

**DIVISION 33 – UTILITIES  
SECTION 33 05 13 – MANHOLES AND PRECAST STRUCTURES**

**PART 1 – GENERAL**

1.01 INTRODUCTION

- A. Manholes shall be constructed at the points showed on the approved final plans or at such points as may be specified by the Engineer. Manholes shall be constructed promptly as the sections of the sewer between them are completed, and unless this is done, the Authority shall have the right to stop trenching and pipe laying until manhole construction is brought up properly. Manholes which admit water after completion must be repaired to the satisfaction of the Engineer and at such time as they may specify. Existing manholes which are to be modified (raised, lowered, connected to, etc.) must pass a manhole vacuum test in accordance with these specifications after construction is complete.

1.02 SECTION INCLUDES

- A. Sanitary sewer manholes and related appurtenances.

1.03 RELATED SECTIONS

- A. Section 09 97 23 – Concrete and Masonry Coatings.

1.04 REFERENCES

- A. American Society for Testing and Materials.
  - 1. ASTM A48, Gray Iron Castings.
  - 2. ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.
  - 3. ASTM A307, Carbon Steel Externally Threaded Standard Fasteners.
  - 4. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - 5. ASTM C270, Mortar for Unit Masonry.
  - 6. ASTM C361, Reinforced Concrete Low-Head Pressure Pipe.
  - 7. ASTM C443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
  - 8. ASTM C478, Precast Reinforced Concrete Manhole Sections.
  - 9. ASTM C923, Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
  - 10. ASTM D2146, Polypropylene Plastic Molding and Extrusion Materials.

- 11. ASTM D2240, Rubber Property-Durometer Hardness.
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.
- C. American Water Works Association:
  - 1. AWWA C 302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.
- D. Federal Specifications:
  - 1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

#### 1.05 SUBMITTALS

- A. Shop Drawings and Product Data:
  - 1. Submit under provisions of Section 01 30 00.
  - 2. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.
  - 3. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.
- B. Certificates:
  - 1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
  - 2. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products as specified in source quality control.
  - 3. Manufacturer's certification of materials for frame and cover Type 316 stainless steel hold-down bolts and washers.

#### 1.06 QUALITY ASSURANCE

- A. Initial Manhole: Construct first manhole in the Project to demonstrate the following, and serve as the minimum acceptable conditions of construction throughout the Project. No additional compensation allowed for initial manhole requirement.
  - 1. Demonstrate manhole base construction methods.
  - 2. Demonstrate manhole component sealing in the case of precast reinforced concrete manholes.

3. Demonstrate manhole step alignment.
  4. Demonstrate pipe opening sealing.
  5. Demonstrate method of adjustment of manhole frame and cover to grade and manhole frame and cover attachment.
  6. Demonstrate successful manhole acceptance test.
- B. Shop Inspection:
1. All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
- C. Field Inspection:
1. All materials furnished shall be tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Engineer.
- D. Source Quality Control:
1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete manholes.
  2. Obtain certificate of construction compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer.
  3. Obtain sworn certification from manufacturer that manholes were constructed using Type II Portland cement.
  4. Obtain certificate of material compliance with ASTM A48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings.
  5. Obtain certification from manufacturer that manhole frame and cover meets or exceeds AASHTO HS-20 highway loading requirements.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Transport and handle precast reinforced concrete manhole components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects. Through-wall lifting holes and cast-in lifting cables not permitted in manhole component construction.

- B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified Products as recommended by the respective manufacturers.

1.08 PROJECT CONDITIONS

- A. Environmental Requirements:
  - 1. In no instance set or construct manhole bases on subgrade containing frost.
  - 2. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70 degrees F or artificially warm compound in a manner satisfactory to the Engineer.

**PART 2 – PRODUCTS**

2.01 BASIC MATERIALS

- A. Concrete Products: Type II Portland cement shall be used.
- B. Waterproofed Mortar:
  - 1. Manufacturers:
    - a. Medusa Cement Company; Medusa Waterproofing Paste or Powder.
    - b. Grace Construction Materials; Hydratite.
    - c. Chem-Master Corporation; Hydrolox.
    - d. Or approved equal.
  - 2. Material composition meeting ASTM C270, Type M with waterproofing admixture included.
- C. Epoxy Bonding Compound:
  - 1. Manufacturers:
    - a. A. C. Horn EPOXTITE BINDER.
    - b. Sika Chemical SIKADUR-HI-MOD.
    - c. Or approved equal.

- D. Manhole Steps: Design as indicated on Drawings.
1. Reinforced Plastic Step: Composed of a 1/2-inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, Type II; M. A. Industries, Inc., Type PS2-PF or PS2-PFS; or equal.
  2. Manhole step dimensions shall meet requirements of OSHA standard 1910.27 for fixed ladders.
- E. Manhole Frame and Cover:
1. Manufacturers:
    - a. Neenah Foundry Company.
    - b. East Jordan Iron Works.
    - c. Bridgestate Foundry Corporation.
    - d. Or equal.
  2. General: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects.
    - a. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic.
    - b. Identification: Cast the letters "SANITARY SEWER" integrally in center of cover in raised letters.
    - c. Frame Hold-down Bolts: Type 316 stainless steel bolts and washers.
    - d. Cover Gasket: One piece gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.
      - 1) Gasket material of neoprene composition having good abrasion resistance, low compression set, Type D 40 durometer hardness determined in accordance with ASTM D 2240 and suited for use in sanitary sewer manholes.
      - 2) Gluing of gasket is not permitted.
  3. Watertight Manhole Frame and Cover: Conforming to the above specified General Requirements with the addition of cover hold-down bolts.
    - a. Cover Hold-down bolts: Type 316 stainless steel bolts and washers.

- F.     Preformed Plastic Sealing Compound:
1.     Manufactures:
    - a.     K. T. Snyder Company, Inc.; RAM-NEK.
    - b.     K. T. Snyder Company, Inc.; RUB'R-NEK.
    - c.     Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
    - d.     Or approved equal.
  2.     Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
- G.     Heat-Shrinkable Sleeves:
1.     Manufactures:
    - a.     CCI Pipeline Systems; WrapidSeal.
    - b.     Cretex Specialty Product; Cretex Wrap.
    - c.     Sealing Systems, Inc.; Infi-Shield Gator Wrap.
    - d.     Or approved equal.
  2.     General: All manhole joints shall be sealed with a minimum nine (9) inch wide exterior joint wrap meeting the Materials requirements of this specification and installed according to manufacturer's recommendations.
    - a.     Material: The external joint seal shall meet or exceed the requirements of ASTM C-877, type II. Joint seal shall be Irradiated and cross-linked polyethylene impermeable backing, coated with protective heat-activated adhesive.
    - b.     Bonding: Bond to primed concrete, metal, and fiberglass surfaces.
    - c.     Compatibility: Compatible with concrete, steel, iron, and fiberglass.
    - d.     Closure: Separate closure seal to secure sleeve in place during installation and seal overlap area.
  3.     Functional Performance:
    - a.     Peel Strength, ASTM D 1000: 8.6 pli (15 N/cm).
    - b.     Lap Shear, ASTM D 1002: 1.5 psi (1.0 N/cm<sup>2</sup>).

- c. Water Absorption, ASTM D 570: 0.05% maximum.
    - d. Low Temperature Flexibility, ASTM D 2671: -40°F.
  - 4. Physical Properties:
    - a. System Type: High shrink.
    - b. Supplied Thickness: 101 mils (2.5 mm).
    - c. Fully Recovered Thickness: 125 mils (3.2 mm).
    - d. Shrink Factor: 40%, minimum.
  - 5. Sleeve Adhesive:
    - a. Softening Point, ASTM E 28: 212°F
  - 6. Sleeve Backing:
    - a. Tensile Strength, ASTM D 638: 2900 psi (20 MPa).
    - b. Elongation, ASTM D 638: 600%
    - c. Hardness, ASTM D 2240, Shore D: 46.
    - d. Abrasive Resistance, ASTM D 1044: 35 mg.
  - 7. Primer:
    - a. Use: Primes concrete surfaces of manhole structures
    - b. Thickness: 3 to 4 mils
    - c. Minimum Curing Temperature: 10°F
- H. Rubber Compression Gasket: Composition conforming to ASTM C 361 or ASTM C 443.
- I. Manhole Adapters: Provide manhole adapters for use on pipe entering manhole base where manhole base is of cast-in-place construction.
  - 1. Gasket type waterstop composed of elastomeric polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter. (CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland).
- J. Manhole Infiltration Dish Insert: Manufactured of high density polyethylene material.

2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A. Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:
1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II sulfate resistant Portland cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
  2. Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C302.
  3. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Drawings. Materials as previously specified.
  4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing preformed plastic sealing compound.
    - a. Rubber Compression Gasket: Composition conforming to ASTM C 361 or ASTM C 443.
    - b. Preformed Plastic Sealing Compound: As previously specified.
- B. Precast Bases and Riser Sections: Design, materials and construction as specified previously.
- C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
1. Resilient Gasket Type Pipe Opening Seals:
    - a. Manufacturers:
      - 1) A Lok Products Corporation; A LOK Manhole Pipe Seal.
      - 2) Dual Seal Gaskets Inc.; DUAL SEAL II.
      - 3) Or approved equal.
    - b. Cast integrally with manhole component conforming to requirements specified in ASTM C 923.
  2. Expandable Sleeve Type: ASTM C923, consisting of a power sleeve, gasket and two (2) take up clamps. Power sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Install at precast plant. Provide seal equivalent to Press Seal Gasket Corp. PSX Positive Seal Gasketing System.
    - a. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.



- b. Gasket: Compound Polyisoprene suitable for use with raw sewage.
  - c. Take Up Clamps: Type 304 stainless steel with stainless steel screw.
- D. Precast Top Sections: Designs as required by Drawings, of materials and construction as specified previously except additional and differing requirements as follows:
- 1. Hold-Down Bolt Inserts: Factory cast in top section no less than two 3/4-inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3-inches depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.
  - 2. Flat Slab Tops: Thickness versus diameter as indicated on Drawings. Tops factory formed to properly accept and support required manhole frame and cover Highway Loading Class HS-20 and formed to join riser section in a matching joint.
  - 3. Eccentric Cone Tops: Manufactured to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.
- E. Coatings:
- 1. Exterior
    - a. Manufacturers
      - 1) Koppers 300 M Epoxy.
      - 2) Pennsbury 32-B-4 Epoxy.
    - b. Apply two (2) coats to outer surface of entire manhole to waterproof manhole. Thickness shall be a minimum of 21 mils.
  - 2. Interior
    - a. Provide interior coating for all force main discharge manholes or where required by Engineer/Authority.
    - b. Refer to Section 09 97 23 – Concrete and Masonry Coatings for specifications pertaining to manhole/precast structures to receive special coatings.
- F. Precast Grade Rings (Inside Roadways):
- 1. Precast Concrete: Leveling and adjusting units of a minimum 2-inch thickness of materials and constructions as specified previously. Factory cast grade rings with hold down bolt holes matching location of same in manhole frame. Design must provide for full bearing of manhole frame.

G. Rubber Grade Rings (Outside Roadways):

1. Multipurpose Rubber Adjustment Riser:

a. East Jordan Iron Works – INFRA-RISER, or equal.

2. The rubber spacers shall be manufactured as compressed molded composites of recycled rubber, nylon fiber and polyurethane pre-polymer, with the finished product having the following physical properties, as referenced by ASTM designations:

a.	Density	1.098 g/cm <sup>3</sup>	ASTM C 642-90
b.	Durometer Hardness	75 A $\nabla$ 7 pts.	ASTM F 2240
c.	Tensile Strength	1.6 Mpa (232 psi)	ASTM D 412-87
d.	Compression Deformation	under 1 Mpa (145 psi)	ASTM D 575
e.	Compression Set	0.4% or more than 4%	ASTM D 395

4. Adhesive/sealant between the casting and the top concrete section for use with Multipurpose Rubber Adjustment Riser shall be urethane based, conforming to ASTM C920-87, Type S, Grade NS, Class 25, Use NT, M, and A. Sealant shall be Chemrex CX-22, as packaged by GNR Technologies.

H. Drop Type Manholes:

1. A drop pipe shall be provided for the sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in the elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be filleted to prevent solids deposition.

2. Drop manholes shall be constructed as an exterior drop connection unless otherwise approved by the Authority. Refer to Standard Details.

a. Exterior Drop Manhole:

- 1) Drop Pipe and Fittings: Drop pipe and fittings shall be SDR 35 PVC meeting requirements of Section 33 31 00. Drop pipe and fittings size shall be determined by incoming pipe size.
- 2) Due to unequal earth pressure that would result from the backfilling operation in the vicinity of the manhole and to support the drop pipe, the entire outside drop connection shall be encased in concrete as shown in enclosed detail.

- b. Interior Drop Manholes:
  - 1. Drop Pipe and Fittings: Drop pipe and fittings shall be SDR 35 PVC meeting requirements of Section 33 31 00. Drop pipe and fittings size shall be determined by incoming pipe size.
  - 2. Flexible Pipe Coupling: Flexible Pipe Coupling shall be constructed of an elastomeric compound meeting the requirements of ASTM C1173 and D5926. Coupling shall be provided with two (2) stainless steel take up clamps. Flexible pipe coupling shall be as manufactured by Fernco, Inc., or equal.
  - 3. Clamping Brackets: Clamping brackets shall be 11 gauge 304 stainless steel. Clamping bracket size shall be determined by drop pipe size. Clamping brackets shall be Reliner as provided by Duran, Inc., or equal.
  - 4. Fasteners: Fasteners shall be stainless steel.

### **PART 3 – EXECUTION**

#### **3.01 EXAMINATION**

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by the Engineer.
- B. All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed from the site.

#### **3.02 PREPARATION**

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork as previously specified in Section 31 23 33 – Trenching and Backfilling for Utilities.

#### **3.03 MANHOLE INSTALLATION**

- A. Precast Concrete Bases: Install bases on an 8-inch deep compacted layer of 2A coarse aggregate.
  - 1. When using prefabricated pipe opening seals (i.e., A-LOK, RES-SEAL, PRES-WEDGE II, etc.) for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed plastic sealing compound (with non-shrinking grout).

- a. Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.
  - b. Following sealing compound (non-shrinking grout) installation, trowel compound surface smooth and flush with interior face of manhole.
  
- B. Length of Pipe Connections into Manholes:
  - 1. Use pipes no longer than 5-feet in length when connecting into manholes through resilient gasket type pipe opening seals (i.e., A-LOK, RES-SEAL, PRES-WEDGE II, etc.).
  - 2. For all other pipe connections into manholes, use pipes of such length that a pipe joint is provided at the outside edge of manhole base or wall as applicable. Also use pipes no longer than 6 feet in length for first pipe joined thereto.
  
- C. Concrete Channel Fill: Field pour concrete channel fill for each manhole base.
  - 1. Form inverts directly in concrete channel fill, with a minimum of 0.10 feet of fall from influent pipe to effluent pipe.
  - 2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
  - 3. Make changes in size and grade gradually.
  - 4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
  - 5. Make slopes gradual outside the invert channels.
  - 6. Use 3000 psi Type II concrete unless indicated otherwise on Drawings.
  
- D. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.
  - 1. Install sealing compound (i.e. RAM-NEK or approved equal) in accordance with manufacturer's recommendations, and join sections also in accordance with written instructions of manhole component manufacturer.
    - a. Clean joint surfaces as required by manufacturer.
    - b. If sealing compound is installed in advance of section joining leave exposed half of two piece protective wrapper in place until just prior to section joining.
    - c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.

- d. To improve workability of "Preformed Plastic Sealing Compound" during cold weather, store such at temperatures above 70 Deg F or artificially warm compound in a manner satisfactory to the Engineer.
  - e. During warm weather stiffen "Preformed Plastic Sealing Compound" by placing under cold water or by other means as recommended by the compound manufacturer.
  - f. Following manhole section installation, trim sealing compound with interior face of manhole.
  - g. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
  - h. Remove all interior excessive plastic sealing compound after all manhole sections have been set.
2. Install heat-shrinkable sleeve (i.e. WrapidSeal or approved equal) in accordance with manufacturer's recommendations.
- a. Ensure surfaces are clean, dry, and free of frost, surface rust, foreign objects, sharp edges, and projections that could damage manhole encapsulation system.
  - b. Allow sleeve to cool before backfilling manhole.
  - c. Prevent damage to sleeve by backfilling manhole as previously specified in Section 31 23 33.
- E. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and air tight. Sealing of lifting recesses with grout is not permitted.
- F. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using grade rings. Frame and Covers installed within paved areas shall be set at 1/4" below final pavement elevation. Frame and Covers installed in all other areas shall be set a minimum of 12" above the final grade elevation.
1. Precast Concrete Grade Ring:
- a. Non-shrink Grout: Wet, but do not saturate precast grade rings immediately before laying. Pre-set grade rings to proper plane and elevation using wedges or blocks of cementitious material not exceeding one square inch wide on all sides. No more than four wedges or blocks per grade ring permitted. Incorporate wedges or blocks in fresh grout only in a manner to completely encase each. Non-shrink grout thickness not to exceed 3/4" maximum and 3/8" minimum. Crown fresh grout to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact grout edge into joints. Clean off excess grout prior to initial grout set.

- b.      **Preformed Plastic Sealing Compound:** Two continuous rings along the inner and outer diameter of grade ring.
  - 2.      **Rubber Grade Ring:** Install rubber grade rings in accordance with the manufacturer's written instructions using continuous beads of polyurethane base sealant on the concrete manhole surface, between each grade rings, and between the last grade ring and the manhole cover frame casting. Perform the manhole cover frame bolt-down operation following the grade ring installation.
  - 3.      **Frame and Coverage Anchorage:** Bolt manhole frames in place on manhole top section after installing sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place. Use ¾" stainless steel bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten stainless steel nut and washer. Tighten manhole frame bolts after grout has cured.
- G.      **Drop Manholes:** Construct in accordance with Type indicated on Drawings. Use same type pipe and fittings in drop connection as used in sewer line from which drop connection is made.
- H.      **Lined or Interior Coated Manholes:** Install lined or interior coated manholes where force mains or low pressure sewer mains discharge into, as well as, the two immediate manholes downstream of the discharge manhole, or where required by the Engineer/Authority.
- I.      **Future Connection Requirements:** Make provisions for future connections to manholes by installing a five foot length of pipe out of the manhole with a pipe bell on the upstream end of the pipe.
- 1.      **Plug the bell end of the pipe opening using a properly designed pipe.**
- J.      **Connections to Existing Manholes:** Cut required opening by core boring; prevent cracking and spalling. Coring through manhole joints will not be permitted. Make openings of sufficient size to accommodate pipe with expandable sleeve manhole adapter. Make connection watertight. Form a new flow channel in the existing manhole base to properly conduct all flows through the existing manhole. Do not permit ground water, surface water or debris to enter the existing facilities. Maintain all existing flow during construction.
- K.      **Connections to Existing Sewers:** Where new manholes are constructed on existing sewers, the Contractor shall have the option to use cast-in-place manhole bases or precast bases, both as specified previously.
- 1.      **Replace existing sewer pipe to first joint outside the manhole base with new sewer pipe in accordance with Section 33 31 00.**

2. Replace broken or damaged pipe resulting from this work. Use solid sleeve pipe couplings (i.e. OMNI 441 Transition Coupling or approved equal).
  3. Maintain flow in existing sewer both during construction operations and until concrete is cured both in the case of cast-in-place work and formed inverts.
  4. Cut with a saw piping to be removed. Chipping or breaking pipe with a hammer shall not be permitted.
- L. Control Manholes: Provide a control manhole on each non-residential sanitary sewer lateral in lieu of the sanitary sewer clean out to facilitate observations, sampling, and measurement of the wastewater. The Developer/Property Owner may request in writing to the Authority that the installation of the control manhole be waived where the nature or volume of flow does not warrant such monitoring. The Authority in consultation with their Engineer and the Municipality shall have sole judgment of this request.

#### 3.04 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed in the Project as specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the test will be visual.
1. Conduct tests in presence of and to complete satisfaction of the Engineer.
  2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
  3. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
  4. Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of the Engineer. Seal openings using properly sized plugs.
  5. Perform testing with frames installed. The joint between the manhole and the manhole frame shall be included in the test.
  6. The tests of the manholes for acceptance shall be conducted after the backfilling has been completed.
- B. Vacuum Testing
1. Vacuum Testing Equipment:
    - a. Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.
    - b. Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.

- c. Vacuum testing equipment and associated testing apparatus subject to Engineer's approval.
  - d. Provide seal plate with vacuum piping connections for inserting in manhole frame.
2. Vacuum Test Procedure:
- a. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
  - b. Draw a vacuum of ten inches of mercury and close the valves.
  - c. Consider manhole acceptable when vacuum does not drop below nine inches of mercury for the following manhole sizes and times.
    - 1) Four foot diameter – 60 seconds.
    - 2) Five foot diameter – 75 seconds.
    - 3) Six foot diameter – 90 seconds.
- C. Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits.
- 1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
  - 2. Materials and methods used to make manhole repairs must meet with Engineer's approval prior to use.
  - 3. Make all repairs, replacements and retests required.

### 3.05 TEMPORARY PAVING

- A. Where a manhole has been constructed within a street right-of-way where final paving has not been completed, a temporary crown shall be formed around the manhole frame and cover using an HMA Wearing Course with a 9.5 mm mixture and appropriate ESALS and SRL ratings in a manner that will allow a snow plow to operate normally without damaging the manhole or the plow.

**END OF SECTION**