

SECTION 33 05 13

MANHOLES, CLEANOUTS, AND CONCRETE STRUCTURES

SUMMARY OF CHANGE(S):

Rev	Date	Package	DESCRIPTION / JUSTIFICATION	AUTHOR
0	29 May 2025	SP-01 IFC	Initial Issue	C. Hardesty

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes manholes and cleanouts.
- B. Related Sections:
 - 1. Section 31 00 00 – Earthwork
 - 2. Section 33 31 01 – Sanitary Sewage
 - 3. Section 33 41 00 – Storm Drainage
- C. CAUTION: Use of this Section without including the above-listed items results in omission of basic requirements.
- D. In the event of conflict regarding Manholes, Cleanouts, and Concrete Structures requirements between this Section and another section, the provisions of this Section govern.

1.2 REFERENCES

- A. In addition to compliance with industry standards and Owner requirements, ensure that the following government acts and regulations (as applicable for any equipment or material) are complied with in design, fabrication, testing and shipment of equipment and materials.
- B. Meet or exceed the requirements of the latest edition of the following codes, regulations and standards.
- C. American Concrete Institute (ACI):
 - 1. ACI 318 - Building Code Requirements for Structural Concrete.
- D. American Society for Testing and Materials (ASTM):
 - 1. ASTM A48/A48M – Standard Specification for Gray Iron Castings.
 - 2. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A536 – Standard Specification for Ductile Iron Castings.
 4. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
 5. ASTM C387/C387M – Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
 6. ASTM C443/443M – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 7. ASTM C478/478M – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
 8. ASTM C497/497M – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
 9. ASTM A615/615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 10. ASTM C891 – Standard Practice for Installation of Underground Precast Concrete Utility Structures.
 11. ASTM C923/C923M – Standard Specification for Resilient Connectors Between Reinforced Concrete Manholes Structures, Pipes, and Laterals.
 12. ASTM C990/990M – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 13. ASTM C1244/C1244M – Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
 14. ASTM D3034 – Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 15. ASTM D3753 – Standard Specification for Glass Fiber (Glass-Fiber-Reinforced Thermosetting-Resin) Manholes and Wetwells.
 16. ASTM D4101 – Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials.
- E. American Water Works Association (AWWA):
1. AWWA C104 / ANSI A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 2. AWWA C110 / ANSI A21.10 – Ductile-Iron and Gray-Iron Fittings.
- F. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M 199 – Standard Specification for Precast Reinforced Concrete
- G. Occupational Health and Safety Administration
1. 1910.27 Scaffolds and Rope Descent Systems
- H. New York State Department of Transportation Standard Specifications

1.3 DESIGN REQUIREMENTS

- A. Precast Manhole Sections: Conforming to requirements specified in ASTM C478/C478M.
- B. Manhole Steps: Capable of withstanding vertical and horizontal load test specified in ASTM C497/497M.

1.4 SUBMITTALS

- A. Refer to Submittal Schedule at end of Part 3 for a list of submittal requirements for this Section.

PART 2 PRODUCTS

2.1 PRECAST UNITS

- A. Precast Manhole Sections: Conform to ASTM C478/C478M.
 - 1. Grade Ring: Maximum 6 inches high. Same quality as riser.
 - 2. Risers:
 - a. Minimum Diameter: 48 inches minimum, increase diameter to suit incoming pipe diameter and orientation.
 - b. Minimum Wall Thickness: 6 inches or 1/12 times inside diameter, whichever is greater.
 - 3. Cones: Eccentric with same wall thickness and reinforcement as riser section.
 - 4. Flat Slab Tops: Concentric with either 24 inch or 35 inch opening, as indicated.
 - 5. Base Bottoms: 8-inch minimum thickness.
 - 6. Joints: Confined O-ring with rubber gaskets meeting ASTM C443 or Preformed Flexible Plastic Gasket, ASTM C990.
 - 7. Resilient Connector Boots: ASTM C923/C923M.
 - 8. Manhole Steps: Conform to ASTM C478/C478M. Attachment provisions for steps are cast in sections provided by manufacturer.
 - 9. Lift Holes: Lifting holes cannot penetrate manhole wall.
 - 10. Cement Type: Provide Type III cement.
 - 11. Precast Invert: Precast inverts from the manhole manufacturer are acceptable.
- B. Precast Base Extension Sections (ASTM C478/C478M):
 - 1. Base Slab with Extension:
 - a. Integral with monolithic sidewall.
 - b. Minimum 6 inches thick and 6-inch minimum sidewall extension.
 - c. Cast with holes to receive pipe as indicated.

2.2 DROP ASSEMBLIES

- A. Exterior:
 - 1. Piping Tees, Ells, Wye, and Drop: As indicated in Section 33 31 01 or 33 41 00.
 - 2. Connection to Entering Pipe:
 - a. Pipe: As indicated in Section 33 31 01 or Section 33 41 00.
 - b. Connection Coupling Between Dissimilar Pipe: Mechanical clamp ring type, stainless steel expanding, and contracting sleeve with neoprene rubber gasket for positive seal.
 - 3. Concrete Encasement: 3,000 psi concrete at 28 days, 6-inch-thick minimum, surrounding tees, ells, wye, and vertical piping.
- B. Interior:
 - 1. Piping Bend and Drop: As indicated in Section 33 31 01 or 33 41 00.

2. Attachment: Use 1/2 inch stainless steel all threaded rod and anchor to wall. Secure pipe with 1/4 inch by 1-1/2 inch stainless steel flat bars bent to match pipe diameter. Use all stainless steel Type 316 hardware.

2.3 PIPE STUBOUTS FOR FUTURE] SERVICE CONNECTIONS

- A. Minimum Length: Extend from manhole 18 inches for small service connections and 48 inches of pipes large than 6 inches.
- B. Pipe: As indicated in Section 33 31 01 or 33 41 00. Where there are two different classes of pipe at a manhole, higher-strength pipe will govern.
- C. Plug: Match pipe material, rubber-gasketed, watertight, and removable. Choose plug to pass all hydrostatic or air tests.

2.4 PVC PIPE TO MANHOLE ADAPTOR

- A. Suitable for connecting and sealing PVC pipe to manhole.
- B. As recommended by manufacturer of PVC pipe.

2.5 MANHOLE STEPS

- A. Material: ASTM D4101, Copolymer Polypropylene Plastic with Grade 60 Steel Reinforcement.
- B. Standards: OSHA CFR 1910.27, ASTM C478/C478M, AASHTO M-199.

2.6 MANHOLE FRAMES AND COVERS

- A. Castings:
 1. Manhole Frames and Covers: ASTM A48/A48M, Class 35B, heavy duty, gray iron, sound, smooth, clean, designed to withstand 16,000 pound wheel load plus impact.
 2. Venting: Vented.
 3. Produced: Manufactured from materials produced in United States.
 4. Defects: Free from blisters, blowholes, shrinkage cracks, cold shuts, and defects.
 5. Bearing Surface: Machine or grind bearing surfaces to ensure flat, true surfaces that will not rattle when driven across.
 6. Identification: Provide label indicating “Sanitary Sewer”, “Industrial Sewer” or “Storm Sewer”, as applicable, in 2-inch raised letters.

2.7 CLEANOUT FRAMES AND COVERS

- A. Cleanout Castings:
 1. Frame and Cover: ASTM A48/A48M, Class 35B, extra heavy duty, gray iron, sound, smooth, clean.
 2. Produced: Manufactured from materials produced in United States.
 3. Defects: Free from blisters, blowholes, shrinkage cracks, cold shuts, and defects.

4. Bearing Surface: Machine or grind bearing surfaces to ensure flat, true surfaces that will not rattle when driven across.

B. Pipe Materials:

1. Same as mainline piping. Use ductile iron for depths greater than 10 feet.

2.8 MORTAR:

- A. Standard premixed meeting ASTM C387/C387M or proportion one part Portland cement to two parts clean, well-graded sand or fine aggregate per ASTM C33/C33M.

- B. Admixtures - May be included, but do not exceed the following percentages of weight of cement:

1. Hydrated Lime: 10 percent.
2. Diatomaceous Earth or Other Inert Material: 5 percent.

- C. Consistency of mortar will readily adhere to concrete.

2.9 STEEL

- A. Conform to ASTM A615, Grade 60, deformed bars.

PART 3 EXECUTION

3.1 PREPARATORY WORK

A. Inspection:

1. Inspect materials prior to installation.
2. Do not install materials not conforming to this Section.
3. Remove or repair unacceptable materials regardless of being stockpiled or installed at no additional cost.
4. Design of shoring systems where space for proper layback of excavation is not available and design of strapping and support plans for existing utilities and structures exposed by the excavation is to be provided by the Contractor as part of "construction means and methods".

B. Notification:

1. Contact utility locator service at least 3 days prior to beginning excavation.
2. Coordinate with Owner to determine locations of private onsite existing utilities at least 7 days prior to beginning excavation.
3. Coordinate to determine and mark location of utilities within limits of Work in advance to allow for relocation or adjustment of utilities.

3.2 EXCAVATION AND BACKFILL

- A. Excavation: As specified in Section 31 00 00 – Earthwork.

- B. Dewatering: Remove water from excavation as specified in Section 31 00 00 – Earthwork.
- C. Inspection:
 - 1. Geotechnical Engineer shall approve subgrade prior to placement of backfill.
 - 2. If bottom of trench is unsuitable for supporting manhole, excavate as directed by Geotechnical Engineer.
 - 3. Backfill to required grade with material conforming to trench stabilization material specified in Section 31 00 00 – Earthwork.
- D. Backfill Around Manholes: As specified for trenches in Section 31 00 00 – Earthwork. Use highest class of trench backfill immediately adjacent as shown.

3.3 BASE ROCK

- A. Stone Base: Place a minimum of 6 inches of crushed stone or base rock and thoroughly compact with a mechanical vibrating or power tamper as specified.

3.4 CAST-IN-PLACE CONCRETE BASE

- A. Deposit sufficient mortar on base to ensure watertight seal between base and manhole wall or place first precast section of manhole in concrete base before concrete has set. Properly locate and plumb first section.
 - 1. General: Construct indicated.
 - 2. Forms: Construct forms to dimensions and elevations required. Provide tight and well-braced forms. Chamfer corners of forms. Prior to placing concrete, remove water and debris from forms. Moisten forms just prior to placing concrete. No standing water, ice, snow, mud, or other deleterious material in forms.
 - 3. Concrete: Handle concrete from transporting vehicle to forms without segregation or loss of ingredients. Immediately after placing, densify concrete with a mechanical vibrator. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.
 - 4. Finishing: Screed top surface of exposed slabs and walls. When initial water has been absorbed, float surfaces with a magnesium float and lightly trowel with a steel trowel to a smooth finish free from marks or irregularities. Finish exposed edges with a steel edging tool.
 - 5. Form Removal: Remove forms and patch any defects in concrete with mortar mixed in same proportions as original concrete mix.
 - 6. Curing: Cure concrete by preventing loss of moisture for a period of 7 days. Apply membrane-forming curing compound immediately after removal of forms or finishing of slabs. Protect concrete from damage during 7-day curing period.

3.5 PLACING PRECAST MANHOLE BASE

- A. General:
 - 1. Install underground precast concrete utility structures per ASTM C891.
 - 2. Examine manhole sections prior to installation.
 - 3. Grade bottom of excavation to provide a firm and level base for precast section.

4. Place wall sections accurately and with care using lubricated rubber gaskets and install in accordance with the manufacturer's recommendations.
5. Reconstruct joints having torn, displaced, or otherwise damaged gaskets or incorrectly installed.
6. Replace damaged gaskets.
7. Replace cracked, chipped or otherwise damaged precast sections, which will endanger watertightness or soundness of manholes or not meet specified requirements.

3.6 MANHOLE INVERT

A. Field Constructed Invert:

1. Construct as indicated with smooth transitions.
2. Form manhole invert and bench with grout, cement brick, and concrete as continuation of lower half of arc of sewers entering manhole.
3. Form inverts where more than one sewer enters manhole as smooth curves to their intersection at center of manhole and curve towards exit sewer. Smoothly form curves at intersections to avoid deposition of sewage solids.
4. Where a full section of pipe is laid through a manhole, break out top section and completely cover exposed edge of pipe with mortar. Trowel mortar surfaces smooth.
5. Slope surface of grout or concrete outside valley formed for passage of sewage at slope of 1:6 to manhole wall.
6. Free Flow: Remove sharp edges or rough sections that tend to obstruct flow. Invert flow path should be smooth and unobstructed.

B. Precast Invert:

1. Comply with manhole manufacturers requirements.

C. Cast In-Place Slide:

1. Where the invert of the incoming pipe is higher than the crown of the outgoing pipe, then a cast in place concrete invert slide is required. Use drop outside connections instead of slide where slide height exceeds 24 inches.
2. Cast in place slide to match requirements of invert section above.

3.7 PLACING PRECAST MANHOLE SECTIONS

A. Confined O-Ring Joints:

1. Carefully inspect precast manhole sections. Do not use sections with chips or cracks.
2. Place manhole in accordance with manufacturer's instructions.
3. Provide gasket lubricant in accordance with manufacturer's recommendation.

B. Preformed Flexible Plastic Gasket Joint:

1. Carefully inspect precast manhole sections. Do not use sections with chips or cracks.
2. Install in conformance with manufacturer's recommendation.
3. Use only pipe primer furnished by gasket manufacturer.

3.8 DROP ASSEMBLIES

- A. Piping:
 - 1. Construct drop assemblies as indicated.
 - 2. Extend pipe 3 feet to undisturbed earth and connected to sewer pipe with coupling.
 - 3. Support lower elbow by concrete poured monolithically with manhole base.
 - 4. Plug top entrance pipe with removable stopper or brick and mortar.
- B. Concrete Encasement:
 - 1. Verify piping is connected and fully supported.
 - 2. Pour 3000 psi concrete around the base elbow up to the top elevation of the mainline pipe. Provide a minimum of 6 inches of concrete encasement around piping.

3.9 RIGID CONNECTIONS

- A. Provide joints in clay pipe sewers not more than 1-1/2 feet from manhole walls. Lay pipes entering manholes on firmly compacted base rock.
- B. Where last joint of line laid up to manhole is more than 1-1/2 feet from manhole base, construct a 6-inch concrete encasement around entire pipe from manhole base to within 1-1/2 feet of pipe joint. Construct encasement monolithically with manhole base. Shorten pipes laid out of manhole to ensure that first joint is no more than 1-1/2 feet from manhole base.

3.10 PIPE STUBOUTS FOR SERVICE SEWER CONNECTIONS

- A. General:
 - 1. Provide stubouts with a watertight gasketed pipe plug suitably braced against internal and external pressures.
 - 2. Terminate sewers entering manhole at 2 maximum inches inside face of manhole wall and connect to manhole by flexible compression sleeve (rubber boot).
 - 3. Fill void between pipe and manhole wall with compression sleeve.
 - 4. Clamp securely around pipe forming watertight joint when subjected to vacuum test per ASTM C1244/C1244M. Perform testing prior to backfilling.
 - 5. Enclose connections to manholes with concrete. Grout joints inside and outside after passing vacuum test.
 - 6. Install semi-permanent plugs in end of stubouts with gasket joints similar to sewer pipe being used. Provide plugs capable of withstanding all internal or external pressures without leakage.
 - 7. Brace plugs to prevent blowoffs.
- B. Service Connections:
 - 1. Install service connection stubouts in manholes as indicated.
 - 2. Place service connection stubouts in manhole base and construct invert channels.
 - 3. Provide maximum length of 2 feet.
 - 4. Unless otherwise shown on Drawings, match elevation of crown of service connection pipe to elevation of crown of outlet pipe.

- C. Future Sewer Connections:
 - 1. Install stubouts from manholes for future sewer connections as indicated.
 - 2. Construct invert channels in accordance with details shown.

3.11 PERMANENT PLUGS

- A. Preparation: Clean interior contact surfaces of all pipes cut off or abandoned.
- B. Plug:
 - 1. Construct concrete plug in end of pipe 18 inches or less in diameter.
 - 2. Provide concrete plugs a minimum length of 8 inches. For pipe 21 inches and larger, plugs may be constructed of common brick or concrete block.
 - 3. Plaster exposed face of block or brick plugs with mortar.
 - 4. Provide watertight plugs capable of withstanding internal and external pressures without leakage.

3.12 TEMPORARY PLUGS

- A. Install 1/2-inch plywood temporary plugs in pipe stubouts as indicated. Backfill against plugs to provide temporary seal.

3.13 MANHOLE EXTENSIONS

- A. Grade Ring Adjustment:
 - 1. Install extensions to height not exceeding 12 inches with precast concrete grade rings. Make adjustment greater than 12 inches with precast concrete riser sections.
 - 2. Lay grade rings on top of preformed flexible plastic gasket joint material with sides plumb and tops level. Seal exterior joints with mortar. Provide watertight extensions.

3.14 MANHOLE FRAMES AND COVERS

- A. General:
 - 1. Install frames and covers on top of manholes to prevent infiltration of surface or groundwater.
 - 2. Set top elevation of frame and cover same as adjacent pavement when in paved areas, flush with ground surface in lawns, grass plots, and 18 inches minimum above ground in fields and wooded areas.
- B. Frame:
 - 1. Place manhole frame and cover, concentric with top opening unless indicated otherwise. Set frames in a bed of mortar with mortar carried over flange of ring.
 - 2. Set frames so tops of covers are flush with surface of adjoining pavement or ground surface unless otherwise indicated.
 - 3. Provide grout bed for frame, and secure in place by grouting around lower flange and sidewall of frame, extending to outside of precast top section.
- C. Cover:

1. Place layer of filter fabric (4-foot by 4-foot sheet) between frame and cover to prevent entrance of dirt and debris into manhole during construction.
2. Verify cover fits snugly within frame. Cover should not rattle when crossed by vehicles.

3.15 MANHOLES OVER EXISTING SEWERS

- A. Maintain flow through existing sewer lines or by diverting sewage flow.
- B. Construct manholes over existing operating sewer lines at locations shown as follows:
 1. Locate position of manhole.
 2. Perform necessary excavation to construct manhole. Over excavate below the bottom of pipe to allow installation of stone base and concrete base slab.
 3. Protect existing piping and structures for damage by excavation equipment.
 4. Grade bottom of excavation to provide a firm and level base for precast section.
 5. Place concrete blocks in bottom of excavation to support precast units. Allow 6-inch minimum clearance between top of concrete block and top of base stone.
 6. Place #4 rebar at 12 inches on center each way in the center of concrete base slab.
 7. Lower precast units and support on concrete blocks.
 8. Place precast section as specified. Verify structure is level.
 9. Apply a bonding agent on all surfaces in contact with concrete and construct new base under existing sewer.
 10. Pour concrete bottom slab no higher than the spring line (horizontal midline) of existing pipe. Invert shelf may be constructed in same pour. Concrete base slab to extend a minimum of 6 inches beyond the outside of the precast structure.
 11. If existing line is plastic material, wipe on a solvent recommended by pipe manufacturer to soften pipe wall and apply a dense coating of clean sand over all areas in contact with concrete. Allow pipe to harden prior to applying bonding agent.
 12. Break out existing pipe within new manhole, cover edges with mortar, and trowel smooth.
 13. Construct manhole invert and benches as specified.
 14. Protect new concrete and mortar for 7 days after placement.

3.16 CONNECTION TO EXISTING MANHOLES

- A. Flow Diversion: Provide diversion facilities and perform work necessary to maintain sewage flow during connection to manholes.
- B. Connection: Connect sewers to existing manholes at locations shown.
 1. Core a circular hole in existing manhole.
 2. Clean all surfaces and apply a bonding agent.
 3. Terminate sewers entering manhole at 2 maximum inches inside face of manhole wall and connect to manhole by resilient watertight connector (boot connector).
 4. Fill void between pipe and manhole wall with compression sleeve.
 5. Clamp securely around pipe forming watertight joint when subjected to vacuum test per ASTM C1244/C1244M. Perform testing prior to backfilling.

6. Enclose connections to manholes with concrete. Grout joints inside and outside after passing testing requirements.

3.1 CLEAN-OUTS

- A. Location:
 1. Piping: As indicated. Install ductile iron pipe in paved and traffic areas.
 2. Provide clean-outs at every turn.
 3. Provide turns of sufficient radius to accommodate rodding equipment.
 4. Provide clean-outs no greater than 100 feet apart on long run service piping.
 5. Provide clean-outs accessible and capped.
- B. Box:
 1. Cap: Use threaded clean-out caps at end of each clean-out.
 2. Concrete Collar: Install concrete collar and threaded plug at finished level.
 3. Acceptance: Clean out boxes must be installed to finished grade before final inspection and acceptance.
 4. Manholes: Use manholes in lieu of clean-out on all service lines greater than 8 inches in diameter.

3.2 ACCEPTANCE

- A. Post-Installation Inspection:
 1. All manholes/structures to be fully clean and dry.
 2. Manhole section joints to be grouted clean and smooth. No cracks or joints seeping water. Joint material not protruding out of joint.
 3. All manhole benches and channels to be formed smooth to convey the flow cleanly through structure.
 4. All castings centered on openings, grouted, and secure.
 5. No settlement or misalignment.
 6. Passed vacuum test per ASTM C1244/C1244M. Provide a single field test log for each structure including date, time, manhole number, description of test, test duration, test pressure, test pass/fail, name and signature of test witness, and name and signature of installer, and name and signature of Owner's Representative approving manhole for use.
- B. Post Installation Inspection Report:
 1. Provide completed and signed off Post Installation Inspection Report for all manholes or other structures indicating a passing result.
 2. As-built (redline) markups of the Drawings indicating actual installation.
 3. Survey as-built for all piping and structures provided in an AutoCAD file indicating top elevations, centerline coordinates of structure locations, pipe size, material type and class, and invert elevations.
 4. Submit Post Installation Report for approval.

3.3 SUBMITTAL SCHEDULE

ITEM NO.	SUBMITTAL REQUIREMENT	WITH BID	AS INDICATED
33 05 13-01	Shop Drawings for precast units		Provide 2 weeks prior to purchase
33 05 01-02	Shop Drawings for cast-in-place units.		Provide 2 weeks prior to casting
33 05 13-03	Manhole steps.		Provide 2 weeks prior to purchase
33 05 13-04	Product data for preformed plastic gaskets and O-ring gaskets.		Provide 2 weeks prior to purchase
33 05 13-05	Product data for frames and covers.		Provide 2 weeks prior to purchase
33 05 13-06	Product data for adapter coupling between dissimilar pipes.		Provide 2 weeks prior to purchase
33 05 13-07	Product data for adapter coupling between manhole and PVC pipe.		Provide 2 weeks prior to installation
33 05 13-08	Certificates of Manufacturer's Compliance for precast units.		Provide 2 weeks prior to installation
33 05 13 -09	Certificates of Manufacturer's Compliance for manhole steps.		Provide 2 weeks prior to installation
33 05 13-10	Certificates of Manufacturer's Compliance for frames and covers.		Provide 2 weeks prior to installation
33 05 13-11	Post Installation Inspection Report		Provide 1 week after installation

END OF SECTION