

HAZGUARD™ FIBERGLASS CONDUIT SYSTEM FOR PHYSICAL DAMAGE LOCATION

CLASS 1 DIVISION 2 - (aka Bullet Resistant)



FRE
COMPOSITES®

F I R S T I N T H E F I E L D

®



FRE Composites' plants produce North America's highest quality fiberglass conduit products, ready for shipment worldwide. These plants house up-to-date automated filament winding equipment, and contains plenty of warehousing capacity, both indoors and outdoors.

FRE
COMPOSITES®

®

OUR VISION

At FRE Composites, we have the experience, having manufactured our first fiberglass products as far back as 1958. Today, the company has skilled and experienced workforce operating two (2) plants and exporting product to numerous countries worldwide.

Currently, FRE Composites is focused exclusively on the design, engineering and production of composite filament-wound fiberglass conduit products and accessories. However, in addition to core products serving electric, telecom, water and wastewater utilities, and transportation industries, FRE Composites has engineered and produced highly specialized products for use in space exploration made from carbon fibers and other exotic materials, such as rocket launch tubes and the main structure of the CANADARM robotic arm, which is used by NASA's Space Shuttle to manipulate payloads in space. The CANADARM was also used to assist in the construction of the International Space Station, and in 2005, a CANADARM system attached to the International Space Station successfully assisted in the first in-orbit repair of the Space Shuttle Discovery.

Our 100,000 sq.ft. plant in Canada and our 50,000 sq. ft. plant in the United States have the capacity to accommodate high production requirements while maintaining substantial flexibility to foster to our growing customer base needs. Although we are the only source of FRE® trademarked conduit, it's no secret that we are not the only suppliers of fiberglass conduit in North America. Considering that you have choices, why should you do business with us ?

EXPERIENCE COMPETENCE COMMITMENT

Quality

Our products are engineered to exacting standards, and are produced to consistent quality standards to provide superior life expectancy. Design performance and quality control always have been, and always will be, our number one priority.

Experience

Our long experience has taught us how to design and to build our products right: First in the Field®.

Production capacity

FRE Composites operates the largest production facility to produce fiberglass conduit in North America, which enables us to produce large volumes of product within tight delivery deadlines while being flexible to service ongoing requirements of numerous projects. We value distribution.

Distribution

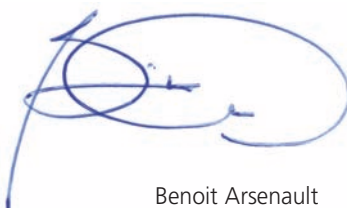
FRE Composites has always joined forces with distribution to promote its product lines. FRE® fiberglass conduit products are available in all popular sizes from stocking distributors from coast to coast in both Canada and the United States.

Service

We are organized to provide courteous and professional customer service in Chinese, English, French, Italian, Russian and Spanish. To better serve clients beyond continental North America, we are in the process of adding service capabilities in several additional languages.

We are eager to serve you professionally and courteously, supplying you with high quality conduit systems in accordance with your requirements.

No job is too small or too big.



Benoit Arsenault

.....

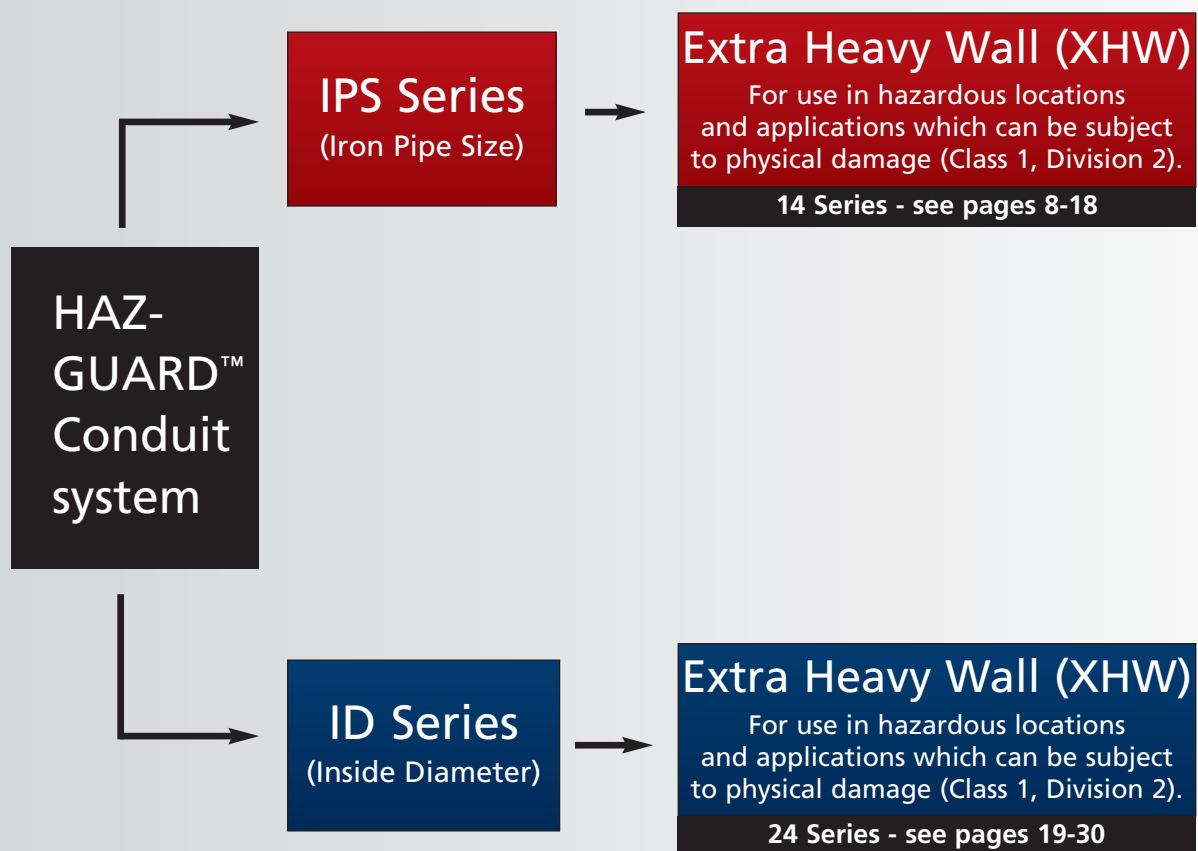


FRE® HazGuard™ Conduit System

SYSTEM

DIMENSIONS

WALL THICKNESS



Upon special request, FRE Composites products can be designed to meet specific requirements such as wall thickness, offset elbows, special radii elbows and adapters.



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LIMITATION OF LIABILITY

Due to the varied nature of electrical system designs, field conditions and installation techniques and practices under which FRE® HAZGUARD™ Conduit may be used, no guaranty or promise can be made regarding its performance in individual applications, since these factors are beyond the control of FRE Composites (2005) Inc. ("FRE Inc."). Therefore FRE Inc. or any of its affiliates and associates, accepts no responsibility for the performance of installed HAZGUARD™ Conduit systems.

At the written request of the engineer, architect, designer or contractor responsible for the design, installation practices or supervision, FRE Inc. may provide assistance or on-site advice based on past experience but only as a guide for successful installation. However said engineer, architect, designer and contractor shall remain solely responsible for ensuring the design, installation practices and supervision are adequate for the intended application. FRE Inc. shall not be liable in any way towards anyone by reason of such assistance or on-site advice.

In all cases, FRE Inc.'s only liability will be the replacement of conduit or fittings shown to be defective in workmanship or materials prior to installation. Under no circumstances shall FRE Inc. be liable for any claims, damages, losses (including a loss of opportunity, business or profit) or costs whether based on the fault or negligence (whether gross or not) of FRE Inc., on contractual, legal or statutory warranties, strict liability or otherwise except as expressly provided herein.

FRE® HazGuard™ Conduit is primarily designed for use in hazardous locations (class 1 division 2) and applications which can be subject to physical damage. Should prolonged exposure be desired, please contact us for details on special protection techniques.

FRE Inc. has prepared this data as a guide only. Although FRE Inc. believes the information contained herein is accurate and reliable, this information shall not be construed as representation, warranty or guarantee, whether express or implied. FRE Inc. reserves the right to update products and /or data as necessary without notice.



Why should you consider using **F**iberglass **R**einforced **E**poxy conduit?

Fiberglass conduit offers many advantages over other commonly used conduit, such as steel and PVC, as listed below:

EASE OF ASSEMBLY:

Epoxy fiberglass conduit is easy to install, partly resulting from its light weight, which facilitates handling. Fitting sections together using the push-fit spigot and bell design further facilitates assembly. Alternatively, fiberglass conduit can be joined through the application of epoxy adhesive, but this is usually not necessary. Contractors report that joining by way of FRE® Conduit push-fit TriSeal™ connections results in considerable labour savings.

LIGHTWEIGHT:

Epoxy fiberglass conduit weighs considerably less than PVC or steel, resulting in cost savings through reduced handling time, reduced assembly time, reduced requirements for mechanized handling, reduced freight charges, reduced system weight, and lower costs of support. By way of example, one hundred ft. of 4" (103 mm) FRE® conduit weighs in at 282 pounds (128 kg), compared with almost 1 000 (454 kg) pounds for steel. The high fluctural strength of FRE® Conduit combined with its light weight allows for much greater span distance between supports hence reducing overall weight and costs.

LOW COEFFICIENT OF FRICTION:

The coefficient of friction of epoxy fiberglass is lower than that of steel, and considerably lower than that of PVC. This means that electrical cables are easier to pull through, resulting in labour savings, less stress on cables, and reduces the number of costly manholes. As FRE®'s minimum resin content is higher than industry standards, FRE®'s coefficient of friction is the lowest and product longevity is the best in the industry.

TEMPERATURE RANGE:

FRE® Conduit can withstand a wide array of temperature ranging from -40°F to 230°F (-40°C to 110°C). Unlike PVC which is extremely brittle in cold temperature (+40°F) and malleable in heat, FRE® Conduit maintains its unique characteristics.

NO BURN-THROUGH:

Unlike rigid PVC, epoxy fiberglass bends and elbows have a strong resistance to being cavitated or pierced as a result of rope pull.

CABLE FUSION:

Fiberglass is an excellent insulator. Unlike fiberglass conduit, steel conduit will weld with cable, and PVC conduit may fuse or melt under electrical fault conditions.

FLEXIBLE AND IMPACT RESISTANT:

The flexibility of epoxy fiberglass conduit allows it to conform to mildly uneven surfaces. Epoxy fiberglass conduit has tended to survive the stresses of earthquakes better than PVC or steel.

CORROSION RESISTANT:

Epoxy fiberglass is not affected by the effects of water or most other chemicals. Contact the factory for further information, if specific information is required.

NON-TOXIC:

Unlike PVC, epoxy fiberglass is low halogen and does not release bromine or chlorine.





Why should you specify **FRE®** conduit made by FRE Composites?

There are a number of reasons why FRE® conduit offers the industry the most for its money. Our **experience** and **quality record** speak for themselves. We live and breathe quality: quality is the number one priority to which everything else is subordinate. After nearly fifty years in the business, we know how to do things right, and we know how to ensure that we keep doing them right.

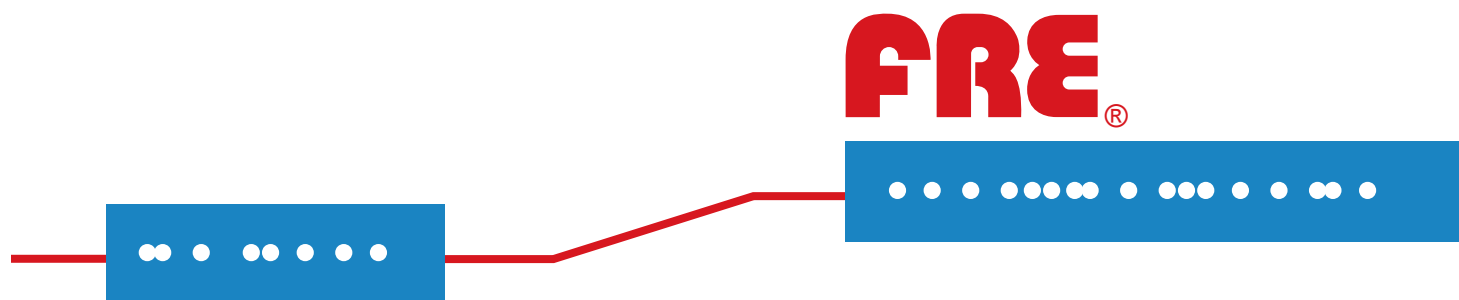
Our **total production capacity** is the largest in the industry enabling us to produce large volumes of product within tight delivery deadlines, and product is available from **stocking distributors** throughout Canada, the United States and elsewhere around the world.

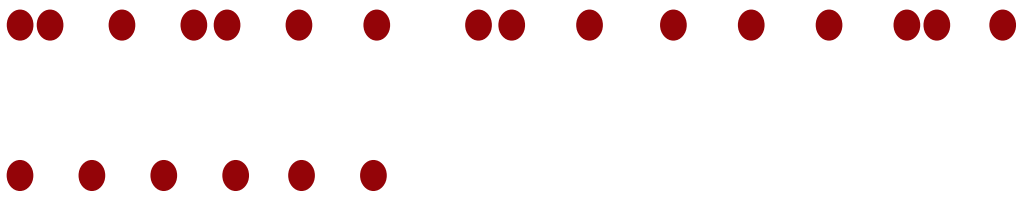
TO ENSURE THAT YOUR PROJECT WILL BENEFIT FROM THE HIGHEST QUALITY CONDUIT PRODUCTS, SPECIFY FRE® CONDUIT:

KEY SPECIFICATION POINTS:

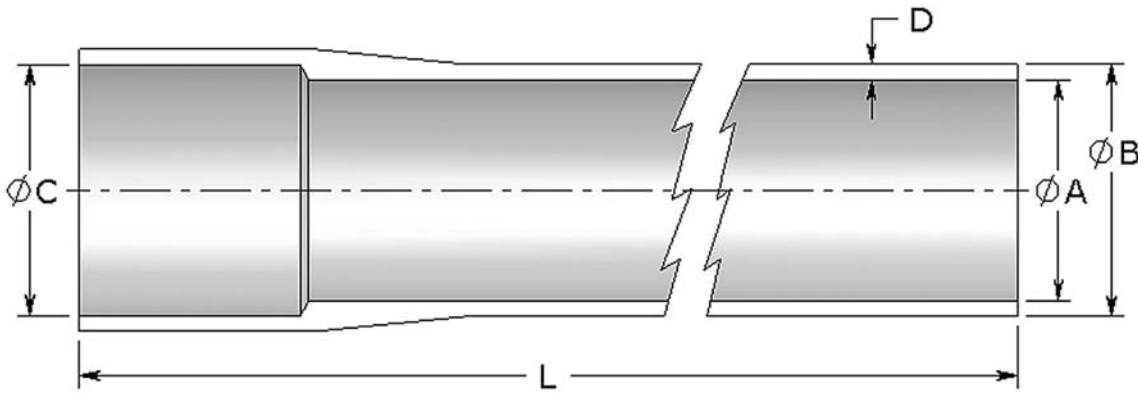
- Shall comply with the latest application UL standards.
- Conduit shall bear UL Listing #E53373, Section 2.
- Shall be manufactured from E or E-CR glass and epoxy resin with no fillers.
- Shall have a resin content of 32%, plus or minus 3%.
- All joints shall be adhesive bonded inside a straight bell end of even socket depth through out the raceway (conduits & fittings).
- Union made.
- Multiple locations to better serve your needs.

**For more information, please contact us
1 888 849-9909**





IPS EXTRA HEAVY WALL (XHW) CONDUIT



Size	Symbol	ØA	ØB	ØC	D	L	
in	• •						• • • • •
	No.						• • • • •
1	• •	1.183	1.683	1.723	0.250	118.25	• • • • •
8❖	• • •	8.393	8.893	8.933	0.250	236.25	• • • • •

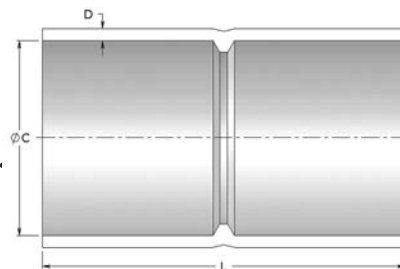
- All our IPS HazGuard™ products are offered with a push-fit assembly requiring adhesive.
- Standard length is 9.84 ft. (3m) for 1" (25mm) and 19.68 ft. (6m) for 8" (203mm) but can also be available in 9.84 ft. section (3m), if required.
- Spigot end tapered for ease of installation

❖ Not UL Listed.



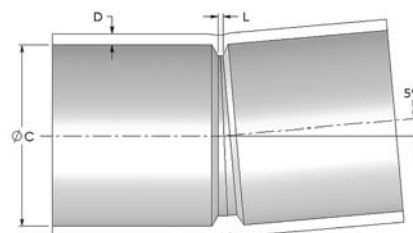
IPS XHW DOUBLE BELL COUPLING

Size	Symbol	ØC	D	L	• • •
in	No.	inches			• • • • •
1	• • 14-1010	1.723	0.250	8.5	• • • • •
8❖	• • • 14-8010	8.933	0.250	8.5	• • • • •



IPS XHW 5° DOUBLE BELL COUPLING

Size	Symbol	ØC	D	L	• • •
in	No.	inches			• • • • •
1	• • 14-1011	1.723	0.205	0.125	• • • • •
8❖	• • • 14-8011	8.933	0.250	0.125	• • • • •

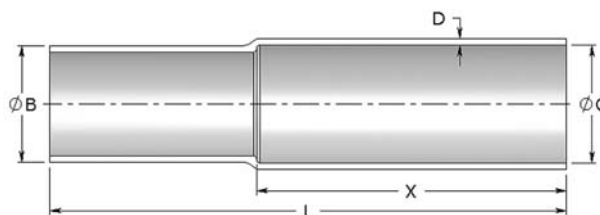


IPS XHW SLEEVE

Size	Symbol	ØC	D	L	• • •
in	No.	inches			• • • • •
1	• • 14-1016	1.723	0.250	12	• • • • •
8❖	• • • 14-8016	8.933	0.250	12	• • • • •



IPS XHW SINGLE EXPANSION JOINT

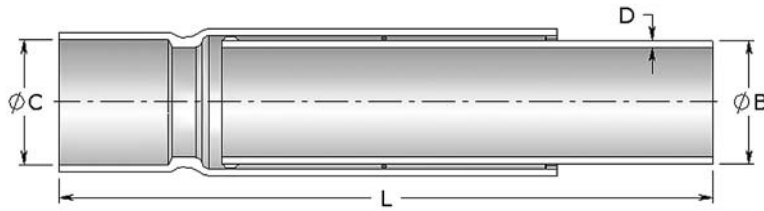


Size	Symbol	ØB	ØC	D	L	X	• • •
in	No.	inches					• • • • •
1	• • 14-1012	1.683	1.723	0.250	20	12	• • • • •
8❖	• • • 14-8012	8.893	8.933	0.250	20	12	• • • • •

❖ Not UL Listed.

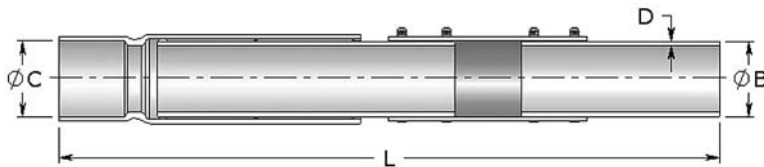


IPS XHW O-RING EXPANSION JOINT



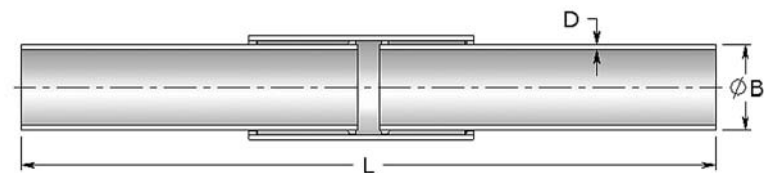
Size	Symbol	ØB	ØC	D	L min	L max	..	..	.	....	...
in	No.	inches					.....				
1	..	14-1017	1.683	1.351	0.250	23	35	....	....	...	.....
8❖	...	14-8017	8.893	8.933	0.250	23	35	....	....	...	.....

IPS XHW O-RING EXPANSION / DEFLECTION JOINT



Size	Symbol	ØB	ØC	D	L min	L max	..	..	.	....	...
in	No.	inches					.....				
1	..	14-1057	1.683	1.723	0.250	39	51	....	....	...	.....
8❖	...	14-8057	8.893	8.933	0.250	39	51	....	....	...	.....

IPS XHW WOBBLE (FOR UP TO 3° CURVATURE)



Size	Symbol	ØB	D	L min	L max	• •	•	• • • •	• • • •	
in	No.	inches				• • • • • • • • • •				
1	• •	14-1013	1.683	0.250	36	46	• • • •	• • •	• • • • •	• • • • • • •
8❖	• • •	14-8013	8.893	0.250	36	46	• • • • •	• • •	• • • • •	• • • • • •

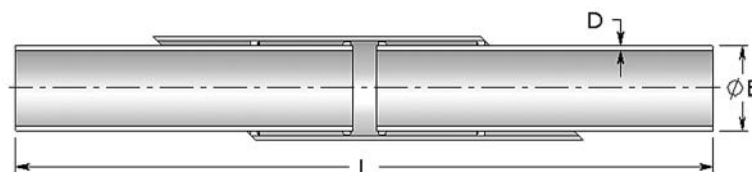
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HAZGUARD™

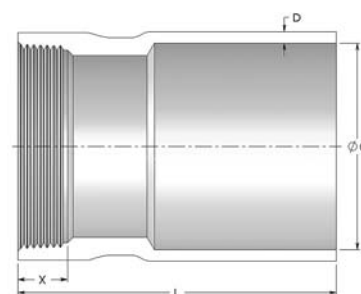
IPS XHW SKEW WOBBLE (FOR UP TO 7.5° CURVATURE)



Size	Symbol	ØB	D	L min	L max				
in	No.								
1	• • 14-1014	1.683	0.250	48	56	• • • • •	• • • • •	• • • • •	• • • • •
8❖	• • • 14-8014	8.893	0.250	48	56	• • • • •	• • • • •	• • • • •	• • • • •

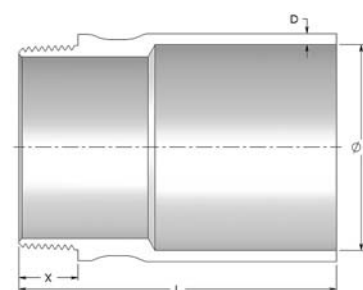
IPS XHW NPT FEMALE THREADED ADAPTER

Size	Symbol	ØC	D	L	X				
in	No.								
1	• • 14-1044	1.723	0.250	6	0.661	• • • • •	• • • • •	• • • • •	• • • • •
8❖	• • • 14-8044	8.933	0.250	7	1.313	• • • • •	• • • • •	• • • • •	• • • • •



IPS XHW NPT MALE THREADED ADAPTER

Size	Symbol	ØC	D	L	X				
in	No.								
1	• • 14-1027	1.723	0.250	6	0.683	• • • • •	• • • • •	• • • • •	• • • • •
8❖	• • • 14-8027	8.933	0.250	7	1.713	• • • • •	• • • • •	• • • • •	• • • • •

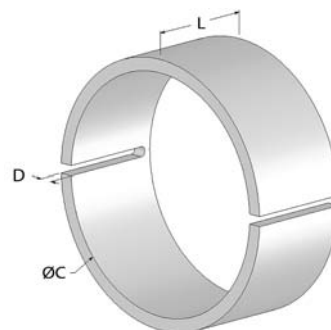


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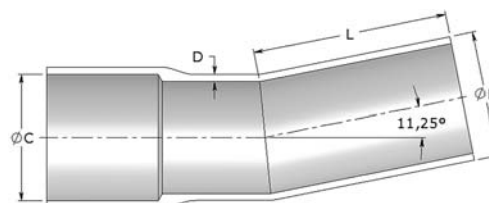
IPS XHW SPLIT STOP RING

Size	Symbol	ØC	D	L	• • • • •
in	No.	inches			
1	• • 14-1064	1.723	0.250	2	• • • • •
8❖	• • • 14-8064	8.933	0.250	2	• • • • •



IPS XHW 11.25° FITTING

Size	Symbol	ØB	ØC	D	L	• • • • •
in	No.	inches				• • • • •
1	• • 14-1035	1.683	1.723	0.250	7	• • • • •
8❖	• • • 14-8035	8.893	8.933	0.250	7	• • • • •



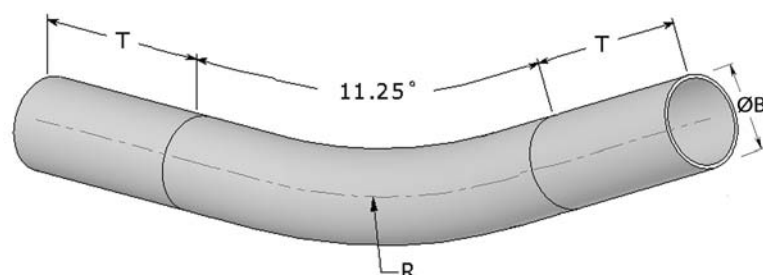
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HAZGUARD™

IPS XHW 11.25° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1035R48	1.683	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1035R12	1.683	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1035R60	1.683	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1035R24	1.683	24	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1035R72	1.683	72	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1035R36	1.683	36	6	• • • • •

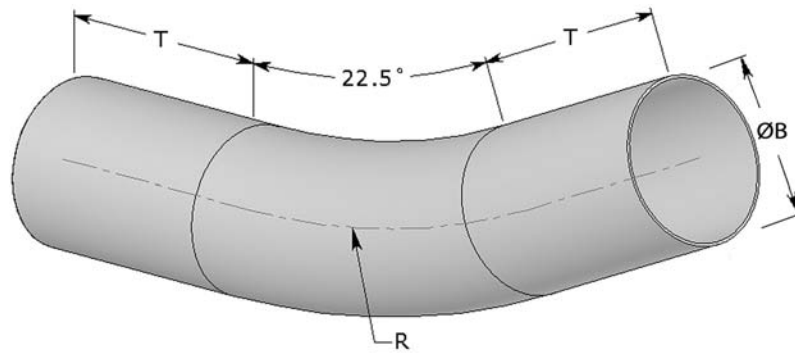
108" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-8035R108	8.893	108	6	• • • • •

❖ Not UL Listed.



IPS XHW 22.5° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1034R48	1.683	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1034R12	1.683	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1034R60	1.683	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1034R24	1.683	24	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1034R72	1.683	72	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1034R36	1.683	36	6	• • • • •

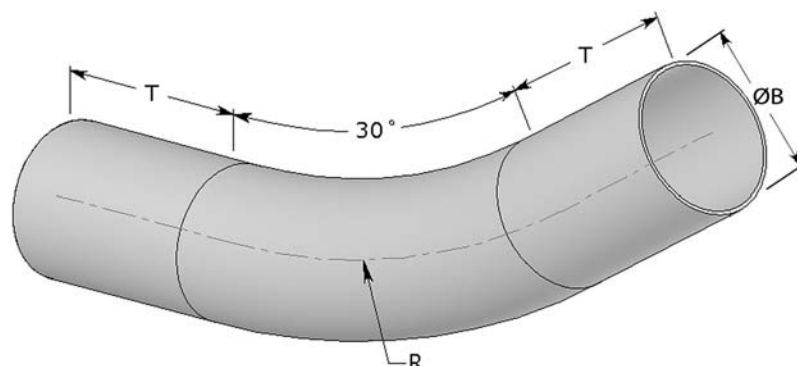
108" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-8034R108	8.893	108	6	• • • • •

❖ Not UL Listed.



IPS XHW 30° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1033R48	1.683	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1033R12	1.683	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1033R60	1.683	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1033R24	1.683	24	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1033R72	1.683	72	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-1033R36	1.683	36	6	• • • • •

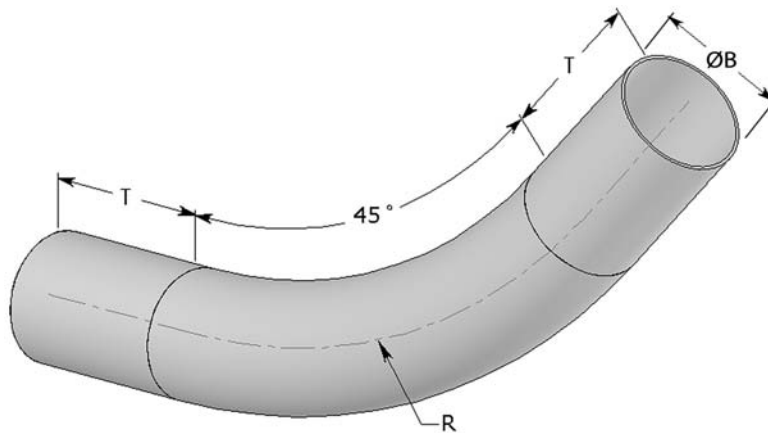
108" RADIUS

Size	Symbol	ØB	R	T	• • • • •
in • •	No.	inches			• • • • •
1 • •	14-8033R108	8.893	108	6	• • • • •

❖ Not UL Listed.



IPS XHW 45° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1032R48	1.683	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1032R12	1.683	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1032R60	1.683	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1032R24	1.683	24	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1032R72	1.683	72	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1032R36	1.683	36	6	• • • • •

108" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-8032R108	8.893	108	6	• • • • •

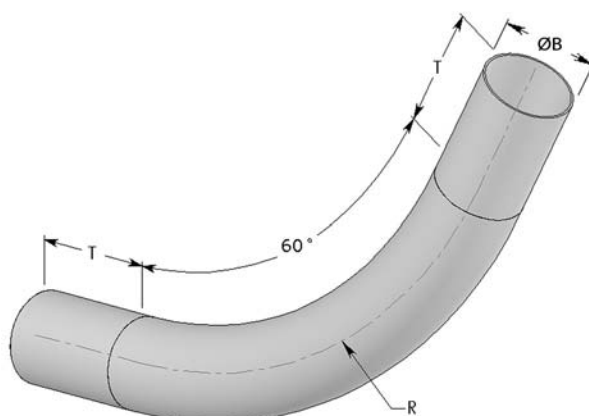
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HAZGUARD™

IPS XHW 60° ELBOW



12" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1031R12	1.683	12	6	• • • • •

48" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1031R48	1.683	48	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1031R24	1.683	24	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1031R60	1.683	60	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1031R36	1.683	36	6	• • • • •

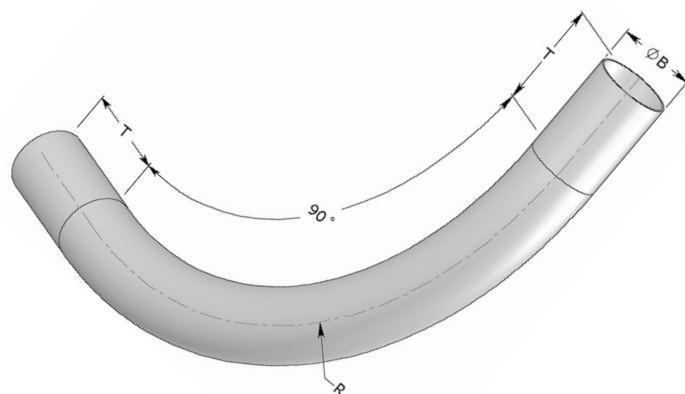
72" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.	inches			• • • • •
1 • •	14-1031R72	1.683	72	6	• • • • •

❖ Not UL Listed.



IPS XHW 90° ELBOW



12" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.		inches		• • • • • • • • • •
1 • •	14-1030R12	1.683	12	6	• • • • • • • • • •

48" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.		inches		• • • • • • • • • •
1 • •	14-1030R48	1.683	48	6	• • • • • • • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.		inches		• • • • • • • • • •
1 • •	14-1030R24	1.683	24	6	• • • • • • • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in • •	No.		inches		• • • • • • • • • •
1 • •	14-1030R60	1.683	60	6	• • • • • • • • • •

36" RADIUS

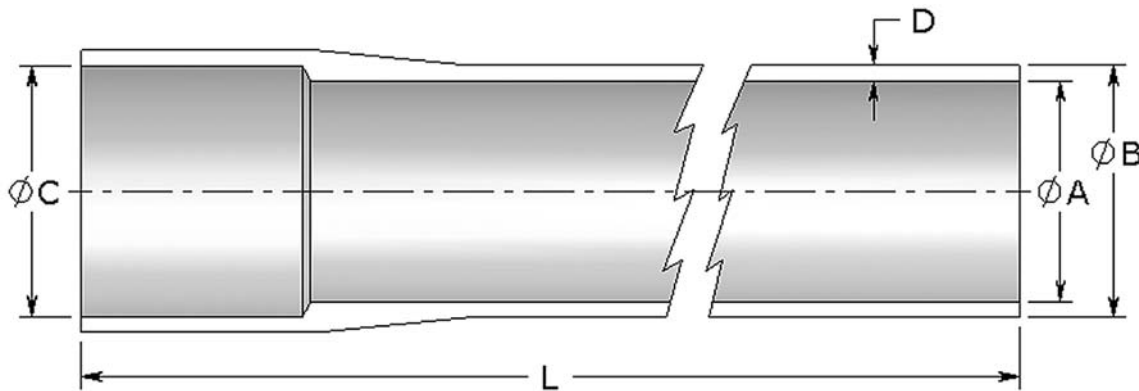
Size	Symbol	ØB	R	T	• • •
in • •	No.		inches		• • • • • • • • • •
1 • •	14-1030R36	1.683	36	6	• • • • • • • • • •

❖ Not UL Listed.





ID EXTRA HEAVY WALL (XHW) CONDUIT



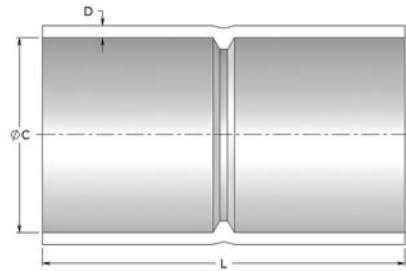
Size	Symbol	ØA	ØB	ØC	D	L	..	..	..	.	.
in	..	inches					.....				
	No.										
2	..	24-2000	2.000	2.500	2.540	0.250	236.25	....	....	....	....
3	..	24-3000	3.000	3.500	3.540	0.250	236.25	....	....	....	....
4	...	24-4000	4.000	4.500	4.540	0.250	236.25	.....	.....	.....	....
5	...	24-5000	5.000	5.500	5.540	0.250	236.25	.....	.....	.....	....
6	...	24-6000	6.000	6.500	6.540	0.250	236.25	.....	.....	.....	....

- All our ID HazGuard™ products are offered with a push-fit assembly requiring adhesive.
- Standard length is 19.68 ft. (6m) but can also be available in 9.84 ft. section (3m), if required.
- Spigot end tapered for ease of installation



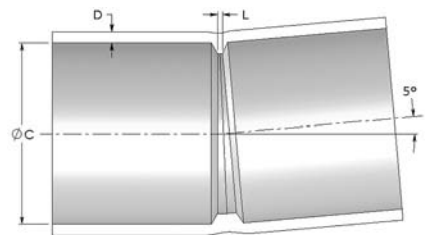
ID XHW DOUBLE BELL COUPLING

Size	Symbol	ØC	D	L	• • •
in	No.		inches		• • • • •
2	• • 24-2010	2.540	0.250	8.5	• • • • •
3	• • 24-3010	3.540	0.250	8.5	• • • • •
4	• • • 24-4010	4.540	0.250	8.5	• • • • •
5	• • • 24-5010	5.540	0.250	8.5	• • • • •
6	• • • 24-6010	6.540	0.250	8.5	• • • • •



ID XHW 5° DOUBLE BELL COUPLING

Size	Symbol	ØC	D	L	• • •
in	No.		inches		• • • • •
2	• • 24-2011	2.540	0.250	0.125	• • • • •
3	• • 24-3011	3.540	0.250	0.125	• • • • •
4	• • • 24-4011	4.540	0.250	0.125	• • • • •
5	• • • 24-5011	5.540	0.250	0.125	• • • • •
6	• • • 24-6011	6.540	0.250	0.125	• • • • •

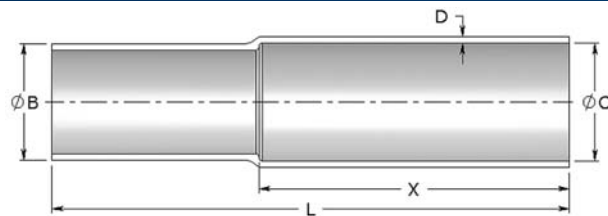


ID XHW SLEEVE

Size	Symbol	ØC	D	L	• • •
in	No.		inches		• • • • •
2	• • 24-2016	2.540	0.250	12	• • • • •
3	• • 24-3016	3.540	0.250	12	• • • • •
4	• • • 24-4016	4.540	0.250	12	• • • • •
5	• • • 24-5016	5.540	0.250	12	• • • • •
6	• • • 24-6016	6.540	0.250	12	• • • • •



ID XHW SINGLE EXPANSION JOINT



Size	Symbol	ØB	ØC	D	L	X	• • •
in	No.						• • • • •
2	• • 24-2012	2.500	2.540	0.250	20	12	• • • • •
3	• • 24-3012	3.500	3.540	0.250	20	12	• • • • •
4	• • • 24-4012	4.500	4.540	0.250	20	12	• • • • •
5	• • • 24-5012	5.500	5.540	0.250	20	12	• • • • •
6	• • • 24-6012	6.500	6.540	0.250	20	12	• • • • •

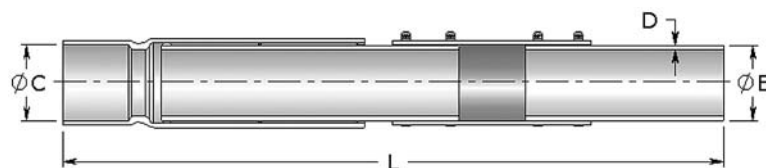


ID XHW O-RING EXPANSION JOINT



Size	Symbol	ØB	ØC	D	L min	L max	
in	• •	No.					• • • • •
		inches					• • • • •
2	• •	24-2017	2.500	2.540	0.250	23 35	• • • • •
3	• •	24-3017	3.500	3.540	0.250	23 35	• • • • •
4	• • •	24-4017	4.500	4.540	0.250	23 35	• • • • •
5	• • •	24-5017	5.500	5.540	0.250	23 35	• • • • •
6	• • •	24-6017	6.500	6.540	0.250	23 35	• • • • •

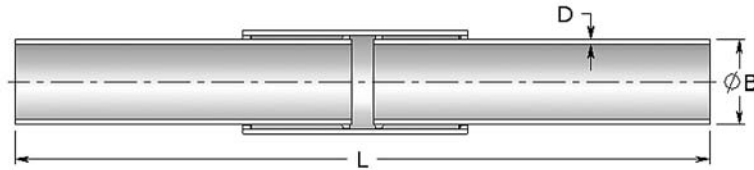
ID XHW O-RING EXPANSION / DEFLECTION JOINT



Size	Symbol	ØB	ØC	D	L min	L max	
in	• •	No.					• • • • •
		inches					• • • • •
2	• •	24-2057	2.500	2.540	0.250	39 51	• • • • •
3	• •	24-3057	3.500	3.540	0.250	39 51	• • • • •
4	• • •	24-4057	4.500	4.540	0.250	39 51	• • • • •
5	• • •	24-5057	5.500	5.540	0.250	39 51	• • • • •
6	• • •	24-6057	6.500	6.540	0.250	39 51	• • • • •

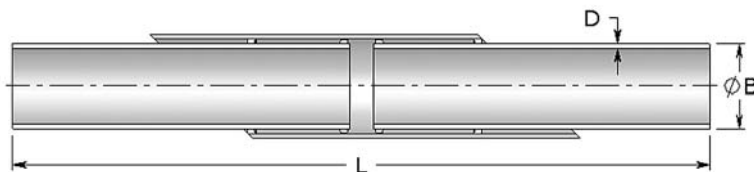


ID XHW WOBBLE (FOR UP TO 3° CURVATURE)



Size	Symbol	ØB	D	L min	L max	• •	•	• • • •	• • • •
in	• •	No.	inches					• • • • • • • •	
2	• •	24-2013	2.500	0.250	36	46	• • • •	• • •	• • • • • • • •
3	• •	24-3013	3.500	0.250	36	46	• • • •	• • •	• • • • • • • •
4	• • •	24-4013	4.500	0.250	36	46	• • • • •	• • •	• • • • • • • •
5	• • •	24-5013	5.500	0.250	36	46	• • • • •	• • •	• • • • • • • •
6	• • •	24-6013	6.500	0.250	36	46	• • • • •	• • •	• • • • • • • •

ID XHW SKEW WOBBLE (FOR UP TO 7.5° CURVATURE)

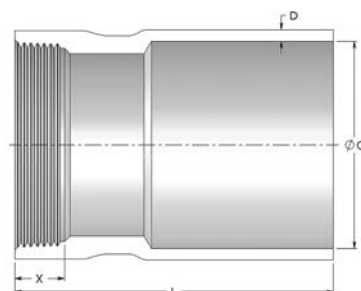


Size	Symbol	ØB	D	L min	L max	• •	•	• • • •	• • • •
in	• •	No.	inches					• • • • • • • •	
2	• •	24-2014	2.500	0.250	48	56	• • • •	• • •	• • • • • • • •
3	• •	24-3014	3.500	0.250	48	56	• • • •	• • •	• • • • • • • •
4	• • •	24-4014	4.500	0.250	48	56	• • • • •	• • •	• • • • • • • •
5	• • •	24-5014	5.500	0.250	48	56	• • • • •	• • •	• • • • • • • •
6	• • •	24-6014	6.500	0.250	48	56	• • • • •	• • •	• • • • • • • •



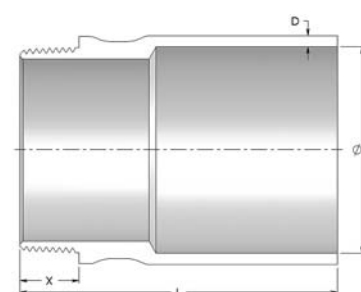
ID XHW NPT FEMALE THREADED ADAPTER

Size	Symbol	ØC	D	L	X	• •	•	•	•
in	• • No.	inches				• • • • •			
2	• • 24-2044	2.540	0.250	7	0.697	• • • •	• • •	• • • •	•
3	• • 24-3044	3.540	0.250	7	1.016	• • • •	• • •	• • • •	•
4	• • • 24-4044	4.540	0.250	7	1.094	• • • •	• • •	• • • •	•
5	• • • 24-5044	5.540	0.250	7	1.187	• • • •	• • •	• • • •	•
6	• • • 24-6044	6.540	0.250	7	1.208	• • • •	• • •	• • • •	•

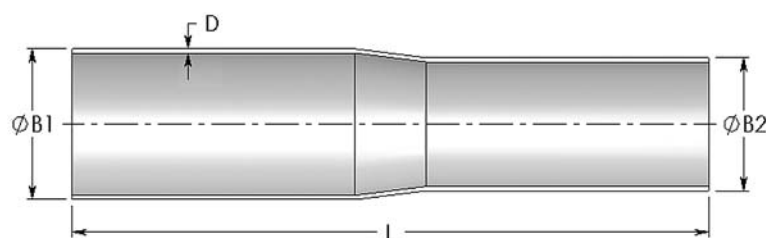


ID XHW NPT MALE THREADED ADAPTER

Size	Symbol	ØC	D	L	X	• •	•	•	•
in	• • No.	inches				• • • • •			
2	• • 24-2027	2.540	0.250	7	0.757	• • • •	• • •	• • • •	• •
3	• • 24-3027	3.540	0.250	7	1.200	• • • •	• • •	• • • •	• •
4	• • • 24-4027	4.540	0.250	7	1.300	• • • •	• • •	• • • •	• •
5	• • • 24-5027	5.540	0.250	7	1.406	• • • •	• • •	• • • •	• •
6	• • • 24-6027	6.540	0.250	7	1.513	• • • •	• • •	• • • •	• •



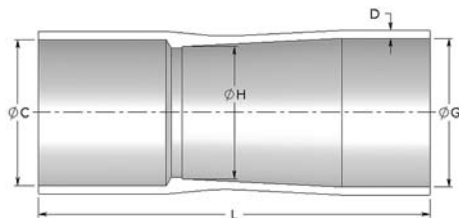
ID XHW REDUCER



Size	Symbol	ØB1	ØB2	D	L	• • •	• • •	•	•
in	• • No.	inches				• • • • •			
3	• • 24-3029	3.500	2.500	0.250	18	• • • •	• • • •	• • •	• • • •
4	• • • 24-4029	4.500	3.500	0.250	18	• • • •	• • • •	• • •	• • • •
5	• • • 24-5029	5.500	4.500	0.250	18	• • • •	• • • •	• • •	• • • •
6	• • • 24-6029	6.500	5.500	0.250	18	• • • •	• • • •	• • •	• • • •



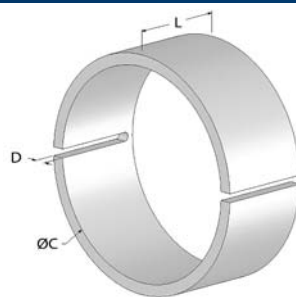
ID XHW MULTIFIT ADAPTER



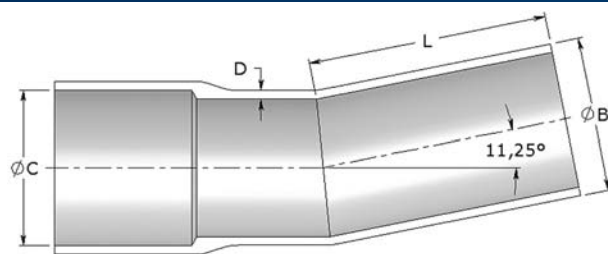
Size	Symbol	ØC	D	ØG	ØH	L	..	.	..	..	.
in	No.	inches					.....				
2	24-2037	2.540	0.250	2.424	2.239	12.25	....	...	....	....	.....
3	24-3037	3.540	0.250	3.549	3.239	12.25	....	...	....	....	.....
4	24-4037	4.540	0.250	4.620	4.109	12.25	.....	...	.....	.....	.....
5	24-5037	5.540	0.250	5.650	5.289	12.25	.....	...	.....	.....	.....
6	24-6037	6.540	0.250	6.686	6.259	12.25	.....	...	.....	.....	.....

ID XHW SPLIT STOP RING

Size	Symbol	ØC	D	L	..	.	.
in	No.	inches			.....		
2	24-2064	2.540	0.250	2	....	...	....
3	24-3064	3.540	0.250	2	....	...	....
4	24-4064	4.540	0.250	2	.....	...	....
5	24-5064	5.540	0.250	2	.....	...	....
6	24-6064	6.540	0.250	2	.....	...	....



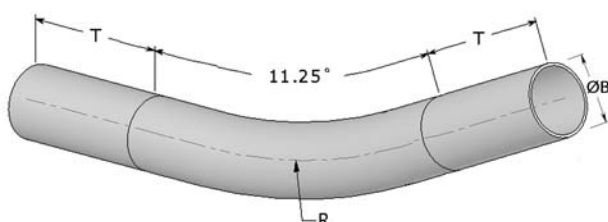
ID XHW 11.25° FITTING



Size	Symbol	ØB	ØC	D	L	..	..	.	.
in	No.	inches				.....			
2	24-2035	2.500	2.540	0.250	7	....	....	...	....
3	24-3035	3.500	3.540	0.250	7	....	....	...	....
4	24-4035	4.500	4.540	0.250	7	.....	.....	...	.....
5	24-5035	5.500	5.540	0.250	7	.....	.....	...	.....
6	24-6035	6.500	6.540	0.250	7	.....	.....	...	.....



ID XHW 11.25° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2035R48	2.500	48	6	• • • • •
3	• • 24-3035R48	3.500	48	6	• • • • •
4	• • • 24-4035R48	4.500	48	6	• • • • •
5	• • • 24-5035R48	5.500	48	6	• • • • •
6	• • • 24-6035R48	6.500	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2035R12	2.500	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2035R60	2.500	60	6	• • • • •
3	• • 24-3035R60	3.500	60	6	• • • • •
4	• • • 24-4035R60	4.500	60	6	• • • • •
5	• • • 24-5035R60	5.500	60	6	• • • • •
6	• • • 24-6035R60	6.500	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2035R24	2.500	24	6	• • • • •
3	• • 24-3035R24	3.500	24	6	• • • • •

72" RADIUS

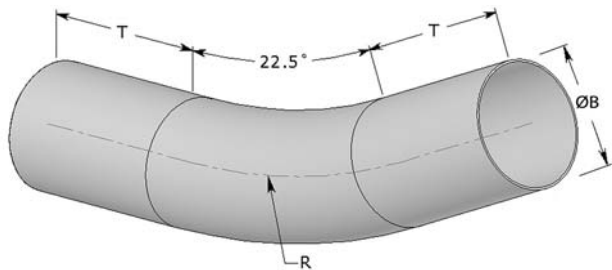
Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2035R72	2.500	72	6	• • • • •
3	• • 24-3035R72	3.500	72	6	• • • • •
4	• • • 24-4035R72	4.500	72	6	• • • • •
5	• • • 24-5035R72	5.500	72	6	• • • • •
6	• • • 24-6035R72	6.500	72	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2035R36	2.500	36	6	• • • • •
3	• • 24-3035R36	3.500	36	6	• • • • •
4	• • • 24-4035R36	4.500	36	6	• • • • •
5	• • • 24-5035R36	5.500	36	6	• • • • •



ID XHW 22.5° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2034R48	2.500	48	6	• • • • •
3	• • 24-3034R48	3.500	48	6	• • • • •
4	• • • 24-4034R48	4.500	48	6	• • • • •
5	• • • 24-5034R48	5.500	48	6	• • • • •
6	• • • 24-6034R48	6.500	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2034R12	2.500	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2034R60	2.500	60	6	• • • • •
3	• • 24-3034R60	3.500	60	6	• • • • •
4	• • • 24-4034R60	4.500	60	6	• • • • •
5	• • • 24-5034R60	5.500	60	6	• • • • •
6	• • • 24-6034R60	6.500	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2034R24	2.500	24	6	• • • • •
3	• • 24-3034R24	3.500	24	6	• • • • •

36" RADIUS

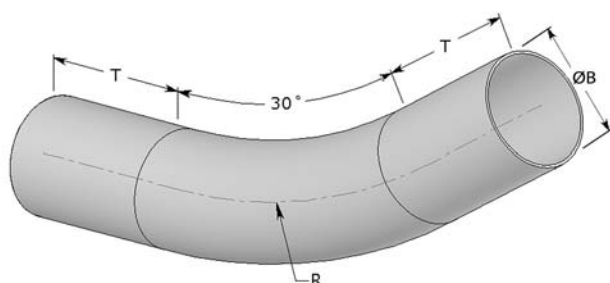
Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2034R36	2.500	36	6	• • • • •
3	• • 24-3034R36	3.500	36	6	• • • • •
4	• • • 24-4034R36	4.500	36	6	• • • • •
5	• • • 24-5034R36	5.500	36	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2034R72	2.500	72	6	• • • • •
3	• • 24-3034R72	3.500	72	6	• • • • •
4	• • • 24-4034R72	4.500	72	6	• • • • •
5	• • • 24-5034R72	5.500	72	6	• • • • •
6	• • • 24-6034R72	6.500	72	6	• • • • •



ID XHW 30° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2033R48	2.500	48	6	• • • • •
3	• • 24-3033R48	3.500	48	6	• • • • •
4	• • • 24-4033R48	4.500	48	6	• • • • •
5	• • • 24-5033R48	5.500	48	6	• • • • •
6	• • • 24-6033R48	6.500	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2033R12	2.500	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2033R60	2.500	60	6	• • • • •
3	• • 24-3033R60	3.500	60	6	• • • • •
4	• • • 24-4033R60	4.500	60	6	• • • • •
5	• • • 24-5033R60	5.500	60	6	• • • • •
6	• • • 24-6033R60	6.500	60	6	• • • • •

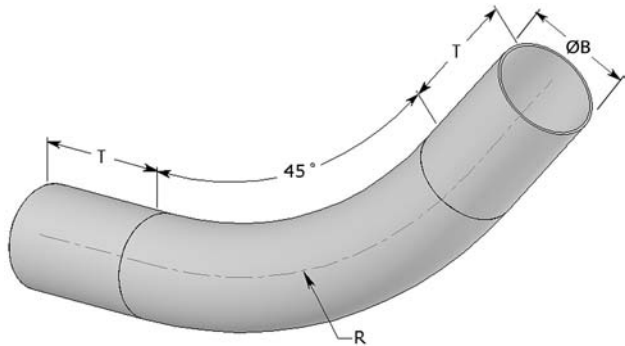
24" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2033R24	2.500	24	6	• • • • •
3	• • 24-3033R24	3.500	24	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2033R72	2.500	72	6	• • • • •
3	• • 24-3033R72	3.500	72	6	• • • • •
4	• • • 24-4033R72	4.500	72	6	• • • • •
5	• • • 24-5033R72	5.500	72	6	• • • • •
6	• • • 24-6033R72	6.500	72	6	• • • • •

ID XHW 45° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2032R48	2.500	48	6	• • • • •
3	• • 24-3032R48	3.500	48	6	• • • • •
4	• • • 24-4032R48	4.500	48	6	• • • • •
5	• • • 24-5032R48	5.500	48	6	• • • • •
6	• • • 24-6032R48	6.500	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2032R12	2.500	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2032R60	2.500	60	6	• • • • •
3	• • 24-3032R60	3.500	60	6	• • • • •
4	• • • 24-4032R60	4.500	60	6	• • • • •
5	• • • 24-5032R60	5.500	60	6	• • • • •
6	• • • 24-6032R60	6.500	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2032R24	2.500	24	6	• • • • •
3	• • 24-3032R24	3.500	24	6	• • • • •

36" RADIUS

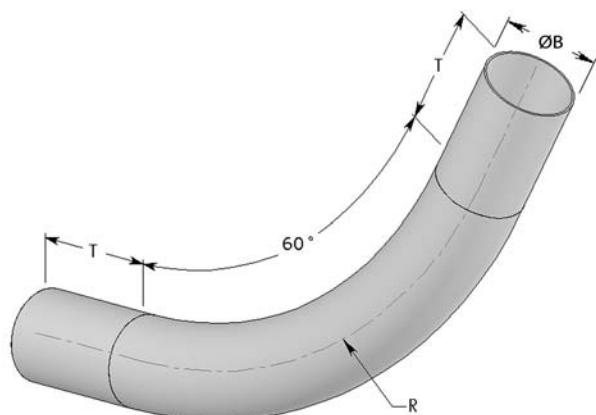
Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2032R36	2.500	36	6	• • • • •
3	• • 24-3032R36	3.500	36	6	• • • • •
4	• • • 24-4032R36	4.500	36	6	• • • • •
5	• • • 24-5032R36	5.500	36	6	• • • • •

72" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2032R72	2.500	72	6	• • • • •
3	• • 24-3032R72	3.500	72	6	• • • • •
4	• • • 24-4032R72	4.500	72	6	• • • • •
5	• • • 24-5032R72	5.500	72	6	• • • • •
6	• • • 24-6032R72	6.500	72	6	• • • • •



ID XHW 60° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2031R48	2.500	48	6	• • • • •
3	• • 24-3031R48	3.500	48	6	• • • • •
4	• • • 24-4031R48	4.500	48	6	• • • • •
5	• • • 24-5031R48	5.500	48	6	• • • • •
6	• • • 24-6031R48	6.500	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2031R12	2.500	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2031R60	2.500	60	6	• • • • •
3	• • 24-3031R60	3.500	60	6	• • • • •
4	• • • 24-4031R60	4.500	60	6	• • • • •
5	• • • 24-5031R60	5.500	60	6	• • • • •
6	• • • 24-6031R60	6.500	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2031R24	2.500	24	6	• • • • •
3	• • 24-3031R24	3.500	24	6	• • • • •

72" RADIUS

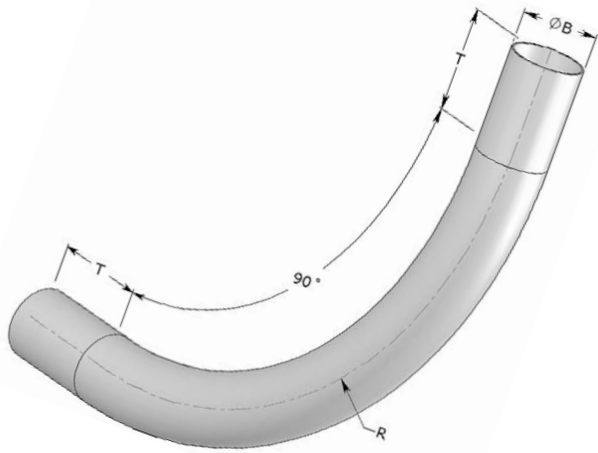
Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2031R72	2.500	72	6	• • • • •
3	• • 24-3031R72	3.500	72	6	• • • • •
4	• • • 24-4031R72	4.500	72	6	• • • • •
5	• • • 24-5031R72	5.500	72	6	• • • • •
6	• • • 24-6031R72	6.500	72	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2031R36	2.500	36	6	• • • • •
3	• • 24-3031R36	3.500	36	6	• • • • •
4	• • • 24-4031R36	4.500	36	6	• • • • •
5	• • • 24-5031R36	5.500	36	6	• • • • •



ID XHW 90° ELBOW



48" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2030R48	2.500	48	6	• • • • •
3	• • 24-3030R48	3.500	48	6	• • • • •
4	• • • 24-4030R48	4.500	48	6	• • • • •
5	• • • 24-5030R48	5.500	48	6	• • • • •
6	• • • 24-6030R48	6.500	48	6	• • • • •

12" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2030R12	2.500	12	6	• • • • •

60" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2030R60	2.500	60	6	• • • • •
3	• • 24-3030R60	3.500	60	6	• • • • •
4	• • • 24-4030R60	4.500	60	6	• • • • •
5	• • • 24-5030R60	5.500	60	6	• • • • •
6	• • • 24-6030R60	6.500	60	6	• • • • •

24" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2030R24	2.500	24	6	• • • • •
3	• • 24-3030R24	3.500	24	6	• • • • •
4	• • • 24-4030R24	4.500	24	6	• • • • •

36" RADIUS

Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2030R36	2.500	36	6	• • • • •
3	• • 24-3030R36	3.500	36	6	• • • • •
4	• • • 24-4030R36	4.500	36	6	• • • • •

72" RADIUS

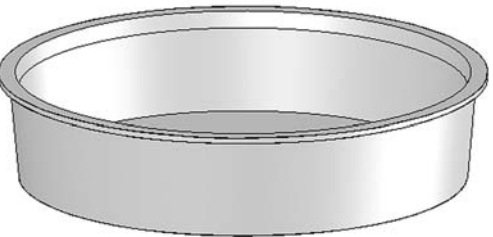
Size	Symbol	ØB	R	T	• • •
in	No.	inches			• • • • •
2	• • 24-2030R72	2.500	72	6	• • • • •
3	• • 24-3030R72	3.500	72	6	• • • • •
4	• • • 24-4030R72	4.500	72	6	• • • • •
5	• • • 24-5030R72	5.500	72	6	• • • • •
6	• • • 24-6030R72	6.500	72	6	• • • • •





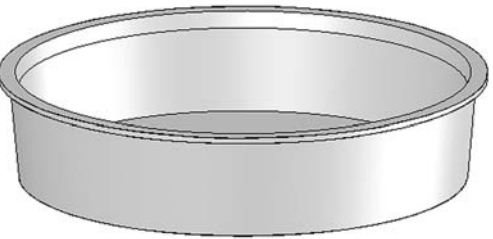
IPS THERMOPLASTIC PLUG

Size		Symbol No.	Depth	
in	• •		in	• •
1	• •	30-1028	0.6	• • • •
8	• • •	30-8028	1.5	• • • •



ID THERMOPLASTIC PLUG

Size		Symbol No.	Depth	
in	• •		in	• •
2	• •	40-2028	1.0	• • • •
3	• •	40-3028	1.0	• • • •
4	• • •	40-4028	1.3	• • • •
5	• • •	40-5028	1.0	• • • •
6	• • •	40-6028	1.5	• • • •



SPLICE & REPAIR KIT

Size	Symbol No.	Conduit size		Length of cut mat		Splices per kit
		in	mm	in	cm	
All	40-0174	2	••	10	••	14
		3	••	12	••	11
		4	•••	15	••	9
		5	•••	19	••	7
		6	•••	23	••	6



ADHESIVE KIT

Size	Symbol No.	
All	40-0161	Epoxy Kit
All	20-0164	Dual Cartridge
All	20-0165	Dual Cartridge Applicator

40-0161



MECHANICAL PROPERTIES (40-0161)

Shore D Hardness	81
Tensile strength	3 060 Psi
Lap shear strength	252 Psi
Viscosity	3 700 cP
Mix ratio	2 : 1
Color	Opaque
Solid content	100%

20-0165



20-0164

MECHANICAL PROPERTIES (20-0164)

Shore D Hardness	90
Tensile strength	9 900 Psi
Lap shear strength	2 600 Psi
Viscosity	40 000 cP
Mix ratio	2 : 1
Color	Opaque
Solid content	100%

JOINT CALCULATION TABLE (ADHESIVE KIT)

IPS BASED

Size	Joints made	Pull-Out Strength
in	per kit	lbs
1	26	2 000
8	3	8 000

ID BASED

Size	Joints made	Pull-Out Strength
in	per kit	lbs
2	18	2 000
3	13	3 000
4	10	4 000
5	7	5 000
6	6	6 000

MIXER TIP

Size	Symbol No.
All	20-0166





FRE® HAZGUARD™ fiberglass conduit

MATERIAL	TEST RESULTS	TEST PROTOCOL
Resin	Epoxy (no fillers)	
Glass	Fiberglass (E or E-CR Glass)	CSA C22.2 No. 2515
Toxicity (Toxic Gas Emission)	< 0.2% halogens by weight	UL 2515
PHYSICAL PROPERTIES	TEST RESULTS	TEST PROTOCOL
Glass Content	68% ± 3%	API 15LR
Specific Gravity	1.94 g/cm ³	ASTM D792
Barcol Hardness	54 ± 2	ASTM D2583
Water Absorption	< 1%	ASTM D570
U.V. Resistance	> 3 500 Hrs (Xenon Arc)	CSA C22.2 No. 2515
MECHANICAL DATA	TEST RESULTS	TEST PROTOCOL
Tensile Strength (axial)	≥ 9 000 Psi (62 Mpa)	ASTM D638
Elasticity Modulus (4") (103 mm)	1.3 E6 Psi (8 963 Mpa)	ASTM D2105
TriSeal™ Joint Pull-Out Load	500 lbs (227 kg)	ASTM D2105
Adhesive Joint Pull-Out Load	1 500 lbs (680 kg)	ASTM D2105
SURFACE FINISH	TEST RESULTS	TEST PROTOCOL
Exterior (average)	<2 000 microinches (50.8 micrometers)	
Interior (average)	<125 microinches (3.2 micrometers)	
Color	Black (standard), Other (upon request only)	
THERMAL PROPERTIES	TEST RESULTS	TEST PROTOCOL
Coefficient of Thermal Expansion	1.37 E-5 in./in./°F (2.47 E-5 m./m./°C)	ASTM D696
Thermal Conductivity	2 Btu.in/ft ² .h. °F (0.288W/ m.K)	ASTM D335
Thermal Resistivity	0.5°F. ft ² .h/Btu.in (3.47 mK/W)	ASTM D335
Flammability	Article 5.10	UL 2515
Heat Deflection Temperature (HDT)	312°F (156°C)	ASTM D648
ELECTRICAL DATA	TEST RESULTS	TEST PROTOCOL
Dielectric Strength	500 volts/mil (19.68 kV/mm)	ASTM D149
Dielectric Breakdown Voltage	29.7 kV	ASTM D149
Dissipation Factor	0.5%	ASTM D150
COEFFICIENT OF FRICTION	TEST RESULTS	TEST PROTOCOL
Cross Linked Polyethylene Cable	0.233 ± .02	CSA B196.1
PVC Jacketed Cable	0.385 ± .06	CSA B196.1
Concentric Neutral Cable	0.160 ± .03	CSA B196.1
Teck (Armored) Cable	0.161 ± .03	CSA B196.1

REPRESENTATIVE PERFORMANCE SPECS

Size in	mm	Wall		Weight		Failure Load (ASTM D2412)		Impact (ASTM D2444)		Moment of inertia	
		in	mm	lbs/ft.	Kg/m	lbs/ft.	Kg/m	lbs ft.	Kg m	in. ⁴	cm ⁴
IPS EXTRA HEAVY WALL (XHW)											
1	• •	.250	6.4	0.95	1.33	14 000	20 872	120	13.86	0.298	12.40
8	• • •	.250	6.4	5.73	8.67	6 000	8 945	300	41.57	63.439	2640.50
ID EXTRA HEAVY WALL (XHW)											
2	• •	.250	6.4	1.49	2.33	12 000	17 890	120	16.63	1.132	47.12
3	• •	.250	6.4	2.16	3.33	11 000	16 400	160	22.17	3.390	140.10
4	• • •	.250	6.4	2.82	4.33	10 000	14 909	200	27.72	7.562	314.75
5	• • •	.250	6.4	3.48	5.33	8 000	11 927	240	33.26	14.238	592.63
6	• • •	.250	6.4	4.14	6.33	7 000	10 436	280	38.80	24.007	999.25

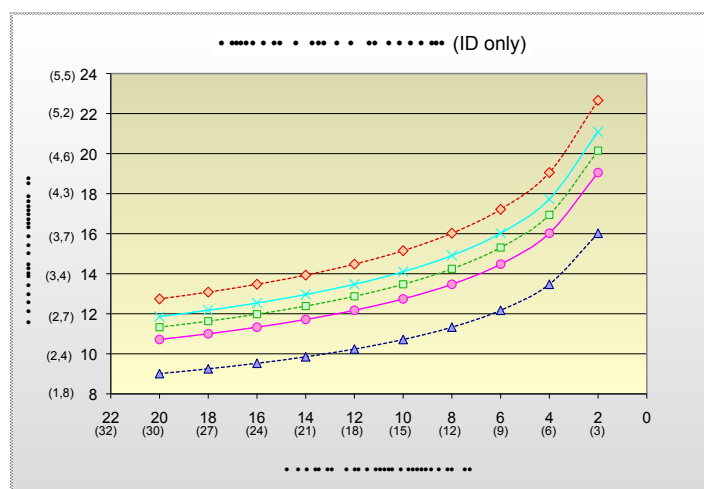
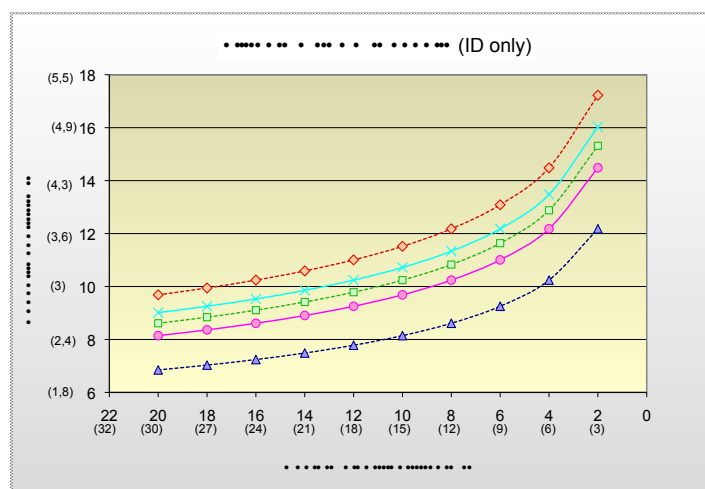
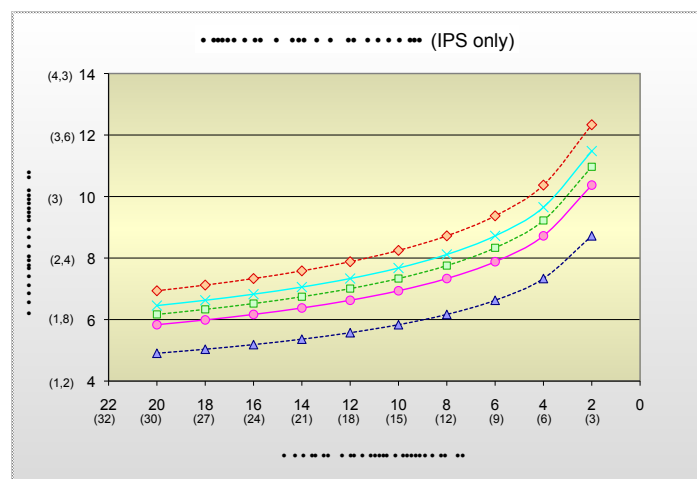
FLEXURAL DATA

Maximum Flexural Modulus:	1.4E6 Psi	9 653 Mpa
Allowable working stress at 0,2% strain:	2 800 Psi	19.31 Mpa
Maximum Long term flexural modulus at 0,2% strain:	1E6 Psi	6 895 Mpa
Long term allowable design stress:	2 000 Psi	13.79 Mpa

CONDUIT DEFLECTION TABLES

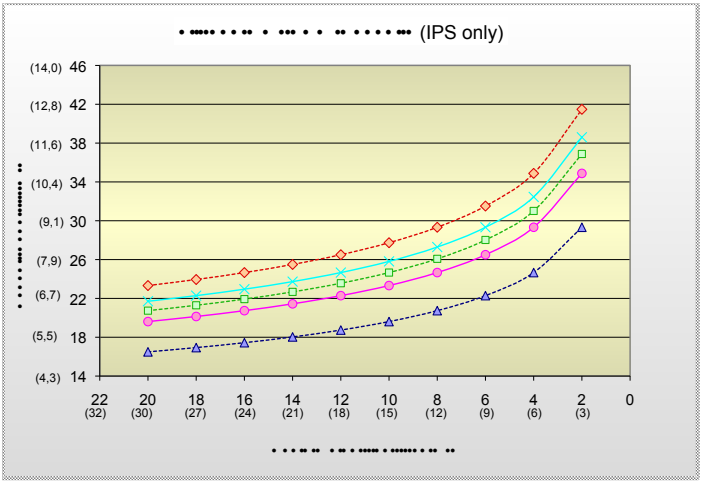
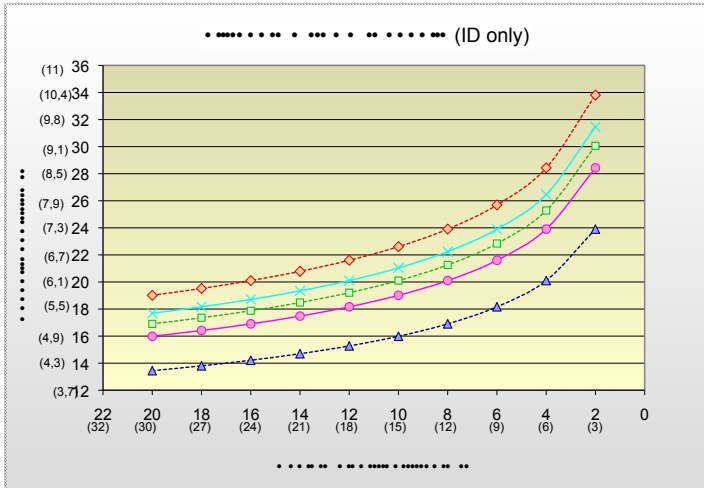
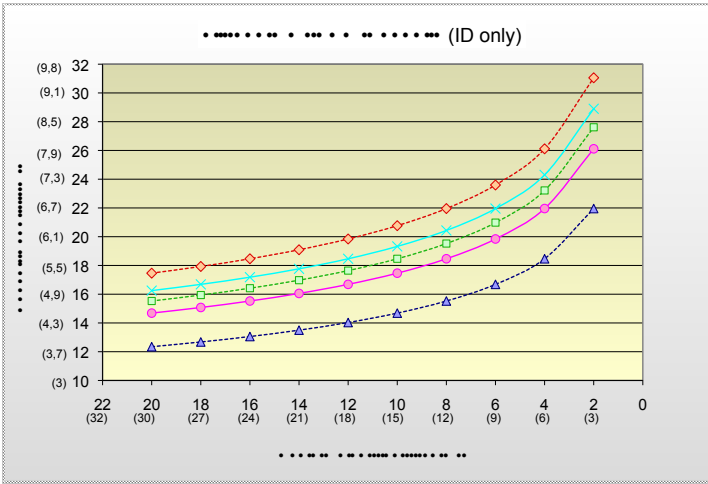
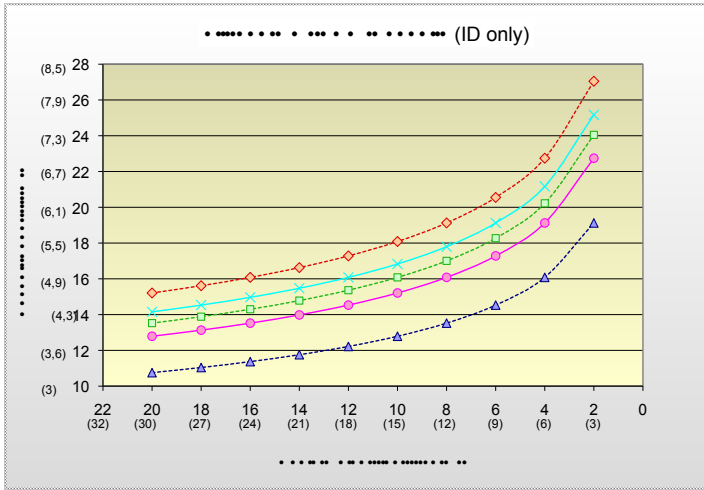
The graphs on the following pages reflect the span-deflection characteristics of FRE® Conduit. First, select the appropriate deflection graph. Continue by selecting the appropriate cable weight from the X-axis and move in a vertical direction, intercepting various deflection lines. At the appropriate deflection line for your application, look left the chart to find the recommended span between supports.

In order to take long-term creep into account, the charts have been tabulated using the long-term modulus in the calculations. Because of this, conduit sections will actually deflect much less than the charted value when first installed. If this long-term safety margin is not required, FRE Composites will prepare appropriate span charts for your application on request.



---▲--- 1/4" (6mm) Deflection —●— 1/2" (13mm) Deflection - - -■- - 5/8" (16mm) Deflection - - -x- - 3/4" (19mm) Deflection - - -◇- - 1" (25mm) Deflection

CONDUIT DEFLECTION TABLES



---▲--- 1/4" (6mm) Deflection —●— 1/2" (13mm) Deflection - - - ■ - - - 5/8" (16mm) Deflection - - - × - - - 3/4" (19mm) Deflection - - - ◆ - - - 1" (25mm) Deflection

CHEMICAL RESISTANCE

	after 45 days	after 90 days		after 45 days	after 90 days
Sodium chloride, 10% aq. sin.	E	E	Nitric acid, 10% aq. sin.	E	E
Diesel fuel	E	E	Sodium carbonate, 10% aq. sin.	E	E
Unleaded gasoline	E	E	Benzene	NR	NR
Jet fuel	E	E	Toluene	E	E
Hydrochloric acid, 10% aq. sin.	E	E	Xylene	E	E
Sulfuric acid, 10% aq. sin.	E	E	Acetone	NR	NR

E: excellent chemical resistance

NR : not recommended for long term contact.

.....

PULLING TENSION FOR CABLES

The cable manufacturer must be consulted for the maximum pull permitted on a selected cable. Other data such as lubrication restrictions should also be obtained from the cable manufacturer. The total pulling force required for a cable in a conduit depends upon the cable weight, length of conduit, number and location of the elbows and the coefficient of friction.

The following formula is published to aid in obtaining tension values: $T_i = T_{i-1}e^{\left(\frac{f\alpha}{180}\right)} + wLf \cos \phi + wL \sin \phi$

T_i = Tension at the point towards end of run (lbs)

α = Elbow angle (°)

f = Coefficient of friction

ϕ = Angle (°) of run with regards to the horizontal

L = Length of conduit subjected to cable weight (ft.)

- positive if run moves upwards

e = Napirian Logarithm base = 2.718

- negative if run moves downwards

T_{i-1} = Tension at point towards beginning of run (lbs)

- equal zero (0) if run is horizontal

w = Cable weight per foot (lbs/ft.)

Example:

Parameters - $f = .25$ $w = 10$ lbs/ft. $r = 36$ inches = Elbow radius (used to calculate elbow length)

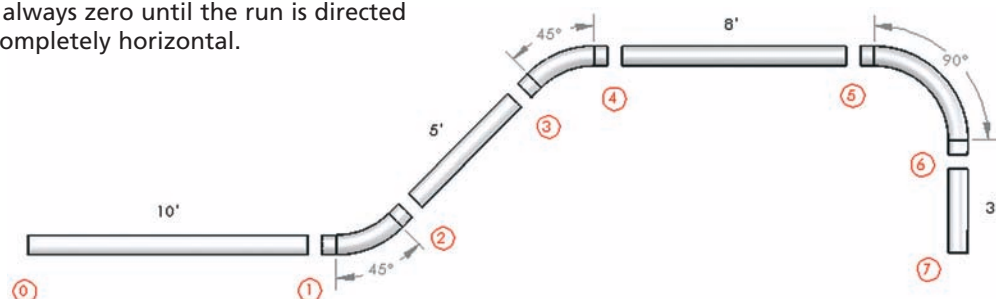
i) Pulling from point "0" to point "7"

ii) Pulling from point "7" to point "0"

Point i	ϕ (°)	α (°)	L (ft.)	$e^{\left(\frac{f\alpha}{180}\right)}$	T_i (lbs)
0	—	—	—	—	0.0
1	0.0	0.0	10.0	1.00	25.00
2	0.0	45.0	3.4	1.22	38.81
3	0.0	0.0	5.0	1.00	51.31
4	0.0	45.0	3.4	1.22	70.84
5	0.0	0.0	8.0	1.00	90.84
6	0.0	90.0	5.7	1.48	148.81
7	0.0	0.0	3.0	1.00	156.31

Point i	ϕ (°)	α (°)	L (ft.)	$e^{\left(\frac{f\alpha}{180}\right)}$	T_i (lbs)
7	—	—	—	—	0.0
6	0.0	0.0	3.0	1.00	7.50
5	0.0	90.0	5.7	1.48	25.39
4	0.0	0.0	8.0	1.00	45.39
3	0.0	45.0	3.4	1.22	63.63
2	0.0	0.0	5.0	1.00	76.13
1	0.0	45.0	3.4	1.22	101.03
0	0.0	0.0	10.0	1.00	126.03

ϕ : This value is always zero until the run is directed other than completely horizontal.



The following table is published to aid in solving the values for $e^{\left(\frac{f\alpha}{180}\right)}$

Elbow Angle(°)	For $f = 0.25$	For $f = 0.35$	For $f = 0.45$	For $f = 0.55$
11.25°	1.050	1.071	1.092	1.114
22.5°	1.103	1.147	1.193	1.241
30°	1.140	1.201	1.266	1.334
45°	1.217	1.316	1.424	1.540
60°	1.299	1.443	1.602	1.779
90°	1.481	1.733	2.028	2.372

MAXIMUM TENSION ALLOWED AT ELBOWS:

The maximum pulling tension at a elbow must not exceed the calculated value of $300 \times r$ (radius of the conduit elbow in feet). The above equations are used to determine what tension will occur at a elbow. This is to avoid cable damage.* In general, it is preferred to pull in the direction which results in the lowest tension. To do this, the pay-off reel should be placed at the end nearest the elbow.

*For safe pulling tension, to avoid cable damage, consult cable manufacturers for tension per cable type.

WIRE FILL

Maximum allowable percentage wire fill from 2008 National Electrical Code (NEC) and 2012 Canadian Electrical Code (CEC).

IPS SIZES

IMPERIAL					
Trade size IPS	Inside Diameter (in)	Total Area 100% (in ²)	NUMBER OF CONDUCTORS & Percent of cross section of conduit for conductors		
			1 53% fill (in ²)	2 31% fill (in ²)	Over 2 40% fill (in ²)
1	1.183	1.099	0.583	0.341	0.440

METRIC					
Trade size IPS	Inside Diameter (mm)	Total Area 100% (mm ²)	NUMBER OF CONDUCTORS & Percent of cross section of conduit for conductors		
			1 53% fill (mm ²)	2 31% fill (mm ²)	Over 2 40% fill (mm ²)
25	30	709	376	220	284

ID SIZES

IMPERIAL					
Trade size ID	Inside Diameter (in)	Total Area 100% (in ²)	NUMBER OF CONDUCTORS & Percent of cross section of conduit for conductors		
			1 53% fill (in ²)	2 31% fill (in ²)	Over 2 40% fill (in ²)
2	2.000	3.142	1.665	0.974	1.257
3	3.000	7.069	3.746	2.191	2.827
4	4.000	12.566	6.660	3.896	5.027
5	5.000	19.635	10.407	6.087	7.854
6	6.000	28.274	14.985	8.765	11.310

METRIC					
Trade size ID	Inside Diameter (mm)	Total Area 100% (mm ²)	NUMBER OF CONDUCTORS & Percent of cross section of conduit for conductors		
			1 53% fill (mm ²)	2 31% fill (mm ²)	Over 2 40% fill (mm ²)
51	53	2027	1 074	628	811
76	78	4560	2 417	1 414	1 824
102	103	8107	4 297	2 513	3 243
127	129	12 668	6 714	3 927	5 067
152	155	18 242	9 668	5 655	7 297



STANDARD CONDUIT PACKAGING

IPS EXTRA HEAVY WALL (XHW)

Size		Length		Weight per Stick		Weight per Crate		Sticks per Crate	Footage per Crate		Crate per Truck	Footage per Truck		Weight per Truck		Width per Crate		Height per Crate	
in	mm	ft	meter	lb	kg	lb	kg		ft	meter		ft	meter	lb	kg	in	mm	in	mm
1	••	9.84	3	9.50	4	1 425	646	150	1 476	450	80	118 080	35 991	114 000	51 710	45	1 143	10	254
8	•••	19.68	6	114.63	52	1 146	520	10	98	30	16	1 574	480	18 341	8 319	45	1 143	24	610

ID EXTRA HEAVY WALL (XHW)

Size		Length		Weight per Stick		Weight per Crate		Sticks per Crate	Footage per Crate		Crate per Truck	Footage per Truck		Weight per Truck		Width per Crate		Height per Crate	
in	mm	ft	meter	lb	kg	lb	kg		ft	meter		ft	meter	lb	kg	in	mm	in	mm
2	••	19.68	6	29.84	14	1 969	893	66	1 299	396	40	51 955	15 836	78 778	35 733	45	1 143	10	254
3	••	19.68	6	43.10	20	3 491	1 583	81	1 594	486	16	25 505	7 774	55 858	25 337	45	1 143	24	610
4	•••	19.68	6	56.37	26	2 424	1 099	43	846	258	16	13 540	4 127	38 783	17 592	45	1 143	24	610
5	•••	19.68	6	69.63	32	2 089	947	30	590	180	16	9 446	2 879	33 422	15 160	45	1 143	24	610
6	•••	19.68	6	82.89	38	1 658	752	20	394	120	16	6 298	1 920	26 525	12 032	45	1 143	24	610

Standard Accessories Packaging

Ordering in multiple of standard packaging is highly recommended.

Product	Size	Amount	Package	Product	Size	Amount	Package	Product	Size	Amount	Package
	in ••				in ••				in ••		
Coupling	2 ••	20	Bag	O-Ring	2 ••	10	Bag	Adapters	2 ••	20	Bag
Coupling	3-5 •••••	10	Bag	O-Ring	3-5 •••••	5	Bag	Adapters	3 - 6 •••••	10	Bag
Coupling	6 •••	8	Bag	Reducers		10	Bag	Elbows	1-2 •••••	10	Bundle
Wobble	2 ••	10	Bag	Expansion JT	2-6 •••••	5	Bundle	Bends	3 - 6 •••••	5	Bundle
Wobble	3-6 •••••	5	Bundle	Adapters	1-1½ •••••	50	Bag	Bell Ends		A/R	Carton



GLOSSARY

FRE® Conduit

Fiberglass **R**einforced **E**poxy conduit manufactured by FRE Composites. **FRE®** is a registered trademark in Canada, United States and elsewhere in the world, and is a recognized name worldwide since 1970's for superior quality advanced composite products.

IPS (Iron Pipe Size)

Dimensional standard widely utilized in North America for both metallic (such as RMC, EMT, IMC) and Rigid Non metallic (RTRC, PVC and HDPE) electrical conduit. This trade size has established its Outside Diameter as the constant value.

ID (Inside Diameter)

Dimensional standard widely utilized in North America for electrical and telecommunication raceways. This trade size has established its Inside Diameter as the constant value.

Standard Wall (SW) conduit for Below Ground (BG) typical Direct Burial (DB) or Encased Burial (EB) installations or for typical Above Ground (AG) exposed applications

Conduit built with a standard nominal wall thickness that varies based on the conduit diameter.

RTRC (Reinforced Thermosetting Resin Conduit)

An industry acronym for conduits that are manufactured using a mineral reinforcement such as fiberglass in a fully cured thermoset resin.

Conduit

Straight section available in 9.84 ft (3m) or 19.68 ft (6m) length, and in standard diameters from ¾" to 8" (21 to 203 mm).



Split conduit (Patented design)

Section of FRE® conduit cut completely on its longitudinal axis while being hinged at 180° to the longitudinal cut. It can be opened and closed, allowing its installation over existing cables to protect them without having to remove them. The original Split conduit invention was issued to General Electric of Canada (CGE), our former parent company, under U.S. Patent No. 4175593 and Canadian Patent No. 1043277

H strip

Thermoplastic strip utilized to seal the split side of a split conduit.

T strip

Thermoplastic strip utilized to seal the hinged side of a split conduit.

Sleeve

Oversized section (12" or 305 mm in length) of straight conduit used to repair a damage section of a conduit.

Wobble coupling

Non-watertight fitting allowing for vertical and horizontal movements ($\pm 3^\circ$) of the raceway.

Skew Wobble coupling

Non-watertight fitting allowing for vertical and horizontal movements ($\pm 7.5^\circ$) of the raceway.

O-Ring Expansion Joint

Section of conduit including a deep socket unthreaded female section and a gasketed male section of conduit. It is designed to accommodate the thermal expansion and contraction of long sections of straight conduit resulting from ambient temperature variation. This guarantees the water tightness of the joint and no dislocation of the fitting.

O-Ring Expansion/Deflection Joint

Similar to O-Ring expansion joint described above, but designed to accommodate slight vertical changes in the direction of the incoming conduit by means of a flexible neoprene sleeve located at the exit of the expansion joint.

Hangers (Intermediate or Anchored)

Corrosion protected metallic supports utilized to hang conduit raceways in above ground installations.



Glass content

Weight percent of glass fiber present in the conduit, as % of total weight.

Span distance

Distance between conduit supports which varies based on the selected cable weight and conduit trade size.

Deflection

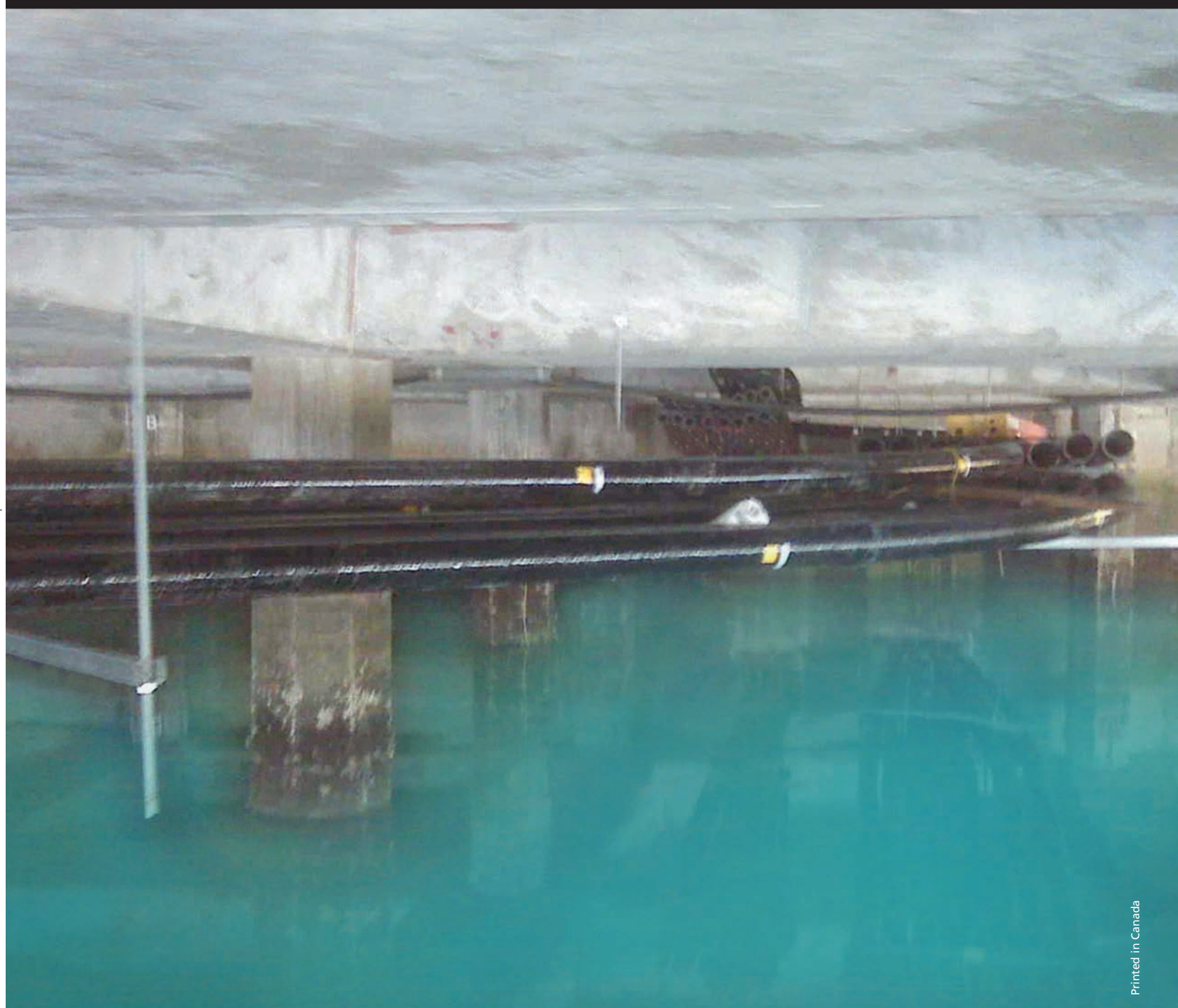
Deformation of conduit due to the weight of the cable installed inside it. Deflection is a function of the diameter and weight of the cables, and of the distance between conduit supports. Measured in inches.

Coefficient of thermal expansion

Ratio representing the change in linear dimension of a section of conduit resulting from changes in temperature (ΔT°).

Coefficient of friction

Ratio of the force tending to maintain contact between two surfaces and the force which opposes the sliding of the surfaces one along the other.



Printed in Canada



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