Alloy 825 Seamless Pressure Tubing

Heat treated / 35 ksi minimum yield strength

UNS N08825

Applications

Alloy 825 seamless pressure tubing in the heat treated condition is typically used in oil and natural gas wells for applications including hydraulically actuated surface-controlled subsurface safety valves, chemical injection, and instrumentation. In such applications, it is commonly referred to as control line tubing. The tubing is generally deployed by strapping it to the outside of the production casing. It may be encapsulated and can be included along with other pressure or TEC and mechanical components, such as bumpers, within a flatpack. The tubing is frequently supplied as 5,000 to 35,000 ft. coils on a wooden or steel reel, depending on size.

Description

Alloy 825 is a titanium-stabilized austenitic nickel - iron - chromium alloy with additions of molybdenum, and copper. The chemical composition of the alloy is listed in Table 1. The alloy is characterized by good resistance to stress-corrosion cracking due to its nickel content (38.0 to 46.0) and satisfactory resistance to pitting and crevice corrosion. Alloy 825 has shown good corrosion resistance in oil and gas production environments containing hydrogen sulfide, carbon dioxide and chlorides. Consult ISO 15156-3, Table A.14 for the limits regarding material type 4c in hydrogen sulfide containing environments for oil and gas production. Draka uses expert system software to assist customers in their selection of alloys for oil and gas environments.

Manufacturing Process and Resultant Properties

Seamless extruded tube hollows are drawn or drawn/sunk to final size to produce seamless tubing coils 500 to 2,000 ft long, depending upon the size. The tubing is heat treated and joined by orbital welding to achieve the desired length. The final material condition of the tubing is heat treated. Mechanical properties, permissible variation in tubing dimensions and size dependant characteristics / properties are listed in Tables 3, 4, and 5 on reverse respectively.

Nondestructive Testing (NDT)

Eddy current testing (ECT) is performed at final size in the heat treated condition. Radiographic testing is performed on all orbital welds. Yield pressure hydrostatic testing is performed on the heat treated tubing at final size.

Standards and Specifications

Tubing Specification PTM-TS-023, Alloy 825 Seamless Tubing for Control Line Applications

ASTM B423, Standard Specification for Nickel-Iron-Chromium–Molybdenum-Copper Alloy (UNS N08825 and N08221) Seamless Pipe and Tube

Meets the material limits for material type 4c listed in ISO 15156-3, Table A.14.

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Table 1 - Chemical Composition, UNS N08825 with further restrictions by Draka Tubing Procurement Specification, PTM-TPS-002, (%)

Ni	Cr	Fe	Mn	C	Cu	Si	S	Al	Ti	Mo
38.0 - 46.0	19.5-23.5	22.0 min	1.0 max	0.03 max	1.5-3.0	0.5 max	0.03 max	0.2 max	0.6-1.2	2.5 - 3.5

Table 2 - Typical Physical Constants and Thermal Properties

Density (lbs/in^3)	0.293
Modulus of tension elasticity (x10^6 psi)	28.3 at 70º F
	26.8 at 400º F
Mean coefficient of thermal expansion from 70º F to temperature shown (in/in/ºF x 10^{-6})	7.8 to 200º F
	8.3 to 400º F

Table 3 - Mechanical Properties

Property	Minimum	Maximum	Typical
Ultimate Tensile Strength UTS, (psi)	85,000	—	100,500
0.2% Offset Yield Strength, YS (psi)	35,000	—	40,500
Elongation in 2 inches, E (%)	30	—	48
Hardness, HRBW	—	90	75

Table 4 - Permissible Variation in Tubing Dimensions

Nominal Outside Diameter (in)	OD (in)	t (± %)
less than 0.625	±0.003	10
greater than or equal to 0.625	+0.004, -0.003	10

Table 5 - Size Dependant Characteristics / Properties (based upon nominal tubing dimensions)

Nominal Outside Diameter in (mm)	Nominal Wall Thickness in	Minimum Burst Pressure psi	Minimum Collapse Pressure psi	Metal Cross Section in^2	Flow Cross Section in^2	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
0.250	0.035	21,166	7,630	0.0236	0.0254	1.3	83.1	827	2,376
0.250	0.049	29,632	10,075	0.0309	0.0181	0.9	108.8	1,083	3,110
0.250	0.065	39,308	12,443	0.0378	0.0113	0.6	132.8	1,322	3,797
0.375	0.035	14,167	5,347	0.0374	0.0731	3.8	131.4	1,308	3,757
0.375	0.049	19,833	7,214	0-0502	0.0603	3.1	176.4	1,756	5,043
0.375	0.065	26,310	9,157	0.0633	0.0471	2.4	222.6	2,216	6,362
0.500	0.035	10,646	4,109	0.0511	0.1452	7.5	179.8	1,790	5,139
0.500	0.049	14,905	5.599	0.0694	0.1269	6.6	244.1	2,430	6,977
0.500	0.065	19,771	7,194	0.0888	0.1075	5.6	312.3	3,109	8,927

Notes Regarding Burst and Collapse Pressure

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

Minimum ultimate tensile strength, UTS_{min} and minimum 0.2% offset yield strength, YS_{min} per above table.

Maximum outside diameter, OD_{max} per above table

Minimum wail thickness, t_{min} per above table

Minimum burst pressure = (2 x t_{min} x UTS_{min}) / OD_{max}; 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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