

SECTION 400513

PIPELINES, PROCESS PIPING

PART 1 GENERAL

1.1 SUMMARY

Section Includes:

1. Carbon steel piping system
2. Plastic piping system.
3. High-density polyethylene (HDPE).
4. Trench systems

1.2 SYSTEM DESCRIPTION

This specification covers the requirements for above grade process pipe, pipe supports, fittings, equipment and accessories from the Soil Vapor Extraction (SVE) well heads to the treatment system at Kirtland Air Force Base (AFB), Albuquerque, New Mexico.

Performance Requirements

The pressure ratings and materials specified represent minimum acceptable standards for piping systems. The piping systems shall be suitable for the services specified and intended. Each piping system shall be coordinated to function as a unit. Flanges, valves, fittings and appurtenances shall have a pressure rating no less than that required for the system in which they are installed.

Above Grade Piping Systems

Piping systems shall be suitable for design conditions, considering the piping both with and without internal pressure, and installation factors such as insulation, support spans, and ambient temperatures. Consideration shall be given to all operating and service conditions both internal and external to the piping systems.

1.3 QUALITY ASSURANCE

1.3.1 Jointing of Polyethylene Piping

- a. Join piping by performance qualified PE joiners, qualified by a person who has been trained and certified by the manufacturer of the pipe, using manufacturer's pre-qualified joining procedures. Inspect joints by an inspector qualified in the joining procedures being used. Welders training, qualifications and procedures, (metal and PE) includes use of equipment, explanation of the procedure, and successfully making joints which pass testing.

b. Submit a certificate of qualified jointing procedures, training procedures, qualifications of trainer, and training test results for joiners and inspectors. Notify the Contracting Officer at least 24 hours in advance of the date to qualify joiners and inspectors

1.4 DELIVERY, STORAGE, AND HANDLING

Materials delivered and placed in storage shall be stored with protection from the weather, excessive humidity variation, excessive temperature variation, dirt, dust and/or other contaminants. Proper protection and care of material before, during and after installation is the Contractor's responsibility. Any material found to be damaged shall be replaced at the Contractor's expense. During installation, piping shall be capped to keep out dirt and other foreign matter. A material safety data sheet in conformance with 29 CFR 1910 Section 1200(g) shall accompany each chemical delivered for use in pipe installation. At a minimum, this includes all solvents, solvent cements, glues and other materials that may contain hazardous compounds. Handling shall be in accordance with ASTM F 402. Storage facilities shall be classified and marked in accordance with NFPA 704. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) radiation damage, or other damage. Pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendation. Plastic pipe shall be packed, packaged and marked in accordance with ASTM D 3892.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide piping materials and appurtenances as specified and as shown on the drawings, and suitable for the service intended. Piping materials, appurtenances, and equipment supplied as part of this contract shall be of equal material and ratings as the connecting pipe, new and unused except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer. The general materials to be used for the piping systems shall be in accordance with the mechanical piping drawings. Pipe fittings shall be compatible with the applicable pipe materials.

2.1.1 Standard Products

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacturing of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Nominal sizes for standardized products shall be used. Pipe, valves, fittings and appurtenances shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.2 CARBON STEEL PIPING SYSTEM

2.2.1 Carbon Steel Pipe

2.2.1.1 General Service

Carbon steel pipe shall meet the requirements of ASTM A 53/A 53M seamless, Grade A, Schedule 40, galvanized.

2.2.2 Carbon Steel Joints

Carbon steel piping 3" and smaller shall be joined by taper-threaded couplings. Carbon steel piping larger than 3" shall be joined by welding. Dielectric fittings or isolation joints shall be provided between all dissimilar metals.

2.2.3 Carbon Steel Fittings

Fittings shall be carbon steel, galvanized.

2.2.3.1 Threaded Fittings

Threaded fittings shall be Class 150, malleable iron, ASTM A 47/A 47M, conforming to ASME B16.3, black, banded, and threaded in accordance with ASME B1.20.2MASME B1.20.1. Threaded, rigid couplings shall be seamless, Type II (electrogalvanized) carbon steel in accordance with ASTM A 865/A 865M and threaded in accordance with ASME B1.20.2MASME B1.20.1. Polytetrafluoroethylene (PTFE) pipe-thread tape conforming to ASTM D 3308 shall be used for lubricant/sealant.

2.2.3.2 Welding Fittings

Welding fittings shall be butt-welding. Welding fittings shall be forged steel, Class 150 low-carbon steel, ASTM A234/ A234M seamless conforming to ASME B16.9.

2.2.3.3 Flanged Fittings

The internal diameter bores of flanges and flanged fittings shall be the same as that of the associated pipe. The flanges shall be slip-on type. Flanges and flanged fittings shall be forged steel, ASTM A 105/A 105M, faced and drilled to ASME B16.5 Class 150 with a 0.0625 inch raised face. Cast steel backing flanges, ASTM A 216/A 216M Grade WCA Bolting shall be alloy-steel ASTM A 193/A 193M Grade B5 hex head bolts and ASTM A 194/A 194M Grade 8 hex head nuts. When mating flange on valves or equipment is cast iron, ASTM A 193/A 193M Grade B8 Class 1bolts and ASTM A 194/A 194M Grade 8 heavy hex head nuts shall be used. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall meet the requirements of ASME B16.5. Nonmetallic gaskets shall conform to ASME B16.21 and be a 0.125 inch thick chloroprene rubber, durometer hardness No.80, 1,500 psi minimum tensile strength, 125 percent minimum elongation, flat ring type for use with raised face flanges.

2.3 PLASTIC PIPING SYSTEM

Plastic piping and fittings shall conform to the following, unless otherwise indicated on mechanical piping drawings:

2.3.1 PVC Pipe

PVC, ASTM D 1784, minimum cell classification 12545-C, pipe shall be Schedule 80 conforming to ASTM D 1785 manufactured to an SDR rating in accordance with ASTM D 2241, so that the pressure rating of the pipe is consistent for all pipe sizes.

2.3.2 PVC Joints

The piping system shall be joined by socket-weld connections except where connecting to unions, valves, and equipment with that may require future disassembly. Connections at those points with piping diameter less than 4" shall be threaded and back-welded, and diameters larger than 4" shall be flanged. Tubing connections shall use compression fittings.

2.3.3 PVC Fittings

The schedule rating for the fittings shall not be less than that for the associated pipe. Fittings shall be ASTM D 1784, minimum cell classification, PVC conforming to the requirements of ASTM D 2467, socket type.

2.3.4 PVC Solvent Cement

Socket connections shall be joined with PVC solvent cement conforming to ASTM D 2564. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility. Joints shall be prepared with primers conforming to ASTM F 656 prior to cementing and assembly.

2.4 HIGH-DENSITY POLYETHYLENE (HDPE)

HDPE piping and fittings shall conform to the following, unless otherwise indicated on mechanical piping drawings:

2.4.1 HDPE Pipe

PE, AWWA Pipe: AWWA C906, DR No. 17, Iron Pipe Sizes (IPS) with PE compound number 3408 required to give pressure rating not less than 200 psig.

2.4.2 PE Joints

PE pipe shall be joined by thermal butt-fusion, except where connecting to valves and equipment that may require future disassembly, then joints shall be flanged.

2.4.3 PE Fittings

AWWA Fittings: AWWA C906, molded butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.

2.4.3.1 Couplings

Couplings and saddle joints shall be joined by electrofusion in accordance with ASTM F 1055.

2.4.3.2 Flanged Fittings

AWWA Fittings: AWWA C906, molded butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.

2.5 ISOLATION JOINTS AND COUPLINGS

2.5.1 Dielectric Fittings

Dielectric fittings shall be provided between threaded ferrous and nonferrous metallic pipe, fittings and valves. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure, temperature and corrosive application.

2.5.2 Isolation Joints

Isolation joints shall be provided between non-threaded ferrous and nonferrous metallic pipe fittings and valves. Isolation joints shall consist of an isolation gasket of the dielectric type, isolation washers and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with an outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

2.5.3 Metallic Piping Couplings

Thrust ties shall be provided where shown on the contract drawings and where required to restrain the force developed by 1.5 times the maximum allowable operating pressures specified. For metallic pipe other than ductile iron, thrust ties shall be attached with fabricated lugs. For ductile iron pipe, thrust ties shall be attached with socket clamps against a grooved joint coupling or flange. For exposed installations, zinc-plated nuts and bolts shall be used. However, high-strength, low-alloy steel, in accordance with AWWA C111/A21.11, may be substituted for use on cast iron and ductile iron couplings.

2.5.4 Couplings for Nonmetallic Piping

2.5.4.1 Bellows Coupling

A bellows coupling shall have a minimum of two polytetrafluoroethylene (PTFE) convolutions unless otherwise shown, with ductile iron flanged, faced and drilled to ASME B16.5 Class 125 end connections, and metal reinforcing bands. The maximum allowable working pressure shall

be 140 psig 120 degrees F. Bolting shall be limited to restrain the force developed by 1.5 times the specified maximum allowable operating pressure. The coupling shall be sized to match the associated piping.

2.5.4.2 Compression Coupling

A compression coupling shall consist of one steel middle section, two steel mechanical nuts, two elastomeric gaskets and two machined steel lock rings. The coupling shall use ethylene propylene diene monomer (EPDM) wedge gaskets. The maximum allowable working pressure shall be 150 psig 120 degrees F. The coupling shall be sized to match the associated piping.

2.6 VALVES

2.6.1 General Requirements For Valves

Valves shall include operator, actuator, hand wheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and all other accessories required for a complete operation. The valves shall be suitable for the intended service. Renewable parts are not to be of a lower quality than those specified. Valves shall be the same size as adjoining pipe unless otherwise indicated on drawings. Valve ends shall be compatible with adjacent piping system. An operator shall be sized to operate the associated valve for the full range of pressures and velocities. Valves will open by turning counterclockwise. Operators, actuators, and accessories shall be factory mounted. Valves in main water distribution piping shall have the ability to except locks for lockout tag, out requirements.

2.6.2 Factory Finishing

Valves shall have an epoxy lining and coating in accordance with AWWA C550 unless otherwise specified. The epoxy shall be either a two-part liquid material or a heat-activated (fusion) material except that only a heat-activated material shall apply if a valve coating is specified as "fusion" or "fusion bonded" epoxy. The epoxy lining and coating shall have a minimum of 7.0 mils dry film thickness except where it is limited by valve operating tolerances. Exposed valves shall be finished in accordance with Section 099000 Painting. Safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be painted "safety yellow."

2.6.3 Ball Valves

2.6.3.1 General Purpose Ball Valves

General purpose ball valves shall conform to the following unless otherwise specified on the mechanical piping drawings:

- a. Ball valves, shall be end entry type with bronze bodies and threaded, in accordance with ASME B1.20.2MASME B1.20.1 regular ports. Valves shall have polytetrafluoroethylene (PTFE) seats and packing, stainless steel balls and hand lever operators. Valves shall be rated for 200 psig service at 150 degrees F.

2.6.3.2 Thermoplastic Ball Valve

Thermoplastic ball valves, 6 inch and smaller, shall be rated for 150 psig service at 120 degrees F, and have ASTM D 1784, polyvinyl chloride (PVC) bodies, balls, and stems. Valves shall be end entry, double union design, with solvent-weld socket ends connections, a ethylene propylene diene monomer (EPDM) seat, and ethylene propylene diene monomer (EPDM) O-ring stem seals. Valves shall have hand lever operators.

2.7 DRAINS AND SAMPLE PORTS

Valved drains and sample ports shall follow the requirements below unless otherwise specified on the mechanical piping drawings.

2.7.1 Locations

All pipeline low points shall be drained. A sample port shall be located immediately downstream of a treatment process. The sample ports shall be located in easily accessible locations, and shall avoid potential stagnant points and/or areas where material could collect.

2.7.2 Sizes

For pipelines 2.5 inch and larger, drains shall be 0.5 inch and equipped with ball valves.

2.8 MISCELLANEOUS PIPING COMPONENTS

The following requirements shall be followed unless otherwise indicated on the mechanical piping drawings.

2.9.1 Vacuum Breakers

Vacuum breakers shall be located as indicated on the mechanical piping drawings. Vacuum breakers 2 inch and smaller shall be an angle type with all cast iron bodies and bonnets, and shall be installed at least 6 inches above the flood line of associated equipment.

2.9.2 Strainers

Strainers shall be installed at start-up and then removed after the system is in normal operation.

2.9.3 Pipe Expansion

2.9.3.1 Expansion Joints

Provide all structural work and equipment required to control expansion and contraction of piping. Verify that the anchors, guides, and expansion joints provided, adequately protect the

piping systems. Locations of expansion joints are located on the contract drawings.

2.9.3.2 Expansion Loops

Expansion shall be accommodated by loops and bends as indicated on the drawings. Pipe in the loops and bends shall accommodate expansion while maintaining required insulation clearance from floors, walls, tops, and other pipes and structures to avoid damage to pipe. Expansion loops may be designed around obstacles such as utility manholes, structures, or trees to avoid construction conflicts. Slopes of pipe and trench bottoms shall be maintained. Contractor shall have the option to adjust the loop dimensions around obstacles based on final field measurements, if approved by Shaw. Submit dimensions to Shaw for verification of loop and bend sizes before proceeding with that segment of work. Allowable pipe stresses shall be in accordance with [ASME B31.1](#).

2.9.4 Pressure Relief Devices

Pressure relief devices shall conform to the requirements of ASME B31.3.

2.10 PIPE SUPPORTS

Provide auxiliary steel where the support of piping systems and equipment is required between building structural elements. Light gauge and structural steel shapes shall conform to the requirements of ASTM A 36/A 36M. The Contractor has the option to use pre-engineered support systems of electrogalvanized steel products. However, a mixture of support system manufacturers products is not permitted. Details of pipe supports are located on the contract drawings.

2.11 CONCRETE TRENCH SYSTEMS

A pre-cast concrete trench system at road crossings shall be provided and installed with a removable top as shown on the drawings.

2.11.1 Joint Sealants

Concrete joints shall be sealed as indicated. Type II sealant (nonsagging) shall be used for vertical joints. Type I sealant shall be used for trench top butt joints. All other joints shall be sealed with Type I or Type II sealant. Sealant in trench bottom shall finish flush with floor.

2.11.2 Concrete Trench Tops

Concrete trench tops shall be metal grate with H-20 load ratings when on vehicle traffic right of way. Concrete trench tops shall be constructed in maximum lengths of 8 feet. Each top section shall be provided with means to accept a lifting device for removal of grate, or as indicated on the drawings.

3.7.4 Concrete Trench Construction

The concrete trench shall be of the sizes indicated on drawings. Inside edge and top of walls shall have smooth even surfaces to accommodate trench tops.

3.7.6 Coordination with Existing Utilities

Before beginning work in a given area, all utility information shall be field verified by surface markings made by the affected utility Owner's Representative. Notify Shaw in advance, and receive prior approval before excavating in any areas. The actual concrete trench routing may be offset or changed if approved by Shaw in order to reduce conflicts, interruptions, expedite the work, or for any other reason to the mutual benefit of the Contractor and the Government.

3.7.9 Pipe Anchors and Supports

Pipe anchors and supports shall be as indicated on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 PREPARATION

3.2.1 Protection

Pipe and equipment openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage.

3.2.2 System Preparation

3.2.2.1 Pipe and Fittings

Pipe and fittings shall be inspected before exposed piping is installed or buried piping is lowered into the trench. Clean the ends of pipes thoroughly, remove foreign matter and dirt from inside of pipes, and keep piping clean during and after laying.

3.2.2.2 Damaged Coatings

Repair damaged coating areas in the field with material equal to the original coating, except for damaged glass-lined pipe which shall be promptly removed from the site. Do not install damaged piping materials. Field repair of damaged and uncoated areas of galvanized piping shall conform

to ASTM A 780/A 780M.

3.2.2.3 Field Fabrication

Notify the Contracting Officer at least 2 weeks prior to the field fabrication of pipe or fittings and at least 3 days prior to the start of any surface preparation or coating application work. Welding electrodes shall be provided in accordance with Table 3.1 of AWS D1.1/D1.1M as required for the applicable base metals and welding process. Fabrication of fittings shall be performed in accordance with the manufacturer's instructions.

3.3 EXPOSED PIPING INSTALLATION

Exposed piping shall be run as straight as practical along the alignment shown on the contract drawings and with a minimum of joints. Piping and appurtenances shall be installed in conformance with reviewed shop drawings, manufacturer's instructions and ASME B31.3. Piping shall be installed without springing or forcing the pipe.

3.3.1 Anchors and Fasteners

Impact expansion (hammer and explosive charge drive-type) anchors and fastener systems are not acceptable. Lead shields, plastic or fiber inserts, and drilled-in plastic sleeve/nail drive systems are also not acceptable.

3.3.1.1 Drilled-In Expansion Anchors and Fasteners

Anchors shall be designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. The expander nut shall be fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches, and bears against the shield bottom. The shield body shall consist of four legs, the inside of each shall be tapered toward shield bottom (or nut end). The end of one leg shall be elongated and turned across shield bottom. The outer surface of shield body shall be ribbed for grip-action. The expander nut shall be of square design with sides tapered inward from bottom to top. The anchor materials of construction shall be TP304 stainless steel 43,541 psi minimum tensile strength. Fasteners shall be machine bolts for use with above anchors; nuts and washers shall conform to ASTM A 194/A 194M. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application.

3.3.1.2 Drilled-In Adhesive Anchors

Drilled-in adhesive anchors shall not be used for overhead applications. The anchors shall be composed of an anchor rod assembly and an anchor rod adhesive cartridge. The anchor rod assembly shall be a chamfered and threaded stud rod of TP304 stainless steel with a nut and washer of TP316 stainless steel. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application. The adhesive cartridge shall be a sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. The capsule

ingredients shall be activated by the insertion procedure of the anchor rod assembly.

3.3.2 Piping Expansion and Contraction Provisions

The piping shall be installed to allow for thermal expansion and contraction resulting from the difference between installation and operating temperatures. Design for installation of plastic pipe exposed to ambient conditions or in which the temperature variation of the contents is substantial shall have provisions for movement due to thermal expansion and contraction documented to be in accordance with PPI TR-21. Anchors shall be installed as shown in the contract drawings to withstand expansion thrust loads and to direct and control thermal expansion. An intermediate pipe guide shall be installed for every pipe at each metal channel framing support not carrying an anchor or alignment guide. Where pipe expansion joints are required, pipe alignment guides shall be installed adjacent to the expansion device and within four pipe diameters. Expansion devices shall be installed in accordance with the manufacturer's instructions and at the locations shown in the mechanical piping drawings.

3.3.3 Piping Flexibility Provisions

Thrust protection shall be provided as required. Flexible couplings and expansion joints shall be installed at connections to equipment, and where shown on the contract drawings. Additional pipe anchors and flexible couplings beyond those shown on the mechanical piping drawings, shall be provided to facilitate piping installation, in accordance with reviewed shop drawings.

3.3.4 Couplings, Adapters and Service Saddles

Pipes shall be thoroughly cleaned of oil, scale, rust, and dirt in order to provide a clean seat for gaskets. Gaskets shall be wiped clean prior to installation. Flexible couplings and flanged coupling adapter gaskets shall be lubricated with the manufacturer's standard lubricant before installation on the pipe ends. Couplings, service saddles, and anchor studs shall be installed in accordance with manufacturer's instructions. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Torque-limiting wrenches shall be used to tighten bolts.

3.3.5 Piping Equipment/Component Installation

Piping components and indicators shall be installed in accordance with manufacturer's instructions. Required upstream and downstream clearances, isolation valves, and miscellaneous devices shall be provided for an operable installation. Straight runs of piping upstream and downstream of flow measuring devices shall be as shown in the mechanical piping drawings or as recommended by the instrument manufacturer.

3.3.6 Pipe Flanges

Pipe flanges shall be set level, plumb, and aligned. Flanged fittings shall be installed true and perpendicular to the axis of the pipe. The bolt holes shall be concentric to the centerline of the pipe.

3.3.7 Valve Locations

Valves shall be located in accordance with the contract drawings where actuators are shown. Where actuators are not shown, valves shall be located and oriented to permit easy access to the valve operator, and to avoid interferences.

3.3.8 Pipe Tap Connections

Taps to pipe barrels are unacceptable. Taps to ductile iron piping shall be made only with a service saddle or at a tapping boss of a fitting, valve body, or equipment casting. Taps to steel piping shall be made only with a welded threadolet connection.

3.3.9 Plastic Pipe Installation

All plastic pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations. Heat joining and electrofusion joining shall be performed in accordance with AWWA C901/C906. Schedule 40 pipe shall not be threaded. Schedule 80 threaded nipples shall be used where necessary to connect to threaded valves or fittings. Strap wrenches shall be used for tightening threaded plastic joints, and care shall be taken not to over tighten these fittings. Pipe shall not be laid when the temperature is below 40.1 degrees F, nor above 90 degrees F when exposed to direct sunlight. Any plastic pipe installed above grade and outdoors shall be ultraviolet (UV) protected or UV resistant. The pipe ends that are to be joined shall be shielded from direct sunlight prior to and during the laying operation. Adequate ventilation shall be provided when working with pipe joint solvent cement and the handling of solvent cements, primers and cleaners shall be in accordance with ASTM F 402. Provide and install supports and hangers in accordance with the manufacturer's recommendations. Where plastic pipe is subjected to severe temperature fluctuations, provisions for expansion and contraction must be provided. This shall be accomplished with the use of expansion joints and offset piping arrangements. All lines shall be hydrostatically tested at the maximum operating pressures.

3.3.9.1 PVC Piping

Solvent-cemented joints shall be constructed in accordance with ASTM D 2855.

3.4 CONNECTING DISSIMILAR PIPE

Flexible transition couplings, dielectric fittings and isolation joints shall be installed in accordance with the manufacturer's instructions.

3.5 EXTERNAL CORROSION PROTECTION

Protect all pipe and piping accessories from corrosion and adverse environmental conditions.

3.6 ABOVE GRADE METALLIC PIPING

Nonferrous and stainless steel piping shall not be painted except for aluminum alloy piping. Where dissimilar metals are joined, isolation joints shall be used. Primed surfaces shall be

painted in accordance with Section 099000 Painting.

3.7 FLEXIBLE JOINTS AT CONCRETE STRUCTURES

Flexible joints shall be provided at the face of all structures. Refer to mechanical piping drawings for types and locations of flexible joints.

3.8 CLOSURES

Closure pieces shall be installed as necessary to end pipe runs and shall conform to ASME B16.9 or ASME B16.11. Elastomer sleeves bonded to pipe ends are not acceptable. Pressure piping shall have closures of blind flanges, with thickness matching the nominal wall thickness of the associated pipe, unless otherwise shown on mechanical piping drawings or approved by the Contracting Officer.

3.10 VALVE INSTALLATION

Flanged valve bolt holes shall be installed so as to straddle the vertical centerline of pipe. Flanged faces shall be cleaned prior to inserting the gasket and bolts, and then the nuts shall be tightened progressively and uniformly. Threaded ends shall have the threads cleaned by wire brushing or swabbing prior to installation.

3.10.1 Valve Orientation

The operating stem of a manual valve shall be installed in a vertical position when the valve is installed in horizontal runs of pipe having centerline elevations 4.5 feet or less above finished floor, unless otherwise shown on mechanical piping drawings.

3.10.1.1 Butterfly Valves

Orientation of butterfly valves shall take into account changes in pipe direction. Valve shafts shall be oriented so that unbalanced flows caused by pipe direction changes or other disturbances are equally divided to each half of the disc.

3.10.2 Isolation Valve

Safety isolation valves shall be installed on compressed air supplies. The valve shall be located to provide accessibility for control and maintenance. If necessary, access doors shall be installed in finished walls and plaster ceilings for valve access.

3.11 AIR RELEASE, DRAINS AND SAMPLE PORTS

Install sample ports, drains, and air release valves shall be provided where indicated on the mechanical piping drawings.

3.12 PIPING SUPPORT SYSTEMS INSTALLATION

The absence of pipe supports and details on the mechanical piping drawings shall not relieve the Contractor of responsibility for sizing and providing supports throughout plant.

3.12.1 General Support Requirements

Pipe support systems shall meet the requirements of MSS SP-58. Contractor-designed and selected support systems shall be installed in accordance with MSS SP-69, and as specified herein. Piping connections to equipment shall be supported by pipe supports and not off the equipment. Large or heavy valves, fittings, and/or equipment shall be supported independently of associated piping. Pipes shall not be supported off other pipes. Supports shall be provided at piping changes in direction or in elevation, adjacent to flexible joints and couplings, and where otherwise shown on the contract drawings. Pipe supports and hangers shall not be installed in equipment access areas or bridge crane runs. Hanging pipes shall be braced against horizontal movement by both longitudinal and lateral sway bracing. At each channel type support, every pipe shall be provided with an intermediate pipe guide, except where pipe anchors are required. Existing support systems may be used to support additional new piping only if the Contractor can demonstrate that the existing support systems are adequate for the additional loads, or if the existing systems are strengthened to support the additional loads. Pedestal type pipe supports shall be provided under base flanges adjacent to rotating equipment and where required to isolate vibration.

3.12.3 Dielectric Barriers

Dielectric barriers shall be installed between supports and copper or stainless steel piping, and between stainless steel supports and non-stainless steel ferrous piping.

3.12.4 Support Spacing

Refer to mechanical piping drawings and notes for support spacing.

3.14 FIELD QUALITY CONTROL

3.14.1 Hydrostatic Tests

Where any section of a pipeline is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least 5 days after the installation of the concrete thrust blocking, unless otherwise approved by the Contracting Officer.

3.14.1.2 Exposed Piping

3.14.2 Pneumatic Tests

Pneumatic testing shall be prepared for and conducted in accordance with the requirements of ASME B31.3. Care must be taken to minimize the chance of a brittle fracture or failure during a pneumatic leak test. Only non-toxic, nonflammable, inert gases or air shall be used.

3.14.2.1 Pressure Relief Device

During pneumatic testing, a pressure relief device shall be provided for each piping section being tested. The device shall have a set pressure not higher than the test pressure plus the lesser of 10 percent of the test pressure or 50.8 psi.

3.14.3 Pipe Leakage Tests

Unless approved by the Contracting Officer, leakage testing shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the piping shall be subjected to not less than 200 psig pressure. Leakage is defined as the quantity of the test liquid, water, that is supplied to the piping system, or any valved or approved section thereof, in order to maintain pressure within 5 psi of the specified leakage test pressure after the piping has been filled with the test liquid and all air is expelled. No piping installation will be accepted if leakage exceeds the allowable leakage determined by the following formula:

$$L = C_f \times N \times D \times P^{0.5}$$

C_f = conversion factor = 0.0001351
 L = allowable leakage, gallons per hour
 N = number of joints in the length of piping tested
 D = nominal pipe diameter, inches
 P = average test pressure during the test, psig.

Should any test disclose leakage greater than that allowed, the leaks shall be located and repaired until the leakage is within the specified allowance, without additional cost.

3.14.4 Testing New to Existing Connections

New piping connected to existing pipe, existing equipment, existing treatment systems, or tanks and treatment systems furnished under other Sections shall be tested. Isolate the new piping with pipe caps, spectacle blinds, or blind flanges. The joint between new piping and existing piping shall be tested by methods that do not place the entire existing system under the test load. Proceed, then, with the testing of new piping systems as specified herein.

3.14.5 Valve Testing

Valves may either be tested while testing pipelines, or as a separate step. It shall be demonstrated that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. Count and record the number of turns required to open and close each valve, and account for any discrepancies with manufacturer's data. Air and vacuum relief valves shall be examined as the associated pipe is being filled to verify venting and seating is fully functional. Set, verify, and record set pressures for all relief and regulating valves. Self-contained automatic valves shall be tested at both maximum and minimum operating ranges, and reset upon completion of test to the design value.

3.15 FINAL CLEANING

3.15.1 Interim Cleaning

Prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication. The piping shall be examined to assure removal of these and other foreign objects prior to assembly and installation.

3.16 TRENCH SYSTEMS

The concrete trench system shall be installed per manufacturer's installation instructions and contract drawings. Install the concrete trench at the elevation shown on the drawings and grade the adjacent areas. Any cut or fill areas adjacent to the concrete trench shall be graded back to the existing grade at a 1 to 10 slope, or as indicated. Care shall be taken to avoid forming pockets adjacent to the concrete trench; thereby, preventing surface drainage. The trench system grating and top elevation shall be installed at the same elevation as existing road elevation and a smooth transition shall be made between the two surfaces.

-- End of Section --