Draka

A brand of the Prysmian Group

Alloy 825 Seam Welded Pressure Tubing

HEAT TREATED AND COLD WORKED / 90 KSI MINIMUM YIELD STRENGTH
UNS N08825

Application

Alloy 825 seam welded pressure tubing in the heat treated and cold worked condition is typically used in oil and natural gas wells for chemical injection applications. In such applications, it is commonly reffered to as capillary tubing and is free-hanging (self supporting) inside the production casing. The chemicals being injected are often used to enhance production flow rates, inhibit corrosion or scaling and/or de-water. The tubing is frequently supplied as 5,000 to 35,000 ft. coils on a wooden 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

Strip splice welds join lengths of cold rolled strip to enable long lengths between orbital welds (greater than 5,000 ft between orbital welds is achievable).

The strip is formed into a tubular cross section and longitudinally seam welded using either the gas tungsten arc (GTAW) or laser beam welding (LBW) process. The tubing is first sunk to an intermediate outside diameter, heat treated, and joined by orbital welding to achieve the desired length. The tubing is then sunk to the final outside diameter and provided in the as-cold worked condition. 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 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 those strip splice welds 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.

Standards and Specifications

Tubing Specification PTM-TS-006, Alloy 825 Tubing with Enhanced Properties

ASTM B704, Standard Specification for Welded UNS N06625, UNS N06219, and UNS N08825 Alloy Tubes, except in the as-cold worked condition

Meets the material limits for annealed and cold-worked, solid-solution, nickel-based alloys listed in ISO 15156-3 for material type 4c in Table A.14.

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006 825 W PT CW 1012

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Table 1 - Chemical Composition
UNS N08825 with further restrictions by Draka Strip Specification, PTM-SS-003, (%)

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 and Thermal Properties

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

Table 3 - Mechanical Properties

Property	Minimum	Maximum	Typical
Ultimate Tensile Strength UTS, (psi)	–	150,000	120,000
0.2% Offset Yield Strength, YS (psi)	90,000	135,000	100,000
Elongation in 2 inches, E (%)	5	–	10
Hardness, HR30TW	–	90	86

Table 4 - Permissible Variation in Tubing Dimensions

Nominal Outside Diameter (in)	OD (± in)	t (± %)
Less than 0.625	0.003	10
Equal to or greater than 0.625	0.005	10

Table 5 - 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^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	27,391	19,621	0.0236	0.0254	1.3	83.1	2,128	2,837
0.250	0.049	38,348	25,906	0.0309	0.0181	0.9	108.8	2,785	3,713
0.250	0.065	50,870	31,997	0.0378	0.0113	0.6	132.8	3,400	4,533
0.375	0.035	18,333	13,750	0.0374	0.0731	3.8	131.4	3,365	4,486
0.375	0.049	25,667	18,550	0.0502	0.0603	3.1	176.4	4,517	6,022
0.375	0.065	34,048	23,546	0.0633	0.0471	2.4	222.6	5,697	7,596
0.500	0.035	13,777	8,792	0.0511	0.1452	7.5	179.8	4,602	6,136
0.500	0.049	19,288	14,398	0.0694	0.1269	6.6	244.1	6,248	8,331
0.500	0.065	25,586	18,500	0.0888	0.1075	5.6	312.3	7,995	10,659
0.625	0.035	11,035	5,263	0.0649	0.2419	12.6	228.1	5,839	7,785
0.625	0.049	15,449	10,854	0.0887	0.2181	11.3	311.8	7,980	10,640

Notes Regarding Burst and Collapse Pressure

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

- Minimum ultimate tensile strength, UTS_{min} = 110,000 psi
- Minimum 0.2% offset yield strength, YS_{min} = 90,000 psi
- Maximum outside diameter, ODmax per above table
- Minimum wall 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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