



3 Sewer Construction Standards

3.1 General

- A. This Section specifies requirements for a gravity flow sewerage system and pressure sewer system.
- B. The work covered under this section includes:
 - 1. Furnishing and installing all pipe, fittings, manholes, structures and appurtenances required for the proposed system to convey sewage by gravity flow conditions.
 - 2. When applicable, will include furnishing and installing all pipe, fittings, valves and structures for a pressure sewer system.
 - 3. Rehabilitation of sewer pipes and structures.
 - 4. Grease Traps.
- C. Work and materials shall be performed in accordance with the State Plumbing Code when work is within ten (10) feet of buildings.
- D. Work under this section shall comply with federal, state, and local requirements for the design, installation, testing, and certification.
- E. Work shall comply with local, state and federal electrical codes to provide "watertight and corrosion resistant" installations. Electrical junctions of any kind are prohibited within the confines of the wetwell.
- H. Submittals required for wastewater projects include:
 - 1. Materials List and Shop Drawings
 - 2. Temporary Bypass Plans
 - 3. As-built Plans

3.2 Temporary Wastewater Bypass

- A. 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.
- B. Spare plugs of the proper size and material shall be stored on site and available at all times of bypass operation.
- C. Pumps shall be either submersible or self-priming type.
- D. All bypass piping and system components shall be watertight and pressure rated for the proposed bypass system operating conditions.
- E. Surcharging of upstream flows during bypass shall be minimized at all times. The pumping system may not surcharge the upstream sewer more than 18-inches in the vertical direction as measured from the invert of the existing suction manhole from which bypass pumps are withdrawing wastewater. The suction and discharge manholes shall be frequently monitored by the Contractor to observe flow rate and flow depth conditions in the existing system during bypass operations.
- F. Flow turbulence in the downstream discharge manhole shall be minimized at all times.



- G. All work shall be coordinated with DPW and no construction activity shall commence without a minimum of 48 hours advance notice.

3.3 Gravity Sewer

3.3.1 Gravity Sewer Pipe and Fittings

- A. All pipes shall be designed based on the standards established in the Water Environment Federation/American Society of Civil Engineers *Manual of Practice No. FD-5, Gravity Sanitary Sewer Design and Construction*, latest edition, and New England Interstate Water Pollution Control Commission, *Guides for the Design of Wastewater Treatment Works, Technical Report # 16*, latest edition, and sound engineering principals.
- B. The connection of the building sewer to the public sewer shall be made at the “Y” branch, if such branch is available at a suitable location. Lateral stubs or stubs for future sewer extensions shall be capped watertight until permanent connections are completed. All lateral stubs shall be approved by the City prior to installation. If no branch is available, a connection may be made by tapping the public sewer by an approved method, then inserting an approved cast iron, ductile iron, stainless steel or PVC “Y” or “T” saddle with stainless steel mounting bands or other approved connection device. Cutting a hole in the public sewer by hand is prohibited.
- C. All sewer mains shall be laid with a straight alignment between manholes. When tying into an existing manhole, the manhole wall shall be cored and an insert installed for water-tightness.
- D. The minimum pipe diameters for gravity building sewers and public sewers shall be six and eight inches, respectively.
- E. Gravity sewers and force mains shall be constructed of Polyvinyl Chloride (PVC) Plastic Pipe and Fittings Polyvinyl chloride pipe and fittings (PVC) shall be minimum SDR 35 with full diameter dimensions conforming to the specifications for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, ASTM Designation D-3034, latest revision, for sizes 3 inches to 15 inches. For sizes 18 inches to 48 inches, the pipe shall comply with ASTM F679, latest record.
- F. Pipe color shall be in accordance with Uniform Color Code as established by the American Public Works Association Utility Location and Coordination Council (adopted September 2000).
- G. Ductile Iron Pipe (Gravity) – where required by City
 1. Ductile Iron Pipe: ASTM A746, Extra Heavy type, bell and spigot end, with Inderon Protecto 401 ceramic epoxy lining or equivalent applied per manufacturer’s recommendation.
 2. Ductile Iron Pipe Joint: ANSI A21.11, rubber gasket joint.
 3. Where petroleum contamination is known or suspected to be in the soil and/or groundwater, nitrile gaskets shall be required.
- H. All sewer pipes shall be laid accurately to the lines and grades shown in the Drawings and in conformance with pipe manufacturer’s recommended procedures.
- I. Pipe shall be handled in an approved manner, using slings or other approved devices. No pipe shall be dropped from trucks or into trenches.
- J. Notch under pipe bells and joints, where applicable, to provide for uniform bearing under entire length of pipe.
- K. Laying Pipe:



1. Pipe shall be laid accurately to line and grade in three-quarter (3/4") crushed stone. The depth of the crushed stone 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. Stone 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.
 2. Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a prepared trench. Pipe shall be laid with bells upgrade unless otherwise approved by the Engineer. Do not permanently support pipes on bells.
 3. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash. Extreme care shall be taken to keep the bells of the pipe free from dirt and rocks so that joints may be properly lubricated and assembled. No pipe shall be trimmed or chipped to fit.
 4. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
 5. All piping shall be laid in the dry with the spigot ends pointing in the direction of flow. Installation shall proceed from the downstream to upstream in all cases.
 6. Backfill material placed above the bedding material and below the roadway foundation shall conform to 6.3.1. Roadway foundation and surface restoration shall conform to Section 5, Roadway Construction Standards, and Section 6, Existing Road Openings, as applicable.
 7. Impervious material may be required on service connections for a distance 10 feet from the inside wall of the foundation to where crushed stone can start. Pipe shall be laid with the spigot end pointing in the direction of the flow.
 8. Sewer pipe shall have a minimum cover of 3 feet unless otherwise approved by DPW.
- L. Pipe Extension: Where an existing pipe is to be extended, the same type of pipe shall be used, unless otherwise approved by the Inspector.
- M. Full Lengths of Pipe: Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- N. Pipe Entrances to Structures: All pipe entering structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Inspector.
- O. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.
1. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary water-tight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
- P. Sewer pipe shall be installed with minimum distance from water pipes as summarized below. Reference detail S 3.5.0



1. *Horizontal Separation:* Whenever possible, sewer shall be laid at a minimum at least 10 feet horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer main may be laid closer than 10 feet to a water main, if:
 - a. It is laid in a separate trench, or if
 - b. It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if
 - c. In either case, the elevation of the top (crown) of the sewer is at least 18 inches below the bottom (invert) of the water main.
 2. *Vertical Separation:* Whenever sewer must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the sewer. One full length of the water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
 3. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, water and wastewater operations shall be given the opportunity to review and provide more stringent requirements such as:
 - a. Pipes shall be pressure tested by an approved method to assure water tightness ;and/or
 - b. Both pipes shall be encased in control density fill (CDF); any ductile or cast iron shall be double wrapped in 6. mil polyethylene plastic.
 - c. Other.
- Q. Sewer pipe shall be laid at a minimum of 5 feet horizontally from a drainage main and 18 inches vertically from a drainage main.
- R. Sewer Pipes-Laser Installation: Sewer pipes shall be laid to required grades by use of a laser and target system, unless otherwise specifically approved in writing by engineer.

3.3.2 Gravity Sewer Couplings and Connectors

- A. Fittings, couplings, and adaptors for use with the gravity sewer system shall be Romac Industries, Inc. or an approved equal. Saddles for low-pressure sewers shall be bolt-on premier units. They shall have polypropylene bodies, stainless steel fasteners, stainless steel reinforced outlets.
- B. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Elastomeric gaskets shall conform to ASTM D3212.
- C. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.
- D. Where petroleum contamination is known or suspected to be in the soil and/or groundwater, nitrile gaskets shall be required.

3.3.3 Cast Iron Pipe (Gravity) (For Plumbing Code Areas Only)

- A. Cast Iron Soil Pipe: ANSI/ASTM A74, Extra Heavy type, bell and spigot end, inside to be asphalt coated per manufacturer standard.
- B. Cast Iron Pipe Joint: ASTM C564, rubber gasket joint devices.



- C. Transitions between different gravity pipe sizes shall be accomplished by using Fernco, or approved equal flexible eccentric reducing couplings with stainless steel bands. Completed pipelines shall be free of deviations from grade. Visible leaks, broken pipes, etc., shall be repaired or replaced.
- D. Fittings for pressure sewer pipe shall be of similar style and material to match the force main material (PVC or DI). Bells shall be gasketed joint conforming to ASTM D3139 with gaskets conforming to ASTM F477. Gasket material shall be equal to that specified for pipe.

3.4 Pressure Sewer

3.4.1 Pressure Sewer Pipe and Fittings

- A. Whenever possible, the force main will be designed on a continuous slope so that no “high points” exist, which may result in entrapment of gases and so that no “low points” exist which may induce settlement of solids. If unavoidable, all “high points” will have an air/vacuum release valve, and “low points” will have a cleanout. Details for these appurtenances will be provided and they will be accessible for maintenance without the need for excavation. During backfill, a polyethylene warning tape will be buried two feet below the ground surface along the entire length of the force main. Restrained joints on the force main should be used in place of thrust blocks.
- B. The minimum pipe diameters for pressure building sewers shall be two inches. All pipe should be sized based on sound engineering principals.
- C. Pressure sewers and force mains shall be constructed of Inderon Protecto 401 ceramic epoxy lined Class 52 DI or SRD 21 (pressure rated) PVC. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings:
 - 1. Size 2 inch to 12 inch diameter, SDR 21, ASTM D-2241, with material per ASTM D-1784, Grade 1, Type 1.
 - 2. Push on joint, bell and spigot type with pressure rating of 200 psi.
 - 3. Joints to meet ASTM F477 and tested to ASTM D-3139 standard.
 - 4. Install at locations and sizes indicated on drawings.
- D. Ductile Iron Pipe and Fittings:
 - 1. Pipe size 4 to 12 inches diameter, push-on joint, pressure Class 350, ANSI/AWWA C150/A21.50, inside epoxy coating per manufacturer standard.
 - 2. Pipe size 12 to 24 inches diameter, push-on joint, pressure Class 250, ANSI/AWWA C150/A21.50, inside epoxy coating per manufacturer standard.
 - 3. Fittings, size 4 to 12 inches diameter, pressure Class 350, ANSI/AWWA C153/A21.53, push-on joints per ANSI/AWWA C111/A21.11.
 - 4. Gaskets shall conform to ANSI/AWWA C111/A21.11. Restrained joints shall be provided by a field lock gasket supplied by the manufacturer of the pipe for that purpose. (U.S. Pipe – “FIELDLOK”, Clow – “SUPER-LOCK,” or U.S. Pipe – “TRFLEX”).
 - 5. Pipe and fittings to have an outside coating of asphaltic material per ANSI/AWWA C153/A21.53 and ANSI/AWWA C110/A21.10.
 - 6. Valves and fittings to have an inside coating of epoxy lining applied in accordance with AWWA C550.
- E. Flanged Ductile Iron Pipe and Fittings:



1. Pipe and fitting sizes 3 inches to 24 inches, pressure Class 250 psi, per ANSI/AWWA C115 A21.15 with asphaltic coating outside and epoxy coated inside.
2. Flange bolt circle and holes per ANSI/AWWA/C115/A21.15.
3. Gaskets per ANSI/AWWA C111/A21.11.
4. Flange adapters to push-on joint pipe sections shall be supplied by the manufacturer of the pipe.

3.4.2 Pressure Sewer Couplings and Connectors

A. Sleeve Couplings

1. Sleeve Type, Buried will consist of the following materials: Cast iron or epoxy coated steel, middle rings, ASTM A513; Reducer type where required; Followers, two steel rings epoxy coated; Bolts ANSI 21.11/AWWA C111, galvanized; Two wedge section compressible gaskets; Dresser Manufacturing Co. – Style 38, 162, or 128 as appropriate.
2. Sleeve Type, Exposed will consist of the following materials: Steel middle ring, shop prime; Reducer type for different pipe sizes; Two steel follower rings; Two wedge section compressible gaskets; Steel bolts; Dresser Manufacturing Co., Style 38.
3. Thoroughly clean pipe ends for a distance of 8 inches from the ends prior to installing couplings, and use soapy water as a gasket lubricant.
4. Slip a follower ring and gasket (in that order) over each pipe and place the middle ring centered over the joint.
5. Insert the other pipe length into the middle ring the proper distance.
6. Press the gaskets and followers evenly and firmly into the middle ring flares.
7. Insert the bolts, finger tighten and progressively tighten diametrically opposite nuts uniformly around the adapter with a torque wrench applying the torque recommended by the manufacturer.
8. Insert and tighten the tapered threaded lock pins.
9. Insert the nuts and bolts for the flange, finger tighten and progressively tighten diametrically opposite bolts uniformly around the flange applying the torque recommended by the manufacturer.

C. Flexible Connectors:

1. Do not use rubber or elastomeric PVC type flexible couplings to connect pressure sewers.
2. Material shall be compatible with pipes being joined.
3. Maximum allowable deflection per joint shall be 15 degrees or per manufacturer's recommendation, whichever is less.
4. Stainless steel metal retaining rings.
5. Use suitable retaining control rods.

3.4.3 Air Release

1. Air Release and Air and Vacuum Release Valves of size and type specified herein are to be able to fit into structure with ample room for access and maintenance of these units.



2. Air Release and Vacuum Valve shall be similar to a Clow F 3077, Valmatic VM-49BW.3 or approved equivalent, threaded joint end, valve with cast iron body and bronze body seat, all in accord with APCO 400 Sewage Valves with a working pressure of 150 psi. ASTM A48, Class 30 and ASTM B62.
3. Air Release and Vacuum Valve shall be installed in the Air Release chamber as shown along the pressure pipe and at any high points constructed due to changes in the pressure pipe route or elevations.
4. If the air release valve manhole is equipped with a water-tight cover, a vent pipe shall be installed. Vent pipe shall be 4 or 6-inch ductile iron "Candy Cane" with an insect screen.

3.5 Pipe Joints

- A. All joints shall be made water-tight.
- B. Pipe shall be jointed in strict accordance with the Pipe manufacturer's instruction. Jointing of all pipe shall be done entirely in the trench.
- C. Lubricant for jointing of PVC pipe shall be applied as specified by the pipe manufacturer. Use only lubricant supplied by the pipe manufacturer.
- D. PVC Pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, shall only be used at the direction of the manufacturer.
- E. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.
- F. Jointing of Ductile Iron and Cast Iron Pipe shall be in accordance with Section 2, Water Construction Standards.
- G. Bentonite collars shall be placed every 500 feet on sewer lines placed in the groundwater table that are more than 1200 feet in length. Collars shall extend to the width and height of the stone bed.

3.6 Cured-In-Place Pipeliners

- A. Pipeline rehabilitation using cured in place pipeliners (CIPP) may be approved by DPW for existing public sewers 8-inches in diameter and greater. CIPP rehabilitation of public sewers less than 8-inches in diameter is not permitted.
- B. The CIPP shall conform to the provisions and all test requirements specified in ASTM D790 – Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Insulating Materials, ASTM F1216 – Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube, and ASTM F2561-11 Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner.
- C. The CIPP shall be designed based on a fully deteriorated condition of the existing host pipe in which it is assumed that the existing host pipe provides no structural support. The CIPP shall be designed to carry soil, groundwater, and other superimposed loads.
- D. The CIPP shall be designed in accordance with ASTM F1216 under the following conditions:
 1. Fully deteriorated host pipe
 2. Height of groundwater above pipe invert = Ground surface elevation
 3. Height of soil above pipe = Final design ground surface elevation



4. Live Load = AASHTO HS-20
 5. Soil density = 120 lbs. / cubic foot
 6. Ovality = 2% to 8%
- E. The Contractor shall prepare and submit a design submittal prepared and stamped by a registered professional engineer that includes the following:
1. Description of materials and product samples
 2. Design parameters
 3. Installation process
 4. Long term creep data, testing duration 10,000 hours minimum
 5. Proposed flexural modulus and flexural strength
 6. Proposed wall thickness supported by design calculations
 7. Bypass pumping plan
 8. Installer's qualifications and relevant experience
- F. The existing sewer shall be cleaned and closed circuit television inspected prior to the CIPP installation to prepare the host pipe and locate the existing service connections.
- G. Installation, curing, cool down, finish, and sealing at manhole and service connections shall conform to CIPP manufacturer's requirements. Curing shall be performed using steam unless otherwise approved by DPW and MWRA.
- H. All service connections shall be reinstated after the CIPP is installed to no less than 95% of the existing service connection diameter and ground or brushed as required to form a neat lateral opening free of any jagged edges, lips, or protuberances. All service connections shall be grouted to prevent infiltration from the edge of lined sewer main to a minimum distance of 3 feet up the service connection.
- I. If any open cut repairs or wye replacements are required, that work shall be completed prior to CIPP lining.

3.7 Cleanouts

- A. The sewer cleanouts shall be minimum 6-inch diameter or sized to match the service pipe, whichever is greater. The cleanouts shall be either stubbed 6 inches above surface grade, or completed at finish grade if contained within a hand hole clearly marked "SEWER" per Standard Detail S-3.2.0. Cleanouts shall include a water-tight cap.

3.8 Sewer Manholes

- A. All manholes shall be built in accordance with the Details and in the locations shown on the City of Framingham Details.
- B. All masonry shall be installed by personnel experienced and skilled in this work, and any person not deemed to be such by the Engineer shall be removed and replaced by a person so qualified.
- C. Manholes shall be constructed as soon as the pipe laying reaches the location of the manhole. Should the Contractor continue pipe laying without making provision for completion of the manhole, the Engineer shall have the authority to stop the pipe laying operations until the manhole is completed.



- D. The Contractor shall accurately locate each manhole and set accurate templates to conform to the required line and grade. Any manhole which is mislocated or oriented improperly shall be removed and rebuilt in its proper location, alignment and orientation at no additional cost to the Owner.
- E. Foundations: All manholes shall be constructed on a 12-inch layer of compacted bedding material. The excavation shall be dewatered to provide a dry condition while placing bedding material and setting the base.
- F. Precast Manholes
1. Structures shall be constructed of precast concrete with a one-pour monolithic base in accordance with ASTM C478 and installed only after Shop Drawings have been approved. All precast concrete manholes shall conform to the ASTM "Specifications for Precast Reinforced Concrete Manhole Sections," Designation D478.
 2. The barrel shall be 4-foot or 5-foot diameter at the City's discretion.
 3. The precast structures shall be manufactured with 4,000 psi minimum compressive strength concrete, with eccentric cone section tapering to 30-inch diameter, or flat top, and one pour monolithic base section conforming to ASTM C478. All units to be designed for HS-20 loading.
 4. The top grade of the precast concrete cone section shall be set sufficiently below finished grade to permit a maximum of five and a minimum of two courses (laid in the flat position) of eight inch brick to be used as risers to adjust the grade of the manhole frame.
 5. Lifting holes on all manhole sections shall be filled with grout.
 6. Precast Unit Joint: Butyl rubber section joint conforming to ASTM C443.
 7. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
- G. Manhole frames and covers
1. Manhole frames and covers shall be minimum Class 25 conforming to ASTM "Standard Specification for Gray Iron Castings," Designation: A48. Manhole frame shall have a clear opening of 26 inches and be a minimum of 6 inches in height.
 2. The surface of the cover shall have a diamond pattern with the words "FRAMINGHAM SEWER" if in the public right-of-way or "SEWER" if on private property cast thereon for sewer manholes.
 3. All manholes frames and covers shall be manufactured by East Jordan Iron Works (formerly LeBaron Foundry Co.) or an approved equal.
 4. Manhole covers shall be watertight when placed in the 100-year flood plain, wetland areas, cross country easements, or as determined by DPW, and as specified in federal, state and local regulations. Manhole frames shall be set on a grout pad to make a watertight fit. Watertight manhole covers shall be secured with four (4) stainless steel bolts and have a watertight gasket. The frame and cover shall be watertight up to 15 psig external pressure.
- H. The corbel shall be constructed of red brick or reinforced concrete grading rings for adjusting frame to match finished surface. Manhole frame shall be flush with grade using a minimum of two (2) and a maximum of five (5) brick courses. Elevations greater than 6 inches vertical may include riser rings designed for that purpose. Brick shall conform to sewer bricks (made from clay) ASTM designation C32, Grade MS.
- I. Inverts



1. Brick invert channels shall be constructed in all manholes to provide a smooth channel for sewage flow through the structure, and shall correspond in shape to the lower half of the pipe. Curve side inverts and layout main inverts (where direction changes) shall be constructed with smooth curves of longest possible radius tangent to adjoining pipelines centerline.
 2. Brick shelves shall be constructed to the elevation of the highest pipe crown and sloped to drain toward the flow channel. Only red sewer brick shall be used for any invert, brick shelves and manhole frame adjustments. Brick shall comply with ASTM Standard Specification for Sewer Brick (made from clay or shale), Designation C32, for Grade SA, hard brick.
 3. Special care shall be taken in laying brick inverts. Joints shall not exceed three-sixteenth inch in thickness and each brick shall be carefully laid in full cement mortar joints on bottom, side and end in one operation. No grouting or working in of mortar after laying of the brick will be permitted. Bricks forming the shaped inverts in manholes shall be laid on edge.
 4. Invert channels shall be built for future extensions where shown on the Drawings and where directed by the Engineer.
 5. Inverts shall not be built above ground. All inverts shall be built with the manhole in place (i.e. at the design elevation) and with all pipes installed.
 6. All inverts shall be constructed with 4,000 psi concrete in void areas and with sewer brick. Brick shall conform to sewer bricks (made from clay) ASTM designation C32, Grade SS.
 7. All sewer inverts are to be constructed once the manhole is installed. Manhole inverts built above ground will not be accepted.
- J. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of Portland cement hydrated lime, and sand, in the proportions of 1 part cement to ¼ part hydrated lime to 3 ½ parts sand, by volume. Sand for masonry mortar shall conform to the gradation requirements of ASTM C144.
- K. Cement shall be Type I or II Portland cement conforming to ASTM C150, Standard Specification for Portland Cement. Hydrated lime shall be Type S conforming to ASTM D207.
- L. All drop manholes will be of the external type. The drop pipe shall be constructed of minimum SDR 35 PVC. The drop piping and horizontal cleanout sections will be sized the same as the sewer main piping and shall enter the manhole at invert elevation. The drop portion of the piping shall be secured with anchor straps. The drop piping shall be encased with control density fill.
- M. Manhole Pipe Connections: Flexible sleeve or rubber gaskets shall be Lock Joint, Kor-n-Seal, A-Lok, or approved equivalent.

3.9 Manhole Connections

- A. Manhole pipe connections for precast manhole bases may be accomplished by any method described below. The Contractor shall make sure that the outside diameter of the pipe is compatible with the particular pipe connection used.
1. A tapered hole filled with non-shrink waterproof grout after the pipe is inserted. This connection method will not be allowed when connecting PVC pipe to manholes.
 2. The LOCK JOINT Flexible Manhole Sleeve cast in the wall of the manhole base. The stainless steel strap and exposed sleeve shall be protected from corrosion with a bitumastic coating.



3. PRESS WEDGE II gasket cast into the wall on the manhole base. The rubber wedge shall only be driven into the V slot from the outside of the manhole.
 4. The RES-SEAL, a cast iron compression ring which compresses a rubber "O" ring gasket into a tapered hole in the wall of the manhole base. Exposed metal shall be protected from corrosion with a bitumastic coating.
 5. KOR-N-SEAL neoprene boot cast into the manhole wall. The stainless steel clamp shall be protected from corrosion with a bitumastic coating.
- B. Sewer manholes shall be constructed with drop connections when the proposed invert of the connection is at least 2 feet above the manhole invert. Drop connections for differences of less than 2 feet shall also be provided if required by the City.

3.10 Bitumastic Coatings

- A. The entire exterior surface of all masonry and concrete (whether precast or cast-in-place) structures associated with sewerage systems, such as: manholes, grease traps, holding tanks, tight tanks, septic tanks, aeration tanks, pump stations, valve pits, etc., shall receive two coats of waterproofing such as Carboline Bitumastic 300M as manufactured by SOMAY Products, Inc., Miami, FL; Sonnosield HLM 5000 as manufactured by Sonneborn, Shakopee, MN or approved equal at a minimum thickness of 7 mils per coat and a total thickness of 14 mils; however, in no case shall the thickness per coat be less than that recommended by the manufacturer.

3.11 Service Connections

- A. General Requirements: The Contractor shall make all required connections of the building sewer service pipes into the sewer system. Work shall include making the service pipe connections into the sewer system pipes or into the manholes located ten (10) feet outside of the proposed building lines. If stubs are constructed for later connection to the building pipes, the ends shall be sealed with watertight plugs.
- B. Coordination with Building Contractor: The Contractor shall coordinate the work with the work of the Building Contractor to determine the exact location and elevation of the point of entry into the building.
- C. Gravity service connections shall be minimum 6 inch PVC.
- D. Sewer service pipe connections to the pipe of the public sewer system shall be made with fittings supplied by the pipe manufacturer. All connections into sewers shall be by wyes, T-wyes, or a Romac saddle, and couplings manufactured for use with the same type of pipe. The Contractor shall install 45 degree wye branch or 90 degree tee fittings in the sewer pipes at all locations where building sewer service pipe connections are shown on the Drawings. Connections of the sewer service pipes shall be made into the wye branches or tees by means of 45 degree bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection. Sewer chimneys shall be encased in concrete unless directed otherwise by the City.
- E. Service connections made using saddles and tapping sleeves shall be allowed only when authorized by the DPW. Replacement of an existing service shall include the replacement of the existing wye, tap or tee. Penetrations to the sewer main shall be kept to a minimum.
- F. All service connections shall have a slope between 2 and 6 percent. Service connections that have a vertical drop of 4 feet to 12 feet between the house sewer invert at the street and the main sewer



invert shall be by sloped line using 22-degree or 45-degree angle connectors to allow snakes and rods to clean the line between the house and the main sewer.

- G. Any sewer lateral that contains a 45-degree (45°) bend or greater shall require a manhole. Alternative connections shall be allowed only if reviewed and approved by DPW.
- H. Chimney drop sewer services shall only be allowed where the depth of the mainline sewer crown is more than 12-feet from the ground surface. Installation of chimney when the mainline crown is less than 12-feet deep will not be allowed without the prior review by DPW. Service connections shall preferably be installed utilizing the most direct (shortest) route from building to main. Services should be laid out to run perpendicular to the main. Refer to standard installation details for materials and requirements.
- I. For grinder pump to gravity sewer connections, the service connections shall be minimum 2-inch DI or SDR 21 PVC. Check valves shall be Y-pattern commercial bronze valves.
- J. On private projects, portions of existing service piping to remain shall be video inspected prior to approval to verify pipe condition, ensure integrity, and limit infiltration. The inspection shall be witnessed by DPW staff. Service piping video shall be provided to DPW for final review prior to approval of existing piping reuse.

3.12 Testing of Sewer

- A. If the visual inspection of the completed sewer or any part thereof shows any pipe, manhole or joint which allows infiltration of water, the defective work or material shall be replaced or repaired as directed. After completing installation and backfill of sewer pipe to the satisfaction of the DPW, the Contractor shall conduct a line acceptance test under the following procedures.

3.12.1 Gravity Main Testing

- A. All gravity sewers that will be become the property of the City of Framingham shall undergo mandrel testing, televised inspection and, as directed by the City, pressure testing. All televised inspections shall be recorded and provided to the City in digital format.
- B. Pressure Testing Gravity Sewers – After a manhole to manhole reach of pipe has been backfilled and cleaned, pneumatic plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches four psig greater than the average back pressure of any groundwater that may be over the pipe. A minimum two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed “Acceptable” if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe), shall not be less than the time shown for the given diameters as indicated in the Uni-Bell PVC Pipe Association’s, Handbook of PVC Pipe, current edition, and the following table.



MINIMUM LOW-PRESSURE TEST TIMES

Pipe Diameter (inches)	Minimum Time (min:sec)	Allowable Maximum Length (L = ft) for Minimum Time	Time for Longer Length (sec)
8	3:46	597	0.380L
10	5:40	398	0.854L
12	7:34	298	1.520L
15	14:10	159	5.342L
18	17:00	133	7.692L
24	22:40	99	13.674L
30	28:20	80	21.366L
36	34:00	66	30.768L
42	39:48	57	41.883L
48	45:34	50	54.705L

- C. If testing is not feasible between manholes due to live sewer service connections the contractor shall conduct low pressure air testing at each pipe joint.
- D. Vacuum testing of service connections may be required as directed by the City.
- E. Deflection testing shall be performed on all flexible pipes, if directed by the Inspector. The tests shall be conducted after the final backfill has been in place for at least 60 days to allow for stabilization. Pipe shall be installed so there is no more than a maximum deflection of 5 percent. Deflection testing shall be performed using a specially designed gauge assembly (mandrel) pulled through the complete section. The gauge assembly shall have a diameter of not less than 95 percent of the base inside diameter or the average inside diameter as specified by ASTM. The pipe shall comply with ASTM D2122, Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings. The deflection test shall be performed without mechanical pulling devices. Other testing methods such as electronic deflectometers, calibrated video cameras, or laser profilers must be submitted for review and approval by DPW prior to use.

3.12.2 Pressure Main Testing

- A. Except as otherwise directed, pressure sewers (force mains) shall be given combined pressure and leakage tests in sections of approved length. The Contractor shall furnish and install suitable temporary testing plugs or caps; necessary pressure pumps, pipe connections, meters, gauges, gates, and other necessary equipment; and required labor. The Owner and Engineer shall have the option of using their own gauges.
- B. Subject to approval and provided that the tests are made within a reasonable time considering the progress of the project as a whole, and the need to put the section into service, the Contractor may make the tests when he desires. However, pipelines in excavation or embedded in concrete shall be tested after the backfilling of the excavation or curing of the concrete and exposed piping shall be tested prior to field painting.
- C. The section of pipe to be tested shall be filled with water of approved quality, and air shall be expelled from the pipe. If blow offs are not available at high points for releasing air, the



Contractor shall make the necessary excavations and do the necessary backfilling and make the necessary taps at such points and shall plug said holes after completion of the test.

- D. The section under test shall be maintained full of water for a period of 24 hours prior to the combined pressure and leakage test being applied.
- E. The pressure and leakage test shall consist of first raising the water pressure (based on the elevation of the lowest point of the section under test corrected to the gage location) to the pressure rating of the pipe or alternately, to two times the maximum calculated operating pressure of the pipe, as approved by the Engineer. If the Contractor cannot achieve the specified pressure and maintain it for a period of one hour, the section shall be considered as having failed the test.
- F. Following or during the pressure test, the Contractor shall make a leakage test by metering the flow of water into the pipe while maintaining in the section being tested a pressure equal to the pressure rating of the pipe. If the average leakage during the two-hour period exceeds a rate of leakage indicated in AWWA Section C600 per 24 hours per mile of pipeline, the section shall be considered as having failed the leakage test.
- G. Reference the appropriate AWWA standards latest version for tightness testing. At minimum, all force mains shall be pressure tested with a minimum pressure of 150 psi for a minimum of two hours.
- H. If the section fails to pass the pressure and leakage test, the Contractor shall do everything necessary to locate, uncover, and repair or replace the defective pipe, fitting, or joint, all at his own expense and without extension of time for completion of the work. Additional tests and repairs shall be made until the section passes the specified test.
- I. If, in the judgment of the City of Framingham, it is impracticable to follow the foregoing procedure exactly for any reason, modifications in the procedure shall be made as approved, but in any event the Contractor shall be responsible for the ultimate tightness of the line within the above leakage and pressure requirements. Passing the test does not absolve the Contractor from his responsibility if leaks develop later within the period of warranty.
- J. The sewer lines shall be inspected via closed-circuit television (CCTV) after completion with a 2 gpm flow of water to reveal pipe bellies. The remote camera shall also pan to view up the service connections to the Fernco fitting.

3.12.3 Manhole Testing

- A. All tests shall be observed by a representative of the DPW and the Contractor on each manhole. Manholes shall be tested by vacuum methods [see below].
- B. Vacuum Testing of Manholes – Leakage tests for four and five foot diameter manholes may be made using vacuum testing equipment. This type of test may be used only immediately after assembly of the manhole and only prior to backfilling. The manhole to pipe connection should only be a flexible connector. All lift holes shall be plugged with a non-shrinking mortar. For this test, each four or five foot diameter manhole shall be tested under 10 inches of Hg vacuum.

Manholes shall be vacuum tested per ASTM C1244 – 11. Manholes shall be prepared by plugging all lift holes and pipes entering the manhole. Care shall be taken to securely brace the pipes and plugs to prevent them from being drawn into the manhole. The test head shall be placed at the top of the manhole in accordance with manufacturer's recommendations and a vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. of mercury. The manhole shall pass if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in the table below. If the manhole fails the initial



test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a passing test is obtained.

Depth (feet)	Testing Time (Seconds) for 48 and 60-Inch Diameter Manhole (inches)	
	48-Inch	60-Inch
8 (and less)	20	26
10	25	33
12	30	39
14	35	46
16	40	52
18	45	59
20	50	65
22	55	72
24	59	78
26	64	85
28	69	91
30	74	98

- C. All excess material including dirt, loose concrete, bricks, grit, stones and any other material, shall be removed from all manholes prior to final acceptance by DPW.

3.12.4 Cured-In-Place Pipeliner Testing

- A. Post construction acceptance testing of the rehabilitated sewer shall conform to manufacturers requirements, ASTM D5813-04 (2012 or latest edition) - Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems, and the requirements of Section 3.3.2.
- B. For each separate manhole to manhole segment of CIPP installed, at least one sample shall be prepared and tested in accordance with ASTM F1216 and ASTM D790. A “restrained” sample shall be taken for pipes 18-inches or less in diameter. A “flat plate” sample shall be taken for pipes more than 18-inches in diameter. The proposed testing laboratory shall be submitted for approval to DPW. Samples shall be tested to verify that the flexural modulus, flexural strength, and wall thickness of the CIPP are at least equal to the parameters proposed in the approved design submittal.

3.13 Sewer Abandonment

- A. Pipes left in place that are equal to or less than 6 inches in diameter may be left unfilled.
- B. Pipes left in place that are greater than 6 inches in diameter shall be filled with LDCC regardless of material (e.g., DI, PVC).
- C. When abandoning asbestos cement pipe, care shall be used to prevent pipe material from becoming friable, thereby rendering it as regulated asbestos containing material.
- D. 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, LDCC, or clean gravel, as directed the DPW Inspector of Construction and Utilities. Demolition debris shall be removed, and the area regraded and compacted over the filled structure.



3.14 Grease Traps

3.14.1 Exterior Grease Traps

- A. Exterior grease traps shall be designed by a registered Professional Engineer. The plans shall be stamped and include the design criteria and calculations used to size the grease trap.
- B. Grease traps shall be sized in accordance with Massachusetts Uniform State Plumbing Code 248 CMR 10.00 and shall have a minimum capacity of 1,000 gallons. The grease trap shall be sized to provide a minimum of 24 hours of detention time for the design flow.
- C. The discharge concentration for grease trap effluent fats, oils, and grease (FOG) shall not exceed 100 mg/l.
- D. The grease trap shall be located a minimum of 10 feet from buildings, property lines, water services, and in compliance with all applicable building and zoning codes. The grease trap shall be located where it is accessible for inspection and cleaning.
- F. Sanitary wastewater flow into the grease trap is strictly prohibited. Sanitary flow from the building shall connect to a manhole located downstream of the grease trap. A manhole shall be provided upstream and downstream of the grease trap to facilitate bypass and treatment of flows if the grease trap must be temporarily taken out of service.
- G. The grease trap shall be constructed of reinforced concrete and shall be designed for AASHTO HS-20 loading at a minimum. A 1-inch thick butyl rubber gasket shall be provided between precast sections of tank. Buoyancy calculations shall be provided by the Contractor, and if necessary, sufficient ballast (such as a buoyancy slab) shall be provided to counteract buoyancy forces when the grease trap is empty, assuming the groundwater table is at the ground surface. Interior baffles shall be provided to retain collected grease and other materials and prevent the discharge of these materials into the City's sewer system.
- I. Water cooled grease traps are prohibited.
- J. The grease trap shall be tested to demonstrate water tightness prior to acceptance and use. Testing shall consist of a water infiltration / exfiltration test. The grease trap shall be filled to 4 inches below the outlet invert. Leakage into or out of the tank shall not exceed 10 gallons per 1,000 gallons of tank volume in a 72-hour period. Test shall be performed before backfilling, and shall be witnessed by the Department.
- K. The grease trap shall be filled to its normal fluid operating depth with clean water prior to its first use.
- L. Unless otherwise required by a schedule established by the DPW, owners or operators shall clean grease traps of accumulated grease and oil in accordance with all applicable local, state and federal laws, and no less frequently than a minimum of once every three months or whenever one quarter of the liquid depth of the trap consists of grease or oil, whichever occurs first. Grease traps shall be cleaned by physically removing accumulated grease, scum, oil or other floating substances and solids. Chemical, biological, or physical means (including flushing with water) shall not be used to release fats, wax, oil, or grease into the sewer, bypass the trap, or otherwise make the trap operate less effectively.

3.14.2 Interior Grease Traps

- A. At locations where Exterior Grease Traps cannot be constructed to serve a building, an interior grease trap shall be provided. Interior grease traps shall be the automatic grease and oil removal type and sized and installed in accordance with Massachusetts Uniform State Plumbing Code 248



CMR 10.00. The grease trap shall be sized using a one (1) minute drain down period. The grease trap shall be cleaned of accumulated grease and oil based on the manufacturer's recommendations, applicable local, state, and federal laws, at a minimum monthly, or on a more frequent basis at the discretion of the DPW. A sample point downstream of the grease trap shall be provided to permit sampling at the digression of DPW to ensure compliance.