Spacing of supports shall be in accordance with the manufacturers published values at the maximum design

operating temperature of the pipe, but in no case shall exceed 6 feet on center.

6. Use "U" clamps with wide band inert plastic circumferential contact. Avoid all pressure contact with piping.

7. On long runs of piping use guides to maintain alignment and reduce chance of elastic failure of pipe. Space guides as recommended by manufacturer.

8. Use expansion joints to take up pipe expansion. Provide anchors to restrain the expansion joint. Use of the expansion joints shall be kept to a minimum. Flexible connectors may be used to absorb thermal movement when approved by Engineer.

9. Do not install pipe when temperature is less than 60°F except as otherwise recommended by manufacturer and approved by Engineer.

K. Restraints, Supports and Thrust Blocks:

1. Install restrained joints as specified.

2. Provide concrete thrust blocks as shown or otherwise approved by Engineer.

3.2 TESTING OF PRESSURE PIPING

A. General:

1. Test all piping as specified below unless otherwise authorized by Engineer.

2. Notify Engineer 48 hours in advance of testing.

3. Provide all testing apparatus including pumps, hoses, gauges, and fittings.

4. Pipelines shall hold the specified test pressure for a period of two hours.

5. Pipelines which fail to hold specified test pressures or which exceed the allowable leakage rate shall be repaired and retested.

6. Test pressures required are at the lowest elevation of the pipeline section being tested, unless otherwise specified.

7. Unless otherwise approved, conduct all tests in the presence of the Engineer.

B. Schedule of Pipeline Tests:

1. For pressure test values see "Exposed Piping Schedule" at the end of this Division.

2. Piping not in Schedule shall be tested at 1.5 times the maximum working pressure or 30 psi, whichever is greater.

C. Hydrostatic Pressure and Leakage Test Procedure:

1. Ensure that all supports and restraint protection are securely in place.

2. Fill section to be tested slowly with water and expel all air. Install cocks, if necessary, to ensure removal of air.

3. Test only one section of pipe at a time.

4. Apply test pressure required for two hours and observe pressure gauge. Check carefully for leaks while test pressure is being maintained.

5. Thermoplastic piping shall be tested with water and after the test, the water shall be removed.

6. Allowable Leakage Rates. No leakage permitted on any exposed pipe and no leakage permitted on any sodium hypochlorite piping (buried or exposed).

3.3 CLEANING AND DISINFECTION

A. Pipe cleaning and disinfection shall be in accordance with the requirements of Section 18175.

3.4 SURFACE PREPARATION AND PAINTING

A. Refer to specific pipe specifications for painting systems required.

B. Piping that is field prepared and painted shall conform to the requirements of Section 09900, Painting.

+ + END OF SECTION + +

SECTION 18064

THERMOPLASTIC PIPE, FITTINGS, VALVES AND SPECIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope:

1. The Plumbing Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to furnish and install and place in satisfactory service polyvinyl chloride (PVC) conveyance pipe, chlorinated polyvinyl chloride (PVC) conveyance pipe, fittings, valves, and specials necessary to complete the Work.

2. The extent of piping is shown on the Contract Drawings and in the schedules following Division 18.

B. Coordination:

1. Review installation procedures under other Sections and Contracts and coordinate with the Work that is related to this Section.

C. Related Work Specified Elsewhere:

1. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Obtain each type of pipe and fittings from one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM D 1598, Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.

2. ASTM D 1599, Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.

3. ASTM D 1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

4. ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

5. ASTM D 2122, Determining Dimensions of Thermoplastic Pipe and Fittings.

6. ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

7. ASTM D 2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

8. ASTM D 2564, Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

9. ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping.

10. ASTM D 2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

11. ASTM D 3139, Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

12. ASTM F 438, Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

13. ASTM F 441, Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

14. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

15. ASTM F 493, Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

16. ASTM F 1970, Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems.

17. AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

18. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm).

19. NSF/ANSI 14, Plastics Piping System Components and Related Materials.

20. American National Standards Institute (ANSI).

C. Shop Tests: Piping manufacturer shall maintain a continuous quality control program. All PVC materials used to manufacture pipe and fittings under this Section shall be tested for conformance to the requirements of ASTM D 1784. Contractor shall furnish the Engineer with certified test results.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Detailed procedures to be used in jointing and installing piping system, including manufacturer's recommendations.

2. Bill of materials indicating material composition of pipe, pressure rating, nominal size and its location on the piping installation drawings.

3. Submit this data with shop drawings required under Section 18051 and 18052.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.

C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Refer to Sections 18051 and 18052.

B. Storage: All Pipe materials shall be stored off the ground in an area approved by the engineer. Do not store pipe in sunlight.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. All pipeline materials shall be permanently marked with the following:

1. Name of manufacturer.

2. Date of manufacture.

3. Operating design pressure at operating design temperature.

4. Mark number to match Shop Drawings.

5. Type of pipe and nominal size.

6. Manufacturer's part number.

2.2 PVC/CPVC PRESSURE AND CONTAINMENT PIPE

A. General:

1. Plastic pipe and fittings covered under this Section shall be suitable for a maximum pressure of 150 psi at a temperature of 120 deg. F and should be provided in straight unthreaded lengths of not greater than 20 feet with ends cut square.

2. All wetted parts of PVC/CPVC piping and accessories shall be compatible with treatment chemicals.

3. Unless otherwise shown or ordered by the Engineer, PVC/CPVC pipe used outside should be solvent welded. Likewise, pipe used inside shall utilized flanged connections.

4. Solvent welded joints for chemical piping shall be made using solvent cement that meets or exceeds ASTM F 493, compatible with PVC/CPVC pipe and fittings. Solvent cement shall be low VOC, heavy duty gray industrial solvent cement by Oatey, Model EP42 or approved equal.

B. PVC Pipe:

1. Unless otherwise shown or specified all pipe shall be PVC, Type 1, Grade 1, Schedule 80, conforming to ASTM D 1785. Rerun or reclaimed materials will not be acceptable.

2. Fittings: Solvent welded fittings shall conform to ASTM D 2467 for socket type.

C. CPVC Pipe:

1. Unless otherwise shown or specified all pipe shall be CPVC, Schedule 80, conforming to ASTM F 441. Rerun or reclaimed materials will not be acceptable.

2. Fittings: Solvent welded fittings shall conform to ASTM F 438 for socket type.

D. Provide suitable sleeve-type expansion joints in exposed piping to permit 1-inch minimum expansion per 50 feet of continuous pipe length.

E. Workmanship: The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other defects. The pipe shall be uniform in color, opacity, density, and other physical properties.

F. Dimensions and Tolerances: Dimensions and tolerances shall be measured in accordance with ASTM D 2122. The eccentricity of the inside and outside circumferences of the pipe walls shall not exceed 12 percent. Where required, internal diameter of flange adapters shall be chamfered to provide adequate clearance for operation of adjacent butterfly valves.

G. Sustained Pressure: The pipe shall not fail, balloon, burst, or weep as defined in ASTM D 1598.

H. Burst Pressure: The minimum burst pressure shall be as given, when determined in accordance with ASTM D 1599.

I. Piping and fittings shall have ultraviolet inhibitor pigment to resist ultraviolet deterioration.

1. All valves shall be supported independently of the piping system.

2. Wide band supports as recommended by manufacturer and approved by Engineer shall be used to minimize localized stresses.

3. Use "U" clamps with wide band inert plastic circumferential contact. Avoid all pressure contact with piping.

4. Spacing of supports shall be in accordance with the manufacturers published values at the maximum design operating temperature of the pipe unless otherwise specified, shown or approved by Engineer.

5. On long runs of piping use guides to maintain alignment and reduce chance of elastic failure of pipe. Space guides as recommended by manufacturer.

6. Piping passing through walls shall be provided with a sleeve of wearing material to prevent abrasion damage to piping.

7. When anchors are required at locations other than equipment they shall be placed at elbows, valve locations and at bends in pipeline.

8. Use expansion joints to take up pipe expansion. Provide anchors to restrain the expansion joint. Use of expansion joints shall be kept to a minimum. Flexible connectors may be used to absorb thermal movement when approved by Engineer.

9. Do not install pipe when temperature is less than 60°F except as otherwise recommended by manufacturer and approved by Engineer.

2.3 PVC AWWA C900 PIPE

A. Products delivered under this specification shall meet the requirements of AWWA C900 for nominal pipe diameters 4 inches through 12 inches and with AWWA C905 for nominal pipe diameters 14 inches through 36 inches.

Pipe shall be made from unplasticized PVC compounds having a minimum cell classification of 12454 as defined in ASTM D 1784. The compound shall qualify for Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D 2837.

Nominal outside diameters and wall thicknesses of PVC pipe shall conform to the requirements of AWWA C900. Integral bell joint pipe shall be furnished in 4", 6", 8", 10" and 12" sizes, in Class 200(DR14). Pipe shall be furnished in standard lengths of 20 feet.

Pipe shall incorporate a formed bell complete with a single rubber gasket conforming to ASTM F477. Joints shall be designed to meet the zero leakage test requirements of ASTM D 3139.

Pipe shall be homogeneous throughout and free from voids, cracks, inclusions and other defects, and shall be as uniform as commercially practicable in color, density and other physical characteristics.

Every pipe shall pass the AWWA C900 hydrostatic proof test requirements of 4 times the pressure class for 5 seconds.

Underground pipe shall be installed in accordance with AWWA C605.

Pipe shall be legibly and permanently marked in ink with the following minimum information

1. Nominal size (for example, 4")

2. PVC

3. Dimension Ratio (for example, DR14)

4. AWWA pressure class (for example, PC 200)

5. AWWA C900, latest edition

6. Manufacturer's name or trademark and production code

7. Seal (mark) of the testing agency verifying the suitability of the pipe material for potable water service

B. Polyvinyl chloride fittings and couplings shall conform to the requirements of the PVC pipe for classification and size. Rubber gaskets for elastomeric joints shall conform to ASTM F477. Lubricant for the joints shall be furnished by the pipe manufacturer. The rubber gaskets shall be factory installed in the bell of the pipe, fittings and couplings. The plain end of the pipe shall be marked by the manufacturer to show the depth of penetration into the bell or coupling.

C. Provisions shall be made at the ends of each individual pipe length to receive and make the joint, as required.

D. Pipe shall be laid with bells up grade.

E. In laying the pipe, it shall be carefully lowered into the trench. Just prior to lowering the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gasket shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. The pipe shall then be forced "home." Before the joint is fully "home" the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in the proper position, the pipes shall be separated and the damaged gasket replaced.

F. Immediately after the pipe is brought to final position, it shall be thoroughly secured and properly bedded, and ample support shall be provided to prevent settlement or disturbances. If a laying box is employed in lieu of sheeting, care should be exercised to prevent disturbing the bedding and position of pipe when moving the box.

G. Manufacturer:

1. CertainTeed Corp.

2. Or approved equal.

2.4 VALVES AND SPECIALS

A. General:

1. Refer to Section 18068 and/or 18099 for general requirements.

2. Transitions from PVC to poly-tubing shall be made with barbed fittings and stainless steel clamps, or approved equal.

3. All wetted parts of PVC/CPVC valves and accessories shall be compatible with treatment chemicals.

4. Threads and dimensions: ASME B1.1 and B18.2.

5. Thread lubricant: Crane Solution 425 or approved equal.

6. Gaskets: Full face, 1/8-inch thick neoprene rubber.

7. Pressure connections to pressure switches, recorders, and indicating gauges shall be equipped with a snubber.

B. Spring-Loaded Y-Check Valves:

1. Valves shall be true union, spring-loaded check type. Valve body shall be PVC and seals shall be EPDM.

2. Manufacturer:

a. Hayward

b. Or approved equal.

C. Swing Check Ball Valves:

1. Valves shall be swing check ball valve combination type constructed from PVC Type I, ASTM D 1784 Cell Classification 12454.

2. All valves shall have Safe-T-Shear stem, Safe-T-Blocked Seal Carrier, and double stop polypropylene handle.

3. All valve components shall be replaceable.

4. All valves shall be maintenance free seal unit construction with EPDM seat and weighted disc.

5. All valves shall have external flow arrow direction designation.

6. All valves shall be pressure rated to 150 psi for water at 73 deg. F in full flow (open) position and to 75 psi at 73 deg. F back pressure (closed).

7. Manufacturer:

   a. Hayward

   b. Spears Manufacturing Company

   c. Or approved equal.

D. Ball Valves:

1. Ball valves shall be Schedule 80, true union, 2000 Industrial type manufactured to ASTM F1970 and constructed from PVC Type I, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447. Ball valves shall be vented.

2. Ball valves shall be manually or electrically actuated as indicated on the Drawings.

3. O-rings shall be EPDM or Viton.

4. All valves shall have Safe-T-Shear stem with double O-ring stem seals.

5. All valve handles shall be polypropylene with built-in lockout mechanism.

6. All valve union nuts shall have Buttress threads.

7. All seal carriers shall be Safe-T-Blocked.

8. All valve components shall be replaceable.

9. All valves shall be certified by NSF International for use in potable water service.

10. All 1/2-inch through 4-inch valves shall be pressure rated to 235 psi. All 6-inch and 8-inch venturied and all flanged valves shall be pressure rated to 150 psi for water at 73 deg. F.

11. Electric actuators, where called out on the drawings, shall be factory installed, 115VAC with thermally protected, reversing motor. Electric actuator shall be equipped with limit switch for the open and closed positions.

12. Manufacturer:

    a. Spears Manufacturing Company.

    b. Or approved equal.

E. Y-Strainer:

1. Strainers shall be y-type and true union. Valve body shall be PVC or CPVC to match in-line piping.

2. O-ring shall be Viton.

3. Strainer shall have 40 mesh stainless steel screen.

4. Manufacturer:

    a. Hayward.

    b. Or approved equal.

F. Anti-Siphon (Back Pressure) Valve:

1. Valve body shall be PVC or CPVC to match in-line piping.

2. Valve connections shall be NPT, except for valves 3-inches and larger which shall be flanged.

3. Diaphragms shall be PTFE, EPDM, or other material as required to be compatible with treatment chemical.

4. Valve top material shall be Noryl for 1/2-inch to 2-inches in size and PVC for 3-inches and 4-inches in size.

5. Manufacturer and Model:

   a. Griffco G Series.

   b. Or approved equal.

G. Pressure Relief Valve:

1. Valve body shall be PVC or CPVC to match in-line piping.

2. Valve connections shall be NPT, except for valves 3-inches and larger which shall be flanged.

3. Diaphragms shall be PTFE, EPDM, or other material as required to be compatible with treatment chemical.

4. Valve top material shall be Noryl for 1/2-inch to 2-inches in size and PVC for 3-inches and 4-inches in size.

5. Manufacturer and Model:

   a. Griffco G Series.

   b. Or approved equal.

H. Unions:

1. PVC/CPVC Unions for chemical service shall have Viton “O” Rings and shall be suitable for use with treatment chemicals.

2. Manufacturer:

a. Hayward.

b. Or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Contractor shall inspect all piping to ensure that piping is free of defects in material and workmanship. The compatibility of all pipe, fittings and coating shall be verified.

3.2 INSTALLATION

A. General: Refer to Sections 18051 and 18052 for piping installation, testing, cleaning and acceptance.

B. Solvent welds: The chemicals used in solvent welding are intended to penetrate the surface of both pipe and fitting, which after curing, results in a complete fusion at the join. Properly used, the solvent effects a permanent and trouble-free weld. Familiarity with the products and techniques will result in a completely satisfactory installation. Use only PVC solvent with no thinner.

C. All necessary precautions and safety procedures as outline by OSHA shall be strictly adhered to while using the solvent.

D. Wipe off all dust, dirt and moisture from surface to be welded.

E. With a non-synthetic bristle brush, in the following sequence, apply an even coating of solvent to the outside of the pipe. Then apply solvent to the inside of the fitting, and then re-apply a light coat of solvent to the outside of the pipe, making sure that coated area on the pipe is equal to the depth of the fitting socket.

F. Insert pipe quickly into the fitting and turn the pipe a quarter turn (approximately) to ensure even distribution of the solvent and to eliminate air bubbles on surface bonded. Hold joint for 15 seconds so that

pipe does not push out from the fitting. Clean off any bead of excess solvent that appears at the outer shoulder of the fitting. Allow at least 15 minutes curing time for each welded joint before moving or handling.

G. Check all fittings for correct position before solvent weld sets.

H. Flanged connections: Flanged connections shall be installed as specified in Section 18051, 18052, and 18053 as applicable. Where flange type fittings are used, or other types of bolted connections such as expansion couplings, the use of a torque wrench is required, so that even tension is applied to all bolt and damage to the plastic components is prevented.

+ + END OF SECTION + +

SECTION 18068

SMALL DIAMETER PIPING, VALVES AND SPECIALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, tools, materials, and equipment necessary for providing piping, valves and specials less than 4-inches in diameter, unless otherwise noted.

2. Included are all pipe, valves, fittings, couplings, specials, jointing materials, bolts, nuts and gaskets, factory-applied painting and other appurtenances required for the installation, testing and cleaning of above piping.

3. It is the intention of the Drawings and of these Specifications to provide complete and workable piping systems. Any miscellaneous fittings and appurtenances required for proper completion of the Work shall be considered as having been included under this Section.

4. Piping specifically excluded from this Section is as follows:

   a. All piping, valves and specials 4-inches in diameter and larger.

   b. All pipe specifically included with equipment.

B. General:

1. All materials, equipment and appurtenances shall be new, clean and in accordance with material specifications. In no case will second-hand or damaged material be acceptable.

2. Piping shall be clearly marked by manufacturer as to material, type and rating.

C. Related Work Specified Elsewhere:

1. Section 09900, Painting (refer to specific piping specifications for surface preparation and shop priming).

2. Division 18, Sections on Piping, Valves and Appurtenances.

1.2 QUALITY ASSURANCE

A. Design Criteria: The design conditions are as described in this Section.

B. Source Quality Control: All pipe and specials shall have the working pressure stenciled thereon. Pipe that has been designed for abnormal load conditions or thrust restraint shall have special markings thereon which can be readily identified.

C. Reference Standards:

1. Comply with applicable provisions and recommendations of the following:

a. AWWA C111 (ANSI A21.11), Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.

b. ASME B16.22, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

c. ASTM A 307, Carbon Steel Externally Threaded Standard Fasteners.

d. FS 0-F-506, Flux, Soldering; Paste and Liquid.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Illustrations, specifications and engineering data including: dimensions, materials, size, weight, coatings and linings for all piping, valves and appurtenances.

2. Complete layout drawings including location of all valves, fittings, supports, and appurtenances. Type of joints, and restraints where provided, shall be clearly indicated.

3. Interfacing of piping system to equipment and appurtenances.

4. Full details of piping, fittings, specials and connections to existing pipes or equipment in both plan and profile.

5. Detailed procedures to be used in jointing and installing piping system, including manufacturer's recommendations.

6. Bill of materials indicating material composition of pipe, pressure rating, nominal size and its location on the piping installation drawings.

7. Submit this data with Shop Drawings required under Sections 18051 and 18052.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of all test reports.

C. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Refer to Sections 18051 and 18052.

PART 2 - PRODUCTS

2.1 COPPER TUBING

A. Tubing:

1. Copper tubing shall be seamless tubing conforming to ASTM B 88.

2. Buried service tubing shall be Type K, soft.

3. Exposed copper tubing shall be Type L.

B. Fittings: Fittings shall be wrought copper conforming to ASME B16.22, except fittings for instrument air shall be compression type, Swagelok, Mueller or approved equal.

C. Joints: Joints shall be sweat type, with solder 95 percent tin, 5 percent antimony and flux conforming to FS 0-F-506, Type 1, except joints for instrument air shall be compression type, Swagelok, or equal.

D. Surface Preparation and Field Painting: All exposed copper piping shall be field painted in accordance with Section 09900, Painting.

2.2 DUCTILE IRON PIPE

A. Conform to requirements of Section 18053.

2.3 CARBON STEEL PIPE

A. Conform to requirements of Sections 18053 and 18061.

2.4 SPECIAL COUPLINGS

A. Flexible Couplings:

1. Conform to requirements of Section 18053 and 18055.

B. Dielectric Pipe Couplings:

1. Dielectric pipe couplings shall be used wherever copper pipe connects to steel, or ductile iron pipe and appurtenances. Couplings shall have steel bodies with nonconducting bushings on both ends. Ends shall have standard pipe threads. Couplings shall be rated for at least 200 psi at 225°F.

2. Manufacturer:

a. ThermoDynamics Corporation.

b. Watts

c. Or approved equal.

2.5 VALVES AND SPECIALS

A. General:

1. All valves shall have manufacturer's name and working pressure cast in raised letters on valve body.

2. All manual valve operators shall turn clockwise to close unless otherwise specified. Valves shall indicate the direction of operation.

3. Unless otherwise specified all flanged valves shall have ends conforming to ASME B16.1, Class 125.

4. All buried valves shall be provided with adjustable two piece valve boxes and provided with extension stems, operating nuts and covers unless otherwise shown or specified. Extension stems shall terminate 12 inches below finished grade. All buried valves shall be of nonrising stem.

5. All bolts, nuts and studs on or required to connect buried valves shall be of stainless steel.

6. All bolts and studs embedded in concrete and studs required for wall pipe shall be of stainless steel.

7. All other bolts, nuts and studs shall conform to ASTM A 307, Grade B; or ASTM A 354.

8. Bolts and nuts shall have hexagon heads and nuts.

9. Gasket material and installation shall conform to manufacturer's recommendations.

10. Whenever bronze body valves are connected to plastic piping, the end connection shall be screwed with a solder adapter.

B. Gate Valves:

1. For Exposed Piping:

a. Gate valves shall be resilient wedge type, iron body, bronze mounted. Gates shall open counterclockwise.

b. The sealing surface of the cast iron wedge shall have the sealing surface of the wedge permanently bonded with resilient material to meet ASTM D429 tests for rubber to metal bond.

c. Gate valves 3-inch diameter and larger shall have flanged end connections, valves less than 3 inches shall have screwed end connections unless otherwise specified.

d. Valves shall have nonrising stem with operating nut and handwheel.

e. Where indicated on the drawings, valves shall be furnished with a handwheel floor stand type valve operator for use on valves with non-rising stems. Extension stem shall be bronze with coupling, and the floor stand shall have an integral indicator to show the valve position. The handwheel floor stand operator shall be model F-5500 as manufactured by Clow Valve Company, or approved equal. The handwheel operator shall be mounted to the grating assembly with stainless steel hardware and appropriate protection shall be provided to prevent dissimilar metal contact, if applicable. Extension stem length shall be coordinated in the field by Contractor to suit the requirement application.

f. Manufacturer:

1) Clow Valve Co.

2) Mueller Co.

2. For Buried Piping:

a. Gate valves shall be double disc, iron body bronze mounted. Gates shall open counterclockwise.

b. Buried gate valves shall have mechanical joint end connections and ductile iron retaining glands.

c. Valves shall have nonrising stem with 2-inch operating nut.

d. Each valve shall be provided with a valve box and cover. Valve box shall be two piece, cast iron with 5 1/2-inch shaft, screw type. Lid must fit securely in top section and "Water" shall be cast in lid.

e. Manufacturer:

1) Clow Valve Co.

2) Mueller Co.

3. For Copper Piping:

a. Gate valves shall be bronze body, with solid wedge disc and solder joints.

b. Valves shall have a union bonnet and rising stem.

c. Manufacturer:

1) CVC Valves.

2) Crane.

3) Or approved equal.

4. For Carbon Steel Piping:

a. Type: Outside stem and yoke, rising stem, split wedge.

b. Body: Carbon steel, ASTM A 105.

c. Stem and Split Wedge: Stainless steel.

d. Ends: Flanged, ASME B16.5, Class 150.

e. Manufacturer:

1) Vogt Valves Inc.

2) Powell Valves.

3) Or approved equal.

C. Check Valves:

1. For Ductile Iron Piping:

a. Valves shall be swing check type of iron body, bronze mounted construction.

b. End connections shall be flanged or screwed.

c. Manufacturer:

1) CVC Valves.

2) Or approved equal.

2. For Copper Piping:

a. Check valves shall be swing check valves of bronze construction and solder joint ends.

b. Manufacturer:

1) Crane.

2) CVC Valves.

3) Or approved equal.

3. For Other Services:

a. Type: Horizontal, swing.

b. Body: Carbon steel, ASTM A 216.

c. Internals: Stainless steel, ASTM A 74.

d. Manufacturer:

1) Crane.

2) Or approved equal.

D. Ball Valves:

1. For Copper Piping:

a. Ball valves shall be quarter turn, full port ball valve with a nonblowout stem and adjustable packing gland. Valve body shall be cast bronze and valve ball shall be chrome plated brass.

b. Valve packing and seats shall be Teflon.

c. Valve end connections shall be screwed. Provide a screw to sweat adapters where required.

d. Manufacturer:

1) Crane.

2) Swagelok.

3) Mueller.

4) Or approved equal.

2. For All Other Uses:

a. Type: Nonlubricated, full port.

b. Body: Carbon steel.

c. Ball and Stem: Stainless steel.

d. Seats and Seals: Teflon.

e. Ends: Flanged, ASME B16.5, Class 150.

f. Manufacturer:

1) Neles Corporation.

2) Or approved equal.

E. Air Release Valve:

1. A 2-inch automatic air release valve shall be installed at each location shown on the Drawings

and at locations where air binding of pipelines might occur.

2. Valve shall be 2-inch NPT screwed inlet and outlet with cast iron body and top, stainless steel trim and stainless steel ball float.

3. The valve shall satisfactorily withstand a hydrostatic pressure of 300 psi and operating pressure of 125 psi.

4. Manufacturer:

   a. Crispin, Model DL20

   b. Or approved equal.

F. Gauges:

1. Pressure gauge shall be installed on suction and discharge connections to all pumps and where otherwise indicated.

2. Materials are as follows:

   a. Case: Phenolic: dust proof

   b. Diaphragm: Stainless Steel

   c. Gauge Cock: Each Gauge: Brass Ball Valves

   d. Miscellaneous Piping: Stainless Steel.

   e. Snubber: Type 316 Stainless Steel.

   f. Dial Size: 4 1/2 inches with a plastic case and white face with black markings. Window shall be acrylic with a micrometer adjustable black aluminum pointer.

3. End Connections:

   a. Diaphragm: 1" NPT x 1/4" NPT.

   b. Gauge Cock: 1" NPT x 1" NPT.

4. Range:

a. Suction - Compound:

1) 0 to 30 inches of Hg.

2) 0 to 30 feet of Water.

b. Discharge

1) Scale shall be as required for the application and as approved by the Engineer.

5. Accuracy: ±1/2% of full scale.

6. Manufacturer:

a. Ashcroft - Model 1279.

b. Marsh.

c. Or approved equal.

2.6 MISCELLANEOUS

A. Dry Taps in Pipe:

1. Taps and connections to piping shall be made as required to connect equipment, gauges, valves, and where otherwise shown on the Drawings.

2. Taps shall be Mueller "CC" pipe thread of the size indicated or required.

3. Where pipe wall thickness is insufficient for the tap sizes shown, bosses or welding plates shall be added to the pipe or fitting, or an approved saddle may be used. Field welding will not be permitted.

4. Threads shall be protected by a brass plug.

PART 3 - EXECUTION

3.1 INSPECTION

A. The Contractor shall inspect all piping to ensure that piping is free of defects in material and workmanship.

The compatibility of all pipe, fittings, and coatings shall be verified.

3.2 INSTALLATION

A. Buried pipe shall be installed in accordance with the requirements of Section 18051. Exposed pipe shall be installed in accordance with the requirements of Section 18052. Valves shall be installed as specified in this Section.

3.3 MISCELLANEOUS FITTING INSTALLATION

A. Pipe in Wall or Floor Sleeves:

1. The annular space between all wall sleeves and carrier pipes shall be sealed with mechanical link-type seals.

B. Transitions from one type of pipe to another shall conform with requirements of Sections 18051 and 18052.

3.4 VALVE INSTALLATION

A. Provide valves and specials in quantity, size, and type with all required accessories as shown on the Contract Drawings.

B. Install all valves and appurtenances in accordance with manufacturer's instructions.

C. Install suitable corporation stops at all points shown and required where air binding of pipe lines might occur.

D. Install all valves so that operating handwheels or wrenches may be conveniently turned from operating floor but without interfering with access, and as approved by Engineer.

E. Unless otherwise approved install all valves plumb and level. valves shall be installed free from distortion and strain caused by misaligned piping, equipment or other causes.

F. Installation of all valves, specials and appurtenances shall conform to the requirements of Sections 18051 and 18052 where applicable.

G. Identification: Provide valve tags as specified under Section 09900.

3.5 SPECIFIC PIPING INSTALLATION

A. Copper Tubing:

1. Joints shall be made with clean bright ends, properly fluxed, using 95 percent tin, 5 percent antimony solder.

2. Runs shall contain unions at connections to equipment and at reasonable distances along the lengths of runs to permit convenient disassembly of piping and removal of equipment.

3. All horizontal lines shall be properly pitched to facilitate draining and all low points shall be provided with 3/4-inch hose bibbs properly located so that the entire system may be drained.

3.6 FIELD TESTING

A. Leakage Tests:

1. Conform with requirements of Sections 18051 and 18052.

2. All auxiliary devices connected to the main process piping, such as pilot piping and gauges, shall be valved off or disconnected prior to the leakage testing. Upon completion of the tests, all connections shall be reestablished and the section of piping incorporating the auxiliary devices shall be retested at the required pressure.

3.7 CLEANING

A. All piping shall be thoroughly cleaned and flushed as approved by the Engineer.

3.8 SURFACE PREPARATION AND PAINTING

A. All piping listed in the Schedule to be painted shall be prepared and painted in accordance with the requirements of Section 09900, Painting.

B. All valves, except stainless steel and PVC, shall be prepared and field painted in accordance with Section 09900, Painting.

+ + END OF SECTION + +

SECTION 18094

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Plumbing Contractor shall furnish all labor, materials, equipment and incidentals as shown on the Contract Drawings, specified and required to provide an acceptable system of support, guidance and anchorage for all piping, valves, fittings, ductwork and specials.

2. Hangers and supports for Plumbing and Ventilation are specified herein.

3. All hangers, rods, bolts, nuts, inserts shall be Type 316 stainless steel. Concrete inserts shall be malleable iron with galvanized finish, fastened with aluminum nails.

4. Contractor shall provide all temporary pipe supports required during construction.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the hangers and supports.

2. Contractor shall coordinate the location and placement of any necessary concrete inserts, and any cutting or drilling of structural members required.

3. Access Pathways, Facility Maintenance, Working Clearances and regular operations and maintenance activities shall be taken into consideration to the placement of pipe supports.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.

2. Section 05120, Structural Steel.

3. Section 05500, Metal Fabrications.

4. Section 09900, Painting.

5. Division 18, Sections on Piping, Valves and Specials.

1.2 QUALITY ASSURANCE

A. General: The Contractor shall conform to the following general criteria:

1. Materials and systems using stock or production parts shall be utilized unless otherwise shown or approved.

2. Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment concentration.

3. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.

4. Hangers shall be installed so that they cannot become disengaged by movements of the supported pipe.

5. Conform to the recommendations of MSS-SP-58 except where requirements of this Section 18094 are more stringent.

B. Source Quality Control: Obtain each type of pipe hanger or support from no more than one manufacturer.

C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. The Manufacturers Standardization Society of the valve and Fittings Industry:

   a. MSS SP-58, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

   b. MSS SP-69, Pipe Hangers and Supports - Selection and Application.

2. FS WW-H-171, Hangers and Supports, Pipe.

3. UL 203, Pipe Hanger Equipment for Fire Protection Service.

4. ASME B1.1, Unified Inch Screw Threads.

5. ASME B31, Codes for Pressure Piping.

6. ASTM A36, Carbon Structural Steel.

7. ASTM A47, Ferritic Malleable Iron Castings.

8. ASTM A276, Stainless Steel Bars and Shapes.

9. ASTM A307, Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

10. ASTM A320, Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.

11. ASTM A575, Steel Bars, Carbon, Merchant Quality, M-Grades.

12. ASTM A666, Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar.

13. ASTM A668, Steel Forgings, Carbon and Alloy, for General Industrial Use.

1.3 SUBMITTALS

A. Contractor shall submit the Shop Drawings for approval of the Engineer. Submittals shall include, but not be limited to:

1. Name and qualifications of the support and hanger engineer.

2. Detailed Shop Drawings showing all hangers and supports for each piping system. Shop Drawings shall show location, installation, material, loads, forces, stresses and deflections of all hangers and supports. Reaction forces imparted to structures to which hangers and supports are attached shall be shown.

3. Manufacturer's catalogs and engineering data on all hangers and supports.

4. Load ratings.

5. Materials.

6. Installation details.

7. All drawings and specified or required design calculations, signed and sealed by a New York State registered professional engineer.

B. Contractor shall provide detailed drawings of each pipe support. Each drawing shall contain enough information to verify the pipe support design and to allow the manufacture of the device. At a minimum, the Contractor shall submit:

1. Scaled details of the device with dimensions.

2. A table of applied forces and moments.

3. A complete bill of materials.

4. An isometric showing the applied forces and moments.

5. Detailed connections to existing structure.

6. Shop and field welds.

C. Each submittal shall have the following:

1. A unique identification number and revision level.

2. Stamp of a New York State registered professional engineer experienced in pipe support design.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: All materials shall be inspected for size, quality, and quantity against approved Shop Drawings.

B. Storage of Materials: All materials shall be packaged, labeled, and stored in a covered dry location until time of installation.

1.5 DESIGN REQUIREMENTS

A. Contractor shall provide hangers and supports of sufficient strength to maintain the pipelines and appurtenances in proper position and alignment under all operating conditions.

B. Contractor shall retain the services of a New York State Licensed Professional Engineer to design the supports for all pipelines and appurtenances, for all weights, forces and applied pressures. In the design of hangers, supports and anchors, unless otherwise shown or specified, pipe pressures shall be the maximum test pressures specified for pipelines carrying gases and twice the maximum test pressures specified for pipelines carrying liquids. The pipe support designer shall have a minimum of 5 years' experience in the design of pipe supports and have completed at least 5 successful pipe support projects of equal complexity as the system specified.

1. Pipe support design shall include load and movement calculations.

2. The following loads shall be included in pipe support design and pipe stress analysis:

    a. Gravity Force, including weight of pipeline and appurtenances, contents, insulation, etc.

    b. Thermal Expansion Force developed by the restraint of free end displacement of the piping.

c. hydrostatic Forces developed by internal pressure during operation of the piping system.

d. Loading due to expansion joint reaction forces.

e. Seismic forces, as required by the Building Code of New York State

3. Supports, guides and anchors for flexible couplings and expansion joints shall be in accordance with the coupling and joint manufacturer's specification and the standards of the Expansion Joints Manufacturers Association.

4. Wherever possible, pipe supports shall be designed using manufacturer's standard catalog products.

5. Hangers and Supports for piping systems subject to thermal expansion and contraction, or to similar movements imposed by other sources, shall be designed to provide flexibility, and pipe stress analysis shall be provided.

6. Where resonance with imposed vibration and/or shock occurs during operation, suitable dampeners, restraints, anchors, etc., shall be added to remove those effects.

7. Occasional load calculations and pipe stress analysis shall be provided where required by the Detailed Specifications, Building codes or Standards. Occasional loads include:

a. Seismic forces.

b. Pressure waves produced by sudden changes in fluid momentum, commonly referred to as water hammer.

c. Wind, snow or ice loads.

d. Safety valve thrust loads.

8. Stresses in hangers, rods and brackets shall be in accordance with MSS-SP-58.

C. All hangers and supports shall conform to the applicable requirements of ASME B31.1, MSS SP-58, SP-59, SP-69 and SP-90, except as modified herein, and be of standard manufacture wherever possible, and best suited for the service required.

D. Unless otherwise approved, all hangers, supports and concrete inserts shall be listed with Underwriters' Laboratory, Inc.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Unless otherwise noted or shown, Contractor shall retain the services of a New York State Licensed Professional Engineer to design all piping supports. The Contractor shall supply and install pipe supports for all piping systems.

B. Pipe and appurtenances connected to equipment shall be supported in a manner to prevent any stress being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, certification shall be submitted stating that requirements have been complied with.

C. The hangers and supports shall meet with the following requirements:

1. Standard and fabricated hangers and supports shall be furnished complete with necessary inserts, bolts, nuts, rods, washers, and other accessories.

2. Run piping in groups and parallel to building walls where practicable. Provide minimum clearance of one inch between pipe and other work.

3. Install hangers or supports at all locations where piping changes direction.

4. All valves and valve operators shall be rigidly supported independently of the piping.

5. All hangers and supports shall be capable of adjustment after placement of piping.

6. Types of hangers or supports shall be kept to a minimum.

7. All suspended or supported ductile iron pipe and cast-iron pipe shall have a hanger or support adjacent to each hub or flanged end.

8. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.

9. Hanger rods shall be straight and vertical. Chain, wire, strap or perforated bar hangers shall not be used. Hangers shall not be suspended from piping.

10. Prevent contact between dissimilar metals by use of copper plated, rubber, vinyl coated, or stainless steel hangers or supports.

11. Uninsulated PVC piping shall be protected from local stress concentrations at each support point. Protection shall be provided by Type 316 stainless steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degrees of support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18 gage minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with stainless steel straps not less than 1/2-inch wide.

12. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location. Provide Type 316 stainless steel protection shields at each location. Weld shields to pipe hangers. Hangers and supports shall provide for expansion throughout the full operating temperature range.

13. All ferrous pipes shall be supported by galvanized steel pipe attachment.

14. All copper piping shall be supported by plastic coated or copper plated steel pipe attachments.

15. Plastic piping shall be supported by plastic coated steel pipe attachments.

16. All supports, straps and hardware in clearwells (if applicable) shall be Type 316 stainless steel.

17. Vertical struts and horizontal members shall be of a size suitable for the service intended and be compatible with frame inserts as specified in Section 05500, Metal Fabrications. Structural steel shall conform to the requirements of Section 05120.

18. Insulated pipes shall have a 300 series stainless steel insulation protection shield a minimum of 12 inches long.

19. Hangers and supports shall provide for expansion and contraction throughout the full operating temperature range.

20. Any required pipe supports, for which the supports called for in this Section are not applicable, shall be fabricated or constructed from standard stainless steel shapes, concrete and anchor hardware, and shall be subject to the approval of Engineer.

21. Where hanger or support spacing does not correspond with joist or rib spacing, structural steel channels shall be attached to joists or ribs, and the pipes suspended therefrom.

22. All points of adjustment for pipe and duct hanger rods shall be locked securely in place using double-nutting. Double-nutting means two nuts torqued directly against each other under each point of adjustment in addition to a third nut on top of the bracket. Damaging threads or tack welding as a method of locking adjustment is not permitted.

23. All threaded assemblies shall be double nutted or provided with pinned nuts. Alternately, tack welding of bolted assemblies may be acceptable unless provisions for vertical adjustment is required.

24. Except where otherwise shown or required, horizontally valves 6-inches and larger shall be supported on each side of the valve, by pipe hangers or supports.

25. At all flexible couplings, supports shall be placed on each side and as close to the coupling as possible. Supports shall be the guide type which prevent axial movement from resulting in pipe deflection and misalignment.

26. Supports, anchorage and guidance for grooved end pipe shall be in accordance with the applicable sections of these specifications and the recommendations of the manufacturer.

2.2 HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2-inch to 1-1/2 inch: Carbon Steel, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2-inch to 4-inch and Cold Pipe Sizes 6-inch and over: Carbon Steel, adjustable clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3-inch: Cast iron hook.

E. Wall Support for Pipe Sizes 4-inch and over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast-iron roll for hot pipe sizes 6-inch and over.

F. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

G. Shield for Insulated Piping 2-inch and smaller: 18 gauge galvanized steel shield over insulation in 180 degree segments, minimum 12-inch long at pipe support.

H. Shield for Insulated Piping 2-1/2 inch and larger (Except Cold Water Piping): Pipe covering protective saddles.

I. Shield for Cold Water Piping 2-1/2 inch and larger: Hard block non-conducting saddles in 90 degree segments, 12-

inch minimum length, block thickness same as insulation thickness.

J. Cast Iron pipe shall be supported at every joint and at a maximum of 5 feet between supports.

K. Components of hangers and supports shall conform to the following where applicable:

1. Materials:

a. Bolts: ASTM A 307, Grade A, unless otherwise specified below.

b. Anchor and Expansions Bolts: Type 316 stainless steel, including nuts and washers.

c. Forgings: ASTM A 668.

d. Malleable Iron: ASTM A 47.

e. Rods and Bars: ASTM A 575.

f. Threads: Unified Screw Threads, Class 2A and 2B, ASME B1.1.

g. Structural Steel: ASTM A 36.

2. Finish:

a. Steel Items: Galvanized unless otherwise specified or shown on the Drawings.

b. Plastic coated steel where specified above.

c. Stainless Steel Items: No finish is required.

L. Pipe Attachments: The following types of pipe attachments are acceptable:

1. Adjustable Steel Clevis: MSS SP-58, Type 1.

2. Steel Double Bolt Pipe Clamp: MSS SP-58, Type 3.

3. Steel Pipe Clamp: MSS SP-58, Type 4.

4. Adjustable Swivel Pipe Ring: MSS SP-58, Type 16.

5. Adjustable Steel Band Hanger: MSS SP-58, Type 7.

6. Riser Clamp: MSS SP-58, Type 8.

7. Light Duty Clevis Hanger: MSS SP-58, Type 1.

8. Long Clips: MSS SP-58, Type 26.

9. Pipe Saddle Support: MSS SP-58, Type 36.

10. Pipe Stanchion Saddle: MSS SP-58, Type 37.

11. Adjustable Pipe Saddle Support: MSS SP-58, Type 38.

12. Insulation Protection Saddle: MSS SP-58, Type 39.

13. Insulation Protection Shield: MSS SP-58, Type 40.

14. Adjustable Pipe Roll and Base: MSS SP-58, Type 46.

15. Adjustable Roller Hanger: MSS SP-58, Type 43.

16. Pipe Slide Assembly, MSS SP-58, Type 35:

    a. Material: Carbon steel tee with stainless steel slide plate; carbon steel base with filled teflon pad.

    b. Type: Suitable for field welding to steel pipe. Modify with clamps and U-bolts for use with ductile iron pipe.

    c. Product and Manufacturer:

        1) Anvil EPS, Figure 257, Type 3.

        2) Or approved equal.

M. Structural Attachments: The following types of structural attachments are acceptable:

1. Welded Steel Bracket: MSS SP-58, Type 32.

2. Side Beam Bracket: MSS SP-58, Type 34.

3. Malleable Concrete Insert: MSS SP-58, Type 18.

4. Center I-Beam Clamp with Eye Nut: MSS SP-58, Type 28.

5. Side Beam Clamp: MSS SP-58, Type 25.

N. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded (minimum size 3/8 inch diameter, see Part 3 – Execution), as required.

O. Hanger Rod Attachments: Use as required to complete assembly:

1. Forged Steel Clevis: MSS SP-58, Type 14.

2. Adjustable Turnbuckle: MSS SP-58, Type 15.

3. Forged Steel Weldless Eye Nut: MSS SP-58, Type 17.

P. Anchorage Items: All anchor or expansion bolts, nuts and washers for anchoring pipe hangers and supports shall be Type 316 stainless steel where stainless steel piping is installed and Type 304 stainless steel in all other locations. Concrete anchors shall be self drilling type.

Q. All other hangers and supports shall be in accordance with MSS SP-58.

R. Product and Manufacturer: Provide hangers and supports as manufactured by one of the following:

1. B-Line.

2. Miro Industries, Inc.

3. Anvil EPS.

4. ELCEN Metal Product Company.

5. Or approved equal.

2.3 ROOFTOP PIPING SUPPORTS

A. Roller bearing pipe support with PVC seat and self lubricating Teflon base, UL rated and ASTM tested. Pillow Block Pipe Stand by Miro Industries, Inc. or approved equal.

2.4 EQUIPMENT CURBS

A. By equipment manufacturer, when available, or fabricate curbs of manufacturer approved design and material. All curbs shall be a minimum of 12 inch in height unless otherwise specified.

2.5 SURFACE PREPARATION AND PAINTING

A. All pipe supports except stainless steel and plastic coated steel for all piping listed in the Schedule to be painted shall be prepared and painted in accordance with the requirements of Section 09900, Painting. All supports shall be painted the same color as the pipe.

PART 3 - EXECUTION

3.1 GENERAL

A. Locate hangers, supports, and accessories to support piping, valves, and all concentrated loads.

B. Locate hangers, supports, and accessories within maximum span lengths specified to support continuous pipeline runs unaffected by concentrated loadings.

C. All in line devices shall be removable without the need for temporary supports for adjacent and connecting pipe.

D. Locate hangers and supports to prevent vibration or swaying and to provide for expansion and contraction.

E. Pipe attachments for insulated pipe shall be large enough to accommodate pipe, insulation and shield.

F. Install items to be embedded before concrete placement.

G. Fasten embedded items securely to prevent movement during concrete placement.

H. Hanger and support units installations methods shall be in accordance with manufacturer’s recommendations.

I. Adjust hangers and supports and place grout for concrete supports to bring pipelines to specified elevations. Grout shall be as specified in Section 03300, Cast-In-Place Concrete.

3.2 INSTALLATION

A. Supports and Hangers for Horizontal Pipes: Space supports and hangers for all piping no farther apart than shown below unless otherwise shown on the Drawings:

1. Copper Tube:

   a. Pipes up to 2 inches: 6 feet-0 inch center to center.

   b. Pipes 2 1/2 inches and larger: 8 feet-0 inch center to center.

2. Steel, Ductile Iron and Stainless Steel Pipe:

   a. Pipes up to 1 inch: 6 feet-0 inch center to center.

   b. Pipes 1 1/4 inches to 6 inches: 8 feet-0 inch center to center.

   c. Pipes 8 inches and larger: 10 feet-0 inch center to center.

   d. In addition, ductile iron pipe shall have a minimum of two supports per length and shall have a hanger or support adjacent to each hub.

3. Plastic Pipe: Maximum support spacing for plastic pipe at ambient temperature shall be one-half the above values for steel pipe except that support spacing shall not exceed 4 foot-0 inches.

4. Cast Iron Pipe:

   a. Two supports per length.

   b. Additional supports shall be placed immediately adjacent to any change in piping direction, and on both sides of valves, expansion joints, and couplings.

   c. Hanger Rods shall be sized for maximum pipe loads and according to the schedule herein for minimum rod diameters:

Nominal Pipe (inches)	Minimum Rod Diameter (inches)
1/2 through 2	3/8
2-1/2 through 3	1/2
4 through 5	5/8
6	3/4

Nominal Pipe (inches)	Minimum Rod Diameter (inches)
8 through 12	7/8
14 through 18	1
20 through 30	1-1/4

d. Hangers and supports for pipe 3 inches in diameter and larger shall be adjustable.

B. Supports for Vertical Piping:

1. Provide riser clamp placed under hub, fitting or coupling with approved solid bearing on steel sleeve.

2. Where riser clamps are used with plastic piping they shall be modified so as not to exert any compressive forces on the pipe.

3. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.

4. Vertical plastic piping riser clamps shall be PVC coated.

C. Expansion Anchors:

1. Use to fasten all base supports to floors.

2. Use at hangers and brackets to support piping 1 inch in diameter and smaller and only if the anchor is designed to carry 200 percent of the load.

D. Rooftop Piping Supports:

1. Support horizontal piping at intervals no less than 6-feet.

2. Place a support within 12-inch of each horizontal or vertical elbow.

3. Where several pipes can be installed in parallel and at same elevation, provide multiple supports.

3.3 SEISMIC RESTRAINT

A. Seismic restraint shall conform to the requirements of section 1621 of the New York State Building Code and the drawings. Shop drawings for the restraining system shall be provided by the manufacturer and shall include seismic analysis certified by a professional engineer licensed by the State of New York and under the employment of the manufacturer of the restraining system. Seismic requirements are defined on the structural drawings.

B. All pipe supports, hangers, equipment supports, etc. shall comply with the above.

3.4 TESTING

A. All pipe support and restraining systems shall be installed and secured prior to the testing or activation or the pipeline on which they are installed.

B. All pipe support systems shall be tested for compliance with the Specifications. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, if shall be repaired or augmented under this Section to the satisfaction of the Engineer.

3.5 ACCEPTANCE AND SERVICE

A. Acceptance: All pipe systems shall be brought up to operating pressures and temperatures. Systems shall be cycled to duplicate operating conditions. All malfunctions shall be corrected. Contractor shall furnish all labor and materials to readjust and correct faults with hangers and supports for the piping systems.

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SECTION 18175

DISINFECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: The Contractor shall be responsible for the disinfection of all potable water lines with compliance to codes and regulations as specified herein.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Building Codes: Comply with applicable requirements of all governing authorities and the following codes:

1. New York State Uniform Fire Prevention and Building Code.

2. Orange County Department of Health.

B. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. ANSI/AWWA B300	Hypochlorites
2. ANSI/AWWA B301	Liquid Chlorine
3. ANSI/AWWA C651	Standard for Disinfecting Water Mains (exception: tablet method of disinfection specified in Section 4.3 is not acceptable.)
4. APHA/AWWA/WPCF	Standard Methods for the Examination of Water and Wastewater

C. Testing: Bacteriological tests as specified below shall be provided by the Contractor.

1.3 SUBMITTALS

A. Submit a description of the forms of chlorine, dosages, and proposed methods of application to the Engineer for approval.

B. The following shall be submitted in compliance with the shop drawing requirements of Section 01342:

1. A testing schedule, including proposed plans for water conveyance, control, disinfection, and disposal shall be submitted in writing for approval a minimum of 14 days before testing is to start. The submittal shall include the methods to determine evaporation loss and the Contractor's plan for the release of water from structures after testing and disinfection has been completed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all necessary equipment and materials, including chemicals, to perform the disinfecting operations.

B. Temporary valves, bulkheads, or other water control equipment and materials shall be as determined by the Contractor. No materials shall be used which would be injurious to the structure or its future function.

C. Chlorine for disinfection shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules. The tablet method shall not be permitted.

D. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:

1. In combination with appropriate gas flow chlorinators and ejectors.

2. Under the direct supervision of an experienced technician.

3. When appropriate safety practices are observed.

E. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300.

PART 3 - EXECUTION

3.1 DISINFECTION

A. General: The method to be followed shall be that prescribed by the local authorities or, in accordance with the procedures recommended by AWWA C651, Section 4.4 or 4.5 except the tablet method of chlorination as described in Section 4.3 of AWWA C651 will not be permitted:

1. Before application of chlorine, flush the piping system with potable water at a velocity of not less than 3.0 feet per second.

2. After the applicable retention period, flush the system using potable water.

3. Disposal of heavily chlorinated water shall be in strict accordance with all applicable regulations and is the sole responsibility of the Contractor. If there is any possibility that the chlorinated discharge will cause damage to the environment, a neutralizing chemical shall be applied to the water to be wasted to thoroughly neutralize the residual chlorine in accordance with ANSI/AWWA C655.

B. Emergency Repair and Connections to Existing: For connections equal to or less than one pipe length from the end of a new main to the existing main, the new pipe, fittings and valve(s) shall be spray disinfected or swabbed with a minimum 1 percent solution of chlorine just before being installed, as described in Section 4.11 of AWWA C651. In this case, after flushing to scour the pipe and obtain three volumes of water turnover, service can be restored prior to testing.

C. Testing: Perform bacteriological tests in accordance with AWWA C651 and current published requirements of the Nassau County Department of Health (NCDH). In general, this shall require two samples for bacteriological analysis collected from sections of new water main not exceeding 1,200 linear feet, the termination of newly installed pipe, and from each branch, taken at intervals of one of the two following options:

1. Take an initial set of samples and then resample again after a minimum of 24 hours.

2. Let the main sit for a minimum of 24 hours without any water use, then collect two samples a minimum of 15 minutes apart while the sampling taps are left running.

D. A chlorine residual measurement shall be collected and recorded at the time of sample collection by the Contractor and represented in the laboratory analytical reports. Samples should be collected after chlorine residual is either absent or no higher than prevailing in the distribution system.

E. If the test for coliform organisms is negative, then the Contractor, at the discretion of NCDH, shall conduct a third set of confirmatory samples.

F. If the NCDH test for coliform organisms is negative, the water main may be placed into service upon approval from the Engineer and NCDH. If the testing shows the presence of coliform bacteria, the disinfection and testing process shall be repeated at the expense of the Contractor until two additional consecutive negative samples are obtained.

G. The disinfection procedure shall be repeated at the Contractor's expense until satisfactory bacteriological sampling has been achieved.

+ + END OF SECTION + +

SECTION 18190

PIPE INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide insulation for piping systems as shown on the drawings and as specified herein, including, but not limited to:

a. Domestic Cold and Hot Water Piping

b. Tempered water

c. Heat traced piping, if applicable

d. Others as shown on the Drawings

B. Coordination: Insulation shall not be installed until piping has been field tested and approved by the Engineer.

C. Related Work Specified Elsewhere:

1. Section 09900, Painting.

2. Division 18, Plumbing.

1.2 QUALITY ASSURANCE

A. Manufacturer's and Installer's Qualifications: Manufacturer and installer shall have at least 5 years experience in producing similar type materials and show evidence of at least 5 installations in satisfactory operation.

B. Design Criteria: Insulation systems including covering, mastics, adhesives, sealers and facings shall have the following fire hazard classifications:

1. Flame spread, 25 maximum.

2. Smoke developed, 50 maximum.

C. Source Quality Control: Provide certified test data for the following tests and inspections:

1. Flame spread.

2. Smoke developed.

D. Requirements of Regulatory Agencies:

1. Permits: Contractor shall obtain and pay for all required permits, fees, inspections and approvals by authorities having jurisdiction.

2. Building Codes: Comply with applicable requirements of all governing authorities and the following codes:

a. New York State Uniform Fire Prevention and Building Code.

b. New York State Energy Conservation Code.

3. Underwriters' Laboratories, Incorporated. Fire hazard ratings to be verified by Underwriters' Laboratories, Inc. label or listing or a certified test report from an approved independent testing laboratory.

4. National Fire Protection Association.

E. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. ASTM C 547, Mineral Fiber Insulation.

2. ASTM C 553, Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

3. ASTM C 592, Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

4. ASTM C 612, Mineral Fiber Block and Board Thermal Insulation.

5. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.

F. Field Measurements: Take field measurements where required prior to installation to ensure proper fitting of Work.

1.3 SUBMITTALS

A. Samples: Submit for approval samples of the following:

1. Fiberglass insulation.

2. Weatherproof insulation jacket and fitting covers.

3. Vapor Barrier.

B. Shop Drawings: Submit for approval Shop Drawings showing the following:

1. Manufacturers' catalog literature, specifications, and illustrations with the following information:

a. Thermal properties.

b. Physical properties.

c. Fire hazard ratings.

d. Facing information.

e. Installation instructions.

f. Jointing recommendations for butt joints and longitudinal seam.

2. Fabrication instructions for pipe fittings and valve insulation and coatings.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Material: Material shall be delivered to the job site in corrugated cartons.

B. Storage of Material:

1. Store material in clean, dry area, out of the weather.

2. Material shall be tightly covered to protect against dirt, water, and mechanical or chemical damage.

3. Material shall remain in original cartons until time of installation.

1.5 JOB CONDITIONS

A. Protection:

1. Insulating materials shall, at all times, be protected from moisture.

2. Material shall be stored on or near the job site and drawn from this protected area as used.

3. All material applied in one day shall have the vapor barrier applied the same day and any exposed ends shall be temporarily protected with a moisture barrier and sealed to the pipe or equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fiberglass Insulation:

1. Manufacturer: Provide one of the following:

a. Johns Manville Corporation.

b. Owens Corning, FIBERGLAS™ Pipe Insulation SSL 11® with ASJ Max.

c. Certain Teed, Certain-Teed 500 F snap-on ASJ-SSL.

d. Or approved equal.

2. Type: Heavy density sectional pipe insulation with vapor barrier and self-sealing lap.

3. Density: 6 pounds per cubic foot, minimum.

4. Fittings: Molded fiberglass.

5. Jointing Materials: Manufacturers recommended adhesives and tape.

6. Valve Insulation: Miter cut nesting size covering segments of same thickness as pipeline, for insulation of valves.

B. Weatherproof Insulation Jacket:

1. Manufacturer: Provide one of the following:

a. Johns Manville Corporation, Zeston 2000 PVC.

b. Or approved equal.

2. Type: Smooth PVC.

3. Thickness: 20 mil, minimum.

4. Fastening: Solvent welded.

C. Insulated Fitting Covers:

1. Manufacturer: Provide one of the following:

a. Johns Manville Corporation, Zeston 2000 PVC.

b. Or approved equal.

2. Type: Factory fabricated PVC jacketing for elbows, tees, valves, flanges, end caps, beveled collar fitting covers, etc.

3. Thickness: 20 mils.

4. Reference: Conform to ASTM E84.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ensure that surfaces of all pipes, valves, and fittings are clean and dry before applying insulation.

3.2 PREPARATION

A. Ensure that piping and equipment has been tested, painted, inspected and released for application of insulation.

3.3 INSTALLATION

A. Pipe insulation shall be continuous through walls and floor openings except where walls or floors are required to be firestopped or required to have a fire resisting rating or required to be gas tight.

B. Install insulation so as to make surfaces smooth, even, and substantially flush with adjacent insulation.

C. Follow manufacturer's application instructions for all materials used.

D. Provide insulation protection shields for insulated piping supported by pipe hangers. The metal shall be 300 series stainless steel and a minimum of 12 inches long.

E. Install and coat insulation in accordance with the manufacturer's recommendations.

F. Insulation for buried pipe shall be wrapped in tape as recommended by the manufacturer. No weatherproof jacket is required.

G. Exposed Insulation shall be painted “Safety Blue” and labelled accordingly.

3.4 FIELD QUALITY CONTROL

A. Insure that insulation is dry when installed, before and during application of any finish.

3.5 SCHEDULE

A. Refer to Paragraphs 1.1.A. for piping to be insulated. See schedule below for minimum thickness of pipe and fittings insulation:

Pipe Size	Minimum Insulation Thickness (inches)
1) All piping:	
1/2" thru 1"	1
1-1/4" thru 2”	1-1/2
4” and larger	2

+ + END OF SECTION + +

NO TEXT ON THIS PAGE

SECTION 18469

PRESSURE AND LEAKAGE TESTING

PART 1 – GENERAL

1.1 GENERAL

A. Under this Section, the Contractor shall furnish all labor, materials and equipment to perform pressure and leakage testing of pipelines as shown, specified and/or directed.

B. All piping carrying liquid, air, or gas shall be tested for tightness after installation in the presence of the Owner or Engineer. All tools, materials, equipment, meters, gauges, water, bulkheads and labor required for making the tests shall be provided by the Contractor and included in the Bid submitted for the work.

1.2 RELATED DOCUMENTS

A. Section 18051 – Buried Piping Installation.

B. Section 18052 – Exposed Piping Installation.

1.3 REFERENCES

A. Testing shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements are specified herein

1. American Water Works Association (AWWA)

2. National Fire Protection Association (NFPA)

1.4 SUBMITTALS

A. Submittals shall be submitted in accordance with the provisions set forth in the Special Project Conditions, General Provisions, and General Specifications.

B. Contractor shall submit a sequence for flushing, testing and disinfection in compliance with AWWA Standard C651, latest version, within ten (10) days of

Notice to Proceed. The sequence shall include sections of newly installed pipe to be tested to 150 psi, Form of Chlorine to be used, method of chlorination, location of injection, flushing locations, rates of flushing (2.5-3.5 ft/sec) , and locations of drainage facilities, and how and where flushing water will be de-chlorinated, number and locations of bacteriological samples, method of sampling.

C. For each test, a completed Tabulation Sheet (Attachment A) shall be submitted.

D. Proof of testing as required by County, State, or Federal Agencies and this Section shall be submitted.

PART 2 – PRODUCTS

2.1 WATER SUPPLY

A. Water supplied for flushing and testing shall be clean, clear and from potable sources acceptable to the Owner and Engineer.

B. All water necessary for flushing and testing shall be furnished and disposed of in accordance with the General Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Before filling, testing, and disinfecting the installed water main, the line shall be flushed in conformance with AWWA C651 ensuring adequate flushing velocity for the appropriate amount of time. Note that water used for these operations must be approved by the Owner or Engineer. Advanced notice shall be provided to the Engineer and Owner prior to conducting the scheduled tests.

B. When existing water mains are used to supply test water, they should be metered and be protected from backflow

contamination by temporarily installing a double check valve assembly between the test and supply main.

C. Lines shall be filled and flushed slowly with potable water while venting air.

D. Hydrostatic pressure testing of all water mains shall be conducted in accordance with the applicable AWWA standards and with satisfactory results. Prior to conducting the test, the Contractor shall bleed the air from the line being tested. All equipment, switches, metering devices in or connected to pipelines and designed only to withstand normal operating pressures shall be protected for the duration of the test. Testing shall be between closed valves, and where there is a hydrant it shall be against a closed hydrant.

3.2 TEST REQUIREMENTS

A. All pressure piping shall be tested in accordance with AWWA Standard C-600. The following procedure shall be used:

1. All newly laid pipe or any valved section thereof, shall be subjected to a hydrostatic pressure 50 percent in excess of the working pressure at any point in the section being tested, but in no case less than 150 pounds per square inch for a period of two hours.

2. The Contractor shall accomplish the required tests on the pipeline by individually testing each component section of the installed main. The maximum length of section permitted to be tested at any one time will be approximately 1,200 linear feet, and normally will be less.

B. Test Pressure Restrictions

1. The test pressure shall not be less than 150 psi at the highest point along the test section.

2. The test pressures shall not exceed pipe or thrust restraint design pressures.

3. The test pressures shall be of at least 2-hour duration and not vary by more than $\pm$5 psi.

4. The test pressures shall not exceed twice the rated pressure of the valves when the pressure boundary of the test section includes closed gate valves.

C. Leakage Test

1. All leakage tests shall be conducted concurrently with the pressure test.

2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure throughout the duration of the test after the pipe has been filled with water to the test pressure.

3. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measurement of makeup water added to maintain the test pressure. The test shall proceed until the rate of leakage has stabilized, or is decreasing below an allowable value, for at least three (3) consecutive 15-minute intervals. After this, the test pressure shall be maintained for at least another 15-minutes.

4. The rate of leakage shall not exceed 10.5 gallons per day, per mile of pipe, per inch of nominal pipe diameter based on a test pressure of 150 psi. To calculate allowable leakage in gallons per hour (gph) for other test pressures, refer to Table 6 of AWWA C600.

5. Upon completion of the test, the line pressure shall be released at a point farthest from the testing point.

3.3 FIELD MEASUREMENTS

A. The length of the test section shall be measured.

B. The quantity of water used to maintain test pressure during test period shall be measured.

C. All measurements required to complete the Tabulation Sheet shall be measured and recorded.

3.4 COORDINATION

A. 48-hour notice shall be provided to the Engineer and Owner when water for flushing and testing is required.

B. The Owner of the existing water system shall operate all valves and hydrants unless Contractor has been authorized by said Owner to operate water systems, valves and hydrants.

3.5 PREPARATION

A. The Contractor shall supply all plugs, pumps, weirs, gauges, etc., necessary to conduct the tests, including means to accurately measure the quantity of water used to maintain test pressure during the test period.

B. All piping systems shall be flushed with water prior to testing.

3.6 TESTING

A. Pressure and leakage tests shall be conducted on all pressure piping.

B. The Owner or Engineer shall be notified of the test at least 48-hours in advance and shall witness all tests.

C. All test results shall be recorded on the Tabulation Sheet (Attachment A).

D. Each valved section of pipe shall be slowly filled with water. The specified test pressure, based on the elevation of the highest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe.

E. Before applying the specified test pressure, air shall be expelled completely from the pipe and valves.

F. Any exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, or valves that are discovered following the pressure test shall be repaired or replaced with sound material as directed by the Engineer and the test shall be repeated.

G. All visible leaks, regardless of the amount, shall be repaired.

H. If the section being tested fails to pass the pressure or leakage test, the Contractor shall determine, at their own expense, the source or sources of leakage, and they shall permanently repair or replace all defective materials and/or workmanship. The extent and type of repair as well as results, shall be subject to the approval of the Engineer. The completed pipe installation shall then be retested and required to meet the pressure and leakage requirements of this test.

I. Testing and retesting shall be completed prior to final paving.

J. The use of sealants, applied from outside or inside of pipe, is not acceptable.

+ + END OF SECTION + +

(ATTACHMENT A FOLLOWS)

ATTACHMENT A

FLUSHING AND TESTING TABULATION SHEET

Job No. _ Location _

Contract No. Contractor _

Project _

Contractor's Representative _ Observed by _

FLUSHING

Date Weather _ Temperature _

Section Flushed ft. of _ _-inch diameter pipe

Line Flushed _ hrs . _ min. @ gal/min
Line Flushed Through _ Manhole # _

PRESSURE AND LEAKAGE TESTING

Date _Weather Temperature

Section Tested

Ft. of)_ inch diameter pipe in __ _ft. laying lengths

Time started Time finished Elapsed time

Test Pressure: Start __ psi Finish __ psi

Water to Make up Initial Pressure gallons

Allowable leakage, as calculated gallons per hour

__ Gallons (allowable leakage from AWWA C600 or Technical Provisions Section

Pass __ Fail __

$$L = \frac{SD\sqrt{P}}{144{,}800}$$

L = Allowable leakage in gallons/hour
S = Length of pipe tested (linear feet)
D = Nominal diameter of pipe (inches)
P = Average pressure during test, psi

*Refer to C600 for additional allowance leakage against closed metal-seated valves.

SECTION 18483

ELECTRIC HOT WATER HEATER

PART 1 – GENERAL

1.1 GENERAL

A. General Provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 WORK DESCRIPTION

A. The Plumbing Contractor shall provide tanked-type hot water heater for providing domestic hot water, and all appurtenances (piping, trim, etc.) defined here-in, as shown and as scheduled on the drawings, and per the manufacturer's installation requirements.

B. Codes

1. The following codes shall apply to the extent noted here-in.

a. Listing and Labeling: Provide electrically operated components specified in this section that are listed and labeled.

1) The terms "listed" and "Labeled": As defined in NFPA 70, Article 100.

2) Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

b. Comply with NFPA 70 for electrical components and installation.

c. CSA/UL Design Certified

d. AHRI Energy Efficiency Certification

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's submittal data for Engineer review and project records. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model

indicated. Where data sheets include multiple models, options or ratings, clearly indicate all applicable data.

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. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and field installed wiring.

C. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams.

1.4 GUARANTEE

A. General Guarantee: The special guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other guarantees made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide two years of guarantee parts and labor.

B. Special Guarantee: Submit a written guarantee, executed by the contractor.

Guarantee Period: From date of acceptance, manufacturer's standard warranty: 3 year limited warranty on storage tank, 1 year warranty for all other components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products

specified in this section with minimum five (5) years experience. Specifications use A.O. Smith as the basis of design.

B. Service Access: Units shall be provided with front access panels for easily accessing all serviceable components. All components must be accessible and able to adjust with the removal of a single cover or cabinet component.

C. Water heater shall include a diagnostic control panel with a full text display. Access to the controls shall not require tools or removal of panels or covers.

2.2 COMPONENTS

A. Storage Tank: Glass lined storage tank, ANSI rated for 150 psig working pressure.

B. Electronic ignition system

C. Jacket: Foam insulation enclosed by a steel outer cover with baked enamel finish.

D. Drip pan: Field supplied and installed drip pan.

E. Drain valve: Hose bibb drain valve.

F. Safety Relief Valve: ASME rated, factory set to protect water heater and piping as per schedule/drawings.

G. Adjustable thermostat up to 180 degrees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive heaters for compliance with requirements for installation tolerances and other conditions affecting water heater performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units level and plumb, according to manufacturer's written instructions and referenced standards.

B. Support water heaters on 12 inch thick concrete base, 4 inch larger on each side than base of unit. Use only manufacturer provided or recommended mounting hardware

C. Install all ancillary devices furnished with units, but not specified to be factory mounted.

D. Install a 3/4 inch drain valve on the outlet piping prior to the first shut off valve.

3.3 CONNECTIONS

A. Connect water piping to inlet and outlet tappings with shutoff valve and union or flange at each connection.

B. Install piping from safety relief valves to nearest floor drain.

C. Electrical: Comply with applicable requirements in Electrical specifications.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to supervise the field installation and assembly of components, including piping and electrical connections. Report results in writing.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Manufacturer’s representative shall supply a factory authorized service technician to start up and commission the units.

3.5 CLEANING

A. Flush and clean units on completion of installation, according to manufacturer's written instructions.

B. After completing installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, construction debris and repair damaged finishes including chips, scratches, and abrasions.

3.6 COMMISSIONING

A. Engage a factory authorized service representative to provide startup service. Start up to be performed only

after complete installation is field verified. Two year guarantee shall be handled by factory authorized tech.

B. Verify that installation is as indicated and specified.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements. Do not proceed with startup until wiring installation is acceptable to equipment Installer.

C. Complete manufacturer's installation and startup checklist. Verify the following:

1. Unit is plumb and level on concrete base and securely fastened per manufacturer’s recommendations.

2. No damage is visible to jacket, refractory, or internal components.

3. All pipe fittings are secure, clean and free of leaks.

4. Clearances have been provided and piping is flanged or installed with unions for easy removal and servicing.

5. Pipe has been connected to correct ports.

6. Labels are clearly visible.

7. Units and surrounding area are clean and free of construction debris.

8. Pressure and temperature gauges are installed.

9. Control installations are completed.

D. Check that fluid level, flow switch, and high temperature interlocks are in place, and that outlet temperature limits have been set.

E. Perform the following tests, and measure and record the following:

1. Inlet water temperature

2. Outlet water temperature

3. Water flow rate

3.7 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel as specified below:

1. Operate units including accessories and controls, to demonstrate compliance with requirements.

2. Train Owner’s maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.

3. Review date in the maintenance manuals.

4. Schedule training with Owner with at least 7 days advance notice.

5. A signed attendance sheet is required.

+ + END OF SECTION + +

SECTION 18600

BACKFLOW PREVENTERS

PART 1 – GENERAL

1.1 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the contract apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Related Sections:

1. Small Diameter Piping, Valves and Specials, Section 18068

1.2 SUBMITTALS

A. General: Submit the following in accordance with Section 01342, Shop Drawings, Product Data and Samples:

1. Product Data:

a. Manufacturer's specifications, installation instructions for each type of backflow preventer and test kit and other data required to demonstrate compliance with the specified requirements.

2. Proof shall be furnished that each make, model/design and size of backflow preventor being furnished for the project is approved by and has a current "Certificate of Approval" from the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California (FCCCHR). Listing of particular make, model/design, and size in NAVFACINST 11330.11D or in the current FCCCHR List of Approved Backflow Prevention Assemblies will be acceptable as the required proof.

1.3 QUALITY ASSURANCE

A. Standards:

1. Referenced Specifications: The State Department of Health Sanitary Code for Cross Connection Control, and other standards listed in Part 2 of this section.

2. Where conflicts occur between referenced standards, the most stringent requirements shall apply.

3. AWWA C511, Reduced-Pressure Principle Backflow Prevention Assembly

4. FCCCHR of USC Manual Section 10

5. IAPMO (Uniform Plumbing Code), ICC (International Plumbing Code)

6. ASSE 1015, Performance Requirements for Double Check Backflow Prevention Assemblies

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Watts, 815 Chestnut Street, North Andover, MA, 01845-6098, USA. Tel: 1-978-689-6066

B. Or approved equal

2.2 REDUCED PRESSURE ZONE ASSEMBLY

A. The assembly shall be Watts LF909.

1. Main Valve Body: Lead free copper silicon alloy

2. Relief Valve Body: Lead free copper silicon alloy

3. Shutoff Valves: Integral ball valve

4. Check Seats: 909 Celcon

5. Spring: Stainless Steel

6. Temperature Range: 33°F - 140°F (0.5°C – 60°C) Continuous

B. The reduced pressure zone assembly shall be installed on the potable water supply at each point of cross-connection to protect against possible backpressure and backsiphonage conditions for high hazard applications.

C. The assembly shall feature lead free construction to comply with low lead installation requirements.

D. The assembly shall consist of a main line valve body composed of a pressure differential relief valve located in a zone between two (2) independently acting approved check modules with replaceable seats.

E. Servicing of the pressure differential relief valve and both check modules shall not require any special tools; both check modules shall be accessible through independent covers.

F. The assembly shall be fitted with two (2) AWWA compliant inlet/outlet resilient seated shutoff valves and contain four (4) properly located resilient seated test cocks as specified by AWWA C511.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install the work of this section in accordance with the manufacturer's printed installation instructions.

B. Installation of plumbing systems including fixtures, equipment, backflow prevention assemblies materials and workmanship shall be in accordance with the New York State Plumbing Code, except as modified herein.

C. Once installed and prior to being placed into service all devices shall be tested in compliance with New York State Department of Health Regulations. The installation and testing of the backflow prevention device must be witnessed by the Engineer or the device and test results will be unacceptable. Replacement and/or retesting of the device shall be at no additional cost to the Owner. Results of the test shall be forwarded to the Engineer and the local health department.

D. Contractor shall complete all applications and registrations to the water supplier and the New York State Department of Health as required.

E. The Contractor shall support the backflow prevention device as required.

+ + END OF SECTION + +