

Sanicro® 276

Tube and pipe, seamless

Datasheet

Sanicro® 276 (UNS N10276) is a nickel-chromium-molybdenum alloy suitable for service in a broad range of severe environments and is characterized by:

- Superior corrosion resistance in H₂S, CO₂ and chloride containing environments
- Excellent resistance to pitting corrosion owing to its high PRE* value of 68
- Excellent corrosion resistance in hydrochloric acid

*PRE = %Cr + 3.3 x %Mo + 16 x %N

Standards

- UNS: N10276
- W.Nr.: 2.4819

Product standard

- ASTM B622

Approvals

ASME Boiler & Pressure Vessel Code, Section I and Section VIII, Division I.

Chemical composition (nominal)

Chemical composition (nominal) %

C	Si	Mn	P	S	Cr	Ni	Mo	W	Fe	Co	V
≤0.010	≤0.08	≤1.0	≤0.03 0	≤0.015	16	57	16	3.5	4.5	<2.5	≤0.35

Applications

The grade is suitable for use in a number of severe industrial environments, such as mixed acid chemical processing, pulp and paper production, industrial and municipal waste treatment and oil and gas.

Corrosion resistance

Sanicro® 276 has excellent corrosion resistance in a wide range of severe environments. It is resistant to general corrosion, localized pitting corrosion and environmental cracking in a wide range of aggressive media.

Pitting and crevice corrosion

The relative resistance of alloys to pitting corrosion can be estimated based on the chemical composition using the Pitting Resistance Equivalent number (PRE). Alloys with higher PRE values generally have better corrosion resistance compared to alloys with lower PRE values.

There are several different equations available for calculating the PRE from the chemical composition. In this document the equation specified in NACE MR0175 is used: $PRE = \%Cr + 3.3 (\%Mo + 0.5W) + 16\%N$

Pitting resistance equivalent numbers (PRE)

Alloy	UNS	PRE*
Sanicro® 276	N10276	68
Sanicro® 28	N08028	38

Stress corrosion cracking

The high levels of nickel, molybdenum and chromium in Sanicro® 276 make the alloy highly resistant to sour environments containing high levels of H₂S, CO₂ and chlorides. The NACE standard MR 0175 is widely used for selecting material for use in H₂S-containing environments in the oil and gas industry. According to NACE MR0175 Sanicro® 276 (UNS N10276) can be used in up to 1000 psi partial pressure H₂S at 232°C (450°F) with no limitation on the chloride concentration. Below 204°C (400°F) there is no limit on the H₂S level or chloride concentration.

Forms of supply

Sanicro® 276 seamless nickel-chromium-molybdenum alloy is supplied bright annealed in the outside diameter range 6 - 42 mm (0.25" - 1.625") and wall-thickness 0.89 - 5.0 mm (0.035" - 0.197").

Tubing is supplied in:

- Hard condition
- Annealed condition

Tolerances

Sanicro® 276, OD 6-42 mm EN 10305-1

OD, mm	OD, mm	Wall thickness %
6-30	+/-0.08	+/-10
32-40	+/-0.15	+/-10
42	+/-0.20	+/-10

Mechanical properties

At 20°C, metric units

Proof strength	Tensile strength	Elongation
R _{p0.2} ¹⁾	R _m	A _{2"}

MPa	MPa	%
≥283	≥690	≥40

At 68°F, imperial units

Proof strength	Tensile strength	Elongation
$R_{p0.2}^{1)}$	R_m	$A_{2''}$
ksi	ksi	%
≥41	≥100	≥40

1) Corresponds to 0.2% offset yield strength

Physical properties

Density: 8.89 g/m³ (0.321 lb/in³)

Thermal conductivity

Temperature, °C	W/(m °C)	Temperature, °F	Btu/(ft h °F)
-168	7.2	-270	4.2
-73	8.7	-99	5
20	9.8	68	5.7
100	11.2	200	6.5
200	12.8	400	7.4
300	14.7	600	8.5
400	16.4	800	9.5
500	18.2	1000	10.5
600	20.0	1200	11.6
700	21.9	1400	12.7
800	23.7	1600	13.7
900	25.4	1800	14.7

Specific heat capacity

Temperature, °C	J/(kg °C)	Temperature, °F	Btu/(lb °F)
20	427	68	0.10

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

Temperature, °C	Per °C	Temperature, °F	Per °F
25-100	12.2	77-200	6.8
25-200	12.4	77-400	7
25-300	12.9	77-600	7.2
25-400	13.2	77-800	7.4
25-500	13.5	77-1000	7.5
25-600	13.6	77-1200	7.7
25-700	14.1	77-1400	8.1
25-800	14.8	77-1600	8.5

Resistivity

Temperature, °C	μΩm	Temperature, °F	μΩin.
20	1.30	68	51.2
100	1.32	200	52.0
200	1.34	400	52.8
300	1.35	600	53.2
400	1.36	800	53.5
500	1.37	1000	54.3
600	1.38	1200	54.3
700	1.38	1400	53.9
800	1.38	1600	54.7
900	1.38	1800	53.1

Modulus of elasticity (x10³) (annealed condition)

Temperature, °C	MPa	Temperature, °F	ksi
25	205	77	29.7
100	203	200	29.4
200	198	400	28.7
300	192	600	27.8
400	186	800	27
500	180	1000	26.1
600	178	1200	25.8

700	167	1400	24.2
800	159	1600	23

Welding

The weldability of Sanicro® 276 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.

For Sanicro® 276, heat-input of <1.2 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 6276/AWS A5.14 ERNiCrMo-4 (e.g. Exaton Ni56)

MMA/SMAW welding

ISO 14172 E Ni 6276/AWS A5.11 ENiCrMo-4

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.