

SECTION 2.7 - SEWER PIPE, FORCE MAINS AND APPURTENANCES

2.07.01 GENERAL

- A. The Contractor shall furnish all material and shall construct the pipe lines and all required appurtenances at the locations and to the lines, slopes and elevations shown on the drawings or designated by the Engineer.
- B. Sewer pipe shall be polyvinyl chloride (PVC) or Ductile iron pipe.
- C. The Contractor shall submit certifications to the Engineer and Easton Utilities that all pipe, fittings and joints are as specified herein.

2.07.02 POLYVINYL CHLORIDE SEWER PIPE AND FITTINGS

- A. Polyvinyl chloride (PVC) pipe, used for sewer main construction, shall equal or exceed the requirements of ASTM D-3034 and shall have a minimum standard dimension ratio (SDR) of 35 and the minimum pipe stiffness, as tested in accordance with ASTM D-2412, shall be 45 when measured under five (5%) percent deflection at 73 degrees Fahrenheit. Pipe shall be manufactured with integral wall bell and spigot joints in standard lengths not exceeding twenty (20') feet. Service lateral pipe of less than 6 inches shall be schedule 40 PVC, ASTM D-2665 & D-1785.
- B. All PVC pipe and fittings shall utilize an elastomeric O-ring gasketed joint assembled in accordance with the manufacturer's recommendations. Service lateral pipes may use glued joints.
- C. PVC wye branches, pipe stoppers and other fittings shall be manufactured in accordance with the same specifications and shall have the same thickness, depth of socket and annular space as the pipe. Tee fittings will not be permitted for use. Wye branches shall be complete pipe sections. Saddles will not be permitted for use, except when installed by Easton Utilities on existing mains.
- D. PVC pipe shall be delivered and stockpiled in unit pallets. Stacking of pallets above five (5') feet in height will not be allowed. If pipe is stockpiled for more than 30 days prior to installation in the trench, it must be suitably covered with reflective material to protect the pipe from ultraviolet rays emanating from sunlight. Do not use plastic sheets. Allow for air circulation under covering.
- E. Bowed sections of pipe will be unacceptable and installation of pipe which has bowed, whether or not the bow has been corrected, will not be allowed.

2.07.03 POLYVINYL CHLORIDE FORCE MAIN PIPE AND FITTINGS

- A. Pipe shall be manufactured to meet the requirements AWWA C-900. Pipe shall be

manufactured in lengths not exceeding twenty (20') feet. Pipe shall be integral bell by spigot end design. No HDPE force main shall be allowed unless specifically approved by Easton Utilities.

- B. All pipes to be connected using elastomeric gasketed joint and lubricant and shall be installed by experienced pipe layers, to the satisfaction of the Easton Utilities. Installation shall be done in the manner recommended by the manufacturers.
- C. Pour concrete thrust blocks according to the details on all horizontal or vertical pipe bends.
- D. Force Mains shall be hydrostatically pressure tested per section 2.06.14-C.
- E. Fittings shall be mechanical joint ductile iron fittings meeting AWWA C153 as manufactured.

2.07.04 PIPE INSTALLATION

- A. Pipe and fittings shall be carefully handled and lowered into the trench. Special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the pipe.
- B. Sanitary Sewer Mains shall be constructed in accordance with Standard Detail SS-7.00. Any defects due to settlement shall be made good by the Contractor.
- C. Proper and suitable tools and appliances for the safe and convenient handling and laying of pipe shall be used.
- D. Whenever a pipe requires cutting to fit into the line or to bring it to the required location, the work shall be done in a satisfactory manner so as to leave a smooth end.
- E. The pipes shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open ends of all pipe lines shall be provided with a stopper carefully fitted so as to keep dirt and other substances from entering. This stopper shall be kept in the end of the pipe line at all times when laying is not in actual progress.
- F. All concrete required to support and reinforce wye branches, bends and other fittings shall be placed as directed, and the cost thereof shall be included and covered.
- G. Backfill materials shall be hand placed and mechanically tamped in six (6") inch layers, placed uniformly on both sides of the pipe to a point at least one (1') foot above the pipe crown. Each layer shall be thoroughly compacted for the full trench width and under, around and over the pipe.
- H. Pipeline detectable tape shall be installed continuously along all sewer mains. The tape shall be installed 24" directly above the pipe and twelve (12") inches from the ground surface. The tape shall be Lineguard Type II Detectable tape as manufactured by Lineguard, Inc. of Wheaton, Illinois or equal. The tape shall be six (6") inches wide, imprinted with the word

"CAUTION – SEWER LINE BELOW" and be capable of being detected with inductive methods.

- I. Pipeline tracer wire shall be installed as shown in the details. Wire shall be a reinforced coated 8 gauge tracer wire as manufactured by Copperhead Industries or approved equal.
- J. For refill of the remaining trench depth, refer to "Excavation and Backfill", Section 2.1 of these specifications.

2.07.05 LAYING PIPE IN FREEZING WEATHER

No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Engineer shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation unless all required precautions as to the minimum length of open trench and promptness of backfilling are observed.

2.07.06 ARTIFICIAL FOUNDATION

Whenever directed, the Contractor shall lay pipe upon an artificial foundation which he shall construct. Such foundation may consist of gravels or of concrete; all to be of the form and dimensions and placed according to the detail or in the manner required by Easton Utilities.

2.07.08 TESTING

- A. Gravity sewer to be tested in accordance with the following:
 - 1. Contractor shall furnish all labor, tools, materials and equipment including water, pumps, compressors, stopwatch, gauges and meters, subject to the approval of the Owner, for testing in accordance with these specifications.
 - 2. Easton Utilities shall be notified in advance of all tests, and all tests shall be witnessed and conducted to his entire satisfaction.
 - 3. The gravity sewer shall be mirror and air tested as follows:
 - a. **MIRROR TEST**
Upon completion of pipe laying and backfilling to a point at least two (2') feet above the crown of the pipe, the Engineer will conduct a mirror test to check for defects, excess deflection, leakage and for horizontal or vertical misalignment. Mirror testing shall consist of reflecting sunlight or artificial light via mirrors through the completed section of pipeline, which, in order to be accepted, shall be true and straight in horizontal and vertical alignment to allow for the full passage of the reflected light. The right is reserved by the Town or Town Engineer to require mandrel testing per Uni-Bell PVC Pipe Association requirements.

b. LEAK TESTING USING AIR:

1. Sewers shall be tested in sections of not more than four hundred (400') foot lengths unless otherwise approved by the Engineer. Each section shall be tested immediately upon completion thereof. Each section shall meet the air pressure drop limitation specified herein.
2. All material and labor required for leakage tests shall be furnished by the Contractor.
3. Sewers shall be tested using the low-pressure air method in accordance with the requirements of the Uni-Bell PVC Pipe Association's recommendations, UNI-B-6 based upon the Ramseier test time criteria. Procedural and equipment details shall be submitted to the Engineer prior to acceptance of its use for testing.
4. If the time for the designated size and length elapses before the test pressure drops 0.5 psig, the section undergoing the test shall have passed.
5. If the pressure drops 0.5 psig before the appropriate test time has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. Contractor shall determine at his own expense the source or sources of leakage and he shall repair or replace all defective materials and/or workmanship to the satisfaction of the Engineer. The completed pipe installation shall then be retested and required to meet the requirements of this test.

c. Mandrel Testing

1. Deflection testing of the sewer shall be performed by the Contractor. No section of sewer shall be tested before at least 30 days have elapsed from the date of completed backfill over the section. The pipe will be observed for evidence of deflected or offset joints and other pipe defects.
2. The deflection, or deformation of the pipe due to external loading, shall not exceed approximately 5 percent. All labor, materials and equipment necessary for cleaning the sewers and performing the deflection testing shall be furnished by the Contractor.
3. Deflection shall be determined by passing an approved go/no go mandrel through the gravity sewer main.

4. The deflection shall be based on the average inside diameter as presented in ASTM D3034, Table XII, for PSM SDR35 PVC sewer pipe.
5. If any pipe fails the deflection test, unstable conditions and/or improper bedding will be assumed. The overly deflected pipe shall be removed and replaced by the Contractor.

2.07.09 BORING AND JACKING OF SANITARY SEWER

- A. Where possible, an approach trench shall be excavated far enough to provide a jacking face of at least three (3') feet from a pavement surface. This open face shall be shored securely to prevent slipping or raveling of the face.
- B. Boring pits shall be large enough to contain all necessary equipment and tools. Adequate provision shall be made for the removal of excavated material.
- C. A substantial backstop of heavy timber or steel beams shall be provided to take the thrust of the jack or boring equipment.
- D. As material is excavated or bored ahead of the pipe, the pipe shall be jacked in to follow this excavation. The distance dug ahead of the pipe shall not exceed six inches (6").
- E. The installation of casing pipe and the boring or excavation shall be done simultaneously.
- F. Voids between the sleeve and excavation shall be filled by pressure grouting.
- G. Cement shall be used to seal the pipe ends between the carrier pipe and sleeve.
- H. A one (1") inch PVC pipe shall be installed in the downgrade seal to permit drainage.
- I. Steel pipe sleeve shall be furnished in the diameter shown on the plans and shall conform to the requirements of AWWA C-200; Grade B pipe shall be used. The pipe, including field connections, shall be coated with bitumastic compound, inside and outside. Pipe wall thickness for sleeves shall be standard thickness. All joints for casing pipe shall be made by continuous weld completely around the perimeter of the pipe in accordance with AWWA C-206.
- J. Carrier pipe shall be as required by the plans.
- K. Use runners or cradles to support the pipe in the casing. A minimum of two supports is needed per joint of pipe providing a maximum span of 6.25 feet for PVC pipe lengths of 12.5 feet or less. The maximum span between supports for pipe lengths of 19 to 20 feet must not exceed 7.5 feet.

2.07.10 SEWER MANHOLES

A. GENERAL

1. The Contractor shall have the option of constructing shallow (4' or less) manholes of precast reinforced concrete or "SS" sewer brick as indicated in the details. Manholes deeper than four feet (4') will be precast reinforced concrete.
2. Manholes shall be built at such points on the pipe lines and of such form and dimensions as are shown on the drawings or as may be directed. Manholes shall be built as pipe laying progresses and the Town or Easton Utilities may stop work entirely on the laying pipe if manhole construction is delayed to such an extent as to be hazardous to construction or the public.
3. Manhole frames and covers shall be installed on grade to match the slope of the paved surface. Use pre-manufactured devices, approved by Easton Utilities, to build up from cone to grade as required to match the slope of the frame and cover to the slope of the paved surface.

B. PRECAST REINFORCED CONCRETE MANHOLES

1. Precast reinforced concrete risers, eccentric cones and bases shall be in conformance with ASTM Designation C-478. Joints between riser sections shall be fitted with an "O" ring rubber gasket, meeting the requirements of ASTM Designation C-443. Installation of risers shall be in accordance with manufacturer's recommendations under the supervision of the Easton Utilities.
2. Precast reinforced concrete base and riser sections shall be 5000 PSI concrete as manufactured by Atlantic Concrete Products Company, Virginia Precast Corporation or equal.
3. Interior and exterior joint spaces of all manhole risers shall be filled prior to application of the exterior waterproofing. The interior joint shall be mortared. The exterior joint may be mortared or filled with a joint filler compound. Said compound shall be Pioneer 301 as manufactured by Daubert Chemical Co., Oakbrook, Illinois or equal.
4. Lifting holes in the walls of precast reinforced concrete risers will be allowed but shall be plugged with rubber stoppers and grouted flush with face or manhole wall after installation of manhole riser sections. Not more than two holes shall be cast in the walls of each riser section for the purpose of handling.
5. The exterior surface of all precast manholes shall receive a minimum two (2) coat application of a sixty eight percent (68%) solids coal tar type protective coating. The total average dry film thickness shall measure 24 mils with no single measurement to be less than 20 mils. Surfaces shall be prepared in accordance with the

manufacturer's instructions and coatings applied in the field in a manner acceptable to the Engineer. The coating material shall be Bitumastic Super Service Black manufactured by Koppers Co., Inc., Pittsburgh, Pennsylvania, Tar-Jet Super Black XX-32-B-22 manufactured by Pennsbury Coatings Corp., New Britain, Pennsylvania or equal.

6. All pipe-to-manhole connections in the precast manhole shall be made by means of an integrally cast flexible connector which shall be Lockjoint flexible manhole sleeve as manufactured by Interpace Corp., Parsippany, New Jersey or A-Lok flexible manhole gasket as manufactured by A-Lok Corp., Trenton, New Jersey or equal.

C. FLOW CHANNELS

1. All manhole flow channels and benches shall be constructed of "SS" sewer brick or concrete, four-inch minimum thickness. Care shall be taken to secure smooth and even surfaces with full special mortar joints. Channel sections shall be built up to true line and radius, and curved sections shall provide a uniform transition in the flow direction.
2. Materials and construction of flow channels shall be in accordance with appropriate sections for materials so used, as hereinafter specified.

D. CONCRETE

All concrete for manhole base slabs and cradles, encasements, blocking, etc. shall have a minimum compressive strength of 3,000 psi at 28 days, and conform to MD-SHA standards.

E. BRICK

All brick shall conform to the "Standard Specifications for Sewer Brick", ASTM Designation C-32, Grade SS, except that the maximum absorption for the average of five (5) bricks shall not exceed ten (10%) percent and the individual brick maximum shall not exceed fourteen (14%) percent.

F. MORTAR

1. Mortar shall be Type S, in accordance with ASTM C-270.
2. Sand shall be composed of sharp, angular, silicious grains, coarse or graded from fine to coarse with the coarsest grains predominating, and sensibly free from clay, loam, dirt, mica, organic matter or other impurities. Sand containing more than five (5%) percent by weight of foreign material shall not be used. This limit may be changed for special classes of work if hereinafter specified. Sand exhibiting more than an acceptable amount of fine matter or impurities may be required to be washed after delivery on the work or shall be rejected altogether. Sand for mortar shall be

screened to reject all particles of a greater diameter than 1/4-inch and shall not contain more than five (5%) percent by weight of a very fine material.

3. Unless hereinafter specified otherwise, all mortar shall be composed of cement and sand of the character above specified. The proportion of volume shall be one part of cement to two of sand. One volume of cement shall be 94 pounds net. One volume of sand shall be 0.9 cubic feet, the sand not being packed more closely than by throwing it into a box the usual way. Mortar shall be fresh mixed in small batches for the work in hand. Tight boxes or platforms made for the purposes shall be used. The sand and cement shall be thoroughly mixed dry, in the proper proportions, until a uniform color has been produced, whereupon a moderate dose of water shall be added, so as to produce a stiff paste of the proper consistency.
4. Sand obtained from the excavation shall not be used.

G. LAYING BRICK

1. All brick work shall be laid by competent professionals.
2. All brick shall be laid in a full bed of mortar with all vertical and horizontal joints filled with solid mortar.
3. Joints shall be not less than 3/8-inch or more than 1/2-inch wide except as otherwise specified in paragraph 5 below.
4. No brickwork shall be laid when the temperature is below 40 degrees or when the indications are for lower temperatures within 24 hours. The Contractor shall take such measures as may be approved to prevent brick work from being exposed to freezing temperatures for a period of not less than five days after laying.
5. Special care shall be taken in laying brick in inverts of manholes to insure a uniform flow of water through the sections. In such locations, joints shall not exceed 1/16-inch in thickness and each brick shall be laid in full mortar bed with joints on bottom side and end made in one operation. No grouting or working in of mortar after laying the brick will be permitted.

H. MANHOLE STEPS

1. Manhole steps shall be made of 3/8-inch diameter (No. 3) steel reinforcing bars, ASTM Designation A-615, grade 60, encased in polypropylene plastic. Manhole steps shall have notched tread ridge with retainer lug on each side.
2. Manhole steps shall be cast-in-place during manufacture of precast reinforced concrete manholes or placed in brick manholes during construction. Embedment length shall be suitable for minimum five (5") inch thick, precast reinforced concrete

riser walls.

3. Manhole steps shall be OSHA approved and as manufactured by M.A. Industries, Inc., Peachtree City, Georgia, ICM, Inc., Jacksonville, Arkansas, or equal.
4. Manhole steps shall be spaced twelve inches (12") apart. The maximum spacing from top of manhole frame to the first step shall not exceed sixteen inches (16").

I. MANHOLE FRAMES AND COVERS

1. Frames and covers for manholes shall be set by the Contractor as the work progresses. The frame shall be well bedded in mortar.
2. Frames and covers shall be as shown in the details and manufactured by by E.A. Quirin Foundry, solid lid with two (2) pick holes and internal ribbing. Material for frames and covers shall be in accordance with standard specifications for gray iron castings ASTM A-48-64 for Class 35B.
3. Furnish Parson manhole inserts with Nylon handles and factory installed gasket in all manholes.
4. Manhole stubs shall be extended four feet (4') outside of the manhole wall unless otherwise detailed. The stub end shall be plugged.

J. TESTS

1. All Manholes will be required to pass a vacuum test. Manholes will be sealed and a vacuum applied to a level of ten (10) inches of mercury. The time will be measured for the vacuum to drop from ten (10) inches to nine (9) inches of mercury.
2. All Sanitary Sewer Manhole/Structure Vacuum Tests shall be performed by the contractor. The contractor shall provide all equipment and personnel to perform the required testing. All Sanitary Sewer Manhole/Structure Vacuum testing equipment shall be approved by Easton Utilities prior to its use. Vacuum testing is recommended to be performed prior to backfilling around the manhole/structure.
3. Vacuum testing times for sanitary sewer structures other than manholes shall be based on the times nearest to the equivalent manhole volume or as directed by Easton Utilities.
4. The following are the minimum allowable test times for manhole/structure acceptance at the specified pressure drop:

<u>Depth of Manhole (feet)</u>	<u>Time Lapse (Seconds) per Manhole Diameter</u>		
	<u>48 "</u>	<u>(inches)</u> <u>60"</u>	<u>72"</u>
8	60	60	60
10	60	60	60
12	60	60	60
14	60	60	60
16	60	60	60
18	60	60	60
20	60	60	60
22	60	60	62
24	60	60	68
26	60	60	74
28	60	64	80
30	60	69	85

If inspection reveals any visible leakage or seepage in any manhole, the Contractor will be required to accomplish such remedial measures as may be directed by the Engineer. Caulking or patching of interior manhole surfaces will not be acceptable.

K. VERTICAL SURVEY

Prior to final acceptance, rim and invert elevations shall be established by a licensed surveyor and provided to the Town of Easton and Easton Utilities.

END SECTION