

ENGINEERING MATERIAL SELECTION GUIDE

NICKEL ALLOYS MATERIAL SELECTION

UNS grade comparison

Composition, mechanical properties and selection notes

NICKEL-COPPER

NICKEL-CHROMIUM

NICKEL-IRON-CHROMIUM

COMPOSITION

MECHANICAL DATA

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UNS grade comparison

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REFERENCE NOTE

Source dimensional values and footnotes are retained. Confirm the applicable material, grade, schedule and project specification before ordering.

MATERIAL FAMILIES

Three nickel-based alloy groups

The grouping below follows the supplied source and uses representative UNS grades from its tables.

Nickel-copper alloys

Alloy 400 - UNS N04400 | Alloy K-500 - UNS N05500

The source associates this family with chemical-process and marine service. Alloy K-500 uses aluminium and titanium additions plus age treatment to increase strength relative to Alloy 400.

Nickel-chromium alloys

Alloy 625, 725, 718 and C276

This family combines corrosion resistance with a broad temperature range. The source distinguishes solution-strengthened Alloy 625 and corrosion-resistant C276 from precipitation-strengthened Alloys 725 and 718.

Nickel-iron-chromium alloys

Alloy 825 - UNS N08825 | Alloy 925 - UNS N09925

The source describes these as lower-nickel alternatives with molybdenum and copper additions for oxidising and reducing acids. Alloy 925 adds precipitation strengthening to the Alloy 825 family concept.

SELECTION CONTROL

Family descriptions support early material comparison only. Final alloy, product form, condition, governing standard, testing and corrosion suitability must be confirmed for the actual service environment.

SOURCE-PRESERVED TABLE

Chemical composition - Part 1

UNS N04400, N05500, N06625 and N07725. Blank cells remain unstated in the supplied source.

UNS Grade	Tradename	Ni	Cr	Mo	Cu	Fe	C	Mn	P	S	Si	Al	Ti	Nb	Other
UNS N04400	Alloy 400, Monel® 400	63.0			28.0 - 34.0	0.024		0.3	0.5			2.5			N 0.2
UNS N05500	Alloy K-500, Monel® K-500	63.0			27.0 - 33.0	2.0	0.3	1.5		0.01	0.5	2.30 - 3.15	0.35 - 0.85		
UNS N06625	Alloy 625, Inconel® 625	58.0	20.0 - 23.0	8.0 - 10.0		5.0	0.1	0.5	0.015	0.015	0.5	0.4	0.4	3.15 - 4.15	
UNS N07725	Alloy 725, Inconel® 725	55.0 - 59.0	19.0 - 22.5	7.0 - 9.5					0.015	0.010	0.2	0.4	1.0 - 1.7	2.75 - 4.0	

Table values reproduced directly from the supplied source image; units are percent as presented.

SOURCE-PRESERVED TABLE

Chemical composition - Part 2

UNS N07718, N08825, N09925 and N10276. The original header is repeated for readability.

UNS Grade	Tradename	Ni	Cr	Mo	Cu	Fe	C	Mn	P	S	Si	Al	Ti	Nb	Other
UNS N07718	Alloy 718, Inconel® 718	50.0 - 55.0	17.0 - 21.0	2.80 - 3.30	0.3		0.1	0.35	0.015	0.015	0.35	0.2 - 0.8	0.65 - 1.15	4.7 - 5.5	Co 1
UNS N08825	Alloy 825, Incoloy® 825	38.0 - 46.0	19.5 - 23.5	2.5 - 3.5	1.5 - 3.0	22.0	0.05	1.0		0.03	0.5	0.2	0.6 - 1.2		
UNS N09925	Alloy 925, Incoloy® 925	42.0 - 46.0	19.5 - 22.5	2.5 - 3.5	1.5 - 3.0	24.0	0.025	1.0	0.02	0.003	0.35	0.1 - 0.5	1.9 - 2.4	0.08 - 0.50	
UNS N10276	Alloy C276, Hastelloy® C276	55.0	14.5 - 16.5	15.0 - 17.0		4.0 - 7.0	0.01	1.0	0.04	0.03	0.08				W 3.0 - 4.5, Co 2.5, V 0.35

Table values reproduced directly from the supplied source image; units are percent as presented.

REPRESENTATIVE SOURCE VALUES

Mechanical properties by UNS grade

Yield and ultimate tensile strength are stated in ksi; elongation is stated in percent.

UNS Grade	Tradename	Yield Strength (ksi)	Ultimate tensile Strength (ksi)	Elongation (%)
UNS N04400	Alloy 400, Monel® 400	25	70	35
UNS N05500	Alloy K-500, Monel® K-500	100	140	20
UNS N06625	Alloy 625, Inconel® 625	60	120	30
UNS N07725	Alloy 725, Inconel® 725	120	165	20
UNS N07718	Alloy 718, Inconel® 718	120	150	20
UNS N08825	Alloy 825, Incoloy® 825	35	85	30
UNS N09925	Alloy 925, Incoloy® 925	110	140	18
UNS N10276	Alloy C276, Hastelloy® C276	55	100	60

Source notes: properties vary by bar diameter; shown values are for mid-size bars, about 100 mm, and common strength levels.

ENGINEERING COMPARISON

Strengthening, temperature and applications

Condensed guidance from the supplied source; use the governing specification for design and procurement.

Strengthening routes

Solution-strengthened

Alloy 625 is described as using molybdenum and niobium additions without a separate ageing step.

Precipitation-strengthened

Alloys K-500, 718, 725 and 925 use age treatment to form fine strengthening precipitates.

Source temperature checkpoints

320 C

Alloy 400 / K-500

540 C

Alloy 825 / 925

650 C

Alloy 625 / 725 / 718 / C276

The source states these as temperatures up to which ambient mechanical properties are retained.

Application themes stated in the source

Nickel-copper

Chemical process equipment, marine shafts, propellers, fasteners and sour-service components.

Nickel-chromium

Corrosive or sour oil-and-gas service, load-bearing components, chemical processing and wide-temperature duty.

Nickel-iron-chromium

Acid service, heat exchangers, pollution control, wet scrubbers, vessels and downhole equipment.

The values and application notes are comparative reference data, not design allowables or purchase acceptance criteria. Confirm the current material specification and service conditions.

Send your requirement

Send a drawing, product list, size, material grade, standard, schedule or wall thickness, testing and project document requirements.

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RESPONSE AND DOCUMENT COORDINATION

Initial enquiries are answered within 24 hours, including weekends, by email or WhatsApp. Drawing review, material/standard matching and project document requirements can be discussed and organized with the buyer. Third-party inspection can be buyer-nominated or coordinated on request.

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