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Sanicro 30

(Tube and pipe, seamless)

Sanicro 30 is a low-carbon version of Alloy 800 austenitic nickel-iron-chromium alloy. The grade is used for steam generator tubing in nuclear stations (PWR) and other heat exchangers for temperature up to about 550°C (1020°F) where good resistance to stress corrosion cracking (SCC) and intergranular corrosion is required.

STANDARDS

- ASTM B163
- UNS N08800
- EN number 1.4558
- EN name X2NiCrAlTi32-20
- W.Nr. 1.4558
- DIN X 2 NiCrAlTi 32 20
- BS NA15

Product standards

Seamless condenser and heat exchanger tubes: ASTM A213, B163
Seamless tube and pipe: ASTM A312, B407, EN 10216-5

Approvals

Approved for use according to ASME Boiler and Pressure Vessel Code Section III, division 1 and Section VIII, division 1 and 2

CHEMICAL COMPOSITION (NOMINAL) %

C max	Si	Mn	P max	S max	Cr	Ni	Cu max	Ti	Al	Fe
0.030	0.5	0.6	0.020	0.015	20	32	0.10	0.5	0.3	bal

The Co content is normally max 0.10%. Subject to agreement, material with a lower Co content can be supplied.

FORMS OF SUPPLY-FINISHES AND DIMENSIONS

Seamless tube and pipe

Tube and pipe are supplied hot- or cold-worked, solution-annealed and white-pickled or bright-annealed. The principal size range can be seen from Fig. 1, but also certain sizes can be delivered on request.

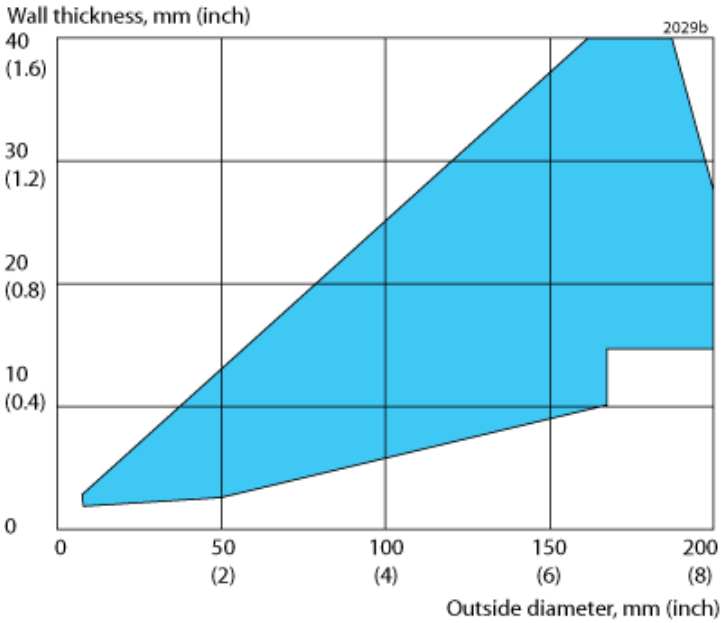

Figure 1. Principal size range for seamless tube and pipe.

MECHANICAL PROPERTIES

The figures below refer to cold-worked and annealed sizes up to 10 mm (3/8") wall thickness. For larger sizes and other finishes values are given on request.
For heat exchangers tubes, higher yield strength according to ASME Code Case N 20 can be applied. Slightly cold worked condition refers to outside diameter below 30 mm (1.2")

AT 20°C (68°F)

Annealed condition

METRIC UNITS

Yield strength		Tensile strength	Elong.	Hardness Vickers
0.2% offset	1.0% offset		2"	
MPa	MPa	MPa	%	
min.	min.		min.	approx.
205	235	520-690	30	150

1 MPa = 1 N/mm^2

IMPERIAL UNITS

Yield strength		Tensile strength	Elong.	Hardness Vickers
0.2% offset	1.0% offset		2"	
ksi	ksi	ksi	%	
min.	min.		min.	approx.
30	34	75-100	30	150

Slightly cold-worked condition (O.D. max. 0 mm; 1.2")

METRIC UNITS

Yield strength		Tensile strength	Elong.	Hardness Vickers
0.2% offset	1.0% offset		2"	
MPa	MPa	MPa	%	
min.	min.		min.	approx.
335	355	570-700	30	170

IMPERIAL UNITS

Yield strength		Tensile strength	Elong.	Hardness Vickers
0.2% offset	1.0% offset		2"	
ksi	ksi	ksi	%	
min.	min.		min.	approx.
48.5	51.5	82-102	30	170

AT HIGHER TEMPERATURES

Annealed condition

METRIC UNITS

Temperature	Yield strength	
°C	0.2% offset	1.0% offset
	MPa	MPa
	min.	min.
100	190	215
200	175	195
300	165	185
400	160	180
500	150	170
600	145	165

IMPERIAL UNITS

Temperature	Yield strength	
°F	0.2% offset	1.0% offset
	ksi	ksi
	min.	min.
200	28	31.5
400	25.5	28
600	24	26.5
800	23	25.5
1000	21.5	24.5
1100	21	24

Slightly cold-worked condition

METRIC UNITS

Temperature	Yield strength	
°C	0.2% offset	1.0% offset
	MPa	MPa
	min.	min.
100	325	335
200	310	320
300	300	310
400	290	300
500	280	290
600	275	285

IMPERIAL UNITS

Temperature	Yield strength	
°F	0.2% offset	1.0% offset
	ksi	ksi
	min.	min.
200	47.5	48.5
400	45	46
600	43.5	44.5
800	41.5	43
1000	40.5	42
1100	40	41.5

PHYSICAL PROPERTIES

Density: 8.0 g/cm3; 0.29 lb/in^3
Scaling temperature in air: 1150°C, 2100°F

THERMAL CONDUCTIVITY

Temperature, °C	W/(m °C)	Temperature, °F	Btu/(ft h °F)
20	12	68	7
100	14	200	8
200	16	400	9
300	17	600	10
400	18	800	11
500	20	1000	12
600	23	1100	13

SPECIFIC HEAT CAPACITY[1)]

Temperature, °C	W/(m °C)	Temperature, °F	Btu/(ft h °F)
20	475	68	0.11
100	500	200	0.12
200	515	400	0.12
300	525	600	0.13
400	525	800	0.13
500	535	1000	0.13
600	585	1100	0.14

1) Mean values

RESISTIVITY

Temperature, °C	µΩm	Temperature, °F	µΩin.
20	0.99	68	39
100	1.01	200	39.5
200	1.03	400	40.5
300	1.05	600	41.5
400	1.08	800	43
500	1.12	1000	45
600	1.18	1100	46

THERMAL EXPANSION[1)]

Temperature, °C	Per °C	Temperature, °F	Per °F
20-100	16	68-200	9
20-200	16	68-400	9
20-300	16	68-600	9
20-400	16.5	68-800	9
20-500	16.5	68-1000	9
20-600	17	68-1100	9.5

1) Mean values ($x10^{-6}$)

MODULUS OF ELASTICITY[1)]

Temperature, °C	MPa	Temperature, °F	ksi
20	200	68	29.0
400	175	600	26.1
600	160	1100	23.4

1) ($x10^3$)

CORROSION RESISTANCE

General corrosion
Sanicro 30 has approximately the same resistance to organic and inorganic acids as steel of the ASTM TP 304 type. Its resistance to sodium hydroxide is very good except at the very highest concentrations and temperatures.

Pitting
The material has somewhat better resistance to pitting than steel of the ASTM TP 304 type.

Intergranular corrosion and stress corrosion cracking
In comparison with the standard Alloy 800, Sanicro 30 has improved resistance both to intergranular corrosion and to intergranular stress corrosion cracking. This is obtained by a high degree of stabilisation and a production sequence giving a small grain size. The resistance to transgranular stress corrosion cracking is very good as for all high-nickel alloys.

Gas corrosion
In general this grade is not used at temperatures high enough for gas corrosion to be a problem. For such cases the appropriate metal to choose is Sanicro 31HT. However, compared with Sanicro 31HT, Sanicro 30 has about the same resistance to gas corrosion.

HEAT TREATMENT

The tubes are delivered in heat treated condition. If another treatment is needed after further processing the following is recommended.

Stress relieving
800-875°C (1470-1605°F), 10-15 minutes, cooling in air

Solution annealing
950-1050°C (1740-1920°F), 1-10 minutes, rapid cooling in water or air.

WELDING

The weldability of Sanicro 30 is good. Suitable fusion-welding methods are manual metal-arc welding with covered electrodes and gas-shielded arc welding, with the TIG and MIG methods as first choice. Preheating and post-weld heat treatment are normally not necessary.

The welding of nickel-base materials calls for special cleanliness. Joint surface and filler metals have to be free from grease, dirt, chalk and other impurities. If necessary, the welding zone should be cleaned with a suitable solvent, e.g. acetone.

Since the material has low thermal conductivity and high thermal expansion, welding must be carried out with a low heat input and with welding plans well thought out in advance, so that the deformation of the welded joint can be kept under control. If, despite these precautions, it is foreseen that the residual stresses might impair the function of the structure be stress-relieved.

The welding of fully austenitic steels often entails the risk of hot-cracking in the weld metal, particularly if the weldment is under constraint. To reduce the cracking risk, the welding should be carried out with a low heat input.

As filler metal for gas-shielded arc welding we recommend wire of Sanicro 72. In manual metal-arc welding we recommend covered electrodes Sanicro 71. These filler metals has a higher nickel content than parent metal.

BENDING

Heat treatment after cold bending is not normally necessary, but this point must be decided with regard to the degree of bending and the operating conditions. Heat treatment, if any, should take the form of stress relieving or solution annealing.
Hot bending is carried out at 1050-850°C (1920-1560°F) and should be followed by solution annealing.

DISCLAIMER:
Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Sandvik materials.