Fiberglass Epoxy GRE Integral Joint Tubing

Applications

- ***Production Wells***
- ***Injection Wells***
- ***Saltwater Disposal Wells***
- ***Chemical Disposal Wells***
- ***Water Source Wells***
- ***Solution Mining***
- ***Riser Mains***

Centron® tubing is precision wound on state-of-the-art computer controlled equipment. The advanced filament-wound construction provides the high axial modulus and tensile strength required for downhole applications. NOV Fiber Glass Systems' quality system is certified to API Specification Q1 and ISO 9001, assuring customers of the highest quality products in the industry.

Connection System

Centron Downhole Tubing is available in two threaded connection systems:

1. Centron's proprietary 4 threads per inch connection (DH) features the multiple seal capability and reliability of both thread and O-ring seals along with outstanding tensile strength across-the-joint. The connection system prevents thread lubricant/sealant from entering the formation in injection service minimizing formation damage.
2. Adapters to the API 8rd EUE long thread per API specification 5B, Table 14 and Table 7 (tolerances per API Specification 15HR).

Both thread forms are available in patented PeNG (Premium Non-Galling) Female Carbon Thread for ease of make-up and breakout required in downhole applications.

Advantages

- About 1/4 the weight of steel
- Assemble in any weather—no adhesives required
- Superior flow characteristics
- Coarse threads—no cross threading
- Excellent corrosion resistance and long service life
- Exceptional pressure and axial load capabilities
- Low installation costs
- Low paraffin and scale build-up
- Centron tubing can be installed using common oilfield tools

NOV Fiber Glass Systems manufactures a complete line of fiberglass surface pipe, line pipe, tubing, casing and associated fittings. See your distributor or call NOV Fiber Glass Systems for all your fiberglass tubular product needs.

Nominal Size		Pressure Rating	Static Pressure Rating - psi	Nominal O.D.		Nominal I.D.		Nominal Wall Thickness		Nominal Box O.D.		Weight	
in	mm	psi	150°F (65°C)	in	mm	in	mm	in	mm	in	mm	lbs./ft.	Kg/M
1 1/2	40	**DH2000**	1650	1.95	47.0	1.60	40.6	.175	4.45	2.95	74.9	0.93	1.38
		DH2500	2100	2.02	51.3	1.60	40.6	.210	5.33	3.05	77.5	1.15	1.74
		DH3000	2500	2.06	52.3	1.60	40.6	.230	5.84	3.15	80.0	1.30	1.94
		DH3500	2900	2.15	54.6	1.60	40.6	.275	6.99	3.25	82.6	1.63	2.43
2 3/8	60	**DH1500**	1250	2.31	58.7	1.95	49.5	.180	4.57	3.35	85.1	1.15	1.72
		DH2000	1650	2.39	60.7	1.95	49.5	.220	5.59	3.45	87.6	1.45	2.16
		DH2500	2100	2.50	63.5	1.95	49.5	.275	6.99	3.55	90.2	1.72	2.56
		DH3000	2500	2.57	65.3	1.95	49.5	.310	7.87	3.65	92.7	2.04	3.03
		DH3500	2900	2.61	66.3	1.95	49.5	.330	8.38	3.70	94.0	2.18	3.25
2 7/8	75	**DH1500**	1400	2.86	72.6	2.48	63.0	.190	4.83	4.00	102	1.55	2.31
		DH2000	1850	2.94	74.7	2.48	63.0	.230	5.84	4.20	107	1.85	2.76
		DH2500	2300	3.08	78.2	2.48	63.0	.300	7.62	4.40	112	2.40	3.58
		DH3000	2750	3.18	80.8	2.48	63.0	.350	8.89	4.50	114	2.80	4.18
3 1/2	90	**DH1200**	1100	3.36	85.3	2.98	75.7	.190	4.83	4.50	114	1.75	2.61
		DH1500	1400	3.44	87.4	2.98	75.7	.230	5.84	4.70	119	1.90	2.83
		DH2000	1850	3.54	89.9	2.98	75.7	.280	7.11	4.85	123	2.65	3.95
		DH2500	2300	3.60	91.4	2.98	75.7	.310	7.87	4.90	125	2.90	4.32
4 1/2	115	**DH1000**	900	4.38	111	3.98	101	.200	5.08	5.55	141	2.50	3.73
		DH1200	1100	4.44	113	3.98	101	.230	5.84	5.60	142	2.70	4.02
		DH1500	1400	4.56	116	3.98	101	.290	7.37	5.75	146	3.50	5.29
		DH2000	1650	4.72	120	3.98	101	.370	9.40	5.85	149	4.50	6.71
		DH2500	2100	4.84	147	3.98	101	.430	13.0	6.00	152	5.40	8.05

1. Joint length 29.5 feet (9.0M).
2. Make-up length 29.12 feet (8.88 M) for Centron 4rd tubing.
3. Axial Thread Loads: 1 1/2 – 35,000 lbs. (15,876 Kg)
2 3/8 – 50,000 lbs. (22,680 Kg)
2 7/8 – 60,000 lbs (27,200 Kg)
3 1/2 – 70,000 lbs. (31,750 Kg)
4 1/2 – 90,000 lbs. (40,800 Kg)

General Technical Data

Mill Test Pressure:	Operating Pressure x 1.25
Axial Tensile Strength:	30,000 PSI (207 MPa)
Axial Modulus of Elasticity:	2.96 x 10^6 PSI (2.04 x 10^4 MPa)
Hoop Modulus of Elasticity:	3.40 x 10^6 PSI (2.34 x 10^4 MPa)
Density:	0.07 lbs/in^3 (Sp. Gr.= 1.95)
Coefficient of Thermal Expansion:	1.0 x 10^{-5} in/in/°F (1.8 x 10^{-5} m/m/°C)
Hazen-Williams Flow Factor:	150
Poisson's Ratio (Hoop Tensile):	.30
Poisson's Ratio (Axial Tensile):	.21

Performance Properties (4rd)

RATED OPERATING VALUES									TYPICAL ULTIMATE VALUES							
Nominal Size		Pressure Rating	Internal [1] Operating Pressure		External Collapse Pressure		Axial Load x10		Short Term [2] Weep Pressure		External Collapse Pressure		Axial Wall Load x 10		Minimum Box O.D.	
in	mm	psi	psi	MPa	psi	MPa	lbs	N	psi	MPa	psi	MPa	lbs	N	in	mm
1 1/2	40	DH2000	2000	13.8	2500	17.2	7.0	32	5000	34.5	5000	34	29	129	2.67	67.9
		DH2500	2500	17.2	3000	20.7	9.0	40	5500	37.0	6200	42	36	160	2.73	69.5
		DH3000	3000	20.7	4000	28.0	10.0	44	6000	41.4	7500	52	44	195	2.78	70.7
		DH3500	3500	24.1	5000	34.0	12.0	53	6500	44.8	9000	62	52	240	2.87	73.0
2 3/8	60	DH1500	1500	10.3	1500	10.3	10.0	44	4500	31.0	4000	28	36	160	3.08	78.2
		DH2000	2000	13.8	2000	13.8	12.0	53	5500	34.5	5000	34	45	200	3.16	80.3
		DH2500	2500	17.2	2500	17.2	14.0	62	6000	37.9	6000	43	57	253	3.27	83.2
		DH3000	3000	20.7	3000	20.7	16.0	71	7000	41.4	7500	52	66	293	3.34	84.8
		DH3500	3500	24.1	3500	24.1	17.0	78	7500	44.8	9000	76	70	311	3.38	85.6
2 7/8	75	DH1500	1500	10.3	1500	10.3	12.0	53	4500	31.0	3600	24	55	245	3.68	93.5
		DH2000	2000	13.8	2000	13.8	15.0	67	5500	34.5	5000	34	71	316	3.76	95.5
		DH2500	2500	17.2	2500	17.2	20.0	89	6000	37.9	6000	41	85	378	3.90	99.0
		DH3000	3000	20.7	3000	20.7	22.0	98	6500	41.4	8000	55	96	427	4.00	101.6
3 1/2	90	DH1200	1200	8.3	800	5.5	14.0	62	3000	20.7	1500	10	60	255	4.28	108.7
		DH1500	1500	10.4	1000	6.9	16.9	71	4500	31.8	1800	12	76	338	4.36	111.0
		DH2000	2000	13.8	2000	13.8	21.0	93	5000	34.5	4500	31	92	409	4.46	113.3
		DH2500	2500	17.2	2500	17.2	26.0	116	5500	37.9	6800	47	109	485	4.52	114.8
4 1/2	115	DH1000	1000	6.9	400	2.8	20.0	89	3000	20.7	700	5	80	356	5.30	134.6
		DH1200	1200	8.3	700	5.0	22.0	98	3600	24.8	1000	6.9	99	440	5.36	136.1
		DH1500	1500	9.8	1100	7.6	28.0	124	4500	31.0	2200	15	120	534	5.48	139.2
		DH2000	2000	13.8	2000	13.8	36.0	160	5000	34.5	3600	25	136	605	5.64	143.2
		DH2500	2500	17.2	3000	17.2	42.0	187	5500	37.9	5000	34	150	667	5.76	146.3

1. Quasi-steady.
2. Unrestrained test.

Note: Centron Tubing can be used in many applications to 210˚F (99˚C). In all applications, chemical compatibility must be established and physical capabilities of the tubing for the expected conditions must be determined. Contact NOV Fiber Glass Systems for technical assistance. Rated operating pressures are at rated axial load.

DHL Light Duty Tubing

Centron® DHL Light Duty Tubing is designed for use in certain types of downhole applications such as gas lift wells and submersible pump operations.

Physical Specifications

Nominal Size		Pressure Rating	Nominal Inside Dia.		Nominal Outside Dia		Nominal Wall Thickness		Nominal Box O.D.		Weight		Volume
in	mm		in	mm	in	mm	in	mm	in	mm	lbs./ft.	kg/m	bbls/100 ft.
1 ½	40	DHL 1500	1.6	40.6	1.83	46.5	.115	2.92	2.85	72.4	0.69	1.03	.25
1 ½	40	DHL 1650	1.6	40.6	1.86	47.2	.130	3.30	2.90	73.7	0.78	1.16	.25
2 ⅜	50	DHL 1250	1.95	49.5	2.18	55.4	.115	2.92	3.30	83.8	0.78	1.16	.37
2 ⅜	50	DHL 1350	1.95	49.5	2.21	56.1	.130	3.30	3.35	85.1	0.88	0.94	.37
2 ⅞	63	DHL 1000	2.48	63.0	2.71	68.8	.115	2.92	4.00	102.0	0.99	0.99	.60

NOTE: Other pressure ratings are available on request.

RATED OPERATING VALUES									TYPICAL ULTIMATE VALUES					
Nominal Size		Pressure Rating	Internal Pressure		Collapse Pressure		Axial Load x 10^3		Internal Pressure		Collapse Pressure		Axial Load x 10^3	
in	mm		psi	MPa	psi	MPa	lbs.	kg	psi	MPa	psi	KPa	lbs.	KPa
1 ½	40	DHL 1500	1500	10.3	560	3.9	4.5	2.0	4500	31.0	1400	9.6	14.5	6.59
1 ½	40	DHL 1650	1650	11.33	625	4.35	5.2	2.3	4900	33.7	1550	10.6	16.9	7.68
2 ⅜	50	DHL 1250	1250	8.62	320	2.2	5.5	2.5	3750	25.8	800	5.5	17.5	7.95
2 ⅜	50	DHL 1350	1350	9.31	350	2.41	6.4	2.9	4000	27.5	900	6.2	20.0	9.10
2 ⅞	63	DHL 1000	1000	6.89	180	1.2	7.0	3.2	3000	20.7	450	3.1	22.0	10.0

General Technical Data

Mill Test Pressure:	Operating Pressure x 1.25
Axial Tensile Strength:	24,900 PSI (172 MPa)
Axial Modulus of Elasticity:	2.6 x 10^6 PSI (1.79 x 10^4 MPa)
Hoop Modulus of Elasticity:	2.6 x 10^6 PSI (1.79 x 10^4 MPa)
Density:	0.07 lbs/in^3 (Sp. Gr.= 1.95)
Coefficient of Thermal Expansion:	1.0 x 10^{-5} in/in/°F (1.8 x 10^{-5} m/m/°C)
Hazen-Williams Flow Factor:	150
Poisson's Ratio (Hoop Tensile):	.58
Poisson's Ratio (Axial Tensile):	.45

Fluid Characteristics

The fluid characteristics of the media being transported (temperature, chemical composition, etc.) determines which type of epoxy resin system NOV Fiber Glass Systems uses to manufacture Centron® tubing. Centron tubing made with anhydride epoxy resin system is ideally suited for the vast majority of common oilfield applications, sweet or sour crudes, fresh water, and brines. Centron tubing made with the anhydride epoxy resin system should not be exposed to continuous service over 150°F (65.5°C). Acidizing with HCL to 37% concentration is allowable.

Centron tubing made with NOV Fiber Glass Systems aromatic amine epoxy resin system should be used for fluids containing high levels of CO_2, H_2S or in high pressure or high temperature conditions to 210°F (99°C). In all applications, the chemical compatibility and physical capability of the tubing for the existing conditions must be determined. Contact NOV Fiber Glass Systems customer service department for product application assistance.

Well Design

1. Good well design is essential to the successful use of Centron Downhole Tubing. The maximum operating conditions must never be exceeded or permanent, irreversible damage may occur that decreases the life expectancy of the tubing. Bottom hole or fluid temperature must not exceed the rated operating temperature of the tubing.

2. Downhole tools, such as, packers, anchors, pumps, must be compatible with GRE Tubing. Permanent or retrievable packers that hold pressure from both sides are preferred. If tension set retrievable packers are to be used, care must be taken not to exceed the rated axial tension capability of the tubing when setting the packer or pressure testing the annulus. Centron stainless steel crossovers are recommended to change from Centron 4 round thread to 8 round EUE thread for tool connections.

Installation

Centron tubing is installed using conventional slips, elevators, pipe wrenches or power tongs. The elevators should be the “slip” type and the tongs capable of low torque (<500 ft-lbs.) operation; a weight indicator must be used. Tongs and wrenches must be used only on the upsets, never on the body of the tubing. Centron fiberglass subs or a steel landing sub must be used when tensioning tubing string.
Centron tubing must always be set in tension, never in compression.

Tubing Stretch in Air

Stretch in air due to the weight of the string is calculated by the following formula:

$$SA = 1.7N^2/1000$$

where *SA* = *Stretch in inches*

N = *Number of joints in the string*

For stretch or weight in water or brine, multiply the stretch or weight in air by the following factors:

In 10% Brine	0.448
In Water	0.484

Tubing Stretch Due to Tension

Stretch due to tension in above string weight is calculated by the following formula:

$$ST = KtLN/100{,}000$$

where *ST* = *Stretch in inches*

Kt = *Constant Factor from Table I (below)*

L = *Tension (pounds)*

N = *Number of joints in the string*

TABLE ONE

1 ½		2 ⅜		2 ⅞		3 ½		4 ½	
Size	Kt	Size	Kt	Size	Kt	Size	Kt	Size	Kt
DH 2000	13.26	**DH 1500**	9.58	**DH 1500**	6.77	**DH 1200**	6.50	**DH 1000**	4.11
DH 2500	10.56	**DH 2000**	7.84	**DH 2000**	5.44	**DH 1500**	5.71	**DH 1200**	3.90
DH 3000	8.71	**DH 2500**	6.73	**DH 2500**	4.52	**DH 2000**	4.60	**DH 1500**	3.21
DH 3500	7.37	**DH 3000**	5.88	**DH 3000**	4.03	**DH 2500**	3.37	**DH 2000**	2.85
DH 4000	6.47	**DH 3500**	5.38					**DH 2500**	2.52

Tubing Tension—Temperature Compensation

Additional tension on the tubing string is necessary if a significant increase in operating temperature over the installation temperature is expected. The additional tension is required to prevent the tubing string from going neutral into compression or, when using a tension set packer, a significant increase in temperature could unseat the packer. The axial load rating of the tubing must never be exceeded.

Use the following formula to calculate additional tension required to accommodate thermal expansions:

$$LT = KI\Delta t$$

where LT = *Additional tension requirement*

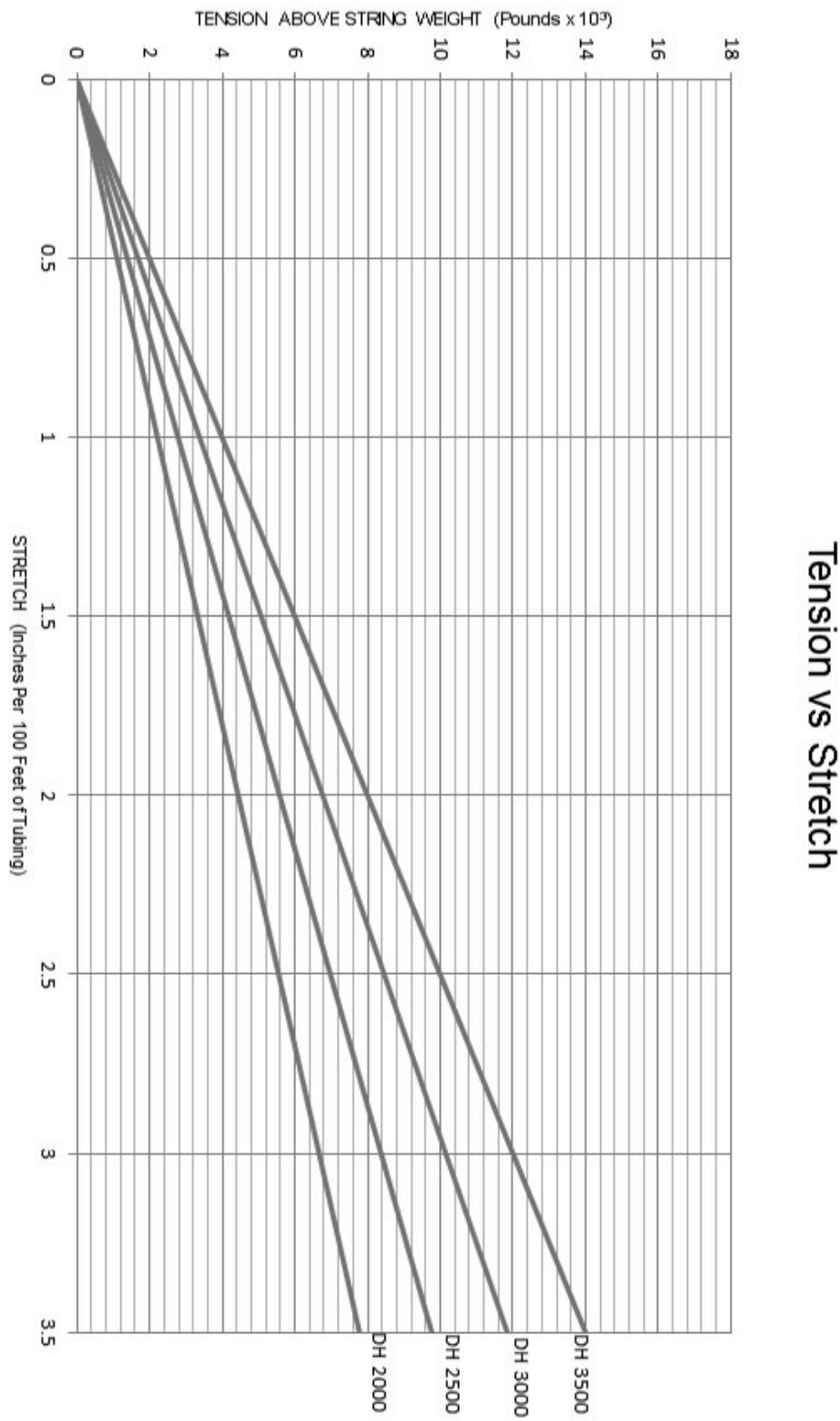
KI = *Constant Factor from Table II (below)*

Δt = *Anticipated temperature change (˚F) above installation temperature*

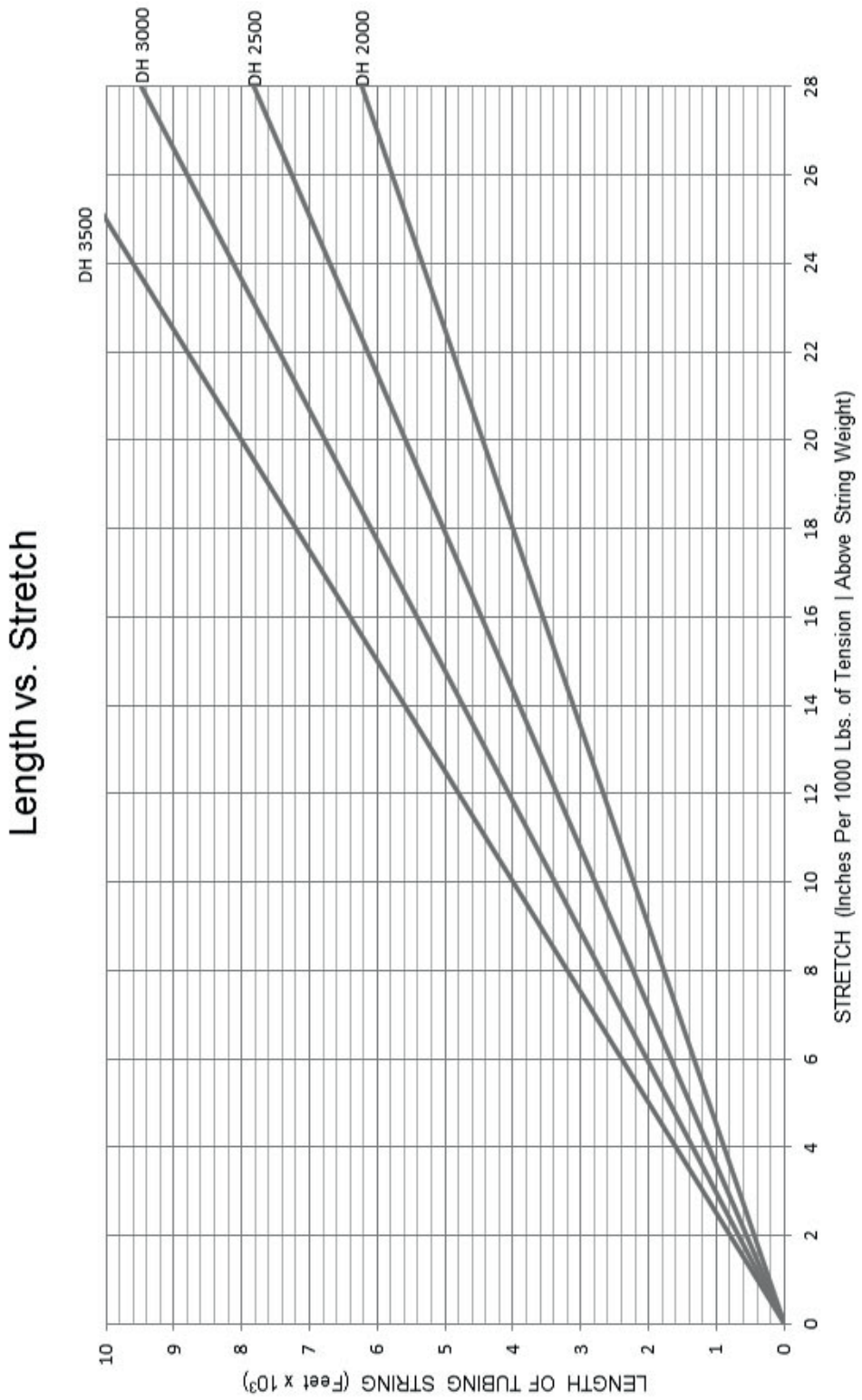
TABLE TWO

1 ½		2 ⅜		2 ⅞		3 ½		4 ½	
Size	KI	Size	KI	Size	KI	Size	KI	Size	KI
DH 2000	18.4	**DH 1500**	25.5	**DH 1500**	36.0	**DH 1200**	42.8	**DH 1000**	57.5
DH 2500	23.2	**DH 2000**	31.2	**DH 2000**	45.0	**DH 1500**	49.5	**DH 1200**	62.8
DH 3000	28.1	**DH 2500**	36.3	**DH 2500**	54.1	**DH 2000**	59.5	**DH 1500**	76.2
DH 3500	33.2	**DH 3000**	41.6	**DH 3000**	60.7	**DH 2500**	72.6	**DH 2000**	85.8
		DH 3500	45.5					**DH 2500**	97.0

INTEGRAL JOINT TUBING



INTEGRAL JOINT TUBING



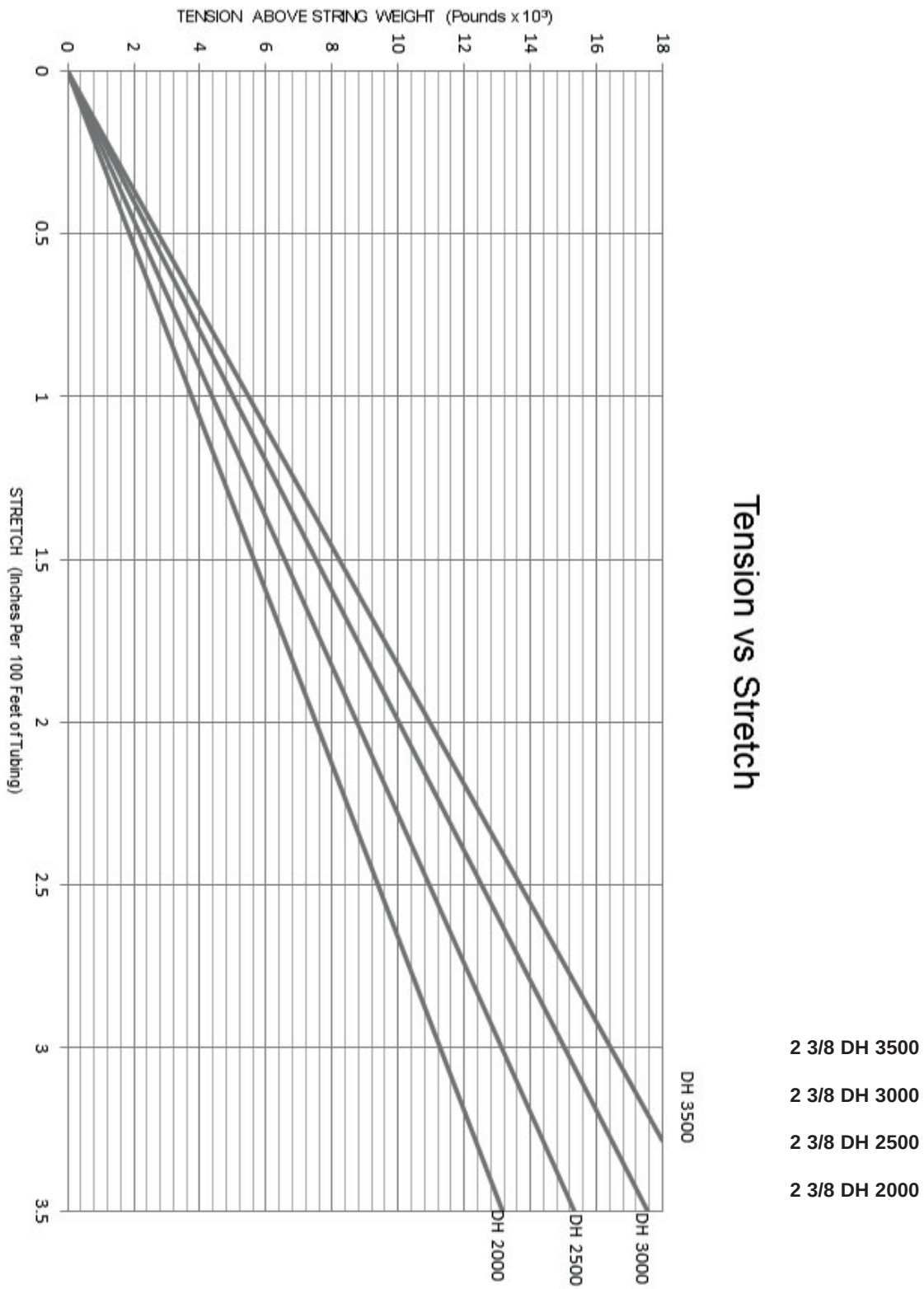
1 1/2 DH 3500

1 1/2 DH 3000

1 1/2 DH 2500

1 1/2 DH 2000

INTEGRAL JOINT TUBING



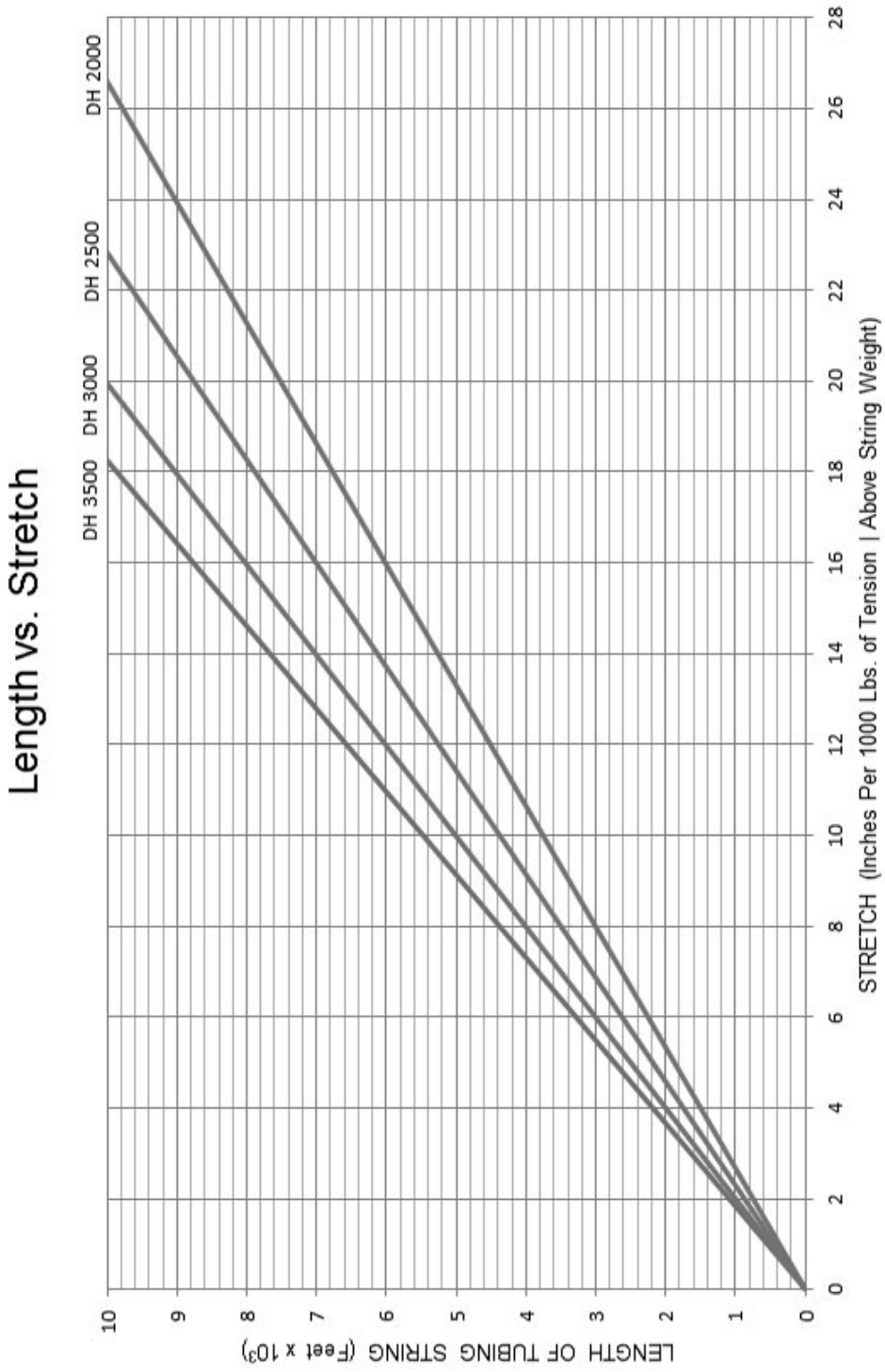
2 3/8 DH 3500

2 3/8 DH 3000

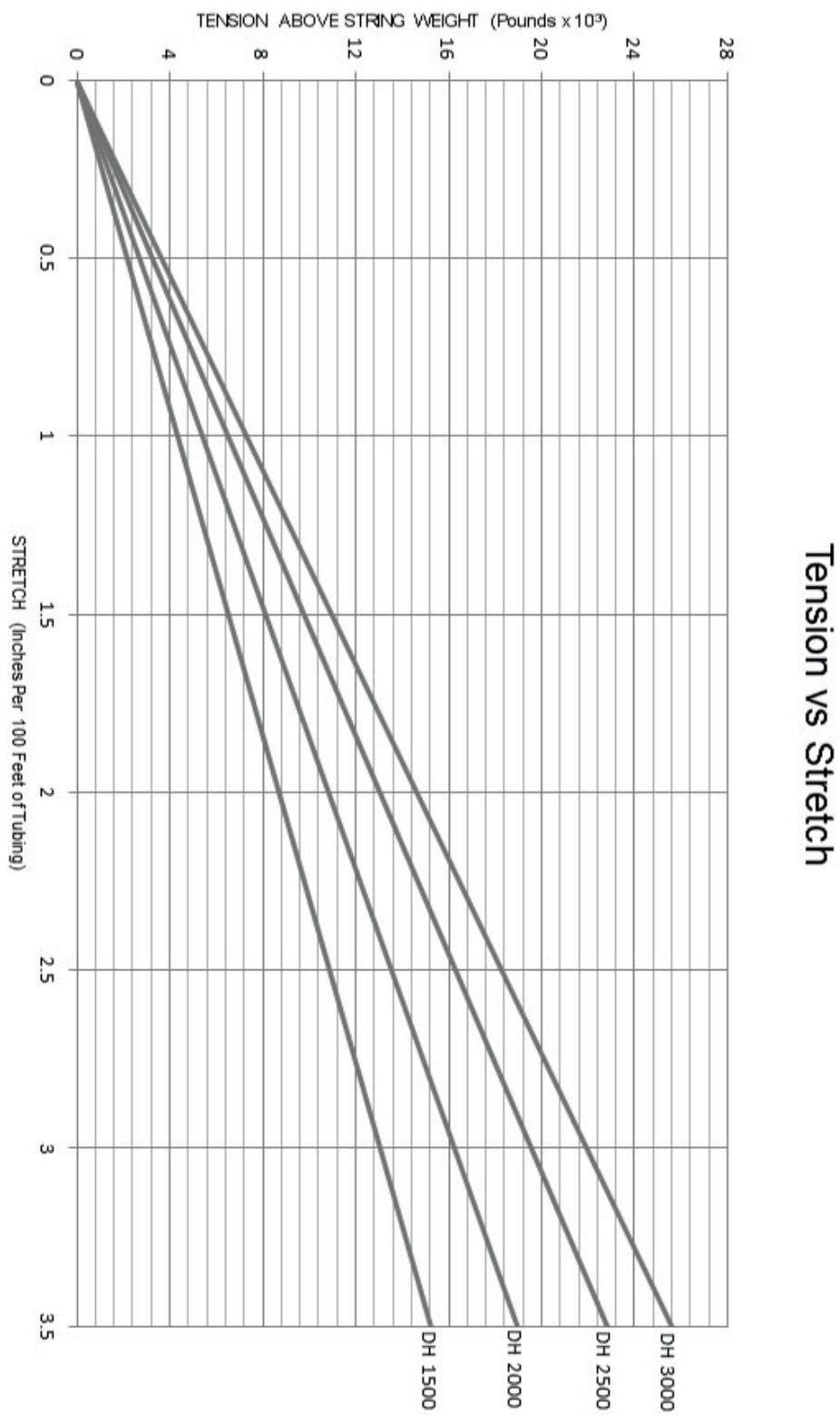
2 3/8 DH 2500

2 3/8 DH 2000

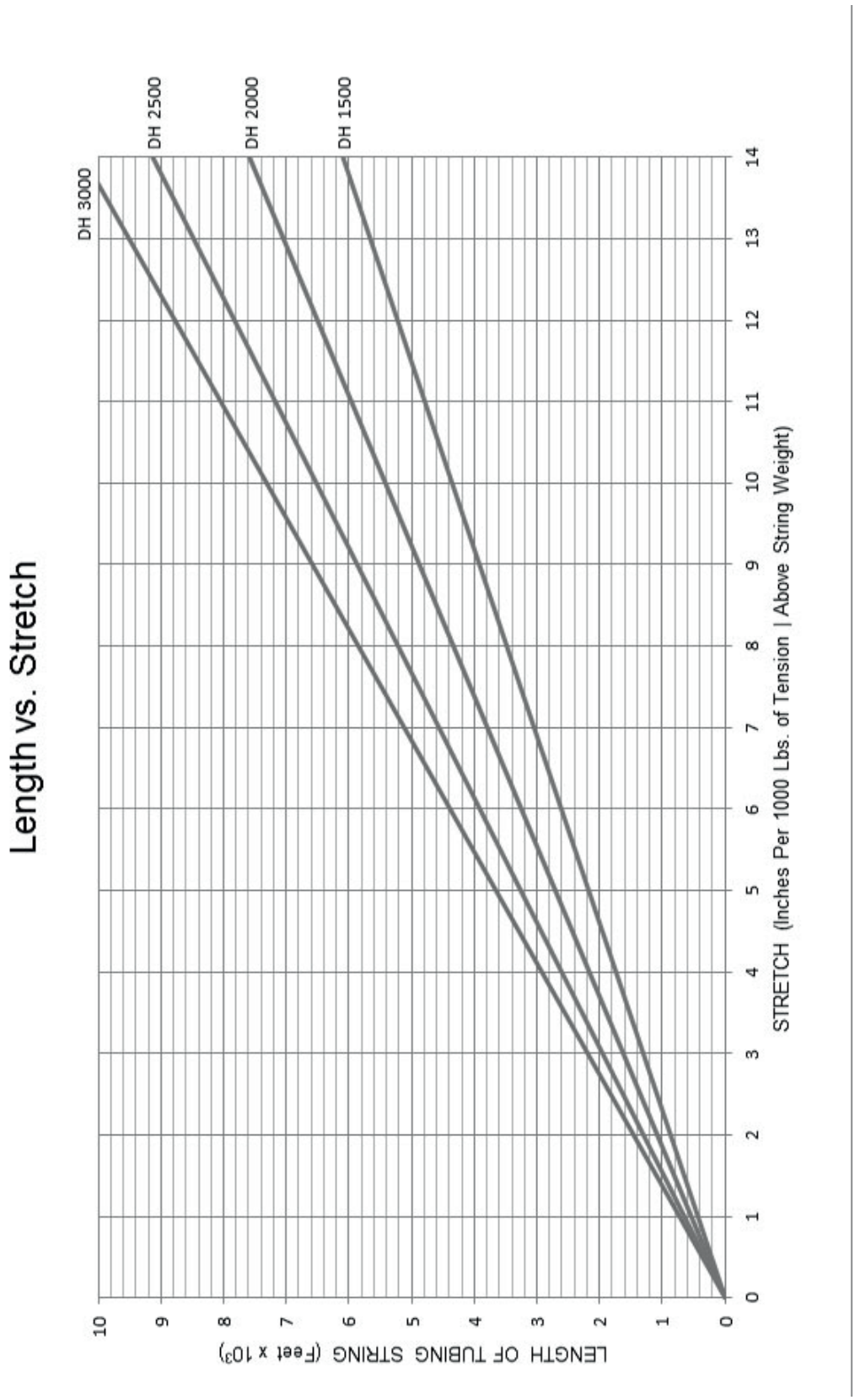
INTEGRAL JOINT TUBING



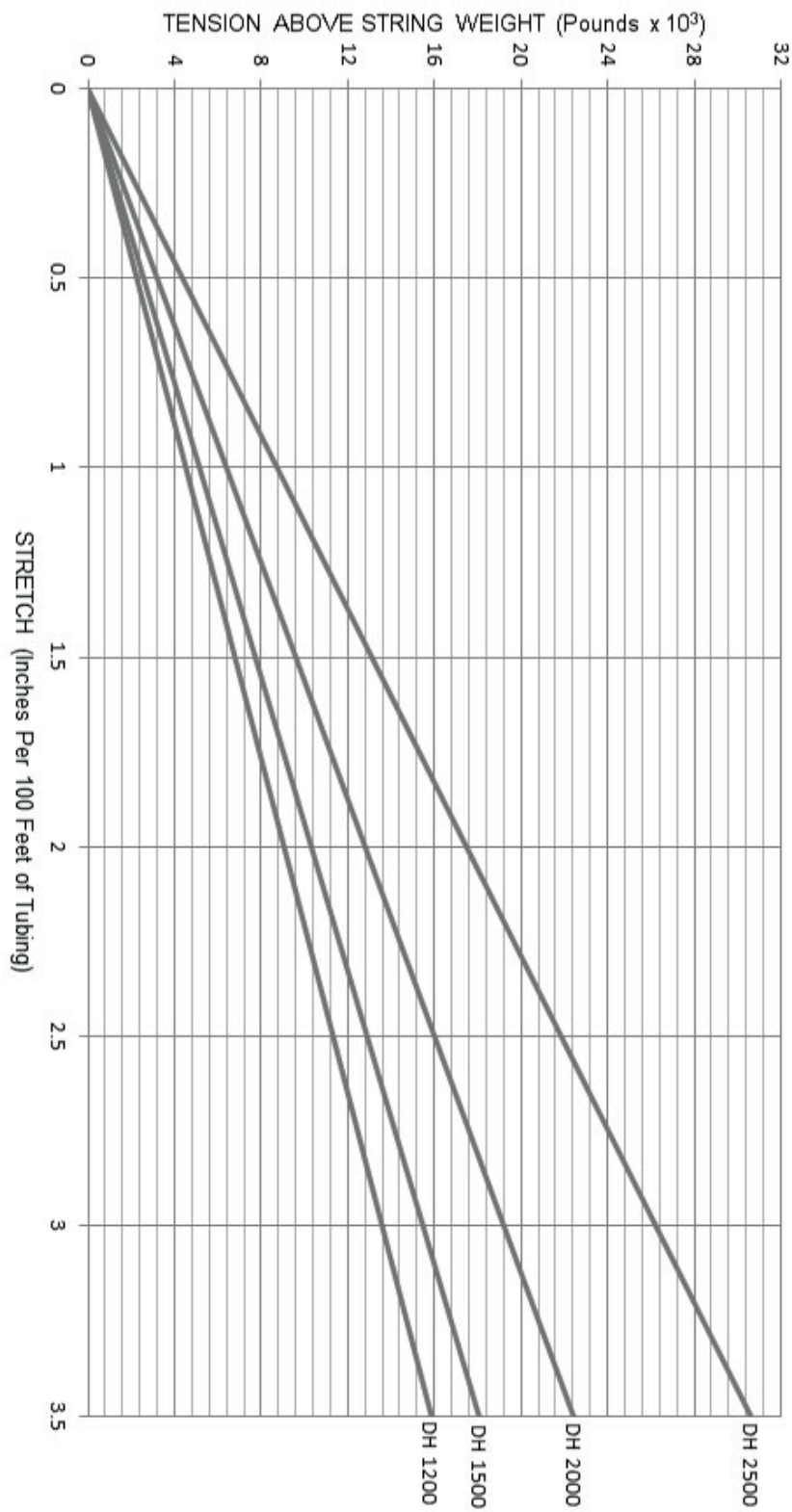
INTEGRAL JOINT TUBING



INTEGRAL JOINT TUBING

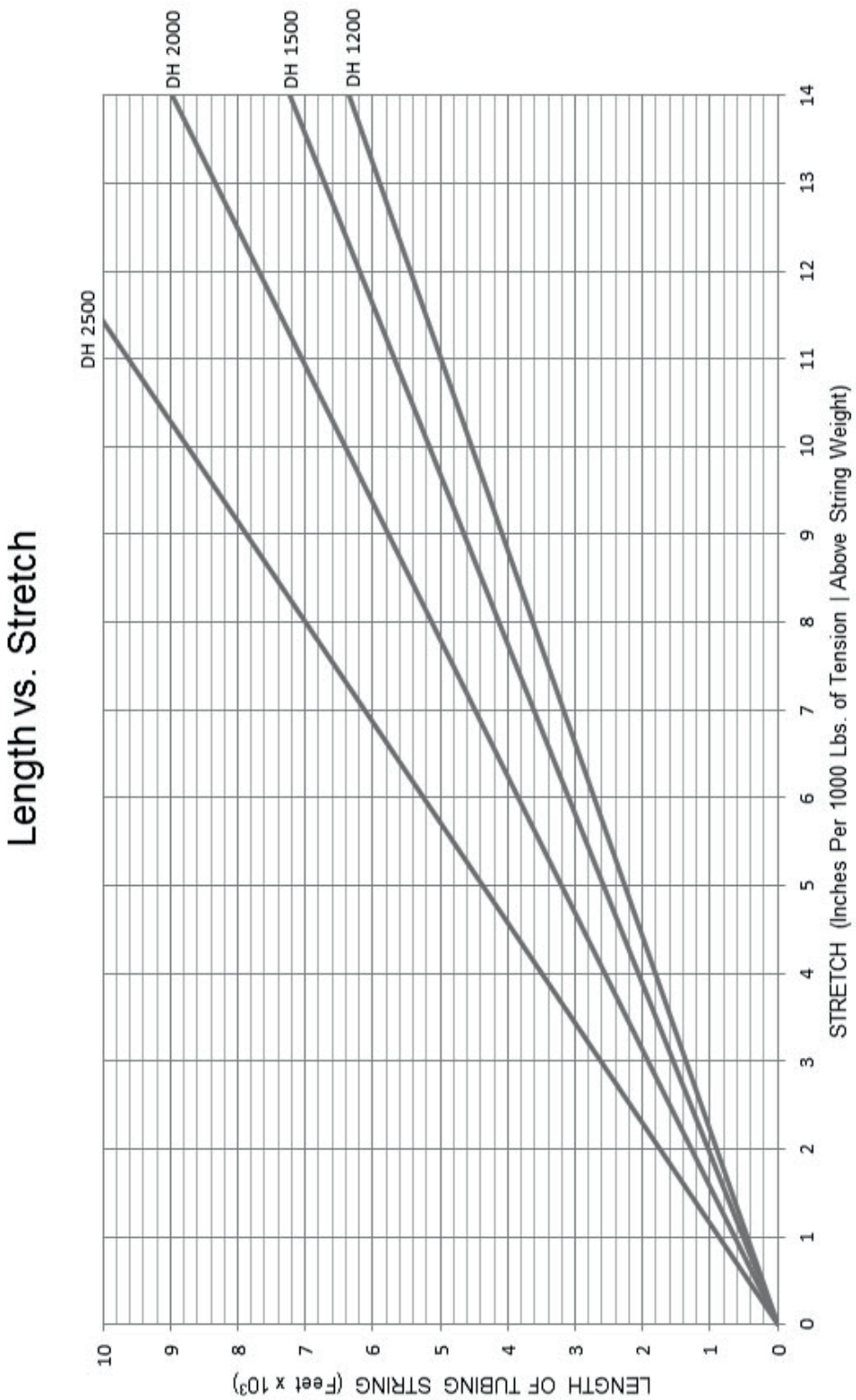


INTEGRAL JOINT TUBING

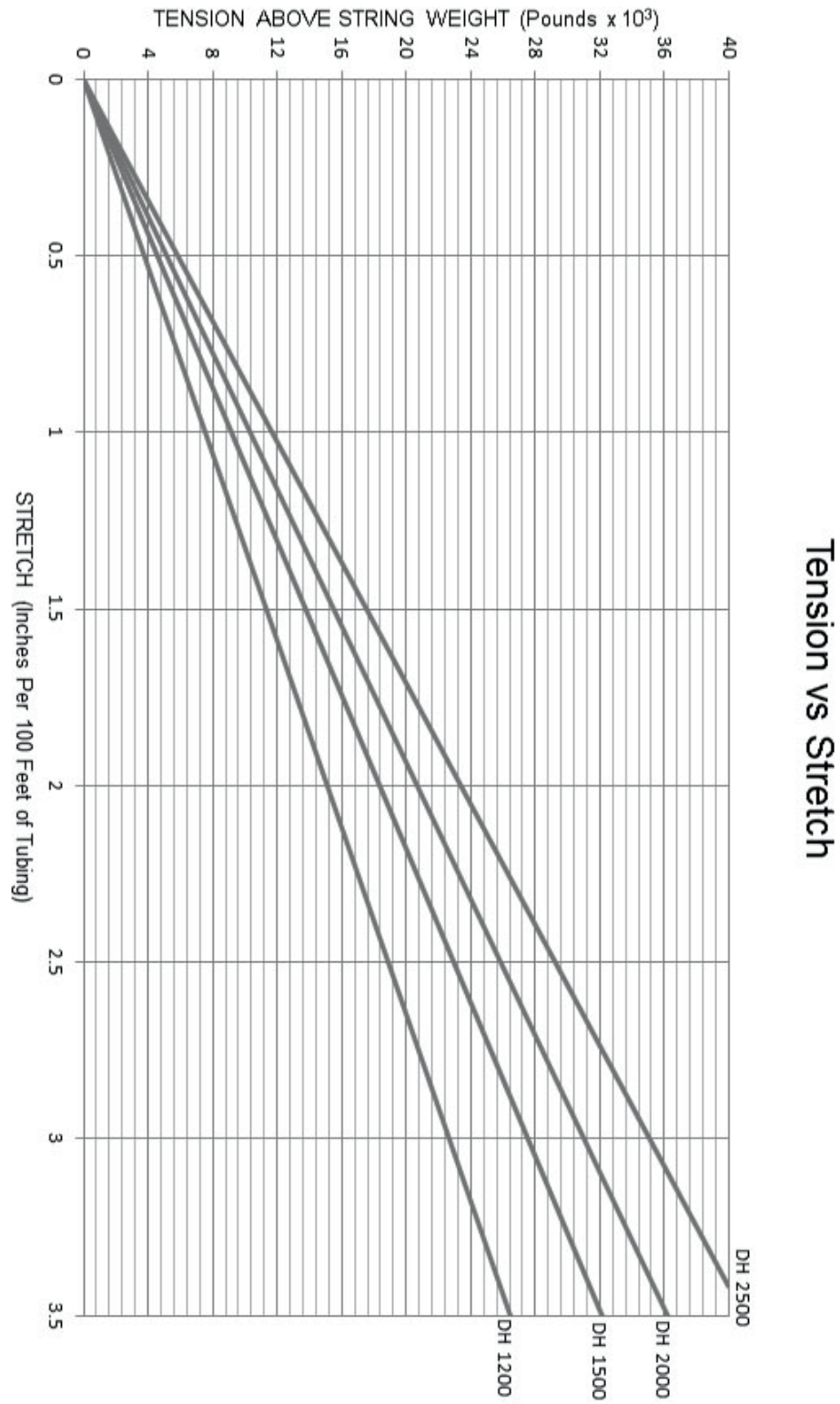


Tension vs Stretch

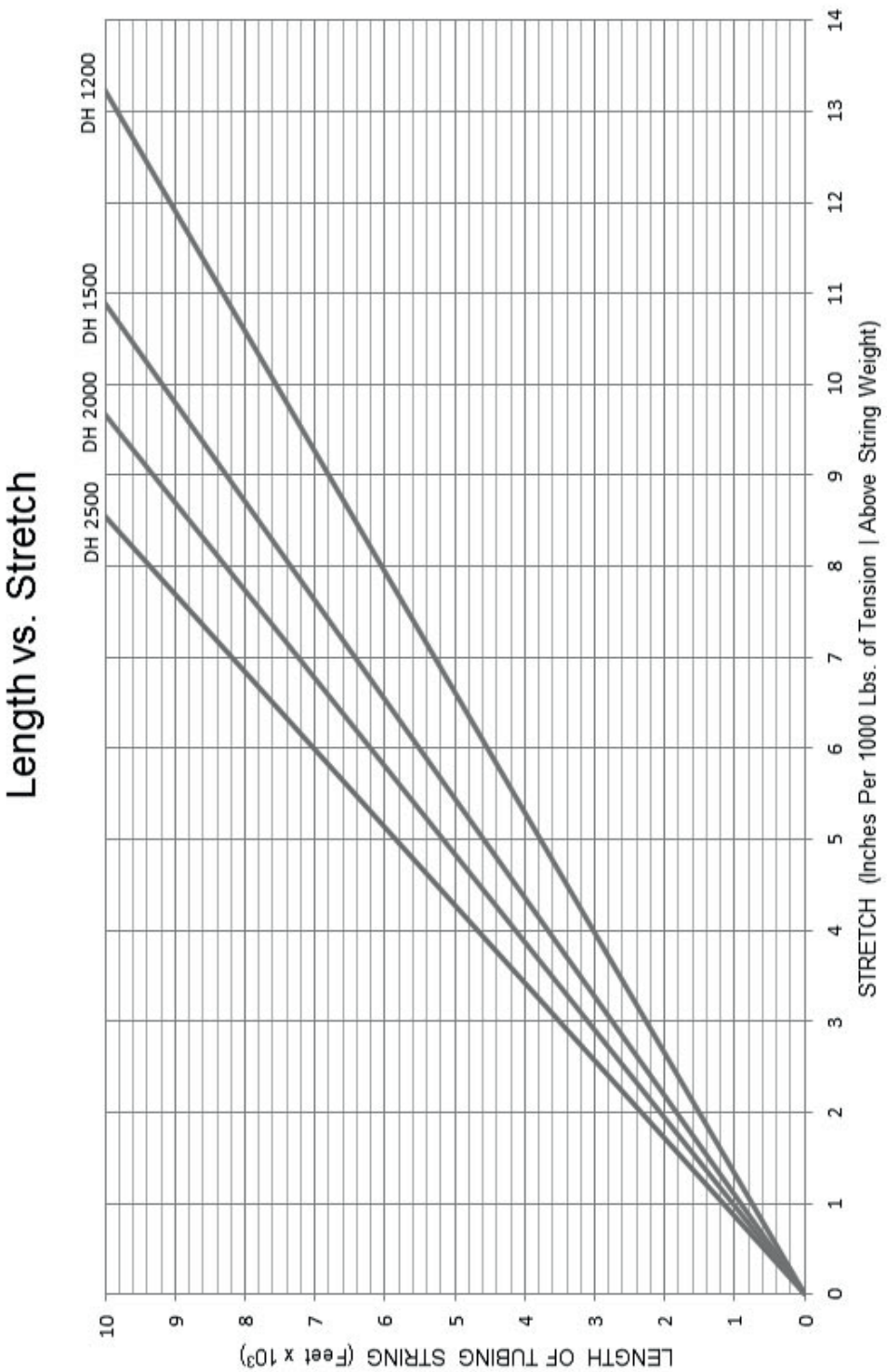
INTEGRAL JOINT TUBING



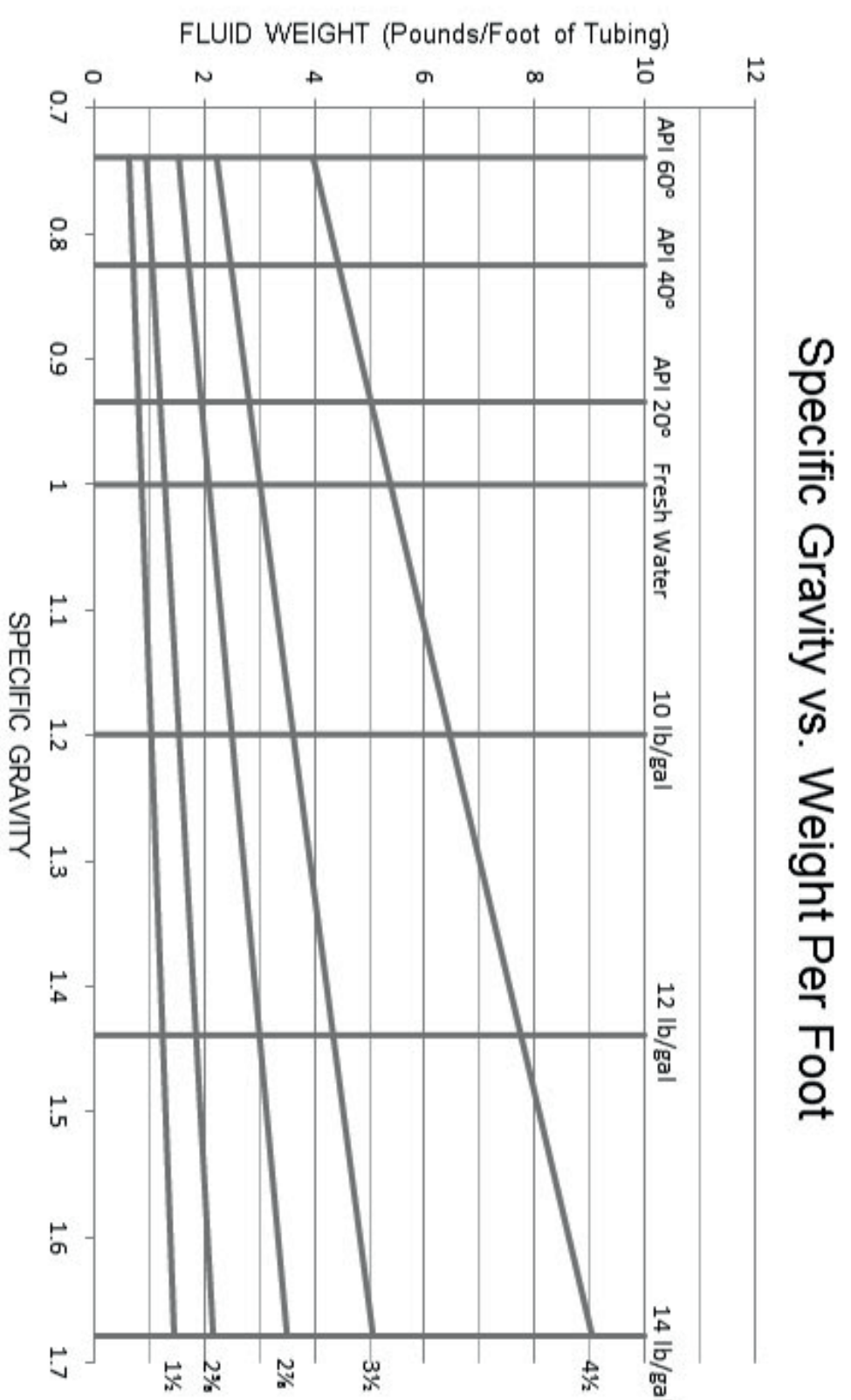
INTEGRAL JOINT TUBING



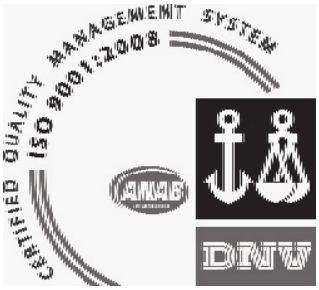
INTEGRAL JOINT TUBING



INTEGRAL JOINT TUBING



15LR-0007
15HR-0003



National Oilwell Varco has produced this brochure for general information only, and it is not intended for design purposes. Although every effort has been made to maintain the accuracy and reliability of its contents, National Oilwell Varco in no way assumes responsibility for liability for any loss, damage or injury resulting from the use of information and data herein. All applications for the material described are at the user's risk and are the user's responsibility.
All brands listed are trademarks of National Oilwell Varco.

North America
17115 San Pedro Ave. Suite 200
San Antonio, Texas 78237 USA
Phone: 210 434 5043

South America
Estrada de Acesso á Zona
Industrial Portuária de Suape, s/no.
Recife, PE, Brazil 55.590-000
Phone: 55 81 3501 0023

Europe
P.O. Box 6, 4190 CA
Geldermalsen, The Netherlands
Phone: 31 345 587 587

Asia Pacific
No. 7A, Tuas Avenue 3
Jurong, Singapore 639407
Phone: 65 6861 6118

Middle East
P.O. Box 17324
Dubai, UAE
Phone: 971 4881 3566

www.fgspipe.com **fgspipe@nov.com**

NOV Fiber Glass Systems

OG9600 May 2013