



TECHNICAL NOTE

Dual Wall HDPE Perforation Patterns

TN 1.01
December 2011

Introduction

Perforated pipe plays an integral role in many applications of HDPE pipe. Generally, perforated pipe is used to accelerate the removal of subsurface water in soils or to allow storm water to percolate into the soil. Currently, two classifications of perforations are specified in the AASHTO material specifications for HDPE pipe: Class I, and Class II. Class I perforations are commonly used in combination storm/underdrain systems while Class II incorporates subsurface drainage and detention/retention systems. Both classes are explained in more detail in the AASHTO materials specifications (M294 and M252). AASHTO M252 covers pipe diameters 3- through 10-inch (75 - 250 mm) while M294 covers 12-inch through 60-inch (300 - 1500 mm).

Standard Perforation Patterns

AASHTO Class II Perforation

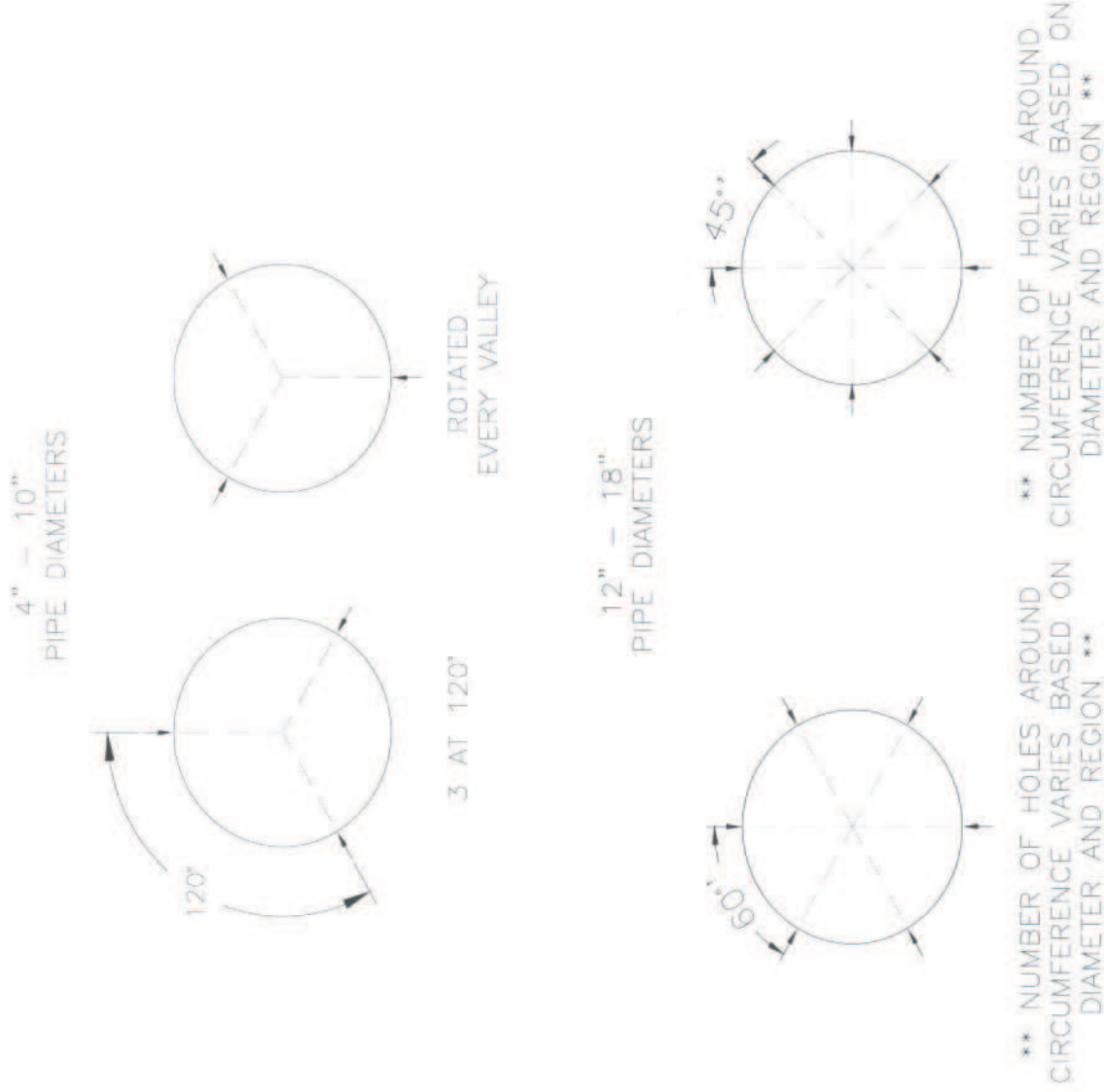
The following terminology for perforations is derived from the applicable AASHTO specification. Differences between the specifications are covered in the table below. Class II perforations shall be located in the outside valleys of the corrugations, be circular and/or slotted and evenly spaced around the circumference and length of the pipe. The perforations shall be located in the outside valleys of the corrugations. The water inlet area shall be no less than 0.945 in²/ft (20 cm²/m) for pipe diameters 4- through 10-inch (100 - 250mm), 1.42 in²/ft (30 cm²/m) for pipe diameters 12- through 18-inch (300 - 450 mm) and 1.89 in²/ft (40 cm²/m) for pipe diameters larger than and equal to 24 inches (600 mm). Table 1 below represents ADS standard perforation patterns for AASHTO Class II.

Nominal I.D.		Perforation Type	Maximum Slot Length or Diameter		Maximum Slot Width		Minimum Inlet Area	
In	mm		In	mm	In	mm	in ² /ft	cm ² /m
4	100	Slot	0.875	22	0.125	3	1.0	21
6	150	Slot	0.875	22	0.125	3	1.0	21
8	200	Slot	1.18	30	0.125	3	1.0	21
10	250	Slot	1.18	30	0.125	3	1.0	21
12	300	Circular	0.313	8	-	-	1.5	32
15	375	Circular	0.313	8	-	-	1.5	32
18	450	Circular	0.313	8	-	-	1.5	32
24	600	Circular	0.313	8	-	-	2.0	42
30	750	Circular	0.375	9.5	-	-	2.0	42
36	900	Circular	0.375	9.5	-	-	2.0	42
42	1050	Circular	0.375	9.5	-	-	2.0	42
48	1200	Circular	0.375	9.5	-	-	2.0	42
54	1350	Circular	0.375	9.5	-	-	2.0	42
60	1500	Circular	0.375	9.5	-	-	2.0	42

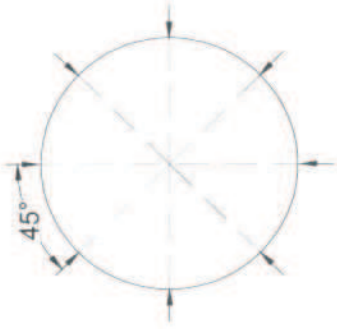
Figure 1

AASHTO Class II Perforation Patterns

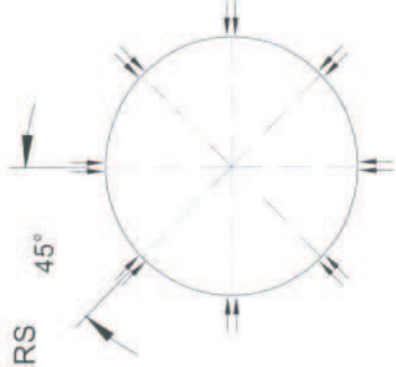
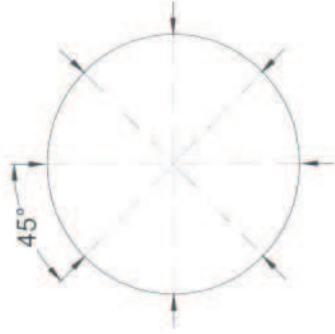
Note: Actual pattern may vary by region, however all patterns meet the AASHTO and ASTM minimum requirements for the open inlet area.



24" PIPE DIAMETERS



30" PIPE DIAMETERS



2 AT EVERY 45°
** NUMBER OF HOLES AROUND CIRCUMFERENCE
VARIES BASED ON DIAMETER AND REGION**

36" - 60"
PIPE DIAMETERS



2 AT EVERY 45°



N-12® WT IB PIPE (PER ASTM F2648)

It's a revolution that began nearly 15 years ago when ADS pioneered the watertight joint for corrugated polyethylene pipe. The ADS N-12 WT IB pipe (per ASTM F2648) – our third generation of watertight joint technology – has set the standard in watertight performance.

Today's N-12 WT IB pipe (per ASTM F2648) is engineered with a blend of virgin and recycled high density polyethylene resins to provide impressive material properties. The performance you've come to expect from N-12, with the added benefit of helping promote responsible use of resources.

The ADS N-12 WT IB pipe (per ASTM F2648) incorporates patented technology developed in the aerospace industry. A 2" wide proprietary polymer composite is fused to the outside wall of the integral bell, improving the joint's integrity and tolerance control. A patented gasket, that meets all requirements of ASTM F477, increases its sealing forces as temporary internal or external hydrostatic pressure increases. Flared bell and spigot significantly improve ease of installation. N-12 ASTM F2648 WT IB pipe is so advanced in its design that it is easy to put your confidence in for long-term reliability.

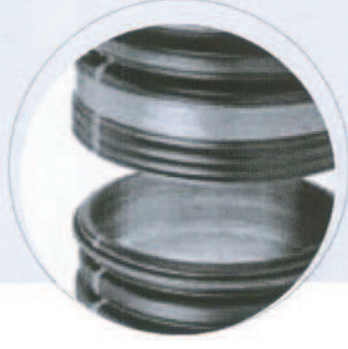
APPLICATIONS:

Storm Sewers	Culverts & Cross Drains
Slope/Edge Drains	Mining/Forestry/Industrial
Retention/Detention	Ditch Enclosures
Roof Drainage	

FEATURES:

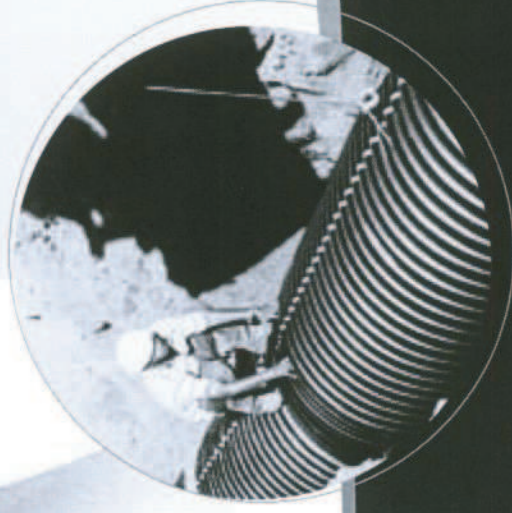
- 4" – 60" (100 - 1500 mm) diameters available
- Nominal 20 ft. (6m) and 13 ft. (4m) lengths available
- Integral bell and factory-installed gasket
- Joint meets or exceeds ASTM D3212 lab test as well as ASTM F2487 and ASTM F1417 watertight field test
- Exceptional joint strength
- Excellent abrasion and corrosion resistance
- Light weight
- Structural strength that will support H-25 or HL-93 live loads with 1' (0.3 m) minimum cover; 60" (1500 mm) pipe requires 2' (0.6 m) cover for H-25 or HL-93 loads

ADS Service: ADS representatives are committed to providing you with the answers to all your questions, including specifications, and installation and more.



BENEFITS:

- Variety of diameters and lengths fit any project
- Pipe requires no extra couplers, grout or other sealants for installation due to built-in bell and factory-installed gasket. This means fewer components to risk performance.
- Installation cost savings from lower shipping costs, fewer people, and less heavy equipment required.
- Hydraulic efficiency from smooth interior
- Long-term durability of HDPE



The Most Advanced Name in Drainage Systems®

ADS N-12® WT IB PIPE (PER ASTM F2648) SPECIFICATION

SCOPE

This specification describes 4- through 60-inch (100 to 1500 mm) ADS N-12 WT IB pipe (per ASTM F2648) for use in gravity land drainage applications.

PIPE REQUIREMENTS

- N-12 WT IB pipe (per ASTM F2648) shall have a smooth interior and annular exterior corrugations.
- 4- through 60-inch (100 to 1500 mm) shall meet ASTM F2648
- Manning's "n" value for use in design shall be 0.012.

JOINT PERFORMANCE

4- through 60-inch (100 to 1500 mm) pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made from polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

12-through 60-inch (300-1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.

FITTINGS

Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM F2306.

FIELD PIPE AND JOINT PERFORMANCE

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

MATERIAL PROPERTIES

Material for pipe production shall be an engineered blend of virgin and recycled high density polyethylene conforming with the minimum requirements of cell classification 424420C, (ESCR Test Condition B) for 4- through 10-inch (100 to 250 mm) diameters, and 435400C, (ESCR Test Condition B) for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The design engineer shall verify compatibility with overall system including structural, hydraulic, material and installation requirements for a given application.

INSTALLATION

Installation shall be in accordance with ASTM D2321 and ADS's published installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot (0.3 m) and for 60-inch (1500 mm) diameters, the minimum cover shall be 2 foot (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted), Class 2 (minimum 90% SPD) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.02. Contact your local ADS representative or visit our website at www.ads-pipe.com for a copy of the latest installation guidelines.

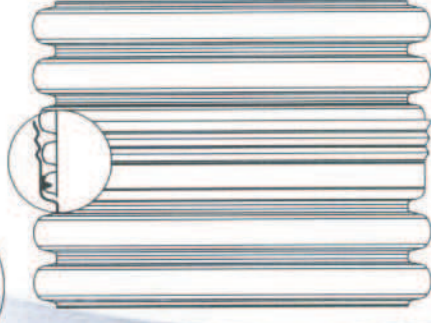
PIPE DIMENSIONS

Pipe I.D., in. (mm)	Nominal Diameter, in (mm)												
	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	60 (1500)
Pipe O.D., in. (mm)	4.8 (122)	6.9 (175)	9.1 (231)	11.4 (290)	14.5 (368)	18 (457)	22 (559)	28 (711)	36 (914)	42 (1067)	48 (1219)	54 (1372)	67 (1702)

••Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are ± 1 inch. Contact a sales representative for exact values.

For more information on ADS N-12 WT IB pipe (per ASTM F2648) and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

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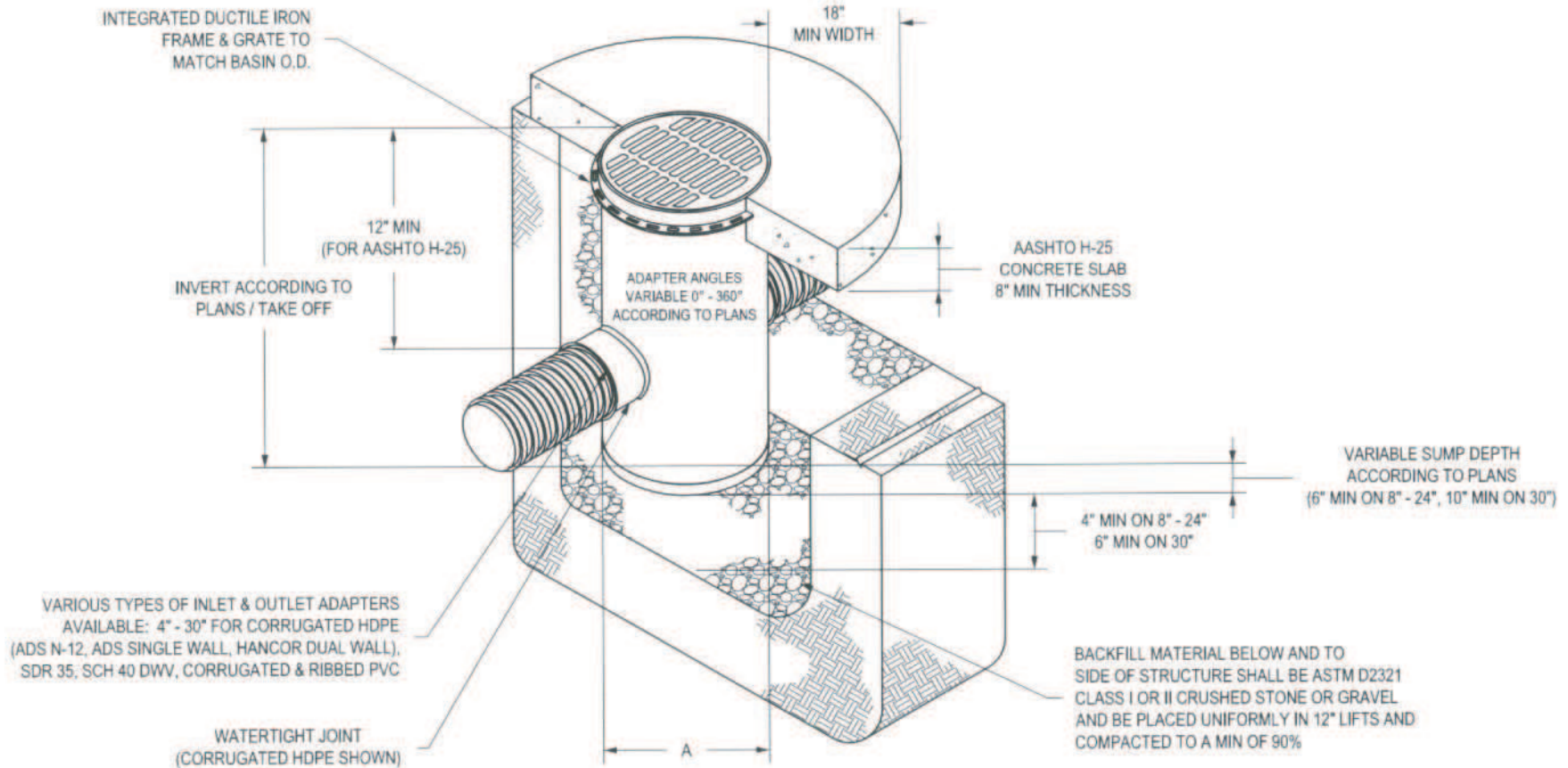


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Advanced Drainage Systems, Inc.
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1-800-821-6710 www.ads-pipe.com



NYLOPLAST DRAIN BASIN



- 1- 8" - 30" GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
- 2- 8", 10", 18", 24" & 30" FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
- 3- 12" & 15" FRAMES SHALL BE CAST IRON PER ASTM A48-83 CLASS 30B
- 4- DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
- 5- DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
- 6- FOR COMPLETE DESIGN AND PRODUCT INFORMATION: WWW.NYLOPLAST-US.COM
- 7- TO ORDER CALL: 800-821-6710

A	PART #	GRATE OPTIONS		
8"	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10"	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12"	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-25	SOLID AASHTO H-25
15"	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-25	SOLID AASHTO H-25

A	PART #	GRATE OPTIONS		
18"	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-25	SOLID AASHTO H-25
24"	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-25	SOLID AASHTO H-25
30"	2830AG	N/A	STANDARD AASHTO H-25	SOLID AASHTO H-25

DRAWN BY	EBC	MATERIAL				 Nyloplast 3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2443 FAX (770) 932-2490 www.nyloplast-us.com
DATE	1-23-06					
APPD BY	CJA	PROJECT NO./NAME				TITLE DRAIN BASIN WITH STANDARD GRATE QUICK SPEC INSTALLATION DETAIL
DATE	1-23-06					
DWG SIZE	A	SCALE	NTS	SHEET	1 OF 1	DWG NO. 7001-110-144 REV A

Section 2721

Engineered Surface Drainage Products

GENERAL

PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surface drainage inlets shall be as manufactured by Nyloplast a division of Advanced Drainage Systems, Inc., or prior approved equal.

MATERIALS

The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

The grates and frames furnished for all surface drainage inlets shall be ductile iron for sizes 8", 10", 12", 15", 18", 24" and 30" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting H-20 wheel loading for traffic areas or H-10 loading for pedestrian areas. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black.

INSTALLATION

The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

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	DATE	3-10-00							
	REVISED BY	EBC	PROJECT NO./NAME			TITLE 8 IN - 30 IN DRAIN BASIN SPECIFICATIONS			
	DATE	2-9-10							
	DWG SIZE	A	SCALE	1:1	SHEET	1 OF 1	DWG NO.	7001-110-011	REV

AdvanEDGE® Pipe

The advanced panel pipe for rapid-response drainage

ADS AdvanEDGE panel pipe provides the dimensional stability and field-proven structural strength for quick, effective subsurface drainage. It consists of a perforated panel-shaped plastic core wrapped with geotextile for soil filtration. The distinguishing performance feature of panel pipe is its ability to rapidly collect and remove water. Compared to 4" round pipe with an equal length of 12", panel pipe has twice the soil contact area and will drain a given quantity of water in about 60% of the time. Its slim 1.5" profile permits a narrow trench and faster installation.

AdvanEDGE is truly a pipe. It's not round, of course, but its panel-shaped core fully encloses the waterway. Lateral pillars maintain the core opening, resulting in a series of oval-shaped channels providing superior strength and relatively few projections into the waterway. The design of the invert permits significantly higher flow velocity at lower head.

An effective solution for a wide range of applications:

- Highway edge drains
- Athletic turf drainage
- Building foundations and retaining walls
- Waste management curtain drains

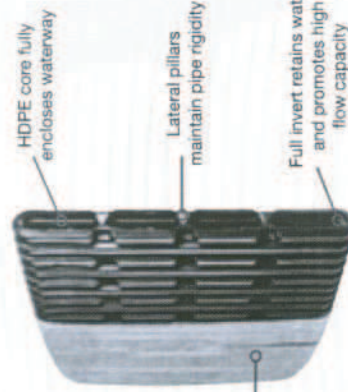


Features:

- 12" and 18" (300 and 450 mm) oblong dimensions available
- 100 ft and 500 ft lengths available
- Fast installation times
- Manufactured from high density polyethylene resin

Benefits:

- Invert design permits significantly higher flow velocity at lower head
- Structural superiority confirmed by state field performance tests of edge drains
- Higher flow capacity compared to various geocomposites
- Slim-line design allows for narrow trench installation, easily cut in with high-speed trenching equipment
- Long-term durability of HDPE



AdvanEDGE is designed to provide significantly higher flow and structural strength

Geotextile acts as a soil filter only, not as a structural member

ADS AdvanEDGE Pipe Specifications

Scope

This specification describes 12" and 18" (300 and 450 mm) ADS AdvanEDGE oblong corrugated pipe for use in subsurface drainage applications.

Pipe Requirements

ADS AdvanEDGE shall meet ASTM D7001 and have outside dimensions of 1.5" wide by 13" tall or 1.5" wide by 18" tall. AdvanEDGE shall have internal bracing adjoining each long wall to prevent crushing under typical loading. AdvanEDGE shall be made available with or without external geotextile wrap.

Material Properties

All pipe and fittings shall be made of polyethylene with a minimum cell classification of 424420C as defined and described in ASTM D3350.

AdvanEDGE Perforations

Nominal Pipe Size, in. (mm)	12 (300)	18 (450)
Slot Length (Avg), in. (mm)	1.125 (29)	1.125 (29)
Slot Width (Avg), in. (mm)	0.125 (3.2)	0.15 (4)
Water Inlet Area (Approx), in ² /ft	15	20

All Values provided are for reference purposes only.

AdvanEDGE Geotextile Wrap

Fabric Properties	Test Method	Minimum Average Roll Values
Grab Tensile Strength (lbs.) (weakest principle direction)	ASTM D4632	120
Grab Elongation (%) (weakest principle direction)	ASTM D4633	60
Trapezoidal Tear (lbs.) (weakest principle direction)	ASTM D4533	40
Puncture (lbs.)	ASTM D3786	30
Permittivity	ASTM D4491	0.7
AOS (U.S. Sieve Size)	ASTM D4751	60
U.V. Resistance	ASTM D4355	70



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