FACILITIES & OPERATIONS
ARCHITECTURE, ENGINEERING AND CONSTRUCTION
UNIVERSITY OF MICHIGAN

**BuildingName**
**The Description of the Project**
**P00000000  0000**

**SPECIFICATION DIVISION  33**
NUMBER  SECTION DESCRIPTION

**DIVISION 33 SANITARY SEWER UTILITIES**
SECTION 333100 - SANITARY SEWER

**END OF CONTENTS TABLE**

**Notes to Designer –**

- **Delete this cover sheet when including in specifications.  Add Division 33, section 333100 to the title sheet.**
- **Directional drilling is not covered in this master specification.**
- **SDR26 material is to be used as a minimum on all U-M projects.**

**DIVISION 33 SANITARY SEWER UTILITIES**

**SECTION 333100 - SANITARY SEWER**

Revise this Section by deleting and inserting text to meet Project-specific requirements.

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

A. This section includes the furnishing and installation of exterior sanitary sewer system. If there is a facility service lead, this exterior sanitary sewer specification for the service lead is applicable starting at five feet outside the building. There should be a cleanout 5’ outside the building either on the mechanical plans or on the civil plans and is the transition point from building plumbing to site civil sanitary.

B. Section Includes: Update/add items to this specification to be project specific.

1. Pipe and fittings.
2. Cleanouts.
3. Manholes.

**1.3 DEFINITIONS**

Retain definition(s) remaining after this Section has been edited.

A. FRP: Fiberglass-reinforced plastic.

B. PVC: Polyvinyl chloride

C. ACI: American Concrete Institute

D. ASTM: American Society for Testing and Materials

E. AWWA: American Water Works Association

F. AASHTO: American Association of State and Highway Transportation Officials

G. SDR: Standard Dimension Ratio

**1.4 ACTION SUBMITTALS**

A. Product Data: For each type of product indicated.

B. Shop Drawings: For manholes and castings. Include plans, elevations, sections, details, and frames and covers.

C. Manufacturer Certification: All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading. Coordinate unloading with Inspector.

D. Cut sheets for Contractor layout and staking locations.

E. Mandrel details and certification.

**1.5 INFORMATIONAL SUBMITTALS**

A. Field quality-control reports regarding elevation of pipe.

B. Testing reports, passed tests upon completion of testing.

**1.6 DELIVERY, STORAGE, AND HANDLING**

Retain first paragraph below for PVC,SDR piping.

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes according to manufacturer's written rigging instructions.

**1.7 PROJECT CONDITIONS**

Retain A. below if interruption of existing sanitary sewerage service is required.

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than five working days in advance of proposed interruption of service. Coordination of a building system shutdown requires a minimum of 10 working days.

2. Do not proceed with interruption of service without Owner's written permission.

B. Product Inspection: All materials furnished shall be subject to inspection on arrival at the job site by the Owner. The purpose of the inspection shall be to cull and reject products that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these specifications. Materials shall be subject to rejection on account of any of the following:

1. Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.

2. Fractures or cracks passing through the barrel or socket.

3. Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than ¼ of the thickness of the wall.

4. Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inches above the surrounding surface of the pipe.

5. Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.

C. Rejected materials shall be clearly marked by the Inspector and immediately removed from the site of work by the Contractor, without cost to the Owner.

**PART 2 - PRODUCTS**

If using more than one type of material and joining method, identify various materials on Drawings and show points of transition from one material to another.

**2.1 PVC PIPE AND FITTINGS**

A. PVC Gravity Sewer Piping:

1. Pipe: ASTM D 3034-83, SDR 26 wall thickness, PVC gravity sewer pipe with integral bell-and-spigot ends and with integral ASTM D 3212-81, elastomeric seals for gasketed joints.

a. Lubricant used shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer's requirements.

b. The following information shall be clearly marked on each length of pipe:

1) Manufacturer's name or trademark.
2) Nominal pipe size.
3) The PVC cell classification.
4) The legend.
5) The designation "Specification D 3034".

2. Fittings: ASTM D 3034-83, SDR 26 wall thickness, PVC gravity sewer pipe with integral bell-and-spigot ends and with integral ASTM D 3212-81, elastomeric seals for gasketed joints.

a. Lubricant used shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer's requirements.

b. The following information shall be clearly marked on each fitting

1) Manufacturer's name or trademark.
2) Nominal size.
3) The material designation "PVC".

4) “PSM”.
5) The designation “Specification D 3034”.

B. PVC Gravity Sewer Service Leads, Risers and Fittings:

1. Pipe: ASTM D 3034, SDR 26 PVC pipe with bell-and-spigot ends for gasketed joints.
   a. Lubricant used shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer’s requirements.
   b. The following information shall be clearly marked on each length of pipe:
      1) The pipe designation and class.
      2) The name or trademark of the manufacturer.
      3) Identification of the manufacturing plant.
      4) Testing lot number.

2. Fittings: ASTM D 3034-83, SDR 35 PVC pipe with bell ends.
   a. Lubricant used shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer’s requirements.

3. Gaskets: ASTM D 3212, elastomeric seals.

4. Adapters: For use when connecting pipe with pipe of other material or manufacturer. The nominal I.D. of adaptors shall be manufactured for that specific purpose and shall be the same size as the nominal diameter of pipe connected thereto.
   a. Adaptor shall be “CB” gasketed sewer saddle by Romac Industries, Inc. or Engineer approved equal.

**2.2 CLEANOUTS**

A. PVC Cleanouts:

1. Pipe: ASTM D 3034-83, SDR 26 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM D 3212-81, elastomeric seals for gasketed joints.
   a. Lubricant used shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer’s requirements.
   b. The following information shall be clearly marked on each length of pipe:
      1) Manufacturer’s name or trademark.
      2) Nominal pipe size.
      3) The PVC cell classification.
      4) The legend.
      5) The designation “Specification D 3034”.

2. Casting: Neenah R-7506-D, EJCO 1574 or Engineer approved equal.
   a. Casting shall be stamped with “Sanitary”

3. Fittings: ASTM D 3034-83, SDR 26 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM D 3212-81, elastomeric seals for gasketed joints.

   a. Lubricant used shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with manufacturer's requirements.

   b. The following information shall be clearly marked on each fitting

      1) Manufacturer's name or trademark.
      2) Nominal size.
      3) The material designation "PVC".
      4) "PSM".
      5) The designation "Specification D 3034".

**2.3 MANHOLES**

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 8-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type as indicated; with top of cone of size that matches grade rings.
7. Joint Gaskets: ASTM C 443, rubber O-ring gasket. Joints pointed with mortar after installation, both inside and outside of the manhole.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection. Neoprene rubber shall meet ASTM C 443 and have a minimum thickness of 3/8 inch. Pipe clamps shall be of corrosion-resistant steel. Pipe connectors shall be one of the following:
   a. Flexible neoprene rubber boot securely clamped into a core-drilled pipe port. Pipe ports shall be core-drilled at the point of manhole manufacture and shall be accurately located within ½ inch of proposed sewer centerline.
   b. Self-adjusting mechanical pipe to manhole seal providing resilient flexible and infiltration-proof joint.
   c. Flexible rubber wedge firmly secured against a rubber gasket cast into the manhole.
   d. Engineer approved equal.
9. Steps: ASTM C 478 injection molded copolymer, polypropylene, encapsulating a ½ inch grade 60 steel reinforcing bar with an impact resistance of 300 ft-lbs and a pull out force resistance of 1500 lbs; Cast or anchor steps into sidewalls at 15-inch intervals. Step depth shall a minimum of 6 inches.

10. Grade Rings: 2-inch Reinforced-concrete rings, 2-inch minimum and 6-inch maximum height, with diameter matching manhole frame and cover. Install all MH's with grade rings to accommodate future adjustment in elevation.
11. Flow Channel: Construct flow channel the full diameter of the incoming and outgoing pipe with class A concrete.
12. Aggregate Base: Structure shall be placed on a minimum of 4 inches of 21AA limestone bedding.
13. Ground water monitor: In areas where ground water is known to exist and sewer is to be air tested, the Contractor shall install a ½ inch diameter, 10-inch-long pipe nipple through the manhole wall above one of the sewer lines entering the manhole. The pipe nipple shall be capped for use in air testing.

B. Manhole Frames and Covers:

1. Description: East Jordan Company, 1040-WT heavy duty or Engineer approved equal. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 48, Class No. 30, gray iron unless otherwise indicated.

## 2.4 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318 and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: The following are the grades of concrete recognized for use with sanitary sewers:

1. Class A concrete.
    a. 564 lbs cement (6 sacks) per cubic yard of concrete.
    b. Minimum 28-day compressive strength of 3,500 psi, conforming to MDOT Sec 7.01, Grade 35P.
    c. Air content shall be between 5-7%
    d. Water-cement ratio may not exceed 0.45 for air entrained concrete and 0.50 for non-air entrained concrete.
2. Class X concrete.
    a. 282 lbs cement (3 sacks) per cubic yard of concrete.
    b. Minimum 28-day compressive strength of 1,000 psi.

C. Cement mortar shall consist of one-part Type II Portland cement, two parts fine aggregate, and sufficient water to produce a workable mix.

D. Steel Reinforcement

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

E. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 1 percent minimum through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 8 percent.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

### 3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, non-pressure, drainage piping according to the following:

Revise first subparagraphs below to suit Project.

1. Install piping pitched down in direction of flow, at the slope indicated on the drawings. Each pipe, as laid, shall be checked by the Contractor. A variation of ¼ inch from plan grade will be deemed sufficient reason to reject the work and require Contractor re-lay the pipe, at no cost to the Owner.

2. Install piping with 5-foot minimum cover or depth as indicated on the drawings.
3. Install ductile-iron, gravity sewer piping according to ASTM A 746.
4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Install force-main, pressure piping according to the following: Retain paragraph if force main work.

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
2. Install piping with 5-foot minimum cover or as indicated on the drawings.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.

G. Maintain dry trench during sewer and manhole construction by pumping, as necessary.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

**3.3 MANHOLE INSTALLATION**

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

Retain paragraph below only if specified in "Manholes" Article.

F. Install manhole-cover inserts in frame and immediately below cover.

G. Manholes shall be placed at every change in grade, direction and pipe size as well as at junctions of sewers.

H. All sewer connections, outside of sewer service leads, shall occur at a manhole.

**I.** Install outside drop manhole connections whenever a sewer enters a manhole at an invert elevation of more than 24 inches above the manhole invert elevation. Outside drop connections shall be sized at least one half the size of the incoming sewer or next larger size, but in no cases not less than 8 inches in diameter. The City of Ann Arbor does not permit inside drop connections.

J. Place cast-in-place concrete according to ACI 318.

## 3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth 3 inches above surrounding grade. If in pavement, set cleanout frames and covers at pavement elevation.

## 3.5 CONNECTIONS

A. Make connections to existing piping and underground manholes.

1. All connections, unless specifically noted otherwise, shall occur at a manhole. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

## 3.6 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to

withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches below final grade. Break the bottom of the manhole. Fill with class II sand up to roadway cross section or 4 inches where outside of pavement influence. Fill the remainder with the typical or required roadway section where in the roadway and with 4 inches of top soil and seed where outside of the pavement influence.

C. Backfill to grade according to Section 312000 "Earth Moving."

**3.7 IDENTIFICATION**

A. Comply with requirements in Section 31200 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.
3. All sanitary sewer shall be locatable. User tracer wire if

**3.8 FIELD QUALITY CONTROL**

A. All sanitary sewers, including leads, 36 inches and smaller shall be air tested by the Contractor, documented by the Contractor provided to the Owner, and witnessed by Owner’s representative. (Required by U-M) All sanitary sewers greater than 36 inches shall be infiltration or exfiltration tested by the Contractor, documented by the Contractor provided to Owner, and witnessed by authority having jurisdiction. The authority having jurisdiction will decide whether infiltration or exfiltration testing is performed based upon ground water conditions.

All sewers, except 4-inch and 6-inch leads, shall be television inspected by the Contractor. Television inspection shall follow current MDOT procedures. (Required by U-M)

All PVC sanitary sewer main shall be mandrel tested (Required by U-M).

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. Mandrel Test: Test sanitary sewerage according to the requirements of the following:

1. Mandrel shall be commercially produced, nine fin mandrel with the following labelled on the mandrel:
   a. Pipe diameter intended for.
   b. Percent deflection accounted for.
   c. ASTM or AASHTO standard stamp.
2. Mandrel test shall take place a minimum of 30 days after installation of the sewer.
3. Mandrel shall be pulled from manhole to manhole for each section of pipe installed.
   a. Passing freely through each section of pipe shall indicate a satisfactory result.
   b. Failure to freely pass through any section of pipe will require that section be exposed, examined and corrective actions taken, as necessary.
4. The mandrel shall meet the following schedule of sizing:

| Pipe I.D. | PVC Mandrel O.D. |
|---|---|
| 8″ | 7.28″ |
| 10″ | 9.08″ |
| 12″ | 10.79″ |
| 15″ | 13.20″ |
| 18″ | N/A |
| 24″ | N/A |

5. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Ground water level shall be determined by removing the cap from the previously installed pipe nipple, blowing air through the pipe into the ground, connecting a clear plastic tube to the pipe. The tube should be vertical and a measurement of the height in feet of water above the pipe centerline shall be taken. The height in feet shall be divided by 2.3I to establish the pressure (in psig) that will be considered to be the average ground water back pressure.

b. The following is the sequence and time requirements for air testing:

1) Each end of the pipe shall be plugged with pneumatic plugs capable of holding line pressure. There shall be three hose connections to the pneumatic plug with one being used for inflation, one used for continuously reading the air pressure in the line, and the third used for introducing low pressure air into the sealed line.

2) Low pressure will 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 above the pipe. At least two minutes shall be allowed for the air pressure to stabilize. After the stabilization period, the pressurization hose shall be disconnected to prevent air from entering or escaping from the line. There shall be a pressure gauge for reading the internal pressure of the line being tested. The gauge shall be capable of showing pressure as low as 0 psig up to no greater than 20 psig. In the 0-10 psig range the gauge shall be both calibrated and accurate to one-tenth of one pound. The 0-10 psig portion of the gauge dial shall cover at least one-half of the complete dial range. This gauge shall have a tee fitting to allow simultaneous pressure reading by Owner gauge.

3) 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:

| Pipe (Inches) | PVC & DIP SEWERS | |
|---|---|---|
| | Holding Time (Seconds) | Minimum Holding Time (min:sec) |
| 4 | 0.380 x L | 3:46 |
| 6 | 0.854 x L | 5:40 |
| 8 | 1.520 x L | 7:34 |
| 10 | 2.374 x L | 9:26 |
| 12 | 3.418 x L | 11:20 |
| 15 | 5.342 x L | 14:10 |
| 18 | 7.692 x L | 17:00 |
| 21 | 10.470 x L | 19:50 |
| 24 | 13.674 x L | 22:40 |
| 30 | 21.366 x L | 28:20 |
| 36 | 30.768 x L | 34:00 |

6. Infiltration Test, if required: Contractor shall test infiltration in all sewers larger than 36 inch or as required by the Authority Having Jurisdiction.

a. Temporary weirs shall be placed, within manholes, at either ends of the sewer being tested. Test shall not exceed 1,200 feet.

1) Allowable infiltration shall not be more than 200 gallons per inch of pipe diameter per mile of sewer per 24 hours, including manholes.
2) If allowable limit of infiltration is exceeded on any test section, the Contractor shall reconstruct or repair the defective portion of the sewer and re-test.

3) Visible leaks shall be repaired regardless the results of the infiltration test.

7. Exfiltration Test, if required: Contractor test either exfiltration or infiltration in all sewers larger than 36 inches or as required by the Authority having jurisdiction.

a. Standpipe method will be used from manhole to manhole for each length of pipe.
1) Hydrostatic head of 10 feet to the sewer's average centerline elevation will be required with adjustments for external submergence due to water in the trench.
2) Owner will establish time durations and procedures for each test.
3) Maximum allowable exfiltration rate will be 200 gallons per inch of pipe diameter per mile of sewer per 24 hours including manholes.

4) Contractor shall pump all water out of the downstream manhole to a storm sewer at the completion of the test.

8. Television Inspection: Contractor shall perform a preliminary television inspection prior to acceptance of sewers and prior to any building connection being made.

a. All sewer lines shall be thoroughly cleaned prior to television inspection.
b. Inverts of sewer shall be wetted by pouring clean water in the upstream manhole until it appears in the downstream manhole.
c. The camera shall be connected to a video monitor and recorder.
d. The camera shall pass from manhole to manhole of each pipe section installed.
e. Television inspection deemed satisfactory if no visible defects, including but not limited to, dips or low spots, high spots, errors in horizontal or vertical alignment, joint offsets, leaks, cracks, or debris are present.

C. Any defects in the sewer shall constitute repairs be made.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**3.9 CLEANING**

A. Clean dirt and superfluous material from interior of piping.

**END OF SECTION 221313**