## SECTION 4 CONTENTS

## SPECIFICATIONS FOR WATERMAINS AND WATER SERVICES

Description of Work ..... 4.01
Materials ..... 4.02
Water Services ..... 4.03
Inspection ..... 4.04
Responsibility for Material ..... 4.05
Handling of Material ..... 4.06
Alignment and Grade ..... 4.07
Laying ..... 4.08
Joining of Mechanical - Joint Pipe ..... 4.09
Joining of Push-On Joint Pipe ..... 4.10
Setting of Valves and Fittings ..... 4.11
Setting of Hydrants ..... 4.12
Anchorage ..... 4.13
Hydrostatic Test ..... 4.14
Cleaning and Disinfection ..... 4.15
Dead Ends/Looping/Phasing ..... 4.16
Shut Downs of Existing Watermain for Connection ..... 4.17

## SECTION 4

## SPECIFICATIONS FOR WATERMAINS AND WATER SERVICES

### 4.01 <br> DESCRIPTION OF WORK

The work shall consist of furnishing and installing watermain of the specified size or sizes at the depths shown on the plans or specified herein, and furnishing all fittings and joint materials, labor, materials, tools, and equipment for receiving, unloading, transporting, laying, testing, and disinfecting of water pipe and fittings. The Contractor shall furnish all hydrants, valves, valve boxes, bends, tees, fittings, restraint glands, and other necessary accessories to complete the pipe work as shown on the plans and specified herein.

### 4.02 MATERIALS

All materials furnished by the Contractor shall conform to the specifications which follow. Where reference specifications are mentioned the current edition or latest issue shall be used.
4.02.01 Ductile Iron Pipe
4.02.01.01 Pipe

Ductile iron pipe shall conform to the requirements of AWWA C-151 (ANSI A21.51). Ductile iron pipe shall be Class 52 unless otherwise specified. Eight (8) inch is the minimum diameter for mainline pipe. All ductile iron watermain shall be produced in the United States of America.

### 4.02.01.02 Fittings

All fittings shall be ductile iron in accordance with AWWA C-153 (ANSI A21.53). Fittings twenty four (24) inches in diameter and smaller shall have a minimum pressure rating of 350 psi., fittings larger than twenty four (24) inches in diameter shall have a minimum pressure rating of 250 psi. Fittings shall have either cement mortar lining with seal coat in accordance with AWWA C-104 (ANSI A21.4) or fusion bonded epoxy coating in accordance with AWWA C-116 (ANSI A21.6). Lining shall have NSF61 approval for use with potable water. All watermain fittings shall be produced in the United States of America.
4.02.01.03 Joints

Unless otherwise specified, all pipe joints shall be rubber gasket joints conforming to the requirements of AWWA C-111 (ANSI A21.11) for bolted mechanical joints or push-on joints. Joints on fittings shall be bolted mechanical joints. (See 4.10.04 for brass wedging requirements)

In soils with known hydrocarbon contamination or in areas with high potential for hydrocarbon contamination in the opinion of the Township Engineer, pipe joints shall be a Fluoroelastomer Fluorel Viton ${ }^{\circledR}$ gasket or approved equal.

All pipe shall have a cement mortar lining with seal coat conforming to the requirements of AWWA C-104 (ANSI A21.4). Seal coat shall have NSF61 approval for use with potable water.

### 4.02.01.05 Polyethylene Wrap

All ductile iron pipe, joints, valves, fittings, and hydrants shall be encased in a seamless polyethylene tube, in accordance with AWWA C-105 (ANSI A21.5) 8 mils minimum thickness. The ends of adjacent sections of polyethylene tubing shall be overlapped a minimum of one (1) foot, and the joint taped with polyethylene compatible adhesive tape or otherwise secured to prevent displacement during backfill operations. All tears, cuts, rips, and punctures must be repaired including those for water services prior to backfill of the ductile iron pipe.

### 4.02.02 Valves

### 4.02.02.01 Resilient Wedge Gate Valves

All 16" and larger buried valves shall be resilient wedge gate valves.
Valves shall be East Jordan Iron Works, Clow Corporation R/W Resilient Wedge, American Flow Control Resilient wedge, U.S. Pipe Metroseal 250, American AVK Company Series 25, or equal (Resilient Wedge valves shall conform to AWWA C-509 or C515-99).

Valves will open right or clockwise.
Valves shall have a 250 p.s.i. design pressure rating and a test pressure of 500 p.s.i. A certification of manufacturer and testing shall be provided on request. Valve body and bonnet shall be totally encapsulated with an epoxy coating.

Resilient Wedge Gates shall be ductile iron and shall be totally encapsulated in rubber. This rubber coating shall be permanently bonded to the ductile iron wedge casting and shall meet A.S.T.M. D429 tests for rubber to metal bonding.

Valve stem shall be made of high strength manganese bronze. Stem seal shall have two O-ring seals in the seal plate which shall be replaceable with the valve in the full open position at rated working pressure.

All watermain valves shall be produced in the United States of America.
4.02.02.02 Butterfly Valves

No butterfly valves may be buried unless approved by the Township.
All butterfly valves shall conform to AWWA C-504, Standard for Rubber Seated Butterfly Valves. Valves shall be Class 150-B and shall have a "short body" form. Valves
shall be suitable for direct buried service without a manhole. Valves shall be constructed of material suitable for handling water. Shaft seals shall be replaceable without removing the valve shaft. Valves shall be equipped with totally enclosed worm gear operators conforming to AWWA C-504. All valves shall be Henry Pratt Company "Groundhog", or approved equal. Valves will open right or clockwise. All watermain valves shall be produced in the United States of America.
4.02.02.03 Tapping Saddles (Branch $11 / 2$ inches or 2 inches)

Tapping saddles shall be Romac Industries 101NS or 202NS, Powerseal Model 3417DI, Ford Meter Box FC202-905-TAP with double stainless steel straps or approved equal.

### 4.02.02.04 Tapping Sleeves (Branch 4 inches or larger)

Tapping sleeves shall be stainless steel Romac Industries SST, Ford FAST, Smith-Blair 663, or Power Seal Model 3480, with stainless steel flange, or approved equal.
4.02.03 Hydrants

Fire hydrants shall conform to AWWA C-502, Standard for Dry Barrel Fire Hydrants. The six (6) inch mechanical joint inlet shall be located six feet (6') below the ground bury line of the hydrant. Hydrants shall be installed so that the ground bury line of the hydrant is placed at the finished grade at the hydrant. The center of the pumper nozzle is to be a minimum distance of eighteen (18) inches above the ground bury line. Access culverts (where required) shall be installed. Joint materials shall conform to those previously specified under ductile iron joints.

The hydrant shall have a $51 / 4$ " valve opening. The operating nut and nozzle caps shall have a $1 \frac{3 / 4 "}{}$ square by 1 " thick section for the wrench. The nozzle caps shall have a suitable rubber-like gasket. The hydrants shall open right or clockwise. Hydrants shall be furnished with a breakable stem and flange. The pumper connection shall be four (4) inches with E.J.I.W. \#2 threads (Grand Rapids thread standard), and there shall be two, two and one-half ( $21 / 2$ ) inch nozzles with national standard male hose coupling threads. The hydrants shall be East Jordan Iron Works 5BR - 250 D with liner, Waterous Pacer, or approved equal. All hydrants must be produced in the United States of America.

The weep holes shall be left unplugged.
All Hydrants shall be factory painted yellow enamel.
All new, salvaged, or existing hydrants within a project shall be outfitted with a 52 " steel hydrant marker stick with spring base. The spring and stick shall be made from a single piece of galvanized steel and have a minimum of 16 " of red and white reflective bands on top.

Hydrants shall be located at all highpoints of the watermain and so that all points of buildings served by the watermain project are within 250 feet of a hydrant.

## Valve Boxes

Valve boxes shall be cast iron screw type, three sections, adjustable with round bases, with an overall length sufficient to permit the tops to be set flush with the established pavement or ground surface. The box shall be provided with a cast iron lid or cover and marked with the word "WATER". The valve boxes shall be designed to withstand heavy traffic. Valve Boxes shall be EJIW 8560-D4 or Tyler 6860 with 5 " minimum inside diameter. Valve boxes shall be placed on a concrete ring as shown on the Valve \& Box Foundation detail. Valve boxes shall be wrapped in geotextile fabric.

Valve boxes located in paved areas shall meet the requirements shown in the Valve Box in Pavement detail.
4.02.05 Stainless Steel

Stainless steel components shall meet the specifications of A.S.T.M. type 304. Anti-seize shall be used on all stainless steel bolts and nuts or other threaded parts.
4.02.06 High Density Polyethylene Pipe

### 4.02.07 Pipe

Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) publication TR-4. The resin material shall meet the specifications of ASTM D3350-98 with a minimum cell classification of PE345574C. The pipe shall be labeled PE4710. The pipe shall also meet ANSI/AWWA C 906-2006 standard for polyethylene pipe and fittings. Pipe must meet both ANSI Standard 61 and ANSI Standard 14. Pipe shall be blue stripe and ductile iron pipe sized (DIPS). Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

## Fittings

BUTT FUSION FITTINGS: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

ELECTROFUSION FITTINGS: Electrofusion fittings shall be PE4710 HDPE, cell classification of PE345574C. and be the same base resin as the pipe. Electrofusion fittings shall have a manufacturing standard of ASTM F1055.

FLANGED AND MECHANICAL JOINT ADAPTERS: Flanged and mechanical joint adapters shall be PE 3608 HDPE, cell classification of 34564 C and be the same base
resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

MECHANICAL RESTRAINT: Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.

Serrated restrainer shall be ductile iron ASTM A536-80 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel. The restrainer shall have a pressure rating equal to that of the pipe on which it is used. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

| Nominal Size | Restraint Width | Serrations per inch |
| :---: | :---: | :---: |
| 4-inch, 6-inch | $11 / 2 "$ | 8 |
| 8-inch, 10 -inch, 12 -inch | $13 / 4 "$ | 8 |

Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal instillation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and R of the HDPE. Stiffeners shall be by JCM Industries or pre-approved equal.

WALL ANCHORS FOR RESTRAINT: In addition to mechanical restraint, wall anchors encased in a minimum of 1 cubic yard of concrete (minimum) must be placed at connections to ductile iron. The wall anchors must be butt fusion fittings meeting ASTM D3261 requirements.

ELECTROFUSION FLEX RESTRAINT: In place of Wall Anchors for restraint, Electrofusion Flex Restraint may be used at connections to ductile iron. Electrofusion Flex Restraint shall be PE3608 HDPE, be of the same base resin as the pipe and conform to ASTM D3350. Electrofusion Flex Restrain shall be installed per manufacturers recommendations and encased in concrete.

## Locator Wire

All HDPE pipe shall have a tracer wire installed. The tracer wire shall be continuous and shall be 12 AGW blue insulated copper high strength locator wire (insulator material shall be rated for direct bury applications) and shall be attached to the HDPE pipe at approximately five (5) foot intervals using tape or other suitable methods to assure that the wire is not dislocated during pipe installation and backfilling. The locator wire shall be placed in the 12 o'clock position.

Locator wire for Horizontal Directional Drilling (HDD) operations shall be 12 AWG (min.) high strength locator wire with a minimum break load of 1150 lbs . Protective blue insulating coating shall be High Molecular Weight, High Density Polyethylene (HWDHDPE) 45 mil. (min.).

After construction and backfilling is complete the tracer wire shall be tested by the Contractor and witnessed by the Township or Township Engineer. If the tracer wire is determined to not be operating properly the Contractor shall locate and correct the issue.

If the locator wire must be spliced, the splice shall be soldered and suitably insulated for underground wet conditions.

Tracer wires shall terminate at the nearest valve box, hydrant valve box, or in a tracer box. Tracer boxes shall be a USA BlueBook Snakepit Roadway Tracer Box with a blue cover, or approved equal.

### 4.02.08 $\underline{\text { Salvaged Equipment }}$

Any hydrants, valves, fittings, pipes, or other watermain appurtenances that are salvaged from an existing installation shall become the property of the Contractor. Any salvaged equipment reinstalled on a new watermain project must be approved by the Township and pass all testing and final inspections as if it were new equipment.

The Township will provide no warranty or guarantee of proper operations of salvaged watermain items. The Contractor shall be fully responsible for all salvaged equipment, any pre-existing equipment conditions of salvaged items, and shall be responsible for all work and costs necessary to bring salvaged equipment up to new condition.

### 4.03 WATER SERVICES

Connection to the water supply system and use of the water supply system is governed by the Township Ordinance to administer, regulate, and provide for the connection to and use of the water and sewer system. See this Ordinance for regulations governing use of the water supply system and penalties for violation of the Ordinance. Application forms and permits for connection are available at the Township office. These forms will provide for payment of the connection fees at the time request is made for service.

Meter and service sizes must be approved by the Township as suitable for the proposed application.

The Township or an authorized representative must inspect all water services in dry conditions under pressure prior to backfill. Temperatures must be above freezing. Inspections can be scheduled by calling the Township a minimum of 24 hours prior to the time an inspection is needed. Inspection times are scheduled on a first come basis. A permit number and building street address are required to schedule an inspection.

Outside of public rights-of-way and easements the customer shall construct, own and maintain the water line at the Owner's expense in its entirety.

Water services in the Townships are to be installed in accordance with the following specifications:
4.03.01 Materials
4.03.01.01 Curb Boxes

Curb Boxes shall be Tyler Series 6500, Model 95E ( $5^{\prime}-6^{\prime \prime}$ bury exactly) or an approved equal having a minimum diameter of $2-1 / 2$ " and a brass bolt to connect the lid. The lids of all boxes shall be marked with the word "Water" or the letter "W". (No rods are required.) The curb box shall be centered over the curb cock (normally to be set on the property line or easement line) and must be plumb after backfilling. The tops of curb boxes are to be left 3 " above finish grade. Stakes for finish grade at the curb stop must be provided prior to installation of a water service.
4.03.01.02 Curb Stops

Curb stops shall be Ball Valves: Ford B44 Series, McDonald Model No. 76100, or Mueller Series 300 Model P-25209, with compression fittings, or approved equal. The curb stop shall normally be set on the property line or easement line. The curb stop shall be installed on a Vadle ${ }^{\mathrm{TM}}$ curb box lock and a brick support so that the valve can be operated normally after backfilling. The service shall be crimped shut at the end.
4.03.01.03 Corporation Stops

Corporation stops shall be Ball Valves: Ford FB1000, McDonald Model 74701B, or Mueller Series 300 Model P-25028, with compression fittings or approved equal.

### 4.03.01.04 Valve Boxes and Valves

Valve Boxes and Valves shall meet the requirements of 4.02.04 and 4.02.02.01. Valves for services shall normally be set on the property line or easement line.
4.03.01.05 Public Water Service Pipe (within public right-of-way and utility easements)

Water service pipe two inches and smaller in diameter ( 1 " minimum diameter) shall be Type K, annealed, seamless copper tubing in accordance with the current ASTM specification B88. All fittings and joints to be drip free at time of inspection.

Water service pipe four inches (4") in diameter and larger shall be cement lined Ductile Iron Class 52 pipe and meet the requirements of 4.02.01. All materials, inspections, pressure testing, and bacteria sampling must be provided in accordance with the watermain mainline specifications for ductile iron pipe and shall also meet restraint requirements as directed by the Township or the Township Engineer. Polyethylene Wrap shall be placed on the ductile iron water service (or fire protection service) pipe meeting all the specifications for mainline ductile iron pipe.

### 4.03.01.06 Private Service Line Pipe (outside of public right-of-way and utility easements)

All Private Service Line Pipe for service lines of any diameter less than 100 feet in length measured from the curb stop to the water meter fittings shall be of the materials specified in Paragraph 4.03.01.05.

Private Service Line Pipe two inches and smaller in diameter (1" minimum diameter) and greater than 100 feet in length measured from the curb stop to the water meter fittings shall be Type K, annealed, seamless copper tubing in accordance with the current ASTM specification B88, or Cross-linked polyethylene plastic ("PEX") tubing in accordance with the current ASTM specification F877, or Polyethylene ("PE") plastic tubing in accordance with ASTM specification D2737. All fittings and joints to be drip free at time of inspection.

Private Service Line Pipe installed using PEX or PE tubing shall conform to current NSF 61 , shall be installed in sand bedding, and shall be installed with a continuous (from stop box to meter fittings) tracer wire consisting of a minimum of 14 gauge copper wire with a coating approved for direct bury. The private service line pipe shall be installed in accordance with all manufacturers' specifications for the material in use.

Private service line pipes using PEX or PE tubing shall be allowed to "rest" for a minimum of 24 hours prior to pressure testing or drip testing unless approved by the Township or Township Engineer for immediate connection. Slack or a serpentine section of PEX or PE tubing shall be included in all private service line pipes for a minimum of 5 feet and as recommended by the manufacturer.
4.03.01.07 Connections and Fittings

Copper to copper connections shall be Mueller No. 15404 or 15403, Ford C44 Series, or McDonald Model No. 4758, with compression fittings, or approved equal. PEX to PEX or PE to PE connections must be Ford C66 Series, McDonald Model No. 74758-33, compression fittings or approved equal. All connections and fittings must comply with lead free requirements.

Within public right-of-way and public watermain easements copper to copper connections will not be allowed between a corporation stop and curb stop unless lengths of copper between the corporation stop and curb stop exceeds 100 feet for 1 " diameter copper tubing or 60 feet for $11 / 2 "$ and $2 "$ diameter copper tubing.

Outside of the public right-of-way and public watermain easements connections and fittings will not be allowed between the curb stop and the water meter fittings unless the distance between these two points exceeds 100 feet for 1 " diameter copper tubing or 60 feet for $1 \frac{1}{2}$ " and $2 "$ diameter copper tubing.

Connections and fittings may not be placed under the influence of pavement. Exceptions may only be allowed by the Township or the Township Engineer.

All new curb stops shall be marked with a blue, 1 -rail, 2.5 " wide by 66 " long plastic utility marker with a "WARNING WATER VALVE" decal. The marker shall be rated for temperatures from $-40^{\circ}$ to $150^{\circ} \mathrm{F}$ and shall be UV stable for at least 10 years. The marker shall not rust, rot, corrode or become brittle after installation.
4.03.02 Installation
4.03.02.01 Requirements

All connections and services must meet the requirements of the Michigan State Plumbing Code and the Department of Environment, Great Lakes, and Energy (EGLE) Administrative Rules.
4.03.02.02 Tapping

Locations for taps will be determined by the Township and/or the Township Engineer. All water services will be installed perpendicular to the watermain and tapped outside of paved areas unless special circumstances warrant the Township and/or the Township Engineer to authorize differently. Tail pieces 10 feet in length shall only be placed where required by the Township or Township Engineer meeting the requirements of 4.03.01.06 and of the same diameter as the public water service.

Tapping of the mains for copper water services shall be made under pressure with a tapping machine similar to a Mueller B-100 or approved equal. Drilling through service clamps, saddles or welded couplings shall be performed with a machine similar to Mueller D-5. The tap shall be installed 45 degrees above the horizontal axis of the pipe, and flow arrow shall point away from the main.

Tapping of the mains for ductile iron water services shall be made under pressure in accordance with the watermain mainline specifications.

### 4.03.02.03 Pavement Crossing

Service lines shall be jacked or bored under paved streets. No pavement shall be cut or removed without permission by the Township Engineer and the Road Commission in which the service is located.
4.03.02.04 Cover

All services shall be installed with a minimum earth cover of five (5) feet. In no case shall the maximum earth cover exceed seven (7) feet.
4.03.02.05 Curb Box Locations

For new developments the location of the curb box shall be at the center of the lot and outside of the driveway pavement. Curb Boxes shall be located on the right-of-way line
or on the utility easement limit. All new curb stops shall be marked as indicated in Section 4.03.01.08.

### 4.03.02.06 Surface Restoration

Restoration required for the installation of the water service is the responsibility of the water service contractor.
4.03.02.07 Dewatering

All taps must be made in a dry trench. The Contractor shall dewater the trench at their expense and with their equipment so that the trench is dry when the tap is made.
4.03.02.08 Polywrap/Coating Repairs

All disturbed polywrap/coatings shall be repaired/replaced to provide the required protection to the mainline watermain.
4.03.02.09 Cross Connections

All connections must meet the requirements of the Township Cross Connections Rules.
4.03.02.10 Community Landscaping Irrigation Connections and Setup

The Township may allow water service connections to irrigate shared spaces within a development. The connection shall consist of a typical water service stubbed 6 " out of the ground, a water meter horn, and ball-style shut-off valves on both sides of the horn. Directly downstream of the meter horn there shall be a backflow prevention device meeting ASSE 1020 or ASSE 1013 standards. Place backflow preventer approximately 18 " above ground.

A tee and blow-out line with a threaded plug end shall be fitted on the incoming water service line. See Community Irrigation Setup Detail.
4.03.03 Meters
A. Installation:

All meters shall be installed at the expense of the customer.
All meters must be located at the point of the water service entrance into the building.
New Meters must be installed 18 " above the finish floor, shall be stable and mounted securely to the structure as required by the Township and according to the manufacturer's specifications.

Valves must be installed immediately upstream and downstream of each meter.
Meters may not be installed in pits.

Meter by-pass piping and valves are strictly prohibited, except as provided for in this section. A commercial or industrial customer may submit a written request to install water meter by-pass piping and valves. The request shall explain why installation of water meter by-pass piping is necessary. The Township Water and Sewer department may approve water meter by-pass piping if it determines, in its discretion, that it is necessary for the protection of equipment and public health. In some cases a gap in the by-pass piping will be required. The Township will maintain an inventory of various spool pieces which may be inserted into the gap while necessary repairs are made to the Water Meter or associated plumbing.
B. Accessibility:

All meters must be placed in a location readily accessible to Township personnel.
Crawl space installations must be approved by the Township prior to service installation.

Customers must provide a chase-way (access way) for installation of the remote wire from the water meter to the outside of the building as necessary.
C. Protection:

Meters and equipment must be protected from freezing and other damaging elements.
D. Fittings:

All pipe and fittings prior to metering must be Class 52 cement-lined Ductile Iron, copper or brass. All PEX or PE services shall transition to brass prior to the water meter set location to provide adequate support for the water meter.

The Township Water Department typically will elect to furnish meter horns and/or meter bars and inside fittings for installation by the property owner or his plumber, the cost of which will be included with the connection fees. Township personnel will install the meter and remote reader in accordance with current specifications required by the Township.
E. Ownership:

All meters shall remain the property of the Township.
All meters shall be furnished by the Township, the cost of which will be passed on to the customer and included in the connection fees as established by Ordinance and Resolution.

### 4.04 INSPECTION

4.04.01 Shop Inspection

All materials furnished by the Contractor are subject, at the discretion of the Township or the Township's Engineer, to inspection and approval at the Manufacturer's plant. All inspection in the plant of the manufacturer of materials furnished by the Contractor shall be made at the expense of the Township. If the materials are defective, the Contractor shall pay for costs for replacing the defective materials and for inspection, both for installation and visit at the manufacturer's plant.

### 4.04.02 Field Inspection

All pipe and accessories shall be laid, joined, and tested under pressure for defects and leakage in the manner specified herein and in the presence of, and as approved by the Township.
4.04.03 Disposition of Defective Material

All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected by the Township. All defective materials furnished by the Contractor shall be promptly removed by the Contractor from the site.

### 4.05 RESPONSIBILITY FOR MATERIAL

4.05.01 Responsibility for Material Furnished by Contractor

The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered prior to the final acceptance of the work.
4.05.02 Responsibility for Safe Storage

The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

### 4.05.03 Replacement of Damaged Material

Any material that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.

The Contractor shall use care and proper equipment during the unloading and distribution of watermain materials on the job site to insure the materials are not damaged.

Pipe and/or fittings shall not be rolled or skidded off the truck beds against previously unloaded materials.

### 4.07 ALIGNMENT AND GRADE

4.07.01 General

The watermain shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations and all valve and hydrant stems plumb.
4.07.02 Deviations Occasioned by Other Structures

Whenever obstructions not shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plans is required, the Township and/or Township Engineer shall have the authority to change the plans and order a deviation from the line and grade or arrange with the Owners of the structures for the removal, relocation, or reconstruction of the obstructions. If the change in plans results in a change in the amount of work by the Contractor, such altered work shall be done by a written field order.

### 4.07.03 Depth of Pipe

All pipe shall be laid with the top of the pipe a minimum depth of five (5) feet below established street centerline grade, and with a minimum cover of five (5) feet below existing grade at the watermain, unless specified otherwise. Watermain eight (8) inches and larger shall be laid to a specified grade. Generally, watermain eight (8) inches and larger shall have a depth of 5 feet 9 inches below proposed centerline of the street or the existing ground to centerline pipe unless specified on the plans or approved by the Township. Maximum depth of cover to be nine (9) feet.
4.07.04 Grade Stakes

Grade stakes for the watermain will be required at a minimum of every 50 feet and at all fittings, valves, hydrants, taps, curb stops, ends of service lines, and deflection points.

### 4.08 LAYING

4.08.01 Lowering of Watermain Material into Trench

Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and expedient completion of the work. All pipe fittings, valves, and hydrants shall be carefully lowered into the trench by means of suitable tools or equipment, in such a manner as to prevent damage to watermain material and protective coatings and linings. Under no circumstances shall watermain materials be dropped or dumped into
the trench. No chains or steel cables will be permitted at any time for the lowering of watermain materials into the trench or for unloading/distribution of watermain materials.

If damage occurs to any pipe, fittings, valves, hydrants, or watermain accessories in handling, the damage shall be immediately brought to the Township's attention. The Township shall prescribe corrective repairs or rejection of the damaged items.
4.08.02 Temperature Limitations

Construction of watermains is limited to construction site temperatures above $25^{\circ} \mathrm{F}$ or as determined by the Township and/or the Township Engineer.

### 4.08.03 Inspection before Installation

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Township, who will prescribe corrective repairs or rejection.

### 4.08.04 Cleaning of Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.
4.08.05 Laying of Pipe

All dirt or other foreign material shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying. No tools or other articles shall be stored in the pipe at any time.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Township. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.
4.08.06 Cutting of Pipe and Connections to Existing Watermains

The Contractor shall cut the pipe in a straight and uniform manner, at right angles to the axis of the pipe, wherever necessary for placing valves, fittings, or closure pieces without damage to the pipe, and without extra cost to the Owner. The cut ends of the pipe shall be beveled before assembly of the joint.

The method of cutting pipe shall be subject to the approval of the Township or Township Engineer.

Connection to existing mains shall be done at a time when it will least interfere with normal use of the main. The Contractor shall be responsible for draining water from the closed off section of the existing main so that the connection can be made.

The Contractor shall uncover existing mains at points of connection sufficiently in advance of making the connection to allow verification of the dimensions of the existing main and shall make any revisions required to the fitting, or obtain special adaptors required for the connection. Existing pipe lines shall be adequately supported during the connection operation and prior to placement of backfill.

The Contractor shall be responsible for preventing contamination of existing watermains while the connection is made. He shall be responsible for any damage caused by his operations to existing mains to which the connections are being made.
4.08.07 Bell Ends to Face Direction of Laying

Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Township and/or Township Engineer. Where pipe is laid on a grade of 10 percent or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe facing up grade.

### 4.08.08 Ductile Iron Sleeves

In connecting ductile iron pipe together with a ductile iron sleeve, the space between adjoining ductile iron pipes shall not exceed one (1) inch. Where the space between adjoining ductile iron pipe exceeds one (1) inch, a spacer shall be placed to fill the space. The spacer shall be a piece of ductile iron pipe of the same diameter and class as the adjoining pipe and shall be cut straight and uniform and be free of defects and damage.

### 4.09 JOINING OF MECHANICAL - JOINT PIPE

4.09.01 General Requirements

The general requirements in Section 4.04-4.08 inclusive shall apply, except that where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of mechanical-joint pipe.
4.09.02 Cleaning and Assembly of Joint

The last eight (8) inches outside of the spigot and inside of the bell of mechanical- joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joint and then coated with a lubricant. The gasket lubricant shall be nontoxic, tasteless, and odorless, and shall be as supplied or recommended by the pipe manufacturer and approved by the Township and/or Township Engineer. The Mega-lug restraint shall then be slipped on the spigot end of the pipe with the lip extension of the
gland toward the socket, or bell, end. The rubber gasket shall be coated with lubricant and placed on the spigot end with the thick edge toward the Mega-lug.

| Pipe Size | Bolt Size | Range of Torque |
| :---: | :---: | :---: |
| Inches | Inches | Foot - Pounds |
| 3 | 5/8 | 45-60 |
| 4-24 | 3/4 | 75-90 |
| 30-36 | 1 | 100-120 |
| 42-48 | 1-1/4 | 120-150 |

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. When tightening bolts it is essential that the Mega-lug be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. Repeat this cycle until all bolts are within the above range or torques. The manufacturers requirements shall be met for tightening all bolts including the pattern of tightening. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Over stressing of bolts to compensate for poor installation practice is not allowed.
4.09.04 Permissible Deflection in Mechanical-Joint Pipe

Whenever it is desirable to deflect mechanical-joint pipe in order to form a long-radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 1.

## TABLE 1

## PERMISSIBLE DEFLECTIONS IN MECHANICAL-JOINT PIPE

| Size of Pipe Inches | Max. Permissible Deflection Per Length - Inches |  |  |  | Approx. Radius of Curve Produced By Succession of Joints - Feet |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 12' | 16' | $\underline{18}$ | $\underline{20}$ | $\underline{12}$ | $\underline{16}$ | 18' | $\underline{20}$ |
| 3 | 21 | 28 | 31 | 35 | 85 | 110 | 125 | 140 |
| 4 | 21 | 28 | 31 | 35 | 85 | 110 | 125 | 140 |
| 6 | 18 | 24 | 27 | 30 | 100 | 130 | 145 | 160 |
| 8 | 13 | 18 | 20 | 22 | 130 | 170 | 195 | 220 |
| 10 | 13 | 18 | 20 | 22 | 130 | 170 | 195 | 220 |
| 12 | 13 | 18 | 20 | 22 | 130 | 170 | 195 | 220 |
| 14 | 9 | 12 | 13.5 | 15 | 190 | 250 | 285 | 320 |
| 16 | 9 | 12 | 13.5 | 15 | 190 | 250 | 285 | 320 |
| 18 | 7.5 | 10 | 11 | 12 | 230 | 300 | 340 | 380 |
| 20 | 7.5 | 10 | 11 | 12 | 230 | 300 | 340 | 380 |
| 24 | 6 | 8 | 9 | 10 | 300 | 400 | 450 | 500 |
| 30 | 6 | 8 | 9 | 10 | 300 | 400 | 450 | 500 |
| 36 | 5 | 7 | 8 | 9 | 330 | 440 | 500 | 550 |
| 42 | 5 | 6 | 7.5 | 8 | 340 | 450 | 510 | 570 |
| 48 | 5 | 6 | 7.5 | 8 | 340 | 450 | 510 | 570 |

**In all cases, the manufacturers specifications for the mechanical-joint pipe maximum permissible deflections shall not be exceeded and the deflections allowed by each pipe manufacturer may differ from the deflections provided in Table 1.

### 4.10 JOINING OF PUSH-ON JOINT PIPE

### 4.10.01 General Requirements

The general requirements in Section 4.04-4.08 inclusive shall apply except that, where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of push-on joint pipe.

### 4.10.02 Cleaning and Assembly of Joint

The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

The thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe or both.

Gasket lubricant shall be non-toxic, tasteless, and odorless and shall be as supplied or recommended by the pipe manufacturer and approved by the Township.

The spigot end of the pipe shall be centered in the bell and forced or pushed home. Smaller sizes of pipe can be pushed or forced into place by hand; larger sizes will require the use of mechanical assistance.

The condition of the trench bottom must be such that correct location and position of the pipe to be joined is in a straight line assuring a joint of maximum tightness and permanent seal.

### 4.10.03 Permissible Deflection in Push-On Joint Pipe

Whenever it is desirable to deflect push-on joint pipe, in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 2, unless recommended by the pipe manufacturer and approved by the Township.

## TABLE 2

## PERMISSIBLE DEFLECTIONS IN PUSH-ON JOINT PIPE

| Size of Pipe Inches | Max. Permissible Deflection Per Length - Inches |  |  |  | Approx. Radius of Curve Produced By Succession of Joints - Feet |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 12' | $\underline{16}$ | $\underline{18}$ | $\underline{20}$ | $\underline{12}$ | 16' | $\underline{18}$ | $\underline{20}$ |
| 3 | 12 | 16.5 | 19 | 21 | 140 | 185 | 205 | 230 |
| 4 | 12 | 16.5 | 19 | 21 | 140 | 185 | 205 | 230 |
| 6 | 12 | 16.5 | 19 | 21 | 140 | 185 | 205 | 230 |
| 8 | 12 | 16.5 | 19 | 21 | 140 | 185 | 205 | 230 |
| 10 | 12 | 16.5 | 19 | 21 | 140 | 185 | 205 | 230 |
| 12 | 12 | 16.5 | 19 | 21 | 140 | 185 | 205 | 230 |
| 14 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 16 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 18 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 20 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 24 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 30 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 36 | 7.5 | 10 | 11 | 12 | 230 | 305 | 340 | 380 |
| 42 | 5 | 6.5 | 7.5 | 8 | 340 | 460 | 510 | 570 |
| 48 | 5 | 6.5 | 7.5 | 8 | 340 | 460 | 510 | 570 |

4.11
4.12.01 Location

Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. Maximum spacing between hydrants shall be five hundred (500) feet. Hydrants shall be located at all highpoints of the watermain and so that all points of buildings served by the watermain project are within 250 feet of a hydrant.

When placed behind the curb, unless otherwise directed, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than two (2) feet from the face of the curb.

When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within six (6) inches of the sidewalk.

### 4.12.03 Connection to Main

Each hydrant shall be connected to the main with a six (6) inch ductile iron branch controlled by an independent 6 -inch gate valve, unless otherwise specified. All hydrant gate valves shall be open at the time of testing and remain open thereafter. The cost of the branch pipe shall be incidental to cost of installing the hydrant.

### 4.12.04 Hydrant Drainage

All hydrant drains and weep holes shall be left unplugged, except at the direction of the engineer in areas where there is a high ground water table or unsuitable or contaminated soils. The hydrant shoe and barrel is to be wrapped with polywrap and a hole cut in the polywrap to allow drainage. One half cubic yards of pea gravel or 6A stone must be placed below the weep hole as shown on the hydrant detail. The stone shall extend 6 inches above the weep hole.
4.12.05 Pumping of Hydrants

All hydrants shall be pumped completely dry as necessary when the watermain is placed in service.

### 4.12.06 Hydrant Marker Sticks

All new, salvaged, or existing hydrants within a project shall be outfitted with a 52 " steel hydrant marker stick with spring base. The spring and stick shall be made from a single piece of galvanized steel and have a minimum of 16 " of red and white reflective bands on top.

### 4.13 ANCHORAGE

4.13.01 Restrained Joint Pipe

The use of restrained joint pipe shall be first approved by the Township and the Township Engineer. If approved, all ductile iron restrained joint pipe shall be American Ductile Iron Pipe "Lok-Ring Joint" or "Flex-Ring Joint", U.S. Pipe "TR Flex", McWane "TR Flex", or approved equal. All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system actually installed.
4.13.02 Joint Restraining Glands

Joint restraining glands shall be Series 1100 Megalug as manufactured by EBAA Iron Sales, Inc. or approved equal.
4.13.04 Joint Restraining Glands

Joint restraining gaskets shall be U.S. Pipe "Field Lok Gaskets", American Ductile Iron Pipe "Fast Grip Gasket", or approved equal. At all joints where joint restraining gaskets are used, the joint is to be wrapped with $21 / 2 "$ minimum width plastic tape with text "restrained joint".
4.13.05 Anchorage for Hydrants

All hydrants shall be restrained to the hydrant lateral valve, and the hydrant lateral valve shall be restrained to the main using an approved joint restraint system consisting of joint restraining glands (Megalug), Mechanical Joint Anchoring Fittings, or approved equal.
4.13.06 Anchorage for Plugs, Caps, Tees, Bends and Valves

Unless otherwise specified or approved by the Township, movement of all plugs, caps, tees, bends, and valves shall be prevented by use of restrained joint pipe, joint restraining gaskets, or joint restraining glands; Mega-lugs as manufactured by EBAA Iron Sales or approved equal.

When joints are to be restrained with mechanical devices as noted above, all joints shall be restrained for a minimum distance from the fitting as required in the following table. All joints of watermain in casings are to be restrained.

Approval of restraining method and distances by the Engineer shall not relieve the contractor from their responsibility for the adequacy and limits of restraint.
4.13.07 Mechanical Joint Anchoring Fittings ("Swivel" Fittings)

Mechanical joint anchoring fittings shall be as manufactured by Tyler Union Corporation, or approved equal. Mechanical joint anchoring fittings may only be used at locations indicated on the Plans and approved by the Township and/or Township Engineer.

## TABLE 3

PIPE RESTRAINT LENGTH REQUIRED, FEET

| Pipe Diameter | Tees, $90^{\circ}$ Bends | $45^{\circ}$ <br> Bends | $\begin{gathered} 22-1 / 2^{\circ} \\ \text { Bends } \end{gathered}$ | $11-1 / 4^{\circ}$ Bends | Dead <br> Ends | Reducers (one size) | ** |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $4 "$ | 33 | 13 | 8 | 3 | 82 | N/A | N/A |
| $6 "$ | 46 | 19 | 9 | 5 | 118 | 62 | 91 |
| 8" | 59 | 25 | 12 | 6 | 149 | 62 | 79 |
| 12" | 83 | 35 | 18 | 9 | 214 | 115 | 172 |
| $16^{\prime \prime}$ | 106 | 45 | 22 | 10 | 275 | 118 | 158 |
| $20 "$ | 128 | 53 | 26 | 13 | 334 | 118 | 149 |
| $24 "$ | 149 | 62 | 30 | 15 | 389 | 118 | 142 |
| $30 "$ | 179 | 73 | 36 | 18 | 470 | 165 | 212 |
| $36 "$ | 202 | 83 | 40 | 20 | 542 | 165 | 201 |

NOTE: The length of restrained joint pipe required as shown in the table above is based on trench backfill being compacted to $95 \%$ of maximum unit weight in accordance with MDOT procedures. Trench backfill placed within the influence of roads, streets, or highways; public or private, shall be compact to $97 \%$ of maximum unit weight in accordance with MDOT procedures. All ductile iron pipe shall be wrapped in polyethylene encasement. Restraint lengths in Table 3 account for polywrapped watermain. If the Township permits watermain without polywrap based on soil conditions, a reduction factor of 1.43 may be applied to the required pipe restraint lengths.

All joints lying within the above minimum distances from the fitting must be restrained as noted herein.

Tees: Tees shall be restrained in the branch direction as required in the table above. Also, to augment the above, in the straight through direction, the minimum length of the first pipe on either side of the tee shall be ten (10) feet. In those cases where a valve is placed within 10 feet of the tee, the valve shall be restrained to the tee as noted below, and the next pipe shall be a minimum length of ten (10) feet.

Plugs/Caps: All dead ends on watermains shall be plugged or capped with standard plugs or caps. The watermain, including the plug or cap shall be restrained back from the plug or cap as required in the table above.

Bends: Bends shall be restrained in both directions as required in the table above.
Valves: Valves used in conjunction with restrained joint pipe shall be restrained in accordance with the recommendations of the manufacturer of the restrained joint pipe. All valves at crosses or tees shall be restrained to the tee by use of restrained joint pipe
or joint restraining glands as specified above. Hydrant valves may be restrained using mechanical joint anchoring fittings.

### 4.14 HYDROSTATIC TEST

4.14.01 Procedure

All tests will be made by the Contractor using his own equipment, operators, and supervision, in the presence of the Township or duly authorized representative. The length of the section to be tested shall be as approved by the Township and/or Township Engineer. The test shall not be against an existing valve, unless written permission is obtained from the Township and/or Township Engineer. In no case shall a test be made against an existing valve that is found to be leaking or otherwise defective.

### 4.14.02 Air Removal and Scouring Flush before Test

Before applying the specified test pressure, the waterman shall be filled slowly, and all air shall be expelled from the pipe. The watermain shall then be thoroughly flushed in accordance with AWWA standard C651-14. The Contractor shall flush at least one (1) times the volume of the watermain at a minimum of 3 feet per second prior to the test. The Township and/or Township Engineer shall verify the flushing time requirements and that the minimum flushing velocity has been achieved.

For watermains eight (8) inches in diameter and smaller, a two (2) inch diameter standpipe may be used when the watermain to be flushed is less than 1,150 feet in length and the available pressure is 45 psi or higher. If the available pressure is less than 45 psi or the watermain to be flushed exceeds 1,150 feet in length, then a four (4") inch diameter standpipe is to be provided for flushing of the watermain. If available pressure is less than 45 psi and the watermain to be flushed is less than 1,150 feet in length, then the Township and/or Township Engineer may require four (4) inch standpipes where deemed necessary to achieve a flushing velocity of $3 \mathrm{ft} / \mathrm{sec}$.

If the Contractor wishes to obtain potable water for filling and flushing from a temporary connection to the existing distribution system, the Contractor must use a backflow prevention device. If the backflow prevention device reduces pressures such that the flushing velocity cannot be achieved, the Township will allow the contractor to flush using a flexible or collapsible hose. The Township or Township Engineer shall be on site to review and observe the filling and flushing hose and operation.

If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. Hydrants may be used for flushing.
4.14.03 Pressure and Leakage Test

A pressure and leakage test shall be conducted in the presence of the Township and/or Township Engineer. The Contractor shall furnish the pump, pipe, connections, pressure gauges, backflow preventer and all other necessary apparatus, and shall furnish the
necessary assistance to conduct the test. All pressure gauges used in a leakage test must be approved of by the Township and/or Township Engineer and shall be of sufficient accuracy and range so as to provide accurate readings with graduations of 1 psi or smaller.

The method for measuring leakage must be approved by the Township, Township Engineer, or their designated representative. Water shall be pumped through an approved water meter or from an approved container with a consistent shape and simple volume formula such as a cylinder or a box. If such a container is used it shall be of a small enough size to allow for accurate measurement.

The Contractor must provide a backflow prevention device during the pressurization of the new main. The backflow prevention device shall be disconnected (physically separated) from the new main during the hydrostatic pressure test.

The duration of the pressure and leakage test shall be two (2) hours, and during the test the main shall be subjected to a minimum pressure of 150 psi at the highest elevation of the main being subjected to the pressure and leakage test.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled, and the pipe has been filled with water. When several valved sections are tested as one test, the maximum allowable leakage will be equivalent to the calculated smallest value of the maximum allowable leakage for any valved section. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$
\mathrm{L}=\frac{\mathrm{SD} \sqrt{ } \sqrt{ }}{148,000}
$$

Where:
$\mathrm{L}=$ Allowable leakage in gallons per hour
$S=$ Length of pipe tested, in feet
$\mathrm{D}=$ Nominal diameter of the pipe, in inches
$\mathrm{P}=$ Average test pressure during the leakage test, in pounds per square inch.
When testing lengths of watermain greater than 1,000 feet, the maximum allowable leakage will be the amount calculated for 1,000 feet.

This formula is based on allowable leakage of 10.49 gallons per day, per mile of pipe, per inch of nominal diameter at a minimum pressure of 150 psi .

The Township and/or Township Engineer shall be furnished a written report of the results of the pressure and leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the amount of leakage. The report shall be signed by the Contractor and the Township and/or Township Engineer or their designated representatives.

### 4.14.04 Variation from Permissible Leakage

If any pressure and leakage test of newly laid pipe discloses leakage greater than that specified above, or if visible leaks are present, the Contractor shall at his own expense locate and repair the leaks until the leakage is within the specified allowance.

### 4.14.05 Time for Making Test

The pipe may be subject to hydrostatic pressure and inspected and tested for leakage at any convenient time after the trench has been partially backfilled. Where any section of the main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five (5) days have elapsed after the concrete reaction backing was installed. If high-early-strength cement is used in the concrete reaction backing, the hydrostatic pressure test will not be made until at least two (2) days have elapsed.

### 4.15 CLEANING AND DISINFECTION

Cleaning and disinfection of watermain shall be in accordance with AWWA standard C651-14.

### 4.15.01.01 Procedure

Township personnel are to be present prior to and during chlorination procedures. The Contractor shall submit to the Township a procedure schedule outlining the method he proposes to use for flushing watermains. Watermains shall be flushed at a maximum of 1/4-mile intervals.

### 4.15.01.02 Time for Flushing

Flushing must be done prior to chlorination of the watermain. The flushing shall be completed in a manner consistent with Section 4.14.02.
4.15 .02

Chlorination
All newly-laid watermains and water services/fire protection lines 4 inches (4") and larger in diameter shall be chlorinated. Township personnel are to be present prior to and during chlorination. The Contractor shall furnish all necessary equipment and materials and shall furnish all necessary assistance for effective disinfection of the watermains. Chlorination shall be accomplished by using the following procedure.

### 4.15.02.01 Procedure

After the watermain has been pressure tested and flushed, the Contractor shall pump a chlorine solution into the watermain in such a manner and at such strength that the residual free chlorine shall be 50 to 100 ppm .

The amount of chlorine required for each 100 feet of pipe of various diameters to produce 50 ppm chlorine solution is as follows:

| Pipe Sizes <br> (Inches) | 100 Percent <br> Chlorine (lb.) | $\underline{16 \% \text { Bleach (gal.) }}$ |
| :---: | :---: | :---: |
|  | .061 |  |
| 8 | .108 | .046 |
| 10 | .170 | .081 |
| 12 | .240 | .128 |
| 16 | .436 | .180 |
| 24 | .980 | .313 |
| 30 | 1.463 | .737 |
|  |  | 1.100 |

### 4.15.02.02 High Test Calcium Hypochlorite

("HTH", Perchloren", Pittchlor"). Prepare a ten-thousand-parts-per-million solution in water and pump at a constant rate into the watermain while bleeding off the water at the extreme end. The bleed rate will determine the feed rate of the chlorine in order to arrive at a 50 to 100 ppm solution in the watermain.

### 4.15.02.03 Point of Application

The chlorinating agent shall be applied at the supply end of the line through a corporation cock or a valved stand pipe. The water for injecting the chlorine into the new main may be taken from the pressure side of the isolation valve or by utilizing a pressure pump.

The point of application must be protected by a temporary backflow prevention device. The backflow prevention device must be consistent with the degree of hazard for backflow prevention and shall approved by the Township. All connections to the existing watermain must be removed from the dosing tank when not in use.

Care shall be exercised to prevent any of the strong chlorine solution from entering existing watermains.

### 4.15.02.04 Retention Period

The chlorinated water shall be retained in the new watermain for a period not to exceed 24 hours nor less than 16 hours in the event 50 parts per million is used. In cases where a shorter retention period is necessary, a stronger solution may be used and the retention period reduced accordingly. For these stronger solutions the approval of the Township or the Township Engineer must be secured in writing as to the length of retention time in relationship to chlorine strength.

While the chlorine solution is in the line, the Contractor shall operate valves and hydrants in the chlorinated section to ensure the complete disinfection thereof.
4.15.02.05 Flushing and Testing

The chlorinated water shall be flushed from the main at the end of the retention time so that the entire line is clear of any residual chlorine. A sample shall be taken from the line by the Township (through a corporation stop, a valved stand pipe, or fire hydrant) after the line is flushed, and delivered for bacteriological analysis. In the event that the water does not pass this bacteriological test, the chlorination procedure outlined above shall be repeated until the quality of water is substantially the same as that being delivered from the existing distribution system. The test procedure shall be repeated until two (2) consecutive safe results are obtained at each location as required by the Michigan Department of Environment, Great Lakes, and Energy. Flushing of the main shall not occur between the two samples.

### 4.15.02.05 Final Connection of New Watermain to Existing Watermain

Final connection of a new watermain to the existing water system must be completed under the supervision of the Township and/or Township Engineer with a minimum of 48 hours notice and shall be completed during normal working hours unless otherwise approved by the Township and/or Township Engineer. Shutdowns of existing watermains for connection shall follow the procedures in Section 4.17.

All new watermain shall be connected to the existing water system no later than 7 calendar days after the watermain has received passing bacteriological test results. Once passing bacteriological testing results are received the 7-day deadline begins.

If the new watermain is not connected in 7 days additional chlorination and bacteriological testing will be required at the direction of the Township and/or Township Engineering.

The Contractor must flush water from the end of the new watermain after the final connection for a period as determined by the Township and/or Township Engineer.

### 4.16 DEAD ENDS/LOOPING/PHASING

Generally, the Township will not permit dead end watermains and will require looping at all times.

The Township reserves the right to determine the appropriate length of watermain extensions for each project or phase within a larger project.

### 4.17 SHUT DOWNS OF EXISTING WATERMAINS FOR CONNECTION

The Township shall be notified in writing prior to any valves being operated on the portion of water supply system owned and operated by the Township. No such valves shall be operated by the Contractor unless authorized in writing by the Township.

1. Shut downs of existing watermain can only be made when approved by and coordinated with the Township.
2. Notice to water customers affected by the shut down shall be given by the Township unless otherwise directed.
3. The duration of the shut down shall be minimized. All necessary labor, equipment and materials must be present before work proceeds.
4. The Township shall be present to perform the shut down and inspect the connection.


## VALVE \& HYDRANT LOCATIONS



HYDRANT OFFSET A


HYDRANT OFFSET B

## HYDRANT OFFSETS



HYDRANT DETAIL


## VALVE \& BOX FOUNDATION



VALVE BOX IN<br>PAVEMENT DETAIL



## BLOW OFF DETAIL


STANDARD AIR RELEASE VALVE - MANHOLE


NOTE:
WHEN THE MINIMUM CLEARANCE AND COVER CAN BE OBTAINED, THE WATERMAIN IS TO BE RELOCATED ABOVE THE SEWER.

WATERMAIN RELOCATION DETAIL

RISERS:
FIRE PROTECTION:
FLANGED END X PLAIN END NO UNI-FLANGES



SCHEMATIC PLAN VIEW


PROFILE VIEW
COMMUNITY LANDSCAPING IRRIGATION SETUP DETAIL
4-39

