



Drainage System Submittal Package

For:
State of Vermont
Agency of Transportation
I-89 Exit Ramp over
Stone St & Thatcher Brook
Route 3 (Shunpike Road)
Project No. IM 089-2(43)
Waterbury

Submitted to:
Beck and Bullucci, Inc.

Date:
December 31, 2015

Bridge Drain Systems

Standard Conduit Products

Custom Conduit Systems

Bullet Resistant Conduit



General Submittal Notes:

80'	UF80A-BD-AG-20-3	8" IPS Above Ground Fiberglass Bridge Drain, Concrete Gray.
1	P665x8	8" Bridge Drain 45 Degree Socket Elbow
4	P657C-60x8	8" Bridge Drain 60 Degree Socket Elbow
4	P615C-60 8x8	8" x 8" Bridge Drain 60 Degree Lateral Saddle
3	P633 8x6P6	8" x 6" Bridge Drain Socket Cleanout with 6" Plug
2	P634 12x8	12" x 8" Bridge Drain Concentric Reducer
3	PADH600	20 oz. Dual Cartridge Epoxy Adhesive System - Warm Weather Installation with 1 mixing tip
1	PADH650	20 oz. Dual Cartridge Epoxy Applicator Gun
11	UF-Strap	8" 2 hole strap domestic steel without mounting hardware. Buy America material certification.

Fiberglass Pipe and fittings manufactured in accordance with ASTM D2996 RTRP-11AQ2-2112, Concrete Gray color pigmented throughout construction.

Type A Certification



UNITED

FIBERGLASS OF AMERICA



Bridge Drain[™] SYSTEMS | Complete Bridge Drain Solutions |



Bridge Drain™ SYSTEMS

United Fiberglass **Bridge Drain™** products provide the performance, value, and durability our customers demand for their applications. Our fiberglass bridge drain can be used practically anywhere that steel, PVC, clay, copper, or other pipe and conduit materials are found. Our fiberglass bridge drain not only performs as well or better than these other, more "traditional" products, but it also offers extended benefits that range from significant overall cost savings to reduced environmental impacts.

□ ADVANTAGES:

- Lightweight—1/5 the weight of steel
- Corrosion Resistant
- High Flow Rates
- Easy On-Site Assembly/Pre-Assembly at Factory Available
- Custom Fabrications
- Wide Range of Colors to Match Structure including Standard Concrete Gray, Interstate Green and Weathering Steel Brown
- Long Unsupported Spans
- Thermal Stability
- High Impact and Crush Resistance
- Freeze/Burst Resistant

□ ADDITIONAL FEATURES:

- Iron Pipe Size OD—No Special Supports Required
- Adhesive Bonded Fittings and Saddles
- Flanged, Coupled and Rubber

□ CONNECTIONS AVAILABLE:

- Odd Angle Elbows and Branch Connections
- Oversize Reducers Eliminate Drain Interference
- Trash Covers Keep Debris Out of System
- Adaptable as Scupper Extensions
- Flexibility to Follow Contours of the Structure

□ ADDITIONAL SERVICES:

Estimating – Take-Off and Bill of Material can be supplied with each job

Engineering – Drafting and system layout AutoCAD submittals and erection drawings

Fabrication – Drain systems can be prefabricated into shippable sub-assemblies, significantly reducing installation time

Installation – UFA partners with installing contractors to provide a complete turnkey package

□ PIPE COMPOSITION

Filament-wound "E" type fiberglass reinforced thermosetting resin pipe manufactured in accordance with ASTM D2996

□ STANDARD FITTINGS

Manufactured specifically for bridge drain and duct work applications in accordance with NBS PS 15-69 standards and ASTM C 582

□ COMPONENTS

90° Elbows, 45° Elbows, Saddle Tees, 45° Lateral Saddles, Concentric Reducers, Trash Covers, Couplings, Cleanouts, Expansion Joints, Flanges

QUICK FACTS

FRP PIPE VS. SCH 40 STEEL PIPE

Avg. Weight of 6" Drain Pipe

FRP	1.91 lbs/ft
Steel	18.98 lbs/ft

Painting

FRP	Pigmented Throughout
Steel	Must be prepped, primed, painted or galvanized

FRP VS. SCH 80 PVC PIPE

Avg. Weight of 6" PVC Pipe

FRP	1.91 lbs/ft
PVC	3.13 lbs/ft

Unsupported Spans

FRP	16' @ 125°F
PVC	6' @ 125°F

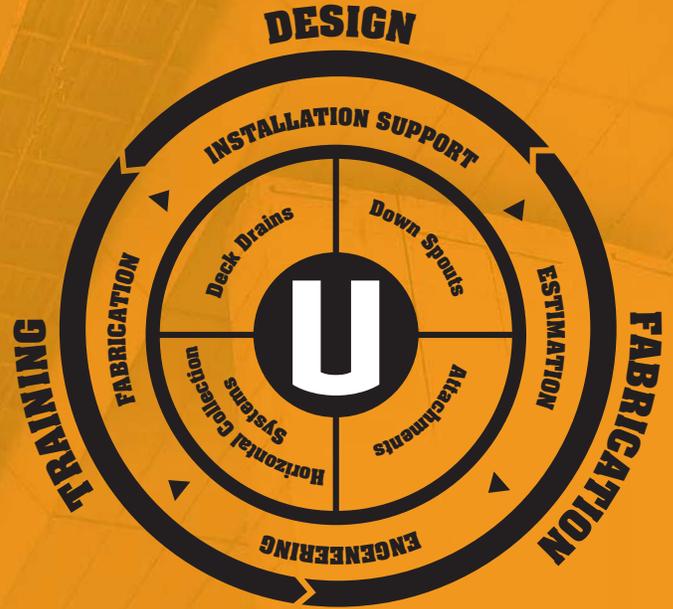
SERVICES / SUPPORT

We're committed to providing everything you need to complete your projects successfully; on time and on budget. As a truly comprehensive partner, we offer a variety of support services to assist you throughout the project life cycle. In addition to our core product solutions, we can also provide on-site training, professional installation services, and pre-assembly of components for simplified installation. We can even take care of supply chain management issues and pre-production design engineering assistance—whatever it takes to create the turnkey solution you're looking for.

We understand that no two bridges are exactly alike, so our skilled staff will work with you to design the ideal system for your application. Our goal is to ensure that your next bridge drainage project delivers optimal performance, longevity, and safety. And by taking advantage of our end-to-end support and service capabilities, you'll get it at a value that appreciates with time as our fiberglass drainage systems outperform and outlast alternative solutions. From planning and sourcing to helping job crews by gluing joints and addressing technical questions with expert field support, we're there when you need us, every step of the way.

■ END TO END SOLUTIONS:

- Planning
- Material Specification
- Design
- Global Supply Chain Management
- Deployment And On-Site Support



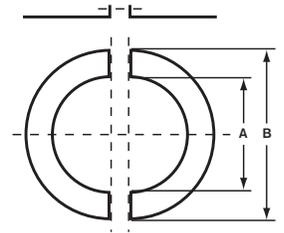
STANDARD PRODUCTS *BridgeDrain*™ SYSTEMS

BRIDGE DRAIN PIPE

NOMINAL PIPE SIZE	OD
4"	4.500"
6"	6.625"
8"	8.625"
10"	10.750"
12"	12.750"
14"	14.400"
16"	16.600"
18"	18.600"
20"	20.670"

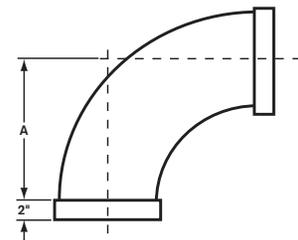
TRASH COVER ASSEMBLY

SIZE	A ± .125"	B ± .25"
4"x8"	4.5625"	10.625"
6"x8"	6.6875"	12.75"
6"x10"	6.6875"	12.75"
6"x12"	6.6875"	14.75"
8"x10"	8.6875"	12.75"
8"x12"	8.6875"	14.75"
10"x12"	10.8125"	14.75"
10"x14"	10.8125"	16.125"
12"x14"	12.8125"	16.125"
12"x16"	12.8125"	18.125"
12"x18"	12.8125"	20.125"



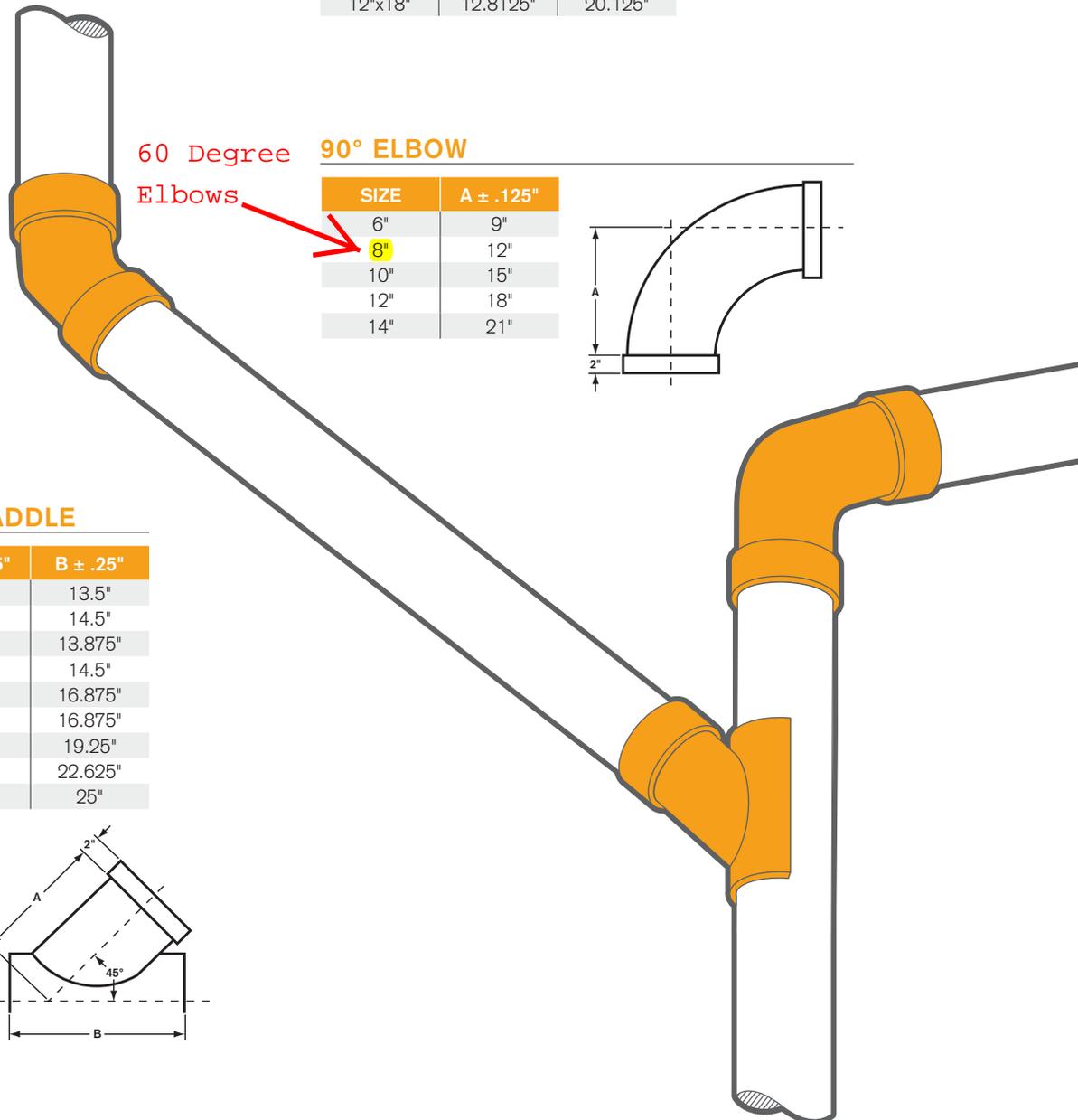
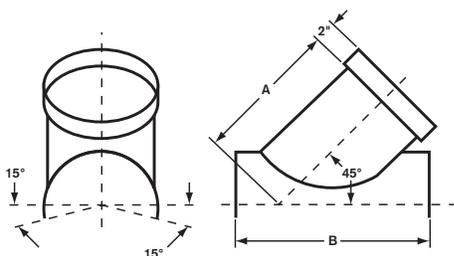
60 Degree 90° ELBOW

SIZE	A ± .125"
6"	9"
8"	12"
10"	15"
12"	18"
14"	21"



45° LATERAL SADDLE

SIZE	A ± .125"	B ± .25"
6"x6"	10"	13.5"
8"x6"	12"	14.5"
10"x6"	12.5"	13.875"
12"x6"	14"	14.5"
8"x8"	13"	16.875"
10"x8"	14"	16.875"
10"x10"	15"	19.25"
12"x12"	18"	22.625"
14"x14"	20"	25"

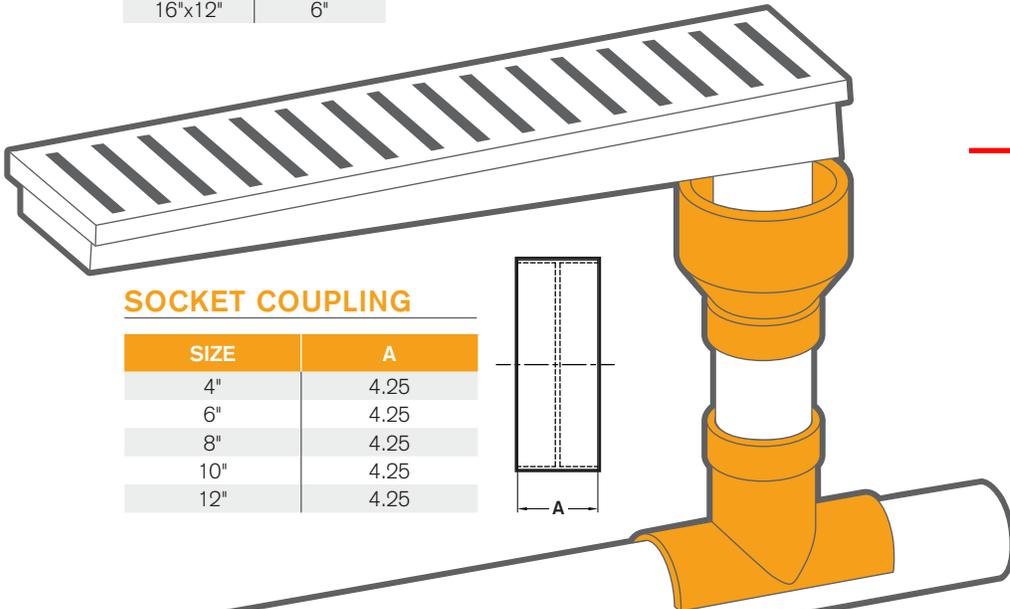
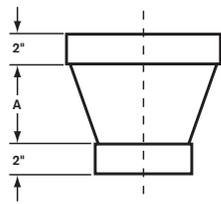


60 Degree Lateral Saddles



DRAIN REDUCER

SIZE	A
8"x6"	3"
10"x6"	6"
12"x6"	9"
10"x8"	3"
12"x8"	6"
12"x10"	3"
14"x10"	6"
14"x12"	3"
16"x12"	6"



SOCKET COUPLING

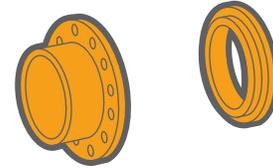
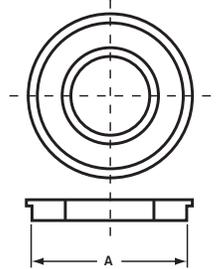
SIZE	A
4"	4.25
6"	4.25
8"	4.25
10"	4.25
12"	4.25



SOCKET CLEANOUT

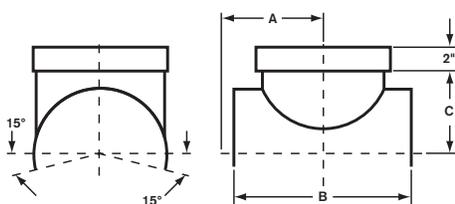
SIZE
4"x6"
6"x8"
6"x10"
6"x12"

** Female Pipe: Thread x Pipe Size



TEE SADDLE

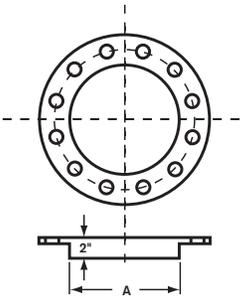
SIZE	A ± .125"	B ± .25"	C ± .25"
6"x6"	5.5"	11"	5"
8"x6"	6.5"	13"	6"
10"x6"	7.5"	15"	7"
12"x6"	5.5"	11"	8"
8"x8"	6.5"	13"	6"
10"x8"	7.5"	15"	7"
12"x8"	8.5"	17"	8"
10"x10"	7.5"	15"	7"
12"x10"	8.5"	17"	8"
12"x12"	8.5"	17"	8"



SOCKET FLANGE

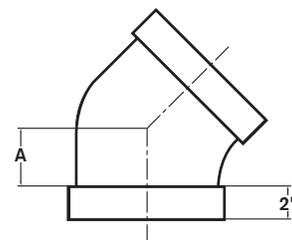
SIZE
6"
8"
10"
12"

150# Drilling or Blank Face Available. Flange Kits Available with Hardware and Silicone Gasket.



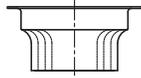
45° ELBOW

SIZE	A ± .125"
6"	3"
8"	3.5"
10"	4"
12"	5"
14"	5.5"

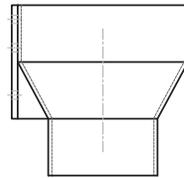
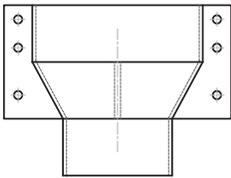
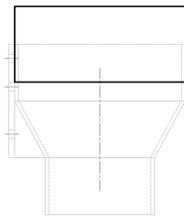
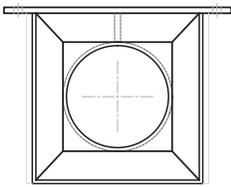


CUSTOM PRODUCTS *BridgeDrain*™ SYSTEMS

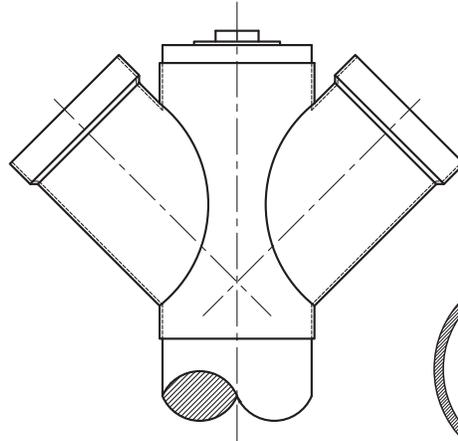
FIBERGLASS



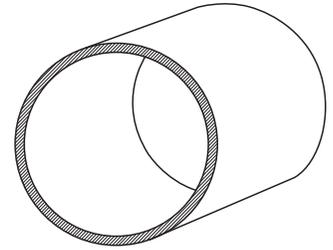
Scuppers



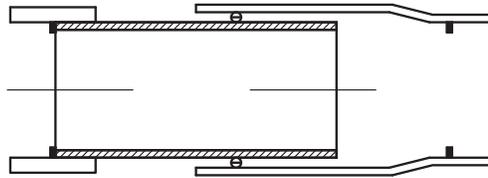
Drain Box



Fittings



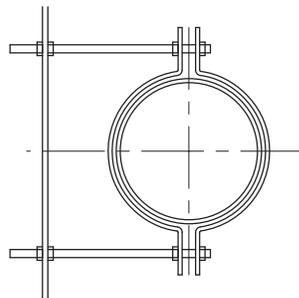
Large Diameter Pipe



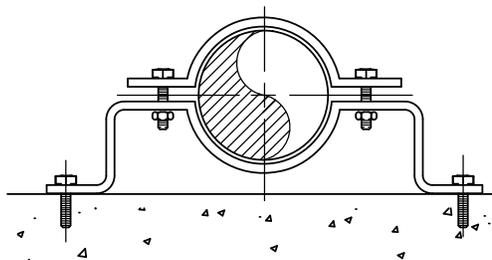
Socket Expansion Fitting

HARDWARE & ATTACHMENTS

VERTICAL

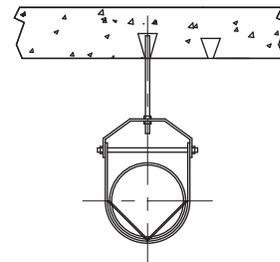


Standard

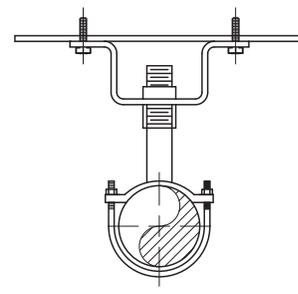


Custom

HORIZONTAL



Standard



Custom

TECHNICAL SPECIFICATIONS

BRIDGE DRAIN PIPE

NOMINAL PIPE SIZE	NOMINAL OD	NOMINAL WALL THICKNESS	WEIGHT/FT. (LBS)	GALLONS/FT.	UNSUPPORTED SPANS @ 125°F
4"	4.50"	0.08"	1.30	0.74	11.7'
6"	6.62"	0.12"	1.91	1.62	16.0'
8"	8.62"	0.12"	2.59	2.79	18.0'
10"	10.75"	0.15"	4.22	4.34	21.0'
12"	12.75"	0.16"	5.00	6.18	22.0'
*14"	14.40"	0.15"	6.83	8.22	19.7'
*16"	16.36"	0.18"	7.82	10.69	20.3'
*18"	18.43"	0.18"	8.76	13.50	23.1'
*20"	20.67"	0.21"	11.36	16.63	23.8'

* Please contact the factory for specific ASTM D2996 specifications. Custom Size: 14" - 20"

BRIDGE DRAIN PIPE FLOW RATES AND VELOCITY FOR FULL BORE GRAVITY FLOW

NOMINAL PIPE SIZE	1/2% GRADIENT		1% GRADIENT		2% GRADIENT		4% GRADIENT	
	Flow (ft ³ /sec)	Velocity (ft/s)						
4"	0.23	2.3	0.33	3.3	0.46	4.6	0.65	6.6
6"	0.65	3.0	0.93	4.3	1.31	6.0	1.85	8.5
8"	1.35	3.6	1.90	5.1	2.69	7.2	3.81	10.2
10"	2.43	4.2	3.43	5.9	4.86	8.4	6.87	11.8
12"	3.90	4.7	5.51	6.7	7.79	9.4	11.02	13.3
*14"	5.54	5.1	7.83	7.3	11.07	10.3	15.66	14.6
*16"	8.09	5.7	11.44	8.0	16.18	11.3	22.88	16.0
*18"	11.03	6.1	15.60	8.6	22.07	12.2	31.21	17.3
*20"	14.57	6.6	20.61	9.3	29.14	13.1	41.22	18.5

*Custom Size: 14"-20". Note: the above flows and velocities are based on Manning Formulas, dimensionless roughness coefficient n=0.009. To convert ft³/sec to gpm multiply by 449. For partial flow multiply by the following factors:

% Flow	75	50	25
Factor	0.910	0.500	0.137

ULTIMATE BENDING MOMENT – 90° ELBOW

NOMINAL PIPE SIZE	MOMENT FOOT-POUNDS	NOMINAL PIPE SIZE	MOMENT FOOT-POUNDS
4"	1,900	14"	3,200
6"	3,600	16"	4,200
8"	5,700	18"	6,400
10"	11,200	20"	7,800
12"	16,300	-	-

Note: The actual operating conditions should never exceed 25% of the ultimate values shown, i.e., for the 10" size, the operating movement should not exceed 4,500 foot-pounds.

THERMAL EXPANSION – UNINSULATED PIPE

CHANGE IN TEMPERATURE °F	CHANGE IN LENGTH (INCHES/100FT)
25	0.375
50	0.750
75	1.125
100	1.500
125	1.875
150	2.25

The coefficient of thermal expansion for uninsulated Bridge Drain pipe is 12.5x10E-6 in/in°F

PIPE COMPRESSIVE END LOADS DUE TO RESTRAINED THERMAL EXPANSION – UNINSULATED PIPE

NOMINAL PIPE SIZE	LBS/°F	NOMINAL PIPE SIZE	LBS/°F
4"	24.3	14"	-
6"	36.0	16"	110.2
8"	46.0	18"	123.6
10"	84.0	20"	137.1
12"	99.0	-	-

Above data based on Modulus of Elasticity values at Ambient Temperature. This data is used to determine expected tensile and compressive loads from the thermal expansion and contraction on the piping for design of anchors, expansion joints and bending moment considerations.

NOMINAL ULTIMATE PROPERTIES

PROPERTY	TEST METHOD	SIZE	@ 75°F
Hoop Tensile Stress (Psi) Based on Reinforced Thickness	ANSI/ASTM D 1599	4"-12"	30,000
		12"-20"	30,000





■ **UNITED FIBERGLASS OF AMERICA SINCE 1983**

United Fiberglass of America is the industry's leading manufacturer of quality fiberglass pipe, conduit, and *BridgeDrain* infrastructure systems. Known as much for our unmatched service and support as for our high-performance products, we work closely with our customers to provide them with everything they need to complete their projects on time and on budget. From expert consultation before the sale to state-of-the-art manufacturing processes, all the way to logistics services, global supply chain management, and field support, our clients come first in everything we do.

We produce our high-performance fiberglass conduit and pipe products using a filament winding process, which uses a mandrel surface to wind resin-impregnated glass fiber or tape in a precise geometric pattern. By winding continuous strands of fiberglass material in very exact patterns, structures stronger and much lighter than steel can be made. Since the final shapes and physical properties are based largely upon how the fiber or tape is wound, the process is highly flexible and easily adaptable to efficiently create products of different, custom specifications. This allows us to deliver competitively priced solutions for our customers without overly extended lead times.



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UNITEDFIBERGLASS.COM | BRIDGEDRAIN.COM

Technical Data Sheet

FRP Adhesive ADH600

Chemical and Water Resistant adhesive/sealer

DESCRIPTION – An extremely smooth consistency two component 1:1 epoxy Fiberglass Reinforced Piping (FRP) cartridge style adhesive that won't sag, run or drip in vertical or overhead applications. The United Fiberglass of America (UFoA) ADH600 adhesive system was developed, designed, formulated, and tested to provide proper bonding for Fiberglass Reinforced Piping (FRP). This adhesive bonds epoxy, polyester, and vinyl-ester joints and fittings.

BENEFITS – United Fiberglass ADH600 is water, chemical, and environmental resistant. It is super smooth and of non-sag consistency.

TEST DATA

Compressive Strength	ASTM D-695	4,940 psi
Compressive Modulus of Elasticity	ASTM D-695	122,000 psi
Tensile Strength	ASTM D-638	4,320 psi
Tensile Modulus of Elasticity	ASTM D-638	124,000 psi
Tensile Elongation	ASTM D-638	4%
Bond Strength (Dry Cure) - 2 Day	ASTM C-882	1,560 psi
Bond Strength (Dry Cure) - 14 Day	ASTM C-882	1,870 psi
Flexural Strength	ASTM D-790	5,590 psi
Shore Hardness	D Scale	73 D
	A Scale	87A

PHYSICAL PROPERTIES AT 73°F

Mix Ratio A: B	1:1 by volume
Viscosity	Flowable Gel
Consistency	Non-Sag Paste
Color	Concrete Gray

	Pot Life	Tack Free
90°F	30 minutes	3 hours
73°F	48 minutes	8 hours
50°F	130 minutes	12-18 hours

Joint Separation	UL 2420	1,500 lbf
	UL 2515	1,500 lbf
	ASTM D3163 Compression	1,500 lbf

Joint Pressure - Internal	ASTM D1599 Procedure B	1,100 psi
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CONTACT INFORMATION

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Adhesive Application Guide ADH600 Cartridge Bridge Drain Application

The United Fiberglass ADH600 Cartridge style FRP Adhesive is a two part 1:1 epoxy based adhesive system developed, designed, formulated, and tested to provide proper bonding for Fiberglass Reinforced Piping (FRP). This adhesive bonds epoxy, polyester, and vinyl-ester joints and fittings.

Follow all procedures completely and follow the safety directions found on the label or on the MSDS sheet.

STORAGE

Store the adhesive in temperatures between 40°F (5°C) and 80°F (27°C). Do not allow the product to freeze.

PREPARATION

Precondition adhesive overnight to temperatures between 70°F (21°C) and 80°F (27°C).
Precondition bonded materials to temperatures between 65°F (19°C) and 85°F (30°C).

The surface being bonded must be freshly sanded; dry and clean; and free of dust, moisture, oil, grease, or any other contaminant. For any field cuts, the spigot end should be sanded with 40-80 grit sandpaper to remove the resin glaze (glossy area) and to prepare for mechanical adhesion. Wear a dust mask, safety glasses, and skin protection when cutting or sanding.

APPLICATION

Assemble dual cartridge applicator gun and cartridge. Unscrew the retaining nut from the cartridge, remove the small end caps, slide retainer nut over mixing tip, and screw onto the cartridge and tighten. Save small end caps to re-seal cartridge if less than full cartridge is used. Cartridge can be used several times until empty; however, a new mixer will be needed each time. Each cartridge kit comes with one mixing tip. Additional mixing tips (ADH620) are available.

Begin squeezing the handle of the gun to start the adhesive moving and mixing within the mixing tip. Squeeze out enough adhesive until you achieve a gray uniform color. Some material will need to be discarded to ensure proper mixing. Discard until uniform gray color is achieved. Adhesive is now thoroughly mixed and ready for application.

Never attempt to reuse a static mixing tip. Reuse can result in material that is not properly mix and the final product may not fully cure.

Approximately 1/2 inch from the spigot end of the pipe, apply enough adhesive to cover a 1-1/2 to 2 inch wide area around the end. A spatula may help in spreading the mixed adhesive for consistent coverage. The thickness of the adhesive should be no less than 1/32 inch.

Immediately insert the pipe spigot end into the properly prepared bell or fitting using a 1/2 to 3/4 turn of the pipe relative to the bell or fitting. The proper amount of adhesive is applied to the joint when excess adhesive oozes out around the junction between the bell or fitting and the pipe. It is okay to remove some of the excess adhesive. Do allow some adhesive to remain as a visual inspection that adhesive has been used for the joint.

For saddle fittings, dry fit the fitting to the pipe, mark the pipe for removal of material at the branch, and mark the outer edge of the saddle fitting. Remove the material required for the branch opening. Sand the pipe where the fitting will be bonding to the pipe and the mating surface of the fitting. Approximately 1/2 inch in from the edge of the fitting, apply enough adhesive to cover the bonding surface. Apply a small amount of adhesive to the cut edge of the pipe for the branch. Immediately install the saddle fitting using the outer edge markings as a reference. This will help in locating the fitting to its previous dry fit position. Use plastic wraps or other mechanical means to pull the saddle joint into position. The proper amount of adhesive is applied to the joint when excess adhesive oozes out around the junction between the saddle and the pipe. It is okay to remove some of the excess adhesive. Do allow some adhesive to remain as a visual inspection that adhesive has been used for the joint.

ALTERNATIVE APPLICATION

An alternate method of mixing the adhesive is to direct the material into a mixing bowl or surface without the use of a mixing tip. Dispense just enough adhesive to complete the required joint. Mix adhesive thoroughly with a spatula until you achieve a gray uniform color. Before applying the mixed adhesive, make certain that the mixture color is uniform with no color streaks. When thoroughly and properly mixed, use a spatula to apply the adhesive to the joint as required using the instructions above.

CUTTING

Cutting of FRP Pipe may be accomplished using a diamond edged blade, a reinforced abrasive blade, a fine-toothed metal cutting, or a tungsten carbide blade. A minimum of 32 teeth/inch will keep the splintering to a minimum. The cut should produce a square edge.

POT LIFE

The pot life of the ADH600 Warm Weather Adhesive is approximately 30 minutes to one hour. The working time is 3-4 hours. Cure is in 24 hours. This product should be used when ambient temperature during cure is above 40°F (5°C).

Cold temperatures will slow down reaction time and increase viscosity. For ambient temperatures during cure below 40°F (5°C), use ADH610 All Weather Adhesive.

DISPOSAL

Do not improperly discard (such as directly in a landfill) any un-cured (un-mixed) adhesive. Cured material is environmentally safe.

ESTIMATED BONDS PER 20 OUNCE CARTRIDGE

Bridge Drain Size	6"	8"	10"	12"	14"	16"	18"	20"
# of Joints	18	13	8	5	3	2.5	2	1.5

*Saddles fittings are considered 3 joints.

