

STANDARD SPECIFICATIONS  
FOR  
WATER MAIN CONSTRUCTION

MERRIMAC WATER DEPARTMENT

October 2016

BOARD OF SELECTMEN  
MERRIMAC, MASSACHUSETTS

## **WATER MAIN CONSTRUCTION SPECIFICATIONS - MERRIMAC WATER DEPARTMENT**

### **Section 1. APPROVAL:**

Work done shall be observed by the engineer and/or inspector, herein called the Engineer and/or Inspector, acting within the authority and with the approval of the Board of Selectmen and the DPW Director. Engineer must be present for Tap and Sleeve, entering into town water supply, or a critical juncture to be determined by DPW Director and/or Water Manager. The Engineer and/or Inspector shall determine the quality and acceptability of the work and materials, per specifications. Consultant fees are the responsibility of the developer.

### **Section 2. CONFORMITY TO PLANS:**

The work shall conform to plans approved by the DPW Director or Water Department for the work involved, and to the requirements of these specifications.

### **Section 3. RESPONSIBILITY OF CONTRACTOR:**

The Contractor shall take all responsibility of the work and shall take all precautions for preventing injuries to persons and property in or about the work. He shall keep himself fully informed of all laws, ordinances and regulations in any manner affecting those engaged or employed in the work, and the work itself. The Contractor shall take full responsibility for the safety and quality of the work.

### **Section 4. MATERIALS AND WORKMANSHIP:**

All materials and equipment shall be of first grade quality. No inferior or low-grade articles will be either approved or accepted.

### **Section 5. DEFECTIVE WORK:**

Observation of the work shall not relieve the Contractor from any of his obligations to perform the work as specified and per the Contract Documents. If the work or any part thereof shall be found defective, the Contractor shall make good such defect.

### **Section 6. LINES AND GRADE:**

All lines and grades shall be subject to check by the Engineer, and the Contractor shall provide such material and give such assistance as may be required, and the marks shall be preserved by the Contractor.

### **Section 7. SANITARY REGULATIONS:**

Sanitary conveniences, properly screened from public observation, for the use of all persons employed on the work shall be provided and maintained by the Contractor.

### **Section 8. EXCAVATION:**

Trenches shall be excavated to sufficient depth and widths as will give ample room for laying and inspection of the work. At pipe joints additional width and depth shall be excavated to properly make the joints.

All the excavation shall be done by open cut from the surface, except as may be otherwise expressly permitted or ordered by the Engineer, or as otherwise stipulated in this contract. Bottom of trenches in earth shall be excavated reasonably flat and the trench shall be excavated at the pipe bells to allow the pipe barrel to rest on the prepared trench bottom. Pipe shall not be placed on blocking to allow clearance for pipe bells without specific approval of the Water Department.

All pipes and structures are to be laid on good foundation of sufficient stability to prevent settlement. If the material forming the bottom at the grade of pipe is not suitable for foundation, a further depth shall be excavated and the space filled with compacted select borrow. Where rock is encountered, it shall be removed to a depth of six (6) inches below the bottom of the pipe or fitting and to such widths as will give clearance of at least nine (9) inches on each side of the pipe or fitting.

Precautions against accident from the handling, storage and use of explosives shall in all cases be entirely in accordance with the requirements of Chapter 148 of the General Laws of the Commonwealth, Sections 10 to 27 inclusive and revisions thereof, additions thereto, with all local ordinances and By-Laws.

The Contractor shall provide pumps and equipment of adequate capacity and type to remove water in such manner as not to interfere with the progress of the work or to cause damage to adjacent property. All existing gas pipes, conduits, water pipes, sewers, drains or other structures which are uncovered by the excavation and which do not in the opinion of the Engineer require to be changed in location, shall be carefully supported and protected from damage by the Contractor, and if damaged or removed, they shall be restored by him.

#### **Section 9. BACKFILLING AND COMPACTION:**

The trenches and other excavations shall be backfilled unless otherwise directed by the Engineer as soon as the laying of the pipe or the completion of other structures will permit. The space between the pipe and the bottom and sides of trench shall be filled with sand borrow, compacted as placed and brought up evenly on both sides of the trench to a point not less than 18-inches above the top of the pipe, in layers not exceeding 6-inches in thickness. No mud or similar material, and no rock shall be placed within 18-inches of the top of the pipe. From 18-inches above the pipe to 18-inches below pavement, backfill shall ordinary borrow, thoroughly tamped with mechanical rammers, in layers not exceeding one (1) foot in depth. No rock fragment weighing more than 50 pounds will be used for backfilling. The top 18-inches of backfill shall be process gravel suitable for road base placed and compacted during the backfilling operation and treated with calcium chloride to maintain the surface until resurfacing is placed.

Compaction of each backfill lift shall be to 95% dry density.

##### **Ordinary Borrow:**

Shall be a friable material consisting of a nature of stone, sand and silt with no objects larger than seven (7)-inches in diameter and no more than thirty (30) percent by weight finer than No. 200 sieve, and be free of pavement, trash, loam, ice, snow, tree stumps and roots. This material must be conducive to proper compaction by the methods to be utilized under this Contract. Excavated trench material from on-site sources which meets these specifications in the Owner's opinion shall be used for Ordinary Borrow trench refill.

##### **Select Borrow:**

Shall be a friable material consisting of a nature of stone, sand and silt with no objects larger than three (3)-inches in diameter and no more than 30 percent by weight finer than No. 200 sieve, and be free of pavement, trash, loam, ice, snow, tree stumps and roots. This material must be conducive to proper compaction by the methods to be utilized under this Contract. Excavated trench material from on-site sources which meets these specifications in the Owner's opinion shall be used for Select Borrow trench refill.

**Process Gravel:**

Shall consist of hard durable sand and gravel, be free from ice and snow, roots, sods, rubbish and other deleterious or organic matter. Maximum stone size shall be three (3)-inches (greatest dimension). In addition, it shall conform to the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>	
	<u>Maximum</u>	<u>Minimum</u>
3"	-	100
1 1/2"	100	70
1/4"	85	50
No. 4	60	30
No. 200	12	-

**Sand Borrow:**

Shall consist of clean inert, hard, durable grains of quartz or other durable rock, free from pavement, trash, loam, ice, snow, tree stumps and roots, with no objects larger than one (1)-inch in diameter and no more than ten (10) percent by weight finer than No. 200 sieve. This material must be conducive to proper compaction by the methods to be utilized under this Contract. In addition, it shall conform to the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>	
	<u>Maximum</u>	<u>Minimum</u>
1"	-	100
1/2"	100	85
No. 4	100	60
No. 16	80	35
No. 50	55	10
No. 200	10	0

**Section 10. PIPE AND FITTINGS:**

All pipe for water mains shall be Class 52 Ductile Iron. Ductile Iron Pipe shall meet the requirements of ANSI/AWWA C151/A21.51-09 or latest revisions thereto. Pipe joint shall be push-on type, meeting ANSI/AWWA C111/A21.11-12 or latest revision thereto. Shall be cement lined, with an asphaltic seal coat meeting the requirements of ANSI/AWWA C104/A21.4-03 or latest revision thereto. Rubber gasket joint shall meet the requirements of ANSI/AWWA C111/A21.11-00 or latest revisions thereto.

Compact fittings shall be mechanical joint, all bell, Ductile Iron, minimum pressure rating of 350 psi, meeting the requirements, of ANSI/AWWA C153/A21.53-11 or latest revision thereto, including gland, rubber ring, bolts and nuts. Mechanical joint shall meet or exceed the requirements of ANSI/AWWA C111/A21.11-00 or latest revision thereto. Fittings shall be epoxy coated, meet the requirements of ANSI/AWWA C550 and C116/A21.16, use stainless steel nuts and bolts, and shall be cement lined meeting the requirements of ANSI/AWWA C104/A21.4-16 or latest revision thereto.

The Contractor shall be responsible for the handling and storage of all pipe and accessories. The interior of pipe and fittings shall be kept free from dirt and other foreign matter and protected from possible damage by freezing of trapped water. All fittings shall have retainer glands.

Retainer glands are required for all fittings and mechanical joints. Shall be EBAA Iron Megalug, Series 1100 retainer glands for use with ductile iron pipe, or approved equal. "Grip Ring" type serrated retainer glands may be used with existing cast iron pipe. Retainer glands shall be cast of high strength ductile iron and fitted with ductile iron wedging devices with twist-off pressure nuts; 3 each for 6-inch pipe, 4 each for 8-inch pipe, 6 each for 10-inch pipe 8 each for 12-inch pipe.

Tapping sleeves and valves shall be designed for installation under pressure without interrupting service, manufactured in two sections for easy installation and with closely spaced bolts located close to the side gaskets to insure a water-tight joint and provide reinforcement of the main. Tapping sleeves shall be stainless steel. Sleeve joints shall be mechanical and branch flange shall be female faced to accommodate the raised male face of the tapping gate. Valves for tapping sleeve shall be flange-mechanical joint, resilient seal, iron body, bronze mounted, double disk, open left, designed for 200 pounds working pressure, shall meet AWWA Specifications, and shall be from same manufacturer as tapping sleeve.

Gate valves shall be Mueller Co., A2360-20 Series (or approved equal), resilient wedge gate valves with ductile iron body, sealed and enclosed AWWA operators with 2-inch square nut, open left. Valves shall be mechanical joint type. Shall meet or exceed the requirements of ANSI/AWWA C515 or latest revision thereto, will be U.L. listed and FM approved. Ends shall be mechanical joint conforming to ANSI/AWWA C111/A21.11 or latest revision thereto. Valve shall be of the non-rising stem type with O-ring stem seals. Valves shall be rated for 200 psi and tested to 400 psi. Shall be fully coated, fusion bonded epoxy on interior and exterior surfaces in accordance with AWWA C550, with a minimum dry film thickness of 3.5 mils. All exterior nuts and bolts shall be 5/8-inch minimum diameter and shall be stainless steel. Valve disc shall be machined to fit the hexagonal shaft without the use of locking pins or keys to maintain alignment. Valve body shall be provided with a machined stainless steel seat, valve disc shall have vulcanized rubber seat.

Valve boxes shall be cast iron, 5-1/4-inch diameter, two-piece sliding type, with lid marked "Water".

Hydrants shall be mechanical joint type, with two (2) 2-1/2-inch nozzles and one (1) pumper connection, with a 5-1/4-inch valve opening. Hydrant shall conform to ANSI/AWWA C502-14, or latest revision, designed for 150 psi, working pressure, dry bonnet type, with breakable flange and compression type main valve. All bolts and nuts shall be stainless steel. Hydrants shall be supplied with a traffic break feature employing a two-part flange which allows 360-degree rotation of the nozzle section during field installation. Hydrants shall be provided with a spring-activated positive compression drain (to assure and assist quick drain closure and allow throttling) consisting of two bronze drain ports and a minimum of two bronze drain outlets. Tubular or bushed drains are not allowed. Hydrant shall be Mueller Co., Super Centurion 250, A-423 or Waterous WB67.

#### **Section 11. LAYING OF PIPE AND FITTINGS:**

All pipe and fittings shall be laid in accordance with best waterworks practice and the applicable requirements of ANSI/AWWA C600-10, or latest revision thereto. Pipe shall be laid true to line and grade and properly supported and braced.

All pipe fittings, valves, hydrants and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such manner as to prevent damage. The pipe and accessories shall be inspected for defects

prior to lowering into trench. Any defective, damaged or unsound pipe shall be replaced. All foreign matter or dirt shall be removed from the interior of pipe before lowering into position in the trench.

Fittings shall be carefully aligned and supported and braced. Mechanical joints shall be assembled in accordance with manufacturer's recommendations and shall be thoroughly wire brushed before assembly to remove loose rust or foreign matter and end of pipe, bell socket, and gasket brushed with soapy water just prior to assembly. Glands shall be brought up evenly and bolts tightened with torque measuring or indicating wrenches as recommended by the manufacturer. Pipe shall not be deflected either vertically or horizontally in excess of that recommended by the manufacturer. When pipe laying is not in progress, the open end of pipes shall be closed by approved means to prevent the entry of dirt or trench water into the line. No pipe shall be laid in water or on frozen trench bottom or when, in the opinion of the Engineer, the trench conditions or the weather are unsuitable for such work.

Where pipe cutting is required, it shall be carefully and accurately accomplished, leaving a smooth, clean cut. Particular care must be exercised to prevent damage to the cement lining.

Hydrants shall be placed at the beginning and end of every project and spaced at intervals of 500-feet. Hydrant branches shall be securely anchored to the water main using an anchor tee and retainer glands throughout. Hydrants and valves shall be set plumb and secure with gate stems vertical and boxes centered to provide for ready application of gate wrench. Hydrants and valves shall be provided with concrete blocking, stone bed, supports and retainer glands as shown on Contract Drawings or as directed by Engineer. Care shall be taken when placing concrete thrust block behind hydrant to keep drip clear and free to drain. Crushed stone suitable for drainage shall be placed at each hydrant base to a height sufficient to cover the drains.

Bends, tees, valves and hydrants and other fittings, shall be provided with reaction or thrust blocking by concrete placed between solid ground and the fittings. Concrete shall be 1:2-1/2:5 mix.

#### Pressure Test:

Hydrostatic testing shall be in compliance with ANSI/AWWA C600. Testing shall be completed by an independent party acceptable to the Owner and paid by the Contractor. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subject to a hydrostatic pressure of at least 1.5 times the working pressure or 150 psi, whichever is greater, at the point of testing. Pressure shall not be less than 1.25 times the working pressure at the highest point along the test section. Test shall not be made until all reaction and thrust blocking have achieved acceptable strength, a minimum of seven (7) days after they were cast.

Duration of test shall be two (2) hours. Test pressure shall not vary by more than  $\pm 5$  psi.

Each section of pipeline shall be slowly filled with water, with the specified test pressure, measured at the point of lowest elevation, applied by means of a pump connection to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection, gauges, and all necessary apparatus shall be furnished by the Contractor.

During the filling of the pipe and before applying the specified test pressure, all air shall be expelled from the pipeline. At all points of high elevation, the Contractor shall install corporation cocks so that air can be expelled as the pipe is filled with water. After all air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Engineer.

#### Leakage Test:

Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain pressure within 5 psi of the specified test pressure after the air has been expelled and the pipe filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = (S \times D \times P^{0.5}) / 133,200$$

where: L = allowable leakage, in gallons per hour.

S = the length of pipe tested, in feet.

D = the nominal diameter of the pipe, in inches.

P = the average test pressure during the leakage test in psi.

Should any test of a section of pipe line disclose leakage greater than permitted, the Contractor shall at his own expense locate and repair the defects until repeated pressure test yields a leakage value within the allowable limit.

The Contractor shall provide the Engineer with a written report on the pressure test, to include the date, time, location, stations, pressure, and quantity of water applied during test, size of pipe, etc.

Notification: The Engineer and the Owner shall be notified, in writing, at least forty-eight (48) hours prior to the hydrostatic testing of the pipeline.

#### Disinfection:

After completion of hydrostatic testing, the pipe lines shall be disinfected by application of chlorine either as calcium hypochlorite or liquid sodium hypochlorite in an amount to produce a solution of 50 p.p.m. for a contact period of 24 hours. The mixture shall be pumped through the section being treated and shall be discharged and monitored at a point farthest from the point of introduction of the chlorine. When the solution reaches the required concentration of 50 p.p.m. the pump and discharge valve shall be closed and the liquid left in the section being chlorinated for 24 hours.

After disinfection is complete, de-chlorination is required. The chlorine residual shall be reduced to less than 1.5 p.p.m. before being discharged.

The Contractor shall furnish all materials and equipment for the sterilization of the mains, but the Water Department will provide necessary assistance in flushing, operation of gate valves and the water for flushing and testing.

## **Section 12. RESURFACING:**

In public ways, Contractor shall resurface all trenches and other excavation as herein specified. In general the work shall be done in cooperation with and according to directions of the Highway Department acting through the Engineer. In general, the following specifications shall apply, however, the DPW Director may modify these requirements to meet special conditions of State Highway Permits or to suit particular locations.

After consolidation and settlement of the trench, temporary resurfacing shall be placed in one course to a compacted thickness of 1-1/2-inches using Type I bituminous concrete rolled to a smooth surface even with the existing road grade with a slight crown across the trench. This surface shall be maintained by the Contractor until the placing of permanent resurfacing.

After 60 days and/or a winter season have passed, the trenches shall be permanently resurfaced. Any temporary resurfacing shall be removed and the gravel base trimmed to provide for the permanent resurfacing and the edges cut to straight lines. Cut edge of existing pavement shall be coated with an oil emulsion primer.

Permanent resurfacing: Type I bituminous concrete shall be placed to a total compacted thickness of 4-inches, consisting of a base course of 2-1/2-inches and a surface course of 1-1/2 inches after compaction. The base course shall be binder material with coarse aggregate compacted and rolled to grade. The surface course shall have pea stone aggregate carefully placed and raked and rolled to conform to existing road surface with a slight crown across the trench to avoid pockets or depressions. Roller weight for finish course shall approximate 1.5 tons per foot width of roller. After placing and rolling bituminous concrete, the joint between the new and old pavement shall be sealed with a primer coat of bitumen and fine sand applied three inches each side of joint.

Existing grass lawn areas cut by trenches or in other locations shall be replaced by a 6-inch layer of suitable loam rake and rolled to grade, fertilized with Scott's Turf Builder or equal, applied at the rate of one-tenth (1/10) pound per square yard and seeded with Scott's Lawn Seed, Special Purpose Blend, or approved equal, applied at the rate of one-tenth (1/10) pound per square yard, sods shall be cut and replaced.