

Nickel Alloys Quik Guide

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| | | | | | NOMINAL CHEMICAL COMPOSITIONS (% BY WEIGHT) | | | | | |
|-----------------------|---------------------------|---|--|------|---|------|------|------|-------------------------------|--|
| | ALLOY | DESCRIPTION | MAJOR APPLICATIONS ⁽⁴⁾ | Ni | Cr | Мо | Fe | Cu | Other | |
| | Nickel 200 ⁽²⁾ | Commercially pure wrought nickel, good mechanical properties and excellent resistance to many corrosives. | Food processing equipment, marine and offshore engineering, solt production, caustic handling equipment and piping. | 99.6 | _ | _ | _ | — | C 0.04 | |
| MONEL ^{®(1)} | alloy 400 | A Ni-Cu alloy with high strength and excellent corrosion resistance to a wide range of media. | Valves, pumps, shafts, marine fixtures, fasteners, electrical and electronic components, processing equipment, petroleum refining and production equipment, feed-water heaters, and other heat exchangers. | 65.1 | _ | _ | 1.6 | 32.0 | Mn 1.1 | |
| | alloy R-405 | Similar to alloy 400. Controlled sulfur added for improved machining characteristics. | Water meter parts, screw machine products, fasteners, valve parts. | 65.0 | _ | _ | 1.2 | 32.5 | Mn 1.1 S 0.04 | |
| | alloy K-500 | Age-hardenable version of alloy 400 for increased strength and hardness. | Pump shafts, impellers, doctor blades, oil well drill collars and instruments, electronic components, springs, valve trim fasteners. | 64.7 | _ | _ | 1.0 | 30.2 | A1 2.7 Ti 0.6 | |
| INCONEL®(1) | alloy 600 | A NFCrFe alloy with good resistance to axidizing and reducing environments; for severely corrosive environments at elevated temperatures. | Furnace muffles, heat-treat equipment, chemical and petrochemical processing equipment, nuclear and automotive applications. | 76.0 | 15.0 | _ | 8.0 | — | - | |
| | alloy 601 | Excellent high temperature properties, resistance to oxidizing, carburizing, and sulfur-containing atmospheres. | Heat exchangers, heat treating baskets and fixtures, radiant tubes, thermocouples, furnace muffles and retorts, combustion cans, aircraft engine parts. | 60.5 | 23.0 | _ | 14.4 | _ | A1 1.4 | |
| | alloy 617 | Optimum high-temperature mechanical stability, oxidation and corrosion resistance. Excellent cyclic oxidation and carbuization resistance at 2000° F. Good stress-rupture properties above 1800° F. | timum high-temperature mechanical stability, oxidation and rosion resistance. Excellent cyclic oxidation and carbuization istance at 2000° F. Good stress-rupture properties above 00° F. eellent resistance to general corrosion, pitting, crevice corrosion, erginalura attack and stress-corrosion cracking in aggressive hazardous waste incinention, and paper processing. 59 0 20 5 | | | | | | | |
| | alloy 622 | Excellent resistance to general corrosion, pitting, crevice corrosion, intergranular attack and stress-corrosion cracking in aggressive chemical environments. | | 59.0 | 20.5 | 14.2 | 2.3 | _ | W 3.2 | |
| | alloy 625 ⁽³⁾ | A Ni-Gr-Mo alloy with high strength and toughness from cryogenic temperatures to 1500°F. Good oxidation resistance, exceptional fatigue strength and good resistance to many corrosives. | Aerospace engineering, gas turbines, chemical and petrochemical processing equipment, all and gas extraction, marine engineering, and pollution control. | 61.0 | 21.5 | 9.0 | 2.5 | _ | Nb 3.6 | |
| | alloy C-276 | Excellent resistance to pitting and stress-corrosion cracking. Superior resistance to corrosion in flue gas desulfurization environments containing chlorides. | Flue gas scrubber parts, liquid incinerating systems, pollution control equipment, chemical processing where strong oxidizers or reducers are present. | 57.0 | 16.0 | 16.0 | 5.5 | _ | W 4.0 | |
| | alloy 718 | An age hardenable alloy which offers a combination of high strength up to 1300°F, corrosion-resistance and good weldability. | Jet engines, gas turbines, pump bodies and parts, oil and gas extraction, nuclear engineering. | 54.0 | 18.0 | 3.0 | 18.5 | _ | Nb 5.0 Ti 1.0 | |
| | alloy 725™ | An alloy with corrosion-resistance comparable to alloy 625 but with higher strength obtainable through age-hardening. | Oil and gas extraction, chemical and petrochemical processing equipment. | 57.0 | 21.0 | 8.0 | 7.5 | _ | Nb 3.5 Ti 1.5 A1 0.3 | |
| | alloy X-750 | An age-hardenable Ni-Cr-Fe alloy with high tensile and creep- rupture properties up to 1300°F. | Gas turbine parts, heat-treat fixtures, nuclear engineering, fasteners, springs and automotive components. | 73.0 | 15.5 | _ | 7.0 | — | Ti 2.5 Nb 1.0 A1 0.7 | |
| | alloy HX | An alloy which offers excellent strength, fabrication and oxidation- resistance at temperatures up to 2000°F. | Aircraft components, marine and land-based gas turbine engine components, thermal processing and nuclear engineering. | 47.0 | 22.0 | 9.0 | 18.0 | _ | Co 1.5 W 0.6 C 0.1 | |
| INCOLOY®(1) | alloy 800 | Strong and resistant to oxidation and carbuization at elevated temperatures. Resists sulfur attack, internal oxidation, scaling, and corrosion in a wide variety of atmospheres. | Heat exchangers, process piping, carburizing fixtures and retorts, electric range heating element sheathing, nuclear steam generator tubing and other components. | 32.5 | 21.0 | _ | 46.0 | — | C 0.05 | |
| | alloy 800HT® | Similar to alloy 800 with better high-temperature strength. Higher design strength values for applications above 1150°F. Improved creep and stress-rupture properties in the 1100°F to 1800°F temperature range. | Chemical and power plant superheater and reheater tubing; steam methane reformer pigtails, headers, furnace tubing, and process piping. | 32.5 | 21.0 | _ | 46.0 | | A1 + Ti 0.85-1.2 C 0.08 | |
| | alloy 20 | Offers excellent resistance to general corrosion, pitting and crevice corrosion in media containing chlorides and sulfuric, phosphoric and nitric acids. | Chemical and process plant applications, pickling tanks, centrifugal pumps, pharmoceutical production and food processing equipment. | 35.0 | 20.0 | 2.5 | 37.0 | 3.5 | Nb 0.6 | |
| | alloy 825 | Excellent resistance to a wide variety of corrosives. Resists pitting and intergranular type corrosion, reducing acids and oxidizing chemicals. | Pickling tank heaters, hooks, chemical tank trailers, evaporators, other processing equipment, ash pit seals, hydrofluoric acid production, pollution control equipment. | 42.0 | 21.5 | 3.0 | 28.0 | 2.0 | — | |
| | alloy 925™ | An alloy with corrosion-resistance similar to alloy 825 but with higher strength obtained through age-hardening. | Oil country tubular products, tool joints, surface and downhole hardware, fasteners, shafting. | 44.0 | 21.0 | 3.0 | 28.0 | 1.8 | Ti 2.1 A1 0.3 | |

(1) Castle Metals is proud to be a distributor of the MONEL®, $\mathsf{INCONEL}^{\circledast}$ and $\mathsf{INCOLOY}^{\circledast}$ registered trademarks of Special Metals Corporation, a PCC Company. (2) Nickel 201, low carbon version suggested for temperatures above 600° F.

(3) Alloy 625 LCF, chemical and process control for optimum resistance to

mechanical and thermal fatigue to 1200°F.

(4) This column is provided for your conveinence. A. M. Castle & Co. cannot and (7) Stress-relieved. does not make recommendations of type or grade of material for end use.

- (5) Many variables influence the performance of nickel alloys in a specific
 - environment. A. M. Castle & Co. cannot and does not make recommendations for end use.
- (6) Typical data, not suited for design or specifications.
- (8) Age-hardened.
- (9) Inventory may not meet all typical specifications. Check with stocking district for
- inventory specifications. (10) Alloys 718 and 925 bar available for the oil and gas industry to NACE MR0175 and API 6A.

| | CORROSION RESISTANCE ⁽⁵⁾ | | | | | | HIGH TEMP. ⁽⁵⁾ RESISTANCE (+ 1000° F) | | | | MECHANICAL PROPERTIES ⁽⁶⁾ | | | SPECIFICATIONS ⁽⁹⁾ | | | | | | |
|---------------|-------------------------------------|-------------------|-----------------|-------------|--------------|----------|--|----------|-------------------|-----------|--------------------------------------|--|-------------------|--|----------------------------|-------------------|---------------------|---------------------|---|------------------------|
| p | ic Acid | ic Acid | Acid | | p | | | | acking | () | | Stability | Density lb/in³ | Nominal Room-Temperature Mechanical Properties (Annealed material unless otherwise noted) | | | | | | |
| Sulfuric Acid | Hydrochloric Acid | Hydrofluoric Acid | Phosphoric Acid | Nitric Acid | Organic Acid | Alkalies | Salts | Seawater | Chloride Cracking | Oxidation | Carburization | High Temperature Strength & Stability | | Tensile Strength ksi | 0.2% Yield Strength ksi | Elongation % | Hardness Brinell | ASTM(B) ASME(SB) | SAE AMS | UNS |
| ₽ | • | • | • | 0 | • | • | • | • | • | 0 | 0 | 0 | 0.321 | 65 | 30 | 45 | 110 | 160 161 162 | | N02200 |
| • | ₽ | • | • | 0 | • | • | • | • | • | 0 | 0 | 0 | 0.318 | 80 | 40 | 45 | 140 | 127 164 165 | 4544 4675 | N04400 |
| • | ₽ | • | • | 0 | • | • | • | • | • | 0 | 0 | 0 | 0.318 | 95 ⁽⁷⁾ | 85 ⁽⁷⁾ | 25(7) | 205(7) | 164 | 4674 | N04405 |
| • | | • | • | 0 | • | • | • | • | • | 0 | 0 | 0 | 0.305 | 155(8) | 100(8) | 25 ⁽⁸⁾ | 310 ⁽⁸⁾ | 586 | 4676 | N05500 |
| | 0 | • | | 0 | • | • | • | • | • | • | • | • | 0.306 | 100 | 50 | 40 | 170 | 166 168 564 | 5540 5665 | N06600 |
| | 0 | | | | • | • | • | | • | • | • | • | 0.293 | 95 | 40 | 50 | 145 | 166 168 | 5715 5870 | N06601 |
| • | ٠ | ٠ | • | • | • | • | • | • | • | • | • | • | 0.302 | 115 | 55 | 50 | 185 | 166 168 | 5887 5888 5889 | N06617 |
| • | ٠ | • | • | • | • | • | • | • | • | ٠ | • | • | 0.311 | 115 | 55 | 60 | 170 | 574 575 | | N06022 |
| • | • | • | • | • | • | • | • | • | • | • | • | • | 0.305 | 125 | 65 | 50 | 200 | 443 446 | 5599 5666 5879 | N06625 |
| • | • | • | • | ₽ | • | • | • | • | • | • | • | • | 0.321 | 110 | 50 | 60 | 180 | 574 575 | | N10276 |
| | | | | | • | • | • | • | • | • | • | • | 0.296 | 205(8) | 165(8) | 20(8) | 425 ⁽⁸⁾ | 637 670 | 5596, 5663 5597, 5664, 5662 | N07718 ⁽¹⁰⁾ |
| • | • | • | • | • | • | • | • | • | • | • | • | • | 0.300 | 185(8) | 130(8) | 30(8) | 355 ⁽⁸⁾ | 805 | | N07725 |
| | 0 | О | | 0 | • | • | • | | • | • | • | • | 0.299 | 180(8) | 120(8) | 15(8) | 325 ⁽⁸⁾ | 637 | 5542, 5670 5667, 5671 5668, 5747 5669, | N07750 |
| • | • | • | | 0 | | 0 | | | | • | • | • | 0.297 | 110 | 50 | 50 | 170 | 435 572 | 5536 5754 | N06002 |
| | Þ | О | | • | • | | | | • | • | • | • | 0.287 | 90 | 50 | 40 | 165 | 408 409 | 5871 5766 | N08800 |
| | • | О | ₽ | • | • | • | • | • | • | • | • | • | 0.287 | 80 | 35 | 45 | 145 | 408 409 564 | | N08811 |
| • | • | • | • | • | • | • | • | • | • | 0 | 0 | 0 | 0.292 | 95 | 60 | 35 | 180 | 463 472 473 | | N08020 |
| • | • | • | • | • | • | • | • | • | • | | • | • | 0.294 | 95 | 45 | 45 | 155 | 424 425 | | N08825 |
| • | • | • | • | • | • | • | • | • | • | | | | 0.292 | 170(8) | 120(8) | 25(8) | 320(8) | | | N09925 ⁽¹⁰⁾ |

● Good to Excellent ▶ Acceptable ○ Not Suitable

The information in this quik guide is correct to the best of our knowledge. A. M. Castle & Co. assumes no responsibility for errors or omissions. A. M. Castle & Co. publishes this quik guide for guidance of their customers and reserves the right to add or delete items without notice.

Standard Inventory Size Ranges*

| | | | Sheet | | | | |
|----------|----------------|-----------|------------------|-----------|--|--|--|
| Alloys | Ba | ar | 36" & 48" Widths | | | | |
| , | Round | Hex | Flat | Coiled | | | |
| 200 | 1/8″ - 3″ | _ | .018″125″ | _ | | | |
| 400 | 1/4″ - 10 1/2″ | _ | .018″140″ | _ | | | |
| R-405 | 1/8″ - 3 1/2″ | 1/2″ - 3″ | _ | _ | | | |
| K-500 | 1/4″ - 9″ | _ | _ | _ | | | |
| 600 | 1/8″ - 6″ | — | .018″140″ | _ | | | |
| 601 | 1/4″ - 2″ | _ | .031″140″ | _ | | | |
| 617 | — | _ | .020″187″ | .020″125″ | | | |
| 625 | 1/2″ - 12″ | _ | .016″250″ | .020″125″ | | | |
| 625LCF | _ | _ | .018″078″ | .020″125″ | | | |
| C-276 | 1/2″ - 8″ | _ | .025″125″ | _ | | | |
| 718 AMS | 1/4″ - 7″ | _ | .016″250″ | .020″125″ | | | |
| 718 NACE | 3/4″ - 12″ | _ | _ | _ | | | |
| X-750 | 1/8″ - 3 3/4″ | _ | .031″125″ | .031″125″ | | | |
| НХ | 5/16" - 7" | _ | .018″187″ | .020″125″ | | | |
| 800HT | 1/2″ - 6″ | _ | .031″125″ | _ | | | |
| 20 | 1/2″ -8″ | | _ | _ | | | |
| 825 | 5/8″ - 2″ | _ | .031″125″ | | | | |
| 925 | 1/2″ - 11″ | — | _ | _ | | | |
| | l | | | | | | |

*Other sizes available on request.

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