

# Bondstrand™ 2400 Series

Product Data - Glassfiber Reinforced Epoxy (GRE) pipe systems



## Applications

- Potable Water
- Cooling Water
- Produced Water
- Fire Water (FM Approved)
- Waste Water
- Salt Water
- Crude Oil & Gas
- Brine Solutions
- Drainage
- Sewage
- CO<sub>2</sub>
- General Service for Mildly Corrosive Liquids

## Materials and Characteristics

Filament wound Glassfiber Reinforced epoxy (GRE) pipe with an integral Taper female x shaved spigot adhesive bonded joint or Key-Lock integral female x male mechanical joint

- Laminate meets requirements of API Specification 15LR and ISO 14692.
- Pipe wall design based on hydrostatic design basis (Procedure B) with a 0.5 service factor.
- Maximum operating temperature: 200°F (93°C). Temperatures up to 250°F (121°C) are possible. Consult NOV Fiber Glass Systems.
- Pipe sizes: 2 - 40 inch (50 - 1000 mm).
- Standard pressure rating up to 725 psi (50 bar). Higher pressure ratings are possible. Consult NOV Fiber Glass Systems.
- ASTM D-2310 classification: RTRP-11AW for conductive pipe and RTRP-11FW for non-conductive pipe.
- Non-conductive pipe has a standard liner thickness of 0.5 mm. Conductive pipe has no liner.

## Joining Systems

### Fittings

Filament wound Glassfiber Reinforced epoxy (GRE) fittings with integral taper female bell ends. A wide range of fittings is available.

### Flanges

Filament wound GRE heavy duty and stub end flanges with integral taper female bell end are available. Standard flange drilling pattern per ASME B16.5 and B16.47A, Class 150 are available. Other drilling patterns, such as Class 300, DIN and JIS are available.

For dimensional data and standard configurations for fittings, refer to the respective fitting guides. Optionally, the system can be supplied conductive (Bondstrand 2400C) or with fireproofing (Bondstrand 2400FP).

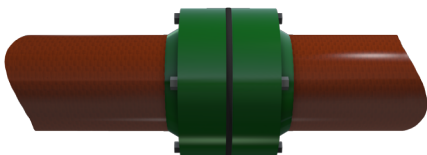
## Pipe Lengths

From 2 - 6 inch (50 - 150 mm), 9 m random length

From 8 - 40 inch (200 - 1000 mm), 11.89 m random length

**Note:** Overall pipe length depends on size, end configuration and production location.

View of Joint Illustrations



Flanged

## Total Wall Thickness & Inner Diameter

Pipe Size		Inside Diameter		Pressure Class																	
				2410		2412		2414		2416		2420		2425		2432		2440		2450	
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
2	50	2.09	53.2	0.09	2.3	0.09	2.3	0.09	2.3	0.09	2.3	0.09	2.3	0.09	2.3	0.09	2.3	0.11	2.8	0.13	3.3
3	80	3.22	81.8	0.09	2.3	0.09	2.3	0.09	2.3	0.09	2.3	0.09	2.3	0.11	2.7	0.12	3.1	0.15	3.9	0.19	4.7
4	100	4.14	105.2	0.09	2.3	0.09	2.3	0.09	2.3	0.10	2.5	0.11	2.7	0.13	3.3	0.15	3.9	0.19	4.9	0.23	5.9
6	150	6.20	159.0	0.10	2.5	0.11	2.7	0.12	3.0	0.13	3.4	0.15	3.8	0.18	4.6	0.22	5.6	0.28	7.0	0.34	8.7
8	200	8.22	208.8	0.12	3.1	0.13	3.2	0.15	3.7	0.17	4.2	0.19	4.8	0.23	5.8	0.28	7.2	0.36	9.1	0.44	11.2
10	250	10.35	262.9	0.14	3.5	0.15	3.9	0.18	4.5	0.20	5.1	0.23	5.8	0.28	7.2	0.35	8.8	0.44	11.2	0.54	13.8
12	300	12.35	313.7	0.15	3.9	0.18	4.5	0.21	5.3	0.24	6.0	0.27	6.8	0.33	8.4	0.41	10.4	0.53	13.4	0.65	16.6
14	350	13.56	344.4	0.16	4.1	0.19	4.8	0.22	5.7	0.26	6.6	0.29	7.4	0.36	9.2	0.45	11.4	0.57	14.5	0.72	18.2
16	400	15.50	393.7	0.18	4.5	0.22	5.5	0.25	6.4	0.29	7.4	0.33	8.4	0.41	10.5	0.51	12.9	0.61	15.6	0.81	20.7
18	450	17.08	433.8	0.19	4.9	0.24	6.0	0.28	7.0	0.32	8.1	0.36	9.2	0.45	11.5	0.56	14.2	0.72	18.2	-	-
20	500	18.98	482.1	0.21	5.4	0.26	6.6	0.30	7.7	0.35	8.9	0.40	10.1	0.50	12.7	0.62	15.7	0.79	20.1	-	-
24	600	22.76	578.6	0.25	6.3	0.30	7.7	0.37	9.3	0.42	10.6	0.48	12.1	0.59	15.1	0.74	18.8	0.94	24.0	-	-
28	700	17.56	700	0.29	7.4	0.36	9.1	0.43	10.8	0.50	12.6	0.56	14.3	0.70	17.9	0.88	22.3	-	-	-	-
30	750	29.53	750	0.31	7.9	0.38	9.7	0.46	11.6	0.53	13.5	0.60	15.3	0.75	19.1	0.94	23.9	-	-	-	-
32	800	31.50	800	0.33	8.4	0.41	10.3	0.48	12.3	0.56	14.3	0.64	16.3	0.80	20.4	1.00	25.5	-	-	-	-
36	900	35.43	900	0.37	9.3	0.45	11.5	0.54	13.7	0.63	16.1	0.72	18.2	0.90	22.8	1.12	28.5	-	-	-	-
40	1000	39.37	1000	0.41	10.3	0.50	12.8	0.60	15.3	0.70	17.8	0.80	20.3	0.98	24.8	-	-	-	-	-	-

**Note:**

- (1) Pipe wall thickness measured according to NOV Fiber Glass Systems' procedure.  
(2) Total pipe wall thickness includes 0.5 mm liner for non-conductive pipe.

## External Pressure (Ultimate Collapse Pressure at 21°C / 70°F)

Pipe Size		Pressure Class																			
		2410		2412		2414		2416		2420		2425		2432		2440		2450			
in	mm	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar
2	50	269.8	18.6	269.8	18.6	269.8	18.6	269.8	18.6	269.8	18.6	269.8	18.6	269.8	18.6	546.8	37.7	961.6	66.3		
3	80	76.9	5.3	76.9	5.3	76.9	5.3	76.9	5.3	76.9	5.3	137.8	9.5	224.8	15.5	488.8	33.7	894.9	61.7		
4	100	36.3	2.5	36.3	2.5	36.3	2.5	49.3	3.4	66.7	4.6	133.4	9.2	236.4	16.3	497.5	34.3	894.9	61.7		
6	150	14.5	1.0	18.9	1.3	29.0	2.0	43.5	3.0	65.3	4.5	121.8	8.4	230.6	15.9	465.6	32.1	906.5	62.5		
8	200	14.5	1.0	16.0	1.1	26.1	1.8	40.6	2.8	63.8	4.4	116.0	8.0	230.6	15.9	475.7	32.8	890.5	61.4		
10	250	11.6	0.8	16.0	1.1	26.1	1.8	39.2	2.7	59.5	4.1	117.5	8.1	220.5	15.2	459.8	31.7	896.3	61.8		
12	300	10.2	0.7	16.0	1.1	26.1	1.8	39.2	2.7	58.0	4.0	114.6	7.9	220.5	15.2	474.3	32.7	894.9	61.7		
14	350	8.7	0.6	14.5	1.0	24.7	1.7	40.6	2.8	58.0	4.0	114.6	7.9	221.9	15.3	467.0	32.2	897.8	61.9		
16	400	7.3	0.5	14.5	1.0	24.7	1.7	39.2	2.7	58.0	4.0	117.5	8.1	219.0	15.1	387.3	26.7	903.4	62.3		
18	450	7.3	0.5	14.5	1.0	24.7	1.7	39.2	2.7	58.0	4.0	116.0	8.0	220.5	15.2	462.7	31.9	-	-		
20	500	7.3	0.5	14.5	1.0	24.7	1.7	39.2	2.7	56.6	3.9	116.0	8.0	219.0	15.1	458.3	31.6	-	-		
24	600	7.3	0.5	14.5	1.0	26.1	1.8	39.2	2.7	58.0	4.0	114.6	7.9	221.9	15.3	-	-	-	-		
28	700	7.3	0.5	13.1	0.9	23.2	1.6	37.7	2.6	55.1	3.8	110.2	7.6	211.8	14.6	-	-	-	-		
30	750	7.3	0.5	13.1	0.9	23.2	1.6	37.7	2.6	55.1	3.8	108.8	7.5	213.2	14.7	-	-	-	-		
32	800	7.3	0.5	13.1	0.9	23.2	1.6	37.7	2.6	56.6	3.9	110.2	7.6	213.2	14.7	-	-	-	-		
36	900	7.3	0.5	13.1	0.9	23.2	1.6	37.7	2.6	55.1	3.8	108.8	7.5	211.8	14.6	-	-	-	-		
40	1000	7.3	0.5	14.5	1.0	23.2	1.6	37.7	2.6	56.6	3.9	108.8	7.5	-	-	-	-	-	-		

**Stiffness Factor per ASTM D2412 @21°C (@70°F)**

Pipe Size		Pressure Class																	
		2410		2412		2414		2416		2420		2425		2432		2440		2450	
in	mm	lb•in	N•m	lb•in	N•m	lb•in	N•m	lb•in	N•m	lb•in	N•m	lb•in	N•m	lb•in	N•m	lb•in	N•m	lb•in	N•m
2	50	114	13	114	13	114	13	114	13	114	13	114	13	114	13	238	27	429	49
3	80	114	13	114	13	114	13	114	13	114	13	208	24	344	39	768	87	1448	165
4	100	114	13	114	13	114	13	156	18	208	24	429	49	768	87	1665	190	3078	350
6	150	156	18	208	24	305	35	477	54	702	80	1347	153	2593	295	5368	611	10777	1227
8	200	344	39	385	44	640	73	990	113	1554	177	2910	331	5879	669	12432	1415	23944	2726
10	250	528	60	768	87	1251	142	1902	217	2910	331	5879	669	11176	1272	23944	2726	48089	5474
12	300	768	87	1251	142	2162	246	3252	370	4887	556	9637	1097	18965	2159	41958	4776	81568	9286
14	350	912	104	1554	177	2748	313	4436	505	6421	731	12871	1465	25312	2881	54790	6237	108384	12338
16	400	1251	142	2443	278	4014	457	6421	731	9637	1097	19545	2225	37266	4242	67294	7661	158981	18107
18	450	1665	190	3252	370	5368	611	8580	977	12871	1465	26015	2961	50258	5721	108384	12338	-	-
20	500	2299	262	4436	505	7295	830	11585	1319	17293	1969	35491	4040	68640	7814	147168	16753	-	-
24	600	3814	434	7295	830	13320	1516	20138	2292	30508	3473	60828	6925	119784	13636	-	-	-	-
28	700	6421	731	12432	1415	21358	2431	34626	3942	51367	5847	102966	11721	202495	23052	-	-	-	-
30	750	7920	902	15220	1733	26731	3043	42941	4888	63362	7213	125772	14318	250433	28509	-	-	-	-
32	800	9537	1097	18396	2094	32114	3656	51367	5847	77093	8776	154029	17534	305397	34766	-	-	-	-
36	900	13320	1516	26015	2961	44954	5117	72785	8286	108384	12338	216750	24674	429060	48843	-	-	-	-
40	1000	17612	2094	36371	4140	63362	7213	101200	11520	151719	17271	301810	33938	-	-	-	-	-	-

**Pipe Stiffness per ASTM D2412 @21°C (@70°F)**

Pipe Size		Pressure Class																	
		2410		2412		2414		2416		2420		2425		2432		2440		2450	
in	mm	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar
2	50	602.8	41.6	602.8	41.6	602.8	41.6	602.8	41.6	602.8	41.6	602.8	41.6	602.8	41.6	1223.8	84.4	2149.5	148.2
3	80	171.6	11.8	171.6	11.8	171.6	11.8	171.6	11.8	171.6	11.8	308.9	21.3	502.7	34.7	1092.8	75.3	2003.0	138.1
4	100	81.9	5.6	81.9	5.6	81.9	5.6	111.7	7.7	147.8	10.2	299.7	20.7	527.7	36.4	1112.6	76.7	2001.4	138.0
6	150	33.0	2.3	43.7	3.0	63.8	4.4	98.8	6.8	144.5	10.0	273.2	18.8	516.2	35.6	1041.8	71.8	2028.4	139.9
8	200	32.0	2.2	35.8	2.5	59.1	4.1	90.8	6.3	141.3	9.7	260.9	18.0	516.8	35.6	1064.5	73.4	1991.9	137.3
10	250	24.7	1.7	35.8	2.5	57.9	4.0	87.4	6.0	132.7	9.1	263.9	18.2	492.9	34.0	1028.6	70.9	2003.6	138.1
12	300	21.2	1.5	34.3	2.4	58.9	4.1	88.0	6.1	131.2	9.0	254.9	17.6	492.4	33.9	1059.6	73.1	2000.5	137.9
14	350	19.0	1.3	32.2	2.2	56.6	3.9	90.6	6.2	130.3	9.0	257.2	17.7	496.5	34.2	1046.2	72.1	2008.4	138.5
16	400	17.5	1.2	33.9	2.3	55.3	3.8	87.9	6.1	130.9	9.0	261.4	18.0	489.5	33.7	866.6	59.7	1960.0	135.2
18	450	17.4	1.2	33.7	2.3	55.3	3.8	87.8	6.1	130.7	9.0	260.1	17.9	493.4	34.0	1036.0	71.4	-	-
20	500	17.5	1.2	33.5	2.3	54.8	3.8	86.4	6.0	128.0	8.8	258.5	17.8	491.0	33.9	1025.3	70.7	-	-
24	600	16.8	1.2	31.9	2.2	57.8	4.0	86.8	6.0	130.6	9.0	256.4	17.7	495.5	34.2	-	-	-	-
28	700	16.0	1.1	30.7	2.1	52.4	3.6	84.4	5.8	124.3	8.6	245.4	16.9	473.7	32.7	-	-	-	-
30	750	16.0	1.1	30.6	2.1	53.3	3.7	85.1	5.9	124.6	8.6	243.7	16.8	476.3	32.8	-	-	-	-
32	800	16.1	1.1	30.5	2.1	52.8	3.6	83.9	5.8	124.9	8.6	245.9	17.0	478.5	33.0	-	-	-	-
36	900	15.6	1.1	30.3	2.1	51.9	3.6	83.5	5.8	123.4	8.5	243.1	16.8	472.3	32.6	-	-	-	-
40	1000	15.7	1.1	30.8	2.1	53.3	3.7	84.6	5.8	125.9	8.7	244.2	16.8	-	-	-	-	-	-

## Single Span Lengths

Pipe Size		Pressure Class																	
		2410		2412		2414		2416		2420		2425		2432		2440		2450	
in	mm	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
2	50	9.2	2.8	9.2	2.8	9.2	2.8	9.2	2.8	9.2	2.8	9.2	2.8	9.2	2.8	9.8	3.0	10.2	3.1
3	80	10.5	3.2	10.5	3.2	10.5	3.2	10.5	3.2	10.5	3.2	10.8	3.3	11.5	3.5	12.1	3.7	12.8	3.9
4	100	11.2	3.4	11.2	3.4	11.2	3.4	11.5	3.5	11.8	3.6	12.5	3.8	13.1	4.0	13.8	4.2	14.4	4.4
6	150	12.8	3.9	13.1	4.0	13.5	4.1	14.1	4.3	14.4	4.4	15.1	4.6	16.1	4.9	16.7	5.1	17.7	5.4
8	200	14.8	4.5	14.4	4.4	15.4	4.7	16.1	4.9	16.4	5.0	17.4	5.3	18.4	5.6	19.4	5.9	20.3	6.2
10	250	15.4	4.7	16.1	4.9	17.4	5.3	17.7	5.4	18.4	5.6	22.6	6.9	20.3	6.2	21.7	6.6	22.6	6.9
12	300	16.1	4.9	17.4	5.3	18.7	5.7	19.4	5.9	20.0	6.1	21.3	6.5	22.3	6.8	23.6	7.2	24.9	7.6
14	350	16.4	5.0	17.7	5.4	19.7	6.0	20.3	6.2	21.0	6.4	22.3	6.8	23.3	7.1	24.6	7.5	25.9	7.9
16	400	17.1	5.2	19.4	5.9	21.0	6.4	21.7	6.6	22.6	6.9	23.6	7.2	24.9	7.6	25.9	7.9	27.8	8.5
18	450	17.7	5.4	20.3	6.2	22.0	6.7	23.0	7.0	23.6	7.2	24.9	7.6	26.2	8.0	27.9	8.5	-	-
20	500	19.0	5.8	21.3	6.5	23.3	7.1	23.9	7.3	24.9	7.6	26.2	8.0	27.6	8.4	29.2	8.9	-	-
24	600	20.3	6.2	23.0	7.0	25.6	7.8	26.6	8.1	27.2	8.3	28.9	8.8	30.2	9.2	32.2	9.8	-	-
28	700	22.0	6.7	24.9	7.6	27.6	8.4	28.9	8.8	29.9	9.1	31.5	9.6	33.1	10.1	-	-	-	-
30	750	23.0	7.0	25.9	7.9	28.5	8.7	30.2	9.2	30.8	9.4	32.5	9.9	34.4	10.5	-	-	-	-
32	800	23.6	7.2	26.6	8.1	29.5	9.0	30.8	9.4	31.8	9.7	33.8	10.3	35.4	10.8	-	-	-	-
36	900	24.9	7.6	28.2	8.6	31.2	9.5	32.8	10.0	33.8	10.3	35.8	10.9	37.7	11.5	-	-	-	-
40	1000	26.2	8.0	29.9	9.1	33.1	10.1	34.8	10.6	35.8	10.9	37.4	11.4	-	-	-	-	-	-

## Continuous Span Lengths

Pipe Size		Pressure Class																	
		2410		2412		2414		2416		2420		2425		2432		2440		2450	
in	mm	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
2	50	13.8	4.2	13.8	4.2	13.8	4.2	13.8	4.2	13.8	4.2	13.8	4.2	13.8	4.2	14.8	4.5	15.4	4.7
3	80	15.7	4.8	15.7	4.8	15.7	4.8	15.7	4.8	15.7	4.8	16.4	5.0	17.1	5.2	18.0	5.5	19.0	5.8
4	100	16.7	5.1	16.7	5.1	16.7	5.1	17.1	5.2	17.7	5.4	18.7	5.7	19.4	5.9	20.7	6.3	21.3	6.5
6	150	19.0	5.8	19.7	6.0	20.3	6.2	21.0	6.4	21.7	6.6	22.6	6.9	23.9	7.3	25.3	7.7	26.6	8.1
8	200	22.0	6.7	22.0	6.7	23.0	7.0	23.9	7.3	24.6	7.5	25.9	7.9	27.2	8.3	28.9	8.8	30.2	9.2
10	250	23.9	7.3	24.9	7.6	25.9	7.9	26.6	8.1	27.6	8.4	29.2	8.9	30.5	9.3	32.2	9.8	33.8	10.3
12	300	25.9	7.9	26.9	8.2	28.2	8.6	29.2	8.9	30.2	9.2	31.8	9.7	33.5	10.2	35.4	10.8	37.1	11.3
14	350	26.9	8.2	28.2	8.6	29.5	9.0	30.5	9.3	31.5	9.6	33.1	10.1	35.1	10.7	37.1	11.3	38.7	11.8
16	400	28.5	8.7	30.2	9.2	31.5	9.6	32.5	9.9	33.8	10.3	35.4	10.8	37.4	11.4	39.0	11.9	41.8	12.7
18	450	30.2	9.2	31.8	9.7	33.1	10.1	34.1	10.4	35.4	10.8	37.4	11.4	39.0	11.9	41.3	12.6	-	-
20	500	31.8	9.7	33.5	10.2	34.8	10.6	36.1	11.0	37.1	11.3	39.4	12.0	41.3	12.6	43.6	13.3	-	-
24	600	34.8	10.6	36.4	11.1	38.4	11.7	39.4	12.0	40.7	12.4	43.0	13.1	45.3	13.8	47.9	14.6	-	-
28	700	38.1	11.6	40.0	12.2	41.7	12.7	43.3	13.2	44.6	13.6	47.2	14.4	49.5	15.1	-	-	-	-
30	750	39.4	12.0	41.3	12.6	43.3	13.2	44.9	13.7	46.3	14.1	48.9	14.9	51.5	15.7	-	-	-	-
32	800	40.7	12.4	42.7	13.0	44.6	13.6	46.3	14.1	47.9	14.6	50.5	15.4	53.1	16.2	-	-	-	-
36	900	43.0	13.1	45.3	13.8	47.2	14.4	49.2	15.0	50.5	15.4	53.5	16.3	56.4	17.2	-	-	-	-
40	1000	45.3	13.8	47.9	14.6	49.9	15.2	51.8	15.8	53.5	16.3	56.4	17.2	-	-	-	-	-	-

Note: Span lengths are at 21°C (70°F).

## Typical Mechanical Properties

Pipe Property	70°F	21°C	200°F	93°C	Method
	psi	N/mm <sup>2</sup>	psi	N/mm <sup>2</sup>	
<b>Hydrostatic Design Basis</b>	23,351	161 <sup>(1)</sup>	17,549	121	ASTM D2992, Proc. B (20 ans)
<b>Ultimate Hoop Stress at Weeping</b>	40,610	280	48,442	334	ASTM D1599
<b>Circumferential</b>					
Hoop Tensile Modulus	3.87 x 10 <sup>6</sup>	26,700	2.36 x 10 <sup>6</sup>	16,300	ASTM D2290
Poisson's Ratio $\nu_{ha}$ <sup>(2)</sup>	0.61		0.80		NOV FGS
<b>Longitudinal</b>					
Axial Tensile Strength	11,603	80	9,427	65	ASTM D2105
Axial Strength Modulus	2.24 x 10 <sup>6</sup>	15,500	1.24 x 10 <sup>6</sup>	8,550	ASTM D2105
Poisson's Ratio, $\nu_{ha}$ <sup>(3)</sup>	0.35		0.42		ASTM D2105
Axial Bending Strength	12,328	85		-	NOV FGS
Axial Bending Modulus	2.24 x 10 <sup>6</sup>	15,500	1.43 x 10 <sup>6</sup>	9,900	ASTM D2925
Shear Modulus	1.75 x 10 <sup>6</sup>	12,100	1.66 x 10 <sup>6</sup>	11,500	NOV FGS

## Typical Physical Properties

Pipe Property	Value	Value	Method
Thermal Conductivity Pipe Wall	0.19 BTU/hr·ft·°F	0.33 W/m°C	NOV FGS
Thermal Expansion	12.0 x 10 <sup>-6</sup> in/in °F	21.6 x 10 <sup>-6</sup> mm/mm °C	ASTM D696
Flow Efficient, Hazen Williams	150		-
Absolute Roughness	17.0 x 10 <sup>-6</sup> ft	5.3 x 10 <sup>-6</sup> m	-
Density	112.4 lb/ft <sup>3</sup>	1800 kg/m <sup>3</sup>	-
Specific Gravity	1.8		ASTM D792
Specific Heat	0.22 BTU/lb °F	910 J/kg °C	-
Grounding Resistance @ 500 Volt-Pipe	<0.3 x 10 <sup>-6</sup> Ohm.ft	<1 x 10 <sup>-6</sup> Ohm/m	ASTM D257
Grounding Resistance @ 500 Volt-Ftg.	<1 x 10 <sup>-6</sup> Ohm/pc	<1 x 10 <sup>-6</sup> Ohm/pc	ASTM D257
Shielding Capability	100 Volt		-

<sup>(1)</sup> value obtained at 65°C

<sup>(2)</sup>  $\nu_{ha}$  = The ratio of axial strain to hoop strain resulting from stress in the hoop direction.

<sup>(3)</sup>  $\nu_{ah}$  = The ratio of hoop strain to axial strain resulting from stress in the axial direction.

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