Seamless MAXAR™ Blue Dual Laminate Pipe and Fittings

1. SCOPE

This specification provides design information applicable to RPS Composites' MAXAR Blue piping products (seamless FEP/FRP dual laminate). Standard manufacturing specifications and dimensions are provided, however, custom specifications and designs can be tailored for unique requirements. Consult RPS Composites for more information.

2. MATERIALS

2.1 Liner: MAXAR Blue liners are Fluorinated Ethylene Propylene (FEP) Teflon®, seamless through 20" diameter. This fluoropolymer meets the requirements of ASTM D2116 Type III and may include less than 1% inorganic pigment for identification. A partial list of physical properties follows:

PROPERTY	VALUE	TEST
Specific Gravity	2.13-2.15	ASTM D-792
Tensile Strength	3800-4100 PSI	ASTM D-638
Elongation	280-330%	ASTM D-638

2.2 Bonding Layer: A knit fiberglass fabric is melt-bonded and partially embedded into the O.D. surface of the FEP liner using a proprietary process. Bond strength between the FEP liner and reinforced vinyl ester structure as measured by ASTM D1781 – Climbing Drum Peel Test for Adhesives, is a minimum of 50 in*lb/in.

2.3 Outer Structure: The bonded FEP liner is reinforced by filament wound (standard) or hand lay-up vinyl ester fiberglass structure yielding a totally bonded dual laminate. Hand lay-up construction when performed is per ASTM C582 Type II, Grade V. Only premium grade vinyl ester resins are used with glass reinforcement and UV stabilized exterior gel coat.

3. DESIGN AND FABRICATION DETAILS

3.1 All dimensional drawings included in this specification are suitable for use in the design of pipe systems. Tolerances in subparagraph 3.3 should be considered in design.

3.2 Flanges for pipe spools and fittings shall have an internal diameter, outer diameter bolt circle, hole diameter and number of boltholes in accordance with ASME B16.5 Class 150, unless otherwise specified.

3.3 Pipe and fittings fabrication tolerances are as follows:

ITEM	DIMENSIONS	TOLERANCES
Pipe Spools	Length	±1/8"
	Bolt hole alignment	±1/16"
	Flange alignment	±1/32" (1" thru 4")
	with pipe centerline	±3/64" (6">)
Flanges	All dimensions except thickness tolerance	ASME B16.5 Class 150
Fittings	Face to centerline	±1/8"
ID/OD Radius		±1/8" (1" thru 10")
		±1/4" (12" thru 20")

3.4 1.5" - 4" flanges can be attached to MAXAR Blue pipe in the shop or in the field using the MAXAR*FLEX* pipe spooling kit. The MAXAR*FLEX* pipe spooling kit provides the ability to fabricate pipe spools in the field. Flanges are bonded to pipe using a high performance epoxy adhesive (3M DP420NS). This method of flange attachment preserves the bonded liner and does not require thermoplastic welding.

4. APPLICATION AND OPERATIONAL PARAMETERS

4.1 MAXAR Blue liner material is suitable for operating temperatures from -5°F (-20°C) to 220°F (104°C). MAXAR piping systems with a continuous operating temperature above 180°F (82°C) should be evaluated by RPS engineering to determine if the process conditions are acceptable.

4.2 Pressure Ranges: MAXAR Blue is suitable for continuous operation from full vacuum to 150 PSI for 1 ½" diameter through 12" diameter and full vacuum to 100 PSI for 14" diameter through 24" diameter when operating within the temperature range specified in subsection 4.1

4.3 Continuous full vacuum services require a bonded flare.

4.4 Thermal Expansion: the Coefficient of Thermal expansion for MAXAR Blue pipe is ~1.7 x 10^{-5}in/in/°F when operating within the temperature range specified in subsection 4.1.

4.5 Chemical Resistance (liner): MAXAR Blue's FEP-Teflon® liner is chemically inert to a broad range of commercial chemicals including the following:

All acids including hydrofluoric, hydrochloric, sulfuric, and aqua regia

All chlorides – organic and inorganic

All sulfates – organic and inorganic

All bleach solutions

All solvents, all caustics, all phenols, all peroxides

4.6 Chemical Resistance: MAXAR Blue's vinyl ester structure is inherently corrosion resistant. This typically allows open air or direct burial installation in harsh chemical environments with no additional protection. Gel coat exterior contains UV stabilizer. Fire retardant protection is available. For specific environments, consult RPS Composites.

4.7 Gas Permeation: RPS' bonding technology eliminates air gaps between the FEP liner and vinyl ester structure. This eliminates condensation between the liner and structure which is a common problem in lined steel pipe. Since these gases/liquids are not trapped between MAXAR Blue's FEP liner and vinyl ester structure, no weep holes are required and internal corrosion of the structure is eliminated.

4.8 Insulation Qualities: MAXAR Blue's vinyl ester structure yields a heat conduction factor (k) of ~ 1.5 Btu*in/FT^2/hr/°F. Check dimensional data for structure thickness. If additional thermal protection is necessary, contact RPS for details on Heat Traceable, Pre-insulated and/or Dual Contained MAXAR Systems.

4.9 Heat Tracing: MAXAR Blue's vinyl ester structure is capable of handling dry heat trace applications up to 180°F. On pre-insulated MAXAR Blue systems, channels can be provided for heat trace wire. Contact RPS Composites for more information.

5. INSPECTION

5.1 All extruded liners are inspected prior to fabrication for pinholes, cracks, gauges, nicks, or inclusion of foreign particles.

5.2 Completed fittings shall be subjected to a 10,000-volt, non-destructive, electrostatic spark test to detect pinholes. This test is to be performed by RPS Composites only with properly controlled voltage and procedures.

6. HANDLING AND SHIPPING

6.1 The gasket face of each spool or fitting shall be protected by end plates or other suitable protective means.

6.2 All spools and fittings shall be packed to provide necessary protection during handling, shipping, and storage.

7. INSTALLATION AND ASSEMBLY DATA

7.1 Supports: Hangers and supports may be ordered from RPS Composites or supplied by customer. Supports should have a minimum 1/8" thick rubber liner. Verify actual pipe outside diameter before ordering supports.

7.2 Support spacing: Support spacing can vary depending on actual service conditions and piping configuration. Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending and shear stresses in the piping with special consideration given where components such as flanges and valves impose concentrated loads. Where calculations are not made, suggested maximum spacing of supports are given in the table on page 3. Vertical supports shall be spaced to prevent the pipe from being over stressed from the combination of all loading effects (ANSI B31.1). In additional, Appendix III, Non-Mandatory Rules for Nonmetallic Piping of ANSI B31.1 should be taken into consideration. The values listed in the table are based on maximum operating conditions but do not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc.

7.3 Gaskets: **RPS recommends Garlock Stress Saver 370.**

7.4 Bolts: Size and grade per ASME specification. SAE washers shall be used on all flanged fittings. Standard hex nuts shall be used on fittings 1 ½" diameter through 6" diameter. Fittings 8" and up can accommodate heavy hex nuts if preferred.

7.5 Torquing Procedure: The following procedure will insure that the necessary forces are applied to seat Stress Saver 370 gaskets using the torque values of subsection 7.6. When other gasket materials are used, they should not exceed 70 durometer to assure proper seating.

A. Lubricate all bolts and nuts with a suitable lubricant, finger tighten all nuts.

B. With torque wrench, using a criss-cross method, tighten each bolt until appropriate torque values are met as specified in the Maximum Bolt Torque table under subsection 7.6.

C. After 24-30 hours, a temperature cycle, or a pressure cycle, torque for each bolt shall be checked. Those below the minimum are to be re-torqued to the values listed in subsection 7.6.

7.6 Bolt Torque: Clamping forces between flanges can vary greatly depending on whether or not lubricated bolts are used when torquing bolts. The values listed in the table assume that bolts are lubricated.

Pipe Size	Max. Pipe Support Spacing (ft)	Max. Bolt Torque (ft.lb.)
1 ½″	6.0	15
2″	6.0	25
3″	8.0	25
4″	8.5	25
6″	10.5	40
8″	11.5	60
10″	13.0	70
12″	14.0	80
14″	14.0	80
16″	15.0	90
18″	17.0	90
20″	19.0	100
24″	22.0	100

8. WARRANTY

All standard MAXAR Blue products are warranted for one (1) year from being placed in service or 18 months from delivery. Consult RPS Composites for warranty information concerning customized parts or systems.

9. WAIVER

9.1 Every effort has been made to ensure that the information provided in this specification is accurate. Changes or updates may occur without notice.

9.2 This specification does not purport to address any personnel safety issues associated with handling, installing, and operating pressure or vacuum pipe systems. For specific information regarding these issues, refer to applicable ASME/ANSI Codes and Standards. ASTM Standards, OSHA Regulations and qualified piping and safety engineers.

Piping Specification

SERVICES:

As specified by user or RPS Composites.

MATERIAL:

MAXAR Blue as provided by RPS Composites: dual laminate, seamless FEP Teflon® liner with bonded fiberglass reinforced vinyl ester structure.

SIZE/RATING:

1 ½" – 12"	Full Vacuum	150 PSI	-5 to 220°F
14" – 24"	Full Vacuum	100 PSI	-5 to 220°F

PIPE:

150# flanged spools 20'-0" standard length

FITTINGS:

Flanged, ASME B16.5 Class 150 Dimensions.

INSTRUMENT CONNECTIONS:

Use full size tee, reducing tees, or stub-ins

FLANGES:

All flanges drilling pattern per ASME B16.5 Class 150 dimensions (except thickness)

- ***Fixed:*** Full face flanges to be fabricated on pipe by manufacturer. 1.5" - 4" flanges can be fabricated on pipe in the field using the MAXAR*FLEX* pipe spooling kit. Pipe liner to be flared over face of flange to inside of bolt holes.
- ***Lap Joint:*** Stub end with loose ring fabricated on pipe by pipe manufacturer. Pipe liner to be flared over stub face to outside diameter of stub.
- ***Blinds:*** Flat faced FRP with 90 mil. min. thickness FEP Teflon® liner bonded to face.

GASKETS:

Gasket material suitable for intended service conditions. Consult gasket manufacturer for recommendation. Garlock Stress Saver® 370 gasket material is comparable to MAXAR Blue liner material.

BOLTING:

Alloy steel machine bolts or studs with (2) SAE washers and standard nuts 1 ½" thru 6"Ø if preferred.

WELDING:

Assembly of MAXAR Blue piping components is accomplished by welding the liner sections and then laminating the components together. The liner weld is accomplished by flow fusion or hot gas welding. Welds are spark tested to detect pinholes prior to laminating.

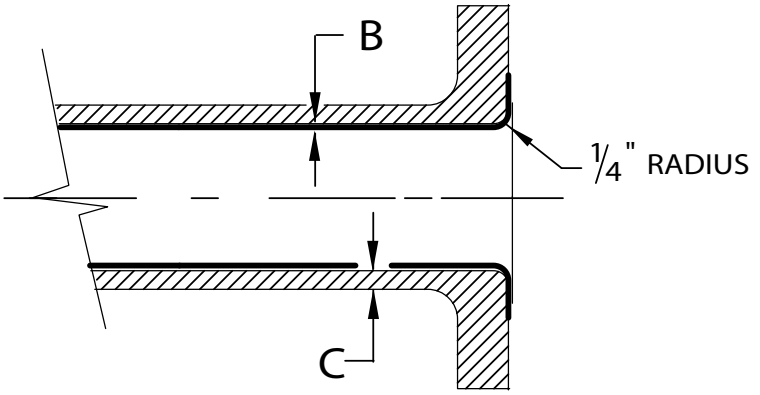
JOINTS:

Butt and wrap per ASTM D6041.

NOTES:

1. Instrument connections (including vents and drains) may be fabricated directly into pipe spools; minimum size is 1" diameter.
2. Piping may be shop fabricated or field welded by manufacturer. 1.5" - 4" piping can be field fabricated using the MAXAR*FLEX* pipe spooling kit.
3. One inch (1") piping is available in short spools only (24" or less).
4. MAXAR Blue piping systems with a continuous operating temperature above 180°F (82°C) should be evaluated by RPS engineering to determine if the process conditions are acceptable.

Standard MAXAR Blue Pipe Dimensions



Nom. Dia.	B (Liner Thickness)	C (F.W. Thickness)
1	0.07	.15
1 1/2	0.08	.15
2	0.08	.17
3	0.09	.21
4	0.1	.21
6	0.1	.21
8	0.1	.25
10	0.1	.36
12	0.1	.39
14	0.1	.39
16	0.1	.39
18	0.1	.43
20	0.1	.46

Notes:

1. See page 7 for fitting dimensions
2. See page 6 for flange dimensions
3. Please consult with RPS Composites for additional dimensional information on the MAXAR Blue Product

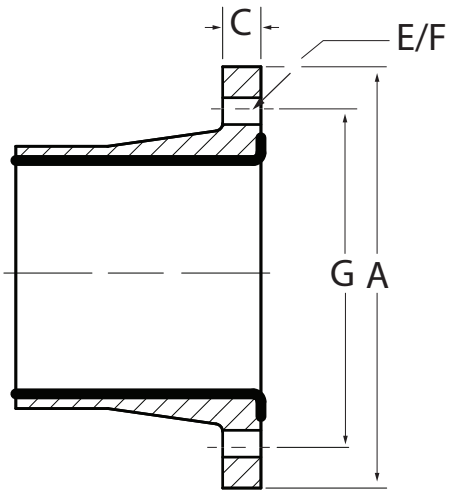
Approximate Weight of Pipe and Fittings (lbs.)

Nom. Dia.	Pipe per foot	Flange
1	.6	1.0
1 1/2	1.4	1.3
2	1.7	2.0
3	2.5	4.0
4	3.4	1.5
6	5.6	7.0
8	8.3	11.5
10	12.8	15.0
12	16.6	24.0
14	17	27
16	21	35
18	26	37
20	31	49

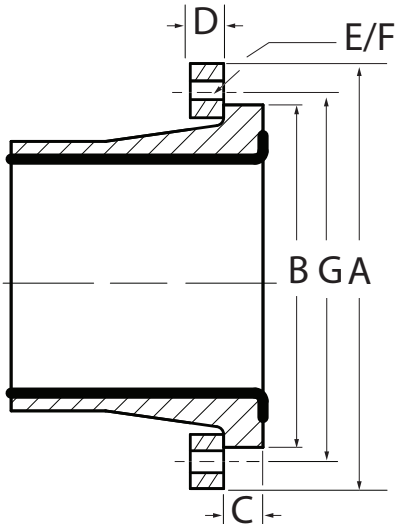
Seamless MAXAR Blue Specifications

Standard MAXAR Blue Flange Dimensions

Standard Flange



Lap Joint Flange

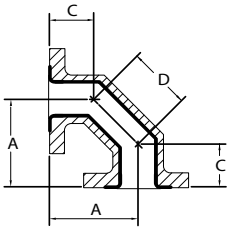


Nom Size	A O.D. Flange	B O.D. Stub End	C Flg/Stub Thickness	D Lap Jt. Thickness	E No. Holes	F Hole Size	G Bolt Circle	Bolt Size See Note 1
1	4 1/4	2 1/2	1	1	4	5/8	3 1/8	1/2
1 1/2	5	3 1/4	1	1	4	5/8	3 7/8	1/2
2	6	4	1 1/8	1 1/4	4	3/4	4 3/4	5/8
3	7 1/2	5 1/4	1 1/8	1 1/4	4	3/4	6	5/8
4	9	6 3/4	1 1/4	1 3/8	8	3/4	7 1/2	5/8
6	11	8 5/8	1 1/2	1 3/4	8	7/8	9 1/2	3/4
8	13 1/2	10 7/8	1 3/4	2	8	7/8	11 3/4	3/4
10	16	13 1/4	1 3/4	2	12	1	14 1/4	7/8
12	19	16	2	2 1/4	12	1	17	7/8
14	21	17 5/8	2	2 1/4	12	1 1/8	18 3/4	1
16	23 1/2	20 1/8	2 1/8	2 3/8	16	1 1/8	21 1/4	1
18	25	21 1/2	2 1/4	2 1/2	16	1 1/4	22 3/4	1 1/8
20	27 1/2	23 3/4	2 1/2	2 3/4	20	1 1/4	25	1 1/8
24	32	28 1/8	2 5/8	2 7/8	20	1 3/8	29 1/2	1 1/4

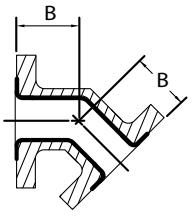
Notes:

1. For bolt lengths when using lap joint flanges, add lap joint flange thickness to length shown.
2. Bonded flares required for full vacuum.

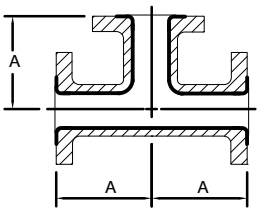
MAXAR Fitting Dimensions



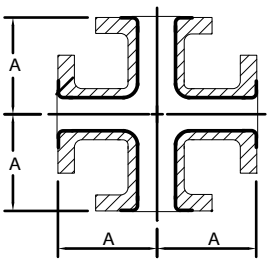
90º Elbow
See Note 1 & 3



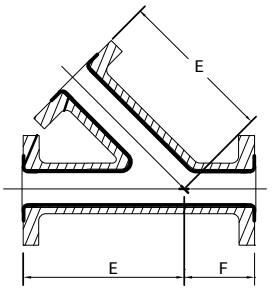
45º Elbow
See Note 1 & 3



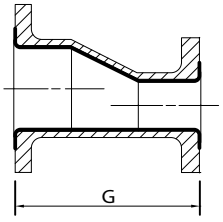
Tee
See Note 1 & 3



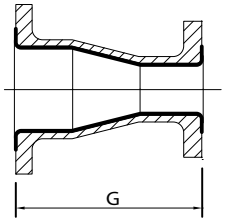
Cross
See Note 3



45º Lateral
See Note 3



Eccentric
Reducer



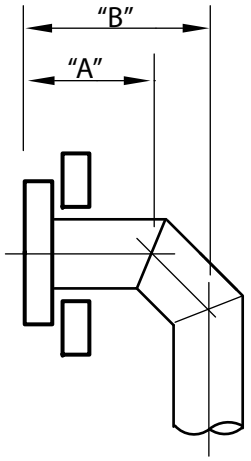
Concentric
Reducer

Nom. Dia.	A	B	C	D	E	F	G
1 1/2	4	2 1/4	2 1/2	2 1/8	7	2	5
2	4 1/2	2 1/2	2 3/4	2 1/2	8	2 1/2	5
3	5 1/2	3	3 1/4	3 3/16	10	3	6
4	6 1/2	4	3 7/8	3 11/16	12	3	7
6	8	5	4 1/2	4 15/16	14 1/2	3 1/2	9
8	9	5 1/2	5	5 5/8	17 1/2	4 1/2	11
10	11	6 1/2	6 1/4	6 11/16	20 1/2	5	12
12	12	7 1/2	7	7 1/16	24 1/2	5 1/2	14
14	21	8 3/4	8 3/4	17 1/4	30	12	12
16	24	10	10	19 3/4	32	14	12
18	27	11 1/4	11 1/4	22 1/4	36	14	12
20	30	12 1/2	12 1/2	24 3/4	38	16	12
24	36	15	15	29 3/4	42	18	15

Notes

1. See page 6 for flange dimensions.
2. See page 5 for wall and liner thicknesses.
3. Tees, crosses and laterals are also available with reducing branch connections. Dimensions are same as full size.
4. Fittings are also available with standard dimensions. Contact RPS Composites for details.

Minimum Length Between First Transition Point and First Flange



	A		B	
Nom. Dia.	**Standard**	**Van Stone**	**Standard**	**Van Stone**
1	2 1/2"	3 1/2"	4	5
1 1/2	2 1/2	3 1/2	4	5
2	2 3/4	4	4 1/2	5 3/4
3	3 1/4	4 1/2	5 1/2	6 3/4
4	3 7/8	5 1/4	6 1/2	7 7/8
6	4 1/2	6 1/4	8	9 3/4
8	5	7	9	11
10	6 1/4	8 1/4	11	13
12	7	9 1/4	12	14 1/4
14	8 3/4	11	21	23 1/4
16	10	12 3/8	24	26 3/8
18	11 1/4	13 3/4	27	29 1/2
20	12 1/2	15 1/4	30	32 3/4
24	15	17 7/8	36	38 7/8

RPS Composites Inc.
8375 Zeigler Blvd.
Mobile, AL 36689
Tel: (251) 445-4411
Fax: (251) 633-3318
Sales@RPSComposites.com
RPSComposites.com

RPS COMPOSITES