



## Exploration & Production

# Control Lines & Flatpacks

## Control Line

### CONTROL LINE MANUFACTURING

This range includes control lines (hydraulic tubing) designed for use in harsh environments such as those created by chemical injection or well monitoring and other applications where strength, corrosion resistance and reliability are essential. PDT's control lines are manufactured and tested to meet or exceed ASTM requirements. Prysmian Downhole Technology offers four types of control lines. Each manufacturing process has its own merits based on cost effectiveness vs. technical requirements.

#### MANUFACTURING METHODS

##### As Welded

A flat strip is formed into a tube through a series of rollers to a round shape and longitudinally welded at size with no additional work.

##### Welded & Drawn

After welding, the tube is drawn through a reduction die to homogenize the seam weld. The weld seam is reworked externally by the die. By drawing through a die, the tube has an improved sealing surface, and a truly round OD and an improved external surface finish.

##### Welded & Floated Plug Drawn

After welding, the tube is drawn through a die with a floating plug in the bore to rework the weld seam. The plug is not attached to a rod or mandrel, but "floating" inside the tube surrounded by lubricant. The weld seam is reworked internally and externally by the die. By drawing through a die, the tube has an improved sealing surface, and a truly round OD and a better internal and external surface finish. This tubing is referred to as "smooth" bore.

##### Seamless

A billet of metal is extruded into a tube and drawn to final size. There is a longitudinal weld with seamless tube although orbital welds are used to manufacture long lengths. The manufacturing process for the seamless tube limits the maximum continuous length, therefore orbital welds are required to join lengths of seamless coil together to achieve lengths that are suitable for well applications.

#### DESIGN & CONSTRUCTION

##### Tube Materials

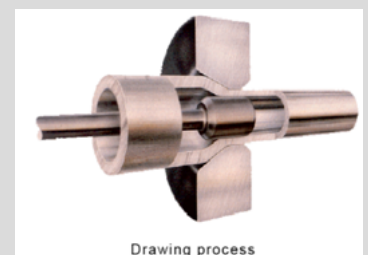
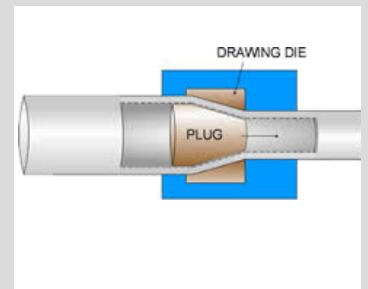
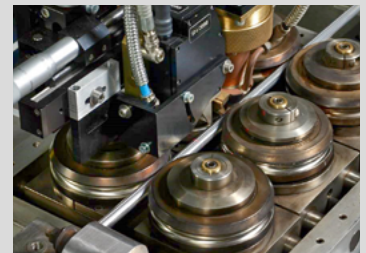
- 316L Stainless Steel
- A825 Alloy
- A825 Alloy Enhanced Properties
- Duplex 2205/2507
- Alloy 625

##### Standard Sizes

- 1/8" x 0.028" & 0.035"
- 1/4" x 0.035", 0.049" & 0.065"
- 3/8" x 0.035", 0.049" & 0.065"
- 1/2" x 0.049", 0.065" & 0.083"
- 5/8" x 0.049", 0.065" & 0.083"

##### Non Destructive Testing

Eddy current testing (ECT) is performed on the longitudinally seam welded tubing and strip splice welds at intermediate size in the as-heat treated condition. Radiographic testing is performed on all orbital welds and strip splice welds are detected by ECT at intermediate size in the as-heat treated condition. Yield pressure hydro static testing is performed on the cold worked tubing at final size.



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## Exploration & Production

# Control Lines & Flatpacks

## Control Line

### 316 L STAINLESS CONTROL LINE

HEAT TREATED /30 KSI MINIMUM YIELD STRENGTH / UNS S31603

**TABLE 1 CHEMICAL COMPOSITION: UNS S31603 WITH FURTHER RESTRICTIONS BY INTERNAL STRIP SPECIFICATIONS**

C	Mn	P	S	Si	Cr	Ni	Mo	N	Cu	Fe
0.030 max	2.00 max	0.040 max	0.017 max	0.75 max	16.0 - 18.0	10.0 - 14.0	2.00 - 3.00	0.10 max	0.50 max	Bal

**TABLE 2 TYPICAL PHYSICAL CONSTANTS & THERMAL PROPERTIES**

Density (lbs./in3)	0.290
Modulus of tension elasticity (x106 psi)	29.0 at 70°F
Mean coefficient of thermal expansion from 70° to temperature shown (in/in/°F 10-6)	9.2 to 200°F

**TABLE 3 MECHANICAL PROPERTIES**

PROPERTY	MIN.	MAX.	TYPICAL
Ultimate Tensile Strength UTS ,(psi)	75,000	-	90,000
0.2% Offset Yield Strength, YS (psi)	30,000	-	43,000
Elongation in 2 inches, E (%)	35	-	50
Hardness, HRBW	-	70	66

**TABLE 4: SIZE DEPENDANT CHARACTERISTICS / PROPERTIES (BASED UPON NOMINAL TUBING DIMENSIONS)**

NOMINAL OUTSIDE DIAMETER IN.	NOMINAL WALL THICKNESS IN.	MINIMUM BURST PRESSURE PSI	MINIMUM COLLAPSE PRESSURE PSI	NOMINAL WORKING PRESSURE PSI	METAL CROSS SECTION IN. <sup>2</sup>	FLOW CROSS SECTION IN. <sup>2</sup>	VOLUME PER UNIT LENGTH GAL/1000FT.	WEIGHT PER UNIT LENGTH LBS./1000 FT.	LOAD AT MINIMUM 0.2% YS LBS.	LOAD AT TYPICAL UTS LBS.
0.125	0.022	23,203	7,846	7,660	0.0071	0.0052	0.27	24.8	214	641
0.125	0.028	29,531	9,487	9,992	0.0085	0.0037	0.19	29.7	256	768
0.125	0.035	36,914	11,132	12,668	0.0099	0.0024	0.12	34.4	297	891
0.250	0.035	18,676	6,540	5,947	0.0236	0.0254	1.32	82.3	709	2,128
0.250	0.049	26,146	8,635	8,629	0.0309	0.0181	0.94	107.7	928	2,785
0.250	0.065	34,684	10,666	11,728	0.0378	0.0113	0.59	131.5	1,133	3,400
0.375	0.035	12,500	4,583	3,820	0.0374	0.0731	3.80	130.1	1,122	3,365
0.375	0.049	17,500	6,183	5,512	0.0502	0.0603	3.13	174.6	1,506	4,517
0.375	0.065	23,214	7,849	7,532	0.0633	0.0471	2.45	220.3	1,899	5,697
0.375	0.083	29,643	9,514	9,862	0.0761	0.0343	1.78	265.0	2,284	6,853
0.500	0.035	9,394	3,522	2,807	0.0511	0.1452	7.54	177.9	1,534	4,602
0.500	0.049	13,151	4,799	4,027	0.0694	0.1269	6.59	241.6	2,083	6,248
0.500	0.065	17,445	6,167	5,481	0.0888	0.1075	5.59	309.1	2,665	7,995
0.500	0.083	22,276	7,587	7,180	0.1087	0.0876	4.55	378.4	3,262	9,786
0.625	0.035	7,500	2,850	2,217	0.0649	0.2419	12.57	225.8	1,946	5,839
0.625	0.049	10,500	3,906	3,167	0.0887	0.2181	11.33	308.6	2,660	7,980
0.625	0.065	13,929	5,054	4,295	0.1144	0.1924	10.00	398.0	3,431	10,292
0.625	0.083	17,786	6,271	5,611	0.1413	0.1655	8.60	491.8	4,240	12,719

### Notes Regarding Burst and Collapse Pressure

Minimum internal burst pressure and external collapse pressure calculations were based upon:

Minimum ultimate tensile strength, UTS<sub>min</sub> and minimum 0.2% offset yield strength, YS<sub>min</sub> per above table.

Maximum outside diameter, OD<sub>max</sub> per above table

Minimum wall thickness, t<sub>min</sub> per above table

Minimum burst pressure = (2 x t<sub>min</sub> x UTS<sub>min</sub>) / OD<sub>max</sub>; assumes no axial or other loading except internal pressure.

Collapse pressure based on API 5C3; assumes no ovality, internal pressure or other loading except external pressure.

Nominal working pressure = Lamé' formula for burst pressure, using YS<sub>min</sub>, OD<sub>nom</sub>, t<sub>nom</sub>, and a safety factor of 1.6.

### Notes Regarding Load at 0.2% YS & UTS

The load at minimum 0.2% YS represents the load at which 0.002 in./in. of plastic (permanent) axial strain deformation has occurred. The load at typical UTS represents the load to cause failure. Decisions regarding the pull out load to be applied to tubing should consider these two loads. The data herein is approximate and subject to normal manufacturing tolerances. These specifications are subject to change without notice.

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## Exploration & Production

# Control Lines & Flatpacks

## Control Line

### ALLOY 825 CONTROL LINE

HEAT TREATED /35 KSI MINIMUM YIELD STRENGTH / UNS N08825

**TABLE 1 CHEMICAL COMPOSITION: UNS N08825 WITH FURTHER RESTRICTIONS BY INTERNAL STRIP SPECIFICATIONS**

Ni	Cr	Fe	Mn	C	Cu	Si	S	P	Al	Ti	Mo	B
38.0 - 46.0	21.5 - 23.5	22.0 min	1.0 max	0.020 max	1.5 - 3.0	0.5 max	0.005 max	0.020 max	0.2 max	0.6 - 1.2	2.5 - 3.5	0.006 max

**TABLE 2 TYPICAL PHYSICAL CONSTANTS & THERMAL PROPERTIES**

Density (lbs/in <sup>3</sup> )	0.290
Modulus of tension elasticity (x 10 <sup>6</sup> psi)	28.3 at 70°F 26.8 at 400°F
Mean coefficient of thermal expansion from 70° to temperature shown (in/in/°F x 10 <sup>-6</sup> )	7.8 to 200°F 8.3 to 400°F

**TABLE 3 MECHANICAL PROPERTIES**

PROPERTY	MIN.	MAX.	TYPICAL
Ultimate Tensile Strength UTS ,(psi)	85,000	-	100,000
0.2% Offset Yield Strength, YS (psi)	35,000	-	50,000
Elongation in 2 inches, E (%)	30	-	38
Hardness, HR30N	-	85	70

**TABLE 4: SIZE DEPENDANT CHARACTERISTICS / PROPERTIES (BASED UPON NOMINAL TUBING DIMENSIONS)**

NOMINAL OUTSIDE DIAMETER IN	NOMINAL WALL THICKNESS IN	MINIMUM BURST PRESSURE PSI	MINIMUM COLLAPSE PRESSURE PSI	NOMINAL WORKING PRESSURE PSI	METAL CROSS SECTION IN <sup>2</sup>	FLOW CROSS SECTION IN <sup>2</sup>	VOLUME PER UNIT LENGTH GAL/1000 FT	WEIGHT PER UNIT LENGTH LBS/1000 FT	LOAD AT MINIMUM 0.2% YS LBS.	LOAD AT TYPICAL UTS LBS.
0.125	0.022	26,297	9,153	8,937	0.0071	0.0052	0.27	25.0	249	712
0.125	0.028	33,469	11,068	11,658	0.0085	0.0037	0.19	30.0	299	853
0.125	0.035	41,836	12,987	14,779	0.0099	0.0024	0.12	34.8	346	990
0.250	0.035	21,166	7,630	6,938	0.0236	0.0254	1.32	83.1	827	2,364
0.250	0.049	29,632	10,075	10,067	0.0309	0.0181	0.94	108.8	1,083	3,094
0.250	0.065	39,308	12,443	13,683	0.0378	0.0113	0.59	132.8	1,322	3,778
0.375	0.035	14,167	5,347	4,456	0.0374	0.0731	3.80	131.4	1,308	3,738
0.375	0.049	19,833	7,214	6,431	0.0502	0.0603	3.13	176.4	1,756	5,018
0.375	0.065	26,310	9,157	8,787	0.0633	0.0471	2.45	222.5	2,216	6,330
0.375	0.083	33,595	11,100	11,506	0.0761	0.0343	1.78	267.6	2,665	7,614
0.500	0.035	10,646	4,109	3,274	0.0511	0.1452	7.54	179.7	1,790	5,113
0.500	0.049	14,905	5,599	4,698	0.0694	0.1269	6.59	244.0	2,430	6,943
0.500	0.065	19,771	7,194	6,395	0.0888	0.1075	5.59	312.2	3,109	8,883
0.500	0.083	25,247	8,852	8,376	0.1087	0.0876	4.55	382.2	3,806	10,873
0.625	0.035	8,500	3,325	2,586	0.0649	0.2419	12.57	228.0	2,271	6,487
0.625	0.049	11,900	4,557	3,695	0.0887	0.2181	11.33	311.7	3,103	8,867
0.625	0.065	15,786	5,896	5,011	0.1144	0.1924	10.00	401.9	4,002	11,435
0.625	0.083	20,157	7,316	6,546	0.1413	0.1655	8.60	496.8	4,946	14,133

### Notes Regarding Burst and Collapse Pressure

Minimum internal burst pressure and external collapse pressure calculations were based upon:

Minimum ultimate tensile strength, UTS<sub>min</sub> and minimum 0.2% offset yield strength, YS<sub>min</sub> per above table.

Maximum outside diameter, OD<sub>max</sub> per above table

Minimum wall thickness, t<sub>min</sub> per above table

Minimum burst pressure = (2 x t<sub>min</sub> x UTS<sub>min</sub>) / OD<sub>max</sub>; assumes no axial or other loading except internal pressure.

Collapse pressure based on API 5C3; assumes no ovality, internal pressure or other loading except external pressure.

Nominal working pressure = Lamé' formula for burst pressure, using YS<sub>min</sub>, OD<sub>nom</sub>, t<sub>nom</sub>, and a safety factor of 1.6.

### Notes Regarding Load at 0.2% YS & UTS

The load at minimum 0.2% YS represents the load at which 0.002 in/in of plastic (permanent) axial strain deformation has occurred. The load at typical UTS represents the load to cause failure. Decisions regarding the pull out load to be applied to tubing should consider these two loads. The data herein is approximate and subject to normal manufacturing tolerances. These specifications are subject to change without notice.

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## Exploration & Production

# Control Lines & Flatpacks

## Control Line

### ALLOY 825 CONTROL LINE - ENHANCED PROPERTIES

HEAT TREATED AND COLD TREATED /35 KSI MINIMUM YIELD STRENGTH / UNS N08825

**TABLE 1 CHEMICAL COMPOSITION : UNS N08825 WITH FURTHER RESTRICTIONS BY INTERNAL STRIP SPECIFICATIONS**

Ni	Cr	Fe	Mn	C	Cu	Si	S	P	Al	Ti	Mo	B
38.0 - 46.0	21.5 - 23.5	22.0 min	1.0 max	0.020 max	1.5 - 3.0	0.5 max	0.005 max	0.020 max	0.2 max	0.6 - 1.2	2.5 - 3.5	0.006 max

**TABLE 2 TYPICAL PHYSICAL CONSTANTS & THERMAL PROPERTIES**

Density (lbs/in <sup>3</sup> )	0.290
Modulus of tension elasticity (x 106 psi)	28.3 at 70°F 26.8 at 400°F
Mean coefficient of thermal expansion from 70° to temperature shown (in/in/°F x 10 <sup>-6</sup> )	7.8 to 200°F 8.3 to 400°F

**TABLE 3 MECHANICAL PROPERTIES**

PROPERTY	MIN.	MAX.	TYPICAL
Ultimate Tensile Strength UTS (psi)	95,000	-	105,000
0.2% Offset Yield Strength, YS (psi)	65,000	85,000	75,000
Elongation in 2 inches, E (%)	18	-	28
Hardness, HR30N	-	55	-

**TABLE 4: SIZE DEPENDANT CHARACTERISTICS / PROPERTIES (BASED UPON NOMINAL TUBING DIMENSIONS)**

NOMINAL OUTSIDE DIAMETER IN	NOMINAL WALL THICKNESS IN	MINIMUM BURST PRESSURE PSI	MINIMUM COLLAPSE PRESSURE PSI	NOMINAL WORKING PRESSURE PSI	METAL CROSS SECTION IN <sup>2</sup>	FLOW CROSS SECTION IN <sup>2</sup>	VOLUME PER UNIT LENGTH GAL/1000FT	WEIGHT PER UNIT LENGTH LBS/1000 FT	LOAD AT MINIMUM 0.2% YS LBS.	LOAD AT TYPICAL UTS LBS.
0.125	0.022	29,391	16,999	16,597	0.0071	0.0052	0.27	26.1	463	747
0.125	0.028	37,406	20,555	21,650	0.0085	0.0037	0.19	31.2	555	896
0.125	0.035	46,758	24,119	27,446	0.0099	0.0024	0.12	36.2	643	1,039
0.250	0.035	23,656	14,171	12,885	0.0236	0.0254	1.32	86.5	1,537	2,482
0.250	0.049	33,119	18,710	18,696	0.0309	0.0181	0.94	113.3	2,011	3,249
0.250	0.065	43,933	23,109	25,410	0.0378	0.0113	0.59	138.3	2,456	3,967
0.375	0.035	15,833	9,931	8,276	0.0374	0.0731	3.80	136.9	2,430	3,925
0.375	0.049	22,167	13,397	11,943	0.0502	0.0603	3.13	183.7	3,262	5,269
0.375	0.065	29,405	17,005	16,319	0.0633	0.0471	2.45	231.8	4,115	6,647
0.375	0.083	37,548	20,614	21,369	0.0761	0.0343	1.78	278.8	4,949	7,995
0.500	0.035	11,899	7,631	6,081	0.0511	0.1452	7.54	187.2	3,323	5,369
0.500	0.049	16,658	10,398	8,725	0.0694	0.1269	6.59	254.2	4,513	7,290
0.500	0.065	22,097	13,361	11,876	0.0888	0.1075	5.59	325.2	5,774	9,327
0.500	0.083	28,217	16,439	15,556	0.1087	0.0876	4.55	398.1	7,068	11,417
0.625	0.035	9,530	6,194	4,803	0.0649	0.2419	12.57	237.5	4,217	6,812
0.625	0.049	13,342	8,488	6,862	0.0887	0.2181	11.33	324.6	5,763	9,310
0.625	0.065	17,643	10,951	9,305	0.1144	0.1924	10.00	418.7	7,433	12,007
0.625	0.083	22,529	13,587	12,157	0.1413	0.1655	8.60	517.4	9,186	14,839

### Notes Regarding Burst and Collapse Pressure

Minimum internal burst pressure and external collapse pressure calculations were based upon:

Minimum ultimate tensile strength, UTSmin and minimum 0.2% offset yield strength, YSmin per above table.

Maximum outside diameter, ODmax per above table

Minimum wall thickness, tmin per above table

Minimum burst pressure = (2 x tmin x UTSmin) / ODmax; assumes no axial or other loading except internal pressure.

Collapse pressure based on API 5C3; assumes no ovality, internal pressure or other loading except external pressure.

Nominal working pressure = Lamé' formula for burst pressure, using YSmin, ODnom, tnom, and a safety factor of 1.6.

### Notes Regarding Load at 0.2% YS & UTS

The load at minimum 0.2% YS represents the load at which 0.002 in/in of plastic (permanent) axial strain deformation has occurred. The load at typical UTS represents the load to cause failure. Decisions regarding the pull out load to be applied to tubing should consider these two loads. The data herein is approximate and subject to normal manufacturing tolerances. These specifications are subject to change without notice.

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## Exploration & Production

# Control Lines & Flatpacks

## Control Line

### DUPLEX 2205 CONTROL LINE

HEAT TREATED /80 KSI MINIMUM YIELD STRENGTH / UNS S32205

**TABLE 1 CHEMICAL COMPOSITION UNS S32205 WITH FURTHER RESTRICTIONS BY INTERNAL STRIP SPECIFICATIONS**

C	Mn	P	S	Si	Cr	Ni	Mo	N	Fe
0.030 max	2.00 max	0.030 max	0.005 max	1.00 max	22.0 - 23.0	4.5 - 6.5	3.0 - 3.5	0.14 - 0.20	Bal

**TABLE 2 TYPICAL PHYSICAL CONSTANTS & THERMAL PROPERTIES**

Density (lbs/in <sup>3</sup> )	0.283
Modulus of tension elasticity (x 10 <sup>6</sup> psi)	29.0 at 70°
Mean coefficient of thermal expansion from 70° to temperature shown (in/in/°F x 10 <sup>-6</sup> )	7.2 at 200°F

**TABLE 3 MECHANICAL PROPERTIES**

PROPERTY	MIN.	MAX.	TYPICAL
Ultimate Tensile Strength UTS ,(psi)	110,000	-	125,000
0.2% Offset Yield Strength, YS (psi)	80,000	-	90,000
Elongation in 2 inches, E (%)	25	-	30
Hardness, HR30TW	-	90	85

**TABLE 4: SIZE DEPENDANT CHARACTERISTICS / PROPERTIES (BASED UPON NOMINAL TUBING DIMENSIONS)**

NOMINAL OUTSIDE DIAMETER IN	NOMINAL WALL THICKNESS IN	MINIMUM BURST PRESSURE PSI	MINIMUM COLLAPSE PRESSURE PSI	METAL CROSS SECTION IN <sup>2</sup>	FLOW CROSS SECTION IN <sup>2</sup>	VOLUME PER UNIT LENGTH GAL./1000 FT	WEIGHT PER UNIT LENGTH LBS/1000FT.	LOAD AT MINIMUM 0.2% YS LBS	LOAD AT TYPICAL UTS LBS.
0.250	0.035	27,391	17,441	0.0236	0.0254	1.3	80.3	1,891	2,955
0.250	0.049	38,348	23,028	0.0309	0.0181	0.9	105.1	2,475	3,868
0.250	0.065	50,870	28,442	0.0378	0.0113	0.6	128.3	3,022	4,722
0.375	0.035	18,333	12,222	0.0374	0.0731	3.8	127.0	2,991	4,673
0.375	0.049	25,667	16,489	0.0502	0.0603	3.1	170.4	4,015	6,273
0.375	0.065	34,048	20,930	0.0633	0.0471	2.4	215.0	5,064	7,913
0.375	0.083	43,476	25,371	0.0761	0.0343	1.8	258.6	6,091	9,517
0.500	0.035	13,777	8,091	0.0511	0.1452	7.5	173.6	4,090	6,391
0.500	0.049	19,288	12,798	0.0694	0.1269	6.6	235.8	5,554	8,678
0.500	0.065	25,586	16,444	0.0888	0.1075	5.6	301.7	7,106	11,104
0.500	0.083	32,672	20,233	0.1087	0.0876	4.6	369.3	8,699	13,592
0.625	0.035	11,035	4,990	0.0649	0.2419	12.6	220.3	5,190	8,109
0.625	0.049	15,449	9,903	0.0887	0.2181	11.3	301.1	7,093	11,084
0.625	0.065	20,494	13,478	0.1144	0.1924	10.0	388.3	9,148	14,294
0.625	0.083	26,169	16,722	0.1413	0.1655	8.6	479.9	11,306	17,666

### Notes Regarding Burst and Collapse Pressure

Minimum internal burst pressure and external collapse pressure calculations were based upon:

Minimum ultimate tensile strength, UTS<sub>min</sub> and minimum 0.2% offset yield strength, YS<sub>min</sub> per above table.

Maximum outside diameter, OD<sub>max</sub> per above table

Minimum wall thickness, t<sub>min</sub> per above table

Minimum burst pressure = (2 x t<sub>min</sub> x UTS<sub>min</sub>) / OD<sub>max</sub>; assumes no axial or other loading except internal pressure.

Collapse pressure based on API 5C3; assumes no ovality, internal pressure or other loading except external pressure.

### Notes Regarding Load at 0.2% YS & UTS

The load at minimum 0.2% YS represents the load at which 0.002 in/in of plastic (permanent) axial strain deformation has occurred. The load at typical UTS represents the load to cause failure. Decisions regarding the pull out load to be applied to tubing should consider these two loads. The data herein is approximate and subject to normal manufacturing tolerances. These specifications are subject to change without notice.

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## Exploration & Production

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## Control Line

### ALLOY 625 CONTROL LINE

HEAT TREATED AND COLD WORKED / 90 KSI MINIMUM YIELD STRENGTH / UNS N06625

**TABLE 1 CHEMICAL COMPOSITION : UNS N06625 WITH FURTHER RESTRICTIONS BY INTERNAL STRIP SPECIFICATION**

C	Mn	Si	P	S	Cr	Nb + Ta	Co	Mo	Fe	Al	Ti	Ni
0.05 max	0.50 max	0.50 max	0.015 max	0.015 max	20.0 -23.0	3.15 - 4.15	1.0 max	8.0 - 10.0	5.0 max	0.40 max	0.40 max	58.0 min

**TABLE 2 TYPICAL PHYSICAL CONSTANTS & THERMAL PROPERTIES**

Density (lbs./in <sup>3</sup> )	0.305
Modulus of tension elasticity (x106 psi)	29.8 at 70°F 28.4 at 400°F
Mean coefficient of thermal expansion from 70° to temperature shown (in/in/°F 10-6)	7.1 to 200°F 7.3 to 400°F

**TABLE 3 MECHANICAL PROPERTIES**

PROPERTY	MIN.	MAX.	TYPICAL
Ultimate Tensile Strength UTS, (psi)	-	165,000	138,000
0.2% Offset Yield Strength, YS (psi)	90,000	135,000	105,000
Elongation in 2 inches, E (%)	25	-	32
Hardness, HR30TW	-	93	86

**TABLE 4: SIZE DEPENDANT CHARACTERISTICS / PROPERTIES (BASED UPON NOMINAL TUBING DIMENSIONS)**

NOMINAL OUTSIDE DIAMETER IN.	NOMINAL WALL THICKNESS IN.	MINIMUM BURST PRESSURE PSI	MINIMUM COLLAPSE PRESSURE PSI	NOMINAL WORKING PRESSURE PSI	METAL CROSS SECTION IN. <sup>2</sup>	FLOW CROSS SECTION IN. <sup>2</sup>	VOLUME PER UNIT LENGTH GAL/1000FT.	WEIGHT PER UNIT LENGTH LBS./1000 FT.	LOAD AT MINIMUM 0.2% YS LBS.	LOAD AT TYPICAL UTS LBS.
0.125	0.022	41,766	23,537	22,981	0.0071	0.0052	0.27	26.1	641	982
0.125	0.028	53,156	28,461	29,976	0.0085	0.0037	0.19	31.2	768	1,177
0.125	0.035	66,445	33,396	38,003	0.0099	0.0024	0.12	36.2	891	1,366
0.250	0.035	33,617	19,621	17,841	0.0236	0.0254	1.32	86.5	2,128	3,262
0.250	0.049	47,063	25,906	25,887	0.0309	0.0181	0.94	113.3	2,785	4,270
0.250	0.065	62,431	31,997	35,184	0.0378	0.0113	0.59	138.3	3,400	5,213
0.375	0.035	22,500	13,750	11,459	0.0374	0.0731	3.80	136.9	3,365	5,159
0.375	0.049	31,500	18,550	16,536	0.0502	0.0603	3.13	183.7	4,517	6,925
0.375	0.065	41,786	23,546	22,595	0.0633	0.0471	2.45	231.8	5,697	8,736
0.375	0.083	53,357	28,542	29,587	0.0761	0.0343	1.78	278.8	6,853	10,507
0.500	0.035	16,909	10,566	8,420	0.0511	0.1452	7.54	187.2	4,602	7,056
0.500	0.049	23,672	14,398	12,080	0.0694	0.1269	6.59	254.2	6,248	9,581
0.500	0.065	31,402	18,500	16,443	0.0888	0.1075	5.59	325.2	7,995	12,258
0.500	0.083	40,097	22,762	21,539	0.1087	0.0876	4.55	398.1	9,786	15,005
0.625	0.035	13,500	8,550	6,650	0.0649	0.2419	12.57	237.5	5,839	8,953
0.625	0.049	18,900	11,718	9,502	0.0887	0.2181	11.33	324.6	7,980	12,236
0.625	0.065	25,071	15,162	12,884	0.1144	0.1924	10.00	418.7	10,292	15,781
0.625	0.083	32,014	18,812	16,833	0.1413	0.1655	8.60	517.4	12,719	19,503

### Notes Regarding Burst and Collapse Pressure

Minimum internal burst pressure and external collapse pressure calculations were based upon:

Minimum ultimate tensile strength, UTS<sub>min</sub> = 135,000 psi

Minimum 0.2% offset yield strength, YS<sub>min</sub> = 90,000 psi

Maximum outside diameter, OD<sub>max</sub> per above table

Minimum wall thickness, t<sub>min</sub> per above table

Minimum burst pressure = (2 x t<sub>min</sub> x UTS<sub>min</sub>) / OD<sub>max</sub>; assumes no axial or other loading except internal pressure.

Collapse pressure based on API 5C3; assumes no ovality, internal pressure or other loading except external pressure.

Nominal working pressure = Lamé' formula for burst pressure, using YS<sub>min</sub>, OD<sub>nom</sub>, t<sub>nom</sub>, and a safety factor of 1.6.

### Notes Regarding Load at 0.2% YS & UTS

The load at minimum 0.2% YS represents the load at which 0.002 in./in. of plastic (permanent) axial strain deformation has occurred.

The load at typical UTS represents the load to cause failure. Decisions regarding the pull out load to be applied to tubing should consider these two loads. The data herein is approximate and subject to normal manufacturing tolerances. These specifications are subject to change without notice.

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