

WATER SYSTEM COMPONENTS

****From Danville FEGC 028-3(32)**

- xx. DESCRIPTION. This work shall consist of providing all labor, tools, materials, and equipment necessary to furnish and install a pressure reducing vault and appurtenances, insertion valves, and ductile iron piping in a water system at the locations indicated in the Plans and as specified herein.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Section 629 of the Standard Specifications.

- xx. MATERIALS. All materials shall conform to the applicable requirements of the Standard Specifications, except as modified herein. Approved equals to the materials/parts detailed in the Plans may be substituted as specified in SUBMITTALS of this Section.

- xx. QUALITY CONTROL. The Contractor shall establish and maintain quality control to assure compliance with Contract requirements and shall maintain records of quality control for all materials, equipment, and construction operations, including but not limited to the following:

- (a) Installation and testing.
- (b) Training of staff.
- (c) Accepted Fabrication Drawings.
- (d) Operational Tests. A copy of these records and Contractor's tests, as well as the records of corrective action taken, shall be furnished to the Engineer and Agency.
- (e) Record Drawings.

- xx. SUBMITTALS.

- (a) In addition to the requirements specified herein, Fabrication Drawings shall be submitted for approval for the system components including all piping, fittings, valves, etc. in accordance with Subsection 105.03 for all items associated with the pressure reducing vault and insertion valve.
- (b) Substitutions. Products and materials of equal quality, detail, function, and performance may be proposed for substitution.

Any proposal for substitution shall be made in writing by the Contractor, who shall submit full details for consideration, including cost savings, and obtain written approval of the Agency. The Agency's decision as to the acceptability of the substitute materials shall be final.

Approval by the Agency for such substitution shall not relieve the Contractor from responsibility regarding a satisfactory installation of such work in accordance with the intent of the Plans and specifications, and shall not affect the Contractor's guarantee covering all parts of the work.

Any material or equipment submitted for approval which is arranged differently or of a different physical size from that shown or specified shall be accompanied by Fabrication Drawings indicating the different arrangements of size and the method of making the various connections to the equipment. The final results shall be compatible with the system as designed.

xx. ROOF HATCH.

(a) Work Requirements.

- (1) Furnishing prefabricated hatches with operable hardware and counter flashing and curb.
- (2) Installation.
- (3) Warranty.

(b) Submittals.

- (1) Fabrication Drawings and product data.
- (2) Manufacturer's installation instructions.

(c) Roof Hatches.

- (1) The roof hatches shall be a standard corrosion resistant aluminum cast-in-place floor door.

(d) Warranty.

- (1) The manufacturer shall provide a 25-year warranty against defects in material and workmanship.

(e) Hatches.

- (1) Hatches. Quantity, sizes, and location as shown on the Plans.
- (2) Cover and Frame. Cover shall be a 6 mm, diamond pattern thread plate reinforced to 300 psf live load. Frame shall be an extruded aluminum channel frame with bend down anchor tabs around the perimeter, with a 38 mm drain coupling welded under the frame for a pipe connection.
- (3) Hardware. Manufacturer's standard manually operated type with compression spring operators, positive snap latch with turn handles inside, and automatic hold-open arm with vinyl covered grip handle for easy release. All hardware shall be stainless steel.
- (4) Hinges. Stainless steel contained within the hatch.
- (5) Latch. Type 316 ss slam lock with fixed interior handle and removable exterior turn/lift handle.

(6) Minimum live load 300 PSF.

(f) Safety Post.

(1) Provide a safety post.

(2) The safety post shall be installed within the pressure reducing vault. The unit shall be completely assembled with fasteners for securing to the manhole rungs in accordance with the manufacturer's instructions.

(g) Installation.

(1) Install as shown on the Plans and in accordance with the manufacturer's instructions. Provide weather tight installations.

(2) The Contractor shall do all necessary cutting or grinding of openings required for the installation of the hatches and shall do all necessary fitting, scribing, leveling, and other work necessary.

(3) The safety post shall be hot-dip galvanized which will attach to the fixed manhole rungs within the vault. The post device shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel balancing mechanism.

(h) Cleaning.

(1) At completion of installation, clean all work, removing all cartons and packaging materials.

xx. PRESSURE REDUCING VALVES.

(a) General. This work shall consist of furnishing and installing the pressure reducing valves as shown on the Plans or as specified herein.

(1) The 200 mm (8 inch) pressure reducing valve shall be specifically designed using "DELRIN" sleeve stems to operate on a very infrequent basis (once a year) and not be subject to failure in either open or closed position.

(2) The exterior of all valves shall be coated at the factory with a fusion bond epoxy coating on an average thickness of 12 mils.

(b) Materials. Materials shall meet the following requirements:

(1) Hydraulically operated, diaphragm actuated, globe or angle pattern valves (as shown on the Plans) shall be furnished and installed by the Contractor. The valves shall have a cast-iron body with a resilient synthetic rubber disc having a rectangular cross section.

- (2) The diaphragm shall consist of nylon fabric bonded with synthetic rubber. The diaphragm shall not be used as the seated surface. Leather seats will not be accepted.
- (3) The pilot controls shall be direct acting, adjustable, spring loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice.
- (4) Pressure reducing valves shall be designed to maintain a constant downstream pressure regardless of varying inlet pressure. The valves shall be of the size shown on the Plans. These valves shall include the closing and opening speed control. Pilot system shut- off cocks, and X101 valve position indicator, a "Y" type strainer, and a 30 to 300 psi spring. All 32 mm (1 ¼ inch) valves shall be equipped with stainless steel trim. The reducing valves shall require less than 5 psi differential to initiate opening and positive downstream pressure control. The following valves are required:

Valve Type	End Details
200 mm (8 inch) Reducing	Flanged
32 mm (1¼ inch) Reducing	Screwed

(c) Submittals.

- (1) Fabrication Drawings, product data, and manufacturer's instructions for installation and use.
- (2) Operation and Maintenance Manual.

(d) Installation.

- (1) The valves shall be installed in strict conformance with the manufacturer's instructions.

(e) Warranty.

- (1) The manufacturer of the pressure reducing valves furnished under this Section shall be responsible for the proper operation of the system when installed according to their instructions. Warranties shall be provided by the manufacturers and shall warrant the units being supplied to the Owner of the water system against defects in workmanship and materials for a period of three (3) years prorated under normal use, operation, and service. A copy of the warranty statement shall be submitted with the approval drawings.

(f) Manufacturer's Service.

- (1) The manufacturer of pressure reducing valves and accessories shall furnish the services of a factory trained representative to check the installation, test, make necessary adjustments, and place equipment in service. The valves shall be calibrated under the direction of the representative. A signed report shall be submitted to the Engineer stating that the equipment has been installed in accordance with the manufacturer's recommendations and that the calibration has been performed on each valve and found to be in full compliance with these provisions.
 - a. Installation Inspection. The manufacturer shall provide the services of a qualified representative to check the installation of each unit and associated equipment prior to placing it into service. After completion of the inspection, the manufacturer shall certify in writing that the installation is proper and that the equipment is ready to start, or make changes and adjustments that may be necessary to ready the equipment for start-up.
 - b. Start-up. Following certification that the equipment has been properly installed and is ready to start-up, the manufacturer shall supply the services of a representative to start the equipment and ensure its proper operation.
 - c. Operator Training. A minimum of four (4) hours of on-site training shall be provided to the Owner of water system personnel in the operation and maintenance of the equipment.
 - d. Performance testing as specified herein.
 - e. The manufacturer's service engineer shall field-adjust all equipment as required to place them in trouble-free operation. This service shall be performed at the request of the Engineer at the time or prior to start-up.

xx. VAULT PIPING.

- (a) General. The Contractor shall furnish, install, and test all of the required plant piping, fittings, and valves for conducting water and other fluids as indicated on the Plans.

Drain piping is specified elsewhere.

- (b) Submittals.

- (1) Before the work is undertaken, submit to the Engineer a complete list of all materials proposed to be furnished and installed.
 - a. Show manufacturer's name and catalog number for pipe, fittings, and valves, together with the catalog cuts

and technical data and the manufacturer's recommendations as to method of installation.

- b. Upon approval of the Engineer, the manufacturer's recommendations shall become the basis for acceptance or rejection of actual methods of installation used in the work.

(c) Product Handling.

- (1) Protection. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout progress of the work.
- (2) Replacements. In the event of loss or damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

(d) Pipe and Fittings.

- (1) All pipe and fittings shall be flanged conforming to AWWA C110 and ANSI A21.10 (125 pound bolt circle), unless otherwise indicated.
- (2) The following pipe materials shall be utilized:
- a. Where shown on the Plans, piping shall be cement lined, ductile iron pipe meeting the requirements of AWWA and ANSI-A21.50-1981 with the following thicknesses:

Size	Thickness	Class
100 mm (4 inch)	8.890 mm (0.35 inch)	53
150 mm (4 inch)	9.398 mm (0.37 inch)	53
200 mm (8 inch)	9.906 mm (0.39 inch)	53

All pipe, spools, and connectors within the vault shall be factory primed and factory epoxy coated with a 12 mil (min) thickness of epoxy, unless otherwise indicated.

- b. Nominal diameters, 25 mm (1 inch) to less than 100 mm (4 inches), shall be seamless ASTM B46 red brass meeting the requirements of ANSI B-16.15 and H-271. Dimensions shall be as scheduled below:

Nominal Diameter	Wall Thickness	End Configuration	Outside Diameter
25 mm (1 inch)	3.200 mm (0.126 inch)	NPT	33.401 (1.315 inches)
32 mm (1¼ inches)	3.708 mm (0.146	NPT	42.164 (1.660

	inch)		inches)
40 mm (1½ inches)	3.810 mm (0.150 inch)	NPT	48.260 (1.900 inches)
50 mm (2 inches)	3.912 mm (0.156 inch)	Flanged	60.325 (2.375 inches)
65 mm (2½ inches)	4.750 mm (0.187 inch)	Flanged	73.025 (2.875 inches)
80 mm (3 inches)	5.563 mm (0.219 inch)	Flanged	88.900 (3.500 inches)

- c. Nominal diameters less than 25 mm (1 inch) carrying water shall be rigid type K copper. Copper tubing shall be hard tempered not recommended for bending, in conformance with ASTM B88.
- d. Nominal diameters less than 25 mm (1 inch) carrying materials other than water shall be Schedule 80, Type 1, Grade 1, PVC as outlined in ASTM D 1784 pipe conforming to ASTM D 1785.

(3) The following fitting materials shall be utilized:

- a. Nominal diameters 100 mm (4 inches) and above shall be flanged ductile iron meeting the requirements of ANSI A21.10 AWWA C100 (125 pound bolt circle). Manufacturer's exceptions as to design dimensions and thickness shall be allowed. The minimum thickness shall be equal to per Class 54 ductile iron as per ANSI/AWWA C151/A21.51. Fittings shall have a cement mortar lining and interior seal coating in accordance with ANSI/AWWA C104/201.4. Ductile iron shall be in accordance with ASTM A 536. All fittings, valves, spools, and connectors shall be factory primed and factory epoxy coated of a minimum 12 mil thickness of epoxy, unless otherwise indicated.
- b. Nominal diameters 25 mm (1 inch) to less than 100 mm (4 inches) shall be bronze in accordance with ASTM B 62. All fittings shall be specifically designed for a minimum working pressure of 400 psi meeting ANSI B16.15. Nominal diameters less than 50 mm (2 inches) shall be threaded NPT and 50 mm (2 inches) and above shall be flanged ANSI A21.10.
- c. Nominal diameters less than 25 mm (1 inch) carrying water shall be in accordance with ASTM B 62. All fittings shall be specifically designed for a minimum working pressure of 400 psi meeting ANSI B151.5. Fittings shall be threaded (NPT).

- d. Nominal diameters less than 25 mm (1 inch) carrying materials other than water shall be PVC I, Schedule 80 socket type conforming to ASTM D 2457. Solvent cement for PVC pipe shall conform to ASTM D 2564. Threaded fittings, if required, shall conform to Schedule 80, PVC I, ASTM D 2464.
- (4) Wall Sleeve. All mechanical penetrations through the vault shall utilize a mechanical joint wall sleeve equal to Clow Model F-1429.
 - (5) Flange Fillers. Flanger fillers for use between two flanges shall be equal to Clow F-1984. The outside shall be factory primed and epoxy coated.
 - (6) Valves at Nominal Diameter Less than 80 mm (3 inches).
 - a. Check valves shall be ASTM B 61 bronze designed for a minimum working pressure of 300 psi water.
 - b. Globe valves shall be ASTM B 61 bronze designed for a minimum pressure of 500 psi water. Valves shall include stainless steel heat-treated plug disc and seat ring.
 - c. Petcocks shall be ASTM B 61 bronze designed for a minimum working pressure of 300 psi water. Valves shall be solid wedge, inside screw, non-rising stem with a screw in bonnet.
 - d. Gate valves shall be ASTM B 61 bronze design for a minimum pressure of 300 psi water. Valves shall be solid wedge, inside screw, non-rising stem with a crew in bonnet.
 - e. Needle valve shall be designed for a minimum pressure of 250 psi. Valves shall be ASTM B 61 bronze.
 - f. Ball valves shall be Type I, Grate I, PVC of the true union type specifically designed for working pressure of not less than 150 psi. Valves shall have permanently lubricated Teflon seats, ABS handle, and Vitron or EPT "O-rings". Unions shall be treated by socket to permit easy removal of the valve without disassembly of the valve from the line.
 - g. Pressure gauge (indicating) shall be 4½ inch diameter in brass case, turret type. Gauge shall be constructed with advanced Bourdon Tube technique, using spring-like alloy helical coil which shall unwind around its own axis linearly in proportion to the pressure applied. Bearings shall provide positive bearing alignment independent of dial face. Accuracy shall be two percent of reading. Pressure range shall be as set by the Engineer. Connections shall be ¼ inch NPT at the bottom. Dials to be aluminum, primer-painted white background with black

characters. Pressure gauge range shall be 0 psi to 200 psi with two psi increments.

(e) Preparation.

- (1) The Plans are based upon design specifications. Exact routing of piping shall be shown on Fabrication Drawings to meet field conditions and coordination between trades.
- (2) Erect piping in straight alignment, parallel to building lines or columns without springing, forcing, or bending; with adequate provisions for thermal expansion and contraction to prevent undue strains on piping or apparatus connected. Arrange branches to take up motion of main.
- (3) Erect piping to clear obstructions, maintain access to openings and passageways, provide maximum headroom and ample space for operations, adjustment and maintenance of valves, and unions and other appurtenances. Keep piping arrangements simple and neat with adequate clearance.
- (4) Make changes in size and direction with fittings. Use couplings only between full lengths of pipe or tubing. Do not use miter fittings, face of flush bushings, close nipples, or street elbows.
- (5) Do not place buried piping deeper than downward slope of 45° from footings and bearing walls parallel to piping.
- (6) Pitch water piping upward in direction of flow and arrange fittings to permit air to be vented automatically to system high points or to expansion tank, and to permit complete drainage to low points. Use eccentric fittings where necessary.
- (7) Provide flanges or unions and arrange piping to permit easy replacement of piping specialties, control valves, and equipment. Provide piping including valves and strainers therein at line size. Make size reductions at points of final connection only.
- (8) Exercise care in handling of pipe, tubing, and fittings to prevent wrench and vise marks. Use tools designed to prevent damage to surface finish of piping.
- (9) Inside of piping must be smooth, clean, and free from blisters, loose mill scale, oxides, and sand, dirt, concrete, and other foreign objects when erected. Keep openings closed during construction.
- (10) Only shoulder nipples shall be used. No close nipples permitted.
- (11) Screw threads shall be clean and true; screw joints made tight without caulking. A non-hardening lubricant will be permitted. No bushings shall be used. Reductions to be

made with eccentric reducers with the tops leveled. Ream out pipe after cutting to remove all burrs.

- (12) Miscellaneous drains, vents, reliefs, and overflows from tanks, equipment, piping, relief valves, pumps, etc., shall be run to the nearest open sight drain or roof drain. Provide drain valves whenever required for complete drainage of piping.
- (13) Cut pipe and tubing ends square, remove burrs and ream to original bore. Clean joint surfaces prior to assembly. Wipe off excess jointing compounds and flux residue.
- (14) Remove scale and dirt, inside and out, before assembly.
- (15) Remove welding slag or foreign material from pipe and fitting materials.

xx. SERVICES OF MANUFACTURER'S REPRESENTATIVES.

(a) Work Included.

- (1) Observing installation of equipment.
- (2) Checking, inspecting, and adjusting equipment and certification of equipment, alarms, instrumentation, and controls.
- (3) Performance testing and start-up of equipment, alarms, instrumentation, and controls.
- (4) Operator training.

(b) Observing Installation; Checking, Inspecting, and Adjusting Equipment, and Certification of Equipment, Alarms, Instrumentation, and Controls.

- (1) Furnish the services of a manufacturer's qualified representative to observe the actual installation of equipment indicated on the schedule in 900.37 E.1 - SERVICES OF MANUFACTURER'S REPRESENTATIVES of this Specification.
- (2) Furnish the services of a manufacturer's qualified trained service representative or designee acceptable to the Agency, to check, inspect, and adjust all equipment and accessories in accordance with the schedule in 900.37 E.1 - SERVICES OF MANUFACTURER'S REPRESENTATIVES of this Specification and in accordance with individual specification sections. The services shall begin when the equipment is requested to be placed into operation by the Contractor and as approved by the Engineer.
- (3) The minimum period of time that the service representatives shall perform the services described herein shall be in accordance with the schedule specified herein. Any additional time to correct and make equipment ready to

start-up will be "as required" and at no additional cost to the Agency or Owner of the water system.

- (4) The service representative shall inspect the equipment for proper installation, lubrication and adjustment, damage, and missing parts; inspect and check control systems and accessory equipment whether or not supplied by other manufacturers; and make all necessary corrections to make equipment ready to start-up and properly operate after start-up.
- (5) Prior to equipment start-up, the service representative shall furnish a letter to the Engineer confirming that equipment installation is in conformance with the manufacturer's recommendations; that all alignments, adjustments, and corrections have been made; and that the equipment is ready for operation.
- (6) Schedule of Manufacturer's Service Representative.
 - (1) Services of the manufacturer's representatives for observing installation, inspecting, adjusting, testing, and start-up shall be provided for the following equipment:

Equipment Description	Days of Observing and Certifying Installation	Days of Observing, Inspecting, Testing, Startup, and Certification	Days of Operator Training
Pressure Reducing Valve	1	1	1

xx. METHOD OF MEASUREMENT. The quantities of Special Provision (Ductile Iron Pipe, Cement-Lined) and Special Provision (Seamless Copper Water Tube, All-Inclusive) of the size specified to be measured for payment will be the number of meters (linear feet) installed in the complete and accepted work, as measured along the flow line of the pipe.

The quantities of Special Provision (Insertion Valve with Valve Box) of the size specified and of Special Provision (Pressure Reducer Vault) to be measured for payment will be on a lump sum basis in the complete and accepted work.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Ductile Iron Pipe, Cement-Lined) of the size and class specified will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for furnishing, transporting, handling, installing, testing, and disinfecting the materials specified, including fittings and clamps; for making all necessary connections; for furnishing and placing the concrete or other materials for reaction backing or furnishing and installing tie rods, clamps, and restrained joints; excavation, including backfill and disposal of excavated material not suitable for backfill; backfill, including material

required to replace poor foundation material below the normal grade of the pipe; and for furnishing all tools, labor, equipment, and incidentals necessary to complete the work.

The accepted quantity of Special Provision (Seamless Copper Water Tube, All-Inclusive) of the size and class specified will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for furnishing, transporting, handling, installing, testing, and disinfecting the materials specified, including fittings and clamps; for making all necessary connections; for furnishing and placing the concrete or other materials for reaction backing or furnishing and installing tie rods, clamps, and restrained joints; excavation, including backfill and disposal of excavated material not suitable for backfill; backfill, including material required to replace poor foundation material below the normal grade of the pipe; and for furnishing all tools, labor, equipment, and incidentals necessary to complete the work.

The accepted quantity of Special Provision (Insertion Valve with Valve Box) of the size specified will be paid for at the Contract lump sum price. Payment will be full compensation for furnishing and installing the materials specified, including all interior piping and appurtenances; for preparing and making specified submittals; for required manufacturer's supervision; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

The accepted quantity of Special Provision (Pressure Reducing Vault) will be paid for at the Contract lump sum price. Payment will be full compensation for furnishing and installing the materials specified, including but not limited to flanged DI pipe, gate valves, pressure reducing valve, drainage piping, concrete pipe supports, concrete vault, insulation, crushed gravel, filter fabric, roof hatch, manhole rungs, solid sleeve, MJ wall sleeve, waterproofing, and floor drain; excavation and backfill; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work..

Payment will be made under:

900.640 Special Provision (Ductile Iron Pipe, Cement-Lined, All-Inclusive)(X mm (X"))	Meter (Linear Foot)
900.640 Special Provision (Seamless Copper Water Tube, All-Inclusive)(X mm (X"))	Meter (Linear Foot)
900.645 Special Provision (Insertion Valve with Valve Box)(X mm (X"))	Lump Sum
900.645 Special Provision (Pressure Reducing Vault)	Lump Sum