

**1.00 GENERAL****1.01 DESCRIPTION**

- A. The CONTRACTOR shall furnish all labor, tools, equipment and materials to construct all sanitary sewers, manholes and necessary appurtenant work as herein specified. No sewers shall be accepted until the sewer system has passed the system acceptance tests.

**1.02 TESTING****A. General**

1. The CONTRACTOR shall furnish all equipment and personnel to conduct system acceptance tests as specified herein on all completed sewers. All tests shall be conducted under the supervision of the ENGINEER. No acceptance tests shall be conducted until the entire sewer system is constructed and has been installed for not less than 30 days.
2. The CONTRACTOR may desire to make an air test prior to backfill for his own purposes but the line acceptance tests shall be conducted after backfilling or extensions.
3. All sewer lines shall be televised while running enough water through the line to be visible at the next downstream manhole.
4. All sewer lines shall be checked for alignment.
5. All manholes shall be tested for leakage. All PVC lines 8-inch or larger shall be tested for deflection.
6. Sewer pipe 30 inches and smaller shall be air tested. Sewer pipe larger than 30 inches shall be tested by exfiltration and shall be tested in lengths of 1600 feet or less.
7. Should the results of any test fail to meet the criteria established in this Specification, the CONTRACTOR shall, at his own expense, locate and repair rejected section and retest until it is within specified allowance.

**B. Test for Leakage - Air Test**

1. After a manhole-to-manhole section of line has been backfilled and cleaned, it shall be plugged at each manhole with pneumatic plugs inflated to 35 psig internal pressure. The design of the pneumatic plugs shall be such that they will hold against the line test pressure without requiring external blocking or bracing.
2. There shall be three (3) hose connections to the pneumatic plug. One hose shall be used only for inflation of the pneumatic plug. The second hose shall be used for continuously reading the air pressure rise in the sealed line. The third hose shall be used only for introducing low pressure air into the sealed line.
3. There shall be a 0-30 psig gauge for reading the internal pressure of the line being tested. Calibrations from the 1-10 psig range shall be in tenths of lbs (not ounces) and this 0-10 portion shall cover 90% of the complete dial range.
4. Low pressure air shall be introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any ground water pressure that may be

over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the third hose shall be disconnected.

5. The portion of line being tested shall be accepted if the portion under test meets the following conditions.

a. DI, and RCP Pipes

- (1) The time requirement for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time given in the following table:

<u>Pipe</u>	<u>Min. Holding Time Seconds/100 ft. Pipe</u>
4-inch	18
6-inch	42
8-inch	72
10-inch	90
12-inch	108
15-inch	126
18-inch	144
21-inch	180
24-inch	216
27-inch	252
30-inch	288

- (2) In areas where ground water is known to exist, the CONTRACTOR shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, the ground water level shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water shall be taken after the water stops rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the lbs of pressure that will be added to all readings. For example, if the height of water is 11-1/2 ft, then the added pressure will be 5 psig. This makes the 3.5 psig to be 8.5 psig, and the 2.5 psig to be 7.5 psig. The 1 lb allowable drop and the timing remains the same.

b. PVC Pipe

- (1) The time requirement for the pressure to decrease from 3.5 to 3.0 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than that shown in the following table:

<u>Pipe Size (inches)</u>	<u>Holding Time (seconds)</u>	<u>Minimum Holding Time (seconds)</u>
4-inch	0.190xL	113
6-inch	0.427xL	170
8-inch	0.760xL	227

10-inch	1.187xL	283
12-inch	1.709xL	340
15-inch	2.671xL	425
18-inch	3.846xL	512

(2) If any section of the sewer fails to meet this requirement, the CONTRACTOR shall perform a television inspection of the faulty section and repair or replace at his own expense all defective materials and/or workmanship to the satisfaction of the ENGINEER. The test procedure shall be repeated until the results are acceptable.

C. Test for Manhole Leakage

1. All manholes shall be tested for leakage by using plugs on inletting-outletting sewers, and filling the manholes with water to the top of the manhole. Four hours shall be allowed for water absorption by the manhole before testing is initiated. Allowable exfiltration for 48-inch diameter manholes shall be 2 gallons per foot of depth per day.

D. Test for Alignment

1. All sewers shall be laid accurately to the line and grade designed by the ENGINEER. The sewers will be tested for alignment by shining a light through the pipe at a manhole and viewing the light from an adjacent manhole. Any section of sewer in which a light cannot be seen from one manhole to the next shall be corrected to the satisfaction of the ENGINEER to pass this test.

E. Test for Deflection of PVC Pipe

1. PVC pipe sewers shall be installed in such a manner that the initial deflection of the conduit shall conform to the latest revision of ASTM D-3034.
2. Deflection of PVC pipe shall be tested by pulling a rigid mandrel or equivalent through the pipe. The mandrel shall be constructed in accordance with the following table of maximum outside diameters and shall be submitted to the ENGINEER for review before testing is initiated.

Pipe I.D.	Mandrel O.D.
6 inches	5.33 inches
8 inches	7.11 inches
10 inches	8.87 inches
12 inches	10.55 inches
15 inches	12.90 inches
18 inches	15.74 inches

3. The mandrel shall be drawn by hand through the pipe from manhole to manhole. Any portion of pipe through which the mandrel passes freely shall be deemed to have passed the deflection test. Sections of pipe through which the mandrel does not pass shall be located, uncovered and the pipe zone bedding improved and backfilled by the CONTRACTOR at his own expense. The pipe shall then be retested before acceptance is granted.

F. Material Tests

1. The CONTRACTOR shall have tests of pipe and strength made by an independent testing laboratory. Tests of up to 4 lengths of sewer pipe per hundred lengths may be required to show compliance with the Specifications. All pipe delivered to the job site shall be accompanied with a manufacturer's certificate of compliance to the Specifications.

**1.03 SUBMITTALS**

- A. The CONTRACTOR shall submit shop drawings or data sheets for all pipe, manholes, manhole castings, and pipe to manhole connections. The CONTRACTOR shall submit certification letter for all pipe proposed on the project. The letters shall contain the following: CONTRACTOR name, project name, township name, current date, certification of pipe provided and letterhead of the certifying company.

**2.00 PRODUCTS**

**2.01 SEWER PIPE**

- A. Pipe for sewer 24-inch diameter and smaller shall be polyvinyl chloride (PVC). Pipe for 30-inch diameter and larger shall be PVC truss pipe. Ductile iron pipe and reinforced concrete pipe shall be used as specified by the ENGINEER.
- B. Pipe for service leads 4 through 8 inches in diameter shall be polyvinyl chloride (PVC).
- C. Reinforced concrete pipe shall be no less than the latest revision of ASTM C76, with the class designation as shown on the Plans.
- D. PVC pipe 4 inches through 15 inches in diameter shall meet or exceed all of the requirements of the current ASTM D-3034 SDR-26 polyvinyl chloride sewer pipe and fittings. 18-inch diameter PVC pipe shall meet or exceed all the requirements of the current ASTM F-679 SDR 26 polyvinyl chloride sewer pipe and fittings. Samples of pipe and physical and chemical data sheets shall be submitted to the ENGINEER for review. Approval shall be obtained before pipe is purchased.
- E. PVC pipe installed at depths greater than 15 feet shall meet or exceed all of the requirements of the current ASTM D-2241 for SDR-21 polyvinyl chloride sewer pipe and fittings.
- F. Truss pipe shall meet or exceed all of the requirements of the current ASTM D2680.
- G. Ductile iron pipe shall meet or exceed all the requirements of ANSI A21.50 special ductile sewer pipe.

**2.02 SEWER PIPE FITTINGS**

- A. Fittings shall be of the same material as the pipe, and in no case shall the walls be thinner than that of the pipe furnished.
- B. Wye and tee fittings for PVC pipe shall be reviewed by the ENGINEER before purchasing.
- C. The dry fit of all fittings must be snug. If the fit is such that it is loose, the pipe or fitting will be rejected as faulty and of improper size.

**2.03 SEWER PIPE JOINTS**

- A. Concrete pipe joints shall be made of a resilient material conforming to the latest revision of ASTM Designation C443. Proper lubricant shall be furnished by the joint manufacturer.
- B. Concrete pipe for use with rubber joints shall be smooth and precisely formed to provide a uniform annular space for joint materials.
- C. PVC pipe shall be jointed with ring gusseted bell ends. Jointing materials shall be applied to the bell end of the pipe at the point of manufacture in such a manner that a tight uniform joint will be achieved and such that when the joint is made up in the field, the joint material will not roll or tear from the pipe. A proper joint lubricant shall be furnished by the pipe manufacturer.

**2.04 REINFORCED CONCRETE MANHOLES**

- A. Manholes shall conform to the current ASTM specifications for precast reinforced concrete manhole sections, serial designation C478. Manhole section joints shall conform to ASTM C990-96. Cone sections shall be straight side type, with an offset step configuration.
- B. All manhole component parts shall have the name of the manufacturer stenciled on the inside. The lettering or logo shall be a minimum of 4-inches high.
- C. Manholes constructed over an existing sewer line shall have a doghouse mudded to an 8-inch thick cookie. The bottom of the existing pipe shall be the channel. All other manholes shall have precast integral base sections with pre-formed concrete channels.
- D. All channels shall be constructed to the full flow depth of the pipe.

**2.05 MORTAR FOR MANHOLES**

- A. Mortar for plastering manholes shall be made of one part Portland cement and two parts fine aggregate.

**2.06 MANHOLE FRAMES AND COVERS**

- A. Manhole frames and covers shall weigh not less than 350 lbs. Each frame and cover shall have machined bearing surfaces and shall be suitably notched for convenient removal of the cover. Each cover shall be marked with the letters, **ASANITARY SEWER@** integrally cast into the cover.
- B. Covers shall be of the "self-sealing" design having a continuous gasket glued in a machined groove and a concealed pickhole. Frames and covers shall be East Jordan 1040Z, with Type AGS cover.
- C. All manhole frames and covers shall be coated by the manufacturer with coal tar pitch varnish or other asphaltum coating reviewed by the ENGINEER.

**2.07 MANHOLE STEPS**

- A. Steps shall be plastic coated steel. They shall be M.A. Industries PS1-PF or PS1-B, or approved equal.

**2.08 MANHOLE CONNECTIONS**

- A. Sewer pipe (6-inch to 24-inch) to manhole connections shall be through: 1) a flexible rubber boot which shall be securely clamped into a core-drilled pipe port. Pipe ports shall be core-drilled at the point of manhole manufacturer and shall be accurately located within 1/2-inch of proposed sewer centerline (Kor-N-Seal); or, 2) a self-adjusting mechanical pipe to manhole seal which provides a resilient flexible and infiltration-proof joint (Res-seal); or, 3) a flexible rubber wedge firmly rammed into a rubber gasket which is cast into the manhole (Press Wedge II), or equal. All flexible pipe to manhole connections shall be installed per the manufacturer's specifications.
- B. Neoprene rubber for the manhole boot shall meet ASTM Specification C443 and shall have a minimum thickness of 3/8-inch. Pipe clamp bands shall be of corrosion-resistant steel.
- C. Sewer pipe over 24 inches to manhole connections shall be in accordance with details shown on the Plan.

**2.09 SANITARY MANHOLE ADJUSTMENTS**

- A. All final grade adjustment of manhole covers and frame assemblies shall be completed utilizing injection molded High Density Polyethylene (HDPE) adjustment rings as manufactured by LADTECH, INC. or approved equal. The adjustment rings shall be manufactured from polyethylene plastic as identified in ASTM Designation D 1248.
- B. All adjustment for matching road grade shall be made utilizing a molded indexed slope ring.
- C. Each adjustment ring shall be sealed with a 3/16 to 1/4 inch bead of butyl rubber sealant per the manufacturer's instructions. Sealant shall meet ASTM specification C-990.
- D. All castings and adjustment rings shall be sealed to the structure with an external Infi-Shield Uni-Band seal manufactured by Sealing Systems, Inc., or approved equal. The seal shall be continuous bands, made of high quality Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall have a 2-inch wide mastic strip on the top and bottom of the band. The mastic shall be non-hardening butyl rubber sealant, with a minimum thickness of 3/16-inch, and shall seal to the cone of the manhole and over the lip of the casting.

**2.10 MANHOLE DROPS**

- A. Manhole drop connections shall be interior drops using the drop bowl as produced by Reliner-Duran Inc. or approved equal.
- B. Drop bowl model AA-4" shall be used for all lines up through full 6-inch inlets. Drop bowl model AA-6" shall be used for all 8-inch inlets. Drop bowl model AB-8" shall be used for all 10-inch inlets. Lines larger than 10 inches shall be as directed by the ENGINEER.
- C. The force line hood shall be attached on models AA-4" and AA-6" when the incoming line is from a force main or the slope is 3 percent or greater.
- D. The drop pipe shall be secured to the manhole wall with Reliner-Duran, Inc. stainless steel adjustable clamping brackets or approved equal.
- E. The drop bowl and each clamping bracket shall be attached to the manhole wall with 3/8-inch x 3/4-inch bolts.

- F. The incoming pipe shall be trimmed such that it protrudes 2 inches into the manhole.
- G. A 1-inch V shaped notch shall be cut into the bottom edge of the incoming pipe.

**3.00 EXECUTION**

**3.01 EXCAVATION AND BACKFILL**

- A. All excavation and backfill above a line 12 inches above the crown of the pipe shall conform to Section 2.04, Earthwork, of these Specifications.

**3.02 BEDDING**

- A. Ductile iron, and concrete pipes shall be laid on a compacted granular material placed on the bottom of the trench to a depth of not less than 3 inches for 24-inch and smaller pipe and not less than 4 inches for pipe larger than 24-inch conforming to Class B bedding as shown on the Plans. Where shown on the Plans or required by the ENGINEER, a concrete encasement or concrete cradle shall be used.
- B. PVC pipe shall be laid on a compacted granular material placed on the bottom of the trench to a depth of not less than 4 inches conforming to Class B bedding as shown on the Plans. Where shown on the Plans, or where the pipe passes under a road with less than 4 ft of cover, the pipes shall be encased.
- C. For all pipes, compacted granular material shall be placed at the sides of the pipe and cover not less than 12 inches above the crown of the pipe.
- D. "Granular Material" shall be class 2NS sand, pea gravel or crushed stone conforming to ASTM C33 Size No. 67 placed in not more than 6-inch layers and compacted to not less than 95% standard density for PVC and 90% standard density for reinforced concrete.
- E. Pea gravel or crushed stone used for bedding shall be separated from the sand backfill with a non-woven geotextile fabric. The fabric shall be Amoco 4551, or approved equal.

**3.03 PIPE INSTALLATION**

- A. Installation of PVC pipe shall be in conformance with ASTM D2321-89.
- B. All pipe shall be laid true to the required lines and grades. All trenches when pipe laying is in progress shall be kept dry; and all pipes and fittings shall be uniformly supported on a properly trimmed bedding with holes at each joint to receive bells. All pipe shall be laid with bells uphill.
- C. All joints shall be made up in accordance with the manufacturer's instructions using materials and equipment especially prepared for the type of joint to be used.
- D. The grade as shown on the profiles is that of the pipe invert and that to which the work must conform. The grade shall be kept by using an interior pipe-laying laser which shall be furnished by the CONTRACTOR at his expense. Each pipe shall be laid accurately to the line and grade as shown on the Plans and in such manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the invert. The interior of sewers shall, as the work progresses, be cleaned of all dirt, cement, debris and other superfluous materials of every description. Bulkheads shall be used to keep foreign materials out of the open end of the sewer when work is not in progress.

- E. The location of the piping as shown on the Plans has been determined to avoid, insofar as possible, interference with trees or structures or fixtures above ground and other underground mains, services, utilities, or structures. Any change in location or alignment of piping which may be found more feasible or practicable as the work progresses shall be made by the CONTRACTOR, as the ENGINEER or Ann Arbor Township personnel may direct.
- F. All pipe and fittings shall be carefully lowered and moved into position in trench or vault in a controlled manner such as will prevent damage to the pipe and any coatings or lining. An excessive amount of scratching on the surface of the PVC pipe will be considered cause for rejection.
- G. The trench shall be backfilled closely behind the pipe laying. Unless otherwise directed or permitted by the ENGINEER, the backfilling shall follow and be completed to the top of the trench within two pipe lengths behind pipe laying.
- H. All cutting of the pipe shall be done in a neat workmanlike manner with the least amount of waste and without damage to existing or new lines. A fine tooth saw, tubing cutter or similar tool may be used to cut PVC pipe. Cuts must be square. Ragged edges shall be removed with a cutting tool or file.
- I. After cutting bell and spigot or socket pipe, a stop mark shall be made with a pencil or crayon using dimensions as shown by the manufacturer's instructions or by using another pipe in the field as a guide.
- J. Breaks in pipe or joints shall be repaired to the satisfaction of the ENGINEER and at the expense of the CONTRACTOR.

**3.04 CONNECTIONS TO EXISTING MANHOLES AND OTHER RIGID STRUCTURES**

- A. When a sewer is connected to an existing manhole, a hole adequate to receive the new pipe shall be cut into the manhole.
- B. If the existing manhole is of brick construction, a single rowlock of brick shall be turned over the new pipe and the existing manhole brick work shall be cleaned, pointed and given a 1/2-inch mortar coat on the outside surface.
- C. For connections to existing precast reinforced concrete manholes, a hole shall be cored into the concrete manhole wall to receive the pipe. A Kor-N-Seal boot or engineer approved equal shall be clamped into the cored hole and used to make the connection.
- D. For connections to existing fiberglass manholes, a hole shall be cored into the manhole wall to receive the pipe. A Kor-N-Seal boot or engineer approved equal shall be installed using fiberglass reinforced pipe stubout for Kor-N-Seal boot sealing surface.

**3.05 STREAM AND RIVER CROSSING**

- A. Whenever a pipe is required to cross a stream or river, all work shall be in accordance with the provisions of Act 346, the Inland Lakes and Streams Act of 1962, and the rules and regulations promulgated thereunder. Stream crossings and all restoration required shall be completed within five days of the construction.
- B. The CONTRACTOR shall utilize such construction methods as are feasible and practicable to divert or stop stream flow to lay the pipe in the dry. Pipe shall be ductile iron. After the sewer is properly laid, the stream-channel shall be cleaned of dirt and debris resulting from the CONTRACTOR's operations.

- C. After the crossing is made, heavy riprap and sodding shall be placed to protect the banks from erosion as shown on the Plans.

END OF SECTION