Red Thread® II Product Data *(Chemical & Industrial Piping Systems)*

Applications

- Potable Water
- pH 2-13 Solutions
- Wastewater
- Brine Solutions
- Food Processing
- Cooling Water
- Chemical Processing
- Saltwater Handling
- Produced Water
- Crude Oil & Gas
- CO_2
- Effluent Drains

Materials and Construction

All pipe manufactured by filament winding process using amine-cured epoxy thermosetting resin to impregnate strands of continuous glass filaments with a resin-rich interior surface.

T.A.B.™ (Threaded and Bonded) is the primary joining method for 2”-6” diameter pipe. Factory supplied ends have special profile, double-lead threads for quick, reliable assembly. Combined with specially-formulated epoxy adhesive. **T.A.B.** joints promote positive make-up and prevent backout during cure.

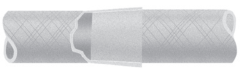
For **8”-24” sizes** , the matched tapered joining method is used. Pipe is supplied with one end belled (integral bell or factory-bonded coupling) and one end tapered. Epoxy adhesive is used to secure the joint.

Fittings

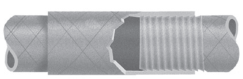
Fittings are manufactured with the same **chemical/temperature** capabilities as the pipe. Depending on the particular part and size, fittings will be compression molded, contact molded, hand fabricated or filament wound.

Joining Systems

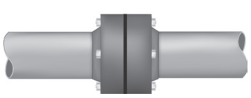
Bell & Spigot
Matched-taper joint secured with epoxy adhesive. Self-locking feature resists movement, facilitating joining runs of pipe without awaiting adhesive cure.



T.A.B.™
Threaded and bonded joining system. Double-lead threads provide quick secure adhesive connections during installation.



Flanged
Available for all piping systems and diameters; factory assembled or shipped loose for assembly in the field.



Nominal Dimensional Data

Pipe Size	I.D.		O.D.		Wall Thickness		Weight		Capacity	
(in)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lbs/ft)	(kg/m)	(gal/ft)	(ft^3/ft)
2	2.238	57	2.395	61	0.079	2.01	0.4	0.60	0.20	0.03
3	3.363	85	3.576	91	0.107	2.71	1.0	1.49	0.46	0.06
4	4.364	111	4.562	115	0.099	2.51	1.2	1.79	0.78	0.10
6	6.408	163	6.678	170	0.135	3.43	2.4	3.51	1.68	0.22
8	8.356	212	8.642	219	0.143	3.63	3.3	4.91	2.85	0.38
10	10.357	263	10.731	273	0.187	4.75	5.3	7.89	4.38	0.59
12	12.278	312	12.710	323	0.216	5.49	7.2	10.71	6.15	0.82
14	14.029	356	14.567	370	0.269	6.83	10.1	15.33	8.03	1.07
16	16.031	407	16.637	423	0.303	7.70	13.2	19.79	10.49	1.40
18	17.820	453	18.460	469	0.320	8.13	15.5	23.07	12.96	1.73
20	19.830	504	20.480	520	0.325	8.25	17.5	26.04	16.04	2.15
24	23.830	605	24.580	624	0.375	9.53	24.3	36.16	23.17	3.10

Tolerances or maximum/minimum limits can be obtained from NOV Fiber Glass Systems.

Properties of Pipe Sections Based on Minimum Reinforced Walls

Size (In)	Reinforcement End Area(In^2)	Reinforcement Moment of Inertia (In^4)	Reinforcement Section Modulus (In^3)	Nominal Wall End Area (In^2)
2	0.50	0.33	0.28	0.58
3	1.01	1.51	0.85	1.16
4	1.21	3.00	1.32	1.39
6	2.60	13.9	4.20	2.99
8	3.69	33.3	7.7	4.23
10	5.41	74.8	13.9	6.19
12	7.40	144	22.6	8.48
14	10.6	268	36.8	12.1
16	13.6	450	54.1	15.6
18	15.9	652	70.6	18.2
20	18.0	909	88.8	20.6
24	24.9	1817	148	28.5

Average Physical Properties

Property		75°F psi	24°C MPa	210°F psi	99°C MPa
Axial Tensile - ASTM D2105					
Ultimate Stress		10,300	71	7,700	53
Modulus of Elasticity		1.82×10^6	12,548	1.18×10^6	8,136
Poisson's Ratio $V_{a/h}$ ($V_{h/a}$)			0.35 (0.64)		
Axial Compression - ASTM D695					
Ultimate Stress		33,000	230	19,400	134
Modulus of Elasticity		1.26×10^6	8,687	0.6×10^6	4,137
Beam Bending - ASTM D2925					
Ultimate Stress		23,000	158.6	16,000	110
Modulus of Elasticity (Long Term)		1.46×10^6	10,000	0.96×10^6	6,630
Hydrostatic Burst - ASTM D1599					
Ultimate Hoop Tensile Stress		34,000	234	43,500	300
Hydrostatic Design - ASTM D2992,	Sizes				
Procedure A - Hoop Tensile Stress	2"- 3"	9,410	64.9	5,790	39.9
Cyclic 150 x 10^6 Cycles	4"-24"	13,073(1)	90.1(1)	8,447(1)	58.2(1)

(1)Data extrapolated from complete data sets obtained at 150°F and 200°F.

Thermal Expansion Coefficient - ASTM D696	0.88×10^{-5} in/in/°F	1.58×10^{-5} mm/mm/°C
Thermal Conductivity	0.23 BTU/hr-ft-°F	0.4 W/m-°C
Specific Gravity - ASTM D792	1.8	
Hazen-Williams Coefficient	150	
Absolute Surface Roughness	0.00021 Inch	0.0053 mm
Manning's Roughness Coefficient, n	0.009	

Testing:

Hydrostatic testing should be performed to evaluate the structural integrity of a new piping system installation. Test pressures of 1.5 times the design pressure but not exceeding 1.2 times the static pressure rating of the lowest rated fiberglass component in the piping system are recommended. Contact the company if test pressures exceed 450 psig before testing. The hydro test pressure should be repeated up to ten times to provide a high degree of confidence in the piping system. The final pressurization cycle should be allowed to stabilize for 15-30 minutes, then inspected for leaks. Do not attempt to repair leaks while system is pressurized. The hydro test should be repeated after any re-work is performed.

When hydro testing, open vents to prevent entrapment of air in the lines as the system is slowly filled with water. Then close the vents and slowly pressurize to the test pressure. Upon completion of hydrotest, relieve the pressure on the system slowly, open vents and any drains to allow for complete drainage of the system.

Piping systems with design temperatures above 150°F should be tested at 1.2 times the static pressure rating of the lowest rated fiberglass component in the system.

Pressure Ratings

Size (In)	Maximum Internal Static Pressure (psig) 210°F	Maximum External Pressure (psig)[1] 75°F	150°F	210°F
2	450	85	80	75
3	450	36	34	32
4	450	34	30	27
6	450	22	20	19
8	225	17	13	11
10	225	17	13	11
12	225	17	13	11
14	225	17	13	11
16	225	17	13	11
18	225	9.9	7.5	6.5
20	225	7.8	6.0	5.2
24	225	6.9	5.3	3.5

[1]Vacuum Service: A full vacuum within the pipe is equivalent to 14.7 psig external pressure at sea level. External pressure ratings are based on test data obtained using ASTM D2924.

ASTM D2996 Designation Codes

2”-3”	RTRP-11AF1-2111
4”	RTRP-11AH1-2111
6”-8”	RTRP-11AH1-2112
10”	RTRP-11AH1-2114
12”	RTRP-11AH1-2115
14”-16”	RTRP-11AH1-2116
18”-24”	RTRP-11AH1-2110

Recommended Operating Ratings

Size (in)	Axial Tensile Loads Max. (lbs) Temperature 75°F	Axial Tensile Loads Max. (lbs) Temperature 210°F	Axial Compressive Loads Max. (Lbs)[1] Temperature 75°F	Axial Compressive Loads Max. (Lbs)[1] Temperature 210°F	Bending Radius Min. (ft) Entire Temp. Range	Torque Max. (Ft Lbs) Entire Temp. Range	Parallel Plate Loading ASTM D2412: Stiffness Factor ($in^3/lbs/in^2$)	Pipe Stiffness (psi)	Hoop Modulus $x10^6$ (psi)
2	1,280	930	4,160	2,420	51	90	71	311	2.6
3	2,601	1,887	8,408	4,900	76	270	174	226	2.6
4	3,110	2,260	10,070	5,860	97	420	142	86	2.6
6	6,230	4,520	20,140	11,730	142	1,200	443	85	2.6
8	8,570	6,220	27,720	16,150	183	2,200	569	49	2.6
10	13,930	10,110	45,030	26,230	227	4,450	955	44	2.6
12	19,050	13,820	61,600	35,890	269	7,250	1,460	40	2.6
14	27,160	19,710	87,830	51,160	308	11,800	2,810	52	2.6
16	35,020	25,410	113,220	65,960	352	17,400	4,030	50	2.6
18	40,990	29,750	132,530	77,210	391	22,700	4,750	43	2.6
20	46,350	33,630	149,850	87,300	433	28,500	4,960	32	2.6
24	64,110	46,530	207,290	120,760	520	47,400	7,430	28	2.6

[1]Compressive loads are for short columns only.

Water Hammer:

Care should be taken when designing an FRP piping system to eliminate sudden surges. Soft start pumps and slow actuating valves should be considered.

Pipe Lengths Available

Size (in)	Random Length (ft)
2-6	25 & 30
8-24	20 & 40

Supports

Proper pipe support spacing depends on the temperature and weight of the fluid in the pipe. The support spacing table is based on unrestrained continuous beam theory using the pipe bending modulus derived from long-term beam bending tests. The maximum spans lengths were developed to ensure a design that limits mid-span deflection to 1/2 inch and dead weight bending to 1/8 of the ultimate bending stress. Any additional loads on the piping system such as insulation, wind, seismic, etc. requires further consideration. Restrained (anchored) piping systems operating at elevated temperatures may result in guide spacing requirements that are shorter than unrestrained piping systems. In this case, the maximum guide spacing governs the support span requirements for the system. Pipe spans near elbows require special attention. Both supported and unsupported elbows are considered in the following tables and must be followed to properly design the piping system.

There are seven basic rules to follow when designing piping system supports:

1. Do not exceed the recommended support span.
2. Support heavy valves and in-line equipment independently.
3. Protect pipe from external abrasion at supports.
4. Avoid point contact loads.
5. Avoid excessive bending. This applies to handling, transporting, inittial layout, and final installed position.
6. Avoid excessive vertical loading to minimize bending stresses on pipe and fittings.
7. Provide adequate axial and lateral restraint to ensure line stability during rapid changes in flow.

Maximum Support Spacing for Uninsulated Pipe

Pipe Size (in.)	Continuous Pipe Spans (Ft.)[(1)(2)]			Gas
	75°F	150°F	210°F	75°F
2	12.6	12.0	11.4	19.1
3	15.0	13.5	12.6	22.1
4	15.9	15.1	14.3	25.2
6	19.2	18.3	17.3	30.8
8	21.1	20.0	19.0	35.0
10	23.2	22.0	20.9	38.9
12	25.1	23.9	22.6	42.4
14	27.4	26.0	24.7	45.3
16	29.2	27.7	26.3	48.4
18	30.4	28.9	27.4	51.1
20	31.4	29.8	28.3	53.9
24	34.1	32.4	30.7	59.0

(1) Consult factory for insulated pipe support spacing.
(2) Maximum mid-span deflection ½" with a specific gravity of 1.0.

Support Spacing vs. Specific Gravity

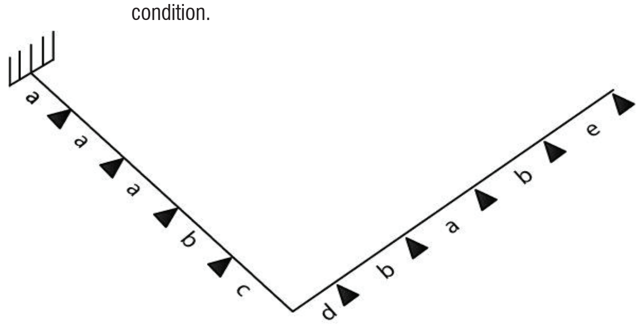
Specific Gravity	2.00	1.50	1.25	1.00	0.75
Multiplier	0.84	0.90	0.95	1.00	1.07

Example: 6" pipe @ 150°F with 1.5 specific gravity fluid, maximum support spacing = 18.3 x 0.90 = 16.5 ft.

Adjustment Factors for Various Spans With Unsupported Fitting at Change in Direction

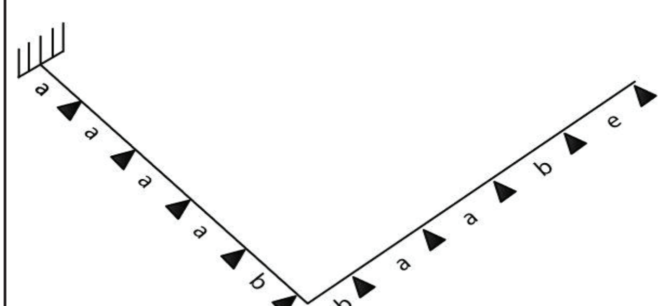
	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Second span from supported end or unsupported fitting	0.80
c+d	Sum of unsupported spans at fitting	$\leq$0.75*
e	Simple supported end span	0.67

*For example: If continuous support is 10 ft., c+d must not exceed 7.5 ft. (c=3 ft. and d=4.5 ft.) would satisfy this condition.



Adjustment Factors for Various Spans With Supported Fitting at Change in Direction

	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Second span from simple supported end or unsupported fitting	0.80
e	Simple supported end span	0.67



Thermal Expansion

The effects of thermal gradients on piping systems may be significant and should be considered in every piping system stress analysis. Pipe line movements due to thermal expansion or contraction may cause high stresses or even buckle a pipe line if improperly restrained. Several piping system designs are used to manage thermal expansion and contraction in above ground piping systems. They are listed below according to economic preference:

1. Use of inherent flexibility in directional changes
2. Restraining axial movements and guiding to prevent buckling
3. Use expansion loops to absorb thermal movements
4. Use mechanical expansion joints to absorb thermal movements

To perform a thermal analysis the following information is required:

1. Isometric layout of piping system
2. Physical and material properties of pipe
3. Design temperatures
4. Installation temperature (final tie in temperature)
5. Terminal equipment load limits
6. Support movements

A comprehensive review of temperature effects on fiberglass pipe may be found in NOV Fiber Glass Systems' **"Engineering and Piping Design Guide", Manual No. E5000, Section 3.**

Change in Temperature °F	Pipe Change in Length (In/100 Ft)
25	0.26
50	0.53
75	0.79
100	1.06
125	1.32
150	1.58
175	1.85

Restrained Thermal End Loads and Guide Spacing

Size (in)	Operating Temperature °F (Based on installation temperature of 75°F)									
	125°F		150°F		175°F		200°F		210°F	
	Guide Spacing (ft)	Thermal End Load (lbs)	Guide Spacing (ft)	Thermal End Load (lbs)	Guide Spacing (ft)	Thermal End Load (lbs)	Guide Spacing (ft)	Thermal End Load (lbs)	Guide Spacing (ft)	Thermal End Loads (lbs)
2	11.4	223	9.5	294	8.5	339	8.0	356	7.8	356
3	17.1	451	14.3	595	12.8	685	12.0	720	11.8	719
4	22.0	540	18.5	713	16.5	821	15.4	863	15.1	862
6	32.3	1,161	27.1	1,532	24.3	1,764	22.6	1,855	22.2	1,853
8	42.0	1,648	35.2	2,175	31.5	2,503	29.4	2,633	28.9	2,630
10	52.0	2,417	43.6	3,189	39.0	3,671	36.4	3,861	35.7	3,856
12	61.7	3,306	51.7	4,363	46.3	5,021	43.2	5,281	42.4	5,274
14	70.5	4,714	59.1	6,220	52.9	7,158	49.3	7,530	48.4	7,520
16	80.4	6,077	67.4	8,018	60.3	9,228	56.3	9,707	55.3	9,694
18	89.5	7,113	75.0	9,386	67.1	10,802	62.6	11,363	61.5	11,347
20	99.4	8,043	83.3	10,612	74.6	12,214	69.5	12,847	68.3	12,830
24	120.0	11,126	100.0	14,681	89.6	16,896	83.6	17,773	82.1	17,748

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