Alloy C276

UNS N10276 / W.Nr. 2.4819

TÜV USA Member of TÜV NORD Group

"ISO 9001-2008 Certified
ISO Registered Since 1993"

Corrosion Material's C276 is a solid-solution-strengthened, nickel-molybdenum-chromium alloy with a small amount of tungsten, which exhibits excellent corrosion resistance in an assortment of harsh environments. Applications include and are not limited to, stack liners, ducts, dampers, scrubbers, stack-gas re-heaters, heat exchangers, reaction vessels and evaporators. Industries where C276 can be utilized are petrochemical and chemical processing, power generation, pharmaceutical, pulp and paper production and waste treatment to name a few.

Resistance to Corrosion

C276 is known as the most universally corrosion resistant material available today. It is used in a variety of environments from moderately oxidizing to strong reducing conditions. The limiting factor when dealing with strong oxidizing environments is the low Cr content, which means that hot, concentrated nitric acid environments are NOT desirable. Although, C276 has exceptional resistance to sulfuric acid and hydrochloric acid, acid chlorides, solvents, formic and acetic acids, acetic anhydride, wet chloride gas, hypochlorites and chlorine solutions. Also, it has excellent resistance to phosphoric acid at all temperatures below boiling and at concentrations lower than 65%.

Alloy C276 has excellent resistance to pitting, stress-corrosion cracking and to oxidizing atmospheres. C276 also exhibits excellent resistance to corrosion by seawater especially under crevice conditions, which induce attack in other commonly used materials.

Chemical Composition

Ni	Balance	Mo	15.0 – 17.0
Cr	14.5 – 16.5	Fe	4.0 – 7.0
W	3.0 – 4.5	Co	2.5 Max.
Mn	1.0 Max.	C	0.02 Max.
V	0.35 Max.	P	0.03 Max.
S	0.03 Max.	Si	0.08 Max.

Mechanical Properties

Typical Room Temperature Tensile Properties of Annealed Material

Product Form	Tensile (ksi)	0.2% Yield (ksi)	Elongation (%)
Bar	110.0	52.6	62
Plate	107.4	50.3	67
Sheet	115.5	54.6	60
Tube & Pipe	105.4	45.4	70

Alloy C276 cannot be hardened by heat treatment but can be hardened by cold working using various means. The increase in tensile and yield properties is dependent on the percentage of cold reduction induced on the material. The chart below shows this relationship.

Cold-Worked Properties

Percent Cold Reduction	Tensile (ksi)	0.2% Yield (ksi)	Elongation (%)
10	129	90	40
20	145	125	30
30	168	155	15
40	194	180	10
50	210	195	7

Physical Properties

Density@ 72°F	0.321 lb/in.^{3}
Elastic Modulus @ 70°F	29.8 x 10^6 psi
Melting Point	2415°F to 2500°F
Specific Heat @ Room Temp.	0.102 Btu/lb·°F
Electrical Resistivity @ 75°F	1.30μΩ·m

Coefficient of Thermal Expansion

Temperature - °F	Coefficient - μin./in.°F
75 - 200	6.2
75 - 400	6.7
75 - 600	7.1
75 - 800	7.3
75 - 1000	7.4

Thermal Conductivity

Temperature - °F	Conductivity - Btu/ft•h•°F
200	6.4
400	7.5
600	8.7
800	9.75
1000	11.0

Fabrication and Heat Treatment

C276 can be formed using various cold and hot working processes. Although C276 tends to work-harden it can be cold formed using the more aggressive methods such as deep-drawing, press forming or punching. Hot forming should be performed within a temperature range between 1600°F and 2250°F (870°C-1230°C) with heavier sections heated to a minimum of 2000°F before forming. Annealing of the material after working is advised and should be performed at a temperature between 2050°F and 2150°F followed by a rapid quench in a protective atmosphere or in an agitated reducing quench bath. To obtain a reducing media, add 2% (by volume) of either ethyl or propyl alcohol to water. Please refer to our "Machining Guide" for proper operating parameters.

Aqueous Corrosion Data

Media	Common Name	Temp. °F (°C)	Corrosion Rate (mpy)
80% $C_2H_4O_2$	Acetic Acid	Boiling	0.15
10% NH_3Br	Ammonium Bromide	176 (80)	Nil
10% NH_3Br	Ammonium Bromide	Boiling	Nil
10% $FeCl_3$	Ferric Chloride	Boiling	2
88% CH_2O_2	Formic Acid	Boiling	1
0.2% HCl	Hydrochloric Acid	Boiling	0.60
1% HCl	Hydrochloric Acid	Boiling	13.3
2% HCl	Hydrochloric Acid	Boiling	43
5% HCl	Hydrochloric Acid	140 (60)	10
20% HCl	Hydrochloric Acid	212 (100)	154
3% HF	Hydrofluoric Acid	176 (80)	53
10% HF	Hydrofluoric Acid	75 (24)	2
10% HF	Hydrofluoric Acid	176 (80)	28
Concentrated HF	Hydrofluoric Acid	75 (24)	24
Concentrated HF	Hydrofluoric Acid	176 (80)	80
10% HBr	Hydrogen Bromide	176 (80)	<1
10% HBr	Hydrogen Bromide	Boiling	<1
10% HNO_3	Nitric Acid	Boiling	15
65% HNO_3	Nitric Acid	Boiling	888
20% H_3PO_4	Phosphoric Acid	Boiling	<1
60% H_3PO_4	Phosphoric Acid	Boiling	1
85% H_3PO_4	Phosphoric Acid	212 (100)	5
85% H_3PO_4	Phosphoric Acid	Boiling	121
50% NaOH	Sodium Hydroxide	Boiling	1
10% H_2SO_4	Sulfuric Acid	Boiling	20
20% H_2SO_4	Sulfuric Acid	176 (80)	3
40% H_2SO_4	Sulfuric Acid	176 (80)	5
80% H_2SO_4	Sulfuric Acid	176 (80)	4

Applicable Specifications

C276	ASTM	ASME	Stahl-Eisen-Profblatt	TÜV	European Standard[1]
Bar	B574, B564[2] , G28-A/B	SB574, SB564[2]	1877 Method II	400[3]	EN10204 - 3.1.B
Plate/Sheet	B575, G28-A/B, A480[4]	SB 575	1877 Method II	400	EN10204 - 3.1.B
Welded Pipe	B619[5] Class I or II, B775[6] , G28-A/B	SB619[5] Class I or II, SB775[6]	/	/	EN10204 - 3.1.B
Welded Tube	B626 Class III , G28-A/B	SB626 Class III	/	/	EN10204 - 3.1.B

1. Formerly know as DIN specification **2.** On Diameters above 3 1/2". In some cases B564 could be referring to chemistry only **3.** Limited to specific producers **4.** Specification for flatness **5.** Up to and including 8" schedule 40 **6.** Above 8" schedule 40, annealed with no filler metal.

Please contact Corrosion Materials for a complete list of available items from inventory.

In-house machine and weld facilities help insure that the most common items will be in stock. Items not in stock can be fabricated in a short period of time either in-house or through our extensive, approved subcontractor and supplier network.

We also supply a complete range of items in the following alloys; B2, B-3®, Alloy 22, 625, F-255, 200/201, Alloy 400, 405 and 600. Bar products are also available in Alloy 20, K500, 800H/HT®, and Alloy 6B, as well as various Ti grades.

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