CITY OF FORT WAYNE MASTER UPDATED: 3/10/15

SECTION

NTS: Portions of this section contain detailed descriptive requirements of the product(s) of the named manufacturer(s). If the product of another manufacturer (where named) is to be included as acceptable, this section may require editing.

This section may be used for the installation of sanitary sewer force mains as well as sanitary sewer gravity piping.

1. GENERAL
	1. DESCRIPTION
		1. Scope:
			1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to install and test all buried piping, and special items. The Work includes the following:

NTS: Coordinate below with applicable sections of Divisions 31 and 33 to ensure proper installation specifications for all buried piping. Edit as required.

* + - * 1. All types and sizes of buried sanitary sewer piping, except where buried piping installations are specified under other Sections.
				2. Unless otherwise shown or specified, this Section includes all buried sanitary sewer piping Work required, beginning at the outside face of structures or structure foundations.
				3. Work on or affecting existing buried piping.
				4. Installation of all jointing and gasket materials, special items, flexible couplings, mechanical couplings, and other Work required.
				5. Supports.
				6. Pipe encasements, with the exception of piping embedded in concrete within a structure or foundation.
				7. Field quality control, including testing.
				8. Cleaning.
				9. Incorporation of special items shown or specified into piping systems in accordance with the Contract Documents and as required.
		1. Coordination:
			1. Review installation procedures under this and other sections and coordinate installation of items to be installed with or before buried sanitary sewer piping Work.
			2. Coordinate with appropriate piping materials sections of Division 33.
		2. Related Sections:

NTS: List below only sections covering products, construction, and equipment specifically identified in this section and specified in another section and directly referenced in this specification. Do not list administrative and procedural Division 01 sections.

NTS: Insert at (--1--) the number and name of the Division 33 material section(s). Edit references to suit the project.

* + - 1. Section 03 00 05, Concrete.
			2. Section 31 00 05, Trenching and Earthwork
			3. Section (--1--).

NTS: Section “1.2” is to be included if project is bid on unit price basis. Section to be deleted or revised if project is to be bid on lump sum basis.

NTS: Adjust Section “1.2” below for additional work item numbers as needed.

* 1. MEASUREMENT AND PAYMENT
		1. Pipe Installation:
			1. Pipe installation is to be included in the measurement and payment of each pipe material and associated appurtenances installed.

NTS: Coordinate Paragraph “B.3” with other work specified, measured, and paid in Division 33 Utilities and Division 31 Earthwork.

NTS: Coordinate Paragraph “B” below with 31 00 05 Trenching and Earthwork for flowable fill used for abandoned pipes.

* + 1. Pipe Plugs (Bulkheads):
			1. Work Item Number and Title

 **33 31 00-A Pipe Plugs**

* + - 1. The payment quantity shall be the number of plugs actually installed.
			2. Payment under this item shall be on a unit price basis regardless of plug size.
			3. This price shall include all cost associated with: removal of surface improvements, excavation, disposal of excavated material, temporary sheeting, shoring, or bracing; dewatering, furnishing and placing Class A concrete for the bulkhead; furnishing, placing and compacting required backfill; and placing required surfacing.
	1. REFERENCES

NTS: Retain applicable standards below. Add others as required.

* + 1. Standards referenced in this Section are listed below:
			1. ASTM International.
				1. ASTM D2321, Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
				2. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
				3. ASTM D3262, Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
				4. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
			2. American Water Works Association.
				1. ANSI/AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
				2. ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
				3. AWWA M23, PVC Pipe - Design and Installation.
				4. AWWA M41, Ductile-Iron Pipe and Fittings.
				5. AWWA M45, Fiberglass Pipe Design.
				6. AWWA M55, PE Pipe - Design and Installation.
			3. American Society of Civil Engineers/Structural Engineering Institute
				1. ASCE 37, Design and Construction of Sanitary and Storm Sewers.
			4. Indiana Administrative Code, Title 327 Water Pollution Control Board
				1. Indiana Administrative Code-327 IAC 3-6-12.
	1. QUALITY ASSURANCE
		1. Regulatory Requirements:
			1. Comply with requirements and recommendations of authorities having jurisdiction over the Work, including.

NTS: Insert at (--1--) names of authorities having jurisdiction over the work, including utility owners as applicable, owners of rights-of-way, INDOT, county highway department, or city right-of-way department and others. Add paragraphs as required.

* + - * 1. 327-IAC , Water Pollution Control Board
				2. Indiana Department of Environmental Management
				3. (--1--)
			1. Obtain required permits for Work beneath roads, in rights‑of‑way, beneath railroads, and in other areas of the Work, as required by Authorities Having Jurisdiction listed above.

NTS: Edit Article “1.5” to suit the project, in coordination with submittal requirements of the pipe material sections.

* 1. SUBMITTALS

NTS: Laying schedules are usually not required for piping with non-restrained joints. If a laying schedule is required for project add to section submittal requirements below. Refer to 33 11 00 Water Piping Installation for details.

NTS: Only field quality control submittals are listed below. Coordinate product data, Shop Drawings, and test results, with submittal requirements listed in applicable material specification sections.

* + 1. Informational Submittals: Submit the following:
			1. Field Quality Control Submittals:
				1. Results of each specified field quality control test.
	1. DELIVERY, STORAGE, AND HANDLING
		1. Material delivery, storage and handling must conform to requirements in Contract Documents. Refer to Section 01 65 00 Product Delivery Requirements and Section 01 66 00 Product Storage and Handling Requirements.
1. PRODUCTS
	1. MATERIALS

NTS: If “Piping Schedule” is used, include on Drawings and edit “A” below.

* + 1. Piping materials are shown on the Drawings.
		2. Piping materials shall conform to Specifications for each type of pipe and piping appurtenances in applicable sections of Division 33.

NTS: Based on project specific requirements include tracing wire for sanitary force mains. Coordinate with the applicable pipe material specification and edit/delete as required.

* 1. BURIED PIPING IDENTIFICATION FOR FORCE MAINS
		1. Tracing Wire Requirements
			1. Provide - No.10 or stronger High Strength Copper Clad Steel Reinforced with HDPE Insulation tracing wire rated for a minimum tensile strength of 600 lbs. The following materials are acceptable:
				1. Soloshot Copperhead Industries, LLC
				2. BoreTough, Agave Wire, LTD
				3. Or approved equal
			2. Splice tracing wire together with the following material:
				1. DRYCONN Direct Bury Lug Aqua
				2. Agave Direct Bury Lug DWTWC-003
				3. Or approved equal
			3. Tracer wire shall be required on all sanitary force mains.
			4. All wire utilized for tracing wire shall be designed for and approved by the manufacturer for use in buried low voltage applications and approved by the Engineer.

NTS: Retain one version of paragraph 5 below. Delete the other.

* + - 1. For open trench installation of force main, the tracer wire shall be laid directly over the main and attached to the pipe at regular intervals not to exceed ten (10) feet. Wire shall be attached to the main with plastic "zip" strapping or wire.
			2. For horizontal directional drilling of force main, the tracer wire shall be pulled in with the main.
			3. At valve structures, the tracing wire shall be drawn toward the surface inside the vault.
		1. Marking Post Requirements
			1. The following marking posts, or approved equal, are acceptable for use in connection with sewer force main installation:
				1. Posts: Flexible Marking Post/Test Station (Glasforms or Carsonite)
				2. Decals: "Warning Sewer Pipeline" (USA Bluebook) or “Caution Sewer Pipeline” (Glasforms or Carsonite)
			2. The marking post/test station shall be made from a flexible impact resistant composite material. It shall contain reinforced hollowed ribs on each side where the test wire is protected. The tracing wire is extended at the bottom; so that it can be spliced to the pipe wire with a direct bury connector.
1. EXECUTION
	1. INSTALLATION
		1. General:
			1. Install piping as shown, specified, and as recommended by pipe and fittings manufacturer.
			2. In the event of a conflict between manufacturer’s recommendations and the Contract Documents, request interpretation from Engineer before proceeding.
			3. Engineer will observe excavations and bedding prior to Contractor laying pipe. Notify Engineer in advance of excavating, bedding, pipe laying, and backfilling operations.
			4. Minimum cover over buried piping shall be 4 feet, unless otherwise shown or approved by Engineer.

NTS: Include the following: “31 00 05, Trenching and Earthwork in the Project Manual.

* + - 1. Earthwork is specified in Section 31 00 05 Trenching and Earthwork.
			2. The width of trenches shall be such as to provide a clearance of not less than 6 inches or not more than 15 inches on each side of the pipe. All pavements shall be cut with an abrasive saw. Concrete driveways, walks, alleys, etc., shall be cut to the nearest joint unless approved by Engineer.
			3. Excavation in excess of that required or shown, and that is not authorized by Engineer shall be filled at Contractor’s expense with granular material furnished, placed, and compacted in accordance with Section 31 00 05, Trenching and Earthwork.

NTS: Delete inapplicable paragraphs below. If separation of sanitary or storm sewers and water mains is required, coordinate Paragraph “C” with requirements of authority having jurisdiction. Although a water main is not usually installed below a sewer, consider each installation individually to determine what additional protection is required for the water main.

* + 1. Separation of Sewers and Potable Water Piping:
			1. Horizontal Separation:
				1. Where possible, proposed sanitary sewers shall be separated from existing potable water mains and service lines horizontally by a clear distance of at least 10 feet, measured edge to edge.
				2. If local conditions preclude the specified clear horizontal separation, installation will be allowed if potable water main is in a separate trench or on an undistributed earth shelf on one side of sewer and with bottom of potable water main at least 18 inches above the crown of the sewer.
				3. Exceptions:

Where it is not possible to provide minimum horizontal separation, construct sewer pipe of pressure pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test newly installed pressure piping to a minimum of 125 psi, meeting the testing requirements in Field Quality Control of this specification.

Sewer in water grade pipe shall extend from manhole to manhole.

NTS: Edit Paragraph “2” to comply with local laws and regulations, and standards, if different than specified below. Consider concrete encasement of water main for at least ten feet on each side of the crossing.

* + - 1. Vertical Separation:
				1. Provide minimum vertical distance of 18 inches between outside of potable water main and outside of sewer when sewer crosses above or below potable water main.
				2. Center a section of potable water main pipe at least 17.5 feet long over sewer so that sewer joints are equidistant from potable water main joints.
				3. Provide adequate structural support where potable water main crosses above or below sewer. At minimum, provide compacted select backfill for 10 feet on each side of crossing.
				4. This deviation may allow installation of the sewer closer to the water main, provided that the water is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at horizontal separation of at least ten feet measured edge to edge.
				5. Exception:

Where it is not possible to provide minimum horizontal separation described above, construct sewer pipe of pressure pipe complying with public water supply design standards of authority having jurisdiction. Hydrostatically test newly installed pressure piping to a minimum of 125 psi, meeting the testing requirements in Field Quality Control of this specification.

Sewer in water grade pipe shall extend from manhole to manhole.

* + 1. Separation of Sewer Mains and Potable Water Structures:
			1. Maintain a 50 feet minimum distance from water supply wells or other water supply sources and structures.
		2. Plugs (Bulkheads):
			1. Temporarily plug installed pipe at end of each day of Work or other interruption of pipe installation to prevent entry of animals, liquids, persons, and deleterious materials into pipe.
			2. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.
			3. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.
			4. Where plugging is required for phasing of the Work, abandonment of existing utilities, or subsequent connection of piping, install watertight, permanent type plugs, caps, or bulkhead acceptable to Engineer.

NTS: Coordinate pipe bedding requirements with details on the Drawings. Type and configuration of bedding required depends on the type of pipe (rigid or flexible) being installed, pipe size, depth and character of soil in the trench, depth of earth cover, and requirements of the pipe manufacturer.

Edit the following paragraphs to suit the project. trench excavation, bottom preparation, bedding materials, and backfill requirements should be specified in Section 31 00 05 Trenching and Earthwork.

* + 1. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings:

NTS: Include in the Contract Documents: “31 00 05 Trenching and Earthwork” as applicable. Coordinate unit price payment items for additional excavation and granular material with the bid form and edit Paragraph “2” as required.

* + - 1. Trench excavation and backfill, and bedding materials shall conform to the Contract Documents.
			2. Where over excavation is required by Engineer, due to unsuitable soil in trench or excavation subgrade, remove and replace unsuitable material with approved granular material furnished, placed, and compacted in accordance with the Contract Documents. Payment for removal and replacement of unsuitable soils will be made under the unit price payment items in the Contract Documents.
			3. Bedding installation and materials shall be in accordance with the Drawings and as specified in Section 31 00 05 Trenching and Earthwork.
			4. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.
			5. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.
		1. Alignment:
			1. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by Engineer.
			2. Slope piping uniformly as shown on the Drawings.
			3. Maintain reference line and grade with laser equipment daily for adjustment and accuracy. Correct deficiencies in equipment, reference line and reference grade. Take precautions to prevent deflections in reference line and grade.
			4. Contractor shall install sewer pipe in compliance with slope requirements shown on the Drawings. All sewer pipes shall have a maximum slope deviation no greater than the indicated percent for the following pipe sizes:

 NTS: Retain only pipe sizes that pertain to the project, delete others.

|  |  |
| --- | --- |
| PipeDiameter | Pipe SlopeDeviation |
| 8 inch | ±15% |
| 10 inch | ±18% |
| 12 inch | ±20% |
| 15 inch  | ±20% |
| 18 inch | ±20% |
| 21 inch | ±20% |
| 24 inch | ±20% |

* + - 1. Contractor shall verify every other section of installed sewer pipe for compliance with design slope. In the event that the as-built slope exceeds the indicated deviation, notify Engineer in writing. Removal and replacement of pipe as directed by the Engineer shall be at no additional cost to the Owner.

NTS: Edit references in Paragraph “G” below to suit types of pipe included in the project.

* + 1. Laying Pipe:
			1. Conform to manufacturer’s instructions and requirements of standards and manuals listed below, as applicable:
				1. Ductile Iron Pipe: ANSI/AWWA C600, ANSI/AWWA C105, AWWA M41.
				2. Thermoplastic Pipe: ASTM D2321, ASTM D2774, ANSI/AWWA C605, AWWA M23, AWWA M45, AWWA, M55.
				3. Sanitary and Storm Sewers: ASCE 37.
				4. Fiberglass Reinforced Pipe: ASTM D3262
			2. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete. Keep clean and protect interiors of pipe, fittings, valves, and appurtenances.
			3. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by Engineer.
			4. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by Engineer.
			5. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.
			6. For push-on jointed pipe, do not push past the manufacturer’s specified home position.
			7. Deflections at joints shall not exceed 50 percent of amount allowed by pipe manufacturer, unless otherwise approved by Engineer.
			8. Carefully examine pipe, fittings, and specials for cracks, damage, and other defects while suspended above trench before installation. Immediately remove defective materials from the Site and replace with acceptable products.
			9. Inspect interior of all pipe, fittings, and specials and completely remove all dirt, gravel, sand, debris, and other foreign material from pipe interior and joint recesses before pipe and appurtenances are moved into excavation. Bell and spigot-type mating surfaces shall be clean and dry immediately before pipe is laid.
			10. Field cut pipe, where required, with machine specially designed for cutting the type of pipe being installed. Make cuts carefully, without damage to pipe, coating or lining, and with smooth end at right angles to axis of pipe. Cut ends on push-on joint type pipe shall be tapered, and sharp edges shall be filed off smooth. Do not flame-cut pipe.
			11. Do not place blocking under pipe, unless specifically approved by Engineer for special conditions.
			12. Touch up protective coatings in manner satisfactory to Engineer prior to backfilling.
			13. Notify Engineer in advance of backfilling operations.
			14. On steep slopes, take measures acceptable to Engineer to prevent movement of pipe during installation.
			15. Exercise care to avoid flotation when installing pipe in cast‑in-place concrete, and in locations with high groundwater.

NTS: Retain applicable joint requirements below, add others as required, and delete joint requirements for materials not used on project. If additional pressure grade joints are required refer to 33 11 00 Water Piping Installation.

* + 1. Jointing Pipe:

NTS: For thermoplastic pipe in Paragraph “1”, below, bell and spigot joints are typically used on sewers. Solvent cement welded joints are typically used on other services, such as buried chemical lines. Add specifications for solvent cement welded joints if required for project.

* + - 1. Thermoplastic Pipe Joints:
				1. Bell and Spigot Joints:

Bevel pipe ends, remove all burrs, and provide a reference mark at correct distance from pipe end before making joints.

Clean spigot end and bell thoroughly before making the joint. Insert O-ring gasket while ensuring that gasket is properly oriented. Lubricate spigot with manufacturer’s recommended lubricant. Do not lubricate bell and O-ring. Insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.

* + - 1. Mechanical Coupling Joints:
				1. Mechanical couplings include: sleeve-type flexible couplings, split flexible couplings, ANSI/AWWA C606 grooved or shouldered end couplings, plasticized PVC couplings, and other mechanical couplings specified.
				2. Prior to installing and assembling mechanical couplings, thoroughly clean joint ends with wire brush to remove foreign matter.
				3. For mechanical couplings that incorporate gaskets, after cleaning apply manufacture’s recommended lubricant to rubber gasket or inside of coupling housing and to joint ends. After lubrication, install gasket around joint end of previously installed piece and mate joint end of subsequent piece to installed piece. Position gasket and place coupling housing around gasket and over grooved or shouldered joint ends. Insert bolts and install nuts tightly by hand. Tighten bolts uniformly to produce an equal pressure on all parts of housing. When housing clamps meet metal to metal, joint is complete and further tightening is not required.
				4. For plasticized PVC couplings, loosen the stainless steel clamping bands and remove clamps from coupling. Slide coupling over plain ends of pipes to be joined without using manufacture’s recommended lubricants. Place clamps over each end of coupling at grooved section and tighten with torque wrench to torque recommended by manufacturer.
			2. HDPE Pipe Joints:
				1. Bell and Spigot Joints:

Remove all burrs and provide reference mark at correct distance from pipe end. Place mark such that no more than ½ inch of machined spigot surface will be visible outside of bell after pipe has been joined.

Clean spigot end and bell thoroughly with soap and water before positioning gasket.

Lubricate spigot groove with manufacturer’s recommended lubricant. Thoroughly clean gasket and place in spigot groove starting at bottom, ensuring that gasket fins face backwards toward pipe.

Thoroughly lubricate gasket with pipe manufacturer’s recommended lubricant and equalize stretch in gasket by means of manufacturer’s recommended procedure. Reposition gasket in groove after stretching.

Thoroughly clean and lubricate receiving bell. Align pipe as straight as possible and insert spigot end of pipe carefully into bell until reference mark on spigot is flush with bell.

If mechanical means are used to insert spigot end, protect the end of pipe being pushed with wood, to provide even distribution of pressure.

* + - * 1. Butt Fusion Welded Joints:

Install joints in accordance with manufacturer’s instructions using hydraulic butt fusion machine or manual machine equipped with torque wrench. Equipment shall be able to achieve and maintain heating tool temperature range of 400 to 450 degrees F and an interface pressure of 60 to 90 psi.

Clean interior and exterior of pipe and fitting ends with clean, dry, lint-free cloth.

Align ends to be joined in the fusion machine without forcing ends into alignment. Adjust alignment as necessary and tighten clamps to prevent slippage.

Place facing tool between ends to be joined and face them to provide clean, smooth, parallel mating surface. If stops are present, face ends down to the stops. Remove all shavings after facing without touching ends.

Re-check alignment of ends and check for slippage against fusion pressure. There shall be no detectable gaps between ends. Align outside diameters.

Heating tool shall maintain pipe manufacturer’s recommended temperature range. Place the tool between ends to be joined. Move ends against heating tool to achieve full contact. Hold ends against heating tool without force until melt bead size is formed per manufacturer’s recommendations.

Upon forming proper melt bead size, quickly separate ends and remove heating tool. Quickly inspect melted ends and bring ends together applying joining force recommended by manufacturer, using 60 to 90 psi interfacial pressure to form double bead rolled over surface of pipe on both ends.

Hold joining force against ends until joint is cool to the touch. Cooling period shall be 30 to 90 seconds per inch of pipe diameter. Heavier wall thicknesses may require longer cooling times as recommended by pipe manufacturer.

Upon completing joint, inspect to verify double bead has been formed on both sides, uniformly rounded and consistent in size all around joint. Remove faulty joints and re-joint.

* + - 1. Ductile Iron Push-On Joint Pipe:
				1. Prior to assembling joints, thoroughly clean with wire brush the last eight inches of exterior surface of spigot and interior surface of bell, except where joints are lined or coated with a protective lining or coating.
				2. Wipe clean rubber gaskets and flex gaskets until resilient. Conform to manufacturer’s instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.
				3. Insert gasket into joint recess and smooth out entire circumference of gasket to remove bulges and to prevent interference with proper entry of spigot of entering pipe.
				4. Immediately prior to joint assembly, apply thin film of pipe manufacturer’s recommended lubricant to surface of gasket that will come in contact with entering spigot end of pipe, or apply a thin film of lubricant to outside of spigot of entering pipe.
				5. For assembly, center spigot in pipe bell and push pipe forward until spigot just makes contact with rubber gasket. After gasket is compressed and before pipe is pushed or pulled in the rest of the way, carefully check gasket for proper position around the full circumference of joint. Final assembly shall be made by forcing spigot end of entering pipe past gasket until spigot makes contact with base of the bell. When more than a reasonable amount of force is required to assemble the joint, remove spigot end of pipe to verify proper positioning of gasket. Do not use gaskets that have been scored or otherwise damaged.
				6. Maintain an adequate supply of gaskets and manufacture’s recommended joint lubricant at the Site when pipe jointing operations are in progress.
			2. Fiberglass Reinforced Pipe Joints:
				1. All joints must be in conformance with recommendations of manufacturers of pipe and joint material
				2. All joint surfaces shall be lubricated with manufacture’s recommended lubrication immediately before the joint is completed. Each spigot end shall be suitably beveled to facilitate assembly.
				3. Use suitable equipment and end protection to push or pull the pipes together.
				4. Do not exceed forces recommended by the manufacturer for coupling pipe.
				5. Provide watertight joints.
				6. Hand fill and compact all bell depressions with granular bedding materials to prevent joints from sagging or moving.
				7. Joints at tie-ins, when needed, may utilize fiberglass or stainless steel, gasket-sealed closure couplings. The coupling must be approved by the pipe manufacturer.
			3. Certa- Lok PVC Joints:
				1. Unless otherwise specified, pipe shall be assembled in the field. The Contractor shall follow the pipe supplier’s written guidelines for this procedure.
				2. The pipe shall be joined using a separate PVC coupling with beveled edges, built-in sealing gaskets and restraining grooves. The restraining splines shall be square or rectangular, and made from Nylon 101.
				3. Exposed splines shall be cut flush to coupling to reduce soil drag.
				4. Couplings shall be beveled on leading edges to minimize soil friction.
				5. Provide elastomeric gaskets complying with ASTM F477 and ASTM D3139.
				6. Restrained Joints: Provide restrained joints where shown or indicated.
			4. Fusible PVC Joints
				1. Fusible polyvinylchloride pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier’s guidelines.
				2. Fusible polyvinylchloride pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.
				3. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
				4. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

Heat Plate - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier’s guidelines.

Carriage – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

General Machine - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

Data Logging Device – An approved datalogging device with the current version of the pipe supplier’s recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

* + - * 1. Other equipment specifically required for the fusion process shall include the following:

Pipe rollers shall be used for support of pipe to either side of the machine

A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier’s recommendations.

An infrared (IR) pyrometer for checking pipe and heat plate temperatures.

Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

Facing blades specifically designed for cutting fusible polyvinylchloride pipe shall be used.

* + 1. Backfilling:
			1. Conform to applicable requirements of the Contract Documents. Refer to Section 31 00 05, Trenching and Earthwork.
			2. Place backfill as Work progresses. Backfill by hand and use power tampers until pipe is covered with at least one foot of backfill.
		2. Transitions from One Type of Pipe to Another:

NTS: There are a limited number of special fittings available to connect cast iron and ductile iron pipe to other pipe of the same nominal size, but with different outside diameters. This condition occurs when connecting ductile iron pipe produced to current standards to older cast iron pipe produced under discontinued standards such as ANSI A21.1 (pit cast pipe) and ANSI A21.6 or A21.8 (Class C-D outside diameter). While some (not all) manufacturers supply special sleeves modified to accept the larger outside diameters of older pipe, available nominal sizes and/or pressure ratings are limited. For additional information, refer to ANSI/AWWA A21.10/C110, Appendix B, dual purpose modified MJ sleeve. Reducing couplings manufactured by Dresser and Smith Blair may also be used.

* + - 1. Provide necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
		1. Closures:
			1. Provide closure pieces shown or required to complete the Work.

NTS: Service connections must be in accordance with City Utilities standard details for building sewer connection. Specifier shall review and include on Drawings City Standard Details SAN-1 thru SAN-7 as applicable.

* + 1. Service Connections:
			1. Provide service connections in accordance with the requirements of the Contract Drawings.
			2. The trench shall be fully backfilled in accordance with this specification and the Contract Drawings.
			3. Prior to backfilling the service pipe, every building service shall be inspected by a representative of the Engineer. A minimum of 3 hours advanced notice shall be given to the New Water/Sewer Permit Department of the City of Fort Wayne, for completing the inspection. The hours of operation for sewer tap inspections are from 8:00 am to 3:00 pm, 5 days a week, excluding holidays.
		2. Concrete Cradle and Encasement:
			1. Where subgrade conditions, in the opinion of the Engineer, warrant extra precautions for the bedding or encasement of pipe, the Engineer may order the construction of a concrete cradle and/or encasement to be installed in conformance with the size and dimensions indicated on the plans. All concrete used in the concrete cradle shall be in accordance with Section 03 00 05, Concrete.

NTS: Based on project specific requirements include tracing wire for sanitary force mains. Coordinate with the applicable pipe material specification and edit/delete as required.

* 1. BURIED PIPING IDENTIFICATION INSTALLATION – FOR FORCE MAINS
		1. Mainline Tracing Wire
			1. Tracing wire is required on all force mains.
			2. Tracing wire shall be laid directly over the water main and attached to the pipe at regular intervals not to exceed 10 feet.
			3. Attach the tracer wire to the pipe using plastic “zip” strapping or metal wire.
			4. The following technique shall be used to splice wires together:
				1. Use DryConn Direct Bury Lug and strip the wire to 5/8”.
				2. Place one stripped conductor into the lug.
				3. Tighten the set screw till it comes in contact with the solid conductor.
				4. Note the location of screwdriver and continue fighting the set screw ¾ turn for # 10 solid copper wire.
				5. Repeat the steps for the adjacent side.
				6. Remove sealant cover and discard. Close housing, aligning conductors until housing lid is fully latched.
			5. For valves in valve boxes, the wire shall be brought up the outside of the valve or curb box riser. Construct an opening in the lip of the valve box to allow the top of the tracer wire to be stored inside the valve box. Ensure that the opening is sized adequate so the cover will fit snug onto the valve box, once the tracer wire is installed. The wire should be installed with an excess length of 4-6 inches that is to be folded down in the valve box.
			6. Successful completion of conductivity test to be completed by the Contractor and in the presence of the Engineer. Successful completion of the test will be required prior to acceptance of force mains.
		2. Marking Post Requirements
			1. Marking post will be required for all bores or as directed by Engineer.
			2. Marking post shall be buried at least 12 inches.
			3. The wire shall be brought up inside the marking post and attached at the top with 2 holes drilled in the marking posts so that the wire can be wrapped around an inserted eyebolt, or the wire can be feed through the hole and left extended on the exterior of the post.
	2. THRUST RESTRAINT
		1. Provide thrust restraint on pressure piping systems where shown or indicated in the Contract Documents.
		2. Thrust restraint may be accomplished by using restrained pipe joints, or harnessing buried pipe. Thrust restraints shall be designed for axial thrust exerted by test pressure specified on Contract Drawings.

NTS: Edit Paragraphs “C” to suit the project. The designer usually specifies Thrust Restraint Method. If harnessed lengths of buried pipe are required for restraint, designer shall indicate the required lengths on the Drawings. Methods for determining the required harnessed lengths based on pipe layout and soil conditions are in AWWA manuals listed in this section as Reference Standards.

* + 1. Restrained Pipe Joints:
			1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.
				1. Ductile Iron, Push-on Joints and Mechanical Joints: Restrain with proprietary restrained joint system, lugs and tie rods; or other joint restraint systems approved by Engineer.
				2. Thermoplastic and HDPE Joints: Where bell and spigot‑type or other non‑restrained joints are utilized, provide tie rods across joint or other suitable joint restraint system, subject to the approval of Engineer.
				3. Joints for Concrete Pipe Other than Prestressed Concrete Cylinder Pipe: Restrain joints utilizing clamp type restrained joint or snap ring-type restrained joint.

NTS: Delete Article “3.4” if not applicable, or edit to suit the project.

* 1. WORK AFFECTING EXISTING PIPING
		1. Location of Existing Underground Facilities:
			1. Locations of existing underground facilities shown on the Drawings should be considered approximate.
			2. Determine the true location of existing underground facilities to which connections are to be made, crossed, and that could be disturbed, and determine location of underground facilities that could be disturbed prior to beginning of excavation and backfilling operations, or that may be affected by the Work.

NTS: Delete Paragraphs “B” and “C”, below, if not applicable.

* + 1. Taking Existing Pipelines and Underground Facilities Out of Service:
			1. Do not take pipelines or underground facilities out of service unless specifically listed in the Contract Documents, or approved by Engineer.
			2. Notify Engineer in writing prior to taking pipeline or underground facilities out of service. Shutdown notification shall be provided in advance of the shutdown in accordance with the Contract Documents.
		2. Work on Existing Pipelines or Underground Facilities:
			1. Cut or tap piping or underground facilities as shown or required with machines specifically designed for cutting or tapping pipelines or underground facilities, as applicable.
			2. Install temporary plugs to prevent entry of mud, dirt, water, and debris into pipe.
			3. Provide necessary adapters, sleeves, fittings, pipe, and appurtenances required to complete the Work.
	1. FIELD QUALITY CONTROL

NTS: Edit requirements below to suit the project. If a piping schedule is used, replace “by the Engineer or Owner’s representative in writing.” with “in the Piping Schedule”.

* + 1. General:
			1. Test all piping, except as exempted by the Engineer or Owner’s representative in writing.
			2. When authorities having jurisdiction are to witness tests, notify Engineer and authorities having jurisdiction in writing at least 48 hours in advance of testing.
			3. Conduct all tests in presence of Engineer or Owner’s representative.
			4. Remove or protect pipeline-mounted devices that could be damaged by testing.
			5. Provide all apparatus and services required for testing, including:
				1. Test pumps, compressors, hoses, calibrated gauges, meters, test containers, valves, fittings, and temporary pumping systems required to maintain Owner’s operations.
				2. Temporary bulkheads, bracing, blocking, and thrust restraints.
			6. Provide air if an air test is required, power if pumping is required, and gases if gases are required.
			7. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.
			8. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest structure. Piping not installed by Contractor and that fails the test shall be repaired upon authorization of Owner. Unless otherwise included in the Work, repair of existing piping or underground facilities will be paid as extra Work.

NTS: Edit Section “B” below if a Test Schedule and/or Piping Schedule is provided on the Drawings. Indicate required test procedures and pressures, or where they are to be found (Drawings)

* + 1. Test Schedule:
			1. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.
			2. For piping not listed in Piping Schedule:
				1. Hydrostatically test pipe that will convey liquid at a pressure greater than five psig.
				2. Use exfiltration testing, low-pressure air testing, or vacuum testing for other piping.
			3. Test Pressure:

NTS: Insert at (--1--) below the appropriate test pressure.

* + - * 1. (--1--)
				2. If test pressure is not listed in Piping Schedule, or if test is required for piping not listed in the Piping Schedule, test pressure will be determined by Engineer based on maximum anticipated sustained operating pressure and methods described in applicable ANSI/AWWA manual or standard that applies to the piping system.

NTS: Delete tests not required for the project. Delete references to types of pipe not included in the project. Hydrostatic testing is required on pressurized pipe, including sanitary force mains and when vertical/horizontal separation is not met. Edit the test pressure based on the maximum anticipated sustained operating pressure.

* + 1. Hydrostatic Testing:
			1. Preparation for Testing:
				1. For PVC pressure pipe follow procedures described in Section 7 of AWWA C605.

PVC pipe test pressure and duration: 150 psi for 2 hours

* + - * 1. For HDPE pipe, follow procedures described in ASTM F2164. If re-testing of a test section or pipeline is required, at least 8 hours shall elapse between tests.

HDPE pipe test pressure and duration: 150 psi for 4-hour expansion; 140psi for 1-hour test

* + - * 1. For Ductile Iron pipe, follow procedures described in AWWA M41.

Ductile Iron pipe test pressure and duration: 150 psi for 2 hours

* + - * 1. Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.
				2. Prior to testing the Contractor shall ensure that the line is clean and free of dirt and debris.

NTS: Insert at (--1--) special requirements, such as a need to limit lengths of test sections, that may be based on the capacity of the testing equipment. If not required, delete Paragraph “f”.

* + - * 1. (--1--).
			1. Test Procedure for DIP and PVC pressure pipe:
				1. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
				2. Expel air from pipe as required. Obtain approval of Engineer prior to tapping pipe for expelling air.
				3. Examine exposed joints and valves, and make repairs to eliminate visible leakage.
				4. Add fluid as required to pressurize line to required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
				5. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
				6. Timed Test Period: After stabilization period, maintain test pressure for at least two hours. During timed testing period, add fluid as required to maintain pressure within five psig of required test pressure.
				7. Pump from test container to maintain test pressure. Measure volume of water pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.
			2. Test Procedure for HDPE Pressure Pipe:
				1. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate shall not exceed one foot of pipe length per second in pipe being tested.
				2. Expel air from pipe as required. Obtain approval from Engineer prior to tapping pipe for expelling air.
				3. Examine exposed joints and valves, and make repairs to eliminate visible leakage.
				4. After filling pipeline, gradually pressurize pipe to test pressure and maintain required test pressure for four hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.
				5. Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
				6. Timed Test Period: After four-hour expansion phase, reduce test pressure by ten psig and do not add liquid. Test pressure shall then remain steady for one hour, indicating no leakage.
				7. If no visible leakage is observed and pressure remains within 5% of the original test pressure for one hour, a passing test is indicated.
			3. Makeup Water Allowances:
				1. The allowable makeup water allowance is the maximum amount of water that is added into a pipeline undergoing hydrostatic pressure testing. The allowable leakage rates for the various pipe materials and joints are listed below.

NTS: Add paragraphs if required to provide allowable leakage rates for piping systems included in the project that are not listed below.

* + - * 1. No Makeup Water: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.

NTS: ANSI/AWWA Manual M41 is for ductile iron pipe. Its leakage rate allowance is applied to ductile iron pipe and the pipe materials specified in Paragraph “c”.

* + - * 1. Rates based on formula or table in AWWA M41:

DIP and PVC pipes joined with rubber gaskets as sealing members, including the following joint types:

Bell and spigot and push-on joints.

Mechanical joints.

Bolted sleeve type couplings.

Grooved and shouldered couplings.

Allowable leakage per 1,000 feet of pipeline at 150 psi test pressure:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Size (in) | Leakage (gph) |  | Size (in) | Leakage (gph) |
| 4 | 0.33 | 24 | 1.99 |
| 6 | 0.50 | 30 | 2.48 |
| 8 | 0.66 | 36 | 2.98 |
| 10 | 0.83 | 42 | 3.17 |
| 12 | 0.99 | 48 | 3.48 |
| 16 | 1.32 | 54 | 4.47 |
| 20 | 1.66 |  | 60 | 4.97 |

* + - * 1. Makeup Water Allowances for Concrete Pressure Pipe shall conform to AWWA M9.

NTS: Low pressure air testing is used to test joints for DIP, PVC, and HDPE pipes and is intended for diameters less than or equal to 36”. Any larger diameter makes increases the force on the pipe plugs and creates an unsafe testing situation. Delete testing if not used for project.

* + 1. Sewer Testing with Low Pressure Air:
			1. Plug and bulkhead ends of pipe segment to be tested.
				1. One plug shall have an orifice through which to pass air and a second orifice shall be continuously connected to a pressure gauge having a range from 0 to 10 psi, minimum divisions of 0.10 psi, and accuracy of plus or minus 0.04 psi.
			2. The air supply line shall have a positive on-off valve and suitable means for readily disconnecting from the control panel.
			3. The section of pipe shall be pressurized to approximately 4 psi.
			4. The air shall be shut off and allowed to stabilize for a minimum of 2 min. If during this time the pressure drops below 3.5 psi, more air shall be added to raise pressure to a minimum of 3.5 psi.
			5. After the air has stabilized, the air line shall be disconnected and testing will begin.
			6. The time of test, in minutes, will be equivalent to one-half of the nominal diameter of the pipe being tested.
			7. The maximum allowable pressure drop during the specified time period will be 1.0 psi.

NTS: Vacuum testing can be done on the pipe alone, manhole alone, or a combination of pipe and manhole. Edit to suit the project.

* + 1. Vacuum Testing:
			1. Pipe Segments
				1. Plug and bulkhead ends and lateral connections of pipe segment to be tested.
				2. Following set-up of test apparatus, draw vacuum of ten inches of mercury on pipe segment being tested.
				3. Brace all plugs to prevent the plug or pipe from being dislodged and drawn into a manhole, when vacuum testing.
				4. Start test upon reaching specified test vacuum. Test duration shall be 15 minutes.
				5. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, pipe segment or manhole fails the test and shall be repaired and retested. If vacuum drop is less than one inch of mercury, pipe segment or manhole passes the test.
			2. Manholes
				1. Temporarily plug pipe connections entering manhole to be tested.
				2. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
				3. Following set-up of test apparatus, draw vacuum of ten inches of mercury on manhole being tested. The time shall be measured for the vacuum to drop nine inches mercury.
				4. Start test upon reaching specified test vacuum. Test duration shall be in accordance with ASTM C1244.

Minimum test times for various manhole diameters shall conform to the following table per ASTM C1244 or be 1 minute; whichever is longer:

|  |  |
| --- | --- |
| **Depth (ft)** | **Diameter, in.** |
| 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 |
| **Time, in seconds** |
| <4 |  |
| 6 |  |
| 8 | 60 |
| 10 |  | 63 | 67 | 71 |
| 12 |  | 62 | 67 | 71 | 76 | 81 | 85 |
| 14 |  | 62 | 67 | 72 | 78 | 83 | 89 | 94 | 100 |
| 16 |  |  | 69 | 70 | 76 | 83 | 89 | 95 | 101 | 108 | 114 |
| 18 |  | 65 | 73 | 79 | 86 | 93 | 100 | 107 | 114 | 121 | 128 |
| 20 |  | 65 | 72 | 81 | 88 | 95 | 103 | 111 | 119 | 126 | 135 | 142 |
| 22 |  | 64 | 72 | 79 | 89 | 97 | 105 | 114 | 122 | 131 | 139 | 148 | 156 |
| 24 |  | 64 | 78 | 87 | 97 | 106 | 114 | 124 | 133 | 143 | 152 | 161 | 170 |
| 26 | 64 | 75 | 85 | 94 | 105 | 114 | 124 | 134 | 144 | 155 | 164 | 175 | 185 |
| 28 | 69 | 81 | 91 | 101 | 113 | 123 | 133 | 145 | 155 | 167 | 177 | 188 | 199 |
| 30 | 74 | 87 | 98 | 108 | 121 | 132 | 143 | 155 | 166 | 178 | 189 | 202 | 213 |

Note: Table per ASTM C1244

* + - * 1. Record vacuum drop at end of test. If vacuum drop is greater than one inch of mercury, pipe segment or manhole fails the test and shall be repaired and retested. If vacuum drop is less than 1 inch of mercury, manhole passes the test.

NTS: Retain Paragraph “F” for flexible pipe, to check whether bedding around pipe has been properly installed and whether pipe has deformed out of round. Edit paragraph “F” below if laser pipe profiling is to be allowed on large diameter installations (pipe 36” and larger).

* + 1. Vertical Deflection Test for Flexible Pipe:
			1. Conduct vertical deflection test at least thirty days after backfill has been placed.
			2. Use rigid ball or mandrel for deflection test, which shall have diameter of at least 95 percent of base inside diameter or average inside diameter of piping, depending on which is specified in applicable ASTM standard, including appendix, to which pipe is manufactured.
			3. Perform test without mechanical pulling devices.
			4. Re-install and retest pipe segments that exceed deflection of 5 percent.

NTS: Retain Paragraph “G” when required, otherwise delete. Requiring televising increases the cost of the project. Televised inspections create a baseline assessment for new pipe and can catch obstructions or construction debris that other tests may miss. Insert at (--1--) the lines to be televised.

* + 1. Televised Inspection:
			1. Televise the following: (--1--).
			2. Televise completed sewer and appurtenant structures, including manholes and chambers, and provide to Engineer copy of video on digital video disc (DVD). Repair apparent leaks and re-televise the pipe until acceptance by Engineer.
			3. Inspection shall be performed by Subcontractor certified in Pipeline Assessment Certification Program (PACP) by National Association of Sewer Service Companies (NASSCO). Provide copy of PACP certification prior to starting inspection. Televising shall conform to coding and reporting standards and guidelines specified in PACP. Identify report annotations, pipe conditions, and pipe defects in accordance with PACP. Severity ratings shall be calculated in accordance with PACP.
			4. Camera for main line shall be pan-and-tilt, radial viewing, pipe inspection camera that pans plus-or-minus 275 degrees and rotates 360 degrees. Use camera with an accurate footage counter that displays on television monitor exact distance of camera from centerline of starting manhole. Use camera with height adjustment so that lens is always centered at one-half inside diameter or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Camera shall operate in 100 percent humidity. Camera, television monitor, and other components of video system produce a minimum 450-line resolution coloredvideo picture. Picture quality and definition shall be satisfactory to Engineer. Camera for lateral televising shall be fixed and capable of moving from main line 80 feet up lateral, and conform in other respects to requirements for main line camera.
			5. Repair apparent leaks in pipe Work in manner satisfactory to Engineer without additional cost to Owner and re-televise the pipe.
	1. CLEANING

NTS: Edit Paragraph “A” to suit the project, and delete inapplicable requirements.

* + 1. Cleaning, General: Clean pipe systems as follows:
			1. Thoroughly clean all piping, in manner approved by Engineer, prior to placing in service.

+ + END OF SECTION + +