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Concord Public Works
Water and Sewer Division

Design and Installation Standard Specifications for Water Mains and Services in the Town of Concord, Massachusetts

October 4, 2007

PART 1 - GENERAL

The sections that follow describe the Town of Concord's design and installation standards for water mains and services. Any deviation from the procedures and materials described herein must be approved by the Superintendent before installation approval will be granted.

1.01 General Requirements

A. Water mains and services may only be installed if allowable by the Town of Concord's Water Rules and Regulations (2002 or most recent version). The standards described herein apply only to projects that have been approved conceptually by either the Water and Sewer Division Superintendent ("Superintendent") or the Public Works Commission ("PWC"), whichever is required by the Water Rules and Regulations.

B. All water service connections shall be made under the supervision of the Water and Sewer Division ("Division") and in accordance with its specifications. The applicant for water service or water main installation ("Applicant") shall notify the Division at least 48 hours prior to the installation to arrange for a Division employee to be present for inspection. If an inspection cannot be scheduled within 48 hours, the installation may not occur until an inspection is arranged, at the discretion of the Division's Operations Supervisor.

C. The Applicant is responsible for procuring the services of a contractor. The Town reserves the right to deny the use of a particular contractor performing work within the Town's right-of-way if said contractor is deemed to have historically not performed proper installation of utilities within the Town.

D. The Superintendent may require that any work done in the right-of-way be performed by a Town employee or contractor employed by the Town, with the owner paying to the Town special service fees for the work performed.

E. The size, alignment, and materials of construction of a water main or service, and the methods to be used in excavating, placing of the pipe, jointing, testing and backfilling the trench, shall conform to the requirements of the building and plumbing code, current specifications from the Division, other applicable rules, regulations and bylaws of the Town, and the requirements outlined herein. In the absence of code

provisions, or in amplification thereof, the materials and procedures set forth in the appropriate specifications of the ASTM and AWWA shall apply.

1.02 Design Plans

A. A site plan must be submitted for all water main or service projects, showing the location of existing utilities and the location of proposed work.

B. Plans for proposed new water mains shall be provided in accordance with the Town of Concord's "*Application for the Extension of Water Mains in Public and Private Ways*" (2005 or most recent version).

C. Proposed water services may be drawn in plan-view only, however, they must show size of the pipe, the depth of cover, the location and elevation of all adjacent or crossing underground facilities, and any other information which may be required to adequately check, construct and inspect the system.

D. For a single-family residence proposing to install a water service connection that meets all of the design specifications described herein, a sketch of the proposed work is sufficient. This sketch may be prepared by the property owner, the property owner's contractor or an engineer and should include the information listed above.

E. For projects other than single family residences, and for all water main extension projects, a more detailed plan may be required, prepared by a registered Professional Engineer, licensed in the State of Massachusetts.

F. For larger projects, the Division may require a sequence of activities and a schedule drawn up in terms of days from the start of the project to key activities in progress toward completion. A list of materials to be used, including the type and manufacturer, may also be required.

1.03 As-Built Drawings

A. Applicants for new water mains shall provide as-built drawings as outlined in the Town's "*Application for the Extension of Water Mains in Public or Private Ways*."

B. The installer of any service connection shall provide an as-built drawing to the Division at the time of final inspection. This drawing shall be neat and legible and fit onto an 8 ½' by 11' piece of paper. More than one sheet may be used if necessary. The drawing shall show all lengths of pipe, connections, elevations, and diameters. Three ties to permanent fixtures and depths below surface shall be shown for each change in line or grade and the beginning and end of each service connection. Location and elevation of all benchmark information shall be provided.

PART 2 – DESIGN STANDARDS

2.01 General Requirements

A. No water main or service connection shall have less than 5-feet of cover over the crown of the pipe unless approved by the Superintendent.

2.02 Materials Standards

A. All materials furnished and installed under this section shall conform to the applicable sections of the following standards:

B. ASA A21.50 (AWWA C150) – Thickness for Design of Ductile-Iron Pipe

C. ANSI A21.4/AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water

D. ANSI A21.10/AWWA C110 - Ductile Iron and Gray Iron Fittings for Water

E. ANSI A21.11/AWWA C111 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

F. ANSI A21.51/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast, for Water

G. ANSI B.16 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

H. ASTM A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings.

I. ASTM B62 - Composition Bronze or Ounce Metal Castings

J. AWWA C502 - Dry Barrel Fire Hydrants

K. ANSI/AWWA C651 - Disinfecting Water Mains

L. AWWA B300 - Hypochlorites

M. ANSI/NSF Standard 61 - Seal Coat for Ductile Iron Pipe

N. AWWA C504 – Rubber Seated Butterfly Valves

O. AWWA C500 – Metal Seated Gate Valves for Water Supply Service

P. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service

Q. AWWA C550 – Protective Epoxy Interior Coatings for Valves and Hydrants

R. AWWA C901 – Polyethylene Pressure Pipe and Tubing

2.03 Water Mains

A. Ductile Iron Pipe: Pipe shall be designed in accordance with AWWA C150 and shall conform to ANSI A21.51/AWWA C151, Class 52 and shall have push-on joints except that pipe installed in vaults or above grade shall have flanged ends conforming to ANSI B16.1. Push-on joints and rubber gaskets shall be in accordance with ANSI A21.11/AWWA C111.

B. Pipe shall be double cement-lined with seal coat inside and out, conforming to ANSI A21.4/AWWA C104. Asphalt seal coat applied to the interior of ductile iron pipe shall be a product acceptable to the National Sanitation Foundation (NSF) for use in potable water and shall be listed in the most current NSF summary of approved products. The asphalt seal coat shall be applied and cured in strict conformance with manufacturer's instructions and cautions. The seal coat shall be applied by the pipe manufacturer under controlled factory conditions. Field application is strictly prohibited. The exterior of buried ductile iron pipe shall be bituminous coated.

C. The pipe manufacturer shall supply the Engineer with certificates of compliance with these specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending or other approved test for ductility.

2.04 Water Main Appurtenances

A. Fittings shall be cast iron, 250 psi pressure rating, or ductile iron, 350 psi pressure rating, conforming to ANSI A21.10/AWWA C110 with mechanical joints. Compact ductile iron fittings conforming to ANSI A21.53/AWWA C153 will be acceptable. Joints and gaskets shall conform to ANSI 21.11/AWWA C111. Joints shall be furnished with ductile iron follower glands. Fittings shall be double cement-lined and seal-coated inside and out in accordance with ANSI A21.4/AWWA C104 and these Specifications.

B. Tees for hydrant branches and for stubs for future use shall have mechanical joints on the run with a plain end having an integral rotating gland on the branch. The gland will anchor mechanical joint pipe or valve ends to the plain end of the tee (anchor tees).

C. All ductile and cast iron pipe and fittings shall be clean, sound and without defects. The castings shall be smooth and free from pinholes, excess iron, etc. The coatings shall be continuous, smooth and neither brittle nor sticky. The Contractor will, as ordered by the Engineer, cut lengths of pipe in the middle to check thickness of the lining.

D. The Contractor shall furnish and install all mechanical joint couplings to be used in connecting two plain ends of cast or ductile iron pipe. The couplings shall be of cast or ductile iron with bolts and nuts complying

with AWWA C111. Couplings shall be Dresser Style 38, Smith-Blair Style 441, or approved equal.

E. Grip lock gaskets or joint retainer glands shall be used in areas where settling could occur (i.e. wetlands crossings, culvert crossings, main road crossings, etc.).

F. JOINT RETAINER GLANDS: Mechanical joint retainer glands shall be ductile iron and shall conform to ASTM A-536. Mechanical joint retainer glands shall be Megalug™, Ford Uni-flange Series 1400, or approved equal. Set screw retainer glands are not acceptable.

G. PLUGS AND CAPS: Plugs and/or caps shall be installed in locations designated by the Engineer. The wetted surfaces of all plugs, caps and blank flanges shall be cement-lined and asphalt seal coated as specified for ductile iron pipe.

2.05 Valves and Hydrants

A. The Applicant shall furnish and install all valves, hydrants, corporations and curb stops, and appurtenances and all copper tubing between corporations and curb stops.

B. All material shall be carefully inspected for defects in workmanship and materials, all debris and foreign materials cleaned out of valve openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily or are otherwise defective should not be installed.

C. All valves and appurtenances shall be new and in perfect working condition. Valves shall be designated for continuous use with a minimum of maintenance and service required and shall perform the required function without exceeding safe limits for stress, strain, or vibration. In no case will used or damaged valves be acceptable. Both workmanship and material shall be entirely suitable for the service conditions specified.

D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed, and standard to which they are manufactured cast in raised letters on some appropriate part of the body. Unless otherwise noted, valves shall be suitable for the pressures noted where they are installed. Valves shall be of the same nominal diameter as the pipe or fittings to which they are connected.

E. Gate valves shall meet or exceed the requirements of AWWA C509. Gate valves shall open right and be resilient wedge design. All valves shall be bubble tight at 200 psi working pressure. Gate valves shall be supplied with stainless steel nuts and bolts on the stuffing box and bonnet. The valve box and body shall be fusion bonded epoxy coated, inside and out, per AWWA C550. Gate valves shall be by Mueller (model A 23-60), American Flow (model 2500), U.S. Pipe (metroseal 250), or AVK resilient wedge gate valves.

F. The Contractor shall furnish all rods and retainer glands, such as Megalug or approved equal, required to properly anchor valves, fittings and hydrants.

G. Valve boxes shall be cast iron, 5 ¼-inch diameter, two piece, sliding type with covers marked "Water." Covers shall provide minimum overlap of 6 inches. Valve boxes shall be manufactured in the U.S. or Canada, only. The use of risers is strictly prohibited.

H. When connections to existing water mains are required, a tapping sleeve and valve shall be used. The tapping sleeve and valve shall be of adequate size and pressure to ensure the continued flow of water through the existing main throughout construction. A gate valve and box will be installed with the tapping sleeve. The gate valve shall conform to the requirements listed above. The tapping sleeve shall be as manufactured by Mueller, U.S. Pipe, American Flow Control, or AVK and shall be stainless steel.

I. Gate valves and boxes shall be set with the stem vertical and box vertically centered over operating nut. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve. The gate box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. All gate boxes located within a paved area will be set in a high early strength concrete collar.

J. Valves shall be anchored to all tees or fittings with 3/4" threaded rods, wherever possible or as directed by the Engineer.

K. Couplings and fittings shall be installed in accordance with manufacturer's instructions.

L. The exact location of the manual air releases will be determined in the field.

M. All valves and hydrants shall be pressure tested during the main pipeline test. Hydrant gate valves shall remain open during the main pressure test. After the pipeline has been pressure tested and accepted, the hydrant gate valve shall be closed and the hydrant valve cracked open to release some pressure on the hydrant side of the gate valve. An acceptable test for each hydrant gate valve shall be no loss of pressure in the main line test pressure as each valve is closed. The Town of Concord will not accept any gate valve and box until a Water and Sewer Division representative has "occupied" a live valve.

N. All main line butterfly or gate valves and control valves on any intersecting side streets shall also be tested by the same procedures outlined above as far as practical. The Engineer shall decide if it is impractical to test any one particular valve location. No pressure test shall be considered acceptable until all possible control valves have been tested to insure proper closing and water tightness.

O. The Contractor shall make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing. He shall also furnish a test pump, gauges and any other equipment required in conjunction with carrying on the hydrostatic tests. He shall at all times protect the new water mains and the existing water mains against the entrance of polluting material.

P. When not provided by the Town of Concord, hydrants shall be open-right, dry barrel U.S. Pipe Metropolitan 250 Model 94, Mueller Super Centurion 200, American Flow (model B-84-B) or AVK (250 psi Series 2780).

Q. Hydrants shall generally be provided not more than every 500 feet along new water mains. The general location and spacing of hydrants must be reviewed and approved by the Concord Fire Department. Exact locations may be refined in the field at the discretion of the Division's field inspector.

R. Hydrants are required at the end of all new dead end water mains, unless otherwise approved by the Engineer.

S. The Contractor shall furnish all rods and retainer glands required to properly anchor valves, fittings and hydrants.

T. Hydrant branches shall consist of a valve anchoring tee, a 6-inch gate valve and one 6-inch ductile iron, mechanical joint nipple of required length.

U. Hydrants shall be set at the location determined by the Water and Sewer Division and bedded on a firm foundation. A drainage pit three feet in diameter and two feet deep below and to the rear of the hydrant shall be filled with crushed stone and satisfactorily compacted. During backfilling, additional pea stone shall be brought up around and six inches over the drain port.

V. Where directed by the Engineer, the Contractor shall install plugs in the hydrant drain ports. No hydrant shall be backfilled until the Contractor is directed to do so by the Engineer. Each hydrant shall be set in true vertical alignment and properly braced. Concrete thrust blocks or material approved by the Engineer shall be placed around the hydrant elbow before placing concrete. Care shall be taken to insure that concrete does not plug the drain ports. The concrete shall be placed as directed by the Engineer.

W. Following final project clean-up, all hydrants shall be given one field coat of paint which shall match existing system hydrants and be approved by the Engineer. Hydrants are to be "bagged" until such time as they are tested, accepted and available for use by the Fire Department.

2.06 Water Services, Corporations, and Curb Stops

A. Water service piping shall be Ultra-High Molecular Weight polyethylene (PE) black tubing. The service piping shall conform to the above-

referenced standards for polyethylene with a pressure rating of 200 psi and a ¾-inch diameter, unless specified by the Water and Sewer Division.

B. The standard service connection to the water system is ¾-inch diameter. One-inch diameter services will also be allowed. Any deviation from this size must be approved by the Superintendent.

C. Copper water services are also allowed. Sizes shall allow the use of compression fittings without special adapters.

D. All fittings, connections, corporations, curb stops, and service appurtenances shall be service brass as follows: Service brass shall conform to AWWA Standard C-800 (latest revision) and pack joint end connections shall consist of Buna-N beveled gasket for a watertight seal. An independent, split-clamp locking device or stainless steel beveled gripper shall be incorporated in the design for additional restraint. Ford, Mueller, MacDonald and Cambridge service brass is accepted without substitute.

E. The curb box shall be cast iron or stainless steel.

F. All pipe shall be color-coded or labeled for in-ground identification as water pipe and shall be installed with the coding facing up, for easy viewing upon excavation.

G. No water service connection shall exceed 200-feet in length without prior approval of the Superintendent.

H. Wherever possible, water services shall be installed with a minimum of 10 feet horizontal separation from sewer services and drains and a minimum of 3 feet from all other utilities. Encasement of either the water or sewer service is required in the form of a 10-foot sleeve on either side of the adjacent structure in the following cases:

1) The minimum 10-foot horizontal separation from sewer services and drains cannot be met;

2) the top of the sewer bell is less than 3-feet from bottom of the water line;

3) a storm drain is within 1.5 feet above the water line; or

4) a sewer main or connection is above water main or connection.

I.. Any person requesting to tie into an existing water service for the purposes of a common connection, if allowed by the Water Rules and Regulations, may be required to investigate the integrity of the pipe to which they are proposing to connect. If applicable, this request will be made of the applicant when design plans are received by the Division.

J. Backflow prevention and cross-connection control shall conform with all applicable federal, state and local standards. Connection to one building of both Town water supply and a private supply is prohibited under most circumstances. If particular circumstances warrant such a connection,

connection shall not be made without prior written approval of the Superintendent.

PART 3 – EXECUTION

3.01 General Requirements

A. No connections to existing mains shall be started without prior written approval of the Division, and each connection with an existing main shall be made at a time and under conditions which will least interfere with service to customers affected thereby. At least 48 hours notice is required to schedule an inspection with the Division. At least 48 hours notice shall be provided to customers of any planned water service interruption.

B. The Contractor shall perform the actual tapping operation for the mains under the direction of the Water and Sewer Division after obtaining written permission from said Division, unless otherwise directed by the Division.

C. The Contractor shall make any and all excavations and backfill as required and furnish all labor, equipment and material necessary to complete the connection as detailed on the plans.

D. Ductile Iron Pipes shall be laid in accordance with AWWA C600 and with manufacturer's instructions.

E. Where new pipe is required to be installed, pipe and accessories shall be handled and stored in such a manner as to insure that pipe is installed in sound, undamaged condition. All pipes shall be thoroughly cleaned before being laid.

F. Ductile iron pipe and fittings and the cement linings are comparatively brittle. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe or lining, scratching or marring machined surfaces, and abrasion of the pipe coating or lining.

G. Any pipe showing a distinct crack with no evidence of incipient fracture beyond the limits of the visible crack, if approved, may have the cracked portion cut off by and at the expense of the Contractor, before the pipe is laid, so that the pipe used is perfectly sound. The cut shall be made in the sound barrel at a point at least 12-inches from the visible limits of the crack.

H. If authorized, cutting of the pipe shall be done so that the cut is square and clean. Unless otherwise authorized by the Division's Inspector, all pipe cutting shall be done by means of an approved type of power cutter. The use of hammer and chisel, or any other method which results in rough edges, chips and damaged pipe, is prohibited. All cut edges shall be field beveled by use of a power grinder, as required, prior to installation.

I. Each pipe section shall be placed into position in the trench in such manner and by such means required to cause no damage to the pipe, person or property.

J. The Contractor shall furnish slings, straps, and/or approved devices to provide satisfactory support of the pipe when it is lifted. Transportation from delivery areas to the trench shall be restricted to operations which can cause no damage to the pipe units.

K. Pipe shall not be dropped from trucks onto the ground or into the trench. The Contractor shall have on the job site, with each laying crew, all the proper tools to handle and cut the pipe.

L. The Division reserves the right to have any or all pipe, fittings and special casting inspected and/or tested by an independent service at either the manufacturer's plant or elsewhere.

M. Pipe and fittings shall be subjected to a careful inspection and a hammer test, if applicable, just before being laid or installed.

N. The Contractor shall furnish and install all of the fittings necessary for connections between new water mains and existing water mains.

O. All tapping operations shall be wet taps, unless otherwise approved by the Engineer.

P. Damaged pipe coating and/or lining shall be restored before installation only as approved or directed by the Engineer.

3.02 Excavation

A. All excavation and backfilling shall be performed in accordance with the standards of the Concord Engineering Division.

B. All persons making excavations will make certain that all utilities have been visibly marked to the best of their knowledge (including the proper advance notice to DigSafe), all material, labor and equipment necessary to complete the work are at the job site, and that they are in compliance with any applicable standards of the Concord Public Works Commission and the Concord Engineering Division.

C. All excavations shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways and other public property disturbed in the course of the work shall be restored in a time and manner satisfactory to the Town, in compliance with all applicable Concord Public Works regulations, as soon as possible after the completion of the installation of the water connection. The Contractor is responsible for scheduling and paying for any Police details required to perform the work.

3.03 Preparation of Bed

A. As soon as excavation has been completed to the required depth, the Contractor shall place and compact bedding material to the elevation necessary to bring the pipe to grade.

B. The trench bottom shall be straight, free of bumps or hollows and at the proper depth. Any irregularities in the trench bottom shall be leveled off or filled in with a selected gravel or sand and thoroughly tamped. Where ledge or rock excavation is required, the trench shall be backfilled with sand.

C. Pipe bedding shall be washed and screened sharp gravel, well graded in sizes from ¼-inch to 1 ½-inch inclusive. It shall be clean, hard, durable and free from dust, clay or organic matter. It shall be well compacted in place. Pipe bedding shall be used to cover the pipe to a height of 6-inches above the crown of the pipe. Material used to backfill above 6-inches above the crown of the pipe shall be subsoil material excavated onsite which is friable, natural soil composed of gravel, sand, or silty or clayey gravel and sand, free from debris or unsuitable materials. Materials unsuitable for backfilling include cut or broken pavement, debris, concrete or other rubble, organic materials, muck, peat, silty soils or clayey soil, rocks over 6-inches in maximum dimension, and any material which will not provide sufficient support to maintain the installed water mains or appurtenant construction in a stable condition.

3.04 Installation of Water Mains

A. The pipe shall be laid on the trench bedding and the pipe pushed home by approved methods. Jointing shall be in accordance with the manufacturer's instructions and appropriate ASTM standards, and the Contractor shall have on hand for each pipe laying crew the necessary tools, gauges, pipe cutters, etc. to install the pipe in a workmanlike manner.

B. Blocking under the pipe will not be permitted except where a concrete cradle is proposed, in which case precast concrete blocks shall be used.

C. If inspection of the pipe indicates that the pipe has been properly installed as determined by the Division's Inspector, the Contractor may then refill or backfill the remainder of the trench in accordance with the Specifications.

D. At any time that work is not in progress, the end of the pipe shall have a temporary, water tight plug to prevent the entry of animals, earth, water, and debris.

E. Concrete thrust blocks or other material approved by the Division shall be installed at all fittings and other locations as directed by the Division's Operations Supervisor. Joints must be protected by felt roofing paper prior to placing concrete. Concrete shall be placed against undisturbed material and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

F. Push-on joints shall be made in strict accordance with the manufacturer's instructions. A rubber gasket shall be inserted in the groove of the bell end of the pipe and joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of

the pipe to which it is to be jointed and pushed home with a jack or by other means. After jointing the pipe, a metal feeler shall be used to make certain that the rubber gasket is located correctly, if directed by the Division's field inspector.

G. Mechanical joints at valves, fittings and where designated shall be in accordance with the "Notes on Method of Installation" under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no conditions shall extension wrenches, pipe over handle or ordinary ratchet wrenches be used to secure greater leverage.

H. As soon as excavation has been completed to the required depth, the Contractor shall place and compact bedding material to the elevation necessary to bring the pipe to grade.

I. The compacted bed shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly for the full length of the barrel.

J. Bell or coupling holes shall be excavated as necessary to ensure that the pipes and not the pipe bells or couplings are bearing the weight of the backfill and traffic load.

K. Acceptable alignment shall be preserved in laying. The deflection at joints shall not exceed five percent for an 18-foot length of pipe. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench. Solid sleeves shall be used only where approved by the Engineer.

L. At the conclusion of work, the Contractor shall thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipe during the construction period. All obstructions shall be removed.

3.05 Installation of Water Services

A. The tapping machine shall be rigidly fastened to the pipe halfway between the horizontal and vertical position. The length of travel of the tap should be so established that when the stop is inserted and tightened with a 14 inch wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation stop shall be inserted with the machine while it is still in place. Stops shall be tightened only sufficiently to give water tightness, and care must be constantly exercised not to overtighten them.

B. Care shall be exercised in the placing and laying of tubing to be sure that the pipe does not have kinks or is not placed on sharp stones or ledge which would cause damage to the pipe. Place at least six inches of sand adjacent to, above and below the tubing. No stone shall be dropped on the tubing until the depth of backfill above the tubing is in excess of one foot.

C. Insert stiffeners shall be installed when compression connections are made.

D. Make connections of new services with existing services unless otherwise directed by the Division's Operations Supervisor. Use bushings and/or couplings as required to connect new tubing with existing services.

E. Appropriate adapters shall be used when changing from one kind of pipe to another. Pipe joint lubricant shall be as provided by the pipe manufacturer.

F. All piping material for a service connection shall be water and air tight, as approved by Massachusetts Building Code and ASTM.

G. All pipe and fittings shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Upon request, the Contractor shall furnish sworn certificates of such tests to the Division.

3.06 Temporary Water Services

A. Water service due to any customer shall not be interrupted due to the construction of the new water main, except as needed to switch over to temporary water service. The Contractor shall provide temporary water service for continuous customer use. The work of providing suitable safety precautions to prevent any interruptions of water service during the period of temporary water service shall be the responsibility of the Contractor.

B. The Contractor shall furnish, install, maintain and remove all temporary pipe and service connections during the period of temporary water service. The Contractor shall do all the necessary excavating for any connections of the temporary service pipes to existing live water mains as directed by the Engineer in the field.

C. The Water and Sewer Division and the Contractor shall shut off curb stops and valves to individual services after the Contractor has installed all temporary services to the satisfaction of the Owner and prior to starting any work which will affect existing water service.

D. The temporary service pipe and connections shall be of the best quality materials, adequate to withstand water system pressures and all conditions of use. The installation shall be watertight. Care shall be exercised throughout to avoid any possible pollution of mains, house services, or the temporary service pipe.

E. The temporary by-pass water main shall be a minimum size of four (4) inches unless otherwise approved by the Concord Fire Department.

F. The temporary by-pass water main shall be steel water pipe with steel or victualic couplings and all other necessary appurtenances. Certain types

of plastic pipe may be used if approved by the Engineer. Submittals to the Engineer will be required for approval of plastic piping.

G. The temporary service pipe shall be laid above ground outside the road construction area. Generally, the temporary service pipe shall be laid in the gutters or off the road at the back of sidewalks or beyond the edges of the existing pavement. At street intersections, street crossings and all driveways, the temporary service pipe shall be laid in a shallow six-inch by six-inch trench properly cut and then covered with temporary resurfacing. Hot asphalt shall be used to cover all temporary service pipes crossing all streets and driveways. No cold patch or stone dust shall be allowed without approval of the Engineer. Whether it is being installed, in service, or being removed, the amount of temporary service pipe kept on the job shall be the minimum that will allow the work to continue at a reasonable rate.

H. The pipe and all other connections shall provide adequate water tightness and be free from excessive leaks. Care shall be exercised during the installation of the temporary pipe and especially during the connection to all house services such that pollution of all water mains and house services is prevented and contamination of the by-pass pipe itself is avoided.

I. Sanitary precautions shall be satisfactory to the Engineer. After the by-pass pipe has been laid and fastened together, but before any connections are made to the public water supply system or any consumers, the Contractor shall chlorinate and test all by-pass pipe in accordance with AWWA standards (C601). The results of the laboratory testing shall be furnished to the Water and Sewer Superintendent in hard copy for approval. If test results show the by-pass pipe to be free of all bacteria, and with the approval of the Superintendent, only then will the Contractor be allowed to connect the by-pass to the public water system and hook-up all individual homes and buildings affected. The cost of all hook-ups and laboratory testing shall be at the Contractor's expense.

J. All service pipe shall be suitably valved at designated places which meet with the approval of the Engineer. Individual shutoff valves shall be provided at each temporary house service or building connection. Line valves shall be located no further than one block or 1,000 feet apart, whichever is less. At each existing hydrant's location which will be out of service, a 4-inch temporary fire hydrant shall be provided and maintained which has a two 2 ½ -inch standard fire connection set in a horizontal position.

K. Pressure reducing valves shall be used in all areas as required.

L. Temporary house service hose connections shall be standard industry 3/4-inch hard rubber hose capable of withstanding the usual water system pressures. No plastic or soft rubber hose shall be allowed. Polyvinyl chloride (PVC) pipe is not acceptable for temporary house service pipe.

M. The Contractor shall be responsible for all consumer connections. The Water and Sewer Division will enter upon all private property and assist the Contractor in making final service connections. The Contractor shall notify the Division so that a water/sewer system operator may be available when required.

N. The Contractor shall be responsible for the maintenance of the temporary by-pass pipe at all times especially after the end of the normal work day, any non-work day, and on all weekends and holidays without exception. He shall be responsible for the immediate correction of any interruption of service caused by any vandalism, physical damage or other condition and shall provide a plan suitable to the Engineer and Water and Sewer Superintendent for immediate corrective action in writing. This plan shall include the name, address and telephone number of the principle personal and an alternate to be contacted after normal working hours in the event any temporary service interruption occurs. Such information shall be given to the Town Engineer, Water and Sewer Division Superintendent, Fire Chief, and Police Dispatch Personnel. It shall be current at all times.

O. If service interruption occurs and the designated personnel or the Contractor cannot be reached for any reason, or if they fail to respond to the emergency situation, then any costs associated with other personnel responding to remedy the situation shall be back-charged to the Contractor and deducted from any monies due him. In no case will any home or facility (building) be without adequate water supply at the end of any work day, weekend or holiday.

3.07 Inspection and Testing

A. All installations must be inspected by Concord Water and Sewer Division personnel.

B. All inspection and testing shall be in accordance with applicable AWWA standards for pressure testing, disinfection, and bacteria testing of all water mains, services, and appurtenances. Test results shall be submitted to the Superintendent prior to approval, acceptance, or use of any water utilities.

C. The Contractor shall furnish all labor, pumps, taps, chemicals, and other necessary equipment to conduct hydrostatic pressure tests, measured leakage tests, and laboratory bacteriological analysis on mains laid and/or lined under this contract in accordance with AWWA C600 Installation of Ductile Iron Water Main and Part 3.7 of this Specification Section.

D. The tests shall be conducted at a time specified by and under the supervision of the Engineer.

E. In the event that the work fails to meet the required standards as stated herein, the Contractor shall perform such excavation, repair, re-laying of pipe, re-chlorinating, and all other work necessary to correct the work and shall repeat the tests as often as may be necessary and until such time as the required standards are met.

A. Before applying the specified test pressure, all air shall be expelled from the pipe. If suitable means of expelling air are not available at high places, the Contractor shall make all the necessary taps as shown on plans or as the Engineer may direct. After the tests have been completed, the corporation stops shall be left in place or removed and plugs inserted, as directed by the Engineer or Owner.

B. The newly laid pipe shall be tested in valved or plugged sections as determined by the Engineer in the field. Water shall be slowly introduced into the section being tested by means of an approved power-driven high pressure test pump.

C. The newly laid pipeline shall be tested to a pressure equal to 150% of the maximum static pressure for the section being tested, measured at the lowest point of the section being tested, corrected to the elevation of the test gauge. If the static pressure of any newly laid section of pipeline being tested is less than 100 psig measured at the lowest point of the pipeline section, then the minimum test pressure shall be 150 psig.

D. The pressure shall be raised to the test pressure required for each section being tested as determined by the Engineer. When the test pressure is reached, the time shall be recorded and the test shall begin. The duration of each pressure test shall be a minimum of two hours. During the test, pressure shall be maintained in the section of pipeline being tested by means of a re-circulating, bypass type test pump. Water shall be added in measured amounts from a container of known volume if required to maintain pressure. The addition of an excessive amount of water shall constitute immediate test failure. The Engineer will approve all gauges and test equipment.

E. During the test, the line will be examined by the Engineer for visible leaks and breaks. Any defects in the works shall be repaired, and any defective materials shall be removed and replaced by the Contractor as and where directed by the Engineer. All visible leaks are to be repaired regardless of the amount of leakage.

4.06 Disinfection

A. After satisfactory pressure and leakage tests have been made, before placing the newly-laid mains in service, and when directed by the Engineer, the Contractor shall clean mains and disinfect by chlorination. Disinfection of water mains shall be in accordance with AWWA C651 and related chemical standards such as ANSI/AWWA B300 - Hypochlorites, or ANSI/AWWA B301 - Liquid Chlorine.

B. Should the first treatment fail to meet the above requirements, the procedure shall be repeated until tests show that, in the opinion of the Engineer, effective disinfection has been accomplished.

C. Following acceptance of the disinfection process, the chlorinated water shall be flushed from the newly-laid main until such time as the replacement water throughout its entire length shall be equal in quality to that elsewhere in the system.

D. 24 hours after the main has been flushed of chlorinated water a representative water sample shall be taken by the Contractor under the supervision of the Engineer. This sample shall be taken to a Massachusetts DEP certified laboratory for a bacteria analysis. The cost associated with the collection and analysis of the sample shall be paid for by the Contractor. A minimum of one (1) sample shall be taken per 3000 linear feet. When satisfactory bacteriological test results indicating zero coliform and background levels are achieved, the new mains may be connected to the existing system and placed into service.

E. Special disinfection procedures, such as soaking or swabbing, approved by the Engineer, shall be used in connections to existing mains and where the approved method noted above is not practicable.