



2 Water Construction Standards

2.1 General

2.1.1 Description

- A. The work includes furnishing and installing all pipe, fittings, valves, structures and appurtenances required for the proposed system to supply water to users of the City's Water System.
- B. Work and materials shall be performed in accordance with the State Plumbing Code when work is within ten (10) feet of buildings.
- C. Only one domestic water service shall be installed per parcel.
- D. All water connections shall be to City owned distribution mains.

2.1.2 Submittals

- A. Materials List and Shop Drawings
 - 1. Materials list of materials proposed shall be submitted to the City.
 - 2. Approved shop drawings for all materials and structures shall be submitted to the City.
 - 3. Plans for chlorination, dechlorination, pressure test, bypass construction shall be submitted to the City. All pressure testing shall be performed by a qualified third party approved by the City. All pressure testing must be in conformance to a written plan submitted to, and approved by, the City.
- B. As-Built Drawings
 - 1. Submit one (1) copies of As-Built Drawings to the DPW upon completion and acceptance of work as wells as an electronic version of the drawings in both AutoCAD and Acrobat (PDF) format.
 - 2. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built Drawings shall include a minimum of three (3) ties to each valve cover and curb stop from fixed permanent objects. Three (3) ties shall also be provided for each bend or other unanticipated field change. As-Built drawings shall also contain any additional information required by the municipality and shall be stamped with the seal of a Professional Land Surveyor or Licensed Professional Engineer. The City may, at its discretion, require that as-built plans be submitted on electronic form (e.g., AutoCAD release 2008 or higher).
 - 3. As-Built Drawings shall be filed or stored on property and available for use by DPW for all commercial, industrial, and institutional properties and large residential properties, such as apartment or condominium complexes and assisted or congregate living facilities.
- C. Temporary Bypass Plans shall be prepared by a registered professional engineer and submitted to DPW for review and approval prior to installation when required by the City. Bypass plans shall include and consider the following:
 - 1. Proposed schedule for installing, testing, disinfecting, operating, and removing the temporary bypass.



2. All components of the bypass shall be for potable water transmission and distribution with a minimum service pressure of 150 psi. Piping and hose shall be galvanized steel, high density polyethylene (HDPE) or polyvinylchloride (PVC) pipe. All plastic pipe or hose shall bear the imprint of the National Sanitary Foundation (NSF) approval for potable water NSF-PW or shall be capable of meeting the standards established by the NSF for this use.
3. Details of the materials, size, and location of temporary facilities including bypass mains, valves, connections, laterals, services, and fire hydrants.
4. Bypass mains shall be supplied by at least two connections to the existing system either via an existing hydrant or a direct connection to an underground main.
5. Bypass mains shall be a minimum of 6-inches in diameter when supplying water for fire protection to temporary hydrants. Temporary hydrants shall be located in the same approximate location as existing hydrants that have been placed out of service and bagged. The number of hydrants on the temporary bypass shall be greater than or equal to the number of existing hydrants that are placed out of service.
6. Minimum size of bypass mains that do not supply water for fire protection is 2-inches. All temporary services shall be greater than or equal to the diameter of the existing service.
7. Bypass mains shall be laid outside of the traveled and access ways whenever possible and trenched when crossing roadways. All services shall be ramped or trenched.
8. Where possible, services shall be connected to the user's sill cock using a wye fitting with valves to accommodate connections of garden hoses by the user.
9. Need to add language about containment – i.e., dentist offices
10. All plans shall include provision of twenty-four/seven contact information for operation and maintenance of the bypass system.
11. Pressure testing shall comply with the requirements of Section 2.3.1.1 and disinfection testing shall comply with the requirements Section 2.3.1.2.
12. All work shall be coordinated with DPW and the Fire Department and no construction activity shall commence without a minimum of 48 hours advance notice to each department.

2.1.3 Inspection

- A. The Applicant is responsible for the provisions and all test requirements specified herein. In addition, all pipe and appurtenances shall be inspected at the plant for compliance with these specifications by an independent testing laboratory.
- B. Inspection of the pipe and appurtenances shall also be made after delivery. The pipe and appurtenances shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though samples may have been accepted as satisfactory at the place of manufacture. Pipe and appurtenances rejected after delivery shall be marked for identification and shall be removed from the site at once.
- C. All bypass plans must be submitted to DPW for review and approval prior to installation.
- D. All work shall be inspected by the City's Inspector of Construction and Utilities or designated representative prior to backfill.

2.1.4 Delivery, Storage and Handling

- A. All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.



- B. All pipe and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Town to be unrepairable.
- C. Storage and handling of pipes and other appurtenances shall be in accordance with the manufacturer's recommendations, subject to the approval of the Town.

2.2 Materials

- A. The Materials section summarizes the City's standards to be used in public or private components that affect the City's water system. All materials should conform to the applicable AWWA standards unless otherwise noted.

2.2.1 Lead Free

- A. All materials used in public or private water systems within the Town of Framingham's water system must be certified "lead free."

2.2.2 Pipe

- A. All water mains shall be minimum Ductile Iron Class 52, single gasket, double sealing pipe with cement mortar lining. All ductile iron water main pipe shall be rated for a minimum operating pressure of 350 psi. All water mains shall be encased in polyethylene film when the trench is backfilled with control density fill.
- B. All water mains shall be minimum 8-inch diameter. All hydrant branches shall be minimum 6-inch diameter.
- C. Push-on type joints are recommended on straight runs of pipe. Gaskets must be standard for pipe used and be acceptable to the DPW.
- D. Mechanical joint restraints shall consist of individually actuated wedges that increase their resistance to pull out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial. They shall have a rated work pressure of 350 psi in sizes 16-inch and smaller and 250 psi on in sizes greater than 16 inches.
- E. The City has standardized on the Series 1100 MEGA-LUG restraint as produced by EBAA Iron, Inc. or approved equal.
- F. Where petroleum contamination is known or suspected to be in the soil and/or groundwater, nitrile gaskets shall be required.

2.2.2.1 Fittings

- A. Ductile iron fittings shall be used and shall be cement lined. Fittings shall be equipped with a mechanical joint restraint, unless otherwise specified by the DPW. Mechanical joint fittings in sizes 4 inch through 12 inch shall be ductile iron compact fittings and rated for 350 psi working pressure. All nuts and bolts shall be of a type equal to ductile iron or KOR-10 steel T-bolts and nuts or an approved equal.

2.2.2.2 Couplings

- A. Couplings shall be provided with AWWA approved plain, Grade 27, rubber gaskets and track-head bolts with nuts. Couplings shall be Smith Blair, Style 441 or Dress, Style 153; 360 or an approved equal. If the outer diameter of the pipe permits, a Dresser coupling is preferred.



- B. Where petroleum contamination is known or suspected to be in the soil and/or groundwater, nitrile gaskets shall be required.

2.2.2.3 Resilient Seat Gate Valves

- A. Resilient seat gate valve bodies shall be manufactured of ductile iron. Gate valves shall be open left (counter clockwise). All valves shall be designed for minimum 250 psi working water pressure.
- B. The City has standardized on American Flow Control and Kennedy.

2.2.2.4 Valve Boxes

- A. Valve boxes shall be heavy duty, adjustable style with the lower part manufactured of cast iron and the upper part of steel or cast iron. All valve boxes shall be designed and constructed to prevent direct transmission of traffic loads to the pipe or valve, and shall have the lower part manufactured of cast iron and the upper part of steel or cast iron. The top of the cover shall be flush with the finish grade. Boxes shall be as manufactured by Bibby Ste-Croix or approved equal.
- B. Box covers shall be round frame and cover manufactured by the Bibby Ste-Croix or approved equal. The boxes shall be labeled to differentiate between division valves ("DIV"), Blow-Off ("B.O.") and generic valves as indicated in the Construction Details. Box covers shall have a minimum height of four (4) inches.

2.2.2.5 Tapping Sleeves and Valves

- A. Tapping sleeves shall be of the mechanical joint type. The valves shall be flanged by mechanical joint outlet with non-rising stem and designed for vertical burial. Tapping valves shall be rated at 200 psi working pressure and shop tested at 300 psi. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be "O" ring type. The operating nut shall be 2 inches square. Gaskets shall cover the entire flange surface. Valves shall open left, (counter clockwise).
- B. The City has standardized on American Darling 1004 or an approved equal.
- C. Tapping sleeves shall be no greater than one-half of the diameter of the main being tapped.

2.2.3 Piping Connections

2.2.3.1 Service Connections

- A. All service pipe shall be type "K" copper tubing.
- B. Plastic services are allowed on a case-by-case basis. In such circumstances, the City will require that the applicant verify that no petroleum constituents are present in subsurface soil in the vicinity of the service. Plastic water services shall be NSW-PW, listed, High Density Polyethylene (HDPE) blue plastic and shall conform to the following:
 1. Copper Tube Size (CTS) – ASTM 2737, 200 psi, PE 3608 or PE 3710, SDR9
 2. Iron Pipe Size (IPS) – ASTM 2239, 200 psi, PE 3608 or PE 3710, SDR7

Plastic pipe shall be as manufactured by Silver Line Plastics or approved equal. Dimensional and performance characteristics shall conform to the requirements of AWWA C901. The use of



HDPE pipe and tubing may be allowed for water service - two (2) inches or under in diameter (4-inch and larger diameter water services shall use cement lined ductile iron water pipe). HDPE pipe shall be installed with enough slack to compensate for settlement and compaction and shall be laid on a bed of fine grained material.

- C. Curb valves shall not include a drain.
- D. The City has standardized on lead-free service connections manufactured by McDonald, Mueller, Ford or an approved equal. Copper tubing shall be of the type commercially known as type "K" soft and conforms to ASTM Specifications B-88-49.
- E. Curb boxes shall be Erie box style for 1-inch services and Buffalo box style (no rod) for 1-1/2-inch and larger services.

2.2.3.2 Corporations

- A. Corporations for 1 inch installations shall be heavy pattern, solid plug, easy turning. The inlet shall be an AWWA (CC) thread. The 1 inch, 1-1/2 inch and 2 inch corporations shall be of a tee head ball valve type which incorporates Teflon seats to assure self-centering of Teflon coated bronze ball. The corporation shall be easy turning and non-binding. The inlet shall be an AWWA (CC) thread. Corporations shall be subject to a sustained hydraulic pressure of 200 psi. All 1½ and 2-inch saddles shall have stainless steel straps.

2.2.4 Hydrants

- A. Hydrants shall have a 5-1/4-inch valve opened by turning the operating unit in the counter clockwise direction. The hydrant shall have one 4-1/2- inch steamer and two 2-1/2- inch hose connections. The hose and steamer connections shall have National Standard Thread. The operating nuts shall be pentagonal in shape, 1-1/2- inch from point to opposite flat and shall open left (counter clockwise). The hydrant shall be the hub or mechanical-joint type having a 6-inch pipe connection to an 8-inch or larger diameter main.
- B. The hydrant valve shall consist of a cast iron valve and valve bottom and hydrant valve rubber. The rod threads shall be permanently sealed from contact with water. The hydrant valve shall seal against the bronze hydrant seat. The upper barrel shall be ductile iron with markings identifying size, model and year of manufacture. The lower barrel shall be ductile iron.
- C. The upper barrel shall connect to the lower barrel with a breakable traffic flange and 8 bolts and nuts. This connection shall allow 360 degree rotation of the upper nozzle section.
- D. The hydrant shall have a bronze drain ring securely held between the barrel and base flange. It shall provide bronze to bronze threaded connection for hydrant seal. The bronze drain ring shall serve as a non-corrosive multi-port drain channel.

Hydrant anchor tees shall be located at the main.

- E. The hydrant shall have a minimum working pressure of 200 psi. Hydrant design shall be of positive automatic drain type to prevent freezing.
- F. All hydrants that will not be City owned shall be painted red. Hydrants that are City owned, or will be City owned, shall be factory painted with Sherman-Williams brand paint to the City's paint scheme:

Hydrant body: hydrant blue b54tz104

Caps: Pure white-b54w2101



- G. The City has standardized on American Darling Model No. B-62B as manufactured by American Flow Control Inc.

2.3 Execution

- A. This section summarizes the City's standardized methods for the installation and maintenance of certain aspects of the water system. All procedures shall be performed consistent with AWWA standards.

2.3.1 Piping

- A. The sizing of water mains shall be based on sound engineering principals. All water mains shall be minimum 8-inch nominal diameter. All hydrant connections shall be minimum 6-inch diameter.
- B. All piping shall be installed with a minimum 5-foot cover. In such cases where 5-foot cover is not possible, the piping shall be appropriately insulated. Water pipe shall be installed with minimum distance from sewer and septic pipe as summarized in Section 3.3.1.2 H.
- C. Pipe shall be laid accurately to line and grade in sand bedding conforming to MassDOT Standard Spec. M1.04.0 Sand Borrow and AWWA guidelines. The depth of the sand bedding shall be one half (1/2) the diameter of the pipe under the main and one half (1/2) the diameter of the pipe over the main or 6 inches both under and over the pipe, whichever is greater. Bedding shall be placed in layers not over six inches thick, and each layer shall be thoroughly compacted by tamping and chinking on each side of pipe to provide uniform support.
- D. Backfill material placed above the bedding material and below the roadway foundation shall conform to W-2.3.0. Roadway foundation and surface restoration shall conform to Section 5, Roadway Construction Standards, and Section 6, Existing Road Openings, as applicable.
- E. Push-on pipe gaskets shall be clean and thoroughly coated with lubricant specified by the manufacturer during installation.

2.3.1.1 Pressure Tests

- A. The pipelines shall be tested (in sections if required by the City) for strength and for leakage at a pressure of 200 pounds per square inch. In certain circumstances, the City may require higher pressure tests. The tests for leakage shall last for two hours although the City may allow a one hour test subject to advanced approval. No more than 1,000 feet of water main shall be tested in a single test.
- B. The additional water needed to maintain the required pressure shall be accurately measured in a manner approved by the City. The container shall be clearly labeled with its capacity in gallons. Allowable leakage amounts will be determined by the AWWA standards for pressure testing Ductile Iron pipe (AWWA C600 latest revision).
- C. Tests shall be made for all newly installed pipe and when required by the City. A 24-hour notice shall be given to the City prior to all tests. The Contractor shall pay for and make all necessary arrangements for securing the water for test purposes. For projects where water is collected straight from an un-metered source, the Contractor shall meter the water. The City will subsequently bill the contractor on a private job for that water usage. For DPW projects, the Contractor will not be billed, but water usage shall be documented.



- D. During this test all hydrant laterals shall be in the open position. Methods of testing and plans showing sections to be tested shall be submitted to the City for approval as requested. The Contractor will not perform a pressure test against existing valves unless authorized by the City.
- E. The Contractor shall submit a written report to the DPW summarizing the results. The Contractor shall repair all leaks discovered under any of the required tests and retest the pipe. The City will not accept any installation where a final test has not been passed.

2.3.1.2 Chlorination of the Pipeline

- A. Prior to disinfection, the Contractor shall submit a detailed disinfection plan to the DPW. The plan shall be prepared consistent with AWWA standards and federal and state regulations, and it shall outline and describe the disinfection procedures. At minimum, the plan shall include the following components:
 - General: All water mains, water services, attached appurtenances and connections shall be disinfected in accordance with AWWA Standard C651.
 - Disinfection of new mains, including all chlorination, chlorine residual measurements, collection of samples, and certification shall be conducted by a third party testing agency approved by the DPW.
 - All pipe, fittings, and appurtenances shall be kept free from dirt and foreign matter at all times. During construction all open pipe ends and fittings shall be fitted with a water tight plug. At the end of the work day the open pipe in the trench shall be plugged in an equally suitable manner.
 - The interior surfaces of new valves, pipe and appurtenances shall be swabbed, as well as the interior surfaces of existing main, both upstream and downstream of the new pipe section, with a minimum five percent concentration of hypochlorite disinfection solution before installation. During the chlorination or chlorinating process, all valves shall be operated, and the chlorine solution shall be drawn through all laterals and appurtenances. Disinfection of mains and appurtenances, hydrostatic testing, and chlorine retention may run concurrently for the required minimum 24- hour period only if prior approval is obtained from DPW.
 - In the event of leakage or where repairs are necessary, added disinfection shall be made only by injecting chlorine into the line whereby adequate mixing is assured. If the test results are not satisfactory, additional disinfection shall be required.
 - Chlorine Dosage and Injection shall be performed in accordance with the continuous feed method as described in AWWA C651. The Disinfection Plan shall summarize the intended chlorine dosage and the method for establishing that dosage. The disinfection may be accomplished by introducing into all the various parts of the new water mains a liquid solution containing one percent available chlorine in such volume that the rate of dosage to the water mains shall be at least 25 parts per million of available chlorine. The Disinfection Plan shall document the locations and methods for applying the chlorine into the pipeline. Disinfection Period and Flushing – The contact period for this disinfection shall be at least twenty-four hours, and a longer period will be required if tests of residual chlorine show it to be less than the required minimum of 10 mg/l. The pipeline shall be adequately flushed with potable water and the Disinfection Plan shall document the method for de-chlorinating and discharging the residual water. All discharges must comply with local, state and federal requirements
 - Water shall be flushed from the line at its extremities and at all outlets until the chlorine residual of the water system being flushed is equal or less than the distribution system level.
 - Sampling – Sampling shall be performed by an independent certified laboratory according to AWWA C651 – Disinfecting Water Mains. B. The Contractor shall not proceed with the



disinfection procedures until the Disinfection Plan has been approved by the DPW. All sampling results shall be submitted to the DPW prior to activation of the water main.

- C. Connections at cuttings shall be swabbed with a 5% solution of chlorine at locations when other methods are not applicable.
- D. All water used to disinfect pipe shall be discharged and managed consistent with the appropriate state and local regulations. These shall include the City of Framingham Conservation Commission permitting and the *Illicit Discharges to Municipal Separate Storm Sewer System* bylaw. Discharge to the sanitary sewer system is not allowed.
- E. Water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory bacteriological sample results received prior to connections being made to the active distribution system.

2.3.2 Valves

- A. All material shall be inspected for defects prior to installation. Defective materials shall be immediately removed from the site. All foreign matter shall be removed from valve openings and seat faces. All nuts and bolts shall be checked for tightness.
- B. For any T-connections that may be considered a lateral connection, the valve for the lateral line shall be attached with an anchor-T or tapping sleeve if approved by DPW (See Detail W-2.4.1). The valves on the main line shall be installed in line with the curb (see Detail W-2.4.3).

2.3.3 Tapping

- A. Where there is more than one public water main in a street, the City shall determine which main the owner may tap for water service pipe connection. Water mains designated as transmission mains shall not be tapped for water service, except when approved by the City.
- B. Service taps to the distribution main shall be separated by a minimum of 18-inches in all directions.
- C. Temporary taps installed for filling and testing a pipe shall be abandoned prior to City acceptance. Abandonment shall include cut pipe no more than 3" from the corporation stop and corporation stop shall be in the closed position.

2.3.4 Thrust Restraint

2.3.4.1 Thrust Blocks

- A. Thrust blocks may only be used against undisturbed soil. They shall be designed in accordance with the Design Standards using the appropriate concrete and pressures as specified in the Construction Details and the AWWA standards and guidelines.

2.3.4.2 Tie Rods

- A. Tie rod systems may be used where approved by the City. All materials shall be steel and coated with an approved bituminous coating or other approved corrosion resistant coatings. Unless otherwise required or approved by the Engineer, the Contractor shall install tie rods in accordance with the following schedule for all fittings:



Minimum Tie Rod Design		
Pipe Size (inches)	Number of Rods	Tie Rod Diameter (inches)
4"-12"	2	¾"
16"	4	¾"
20" – 24"	4	1 ½"

2.3.4.3 Wedge Action Retaining Joints

- A. Wedge Action Retaining Joints may be used wherever approved by the City and shall be manufactured of ductile iron conforming to ASTM A536. The mechanical joint restraint shall be Megalug Series 1100 or equal approved by DPW.

2.3.5 Electrical Grounding

- A. No electrical grounds shall be made on water service pipes where a driven ground rod can provide the needed grounding service. Electrical grounding shall be provided in accordance with the Massachusetts Electric Code.

2.3.6 Fire Suppression

- A. All new fire suppression (i.e. sprinkler) connections shall be coordinated with and approved by the City's fire department.
- B. Fire suppression connections shall be coordinated with the property owner. Sprinkler valves shall only be operated by a certified sprinkler operator. The certified sprinkler operator shall bleed air from the sprinkler system upon completion of installation.
- C. Single-family detached dwellings (i.e. single-family homes) may tap a single fire suppression service connection from their domestic water line if all of the following conditions are met:
1. The connection is made after the water meter
 2. A testable backflow preventer is installed on the fire service line next to the connection
 3. All pipes used in the fire suppression system be approved to carry potable water
 4. Fire suppression system does not contain anti-freeze or any substance other than potable water
- D. No fire service connection may be tapped off a domestic service (and vice-versa) for all commercial and multi-family properties. Separate domestic and fire services shall be installed from the building serviced to the public water main.

2.3.7 Pipe, Valve and Structure Abandonment / Removal

- A. Pipes left in place that are greater than 6 inches in diameter shall be filled with CDF regardless of material (e.g., DI, PVC).
- B. Pipes left in place that are equal to or less than 6 inches in diameter may be left unfilled.
- C. Structures left in place shall be demolished down to five feet below ground surface, the bottom shall be cracked and compacted, and the remaining structure filled with CDF. Demolition debris shall be removed, and the area regraded and compacted over the filled structure.



- D. When abandoning asbestos cement pipe, care shall be used to follow DPW's Standard Operating Procedures for ACM.

2.4 References

- A. All materials and execution shall conform to the highest applicable standards. If there is a conflict between other standards, or between other standards and these Design standards, then the most stringent criteria shall be used.
- B. The City commonly references AWWA standards as guidance for the materials and execution of work performed on the City's water infrastructure. The following summarizes select AWWA standards applicable to the sections in these Design Standards. This list is not exclusive as other standards may apply. The latest revision of each standard shall be referenced.

<u>Standards</u>	<u>Title/Subject</u>
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM D3350.	Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
AWWA C104/ANSI 21.4.	American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/ANSI A21.5.	American Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/ANSI A21.10.	American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 Inch Through 48 Inch for Water
AWWA C111/ANSI A21.11.	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C150/ANSI A21.50.	American National Standard for the Thickness Design of Ductile-Iron Pipe
AWWA C151/ANSI A21.51.	American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153/ANSI A21.53.	American National Standard for Ductile-Iron Compact Fittings, 3 In. Through 64 In.
AWWA C502.	AWWA Standards for Dry-Barrel Fire Hydrants
AWWA C504	AWWA Standard for Rubber-Seated Butterfly Valves
AWWA C509.	AWWA Standard for Resilient-Seated Gate Valves for Water Supply Service
AWWA C515.	AWWA Standard for Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service
AWWA C600.	AWWA Standard for the Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C651.	AWWA Standard for Disinfecting Water Mains



AWWA C901.	Polyethylene (PE) Pressure Pipe and Tubing, ½ Inch – 3 Inch, for Water Service
MassDEP	Guidelines for Public Water Systems (April 2014)
US EPA	In a Guidance Letter dated July 17, 1991, identified as Control # C99 within the Agency Applicability Determination Index, the U.S. EPA determined that “the pumping of grout into buried lines is not a process which, in and of itself, would cause asbestos cement pipe to become regulated asbestos containing material.”