

# Hastelloy® C-276

Material no. 2.4819 · NiMo16Cr15W · Nickel-molybdenum-chromium-tungsten alloy

**Material group:** Nickel-molybdenum-chromium-tungsten alloy, corrosion resistant

**Material no. (EN):** 2.4819

**EN designation:** NiMo16Cr15W

**UNS / ASME:** UNS N10276

**Trade names:** Hastelloy® C-276, Nicrofer® 5716 hMoW, Alloy C-276

**ASTM / ASME equivalent:** Pipes: B622 (seamless) / B626 (welded) · Fittings: B366 WPHC276 · Flanges: B564

**Service temperature:** -196 °C to +400 °C (continuous); short term to 675 °C

**Standards (pipes):** EN 10216-5 · ASTM B622 / B626 · VdTÜV 400

**Standards (fittings):** EN 10253-4 · ASTM B366 WPHC276

**Forms (Nirotec):** Elbows · tees · reducers · caps · flanges · custom parts

## 1 Material Equivalents & Comparable Grades

### National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN	NiMo16Cr15W	2.4819	Current European designation
UNS	Alloy C-276	N10276	ASTM/ASME designation
DIN (old)	NiMo16Cr15W	2.4819	Identical, unchanged
ASTM/ASME	A/SA B622 / B626	UNS N10276	Seamless / welded pipes
ASTM/ASME	A/SA B366 WPHC276	UNS N10276	Buttweld fittings
ASTM/ASME	A/SA B564	UNS N10276	Forgings, flanges
Trade names	Hastelloy® C-276, Nicrofer® 5716 hMoW	–	Common trade names

### Alternative materials

Material	Material no.	Reference / use	Note
Hastelloy C-22 / 2.4602	2.4602	Higher resistance to oxidising chlorides	Aggressive oxidising media
Hastelloy C-4 / 2.4610	2.4610	Simplified composition	General corrosion applications

Material	Material no.	Reference / use	Note
Inconel 625 / 2.4856	2.4856	Higher strength, similar corrosion	Structural applications
Alloy 59 / 2.4605	2.4605	Highest resistance to reducing acids	FGD, acid scrubbers

## 2 Chemical Composition

Composition in mass percent (%). Standard: ASTM B575 / VdTÜV 400. Hastelloy C-276 is a nickel-base alloy with outstanding resistance due to its high Mo and W content – especially against pitting, crevice corrosion and stress-corrosion cracking.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Nickel	Ni	Rest	Rest	Rest	Matrix (~57 %)
Molybdenum	Mo	15.0	17.0	17.0	Pitting / crevice corrosion resistance
Chromium	Cr	14.5	16.5	16.5	Oxidation resistance
Iron	Fe	4.0	7.0	7.0	Structural element
Tungsten	W	3.0	4.5	4.5	Crevice corrosion resistance
Cobalt	Co	–	2.5	2.5	Limit
Manganese	Mn	–	1.0	1.0	Limit
Vanadium	V	–	0.35	0.35	Limit
Carbon	C	–	0.010	0.010	Low-carbon limit (avoids precipitation)
Silicon	Si	–	0.08	0.08	Low-Si limit
Phosphorus	P	–	0.04	0.04	Impurity limit
Sulfur	S	–	0.03	0.03	Impurity limit

## 3 Mechanical Properties

### Solution annealed – minimum requirements (ASTM B622 / VdTÜV 400)

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	≥ 283	Solution annealed
Tensile strength	Rm	MPa	≥ 690	Solution annealed
Elongation at fracture	A	%	≥ 40	Longitudinal specimens
Impact energy (20 °C)	KV	J	≥ 60	Mean value
Hardness	HRB	–	≤ 100	Reference value

### Hot yield strength Rp0.2 in MPa (typical values per standard)

Temperature	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C
Rp0.2 (MPa)	250	225	210	195	180	170

## 4 Physical Properties

Property	Symbol	20 °C	200 °C	400 °C	600 °C	Unit
Density	$\rho$	8.89	8.82	8.71	8.61	g/cm <sup>3</sup>
Modulus of elasticity	E	205	196	182	168	GPa
Thermal conductivity	$\lambda$	10.2	12.2	15.0	17.7	W/(m·K)
Coeff. thermal expansion	$\alpha$	11.2	11.6	12.4	13.1	10 <sup>-6</sup> /K
Specific heat capacity	cp	427	446	474	510	J/(kg·K)

## 5 Corrosion Resistance

Medium / environment	Remark	Resistance
Hydrochloric acid (dilute)	Excellent resistance at all concentrations	++
Sulphuric acid (H <sub>2</sub> SO <sub>4</sub> )	Resistant across full concentration range	++
Chlorides / seawater	Outstanding pitting and crevice resistance (PREN > 70)	++
Sour gas (H <sub>2</sub> S)	NACE MR0175 qualified	++
Mixed oxidising and reducing media	Universal resistance	++
Stress-corrosion cracking	Highly resistant	++
Phosphoric acid (H <sub>3</sub> PO <sub>4</sub> )	Very good resistance	++
Nitric acid (HNO <sub>3</sub> ) concentrated	Resistant, but other materials more economical	+
High-temperature oxidation > 600 °C	Limited resistance	o
Hydrofluoric acid (HF)	Not recommended	-

++ excellent resistance
+ good resistance
o limited resistance
- not resistant

*Hastelloy C-276 is the reference material for complex chemical applications with mixed acids and chlorides – near-universal resistance.*

## 6 Typical Applications

Industry / plant	Typical application	Operating condition
Chemical industry	Reactors, acid piping, columns	HCl, H <sub>2</sub> SO <sub>4</sub> , mixed acids
Flue-gas desulphurisation (FGD)	Scrubbers, absorbers, demisters	Acidic flue gases with chlorides
Pharma / food industry	Hygienic piping, reactors	Demanding cleaning media
Pulp & paper	Bleaching plants, ClO <sub>2</sub> equipment	Chlorine-bearing aggressive media
Offshore / marine	Subsea components, umbilicals	Seawater, sour service
Waste incineration	Boiler and scrubber components	Acidic, chloride-loaded combustion gases

## 7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-4	ASME B16.9 · B366 WPHC276	LR/SR, custom angles on request
Tees	EN 10253-4	ASME B16.9 · B366 WPHC276	Equal and reducing branch
Reducers	EN 10253-4	ASME B16.9 · B366 WPHC276	Concentric and eccentric
Caps	EN 10253-4	ASME B16.9 · B366 WPHC276	Hemispherical caps
Weld neck flanges	EN 1092-1 type 11	ASME B16.5 · B564	PN 10 – PN 400 / Class 150 – 2500
Custom parts	Per drawing	Per drawing	Custom geometries on request

## 8 Standards, Approvals & Codes

Standard / code	Title / application
EN 10216-5	Seamless pipes for pressure purposes – stainless and nickel-base alloys
EN 10253-4	Butt-welding fittings – austenitic and nickel-base alloys
EN 1092-1	Flanges and their joints
VdTÜV 400	NiMo16Cr15W (2.4819) – material data sheet
ASTM B622 / B626	Seamless / welded pipes – UNS N10276
ASTM B366	Factory-made wrought nickel-alloy fittings (WPHC276)
ASTM B564	Nickel-alloy forgings

Standard / code	Title / application
NACE MR0175 / ISO 15156	Materials for H <sub>2</sub> S-containing environments (sour service)
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.1 / B31.3	Power piping / process piping

## 9 Processing Notes

### Weldability

Parameter	Specification / recommendation	Remark
Preheat	Not required	Room-temperature welding
Post-weld heat treatment	Generally not required	PWHT only in special cases
Filler metal	ERNiCrMo-4 (AWS A5.14)	Matching nickel-base filler
Welding processes	GTAW (TIG), GMAW, SMAW	All standard processes suitable
Interpass temperature	≤ 150 °C	Prevents carbide precipitation

- Delivery condition: solution annealed – maximum corrosion resistance
- Cleanliness: free from grinding marks, oil and contaminants before welding
- Identification per ASTM B622: heat no., 2.4819 / UNS N10276, standard, dimensions
- Caution at sustained 600–1000 °C exposure – possible phase precipitation
- Excellent suitability for sour service per NACE MR0175

## 10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Standard and type (e.g. ASTM B622 / B366 WPHC276 LR 90°)
- Dimensions: DN / NPS, wall thickness or schedule
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, NDT, external inspection)
- Project-specific specification (NACE MR0175, FDA, etc.)

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