RED THREAD® II PIPING SYSTEMS

One Company | Unlimited Solutions

NOV Fiber Glass Systems

NOV Fiber Glass Systems is the combination of the **Star® Fiberglass** product line and the **Smith Fibercast®** product lines bringing over 60 years of "Time-Tested" composite pipe experience to the Oilfield, Chemical/Industrial, Petroleum Marketing, Marine and Offshore markets.

PRODUCT

Red Thread II pipe is a filament wound product using epoxy resins and continuous glass filaments with a resin rich interior surface. Its major advantages are long service life, light weight and corrosion resistance.

Pipe and fittings are available in **2" through 24"** diameters with pressure ratings up to 450 psig static at a maximum operating temperature of **210°F**. Diameters up to 36" are available upon request.

FITTINGS

Compatible epoxy 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.

- Fittings Literature:
  A1350-Standard 1"-16"

JOINING METHODS

T.A.B.™ (Threaded and Bonded) is the primary joining method for **2" through 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" through 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.

FIELD TAPERING & JOINING

Pipe can be cut and easily retapered for installation in the field using NOV Fiber Glass Systems tapering tools. Power or manual tools are available for smaller diameter pipe. Both manual and power operated tools are available for larger diameter pipe. Power-driven tools are recommended for larger pipe sizes and where many tapers are required. See **Manual No. F6000, *Pipe Installation Handbook for Matched Tapered Bell & Spigot Joints,*** for installation instructions and recommendations on the proper tool for your particular application.

RECOMMENDED SERVICES

Red Thread II epoxy resin pipe is excellent for **light chemical services in salts, solvents, and pH 2 to 13 solutions** that corrode traditional **metallic** pipe. It has been used extensively with great success for petroleum production applications such as produced water, CO_2, crude oil and gas, and flow lines; and also in food processing services, water and wastewater facilities, and chemical processing services. All **Red Thread II** pipe and fittings carry the ANSI/NSF 61 Listing for handling potable water. **Refer to E5615 "*Chemical Resistance Guide*" for proper application.**

BENEFITS

There are many advantages to choosing **Red Thread II** pipe. For example, when considering total installed cost, **Red Thread II** piping provides significant savings due to its light weight and easy installation features. No heavy handling equipment is required, and the load the pipe adds to a structure is minimal compared to steel, black iron, copper, and stainless steel. For example, 4" pipe weighs only 1.2 lbs. per foot compared to 5.6 lbs. for Schedule 10 stainless.

DISTRIBUTION

NOV Fiber Glass Systems has a network of stocking distributors across the U.S. as well as representatives and distributors in many other parts of the world. These distributors are supported by a staff of experienced technical personnel at the home office and by highly trained, strategically located field personnel.

PRODUCT DATA

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.

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

Pipe Lengths Available

Size (In)	Random Length (Ft)
2-6	30
8-24	40

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. Contact NOV Fiber Glass Systems if higher external pressure designs are required.

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
Design Stress		2,575	17.8	1,925	13.3
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
Design Stress		8,325	57.4	4,850	33.4
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
Design Stress(1)		2,875	19.8	2,000	13.8
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(2)	90.1(2)	8,447(2)	58.2(2)

(1)Beam bending design stress is 1/8 of ultimate to allow for additional stresses.
(2)Data extrapolated from complete data sets obtained at 150ºF and 200ºF.

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	

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

Recommended Operating Ratings

Size (In)	Axial Tensile Loads Max. (Lbs) Temperature 75°F	210°F	Axial Compressive Loads Max. (Lbs)[1] Temperature 75°F	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.

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, initial 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] 75°F	150°F	210°F	Gas 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

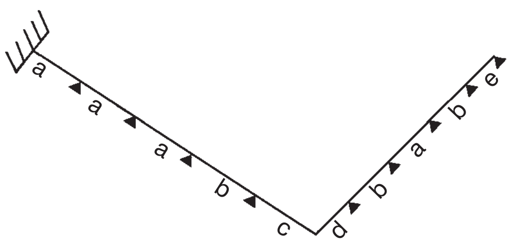
Specific Gravity	2.00	1.50	1.25	1.00	0.75
Multiplier	0.84	0.90	0.95	1.00	1.07

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

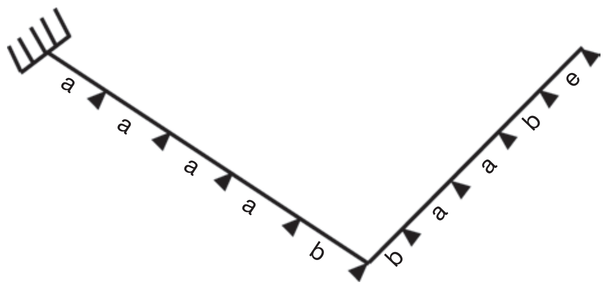
	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Second span from supported end or unsupported fitting	0.80
c+d	Sum of unsupported spans at fitting	≤0.75*
e	Simple supported end span	0.67

*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)	125°F Guide Spacing (Ft)	125°F Thermal End Load (Lbs)	150°F Guide Spacing (Ft)	150°F Thermal End Load (Lbs)	175°F Guide Spacing (Ft)	175°F Thermal End Load (Lbs)	200°F Guide Spacing (Ft)	200°F Thermal End Load (Lbs)	210°F Guide Spacing (Ft)	210°F Thermal End Loads (Lbs)
	Operating Temperature °F (Based on installation temperature of 75°F)									
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

OTHER CONSIDERATIONS

Testing:

The recommended field test procedure for **Red Thread II** pipe is to conduct the following cyclic pressure test. The piping system should be pressurized to 1½ times the operating design pressure, ten times. The tenth pressurization should be maintained for 1-8 hours and the line inspected for leaks.

Field test pressures are limited to 1½ times the maximum cyclic rating of the lowest rated component in the system. The maximum test pressure should not exceed 450 psig for any system without consulting NOV Fiber Glass Systems.

Pipelines operating at low pressures subjected to severe thermal cycling should be tested at 1½ times the piping system pressure rating.

Do not field test until all supports, anchors and guides are properly installed.

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.

APPROVALS

15LR-0004
LICENSEE
Contact Fiber Glass Systems for licensed products

ISO 9001
LITTLE ROCK, AR
SAND SPRINGS, OK
SUZHOU, CHINA
NOV FIBER GLASS SYSTEMS

CLASSIFIED UL WATER QUALITY
ANSI/NSF 61
Drinking Water System Components 35GH
Water Contact Temp: 23°C

Fiber Glass Systems

SALES OFFICES

North America
2700 West 65th Street
Little Rock, AR 72209
Phone: 501 568 4010
Fax: 501 568 4465

25 S. Main Street
Sand Springs, OK 74063
Phone: 918 245 6651
Fax: 918-245 7566

Canada
30 Strathlea Crescent SW
Calgary, Alberta Canada T3H 5A8
Phone: 403 660 4131
Fax: 403 246 7850

Latin America
2425 SW 36th Street
San Antonio, Texas 78237
Phone: 210 434 5043
Fax: 210 434 7543

Brazil
Albano de Carvalho #400
Officina 301
Recreio dos Bandeirantes
Rio de Janeiro 22795-380
Phone: 55 21 88619170

Central Asia / Russia
Microdistrict-13, Bldg-23, Apt. 4
Mangistau Region
Aktau, Kazakhstan
Phone: 7 701 5141087
Fax: 7 7292 436176

Middle East
PO Box 61335
Jafza View 18, Office 0506
Jebel Ali Free Zone
Dubai, United Arab Emirates
Phone: 9714 886 5660
Fax: 9714 886 5670

Pacific Rim
10 Ubi Crescent
#02-93 Ubi Techpark (Lobby E)
Singapore
Phone: 65 6842 2293
Fax: 65 6741 2293

China
6 Ning Bo Road, Haping Road
Centralized, Industrial Park,
Harbin Development Zone
Harbin China 150060
Phone: 86 451 8709 1718
Fax: 86 451 8709 1719

Litanghe Road
Xiangcheng Economic Development Zone
Suzhou, China 215131
Phone: 86 512 8518 0099
Fax: 86 512 8512 0101

Europe
Dlha 27
Nesvady 94651
Slovakia
Phone: 42 191 836 0122

West Africa
P.O. Box 14148
Chioma Loveday Flats,
Chief Ogbonda's Compound, #105
Woji Road
Woji, Port Harcourt, RV 500001
Nigeria
Phone: 234 803 338 2623
Fax: 215 252 5140

MANUFACTURING FACILITIES

San Antonio, Texas USA
Big Spring, Texas USA
Wichita, Kansas USA
Little Rock, Arkansas USA
Sand Springs, Oklahoma USA
Harbin, China
Suzhou, China

Headquarters

2425 SW 36th Street
San Antonio, Texas 78237
USA
Phone: 210 434 5043
Fax: 210 434 7543

Downhole Solutions

Drilling Solutions

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