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PRODUCT DATA SHEET

Alloy C-276 UNS N10276

Nickel Alloys

Alloy C-276 is a versatile nickel molybdenum chromium tungsten alloy with outstanding corrosion resistance in a wide range of severe media. It resists corrosion attack of many types, and is often used in severe environments of variable or undefined aggressiveness.

Chemical Composition

(ASTM B575 – {Nickel Alloy} plate, sheet & strip)

Element	%	Element	%
Nickel	rem {-57}	Tungsten	3.0 – 4.5
Molybdenum	15.0 – 17.0	Cobalt	2.5 max
Chromium	14.5 – 16.5	Carbon	0.010 max
Iron	4.0 – 7.0	Sulphur	0.03 max

Specified Minimum

Mechanical

Properties

(ASTM B575 – {Nickel Alloy} plate, sheet & strip)

	ASTM B575	Typical
0.2% Proof Stress, MPa	283 min	350
Tensile Strength, MPa	690 min	740
Elongation, %	40 min	67
Hardness, HRB	100 max	-

Typical Applications Chemical plant, pollution control, pulp & paper production, waste treatment, process vessels & piping, heat exchangers, stack liners, ducts, dampers, scrubbers, fans & housings.

Description Alloy C-276 is a Ni-Mo-Cr-W alloy developed for outstanding resistance to corrosion. It has good strength and excellent ductility, good weldability and fabrication ability, and is tough at all temperatures. It is highly resistant to oxidising atmospheres up to 1040°C, and to pitting and stress corrosion attack. C-276 is readily welded, and generally does not require post weld heat treatment.

Corrosion rates in laboratory tests in various media.

Austral Wright Metals can supply alloy C-276 as plate, sheet and strip, rod and bar, seamless and welded tube and pipe, condenser and heat exchanger tube, welding fittings, forgings and forging billet, wire.

Corrosion Resistance C-276 is outstanding in resisting general corrosion, stress corrosion cracking, pitting and crevice corrosion even in severe environments. It has a low carbon content, and resists intergranular corrosion in the as-welded condition.

It gives excellent service in highly oxidising neutral and acid chlorides, solvents, formic & acetic acids, acetic anhydride, wet chlorine gas, hypochlorites and chlorine solutions. It has good resistance to many hot acids.

The broad range of corrosion resistance makes the alloy useful in applications where a mixture of corrodents, often undefined or variable, are present. Examples are flue gas desulphurisation equipment in power generation plant, downhole environments in sour oil & gas wells, & in pulp & paper manufacturing.

Solution	Temperature		Corrosion Rate	
	°F	°C	mpy	mm/y
10% HNO ₃	Boiling	Boiling	15 ^b	0.38 ^b
10% HNO ₃ + 3% HF	140	60	113	2.87
15% HNO ₃ + 3% HF	140	60	179	4.55
20% HNO ₃ + 2% HF	140	60	215	5.46
3% HF	176	80	53	1.35
10% HF	75	24	2	0.05
10% HF	176	80	28	0.71
Concentrated HF	75	24	1	0.03
Concentrated HF	176	80	34	0.86
1% HCl	Boiling	Boiling	9	0.23
5% HCl	140	60	10	0.25
10% HCl	150	66	35-39	0.89-0.99
20% HCl	212	100	154	3.91
30% HCl	150	66	22-28	0.56-0.71
20% H ₃ PO ₄	Boiling	Boiling	<1	<0.03
60% H ₃ PO ₄	Boiling	Boiling	1	0.03
85% H ₃ PO ₄	212	100	5	0.13
85% H ₃ PO ₄	Boiling	Boiling	121	3.07
20% H ₂ SO ₄	176	80	3	0.08
20% H ₂ SO ₄	194	90	13	0.33
20% H ₂ SO ₄	Boiling	Boiling	22-27	0.56-0.69
40% H ₂ SO ₄	176	80	5	0.13
60% H ₂ SO ₄	200	93	16-25	0.41-0.64
80% H ₂ SO ₄	176	80	4	0.10
99.9% CH ₃ COOH + 0.1% NaCl	Boiling	Boiling	<1	<0.03
50% NaOH	Boiling	Boiling	1	0.03

^a Test duration of 168 h except as noted. ^b Test duration of 24 h.

The technical advice and recommendations made in this Product Data Sheet should not be relied or acted upon without conducting your own further investigations, including corrosion exposure tests where needed. Please consult current editions of standards for design properties.

Austral Wright Metals assumes no liability in connection with the information in this Product Data Sheet.

Maximum pitting or crevice attack, mm, in flue gas desulphuriser scrubber slurry

Alloy	Quencher	Absorber	Absorber Outlet	Outlet Duct	Bypass Duct
316L	0.56	0.53	0.89 ^b	0.89 ^b	0.30
317LM	0.51	0.56	0.74	0.84	0.74
Incoloy 825	0.38	0.84	0.99	1.27 ^b	0.25
Inconel 625	<0.05	0.25	0.28	0.18	nil
C-276	nil	nil	<0.05	nil	nil

a: 6 month exposure at 52°C, pH 5.5, 5000 ppm chloride

b: perforated

Please consult Austral Wright Metals for your specific corrosion application.

Pressure Vessels AS1210 & ASME Boiler & Pressure Vessel Codes pre-qualify C-276 for use in pressure vessels up to 675°C.

Equivalent Grade Specifications

Country	Body	Grade
USA	UNS	N10276
France	AFNOR	NC 17 D
Germany	DIN	2.4819

Fabrication C-276 can be readily fabricated, using standard methods for nickel alloys. Hot working is done at 870 – 1230°C, with all heavy forming above 1090°C. Cold forming may require intermediate annealing to remove the work hardening developed.

Machinability C-276 is fairly difficult to machine (group D-2). Sharp tools, slow speeds and deep uninterrupted cuts to remove the work hardened layer are needed. Tools need positive rake angles.

Welding C-276 is readily welded by GMAW (MIG), GTAW (TIG) and SMAW (manual) processes. Preheat, post heat and post weld heat treatment are not required. The area around the weld must be clean to prevent contamination of the weld pool. Argon shielding gas is used.

Filler Metal Selection (self welds)

	Normal Service	Higher Strength	Best Corrosion Resistance
Welding electrode	C-276	686CPT	686CPT
Filler metal	C-276	686CPT	686CPT
Flux cored wire	N/A	N/A	N/A

Heat Treatment C-276 is annealed at 1150 – 1175°C, cooled by water quenching.

Physical Properties

Property	at	value	unit	Property	at	value	unit
Density	20°C	8,820	kg/m ³	Specific Heat	20°C	427	J/kg . °C
Melting Range		1325 – 1370	°C	Mean Coefficient of Expansion	100°C	12.2	x 10 ⁻⁶ / °C
Modulus of Elasticity				Thermal Conductivity	20°C	9.8	W / m . °C
Tension	20°C	205	GPa	Electrical Resistivity	25°C	1.229	micro-ohm . m
Torsion	20°C	79	GPa				
Poisson's ratio	20°C	0.307					

ASTM Product Specifications

Specification	Title
B366	Nickel & nickel alloy fittings
B564	Nickel alloy forgings
B574	Low C Ni-Mo-Cr, low C Ni-Cr-Mo, low C Ni-Cr-Mo-W alloy rod
B575	Low C Ni-Mo-Cr, low C Ni-Cr-Mo, low C Ni-Cr-Mo-W alloy plate, sheet & strip
B619	Welded nickel and nickel cobalt alloy pipe
B622	Seamless nickel and nickel cobalt alloy pipe
B626	Welded nickel and nickel cobalt alloy tube
B751	General requirements for nickel & nickel alloy welded tube
B775	General requirements for nickel & nickel alloy welded pipe