SECTION 15241
POLYPROPYLENE PIPING SYSTEMS

1.01 PROVISIONS INCLUDED

A. The general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to work specified in this Section.

B. Requirements of Section 15050, "Basic Mechanical Materials and Methods," apply to work specified in this section.

1.02 SUMMARY

A. This Section specifies the components of and the installation of the following systems;
1. Acid Waste and Vent Piping.
2. Reverse Osmosis Distribution.

B. Related Work Specified in Other Sections:
1. Firestopping of piping penetrations: Section 07840, "Firestopping."
2. Hangers and supports: Section 15060, “Hangers and Supports.”
3. Pipe identification: Section 15075, "Mechanical Identification."

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Installer Qualifications: Installer must have a minimum of 5-years experience in the installation of plastic process waste systems, and high purity water distribution systems.

B. Acid Waste and Vent Systems: Minimum working pressure rating of 10-foot head of water.

C. Reverse Osmosis Systems: Minimum rating of 150 psig @ 70^{o}F.

1.04 SUBMITTALS

A. General: Make submittals in accordance with requirements of Section 01300, "Submittals."

B. Product data for pipe, fitting, and joining materials.

C. Test results, and reports specified in "Field Quality Control" and "Cleaning" Articles.

D. Operating and Maintenance, (O&M) Manuals: Include pipe, fitting, and joining data in the O&M Manuals.

1.05 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking of a nationally recognized testing laboratory on equipment made to specified standards.

B. Comply with USM IDAT per section 01810.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acid Waste Piping System Components: Subject to compliance with requirements, provide products by one of the following:
   1. Zurn Industries, Inc.
   2. Asahi America.
   3. George Fischer, Inc.
   4. IPEX / Enfield Industrial.
   5. Orion Piping Systems.

B. Reverse Osmosis Piping System Components: Subject to compliance with requirements, provide products by one of the following:
   1. George Fischer, Inc.
   2. Ashahi America.
   3. Sanitech.

2.02 PIPES AND TUBES

A. General: Piping shall meet ASTM 1785 with regards to dimensional tolerances.

B. Polypropylene Drainage and Vent Pipe: ASTM D 4101 resin, schedule 40.

C. Polypropylene Drainage and Vent Pipe, Flame Retardant: ASTM D 4101 fire-retardant resin, schedule 40.

D. Polypropylene Pressure Pipe; George Fischer "Beta Polypropylene" product line, or equal.

2.03 PIPE AND TUBE FITTINGS

A. General: Fittings shall meet ASTM 1785 with regards to dimensional tolerances, and ASTM D 3311 with regards to drainage pattern.

B. Polypropylene Drainage and Vent Pipe Fittings: ASTM D 4101 resin, schedule 40, drainage pattern fittings with socket/heat-fusion ends.

C. Polypropylene Drainage and Vent Pipe Fittings, Fire Retardant: ASTM D 4101 fire-retardant resin, schedule 40, drainage pattern fittings with socket/heat-fusion ends.

D. Polypropylene Pressure Pipe Fittings, Socket Fusion: George Fischer "Beta Polypropylene" product line, or equal.

2.04 JOINING MATERIALS

A. General: Install piping system components in strict accord with manufacturer's written instructions. Use joining methods and materials specifically listed for use with the pipe and fittings being joined.

B. Polypropylene drainage, vent and pump discharge piping systems, (PP): Fittings shall have integral heat fusion element embedded within the fitting.

2.05 WASTE PIPE LINE SPECIALTIES

A. Floor Cleanouts: ASTM A 861, high-silicon iron, fitting, polytetrafluoroethylene (PTFE) gasket, and closure plug, cleanout assembly.

2.06 VALVES AND SPECIALTIES

A. General: Pipe line components shall be by the same manufacturer as the piping system.

B. Ball Valves: Full port, polypropylene, double union ends.

C. Check Valves: Swing pattern, polypropylene, flanged ends.

D. Rotometers: Double union end connections, sized to indicate average flow rate in the middle range of the scale.

E. Gauge Guards: Liquid filled polypropylene guards with diaphragm to isolate process fluid from gauge.

PART 3 - EXECUTION

3.01 PIPING AND FITTING APPLICATIONS

A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.

B. Acid Waste and Vent Piping Systems, Above Ground: Fire Retardant Polypropylene pipe and drainage pattern fittings, single wall.

C. Reverse Osmosis Piping System: Polypropylene pressure piping and socket fusion joints, George Fischer "Beta Polypropylene" product line or equal.

3.02 WASTE PIPING INSTALLATION

A. General: Install piping systems in strict accord with manufacturers written instructions, as well as applicable ASTM standards.

B. Make changes in direction for drainage and vent piping using appropriate Y branches, Y branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Sanitary tees and short-sweep quarter bends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical. Use long-turn double-Y-branch and 1/8-bend fittings where 2 fixtures are installed back to back or side by side and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than 90 degrees. Where different sizes of drainage pipes and fittings are connected, use proper size standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

C. Install horizontal runs of drainage and vent piping at the following minimum slopes, except where another slope is indicated:
   1. Waste Piping, smaller than 4-inch diameter carrier pipe: 1/4-inch per foot, (2 percent).
   2. Waste Piping, 4-inches and larger carrier pipe: 1/8-inch per foot, (1 percent).
   3. Vent Piping: 1/8 inch per foot, (1- percent).

D. Sleeves are not required for pipes passing through concrete slab, without membrane waterproofing, on grade.

E. Install cleanouts in process waste piping systems according to the following:
   1. Size same as the carrier piping up to 4-inch size. Use 4-inch size for larger carrier piping.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for carrier piping 4 inches and smaller and 100 feet for larger carrier piping.
   4. Locate at base of each vertical waste stack.
   5. Locate at the building wall at drainage exit points from the building.

F. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

G. Install flashing flange and clamping device with each stack and cleanout passing through floors having waterproof membrane.

H. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to the manufacturer's written instruction.

I. Install 180 degree return bends on vent terminations above the roof.

3.04 REVERSE OSMOSIS PIPING INSTALLATION

A. General: Install piping system in strict accord with manufacturer's written instructions.

B. Piping installations shall minimize non-circulated portions of the system. In no case shall the length of a non-circulated piping section exceed (6) pipe diameters.

C. Joint construction to be by the heat fusion method only.

D. Install vent valves at system high points. Install drain valves at system low points.

E. System installation shall be performed in a clean manner, to maintain the cleanliness of the pipe, valves and fittings. Installed must have a minimum of 5 years of experience in the installation of "clean" piping systems, using plastic piping systems of similar joining methods.

F. The installation of this piping system shall be done only while the areas being worked in are in a vacuumed-cleaned condition. Pre-assembly of portions of the piping system may be done in a remote construction area that has been cleaned, or in other building areas, in trailers, or at a remote site, all at the discretion of the installing contractor to maintain the system cleanliness.

3.05 HANGERS AND SUPPORTS INSTALLATION

A. Hanger and support devices are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal piping with following maximum spacing and minimum rod sizes:

Nom. Pipe Size (Inches)	Plastic Drainage & Vent Pipe Max. Span (Feet)	Plastic Pressure Pipe Max. Span (Feet)	Min. Rod Diameter (Inches)
1/2	-	2	3/8
3/4	-	2.5	3/8
1	-	2.5	3/8
1-1/4	-	3	3/8
1-1/2	4	3.5	3/8
2	5	4	3/8
3	6	-	3/8
4	6	-	3/8

C. Support vertical runs of piping at each floor

3.06 CONNECTIONS

A. Connect waste piping systems to waste treatment equipment.

B. Connect water piping to water purification equipment.

3.07 FIELD QUALITY CONTROL

A. Inspect acid waste and vent systems piping as follows:
   1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction and SMMA respresentative.
   2. During progress of installation, notify the plumbing official having jurisdiction at least 24 hours prior to time of inspection. Perform tests specified below in presence of the plumbing official.
      a. Roughing-in Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures and equipment.
      b. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
   3. Reinspections: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.
   4. Reports: Prepare inspection reports signed by the plumbing official.

B. Acid Waste and Vent Piping System Tests, (Carrier Piping): Test systems according to procedures of authority having jurisdiction, or in absence of published procedure, as follows:
   1. Test for leaks and defects new piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of the system tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced piping until it has been tested and approved. Expose for testing all such work that has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure: Test piping systems at completion of roughing-in piping installation. Tightly close all openings in piping system, and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures and equipment have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves the building, and introduce air into the system equal to pressure of 1-inch water column. Use a U tube or manometer inserted in the trap of a fixture to measure this pressure. Air pressure shall remain constant without introduction of additional air throughout period of inspection. Inspect fixture connections for gas and water leaks.
5. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

C. Acid Waste Containment Piping Tests: Test containment piping as follows:
1. Test for leaks and defects new piping systems and parts of existing systems which have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of the system tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced piping until it has been tested and approved. Expose for testing all such work that has been covered or concealed before it has been tested and approved.
3. Test Procedure: Tightly close all openings in piping system, and fill space between carrier and containment piping with 5 psig compressed air, (5 psig is the maximum allowable air pressure, as well as the test pressure). Inspect joints for leaks. Air pressure shall remain constant without introduction of additional air throughout 15-minute period of inspection.
4. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

D. Reverse Osmosis Piping Tests:
1. Test for leaks and defects in new piping systems. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
2. Leave uncovered and unconcealed all new piping until it has been tested and approved. Expose for testing all such work that has been covered or concealed before it has been tested and approved.
3. Valve off and subject the piping system to a static water pressure of 150% of normal operating pressure, not less than 100 psig, (at ambient temperatures). Do not exceed the pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
a. 1.0 megohm/cm RO water only shall be used to test the piping system.
4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

E. Comply with USM IDAT per section 01810.

3.08 CLEANING

A. Acid Waste: Clean acid waste piping by thoroughly flushing with potable or protected water. Clean piping systems prior to bringing process waste treatment on-line.

B. Reverse Osmosis Piping: Cleaning of the distribution piping system to be performed by the RO equipment vendor.

3.09 SYSTEMS START-UP

A. Before Starting Checks: Perform the following final checks before startup:
1. Verify specified tests of piping systems are complete.
2. Verify that specified tests of waste treatment equipment are complete.
3. Verify that specified testing and cleaning of the RO system are complete. Coordinate RO start-up with the RO equipment vendor.

END OF SECTION 15241