

**MILLCREEK TOWNSHIP WATER AUTHORITY  
GENERAL SPECIFICATIONS**

**A. WATERLINE MATERIALS**

1. PIPE AND FITTINGS - All pipe and fittings shall conform to the following materials:

- a. Ductile Iron Pipe - conforming to ANSI/AWWA Specifications A21.50-91 /C150. The minimum pipe size shall be 6-inches in diameter, unless approval for a smaller size is granted by the Authority's Engineer. The wall thickness for 6-inch diameter through 12-inch diameter shall be Class 52, conditioned upon approval by the Authority's Engineer. The wall thickness for pipe over 12-inches diameter shall be Class 52. All pipe and fittings 6-inches to 12-inches in diameter shall have a cement mortar lining of 1/8" thickness; and pipe and fittings of 14-inch to 48-inch shall have 3/16" mortar lining thickness; and be in accordance with the requirements other than thickness of ANSI/AWWA A 21.4-90/ C-104, Lining and Joints ANSI/AWWA A21.10-93/C-110. Ductile Iron Pipe with flanged joints shall be manufactured to a wall thickness that provides adequate metal under threads for a 250 psi working pressure. Flanged pipe shall not be threaded or flanged in the field. The minimum thickness for flanged pipe is as follows:

<u>DIAMETER</u>	<u>THICKNESS IN INCHES</u>	<u>DIAMETER</u>	<u>THICKNESS IN INCHES</u>
6	.34	16	.46
8	.36	18	.50
10	.38	20	.51
12	.40	24	.56
14	.45		

- b. Fittings - shall be ductile iron pipe conforming to ANSI/AWWA Specifications A 21.10-93/C-110). Mechanical joint accessories shall conform to ANSI/AWWA A 21.11-90/C -111 Specifications. Fittings shall be double cement lined and bituminous coated in accordance with AWWA C-104/ANSI A21.4. The nuts, bolts and studs shall be non-corrosive. The gasket shall be plain rubber.
- c. Joints - shall be either mechanical joint or push on joint with a single molded rubber gasket of the type designated as "Bell-Tite", "Fastite", "Super Bell Tite" or approved equal. Mechanical joints shall be in conformance with ANSI/AWWA A 21.11-90C-111 Specifications. Flanged joints shall meet ANSI/AWWA A 21.15-88/C-115 Specifications.

- d. Plugs, Tees and Bends - all plugs, tees and bends shall be provided with concrete thrust blocks as directed by Authority.
- e. Concrete Pipe - Concrete pipe or PVC shall not be used unless written approval is received from Authority.
- f. Blow-Offs - a 2-inch blow-off, meeting the Authority's specifications, shall be provided at any dead-end lines, and as may be directed by Authority.

## 2. SERVICE PIPE AND APPURTENANCES

- a. Pipe - shall be copper water tube, type K, soft temper, for underground service, conforming to ASTM B-88 and B-251. The pipe shall be marked with the manufacturer's name or trademark and a mark indicative of the type of pipe. The outside diameter of the pipe and minimum weight per foot of the pipe shall not be less than that listed in ASTM B-251, Table 11.
- b. Stop and Fittings - All corporation stops and curb stops shall be fabricated to meet AWWA Specifications of brass and shall be provided with outlets suitable for flared copper connections. Curb stops shall be of the ball valve or nuseal, or equal. Fittings for copper pipe shall be of brass and shall be equal to those manufactured by the A. Y. McDonald Manufacturing Company. Fittings shall include all accessories.
- c. Service Curb Boxes - extension service boxes shall be the type as manufactured by the A. Y. McDonald Manufacturing Company model 5601 (Erie Pattern) or approved equal. The boxes shall have a cast iron base and a 1-inch upper steel section. Extension pipes shall be threaded 1-inch to fit the cover. Covers shall be stamped "Water". The inside stop rods shall be of the standard stationery type and designed for 3/4-inch, 1-inch, 1 1/2-inch and 2-inch curb stops. The overall length of the pipe and the extension to be approximately 4.5' to 5.5'. The rods to be approximately 36 to 42 inches in length. Curb boxes and rods shall be painted or dipped.

### 3. VALVES AND VALVE BOXES

- a. Valves - The Gate Valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C-509 or latest revision and in accordance with the following specifications.

Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. The valves are to be non-rising stem with the stem made of cast, forged, or rolled bronze shown in AWWA C-509. Two stem seals shall be provided and shall be of the O-ring type. The stem shall also be provided with an external dirt and weather seal independent of the O-ring pressure seal.

The minimum diameter of valve stems at base of thread shall be 4-inch valve 0.875", 6-inch valve 1.250", and 12-inch valve 1.50". The housing for the valve stem thrust collar shall be carefully machined and be fully bronze lined. Valve stems shall have the tensile strength and yield of not less than 70,000 psi and 30,000 psi respectively. All valve stems shall have stem collar bushings accurately machined. The stem nut, also made of bronze, may be independent of the gate or cast integrally with the gate. If the stem nut is cast integrally, the treads shall be straight and true with the axis of the stem to avoid binding during the opening or closing cycle. All valves shall open to the left - counter-clockwise.

The sealing mechanism shall consist of a cast iron gate having a vulcanized synthetic rubber coating or a rubber seat mechanically retained on the gate. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either directions.

All internal and external surfaces shall be coated with epoxy to minimum thickness of 8 mils. Said coating shall be non-toxic, impart no taste to water, and shall conform to AWWA C-550 or latest revision. Said Coating shall be applied prior to assembly in such a way that all exposed external areas, including end connection bolt holes, body and bonnet bolt holes, etc., shall be coated with epoxy.

The valve body, bonnet, and bonnet cover shall be cast iron ASTM A-126, Class B. Valves shall be furnished with the standardized mechanical joint end with mechanical joint accessories. A wrench nut shall be provided for operating the valve.

All valves are to be tested in strict accordance with AWWA C-509.

All valves shall be of ample strength to withstand and operate satisfactorily under the working pressures and shall be subject to the test

pressures both expressed in pounds per square inch given in the following table. The class of valve to be used on each service shall be as defined by the Authority.

<u>CLASS OF VALVE</u>	<u>COLD WATER PRESSURE IN POUNDS WORKING</u>	<u>PER SQUARE INCH TEST</u>
4 TO 12 INCH	200	400
16 INCH OR LARGER	150	300

- b. Tapping Sleeve and Valves - the tapping sleeves and valves shall be designed and manufactured for a maximum water pressure of 250 psi. All material employed shall be in accordance with AWWA Specifications C-500. The Tapping sleeves shall be the Mechanical Joint Type Sleeve.

The dimensions shall be such that they can be installed on Class D or smaller outside diameter AWWA Specifications for Cast Iron Pipe. The accompanying valves shall be Clow AWWA tapping valves as manufactured by Clow Corporation or approved equal.

All mechanical joint tapping sleeves shall be furnished with the mechanical joint accessories and all required bolts, nuts, and gaskets. A lead (ring type) gasket shall be furnished for the outlet flange of each tapping sleeve. The end joint, mechanical joint gaskets shall be rubber and suitable for installation on Class D pipe.

- c. Valve Vaults - all valves over 12-inches shall be housed in prefabricated concrete valve vaults. The size of the vaults and frame and grate shall be determined by the size of the valves. Shop drawings must be submitted by the Contractor for approval on all valve vaults, frames and grates, including bracing of the valves in the vaults.
- d. Valve Boxes - Valve box tops and bottoms to be the Buffalo Valve box type or equal, for use with valves 12-inch in size and smaller. Buffalo Valve box two piece screw type valve box, 5 1/4 -inch shaft, style B-5003, Catalog #21 extension inches 36"-48". Lid shall have the word "Water" cast on the top surface, boxes shall be completely painted with black asphaltum paint. Minimum uniform wall thickness not less than 1/2".

#### 4. FIRE HYDRANTS WITH AUXILIARY VALVES AND VALVE BOXES

Fire hydrants, auxiliary valves and valve box shall be in compliance with AWWA C-502. All valves and piping shall be designed for 150 psi working pressure.

Hydrant shall be "Mueller" fire hydrants, Model Super Centurian 200 as manufactured by "Mueller Company",

OR

“Kennedy”, Guardian Model, manufactured by “Kennedy Valve”.

Hydrants shall be of the compression type, opening against and closing with the direction of normal water flow. Hydrants shall open counter-clockwise. Hydrants shall have at least a 5-inch valve opening, 6-inch inlet, 5-foot bury (unless shown otherwise on the profile), two - 2 1/2" hose nozzles with threads for the City of Erie Standard and one Pumper nozzle with a Integral 5" Hydrant Storz Quick Connector as manufactured by Harrington Incorporated. The Storz Connector shall be model HIHS50 with Storz Cap. The 2 1/2" Hose threads shall be 3 - 3/8" O.D., eight threads per inch with a pitch diameter of 2.981.

Hydrants shall be tested in accordance with AWWA Specifications C-502 and shall conform to this AWWA Specification unless otherwise specified. Hydrants shall be painted yellow.

Auxiliary valves to be furnished under this item shall be 6-inches internal diameter gate valves and shall conform to the type specified under Section B-4 for the 6-inch gate valves.

## 5. PRESSURE REDUCING VALVES AND VAULT

### *STRUCTURAL*

#### a. Hatch

The access hatch specified has a perimeter channel frame that serves as a drain, with a drain coupling welded to the underside of the frame for a pipe connection (pipe not supplied by hatch manufacturer) to drain the channel around the perimeter of the hatch. The drain can daylight through the wall to a gravel pocket or the drain can extend to the drain at the base slab of the vault. Either way the channel frame requires a drain pipe and this drain pipe should probably be shown to provide direction to the contractor.

The hatch should be designed for an H-20 truck loading and should be capable of locking (with padlock) particularly if not enclosed in a fenced area.

#### b. Waterstops

Keyways raised 4" will be required to accommodate the PVC waterstops and to avoid conflicts with the waterstop and the reinforcing bars in the top mat of the base slab.

#### c. Concrete

Concrete shall have a minimum 28-day concrete compressive strength of 5000 PSI. Do not backfill walls until 14 days and the compression strength reaches at least 4000 PSI.

NOTE: A pre-cast vault may be used in lieu of constructed in place.

### *PROCESS*

#### a. Process Piping

The interior process piping shall be flanged Ductile Iron Pipe, AWWA C151/ANSI A21.51, thickness class 53. Pipe shall be cement lined and bituminous coated inside and outside in accordance with ANSI 21.4. Joints shall be flanged in conformance with AWWA C111. Cement line ductile iron pipe per AWWA C104.

Reducers, if necessary, shall be placed outside of the vault and should be at least three (3) feet from the wall.

#### b. Process Valving

The isolation valves shall be resilient seated nonrising stem (NRS) OS&Y (outside stem and yolk) gate valve with stainless steel nuts and bolts and conforming to AWWA C509, closing clockwise.

#### c. Pressure Reducing Valves

Pressure Reducing Valves shall be CLA-VAL 3" 90-01AS/690-01AS and 6" 90-01ab/690-01ab unless otherwise directed by the engineer.

#### d. Wall Penetrations

Where any piping penetrates the wall, the method of penetration should be specified. Typically, with cast in place structures, a mechanical joint (MJ) x Flange wall casting (with water bar collar at the center) of appropriate size is cast with the concrete (flange set flush on the inside wall and tapped for studs). A link seal may be used through a pre-cast vault.

#### e. Drain

The drain line should only be installed where suitable soil conditions exist. Wet soils may cause water to actually enter the vault through the drain and inundate the pressure reducing valves. Where unsuitable soil conditions are present, a sump pit may be added to the vault to enable a submersible pump to be permanently installed or temporarily lowered into the vault for dewatering. The addition of a sump pit would require additional structural review. Drain line penetration through the vault should be through a core hole with link seal or a casting.

#### f. Pressure Gauges

Pressure gauges shall be placed on each side of the pressure reducing valves as shown on the construction detail. The ranges of the gauges shall be determined by the engineer.

## **B. WATER MAIN INSTALLATION**

1. Standards - Where materials and methods are indicated in the following Specifications as being in conformance with a standard specification, it shall refer in all cases to the latest edition of the specification and shall include all interim revisions.
2. Shop Drawings - Shop Drawings shall be submitted for approval by authority as follows:
  - a. Full details of all pumps, fans & major electrical items, hydrants, pipe, specials, meter pits, fittings, joints and assembly thereof.
  - b. Joint materials and details.
  - c. Reinforcing steel bending and setting drawings.
  - d. In addition, for all pipelines 16-inches in diameter and larger, a location profile referenced to the Project Drawings showing the size, length, and location of each pipe and fitting, and the details of all anchorage proposed.
3. Survey and Staking - Control stakes for general layout and control lines and grades for construction work shall be provided by the Contractor as directed by Authority.
4. Backfilling and Excavation
  - a. Backfill of excavation for the installation of waterlines and appurtenances within the limits of the right-of-way of any public street, road or thoroughfare shall be governed by the Township of Millcreek Specifications for Backfill in township rights-of-way, and by PennDOT specifications for state rights-of-way. Backfill under sidewalks, driveways and other similar structures shall be the same as under Township streets.

- b. The width of the trenches shall not exceed the outside diameter of the pipe, plus two feet, from the bottom of the respective trench to a horizontal plane located one foot above the top of pipe. In the event that the contractor's construction methods/activities result in a trench wider than the pipe diameter plus two feet within that pipe zone, he shall install concrete bedding or encasement or shall make such other provisions as may be directed by the Authority to protect the structural integrity of the pipe.
  - c. Where the trench bottom contains satisfactory material the pipe shall be laid on the flat bottom with holes for bells provided to insure that the pipe shall lie flat and be supported for its full length.
  - d. Where excavation exposes the bottom of proposed trenches where very soft or other unsatisfactory pipe foundation materials exist, the Contractor will be directed to overcut or stabilize (in the case of soft material). The pipe shall be supported on bedding material with a minimum thickness of 6" below the bottom of the pipe barrel; said material shall also be placed on the sides of the pipe and to a horizontal plane located one foot above the top of pipe, identified as the pipe zone with the exception of backfill provisions under pavement areas as described hereinafter.
  - e. When excavation of rock is encountered, all rock shall be removed to provide a clearance below and on each side of all pipe, valves, and fittings of at least 6" for pipe sizes 24" or smaller, and 9" for pipe sized 30" and larger. When excavation is completed, a layer of approved backfill material shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped.
5. Joint Deflection - When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of joint deflection shall not exceed that shown on the following table. Also refer to Manufacturer Specifications.

<u>Size</u>	<u>Deflection Angle</u>	<u>Maximum Offset</u>
3	5°	18¾"
4	5°	18¾"
6	5°	18¾"
8	5°	18¾"
10	5°	18¾"
12	5°	18¾"
14	3°	11"
16	3°	11"
18	3°	11"
24	3°	11"

6. Depth of Bury - The minimum depth from the top of pipe to ground surface shall be five feet, and the maximum depth from the top of pipe to ground surface shall be seven feet, unless required otherwise by the Authority.
7. Restoration
  - a. Roadways, driveways, and sidewalks - Any and all paved and concrete areas disturbed by construction shall be left in as good condition as it was before the start of work, and it shall be promptly and regularly maintained in such condition during a period of eighteen (18) months after acceptance of the work. This restoration includes all pavements, curbs, gutters, driveways, and sidewalks.
  - b. Miscellaneous - Any private or public property such as signs, fences, posts, and mailboxes must be put back in place and in the same condition.
8. Landscaping - Any landscaped areas disturbed by construction shall be left in as good condition as it was before the start of work, and it shall be promptly and regularly maintained in such condition during a period of eighteen (18) months after acceptance of the work. This restoration includes the replacement of all trees, shrubs, topsoil, seeding, fertilizer, and mulching.
  - a. Scarify subgrade to 3-inch depth where topsoil is scheduled after the trench area has been contoured and compacted. Place 3 inches of topsoil where scheduled. Place only during dry weather.
  - b. Seeding in Pennsylvania Department of Transportation right-of-ways shall conform to Pennsylvania Department of Transportation specifications. Seeding in all other areas shall use the following seed mixture:
    - Kentucky Blue Grass: 62 percent
    - Creeping Red Fescue Grass: 13 percent
    - Norlea Perennial Rye: 25 percent
  - c. Fertilizer shall be standard commercial 10-8-6 grade.
  - d. Mulching material - must be free of weeds and foreign matter detrimental to plant life. Do not use hay or chopped cornstalks.
  - e. Erosion - Use jute matting in sloped areas to prevent the erosion of seeding.
9. Thrust Blocks - All waterlines shall be backed up and anchored with poured concrete at all bends 22½ degrees or greater and all changes of direction. All fire hydrants shall be similarly backed up.
10. Blow-off-Assemblies - Blow-off assemblies shall be installed at any dead end lines. The assemblies shall consist of 2-inch galvanized piping with a 2-inch drain and waste valve and elbows to bring the piping to the surface of the ground.

11. Safety - All open trenches for construction of the pipeline shall be constructed in accordance with the provisions of the Occupational Safety and Health Act Regulations, as the same pertain to the shape of trenches above the pipe zone, trench side-wall supports, the construction methods employs, the general protection requirements, the general excavation requirements, the general trenching requirements and the minimum requirements for trench shoring. Those excavations for performance of the tunneling, boring and/or jacking operation shall be similarly constructed and shall be continuously sheeted with steel and/or timber which shall be adequately braced with whaling or other supports from the respective pit bottoms to the tops. All sheeting and/or shoring shall be designed by the Contractor for the conditions encountered and, shall be structurally adequate to withstand the loads to be imposed. Methods of installation shall be compatible with assuring the protection against disturbance of adjacent facilities and/or grounds and, the safety of construction and other personnel. Removal of the sheeting and bracing shall be reasonably and carefully performed to avoid displacement of the entrenched pipe and/or adjacent ground facilities.
12. Dewatering - All trenches shall be dewatered thoroughly in advance of the pipe installation construction activities. The dewatering operation may be accomplished by the use of pumps, well-points, wells or any combination of those systems, but in any event, the pipeline shall be constructed in a trench which will be required to be free of ground water, surface or any other source of water inflow and/or infiltration. The proposed water pipeline may not be used for dewatering purposes under any circumstances and particular care shall be exercised to keep open pipe ends sealed with plugs which are fabricated for that purpose and to prohibit the entrance of any extraneous water. Where dewatering pumps are required to be used sufficient discharge hose and other appurtenances shall be provided so that the water is discharged into storm drains, creeks, streams or other suitable water courses intended for such purposes.
13. All roadways, highways, driveways, and sidewalks shall be broomed and kept clear of any debris such as stones, dirt, tools, or any other materials.

## B. STERILIZATION

### 1. General

- a. All pipe and fittings connected to and forming a part of a potable water supply shall be sterilized in a manner acceptable to the Authority. The following method, or other acceptable to the Authority shall be used.
- b. Generally, sampling taps shall be provided on the water main every five hundred (500) feet, in order to afford representative water testing and sample collection. When long transmission mains are constructed, without side connections, the distance between each tap may, at the discretion of the Authority, be increased. In all instances, however, sampling taps shall be provided to collect a source sample and enough representative water samples for laboratory examination.

### 2. Preliminary Flushing

- a. Valves supplying water to the main to be filled and/or testing shall be operated only with the knowledge and permission of the Authority. Violations from this provision will result in charges being placed against the contractor and the contractor will be barred from performing work requiring the making of connections to the Authority's water system.
- b. Each valved section of the completed main shall be flushed prior to sterilization as thoroughly as possible with water pressure and outlets available. If no hydrant is provided at the end of the main section, a tap shall be installed at the main section extremity, large enough to develop a velocity in the main of, at least, 2.5 fps. The flushing operation shall be done after the pressure test has been made. Each valved section of the newly laid pipe shall be flushed separately.

### 3. Disinfecting

- a. Before being placed in service, all new mains and existing piping disturbed in any manner by the work shall be disinfected. Draining the water from existing piping or even lowering the water pressure more than one-half will constitute disturbances of the piping.
- b. The disinfecting of water mains, valves and other appurtenances incorporated into the main construction shall be done by a method approved by the Authority. There are three methods of chlorination approved by the Authority.

- (1) Tablet: This method consists of placing calcium hypochlorite tablets in the water main as it is being installed and then filling the main with potable water when installation is completed. This method may be used only if the pipes and appurtenances are kept clean and dry during construction. During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe. Also one tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The following table can be used to show the number of 5-g tablets to be used for the chlorination process for each section of pipe.

<u>Pipe Diameter</u>	<u>Length of Pipe Section in Feet</u>				
	<u>13</u>	<u>18</u>	<u>20</u>	<u>30</u>	<u>40</u>
	<u>Number of Tablets</u>				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

The tablets shall be attached by using a food-grade adhesive (Permatex Form-a-Gasket No.# 2) or equal. Apply the adhesive to the broadside of the tablet ,attached to the pipe, and attach the tablet inside on the top of the pipe with equal amounts of tablets on each end of the pipe if more than one is needed.

When installation has been completed, fill the pipe with water at such a rate that the velocity inside the pipe will not exceed 1 ft/sec. Eliminate all air pockets. This water shall remain in the waterline for a period of at least 96 hours.

2. Continuous-Feed Method: This method consists of placing Hypochlorite granules in the upstream end of the first section of pipe and then placed at every 500 foot intervals through the rest of the watermain.

The following table is to be used for the placement of Hypochlorite granules in the waterline, at every 500 ft intervals, for the chlorination process.

<u>Pipe Diameter</u>	<u>Calcium Hypochlorite Granules</u>	
	<u>oz</u>	<u>g</u>
4	0.5	14
6	1.0	28
8	2.0	57
12	4.0	113
16 or larger	8.0	227

When installation has been completed, fill the pipe with water at such a rate that the velocity inside the pipe will not exceed 1 ft/sec. Eliminate all air pockets. This water shall remain in the waterline for a period of at least 48 hours.

3. Chlorine Solution: Upon approval of the Authority, a chlorine-bearing compound of known chlorine content, prepared in solution form, may be used. The recommended chlorine-bearing compound shall be high-test calcium hypochlorite (65-70 percent available chlorine). In the preparation of this solution, the powder shall first be made into a paste and then gradually thinned with water to approximately one percent chlorine solution (10,000 parts per million). This will require about 7.50 gallons of water to each one pound of powder. Solution shall be prepared in a plastic barrel and the solids permitted to settle out. The clear supernatant shall be applied to the main through a rubber hose by gravity, siphonage, injection or by suitable pump feeder.

The point of chlorine application shall be at the beginning of the water main construction and/or any valve section thereof, through a corporation cock installed close to and on the downstream side of the regulating gate valve controlling the flow of water into the main. The rate of chlorine application shall be in such proportion to the rate of water flow entering the main that the chlorine dose applied shall produce fifty (50) parts per million (420 pounds per million gallons) chlorine concentration in the water within the main.

- c. During the disinfecting operation, valves, hydrants, and other mechanical devices controlling the flow of water shall be operated to permit full effectiveness of the chlorine. Valves shall be manipulated so that the strong solution within the main being sterilized will not flow back into the supply line nor flow into mains already in service. A chlorine concentration test shall be made, in turn, at each of the hydrants and/or taps provided for that purpose.

#### 4. Retention Period

- a. After the disinfecting operation has been completed and upon test, proved satisfactory, and heavily chlorinated water shall be retained in the main long enough to destroy all non-spore formatting bacteria. This period shall be at least forty-eight (48) hours. At the completion of the retention period, the chlorine concentration of the water within the main shall be at least twenty-five (25) parts per million (210 pounds per million gallons) of chlorine.

## 5. Final Flushing and Tests

- a. There shall be a passing purity test before any pressure tests are performed unless specified by the Engineer.
- b. After the required period of retention has elapsed, the heavily chlorinated water shall be flushed out completely to waste by the Contractor until the replacement water through-out the length of the main shall, upon test, be proven comparable in quality to the water supply source. The heavily chlorinated water shall be flushed out into a sanitary sewer with prior approval by the Authority. Compliance to the Erosion and Sedimentation Control Plan is mandatory if no sanitary sewers are reasonably available.
- c. When the water in the treated main shall have been proven comparable to that of the source, water shall be retained in the main for at least twenty-four (24) hours. Then water samples shall be collected at each of the sampling taps and submitted to a laboratory on two (2) separate days. Under no circumstances shall such samples be collected from hydrants or unsterilized hose connections. Samples should be taken from new clean copper lines. Should the results of the bacteriological examination prove satisfactory, the main shall be placed in service. Should the initial disinfecting fail to result in approval, the disinfecting procedure shall be repeated until satisfactory results are obtained.
- d. Bacteriological analysis will be run by a commercial or other laboratory, approved by the Authority, employed and paid by the Contractor, at the Contractors expense. Samples must be picked up by the laboratory who will maintain custody of the samples.

## C. PRESSURE TESTING

1. When a stretch of pipe and appurtenances have been completed and before any valves or joints have been covered, the Contractor shall furnish proper appliances and facilities for testing and draining the same, without injury to the work, or surrounding territory. He shall test by filling the pipe with clean water furnished by the Contractor at his expense. Air shall not be used for pressure testing. Unless otherwise directed by the Authority, all pipe shall be subject to the following hydrostatic test.

2. Small Pipe - All newly laid pipe or valved section thereof shall be tested under a minimum hydrostatic pressure of one hundred fifty (150) pounds per square inch or fifty per cent (50%) above normal operating pressure, which ever is greater. The test duration shall be at least 2 hours. Test pressure shall not vary by more than  $\pm 5$  psi.
3. Pressure tests are to be taken against the hydrant valves, then against the hydrant.
4. Depending on the investigatory work performed, the Authority may require a purity test be performed after a failed pressure test.
5. Allowable Leakage

In no case shall there be any visible leakage, nor shall the leakage in any stretch of pipe exceed the amount determined by the following formula:

In inch-pounds units,

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

$L$  = allowable leakage, in gallons per hour

$S$  = length of pipe tested, in feet

$D$  = diameter of the pipe, in inches

$P$  = average test pressure, psi

3. Any defects, cracks, or leakage that may develop, or that may be discovered either in the joints or in the body of the castings or pipe walls, shall be promptly made good by the contractor, at his own expense, either by replacement of defective items or by repairs as approved by the Authority. Backfilling around joints shall not be made until the leakage tests have been made and if any leaks are discovered, the installation shall be repaired and leaks eliminated to meet the requirements stated above.
4. Water service pipe and fittings shall be checked for leaks by visual inspection. Do not backfill these areas until the inspector has inspected these connections.