

Seamless MAXAR™ Red Dual Laminate Pipe and Fittings



1. SCOPE

This specification provides design information applicable to RPS Composites' MAXAR Red piping products (seamless PVDF/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 Red liners are Polyvinylidene Fluoride (PVDF) resin, seamless to 12". This resin meets the requirements of ASTM D5575 and may include less than 1% inorganic pigment for identification. A partial list of physical properties follows:

PROPERTY	VALUE	TEST
Specific Gravity	1.76	ASTM D-792
Tensile Strength	>5000 PSI	ASTM D-638
Elongation	40%	ASTM D-638

- 2.2 Bonding Layer: A knit fiberglass fabric is melt-bonded and partially embedded into the O.D. surface of the PVDF liner using a proprietary process. Bond strength between the PVDF 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 PVDF 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	DIMENSION	TOLERANCES
Pipe Spools	Length	±1/8"
	Bolt hole alignment	±1/16"
	Flange alignment (with pipe centerline)	±1/32" (1" thru 4") ±3/64" (6">)
Flange	All dimensions except thickness	ASME B16.5
Fittings	Face to centerline	±1/8"
	Flange alignment (with pipe centerline)	±1/32" (1" thru 4") ±3/64" (6">)
ID/OD Radius		±1/16" (1" thru 6") ±1/8" (8" thru 14") ±1/4" (16" thru 24")

- 3.4 1.5" - 4" flanges can be attached to MAXAR Red pipe in the shop or in the field using the MAXARFLEX pipe spooling kit. The MAXARFLEX 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 Red 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 Red is suitable for continuous operation from full vacuum for 150 PSI for 1 1/2" 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

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- 4.3 Thermal Expansion: the Coefficient of Thermal expansion for MAXAR Red pipe is $\sim 1.7 \times 10^{-5}$ in/in/°F when operating within the temperature range specified in subsection 4.1.
- 4.4 Chemical Resistance (liner): MAXAR Red's PVDF liner is chemically inert to a broad range of commercial chemicals including the following:
- All acids including hydrofluoric, hydrochloric, sulfuric, and hydrobromic
 - All chlorides – organic and inorganic
 - All sulfates – organic and inorganic
 - All bleach solutions
 - All solvents, all caustics, all phenols, all peroxides
- 4.5 Chemical Resistance: MAXAR Red'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.
- 4.6 Gas Permeation: RPS' bonding technology eliminates air gaps between the PVDF 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 Red's PVDF liner and vinyl ester structure, no weep holes are required and internal corrosion of the structure is eliminated.
- 4.7 Insulation Qualities: MAXAR Red's vinyl ester structure yields a heat conduction factor (k) of ~ 1.5 Btu*in/FT²/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 PVDF/FRP Systems.
- 4.8 Heat Tracing: MAXAR Red's vinyl ester structure is capable of handling dry heat trace applications up to 180°F. On pre-insulated MAXAR Red 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 overstressed from the combination of all loading effects (ANSI B31.1). In addition, 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 1/2" 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 1/2"	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 Red 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.



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Piping Specification

SERVICES:

As specified by user or RPS Composites.

MATERIAL:

MAXAR Red as provided by RPS Composites: dual laminate, seamless PVDF 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.

BRANCH CONNECTIONS:

Use full size or reducing tees

INSTRUMENT CONNECTIONS:

Use tee

FLANGES:

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

Blinds: Flat faced FRP with PVDF liner bonded to face.

Fixed: Full face flanges to be fabricated on pipe spools by pipe manufacturer.

Lap Joint: Stub end with loose ring fabricated on pipe by pipe manufacturer.

Fixed or Lap Joint flanges available as:

- A. Flared over face of flange to the inside of the bolt holes.
- B. Fabricated with flat sheet welded and bonded to face.
- C. Molded weld neck stub flanges, if available, connected by either hot plate fusion welding or hot air hand welding, reinforced with FRP structure.

GASKETS:

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

BOLTING:

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

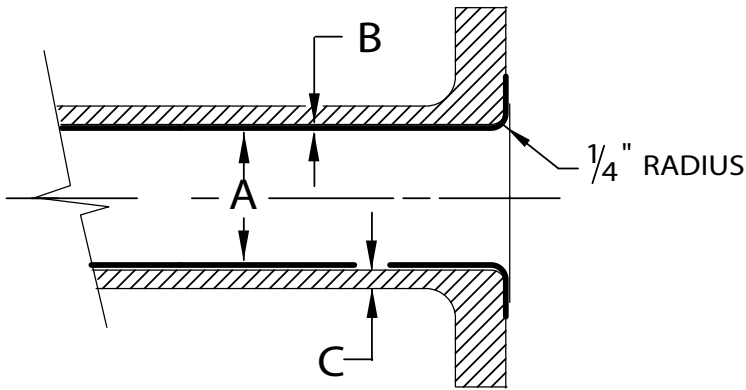
WELDING:

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

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
3. One inch (1") piping is available in short spools only (24" or less).
4. MAXAR Red 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.

Pipe and Fittings Dimensions, Pipe and Fitting Weights



Approximate Weight of Pipe and Fittings (lbs.)

Nom. Dia.	A (I.D.)	B (Liner Thickness)	C (F.W. Thickness)
1	0.875	0.08	0.15
1 1/2	1.49	0.08	0.15
2	2.0	0.08	0.17
3	3.0	0.09	0.21
4	4.0	0.10	0.21
6	6.0	0.10	0.21
8	8.0	0.10	0.25
10	9.875	0.10	0.36
12	11.875	0.10	0.40
>12		min of 0.10	design to 150 psi

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

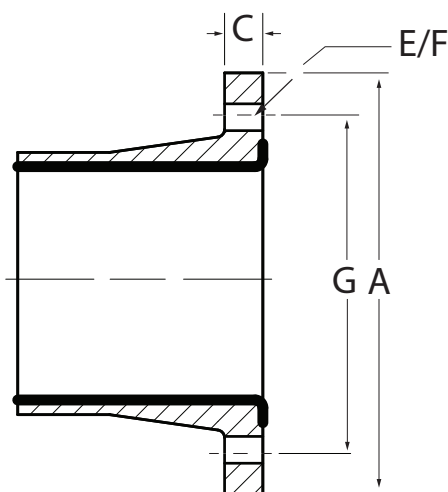
Note:

1. Please consult with RPS Composites for additional dimensional information on the MAXAR Red Product.

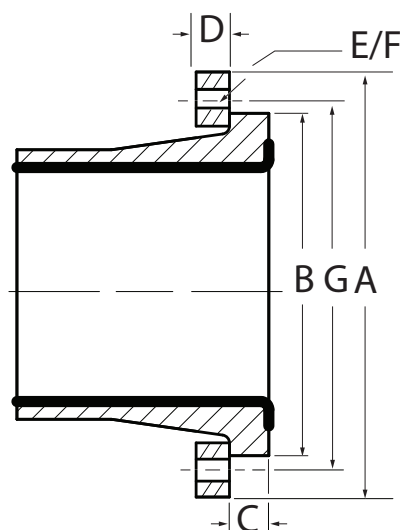
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Standard Flange Dimensions

Standard Flange



Lap Joint Flange

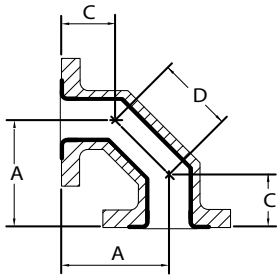


Nom. Size	A O.D. Flange	B O.D. Stub End	C Flg/Stub Thickness	D Lap Jt. Thickness	E No. Holes	F Hole Size	G Bolt Circle	Bolt Size See Notes 1 and 2
1	4 1/4	2 1/2	1	1	4	5/8	3 1/8	1/2
1 1/2	5	3 1/4	1	1	4	5/8	3 7/8	1/2
2	6	4	1 1/8	1 1/4	4	3/4	4 3/4	5/8
3	7 1/2	5 1/4	1 1/8	1 1/4	4	3/4	6	5/8
4	9	6 3/4	1 1/4	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

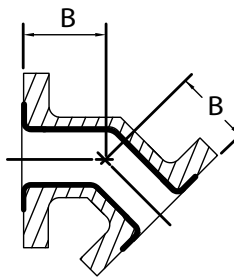
Notes:

1. Dimensions shown are for all flanges and includes thermoplastic flange face where applicable.
2. For bolt lengths when using lap joint flanges, add lap joint flange thickness to length shown.
3. Flared PVDF liner may not seat to face until bolt up.

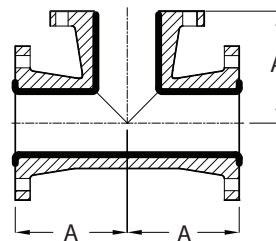
Fittings Dimensions



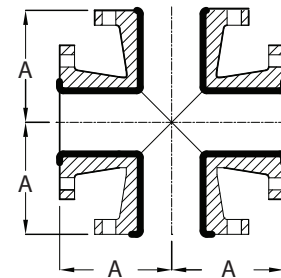
90° Elbow
See Note 1 & 3



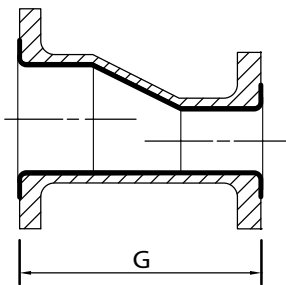
45° Elbow
See Note 1 & 3



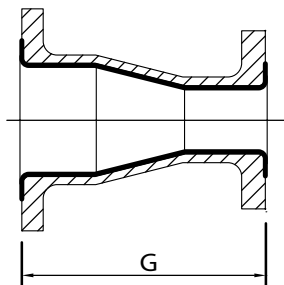
Tee
See Note 1 & 3



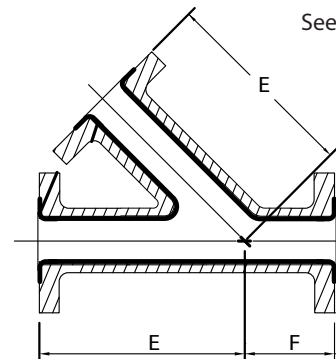
Cross
See Note 3



Eccentric Reducer



Concentric Reducer



45° Lateral
See Note 3

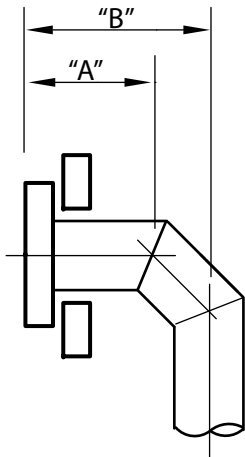
Nom. Dia.	A	B	C	D	E	F	G
1 1/2	4	2 1/4	2 1/2	2 1/8	7	2	5
2	4 1/2	2 1/2	2 3/4	2 1/2	8	2 1/2	5
3	5 1/2	3	3 1/4	3 3/16	10	3	6
4	6 1/2	4	3 7/8	3 11/16	12	3	7
6	8	5	4 1/2	4 15/16	14 1/2	3 1/2	9
8	9	5 1/2	5	5 5/8	17 1/2	4 1/2	11
10	11	6 1/2	6 1/4	6 11/16	20 1/2	5	12
12	12	7 1/2	7	7 1/16	24 1/2	5 1/2	14
14	21	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 non-standard dimensions. Contact RPS Composites for details.

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Minimum Length Between First Transition Point and First Flange



Nom. Dia.	A		B	
	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

