

**SECTION 01**

**STORM WATER QUALITY SEPARATOR**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies construction of outside, underground storm water quality separators. The storm water quality separators shall include a vortex motion (centripetal force, swirl separator) that provides enhanced settling characteristics.

**1.2 QUALITY ASSURANCE:**

A. Products Criteria:

1. Multiple Units: When two or more separators are required on one project, these units shall be products of one manufacturer.
2. Identification: The separator manufacturer's name, or identifiable trademark, shall be cast into the frame and cover(s) /grate of each separator.

B. The separator must comply with the rules and regulations of the Public Utility having jurisdiction over the connection to public storm sewers and the extension, and/or modifications to Public Utility systems.

**1.3 SUBMITTALS:**

A. Submit SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturers' Literature and Data: Submit the following as one package:

1. Sizing Calculations including Particle Size Distribution.
2. Operations and Maintenance Manual.
3. Independent Laboratory or Field Testing Results.
4. Frames and Covers / Grates.
5. CAD Detail of Separator

**1.4 APPLICABLE PUBLICATIONS:**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

- A48-03/A48M-03.....Gray Iron Castings
- A536-84(2004).....Ductile Iron Castings
- A615-05/A615M-05.....Deformed and Plain-Billet Steel Bars for  
Concrete Reinforcement

A655-04e1/A655M-04e1... Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe

C76-05a/C76M-05a.....Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

C139-03.....Concrete Masonry Units for Construction of Catch Basins and Manholes

C150-04ae1.....Portland Cement

C443-05/C443M-05.....Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C478-03a/C478M-03a.....Precast Reinforced Concrete Manhole Sections

C857-95(2001).....Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

C923-02/C923M-02.....Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Materials

C1103-03/C1103M-03.....Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

D256.....Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

D570.....Standard Test Method for Water Absorption of Plastics

D638.....Standard Test Method for Tensile Properties of Plastics

D648.....Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

D698-00ae1.....Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))

D785.....Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

D790.....Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D792.....Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D1056-00.....Flexible Cellular Materials-Sponge or Expanded  
Rubber

NOTE: ASTM test methods shall be the current version as of the date of  
advertisement of the project.

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

HB17.....Standard Specifications for Highway Bridges  
(AASHTO Standard H20-44)

**PART 2 - MATERIAL**

**2.1 SEPARATOR EXTERIOR**

- A. The exterior shell of the separator shall be constructed of precast reinforced concrete rings, precast reinforced sections, or cast-in-place concrete. The following requirements must be adhered to for the concrete portion of the separator:
1. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 1200 mm (48 inches) in diameter. Wall thickness shall conform to requirements of ASTM C76. Tops shall conform to ASTM C478. Top section shall be a flat top type.
  2. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be flat.
  3. Flat top manhole tops shall be reinforced concrete rated for AASHTO HS20-44 loading.
  4. Concrete for precast sections shall have a minimum compressive strength of 35 MPa (5,000 psi) at 28 days, ASTM A615, Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C-857.
  5. Mortar mixture shall be by volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 21L (5-1/2 gallons) per sack of cement.
  6. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M-198B.

## **2.2 CASTINGS:**

1. Frames and covers shall be gray cast iron conforming to ASTM A48 or cast ductile iron conforming to ASTM A536. The frame and cover shall be rated for HS20-44 loading, and have the name of the separator manufacturer cast into the cover. The cover shall be a minimum of 600 mm (24 inches) in diameter. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
2. Frame and Grates shall be cast gray iron conforming to ASTM A48 or cast ductile iron conforming to ASTM A536. The frame and grate shall be rated for HS20-44 loading, and have the name of the separator manufacturer cast into the grate. The grate shall be a minimum of 750 mm (30 inches) square or 800 mm (32") in diameter. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.

## **2.3 CONCRETE:**

Concrete shall be in accordance with local State Department of Transportation standards. For concrete not specified in above standards, concrete shall have a minimum compressive strength of 20 MPa (3000 psi) at 28 days. The cement shall be Type III conforming to ASTM C150.

## **2.4 REINFORCING STEEL:**

Reinforcing steel shall be deformed bars, ASTM A615, Grade 40 unless otherwise noted.

## **2.5 RESILIENT CONNECTORS:**

Resilient Connectors: Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

## **2.6 INTERNAL BAFFLES:**

Internal baffles are to be made of co-polymer polypropylene conforming to a tensile strength of 4000 psi (ASTM D-638), an Izod impact value of 2.5 (ASTM D-256), water absorption of 0.01% (ASTM D-570), a density of 0.91 (ASTM D-792), a flexural modulus of 195000 (ASTM D-790), a heat distortion temperature of 190 °F (ASTM D-648), and a Rockwell Hardness of 74 (ASTM D-785). Thickness of baffles will be ¼" for 48" diameter separators, 3/8" for separators between 60" and 96" in diameter and ½" for separators greater than 96" in diameter. Co-polymer polypropylene joints must be nitrogen welded.

## **2.7 FASTENERS:**

Internal baffles are to be fastened to the precast concrete structure using stainless steel hardware Grade 304 or 316. Stainless steel wedge anchors used to fasten the internal baffles to the concrete wall are to be ½" in diameter and 4.5" long. Fender washers (2" diameter) are to be used with wedge anchors where the internal baffles are fastened to the concrete walls to disperse the anchor pressure over the baffle surface area.

## **PART 3 - EXECUTION**

### **3.1 EXCAVATION FOR STORM WATER SEPARATORS:**

Excavation and backfilling for storm water quality separators shall be in accordance with all other applicable portions of the EARTH MOVING section for the project.

### **3.2 SEPARATOR BEDDING:**

The bedding surface of the separator shall provide a firm foundation of uniform density throughout the entire area of the separator. If not otherwise instructed by the engineer or local or state requirements, the separator should be set on 12" of granular bedding. The bedding should conform to local or state standards and be free draining. In areas with high groundwater, de-watering shall be used to ensure the structure is installed in the dry.

### **3.3 SEPARATOR CONSTRUCTION:**

#### **A. General:**

#### **1. Precast Concrete Base and Risers/Rings:**

- a. Precast reinforced concrete rings and base shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preformed flexible gasket material specifically manufactured for this type of application. Adjust the length of the rings so that the flat top section will be at the required elevation pursuant to any local or project specific grade adjustment requirements.
- b. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.

2. Lifting Holes:
  - a. All lifting holes shall be filled with concrete plugs and sealed with non-shrink grout.
3. Concrete Structure Joints:
  - a. All joint surfaces must be clean prior to the application of the joint gasket. The gasket shall be applied according to the manufacturer's specifications to ensure water tightness.
4. Inlet and Outlet Pipes:
  - a. The inlet and outlet pipes should be installed concentric in the pipe holes provided. The pipes can be connected to the concrete structure using either flexible rubber boots or non shrink mortar or grout. If grout is to be used, the annular space between the wall and the pipes shall be plugged with non-shrinking mortar or grout. The mortar or grout is to be applied and cured as per the manufacturer's recommendations such that there is zero leakage through the annular space. The mortar shall be finished smooth and flush with the interior and exterior concrete wall surfaces. The inlet pipe may protrude several inches into the structure but the outlet pipe should be installed such that the edges of the pipe are flush with the interior wall surface.
5. Top Cap:
  - a. The cap must be installed according to the approved drawings to ensure that the access openings are aligned properly for inspection and maintenance.
6. Frame and Covers / Grates:
  - a. Install separator frames and covers/grates on a mortar bed, and flush with the finish pavement. Frames and covers/grates shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 100 mm (4 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.
  - b. Concrete grade adjustment rings (minimum 2" thick) or other acceptable materials to the engineer and local or state agencies shall be used to adjust the frame and covers/grates to the approved grade elevation.

**3.4 BACKFILL:**

The unit must be backfilled with material acceptable to the engineer, and local and state authorities. The backfill should be placed in 12" lifts and compacted after each lift to the standards set forth by the engineer or local/state authorities.

**3.5 INSPECTION OF SEPARATORS:**

Inspect and obtain the Resident Engineer's approval. Thoroughly clean out separator before inspection.

**3.6 TESTING OF SEPARATOR WATER TIGHTNESS:**

1. Exfiltration Test:

- a. Subject separator to hydrostatic pressure test produced by the head of water at the depth of the outgoing separator pipe invert (full tank). Maintain head of water for one hour for full absorption by concrete structure before testing. Leave separator for a 24 hour period without addition of water. Measure water loss in separator after 24 hour test by measuring water volume needed to fill the separator back up to outgoing pipe invert. During the 24 hour test period, the measured maximum allowable water loss due to exfiltration shall be 0.5% of the original permanent pool (separator) storage volume.
- b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

**PART 4 - PERFORMANCE**

1. Annual TSS Removal:

The storm water separator will be designed to satisfy all site specific, local, and state regulatory requirements. If the separator is designed for total suspended solids (TSS) removal, the design should be based on using continuous analysis with local precipitation data. Designs based on TSS removal will be designed using the following particle size distribution and an annual load removal of 80% unless a different regulatory or site specific distribution and TSS removal rate are specified.

Design Particle Size Distribution	
Diameter (μm)	Percentage (%) by Mass
8	20
50	25
100	15
250	30
500	5
1000	5

2. Trash Removal:

The separator will remove over 90% of floatable trash and sinking trash at all flow rates influent to the separator.

3. Treatment Flow Rate:

The separator will fully treat the water quality flow rate without by-pass. The water quality flow rate will conform to local or state calculation requirements. In the absence of specific local or state calculation methods, the water quality flow rate will be calculated based on a Rational Method calculation using 1 inch per hour as the rainfall intensity, the area draining to the separator, and the imperviousness of the drainage area.

4. Oil Removal:

The separator will remove 95% of free oil spills during dry weather conditions. The separator will remove a minimum of 85% of the free oil influent to the separator up to the water quality flow rate during wet weather conditions.

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