

KUBRICKY CONSTRUCTION CORP.  
269 BALLARD ROAD

WILTON, NY 12831  
518 792-5864



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Rutland City BRF 3000 (2014036)  
SUBMITTAL 48

Issued 04/10/15  
Respond by 04/17/15

To

**Timothy Pockette, PE**

Topic 605.10 6" Underdrain Pipe  
Status For Approval  
Spec section 605.10  
Responsibility (19) Ripley Road  
Sent to approver 4/10/15  
Required from approver 4/17/15

From

**Volker H.D. Burkowski**

Signed by

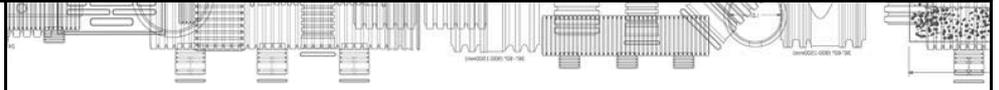
Date

4/10/15

Proceed as Indicated

Date

Owner Authorized Representative



# 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 in<sup>2</sup>/ft (20 cm<sup>2</sup>/m) for pipe diameters 4- through 10-inch (100 - 250mm), 1.42 in<sup>2</sup>/ft (30 cm<sup>2</sup>/m) for pipe diameters 12- through 18-inch (300 - 450 mm) and 1.89 in<sup>2</sup>/ft (40 cm<sup>2</sup>/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 <sup>2</sup> /ft	cm <sup>2</sup> /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

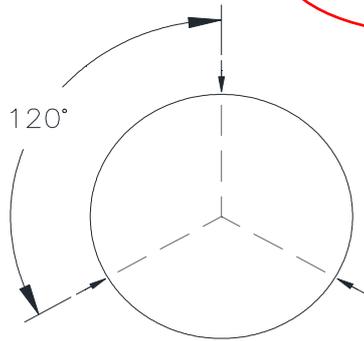


**Figure 1**

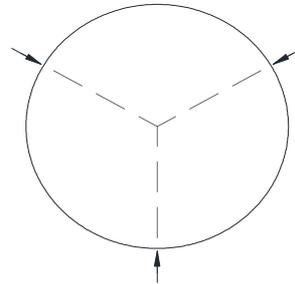
**AASHTO Class II Perforation Patterns**

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

4" – 10"  
PIPE DIAMETERS

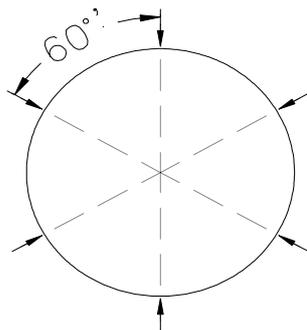


3 AT 120°

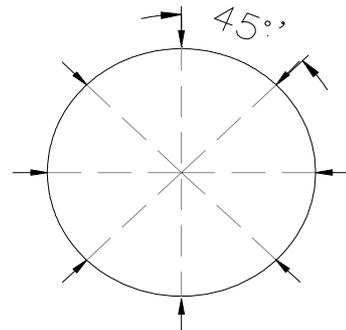


ROTATED  
EVERY VALLEY

12" – 18"  
PIPE DIAMETERS



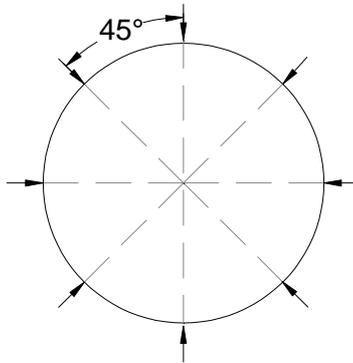
\*\* NUMBER OF HOLES AROUND CIRCUMFERENCE VARIES BASED ON DIAMETER AND REGION \*\*



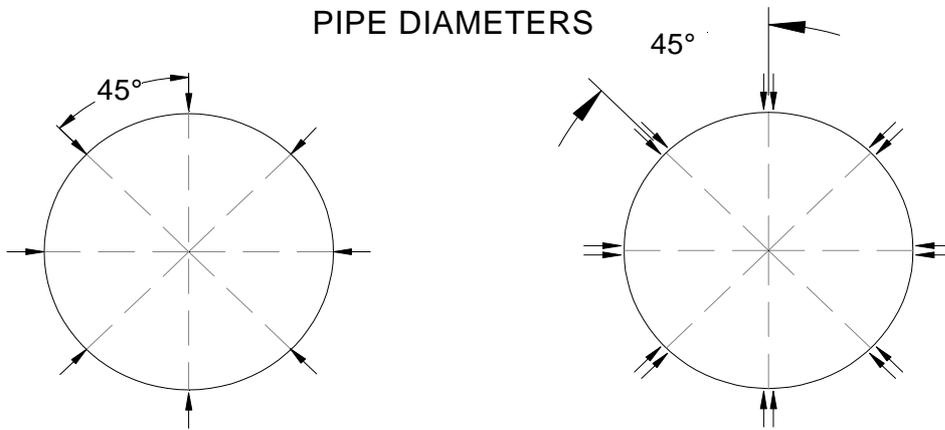
\*\* NUMBER OF HOLES AROUND CIRCUMFERENCE VARIES BASED ON DIAMETER AND REGION \*\*



24"  
PIPE DIAMETERS



30"  
PIPE DIAMETERS

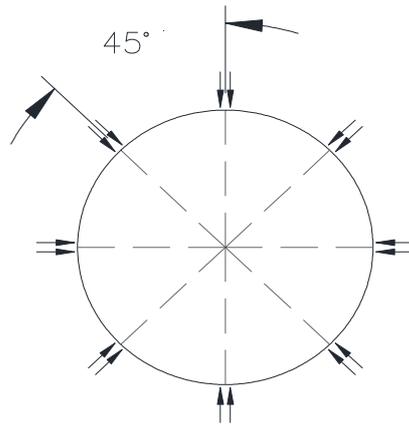


2 AT EVERY 45°

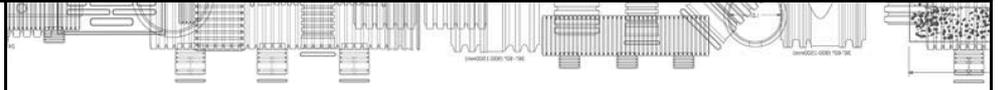
**\*\* NUMBER OF HOLES AROUND CIRCUMFERENCE  
VARIES BASED ON DIAMETER AND REGION\*\***



36" - 60"  
PIPE DIAMETERS



2 AT EVERY 45°



## AASHTO Class I Perforation

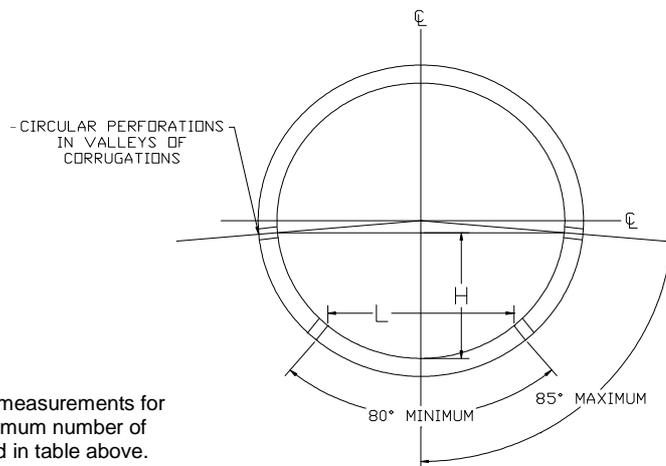
The following terminology is derived from the applicable AASHTO specification. ADS manufactures 12- through 24-inch (300 – 600 mm) Class I perforation as a standard product (ADS designation 'C' perforation), however, other sizes may be ordered as a made to order with sufficient lead time. Please contact your local ADS representative when ordering 4- through 10-inch and 30- through 60-inch Class 1 perforated pipe. The perforations shall be approximately circular and arranged in rows parallel to the axis of the pipe. The locations of the perforations shall be in the valley of the outside corrugation and also in each corrugation. The perforations shall be arranged in two equal groups placed symmetrically on either side of the lower half of the pipe. Please note that certain perforation patterns are not available in various parts of the United States. **Please contact your local ADS representative for availability and ordering of Class I perforations.**

Nominal I.D.		Min. No. of Rows of Perforations	Maximum Perforation Hole Diameter		Minimum Perforation Hole Diameter		"H" Maximum		"L" Minimum		Nominal Inlet Area	
in	mm		in	mm	in	mm	in	mm	in	mm	in <sup>2</sup> /ft	cm <sup>2</sup> /m
4*	100	2	0.19	5	n/a		1.77	45	2.56	65	1.0	21.8
6*	150	4	0.19	5	n/a		2.76	70	3.74	95	1.7	37.4
8*	200	4	0.19	10	n/a		3.70	94	1.18	130	1.4	30.0
10*	250	4	0.19	10	n/a		4.72	6.30	6.30	160	1.1	22.8
12	300	6	0.40	10	0.20	5	5.4	138	7.6	192	2.9	62.3
15	375	6	0.40	10	0.20	5	7.2	184	10.1	256	2.2	46.2
18	450	6	0.40	10	0.20	5	8.1	207	11.3	288	2.1	44.6
24	600	8	0.40	10	0.20	5	10.9	276	15.1	384	2.4	50.6
30*	750	8	0.40	10	0.20	5	13.6	345	18.9	480	1.8	38.7
36*	900	8	0.40	10	0.20	5	16.3	414	22.7	576	1.4	30.4
42*	1050	8	0.40	10	0.20	5	19.0	483	26.5	672	1.4	30.7
48*	1200	8	0.40	10	0.20	5	21.7	552	30.2	768	1.4	30.4
60*	1500	8	0.40	10	0.20	5	27.2	690	37.8	960	1.2	26.6

\* Denotes perforation pattern made to order. Special pipe request required.

n/a Denotes no requirement specified in AASHTO

**Figure 2**  
**AASHTO Class I Perforation Patterns**



NOTE: Diagram illustrates measurements for values of "H" and "L" – minimum number of rows of perforations is listed in table above.

FOR 4"-60" (100-1500mm)  
PIPE PER AASHTO M252/294

# Small Diameter Pipe and Fittings

**New line of pipe and fittings results in a water-tight or soil-tight HDPE piping system from 4" through 60".**

## Completing the HDPE system

Until now, specifiers have been forced to switch to other materials in pipe diameters under 15" to get soil- or water-tight performance. And, until now, the most commonly specified material for small-diameter drainage has been SDR-35 PVC pipe.

Now, ADS offers you a new line of 4" through 12" N-12® pipe and injection molded fittings\* for maximum integrity in drainage service. This means that all the economy and performance benefits you've come to trust in polyethylene pipe can now be enjoyed in a complete 4" through 60" system.

## The advantages of polyethylene

The superiority of HDPE over metal and concrete pipe has been well documented in the lab and in the field. But polyethylene also has some significant benefits over PVC pipe in smaller diameter applications:

- **Better impact strength.** HDPE is less brittle than PVC, particularly in cooler temperatures. N-12 survives the impact of rocks in the backfill and the rigors of cold weather handling.

\* Injection molded fittings are not compatible with single wall corrugated HDPE pipe.



- **No edge beveling.** N-12 pipe installs more quickly because there is no need to bevel the pipe edge when making the joint.

- **No special adapters.** With an all-polyethylene system, there is no requirement for special adapter fittings to join N-12 pipe to other materials.

- **Better chemical and abrasion resistance.** HDPE is virtually unaffected by acidic and alkaline solutions as well as by soil hydrocarbons.

## Applications

The new line of small diameter pipe and fittings makes possible a complete drainage system from the top of the building to the storm sewer.

- Roof drains
- Foundation lines
- Collector pipe
- Roadway edge drains
- Construction site dewatering

## Complete product selection

ADS offers a full complement of injection molded fittings (not welded fabrications) in 4" through 12" sizes. These fittings are available in both water-tight models which include an F477 gasket for attaching to the spigot end of the pipe, and soil-tight styles with cleats in the bells of the fittings.

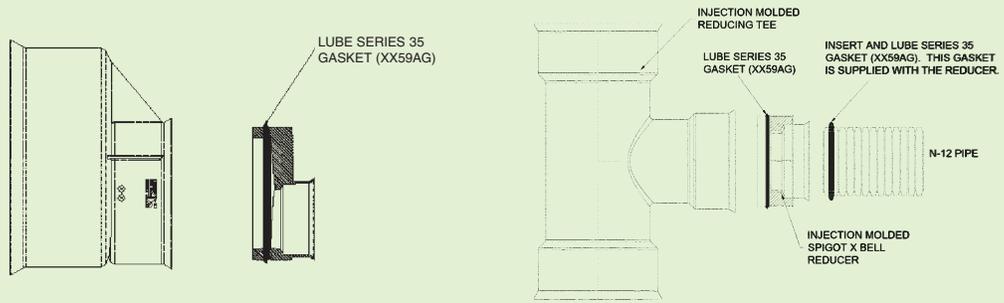
**The complete line, with item numbers, sizes, and the fabricated fittings they replace, is shown on page 2. Some Reducers, Tees and Wyes require a two-piece field assembly. These are described on page 3.**

WATER-TIGHT FITTINGS (Includes F477 gasket for attachment on pipe end)			SOIL-TIGHT FITTINGS (Cleated bells)		
Size	Item Number	Replaces	Size	Item Number	Replaces
<b>Coupler, Bell/Bell</b>			<b>Wye, Bell/Bell</b>		
4"	0413WT	S35 10.8	4"	0480WT	0480AN
6"	0613WT	S35 10.8	6" x 4"	0680WT*	—
8"	0813WT	S35 10.8	6"	0681WT	0681AN
			8" x 4"	0880WT*	—
			8" x 6"	0881WT*	—
			8"	0882WT	0882AN
			10" x 4"	1080WT*	1080AN
			10" x 6"	1081WT*	1081AN
			10" x 8"	1082WT	1082AN
			10"	1083WT	1083AN
			12" x 4"	1280WT*	1280AN
			12" x 6"	1281WT*	1281AN
			12" x 8"	1282WT	1282AN
			12" x 10"	1283WT**	—
			12"	1284WT	1284AN
<b>Reducing Coupler, Bell/Bell</b>			<b>Tee-Wye, Bell/Bell</b>		
6" x 4"	0614WT	0670AN	8" x 6"	0836WT	0836DAN
8" x 4"	0814WT	0870AN			
8" x 6"	0816WT	0871AN			
10" x 4"	1074WT*	—			
10" x 6"	1076WT*	—			
10" x 8"	1018WT	1072AN			
12" x 4"	1274WT*	—			
12" x 6"	1276WT*	—			
12" x 8"	1218WT	1272AN			
12" x 10"	1210WT	1273AN			
<b>Reducing Coupler, Spigot/Bell</b>			<b>45° Elbow, Bell/Bell</b>		
6" x 4"	0674WT	—	4"	0494WT	0490AN
8" x 4"	0874WT	—	6"	0694WT	0694AN
8" x 6"	0876WT	—	8"	0894WT	0894AN
			10"	1094WT	1094AN
			12"	1294WT	1297AN
<b>Tee, Bell/Bell</b>			<b>90° Elbow, Bell/Bell</b>		
4"	0460WT	0460AN	4"	0499WT	0499AN
6" x 4"	0660WT*	—	6"	0699WT	0699AN
6"	0661WT	0661AN	8"	0899WT	0899AN
8" x 4"	0860WT*	—	10"	1099WT	1099AN
8" x 6"	0861WT*	—	12"	1299WT	1298AN
8"	0862WT	0862AN			
10" x 4"	1060WT*	1060AN			
10" x 6"	1061WT*	1061AN			
10" x 8"	1062WT	1062AN			
10"	1063WT	1063AN			
12" x 4"	1260WT*	1260AN			
12" x 6"	1261WT*	1261AN			
12" x 8"	1262WT	1262AN			
12" x 10"	1263WT**	—			
12"	1264WT	1264AN			
<b>Tee, Bell/Bell</b>			<b>45° Elbow, Bell/Bell</b>		
4"	0460ST	0460AN	4"	0494ST	0494AN
6" x 4"	0660ST*	—	6"	0694ST	0694AN
6"	0661ST	0661AN	8"	0894ST	0894AN
8" x 4"	0860ST*	—	10"	1094ST	1094AN
8" x 6"	0861ST*	—	12"	1294ST	1297AN
8"	0862ST	0862AN			
10" x 4"	1060ST*	1060AN			
10" x 6"	1061ST*	1061AN			
10" x 8"	1062ST	1062AN			
10"	1063ST	1063AN			
12" x 8"	1262ST	1262AN			
12" x 10"	1263ST**	—			
12"	1264ST	1264AN			
<b>Wye, Bell/Bell</b>			<b>90° Elbow, Bell/Bell</b>		
4"	0480ST	0480AN	4"	0499ST	0499AN
6" x 4"	0680ST*	—	6"	0699ST	0699AN
6"	0681ST	0681AN	8"	0899ST	0899AN
8" x 4"	0880ST*	—	10"	1099ST	1099AN
8" x 6"	0881ST*	—	12"	1299ST	1298AN
8"	0882ST	0882AN			
10" x 8"	1082ST	1082AN			
10"	1083ST	1083AN			
12" x 8"	1282ST	1282AN			
12" x 10"	1283ST**	—			
12"	1284ST	1284AN			

\* Shipped as two injection molded fittings. See page 3.

\*\* 12" x 10" Tees and Wyes require about 15" of 12" N-12 pipe to join the injection molded fittings. See page 3.

Some of the injection molded Reducers, Tees and Wyes require field assembly of two parts, as shown in the table below.

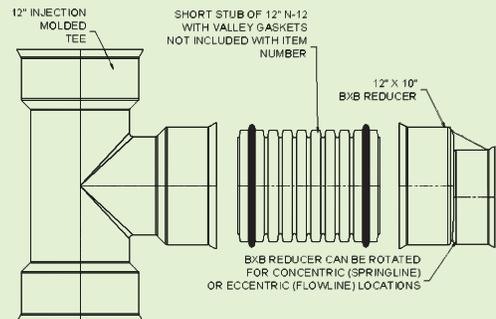


Fitting (Bell/Bell)	Water-Tight Fittings		Soil-Tight Fittings	
	Item No.	Consists of:	Item No.	Consists of:
Reducer, 10" x 4"	1074WT	1018WT 10 x 8 Reducer + 0874WT 8 x 4 Reducer	-	
Reducer, 10" x 6"	1076WT	1018WT 10 x 8 Reducer + 0876WT 8 x 6 Reducer	-	
Reducer, 12" x 4"	1274WT	1218WT 12 x 8 Reducer + 0874WT 8 x 4 Reducer	-	
Reducer, 12" x 6"	1276WT	1218WT 12 x 8 Reducer + 0876WT 8 x 6 Reducer	-	
Tee, 6" x 4"	0660WT	0661WT 6" Tee + 0674WT 6" x 4" Reducer	0660ST	0661ST 6" Tee + 0674WT 6" x 4" Reducer
Tee, 8" x 4"	0860WT	0862WT 8" Tee + 0874WT 8" x 4" Reducer	0860ST	0862ST 8" Tee + 0874WT 8" x 4" Reducer
Tee, 8" x 6"	0861WT	0862WT 8" Tee + 0876WT 8" x 6" Reducer	0861ST	0862ST 8" Tee + 0876WT 8" x 6" Reducer
Tee, 10" x 4"	1060WT	1062WT 10" X 8" Tee + 0874WT 8" x 4" Reducer	1060ST	1062ST 10 X 8 Tee + 0874WT 8 x 4 Reducer
Tee, 10" x 6"	1061WT	1062WT 10" X 8" Tee + 0876WT 8" x 6" Reducer	1061ST	1062ST 10 X 8 Tee + 0876WT 8 x 6 Reducer
Tee, 12" x 4"	1260WT	1262WT 12" X 8" Tee + 0874WT 8" x 4" Reducer	-	
Tee, 12" x 6"	1261WT	1262WT 12" X 8" Tee + 0876WT 8" x 6" Reducer	-	
Tee, 12" x 10" *1	1263WT*	1264WT 12" Tee + 1210WT 12" x 10" Reducer	1263ST*	1264ST 12" Tee + 1210WT 12" x 10" Reducer
Wye, 6" x 4"	0680WT	0681WT 6" Wye + 0674WT 6" x 4" Reducer	0680ST	0681ST 6" Wye + 0674WT 6" x 4" Reducer
Wye, 8" x 4"	0880WT	0882WT 8" Wye + 0874WT 8" x 4" Reducer	0880ST	0882ST 8" Wye + 0874WT 8" x 4" Reducer
Wye, 8" x 6"	0881WT	0882WT 8" Wye + 0876WT 8" x 6" Reducer	0881ST	0882ST 8" Wye + 0876WT 8" x 6" Reducer
Wye, 10" x 4"	1080WT	1082WT 10" x 8" Wye + 0874WT 8" x 4" Reducer	-	
Wye, 10" x 6"	1081WT	1082WT 10" x 8" Wye + 0876WT 8" x 6" Reducer	-	
Wye, 12" x 4"	1280WT	1282WT 12" x 8" Wye + 0874WT 8" x 4" Reducer	-	
Wye, 12" x 6"	1281WT	1282WT 12" x 8" Wye + 0876WT 8" x 6" Reducer	-	
Wye, 12" x 10" *	1283WT*	1284WT 12" Wye + 1210WT 12" x 10" Reducer	1283ST*	1284ST 12" Wye + 1210WT 12" x 10" Reducer

### \* 12" x 10" Reducing Tee or Wye (WT or ST)

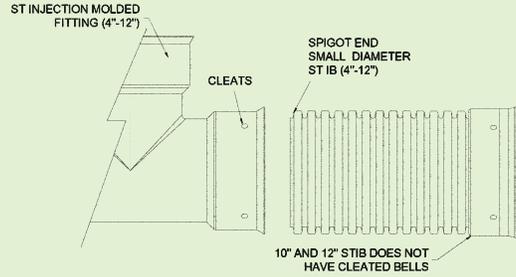
- 12" x 10" Tee:** order 1264 (WT or ST) 12" x 12" Tee, 1210WT 12" x 10" Bell/Bell Reducer, and approximately 15" of 12" diameter N-12 pipe to make the connection between the two bell ends.
- 12" x 10" Wye:** order 1284 (WT or ST) 12" x 12" Wye, 1210WT 12" x 10" Bell/Bell Reducer, and approximately 15" of 12" diameter N-12 pipe to make the connection between the two bell ends.

\* Additional pipe stub not shipped with item number, order this pipe separately



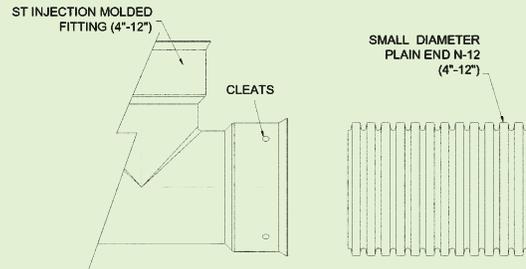
### Soil-Tight Connection to N-12 IB Pipe

Push home the spigot end of the N-12 IB pipe until the cleats on the fitting bell lock into the second or third valley of the pipe. If joining to the bell end of N-12 IB pipe, cut off the bell. For 12" N-12 IB pipe, the mini-corrugations will need to be removed prior to joining.



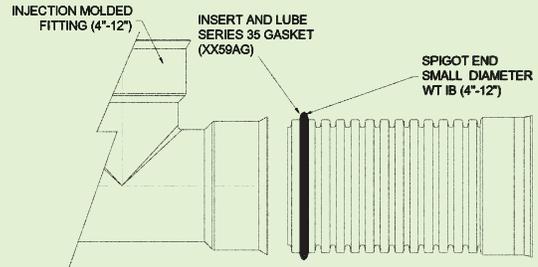
### Soil-Tight Connection to Plain End N-12 Pipe

Push home the plain end of the N-12 pipe until the cleats on the fitting bell lock into the second or third valley of the pipe.



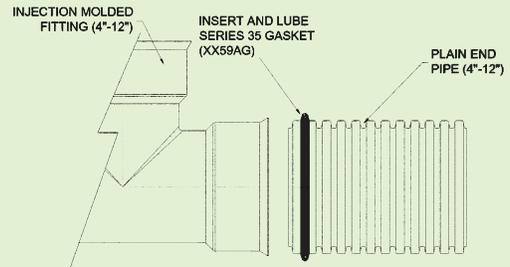
### Water-Tight Connection to N-12 IB Pipe

Insert the Series 35 gasket (XX59AG) in the first valley of the plain end of the N-12 IB pipe. Lube the gasket and the bell end of the injection molded fitting. Holding the fitting, push home the pipe end for a secure connection. For 12" N-12 IB pipe, the mini-corrugations will need to be removed prior to joining with a valley gasket installed on the end.



### Water-Tight Connection to Plain End N-12 Pipe

Insert the Series 35 gasket (XX59AG) in the first valley of the plain end of the N-12 pipe. Lube the gasket and the bell end of the injection molded fitting. Holding the fitting, push home the pipe end for a secure connection.



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