Red Thread™ HP 16 Product Data

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

Red Thread HP 16 pipe is manufactured by the filament winding process using aromatic amine-cured epoxy thermosetting resin to impregnate strands of continuous glass filaments. The pipe is rated to 232 psig in accordance with API 15LR, 20 year design life at 200°F (93°C), serviceable up to 210°F (99°C) by applying a derating factor of 0.92 to all component ratings.

ASTM D-2996 Classification: RTRP-11AW1-3110 for static design basis.

Fittings

Fittings are manufactured with the same chemical and temperature capabilities as the pipe. Depending on the configurations and size, the fittings construction method will be compression molded, contact molded, fabricated or filament wound. Fittings details are in two documents; use CI1350 for sizes 2”-16” and CI1351 for 18”-42”. All fittings may not have the same pressure rating as the pipe. System rating is governed by the lowest rated component used.

Joining Systems

T.A.B.™

In sizes 2”-6”, pipe and couplings are supplied with a threaded and bonded (T. A. B) joining system. Double-lead threads provide quick secure adhesive connections during installation.

Bell & Spigot

The pipe and fittings are joined using the bell and spigot connection. Pipe is supplied with one end belled (integral bell or factory-bonded coupling) and one end tapered in sizes 8”-42”.

For 8”-42” sizes, the matched tapered joining method is used and the pipe is available in random 12 meter (40 feet) lengths.

Epoxy adhesive is used to secure the joint.

Flanged

Flanged connections are available for all components and diameters.

Nominal Dimensional Data

Pipe Size		I.D.		O.D.		Minimum Reinforced Wall Thickness		Weight		Capacity	
in	mm	in	mm	in	mm	in	mm	Lbs/ft	kg/m	gal/ft)	ft^3/ft
2[1]	50	2.238	57	2.371	60	0.058	1.47	0.4	0.63	0.20	0.03
3[1]	80	3.363	85	3.559	87	0.086	2.18	0.9	1.37	0.46	0.06
4[2]	100	4.364	111	4.553	116	0.083	2.11	1.1	1.64	0.78	0.10
6[2]	150	6.408	163	6.686	169	0.122	3.10	2.4	3.68	1.68	0.22
8	200	8.356	212	8.642	219	0.127	3.23	3.3	4.91	2.85	0.38
10	250	10.36	263	10.71	272	0.156	3.96	5.1	7.59	4.38	0.59
12	300	12.28	312	12.70	323	0.185	4.70	7.2	10.7	6.16	0.82
14	350	14.03	356	14.57	370	0.238	6.05	10.6	15.8	8.03	1.07
16	400	16.03	407	16.65	423	0.272	6.91	13.8	20.5	10.5	1.40
18	450	17.82	453	18.45	468	0.277	7.04	16.4	24.4	13.0	1.73
20	500	19.83	504	20.48	520	0.286	7.26	18.8	28.0	16.0	2.15
24	600	23.83	605	24.59	625	0.334	8.48	26.4	39.3	23.2	3.10
30	750	30.03	763	31.01	788	0.430	10.9	42.8	63.7	36.8	4.92
36	900	36.03	915	37.20	945	0.510	13.0	60.8	90.5	53.0	7.08
42[3]	1050	42.03	1068	43.402	1102	0.600	15.24	83.5	124.3	72.1	9.64

[1] Minimum reinforced wall thickness exceeds the requirement for the 16 Bar class and may be operated up to 30 Bar(435 psi).
[2] Minimum reinforced wall thickness exceeds the requirement for the 16 Bar class and may be operated up to 25 Bar(362 psi).
[(3)]Qualified for16 Bar class, see fittings ratings in CI1351 for exceptions.

NOV Fiber Glass Systems

Typical Mechanical Properties

Property		75°F psi	24°C MPa	200°F psi	93°C MPa
Axial Tensile - ASTM D2105					
Ultimate Stress		9,530	65.7	6,585	45.4
Modulus of Elasticity		1.68×10^6	11,583	1.42×10^6	9,791
Poisson's Ratio [4] ν_{ah} (ν_{ha})				0.35 (0.61)	
Axial Compression - ASTM D695					
Ultimate Stress		12,510	86.3	8,560	59.0
Modulus of Elasticity		0.68×10^6	4,688	0.38×10^6	2,620
Beam Bending - ASTM D2925					
Ultimate Stress		20,200	139.3	15,400	106.2
Modulus of Elasticity (Long Term)		2.60×10^6	17,927	0.72×10^6	4,964
Hydrostatic Burst - ASTM D1599					
Ultimate Hoop Tensile Stress		40,150	276.8	36,480	251.5
Hydrostatic Design - ASTM D2992, Procedure B - Hoop Tensile Stress					
Static 20 Year Life	LTHS - 95% LCL			18,203 - 14,689	125.5 - 101.3
Static 50 Year Life	LTHS - 95% LCL			16,788 -13,142	115.7 - 90.6
Parallel Plate - ASTM D 2412					
Hoop Modulus of Elasticity		3.02×10^6	20,822		

Typical Physical Properties

Thermal Expansion Coefficient - ASTM D696	8.5×10^{-6} in/in/°F	15.3×10^{-6} 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 in	0.0053 mm
Manning's Roughness Coefficient, N	0.009	

[1] The differential pressure between internal and external pressure which causes collapse.

[2] A 0.67 design factor is recommended for short duration vacuum service. A full vacuum is equal to 14.7 psig (0.101 MPa) differential pressure at sea level.

[3] A 0.33 design factor is recommended for sustained (long-term) differential collapse pressure design and operation.

[4] ν_{ha} = The ratio of axial strain to hoop strain resulting from stress in the hoop direction.
ν_{ah} = The ratio of hoop strain to axial strain resulting from stress in the axial direction.

Ultimate Collapse Pressure

Size		Collapse Pressure[1,2,3]			
		psig		MPa	
in	mm	75°F	200°F	24°C	93°C
2	50	177	133	1.22	0.92
3	80	171	129	1.18	0.89
4	100	69	51	0.48	0.35
6	150	69	51	0.48	0.35
8	200	29	20	0.20	0.14
10	250	27	20	0.19	0.13
12	300	27	20	0.19	0.14
14	350	45	33	0.31	0.23
16	400	45	33	0.31	0.23
18	450	31	23	0.22	0.16
20	500	23	16	0.16	0.11
24	600	20	14	0.14	0.10
30	800	21	15	0.14	0.10
36	900	21	15	0.14	0.10
42	1050	21	15	0.14	0.10

Supports

The following engineering analysis must be performed to determine the maximum support spacing for the piping system. Proper pipe support spacing depends on the temperature and weight of the fluid carried in the pipe. The support spacing is calculated using continuous beam equations and the pipe bending modulus derived from long-term beam bending tests. The following tables were developed to ensure a design that limits beam mid-span deflection to ½ inch and bending stresses to less than or equal to 1/8 of the ultimate bending stress. Any additional weight on the piping system such as insulation or heat tracing requires further consideration. Restrained (anchored) piping systems operating at elevated temperatures often result in guide spacing requirements that are more stringent than simple unrestrained piping systems. In this case, the maximum guide spacing will dictate the support/guide spacing requirements for the system. Pipe support spans at changes in direction require special attention. Supported and unsupported fittings at changes in direction are considered in the following tables and must be followed to properly design the piping system.

Maximum Support Spacing for Uninsulated Pipe[1]

Size		Continuous Spans of Pipe[2]			
		ft		m	
in	mm	75°F	200°F	24°C	93°C
2	50	13.9	10.1	4.25	3.08
3	80	17.0	12.3	5.19	3.76
4	100	18.1	13.1	5.54	4.02
6	150	22.0	15.9	6.70	4.86
8	200	23.9	17.3	7.28	5.28
10	250	26.5	19.2	8.09	5.86
12	300	28.9	20.9	8.81	6.39
14	350	31.7	23.0	9.67	7.01
16	400	33.9	24.6	10.3	7.49
18	450	35.0	25.4	10.6	7.73
20	500	36.3	26.3	11.0	8.02
24	600	39.6	28.7	12.0	8.73
30	800	44.6	32.4	13.6	9.85
36	900	48.7	35.3	14.8	10.7
42	1050	52.7	38.2	16.1	11.7

(1) Consult manufacturer for heavier insulated pipe support spacing.
(2) Max. mid span deflection ½" (12.7 mm) with specific gravity 1.0.

Support Spacing vs. Specific Gravity

Specific Gravity	2.00	1.50	1.25	1.00	0.75
Multiplier	0.85	0.91	0.95	1.00	1.06

Example: 18" pipe @ 75°F (23.9°C) with 1.5 specific gravity fluid, maximum support spacing = 35.0 x 0.91 = 31.85 ft. (9.71 m)

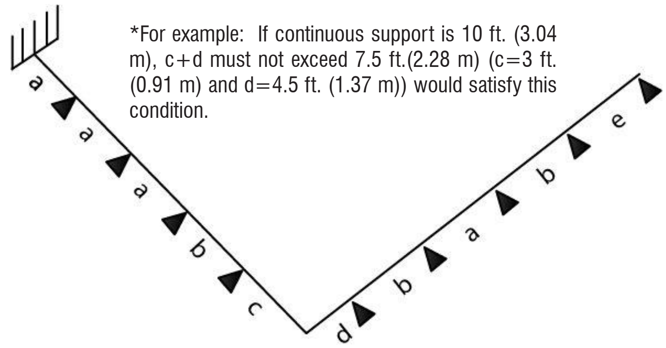
There are seven basic rules to follow when designing piping system supports, anchors, and guides:

1. Do not exceed the recommended support span.
2. Support valves and heavy in-line equipment independently. This applies to both vertical and horizontal piping.
3. Protect pipe from external abrasion.
4. Avoid point contact loads
5. Avoid excessive bending. This applies to handling. transporting, initial layout, and final installed position.
6. Avoid excessive vertical run loading. Vertical loads should be supported sufficiently to minimize bending stresses at outlets or changes in direction.
7. Provide adequate axial and lateral restraint to ensure line stability during rapid changes in flow.

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

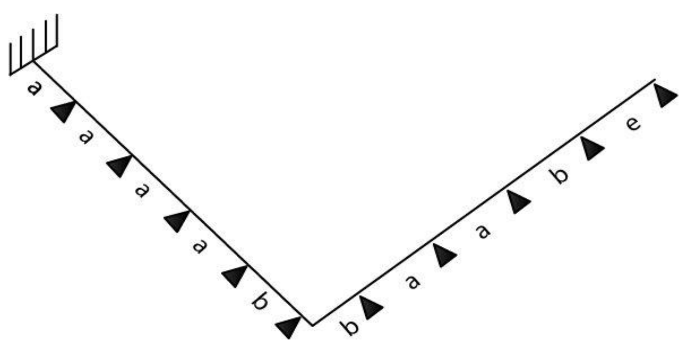
	Span Type	Factor
a	Continuous interior or fixed end spans	1.00
b	Second span from supported end or unsupported fitting	0.80
c+d	Sum of unsupported spans at fitting	≤0.75*
e	Simple supported end span	0.67

*For example: If continuous support is 10 ft. (3.04 m), c+d must not exceed 7.5 ft.(2.28 m) (c=3 ft. (0.91 m) and d=4.5 ft. (1.37 m)) 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' ENG1000 "Engineering and Piping Design Guide", Section 3.

Change in Temperature °F	Pipe Change in Length (In/100 Ft)
25	0.26
50	0.51
75	0.77
100	1.02
125	1.28

Testing

Hydrostatic testing is recommended to evaluate the integrity of all new piping installations. For systems operating below the system rating, a test pressure of 1.5 times the system operating pressure is recommended; however, the maximum test pressure must not exceed 1.3 times the lowest pressure rated fiberglass component in the piping system.

The hydro test pressure should be repeated up to ten cycles from 0 psig to the test pressure 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 high-point vents (if used) 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 hydro test, relieve the pressure on the system slowly, open vents and any drains to allow for complete drainage of the system.

Water Hammer

Piping systems may be damaged by pressure surges due to water hammer. The use of soft start pumps and slow actuating valves will reduce the magnitude of surge pressures during operation and are highly recommended.

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