outokumpu
high performance stainless steel

Ultra Alloy 825

General characteristics

Outokumpu Ultra Alloy 825 (W.-Nr. 2.4858, UNS N08825, ISO NW8825) is a titanium stabilized austenitic nickel base alloy with an addition of copper.

- Excellent resistance to stress corrosion cracking
- Very good resistance in oxidizing and reducing acids
- Moderate resistance to pitting and crevice corrosion
- Good mechanical properties also at elevated temperatures
- Reduced risk for sensitization when used in temperature ranges where this is a problem for stainless steels

Outokumpu Ultra Alloy 825 is listed in ISO 15156-3 (NACE MR0175), materials for oil and gas production, and in NACE MR0103, materials resistant to sulfide stress cracking.

Typical applications

- Components in sour gas service
- Offshore oil and gas piping systems
- Equipment in petroleum refineries
- Heating coils
- Heat exchangers
- Tanks
- Scrubbers
- Chemical processing equipment
- Food process equipment
- Nuclear industry equipment

Products & dimensions

Cold rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
2E	Cold rolled, heat treated, mech. desc. pickled	0.40-6.00	1100-1520	3.00-6.00	1219-1500

Continous hot rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1D	Hot rolled, heat treated, pickled	5.50-8.00	1100-1540	6.00-8.00	1100-1500

Chemical composition

The typical chemical composition for this grade is given in the table below, together with composition limits given for this grade according to different standards. The required standard will be fully met as specified on the order.

	C	Mn	Cr	Ni	Mo	N	Other
Typical	**0.010**	**0.8**	**23.0**	**39.5**	**3.2**		**Si:0.35 Cu:1.7 Ti Al:0.1**
ASTM B424	≤0.05	≤1.0	19.5-23.5	38.0-46.0	2.5-3.5		Cu:1.5-3.0 Ti
ISO 6208	≤0.05	≤1.0	19.5-23.5	38.0-46.0	2.5-3.5		Cu:1.5-3.0 Ti

Corrosion resistance

Uniform corrosion

Outokumpu Ultra Alloy 825 shows very good resistance in many acids, e.g. sulphuric acid (see Fig. 1), phosphoric acid, nitric acid as well as organic acids. Alloying with e.g. molybdenum and copper improves the corrosion resistance in reducing acids. Outokumpu Ultra Alloy 825 also shows good resistance in alkaline environments like sodium and potassium hydroxide solutions.

Pitting and crevice corrosion

The resistance to pitting and crevice corrosion is higher than for e.g. Supra 316L/4404 types of stainless steel, but does not reach the level of e.g. Ultra 254 SMO. Typical values in Table 4.

Stress corrosion cracking

The high nickel content of Outokumpu Ultra Alloy 825 contributes to the very high resistance to stress corrosion cracking, both chloride induced as well as in alkaline environments. This is illustrated by the fact that it is expected to pass over 24 hours without cracking when tested according to the very aggressive ASTM G36 (boiling 45% MgCl2).
Outokumpu Ultra Alloy 825 also has excellent resistance to sulphide
stress cracking. In accordance with ISO 15156-3 (NACE MR0175)solution annealed and cold worked Ultra Alloy 825 is acceptable for use for any component or equipment up to 232 °C in sour environments, with no limits on chloride concentration and in situ pH, providing that the partial pressure of hydrogen sulphide (pH2S) does not exceed 2 bar (30 psi). If the temperature does not exceed 132 °C, the material is acceptable for use without restriction on partial pressure.

Intergranular corrosion

Outokumpu Ultra Alloy 825 is stabilized with titanium which in combination with the low carbon content improves the resistance to intergranular corrosion.

Pitting corrosion resistance		Crevice corrosion resistance
PRE	CPT	CCT
34	58	5

Pitting Resistance Equivalent (PRE) is calculated using the following formula: PRE = %Cr + 3.3 x %Mo + 16 x %N
Corrosion Pitting Temperature (CPT) as measured in the Avesta Cell (ASTM G 150), in a 1M NaCl solution (35,000 ppm or mg/l chloride ions).
Critical Crevice Corrosion Temperature (CCT) is obtained by laboratory tests according to ASTM G 48 Method F

Mechanical properties

The mechanical properties of the available products are given in the table below.

Cold rolled coil and sheet	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1)] %	Impact strength J	Rockwell	HB	HV
Typical (thickness 1 mm)	**280**		**620**					
ASTM B424	≥ 241		≥ 586					
ISO 6208	≥ 240		≥ 590	≥ 30				

Hot rolled coil and sheet	$R_{p0.2}$ MPa	$R_{p1.0}$ MPa	R_m MPa	Elongation[1)] %	Impact strength J	Rockwell	HB	HV
ASTM B424	≥ 241		≥ 586					
ISO 6208	≥ 240		≥ 590	≥ 30				

Outokumpu Ultra Alloy 825 shows good mechanical properties from moderately high temperatures down to cryogenic temperatures. Outokumpu Ultra Alloy 825 shall not be used at temperatures above approximately 540 °C as ductility and impact strength become lowered due to changes in the microstructure. Outokumpu Ultra Alloy 825 is normally not used where creep rupture properties are design

factors.

Physical properties

Density kg/dm^3	Modulus of elasticity GPa	Thermal exp. at 100 °C 10^{-6}/°C	Thermal conductivity W/m°C	Thermal capacity J/kg°C	Electrical resistance µΩm	Magnetizable
8.1	195	14,1	10,5	440	1.12	No

Fabrication

The fabricability of Outokumpu Ultra Alloy 825 is similar to other types of nickel base alloys.

Formability

Outokumpu Ultra Alloy 825 has good ductility and can be formed using conventional methods.
Heat treatment
Post fabrication annealing is done at 950°C followed by rapid air cooling or water quenching.

Machining

Conventional techniques can be used also with Outokumpu
Ultra Alloy 825. The material work hardens during machining.

Welding

Outokumpu Ultra Alloy 825 is readily weldable with conventional welding methods such as:

- Shielded metal arc welding (SMAW, MMA)
- Gas tungsten arc welding (GTAW, TIG)
- Gas metal arc welding (GMAW, MIG/MAG)
- Submerged Arc Welding (SAW)

Preheating before welding is not necessary.

Filler

Outokumpu Ultra Alloy 825 can be welded using matching filler. For e.g. SMAW, covered electrodes of the type 2.4621 or 2.4652 can be used.

Standards & approvals

Outokumpu Ultra Alloy 825 is approved for pressure vessels operating at temperatures up to 538°C, according to ASME Boiler & Pressure Vessel Code, Sections I, III, VIII, IX, Code cases 1936, N-188-1. Material data in Section IID. Some material standards are shown in the table below

Standard	Designation
ASTM B424	UNS N08825
ISO 6208	NW8825

Contacts & Enquiries

Contact your nearest sales office

www.outokumpu.com/contacts

Working towards forever.

We work with our customers and partners to create long lasting solutions for the tools of modern life and the world's most critical problems: Clean energy, clean water and efficient infrastructure. Because we believe in a world that lasts forever.

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