CITY OF FORT WAYNE MASTER UPDATED: 6/19/2017

SECTION 33 11 00

Water Piping Installation

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.

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, fittings, and specials. 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 potable water piping, except where buried piping installations are specified under other Sections.
				2. Unless otherwise shown or specified, this Section includes all buried water piping Work.
				3. Work on or affecting existing buried piping.
				4. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, and other Work required for a complete, buried piping installation.
				5. Supports, restraints, and thrust restraint.
				6. Pipe encasements.
				7. Field quality control, including testing.
				8. Cleaning and disinfecting.
				9. Incorporation of valves, meters, and 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 potable water piping Work.
			2. Coordinate with appropriate piping materials Sections of Division 33, Utilities.
		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 (--1--).
			2. Section 31 00 05, Trenching and Earthwork.
			3. Section 33 05 38.16, HDPE Pressure Utility Piping.
			4. Section 33 12 00, Water Appurtenances.

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. Coordinate M&P below with other work specified, measured, and paid in Division 33 Utilities and Division 31 Earthwork.

* 1. MEASUREMENT AND PAYMENT
		1. Measurement and payment for installation of piping and associated appurtenances shall be included in the measurement and payment of each pipe material, except for the specific Work items listed separately below and in other specification sections.

NTS: Edit Section B below if separate pay items will be listed for different size connections.

Water Maintenance Services (WMS) cannot make taps larger than 12”

Any size main can be tapped, however the tap must be smaller than, or equal to, the main size.

* + 1. Water Main Connection (Tapping Sleeve and Valve provided and installed by Water Maintenance and Service, regardless of size up to 12”).
			1. Work Item Number and Title

 **33 11 00-A Water Main Connection (Tapping Sleeve and Valve)**

* + - 1. The number of water main connections to be measured for payment shall be the actual number successfully installed.
			2. The payment for the water main connections shall be based on the unit price as listed on the submitted bid schedule.
			3. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, for the excavation, connection and restoration Work necessary for the water main connection as shown and specified unless otherwise directed by the Engineer. The Work includes, but is not limited to: excavation, bracing or shoring, dewatering, disposal of surfaces and spoil where required, saw cutting fittings, furnishing and placement of connection sleeves and materials necessary to make the connection including any required fittings and valves, bedding, granular backfill and/or special backfill ,backfilling and compaction, coordinating and cooperating with Water Maintenance and Service, protection of existing utilities, light poles, fences and mailboxes, Site restoration including, but not limited to, pavement restoration as required, removing and returning or replacing trees, shrubbery, storm sewers, mulched seeding, and incidentals for performing all Work for the connections as specified.
			4. Connections: Contractor to perform all Work, including removal of existing materials as necessary to make connection to existing valve. Water Maintenance and Service (WMS) will provide tapping sleeve and valve. Contractor shall excavate a 6’ by 9’ pit for WMS to perform a “hot tap”. Contractor shall set valve box, backfill pit and restore area.

NTS: Edit Section C below if separate pay items will be listed for different size connections.

* + 1. Water Main Connection (Connect to Existing Valve “Cut in Fittings”), regardless of size.
			1. Work Item Number and Title

**33 11 00-B Water Main Connection (Connect to existing Valve or Water Main “Cut in Fittings”)**

* + - 1. The number of water main connections to be measured for payment shall be the actual number successfully installed.
			2. The payment for the water main connections shall be based on the unit price as listed on the submitted bid schedule.
			3. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, for the excavation, connection and restoration Work necessary for the water main connection as shown and specified unless otherwise directed by the Engineer. The Work includes, but is not limited to: excavation, bracing or shoring, dewatering, disposal of surfaces and spoil where required, saw cutting fittings, furnishing and placement of connection sleeves and materials necessary to make the connection including any required fittings and valves, bedding, backfilling and compaction, granular backfill and/or special backfill, coordinating and cooperating with Water Maintenance and Service, protection of existing utilities, light poles, fences and mailboxes, Site restoration including, but not limited to, all pavement restoration as required, removing and returning or replacing trees, shrubbery, storm sewers, mulched seeding, and incidentals for performing all Work for the connections as specified.
			4. Contractor to perform all Work, including removal of existing materials as necessary to make connections to existing valve.
		1. Test Riser (Temporary)
			1. Work Item Number and Title

 **33 11 00-C Test Riser (Temporary)**

* + - 1. The number of test risers to be measured for payment shall be the actual number installed and removed.
			2. The payment for test risers shall be based on the unit price as listed on the submitted bid schedule.
			3. This item shall include all costs to furnish all labor, materials, tools, and equipment to install and maintain complete the test risers as shown and specified unless otherwise directed by Water Maintenance and Service or the Engineer. The Work shall include, but is not limited to: furnishing and installing corporation stop, ¾” type "K" copper riser or 1”HDPE riser, curb stop, all materials necessary to construct the item, and coordinating and cooperating with Water Maintenance and Service throughout the pressure testing and disinfection process. This item is specified as temporary and shall include removal of the item. If proposed test riser is to be installed and exposed to traffic prior to removal, the Contractor shall install riser inside a valve box or extend copper pipe outside pavement area. Contractor shall consult with Water Maintenance for all such installations.
		1. Removal of Fire Hydrants
			1. Work Item Number and Title

 **33 11 00-D Removal of Hydrants**

* + - 1. The quantity for fire hydrant removal shall be the actual number successfully removed.
			2. The payment for fire hydrant removal shall be based on the unit price as listed on the submitted bid schedule.
			3. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, for removal of existing fire hydrants and auxiliary valve box as shown and specified unless otherwise directed by the Engineer. The Work includes the plug (for main that is to remain in use), plugging materials, coordinating with Water Maintenance and Service for isolation, excavation, removal and disposal of existing facilities, pavement removal and all restoration for the fire hydrant area as set out in these Specifications.
			4. Water Maintenance and Service has the first right of refusal for the removed fire hydrant. Contractor shall dispose of fire hydrant if Water Maintenance and Service, does not want the removed fire hydrant.
		1. Removal of Valve Boxes
			1. Work Item Number and Title

 **33 11 00-E Removal of Valve Boxes**

* + - 1. The quantity for valve box removal shall be the actual number successfully removed.
			2. The payment for valve box removal shall be based on the unit price as listed on the submitted bid schedule.
			3. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, for removal of existing valve boxes as shown and specified unless otherwise directed by the Engineer. The Work includes coordinating with Water Maintenance and Service for isolation, excavation, removal and disposal of existing facilities, pavement removal and all restoration for the valve box area as set out in these Specifications.

NTS: As a “Rule of Thumb” blow off is ½ the OD of the pipe being tested. Blow off may need to be bigger than 2”. Consult CUE for mains larger than 8”.

* + 1. 2-Inch Temporary Blow Off Assembly
			1. Work Item Number and Title

 **33 11 00-F Temporary 2-inch Blow-off**

* + - 1. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary to install and maintain complete blow-off assembly as shown and specified unless otherwise directed by the Engineer. The Work shall include, but is not limited to, furnishing and installing plug on end of pipe and 2” blow-off assembly, and coordinating and cooperating with Water Maintenance and Service throughout the pressure testing and disinfection process.
			2. The number of plug and blow-off assemblies to be measured for payment shall be the actual number installed and removed.
			3. The payment for these items shall be based on the unit price as listed on the submitted bid schedule.

NTS: Insert at (--1--) below the project specific pipe size. Edit Section H below if separate pay items will be listed for different size pipe cut and plugs.

* + 1. Cut and Plug (Water Main Abandonment)
			1. Work Item Number and Title

 **33 11 00-G Cut and Plug ((--1--) pipe abandonment)**

* + - 1. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, for the excavation, abandonment of existing mains, and restoration Work necessary for the cut and plugs as shown and specified unless otherwise directed by the Engineer. The Work includes, but is not limited to: excavation, bracing or shoring, dewatering, disposal of surfaces and spoil where required, furnishing and installing all materials for cutting and plugging existing water mains, removal of any nearby valve boxes (if plugging valve face), bedding, backfilling and compaction, granular backfill and/or special backfill, coordinating and cooperating with Water Maintenance and Service, protection of existing utilities, light poles, fences and mailboxes, Site restoration including, but not limited to, pavement replacement as required, removing and returning or replacing trees, shrubbery, storm sewers, mulched seeding, and incidentals for performing all Work for excavation and restoration for the cut and plugs as specified.
			2. The number of cut and plugs to be measured for payment shall be the actual number of existing main locations cut and plugged for abandonment.
			3. The payment for cut and plug shall be based on the unit price as listed on the submitted bid schedule. Payment for any associated road replacement/restoration shall be paid for under its respective Work item.

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

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

 **33 11 00-H 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 standards referenced in this section are listed below:

* + 1. Standards referenced in this Section are listed below:
			1. ASTM International.
				1. ASTM B843, Standard Specification for Magnesium Alloy Anodes for Cathodic Protection.
				2. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
				3. ASTM D2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
				4. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
			2. American Water Works Association.
				1. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
				2. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
				3. AWWA C605, Underground Installation of PVC and PVCO Pressure Pipe and Fittings.
				4. AWWA C606, Grooved and Shouldered Joints.
				5. AWWA C651, Disinfecting Water Mains.
				6. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2-inch through 3-inch, for water service.
				7. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission.
				8. AWWA M9, Concrete Pressure Pipe.
				9. AWWA M23, PVC Pipe-Design and Installation.
				10. AWWA M41, Ductile-Iron Pipe Fittings.
				11. AWWA M45, Fiberglass Pipe Design.
				12. AWWA M55, PE Pipe-Design and Installation.
			3. National Fire Protection Association.
				1. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
	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, and others. Add paragraphs as required.

* + - * 1. Indiana Department of Environmental Management
				2. INDOT ROW permit and other permits deemed necessary by Owner
			1. Obtain required permits for Work in roads, rights‑of‑way, and other areas of the Work, unless otherwise stipulated by Owner.
	1. SUBMITTALS
		1. Action Submittals: Submit the following:
			1. Shop Drawings:

NTS: Laying schedules are required for pipe and for piping that has proprietary restrained joints, such as American Lok-Ring or Flex-Ring, Clow Super-Lock, U.S. TR Flex. Laying schedules are usually not required for piping with non-restrained joints. Delete information that is not required.

* + - * 1. Laying schedules for concrete piping.
				2. Details of piping, specials, joints, harnessing and thrust blocks, and connections to piping, structures, equipment, and appurtenances.
			1. Product Data:
				1. Manufacturer’s literature and Specifications, as applicable, for products specified in this Section.
			2. Testing Procedures:
				1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain Engineer’s approval prior to commencing testing.
		1. Informational Submittals: Submit the following:
			1. Certificates:
				1. Certificate signed by manufacturer of each product certifying that product conforms to applicable referenced standards.
			2. Field Quality Control Submittals:
				1. Results of each specified field quality control test.
		2. Closeout Submittals: Submit the following:
			1. Record Documentation:
				1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work. Submittal shall show actual location of all piping Work and appurtenances at same scale as the Drawings.
				2. Show piping with elevations referenced to Project datum and dimensions from permanent structures. For each horizontal bend in piping, include dimensions to at least three permanent structures, when possible. For straight runs of piping provide offset dimensions as required to document piping location.
				3. Include profile Drawings with buried piping record documents when the Contract Documents include piping profile Drawings.
	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
		1. Piping materials shall conform to Specifications for each type of pipe and piping appurtenances in applicable Sections of Division 33, Utilities.

NTS: Tracing wire is required for all water pipe installation, if buried warning tape is necessary for project add to Section “2.2” below.

* 1. BURIED PIPING IDENTIFICATION
		1. Tracing Wire Requirements
			1. Tracer wire shall be required on all water mains and services.
			2. Horizontal Directional Drilling Installation Wire:
				1. Provide - No.12 or stronger Extra High Strength Copper Clad Steel Reinforced with HDPE Insulation tracing wire rated for a minimum tensile strength of 1,100 lbs. The following materials are acceptable:

Soloshot EHS 1245 - Copperhead Industries, LLC

BoreTough Extra High Strength, Agave Wire, LTD

Or approved equal

* + - 1. Open Cut Installation Wire:
				1. Provide - No.12 or stronger High Strength Copper Clad Steel Reinforced with HDPE Insulation tracing wire rated for a minimum tensile strength of 300 lbs. The following materials are acceptable:

Superflex 1230 - Copperhead Industries, LLC

Or approved equal

* + - 1. 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
			2. 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.
			3. Tracing Wire Corrosion Protection – Sacrificial Anode
				1. Provide a magnesium alloy anodes for cathodic protection that conforms to the requirements of ASTM B843. Supply a minimum 17 lbs packaged magnesium anode that is cast with a perforated galvanized steel core. The anodes shall be of the specified weight and shall consist of an alloy of the following chemical composition:

Aluminum…………...0.010%

Manganese……….0.50 – 1.30

Copper…………......0.02 Max

Nickel…………….0.001 Max

Iron………………...0.03 Max

Magnesium……….Remainder

* + - * 1. Each anode shall be packaged in a permeable cloth bag containing a backfill mixture of the following:

Ground Hydrated Gypsum…………75%

Powdered Bentonite………………..20%

Anhydrous Sodium Sulfate…………5%

* + - * 1. The following materials are acceptable:

Packaged Magnesium Anode 17D4 as manufactured by Corrpro Companies Inc.

Or approved equal

* + 1. Marking Post Requirements
			1. The following marking posts, or approved equal, are acceptable for use in connection with water main installation:
				1. Posts: Flexible Marking Post/Test Station (Glasforms or Carsonite)
				2. Decals: "Warning Water Pipeline" (USA Bluebook) or “Caution Water 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 event of conflict between manufacturer’s recommendations and the Contract Documents, request interpretation from Engineer before proceeding.
			3. Engineer or Owner or Owner’s representative will observe excavations and bedding prior to laying pipe by Contractor. Notify Engineer or Owner or Owner’s representative in advance of excavating, bedding, pipe laying, and backfilling operations.

NTS: Edit the minimum cover required in Paragraph “4” below to suit local requirements and conditions.

* + - 1. Minimum cover over buried piping shall be 5 feet, unless otherwise shown or approved by Engineer.

NTS: Insert the following: “31 00 05, Trenching and Earthwork” as applicable in the Contract Documents.

* + - 1. Excavation in excess of that required or shown, and that is not authorized by Engineer or Owner or Owner’s representative shall be filled at Contractor’s expense with granular material furnished, placed, and compacted in accordance with the Contract Documents.
			2. The width of trenches for 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.
			4. Comply with NFPA 24 for “Outside Protection”, where applicable to water piping systems used for fire protection.

NTS: Paragraph “9” below if for watermain replacement projects. Delete or edit for new watermain projects.

* + - 1. Contractor shall not be actively installing more than 3,000 lineal feet of main at any one time with Owner’s prior approval. Actively installing a main begins when a drill rod is first pushing into the ground and is completed when a segment of main has all services transferred.

NTS: Paragraph “B” is generally used for concrete pipe or special piping systems. It is not typically required for ductile iron pipe, PVC, or HDPE in 8 inch and smaller diameter. Insert at (--1--) additional piping system(s) as required. Insert at (--2--) the site visit time; coordinate during design with pipe suppliers. Delete if not required.

* + 1. Manufacturer’s Installation Specialist:
			1. Provide services of competent installation specialist of pipe manufacturer when pipe installation commences for:
				1. Concrete pipe.
				2. HDPE 12 inches and larger in diameter
			2. Retain installation specialist at the Site for minimum of (‑‑2--) days (eight hours per day at the Site) or until competency of pipe installation crew has been satisfactorily demonstrated.

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, existing and proposed potable water mains and service lines, and sanitary, combined, and storm sewers shall be separated horizontally by clear distance of at least ten 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 separate trench or on undistributed earth shelf on one side of sewer and with bottom of potable water main at least 18 inches above top of sewer.
				3. This deviation may allow installation of the sewer closer to the water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least eighteen inches above the top of the sewer.
				4. 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 water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

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 over 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 under sewer. At minimum, provide compacted select backfill for ten 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. Exceptions:

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 water main and sewer as specified in this Section prior to backfilling. Hydrostatic test pressure at crossing shall be at least 150 psi.

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

* + 1. Temporary Pipe Plugs Between Work Days
			1. Temporarily cap and seal, using watertight plug, installed pipe at end of each day of Work or other interruption of pipe installation to prevent entry of animals, liquids, and persons into pipe, and entrance or insertion of deleterious materials into pipe.
		2. Plugs (Bulkheads):
			1. Install standard plugs in bells at dead ends, tees, and crosses. Cap spigot and plain ends.
			2. Fully secure and block plugs, caps, and bulkheads installed for testing to withstand specified test pressure.
			3. Where plugging is required for phasing of the Work 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 appropriate, cross-referenced Division 31 sections. If bedding conditions and materials are adequately shown and specified in Division 31, it is not necessary to repeat the requirements in this section.

* + 1. Bedding Pipe: Bed pipe as specified and in accordance with details on the Drawings and the requirements in Section 31 00 05, Trenching and Earthwork.

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 or Owner, 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.

NTS: Coordinate Paragraph “3” with the details on the drawings and project requirements. Some larger pipes may require additional bedding, depending on trench conditions; coordinate with specified pipe manufacturers and edit to suit the project.

* + - 1. Where pipe is installed in rock excavation, provide minimum of 3 inches of granular bedding material underneath pipe smaller than 4 inch nominal diameter, and minimum of 6 inches of granular bedding material underneath pipes 4 inch nominal diameter and larger.
			2. Excavate trenches below bottom of pipe by amount shown and indicated in the Contract Documents. Remove loose and unsuitable material from bottom of trench.
			3. Carefully and thoroughly compact pipe bedding with hand held pneumatic compactors.
			4. Do not lay pipe until Engineer or Owner approves bedding condition.
			5. Do not bring pipe into position until preceding length of pipe has been bedded and secured in its final position.
			6. It shall be the Contractor’s responsibility to prove that the required compaction is achieved. This may require the employment of an outside independent testing laboratory. No additional payment will be made to the Contractor for such test.

NTS: Section G below is for open cut excavation. Edit for specific installation procedures. If using HDD installation, delete Section F below and reference separate HDD installation specification Section, 33 05 23.13

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: AWWA C600, ANSI/AWWA C105, AWWA M41.
				2. Thermoplastic Pipe: ASTM D2321, ASTM D2774, AWWA C605, AWWA M23, AWWA M45, AWWA, M55.
			2. Install pipe accurately to line and grade shown and indicated in the Contract Documents, unless otherwise approved by Engineer. Remove and reinstall pipes that are not installed correctly.
			3. Slope piping uniformly between elevations shown.
			4. 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.
			5. Start laying pipe at lowest point and proceed towards higher elevations, unless otherwise approved by Engineer.
			6. Place bell and spigot-type pipe so that bells face the direction of laying, unless otherwise approved by Engineer.
			7. Excavate around joints in bedding and lay pipe so that pipe barrel bears uniformly on trench bottom.
			8. Deflections at joints shall not exceed 75 percent of amount allowed by pipe manufacturer, unless otherwise approved by Engineer.
			9. Carefully examine pipe, fittings, valves, 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.
			10. Inspect interior of all pipe, fittings, valves, 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 thoroughly wire brushed, and wiped clean and dry immediately before pipe is laid.
			11. 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 filed off smooth. Do not flame-cut pipe.
			12. Do not place blocking under pipe, unless specifically approved by Engineer for special conditions.
			13. Touch up protective coatings in manner satisfactory to Engineer prior to backfilling.
			14. Notify Engineer in advance of backfilling operations.
			15. On steep slopes, take measures acceptable to Engineer to prevent movement of pipe during installation.
			16. Thrust Restraint: Where required, as shown on Contract Documents, provide thrust restraint.
			17. Exercise care to avoid flotation when installing pipe in cast‑in-place concrete, and in locations with high groundwater.

NTS: Delete references in Paragraph “H” to types of pipe joints not used in the project and add others as required. Coordinate jointing specifications with pipe product Specification Sections.

* + 1. Jointing Pipe:
			1. Ductile Iron Mechanical Joints- For fittings and valves:
				1. Immediately before making joint, wipe clean the socket, plain end, and adjacent areas. Taper cut ends and file off sharp edges to provide smooth surface.
				2. Lubricate plain ends and gasket with soapy water or manufacturer’s recommended pipe lubricant, in accordance with AWWA C111, just prior to slipping gasket onto plain end of the joint assembly.
				3. Place gland on plain end with lip extension toward the plain end, followed by gasket with narrow edge of gasket toward plain end.
				4. Insert plain end of pipe into socket and press gasket firmly and evenly into gasket recess. Keep joint straight during assembly.
				5. Push gland toward socket and center gland around pipe with gland lip against gasket.
				6. Insert bolts and hand-tighten nuts.
				7. If deflection is required, make deflection after joint assembly and prior to tightening bolts. Alternately tighten bolts approximately 180 degrees apart to seat gasket evenly. Bolt torque shall be as follows:

NTS: Obtain recommendation of ductile iron pipe manufacturers for pipe larger than 48-inch diameter and edit the following table accordingly.

|  |  |  |
| --- | --- | --- |
| **Pipe Diameter (inches)** | **Bolt Diameter (inches)** | **Range of Torque (ft-lbs)** |
| 3 | 5/8 | 45 to 60 |
| 4 to 24 | 3/4 | 75 to 90 |
| 30 to 36 | 1 | 100 to 120 |
| 42 to 48 | 1.25 | 120 to 150 |

* + - * 1. Bolts and nuts, except those of stainless steel, shall be coated with 2 coats, minimum dry film thickness of 8 mils each, of high build solids epoxy or bituminous coating manufactured by Tnemec, or equal.
				2. Restrained mechanical joints shall be in accordance with Section 33 05 33, Ductile Iron Pressure Utility Piping.
			1. Ductile Iron Push-On Joint Pipe:
				1. Prior to assembling joints, thoroughly clean with wire brush the last 8 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. Ductile Iron Proprietary Joints:
				1. Install pipe that utilizes proprietary joints for restraint specified in Section 33 05 33, Ductile Iron Pressure Utility Piping, or other such joints, in accordance with manufacturer’s instructions.

NTS: Flanged joints are not normally used or recommended for use with buried pipe. If project requires buried flanged connections, include Paragraph “4” below, otherwise delete.

* + - 1. Ductile Iron Flanged Joints:
				1. Assemble flanged joints using ring-type gaskets, thickness as recommended by pipe manufacturer but not less than 1/8 inch thick, for raised face flanges. Use full face gaskets for flat face flanges, unless otherwise approved by Engineer or recommended by pipe manufacturer. Gaskets shall be suitable for service intended in accordance with manufacturer’s ratings and instructions. Gaskets shall be properly centered.
				2. Bolts shall be tightened as recommended by the manufacturer in sequence that ensures equal distribution of bolt loads.
				3. Length of bolts shall be uniform. Bolts shall not project beyond the nut more than 1/4 inch when fully tightened. Bolts shall not fall short of the nut when fully taken up. Ends of bolts shall be machine cut and neatly rounded. Do not use washers.
				4. Prior to assembly, lubricate bolt threads and gasket faces.
				5. After assembly, coat all bolts and nuts, except those of stainless steel, with 2 coats, minimum dry film thickness of 8 mils each, of high-build epoxy or bituminous coating manufactured by Tnemec, or equal.

NTS: For thermoplastic pipe in Paragraph “5”, below, bell and spigot joints are typically used on sewers and waterlines. Solvent cement welded joints are typically used on other services, such as buried chemical lines.

* + - 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, 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.
			2. HDPE Pipe Joints:
				1. HDPE 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 manufacture’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 the following melt bead size is formed:

|  |  |
| --- | --- |
| **Pipe Diameter (inches)** | **Required Melt Bead Size (inches)** |
| 2 to 4 | 1/8 to 3/16 |
| 4 to 12 | 3/16 to 1/4 |
| 12 to 24 | 1/4 to 7/16 |
| 24 to 54 | 7/16 to 9/16 |

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.

HDPE Mechanical connections of the polyethylene pipe to auxiliary equipment/fittings shall be through flanged connections which shall consist of the following:

A polyethylene “sub-end” shall be thermally butt-fused to the ends of the pipe.

Provide ASTM A240, Type 304 stainless steel backing rings, 125 pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.

Stainless steel bolts and nuts of sufficient length to show a minimum of four complete threads when the joint is made and tightened to the manufacturer’s standard. Retorque the nuts after a minimum of 4 hours.

* + - * 1. HDPE Electro Fusion Joints:

Install electrofusion joints and fittings according to manufacturers recommended procedures. Use an appropriate electrofusion machine.

Follow the guidelines listed in the MAB Generic Electrofusion Procedure for Field Joining of 12-inch and Smaller Polyethylene (PE) Pipe, and ASTM F2620.

Clean and scrape the pipe to prepare for the electrofusion process. Remove the required amount of surface to promote pipe bonding during the electrofusion process. Do not use sand paper, emory cloth or other abrasives to prepare the joint for electrofusion. Use scraping tools specifically for electrofusion surface preparation.

Prior to the electrofusion process, install alignment and restraining clamps. Do not allow the pipe to move during electrofusion. Ensure that the mainline pipe is fully inserted into the fitting.

Allow the fitting to cool prior to moving the pipe and fitting, based on the manufacturers recommended time.

NTS: Include “31 00 05 Trenching and Earthwork” as applicable in the Contract Documents.

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

NTS: Delete Paragraphs “J”, “K”, and “L” as necessary, if not applicable to the project. Add paragraphs for pipe encasement, carrier pipe, pressure grouting, and other project-specific requirements as necessary.

* + 1. Connections to Valves and Hydrants:
			1. Install valves and hydrants as shown and indicated in the Contract Documents.
			2. Provide suitable adapters when valves or hydrants and piping have different joint types.
		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: Tracing wire is required for all water pipe installation, if buried warning tape is necessary for project edit Section “3.2” below.

NTS: Include tracing wire standard details (STR-43,W-17, and W-48) from the Design Standards Manual, in Contract Drawings.

* 1. BURIED PIPING IDENTIFICATION INSTALLATION
		1. Mainline and Service Tracing Wire
			1. Tracing wire is required on all water mains and services.
			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 tightening the set screw ¾ turn.
				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, 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. For hydrants, install tracing wire in the hydrant shut off valve box in accordance with the installation requirements for values listed above.
			7. For services, install tracing wire in the curb stop valve and 6-inches of wire folded down into the top of the curb box. At service meter, 18-inches of wire shall be wrapped around pipe.
			8. Ensure connectivity is maintained between the mainline tracer wire and the service connection tracer wire.
			9. 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 water main.

NTS: Retain one paragraph “B” below, delete the other. The first paragraph requires that sacrificial anodes be placed where shown on the Drawings. The second specifies a typical spacing requirement. Edit as required based on project specific requirements.

* + 1. Tracing Wire - Sacrificial Anode Installation
			1. Install magnesium anodes onto the tracing wire. Place at approximately 3,000 ft spacing intervals along the entire length of the proposed pipeline.
			2. Connect the lead wire from the anode to the tracing wire using approved direct bury lug connectors.
			3. Insulate the splice with two half-lapped layers of 3/4 inch wide self-sealing rubber tape followed by two half-lapped layers of 3/4 inch wide electrical tape.
			4. Do not dangle the anodes by the lead wire.
		2. Tracing Wire - Sacrificial Anode Installation
			1. Install magnesium anodes as shown on the Drawings.
			2. Connect the lead wire from the anode to the tracing wire using approved direct bury lug connectors.
			3. Insulate the splice with two half-lapped layers of 3/4 inch wide self-sealing rubber tape followed by two half-lapped layers of 3/4 inch wide electrical tape.
			4. Do not dangle the anodes by the lead wire.
		3. Marking Post Requirements
			1. Marking post will be required for all bores or on feeder mains where standard valve and hydrant spacing cannot be maintained, 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.

NTS: Where applicable include thrust restraint standard details and requirements.

* 1. THRUST RESTRAINT
		1. Provide thrust restraint on pressure piping systems where indicated on the Contract Drawings.

NTS: Edit Paragraphs “B” through “E” 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. 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 and in the Hydrostatic Testing requirements of this Section.
		2. 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 as specified lugs and tie rods; or other joint restraint systems approved by Engineer.
				2. Thermoplastic, and HDPEJoints: 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.

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 during 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 or Owner.
			2. Notify Engineer or Owner 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 General Conditions or 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.

NTS: Section 3.5 outlines the preferred method for start up of a water main. Edit based on project specific requirements.

* 1. WATERMAIN START-UP SEQUENCING
		1. When connecting new or replacement water main to City Utilities’ water distribution system, use the following method:
			1. Maintain one point of connection between the new/replacement water main and the in-service water main. Water Maintenance and Service shall be the sole entity responsible for turning the valves that create this single point of connection to the existing system.
			2. The separation between the new/replacement water main is commonly called an air gap, and used to maintain the integrity of the in-service water main.
			3. Successfully complete the pressure testing and disinfection of the new/replacement water main.
			4. Services shall be approved for potable use after successful pressure testing and disinfection.
			5. After successful pressure testing and disinfection install all service connections.
			6. Continue this process until all water mains within the project are connected to City Utilities’ water distribution system.
			7. The Contractor is responsible for turning all other valves not accepted as part of the distribution system.
			8. Close gap after water main has been successfully pressure tested and disinfected.
	2. FIELD QUALITY CONTROL

NTS: Edit requirements below to suit the project.

* + 1. General:
			1. Test all piping.
			2. Notify Construction Manager at least 48 hours in advance of testing.
			3. Conduct all tests in presence of Engineer or Owner.
			4. Air Gaps
				1. To maintain the integrity of the water main still in service, use a 1-20 foot air gap between the new main and the existing.
				2. After successful completed pressure testing and disinfection, provide closure piping and appurtenances as required to complete the connection to the new water main.
			5. Remove or protect pipeline-mounted devices that could be damaged by testing.
			6. Provide all apparatus and services required for testing, including:
				1. Test pumps, compressors, hoses, calibrated gages, meters, test containers, valves, fittings, and temporary pumping systems required to maintain Owner’s operations.
				2. Temporary bulkheads, bracing, blocking, and thrust restraints.

NTS: Paragraph “7”, below, states that the owner will provide the water required for testing. The Owner is usually in a better position to supply the water; however, there may be cases where contractor may be the more appropriate responsible party. Edit to suit the project and Owner’s preference.

* + - 1. Unless otherwise specified, Owner will provide water required for hydrostatic testing. Contractor shall provide means to convey water for hydrostatic testing into piping being tested. Contractor shall provide water for other types of testing required.
			2. Repair observed leaks and repair pipe that fails to meet acceptance criteria. Retest after repair.

NTS: Edit Paragraph “9” below based on if the new pipe is to be tested including with the existing pipe or separately.

* + - 1. Unless otherwise specified, testing shall include existing piping systems that connect with new piping system. Test existing pipe to nearest valve. 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.
			2. Contractor shall provide a competent person to do the work in the presence of the Owner.. The competent person must remain on the job the duration of the PTD project, which may include not standard working hours. It is recommended that the competent person shall have read and be familiar with AWWA standards C651, C600, C605 and other applicable standards.
			3. Valves owned by the City of Fort Wayne shall only be operated by Owner.
			4. Contractor shall operate new valves until substantial completion.
		1. Test Schedule:
			1. Do not place potable water into the newly installed pipe until Owner is on the project site and gives the Contractor approval. A visual continuity test must be passed first.
			2. Unless otherwise specified, required test pressures are at lowest elevation of pipeline segment being tested.
				1. Piping Schedule: Hydrostatically test pipe that will convey liquid at a pressure greater than 5 psig.
				2. Use exfiltration testing, low-pressure air testing, or vacuum testing for other piping.
				3. Disinfect for bacteriological testing piping that conveys potable water.
			3. Test Pressure:
				1. Pressure tests shall conform to the applicable AWWA and ASTM standard.

NTS: Delete tests not required for the project. Delete references to types of pipe not included in the project.

NTS: Consider the following when specifying test pressures:

1. Paragraph “3.6.B.1” references hydrostatic test pressure to lowest elevation in pipe segment tested.

2. Excessive test pressure requirements may increase extent and cost for testing and thrust restraint, which must be designed for the test pressure.

3. Required test pressure should not normally exceed 150 percent of maximum operating pressure for liquids, and 110 percent of maximum operating pressure for air and gas. Verify system design parameters and consult with pipe suppliers while determining the required test pressure.

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

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

* + - * 1. For HDPE pipe, follow procedures described in ASTM F2164. Test duration, including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize, shall not exceed 8 hours. 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 other Concrete Pressure pipe follow procedures described in AWWA M9. Wetting period is not required for pipe that is not cement mortar-lined.
				2. 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 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. Pressure Gauges
				1. Utilize spot gage trees for the pressure test gages for Owner to attach their pressure gage. The following gages are acceptable:

Noshawk 200 PSI

Wikai 300 PSI

* + - 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. Test Procedure for Concrete 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. After filling the pipe allow for a 48-hr momentum wetting period to saturate the concrete lining.
				4. Bring the pipeline to 120% of the working pressure, and maintain, within 5 psig, the pressure for the test duration of a minimum of 2hrs.
			4. 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, or threaded, 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 “b”.

* + - * 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.

Bolted sleeve type 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.
	1. CLEANING AND DISINFECTION

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

* + 1. Cleaning, General: Clean pipe systems as follows:
			1. Thoroughly clean all piping, including flushing with water, dry air, or inert gas as required, in manner approved by Engineer or Owner, prior to placing in service. Flush chlorine solution and sodium hypochlorite piping with water.
			2. Piping 24 inch diameter and larger shall be inspected from inside and debris, dirt and foreign matter removed.
			3. For piping that requires disinfection and has not been kept clean during storage or installation, swab each section individually before installation with five percent sodium hypochlorite solution.

NTS: Delete Paragraph “B” below if not applicable.

* + 1. Disinfection:
			1. Disinfect all potable and finished water piping.
			2. All equipment, tools, and mixing machines used in the disinfection process, shall be clean and free from debris, and substances not acceptable for contact with potable water.
			3. Procedure for accomplishing complete and satisfactory disinfection is specified below.
			4. Other procedures may be considered for acceptance by Engineer or Owner. Any deviations or changes must be confirmed in writing by Owner.
				1. Prior to disinfection, clean piping as specified and flush thoroughly.
				2. Conform to procedures described in AWWA C651. Use the slug method of disinfecting, unless alternative method is acceptable to Engineer.
				3. No chlorine tabs are to be glued to the inside of the pipe or fittings.
				4. Do not place any other material or substance inside the pipe, including dye, without prior approval from Owner.

NTS: Edit Paragraphs “5” through “9” below to suit the project.

* + - 1. Water for initial flushing, testing, disinfection, Work and all necessary equipment, tools, and machines will be furnished by Contractor. Contractor shall be responsible for damage caused by water from hydrants.
			2. Use a clean and free from debris rotary mixer for chlorine preparation. Any other equipment shall be approved by Owner.
			3. Chlorine shall be provided by Contractor. The following is acceptable:
				1. Prestochlor- 65% Hydrated Calcium Hypochlorite- Product No. 839284.
				2. Or approved equal.
			4. Dechlor chemical, injector pump and hoses shall be provided by the Contractor, if necessary.
			5. Test Risers shall be installed every 1,200 feet of new water main plus one at the end of branches. Contractor shall be responsible for maintaining all test risers in operable condition, erosion protection, and that test risers are ready for sampling when the owner arrives. Test riser maintenance includes but is not limited to freezing, and protection from dust and dirt, Obtain owner approval prior to allowing more than a pencil diameter flow through a test risers shall not flow more than a pencil diameter water flow without contractor presence. Contractor shall coordinate test risers to be ready for sampling at the time when the owner arrives.
			6. Bacteriologic samples and tests will be performed by the Owner. This includes procuring the sample, transporting sample to the Filtration Plant, and receiving and communicating the results of the test. Certified test laboratory report will be provided to Contractor, if requested.
			7. Chlorine concentration in water entering the piping shall not have less than 100 mg/L free chlorine. The chlorine shall be applied continuously and for a sufficient period to develop a column or “slug,” of chlorinated water that will as it moves through the main, expose all interior to a concentration of approximately 100 mg/L for at least 3 hours. Disinfect piping and all related components. Repeat as necessary to provide complete disinfection.
			8. After required retention period,
				1. Flush chlorinated water to the Sanitary Sewer, unless otherwise acceptable to Engineer or Owner.
				2. If water has been properly dechlorinated, flushing to the Storm Sewer is acceptable. Properly dispose of chlorinated water in accordance with Laws and Regulations.
				3. Do not discharge chlorinated water to storm sewers, ditches, or overland.
				4. No flushing during a rain event.
			9. If first sample fails, one more is allowed. If the second sample fails, another flush must take place. If the sample failures continue, the disinfection process must be repeated. Contractor must remain on site for the entire disinfection process until the pipe passes.

+ + END OF SECTION + +