SECTION 22 66 00
CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for chemical waste systems, including piping, neutralization equipment and all necessary accessories as designated in this section.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

F. Section 07 92 00, JOINT SEALANTS.

G. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

H. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

I. Section 22 07 11, PLUMBING INSULATION.

J. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

A13.1-2007.....Scheme for Identification of Piping Systems

A112.3.1-2007.....Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above and Below Ground

B1.20.1-2013.....Pipe Threads, General Purpose, Inch

B16.11-2011.....Forged Fittings, Socket-Welding and Threaded

B16.12-2009.....Cast Iron Threaded Drainage Fittings

B16.15-2013.....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

C. American Society for Testing and Materials (ASTM):

A74-2013a.....Standard Specification for Cast Iron Soil Pipe and Fittings

A183-2003 (R2009).....Standard Specification for Carbon Steel Track Bolts and Nuts

A312/A312M-2013b.....Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe

A518/A518M-1999 (R2012).Standard Specification for Corrosion-Resistant High-Silicon Iron Castings

A666-2010.....Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

A733-2013.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

A861-2004 (R2013).....Standard Specification for High-Silicon Iron Pipe and Fittings

C564-2012.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C1036-2011e1.....Standard Specification for Flat Glass

C1053-2000 (R2010).....Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications

D2321-2011.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2447-03.....Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter

D2564-2012.....Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2012.....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-1996 (R2010).....Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

D3222-2005 (R2010).....Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials

D4101-2011.....Standard Specification for Polypropylene Injection and Extrusion Materials

E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials

F402-2005 (R2012).....Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F493-2004.....Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

F1412-2009.....Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems

F1673-2010.....Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems

F2618-2009.....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems

D. Cast Iron Soil Pipe Institute (CISPI):

2006.....Cast Iron Soil Pipe and Fittings Handbook, 12th Printing

301-2012.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012.....Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

E. International Code Council (ICC):

IPC-2012.....International Plumbing Code

F. National Electrical Manufacturers Association (NEMA):
250-2008.....Enclosures for Electrical Equipment (1000 Volts Maximum)

G. Underwriters' Laboratories, Inc. (UL):
723-2008.....Test for Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Chemical resistant waste and vent piping
   2. Silver recovery piping
   3. Ethylene oxide
   4. Piping specialties
   5. Cleanouts
   6. Floor drains
   7. Waterproofing

D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

E. Seismic-Design Submittal: For seismic restraints of aboveground piping, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.

3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

H. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments, construction revisions and any equipment substitutions.

B. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on Auto-Cad version //____// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

C. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Chemical-Waste Service: Do not interrupt chemical-waste service to facilities occupied unless permitted under

the following conditions and then only after arranging to provide temporary chemical-waste service according to requirements indicated:

1. Provide written notice to COR no fewer than two days in advance of proposed interruption of chemical-waste service.
2. Do not proceed with interruption of chemical-waste service without COR's written permission.

PART 2 - PRODUCTS

2.1 CHEMICAL RESISTANT WASTE AND VENT PIPING

A. The material shall include connecting fittings in stacks or mains.

B. Chlorinated Poly (Vinyl Chloride) (CPVC) pipe shall be manufactured from CPVC Type IV, ASTM Cell Classification 23447 and in strict accordance to the requirements of ASTM F2618 for physical dimensions and tolerances and certified by NSF International for corrosive waste end use (NSF-cw). Joining method for pipe and fittings shall be solvent cement welding. Solvent cement shall be a solvent cement specially formulated for resistance to corrosive chemicals and manufactured in accordance with ASTM F 493. This pipe shall have a flame spread rating of < 25 and a smoke development rating of < 50 when tested for surface burning characteristics in accordance with ASTM E84 and UL 723 or equivalent.

2.2 SILVER RECOVERY PIPING

A. Silver recovery piping shall be Polyvinyl Chloride (PVC) pipe with drainage pattern fittings conforming to ASTM D2665.

2.3 ETHYLENE OXIDE (ETO) WASTE PIPING

A. ETO waste pipe material shall be schedule 10, stainless steel, conforming to ASTM A312/A312M with butt welded joints and fittings.

2.4 PIPING SPECIALTIES

A. Plastic dilution traps shall be corrosion resistant polypropylene with removable base and mechanical joint connections. The dilution tanks shall have a 3.8 liter (one gallon) capacity with a clear base unless color base is indicated. The dilution tank shall have two 40 mm or DN40 (NPS 1-1/2) top inlets and one 40 mm or DN40 (NPS 1-1/2) side outlet.

B. High silicon iron dilution traps shall have 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 or NPS 2) as required for fixture and waste with mechanical joints, and conforming to ASTM A861.

C. Glass drain line interceptor drum traps shall have 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 or NPS 2) as required for fixture and waste and conforming to ASTM C1053.

D. Corrosion resistant P-trap or drum trap shall have 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 or NPS 2) as required for fixture and waste and conform to ASTM A861 for high silicon iron pipe with hubless joints, ASTM D4101 for polypropylene pipe with mechanical joints, ASTM D3222 for PVDF pipe with mechanical joints, and ASTM C1053 for glass pipe with coupling connections.

2.5 CLEANOUTS

A. Cleanouts shall be the same size as the pipe, up to 100 mm or DN100 (4 inches); not less than 100 mm or DN100 (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged chemical waste drain.

B. Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. The cleanout shall be vertically adjustable for a minimum of 50 mm or DN50 (2 inches). When a waterproof membrane is used in the floor system, a clamping collar shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on drawings.

C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. The vertical cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover shall be furnished with a minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without

disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.6 FLOOR DRAINS

A. Type L: Flushing Rim Drain. Heavy cast iron body, double drainage pattern with flushing rim and clamping device. Solid bronze gasketed grate approximately 275 mm (11 inches) in diameter, with 50 mm (2 inch) length of 20 mm (3/4 inch) brass pipe brazed or threaded into the center of the solid grate, pipe shall be threaded and provide brass cap with inter gasket (neoprene) to provide a gas tight installation. Attach deep seal P-trap to drain. Body and trap shall have pipe taps for water supply connections:

1. Drain Flange: Flange for synthetic flooring.

2. Cystoscopy Rooms:

a. Flush Valve: The flush valve shall be large diaphragm type flushometer, solenoid operated with a single circuit timer. Mount in valve cabinet.

b. Operation: Valve solenoid shall be cycled by a single circuit timer set to operate flush valve at five minute intervals. Timer shall be electrically connected to an "on - off" toggle switch and be provided with pilot light. Timer and flush valve shall operate only when timer/valve switch is in the "on" position.

c. Valve Cabinets:

1) General: Sheet metal not lighter than 1.6 mm thick (16 gauge), size as required, rigidly assembled with joints welded, and punched or drilled for passage of required pipes and services. Provide anchors for fastening cabinet in place. Front shall be flush with wall finish and shall have flush fitting, hinged doors, with latch. Door shall be arranged to not offer any obstruction when open.

2) Doors and Trim: Flush with front of cabinet, constructed of not lighter than number 2.7 mm thick (12 gauge) steel. Doors

shall open through 180 degrees and be provided with two butt hinges or continuous hinge. Latch shall be provided by manufacture of cabinet.

3) Painting: Prime and finish painting is specified under Division 09.

2.7 WATERPROOFING

A. A sleeve flashing device shall be provide at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

B. Walls: See detail shown on drawings.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the International Plumbing Code and these specifications.

B. Branch piping for chemical waste piping system shall be installed and connected to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

C. Piping shall be installed for reagent racks. The piping shall be arranged neatly and located as required by the equipment.

D. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

E. All pipe runs shall be laid out to avoid interference with other work.

F. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.

G. The piping shall be installed to permit valve servicing or operation.

H. The piping shall be installed at the indicated slopes or according to the International Plumbing Code.

I. The piping shall be installed free of sags and bends.

J. Seismic restraint shall be installed where required by code.

K. Changes in direction for chemical waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer’s written instruction for use of lubricants, cements, and other installation requirements.

M. Cast iron piping shall be installed according to CISPI’s “Cast Iron Soil Pipe and Fittings Handbook,” Chapter IV, “Installation of Cast Iron Soil Pipe and Fittings”.

N. Aboveground CPVC piping shall be installed according to ASTM F2618. Underground CPVC piping shall be installed according to ASTM D2321.

O. PVDF piping shall be installed according to ASTM F1673 and manufacturer’s recommendations.

P. Silver recovery, aboveground PVC piping shall be installed according to ASTM D2665, and underground PVC piping shall be installed according to ASTM D2321.

Q. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

R. Chemical-resistant vent pipe shall be independently vented through the roof.

3.2 JOINT CONSTRUCTION

A. Hubless, cast iron piping shall be joined in accordance with CISPI’s “Cast Iron Soil Pipe and Fittings Handbook” for hubless piping coupling joints.

B. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.
   2. Pipe sections with damaged threads shall be replaced with new sections of pipe.
C. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.
B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.
C. All chemical waste piping shall be joined with specialty fittings in accordance with referenced standards and manufacturer’s recommendations for the applications used.

3.4 PIPE HANGERS, SUPPORTS, AND ACCESSORIES

A. All piping shall be supported according to the International Plumbing Code, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.
B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Refer to Division 09.
C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.
D. Vinyl coated hangers shall be installed for glass piping. The maximum horizontal spacing and minimum rod diameters shall be:
   1. For 25 mm or DN25 to 32 mm DN32 (NPS 1 and NPS 1-1/4), the maximum spacing shall be 1.22 meters (48 inches) with 10 mm (3/8 inch) rod.
   2. For 40 mm or DN40 and 50 mm or DN50 (NPS 1-1/2 and NPS 2), the maximum spacing shall be 1.83 meters (72 inches) with 10 mm (3/8 inch) rod.

3. For 75 mm or DN75 (NPS 3 inch), the maximum spacing shall be 1.83 meters (72 inches) with 15 mm (1/2 inch) rod.
4. For 100 mm or DN100 (NPS 4 inch), the maximum spacing shall be 1.83 meters (72 inches) with 18 mm (5/8 inch) rod.

E. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 meters (15 feet).

F. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PUMBING, floor, Wall and Ceiling Plates, Supports, and Hangers shall have the following characteristics:
1. Solid or split unplated cast iron.
2. All plates shall be provided with set screws.
3. Height adjustable clevis type pipe hangers.
4. Adjustable Floor Rests and Base Flanges shall be steel.
5. Hanger Rods shall below carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
6. Riser Clamps shall be malleable iron or steel.
7. Rollers shall be Cast iron.
8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 100 mm (4 inches) in length and be 16 gauge steel. The shield shall be sized for the insulation.

G. Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories.

H. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

I. Penetrations:
1. Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a firestop system that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the firestopping materials.

2. At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

J. Chemical waste and vent piping shall conform to the following:

1. Where waste lines from fixtures are shown on plans to be chemical resistant, vents from those fixtures shall also be chemical resistant.
2. Storage and installation for PVDF or CPVC chemical resistant pipe shall comply with ASTM D2665.
3. Glass Pipe installation shall be as recommended by the manufacturer. Glass pipe pitch shall be 1 : 50 (1/4 inch per foot), minimum.
4. Silver recovery pipe pitch shall be 1 : 200 (0.5 percent), minimum.
5. Mechanically Joined Polypropylene Pipe requires a pre-grooved pipe or cutting of a groove in each pipe section using a rotation cutting tool. Polypropylene chemical resistant pipe pitch shall be 6 mm minimum (1/4 inch per foot) minimum. Mechanically joined pipe shall not be installed below grade.
6. Plastic chemical waste pipe shall not be installed within 23 m (75 feet) of hot water appliances (autoclaves, dishwashers, sterilizers) and similar equipment.
7. High silicon content cast iron pipe with bell and spigot joints and heat fusion plastic pipe may be used below grade under building.
8. Stainless steel, mechanical joints shall not be installed below grade.
9. Stainless Steel Piping system shall be Joined and supported per manufacturer's recommendations.

3.5 TESTS

A. The chemical resistant pipe system shall be tested either in its entirety or in sections.

B. Tests for Chemical Resistant Waste, vent, and Silver Recovery Systems shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted as directed.

1. Entire system is tested using a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of

water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. Entire system is tested using an air pressure test of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and column gage shall be used for the test.
3. Final Tests: Either one of the following tests may be used.
   a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
   b. Peppermint Test: Introduce 60 ml (two ounces) of peppermint into each line or stack.

3.6 STARTUP AND TESTING

A. As recommended by product manufacturer and listed standards and under actual or simulated operating conditions, tests shall be conducted to prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with each integrated system.

B. The tests shall include system capacity, control function, and alarm functions.

C. When any defects are detected, correct defects and repeat test at no additional costs to the Government.

D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative and Commissioning Agent. Provide a minimum of 7 days prior to notice.

3.7 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.8 DEMONSTRATION AND TESTING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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