SANDVIK SAF 32760
BAR

DATASHEET

Sandvik SAF 32760 is a high alloy super-duplex (austenitic-ferritic) stainless steel for service in highly corrosive conditions.

The grade is characterized by:

- Excellent resistance to stress corrosion cracking in chloride-bearing environments
- Excellent resistance to pitting and crevice corrosion
- High resistance to general corrosion
- Very high mechanical strength
- Physical properties that offer design advantages
- High resistance to erosion corrosion and corrosion fatigue
- Good weldability
- Excellent mechanical properties that allow for lighter constructions, more compact design and less welding

STANDARDS

- UNS S32760
- EN Number 1.4501
- EN Name X2CrNiMoCuWN25-7-4

Product standards

- EN 10088-3, (dimensions up to 160 mm)
- EN 10272
- ASTM A479, ASTM A276
- NORSOK M630 MDS D57 Rev 5
- Suitable for manufacturing of components in accordance with ASTM A182

Approvals

- Pressure Equipment Directive (97/23/EC)
- NORSOK M650 Ed. 4

Certificate

- Status according to EN 10 204/3.1

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn	P	S	Cr	Ni	Mo	N	W	Cu

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C	Si	Mn	P	S	Cr	Ni	Mo	N	W	Cu
≤0.030	≤1.0	≤1.0	≤0.030	≤0.010	25.5	7	3.8	0.26	0.7	0.8

APPLICATIONS

Sandvik SAF 32760 is a super-duplex stainless steel especially designed for service in aggressive chloride-containing environments. Some typical applicational areas are:

- Oil and gas industry
- Seawater cooling
- Salt evaporation industry
- Desalination plants
- Geothermal wells
- Refineries and petrochemical plants
- Mechanical components requiring high strength
- Pulp and paper industry
- Chemical processing

FORMS OF SUPPLY

Finishes and dimensions

Sandvik SAF 32760 bar steel is stocked in a large number of sizes. Round bar is supplied in solution annealed and water quenched condition. The surface is peel turned and burnished.

Lengths

Bars are delivered in random lengths of 3-7 m, depending on diameter.

Straightness

Diameter mm	Height of arch, mm/m Typical value
> 70	2

Tolerances, mm-sizes

Diameter, mm	Tolerances, mm
80-95	-0/+1.00
100-250	-0/+1.50

Surface conditions

Surface conditions	Ra, µm Typical value	Size, mm dia
Peeled and burnished	1	80-250

MECHANICAL PROPERTIES

Bar steel is tested in delivery condition.

The following figures apply to material in the solution annealed and quenched condition.

More detailed information can be supplied on request.

At 20°C (68°F)

Metric units

Proof strength	Tensile strength	Elong.	HB
$R_{p0.2}$[a)]	R_m	A[b)]	
MPa	MPa	%	
≥550	750-930	≥25	≤290

Imperial units

Proof strength	Tensile strength	Elong.	Hardness
$R_{p0.2}$[a)]	R_m	A[b)]	HB
ksi	ksi	%	
≥80	109-135	≥25	≤290

1 MPa = 1 N/mm²
[a)] $R_{p0.2}$ corresponds to 0.2% offset yield strength.
[b)] Based on $L_0 = 5.65\sqrt{S_0}$, where L_0 is the original gauge length and S_0 the original cross-section area.

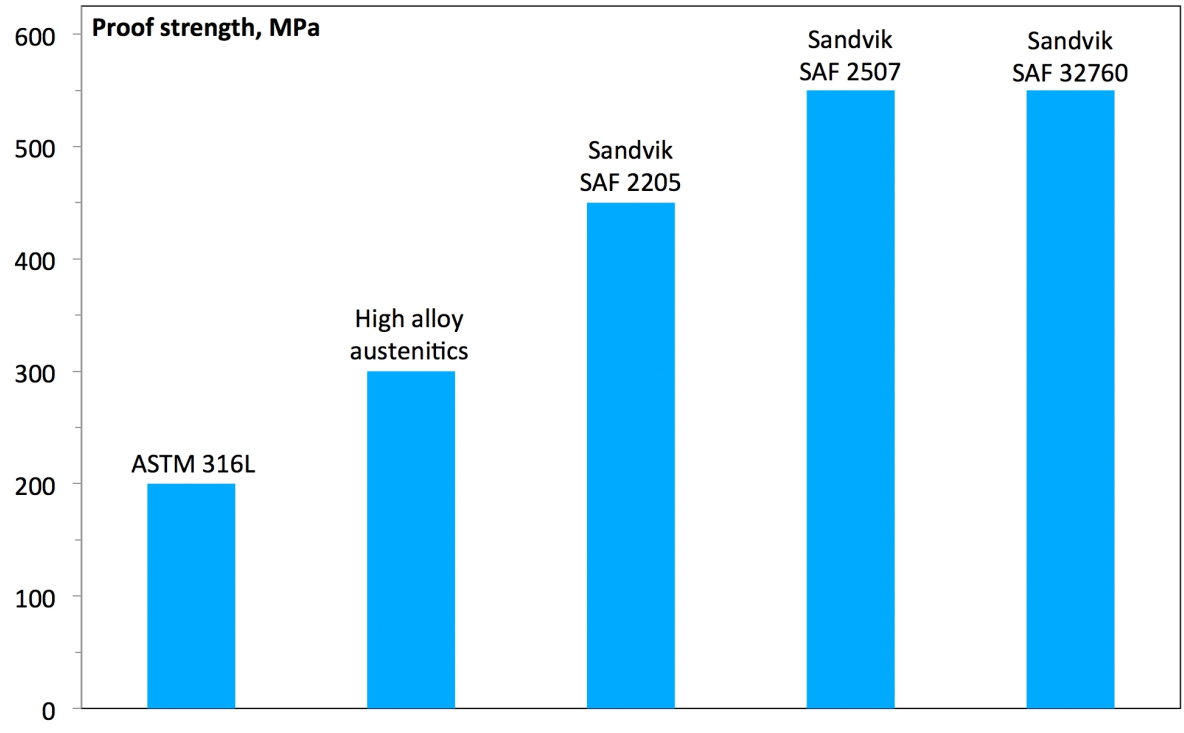


Figure 1. Comparison of proof strength.

At high temperatures

If Sandvik SAF 32760 is exposed for prolonged periods to temperatures exceeding 250°C (480°F), the microstructure changes which results in a reduction in impact strength. This effect does not necessarily affect the behaviour of the material at the operating temperature.

Metric units

Temperature, °C	Proof strength $R_{p0.2}$, MPa
	min.
100	450
150	420
200	400
250	380

Imperial units

Temperature, °F	Proof strength $R_{p0.2}$, ksi
	min.
200	67
300	61
400	58
480	55

Impact strength

Sandvik SAF 32760 possesses good impact strength. Figure 2 shows typical impact energy values for Sandvik SAF 32760 in different sizes at -46°C (-50°F), using standard Charpy V specimens. Samples are taken in the longitudinal direction and the impact strength (Charpy V) at -46°C (-50°F) is min 45 J (74 ft-lb).

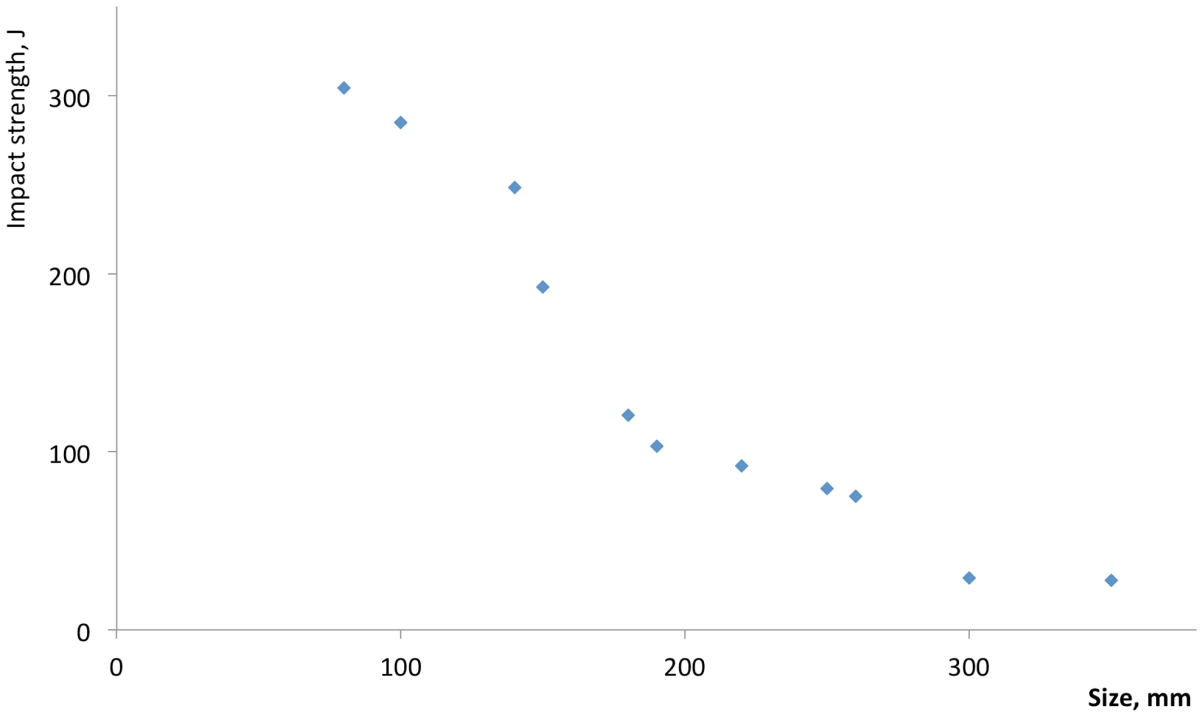


Figure 2. Typical impact energy values for Sandvik SAF 32760 in different sizes at -46°C (-50°F), using standard Charpy V specimens.

CORROSION RESISTANCE

General corrosion

Sandvik SAF 32760 is highly resistant to corrosion by organic acids, e.g. formic and acetic acid. It is suitable for use at high concentrations and temperatures, where austenitic stainless steels corrode at a high rate.

Resistance to inorganic acids is comparable to that of high alloy austenitic stainless steels in certain concentration ranges.

Pitting and crevice corrosion

The pitting and crevice corrosion resistance of a stainless steel is primarily determined by the content of chromium, molybdenum and nitrogen. An index for comparing the resistance to pitting and crevice corrosion is the PRE number (Pitting Resistance Equivalent).

The PRE is defined as, in weight-% PRE = %Cr + 3.3x%Mo +16x%N

For duplex stainless steels the pitting corrosion resistance is dependent on the PRE-value in both the ferrite phase and the austenite phase, so that the phase with the lowest PRE-value will be limiting for the actual pitting corrosion resistance.

The minimum PRE-value for Sandvik SAF 32760 is 40. This is significantly higher than e.g. the PRE-values for other duplex stainless steels of the 25Cr type which are not "super-duplex". As an example UNS S31260 (25Cr3Mo0.2N) has a PRE-value of typically 38.

Stress corrosion cracking

Sandvik SAF 32760 has excellent resistance to chloride induced stress corrosion cracking.

Erosion corrosion and corrosion fatigue

The superior mechanical properties combined with the improved corrosion resistance of Sandvik SAF 32760 result in excellent resistance to both erosion corrosion and corrosion fatigue compared to standard austenitic stainless steels.

MACHINING

Being a two-phase material (austenitic-feritic) Sandvik SAF 32760 will present a different wear picture from that of single-phase steels of type ASTM 304L. The cutting speed must therefore be lower than that recommended for ASTM 304L. It is recommended that a tougher insert grade is used than when machining austenitic stainless steels, e.g. ASTM 304L. Also in comparison with Sanmac SAF 2205 lower speed and tougher insert grade is recommended. Machining recommendations available on request.

PHYSICAL PROPERTIES

Density

7.8 g/cm^3, 0.28 lb/in^3

Specific heat capacity

500 J/(kg °C) at 20°C, 0.12 Btu/(lb °F) at 68°F

Thermal conductivity

Temperature	20°C	68°F
SAF 32760	15 W/(m °C)	9 Btu/(ft h °F)
AISI 316L	14 W/(m °C)	9 Btu/(ft h °F)

Thermal expansion

Sandvik SAF 32760 has a coefficient of thermal expansion close to that of carbon steel. This gives Sandvik SAF 32760 definite design advantages over austenitic stainless steels in equipment comprising both carbon steel and

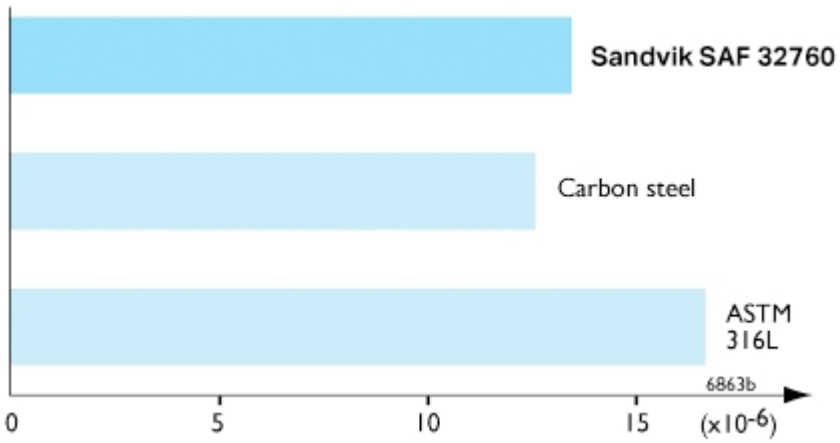
stainless steel. The values given below are average values in the temperature ranges.

Metric units, x10^{-6}/°C

Temperature, °C	30-100	30-200	30-300
SAF 32760	13.0	13.5	14.0
Carbon Steel	12.5	13.0	13.5
AISI 316L	16.5	17.0	17.5

Imperial units, x10^{-6}/°F

Temperature, °F	86-200	86-400	86-600
SAF 32760	7.0	7.5	7.5
Carbon Steel	6.8	7.0	7.5
AISI 316L	9.0	9.5	10.0



Resistivity

0.8 µΩm at 20°C, 31.5 µΩin. at 68°F

Modulus of elasticity, (x10^3)

Metric units; Imperial units

Temperature, °C	MPa	Temperature, °F	ksi
20	200	68	29.0
100	194	200	28.2
200	186	400	27.0
300	180	600	26.2

WELDING

The weldability of Sandvik SAF 32760 is good. Suitable welding methods are manual metal-arc welding with covered electrodes or gas-shielded arc welding. Welding should be undertaken within the heat input range of 0.2-1.5 kJ/mm and with an interpass temperature of maximum 150°C (300°F). Preheating or post-weld heat treatment is not necessary.

Matching filler metals are recommended in order to obtain a weld metal with optimum corrosion resistance and

mechanical properties. For gas-shielded arc welding use Sandvik 25.10.4.L, and for manual metal-arc welding the covered electrode Sandvik 25.10.4.LR (2594-16).

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