

SuperElso® 533E SA-533 Type E Class 2

SuperElso® 533E: Quenched and tempered High Strength Steel for Pressure Equipment in Wet H₂S Service

SuperElso® 533E (SE 533) is a quenched and tempered steel dedicated to pressure equipment operating under wet H₂S service condition. SE 533 is manufactured via the electric arc furnace route, with dephosphorization, ladle refining and vacuum degassing to provide reproducible, clean and homogeneous steel.

The chemistry of SE 533 has been carefully adapted to combine high strength, good weldability and excellent impact properties at low temperature (down to -60°C / -76°F). It is designed to meet the requirements of NACE standard MR0175 / ISO15156.

SuperElso® 533E is particularly suitable for pressure equipment in wet H₂S service in the offshore oil and gas industry, where its high strength allows significant weight reduction.

PROPERTIES

STANDARDS

> ASME SA-533 Type E Class 2

> ASTM A-533 Type E Class 2

Note: this grade exists also in EN10028 standard under SuperElso® 500HR

CHEMICAL ANALYSIS (MASS WEIGHT %)

Typical heat analysis

C	Mn	Si	P	S	Ni	Cr	Mo
≤ 0.10	1.15 - 1.70	≤ 0.40	≤ 0.007	≤ 0.002	≤ 1.0	≤ 0.60	0.25 - 0.60

Nb+V ≤ 0.02% (in order to allow adequate softening of the HAZ during PWHT).

DELIVERY CONDITION

Water quenched and tempered.

MECHANICAL PROPERTIES

Tensile properties at room temperature for all plate thicknesses (transverse test specimens):

Tensile properties of ASTM A533 Type E Class 2 / ASME SA-533 Type E Class 2.

Yield strength, min		Tensile strength		Elongation
ksi	MPa	ksi	MPa	%
70	485	90 - 115	620 - 795	16

Tensile properties at high temperatures are available on request.

PROPERTIES

Impact properties with Charpy-V transverse test specimens:

Impact test according to ASTM A370

Test temperature °C (°F)	Average impact value in Joules
-50 (-58)	≥ 60

The specified value is the average of three tests. Charpy-V notch (CVN) properties are guaranteed at quarter-thickness.

Impact requirements at other temperatures can be agreed on request.

SOUR SERVICE PROPERTIES

SuperElso® 533E is designed to meet following requirements:

- > Hardness requirements as per NACE MR0175 / ISO 15156-2
- > HIC criteria as per ISO 15156-2 Table B.3 (latest edition)
- > Other requirements upon agreement.

PLATE PROCESSING

FORMING

SuperElso® 533E can be processed by cold forming or hot forming:

Cold or warm forming

Cold forming has to be followed by post weld heat treatment (PWHT).

Hot forming

Following hot forming, a subsequent full heat treatment (quenching and tempering) may be necessary. *Please consult us in order to get recommendations on heat treatment.*

HEAT TREATMENT

Austenitizing and tempering treatment

Austenitizing at 900°C – 950°C (1650°F – 1800°F), water quenching.

Tempering after water quenching according to the manufacturer 's recommendations.

Stress relieving treatment (post weld heat treatment)

At 600°C – 635°C (1110°F – 1175°F).

SA-533 type E is P-No. 3 Group No.3 material per ASME BPVC Section IX. Minimum PWHT temperature is 595°C (holding time depending on thickness).

WELDING

Filler materials

A non-exclusive list of suitable filler materials is provided below for submerged arc welding (SAW):

Process	Supplier	Flux		
		Trade name	AWS	Trade name
SAW	ESAB	OK AUTROD 13.40	F9P6-EG-F3	OK Flux 10.62
SAW	BOEHLER	Union S 3 NiMo1	F9A6- EG-F3-N	UV 420 TTR
SAW	OERLIKON	OE- SD3NiMo1	F9P8- EF3-F3	OP 121 TT



WELDING

Welding conditions

Process	Heat input	Preheating	Interpass	Post-heating *
Submerged Arc Welding (SAW)	2.7 kJ/mm max	min 150°C	max 250°C	150°C – 2h

* These values are reliable for HAZ and base metal. For post heating on Weld metal, please consult filler material supplier.

The heat affected zone (HAZ) properties meet the NACE MR0175 / ISO 15156-2 hardness requirements following the recommendations above and good practice on welding sequence and PWHT.

For more information on welding conditions, please consult us.

APPLICATIONS

SuperElso® 533E is suitable for pressure vessels where H₂S is present, such as gas processing equipment (separators, scrubbers etc.) in the oil and gas industry. It is particularly aimed at offshore applications where its high mechanical properties allow significant wall thickness reduction.

SuperElso® 533E can be supplied as:

- Solid plates,
- Clad plate (cladding: stainless or corrosion resistant alloy)
- Shells
- Heads (elliptical, hemispherical)

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Technical data and information are to the best of our knowledge at the time of printing. However, they may be subject to some slight variations due to our ongoing research programme on steels. Therefore, we suggest that information be verified at time of enquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here are only for the purpose of description, and considered as guarantees when written formal approval has been delivered by our company. Further information may be obtained from the address opposite.