



PFA TUBING

Ultrapure tubing for your high-purity, corrosive applications

Overview

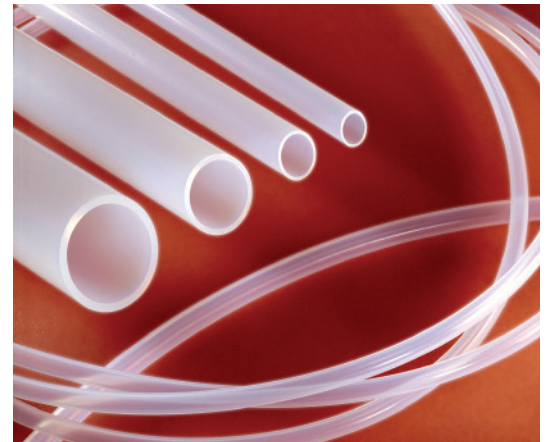
Entegris PFA tubing is ideal for ultrapure, highly corrosive applications. Our high-purity PFA tubing is available in various standard sizes from 1/4" to 1 1/2".

Applications

The full range for use in high-purity process equipment as well as bulk chemical delivery applications.

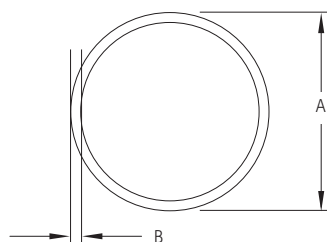
Features and Benefits

- 100% virgin PFA resin
- Meets the semiconductor industry's ultrapure chemical requirements
- High transparency
- Available in roll lengths up to 200 meters



Dimensions

Size	Outside Diameter (A)	Outside Diameter Tolerance	Wall Thickness (B)	Wall Thickness Tolerance
1/4"	6.35 mm (0.250")	±0.102 mm (0.004")	1.194 mm (0.047")	±0.102 mm (0.004")
3/8"	9.53 mm (0.375")	±0.102 mm (0.004")	1.574 mm (0.062")	±0.127 mm (0.005")
1/2"	12.70 mm (0.500")	±0.127 mm (0.005")	1.574 mm (0.062")	±0.127 mm (0.005")
3/4"	19.05 mm (0.750")	±0.127 mm (0.005")	1.574 mm (0.062")	±0.127 mm (0.005")
1"	25.40 mm (1.000")	±0.127 mm (0.005")	1.574 mm (0.062")	±0.127 mm (0.005")
1 1/4"	31.75 mm (1.250")	±0.203 mm (0.008")	1.905 mm (0.075")	±0.127 mm (0.005")
1 1/2"	40.00 mm (1.575")	±0.203 mm (0.008")	2.184 mm (0.086")	±0.127 mm (0.005")

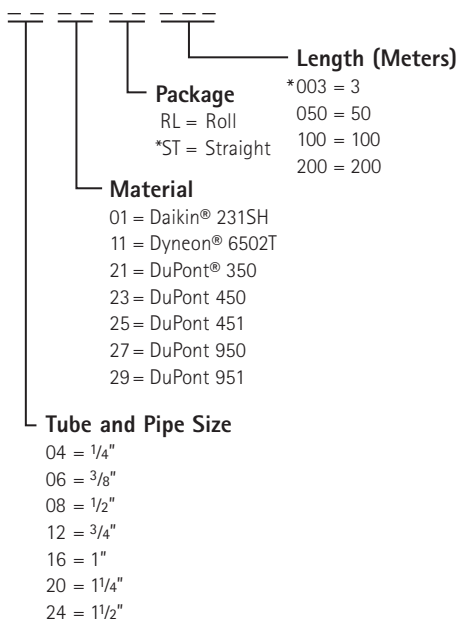


Ordering Information

PFA Tubing

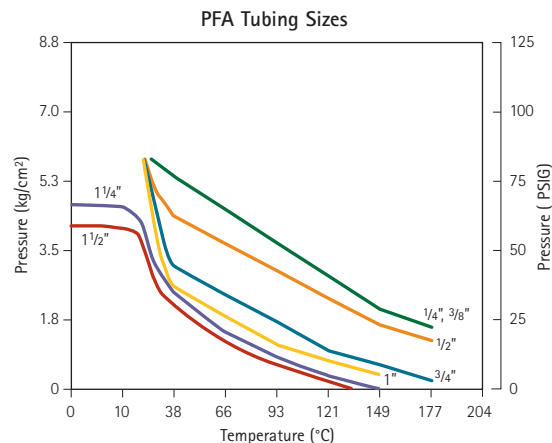
Part Number

E P L T



* Straight lengths available only in the 3-meter lengths

Performance Data



For More Information

Please call your Regional Customer Service Center today to learn what Entegris can do for you. Visit www.entegris.com and select the "Customer Service" link for the center nearest you.

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ENTEGRIS, INC.

Corporate Headquarters / 3500 Lyman Boulevard / Chaska, Minnesota 55318 USA
Customer Service Tel. +1 952-556-4188 / Customer Service Fax +1 952-556-8022
www.entegris.com

Tubing



Entegris offers three grades of FluoroLine® PFA tubing: 4300 high purity high molecular weight (HMW), 4200 high purity PFA and 4100 industrial grade tubing. FluoroLine® 4300 and 4200 tubing are made from 100% virgin high purity PFA materials. We also offer 2000 FEP tubing.

Permanent serialized laser marking is nonintrusive and noncontaminating and it allows immediate tube material and size identification. Laser marking also allows 100% traceability to a specific material lot, production date and production inspection record. Custom laser marking is available upon request.

FluoroLine® 4300 and 4200 PFA materials are FDA approved for repeated contact with food (21 CFR 177.1550), and they comply with 3-A standards for multiple use plastic materials used as product contact surfaces for dairy equipment. These materials also meet the requirements for USP Class VI materials and are USDA accepted.

FluoroLine® 4400 High Purity PFA Plus Tubing

This product is made from 100% virgin high purity, PFA Plus material. Entegris' testing has shown that this high performance resin has the highest resistance to certain specialized developers containing certain surfactants, and is ideal for ultrapure, highly corrosive applications. Standard wall tubing is available in 1/4", 3/8", 1/2", 3/4" and 1" diameters.

FluoroLine® 4300 High Purity HMW PFA Tubing

This product is made from 100% virgin high purity, high molecular weight (HMW) PFA material. Entegris testing has shown that high purity HMW withstands specialized developers containing certain surfactants and is ideal for ultrapure, highly corrosive applications. Standard wall tubing is available in 1/4", 3/8", 1/2", 3/4" and 1" outside diameters.

FluoroLine® 4200 High Purity PFA Tubing

This special product is made from 100% virgin high purity PFA material, and is recognized by the Plastic Pipe Institute (PPI) for having successfully completed material testing to ASTM D2837. High purity tubing is ideal for ultrapure, highly corrosive applications. Standard and thin wall tubing are available in 1/16", 1/8", 3/16", 1/4", 5/16", 3/8", 1/2", 3/4", 1", 1 1/4", 6 mm, 8 mm, 10 mm and 12 mm outside diameters.

FluoroLine® 4100 Industrial Grade PFA Tubing

This product is made from a special blend of high purity PFA and is recognized by the Plastic Pipe Institute (PPI) for having successfully completed material testing to ASTM D2837. Excellent in harsh chemical applications where ultra high purity is not required. Available in 1/16", 1/8", 3/16", 1/4", 5/16", 3/8", 1/2", 3/4" and 1" outside diameters.

FluoroLine® 2000 FEP Tubing

This product is made of FEP. Excellent and economical in low temperature, highly corrosive applications. FEP material meets FDA requirements for repeated contact with food (21 CFR 117.1550). Standard and thin wall tubing are available in 1/16", 1/8", 3/16", 1/4", 5/16", 3/8", 6 mm, 8 mm, 10 mm and 12 mm outside diameters.

Pressure/Temperature Rating for Tubing and Pipe

Entegris tubing and pipe pressure ratings were established using ASTM D2837. This test exposes the tubing or pipe to long-term, constant pressures at various temperature settings. Our test took 22 months to complete. From the analysis, a hydrostatic design basis (HDB) value is multiplied by a safety design factor to obtain a hydrostatic design stress. The HDB value is used to determine the operating parameters of tubing and pipe. FluoroLine® 4200 PFA tubing and pipe have completed this extensive testing.

The Plastic Pipe Institute (PPI) TR-4 technical report list thermoplastic pipe and tubing materials with a PPI recommended hydrostatic design basis value. Our FluoroLine® 4200 PFA tubing, 4100 industrial grade PFA tubing and PureBond® 4200 PFA pipe are listed in the TR-4 report published by PPI.

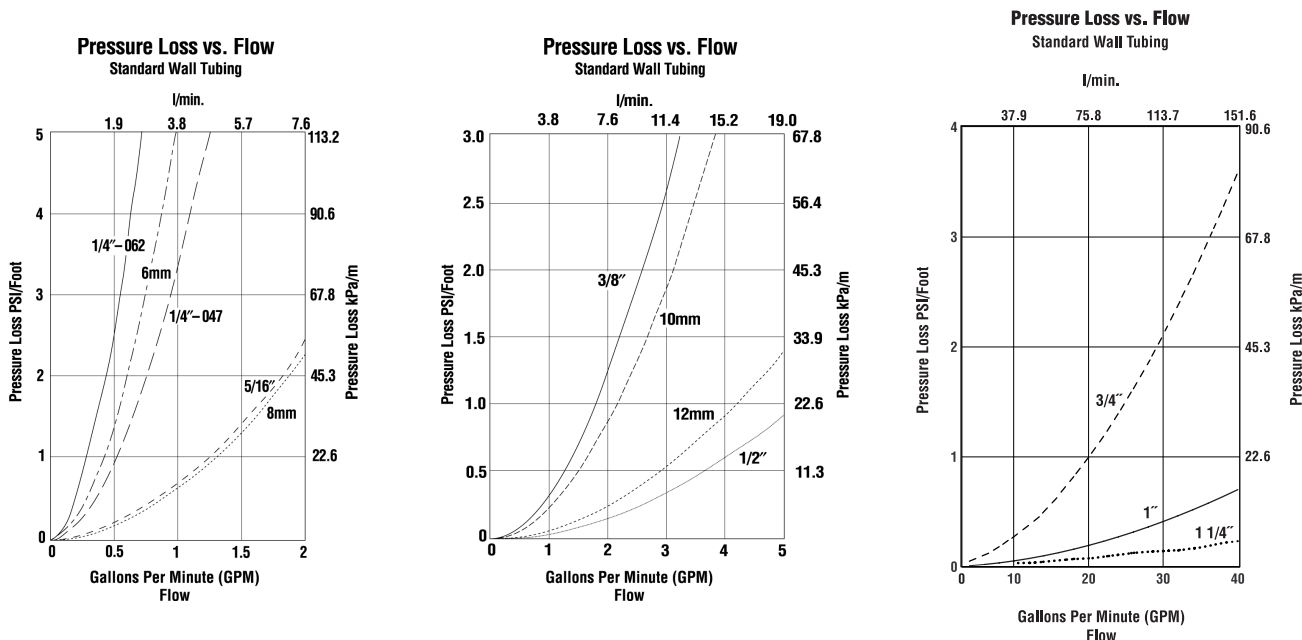
The Sematech Ultrapure Water Components Task Force established a specification (SemaSpec) that states any tubing of PFA material used for high performance and high purity applications must meet the ASTM D2837 test criteria. Entegris' extruded products meet these specifications.

All FluoroLine® tubing products are fully characterized and all performance ratings are derived from quantifiable data. Entegris' design and process expertise allow you to confidently design your systems reliably and safely.

This data is for water (fluid with s.g = 1.0).

For pressure loss vs. flow capability outside of these calculations please consult the factory.

Pressure Loss vs. Flow



FluoroLine[®] 4400, 4300 and 4200 PFA Tubing

- Entegris tubing is compliant to SEMI Standard F57-0301, the specification for polymer components used in ultrapure water and liquid chemical distribution systems.
- Entegris 4400, 4300 and 4200 tubing is made of 100% virgin high purity PFA material to provide the lowest extractable ionic and organic levels in PFA materials.
- The FluoroLine[®] tubing pressure ratings were established using ASTM D-2837. This test exposes the tubing to long-term constant pressures at various temperature settings.
- FluoroLine[®] 4400, 4300 and 4200 PFA tubing are recognized by the Plastic Pipe Institute (PPI) as meeting the necessary requirements to have FluoroLine[®] tubing listed in their TR-4 report. The TR-4 is a technical report that lists thermoplastic pipe and tubing materials with a PPI recommended HDB value. See page 543 for more information on PureBond[®] weldable pipe and FluoroLine[®] tubing test data.
- Permanent serialized laser marking is a nondestructive and noncontaminating method to identify tube material and O.D. It also allows for 100% traceability to a specific material lot, production date and production inspection record. Custom laser marking and precleaning are available upon request.
- Tight and consistent tolerances, along with lot-to-lot consistency, are maintained using continuous on-line measurements of the FluoroLine[®] tubing O.D. and wall thickness.
- Entegris tubing is produced with specially designed extruders and extrusion processes. Tubing cleanliness is maintained during and after extrusion including continuous nitrogen purge, immediate capping and packaging in heat-sealed polyethylene bags. FluoroLine[®] 4400, 4300 and 4200 tubing are available in coils or on reels.

Part Number System

Tubing **U AT 500 - 062**

Wall Thickness

(i.e., 062 = .062" or for metric sizes 1.6 m = 1.6 millimeters)

Outside Tube Diameter

(i.e., 500 = 1/2" or for metric sizes 6 m = 6 millimeters)

Tube Material

AT = 4200 PFA

ET = 2000 FEP

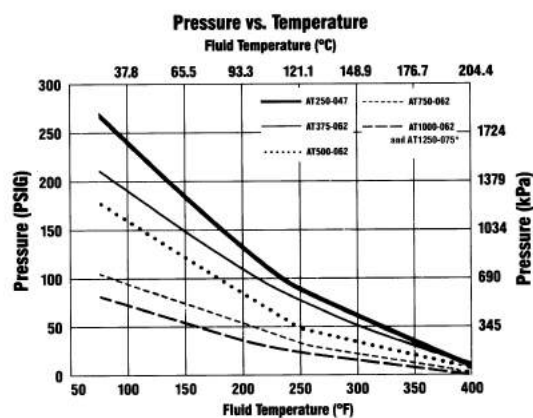
UAT = 4300 PFA

XAT = 4400 PFA Plus

Specifications

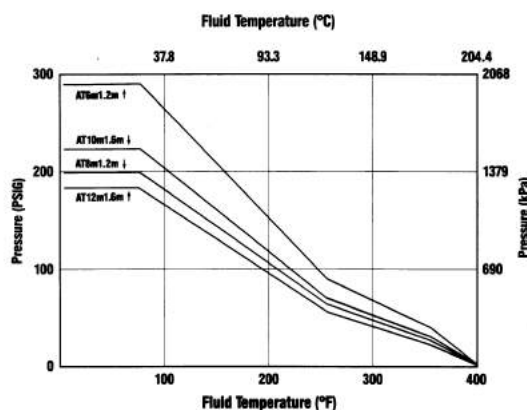
Standard Wall Ratings

Ratings for Standard Wall
FluoroLine® 4400, 4300 and 4200 PFA Tubing
Fractional Size



*1" and 1 1/4" ratings vary slightly. Please consult the factory for specific rating information.

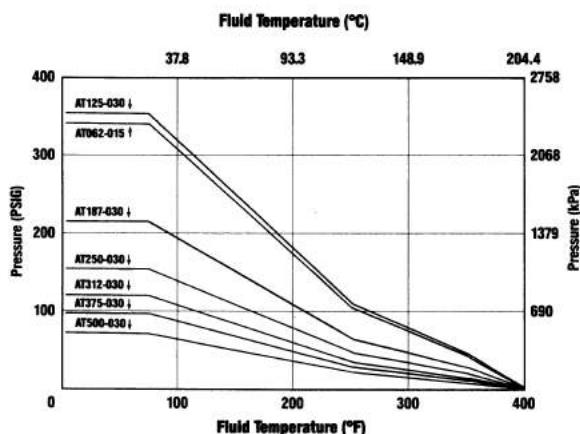
Ratings for Standard Wall
FluoroLine® 4300 and 4200 PFA Tubing
Metric Size



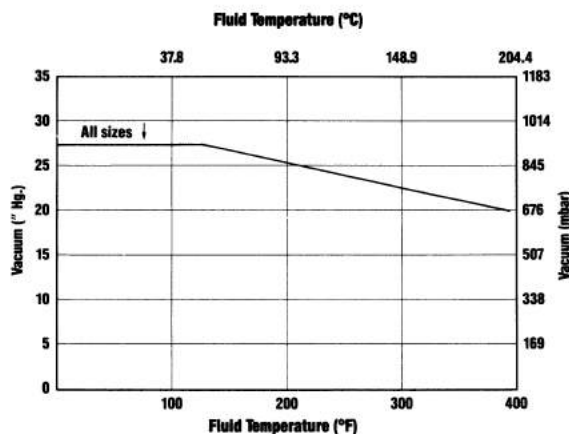
FLUOROLINE® 4400, 4300
AND 4200 PFA TUBING

Thin Wall Ratings

Ratings for Thin Wall
FluoroLine® 4300 and 4200
PFA Tubing



Vacuum Limitations on
Thin (.030") Wall FluoroLine® 4300 and 4200
PFA Tubing



FluoroLine[®] 4400 High Purity PFA Plus Tubing

Ordering Information

Standard Wall

Part Number	O.D.	O.D. Tolerance	I.D.	Wall Thickness	Wall Thickness Tolerance	Minimum Bend Radius
XAT250-047	.250" (6.35 mm)	±.004" (±.102 mm)	.156" (3.96 mm)	.047" (1.19 mm)	±.004" (±.102 mm)	1.5" (38 mm)
XAT375-062	.375" (9.52 mm)	±.004" (±.102 mm)	.251" (6.38 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	2.0" (51 mm)
XAT500-062	.500" (12.70 mm)	±.005" (±.127 mm)	.376" (9.55 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	2.3" (58 mm)
XAT750-062	.750" (19.05 mm)	±.005" (±.127 mm)	.626" (15.90 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	9.0" (229 mm)
XAT1000-062	1.000" (25.40 mm)	±.005" (±.127 mm)	.876" (22.25 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	11.0" (279 mm)

FluoroLine[®] 4300 High Purity High Molecular Weight (HMW) PFA Tubing

Ordering Information

Standard Wall

Part Number	O.D.	O.D. Tolerance	I.D.	Wall Thickness	Wall Thickness Tolerance	Minimum Bend Radius
UAT250-047	.250" (6.35 mm)	±.004" (±.102 mm)	.156" (3.96 mm)	.047" (1.19 mm)	±.004" (±.102 mm)	1.5" (38 mm)
UAT375-062	.375" (9.52 mm)	±.004" (±.102 mm)	.251" (6.38 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	2.0" (51 mm)
UAT500-062	.500" (12.70 mm)	±.005" (±.127 mm)	.376" (9.55 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	2.3" (58 mm)
UAT750-062	.750" (19.05 mm)	±.005" (±.127 mm)	.626" (15.90 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	9.0" (229 mm)
UAT1000-062	1.000" (25.40 mm)	±.005" (±.127 mm)	.876" (22.25 mm)	.062" (1.57 mm)	±.005" (±.127 mm)	11.0" (279 mm)
UAT1250-075	1.250" (31.75 mm)	±.007" (±.178 mm)	1.100" (27.94 mm)	.075" (1.90 mm)	±.007" (±.178 mm)	12.5" (318 mm)

Thin Wall

Part Number	O.D.	O.D. Tolerance	I.D.	Wall Thickness	Wall Thickness Tolerance	Minimum Bend Radius
UAT250-030	.250" (6.35 mm)	±.004" (±.102 mm)	.190" (4.83 mm)	.030" (0.76 mm)	±.004" (±.102 mm)	2.0" (51 mm)
UAT375-030	.375" (9.52 mm)	±.004" (±.102 mm)	.315" (8.00 mm)	.030" (0.76 mm)	±.004" (±.102 mm)	3.5" (89 mm)
UAT500-030	.500" (12.70 mm)	±.005" (±.127 mm)	.440" (11.18 mm)	.030" (0.76 mm)	±.004" (±.102 mm)	5.0" (127 mm)

PureBond® Weldable Pipe System

The PureBond® weldable pipe system from Entegris is a state-of-the-art patented method for joining PFA pipe, fittings, valves and other fluid handling devices into an ultra clean, chemically resistant, leak-free fluid delivery network. Our pipe welding expertise provides you quality weldable pipe products, technical support and training. With the weldable pipe system from Entegris, you have the flexibility of designing and assembling your system yourself, or we can produce a complete fluid management assembly for you.

The Material

PFA is a chemically inert, strong, moldable and extrudable plastic material. The properties make it safe and dependable for handling a wide range of high purity, aggressive and corrosive chemicals.

The Product

Entegris offers a wide range of sizes (from 1/4" to 2"), a wide range of components (valves, fittings, pipe, adapters, filter housings) and the design expertise to provide complete fluid management systems for your applications. The product is made of a dense, ultra clean plastic and can be used for a wide range of chemicals at a wide range of application temperatures and pressures.

The Process

Patented PureBond® welding is a unique noncontact, butt-fusible process. Entegris provides the necessary tools to butt-fuse all components in a leak-free network. The welding tool allows for the proper cutting, facing and heating of components to be joined into whatever design is needed.

The Benefits

With PureBond® weldable pipe your system is "leak free."

- PureBond® weldable pipe joints eliminate threads so there is no danger of cold flow and its resultant leakage.
- The joints are as strong as the pipe, eliminating potential leak paths common to threaded systems.

With PureBond® weldable pipe your system is versatile.

- PureBond® products allow you to handle volatile chemicals, in wide serviceable temperatures and pressures.

- PureBond® pipe, fittings and valves are adaptable to connect with any system. For example, they can be used with tubing and with NPT threaded systems.

- PureBond® pipe, fittings and valves are designed to be welded to create any length or size fluid handling unit.

With PureBond® weldable pipe your system is chemically compatible and inert.

- PureBond® products are chemically compatible and inert because they are made of virgin PFA. They ensure your system delivers the cleanest possible chemicals.
- PureBond® products of virgin PFA will not contaminate your chemicals or pure water.
- PureBond® products will not compromise your samples.

Installation

PureBond® welding equipment is portable and simple to use. Each welding tool is used for the different sizes of pipe, fittings and valves.

The PureBond® welding tool holds pipe, fittings and valves in proper alignment. A facing tool presets the distance the parts extend into the welding tool with a flat and smooth surface. A guided slide mechanism holds the parts together while the material cools, joining the components permanently. A noncontact heater is centered by guides on the welding tool. Preset locking prevents molten ends from being pressed too far together. PureBond® welding tools provide bonds of consistent quality.

PureBond® welding pipe installation, maintenance, repairs or changes can be made by your personnel.

Training

Along with the welding tool, Entegris provides a complete video training program and a companion operation and troubleshooting guide. The process is easy to understand. Operator expertise is developed enabling the complete welding of fluid management systems using Entegris PFA components.

Pipe Thread (NPT) Assembly Procedure

1. Apply PTFE tape or paste sealant to MNPT threads starting one thread back from end of fitting.

When using tape tightly wrap in direction of threads to conform tape to shape of threads.

- a Use 3 1/2 to 4 wraps of tape when assembling PFA threads to PFA material.
- b Use 4-5 wraps of tape when assembling PFA threads to another material other than PFA.

When using paste pipe sealant fill approximately two threads of the male part.

2. Thread the fitting onto the mating component until hand-tight.

PTFE tape = 1/2" wide for all NPT fittings

Note: PTFE tape is not recommended for use in a gaseous application

$$\text{in} \bullet \text{lbs} \times .11298 = \text{newton} \bullet \text{m}$$

In actual laboratory testing, several paste sealants have shown better results than PTFE tape in sealing threaded pipe connections at fluid temperatures up to 250°F (120°C). For applications where fluid temperatures may go above 250°F (120°C) PTFE tape is recommended.

Torque

	In•lbs	Newtons•m
1/16"	5.0	0.57
1/8"	7.0	0.79
1/4"	16	1.81
3/8"	23	2.60
1/2"	30	3.39
3/4"	54	6.10
1"	78	8.81

Paste Sealant

2 to 2 - 1/4 Turns	1 - 1/4 to 1 - 1/2 Turns	
1/16"	1/4"	1/2"
1/8"	3/8"	3/4"
		1"

PureBond® 4300 High Molecular Weight PFA Pipe

Ordering Information

Part Number	Length	Nominal Pipe Size	O.D.	O.D. Tolerance	Minimum Wall Thickness	Wall Thickness Tolerance
PA500-HMW	8'	1/2"	.840" (21.3 mm)	±.005" (±.127 mm)	.109" (2.769 mm)	±.015" (±.381 mm)
PA750-HMW	8'	3/4"	1.050" (26.7 mm)	±.005" (±.127 mm)	.113" (2.870 mm)	±.015" (±.381 mm)
PA1000-HMW	8'	1"	1.315" (33.4 mm)	±.007" (±.178 mm)	.133" (3.378 mm)	±.015" (±.381 mm)
PA500X-HMW	10'	1/2"	.840" (21.3 mm)	±.005" (±.127 mm)	.109" (2.769 mm)	±.015" (±.381 mm)
PA750X-HMW	10'	3/4"	1.050" (26.7 mm)	±.005" (±.127 mm)	.113" (2.870 mm)	±.015" (±.381 mm)
PA1000X-HMW	10'	1"	1.315" (33.4 mm)	±.007" (±.178 mm)	.133" (3.378 mm)	±.015" (±.381 mm)

Schedule 40 PureBond® pipe is laser marked so you can identify pipe material and O.D. It also allows for 100% traceability to a specific material lot, production date and production inspection record.

Laser Marking Codes

5 XX 0123456789 40

