STANDARD CONSTRUCTION SPECIFICATIONS
FOR "STEP" PRESSURE SEWER SYSTEM
DIVISION 51.00
I N D E X

SECTION 51.01 GENERAL

Article 1.1 Scope of Work

The work covered by these Specifications consists of providing all plant, labor, equipment, supplies, material, transportation, and storage, and performing all operations necessary to complete the construction for pipe laying, jointing, and testing of the Septic Tank Effluent Pump (STEP) pressure sewer system, including the installation of interceptor tanks, vaults and pumping assemblies.

Requirements for earthwork including trench excavating and backfill are specified in Division 20.00 Standard Construction Specifications for Earthwork.

Article 1.2 Applicable Standards

The latest revision of the following standards of the American Society of Testing and Materials (ASTM), the American Association for State Highway and Transportation Officials (AASHTO), the American Standards Association (ASA), and the American Water Works Association (AWWA) are hereby made a part of these Specifications

ASTM A-48 & ASTM A-438	Strength Requirements for Manhole Frames and Covers
ASTM C-76	Specification for Reinforced Concrete Culvert
ASTM C-150	Specification for Portland Cement
ASTM C-478 (AASHTO-199)	Specification for Pre-cast Reinforced Concrete Manhole Sections
ASTM D-2321	Underground Installation of Thermoplastic Sewer Pipe
ASTM D-3034	Specification for PVC Sewer Pipe and Fittings
AASHTO M-45	Aggregate for Masonry Mortar
ASTM D-1248-84	Polyethylene Plastics Molding and Extrusion Materials
ASTM D-2837-85	Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D-3350-84	Polyethylene Plastics Pipe and Fittings Materials
ASTM D-2321-83a	Underground Installation of Thermoplastic Pressure Piping

ASTM D-3341-78	Polyethylene Foam Insulation
ASTM D-3035-85	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
ASTM D-3271-85	Butt Heat Fusion Polyethylene (PE)
	Plastic Fittings for Polyethylene (PE)
ASTM D-2657-79	Heat-Joining Polyolefin Pipe and Fittings
ASTME D-3350-84	Polyethylene Plastics and Fittings
ANSI B16.1-75	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ASTM F-714-85	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM D 3261-85	Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 2657-79	Heat-Joining Polyolefin Pipe and Fittings
ASTM D 3350-84	Polyethylene Plastics and Fittings
ANSI B16.1-75	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800 Based on Outside Diameter
ASTM F 645-80	Selection, Design and Installation of Thermoplastic Water Pressure Piping System
ASTM D 2683-85	Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Fittings
ASTM D 1598	Time-To-Failure of Plastic Pipe Under Constant Internal Pressure
ASTM D 1599	Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings

AWWA C 901-78	Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inches for water

Article 1.3 Suppliers'/Manufactures' Special Services

Installation Assistance: Competent and experienced technical personnel shall represent the manufacturers of all equipment and systems as may be necessary to resolve assembly or installation problems at the worksite, which are attributable to, or associated with, the equipment furnished.

Functional Testing: Where functional testing services are called for in the Specifications, or when technical assistance is necessary to resolve performance problems that may become apparent during the performance test, the manufacturer's representative shall provide such assistance as necessary to demonstrate the specified performance.

Training of Owner's Personnel: Where training is called for in the Specifications, the manufacturers or supplier's representative shall provide classroom and on-the-job training for the Owner's personnel in the operation and maintenance of the specified equipment.

Scheduling and Coordination of Services: The contractor shall designate and provide one person to be responsible for scheduling, coordinating, and expediting the specified services. Scheduling the services shall be done in cooperation with, and with the approval of the Engineer and Owner's operating personnel. Such schedule shall be arranged with the appropriate subcontractors, manufacturers, and suppliers in sufficient time to assure their compliance with the service requirements.

Costs for Services: Costs for providing services during installation, testing, and for the training of Owners personnel shall be included in the costs for providing the applicable specified equipment.

Where the number of days for services is stated in the Specifications, this shall be considered the minimum number of days. Should additional time be required for services, such time shall be at the expense of the manufacturer, supplier, or Contractor as applicable, at no additional cost to the Owner.

Where the number of days for services is not stated in the Specifications, services shall be furnished for installation, testing, and plant startup required providing the Owner with a satisfactorily operating facility.

Article 1.4 Manufacturer's Certificate of proper Installation

Where required in the Specifications, the Contractor shall submit manufacturer's certification of proper installation of equipment prior to startup or performance testing. Such certificate shall state that the equipment or system has been installed in accordance with the manufacturer's recommendation and has been inspected by a manufacturer's authorized representative that has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, and that the proper electrical and mechanical connections have been made.

Article 1.5 Samples and test Specimens

Where required in the Specifications, and determined necessary by the Engineer, test specimens or samples of materials, appliances, and fittings to be used or offered for use

in connection with the work shall be submitted to the Engineer at the Contractor's expense, with information about their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination to establish the quality or equality thereof, as applicable.

All samples and test specimens shall be submitted in ample time to enable the Engineer to make any tests or examinations necessary, without delay to the work. The Contractor will be held responsible for any loss of time due to his neglect or failure to deliver the required samples to the Engineer, as specified.

Samples also shall be taken during the course of the work, as required by the Engineer.

Laboratory tests and examinations that the Owner elects to make in its own laboratory will be made at no cost to the Contractor, except that, if a sample of any material or equipment proposed for use by the Contractor fails to meet the Specifications, the cost of testing subsequent samples shall be borne by the Contractor.

All tests required by the Specifications to be performed by an independent laboratory shall be made at the sole expense of the Contractor.

Material used in the work shall conform to the submitted samples and test certificates as approved by the Engineer.

Article 1.6 Certificates of Compliance with Specified Standards and Codes

A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the work. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate.

All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the work which conforms to the requirements of the Contract Documents and any such material not conforming to such requirements will be subject to rejection whether in place or not.

The Engineer reserves the right to refuse permission for use of material on the basis of a Certificate of Compliance.

The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

Article 1.7 Required Clearance from Water Mains

Interceptor tank, pump vault, or pressure sewer in the ground shall not be installed within 10 feet of a water line. Where the sewer and water lines must cross, the water line should be above a sewer line whenever possible, and the sewer line must be at least 18-inches measured vertically from the water line.

Article 1.8 Surveys

The contractor shall lay out in the field the alignment and grade of Work to be done under the Contract. The Contractor shall be responsible for the preservation of all line stakes, grade stakes, and hubs. In the event of their loss or destruction, the Contractor shall be responsible for their proper placement. The contractor shall be responsible for the transfer of the control points from the referenced hubs to such hubs or batter boards as he may desire or need for the prosecution of the Work.

Benchmarks, control points, and other information necessary for control of Work are shown on the Drawings. Prior to utilizing information such as benchmarks, etc., it shall be the Contractor's responsibility to verify benchmark elevations by checking between at least two benchmarks. The Contractor shall protect the existing benchmarks and control points. The Contractor shall be responsible for any necessary replacement.

Article 1.9 Record Documents

The Contractor shall maintain Record Documents on the job site consisting of a complete set of Drawings and the Project Manual on which all changes of material, equipment, dimensions, or other changes in the Work shall be recorded ("marked up") and kept current on a daily basis and shall be made available to the Engineer at all times. This shall include the following:

Placing special emphasis on concealed items, and substitutions for items specified or shown and including all approved changes.

Requiring subcontractors, including mechanical and electrical, to keep their portions up to date and corrects.

Dimensioning all relocations and routing adequately to assure easy access for maintenance or remodeling.

Upon completion of the "marked up" Record Documents, the Engineer will furnish to the Contractor Mylar reproducibles. The reproducibles shall be the base upon which the final Record Documents are prepared. The Contractor shall employ only personnel who are proficient in the preparation of engineering drawings.

All additions and corrections shall be neat, clean and legible, and match the adjacent existing line work and lettering annotated in type, density, size, and style. If additional drawings are required, the Contractor shall prepare them upon sheets of "Mylar" material of the same size as the original Drawings. Drawings damaged or lost by the Contractor shall be satisfactorily replaced by the contractor at his expense.

The Engineer will review all Record Documents for accuracy and conformance to the standards stated above. The Contractor shall make all corrections, changes, additions, and deletions required to conform to those standards.

Approved final Record Documents, bearing certification of their correctness, shall be delivered to the Engineer prior to the pre-final inspection.

SECTION 51.02 SEWER MAIN VAULTS

Article 2.1 Description

This section Covers the work necessary for the construction and installation of sewer main valve, cleanout, and inspection vaults, complete with frames and covers..

Article 2.2 Products

A Base Material

Shall conform to pipe bedding material as specified in Section 20.11 TRENCH EXCAVATION AND BACKFILL.

B Poured-In-Place Vaults

Poured-in-place type vaults may be used provided the engineer approves all details of construction.

C Concrete

Conform to Section 30.00 Portland Cement Concrete.

D Reinforcing Steel

Refer to Article 1.3 of Section 30.01 Portland Cement Concrete.

E Pre-cast Concrete Vaults

Pre-cast vault sections shall be minimum 48 inches in diameter, conforming to ASTM C 478. Minimum wall thickness shall be 4 inches. Provide eccentric cones for all vaults. Cones shall have same wall thickness and reinforcement as vault section. Top and bottom of all sections shall be parallel. Vault steps shall be cast in the pre-cast sections by the manufacturer. Joints shall be tongue-and-groove or confined O-ring with rubber gaskets conforming to ASTM C 443. The Contractor's attention is directed to specification for MORTAR hereinafter.

Prior to the delivery of any size of pre-cast manhole section on the jobsite, yard tests will be conducted at the point of manufacture. The pre-cast sections to be tested will be selected at random from the stockpile material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C14.

At the option of the Contractor, pre-cast base sections or bases may be used provided all details of construction are approved by the Engineer. Pre-cast base sections shall have the base slab integral with sidewalls. Base slabs shall be 6 inches thick with No. 4 reinforcing bars, 8-inch centers, both directions in center of slab. Tie reinforcing steel to wall steel. Provide open base rings in lieu of solid bases where shown on the plan or as directed by the Engineer.

F Grade Rings

Concrete Grade Rings for extensions shall be a minimum of 2 inches high and a maximum of 6 inches high and shall be approved by Engineer before installation.

G Mortar

Standard premixed mortar conforming to ASTM C 387 or proportion 1 part Portland cement to 2 parts clean, well graded sand that will pass a 1/8-inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: Hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the pipe if using the standard tongue-and-groove type joint. Mortar mixed for longer than 30 minutes shall not be used.

H Preformed Plastic Gaskets

Preformed plastic gaskets may be used in lieu of mortar type joints and shall be Kent-Seal No. 2 manufactured by Hamilton Kent Manufacturing Company, Box 178, Kent, OH 44140; or equal, meeting all requirements of Federal Specifications SS-S-00210.

I Vault Steps

Vault steps shall conform to ASTM C 478 and be made of minimum ¾-inch galvanized steel bar conforming to ASTM A 36, or ½-Inch polypropylene-coated grade 60 steel bar conforming to ASTM A 615. Steps shall be 12 inches wide minimum, center-to-center of legs, and shall be drop pattern and shall be done after bending. Polypropylene shall conform to ASTM 2146-82, Type II, Grade 43758.

The installed steps shall be located so as to provide a continuous ladder with steps equally spaced vertically in the assembled vault at 12 inches, plus or minus ¾-inch. Thy shall be capable of withstanding a force of 350 pounds, applied at any place on the step and in any direction which projects from the point of application through a diameter of the step cross-section at that point, with no permanent deformation resulting. Steps by M. A. Industries, Peachtree City, GA, or equal.

J Vault Frames and Covers

Vault frames and covers shall be Nennah Foundry Company R-1669 or approved equal. Covers shall be Type B design and shall have the word Sewer in 2-inch letters. Units shall be heavy duty. They shall be ductile iron Grade 60-40-18 meeting ASTM A 536.

Article 2.3 Construction

A Excavation and Backfill

Conform to applicable portions of Section 20.02, TRENCH EXCAVATION AND BACKFILL.

B Rock Base

Remove water from the excavation. Place a minimum of 6 inches of bedding material conforming to that required for the pipe.

C Placing Pre-cast Vault Sections

Carefully inspect pre-cast vault sections to be joined. Sections with chips or cracks in the tongue shall not be used. O-ring gaskets shall be installed in strict conformance with the manufacturer's recommendations. Only lubricant furnished by the gasket manufacturer will be used. The Contractor shall align pre-cast sections so that the steps form a vertical ladder throughout the height of the vault. Sections shall be set evenly to provide full seating of the O-ring with the grooves in the concrete sections. The interior joint shall then be filled with mortar and trimmed smooth.

D Preformed Plastic Gaskets

Carefully inspect pre-cast vault sections to be joined. Sections with chips or cracks in the tongu shall not be used. Preformed plastic gaskets shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the gasket manufacturer will be approved.

E Vault Sumps

Construct vault sumps in conformance with details shown on the Drawings.

F Vault Knockouts for Service Connections

Vaults with knockouts shall be provided where provision for future pipeline extension are shown on the Drawings.

G Vault Extensions and Grade Rings

Install extensions in conformance with the details shown on the Drawings, and to height determined by Engineer. Lay grade rings in Mortar with sides plumb and tops level. Seal joints with mortar as specified. Extensions shall be watertight. No more than 12 inches of grade rings shall be permitted on a vault.

H Vault Frames and Covers

Install frames and covers to prevent infiltration of water into vaults. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Vault Details on the Drawings. Set frames so tops of covers are approximately 8 inches below gravel roadway surfaces and ½ inch below paved roadway surfaces. Finish grade of vault frames in non-roadway areas shall be determined by the Engineer.

Article 2.4 Measurement

Vaults shall be measured as units completed in place.

Article 2.5 Basis of Payment

Payment for vaults will include payment for all work necessary to construct the vaults. Payment will be based on the unit price state in the Contractor's Proposal for the various diameters or rectangular sizes of vaults. Payment shall include compensation for a complete vault, including the base, steps, frame and cover, ring extensions, pipe

knockouts and waterproofing as directed by the Drawings or the Engineer, and for over-excavating and placing the compacted 6-inch layer of base rock under the concrete base.

No differentiation will be made for vaults with solid or open (ring) bases.

Payment shall be made under the following units:

ITEM	UNIT
Furnish and Install 4’ Diameter Concrete Vault	Each
Furnish and Install 6’ Diameter Concrete Vault	Each
Furnish and Install 8’ x 10’ Concrete Vault	Each

SECTION 51.03 VALVES, GATES AND ELECTRICAL ACTUATORS

Article 3.1 Description

This section covers the work necessary for furnishing and installing the various manually operated valves, check valves, and electric actuators.

See Conditions of the Contract and General Requirements, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

For the purpose of designating the type and grade of valve desired, a manufacture's name and list or figure number is given in the following specifications. Valves of equal quality by other manufacturers, which conform to these specifications, may be offered for approval by the Engineer, in accordance with the General Conditions.

Article 3.2 Materials

All valves shall be complete with all necessary operating hand-wheels, electric actuators, manual actuators, extension stems, floor stands, worm and gear operators, operating nuts, and wrenches which are required for the proper completion of the work included under this section.

Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service.

All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.

For the purpose of designating the type and grade of valve desired, a manufacturer's name and list or figure number is given in the following specifications. Valves of equal quality by other manufacturers, which conform to these Specifications, may be offered for approval by the Engineer, in accordance with the General Conditions.

A Brass and Bronze Components

Brass and Bronze components of valves and appurtenances which have surfaces in contact with the water shall be alloys containing less then 16 percent zinc and 2 percent aluminum. Approved Alloys are of the following ASTM designations:

B 61, B 62, B 98 (Alloy A, B, or D), B 139 (Alloy A), B 143 (Alloy 1-B), B 164, B194, B 292 (Alloy A), And B 127.

Stainless Steel Alloy 18-8 may be substituted for bronze at the option of the manufacturer and with the approval of the Engineer.

All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.

B Valve Operator for Electric Operated Valves

All Valve operators shall open by turning counterclockwise. Hand-wheel operators shall be provided unless otherwise shown or specified. Valves requiring enclosed

worm gear manual hand-wheel operators (GO) will be designated on the drawings. Worm and gear operators used on manually operated valves shall be of totally enclosed design, so proportioned as to permit operation of the valve under full operating head with a minimum pull of 40 pounds on the hand-wheel or crank. The valve operators shall be of the self-locking type to prevent the disc or plug from creeping. Self-Locking worm gears shall be a one-piece design of gear bronze material, accurately machine cut. The worm shall be hardened alloy steel, with thread ground and polished. The reduction gearing shall run in a proper lubricant. Valve operators shall be provided with position indicators, where specified, to show the position of the valve disc or plug. Hand-wheels shall be galvanized and painted the same color as the valve and associated pipeline.

C Gate Valves

1 Type 100

Gate valves 2 inches and smaller shall be all-bronze with screwed bonnet and ends, single solid wedge gate, and non-rising stem. Valves shall be rated 125-pound SWP, 200-pound WOG, and shall be Walworth Company Figure 4; Crane co. Cat. No. 438; or equal.

2 Type 110

Gate valves 2-1/2 inches and larger for buried service shall be iron body, mechanical joint ends, non-rising bronze stem with O-ring stem seals, with resilient seats applied to the body gate, shall seat against a corrosion-resistant surface, and shall open when the stem is rotated counterclockwise. Valves shall have 2-inch square operating nut. Conform to AWWA A509-80.

3 Type 115

Gate valves 2-1/2 inches and larger for buried service shall be iron body, mechanical joint ends, non-rising bronze stem with O-ring stem seals, with resilient seats applied to the body or gate, shall seat against a corrosion-resistant surface, and shall open when the stem is rotated counterclockwise. Valves shall have 2-inch square operating nut. Conform to AWWA A509-80.

The Valves shall have the interior surfaces of the valve body and the valve disc coated with material specified in AWWA C550-81, Sections 2.2. Joint materials for mechanical joint ductile iron pipe shall conform to AWWA C111. Valves shall be Mueller Resilient Seat Gate Valves, or equal.

D Ball Valves

1 Type 300

Threaded valves for use on lines thru 2 inches shall be AWWA approved, bronze valves , such as Model FB1000 manufactured by The Ford Meter Box Company, New York, New York; or equal.

2 Type 330

Thermoplastic ball valves 2 inches and smaller shall be rated 150 psi at 105 degrees F, with ASTM D 1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem. Valves shall be of end entry, double union design, with solvent weld socket ends. Valves shall have replaceable elastometer seats and Viton or Teflon O-ring stem seals. Valves shall have handle for manual operation.

Single Union ball valves with flanged ends drilled to 150-pound ANSI standard are also acceptable, including Chemtrol Series SU as manufactured by Celanese Piping Systems, Inc., Louisville, KY; McCannaplast Series 150 as manufactured by Hills McCanna Company, Carpentersville, IL; GSR valves as manufactured by R & G Slone manufacturing Company, Inc., a subsidiary of the Susquehanna Corp., Woodland Hills, CA; or equal.

E Plug Valves

1 Type 400

Eccentric plug valves 3 inches and smaller shall be of the nonlubricated type with attached wrench lever manual operator, rated 175-pound WOG. Valves shall have a cast iron body with screwed ends, balanced plug coated with Hycar or EPT elastomer, and O-ring seals. Valves shall be Homestead Figure 1512; DeZurik Series 100, Figure 118; or equal.

2 Type 405

Eccentric plug valves 4 inches through 20 inches shall be of the nonlubricated type with geared operators, unless otherwise shown. Valves shall be rated 150-pound WOG minimum, and shall have a cast iron body with flanged ends, balanced plug coated with Hycar or EPT elastomer, Buna-Vee packing or O-ring seals, stainless steel bearings, and nickel or epoxy coated seats. Flanges shall meet 125-pound ANSI Standards. Valves shall be Homestead Figure 1122 or 1522; DeZurik Series 100, Figure 118; or equal.

3 Type 460

Drain cocks, 1-inch and smaller, shall be 125-pound bronze body square-head type with screwed ends and stop, Crane Co. Cat. No. 254; Lunkenheimer Figure 454; or equal.

4 Type 462

Gauge cocks shall be 1/4 – inch bronze body valves, hexagon end pattern with tee head and male and female ends, rated for 125-pound SWP. Cocks shall be Lunkenheimer Figure 1180; Crane No. 744; or equal.

F Butterfly Valves

All butterfly Valves, except as herein otherwise noted, shall conform to AWWA C504, latest revision. All valve shafts shall be connected to operators by the use of keys and keyways. The use of compression or friction connections is not acceptable.

The seat on disc-seated valves shall be continuous around the periphery of the disc and shall not be penetrated by the valve shaft. Also the seat shall be adjustable and replaceable without removing the disc from the valve body on valves 30 inches and larger.

The seat on disc-seated valves shall be continuous around the periphery of the disc and shall not be penetrated by the valve shaft. Also the seat shall be adjustable and replaceable without removing the disc from the valve body on valves 30 inches and larger.

1 Type 500

Standard service butterfly valves 10 inches and smaller for low-pressure service shall be lug end, short body type, with electric operated valve actuators. Valves shall have ASTM A126, Class B cast iron valve body with 125-pound flange pattern drilled in accordance with ANSI B16.1. Valve disc shall be contoured ASTM A 395 ductile iron. Valve shaft shall be Type 304 stainless steel with self-lubricating, corrosion-resistant sleeve type bearings. Valve seat shall be attached to the valve body and shall be of Buna-N. Valves shall be Center Line Butterfly Valve Series LT, or equal.

2 Type 502

Lug wafer butterfly valves 12 inches and smaller shall have semi-steel bodies with bronze disc, Type 316 stainless steel disc and stem (AWWA C504-80, Class 75B minimum), reinforced TFE or TFE-coated stainless steel bearings at both ends, and neoprene or EPT replaceable resilient seat. Valves shall be bubbletight at 175-psi differential pressure and shall be suitable for installation between ANSI 125- and 150-pound flanges. Valves shall be gear operated Crane Monarch Model 23, DeZurik Figure 632-L, or equal.

3 Type 515

Buried service butterfly valves shall have ANSI/AWWA C111/A21.11, Class 150B, integrally cast mechanical joint ends and enclosed geared operators. Valves shall have ASTM A126, Class B cast iron body. Valve disc shall be contoured ASTM A 436, Type 1 Ni-resist cast iron with maximum lead content of 0.003 percent; ASTM A 48, class 40 cast iron or STM A 536, Grade 65-45-12 ductile iron. Valve shaft shall be Type 304 stainless steel type bearings. Valve seats shall have attached to either the valve body or the disc and shall be of natural rubber.

Operators shall be equipped with a square operating nut and be fully gasketed and grease packed to withstand an external ground-water pressure of 10-psi minimum. A valve position indicator shall show valve disc position, direction of rotation,

and number of turns from fully opened to fully closed. This indicator shall be provided by the valve manufacturer, complete. Valves shall be Henry Pratt Company Groundhog, Allis Chalmers Streamseal 150MJR, BIF Sure-Seal Model 0651, American-Darling 150B, or equal with ground level position indicator.

G Check Valves

Certain check valves require the mounting of limit switches and associated attachments; check process instrumentation and control drawings and the various process mechanical drawings for application. Switches shall actuate when the valve clapper is 0.1 inch off its seat.

1 Type 800

Check valves shall be threaded, bronze, swing check valves, such as Model 92-A, manufactured by Jenkins Valves of Bridgeport, Connecticut; Model 37, manufactured by Crane Company, New York, New York; or equal.

2 Type 805

Check Valves 2-1/2 inches through 12 inches inclusive shall be flanged end, cast iron body, bronze mounted swing type, with solid bronze hinges and stainless steel hinge shaft.

Valves shall be rated 200-pound WOG, and shall be List 37, Clearway check valves as manufactured by Ludlow-Rensselaer Valve Division of Patterson Industries, East Liverpool, OH; Crane Co. Cat. No. 373; or equal.

3 Type 807

Check valves 2-1/2 inches through 12 inches inclusive shall be flanged end, cast iron body, bronze mounted swing type, with solid bronze hinges, stainless steel hinge shaft, and outside level and weight. Valves shall be rated 200-pound WOG, and shall be List 340, Clearway check valves as manufactured by Ludlow-Rensselaer Valve Division of Patterson Industries, East Liverpool, OH; Crane Co. Cat. No 383; or equal.

4 Type 810

Check Valves 2-1/2 inches through 12 inches inclusive shall be flanged end, all-iron swing checks with stainless steel hinge shafts. Valves shall be rated 200-pound WOG, and shall be Walworth No. 928-1/2; Crane No. 373-1/2; or equal.

5 Type 812

Check valves 2-1/2 inches through 12 inches inclusive shall be flanged end, all-iron swing checks, with stainless steel hinge shafts and outside level and weight. Valves shall be rate 200-pound WOG, and shall be List 340, Clearway check valves as manufactured by Ludlow-Rensselaer Valve Division of Patterson Industries, East Liverpool, OH; Walworth No. LW-928-1/2; or equal

6 Type 820

Check valves for low-pressure process air service shall be iron body type with ANSI 150-pound flanged or grooved ends, rated 150 psig at 200 degrees F. Valves shall have bronze split disc mounted on Type 316 stainless steel center post, such that wafer type butterfly valve can be mounted directly downstream of check valve when discs of both valves are in the open position. Valves shall be Technocheck as manufactured by Techo Corporation, Erie, PA; Mission Duo-check Model 12HMP as manufactured by Mission Manufacturing co., Houston, TX; or equal.

7 Type 870

Ball Check valves 3 inches and larger shall be iron body with a sinking type hollow steel ball with vulcanized nitrile rubber exterior. Flanges shall be ANSI B16.1, Class 125 flat faced. Valve shall be rated 150-pound WOG, Suitable for vertical up or horizontal flow.

H Electric Actuators

1 Type 1100

Electric actuators for Type BV 1 butterfly valves for 90 degree open/close (power to open/power to close) service shall have no minimum operating differential pressure requirement and shall be capable against a maximum pressure of 25 psig for the valve size it is being used on. Actuator shall have a hand wheel manual override feature with an electrical lockout switch to prevent electrical operation while hand wheel engaged

Actuator shall have the following options, Heater and thermostat, end of travel light indication on standard limit switches, NEMA 4 enclosure, motor brake and relays for two-wire control, normally closed.

Motor shall be suitable for operation with 120 volts, 60-Hz power supply, with extended duty service capacitor, and shall be powered by an integral, single-phase reversible motor with overload protection.

Size of motor and actuator, in inch/pound torque requirements, shall be determined from the valve operating torque requirements, the diameter, and the operating pressure. Operating time shall be 16 seconds to either open or close.

2 Type EA2

Electric actuator for Type BV1 butterfly valve for 90-degree open/close (spring actuated fail open/power to close) service shall have no minimum operating differential pressure requirement and shall be capable of operating against a maximum pressure of 25 psig.

Actuator shall have the following options: Heater and thermostat, end of travel light indication on standard limit switches, and NEMA 4 enclosure.

Motor shall be suitable for operation with 120 volts, 60-Hz power supply, with extended duty service capacitor, and shall be powered by an integral, single-phase reversible motor with overload protection.

The motor and gear train components shall be connected to the output shaft by means of an electromechanical clutch assembly, which is capable of engagement on electric impulse and release upon power interruption. The actuator shall open the 4-inch butterfly valve Type 500 in Vault No. 1 upon power failure.

Actuator shall be Raymond Control Systems Type Surepower Series or equal.

3 Type P.V. 4

Gauge cocks shall be ¼-inch bronze body valves, hexagon end pattern with tee head and male and female ends, rated for 125-pound SWP. Cocks shall be Lunkenheimer Figure 1180; Crane No. 744; or equal.

Article 3.3 Miscellaneous

A Valve Boxes

Valve boxes shall be Buffalo two-piece sliding type, cast iron, with 5-1/4-inch shaft and shall be of appropriate length for the installation. The word SEWAGE shall be cast into the top of the lid. Extension pieces, if required, shall be the manufacturer's standard type. Units shall be Mueller H-10364, Clow Corporation F-2452, or equal. All units shall be complete with all necessary bases and accessories.

B Extension Stems for Valve Operators

Where the depth of the valve is such that its centerline is more than 4 feet below grade, operating extension stems shall be provided to bring the operating nut to a point 6 inches below the surface of the ground and /or box cover. Extension stems shall be constructed of steel and shall be complete with 2-inch square operating nut.

C Extension Bonnets for Valve Operators

Where shown on drawings, extension bonnets shall be supplied, complete with stem and accessories, as required to fit the given valves and operators. Bonnet and stem shall be constructed of steel and given manufacturer's standard paint system. Bonnets shall be as supplied by Pratt, Allis Chalmers, or equal.

D Floor Stands and Extension Stems

When required by the installations, floor stands and extension stems shall be provided for operation of valves. Floor stands shall be of the rising stem type, complete with all necessary steel extension stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Stem guides shall be spaced so that the stem L/R ratio does not exceed 200. Provide all necessary anchor bolts in Type 316 stainless steel. Floor stands shall be cast iron base type, Figure F-5510 as manufactured by Clow Corporation; Type 2P as manufactured by Waterman Industries; or equal. All handwheels shall turn counterclockwise to open the valves.

E T-Handled Operating Wrenches

Provide four galvanized operating wrenches, 4 feet total length, Mueller No. A-24610, Clow No. F-2520, or equal.

F Shear Gates

1 Type S.G. 1

Shear gates shall be cast iron of the flanged-face type, with bronze seat rings in frame and disc, and bronze hinge pin and bushings. Shear gates shall be furnished complete with lift handles of necessary length, hooks, and catch for installation as shown on the Drawings. Shear gates shall be Mueller Co. Figure A-2520-6; Clow Corporation Figure F-3002; or equal.

G Sluice Gates

1 Type S.G. G1

Sluice gates shall be cast iron, bronze mounted, and have solid bronze adjustable wedges. Sluice gates shall be Model F-5350, as manufactured by Clow Corporation, Bnsenville, Illinois; or equal.

H Combination Sewage Air Valves

1 Type A.R. 1

Combination air release valves shall have cast iron bodies and covers and stainless steel floats. Float guides, bushings, and lever pins shall be stainless steel. Valves shall be designed for operating service to 150 psi. The valves shall be APCO No. 400/402; or equal.

Article 3.4 Construction and Testing

Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reseat or replace the gasket, retighten and/or reinstall the nuts and bolts,, and retest the joints. Joints shall be watertight at test pressures before acceptance.

Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods. Apply approved joint compound to threads prior to making joints. Joints shall be watertight at test pressures before acceptance.

Generally, unless otherwise indicated on the drawings, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of pipe having centerline elevations between t feet and 6 inches and 6 feet 9 inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems orientated to facilitate the most practicable operation.

Anchor bolts for floor stands, stem guides, etc. shall be cast-in-place during concrete placement. Threads shall be protected and shall be cleaned before the nuts are attached and tightened.

Valves shall be tested at the same time that the adjacent pipeline is tested. Joints shall show no visible leakage under test. Repair joints that show signs of leakage prior to final acceptance. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The Contractor will be held responsible for any damage caused by the testing.

If requested by the Engineer, the valve manufacturer shall furnish an affidavit stating the materials options furnished and/or that he has complied with these and other referenced specifications.

Article 3.5 Measurement

The quantity to be paid for shall be the actual number of valves of each class and size (including valve boxes and marker posts) furnished, installed and accepted.

Article 3.6 Basis of Payment

Payment for this Work shall be accordance with Section 60.01-General, Article 1.4 – Payment – General of this Division and shall include full payment for all Work described in Section 60.03.

Unit cost payment shall be made on the following unit:

ITEM	UNIT
Furnish and Install (Size) (Type) Valve, Valve Box and Marker	Each
Furnish and Install (Size) (Type) Valve	Each

SECTION 51.04 Effluent Pump Units

Article 4.1 Description

This section covers the work necessary for furnishing and installing the effluent pump units utilized in the pressure sewer collection system, complete, including connection of the units to existing electrical systems as available for each installation and as detailed in the drawings.

The Contractor shall submit full descriptive literature to the Engineer for approval, including pump curves, pump efficiency, horsepower, head-capacity relationships, control system schematics, panel layout, level sensor switch, and alarm characteristics. These submittals shall be made as specified in Section 51.01, General Requirements.

Article 4.2 Materials

A Effluent Pumps

The pumps shall be, 240-volt, single-phase, submersible effluent-type pump capable of delivering 10 Gallons Per Minute (gpm) at a Totally Dynamic Head (tdh) of 72 feet at locations required by the City or 10 gpm at 102 feet tdh at locations as required by the City.

Each pump shall be fitted with 15 feet of heavy-duty waterproof electrical connection cable suitable for submerged service and 10 feet of 3/8-inch polypropylene lifting rope. The pumps shall be specifically designed for pumping septic tank effluent and shall utilize corrosion-resistant materials of construction throughout, such as bronze and Type 316 stainless steel components. Models STEP 52 and 102, as manufactured by Peabody Barnes, Mansfield, OH; or approved equal.

B Pipe, Valves, and Fittings

All sewer system piping materials shall conform to the applicable portions of used sections.

C Flexible Hose

Flexible hose may be supplied at cost plus 25%, by the City of Wasilla.

D Effluent Pump Control Panel

Provide an effluent pump control panel suitable for use on single-phase, 120/140 volt, three-wire, 60-Hz pumping installations. The pump installations shall consist of one or two pumps, as shown on the drawings.

The pump installations shall consist of one or two pumps, as required. Each pump shall be rated for 240 volts and horsepower requirements may range for .5 Hp to 2 Hp.

The control panel and enclosure shall have the following construction features:

Corrosion-resistant gasketed metal or fiberglass enclosure, wall mounting, suitable for outdoor weatherproof installations. The enclosure front shall be attached to the enclosure box by four tamperproof screw.

Hinged panel door inside the enclosure with tamperproof fastening screws.

External flashing alarm light mounted on top of the enclosure, suitable for weatherproof installations.

External alarm horn and silence button, suitable for weatherproof installation. Horn shall be vibrating horn with an output of 90 dB minimum.

The control panel and all electrical components shall be intrinsically safe and bear the UL label.

The control panel shall contain a Main Disconnect Switch, combination motor starter(s) with motor circuit protector(s), ambient compensated overload relays and quick-trip heaters, electric alternator in duplex control panels, HAND/OFF/AUTO selector switch(es), running light(s), elapsed time meter(s), and event counter(s) to register the number of pump operations. The control panel shall also contain an ON/OFF/T-STAT control switch for operation of the service line heat tracing. Provide motor starter(s) as required by motor horsepower and phase. A terminal strip shall be provided within the control panel for interfacing all exterior wiring. The control panels shall be pre-wired and factory tested.

Level control shall be provided by PUMP OFF, PUMP ON, and HIGH LEVEL ALARM level switches for single pump installations and BOTH PUMP OFF, LEAD PUMP ON, LAG PUMP ON, and HIGH LEVEL ALARM level switches for duplex pump installations. Level switches shall be direct-acting, float-type mercury switches of the type designed for wet well sewage applications, with elevations as shown on the drawings. Switches shall be as manufactured by Consolidated Electric Co., Flygt, or equal.

Level switches shall be chain mounted. Each chain mounting shall be provided with necessary brackets and clamps to suspend the unit form the side of the tank. The chain mounting shall include a weighted chain assembly for drift-free mounting and convenient removal of the floats. Fasteners shall be provided to mount the floats to the chain. The chain mounting kit shall be Consolidated Electric Co., CHM Kit, or equal.

When the HIGH LEVEL ALARM level is reached, the alarm light shall flash and the alarm horn shall sound until silenced by an external SILENCE button. The alarm light shall continue to flash until the alarm condition is removed at which time the alarm system shall reset automatically.

Article 4.3 Construction

A Effluent Pumps

Installation shall be in accordance with the drawings and Specifications, and the manufacturer's instructions. Pump installations shall be checked by a representative of the manufacturer prior to startup of the equipment. The pump controls shall be in operation the same day the unit is installed.

Requirements for the horsepower rating at each pump location are shown on the drawings.

Prior to starting the unit, all construction debris shall be removed from the system.

All supplementary water required to start, test and adjust the effluent pumps shall be supplied by the Contractor, as approved by the Engineer. It will be the responsibility of the Contractor to make all necessary arrangements for the source water.

B Pressure Pipe, Valves, and Fittings

Install in conformance with applicable portions of Sections, Polyethylene Pipe, Fittings, Insulation, and Heat Tracing and Gravity Sewer Service Connections.

C Electrical

Electrical equipment required to complete the work shall conform to the applicable requirements of the National Electrical Code (NEC), National Electrical Safety Code (NESC), National Electrical Manufacturer's Association (NEMA), the State of Alaska, and the City of Wasilla.

D Startup

Provide two (2) copies of the manufacturer's catalog information and diagrams for the preparation of Operation and Maintenance Manuals as specified in Section General Requirements.

Article 4.4 Guarantee in Operation

Each complete effluent pump unit shall be guaranteed for a period of 1 year from final acceptance against defective materials and workmanship.

Article 4.5 Measurement

The quantity to be paid for shall be the actual number of effluent pump units, including the mercury switch liquid level controls, effluent control panels and any miscellaneous piping as shown on the drawings, furnished, installed and accepted.

Article 4.6 Basis of Payment

Payment for furnishing and installing the mercury switch liquid level controls, effluent control panels, and effluent pump units, complete with piping within the limits shown on the drawings and specified herein, will be according to the unit prices for each type as stated in the Contractor's Proposal.

Unit Cost Payment shall be made on the following unit:

ITEM	UNIT
Install _ _ hp Effluent pump unit with all accessories	Each
Furnish pump accessories	Each

SECTION 51.05 INTERCEPTOR TANKS, INDIVIDUAL PUMP VAULTS & GREASE TRAPS

Article 5.1 Descriptions

This section covers the work necessary for furnishing and installing the interceptor tanks with integral pumping vaults and individual pump vaults.

Where not in conflict with these Contract Documents, the Alaska Department of Environmental Conservation publication "1987 Certified Installers Reference Requirements for On-Site Sewer Installation Serving Single Family Dwellings", applies and shall be followed.

As required in Section 10.5, Control of Work, Article 5.6, Product Data, and elsewhere in the Contract Documents and before any material is fabricated or shipped, furnish full details, shop drawings, catalog cuts, schematic (elementary) diagrams, seismic analyses, and other descriptive matter as required to fully describe the equipment specified under this section to the Engineer. Should any item, which deviates from these Specifications, be included, the deviation shall be clearly indicated and explained at the time of submittal.

All materials and workmanship are subject to inspection at any time by the Owner or his representatives. Correct any work or materials not in accordance with these Contract Documents or found to be deficient or defective at no additional cost to the Owner.

Article 5.2 Sizing and Tank Volumes

A Residential, Up to 12 Bedrooms

1	**3 Bedrooms or less**	**1000 gallon nominal capacity**
2	**4-5 Bedrooms**	**1500 gallon nominal capacity**
3	**6-8 Bedrooms**	**2000 gallon nominal capacity**

4 **9-12 Bedrooms computed by the following E.P.A./A.D.E.C. sizing formula:**

1125 gallons + 0.75 (No. of Bedrooms x 150 gallons)

B Non Residential of less than 25 people and less that 2000 gpd flow.

1 **Waste/sewage flow up to 1500 gallon/day is computed as follows:**

Flow x 1.5 = Septic Tank Size

2 **Waste/sewage flow over 1500 gallons/day is computed as follows:**

Flow x 0.75 + 1125 = Septic Tank Size

C Class II.

Size of all Class II shall be determined by A.D.E.C. Wastewater Disposal Regulation 18AAC72 and/or as approved by A.D.E.C.

Article 5.3 Septic Tanks

All tanks shall have a minimum of two compartments with the inlet compartments not less than two-thirds (2/3) of the total capacity of the tank. Each compartment shall have a minimum 24-inch diameter access man way and a minimum 4-inch diameter clean-out pipe extending to the ground surface. The construction of interceptor tanks shall meet the applicable State specifications for septic tanks and shall be manufactured from corrosion-resistant materials and meet watertight specifications at adjoining seems and welds.

Tanks shall have a nominal capacity of 1,000 gallons (1,170 gallons, actual volume), or 1,500 gallons (1,676 gallons, actual volume). Structural design information shall be submitted to the Engineer as required in Section 10.5, Control of Work, Article 5.5, Shop Drawings.

Tank Sized 2,000 gallons and up are required to have oversized cleanouts as shown in Figure 440A/B and installed as shown in Figure 440C.

A Steel

Minimum of 10 U.S. gauge steel protected externally and internally by an approved bituminous coating (Engard 800 or Themec). All pump basin risers must meet the same specifications as those for the tank. All surfaces must be prepared to meet the specifications of the surface coating. All welds must be continuous to assure a watertight seal.

B Polyethylene Interceptor Tanks

Polyethylene Medium density polyethylene conforming National Bureau of Standards, Voluntary Products Standards PS15-69. The internal pumping vault and surface riser must conform to the same standard.

Specific information relative to the interceptor tanks and pump vaults including installation conditions, sizes, accessories, and other information, is shown on the Drawings. All tanks shall pass the Canadian Standards Association test CAN3-B66-M79 for static loads and deflection allowances.

All appurtenant features such as stiffeners, baffles, fasteners, pipefittings, wall penetrations, etc. shall be manufactured from corrosion-resistant materials. Any materials used in tank construction other than polyethylene shall require specific approval by the Engineer.

Interceptor tanks shall be flat-bottomed medium density polyethylene conforming to the National Bureau of Standards, Voluntary Product Standard PS15-69.

The tanks shall be manufactured by Hancor, Inc., Findlay, Ohio, Quadel Industries, inc., Coos Bay Oregon; or equal.

C Concrete Interceptor Tanks

Interceptor tanks and pump vaults shall be modified pre-cast concrete tank and shall have been designed by a registered professional engineer licensed to practice in the State of Alaska. The structural design and analysis shall be done in accordance with accepted engineering practice.

Each commercial tank manufacturer shall provide the City with written certification that the interceptor tanks for use in the City of Wasilla STEP (Septic Tank Effluent Pump) System will comply with all requirements of this Specification and those of the State of Alaska.

All tanks shall be guaranteed in writing by the tank manufacturer for a period of two (2) years from the date of installation.

1 Structural Requirements

The tanks shall be designed to withstand the following anticipated loading conditions:

Vertical Loads – Live Load of 100 psf and minimum of 6 feet of earth backfill.

Lateral Loads - Tanks shall be designed for the internal hydrostatic pressure existing when they are full of liquid. The walls shall withstand ordinary earth pressure described above including external hydrostatic pressure when the tank is empty.

Walls, bottom and top of reinforced-concrete tanks shall be designed across the shortest dimension using one-way slab analysis. Stresses in each face of monolithically-constructed tanks may de determined by analyzing the tank cross-section as a continuous fixed frame.

The walls and bottom slab shall be poured monolithically: alternatively, water stops may be provided.

Reinforcing steel shall be ASTM A-615 Grade 60, fy=60,000 psi. Details and placement shall be in accordance with ACI 315 and ACI 318.

Concrete shall be ready mix with cement conforming to ASTM C150, Type II. There shall be a cement content of not less than six (6) sacks per cubic yard, with ¾ inch maximum aggregate size, and concrete shall achieve a minimum compressive strength of 5,000 psi, in 28 days.

Tanks shall be protected by applying a heavy cement base, water proof coating, Thoroseal or equal, on both inside and outside surfaces, in compliance with Council of American Building Officials (CABO), report #NRB-168; 6181.

In order to demonstrate water tightness, tanks shall be tested twice prior to acceptance. Each tank shall be tested at the factory, prior to shipping, by filling to the soffit and letting stand. After 24 hours, the tank shall be refilled to the soffit and exfiltration rate shall be determined by measuring the water loss during the next two hours. The two-hour loss shall not exceed six gallons. After installation

is completed, each tank shall be filled with water to the top of the riser and retested in the manner previously described.

D Steel Interceptor Tanks

Steel tanks shall conform to the 1985 Uniform Plumbing Code for septic tanks.

E External Pump Vaults

Specific information relative to the individual pump vaults, including installation conditions, size, accessories, and other information, is shown on the drawings. The material of construction for the pump vault sump shall be the same as specified in INTERCEPTOR TANKS above. Individual pump vaults shall be manufactured to the dimensions shown on the drawings.

F External Kitchen Waste Interceptor "Grease Trap"

The plumbing of a Commercial business kitchen or area where grease is produced is required to install an external grease trap as shown in Plan View Service Commercial Figure 422A. All plumbing in this area is plumbed in such a manner that all kitchen waste passes through the grease trap before entering the septic tank. Sizing of the grease trap is determined by the flow of said area using septic tank sizing criteria. Minimum size is 1000 gallons to allow for cooling of the grease. The grease trap consists of a two compartment septic tank. Note that in figure 422A the solid side of the grease trap clean out is oversized to allow for easy cleaning by the property owner. See Figure 440C.

Article 5.4 Construction

A Installation

All interceptor tank or individual pump vault excavations, regardless of the character, nature, or condition of the material encountered, shall be performed to the line, depth and grade as established by the Contractor and approved by the Engineer in the field. Workmanship shall conform to the applicable portions of Section 20.07, TRENCH EXCAVATION AND BACKFILL.

Bedding Material shall conform to Section 20.10 FURNISH BEDDING MATERIAL. Bedding material shall be type I. Type I consists of 2' minus. A minimum of 18" of fill 12" under and 6" over shall be used around pipe. Place a minimum of 6 inches of gravel under the interceptor tank or pump vault pad and compact to achieve maximum support and prevent future settlement of the structure. All structures are to be set level with uniform bearing on the gravel pad.

Take extreme care in backfilling to prevent damage to the outside protective coating and interior parts. All backfill shall be placed in a manner to prevent damage to the structure. Pushing the backfill material into the excavation in such a manner as to permit free fall of the material will not be allowed.

All material should be mechanically tamped or otherwise compacted to prevent settlement of the backfill. The Contractor at no cost to the Owner shall repair any such damage or settlement within 1 year after the final acceptance of the interceptor

tank. Plug and stake the tank inlet until such time as the gravity sewer service pipe is constructed.

B Anti-Flotation Concrete

Conform to the applicable portions of Section 30.01, CONCRETE. Give broom finish to exposed anti-flotation slabs. Anti-flotation concrete is to be placed over a minimum of 2 inches of backfill material with lifting eyes attached to the slab reinforcing in such a manner that the slab may be removed without damage or interference to the interceptor tank.

Anti-flotation concrete for pump vaults shall be incorporated within the base or sidewalls of the structure at the direction of the Engineer. Determination of the need for anti-flotation concrete shall be made by the Engineer.

C Abandon Existing Septic Tanks, Dry Wells, and Cesspools

At the Engineer's Direction, dry wells, privies, sumps, seepage pits, log cribs, cesspools, and other private on-site sewage disposal systems shall be abandoned after all new facilities are installed and connections made, and the new effluent pumping system is functioning properly, as determined by the Engineer.

All existing systems requiring abandonment shall have the sewage and sludge removed and be completely filled with earth, sand, gravel, concrete, or other approved material in conformance with the Uniform Building Code, Appendix I-11, as published by the International Association of Plumbing and Mechanical Officials.

The top cover or arch over the sewage facility shall be removed before filling with the approved material. The fill material shall not extend above the level of any outlet pipe or above the top of the vertical sidewalls until approval of the Engineer has been obtained. At this time, the remainder of the tank shall be filled and the fill brought up to a point of 12 inches below the adjacent ground. The final 12 inches shall be filled with topsoil or granular fill as specified in Section 75.04, TOPSOIL, and 75.05, SEEDING. All the backfill shall be thoroughly compacted to prevent any subsequent settlement.

Article 5.5 Measurement

Measurement for furnishing and installing interceptor tanks and Individual Pump Vaults shall be for actual number of interceptor tanks or pump vaults, of the types and size specified, completed and accepted.

Article 5.6 Basis of Payment

A Interceptor Tanks

Payment for the interceptor tanks, complete, of the types shown on the Drawings and specified herein will be made at the unit price for each type as stated in the Bid

Schedule of the Contractor's Proposal. Payment shall constitute full compensation for furnishing and installing the interceptor tank, complete, including pump container, manways, covers, anti-flotation concrete, and backfill. Effluent pumps (as specified in Section 51.04, EFFLUENT PUMP UNITS), mercury switch liquid level controls and effluent pump control panel (see Section 51.04, EFFLUENT PUMP UNITS).

B Individual Pump Vaults

Payment for individual pump vaults will be made on the unit price basis as stated in the Contractor's Proposal and will include furnishing and complete installation off the pump vault, manways, waterproofing, covers, and backfill.

Effluent pump units, all controls, alarms, control panels, breakers and all electrical materials needed to provide a complete working system shall be paid under Section 51.04.

C Septic Tank Abandonment

Payment for abandoning existing dry wells, log cribs, cesspools, and other private sewage disposal facilities as required, will be made at the unit price per each as stated in the Contractor's Proposal and shall include pumping out the tank, backfilling, and disposing of all excess material.

Payment shall be made under the following units:

ITEM	UNIT
Furnish and Install (size) (Type) Interceptor Tank.	Each
Furnish and Install (Size) (Type) Individual Pump Vaults	Each
Septic Tank Abandonment	Each

SECTION 51.06 POLYETHYLENE PIPE, FITTINGS, INSULATION AND HEAT TRACING

Article 6.1 Description

This section covers the work necessary for furnishing and installing the insulated and un-insulated polyethylene piping, heat trace channel, fittings, and heat tracing, complete, as shown on the Drawings.

The pipe system furnished shall be complete with all adapters, fittings, pipe plugs, jointing materials, accessories, and all other necessary appurtenances needed for a complete installation.

Submittals shall be made in accordance with the GENERAL PROVISIONS and shall include descriptive information as required to fully describe the materials and methods of application. Shop drawings shall include, but not be limited to, the following:

1 **Catalog information on all polyethylene pipe, insulating and heat tracing materials, including system components fabrication method, performance characteristics, and installation instructions.**

2 **Certification of ASTM D 3350 cell classification, Plastic Pipe Institute listing; ASTM D 2837 pressure rating, ASTM D 2341 insulation characteristics, and standards as specified herein.**

Article 6.2 Materials

For the purpose of designating the type and grade of polyethylene pipe, heat tracing and insulation desired, a manufacturer's name and list or figure number may be given in the following specifications. Polyethylene pipe, heat tracing and insulation of equal quality by other manufacturers which conform to these specifications may be offered for approval by the Engineer.

A Un-insulated Polyethylene Pipe and Fittings

The pipes and fittings shall be extruded from a polyethylene compound which conforms to ASTM D 1248 and which possesses the following properties:

1 **Pipe. Material**

The polyethylene resin shall be classified by ASTM D 1248 as Type III, Class C, Category 5, Grade P34, and have a minimum ASTM D 3350 cell classification of 355434C and a designation of PE 3408 by the Plastic Pipe Institute.

Other requirements shall be as follows:

Minimum compounded Density, ASTM 792	o.952 gm/cm3
Environmental Stress Crack Resistance ASTM D 1693,	> 500 hrs.

Condition C

Minimum hydrostatic Design stress rating @ 73.4 degrees F, ASTM D 2837	1,600 psi

The polyethylene compound shall be suitably protected against degradation by ultra-violet light by means of a 2 percent concentration of carbon black, well dispersed by pre-compounding in with the resin (by the resin manufacturer).

The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification form the same raw material supplier. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties.

The Engineer may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing. Additionally, test results from manufacturer's testing or random sampling by the Engineer that do not meet appropriate ASTM standards or manufacturer's representations may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9.

2 Pipe Design

The pipe shall be designed according to the ISO modified formula ASTM D 3035. The design pressure rating shall be expressed in terms of the static working pressure in psi for water at 73.4 degrees F according to ASTM D 2837. The minimum allowable pressure rating for the pipe shall be 110 psi except as noted on the Drawings.

Unless other wise specified or allowed, the pipe shall be manufactured in 40-foot lengths.

Polyethylene fittings shall be manufactured by molding or fabrication form polyethylene pipe using thermal butt-fusion. All polyethylene fittings shall have the same or higher pressure rating, composition, and manufacturer as the pipe.

B Compression Fittings

Compression fittings may be sued to adapt the plastic pipe to threaded valves or pipe fittings in all lines less than 3 inches in diameter. Threading of the polyethylene pipe directly will not be allowed.

Compression fittings shall incorporate stainless steel stiffeners in all applications.

Fittings shall be Mueller 110 Compression Fittings for Plastic Pipe, Ford Meter Box Company, Pack Joint Coupling or Insert Fitting for Polyethylene Pipe with stainless steel clamps (2 per insert), Emco Successor Compression Fitting or equal.

C Insulated Pipe and Fittings

The Contractor shall provide and install the pipe insulation and heat tracing system complete and operable. Submittals and shop drawings shall conform to General Provisions and shall include design details for installation of test and junction boxes in reaches where valve vault spacing exceeds the manufacturer's recommended distance between heat tracing terminals.

Before installation, the Contractor shall provide a system plan showing locations of required additional terminal points with details of heat trace mounting, termination, and terminal box mounting for review and approval by the Engineer.

1 Inner Core Pipe

The pipe shall conform to the same specification as for the uninsulated pipe in paragraphs entitled UNINSULATED POLYETHYLENE PIPE AND FITTINGS.

2 Insulation

The insulation installed between the inner core and outer jacket shall be a low density rigid closed-cell polyurethane foam with a minimum thickness of 1.90 inches. For 2-inch diameter inner core, 1.75 inches for 3-inch diameter inner core, and 2.0 inches for all other insulated pipe. It shall be applied and cured in strict accordance with the manufacturer's recommendations and good commercial practices such that the resulting cellular insulation completely fills the annular space between inner pipe and outer jacket. The insulation shall be free of defects affecting its intended use. The contractor shall provide manufacturer's certified test results for voids. The exterior of the inner core pipe shall be prepared by shot blasting, or other approved method, to a maximum depth of 0.002 inches, to ensure adhesion of the foam insulation to the pipe.

The polyurethane foam shall be in accordance with the requirements of ASTM D 2341 for insulation sample conditioning, test temperature, and relative humidity conditions. Other requirements shall be as follows:

Core density range, ASTM D 1622	2.5 to 3.5 lbs/ft3
Minimum compressive Strength, ASTM D 1621	35 psi
Minimum closed cell Content (porosity), ASTM D 2856	90 percent
Maximum water Absorption,	0.05 lbs/ft2

ASTM D 2842	
Maximum water vapor Permeability, ASTM C 355	5.0 lbs/ft2
Dimensional stability At – 20 degrees F (Maximum Linear Change) ASTM D 2126	1 percent
Dimensional Stability At +100 degrees F (Maximum Linear Change), ASTM D 2126	3 percent
Maximum K-factor as Produced, ASTM C 518 or C 177	0.13 btu-inch/ hr. ft2 degrees F
Maximum K-factor As received by The Owner ASTM C 518 or C 177	0.15 btu-inch/ hr. ft2 degrees F

Exposed faces of polyurethane foam at pipe ends shall be coated to protect against physical abuse and ultra-violet attack during shipping and storage and against water intrusion in service. The coating shall be an asphaltic based sealant, specifically formulated by the manufacturer for direct application over urethane foam insulation and for long-term service and retained flexibility over extended periods of exposure to sunlight, harsh weather , and salt water spray. It shall be applied and cured in strict accordance with the manufacturer's recommendations and good commercial practice such that the finished product is free of defects affecting its intended purpose.

The coating shall be capable of field application with a brush for touch-up shipping damage and recoating field cut piping. A minimum of 5 gallons shall be provided with each 5,000 linear feet of pipe supplied.

3 Heat Trace Channel

A heat trace channel shall be provided on insulated pipe. The channel shall be applied longitudinally on the exterior of the core pipe. It shall be taped with 1-inch (minimum) wide adhesive tape longitudinally along both seams where the channel meets the pipe and circumferentially to hold the channel in place as required. The maximum lateral displacement of the channel along the length of

the pipe shall be ¼ of the nominal pipe diameter, but in no case greater than 1-inch.

It is essential that the entire length of the channel be free from kinked, squashed, or any other kind of deformity and that there be no obstruction or ridges anywhere along the length.

The channel shall extend 1-inch (minimum) beyond the insulation cutback point. A method shall be provided for easy removal and replacement of heat tracing for service connections from the pumping vault end only.

4 Outer Jacket Material

The pipe shall be factory jacketed with a continuous, seamless, single layer, extruded high-density polyethylene jacket of minimum thickness of 0.060-inches.

The jacket shall be bonded to the foam insulation by using a layer of elastomeric sealant a minimum of 0.010 inches thick.

The outer jacket shall exhibit the following properties and characteristics:

Color	Black
Carbon Black Content, ASTM D 1603	2.0 percent
Minimum base density (compounded), ASTM D 792	0.952 gm/cm3
Minimum tensile yield ASTM D 638	3,200 psi
Minimum elongation, ASTM D 638	400 percent
Minimum hardness, Shored, ASTM 1706	45
Minimum Izod impact, ASTM D 256	1.5 ft-lb./inches
Minimum brittleness ASTM D 746	-94 degrees Fahrenheit
Vicat softening point, ASTM D 1525	248 degrees Fahrenheit

The outer jacket shall be marked at minimum 6 feet intervals in a permanent manner to indicate manufacturer, pipe size, pressure rating, nominal insulation thickness, and the words “CAUTION: ELECTRICALLY HEAT TRACED”.

Each end of each joint of insulated pipe shall be covered with an end cap. The end cap shall prevent water, dirt, or foreign objects from entering the heat tracing channel or the core pipe.

5 Joints

Finished ends of pre-insulated pipe shall have the insulation and outer jacket cutback for each length of pipe to leave approximately 8-inches of bare polyethylene pipe. The ends of the cutback portion shall be coated as specified in Paragraph INSULATION.

The insulation material for each pipe joint shall consist of two split insulation halves (half shells) with outer jacket, precut to a minimum length of 16 inches and shall be provided for each length of pipe. The insulation shall contain an appropriate groove for the heat trace channel.

The Contractor shall supply cross linked polyolefin heat shrink sleeves and tape with heat sensitive color indicator, sized to overlap the preformed insulation ends a minimum of 3 inches and to form a seal when shrunk with heat application; Raychem Dual-Seal, or approved equal.

Heat shrink tape shall be of the same material as the sleeves, and in widths recommended by the manufacturer not to be less than two inches wide.

An extra joint assemble (shrink sleeve tape and half shells) shall be provided for each 20 joints of insulated pipe furnished.

6 Fittings and Special Assemblies

Polyethylene fittings shall be manufactured by molding or fabrication from polyethylene using thermal butt-fusion. The fittings shall be at least the same grade as the polyethylene inner core pipe.

Fabricated pipe fittings shall be joined to the polyethylene pipe by using flanges, butt-fused to the pipe unless otherwise specified. The Contractor shall provide the proper bolts, back-up rings, and gaskets for the fittings. Bolts shall be provided for the intended use. Gaskets shall be reinforced black rubber, asbestos-rubber compound, Buna N, or red rubber.

All fabricated fittings shall be reinforced with a suitable fiberglass-reinforced-polyester (FRP) material or be of sufficient allowable working pressure design to be equal to or better than the pipe to which they are attached. This material shall meet all applicable governing standards for reinforced polyester materials. The thickness of the FRP material shall be based on the pipe pressure rating.

All fittings will be factory pre-insulated to a nominal thickness of 2 inches. The exposed foam ends will be sealed as previously specified under INSULATION.

Compression fittings incorporating stainless steel stiffeners may be used to adapt the polyethylene pipe to threaded valves or pipe fittings in all lines less than 3 inches in diameter. Threading of the polyethylene pipe directly will not be allowed.

Fittings shall be Mueller 110 Compression Fittings for Plastic Pipe, Ford Meter Box Company, Pack Joint Coupling or Insert Fitting for Polyethylene Pipe with

stainless steel clamps (2 per insert), Emco Successor Compression Fitting, or equal.

Polyethylene pipe and molded or fabricated fittings shall be as provided by Phillips Driscopipe, or equal.

7 Insulation Kits for Special Couplings

Insulation kits shall be provided for all flange assemblies, valves, and for special couplings. Valve insulation kits shall be provided for valves as indicated on the Drawings and shall be custom tailored to the valves provided. The Contractor shall be responsible for this coordination.

Each kit shall contain the following components.

Two form-fitting polyurethane foam halves with integral FRP jacket or approved other material for watertight seal. Halves shall extend to cover flange connections on fittings, or other intended purpose as described in this Specification.

Appropriate stainless steel strapping and seals.

Caulking / adhesive compound.

Installation instructions.

8 Components of the insulation kits

a. Insulation

Same as specified for pipe with 2 inches minimum over flanges.

b. Jacket

Pigmented black polyvinyl resin for fiberglass reinforced plastic of commercial grade suitable for continuous exposure to solar radiation and water. Minimum thickness shall be 0.10-inch. The exterior shall be coated with a gel coat suitable for sealing.

c. Caulking

The material shall be suitable for low temperature use and application. PRC 6000, Childers CP-76 or equal.

Stainless Steel Straps and Seals – Strapping shall be ACME Steel Type 300 or equal. It shall be ½-inch wide and 0.015-inch thick. Seals shall be double notch stainless steel closed seals, ACME Type 42 or equal.

The manufacturer of the insulated and un-insulated piping system shall demonstrate a minimum of 5 years of satisfactory operating experience in cold region conditions. The Contractor shall guarantee the piping system for a period of 2 years and will be responsible for the full coast of repairs or replacement of any supplied materials that fail during the period.

9 Heat Tracing

Heat tracing shall be a self-limiting 240-volt electrical heating strip of parallel circuit construction consisting of a continuous inner core of variable resistance conductive heating material between two parallel copper bus wires. The heat tracing shall be capable of producing 5 watts per foot at a pipe temperature of 50 degrees F. Heat tracing shall be equal to Chemelex Auto-Trace, 5 BTV2-CR, with metallic braid and protective outer jacket or equal.

Heat tracing cable shall have a minimum rating, according to Table 500-2(6) of the National Electric Code of T6. Under no circumstance shall the heating cable produce sheath temperatures in excess of the temperature limitations of the polyethylene pipe or heat-tracing channel, or damage the empty pipe by excessive heating. The Contractor shall provide certification of compatibility of the heat tracing and pipe from the manufacturers.

Heat tracing cable shall have an extruded outer jacket capable of passing the Canadian Standards Association Standard 22.2, No. 130-1974 TEST FOR CUT-THROUGH AND INSULATION RESISTANCE.

Heat tracing shall be furnished with all the necessary components to ensure a complete installation. These components shall include connectors, end caps, splice kits, aluminum fastening tape, labels, pull boxes, wiring, and junction boxes as required and in accordance with Section ELECTRICAL. Components shall be provided by the heat-tracing supplier.

Continuity and Megger tests shall be performed on heat tracing cable before and after installation (including insulation) has been completed. Megger test shall be at 2,500 V dc from each bus wire to the sheath. Resistance value shall be a minimum of 5-megohms per 100 ft.

The manufacturer of heat tracing cable shall demonstrate a minimum of 2 years of satisfactory operating experience in cold region conditions with self-regulating heaters. The Contractor shall guarantee the heat tracing for a period of two years and will be responsible for the full cost of repairs or replacement of any supplied materials that fail during the period.

10 Detection Tape

Detection tape shall be 3 inches wide with a metallic backing. The tape shall be imprinted with the words, CAUTION PRESSURE SEWER LINE BELOW. Tape shall be Safety Green, “Terra Tape/D” as manufactured by Griffolyn Company, Inc., Houston, Texas; “Detectatape” by Calpico, South San Francisco, California; or equal.

Article 6.3 Construction

Conform to applicable portions of ASTM D 2774, UNDERGROUND INSTALLATION OF THERMOPLASTIC PRESSURE PIPING. The Contractor shall be responsible for the entire pipe system furnished, including system testing and performance. The Contractor shall also ensure that necessary field service and on-site

consultation by material suppliers are readily available and provided during construction.

Tests for acceptance of materials, methods of manufacture, and proof of design shall be made at the expense of the Contractor. The Contractor shall provide the Owner with a schedule of various parts of production of the pipe system. At the time the Engineer inspects the items required, all other test data shall be presented for inspection.

The Owner reserves the right to sample and test any pipe or component after delivery and to reject all pipe or components represented by any sample, which fails to comply with the specified requirements. All deficiencies and/or test failures shall be corrected and the work carried out at the Contractor's expense.

A Transportation

Care shall be taken during transportation of the pipe that it is not cut, kinked, or otherwise damaged.

B Storage

Pipes shall be stored on level ground after unloading from shipping containers, free of sharp objects, which could damage the pipe. Stacking of the Polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, space suitable and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

C Handling Pipe

The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by ragging it over sharp and cutting objects. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe dens shall not be used. Two slings shall be used for lifting each length of pipe. Pipe or slings shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground.

Adhere to manufacturer's recommendations for specific handling procedures.

D Joining Pipe Sections

Pipes shall be joined to one another, to the polyethylene fittings, and to the flange connections by means of thermal butt-fusion. Polyethylene pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

E Butt-Fusion Joining

Butt-Fusion of pipes and fittings shall be performed in accordance with the pipe manufacturer's recommendations for equipment and technique, using the correct size equipment. Butt-fusion will be performed only by personnel certified as competent by the polyethylene material supplier.

The Contractor shall provide butt-fusion equipment compatible with the piping system being used as necessary to complete all joints on the project. All costs in connection with this equipment shall be included in the unit price bid for pipe installation.

Installation of all components shall be accomplished using the manufacturer's own recommendations. Unless the Contractor's personnel are certified in the installation of pre-insulated polyethylene piping systems, the pipe suppliers shall provide for the on-site services of one supplier's representative for a minimum period of one week at the start of construction. Additional technical representative services, if necessary, will also be at the Contractor's expense.

After each section of joined insulated pipe has been laid in the trench and all connections made, the Contractor shall perform a visual inspection to ensure that the waterproof jacket is completely intact and all mechanical connections have been made according to suppliers recommendations and specifications. Repairs to the jacket shall be made with heat shrink sleeves or heat shrink tape and sufficient quantities of elastomeric sealant until it is watertight.

Random tests of field joints will be made by the Engineer, as necessary, as a quality control measure. The Contractor shall be responsible for removal or repair of unsatisfactory butt-fusion joints.

F Mechanical Connections

Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps, tanks, and other piping materials shall be through flanged connections (all sizes), compression connections (up to 3-inch diameter), or screwed connections (up to 3-inch diameter), which shall consist of the following:

A polyethylene flange connection called a "stub end" shall be thermally butt-fused to the ends of the pipe.

A metal back-up flange shall be ductile iron or approved equal and shall be sized to ANSI B16.1 outside diameter and drilling.

Alloy steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made up and tightened to manufacturer's standards shall be used to make up a mechanical connection. The Contractor shall re-torque nuts after four hours.

Gaskets of red rubber, asbestos composition, or other material as directed by the Engineer shall be made to fit the joint.

Install compression fittings where needed to adapt threaded valves to polyethylene pipe. Full circle stainless steel sleeve stiffeners shall be used with all compression fittings, with the exception of insert type connectors where the stiffener is integral to the approved fittings.

Polyethylene pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between the polyethylene pipe at the flanged joint and the rigid structures is possible.

G Placement in Trench (PE Pipe for Collection System)

Care shall be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe. Pipe and fittings shall be laid directly on the pipe base material. At flanges, valves, and connections, the trench bottom shall be formed with bell holes with sufficient length, width, and depth to ensure clearance between the pipe base material and the flanges, valves, and such connections. Depending on site conditions, butt-fusion joining shall be performed in or outside of the excavation at the Contractor's option.

The trench bottom shall be free of stumps, stones, boulders, rocks, and similar objects. The backfilling operation shall be carried out to 6 inches over the top of the pipe up to 6 inches in diameter. Compact in layers of 6 inches using sand, gravel, or dry fiable soil. Final backfilling shall be as shown on the Drawings.

H Installation of Heat Trace Cable

The heat trace cable shall be installed in the appropriate channel on the pipe before pipe joints, fittings and connections are insulated. This cable should be pulled into position using manufacturer's recommendations. Care shall be taken to ensure that the cable is not excessively stretched, is not cut, gouged, or twisted during insertion.

Every precaution should be taken to ensure that the cable channel remains dry after the pipe is installed. This will include caulking at pipe ends as necessary.

The heat tracing shall be accessible from the heat trace pull points and be able to be replaced easily.

I Detection Tape

Detection tape shall be installed over all pressure sewer pipe and service connection pipe, which lies in the public right-of-way. It shall be placed in accordance with the manufacturer's recommendations directly over the pipe at a depth of 12 inches below final grade.

Article 6.4 Testing

A Testing (PE Pipe in Collection System)

All pipe shall be inspected at the point of manufacture in accordance with the appropriate ASTM specification. Provide a certificate of test results to the Engineer.

After all piping, including individual property services, has been installed and backfilled, and pipe-laying has proceeded beyond the nearest isolation valve, the Contractor shall pressurize the reach of line between the adjacent isolation valves.

After the line has been filled and the test pressure allowed to stabilize (usually after 2-3 hours), the test section shall be pressurized to the allowable operating pressure or 110 psig maximum for a minimum of 2 hours.

Allowable amounts of make up water for expansion during the pressure test are shown in the table below. If there are no visible leaks or significant pressure drops during the final test period, the pipe reach will be accepted.

ALLOWANCE FOR EXPANSION AT PRESSURE

Diameter	U.S. Gallons/100-ft.
1-1/2”	0.05
2”	0.09
3”	0.15
4”	0.25
6”	0.60
8”	1.00
10”	1.30
12”	2.30
14”	2.80
16”	3.30

Under no circumstances shall the total time under test exceed 8 hours at 1-1/2 times the pressure rating. If the test is not completed due to leakage, equipment failure, etc., the test section shall be permitted to “relax” for 8 hours prior to the next testing sequence.

B Heat tracing Cable testing

The Contractor will be required to ensure a working heat trace system by testing the resistance of the cable in accordance with the manufacturer’s recommendations. He shall log the length of cable at each point where a test was made for future use by the City of Wasilla.

The Contractor shall also ensure that the cable moves freely at the pull points by pulling the cable each direction to see that it does not bind or hang up in any way.

Article 6.5 Measurements

Measurement for all sizes of pipe shall be based on the horizontal distances and will be from center to center of manholes or from center of manhole to center of cleanout wye.

Article 6.6 Basis of Payment

A Collection System

Payment for furnishing, installing and hydrostatically testing the insulated and un-insulated polyethylene pipe, fittings, heat tracing (including additional heat tracing for each interceptor tank or where otherwise necessary as shown on the Drawings), and detection tape will be made on the unit price basis as included in the Contractor’s Proposal.

Payment for furnishing and installing all fittings, heat tracing, detection tape, and other piping accessories is incidental to the project.

Payment for this work shall be in accordance with Section 51.01 General, Article 1.1 Payment, of this Division and shall include full payment for all work described in Section 51.06.

Unit cost payment shall be made on the following basis:

ITEM	UNIT
Furnish and Install (include Size, type of material) Pipe	Linear Foot