

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
TECHNICAL STANDARD
STORM DRAIN INLET PROTECTION FOR CONSTRUCTION SITES

1060

DEFINITION

A temporary device installed in or around a storm drain inlet, drop inlet, or curb inlet.

PURPOSE

This practice is intended to minimize sediment from entering storm drainage systems in areas where the contributing drainage area is temporarily disturbed or receives traffic from temporarily disturbed areas nearby.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where runoff from construction sites enters conveyance system inlets, such as drain inlets, drop inlets, and curb inlets. Inlet protection devices are for drainage areas of one acre or less. Runoff from areas larger than one acre shall be routed through a properly designed sediment trapping or settling practice upstream of the inlet.

CRITERIA

General Criteria

Be aware of applicable federal, state and local laws, rules, regulations, or permit requirements governing the use and placement of storm drain inlet protection. This standard does not contain the text of federal, state, or local laws.

Install the appropriate type of inlet protection prior to drain, drop, or curb inlet receiving runoff.

Keep the inlet protection in place and maintain until the disturbed contributing area is stabilized. Use Table 1 to select inlet protection type.

Table 1 Inlet Device Selection			
Inlet Type	Project Phase	Inlet Protection	Notes
Yard Drain or Field Inlet	Major grading through final stabilization	Type A	Allow ponding around drain if conditions allow
Paved Area Drain	Pre-Paving	Type A	After castings are in place, use Type D Series when needed for safety, or use Type B if insufficient depth is available
	Post-Paving	Type D, D-M, D- HR, or D-RF	Use Type B if inlet is not deep enough for Type D Series
Curb Inlet	Pre-Paving	Type A	After castings are in place, use Type D Series when needed for safety, or use Type C if insufficient depth is available
	Post-Paving/Curbing	Type D, D-M, D- HR, or D-RF	Use Type C if inlet is not deep enough for Type D Series

Technical Standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your local WDNR office or the Standards Oversight Council office in Madison, WI at (608) 441-2677.

To provide additional sediment settling, allow ponding below inlet rim where it will not interfere with traffic, create a safety hazard, impede site access, or cause property damage.

Leave no gaps in the material that would allow the flow of water to bypass the inlet protection device, except for overflow holes or “emergency spillways” needed to limit ponding to avoid interfering with the flow of traffic, creating a safety hazard, impeding site access, or causing property damage.

Use fabrics that meet Wisconsin Department of Transportation (WisDOT) specifications for the specified fabric.

Use *FF fabric*¹ as specified in the WisDOT Erosion Control Product Acceptability List (PAL), for Type A, B, C or D inlet protection.

Use *R, DF, and HR fabrics* as specified in the WisDOT Standard Specifications for Highway and Structure Construction.

Criteria for Type A Devices

Install frame and trench-in FF fabric around entire perimeter of device. (See Type A detail in Figure 1.)

Criteria for Type B Devices

Use Type B inlet protection only where there is no curb inlet and there is insufficient depth to install Type D Series inlet protection.

For Type B inlet protection, use FF fabric.

Leave at least 6 inches of geotextile fabric ‘flap’ around the perimeter of the grate. Stand on or hold the flap while removing grate for maintenance to prevent discharge of accumulated sediment into inlet. (See Type B detail in Figure 1.)

Criteria for Type C Devices

Use Type C inlet protection only where there is a curb inlet and there is insufficient depth to install Type D Series inlet protection.

For Type C inlet protection, use FF fabric.

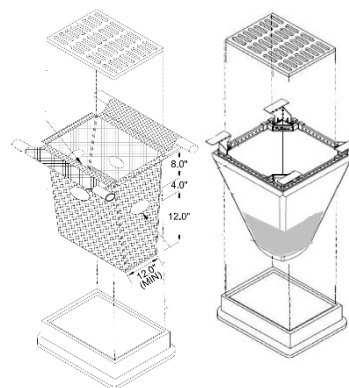
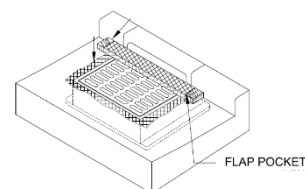
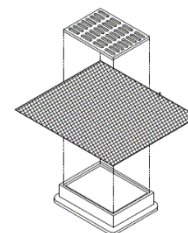
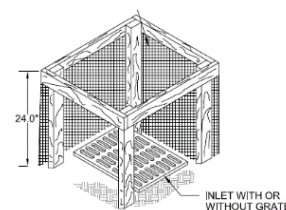
Wrap a 2-inch by 4-inch (nominal) piece of wood, secure it in the fabric and place in front of the curb head, as shown in Figure 1. Do not block the entire opening of the curb box with wood. Secure wood to the grate with wire or plastic ties. Water ponding more than 2 inches around the inlet should be able to overflow into the curb box. Leave at least 6 inches of geotextile fabric ‘flap’ around the perimeter of the grate. Stand on or hold the flap while removing grate for maintenance to prevent discharge of accumulated sediment into inlet. (See Type C detail in Figure 1.)

Criteria for Type D Series Devices

For Type D Series inlet protection devices, keep three inches of clearance between the bag and the sides of the inlet to prevent the filter bag from blocking overflow water. Cinch device bags when used in inlets less than 30 inches in depth to provide the required 3-inch clearance for overflow.

In general, device bags should not extend below the lowest outlet for inlets with sumps.

Refer to Table 2 for filter fabric type and exposed soil texture and particle diameter where a Type D Series device is appropriate.



¹ Words in the standard that are shown in italics are described in the Glossary section. The words are italicized the first time they are used in the text.

Table 2 Fabric Selection			
Exposed Soil Texture	Exposed Soil Average Particle Diameter (mm)	Filtering Fabric	Inlet Protection Type
Coarse (Sand)	≥ 0.0625	FF*	D, D-M, D-RF
Medium (Silt Loam)	0.0624 – 0.005	DF**	D-M, D-RF
Fine (Clay)	≤ 0.004	R	D-M, D-RF
		HR	D-HR, D-RF

Notes: * DF, R or HR fabrics may be used where FF is the required minimum standard.
 ** R or HR fabrics may be used where DF is the required minimum standard.

For **Type D** inlet protection, use FF fabric. (See Type D detail in Figure 2.)

For **Type D-M** inlet protection, use FF fabric for both the upper section and the outer lower sections of the device. Select the replaceable interior filter fabric type according to the particle size trapped. (See Type D-M detail in Figure 3.)

For **Type D-HR** inlet protection, use FF fabric for the upper half of the device and use HR fabric in the lower half of the device. (See Type D-HR detail in Figure 4.)

For **Type D-RF** inlet protection, include a rigid frame and a removable geosynthetic bag fixed to the frame with adequate strength to support the weight of the sediment bag when completely full. Use FF fabric for the upper section of the bag and a nonwoven liner based according to the particle size trapped. Bags can be a dual fabric bag sewn together, or a nonwoven liner sewn inside of an FF bag. Bypass overflows, within the frame or the sediment bag, shall be sized so that the flow through the overflows shall equal or exceed the design flow of the inlet required at a specific drainage location. (See Type D-RF detail in Figure 5.)

Criteria for Other Inlet Protection Methods

Rock bags, straw bales, stone weepers, and other ditch check devices can be used to settle sediment or divert flow. These devices are not applicable to areas adjacent to traffic and are not approved for inlet protection use on WisDOT projects.

- Manufactured rock bags shall conform to the WisDOT specification for rock bag material, including fill material.
- Ditch check device installation shall conform to the criteria outlined in the WDNR Technical Standard 1062 Ditch Check.
- Stone weeper installation shall conform to the criteria in WDNR Technical Standard 1063 Sediment Trap.

CONSIDERATIONS

- (1) Inlet protection is only one element in an erosion control plan and can be the last line of defense before runoff leaves a site. Use other practices, including temporary stabilization and area clean up, upstream of the inlet. Good construction site housekeeping measures, such as maintaining clean gutters and street sweeping, are also important.
- (2) Temporarily close or seal inlets completely to prevent entrance of runoff and sediment when site conditions allow.

- (3) Stabilize and restore disturbed areas as quickly as possible. Timely stabilization is the most effective method to control sediment entering the storm sewer.
- (4) Inlet protection should be considered for use along haul routes to supplement trackout control measures in WDNR Technical Standard 1057 Trackout Control Practices.
- (5) Inlet protection is only as effective as the filter or device used around the inlet. In general, inlet protection provides relatively good removal of coarse and medium-sized soil particles from runoff; however, to effectively trap fine soil particles, other practices such as the use of polyacrylamides, may be required (see WDNR Technical Standard 1050 Land Application of Additives for Erosion Control.)
- (6) Inlet protection requires routine inspection and maintenance. Effectiveness decreases rapidly if the inlet protection is not properly maintained. Field inspections have shown where inlet protection causes excessive ponding that the device is removed, punctured, or bypassed. In such situations, upstream erosion control effectiveness should be evaluated and replacement with a device including an overflow mechanism is appropriate, instead of simply removing the inlet protection device.
- (7) The effectiveness of inlet protection devices in unpaved areas can be enhanced by additional excavation to increase the storage capacity around the inlet.
- (8) The use of fabric intended for a finer soil type on a construction site with coarser soil may increase the required maintenance frequency due to faster clogging.
- (9) Consider using Type D-M, D-HR, and D-RF inlet protection rather than Type B, C, or D in areas with fine soils where more effective filtering is desired.
- (10) Inlet protection devices listed in the WisDOT PAL are accepted for use in accordance with this standard.
- (11) Stabilize contributing drainage area prior to winter season. Once contributing area is stabilized, remove inlet protection to prevent flooded conditions. Replace inlet protection prior to site disturbance in spring. Where this is not feasible, Type D-RF is recommended for inlets on snow plow routes.
- (12) Where vegetated buffers are present around yard drains or field inlets, Type B inlet protection may be sufficient.
- (13) Permanent inlet filters for stormwater management should not be installed until after construction is complete and the site has been stabilized as they may clog prematurely.

PLANS AND SPECIFICATIONS

Develop all plans and specifications in accordance with this standard, and to describe the requirements for applying the practice to achieve its intended purpose. In the plans and specifications address the following:

- (1) Locations and types of inlet protection. If the type of inlet protection will change as construction progresses, note this in the plans.
- (2) Material specification conforming to this standard.
- (3) In all construction documents, identify the responsible party and include a schedule for installation, inspection, and maintenance requirements.
- (4) Include a copy of the applicable inlet protection details in the construction plans.

OPERATIONS AND MAINTENANCE

Remove inlet protection devices once the contributing drainage area is stabilized with appropriate vegetation or impervious surface.

At a minimum, inspect inlet protection weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period. Use a flashlight to improve visibility when necessary.

When maintaining and removing inlet protection devices, exercise care to minimize sediment falling into the inlet. Immediately remove all material that has fallen into inlets. Deposit sediment removed from the device in a suitable area and stabilize.

Replace inlet protection if flaps become too damaged to allow cleaning without material falling into the inlet.

Operations and Maintenance (O&M) for Type A, B or C Inlet Protection

Remove sediment deposits when sediment has accumulated between $\frac{1}{3}$ to $\frac{1}{2}$ of the design height or the device is no longer functioning as designed.

Inspect the device routinely, and as necessary repair and restore to original condition.

Ponding may indicate that the device's fabric needs maintenance and sediment removal. Unless extraordinary circumstance arise, fabric should not be cut to bypass the fabric. If filter fabric is cut, replace inlet protection as soon as water levels recede enough to do so.

O&M for Type D, D-M, and D-HR Inlet Protection

Remove sediment when it accumulates to within 6 inches of the bottom of the overflow holes.

If standing water remains within 6 inches of the bottom of the overflow holes 24 hours after a runoff event, remove accumulated sediment to restore the fabric's filtering capacity.

Holes in the FF fabric less than 2 inches in length may be repaired by stitching. The bag must be replaced if holes greater than 2 inches are observed in the FF fabric.

Replace insert filters and HR fabrics if any holes are observed.

The filter must be replaced if the flap pockets sustain damage that compromises the integrity of the filter or the ability to perform maintenance. If in good condition, bags can be cleaned and reused on subsequent project sites.

O&M for Type D-RF Inlet Protection

Remove sediment deposits when sediment has accumulated between $\frac{1}{3}$ to $\frac{1}{2}$ of the design storage depth or the device is no longer functioning as designed.

Holes in the FF fabric less than 2 inches in length may be repaired by stitching. The bag must be replaced if holes greater than 2 inches are observed in the FF fabric.

Replace the bag if any holes are observed in the nonwoven liner fabric. If in good condition, bags can be cleaned and reused on subsequent project sites.

REFERENCES

Wisconsin Department of Transportation, Erosion Control Product Acceptability List, <https://wisconsin.gov/Pages/doing-business/eng-consultants/cnslt-rsrcs/tools/pal/default.aspx>

Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, <https://wisconsin.gov/Pages/doing-business/eng-consultants/cnslt-rsrcs/rdw/stnds-spec.aspx>.

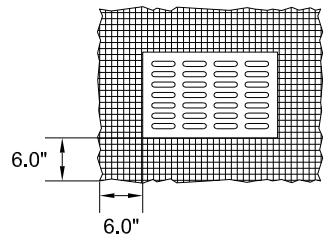
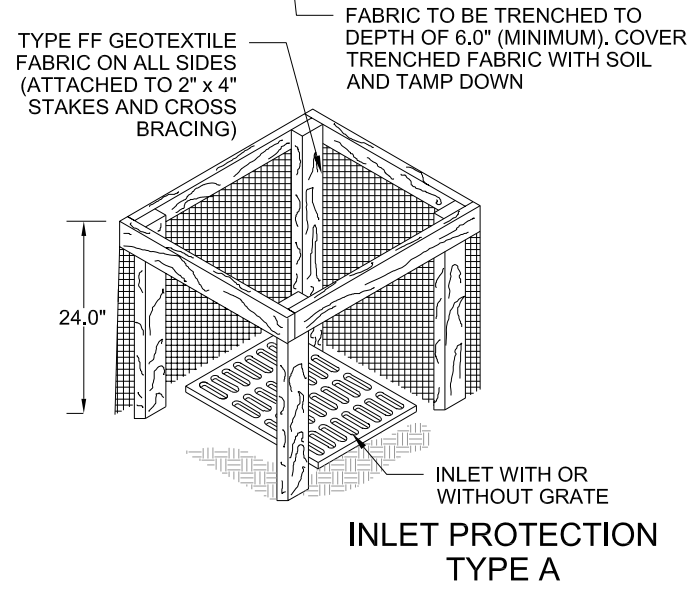
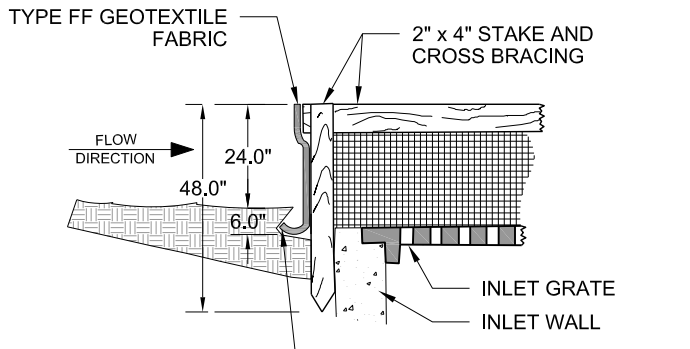
ASTM International. *D8057-17 Standard Specification for Inlet Filters with a Rigid Frame*. West Conshohocken, PA, 2017.

GLOSSARY

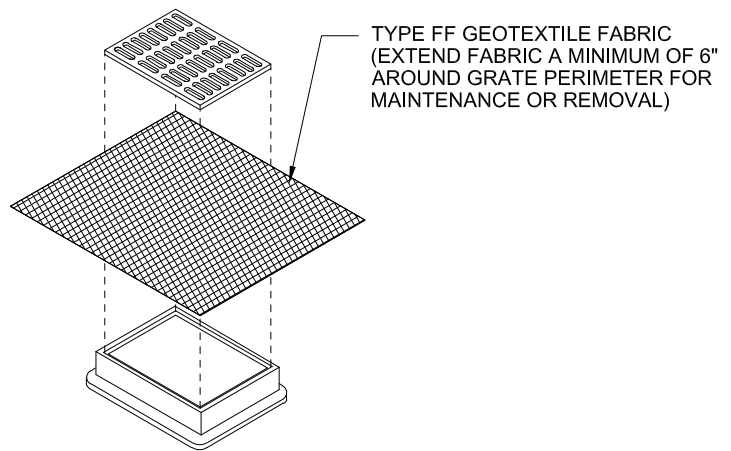
FF Fabric is a woven polypropylene monofilament geotextile and is resistant to biological degradation and commonly-encountered soil chemicals.

R, DF and HR Fabrics are nonwoven geotextiles composed of bonded polypropylene fibers and are resistant to biological degradation and commonly-encountered soil chemicals.

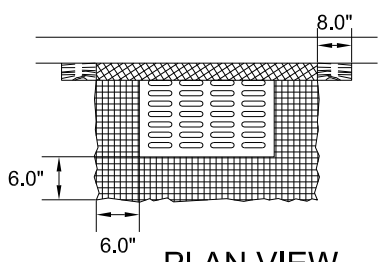
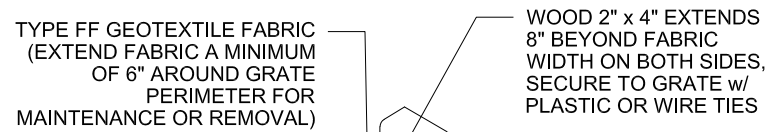
FIGURE 1. INLET PROTECTION TYPES A, B AND C



PLAN VIEW TYPE B WITHOUT CURB BOX



INLET PROTECTION TYPE B WITHOUT CURB BOX



PLAN VIEW TYPE C WITH CURB BOX

INLET PROTECTION TYPE C WITH CURB BOX

FLAP POCKET (SEE NOTE #1)

NOTES:

1. FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2" x 4". THE REBAR, STEEL PIPE, OR WOOD SHALL BE INSTALLED IN THE REAR FLAP AND SHALL NOT BLOCK THE TOP HALF OF THE CURB FACE OPENING.

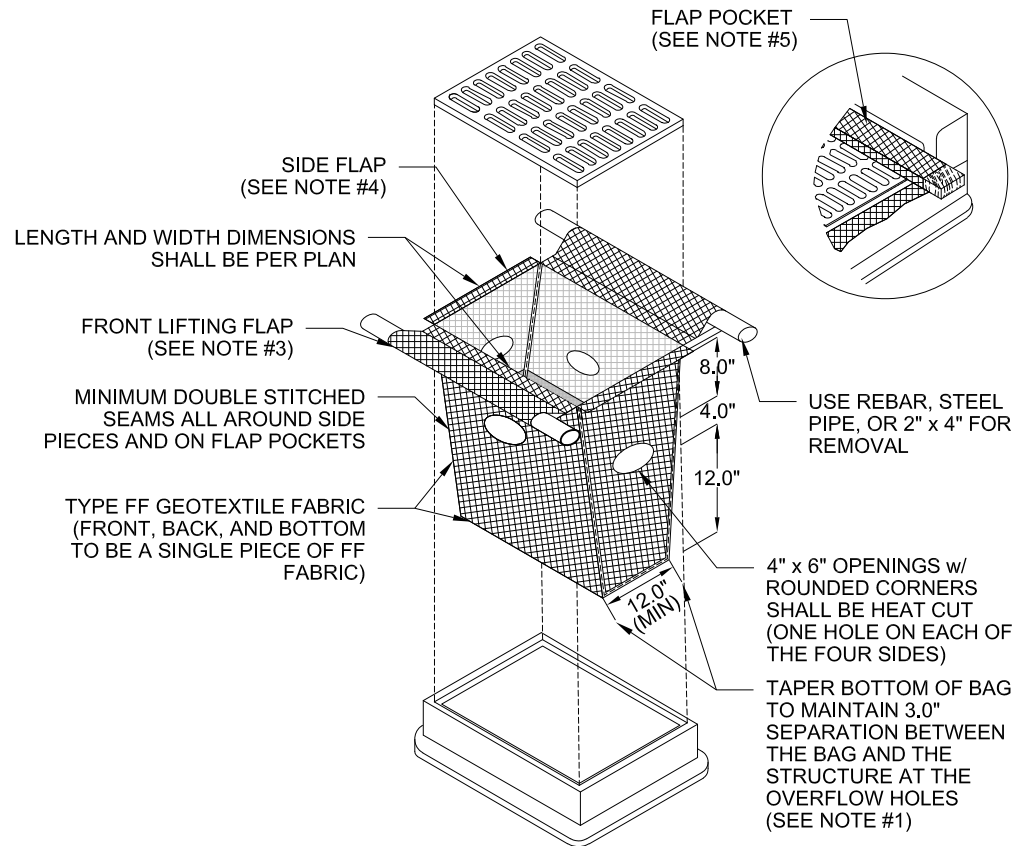
MAINTENANCE NOTES:

1. WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED IN THE FABRIC DOES NOT FALL INTO THE STRUCTURE. MATERIAL THAT HAS FALLEN INTO THE INLET SHALL BE IMMEDIATELY REMOVED.



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FIGURE 2. INLET PROTECTION TYPE D



INLET PROTECTION TYPE D

CAN BE INSTALLED IN INLETS WITH OR WITHOUT CURB BOXES

NOTES:

1. TAPER BOTTOM OF BAG TO MAINTAIN 3" OF CLEARANCE BETWEEN THE BAG AND THE STRUCTURE, MEASURED FROM THE BOTTOM OF THE OVERFLOW OPENINGS TO THE STRUCTURE WALL.
2. GEOTEXTILE FABRIC TYPE FF FOR FLAPS, TOP AND BOTTOM OF OUTSIDE OF FILTER BAG. FRONT, BACK, AND BOTTOM OF FILTER BAG BEING ONE PIECE.
3. FRONT LIFTING FLAP IS TO BE USED WHEN REMOVING AND MAINTAINING FILTER BAG.
4. SIDE FLAPS SHALL BE A MAXIMUM OF 2" LONG. FOLD THE FABRIC OVER AND REINFORCE WITH MULTIPLE STITCHES.
5. FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2" x 4". THE REBAR, STEEL PIPE, OR WOOD SHALL BE INSTALLED IN THE REAR FLAP AND SHALL NOT BLOCK THE TOP HALF OF THE CURB FACE OPENING.

MAINTENANCE NOTES:

1. WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED IN THE FABRIC DOES NOT FALL INTO THE STRUCTURE. MATERIAL THAT HAS FALLEN INTO THE INLET SHALL BE IMMEDIATELY REMOVED.



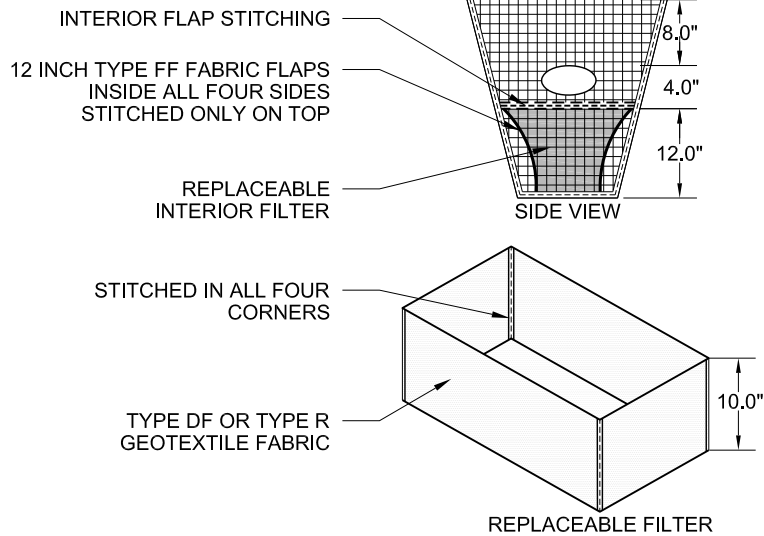
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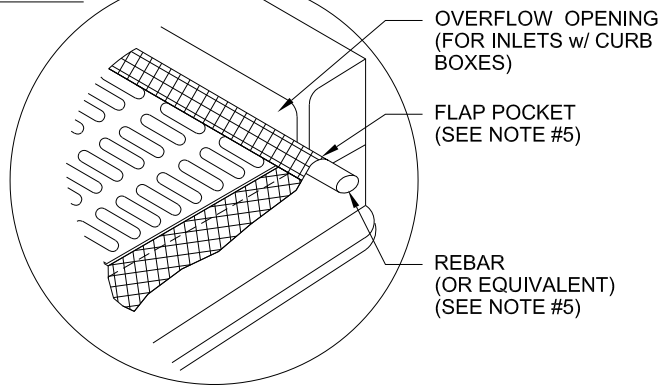
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FIGURE 3. INLET PROTECTION TYPE D-M

INSET #1



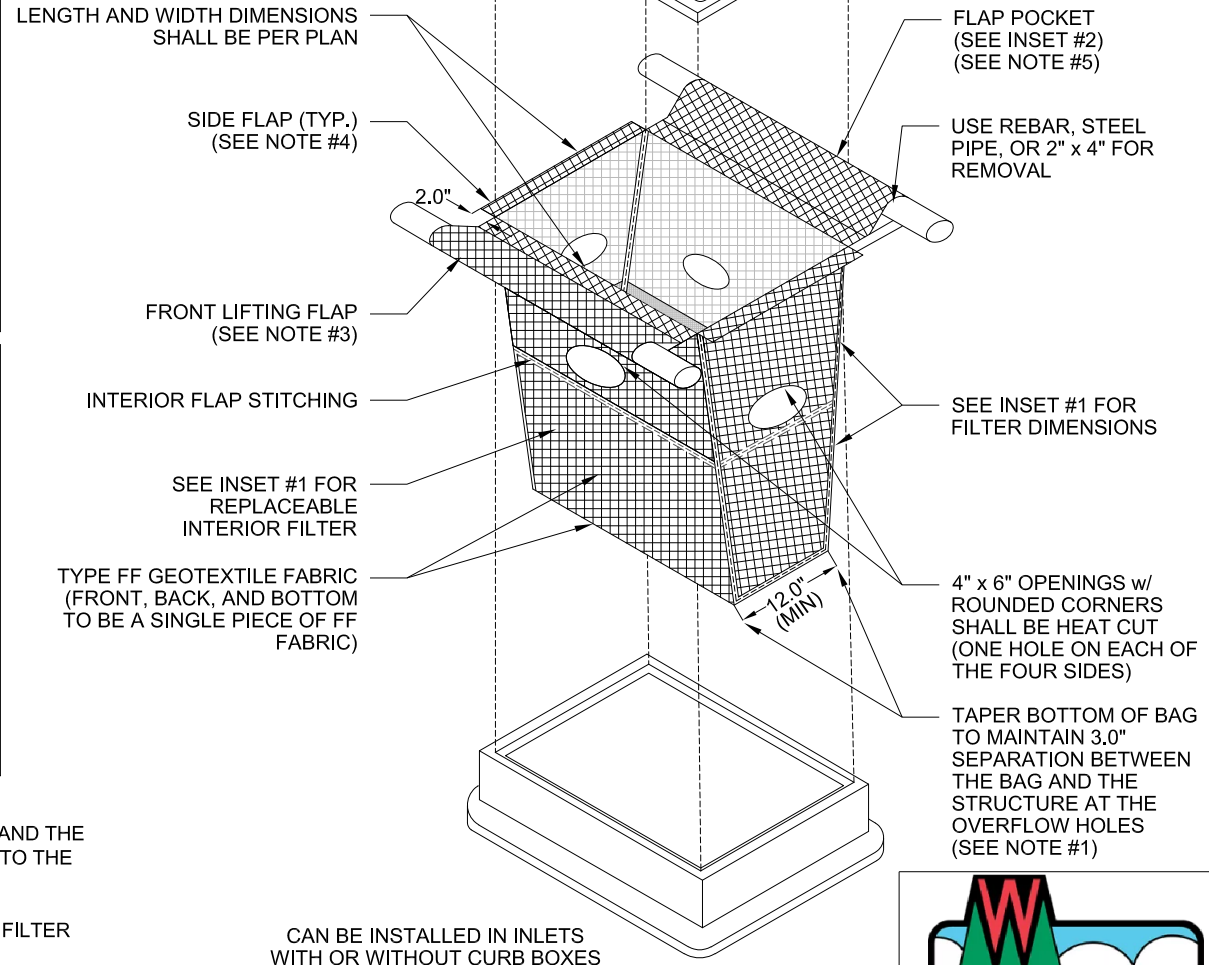
INSET #2



NOTES:

1. TAPER BOTTOM OF BAG TO MAINTAIN 3" OF CLEARANCE BETWEEN THE BAG AND THE STRUCTURE, MEASURED FROM THE BOTTOM OF THE OVERFLOW OPENINGS TO THE STRUCTURE WALL.
2. GEOTEXTILE FABRIC TYPE FF FOR FLAPS, TOP AND BOTTOM OF OUTSIDE OF FILTER BAG. FRONT, BACK, AND BOTTOM OF FILTER BAG BEING ONE PIECE.
3. FRONT LIFTING FLAP IS TO BE USED WHEN REMOVING AND MAINTAINING FILTER BAG.
4. SIDE FLAPS SHALL BE A MAXIMUM OF 2" LONG. FOLD THE FABRIC OVER AND REINFORCE WITH MULTIPLE STITCHES.
5. FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2" x 4". THE REBAR, STEEL PIPE, OR WOOD SHALL BE INSTALLED IN THE REAR FLAP AND SHALL NOT BLOCK THE TOP HALF OF THE CURB FACE OPENING.

LENGTH AND WIDTH DIMENSIONS SHALL BE PER PLAN



MAINTENANCE NOTES:

1. WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED IN THE FABRIC DOES NOT FALL INTO THE STRUCTURE. MATERIAL THAT HAS FALLEN INTO THE STRUCTURE SHALL BE IMMEDIATELY REMOVED.

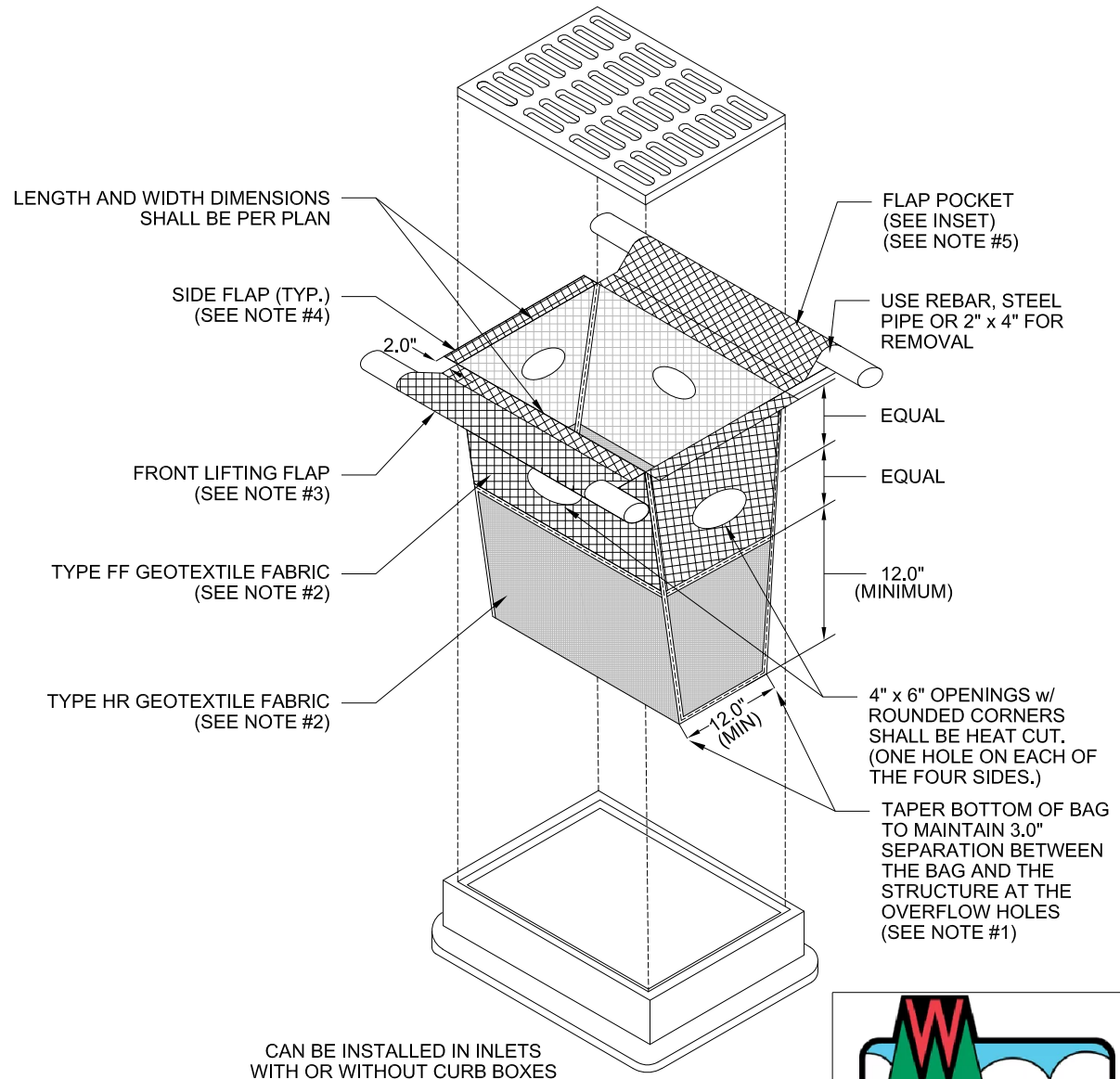
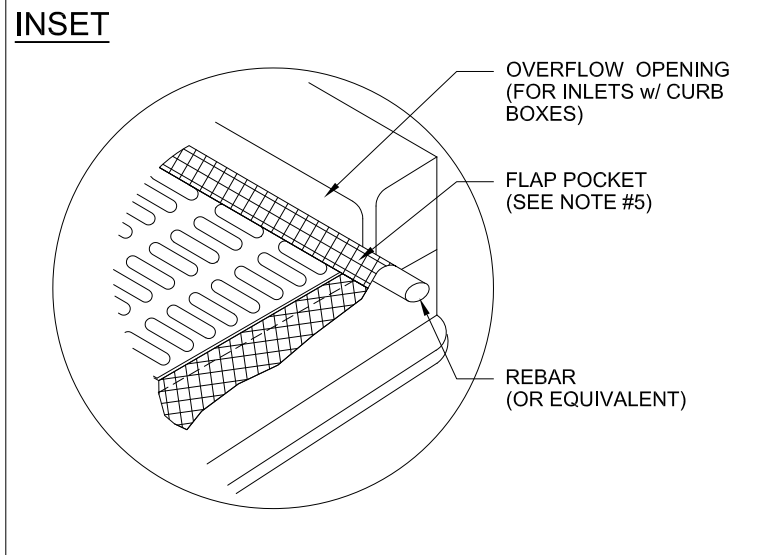


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FIGURE 4. INLET PROTECTION TYPE D-HR



NOTES:

1. TAPER BOTTOM OF BAG TO MAINTAIN 3" OF CLEARANCE BETWEEN THE BAG AND THE STRUCTURE, MEASURED FROM THE BOTTOM OF THE OVERFLOW OPENINGS TO THE STRUCTURE WALL.
2. GEOTEXTILE FABRIC, TYPE FF FOR FLAPS AND TOP HALF OF FILTER BAG. GEOTEXTILE FABRIC, TYPE HR FOR BOTTOM HALF OF FILTER BAG WITH FRONT, BACK, AND BOTTOM BEING ONE PIECE. DUAL FABRIC BAGS SHALL BE STITCHED TOGETHER
3. FRONT LIFTING FLAP IS TO BE USED WHEN REMOVING AND MAINTAINING FILTER BAG.
4. SIDE FLAPS SHALL BE A MAXIMUM OF 2" LONG. FOLD THE FABRIC OVER AND REINFORCE WITH MULTIPLE STITCHES.
5. FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2" x 4". THE REBAR, STEEL PIPE, OR WOOD SHALL BE INSTALLED IN THE REAR FLAP AND SHALL NOT BLOCK THE TOP HALF OF THE CURB FACE OPENING.

MAINTENANCE NOTES:

1. WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED IN THE FABRIC DOES NOT FALL INTO THE STRUCTURE. MATERIAL THAT HAS FALLEN INTO THE STRUCTURE SHALL BE IMMEDIATELY REMOVED.



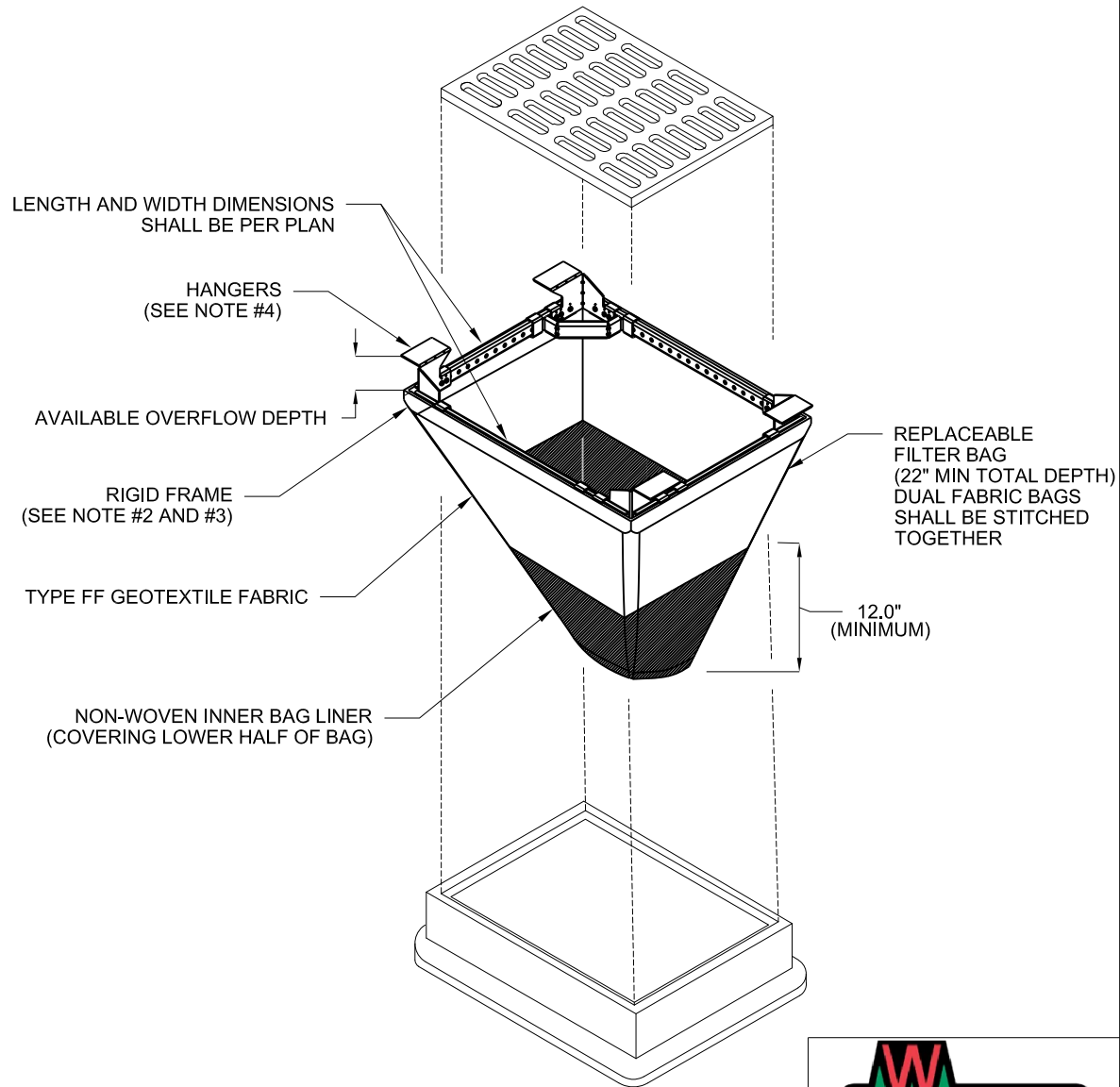
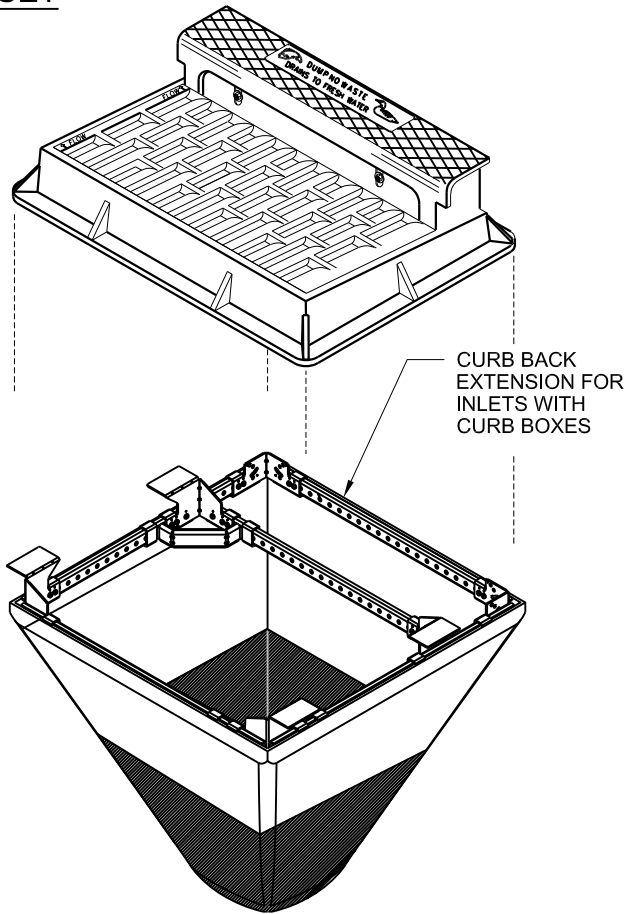
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FIGURE 5. INLET PROTECTION TYPE D-RF

INSET



CAN BE INSTALLED IN INLETS WITH OR WITHOUT CURB BOXES

NOTES:

1. TAPER BOTTOM OF BAG TO MAINTAIN 3" OF CLEARANCE BETWEEN THE BAG AND THE STRUCTURE, MEASURED FROM THE BOTTOM OF THE OVERFLOW OPENINGS TO THE STRUCTURE WALL.
2. THE RIGID FRAME SHALL BE CONSTRUCTED OF GALVANIZED STEEL AND HAVE ADEQUATE STRENGTH TO SUPPORT THE WEIGHT OF THE SEDIMENT BAG WHEN COMPLETELY FULL.
3. THE RIGID FRAME SHALL NOT INTERFERE WITH OR ELEVATE THE GRATE MORE THAN 1/8".
4. DROP THE INLET FILTER THROUGH THE CLEAR OPENING SUCH THAT THE HANGERS REST FIRMLY ON THE LIP OF THE STRUCTURE.

MAINTENANCE NOTES:

1. WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED IN THE FABRIC DOES NOT FALL INTO THE STRUCTURE. MATERIAL THAT HAS FALLEN INTO THE STRUCTURE SHALL BE IMMEDIATELY REMOVED.



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