

# SANICRO® 70 TUBE AND PIPE, SEAMLESS

DATASHEET

Sanicro® 70 is an austenitic nickel-chromium-iron (NiCrFe) alloy characterized by very good resistance to carburization and nitrogen absorption and good structural stability at high temperatures. It also has good resistance to stress corrosion cracking (SCC).

#### **STANDARDS**

UNS: N06600 W.Nr.: 2.4816 DIN: NiCr 15Fe BS: NA14

#### Product standards

- ASTM B163, B167
- BS 3074

#### CHEMICAL COMPOSITION (NOMINAL) %

## Chemical composition (nominal) %

State C State State State State State S	Si	Mn	P	S	Cr	Ni de de la companya	Cu	Fe and and
≤0.05	0.4	0.8	≤0.015	≤0.015	16.5	72.5	≤0.5	≤10.0

#### FORMS OF SUPPLY

Seamless tube and pipe

Tube and pipe are normally supplied in the solution annealed and white-pickled condition. Small sizes, e.g. heat exchanger tubes, can also be supplied in the bright-annealed condition. The principal size range is shown in figure

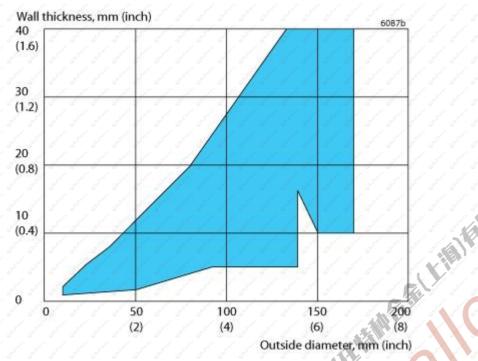


Figure 1. Principal size range for seamless tube and pipe.

Other forms of supply Welding consumables

#### **MECHANICAL PROPERTIES**

At 20 °C (68 °F)

## Metric units

Condition	Proof str	ength	Tensile streng	th	Elongation	Hardness Vickers
of state state state state state state state	Rp0.2a)	Rp1.0a)	Rm grand grand	Station Station	<b>A</b> b)	Stellam Stellam Stellam Stellam Stellam
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			ateria ateria ateria	Staller Staller	Stellan Stellan Stellan Stellan	approx.
Cold finished OD≤127 mm	≥241	≥265	552-700	States States	≥35 at at	160
Cold finished OD>127 mm	≥205	≥265	552-700	Statem Statem	≥35	160
Hot finished	≥205	≥230	550-700	Sterior Sterior	≥35	160

# Imperial units

Condition	Proof str	ength	Tensile strength	Elongation	Hardness Vickers		
	Rp0.2a)	Rp1.0a)	, st. Rm	A2" 3" 3" 3"			
and the state of t	ksi	ksi	ksi	% %			
	Transport Transport Transport Transport	Standay Thomas Standay		Stern Stern Stern Stern Stern Stern	approx.		
Cold finished OD ≤ 5"	≥35	≥38	80-101	≥35	160		
Cold finished OD > 5"	≥30	≥38	80-101	≥35	160		
Hot finished	≥30	≥33	80-101	≥35 ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	160		

1 MPa = 1 N/mm2

- a) Rp0.2 and Rp1.0 correspond to 0.2% and 1.0% offset yield strength, respectively.
- b) Based on L0 = 5.65 ÖSO where L0 is the original gauge length and SO the original cross-section area.

## At high temperatures

# Metric units

Temperature	Proof strength	Tensile strength
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aterial Section Section Section Section Section Section	MPa start	MPa
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100 8 8 8 8 8 8	200 8 8 8 8 8 8	500
200	180	480
300	170	470
400	160	460
500	140	450
600	100	440

## Imperial units

Temperature	Proof strength	Tensile strength	e de la companya de l
AND FOR THE STATE OF THE STATE	Rp0.2	Rm	e de la companya de l
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Trades September Statement September Statement Statement Statement	min." get	min.	offer Control
200	29.6	73.2	State.
400 g/f g/f g/f g/f	of of 26.0 of of of	69.6	Straffe
600	24.4	67.9	Steller
800	22.4	66.3	Straffer
1000	18.1	64.7	and Stratus
1100	14.9	63.9	Graff.

#### Creep strength

Sanicro® 70 has a creep strength which is comparable to that of AISI tp 310 (UNS S31008).

#### **PHYSICAL PROPERTIES**

Density: 8.4 g/cm3, 0.30 lb/in3

Scaling temperature in air: 1175 °C, 2145 °F

## Thermal conductivity

Tem	per	atui	e,°	C Staffel	Straft				W/ı	n °C				Tem	pera	atur	e, °F	Stratus.				Btu/	ft h '	F,		
20	Skaling.	Shelling	Staffer Staffer	State.	Staff'	Staff.	Str.	3	13	The first	Straft of	States	34	68	Sheling.	Strafted.	of Staffer	Staffe.	Stale.	Steffe.	G. fas Tream	7.5	Steffen	Stration.	" Skeling	Str. Iret
100	Staling	Steller.	Stell"	State.	Stell'	Steel	ST.	3	14	Status	Steeling	Sitestin	31	200	Sheling	States	State.	Sterlin.	Siler In	Sike Tre	Station	<b>8</b> 5	Stefan	Steller	States	Sheling
200	Stalin	The first	Street.	Jan Straff	Steel.	Strati	3tr	3	16	State.	Stales	Stell.	St.	400	Shell and	Steller.	Stales	Staff.	Stell.	Skell.	Straft and	9 5	Stefm	Steller	Stration	Skaller and
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400	Str.	The Street	370		aller Street	STATE OF THE STATE	50 <sup>10</sup>	(Market)	19	Sharing Sharing	er Stee	STATE OF THE STATE	3 <sup>1</sup>	800	Share	Stran	A Street	gar Stadio	Jest Jest	gradient (	Stade First	11	greet greet	Strain	The state of	Stranger Stranger
500	G Tree	71 THE			31	ger Gran	A STORY	Treatment Co	21	and the	A STATE	AN THE	a <sup>gen</sup> Si	1000	) ",,,	ari Tresi	er Street	pri Siri	gari gar	Service Tree	Grand Tree of	13	Series Tres	gard Treat	and The s	Edit Tresport

#### Thermal conductivity

Tite!	Temperature, °C	W/m °C	Temperature, °F	Btu/ft h °F
STAR.	600	25	1100	15

## Specific heat capacity

Temperature, ℃	J/kg ℃	Temperature, °F	Btu/lb °F
20 / / / / / /	460	68	0.11
100	480	200	0.11
200	495	400	0.12
300	510	600	0.12
400	515	800	0.12
500 / / /	525 35 35	1000	f 0.13 f f f
600 % % % %	590 / 590	1100	0.14

# Thermal expansion, mean values in temperature ranges (x10-6)

Temperature, C	and and and Per°C	Temperature, °F	of the second se
30-100	3 13.5 St. 3 5 St.	86-200	<b>7.5</b> 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
30-200	34. 34. 34. 34. 143. 34. 34. 34. 34. 34. 34. 34. 34. 34.	86-400	8 34th 34th 34th 3
30-300	, 3 <sup>th</sup> , 3 <sup>th</sup> , 3 <sup>th</sup> 14 <sup>th</sup> , 3 <sup>th</sup> , 3 <sup>th</sup>	86-600	Strate St
30-400	14.5	86-800	8 3 3 3 3
30-500	15	86-1000	8.5
30-600	15.5	86-1100	8.5

## Modulus of elasticity (x103)

Temperature, °C	MPa	Temperature, °F	ksi
20	214	68	31.0
100	206	200	30.0
200	202	400	g/ g/ g/ g/ 29.3
300 300 300 300 300 300 300 300	196	600 / 3/1 3/1 3/1 3/1	f f f 28.3
400	190	800	27.4
500	185	1000	J. J. J. J. J. 26.6
600	180	1200	25.5
700	171	1400	23.9
800	161	1600	22.1
900	149	1800	19.9
1000	135		

## **CORROSION RESISTANCE**

General corrosion

Sanicro® 70 has approximately the same resistance to organic and inorganic acids as steel of the AISI 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 AISI 304 type.

#### Stress corrosioncracking

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)
- Up to 800°C (1470°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 high nickel content the material should not be used in reducing, sulphurous atmospheres (containing hydrogen sulphide) at temperatures above 550°C (1020°F).

#### **HEAT TREATMENT**

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

#### Stress relieving

800-875°C (1470-1920°F), 10-15 minutes, cooling air.

#### Solution annealing

950-1050°C (1740-1920°F), 5-30 minutes, rapid cooling in air or water.

#### WELDING

The weldability of Sanicro® 70 is good. Suitable fusion-welding methods are manual metal-arc welding (MMA) and gas-shielded arc welding, with the TIG and MIG methods as first choice. Preheating and post-weld heat treatment are normally notnecessary.

The welding of high-nickel materials calls for high standards of cleanliness. Joint surfaces and filler metals must be free from grease, dirt, color (pigments) and other impurities. If necessary, the welding zone shall be cleaned with a suitable solvent, e.g. acetone or alcohol.

Since Sanicro® 70 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 joints can be kept under control.

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 lowest practical heat input, <1.0 kJ/mm and interpass temperature <150°C.

#### Recommended filler metals for:

MIG and TIG: Sanicro® 72HP or Sanicro® 68HP (wire electrodes and filler wire/rods). MMA: Sanicro 71or Sanicro® 69 (covered electrodes).

#### **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 1100-850°C (2010-1560°F) and should be followed by solution annealing.

#### **APPLICATIONS**

Sanicro® 70 has good resistance to chlorine and hydrogen chloride at high temperatures and can therefore be used in the production of chlorinated hydrocarbons, e.g. in the oxychlorination reactor and the cracking furnace in vinylchloride plants.

Sanicro® 70 can also be used in wet corrosive conditions, where austenitic 18Cr/8Ni steels would be susceptible to stress corrosion cracking.

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.



