SECTION 33 05 61

precast MANHOLES AND BELOW GRADE STRUCTURES

# GENERAL

## summary

### Section includes general information, products, and execution for precast manholes and below grade structures.

## REFERENCEs

### American Association of State Highway and Transportation Officials (AASHTO):

#### Standard Specifications for Highway Bridges

### American Concrete Institute (ACI):

#### 301 – Specifications for Structural Concrete

#### 318 – Building Code Requirements for Structural Concrete

#### 350 – Code Requirements for Environmental Engineering Concrete Structures

### ASTM International (ASTM):

#### A 48 – Standard Specification for Gray Iron Castings

#### A 536 – Standard Specification for Ductile Iron Castings

#### C 33 – Standard Specification for Concrete Aggregates

#### C 88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

#### C 150 – Standard Specification for Portland Cement

#### C 260 – Standard Specification for Air-Entraining Admixtures for Concrete

#### C 478 – Standard Specification for Precast Reinforced Concrete Manhole Sections

#### C 497 – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile

#### C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

#### C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

#### C 1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

## SUBMITTALS

### Concrete mix design, base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, subdecks, manhole platforms, grade rings, manhole frame and cover, sectional plans and elevations showing dimensions and reinforcing steel placement, lifting inserts, and joint; include the Manufacturer’s certification of compliance with this Section.

### Structural design calculations and drawings that are prepared, stamped, and signed by a Professional Engineer registered in the State of Colorado.

### Pipe connections to the manholes.

### Manhole steps including the method of installation and the Manufacturer’s certification of compliance with the pull-out resistance test as specified in this Section.

### The repair method for minor damage to precast concrete sections.

### Concrete test cylinder reports from an independent testing laboratory certifying conformance with this Section.

### Joint sealant data sheets.

## QUALITY ASSURANCE

### Materials shall be new and unused.

### The quality of materials, manufacturing process, and finished sections are subject to inspection and approval by the OWNER and the ENGINEER. Inspections may be made at the place of manufacture or at the Work site following delivery.

### The materials will be examined for compliance with ASTM specifications, the Contract Documents, and the approved Manufacturer’s drawings. Additional inspection criteria may include appearance, dimensions, blisters, cracks, and soundness.

### The OWNER or the ENGINEER will reject materials for failure to meet any specification requirement. Rejection may occur at the place of manufacture, at the Work site, or following installation. Mark and identify rejected materials and immediately remove them from the Work site; replace rejected materials at the CONTRACTOR’s sole expense.

### Repair minor damage to precast concrete sections by Manufacturer-approved methods if the repair is approved by the OWNER or the ENGINEER.

# PRODUCTS

## approved manufacturers

### Precast Concrete Manholes and Structures:

#### Copeland Precast, Inc.

#### Forterra Precast

#### Lindsay Precast

#### Oldcastle Precast, Inc.

#### Vaughn Concrete Products

#### Rinker Materials

#### Eagle Precast (manholes only)

### Manhole Frame and Cover, CI and DI:

#### D&L Foundry

#### Deeter Foundry Inc.

#### EJ

#### Neenah Foundry Company

#### Sigma Corporation

#### Star Pipe Products

### Manhole Steps or Rungs: M.A. Industries, No. PS2-PFS

### Preformed Flexible Joint Sealant:

#### Hamilton-Kent, Kent Seal No. 2

#### Henry Company, Ram-Nek

### Pipe Penetrations:

#### Waterplug

#### Embeco

#### Flexible sleeve: Press-Seal, PSX Gasket

#### Compression seal assembly: Link-Seal

#### Compression gasket: A-LOK

## Materials

### General:

#### Reference to a Manufacturer’s name and model or catalog number is for the purpose of establishing the standard of quality and the general configuration desired.

#### Like items of materials or equipment shall be the end products of one Manufacturer to provide a standardization of appearance, operation, maintenance, spare parts, and the Manufacturer’s service.

#### Provide lifting lugs or holes in each precast section for proper handling.

#### Openings through the manhole riser shall be cored or cast-in with blockouts. Breakouts and doghouse openings are not allowed.

#### Finish: Standard grade finish in accordance with ACI 301.

### Precast Concrete Manhole Sections:

#### Precast concrete riser sections, transition top sections, flat slab tops, and grade rings shall be in accordance with ASTM C 478 and the following requirements:

##### Flat top covers shall be used where shown on the Drawings or where the manhole rim to the top of the pipe is 8 feet or less.

##### Tongue and groove joints for riser sections, transition top sections, and flat slab tops.

##### Adjustable grading rings; concrete; 3 inches, 4 inches, or 6 inches.

##### Sections shall be cured by an approved method.

##### Design criteria shall be as follows:

###### Minimum AASHTO H-20 and HL-93 loading plus the earth load.

###### Calculate the earth load with a unit weight of 130 pcf.

###### Lateral soil pressure based on saturated soil producing 100 pcf/ft acting on an empty manhole.

###### Internal fluid pressure based on a unit weight of 63 pcf with the manhole filled from invert to cover with no balancing external soil pressure.

###### Dead load of manhole sections fully supported by the base and transition.

###### Provide additional reinforcing steel in walls and slabs to transfer stresses and openings.

###### The minimum clear distance between the edges of any two wall penetrations shall be 12 inches or 1/2 the diameter of the smaller penetration, whichever is greater.

##### Mark the date of manufacture, the Manufacturer’s name, and the Manufacture’s trademark on the inside and outside of each precast section.

##### Ship precast concrete sections after concrete has attained 3,000 psi compressive strength.

### Precast Concrete Structures:

#### Precast reinforced concrete structures include vault structures with integral base and top slabs.

#### Notify the OWNER and the ENGINEER in writing at least 5 days prior to placing concrete during the manufacturing process. The OWNER or the ENGINEER may inspect the reinforcing steel placement prior to placing concrete.

#### Design criteria:

##### Precast concrete:

###### Minimum compressive strength: 5,000 psi.

###### Concrete mix:

Cement:

Type II portland cement in accordance with ASTM C 150.

Site specific soil may require cement that meets high sulfate resistance limits for Type V cement in accordance with Table 4 in ASTM C 150.

Type III cement in accordance with ASTM C 150 meeting sulfate resistance is allowed for high-early strength mixes.

Fly ash: Class C or Class F fly ash in accordance with ASTM C 618.

Aggregates:

Natural aggregates, free from deleterious coatings and substances in accordance with ASTM C 33.

Alkali reactivity of aggregates:

In accordance with ASTM C 33.

Tested for reactivity in accordance with ASTM C 1260.

A maximum of 0.10% expansion for any aggregate product used in portland cement concrete.

Aggregate soundness testing in accordance with ASTM C 33 and ASTM C 88, using sodium sulfate solution.

Aggregate grading and quality shall be in accordance with ASTM C 33.

Admixtures:

Furnish from one Manufacturer.

Free of chlorides, calcium chloride, or other corrosive chemicals.

##### Manufactured products:

###### In accordance with ACI 301, ACI 318, and ACI 350, as applicable.

###### Analyze walls and slabs using accepted engineering principals.

###### When fy exceeds 40,000 psi fs shall not exceed 50% of fy.

###### Design products to support their own weight, weight of soil at 130 pcf, and a live load equal to AASHTO HS-20 and AASHTO HL-93 applied to top slab.

###### Cast base slab and walls together to form a monolithic base section.

###### Design structure walls for a water pressure assuming groundwater level at ground surface; originate the pressure diagram at finished ground surface; include lateral pressure from vehicles in accordance with AASHTO Standard Specifications for Highway Bridges.

###### Consider discontinuities in the structure produced by openings and joints; provide additional reinforcing around openings; frame openings to carry full design loads to support walls.

###### Locate horizontal wall joints through the centerline of any wall openings or at a 12 inch minimum clear distance from the closest outside edge of wall openings.

###### Design the structure with a minimum number of joints; the maximum number of structure sections including the top slab shall be four.

###### Provide lifting hooks for the top slab.

## accessories

### Manhole Frame and Cover:

#### Good quality, strong, tough, even grained CI, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind that render the product unsuitable for the service for which it is intended; machined to a true surface; thoroughly cleaned castings and subject to hammer inspection.

#### The Manufacturer shall submit a written statement that the inspection and specified tests have been completed and the results comply with the requirements of these standards. A copy of the certification shall be provided to DW, if requested. The report shall include the material data that is traceable to the originating foundry, traceable test bars that match, the name of the Manufacturer, and the date of the pour.

#### Ring: CI in accordance with ASTM A 48, Class 35B or better.

#### Cover: DI, in accordance with ASTM A 536, Grade 60-40-18 or better.

#### Designed for AASHTO H-20 and AASHTO HL-93 loading.

#### Nominal size: 24 inches diameter; cover shall weigh approximately 165 lbs; frame (ring) shall weigh approximately 240 lbs.

#### The cover shall contain the OWNER’s name, Denver Water, in 1 1/2 inch high lettering that is centered and recessed on the exposed face.

#### Stamped with the Manufacturer’s name and model identification.

#### Recycled piping manhole lids:

##### Coated with fusion-bonded epoxy, 20 mils minimum, Pantone 2577U in color.

##### Lids shall be labeled Recycled Water.

### Manhole Steps or Rungs:

#### Comprised of 1/2 inch grade 60 steel reinforcement rod encased in PP co-polymer plastic with a tread width of 14 inches.

#### Furnish horizontal and vertical load test results in accordance with ASTM C 478 and ASTM C 497.

# EXECUTION

## erection

### Jointing Precast Manhole Sections and Structures:

#### Seal tongue and groove joints with preformed flexible joint sealant.

#### Completed joint shall withstand 15 psi internal water pressure without leakage or the displacement of sealant.

#### In accordance with ASTM C 990.

#### Joint sealant:

##### Packaged in extruded preformed rope shapes of proper size to completely fill the joint when completely compressed.

##### Protected by a suitable, renewable two-piece wrapper that may be removed as the material is applied to the joint without disturbing the other wrapper.

## INSTALLATION

### Pipe penetrations shown on the Drawings shall be made through the manhole or the vault sections in the following manner:

#### Modular mechanical seal: Integrally cast the sleeve in the precast manhole or the vault section or install the sleeve in a form or cored opening. Install pipe through the sleeve. Wrap the assembly around the pipe and connect the first and the last links. Slide the assembly into the space between the pipe and the sleeve. Tighten bolts to expand the links of the assembly to create a gas and water tight seal. The seal shall be rated at 20 psig hydrostatic pressure.

#### Grout in place: The precast manhole or the vault section shall have a formed, tapered circular opening larger than the outside diameter of the pipe. Plastic pipe shall have a waterstop gasket secured to the pipe with a SST clamp. Grout shall be non-shrink and waterproof.

#### Flexible sleeve: Integrally cast the sleeve in the precast manhole or the vault section or install the sleeve in a form or cored opening. Fasten pipe in the sleeve with SST clamps. Coat SST clamps with bituminous material to protect from corrosion. The flexible sleeve shall be tested and approved by the PVC Pipe Manufacturer.

#### Compression gasket: Integrally cast the compression gasket in the precast manhole or the vault section. Insert pipe into the compression gasket. Compression gaskets shall be tested and approved by the PVC Pipe Manufacturer.

### Manhole and Structure:

#### Transport and handle precast concrete sections in accordance with the Manufacturer’s instructions. Use lifting devices where provided in the precast sections. Follow the Manufacturer’s instructions for lifting procedures when lifting devices are not provided.

#### Assemble and place buried precast concrete structures in properly excavated and compacted soil foundations. Set precast concrete structures to grade and oriented to provide the required dimensions and clearances from pipes and other structures.

#### Prevent flotation, with ground water level at finished ground surface, by dead weight of the structure and soil load above the structure; do not consider the skin friction, the soil friction, or the weight of equipment in the structure. Protect Work from flooding.

#### Place the manhole base on a bed of 12 inches of No. 57/67 aggregate. Set the manhole base grade so that a maximum grade adjustment of 12 inches is required to bring the manhole frame and cover to the final grade.

#### Use precast concrete grade rings and non-shrink mortar to adjust the manhole frame and the cover to the final grade.

#### Set precast concrete barrel sections and structures plumb within 1/4 inches. Seal the joints of precast barrel sections with preformed flexible joint sealant in a sufficient quantity to fill 75% of the joint cavity. Fill the inside joint with non-shrink grout and finish flush with adjoining surfaces. Caulk the inside of any leaking barrel section joint with non-shrink grout to the satisfaction of the ENGINEER.

#### Where required, core holes in precast sections to accommodate pipes prior to setting manhole sections in place and prevent loosening of the joints.

#### Plug holes in the concrete barrel sections that are required for handling with a non-shrink grout or non-shrink grout in combination with concrete plugs; finish flush on the inside.

#### Allow joints to set for 12 hours before backfilling unless a shorter period is approved by the ENGINEER.

### Manhole Step:

#### Preform holes for manhole steps during casting of the riser and cone sections using tapered form pins specifically made for preforming manhole rungs.

#### Drive manhole steps into preformed holes after concrete has developed a compressive strength of 3,000 psi.

#### Alternatively, cast manhole steps into riser and cone sections when concrete is placed.

#### Drilling holes for manhole steps may be used to accommodate field conditions when approved by the ENGINEER. Drill holes shall be of the diameter, spacing, and depth required by the Manhole Step Manufacturer.

#### Install steps at 12 inches o.c. vertically, not more than 1/2 inch out of plumb. The top step shall be 18 inches to 24 inches below the manhole cover.

### Manhole Frame and Cover:

#### Utilize precast concrete extension collars to ensure the frame and the cover are set to the finished grade. Concrete extension collars shall make up the riser section providing the riser section does not exceed 12 inches vertically. Set the manhole frame and the cover to final grade prior to placement of permanent paving or final backfill.

#### Extension collars shall be securely attached to the manhole riser section with a non-shrink grout bed and plastic joint sealing compound in the pavement or with a concrete collar in unpaved areas.

### Manhole Pipe Connections: Connect pipe to manholes and structures with the connectors shown on the Drawings. Close or seal pipes for future connections with a gasketed watertight plug.

## Quality COntrol

### Manhole and Structure Testing: The ENGINEER will visually inspect manholes and structures for potential leaks before backfilling is allowed. Seal joints to the satisfaction of the ENGINEER.

## CLEANING

### Clean new manholes of silt, debris, and foreign matter of any kind prior to final inspections.

END OF SECTION