

**SECTION 33 49 00 - STORM DRAINAGE STRUCTURES****PART 1 GENERAL**

## 1.01 SUMMARY

## A. Section Includes:

1. Catch basins.
2. Stormwater inlets
3. Stormwater manholes
4. Stormwater junction boxes
5. Endwalls

## B. Related Requirements:

1. Section 33 41 00 – Stormwater Piping
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 31 23 33 – Trenching and Backfilling for Utilities.

## 1.02 REFERENCES

## A. Pennsylvania Department of Transportation (PENNDOT):

1. Publication 72 – Standard Drawings
2. Publication 408 – Standard Specifications, Section 605 and 714.
3. Bulletin 15 - Approved Construction Materials

## B. ASTM International:

1. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
2. ASTM A 536 - Standard Specification for Ductile Iron Castings
3. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
4. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
5. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
6. ASTM C 913 - Standard Specification for Precast Concrete Water and Wastewater Structures

## C. American Association of State Highway Transportation Officials:

1. AASHTO M306 - Drainage Structure Castings.
2. AASHTO S99-HB - Standard Specifications for Highway Bridges.

## 1.03 SUBMITTALS

## A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

- B. Product Data: Submit data for inlet tops, grade adjustment rings, grates, and steps.
- C. Shop Drawings: Indicate structure locations, elevations, sections, equipment supports, and sizes and elevations of penetrations.
- D. Certifications:
  - 1. For all Precast Concrete Structures within the PennDOT right-of-way submit completed PennDOT CS-430 form. This form shall be completed by the Contractor, not the material supplier.
  - 2. Submit certification that all products supplied under this Section comply with the Pennsylvania Steel Products Procurement Act.
  - 3. Manholes: certificate of construction compliance with ASTM C478 from the precast reinforced concrete structure manufacturer.
  - 4. Manhole Frame and Cover:
    - a. 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.
    - b. Manufacturer certification that manhole frame and cover meets or exceeds AASHTO HS-20 highway loading requirements.

#### 1.04 QUALITY ASSURANCE

- A. Regulatory Compliance:
  - 1. Comply with applicable portions of federal, state and local environmental agency regulations pertaining to storm drainage systems.
  - 2. Comply with local municipal and county regulations and standards pertaining to storm drainage systems in accordance with approved plan.
  - 3. Comply with PENNDOT Publication 408, Sections 605, 714, and 1105.
- B. Structural Design Loading: Unless otherwise noted, utilities, structures and underground conveyance systems shall be constructed to withstand minimum loads in accordance with ASTM C857 with the following loading conditions, including impact load.
  - 1. Heavy Traffic: ASTM C857; A-16, maximum 16,000 lb each wheel.
- C. Source Quality Control:
  - 1. Precast concrete unit manufacturer shall be listed in PennDOT Bulletin 15.
  - 2. Precast concrete supplier plant shall be registered and certified under either the Prestressed Concrete Institute (PCI) or the National Precast Concrete Association (NPCA) plant certification program.
  - 3. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete structures.
- D. Product Substitutions: Sewer systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers but having equal performance characteristics will be considered, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by Engineer.

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## 1.05 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01 61 00 Product Requirements
- B. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing and moving precast structures.
- C. Store precast concrete structures to prevent damage to public or private property. Repair property damaged from materials storage.
- D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

## PART 2 PRODUCTS

### 2.01 INLETS

- A. Precast Concrete Inlets: precast reinforced concrete, of depth indicated. The top section shall match the frame and grate for the inlet type specified.
  - 1. Materials
    - a. Base Section: 6" minimum thickness for floor slab and 6" minimum thickness of walls and base riser section for rectangular structures and 5" minimum thickness of walls and base riser section for 48" circular structures and having a separate base slab or a base section with integral floor.
    - b. Riser Sections: 6" minimum thickness for rectangular structures and 5" minimum thickness for 48" circular structures and lengths required to provide the depth indicated.
    - c. Top Section: Flat slab type with opening to match grade rings and frame and grate.
    - d. Grade Rings: Provide maximum of 2 reinforced concrete rings as required and necessary. Match dimensions of frame and grate.
    - e. Gaskets: ASTM C 443, rubber.
    - f. Protective Coatings: One-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to exterior vertical surfaces and bottom.
    - g. Pipe Connectors: ASTM C 270-91a, "Standard Specification for Mortar for Unit Masonry" requirements. Mortar joints shall be smooth and flush with manhole walls.
    - h. Channel and Bench: Concrete.
    - i. Corner intersections of pipes and structures are prohibited.
- B. Inlet Steps: Wide enough for an adult to place both feet on one step and designed to prevent feet from slipping forward, backward or sideways off the step. Steps shall be provided in all structures of 5' or more in depth between top of grate and invert elevation.

- C. Frames and Grates: As shown on the Drawings, either structural steel, or gray, malleable, or ductile iron as specified in Section 1105.02(h) of PA DOT Publication 408 and shown in PennDOT Publication 72 - RC 34M standards for structural steel grate bicycle safe top approved for HS-25 loading.
1. Materials
    - a. Coat structural steel with bituminous paint in the shop or in the field, prior to placement. Cover frames and grates completely with no pin holes or voids.
    - b. All grates shall be bicycle safe.
  2. Unless shown otherwise on Drawings, provide Type M inlet concrete top unit for non-paved areas and Type C inlet structural steel top unit for paved areas with curbing.
- D. Yard Inlets: Nyloplast, a division of Advanced Drainage Systems, Inc., or approved equal.
1. Landscape Area: Inlet frame shall have 12" opening to inlet. Grate shall be 12" flat grate opening, ductile iron, light duty rating (Grade 70-50-05), meeting ASTM A536 as manufactured by Neenah Foundry or approved equal.
  2. Pavement Area: Inlet frame shall have 12" square opening to inlet. Grate shall be 12" lockable, hinged pedestrian grate opening, cast iron frame with ductile iron grate, light duty rating Grade 70-50-05 and A48-Class 30B, meeting ASTM A536 as manufactured by Neenah Foundry or approved equal.

## 2.02 HEADWALLS – ENDWALLS – CUTOFF WALL

- A. General: Construct reinforced concrete, headwall or endwall with apron, tapered sides with guard bars and with rip rap outlet protection or erosion blanket, as indicated on the drawings.
- B. Head Walls: Precast or Cast-in-place reinforced concrete, with apron and tapered sides conforming to PA DOT Publication 72 RC-31.
- C. End Section: Conforming with Section 616 of PA DOT Publication 408

## 2.03 PRECAST REINFORCED CONCRETE MANHOLE

- A. Materials and Construction: Conforming to requirements as detailed in PennDOT RC-39 and specified in ASTM C478 except as follows:
1. Concrete: Composition and compressive strength conforming to ASTM C478 except 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, pre-aligned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Contract Drawings.
  4. Manhole Seals: Manhole component joints factory formed for self-centering concrete-to-concrete bearing utilizing sealing compound materials specified.
  5. Manhole Component Design: Base, tapered and straight riser section, and top

section dimensions and diameters, not consistent with ASTM C478, are as indicated on Contract Drawings.

- 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 provided.
  - 1. Resilient Gasket Type Pipe Opening Seals:
    - a. Manufacturers: A-LOK Products Corporation or equal.
    - b. Cast integrally with manhole component conforming to requirements specified in ASTM C923.
  - 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.
    - a. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.
    - b. Gasket: Compound Polyisoprene.
    - c. Take Up Clamps: Type 304 stainless steel with stainless steel screw.
- D. Precast Top Sections: Designs as required by Contract 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 four 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. Eccentric Cone Tops: Manufactured to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections and as shown in the Contract Drawings.
  - 3. Flat Tops: Minimum 8" thick.
- E. Precast Grade Rings:
  - 1. Precast Concrete: Leveling and adjusting units of 2-inches, 3-inches or 4-inches 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.
- F. Standard Manhole Frame and Cover:
  - 1. Manufacturers: Neenah Foundry Company; R-1788-A; or equal.
  - 2. General: Gray iron castings conforming to ASTM A48, Class No. 35B, designed for AASHTO Highway Loading Class H-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. Cast the letters "STORM" integrally in the center of cover in raised letters.
    - c. Two concealed pick holes shall be provided.

- d. Frame Hold-down Bolts:  $\frac{3}{4}$ " diameter Type 316 stainless steel bolts and washers.

## 2.04 ACCESSORY MATERIALS

- A. Waterproofed Mortar:
  1. Manufacturers: Medusa Cement Company; Grace Construction Materials; Chem-Master Corporation; or equal.
  2. Material composition meeting ASTM C270, Type M with waterproofing admixture included.
- B. Epoxy Bonding Compound:
  1. Manufacturers: A. C. Horn EPOXTITE BINDER; Sika Chemical SIKADUR-HI-MOD; or equal.
- C. Steps: Design as indicated on Contract Drawings.
  1. Manufacturers: MA Industries, Inc.; Type PS-2-B; American Step Company, Inc.; Or equal.
  2. 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.
  3. Manhole step dimensions shall meet requirements of OSHA standard 1910.27 for fixed ladders.
- D. Preformed Plastic Sealing Compound:
  1. Manufactures: K. T. Snyder Company, Inc. - RAM-NEK; Or 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.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Coordinate placement of inlet and outlet pipe required by other sections.
- B. Inspect precast concrete structures immediately prior to placement in excavation to verify are internally clean and free from damage. Remove and replace damaged units.

### 3.02 INSTALLATION

- A. Excavation and Backfill:
  1. Excavate for utility structure in accordance with Section 31 23 33 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
  2. When groundwater is encountered, prevent accumulation of water in excavations.

3. Place structure in dry trench.
- B. Install structure supported at proper grade and alignment on compacted AASHTO No. 57 bedding (min. 12" depth, placed in 4" lifts).
  - C. Lift precast concrete structures at lifting points designated by manufacturer.
  - D. Install precast concrete base to elevation and alignment indicated on Drawings.
  - E. Locate pipe(s) as indicated on plan and cut pipe to finish flush with concrete face. Connect pipe(s) to inlets and manhole structures with watertight connection.
    1. When using prefabricated pipe opening seals (i.e., A-LOK, etc.) for connecting pipes into manholes, fill such annular spaces with preformed plastic sealing compound.
    2. For other pipe connections: grout all pipe entries flush to interior walls for watertight connection.
  - F. Length of Pipe Connections into Structure:
    1. Use pipes no longer than 5-feet in length when connecting through resilient gasket type pipe opening seals.
    2. For all other pipe connections, 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.
  - G. Assemble multi-section structures by lowering each section into excavation.
    1. Clean joint surfaces.
    2. Install watertight joint seals in accordance with manufacturer's instructions using gasket joints, preformed joint sealants, or elastomeric joint sealants.
  - H. Form bottom channel of inlet and manhole structure with cast in place concrete as detailed on the drawings.
  - I. 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.
  - J. Inlet Frame and Grate Installation: Where required, make final adjustment of frame to elevation using precast grade rings. Frame and Covers installed within paved areas shall be set at 1/8" below final pavement elevation. Frame and Covers installed in all other areas shall be set within 1/8" of final grade elevations, with exception of manholes with rim elevations identified above final grade elevations.
    1. Waterproof Mortar. Mortar thickness not to exceed 1/2-inch maximum and 3/8-inch minimum. Wet, but do not saturate precast grade rings immediately before laying.
  - K. Manhole Frame and Cover Installation: Where required, make final adjustment of frame to elevation using precast grade rings. Frame and Covers installed within paved areas shall be set at 1/8" below final pavement elevation. Frame and Covers installed in all

other areas shall be set within 1/8" of final grade elevations, with exception of manholes with rim elevations identified above final grade elevations.

2. Set precast grade rings:
    - a. Waterproof Mortar. Mortar thickness not to exceed 3/4-inch maximum and 3/8-inch minimum. Wet, but do not saturate precast grade rings immediately before laying.
    - b. Preformed Plastic Sealing Compound. Two continuous rings along the inner and outer diameter of grade ring.
  3. Preset 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 mortar only in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.
  4. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing 1/2-inch thick preformed plastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.
  5. Use 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 nut and washer. Tighten manhole frame bolts after mortar has cured.
- L. Connections to Existing Manholes and Inlets: Cut required opening by core drilling; prevent cracking and spalling. Make openings of sufficient size to accommodate pipe. Grout pipe entry flush to interior wall and make connection watertight. Form a new flow channel in the existing base to properly conduct all flows through the existing structure. Do not permit ground water, surface water or debris to enter the existing facilities. Maintain all existing flow during construction.
- M. Connections to Existing Storm Pipe: Where new manholes are constructed on existing storm pipe, the Contractor shall have the option to use cast-in-place manhole bases or precast bases, both as specified previously.
1. Replace with new, broken or damaged pipe resulting from this work. New pipe material shall match existing. Use solid sleeve coupling.
  2. Connect new pipe to new bases or new in-line structures as specified previously.
  3. If precast bases are used, replace existing pipe with new to first joint outside the structure.
  4. Maintain flow in existing structure.
  5. Use mechanical saw for all cutting. Chipping or breaking pipe with a hammer not permitted.
- N. Backfill excavation for structure in accordance with Section 31 23 33.

### 3.03 FIELD QUALITY CONTROL



- A. Where structure is indicated to be watertight, perform vacuum test per ASTM C1244.

**END OF SECTION**