

POLYTETRAFLUOROETHYLENE (PTFE) and PERFLUOROALKOXY (PFA) Lined Pipe

Sales Specification: Effective October 27, 2000 · Supersedes: May 04, 1999

TEST REQUIREMENTS:

TEST ITEM AND CONDITION	LIMIT	UNIT	METHOD
PTFE LINER:			
Tensile @ Yield	3000 Min	psi	ASTM D638
Elongation @ Yield	250 Min	%	ASTM D638
Colorants	0 Max	% wt	ASTM F1545
PFA LINER:			
Tensile @ Yield	3800 Min	psi	ASTM D3307
Elongation @ Yield	300 Min	%	ASTM D3307
Colorants	0 Max	% wt	ASTM F1545

1. PIPE REQUIREMENTS

- A. Pipe 1" through 8" – Thermalok® Style
 - 1. Pipe is manufactured from electric resistance welded carbon steel pipe. Pipe conforms to ASTM A587 in 1" – 4" sizes, and A53 Gr. B in sizes 6" and 8". 1" – 8" pipe conforms dimensionally to Schedule 40.
 - 2. Pipe is also available in stainless steel, type 304 or 316. Stainless steel pipe conforms to ASTM A312.
 - 3. Pipe is vented on the housing by means of small vent holes (1"-4" = 3/32"; 6"-8" = 5/32"), allowing permeant vapors to escape. Pipe spools up to 18" in length receive (1) vent hole in the center of the pipe. Pipe spools longer than 18" in length receive (2) vent holes, one at each end, 180° apart.
 - 4. The liner is mechanically locked to the interior of the steel pipe via the Thermalok® process. The PTFE liner is first molded oversized, such that it will not fit in the pipe housing. The liner is then drawn through a sizing die into the pipe housing. Next, the liner and pipe are put in an oven, where the liner is thermally relaxed into the pipe housing, causing a tight interference fit. Pipe is available as "factory flared" with locked liner, or "field flare" (at least one plain end) with movable liner.
 - 5. Stainless steel MULTI-AXIS® pipe is available in 1" through 4" sizes.
- B. Pipe 1" through 8" – Swaged Style
 - 1. Pipe is manufactured from electric resistance welded (ERW) normalized ASTM A513 C-1010 aluminum killed carbon steel tubing with chemical composition meeting ASTM A587, a diamond picked spiral groove interior and is lined with PTFE or PFA.
 - 2. The diamond picked interior provides a path for permeants to escape at the flange face venting collar.
 - 3. The liner is mechanically locked to the interior of the steel tubing by swaging the steel tubing to nominal size (NPS) dimensions.
 - 4. Finished steel pipe dimensions 1" through 6" are Schedule 40.
 - 5. Finished steel pipe dimensions 8" are Schedule 30.
 - 6. MULTI-AXIS® pipe is available in 1" through 4" sizes.
- C. Pipe 10" and 12" – Full Vacuum
 - 1. Pipe is manufactured from ERW ASTM A53, Grade B carbon steel with a smooth interior and is lined with PTFE by the Thermalok process. The metal pipe is Schedule 30 in 10" size, and Schedule 20 in 12" size.
 - 2. Pipe is also available in stainless steel type 304 or 316. Stainless steel pipe conforms to ASTM A312.
 - 3. Pipe is vented on the housing by means of 5/32" diameter vent holes, allowing permeant vapors to escape. Pipe spools up to 18" in length receive (1) vent hole in the center of the pipe. Pipe spools longer than 18" in length receive (2) vent holes, one at each end, 180° apart.
 - 4. 10" and 12" pipe with the "full vacuum" designation is rated for full vacuum at 450°F.
- D. Pipe 10" and 12" – Non-Vacuum
 - 1. Pipe is manufactured from ERW ASTM A53, Grade B, Type E carbon steel with a smooth interior and is lined with PTFE by a reverse swaging process.
 - 2. Four 1/8" diameter vent holes equally spaced are located 1 1/2" from each end of the pipe. On pipe shorter than 18", only one end has vent holes.
 - 3. Finished steel pipe dimensions are Schedule 30.

SALES SPECIFICATIONS PTFE & PFA PIPE

E. Minimum lengths available are:

Size (NPS)	Factory Fabricated Lengths, in. Thermalok®	Swaged	Field Fabricated Lengths, in. Thermalok® or Swaged
1"	3	2 7/16	7
1 1/2"	3 3/8	2 11/16	7
2"	3 1/2	3 1/16	7
2 1/2"	N/A	3 5/16	8
3"	4	3 7/16	8
4"	4 3/8	3 11/16	8
6"	5 1/2	4 1/8	10
8"	6 1/2	4 1/2	12
10"	8 1/2	6 (non-vacuum)	12
12"	8 1/2	7 1/2 (non-vacuum)	12

F. PTFE and PFA plain end pipe is a minimum of 20 feet 6 inches for 20-foot spools. For 1" and 6" through 12" PTFE pipe and 1" PFA pipe, the maximum finished pipe length is 20 feet + or - 1/8" at 75°F. The maximum finished pipe length for PFA lined pipe 1 1/2" and 2" and PTFE lined pipe 1 1/2" through 4" is 40 feet + or - 1/8" at 75°F.

2. FLANGE REQUIREMENTS:

- A. Pipe 1" through 8" – Thermalok® Style
- Standard flange for pipe is rotating lap joint (van stone) on both ends. Lap is formed by a metal flaring process, and is not a welded stub-end.
 - Slip-on, weld-neck, and socket-weld flanges are available. This is generally a cost adder over the standard configuration (rotating both ends).
 - Standard rotating flanges are ductile iron conforming to ASTM A395. All flanges are available in carbon steel conforming to ASTM A105 or stainless steel (304 or 316) conforming to ASTM A182.
- B. Pipe 1" through 8" – Swaged Style
- Pipe has chamfered threaded flanges or is available with a rotatable flange assembly.
 - Pipe flanges are forged steel. Class 150 and 300 forged steel flanges conform to ASTM A105 with drilling per ANSI B16.5.
 - Stub ends for rotatable flange assemblies are ASTM A105 or ASTM A516 Grade 70.
 - Pipe lined with PTFE and PFA have flare formed sealing surfaces in conjunction with a perforated nickel plated steel venting collar.
- C. Pipe 10" and 12" – Full Vacuum
- Standard flange for pipe is rotating lap joint (van stone) on both ends. Lap is formed by a metal flaring process, and is not a welded stub-end.
 - Slip-on, weld-neck, and socket-weld flanges are available. This is generally a cost adder over the standard configuration (rotating both ends).
 - Standard rotating flanges are ductile iron conforming to ASTM A395. All flanges are available in carbon steel conforming to ASTM A105.

- D. Pipe 10" and 12" – Non Vacuum
- Pipe is flared steel with lap joint flanges.
 - Pipe flanges are Class 150 forged steel and conform to ASTM A105 with drilling per ANSI B16.5.

3. LINER REQUIREMENTS:

- A. Resin is PTFE or PFA conforming to the requirements of ASTM F1545.
- B. Standard liners are unpigmented. PTFE is white in color; PFA is clear.
- C. The nominal liner thickness are:

Size (NPS)	PTFE Liner Thickness		PFA Liner Thickness, in.
	Thermalok®	Swaged	
1"	0.130	0.130	0.130
1 1/2"	0.150	0.130	0.130
2"	0.160	0.130	0.130
3"	0.160	0.130	N/A
4"	0.160	0.160	N/A
6"	0.275	0.225	N/A
8"	0.310	0.300	N/A
10"	0.320 (FV)	0.200 (NV)	N/A
12"	0.425 (FV)	0.200 (NV)	N/A

NV = Non-Vacuum FV = Full Vacuum

- D. The minimum outside diameter of the plastic sealing surface on pipe per ASTM F1545 is:

Size (NPS)	Minimum Sealing Diameter	
	Inch	Millimeter
1"	1 7/8	48
1 1/2"	2 11/16	68
2"	3 7/16	87
3"	4 5/8	117
4"	5 15/16	151
6"	8	203
8"	10 1/16	256
10"	12 1/4	311
12"	14 3/8	365

- E. The minimum liner flange face thickness is 0.100 inch (2.54 mm).

4. OPERATING REQUIREMENTS:

- A. Service Temperature:
 PTFE: -20°F (-29°C) to 450°F (232°C)
 PFA: 0°F (-18°C) to 450°F (232°C)
 Note: Operating temperature limitations may be encountered depending upon specific chemical environments. (Refer to our web-site at www.resistoflex.com)
- B. Pressure:
 1. For Class 150, the maximum allowable working pressure equals the corresponding ANSI pressure-temperature rating per the designated metallurgy. (Refer to our web-site at www.resistoflex.com)
 2. The maximum allowable working pressure for Class 300 steel (accounting for the plastic raised face) is:
 - 20°F to 100°F = 475 psi
 - 200°F = 460 psi
 - 300°F = 440 psi
 - 450°F = 400 psi
- C. Vacuum:
 1. 1" through 8" pipe has a full vacuum rating to 450°F.
 2. Pipe 10" and 12" is available in either "full vacuum" (up to 450°F) or "non-vacuum" styles.

5. STORAGE AND HANDLING REQUIREMENTS:

- A. Avoid dropping or impacting pipe with heavy objects or storing near high traffic areas.
- B. Uninstalled lined pipe should not be stored or handled at temperatures below 0°F (-18°C).
- C. The center of gravity for pipe can be very deceptive. Use extra care in handling, transfer, and storage of the product to avoid sudden load shifting causing possible personal injury and/or product damage.

6. PAINT:

- A. Thermalok style products and 10" and 12" full vacuum pipe are painted with a two-part, water reducible epoxy-polyamide primer. The maximum external temperature rating for the paint is 250°F.
- B. Swaged style products and 10" and 12" non-vacuum pipe are painted with a two-component epoxy zinc phosphate/micaceous iron oxide primer, formulated on proprietary polymer technology, which provides rapid cure and overcoating even under low temperature conditions. The maximum external temperature rating for the paint is 212°F (100°C).

7. INSPECTION AND QUALITY CONTROL:

- A. 1" – 8" swaged style and 10" and 12" non-vacuum pipe passes a 15,000 volt minimum electrostatic spark test to ensure integrity of the plastic liner. 1" – 8" Thermalok pipe and 10" and 12" full vacuum pipe passes either of the following tests: a 12,500 volt electrostatic test or a 425 psig hydrostatic test.
- B. All parts pass visual inspection.
- C. The sealing surface of the liner is free of defects that would impair sealing effectiveness.
- D. Wooden end protectors are used to protect the plastic faces for flanged pipe. Plastic end caps are used to protect the plastic liner for plain end pipe. End protectors should stay in place until immediately prior to installation.
- E. Flanged pipe is labeled with a sticker located on the wooden end protectors, which identifies the plastic liner type and the flange material. Plain end pipe is labeled with a sticker located on the pipe, which identifies the plastic liner type.
- F. Band coding:
 Pipe spool liner material is indicated by a color band as follows:

Product Liner Material	Band/ Lettering	Imprint
Thermalok® PTFE	Natural/Black	RESISTOFLEX-M-PTFEAST-M-F1545
PTFE 10" & 12" FV	Natural/Black	RESISTOFLEX-M-PTFE-ASTM-F1545
Swaged PTFE	Natural/Black	RESISTOFLEX-BC-PTFE-ASTM-F1545
PTFE 10" & 12" NV	Red/Black	RESISTOFLEX-BC-PTFE NO VAC-ASTM-F1545
PFA	Brown/White	RESISTOFLEX-BC-PFA-ASTM-F1545

FV = Full Vacuum; NV = Non Vacuum

- G. Swaged PTFE, PFA, and 10" and 12" non-vacuum products are impression marked for material traceability.

REFERENCES:

Detailed information on dimensions, installation, chemical resistance, etc., is available on our website at www.resistoflex.com.

THIS PRODUCT IS SHIPPED IN COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS REGARDING CLASSIFICATION, PACKAGING, SHIPPING AND LABELING.