

Sanicro[®] 31HT

Billets

Datasheet

Sanicro[®] 31HT, commonly known as Alloy 800HT, is an austenitic nickel-iron-chromium alloy. It is characterized by:

- High creep strength
- Very good resistance to oxidation
- Good resistance to combustion gases
- Very good resistance to carburization
- Good resistance to nitrogen absorption
- Good structural stability at high temperatures
- Good weldability

The grade can be used at temperatures up to about 1100°C (2010°F). In order to have the best ductility this grade should be used above 700°C (1290°F). Because of its high nickel content and prescribed maximization of (Ti + Al) content, Sanicro[®] 31HT shows extremely little tendency to precipitation of embrittling phases.

Standards

- UNS: N08810/N08811
- EN Number: 1.4959
- W.Nr.: 1.4876/1.4959

Product Standards

Suitable for the production of flanges etc. according to ASTM B564
Chemical composition according to EN 10095.

Certificate

Status according to EN 10 204/3.1

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr	Ni	Ti	Al	Fe
0.07	0.6	0.6	≤0.025	≤0.010	20.5	30	0.5	0.5	bal.

Applications

The combination of good hot strength, with good structural stability and ductility, makes Sanicro 31HT a suitable grade for various products in plants producing synthetic gas for ammonia, methanol and town gas. Sanicro 31HT is a good choice for applications involving long term exposure at high temperatures and corrosive environments.

Industrial categories	Typical applications
Chemical industry	Flanges
Industrial heating	Valves
Petrochemical industry	Fittings
Pulp and paper industry	Couplings
Oil & Gas industry	Rings
	Seals
	Bolts and nuts
	Shafts
	Forgings
	Discs

Corrosion resistance

Since Sanicro[®] 31HT is used for its high temperature strength, it is often exposed to high-temperature reactions, such as oxidation and carburization. Sanicro[®] 31HT is highly resistant to oxidation, both at constant and cyclically varied temperatures because of the high chromium and nickel contents. The service temperature in air should not exceed 1100°C (2010°F). The high nickel content also gives good resistance to carburizing environments, whilst the high chromium content provides good resistance to many sulphur-containing atmospheres at high temperatures.

Sanicro[®] 31 HT has roughly the same resistance as Alloy 800 to general corrosion and pitting. Due to the high nickel content, its resistance to stress corrosion is also good.

Owing to its relatively high carbon content and the heat treatment applied, Sanicro[®] 31HT displays a certain tendency to intergranular corrosion.

This problem can be disregarded where high temperature operations are concerned, but should be observed in cases where the alloy is exposed to corrosive condensates or pickling solutions. Sanicro[®] 31HT has passed the Strauss-test according to ASTM A262 Practice E.

For further information regarding corrosion resistance of Sanicro[®] 31HT, please see the data sheet for Seamless tube and pipe Sanicro[®] 31HT. The data should be considered in the knowledge that it may not be applicable for thick sections, such as forgings.

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

Unground round billets

Size mm	Tolerance mm	Length 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

Sanicro[®] 31HT is designed for high temperature service. For optimum creep rupture strength, the material should be solution annealed to obtain an average grain size of ASTM No 5 or coarser. The recommended temperature is 1150-1200°C (2100-2190°F). Soaking time depends on the product size and type of furnace. Rapid cooling in water is also recommended. Excessive grain growth should be avoided.

Mechanical properties

Sanicro[®] 31HT 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 (68°F)

Metric units

Proof strength	Tensile strength	Elongation
$R_{p0.2}^{1)}$	R_m	A
MPa	MPa	%
≥172	≥448	≥30

At 68 °F

Imperial units

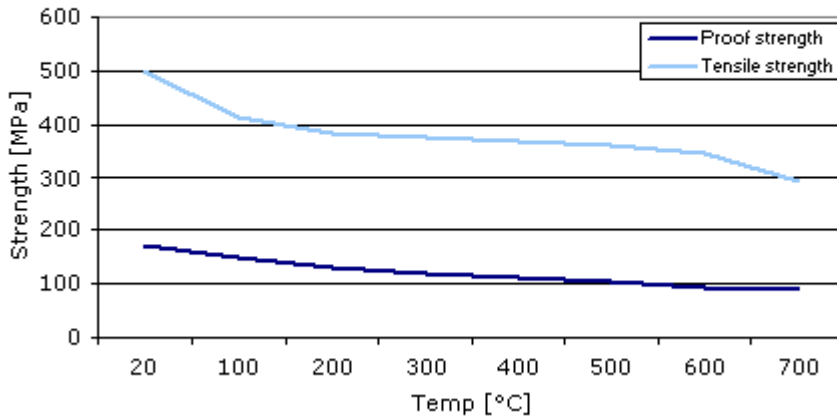
Proof strength	Tensile strength	Elongation
$R_{p0.2}^{1)}$	R_m	A
ksi	ksi	%
≥25	≥65	≥30

1) Corresponds to 0.2 % offset yield strength

At high temperatures

Fig. 1 shows indicative values for tensile strength properties of Sanicro® 31HT at high temperatures.

High-temperature tensile strength properties of Sanicro 31HT



Physical properties

Density: 7.9 g/cm³

Specific heat capacity ¹⁾

Temperature, °C	J/kg °C	Temperature, °F	Btu/lb °F
20	470	68	0.11
200	520	400	0.12
400	570	800	0.14
600	605	1200	0.15
800	630	1600	0.15
1000	655	2000	0.16

1) Typical values

Thermal conductivity ¹⁾

Temperature, °C	W/m °C	Temperature, °F	Btu/(ft h °F)
20	12	68	6.5
200	16	400	9
400	19	800	11.5
600	22	1200	13.5
800	25	1600	15
1000	28	2000	16.5

1) Typical values

Thermal expansion ¹⁾

Temperature, °C	Per °C	Temperature, °F	Per °F
30-200	16	86-400	9
30-400	16.5	86-800	9.5
30-600	17	86-1200	9.5
30-800	18	86-1600	10
30-1000	18.5		

1) typical values (x10⁻⁶)

Modulus of elasticity ¹⁾

Temperature, °C	MPa	Temperature, °F	ksi
20	200	68	29.0
200	190	400	27.5
400	175	800	25.0
600	160	1200	22.5
800	145	1400	21.5
1000	130	1800	19.0

1) typical values (x10³)

Hot working

The hot forming range for Sanicro[®] 31HT is 900-1200°C (1600-2200°F). To avoid chilling the metal during working, preheating tools and dies is recommended. Heavy forging should not be carried out so rapidly that the metal becomes overheated. Because of the risk of intermetallic precipitations in the temperature range 540-760°C (1000-1400°F), water cooling is recommended after hot working, in order to avoid intergranular corrosion.

Welding

The weldability of Sanicro[®] 31HT 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 not necessary.

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

For Sanicro[®] 31HT, 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 for temperature under 800 °C

TIG/GTAW or MIG/GMAW welding

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

MMA/SMAW welding

ISO 14172 E Ni 6182/AWS A5.11 ENiCrFe-3 (e.g. Exaton Ni71)

Recommended filler metals for temperature ≥ 800 °C

TIG/GTAW or MIG/GMAW welding

ISO 18274 S Ni 6617/AWS A5.14 ERNiCrCoMo-1 (e.g. Exaton Ni53)

MMA/SMAW welding

ISO 14172 E Ni 6117/AWS A5.11 ENiCrCoMo-1

Machining

Machining Sanicro[®] 31HT, as with other 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 45-55%, when turning Sanicro[®] 31HT 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](#).

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.