

SECTION 03450**PRECAST STRUCTURES****PART 1 GENERAL****1.01 SUMMARY**

- A. This Section includes furnishing and installing precast manholes, rings, concrete sections, castings, frames, and covers. Where MDPW or MassDOT requirements are referenced on the Contract Drawings, such requirements shall govern and shall supersede the requirements specified herein.
- B. Refer the Town of Needham Reference Specifications included in Appendix I for work related to the Town of Needham water, sewer or drain utilities.

1.02 RELATED SECTIONS

- A. Section 01300 – Submittals
- B. Section 02200 – Earthwork

1.03 CODES AND STANDARDS

- A. American Society for Testing and Materials International (ASTM):
 - 1. ASTM A48 – Standard Specification for Gray Iron Castings
 - 2. ASTM A536 – Standard Specification for Ductile Iron Castings
 - 3. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 4. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 5. ASTM C32 – Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)
 - 6. ASTM C150 – Standard Specification for Portland Cement
 - 7. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete
 - 8. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

9. ASTM C858 – Standard Specification for Underground Precast Concrete Utility Structures
 10. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 11. ASTM C920 – Standard Specification for Elastomeric Joint Sealants
 12. ASTM C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 13. ASTM C990 – Standard Specification for Joint for Concrete Pipes, Manholes, and Precast Box Sections Using Performed Flexible Joint Sealants
 14. ASTM C1193 – Standard Guide for Use of Joint Sealants
 15. ASTM D2240 – Standard Test Method for Rubber Property - Durometer Hardness
 16. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- B. Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges
- C. American Association of State Highway and Transportation Officials (AASHTO) Standard Specification for Highway Bridges

1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – Submittals:
1. Product data for precast manholes, adjusting rings, concrete sections, castings, frames, and covers.
 2. Shop Drawings:
 - a. Complete drawings and details of all precast concrete, manholes, concrete sections, castings, frames and covers.

1.05 QUALITY ASSURANCE (NOT USED)

1.06 QUALIFICATIONS

- A. Precast pieces shall be fabricated by a precast plant certified by the National Precast Concrete Association's Plant Certification Program, Precast/Prestressed Concrete Institute Plan Certification or American Concrete Pipe Association. The Authority shall

be permitted to inspect the material, manufacture and finished precast elements at their discretion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:

1. Check each unit for compliance with tolerances specified in 2.03.A.1 and repair before shipment to site.
2. Where surface repairs are required, repaired surfaces shall match adjacent surfaces. Precast manholes which require surface repairs to more than 25 percent of interior or exterior surfaces shall not be delivered to site.
3. Precast structures with any crack which is greater than 1/16 inch wide or 12 inches in length shall not be delivered to the site.

B. Acceptance at Site:

1. Inspect precast concrete sections when delivered.
 - a. Structures which do not meet the requirements of the Contract Documents shall be repaired or removed from site and replaced, at the sole option of, and at no additional cost to the Authority.

C. Storage and Protection:

1. Do not overstress, crack, distort, or otherwise physically damage precast concrete sections when handling or storing.
2. Do not bump or drop.
3. Do not allow hooks to come in contact with joint surfaces.

1.08 PROJECT/SITE CONDITIONS (NOT USED)

1.09 DEFINITIONS (NOT USED)

1.10 TOLERANCE (NOT USED)

1.11 SEQUENCING AND SCHEDULING

- ##### A.
- Do not deliver precast concrete sections until representative concrete control cylinders have attained a strength of at least 100 percent of minimum specified herein.

PART 2 PRODUCTS**2.01 MANUFACTURERS****A. Precast Concrete:**

1. OldCastle Precast, Inc., Rehoboth, MA
2. Concrete Systems, Inc., Hudson, NH
3. Scituate Ray Precast, Inc., Marshfield, MA
4. Or equal

B. Standard Authority Manhole Frames and Covers:

1. East Jordan Iron Works, East Jordan, MI, Product Numbers 0010400 49/50/51/52/53/54 L02, Heavy Duty, or equal. **[THIS IS A PROPRIETARY ITEM]**

C. Municipal Manhole Frames and Covers

1. East Jordan Iron Works, East Jordan, MI
2. Neenah Foundry, Neenah, WI
3. Olympic foundry, Seattle, WA
4. Or equal

D. Non-Shrink Grout:

1. L&M Concrete Forms, Inc., Omaha, NE – “Crystex”
2. Sauereisen Cements Co., Pittsburgh, PA – “F-IDO Level Fill Grout”
3. U.S. Grout Corporation, Fairfield, CT – “Five Star Grout”
4. Or equal

E. Coal Tar Coating:

1. Koppers, Pittsburgh, PA – “Bitumastic Super Service Black”
2. Tnemec, Kansas City, MO – “Series 46-465 H.B. Tnemecol”
3. Sherwin Williams, Cleveland, OH – “TarGuard Coal Tar Epoxy”
4. Or equal

F. Resilient Manhole/Pipe Connectors

1. A-LOK Premium manhole pipe seal
2. Tylox WT+ in connector
3. Cast-A-Seal 802 boot connector
4. Or equal

2.02 MATERIALS

A. Concrete sections:

1. Precast manholes, adjusting rings, concrete sections, castings, frames and covers:
 - a. General:
 - i. Conform to ASTM C478 for circular sections and ASTM C858 for rectangular sections.
 - ii. The minimum wall thickness shall be one twelfth of the largest internal diameter of the riser or conical top.
 - b. Riser and base sections:
 - i. Provide circular sections with uniform outside diameter.
 - ii. Provide rectangular sections with square corners and true sides.
 - iii. Cast base slab and walls together to form a monolithic base section.
 - c. Minimum compressive strength: 5,000 pounds per square inch at 28 days.
 - d. Design top slabs to support their own weight, weight of soil at 130 pounds per cubic foot and a live load equal to AASHTO HS-25, including dynamic load allowance, applied to top slab.
 - e. Structure walls shall withstand a water pressure of 90 pounds per square foot. Originate pressure diagram at finished ground surface. Include lateral pressure from vehicles, or other surcharge pressures at ground surface, in accordance with AASHTO.
 - f. Provide additional reinforcing around openings to prevent cracking. Frame openings to carry full design loads to support walls.
 - g. Prevent flotation, with ground water level at finished ground surface, by dead

weight of structure and soil load above structure. Do not account for skin friction, soil friction, or weight of equipment in structure. Factor of safety for resisting flotation shall be 1.2.

- h. Provide wall castings to the precast concrete manufacturer for inclusion in the manufacture of the structure.
- i. Provide base sections with circular openings, with continuous, circular, resilient connectors cast into the wall.
- j. Resilient connectors shall be installed in accordance with the manufacturer's recommendations, except that connectors shall be positioned so that sealing or resealing operations may be accomplished from inside the manhole.

B. Precast Structure Joint Gaskets:

1. Butyl Rubber Sealant:

- a. AASHTO Specification M-198, Type B
- b. Use cross-sectional area as recommended by structure manufacturer.

C. Castings:

1. General:

- a. Cast Iron – ASTM A48, Class 30B or better
- b. Ductile Iron – ASTM 536-77:
 - i. Provide frames and covers that are for heavy duty use and able to withstand a live load equal to AASHTO HS-25.

2. MWRA Manhole frames and covers:

- a. Cast Iron:
 - i. 24 inch manhole frame and cover as indicated on the Contract Drawings.
- b. Ductile Iron:
 - i. Provide watertight and locking manhole frame and covers made of ductile iron and include one (1) polyethylene ring for load transmission and one (1) rubber gasket for air and water tightness. The watertight and locking frame and covers shall be airtight and watertight up to 15 pounds per square inch external pressure.

- ii. Secure watertight and locking manhole frame and covers with iron cams and ANSI type 316 stainless steel bolts equally spaced around the cover. Locate internal threads for bolts entirely in blind holes of frame to prevent sticking or corrosion.
- iii. Cover maximum weight: no more than 150 pounds.
- iv. Furnish one (1) set of spare parts for each watertight and locking manhole frame and cover. Furnish two (2) sets of tools suitable for locking/unlocking ductile iron covers.

D. Miscellaneous materials:

- 1. Precast concrete adjusting rings.
- 2. Circular rings with shear keys.
- 3. Mastic fill:
 - a. Butyl rubber compatible with resilient connector material.
- 4. Asphalt Varnish: Federal Specification TT-C-494.
- 5. Expandable plugs: rubber, air tight to 8 pounds per square inch with wing nut type expansion mechanism.
- 6. Connector between sewer manhole and pipe: rubber seal system meeting the requirements of ASTM C923 and recommended by the manhole manufacturer for the type of connection.
- 7. Protective Epoxy Coating: epoxy-resin-based product providing high bond strength to concrete and steel surfaces conforming to ASTM C881.
- 8. Water-Based Masonry Waterproofer:
 - a. Apply DRYLOK Masonry Waterproofer by United Gilsonite Laboratories; Thompson's Water Seal Concrete Care Sealer by the Thompson's Company, Memphis, TN; Conspec Weather Seal WB, Dayton Superior, Kansas City, KS; or equal to all interior and exterior surfaces of precast structures.
- 9. Hydraulic Cement:
 - a. Seal vault penetrations, except penetrations for water piping, both inside and outside structure with quick-setting Portland cement, Type 2, conforming with ASTM C150.

- b. Use concrete bonding adhesives or acrylic fortifiers as recommended by manufacturer for preparing surfaces to be sealed.

10. Mechanical Penetration Seal and Wall Sleeve

- a. Provide seals around all water pipe penetrations through precast structures.
- b. Penetration seal shall be a modular, mechanical seal consisting of rubber links shaped to continuously fill the annular space between the pipe and wall opening. Hardware shall be steel with a 60,000 pounds per square inch minimum tensile strength.
- c. Wall sleeve shall be a molded sleeve with an integral hollow, molded water-stop ring and in accordance with manufacturer's recommendations.
- d. Nuts and bolts shall be ANSI type 316 stainless steel.

E. Brick for Drain and Sewer Benches and Inverts:

- 1. Pave manhole benches and inverts with bricks meeting ASTM C32. Brick for inverts and shelves shall be Grade SS and tested so that the mean of five tests for absorption shall not exceed 8 percent and no individual brick exceed 11 percent; all other manhole brick may be Grade MS, or better.

2.03 FABRICATION

A. Concrete sections:

- 1. Cast and Finish to following tolerances:
 - a. Overall length - $\pm 1/4$ inch
 - b. Overall height - $\pm 1/4$ inch
 - c. Overall width - $\pm 1/4$ inch
 - d. Wall, floor, and roof thickness - $+1/4$ inch, - $1/8$ inch
 - e. Position of handling devices - $\pm 1/2$ inch
 - f. Squareness of ends (vertical and horizontal alignment) - $\pm 1/4$ inch
 - g. Face width of joint - $\pm 3/16$ inch
 - h. Anchors and inserts - $\pm 1/4$ inch
- 2. If boxouts for grouting are used, groove or roughen surfaces.

3. Provide lifting notches on inside faces of precast section walls for handling.
 - a. Do not make notches more than three (3) inches deep.
 - b. Do not extend hole through wall.

B. Castings:

1. Standard dimensions for manhole frames and covers as indicated on the Drawings.
2. Machine the bearing surfaces of frames and covers and frames and grates against each other to give continuous contact throughout their entire perimeter.
3. Clean iron castings at foundry.
4. The castings shall be free from defects including scale, lumps, blisters, or sandholes.
5. Catch basin frames shall have a clear opening of at least 22 inches and a depth of not less than eight (8) inches. Catch basin grates shall have openings with a minimum size of two (2) inches square. Frame and grate together shall weigh between 460 and 500 pounds.
6. Drain and Sewer Manhole Frames and Covers shall have a clear opening of 24-inch with a 7 to 9-inch depth and 26-inch diameter cover with indented top design with the following cast into cover:
 - a. Sanitary Sewerage Piping Systems: "SEWER".
 - b. Storm Drainage Piping Systems: "DRAIN".

C. Benches and inverts shall be paved with brick as indicated on the Contract Drawings.

1. Manhole Channels: Concrete invert, formed to widths indicated and form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: minimum 2.5 percent through manhole.
2. Manhole Benches: sloped to drain into channel.
 - a. Slope: 1 inch per foot.

PART 3 EXECUTION

3.01 INSTALLATION

A. Bases:

1. Construct structures with precast concrete bases.
 - a. Excavate subgrade materials to undisturbed earth and uniform elevation allowing installation and dynamic compaction of at least 12 inches of crushed stone, as specified in Section 02200 – Earthwork.
2. Grade surface of granular material and set base section so connecting pipes will be on line and grade.
3. Adjust elevation of granular material until grade and alignment of base section is attained.
4. Do not wedge or block under precast concrete bases.

B. Riser Sections for Manholes:

1. Provide circular precast sections with mastic fill to seal joints between sections.
 - a. Only use mastic fill at temperature recommended by manufacturer.
2. Fill lifting notches in manhole walls with non-shrink grout.

C. Connecting Piping for Manholes:

1. Drains: fill space between connecting pipes and wall of precast sections with non-shrink grout, except where resilient connectors are provided.
2. When resilient connectors are used, the connecting pipe shall be carefully adjusted to proper line and grade, and the bedding material shall be compacted under the haunches and to the spring line of the pipe for a distance of at least six (6) feet from the manhole wall and to at least the minimum trench width. The pipe shall be installed in the resilient connector prior to backfilling outside the manhole and shall be resealed after completion of the manhole and backfill. All visible leakage shall be eliminated.
3. The connecting pipe for installation with resilient connectors shall be plain-end, square cut spigots and shall not protrude more than one (1) inch inside the manhole wall. A clear distance of at least one (1) inch from the end of each connecting pipe and around the pipe shall be provided when the concrete invert fill is installed. After completion of the manhole, the boxout shall be filled with mastic filler material, completely filling the space beneath the pipe and extending to at least the spring line. The filler material shall provide a smooth, uniform surface between the inside diameter of the pipe and the manhole invert.

4. Sewer and Water: use rubber seal system in accordance with ASTM C923.

D. Dampproofing:

1. Field applied:

- a. If shop-applied dampproofing has been damaged, paint outside surface of structure with one (1) coat of coal tar coating before backfilling.

E. Waterproofing:

1. Field apply masonry waterproofer to exterior surfaces of precast structures in accordance with manufacturer's instructions.

F. Castings:

1. Frames shall be set in full mortar beds. Voids beneath the bottom flange shall be completely filled to result in a watertight fit.

G. Core Drilling:

1. When core drilling is completed, clean the exposed concrete surface and ends of reinforcing steel and apply two (2) coats of protective epoxy coating for a total dry film thickness of 10-15 mils. Allow first coat to cure before applying second coat. Allow second coat to cure before installing component requiring the concrete penetration.

H. Painting:

1. Castings shall be furnished unpainted.

I. Sealing:

1. Seal concrete manhole, chamber and vault penetrations, except penetrations for water pipe, on both inside/outside surfaces with hydraulic cement in accordance with manufacturer's instructions.
 - a. Seal water pipe concrete vault penetrations with mechanical penetration seal and wall sleeve in accordance with manufacturer's instructions.

3.02 FIELD QUALITY CONTROL

A. Castings:

1. Install a new gasket for each watertight and locking manhole frame and cover within seven (7) days prior to substantial completion.
2. Clean and dewater manholes prior to final walkthrough.

**** END OF SECTION ****