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Specification for Plastic Lined Piping Systems

The information contained in this publication is intended as a guide to customers, and is freely given in good faith.

Whilst every care has been taken in its preparation, the company does not accept responsibility for inaccuracies. Development is continuous. Drawings and specifications may be modified from time to time without notice. Attention is drawn to the company's conditions of sale.

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1) SCOPE.

This specification defines the constituent materials, properties, and performance of the products available in the Piping lined with range of lined pipework.

2) PRODUCT RANGE and SPECIFICATIONS.

Piping lined with PTFE/PFA
Piping lined with antistatic PTFE/PFA
Piping lined with PVDF
Piping lined with Polypropylene

Performance and Testing conform to or exceed the requirements of ASTM F 1545-96. Some deviations from the above standard are permitted to include substitution of British Standard and other National standards with similar properties to those called up in the ASTMs.

Fittings, produced by casting or fabrication, are dimensioned to the relevant flange specification:

ANSI B16.5 # 150 and # 300

Spool fabrication is generally to ANSI B31.3, with modifications necessary to the lining process and service constraints.

3) SERVICE LIMITATIONS.

For pressure and vacuum limitations versus temperature see Table J.

Temperature limits:

Piping lined with PTFE/PFA -75⁰ F to 400⁰F

Piping lined with PVDF 0⁰F to 250⁰F

Piping lined with P 0⁰F to 212⁰F

In very low temperature (< 0⁰ F) applications with Piping lined with T, consideration must be given to the suitability of housings. Fabricated and cast steel housings are available for low temperature service.

Chemical Resistance:

Piping lined with PTFE/PFA can be regarded as universally chemically resistant. Exceptions are molten alkali metals and their solutions, and very strong fluorinating agents such as elemental fluorine and chlorine trifluoride.

For information on the chemical resistance of pipe lined with PVDF and Polypropylene, please refer to the factory Technical department.

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4) MATERIALS of CONSTRUCTION.

Lining Materials:

PTFE: The resins used meet the requirements of ASTM D1457 type IV (Granular) or type III (Coagulated Dispersion).

PFA: The resins used meet the requirements of ASTM D 3307 type II (high molecular weight).

These linings are normally unpigmented.

Antistatic PTFE and PFA: These are modified versions of the above polymers, with volume resistivity less than 10^6 ohm-cm. Antistatic resins are black.

PVDF: The resins used meet the requirements of ASTM D 3222. The resin is pigmented red to distinguish it from polypropylene lined pipework.

Polypropylene: The resins used meet the requirements of ASTM D 4101. Only copolymers are used, so that the best combination of high impact strength, high heat resistance and high chemical resistance can be selected. PP is pigmented light orange or supplied unpigmented.

Only polymers specified in FMS 12 are used. Substitution is conditional on satisfactory performance under the relevant ASTM specification for lined pipe.

Housings:

Carbon-steel pipes:

These are supplied from tube to API 5l gr. B. Sizes 1 NB to 6 NB are supplied in schedule 40 thickness. 8, 10 and 12NB are supplied in schedule 30. Tube to ASTM A 106 is available if specified.

Flanges for ANSI B 16.5 # 150 and # 300 are supplied in material to ASTM A 105N.

Low temperature steels are available as required.

Stainless steel pipes are available in sizes up to 300 mm NB in wall thicknesses from schedule 5S to schedule 40.

Pipe Fittings:

These are available in the following grades:

Ductile Iron to BS EN 1563, material EN-GJS-400-18-LT having a minimum ultimate tensile strength of 58,000 psi, 0.2% proof stress exceeding 34,800 psi and an impact value at -20°C of 12J (8.8lbs-ft force).

Cast steel to ASTM A 216 WCB. A352 LCB is also available.

Steel fabrications use A 234 WPB forgings, standard tube, flanges, and boiler plate as specifications require.

Stainless steel castings and fabrications are also readily available.

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Material Certification.

Housings are procured with supporting certification, to EN 10204: 1991 or with certificates endorsed by the manufacturer's independent Quality Controller.

Polymers are purchased with the manufacturer's Certificate of Conformity

Fabrication.

Pipe spools are fabricated to the following proprietary drawings:

CPD 1281 Standard spool. This covers ANSI # 150, and # 300 flanges. Optional additions include vent hole bosses, plugs, and vent extension pipes.

CPD 1111 Minimum recommended spool lengths, by nominal bore size.

CPD 1097 Jacketed spool.

Weld procedures for flange attachment and setting on of branches are defined in FMS 5.

7) Painting Systems.

The standard paint system is defined in FMS 4.

8) Identification.

The liner specification is defined on the fixed flange by hard-stamping. e.g. AS PFA, AS HD PTFE, etc. The Works order number, polymer batch (PTFE only) and spool length are also added. Further identification is to order requirement. This information is painted on the body of the pipe or fitting, or on the flare cover of the fitting.

9) Quality Management System.

Piping is manufactured to practices that conform fully to, and are approved to BS EN ISO 9002: 1994.

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Design data for PTFE LINED PIPES with ANSI # 150 Flanges

Table A

NB	Max. Length ft	Flare Diameter In	Ave. ID HD Wall in	HD Wall Thickness Min.	Max. °C Full Vac.
½	20	1.25	0.51	0.051	400
¾	20	1.19	0.71	0.063	400
1	20	1.88	0.83	0.120	400
1.25	20	2.5	1.14	0.120	400
1.5	20	2.75	1.34	0.120	400
2	20	3.5	1.81	0.120	400
2.5	20	4.125	2.24	0.120	400
3	20	4.63	2.83	0.120	400
4	20	6	3.82	0.157	400
5	10	7.25	4.72	0.197	400
6	10	8	5.71	0.197	400
8	10	10.25	7.60	0.256	350
10	10	12.25	9.61	0.295	200
12	10	14.5	11.46	0.335	120

For minimum spool lengths see table N

Design data for PVDF LINED PIPES with ANSI #150 FLANGES

Table G

NB	Max. Length ft	Flare Diameter in	Nom.LinerT hickness in	Ave. ID In	Max. °F Full Vac.
1	20	1.9	0.100	0.87	280
1.5	20	2.75	0.100	1.42	280
2	20	3.5	0.100	1.77	280
3	20	5	0.100	2.87	280
4	20	6	0.125	3.90	280
6	20	8	0.145	5.67	80
8	20	10.25	0.160	7.80	80
10	20	12.25	0.220	9.72	80
12	20	14.4	0.250	11.61	80

For minimum spool lengths see table N

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Design data for POLYPROPYLENE LINED PIPES with ANSI #150 FLANGES

Table H

NB	Max. Length ft	Flare Diameter in	Liner Thickness in	Ave. ID in	Max. °F Full Vac.
1	20	1.9	0.15	0.75	212
1.5	20	2.75	0.16	1.30	212
2	20	3.5	0.18	1.77	212
3	20	5	0.18	2.87	212
4	20	6	0.21	3.62	212
6	20	8	0.22	5.67	212
8	20	10.25	0.22	7.68	212
10	20	12.25	0.25	9.69	212
12	20	14.4	0.25	11.46	212

For Minimum spool lengths see table N

Pressure/Temperature Ratings

Table L

Rating	# 150		# 300	
Temp. °F	P.S.I.G.	Bar g.	P.S.I.G.	Bar g.
80	250	17.2	450	31
120	244	17	425	29.3
200	235	16	390	26.9
300	215	14.8	345	23.8
400	200	13.9	295	20.3

Pressure ratings for # 150 flanges are based on the rating in ANSI B16.4.

Pressure ratings for # 300 dimensioned fittings are based on the rating in ANSI B16.5 # 300, down-rated to compensate for the decrease in mechanical properties at elevated temperatures of the lining materials.

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Vacuum/Temperature Ratings

Table M

Material	Temp. °F	1	1.5	2	3	4	6	8	10	12
PTFE	120	Full	Full	Full	Full	Full	Full	Full	Full	Full
	212	Full	Full	Full	Full	Full	Full	Full	Full	
	300	Full	Full	Full	Full	Full	Full	Full		
PVDF	450	Full	Full	Full	Full	Full	Full			
	80	Full	Full	Full	Full	Full	Full	Full	Full	Full
	180	Full	Full	Full	Full	Full				
	280	Full	Full	Full	Full	Full				
PP	80	Full	Full	Full	Full	Full	Full	Full	Full	Full
	200	Full	Full	Full	Full	Full	Full	Full	Full	Full

Limits of vacuum service are established by methods which comply with ASTM F 1545.

Antistatic PTFE/PFA Linings.

The performance of these linings is equal to that of the unmodified polymers as far as can be ascertained.

The volume resistivity of the liners is less than 10^6 ohm-cm. The resistance to earth of any item is less than 10^7 ohms.

Minimum Spool Lengths

Table N

Nom. Bore	fixed flanges #150	Standard Lap flange #150	Fixed Flange #300	Lap Flange #300
1	3	3.5	3.5	4
1.5	3.25	3.75	3.75	4.25
2	4	4.5	4	4.5
3	4.25	4.75	4.5	5.25
4	4.5	5	4.75	5.5
6	4.75	5.5	5.25	6.25
8	5	5.75	5.5	6.50
10	5.5	6.25	6.25	7.25
12	6	6.5	6.5	7.5

For non-standard pipe diameters, use the next higher standard pipe-length

Below these lengths, lined spacers, or solid spacers if permitted, must be used.