

# WATER MAIN GENERAL NOTES

## 1. GENERAL STANDARDS

All material and construction shall be in accordance with the current American Water Works Association (AWWA) Standards and Specifications, the current Ohio Department of Transportation (ODOT) Standards and Specifications, the current Ohio Environmental Protection Agency (OEPA) Standards and Specifications, Recommended Standards for Water Works (10 State Standards), and American Society of Testing Materials (ASTM).

Reference to the “ENGINEER” in these specifications shall mean the City of Findlay or the designated representative.

## 2. INSPECTION AND REJECTION

All pipe sections, fittings and appurtenances shall be appropriately marked for purposes of identification. Tarp all deliveries while in transit and also tarp piping materials onsite that are not in use. Notify the ENGINEER for a visual inspection when the pipe delivery is onsite. The materials and methods of manufacture and the completed pipe, fittings and appurtenances shall be subject to inspection by the ENGINEER at all times. Unsatisfactory items will be rejected and shall not be used in construction.

## 3. MANUFACTURER’S AFFIDAVIT

The manufacturer shall furnish an affidavit indicating that all pipe, fittings and appurtenances have been manufactured and tested in accordance with all requirements of the applicable referenced specifications. A copy of the affidavit, indicating the project on which the material is to be used, shall be forwarded to the ENGINEER prior to construction.

## 4. PIPE MATERIALS GENERAL

The pipe shall be appropriately marked to allow the ENGINEER to verify the provided pipe material meets the requirements of these Specifications.

Materials not specifically meeting the requirements of these Specifications may be submitted for review and approval by the ENGINEER. The CONTRACTOR shall submit a bid unit price for materials that meet the requirements of these Specifications. If alternate materials are approved, the ENGINEER may request a unit price deduct from the CONTRACTOR.

The ENGINEER reserves the right to specify materials with more stringent or conservative performance characteristics for particular applications.

The ENGINEER reserves the right to require manufacturer or supplier certifications or test reports that the supplied material meets the requirements of these Specifications.

Polyvinyl Chloride (PVC) Pipe shall be used for water main pipe sizes 4 inches through 16 inches in diameter. Ductile Iron pipe (DIP) shall be used for pipe 18 inches through 36 inches. The ENGINEER shall reserve the right to specify the pipe material for water main and services based on the proposed service or installation method.

All DIP pipe, all DI fittings, and Mechanical Joint Restraints (for PVC & DIP) must be manufactured domestically only unless prior approval from the ENGINEER is granted.

Bolts, nuts, or other required hardware to be placed below grade shall be Type 304 stainless steel or shall be coated with a baked ceramic filled fluorocarbon resin (Cor-Blue).

## 5. POLYVINYL CHLORIDE (PVC) PIPE

All water mains 4 inches through 16 inches, except for hydrant leads shall be polyvinyl chloride (PVC) or molecular oriented polyvinylchloride (PVCO) pipe as specified herein.

PVC pipe for 4-inch water mains shall be in accordance with AWWA C900 and have a ductile iron equivalent outside diameter.

PVC pipe for water mains 14 inches through 16 inches in diameter shall be a minimum of PC235 and in accordance with AWWA C905.

PVC pipe shall be ductile iron equivalent outside diameter. Pipe shall be of the integral wall-thickened bell end type incorporating elastomeric gaskets to affect the pressure seal. Pipe shall have a nominal laying length of 20-feet. Pipe shall be designed for direct connection into ductile iron pipe fittings using mechanical joints.

Pipe shall be blue in color.

## 6. MOLECULARLY ORIENTED POLYVINYL CHLORIDE (PVCO) PIPE

PVCO pipe to be used for water mains shall be provided in accordance with AWWA C909, PC235 for pipe sizes 6-inch through 12-inch.

PVCO pipe shall be ductile iron equivalent outside diameter. Pipe shall be of the integral wall-thickened bell end type incorporating elastomeric gaskets to affect the pressure seal. Pipe shall

have a nominal laying length of 20-feet. Pipe shall be designed for direct connection into ductile iron fittings using mechanical joints.

Pipe shall be blue in color.

## 7. DUCTILE IRON PIPE

All water mains 18 inches through 36 inches shall be Ductile Iron pipe, Class 52 minimum, Pressure Class 250, and designed in accordance with AWWA C150 / A21.50 and manufactured in accordance with AWWA C151 / A21.51. Push-on or mechanical joint pipe shall be used except in areas specified for restrained joint pipe. All pipe shall be coated with a bituminous material on the outside and shall be cement mortar lined in accordance with AWWA C104 / A21.4.

In addition to the Polyethylene Encasement section described below, necessary appurtenances shall be installed to ensure that the entire pipeline is electrically continuous. Acceptable products for achieving electrical continuity include pre-installed copper strips from the pipe manufacturer, copper strips attached with exothermic weld-type connections, copper wire with high molecular weight polyethylene (HMWPE) insulation attached with exothermic weld-type connections, or other approved equal. In all cases, the copper strip or wire must have the minimum cross-sectional area equivalent to an AWG #4 wire. In no case are bronze wedges acceptable for providing electrical continuity. Field cut joints and connections to valves, fittings, etc. will require exothermic weld connections. Special provisions may be necessary to perform an exothermic weld on a valve. Copper tabs may be fabricated that can be connected directly to a bonnet bolt on the valve. Exothermic welding shall be “Cadweld” or approved equal and be entirely coated with bituminous coating.

Pipe for hydrant leads shall be Class 52 minimum ductile iron, designed in accordance with AWWA C150 and manufactured in accordance with AWWA C151. Anchor pipe shall be used for all hydrant leads.

A. Push on Joint Pipe: Push-on joints shall meet requirements set forth in AWWA C111 / A21.11, incorporating rubber gaskets. The pipe surfaces to be in contact with the rubber gasket shall be wiped clean and dry just prior to making the joint. A lubricant shall be used in accordance with the manufacturer’s recommendations when making the joint.

B. Mechanical Joint Pipe: Mechanical joints shall also meet requirements set forth in AWWA C111 / A21.11, incorporating rubber gaskets. With mechanical joints, the surfaces to be in contact with the rubber gasket shall be brushed with chlorine and water to remove all sand and grit just prior to making the joint.

C. Restrained Joint Pipe: Restrained joints shall be push-on boltless flexible (minimum 2 degrees) manufacturer’s joints such as American Iron Works Flex-Ring, U.S. Pipe TR Flex, Griffin Pipe Products Co. Snap-lok, or similar as approved in writing by the City of Findlay. In locations where push-on restrained joints are not feasible, manufactured restrained mechanical joints may be acceptable. However, mechanical joint retainers, including Meg-a-lug or equal, friction-type fittings, or gaskets with built-in gripper rings shall not be used as a restrained pipe substitution. Concrete thrust blocks shall only be used if field conditions dictate, and only with approval of the ENGINEER. Restrained joint pipe shall be used in all cases when the installation of an 11.25-degree bend, a 22.5-degree bend, or a 45-degree bend is specified on the water mains. At least two full lengths of restrained joint pipe shall be installed on either side of a bend. Restrained joint pipe may be specified by the ENIGNEER in other cases.

## 8. DUCTILE IRON FITTINGS

All fittings shall be ductile iron conforming to AWWA C153 and AWWA C111 and shall be lined and coated as specified above.

Fittings shall be of the mechanical joint or push-on type incorporating rubber gaskets. Caps and plug fittings required for testing of the water mains shall be provided with standard tapped connections. Fittings shall be Class 250 minimum, provided in accordance with AWWA C111 and C150, asphaltic coated in accordance with AWWA C151 and shall be cement mortar lined in accordance with AWWA C104 / A21.4.

Where a “solid sleeve” is indicated on the plans or Bid Items, the contractor shall use a Ductile Iron C110 full-body dual-purpose sleeve.

## 9. MECHANICAL JOINT RESTRAINTS

Mechanical joint restraints shall be provided in accordance with ASTM A536, AWWA C111 and AWWA C153.

Mechanical joint restraints shall be provided at all dead ends, bends, tees, valves and other locations as specified. The mechanical joint shall include a restraining mechanism that when actuated, impacts multiple wedging actions against the pipe, increasing its resistance to movement as internal pipe pressure increases. The joint shall maintain some flexibility following placement of final bedding and backfill. The restraining device shall be constructed of ductile iron heat treated to a hardness of 370 BHN with a minimum working pressure of 250 psi and a safety factor of 2:1.

Dimensions of the joint restraint shall be such that it can be used with standard mechanical joint bell and tee-head bolts conforming to AWWA C111. Twist-off nuts shall be used to insure proper actuation of the restraining devices.

Mechanical joint restraints MUST be AWWA approved as specified and approved for use on C900 PVC, C905 PVC, or C909 PVCO pipe.

## 10. VALVES AND APPURTENANCES

A. **VALVES-** All valves shall have standard AWWA nut, shall open by turning to the right (clockwise “rednut”) and shall have ends suitable for lying with the type of pipe provided. Valves shall be supplied complete with a valve box as subsequently specified. Valves shall be set plumb with the valve box accurately centered over the operating nut.

1. **Gate Valves:** Gate valves shall be iron body, resilient seat type meeting the requirements of AWWA C509 and designed for a maximum working pressure of 200 psi. Valves shall be of the non-rising stem type. Stem seals shall consist of at least two "0" rings. Gate valves shall be as manufactured by Mueller, Kennedy, American Flow Control, Clow, or equal as approved by the ENIGNEER.

2. **Tapping Valves:** Tapping valves for new mains 4 inches thru 14 inches shall be 250 psi, iron body, bronze mounted, resilient wedge gate valves. The valves shall be of the non-rising stem type and stem seals shall consist of at least two "0" rings. Tapping valves shall meet the requirements of AWWA C509, except that the waterway shall accommodate full size cutters and one end shall be flanged to match the tapping sleeve outlet. The valve outlet shall be mechanical joint in compliance with AWWA C111/A21.11. Valves shall be as manufactured by M & H Valve Company – Style 4751-01, Mueller T-2360, American Flow Control, East Jordan, or approved equal. Tapping valves for new water main connections shall be Mueller A2361, American Flow Control, East Jordan, or approved equal in accordance with AWWA C509.

3. **Butterfly Valves:** Butterfly valves shall be used on all water mains 16 inches in diameter and larger. Butterfly valves shall be iron body, resilient seat type meeting the requirements of AWWA C504, Class 150A. They shall be rated for a maximum working pressure of no less than 150 psig and hydrostatic test pressure of no less than 300 psig. Valves shall be constructed for water velocities of 8 feet per second or less. Valves shall be provided with cast iron disc and rubber seat. The shaft shall be 304 stainless steel and the seat ring shall be 316 stainless steel. Butterfly valves shall be as manufactured by Mueller, Kennedy, DeZurik, American-Darling, or equal as approved by the ENIGNEER.

B. **VALVE BOXES** – Valve boxes shall be constructed of coated cast iron and shall be the correct size to cover the entire bonnet section of the valve. They shall be of the three-piece screw type with a 5-¼ inch shaft. A heavy neat-fitting cover having the word "WATER" cast on the top shall also be included. Valve boxes shall have sufficient length for the mains of the sizes indicated and for a depth of bury as required. The top of the cover shall be flush with the surrounding surface with each section properly engaged.

One hundred sixty pound (#160) oval base shall be used for valve boxes installed in a pavement application. Valve boxes installed in pavement shall be installed so that no loads are transmitted from the valve box onto the valve.

After installation, all valve boxes shall be checked to ensure the box is not filled with stones, dirt, or backfill material.

C. **TAPPING SLEEVES AND VALVES** – Stainless-steel tapping sleeves are to be used for the construction of a new water main connecting to an existing main. Stainless steel tapping sleeves can be as manufactured by The Ford Meter Box Company, Inc., Cascade Waterworks Mfg. (CST-EX style), or approved equal.

If tapping an existing main for a new fire hydrant lead, tapping sleeves shall be cast iron and shall be of the mechanical joint type made in two halves for assembly around the main. Gaskets shall extend the entire length of the sleeves to form watertight joints when the side bolts are tightened in accordance with the manufacturer’s instructions. Branch flanges shall have female faces to accommodate the male faces of the tapping valves. Tapping sleeves shall be pressure tested prior to tapping the water main.

## 11. FIRE HYDRANTS AND APPURTENANCES

A. **Fire Hydrants** – Fire hydrants shall only be purchased from the City of Findlay Water Distribution Department, 419-424-7192. Hydrant exterior shall be given one field coat of asphalt varnish upon request of the ENGINEER after installation and before backfilling from ground level down.

B. **Watch Valves and Valve Boxes-** Watch valves and valve boxes shall be gate valves and valve boxes as previously specified in Section 10, except the valves shall have ends suitable for receiving the spigot end of 6-inch anchoring pipe.

C. **Anchoring Pipe** – Anchoring pipe for fire hydrant assemblies shall be plain end mechanical joint pipe incorporating an integral follower gland. Anchoring pipe may be manufactured by McWane Incorporated (Clow), American Cast Iron Pipe Company, United States Pipe and Foundry Company, or equal as approved by the ENINGEER.

D. **Installation** – Hydrant shall be set plumb and to the grade of the curb, street, alley, highway or right-of-way as approved by the ENGINEER. The pumper nozzle shall always be set toward the middle line of the street, highway or right-of-way. The hydrant shall be installed in accordance with the hydrant setting details shown on the drawings, including the use of anchor pipe for all hydrant leads. Excavation shall be backfilled as specified for the trenches.

## 12. PIPE LAYING

Pipe shall be unloaded using lift straps, and shall be carefully placed in the trench. Under no circumstances shall the pipe be rolled into the trench.

Water mains shall be installed with a minimum cover of 4 foot below finish grade. The main shall be laid in the locations and at the grades shown on the drawings, except as specifically permitted or directed otherwise by the ENGINEER. Location or grade may be altered by the ENGINEER in order to avoid existing or proposed utility lines or any other obstructions encountered in the progress of the work, to secure a more readily accessible position for trenching; or to facilitate the location of various appurtenances of the main.

When abrupt changes in the grade of the main are necessary to avoid existing utilities or other obstructions, 11.25-degree, 22.5-degree or 45-degree bends, shall be used unless otherwise specified or approved by the ENGINEER. Pipe shall be located so as to maintain a minimum clearance of 18 inches vertically and 5 feet horizontally with respect to other utilities to allow for taps to be inserted.

In accordance with current “Recommended Standards for Water Works” and/or “Recommended Standards for Wastewater Facilities” (10 States Standards), pipe shall be laid at a minimum 10 foot horizontal and 18 inches vertical distance from existing or proposed combination or sanitary sewer lines at their crossing, as measured between the outside of the pipe walls. At crossings, one full length of water main pipe shall be installed so both joints will be as far from the sewer as possible. In an occurrence where this separation cannot be maintained, work with the ENGINEER and follow the options provided in the fore-mentioned documents.

## 13. PROTECTION OF EXISTING UTILITIES

Existing underground utilities along the route of construction, as shown on the drawings, shall be uncovered and their elevations determined at least 300 feet in advance of pipe installation. The cost of such work shall be included in respective prices bid for the pipe being installed.

## 14. BEDDING

The waterline shall be laid on a properly shaped and firm bedding meeting the requirements for a Type B or Type C trench as shown on the City of Findlay Standard Detail plan sheets. The materials shall be placed in lifts not exceeding 8 inches in thickness and securely compacted by hand or mechanical tamping to secure a good compaction.

Pipe bedding material for waterlines shall consist of a bed of granular stone with a thickness of six (6) inches below the bottom of the pipe to provide proper support, extending to a plane twelve (12) inches to the left and the right of the outside of the pipe, and extending to a plane twelve (12) inches above the crown of the pipe. Granular bedding material shall be No. 8 or No. 57 aggregate stone, meeting current ODOT Specification requirements.

If directed by the ENGINEER, the CONTRACTOR shall excavate unstable material below the bottom of the pipe bedding and shall be replaced with approved granular material. The cost of the pipe embedment shall be included in the cost of the pipe.

Trenches in rock shall, at a minimum, be bedded 6 inches below the pipe and up to twelve (12) inches above the top of pipe (even if the trench is classified as Type C), and the trench width in rock shall be no less than 24 inches greater than the outside diameter of the pipe. Payment limits for rock excavation shall be limited to these dimensions. Any excavation beyond the payment limits will not be directly compensated for if a specific pay item is present for “Rock Excavation – Waterline” (paid per CY).

## 15. BACKFILL

Backfill shall be to the limits shown on the drawings and include the materials placed above the pipe embedment. Backfill material shall be placed and compacted, according to the requirements of this section, for the entire length, width, and height of the trench or excavation. See City of Findlay Standard Detail plan sheets for more detailed information. Backfill shall consist of finely divided soil free from stones, large lumps or other harmful debris.

Trenches shall be backfilled immediately after the pipe is placed and bedded. Backfill material shall be placed in the presence of the ENGINEER. The backfill material shall not contain stones, rock, pieces of masonry, organic material, frozen earth, debris, earth with a high void content or other material considered unsatisfactory by the ENGINEER.

- A. TYPE C TRENCHES, NON-STRUCTURES: Backfill not under structures or outside the pavement influence area shall be compacted in 12-inch layers as directed by the ENGINEER for the entire width, length, and vertical height of the trench.
- B. TYPE B TRENCHES, STRUCTURES: Backfill under structures or adjacent to pavement shall be ODOT Type 304 or 411 and compacted in 12-inch lifts to 95% compaction based on standard or modified proctor. Structures include manholes, pump stations, grinder pumps, roads, drives, sidewalks, and any other miscellaneous items called out on the drawings.
- C. PAVEMENT INFLUENCE AREA: Excavations below a line extended from the edge of pavement (or back of curb) at a 45 degree angle downward from the surface shall be backfilled as specified for structures. Areas of the excavation above the 45 degree projection may be backfilled as listed for non-structures.
- D. Water may be used to attain the proper moisture content in achieving compaction requirements. Prior to the placement of soil over the granular material all free water shall be drained from the excavation.

#### 16. IDENTIFICATION WARNING TAPE

An identification warning tape shall be installed with all new water mains (Ductile Iron Pipe & PVC Pipe). The warning tape shall be a minimum 3 inches wide with the words "BURIED WATERLINE BELOW," in 1.5-inch high bold black letters repeated every 21 inches printed with blue warning colors. Identification warning tape shall be installed 30 inches below final grade directly above the water main.

#### 17. TRACER WIRE (PVC ONLY)

Tracer wire shall be installed directly over and on the center of PVC water mains and shall be connected to the water main with tape at 15-foot maximum intervals. The wire shall not be wrapped around the water main.

Tracer Wire

- A. Open Trench Installation - Tracer wire shall be minimum 12 AWG with a 30-mil polyethylene jacket, specifically designed for buried use.
- B. Directional Bore Installation - Tracer wire shall be Reinforced Tracer Wire, Copperhead Extra High Strength (EHS) or City approved equal, 12 AWG Solid (.0808" conductor diameter), 21% conductivity annealed copper-clad high carbon steel high strength tracer wire, 1,150# average tensile break load, 30 mil. high molecular weight-high density yellow polyethylene jacket complying with ASTM D1248, 30 volt rating.

The tracer wire shall be brought to the surface every valve body or as directed by the ENGINEER. Access points may be valve boxes, vaults, tracer wire access box or other covered access devices clearly marked "WATER." The CONTRACTOR shall provide an extra twenty four (24) inches of wire at all access points. The CONTRACTOR shall include necessary appurtenances for access in the bid unit price for water main installed.

Splices in the tracer wire shall be connected by means of a split bolt or compression type connector to ensure continuity. Wire nuts shall not be used. A waterproof or corrosion-proof connector for direct bury applications shall be used. After installation, the tracer wire shall be tested to verify continuity of the tracer wire system.

#### 18. CATHODIC PROTECTION

This specification section will only apply if specifically directed by the ENGINEER during certain soil conditions. Confirm with the ENGINEER if this section applies to the project. If not, follow the Section 19, below regarding polyethylene wrap. If this section does apply to the project, the following applies:

All valves, hydrant leads and mechanical joints shall be installed with sacrificial anode bags.

Anode bags shall be 32 pound high potential prepackaged magnesium anodes. Anode leads shall be #12 TW solid copper. Anodes shall be set a minimum of 5-feet horizontally offset from water main. Anodes and lead wires shall be backfilled with stone-free native soil compacted in 6-inch layers.

Anodes shall be connected to the anode lead wire using a copper crimp. Connections between lead wires shall be wrapped with rubber tape followed by one wrap of vinyl tape. The anode lead connection wires shall be installed a minimum of 24 inches below grade.

The water main pipe coating materials shall be removed to white metal over an area sufficient to make the connection. Use of resin impregnated wheels or discs will not be permitted. The lead wire shall be welded to the pipeline using an exothermic process as approved by the ENGINEER. All slag material shall be removed, and the weld shall be tested with a sharp hammer blow to assure a proper metallurgical bond. All defective welds shall be removed and replaced. All exposed surfaces of copper and steel shall be covered with a bitumastic filled shield encapsulating the connection.

For anode beds consisting of more than one anode installed in series; install a 3-inch wide non-detectable warning tape as manufactured by Pro-Line Safety Products or approved equal. Warning tape shall be buried 12 inches below final grade and above the anode lead wire. Warning tape for anode leads shall be printed "Caution Cathodic Protection Line Buried Below."

The cost of all anodes, including installation, parts and accessories, shall be included in the bid price.

#### 19. POLYETHYLENE WRAP

Ductile iron fittings (and any Ductile Iron pipe) shall be wrapped in a minimum 8 mil thick polyethylene tube per AWWA C905. Fittings shall be wrapped for a distance of 5 feet on each side of the fitting. Rips, tears, punctures, or other damage to the polyethylene tube shall be repaired prior to placement of the backfill material.

#### 20. CONNECTIONS TO EXISTING MAINS

New mains shall be connected to existing mains or services, using fittings appropriate for the pipe materials being used and as approved by the ENGINEER. No connections to existing mains will be made without at least a forty-eight (48) hour notice of such connection given to the ENGINEER and the City of Findlay Water Distribution Department. Connections will not be made to the existing main until the related portion of the new main has been sterilized and all testing completed, as subsequently specified.

Extreme care shall be taken in making such connections to prevent contamination of the existing mains. All fittings, valves, and pipe shall be washed with clean potable water and then disinfected by washing with a chlorine solution having residual chlorine strength of not less than 50 ppm.

The tapping saddle shall be hydrostatically tested in accordance with the manufacturer's recommendations prior to connection to the new water main.

Three days prior to shutting valves on existing lines, the CONTRACTOR shall notify all affected property owners, the ENGINEER, and the City of Findlay Water Distribution Superintendent of such shut off. The shut off time shall be kept to a minimum and shall be made at off-peak hours. Existing valves shall be operated only by an approved representative of the ENGINEER. The CONTRACTOR shall not operate existing valves. The ENGINEER assumes no responsibility for delays occasioned by late shut-off notice or special requirements or conditions that must be met in making connections.

The cost of making connections shall be included in the price bid per lineal foot for the water main, or as otherwise specifically specified in any particular project.

#### 21. ABANDONMENT OF EXISTING WATER MAINS

Existing mains to be abandoned shall not be abandoned until new mains and services have been tested, accepted and placed in service by the City of Findlay. A mechanical joint plug or cap shall be installed on the abandoned main to prevent soil erosion into the pipe. A concrete cap may be used with approval from the City of Findlay.

The cost of abandonment shall be on a per section basis (each or lump sum) or as otherwise specified in any particular project.

#### 22. DISINFECTION

Disinfection shall be done in accordance with AWWA C651 latest edition. Air shall be exhausted at fire hydrants. In addition; a ¾-inch copper corporation stop must be installed for sampling purposes only. Flushing will still be accomplished with the hydrant outlets, 2-inch corporation stops inserted at the extremities, and a 1-inch corporation at the high points of the main. During the sterilization process, the main shall be isolated from existing adjacent mains and extreme care shall be used to prevent the main from rising above 20 psi. This low pressure is to prevent any possibility of high chlorinated water from entering adjacent water mains which are in service. After the main has been filled with the chlorine solution, the solution shall remain in the main for at least 24 hours to assure complete sterilization.

The Contractor shall provide all materials, labor and equipment (including all corp stops), and dispose of all heavily chlorinated water. Any additional flushing will be at the CONTRACTOR's expense.

#### 23. BACTERIOLOGICAL TESTING

After a water main has been sterilized and tested, and before pressure and leakage tests are preformed, bacteriological samples shall be performed in accordance with Section 7 of AWWA

C651 latest edition by an employee of the City of Findlay Water Department experienced in the taking of water samples. Bacteriological samples shall not be taken by the CONTRACTOR.

Samples shall be collected from the extremities and every 1,200 feet or less of the main. At least two samples taken at 24-hour intervals shall show the water to be safe. All flushing must cease 12 hours before the first sample is collected.

If results of two consecutive sets of bacteria tests show the water to be safe, the main may be hydrostatically tested for pressure and leakage. If bacteria results show the water to be unsafe, the main shall be completely sterilized and retested again. Sterilizing of the main is the responsibility of the CONTRACTOR who shall provide all necessary materials and labor, and the main will not be accepted for pressure and leakage testing until the bacterial quality of the water has been approved by the City of Findlay Water Treatment Plant. All required samples shall be at the expense of the Contractor.

#### 24. PRESURE TESTING

All new waterlines shall be pressure tested in accordance with procedures outlined in AWWA C600 and AWWA C605. After a main has been sterilized, flushed and bacteria tested, a pressure test shall be applied to it. The main shall remain isolated from adjacent mains and a pressure of at least one hundred and fifty (150) pounds per square inch shall be applied for a duration of four (4) hours minimum by pumping clean water from a cleaned and sterilized container through the ends of the main, with the CONTRACTOR to provide an initial pressure of one hundred and fifty to one hundred and sixty (150-160) psi.

When hydrants are in the test section, the test shall be made against the closed hydrant.

Pressure testing of each side of the intermediate valves shall be done at this time by shutting each valve and exhausting the pressure on one side and then applying the test pressure of one hundred and fifty (150) psi or more to the main on the opposite side of the valve. This procedure shall be repeated for each intermediate valve. Sections tested shall not exceed 1,200 feet in length.

Fire lines shall be tested by applying the test pressure of two hundred (200) psi for a duration of two (2) hours.

If the main valves do not pass the pressure test, the leak or leaks shall be located and repaired and the testing procedure repeated.

Upon completion of the pressure tests, the main shall be thoroughly flushed with potable water from the public supply until the water in the main has approximately the same chlorine content as water in the existing main.

After the pressure and leakage tests are satisfactory, a representative of the Findlay Water Treatment Plant will open all valves to place the line in service.

The CONTRACTOR shall furnish all material, labor and equipment for testing.

#### 25. REPAIRS

If any section of the water main is failing to meet the testing requirements outlined in the previous sections, the CONTRACTOR shall submit a plan to remediate the section of pipe to the ENGINEER. All cost for repairs shall be at the expense of the CONTRACTOR.

#### 26. COMPLETION OF TESTS

When all tests on the water main have been successfully completed and the main is placed in service by the City of Findlay, no further work on the main or valves will be permitted without the full knowledge of the work by the Superintendent of Water Distribution.