Sanicro® 70

Billets

Datasheet

Sanicro® 70, commonly known as Alloy 600, is an austenitic nickel-chromium-iron alloy. It is characterized by:

- Very good resistance to carburization and nitrogen absorption
- Good structural stability at high temperatures
- Good resistance to stress corrosion cracking

Standards

- UNS: N06600
- W.Nr.: 2.4816
- BS: HR208

Product standards

Suitable for production of flanges etc. according to ASTM B564

Certificates

Status according to EN 10 204 3.1

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr	Ni	Others
0.06	0.4	0.8	≤0.015	≤0.015	16.5	72.5	Ti=0.15 Fe=9.5

Applications

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Sanicro® 70 is used in a variety of applications in the chemical industry, which require high strength and good corrosion resistance .
High strength, combined with oxidation resistance at high temperatures, makes the material useful also for different components in heating furnaces.
The material can also be used in wet corrosive conditions, where austenitic 18Cr/8Ni steels would be susceptible to stress corrosion cracking.

Industrial categories	Typical applications
Chemical industry	Flanges
Food industry	Valves and discs
Petrochemical industry	Fittings
Pulp and paper industry	Couplings
Pickling equipment	Rings and seals
Oil & Gas industry	Bolts and nuts
Nuclear plants	Shafts
	Forgings
	Piping
	Pumps
	Tanks

Corrosion resistance

General corrosion

Sanicro® 70 has approximately the same resistance to organic and inorganic acids as steel of the ASTM 304 type. Its resistance to sodium hydroxide is very good even at high concentrations and temperatures.

Pitting

Resistance to pitting is equal to that of steel of the ASTM 304 type.

Stress corrosion cracking

Sanicro® 70 has very good resistance to stress corrosion cracking, particularly in chloride-bearing solution.

Gas corrosion

Sanicro® 70 has very good oxidation resistance. It can be used in:

- air up to 1175°C (2145°F)
- dry chlorine and hydrogen chloride up to about 550°C (1020°F)
- synthesis gas (ammonia synthesis) up to 600°C (1110°F). The resistance to nitrogen absorption, e.g. cracked ammonia at high temperatures, is very good.

Due to the high nickel content, the material should not be used in reducing, sulphurous atmospheres (containing hydrogen sulphide), at temperatures above 550°C (1020°F).

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Forms of supply

Sizes and tolerances

Round-cornered square, as well as round billets, are produced in a wide range of sizes according to the following tables. Larger sizes offered on request.

Surface conditions

Square billets

Unground, spot ground or fully ground condition.

Round billets

Peel turned or black condition.

Square billets

Size	Tolerance	Length
mm	mm	m
80	+/-2	4 - 6.3
100, 114, 126, 140, 150	+/-3	4 - 6.3
160, 180, 195, 200	+/-4	4 - 6.3
>200 - 350	+/-5	3 - 5.3

Sizes and tolerances apply to the rolled/forged condition.

Peel turned round billets

Size	Tolerance	Length
mm	mm	m
75 - 200 (5 mm interval)	+/-1	max 10
>200 - 450	+/-3	3 - 8

Unground round billets

Size	Tolerance	Length
mm	mm	m
77 - 112 (5 mm interval)	+/-2	max 10
124, 134	+/-2	max 10
127, 147, 157	+/-2	max 10
142, 152, 163	+/-2	max 10
168, 178, 188	+/-2	max 10
183, 193	+/-2	max 10

Other products

– Seamless tube and pipe
– Hollow bar

Heat treatment

Billets are delivered in hot worked condition. Depending on the properties required the recommendations for heat treatment differ.

For a combination of the optimum tensile and fatigue properties, a low annealing temperature range of 870-980°C (1600-1800°F) should be used.

For an optimum combination of fatigue resistance and creep rupture properties at high temperatures, the material should be annealed at 1120-1200°C (2050-2200°F). Both treatments are followed by quenching in water.

Mechanical properties

Sanicro® 70 conforms to the required mechanical properties according to specification ASTM B564. Testing is performed on separately solution annealed and quenched test pieces.

At 20 °C

Metric units

Proof strength	Tensile strength	Elongation
$R_{p0.2}$ 1)	R_m	A
MPa	MPa	%
≥241	≥552	≥30

At 68 °F

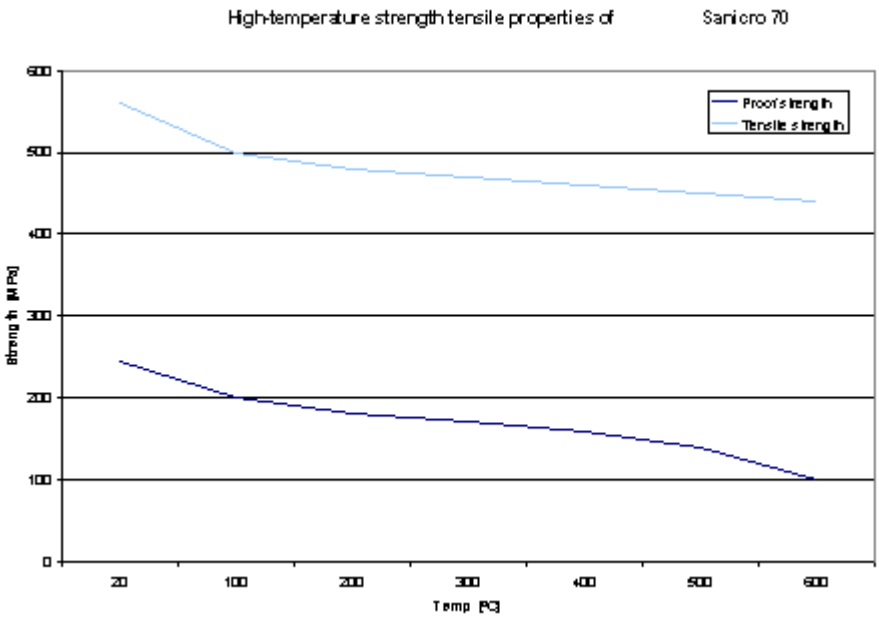
Imperial units

Proof strength	Tensile strength	Elongation
$R_{p0.2}$ 1)	R_m	A
ksi	ksi	%
≥35	≥80	≥30

1) Corresponds to 0.2 % offset yield strength

At high temperatures

Fig. 1 shows indicative values for tensile strength properties of Sanicro 70 at high temperatures.



Physical properties

Density: 8.4 g/cm^3, 0.30 lb/in^3
Scaling temperature in air: 1175 °C, 2145 °F

Specific heat capacity [1)]

Temperature, °C	J/kg °C	Temperature, °F	Btu/lb °F
20	460	68	0.11
200	495	400	0.12
400	515	800	0.12
600	590	1100	0.14

1) typical values

Thermal conductivity [1)]

Temperature, °C	W/m °C	Temperature, °F	Btu/ft h °F
20	13	68	7.5
200	16	400	9
400	19	800	11
600	25	1100	15

1) typical values

Thermal expansion [1)]

Temperature, C	Per °C	Temperature, °F	Per F

30-200	14	86-400	7.5
30-400	14.5	86-800	8
30-600	15.5	86-1100	8.5

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

Modulus of elasticity [1)]

Temperature, °C	MPa	Temperature, °F	ksi
20	214	68	31.0
200	202	400	29.3
400	190	800	27.4
600	180	1200	25.5
800	161	1600	22.1
1000	135		

1) typical values($x10^{3}$)

Hot working

Hot working should be carried out at a material temperature of 900-1200°C (1650-2200°F), followed by cooling in water. If additional heat treatment is needed, it should be carried out in accordance with the recommendations given for heat treatment.

Welding

The weldability of Sanicro® 70 is good. Suitable methods of fusion welding are manual metal-arc welding (MMA/SMAW) and gas-shielded arc welding, with the TIG/GTAW method as first choice. Preheating and post-weld heat treatment are normally not necessary.

For Sanicro® 70, heat-input of <1.0 kJ/mm and interpass temperature of <100°C (210°F) are recommended. A string bead welding technique should be used.

Recommended filler metals

TIG/GTAW or MIG/GMAW welding

ISO 18274 S Ni 6082/AWS A5.14 ERNiCr-3 (e.g. Exaton Ni72HP)

Machining

Machining Sanicro® 70, as with stainless steels, requires an adjustment to tooling data and machining method, in order to achieve satisfactory results. Compared to Sanmac® 316/316L, the cutting speed must be reduced by approximately 15-20%, when turning Sanicro® 70 with coated, cemented carbide tools. Much the same applies to other operations. Feeds should only be reduced slightly and with care.

Detailed recommendations for the choice of tools and cutting data are provided in the data sheet for Sanmac® 316/316L.

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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 Alleima materials.

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