ValbrunaNordic

High Temperature Stainless Steel
EN 1.4835 – UNS S 30815 – 253 MA®*

A stainless austenitic steel

Typical analysis %	C	N	Cr	Ni	Si	Others
EN 1.4835	0,03	0,17	21	11	1,7	Ce
Delivery condition			Solution annealed			

(EN 1.4835 Replaces SS 2368 –02)

Characteristic temperatures

	Temperature°C
Solidification range Scaling temperature in air	1430-1350 1150
Hot forming Solution annealing Stress relief annealing (min. 0,5h)	1150-900 1020-1120 900
Use in pressure vessels	830-1100

Mechanical properties

Values for solution annealed condition to EN 10095

Tensile strength Rm	N/mm^2	650 - 850
Proof strength Rp_{02}	N/mm^2	Min 310
Proof strength $Rp_{1,0}$	N/mm^2	Min 350
Elongation A_5	%	Min 40
Impact energy KV 20°C	J/cm^2	Min 120
Hardness	HB	Max 210

Physical properties acc. to EN 10088

Temperature°C	20	100	200	400	600	800	1000
Density kg/dm^3	7,8						
Modulus of elasticity E GPa	200	195	182	170	155	135	120
Mean coeff. of therm.expansion 20°C –Temp. $x10^{-6} \cdot K^{-1}$	-	16,5	17,0	18,0	18,5	19,0	19,5
SpecificTherm. Capacity $W/m \cdot K$	15	15,5	17,5	20,0	22,5	25,5	29,0
Electrical Resistivity $\Omega \cdot mm^2/m$	0,85	0,93	1,03	1,22	1,37	1,43	1,45
Specific heat $J/kg \cdot K$	500	520	540	570	600	630	660

EN 1.4835 – 253MA®* is an austenitic stainless steel, designed primarily for use at temperatures exceeding ~550° C. It has an increased nitrogen content and has been microalloyed with rare earth metals (REM) which gives good resistance to oxidation and relatively high creep strength values.The most suitable temperature range is 850-1100° C , because structural changes when used between 600 and 850°C can lead to reduced impact toughness at room temperature.
It is non-magnetic in the annealed condition but may become slightly magnetic as a result of cold-working or welding.

Design features

⇒ Good resistance to oxidation
⇒ Good resistance to high temperature corrosion
⇒ Good mechanical strength at elevated temperatures
⇒ Relatively high creep strength values
⇒ Good formability and weldability, acceptable machinability

Corrosion resistance

Aqueous corrosion

EN 1.4835 is optimised with regard to corrosion resistance (and strength) at high temperatures. The high contents of N and C make the steel sensible to intergranular corrosion. Its resistance to aqueous corrosion has been limited.

Components made of **EN 1.4835** should therefore be designed and operated so that acid condensates are not in contact with the material.

High-temperature corrosion

The resistance of a material to high temperature corrosion is in many cases dependent on its ability to form a protective oxide layer. In reducing atmosphere, when such a layer cannot be created, the corrosion resistance of the material will be determined by the alloy content of the material.

Oxidation

EN 1.4835 has good resistance to oxidation. The high contents of Cr, Si and rare earth metals (REM) decreases the oxide growth rate of the thin protective oxide layer which will be formed on the metal surface. The oxidation behaviour is
important, because the properties of the oxide layer will determine the resistance to attack by other aggressive elements in the environment. The oxide growth rate increases regularly with increasing temperature until the rate of oxidation becomes unacceptably high or until the oxide layer begins to crack and spall off, i.e. scaling temperature is reached. Scaling temperature for **EN 1.4835** in air is 1150 ˚C.

Heat treatment

Solution annealing 1020-1120ºC. Holding time at solution annealing temperature approx. 30 min., followed by rapid cooling in air or water.

Hardening

This grade cannot be hardened by heat treatment. But it can be hardened by cold working.

Fabrication

Hot and cold forming

Hot forming should be carried out in the temperature range 1150-900˚C. Solution annealing is generally not required since the material will be exposed to high temperatures when in operation. Like common austenitic stainless steels, the material can easily be formed in cold condition. Due to its relatively high nitrogen content, the mechanical strength of **EN 1.4835** is higher and greater deformation forces are required.

Machining

The relatively high proof strength of **EN 1.4835** and its tendency to cold hardening must be taken into account in connection with machining.

Welding

EN 1.4835 has a good weldability and can be welded using the following metods:

- Shielded metal arc welding (SMAW)
- Gas tungsten arc welding, GTAW (TIG)
- Plasma arc welding (PAW)
- Gas metal arc GMAW (MIG)
- Submerged-arc welding (SAW)

Filler metal of type **EN 1.4835** is recommended for both covered electrodes and welding wire. This ensures a weld metal with properties equivalent to those of the parent material. Welding shall be done without rised welding temperature. Heat input shall be kept low during welding. Welding shall be performed with small diameter welding electrodes, narrow passes without weaving and low welding current. Material shall be cooled to below 150˚C between passes.
More detailed information concerning the procedures for welding these steels can be obtained from Avesta Welding AB.

Surface finish

EN 1.4835 is available with pickled, machined and peeled surface.

Stock standard

Please refer to our stock standard leaflet.

Technical support

VALBRUNA NORDIC AB will be helpful in giving further advice and recommendations concerning choice of materials, welding, heat treatment etc.

MATERIAL STANDARDS

SS-EN 10095	Heat resisting steels and nickel alloys
ASTM A 276/ ASME SA-276	Stainless steel bars for general purposes
ASTM A 479/ ASME SA-479	Stainless steel bars for pressure boilers/pressure vessels