

FRANKLIN DEPARTMENT OF PUBLIC WORKS

257 FISHER STREET
FRANKLIN, MA 02038

STANDARD DOCUMENTS FOR SEWER MATERIALS AND INSTALLATION

MAY 2013

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SECTION 02222

EARTHWORK FOR SEWER

PART 1 GENERAL

1.01 DESCRIPTION

- A. In general the work of this Section shall include but not necessarily be limited to, excavation, trenching, filling, backfilling, compaction and grading for sewer systems.

1.02 PROTECTION OF PROPERTY AND UTILITIES

- A. Extreme care shall be exercised to prevent damage to existing trees, shrubs, utilities, walls, sidewalks, fences and private property.
1. Any damage to these items as a result of work performed by the Contractor shall be repaired by the Contractor at his own expense.
 2. Existing property boundary markers, control points and datum elevation markers or bench marks shall be preserved.
 - a. All such items which are displaced or destroyed by the Contractor shall be replaced by a registered Engineer or Land Surveyor, as required, with all expenses paid by the Contractor.
- B. Utility agencies shall be contacted and advised of proposed work prior to the start of work by the Contractor.
1. Notify Dig Safe.
 2. Obtain information from the proper sources and authorities concerning locations of all utilities within the scope of this work.
 3. If and when encountered, utilities shall be supported and protected, and the Franklin Department of Public Works (DPW) shall be notified.
 - a. Ample time shall be allowed for entrance and taking such measures as may be required for the continuance of such services by the utility owner.
 4. Rules and regulations governing the respective utilities shall be observed.

1.03 REFERENCE STANDARDS

- A. The Contractor shall comply with the provisions of the following agencies as they apply to this project.
1. Associated General Contractors of America, Inc. (AGCA) "Manual of Accident Prevention in Construction."
 2. Occupational Safety and Health Administration, United States Department of Labor Requirements
 3. ANSI "Safety Regulations for Construction and Demolition".
 4. American Society for Testing & Materials (ASTM)
 5. Massachusetts Highway Department "Standard Specifications for Highways and Bridges"

1.04 SUBMITTALS

- A. Testing and Samples:
1. Test reports on backfill materials, moisture density tests, in place density tests (ASTM D 1557 and D 1556).
 2. Representative backfill and bedding samples and gradation tests (ASTM D 422).

PART 2 MATERIALS

2.01 GENERAL

- A. Except as specified for pipe bedding, pipe cover, roadway subbase, and refill for rock and unsuitable materials, backfill materials may be as follows:
 - 1. Suitable materials for trench backfill shall be the material excavated during the course of construction, but excluding debris, pieces of pavement, frozen materials, organic matter, silt, top soil, ledge excavation and rocks over six inches in largest dimension.
 - 2. Gradation of material shall be generally as specified for gravel borrow except that maximum size of stone shall be 6 inches.
 - 3. The suitability of existing material for use as backfill will be determined by the Franklin DPW.

2.02 PIPE BEDDING AND COVER MATERIAL

- A. Ductile Iron Pipe:
 - 1. Gravel borrow shall be a granular material, well graded from fine to coarse, with a maximum size of 3 inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
 - 2. It shall not contain vegetation, masses of roots, or individual roots.
 - 3. It shall be free from loam and other organic matter, clay, and other fine or harmful substances.
 - 4. Gravel borrow shall conform to requirements as specified in paragraph 2.05 herein.
- B. Plastic Pipe or Copper Tubing:
 - 1. Sand borrow shall consist of clean inert, hard, durable grains of quartz or other hard durable rock free from loam or clay, surface coatings and deleterious materials.
 - 2. The allowable amount of material passing a No. 200 sieve as determined by AASHTO shall not exceed 10 percent by weight.
 - 3. The maximum particle size shall be 3/8 inch.

2.03 CONCRETE SAND

- A. Concrete sand shall meet ASTM C-33 for fine aggregate.

2.04 STRUCTURAL FILL

- A. Structural fill shall generally range from gavelly sand to gravel, free of organic material, trash, loam, ice, snow, frozen soil and other objectionable material, and shall conform to the following:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
6 inch	100
No. 4	30-80
No. 40	5-35
No. 200	0-8

2.05 GRAVEL BORROW

- A. Gravel borrow shall be a granular material, well graded from fine to coarse, with a maximum size of 3 inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
1. It shall not contain vegetation, masses of roots, or individual roots.
 2. It shall be substantially free from loam and other organic matter, clay, and other fine or harmful substances.
 3. Gravel borrow shall have the following gradation:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3 inch	95-100
1/2 inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-8

2.06 PROCESSED GRAVEL FOR ROADWAY BASE

- A. Shall meet the requirements of the Commonwealth of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges, latest edition, M1.03.1.

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3 inch	100
1 1/2 inch	70-100
1/4 inch	50-85
No. 4	30-60
No. 200	0-10

2.07 CRUSHED STONE

- A. Crushed Stone: Shall consist of durable crushed stone or durable crushed gravel stone, washed, free from ice and snow, stone dust, sand, clay, loam, or other deleterious material. The crushed stone shall be uniformly blended and conform to the following:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
5/8 inch	100
1/2 inch	85-100
3/8 inch	15-45
No. 4	0-15
No. 8	0-5

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

- A. The Contractor shall make all excavation in earth and in rock, necessary or incidental to the proposed construction under the terms of this Contract and as herein specified or indicated on the Drawings.
1. All trench excavation shall be accomplished by open cut method.

2. All excavation shall be made in such manner and to such widths as will give ample room for properly installing, constructing and inspecting pipe lines and structures they are to contain.
3. The width of trenches shall be sufficient to allow thorough compacting of the refill adjacent to the lower quarters of the pipe. At pipe joints such additional width and depth shall be excavated as is necessary to give ample room for properly making and inspecting the pipe joint.
4. Bracing and support of all trench excavation shall meet all requirements of Local and State ordinances and OSHA regulations.
 - a. Sheet piling and bracing, or the use of a steel support box shall be used where required to maintain a safe working condition and provide protection from collapse of the trench walls.
5. During excavations, material determined by the Franklin DPW to be suitable for backfilling, shall be placed a sufficient distance from the banks of the trench to avoid slides or cave-ins. Unsuitable material shall be disposed of and replaced with surplus suitable material and gravel borrow to the extent necessary.
6. Should conditions make it impractical or unsafe to place material along the trench, it shall be hauled and stored at a location provided by the Contractor. When required, it shall be re-handled and used in backfilling the trench. No additional compensation will be made for re-handling this material.
7. Pipe trenches shall be backfilled as soon as practical after the pipes have been laid, jointed and inspected by the Franklin DPW. The extent of excavation open at any one time shall be no more than 50 linear feet of trench during working hours and no more than 20 linear feet during non-working hours.

3.02 EXCAVATION CLASSIFICATION

- A. Earth excavation shall comprise all materials not classified as rock excavation and shall include clay, silt, sand, muck, gravel, hardpan, loose shale, pavement, pavement bases, loose stone in masses and boulders measuring less than one cubic yard in volume.

3.03 TRENCH EXCAVATION IN PAVED ROADWAYS

- A. In excavating trenches in roadways with pavement, the Contractor shall cut the pavement twice; once prior to excavation and again prior to permanent resurfacing.
 1. The first cut may be made using a water cooled abrasive saw, pneumatic chisel or a wheel cutter attached to a front end loader.
 2. The second and final cut shall be made with a water cooled abrasive saw.
 3. In all cases a trial section shall be cut to indicate the performance of the equipment to be used.
 4. Pavement removed shall not be mixed with other excavated materials, but shall be disposed of away from the site of the work before the remainder of the excavation is made.
 5. Existing pavement and base course to remain shall be protected by the Contractor. All existing pavements and base courses which are to remain and have been damaged, shall be restored or replaced by Contractor to match existing pavements, base courses and grades, at no additional expense to the Franklin DPW.

3.04 UNSUITABLE MATERIAL

- A. All pipes and structures are to be laid on a stable foundation. If material at grade is determined to be unsuitable by the Franklin DPW, the Contractor shall excavate a further

depth and/or width, and refill with an approved material. Refill material shall be structural fill, gravel borrow or crushed stone as determined by the Franklin DPW.

1. Where fine sand and silt are encountered at the bottom of the trench, it shall be the option of the Franklin DPW to require a 6-inch compacted depth of concrete sand meeting ASTM C-33 for fine aggregate to be installed beneath the pipe bedding to the full width of trench.
2. Payment width limits shall be the same as specified for trench excavation, unless an additional width of trench is ordered by the Franklin DPW.
3. Any excavation in excess of the amount ordered by the Franklin DPW shall be backfilled and compacted with an approved granular material, at the Contractors expense.

3.05 BACKFILLING AND COMPACTING

- A. Backfill shall be placed in uniform layers. Each layer shall be thoroughly compacted by tamping or vibrating with mechanical compacting equipment.
 1. Care shall be taken to compact the backfill materials throughout the full width of the excavation and beneath all pipes and structures.
 2. The backfilling of trenches shall proceed as soon as the laying of the pipe (s) or installation of the structures will allow.
 3. Pipe bedding shall be required below and up to the springline of all pipe.
 - a. Pipe bedding shall be placed to the full width of the trench and to a depth of 6 inches below the bottom of the pipe barrel.
 4. Pipe bedding shall be placed 12 inches beyond the widths of a utility structure foundation (base) and to a depth of 6 inches below the foundation (base).
 5. After a pipe has been placed and bedded, the trench shall be filled to the centerline of the pipe with pipe bedding and compacted.
 - a. Material under and around the pipe shall be carefully and thoroughly compacted and tamped with approved compacting equipment.
 6. From the centerline of the pipe to a point 12 inches above the top of the pipe, the fill shall be pipe bedding.
- B. Placement of Backfill Above the Pipe Bedding
 1. Above the pipe bedding, backfill shall be suitable material from the excavation or, if ordered by the Franklin Department of Public Works, gravel borrow.
 - a. This backfill shall be placed in layers 12 inches deep in loose measure, and each layer shall be thoroughly compacted.
 - b. This backfill shall be placed up to the bottom of materials specified to be placed for surfacing requirements.
- C. Roadway Trench
 1. The following additions shall apply specifically to trenches within roadways:
 - a. The top twelve (12) inches of trench refill, roadway sub-base, shall be comprised of processed gravel furnished, placed, graded and compacted by the Contractor. This material shall be placed during the backfilling operation.
 - b. The Contractor shall fine grade the surface, apply dust control treatment and maintain the surface in a condition which will allow safe vehicular traffic until resurfacing is placed.
 2. The length of unsurfaced trench shall not exceed 500 linear feet, and shall be maintained to the Franklin DPW's satisfaction, in a condition to allow safe vehicular traffic.
 - a. If the trench is not maintained in a satisfactory condition, the allowable length of unsurfaced trench shall be reduced accordingly.

3.06 TRENCH SIZE

- A. Trenches shall be excavated to the necessary width and depth for proper laying of pipe and placement of concrete and other materials and shall have vertical sides to 12 inches above the pipe.
 - 1. Widths of trenches shall provide 12 inches clearance between the sides of the trench and the outside face of the pipe.
 - 2. Maximum trench width (W) (to 12 inches above the pipe) for 12 inch nominal diameter and smaller pipe shall be 36 inches.
 - 3. Maximum payment trench width (W) (to 12 inches above the pipe) for pipes larger than 12 inches in diameter shall be the outside diameter of the pipe plus 24 inches.
 - 4. Above 12 inches over the pipe, the maximum trench width shall be as close to the above widths as installation requirements allow.
 - 5. The depth of trench shall be a minimum 6 inches below the pipe barrel, or 1/4 of the pipe diameter, whichever is greater.

3.07 STRIPPING TOPSOIL

- A. Topsoil shall be carefully stripped and separately stored to be used again for topsoiling and seeding on off-pavement areas within which excavations are to be made.

3.08 EXCAVATION NEAR EXISTING STRUCTURES AND UTILITIES

- A. It is called to the attention of the Contractor that there are utilities and other underground pipes along the course of the work. Information shown on the Drawings as to the location of said utilities and pipes is from the best available sources, but no guarantee is implied, nor is it to be assumed that such information is accurate or complete. Utility lines shall be crossed in the course of the work.
- B. The Contractor shall exercise special care during his operations to avoid injury to all such underground utilities and structures.
 - 1. When necessary, the Contractor shall cooperate with, and consult with representatives of the Franklin DPW and the utility companies in order to avoid damage to the utilities.
 - 2. The Contractor shall arrange for or furnish and erect suitable supports and shoring or other means of protection where required to protect the utilities, all at no additional cost to the Franklin DPW.
 - 3. Hand methods of excavating shall be used around buried utilities and is included in the work to be done under this Contract, at no additional cost to the Franklin DPW.

3.09 PROTECTION OF PROPERTY

- A. The Contractor shall, at his own expense, preserve and protect from injury all property either public or private along and adjacent to the line of work, and be responsible for and repair any and all damage and injury thereto, arising out of or in consequence of any act or omission of the Contractor.
 - 1. All existing pipes, culverts, poles, wires, fences, mailboxes, stone walls, curbs, bounds, etc., shall be temporarily removed, supported in place or otherwise protected from injury, and shall be restored to at least as good condition as that in which they were found immediately prior to the start of work.

2. Lawns, shrubs, bushes, planting beds and decorative trees disturbed or damaged shall be restored to a condition equal to that found prior to the start of construction, either by temporary transplant or replacement in kind, except as otherwise indicated on the Drawings.

3.10 SAFETY AND ACCOMMODATION

- A. The Contractor shall provide, at his own expense, suitable bridges over trenches where required for the accommodation and safety of the traveling public, and provide facilities for access to private driveways for vehicular use.
 1. He shall erect suitable barriers around the excavation to prevent accidents to the public and shall place and maintain during the night, sufficient lights on or near the work.
 2. A space of twenty (20) feet shall be left so that free access may be had at all times to fire hydrants and proper precautions shall be taken so that the entrances to fire hydrants and fire stations shall not be blocked or obstructed.

3.11 DETOURS

- A. It is the intent of this Contract to keep the roadways open to two way traffic at all times. In order to obtain permission for the closing of the roadway, the Contractor shall satisfy the Franklin DPW, Police Chief and Fire Chief, that his operations will allow emergency access at all times.

3.12 UNIFORMED POLICE OFFICERS

- A. The Contractor shall make all arrangements with the local Police Chief and/or the State Police for the services of uniformed police officers.
 1. If, in the opinion of the State Police, Police Chief or the Franklin DPW, uniformed police officers are required for protection of persons and control of traffic, the Contractor shall be responsible for making all arrangements for said uniformed police officers as may be required.

3.13 COMPACTION REQUIREMENTS AND TESTING

- A. All backfill materials shall be thoroughly compacted by rolling, tamping or vibrating with approved mechanical or pneumatic compacting equipment so that pipe, structures, paving and other construction will not settle at the time of construction or in the future. The responsibility for thorough compaction is that of the Contractor irrespective of methods of backfill and depth of backfill layers placed.
- B. All percentages of compaction specified herein shall be of the maximum dry density at the optimum moisture content as established by Method D of AASHTO Standard T180 (ASTM D1557) (Modified Proctor) and verified by AASHTO Standard T147 (ASTM D 1556). When the term "thoroughly compacted" is used in these specifications, it shall mean compaction to at least 95% of the maximum density of the soils at optimum moisture content.
- C. The following numbers and types of soil tests shall be made where directed by the Franklin DPW. These tests shall be made by qualified personnel of an independent testing laboratory, acceptable to the Franklin DPW and paid by the Contractor.
 1. Particle-Size analysis of Soils and Backfill Materials in accordance with ASTM D422. A total of 5 satisfactory tests.
 2. Moisture-Density Relationship of soil in accordance with ASTM D1557, Method D. A total of 5 satisfactory tests.

3. In-Place Density Tests of materials in accordance with ASTM D1556. One in-place density test shall be performed every 300 linear feet, or as directed by the Franklin DPW. Compaction tests will be taken at random on compaction layers below and at finished surfaces.
 4. Failed tests shall be repeated at the Contractor's expense.
- D. The Franklin DPW reserves the right to have additional compaction tests performed by an independent laboratory with testing costs borne by the Franklin DPW, except that failed tests shall be repeated at the Contractor's expense.
- E. If any of the field density test results fail to meet the density as specified herein for the earthwork involved, then the Contractor shall remove all of the earthwork in that portion of the work involved as determined by the Franklin DPW, and shall replace it in accordance with these Specifications to the required density. After the work is replaced, additional field density tests will be made by an independent testing laboratory retained by the Franklin DPW, and the Contractor shall reimburse the Franklin DPW for all costs for such additional testing.

1. Compaction shall be to the following densities:

<u>Fill and Backfill Location</u>	<u>Modified Proctor Density (Percent)</u>
Under structures and pipes	95
Beside structure foundation walls	95
Top two feet under pavements	95
Under pavements below top two feet	95
Trenches through unpaved areas	90
In embankment	90

- F. Puddling and jetting of the backfill shall not be permitted except in special cases approved by the Franklin DPW.

3.14 TRENCH EXCAVATION IN FILL

- A. Where the existing ground surface does not permit at least 4 feet of cover over the finished pipe, and where indicated on the Drawings, the Contractor shall place and compact suitable fill material to the depth necessary to provide the 4 foot minimum cover, including loam to a minimum top width of 6 feet, or as otherwise shown on the Drawings
1. Minimum side slopes shall be two horizontal to one vertical.
 2. Fill material shall be from surplus suitable material or gravel borrow, and be clean, dry, and capable of satisfactory compaction, all as approved by the Franklin DPW, and shall be placed in layers not exceeding 8 inches thick and compacted.
 3. The trench shall be excavated in the compacted fill and the remainder of the work shall be in accordance with other portions of these Specifications.

3.15 DISPOSAL OF SURPLUS AND UNSUITABLE EXCAVATED MATERIAL

- A. All surplus excavated material and any material unsuitable for use shall be disposed of in disposal areas provided by the Contractor.
1. It is the Contractor's responsibility to dispose of unsuitable excavated material in an approved manner.
 2. The Contractor shall not dispose of surplus materials on wetlands or other areas prohibited by the Corps of Engineers or the Commonwealth of Massachusetts

Department of Environmental Protection, or any other local authority having jurisdiction.

3.16 CLEAN-UP

- A. The Contractor shall remove all surplus materials (earth, pipe, fittings, storage and office trailers, barricades, etc.), from the construction site.
 - 1. All paved roadways affected by the construction shall have their full width swept clean (paved edge to paved edge) using methods which control the dust.
 - 2. Before the Contractor may proceed to another roadway, clean up of the previous roadway must be complete.

END OF SECTION

SECTION 02625

POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: Furnish polyvinyl chloride sewer lines, complete with chimneys, wyes, fittings, service connections and other related items, as required.

1.02 SUBMITTALS

- A. The Contractor shall submit shop drawings which shall contain the following for each type of valve and appurtenant to be furnished:
1. Manufactures' catalog cut.
 2. An exploded view diagram with a materials list.
 3. Performance characteristics with indication that it meets or exceeds the standards specified herein.

1.03 STANDARDS

- A. The following ASTM standards form a part of this specification as referenced:
1. ASTM D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 2. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 3. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 4. ASTM D2412 Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
 5. ASTM D2444 Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
 6. ASTM D2729 Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 7. ASTM C425 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
 8. ASTM D5926 Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
 9. ASTM F794 Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
 10. ASTM F1336 Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

- A. The polyvinyl chloride (PVC) gravity sewer pipe and fittings shall conform to ASTM Specification D3034, SDR 35.
1. Minimum pipe stiffness (F/delta Y) at 5 percent deflection shall be 46 psi for all sizes when tested in accordance with ASTM Method of Test D2412, "External Loading Properties of Plastic Pipe by Parallel-Plate Loading".

2. Pipe (6" long section) shall be subjected to impact from a free falling tup (20-lb. Tup A.) in accordance with ASTM Method of Test D2444.
3. The bell end of the pipe shall consist of an integral wall section with a solid cross-section rubber ring, factory assembled, securely locked in place to prevent displacement during assembly.
4. Each length of pipe shall be marked with the nominal pipe size, manufacturer's name or trademark, and the PVC cell classification.
5. Gravity sewer pipe shall be furnished in the longest laying length manufactured, approximately 13 feet.
6. Pipe exterior barrel section shall be smooth wall.
7. Manufactured in North America.

2.02 PIPE JOINTS

- A. Joints for the gravity sewer pipe shall be of the bell and spigot type (push-on) with elastomeric gasket seal conforming to ASTM Specification D-3212, "Joints for Drain and Sewer Plastic Pipe using Flexible Elastomeric Seals".
 1. Gaskets shall be manufactured of a continuous elastomeric ring which is oil resistant (Neoprene compound).
 2. Shall be tested by the manufacturer at his expense as specified in ASTM F 477.
 3. The elastomeric gaskets shall be factory installed and securely locked in place with each length of pipe furnished.

2.03 FITTINGS

- A. All fittings and accessories for the sewer pipe shall be as manufactured by the pipe supplier.
 1. Have bell and spigot configurations compatible with that of the pipe.
 2. Locked in rubber ring.
 3. Shall be marked with manufacturer's name or trademark, size, etc.

2.04 COUPLINGS

- A. Sewer couplings as manufactured by Fernco Inc., or approved equal.
 1. Manufactured in the United States.
 2. Elastomeric with stainless steel tension bands conforming to ASTM C425.
 3. Sized to accept pipe diameters and materials as specified by the Franklin DPW.

2.05 SEWER CLEAN-OUT

- A. Cleanout shall be installed with a cast iron clean out box assembly as manufactured by LeBaron, or approved equal.
 1. Cleanout frame and cover shall conform to ASTM A48 CL35B.
 2. Pipe material shall match lateral.
 3. Stand pipe to be the same size as mainline up to and including 8-inch pipe.
 4. Cleanout adapter and threaded plug

2.06 SADDLE

- A. Saddle shall be double band or double strap type with a ductile iron body conforming to ASTM A-536, Grade 65-45-12.
 1. Finished epoxy coat of 10 mils minimum.
 2. Bolts, nuts and washers shall be type 304 stainless steel.
 3. Gaskets shall be virgin NBR compounded for water and sewer service.
 4. Straps shall be type 204 stainless steel with coated threads to prevent galling.

PART 3 EXECUTION

3.01 PIPE DELIVERY AND HANDLING

- A. All delivered pipe shall be accompanied by test reports certifying that the pipe conforms to ASTM D3034 Standard Specification.
- B. Pipes shall be stored in an approved, orderly manner so that there will be a minimum of rehandling from the storage area to the final position in the trench and so that there is a minimum obstruction and inconvenience to any kind of traffic.
 - 1. All pipe is to be loaded, unloaded and stockpiled in strict conformance with the manufacturer's recommendations.
 - 2. Deliveries shall be scheduled so that the progress of the work is at no time delayed and also so that large quantities of pipe shall not be stored for excessive lengths of time.
 - 3. Provide slings, straps and/or other approved devices to provide satisfactory support of the pipe when it is lifted.
 - 4. Under no circumstances shall the pipe be dropped from trucks or into the trench.
 - 5. All pipe and fittings shall be carefully inspected in the field before lowering into the trench. All pieces found to be defective or damaged shall be removed from the work.

3.02 PIPE LAYING

- A. Lines and Grades
 - 1. The Contractor shall establish benchmarks along the route of the pipeline at convenient intervals for reference in checking the pipe and manhole inverts and other elevations throughout the project.
 - 2. The pipe shall be set with a laser beam. The laser beam projector shall be rigidly mounted with two-point suspension to its support platforms. This will ensure that all ground equipment vibrations will be kept to a minimum and permit the laser beam to project itself coaxially through the center of the pipe. All units shall have equipment to control atmosphere conditions in the pipe that could affect the acceptable standard of construction. The alignment method selected must be shown to have worked satisfactorily on at least 3 contracts and competent, trained personnel shall operate laser. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stakes as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 600 feet.
- B. Bed Preparation

The contractor shall install and properly compact gravel bedding in the trench. Immediately following, piping shall be firmly bedded in the trench and lines and grades shall be confirmed for accuracy.

 - 1. The compacted bedding shall be shaped such that the bottom quadrant of the pipe shall rest firmly for the full length of the barrel. Suitable holes for bells or couplings shall be dug around the pipe joints to ensure space for making joints tight.
 - 2. The contractor shall control water in the trench below the pipe invert and install clay or other approved impermeable material in the bedding at intervals to prevent horizontal movement of groundwater, which may induce settling of the bed over time.
- C. Laying Pipe
 - 1. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

2. All pipe shall be laid with utmost attention to grade and alignment. All pipe shall form a close joint with the next adjoining pipe. Inverts shall be set at required grades.
 3. Trenches shall be backfilled with a minimum of 12 inches of gravel over the top of the pipe. In order to minimize movement or disturbance, only two lengths of pipe may be laid before backfilling.
 4. Excavations shall be made to accommodate the bedding material. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Franklin DPW and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be re-laid to the satisfaction of the Franklin DPW. No blocking shall be used.
- D. Installation of Wyes and Tees
1. At locations in the field as determined by the Franklin DPW, the Contractor shall furnish and install 6-inch wye branches and/or tees. Watertight end caps shall be installed on all wyes and branches until the service is installed.
 2. The depth of cover from the road surface to the top of the branch and the distance from the downstream manhole shall be recorded. No wyes and tees shall be backfilled before the location measurements are taken.
- E. Installation of Chimneys
1. Chimneys shall be located as directed by the Franklin DPW, and constructed in accordance with the details shown on the Drawings.
 2. Ends of the wye branch shall be capped with standard caps.
- F. Service Connections
1. Service connections shall be installed in accordance with the applicable paragraphs of this section of these specifications at a slope of 1/4 inch per foot unless otherwise directed by the Franklin DPW. The extreme end of the service connection shall be capped unless it is to be connected to an existing service.
 2. A steel marker shall be installed at the end and tied into a minimum of three points including, if possible, the permanent corners of the building which is to be served. The depth of cover from the ground surface to the top of the pipe at the cap shall be recorded. The depth and tie information shall be recorded.

3.03 VISUAL INSPECTION

- A. At the conclusion of the work, all pipelines shall be visually inspected by the Franklin DPW to insure a straight and plumb alignment. All pipelines which are not straight and plumb shall be removed and replaced

3.04 LEAKAGE AND TESTING

- A. After the completed sewer line, including service connections has been installed, the trench has been compacted to specification requirements, and manhole or joints showing noticeable streams or jets have been repaired and/or replaced the Contractor shall perform all tests.
- B. The Contractor shall be responsible for furnishing all labor, materials and equipment so that such tests can be accomplished at the times and locations the Franklin DPW deems necessary.
- C. Test Procedure
1. The rate of infiltration/exfiltration shall not exceed 100 gallons per inch of pipe diameter per mile of pipe per day. Weirs shall be constructed in accordance with the drawings.

2. The attention of the Contractor is directed to the strict requirements relative to maximum rates of infiltration/exfiltration and to the importance of these specifications relative to tight joints required. Sewers not meeting the above requirements shall be repaired as necessary at the Contractor's expense.
3. When infiltration is observed the Contractor shall conduct V-notch weir infiltration tests. If such tests show that the infiltration rate exceeds the limits specified above, he shall make all necessary repairs to reduce the infiltration to the specified limit.
4. When the V-notch weir tests as specified above show that the rate is within the specified limits or when no infiltration has been observed an exfiltration test utilizing water or air shall be performed.

D. Exfiltration Tests

1. Low air pressure tests shall be conducted in accordance with UNI-B-6, "Recommended Low-Pressure Air Testing of Installed Sewer Pipe".
2. For making low-pressure air tests, the Contractor shall use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve of air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig.
3. The leakage test using low-pressure air shall be made on each manhole-to-manhole section of pipeline.
4. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.
5. All air used shall pass through a single control panel.
6. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of the test.
7. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the following table:

Pipe diameter (inches)	Time (minutes)
6	4.0
8	5.0
10	6.5
12	7.5
14	9.0
15	9.5
18	11.5
Greater than 18	7.7 X Pipe Diameter (ft)

8. When the sewer section to be tested contains more than one size of pipe, the minimum allowable time shall be based on the largest diameter pipe in the section.
9. Pipeline sections failing a leakage test shall be repaired by the Contractor, at no expense to the Franklin DPW, in a manner approved by the Franklin DPW. If corrective actions fail, all portions of the section tested shall be dug up and relaid at the Contractor's expense.

3.05 ALLOWABLE PIPE DEFLECTION FOR PVC PIPE

- A. Pipe installed under this specification shall have a maximum deflection of 5 percent at the time of testing. Such deflection is defined as the amount of vertical deformation (nominal inside diameter less the minimum vertical diameter when measured) multiplied by one hundred and divided by the nominal diameter of the pipe.
- B. Upon completion of a sewer section, including the placement and compaction of backfill, and the cleaning of the sewer, the Contractor shall measure the amount of deflection in all of the sewer lines. This testing shall be done by the use of a deflectometer, calibrated television or photography, or a properly sized "go, no go" mandrel or sewer ball. The method of deflection testing shall have the written approval of the Franklin DPW.
- C. The Contractor shall pull the gauges through the pipeline by hand using smooth and easy motions. If the Contractor encounters an obstruction, he shall pull tightly to free the gauge from the obstruction. If the gauge will not clear the obstruction, the Contractor shall record the distance from the manhole and pull the gauge out.
- D. All sewer lines with a deflection angle of greater than 5 percent shall be repaired by re-bedding or replacement of the pipe.

3.06 CLEANING

- A. At the conclusion of the work, the Contractor shall thoroughly clean the sewers by flushing with water or other means to remove dirt, stones, and other material. Prior to acceptance, all pipelines shall be inspected for cleanliness and to be sure no sandbags, broken pipe or other obstructions exist.

END OF SECTION

SECTION 02629
HDPE SEWER PRESSURE PIPE

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the construction of High Density Polyethylene (HDPE) low-pressure sewer pipe and low-pressure sewer pipe laterals, complete with fittings, and other related items, as specified herein and as shown on the Drawings.

1.02 DESIGN CRITERIA

- A. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations.

1.03 PRODUCT HANDLING

- A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.
- B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.04 SUBMITTALS

- A. Shop drawings and/or brochures shall be submitted for all items to be furnished. Submittals shall include at least information of the pipe and gaskets intended to be utilized and other submittals as specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. High Density Polyethylene (HDPE) Pressure I.P.S. butt-fused pipe sewer pipe, couplings and fittings shall conform to ASTM 2241, with an SDR of 11 for the sizes as shown on the Drawings. HDPE pipe shall be pressure rated for 160 psi and shall conform to ASTM D1248, ASTM D3350, ASTM D2239, and NSF-14. All couplings, fittings, adapters, valves, reducers, wyes and tees shall be compatible with the type of pipe used. Compression fitting shall be brass and manufactured by Ford, or equal.
- B. Pipe utilized for service connections shall be 1-1/4 inches in diameter HDPE with an SDR of 11 conforming to ASTM 2241.
- C. Sewer pipe inside of all flushing/drain manholes shall be Schedule 80 PVC flanged pipe. This piping, fittings and valves shall be insulated and jacketed.
- D. Wye branches or tees shall be of the class and type compatible with the pipe used under this Contract. If wyes or tees with a 1-1/4" branch and/or run size are not available in the material being used, the Contractor shall furnish and install 1-1/4" x 1-1/2" reducers and

- wyes or tees with a 1-1/2" branch size or 1-1/2" x 1-1/2" wyes or tees and 1-1/4" x 1-1/2" reducers (3) for each service connection.
- E. Service Connections - Ball Valves and Service Boxes
1. Curb stops/ball valves shall be bronze and shall be American made by Mueller Mark II, Oriseal, Ford Ball Valve or equal.
 2. Service Boxes. Valve boxes shall be furnished and installed for all valves. They shall be cast iron, tar coated, sliding type adjustable valve boxes, with cast iron covers. The word "SEWER" shall be cast into the cover. The bell end of the lower sections shall in all cases be sufficiently large to fit over the stuffing boxes of the valves. (Operating nut shall be centered in the bell end of the valve boxes.) The smallest inside dimension of the shaft shall not be less than 5-1/4 inches with two piece sliding type construction providing a minimum overlap of 12 inches. The valve box shall not transmit stress to the valve and shall enclose the operating nut and stuffing box with a lower diameter of 8 inches. Upper section shall have a flange sufficiently strong to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve. Each valve box, including cover shall weigh at least 100 pounds. Valve box extensions if required, shall be supplied at no additional cost to the Owner.
- F. Concrete utilized for thrust blocks shall have a minimum compressive strength of 3,000 psi.
- G. If HDPE sewer pipe is installed via an open cut trench, underground tape shall be provided for all low pressure sewer mains and services and shall be 3-inch wide silver metal detectable tape which permanently identifies the underground low pressure sewer and services. The tape shall meet APWA requirements and use brown colored stripes with black print indicating "CAUTION BURIED FORCE MAIN BELOW". If the HDPE sewer pipe is installed via directional drill, No. 14 trace wire shall be installed along the pipe.

PART 3 EXECUTION

3.01 GENERAL

- A. Pressure sewer pipe shall have a continuous slope between the high and low points.

3.02 PIPE INSTALLATION

- A. Excavations shall be made to accommodate the bedding material as specified in Section 02200 - Earthwork. All excavations shall be kept dry while pipe is being installed and until each joint and pipe has been viewed by the DPW and approval given to commence backfilling operations. Any pipe which is not laid to grade and alignment shall be reinstalled to the satisfaction of the DPW. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.
- B. The pipe marker tape (open cut trench installation) shall be installed, centered, along the entire length of the pressure sewer, including service piping at a maximum depth of 12 inches below finished grade. Tracer wire (horizontal directional drilling installation) shall be installed along the entire length of pipe installed.

3.03 SERVICE LATERALS

- A. Sewer service connections between the property line and the pressure sewer main shall be 1-1/4 inch diameter HDPE pipe. Each service connection shall include a 1-1/4 inch ball valve with valve box at the property line.
- B. HDPE pressure pipe shall be tapped as recommended by the manufacturer.
- C. Any bedrock encountered during installation of service pipe shall be removed to a point 5 feet beyond the end of the service pipe.

3.04 THRUST BLOCKS

- A. Concrete thrust blocks shall be placed at all pressure sewer bends 11-1/4 degrees and greater, at fittings and as designated by the DPW or Engineer.

3.05 TESTING

- A. The pressure sewer shall be tested by the Contractor, in the presence of the DPW, by water pressure equal to 150 psi. Testing shall conform to the requirements of the AWWA Standard C600. Pressure within the sewer mains shall be held for a period of at least 2 hours allowing no loss in pressure. Any defective work shown by this test shall be replaced/repared and retested entirely at the Contractor's expense.
- B. All equipment, labor, water, gauges, and the like for the testing of the pressure sewer pipe shall be supplied by the Contractor at his expense.

END OF SECTION

SECTION 02630

DUCTILE IRON FORCE MAIN

PART 1 GENERAL

1.01 SCOPE

- A. Work included: Furnish ductile iron force main piping, complete with appurtenances as required.

1.02 DESIGN CRITERIA

- A. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.
- B. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations.

1.03 PRODUCT HANDLING

- A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.
- B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.04 SUBMITTALS

- A. Shop drawings and/or brochures shall be submitted for all items to be furnished. Submittals shall include at least information of the pipe and gaskets intended to be utilized and other submittals as specified in this section.

PART 2 PRODUCTS

2.01 DUCTILE IRON SEWER PIPE

- A. The ductile iron pipe shall be centrifugally cast and conform to ANSI A21.51 and ANSI A21.50.
 - 1. The pipe shall be cement lined to twice the thickness specified in ANSI A26.51 and ANSI 21.4 and shall be asphalt seal coated twice.
 - 2. All pipe shall be made of ductile iron equal to grade 60-42-10.
 - 3. The pipe shall be in nominal laying lengths of 18 to 20 feet.
 - 4. Joints shall be mechanical or "push-on" type with rubber gaskets and shall conform to ANSI A21.11.
 - 5. Fittings shall be ductile-iron with mechanical joints conforming to all requirements of ANSI A21.10.
 - 6. The pipe shall be coated on the outside and inside in accordance with the requirements of ANSI A21.51.
 - 7. Wye branches or tees shall be of the class and type compatible with the pipe used under this Contract. If wyes or tees with a 1-1/4" branch and/or run size are not

available in the material being used, the Contractor shall furnish and install 1-1/4" x 1-1/2" reducers and wyes or tees with a 1-1/2" branch size or 1-1/2" x 1-1/2" wyes or tees and 1-1/4" x 1-1/2" reducers (3) for each service connection.

- B. Service Connections - Ball Valves and Service Boxes
 - 1. Curb stops/ball valves shall be bronze and shall be American made by Mueller Mark II, Oriseal, Ford Ball Valve or equal.
 - 2. Service Boxes. Valve boxes shall be furnished and installed for all valves. They shall be cast iron, tar coated, sliding type adjustable valve boxes, with cast iron covers. The word "SEWER" shall be cast into the cover. The bell end of the lower sections shall in all cases be sufficiently large to fit over the stuffing boxes of the valves. (Operating nut shall be centered in the bell end of the valve boxes.) The smallest inside dimension of the shaft shall not be less than 5-1/4 inches with two piece sliding type construction providing a minimum overlap of 12 inches. The valve box shall not transmit stress to the valve and shall enclose the operating nut and stuffing box with a lower diameter of 8 inches. Upper section shall have a flange sufficiently strong to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve. Each valve box, including cover shall weigh at least 100 pounds. Valve box extensions if required, shall be supplied at no additional cost to the Town.
- C. Concrete utilized for thrust blocks shall have a minimum compressive strength of 3,000 psi.

PART 3 EXECUTION

3.01 GENERAL

- A. Force main shall be laid as shown on the Drawings with a continuous slope between the high and low points defined on the Drawings.

3.02 LAYING PIPE

- A. Excavations shall be made to accommodate the bedding material. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Franklin DPW and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be re-laid to the satisfaction of the Franklin DPW. No blocking shall be used. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer.

3.03 THRUST BLOCKS

- A. Concrete thrust blocks shall be placed at all force main bends 11-1/4 degrees and greater, at fittings and as designated by the Franklin DPW, and shall conform to the Drawings.

3.04 TESTING

- A. The force main shall be tested by the Contractor, in the presence of the Franklin DPW, by water pressure equal to 2 times the total dynamic head of the pump to which the force main is attached or 150 psi which ever is more stringent, unless the test pressure is greater than the working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. The Franklin DPW shall provide the test pressure to the Contractor. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 5 psi. Any defective work shown by this test shall be replaced entirely at the Contractor's expense.
- B. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied by the Contractor at his expense.

END OF SECTION

SECTION 02631

POLYVINYL CHLORIDE FORCE MAIN

PART 1 GENERAL

1.01 SCOPE

- A. The work of this section includes furnishing all labor, tools, equipment and materials, and performing all operations in connection with the construction of polyvinyl chloride (PVC) force main, complete with fittings.

1.02 DESIGN CRITERIA

- A. The materials covered by this specification are intended to be standard materials of proven ability as manufactured by reputable concerns. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the materials.
- B. Materials shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations.

1.03 PRODUCT HANDLING

- A. Products shall be shipped, stored and handled in a manner consistent with the written recommendations of the manufacturer and as to not to degrade quality, serviceability or appearance. All products delivered to the project site shall be accompanied by test reports certifying that the pipe conforms to the ASTM specifications listed herein. Any unit found to be defective either before or after installation shall be removed from the project site and replaced with a sound unit.
- B. If stored for more than two weeks, the materials shall receive all maintenance considerations required by the manufacturer for proper storage of the materials.

1.04 SUBMITTALS

- A. Shop drawings and/or brochures shall be submitted for all items to be furnished. Submittals shall include at least information of the pipe and gaskets intended to be utilized and other submittals as specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Polyvinyl Chloride Pipe, couplings and fittings shall conform to ASTM 2241, with an SDR of 21. Joints for PVC pipe shall be push-on joints using permanently bonded elastomeric ring joints conforming to ASTM F477. Such joints shall be installed in accordance with the pipe manufacturer's written instructions. Any joint which is not properly made, shows signs of leakage or is in the opinion of the DPW, defective in any way shall be repaired to the satisfaction of the DPW at no expense to the DPW. PVC fittings shall be provided with PVC pipe joint restraints as manufactured by Harrington Company or approved equal.
- B. Wye branches or tees shall be of the class and type compatible with the pipe used under this Contract. If wyes or tees with a 1-1/4" branch and/or run size are not available in the material being used, the Contractor shall furnish and install 1-1/4" x 1-1/2" reducers and wyes or tees with a 1-1/2" branch size or 1-1/2" x 1-1/2" wyes or tees and 1-1/4" x 1-1/2" reducers (3) for each service connection.
- C. Service Connections - Ball Valves and Service Boxes
 1. Curb stops/ball valves shall be bronze and shall be American made by Mueller Mark II, Oriseal, Ford Ball Valve or equal.

2. Service Boxes. Valve boxes shall be furnished and installed for all valves. They shall be cast iron, tar coated, sliding type adjustable valve boxes, with cast iron covers. The word "SEWER" shall be cast into the cover. The bell end of the lower sections shall in all cases be sufficiently large to fit over the stuffing boxes of the valves. (Operating nut shall be centered in the bell end of the valve boxes.) The smallest inside dimension of the shaft shall not be less than 5-1/4 inches with two piece sliding type construction providing a minimum overlap of 12 inches. The valve box shall not transmit stress to the valve and shall enclose the operating nut and stuffing box with a lower diameter of 8 inches. Upper section shall have a flange sufficiently strong to furnish the bearing for that section so that all weight or jolting from street traffic or the like shall not be transmitted to the valve. Each valve box, including cover shall weigh at least 100 pounds. Valve box extensions if required, shall be supplied at no additional cost to the Town.
- D. Concrete utilized for thrust blocks shall have a minimum compressive strength of 3,000 psi.
- E. Underground tape shall be 3-inch wide silver metal detectable tape, which permanently identifies the underground force main. The tape shall meet American Public Works Association (APWA) requirements and use brown colored stripes with black print indicating "CAUTION BURIED FORCE MAIN BELOW". If the PVC sewer pipe is installed via directional drill, No. 14 trace wire shall be installed along the pipe.

PART 3 EXECUTION

3.01 GENERAL

- A. Force main shall be laid with a continuous slope between the high and low points.
- B. Force main piping installed within 4 feet of finished grade shall be provided with adequate insulation to prevent freezing.

3.02 LAYING PIPE

- A. Excavations shall be made to accommodate the bedding material as specified in Section 02200 - Earthwork. Pipe shall be installed in accordance with published recommendations of the pipe manufacturer. All excavations shall be kept dry while pipe is being laid and until each joint and pipe has been viewed by the Engineer and approval given to commence backfilling operations. Any pipe, which is not laid to grade and alignment, shall be re-laid to the satisfaction of the DPW. No blocking shall be used.

3.03 SERVICE LATERALS

- A. Sewer service connections between the property line and the pressure sewer main shall be 1-1/4 inch diameter PVC pipe. Each service connection shall include a 1-1/4 inch ball valve with valve box at the property line.
- B. PVC pressure pipe shall be fapped as recommended by the manufacturer.
- C. Any bedrock encountered during installation of service pipe shall be removed to a point 5 feet beyond the end of the service pipe.

3.04 THRUST BLOCKS

- A. Concrete thrust blocks shall be placed at all pressure sewer bends 11-1/4 degrees and greater, at fittings and as designated by the DPW or Engineer.

3.05 TESTING

- A. The force main shall be tested by the Contractor, in the presence of the DPW, by water pressure equal to 2 times the total dynamic head of the pump to which the force main is attached or 150 psi, whichever is more stringent, unless the test pressure is greater than the

working pressure of the pipe. In that case the pipe shall be tested to the working pressure of the pipe. The DPW shall approve the test pressure prior to testing. This pressure shall be held for a period of at least 15 minutes, allowing a maximum pressure drop of 5 psi. Any defective work shown by this test shall be replaced entirely at the Contractor's expense.

- B. All equipment, labor, water, gauges, and the like for the testing of the force main shall be supplied by the Contractor at his expense.

END OF SECTION

SECTION 02725
SEWER MANHOLES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: Furnish precast concrete manholes including bases complete with inverts, tables, steps, frames, grates and covers, man catchers, fittings, and piping, as required.

1.02 SUBMITTALS

- A. The Contractor shall submit shop drawings which shall contain the following for each type of valve and appurtenant to be furnished:
1. Manufactures' catalog cut.
 2. An exploded view diagram with a materials list.
 3. Performance characteristics with indication that it meets or exceeds the standards specified herein.
- B. Submittals required under this section may include, but are not limited to:
1. Precast concrete manholes.
 2. Frames, covers, and grates.
 3. Horizontal joint sealing material.
 4. Pipe connections.
 5. Manhole steps.

1.03 STANDARDS

- A. The following standards form a part of this specification:
1. ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections
 2. ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 3. ASTM C32 Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)
 4. ASTM C150 Standard Specification for Portland Cement
 5. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes

PART 2 PRODUCTS

2.01 PRECAST CONCRETE SECTIONS FOR SEWER

- A. Precast reinforced concrete sections for sewer manholes (hereinafter referred to as "manholes") shall conform to the applicable requirements of ASTM C478 "Specifications for Precast Reinforced Manhole Sections", PCI MNL-116 "Quality Control for Plants and Production of Structural Precast Concrete Products", CRSI "Manual of Standard Practice". In event of a conflict between these standards, the more stringent provision shall govern.
- B. Precast Manhole Sections
1. Wall thickness shall not be less than 5 inches for a 48-inch diameter reinforced concrete section, and 6 inches for a 60-inch diameter reinforced section.
 2. All sections shall have tongue and groove joints.

3. Concrete compressive strength shall be 4000 psi after 28 days.
4. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of H-20 loading plus the weight of soil above.
5. Top sections shall be eccentric cones to provide a vertical wall from ground surface to manhole base, except that precast reinforced concrete slabs shall be used where cover over the top of the pipe is less than 5 feet.
6. The inside clear diameter of the opening at the top of the cone or in the slab shall be 24 inches.
7. The date of manufacture, and name of trademark of the manufacturer shall be clearly marked on the inside of each precast section.
8. The thickness of the bottom slab of the precast bases shall be no less than that of the manhole barrel sections to top slab, whichever is greater.

2.02 HORIZONTAL JOINTS

- A. Horizontal joints between sections of manholes, unless otherwise specified herein, shall be double sealed with a self-sealing butyl rubber based flexible joint sealant in rope form. Sealant material shall be Kent-Seal No. 2 as manufactured by Hamilton-Kent Mfg. Co., Kent, Ohio; C-S146 as manufactured by Concrete Products Supply Co. Div., Press Seal Gasket Corp., Fort Wayne, Indiana; Ram-Nek as manufactured by K.T. Snyder Co., Inc., Houston, Texas, or equal. Sealant shall be installed in accordance with the manufacturers written instructions.

2.03 MANHOLE STEPS

- A. Manhole steps shall be aluminum alloy 6061 T6, extruded, safety-type or ½ inch diameter grade 60 steel reinforced bar continuous throughout the step, bent to shape and encased in a co-polymer polypropylene plastic with a tread design.
- B. All steps shall be 12 inches on center with abrasive step surface and safety edge, drop front design, and 14 inches wide. Metal items embedded in concrete shall be painted with a zinc chromate primer.

2.04 PIPE CONNECTIONS

- A. Premolded elastomeric sealed joints shall be used at the joints between the gravity pipe and sewer manhole sections. Premolded elastomeric sealed joints shall be A-Lok, Res-Seal, Press-Wedge II, Lock Joints Flexible Manhole Sleeve, Kor-N-Seal Joint Sleeve, or equal. Said connections shall be provided with stainless steel clamps and stainless steel expansion rings. Force main connections to manholes shall utilize mechanically expanded interlocking synthetic rubber links shall be used at the joints between the pipe and manhole sections, both at the interior and exterior of the manhole, for a watertight seal. Mechanically expanded interlocking synthetic rubber links shall be of the Link-Seal type, or approved equal.
- B. Manholes shall be manufactured with knockout panels for future pipe connections/ extensions at the locations shown on the Drawings.

2.05 MANHOLE FRAMES AND COVERS

- A. Manhole frames and covers shall be cast iron conforming to the requirements of ASTM A48, Class 30, and shall be of noiseless, non-rocking design with pick holes. The word "Sewer," or "Valve" shall be cast on each cover in three inch letters as applicable. The castings shall be made in the United States.
- B. Standard manhole covers and frames shall have a minimum total weight of 420 pounds with a clear opening of 26-inches, unless otherwise indicated on the Drawings. Standard

manhole frames and covers shall be LeBaron Foundry Company (Model No. LK110) or equal as manufactured by Neenah Foundry Co., or Campbell Foundry Co.

C. H2O loading

2.06 BRICK

A. Brick for leveling manhole frames shall conform to ASTM C32 and shall be new, first quality, whole, sound brick.

B. For tables and inverts, ASTM C32 Type SS shall be used with cement mortar (no lime).

2.07 MORTAR

A. Mortar shall be composed of one part Type II Portland cement to two parts sand.

B. Portland cement shall conform to the requirements of ASTM C150. Sand shall conform to the requirements of ASTM C144. Hydrated lime shall conform to the requirements of ASTM C207 and the quantity shall not exceed 10% by weight.

2.08 WATER

A. Water shall be clean, fresh and free from organic matter, oil, acid, alkali, or deleterious substances.

PART 3 EXECUTION

3.01 DELIVERY AND HANDLING

A. Product shall be stored in an approved, orderly manner so that there will be a minimum of rehandling from the storage area to the final position in the trench and so that there is a minimum obstruction and inconvenience to any kind of traffic.

1. All material is to be loaded, unloaded and stockpiled in strict conformance with the manufacturer's recommendations.
2. Deliveries shall be scheduled so that the progress of the work is at no time delayed and also so that large quantities of materials shall not be stored for excessive lengths of time.
3. Provide slings, straps and/or other approved devices to provide satisfactory support of the materials when it is lifted.
4. The precast units shall be lifted and supported only at designated lifting points or support points.

3.02 PRECAST REINFORCED CONCRETE STRUCTURES

A. Precast Reinforced Concrete Structures shall be installed as shown on the Drawings and in accordance with manufacturer requirements.

1. The Contractor shall protect the work against flooding and floatation.
2. The base of a precast structure shall be placed on a 6-inch bed of screened gravel.
3. Precast barrel sections shall be plumb with all sections in true alignment.
4. Joints shall be sealed watertight.
5. Grade at the top of the precast manhole shall be so as to allow a maximum of 12-inches of brickwork to bring the frame and cover to finish grade.
6. The Contractor shall grout all lifting holes with non-shrinking grout.
7. Sewer manholes shall be vacuum tested.

3.03 COVERS/GRATES AND FRAMES

- A. Manholes frames with cover/grates shall be set in a full bed of mortar at finish grade, on the grade-adjusting brick course.
- B. Frames and covers not on the same plane as the final grade shall be reset, at the Contractor's expense.
- C. All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind prior to final inspection.

3.04 LEAKAGE TESTS

- A. Leakage tests shall be made and observed by the Town of Franklin or designee on each sewer manhole. The test shall be vacuum test made as described below. The Contractor, upon approval of the Town of Franklin, may conduct an exfiltration or infiltration test if conditions favorable to these tests exist.
 - 1. Preparation for Testing
 - a. After the manhole had been assembled in place, all lifting holes and horizontal joints shall be filled and pointed with an approved non-shrinking mortar. The test shall be made prior to placing the tables and invert and before filling and pointing the horizontal joints.
 - b. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and plugs braced to prevent blow out.
 - 2. Backfilling
 - a. The test may be conducted before backfilling around the manhole.
 - b. There will be adjustment in the leakage allowance for unknown causes including, but limited to, leaking plugs and absorption. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.
 - 3. The Contractor may have the option of test method depending upon the actual field conditions upon approval of the Town of Franklin or designee. At a minimum, vacuum testing of each manhole shall be required:
 - a. If the measured ground water table is above the highest joint in the manhole, and if there is not leakage into the manhole as determined by the Town of Franklin or designee, the Contractor may perform an infiltration or vacuum test as described herein.
 - b. If the measured ground water table height is lower than the invert of the manhole, the Contractor may perform an exfiltration or a vacuum test.

3.05 TEST PROCEDURES

- A. Vacuum Test
 - 1. The Contractor shall take any and all steps necessary to assure the Town of Franklin or designee that the water table is below the invert of the manhole throughout the test. Any and all measures necessary by the Contractor to lower the ground water table below the invert of the manhole will be at the Contractor's cost. The vacuum test shall be based on the following criteria:
 - a. Manhole test pressures and time shall be as follows:
 - (1) Initial test pressure, 10 inches Hg (i.e., 20 inch absolute).
 - (2) Test time, 1 inch Hg drop to 9 inch Hg in 2 minutes minimum allowable, for 0 to 10 foot deep manholes; 2-1/2 minutes minimum

allowable for 10 foot to 15 foot deep manholes; 3 minutes minimum allowable for manholes greater than 15 foot in depth.

- b. If the pressure drop exceeds 1 inch Hg in 2 minutes the manhole shall be repaired and retested.
- c. If a manhole fails to meet a 1-inch Hg drop in 1 minute after repair, the manhole shall be water exfiltration tested and repaired as necessary.
- d. Testing using either air or water shall be done whenever possible prior to backfilling to assist in locating leaks. Joint repairs by parging are to be done on both outside and inside of the joint to ensure a permanent seal. Vacuum testing draws together the joint and applies high pressure to the elastomeric joint material. Properly placed and sized elastomeric joint material must be used to avoid leakage or to enable sections to be separated if necessary to effect a repair

B. Infiltration Test

1. The manhole interior shall be visually inspected. The manhole shall be considered acceptable for use when no infiltration of ground water is observed on the interior surfaces of the manhole.

C. Exfiltration Test

1. The manhole shall be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily watertight.
2. If the test as described above is unsatisfactory as determined by the Town of Franklin or designee or if the manhole excavation has been backfilled the test shall be continued. A period of time may be permitted, if the Contractor so wishes, to allow for absorption.
3. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and the measuring time of at least 8 hours shall begin. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period.
4. If the test fails, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as to bring the leakage within the allowable rate of 1 gallon per vertical foot per day. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as required, at no additional cost to the Franklin DPW. The manhole shall then be retested.

3.06 VISUAL INSPECTION

- A. At the conclusion of the work, all manholes shall be visually inspected by the Town of Franklin or designee to insure a straight and plumb alignment.
- B. All manholes that are not straight and plumb shall be removed and replaced.

3.07 CLEANUP

- A. Upon completion, of all construction and testing, and prior to final acceptance all debris shall be removed from manholes and the tables cleaned.

END OF SECTION