

PRODUCT HANDBOOK OF
**HIGH-PERFORMANCE
NICKEL ALLOYS**

THE ALLOY SPECIALISTS

PRODUCT HANDBOOK OF HIGH-PERFORMANCE NICKEL ALLOYS

Daxun Alloys offers the industry's broadest selection of nickel, Hastelloy, and cobalt alloys, along with various product types, backed by over 20 years of experience in nickel alloy technology. These alloys are engineered to deliver exceptional properties to meet the needs of the world's most demanding applications. These properties include heat and corrosion resistance, strength, machinability, electrical resistance, controlled thermal expansion, and magnetic properties.

TRADEMARKS OF THE Daxun alloy CORPORATION GROUP OF COMPANIES

· BRIGHTRAY	· INCOTEST	· NIMONIC	· 718SPF
· DURANICKEL	· INCOTHERM	· NI-ROD	· 725NDUR
· FERRY	· INCO-WELD	· RESISTOHM	· 740H
· INCOFLUX	· KOTHERM	· UDIMET	· 800HT
· INCOLOY	· MONEL	· 27-7MO	· 945
· INCONEL	· NILO	· 625LCF	· 945X

LEVERAGING A NETWORK OF EXPERTISE

The specialty metals we offer are unmatched in performance, but as part of the Daxun Metals Group, Daxun Alloys can leverage the capabilities of a leader in metals to provide an unmatched range of alloy components and products to industries worldwide.

To meet the critical needs of the manufacturing and energy sectors, Daxun Alloys, a member of the Daxun Metals Group, is dedicated to advancing the development of metals in industrial applications including oil and aerospace, natural gas, processing and refining, and power generation.

DISTRIBUTION

Our products can be purchased directly from Daxun Alloys and our alloys and products can be shipped to most industrialized countries..

QUALITY STANDARDS

All of our operations maintain ISO 9001-certified quality management standards to produce alloy compositions and forms that meet nationally and internationally recognized standards or customers' own specifications.

ADDITIONAL INFORMATION

Comprehensive product data sheets and bulletins on Daxun alloy High-Performance Alloys are available on our website, www.daxuns.com. Technical and commercial inquiries may be entered on the website as well.

CONTENTS

Nickel

Nickel 200	4
Nickel 201	4
Nickel 270	5
DURANICKEL alloy 301	5

MONEL

MONEL alloy 400	6
MONEL alloy R-405.....	6
MONEL alloy K-500	7

INCONEL

INCONEL alloy 600	8
INCONEL alloy 601	8
INCONEL alloy 617	9
INCONEL alloy 625	9
INCONEL alloy 625LCF.....	10
INCONEL alloy 686	10
INCONEL alloy 690	11
INCONEL alloy 693	11
INCONEL alloy 706	12
INCONEL alloys	
718 & 718SPF	12
INCONEL alloy 725	13
INCONEL alloy 740H	13
INCONEL alloy X-750.....	14
INCONEL alloy 751	14
INCONEL alloy 783	15
INCONEL alloy 22.....	15
HASTE alloy C-276	16
INCONEL alloy G-3	16
HASTE alloy X.....	17
INCONEL alloy N06230	17

INCOLOY

INCOLOY alloy 800	18
INCOLOY alloys	
800H & 800HT	18
INCOLOY alloy 803	19
INCOLOY alloy 825	19
INCOLOY alloy 864	20
INCOLOY alloy 865	20
INCOLOY alloy 903	21
INCOLOY alloy 907	21
INCOLOY alloy 909	22
INCOLOY alloy 925	22
INCOLOY alloy 945	23
INCOLOY alloy 945X.....	23
INCOLOY alloy 20	24
INCOLOY alloy 28	24
INCOLOY alloy 330	25
INCOLOY alloy 25-6MO	25
INCOLOY alloy 25-6HN.....	26
INCOLOY alloy 27-7MO	26
INCOLOY alloy A-286.....	27
INCOLOY alloy 890	27

NIMONIC

NIMONIC alloy 75	28
NIMONIC alloy 80A	28
NIMONIC alloy 86	29
NIMONIC alloy 90	29
NIMONIC alloy 105	30
NIMONIC alloy 115	30
NIMONIC alloy 263	31
NIMONIC alloy 901	31
NIMONIC alloy PE11.....	32
NIMONIC alloy PE16.....	32
NIMONIC alloy PK33.....	33
NIMONIC alloy MP35N.....	33

NILO

NILO alloy 36.....	34
NILO alloy 42.....	34
NILO alloy 48.....	35
NILO alloy K.....	35

Other Alloys

FERRY alloy.....	36
NI-SPAN-C alloy 902.....	36
Waspaloy	37
UDIMET alloy 188	37
UDIMET alloy L-605	38
UDIMET alloy 520	38
UDIMET alloy 720	39
UDIMET alloy D-979	39
UDIMET alloy R41	40
INCOTHERM alloy TD.....	40

Appendix

Conversion Factors for	
Units of Measure.....	41
Welding Products.....	42-43

NICKEL 200

Commercially pure [99.6%] wrought nickel with good mechanical properties and resistance to a range of corrosive media. Good thermal, electrical and magnetostrictive properties. Used for a variety of processing equipment, particularly to maintain product purity in handling foods, synthetic fibers and alkalies.

NICKEL 201

Commercially pure [99.6%] wrought nickel essentially the same as Nickel 200 but with a lower carbon content to prevent embrittlement by intergranular carbon at temperatures over 600°F [315°C]. Lower carbon content also reduces hardness, making Nickel 201 particularly suitable for cold-formed items.

NICKEL 270

A high-purity grade of nickel made by powder metallurgy. It has a low base hardness and high ductility. Its extreme purity is useful for components of hydrogen thyratrons. It is also used for electrical resistance thermometers.

DURANICKEL ALLOY 301

An age-hardened alloy that combines the excellent corrosion resistance characteristics of Nickel 200 with the added advantages of greater strength and hardness. The alloy is used for springs requiring high electrical conductivity, parts of equipment requiring good thermal conductivity and magnetostrictive units, which are operated under stress conditions in which the fatigue strength of Nickel 200 is inadequate.

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

MAJOR
SPECIFICATIONS

UNS N02200
BS 3072 – 3076 [NA11]
ASTM B 160 – B 163, B 366,
B 564, B 725, B 730,
B 751, B 775, B 829
ASME SB-160 – SB-163,
SB-366, SB-564, SB-725,
SB-730, SB-751, SB-775,
SB-829

ASME Code Case 2249
DIN 17740, 17750 – 17754
Werkstoff Nr. 2.4060, 2.4066
ISO 6207, 6208, 9723 – 9725

UNS N02201
BS 3072 – 3074 [NA12]
ASTM B 160 – B 163, B 366,
B 725, B 730, B 751,
B 775, B 829
ASME SB-160 – SB-163,
SB-366, SB-725, SB-730,
SB-751, SB-775, SB-829

ASME Code Case 2249
SAE AMS 5553
DIN 17740, 17750 – 17754
Werkstoff Nr. 2.4061, 2.4068
VdTÜV 345
ISO 6207, 6208, 9723 – 9725

LIMITING CHEMICAL
COMPOSITION, %

Ni^a.....99.0 min.
Cu.....0.25 max.
Fe.....0.40 max.
^aPlus Co.

Mn.....0.35 max.
C.....0.15 max.
Si.....0.35 max.

S.....0.01 max.

Ni^a.....99.0 min.
Cu.....0.25 max.
Fe.....0.40 max.
^aPlus Co.

Mn.....0.35 max.
C.....0.02 max.
Si.....0.35 max.

S.....0.01 max.

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.321
g/cm³..... 8.89
Melting Range, °F2615 – 2635
°C1435 – 1446
Specific Heat, Btu/lb•°F0.109
J/kg•°C..... 456
Curie Temperature, °F680
°C360
Permeability Ferromagnetic
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in •°F..... 7.4
21 – 93°C, µm/m •°C..... 13.3
Thermal Conductivity, Btu • in/ft²•h•°F487
W/m •°C..... 70.2
Electrical Resistivity, ohm •circ mil/ft.....58
µΩ •m0.096

Density, lb/in³0.321
g/cm³..... 8.89
Melting Range, °F2615 – 2635
°C1435 – 1446
Specific Heat, Btu/lb•°F0.109
J/kg•°C..... 456
Curie Temperature, °F680
°C360
Permeability Ferromagnetic
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in •°F..... 7.3
21 – 93°C, µm/m •°C..... 13.1
Thermal Conductivity, Btu • in/ft²•h•°F550
W/m •°C..... 79.3
Electrical Resistivity, ohm •circ mil/ft.....51
µΩ •m0.085

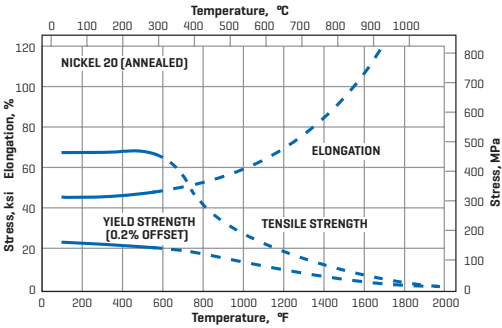
TYPICAL MECHANICAL
PROPERTIES

[Annealed]

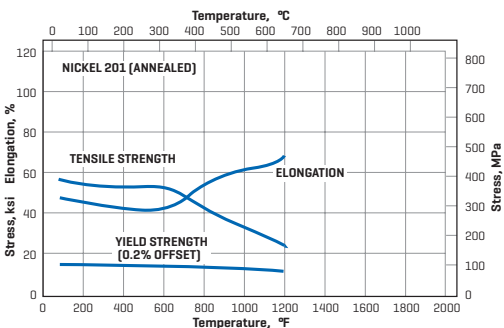
Tensile Strength, ksi.....67
MPa..... 462
Yield Strength [0.2% Offset], ksi.....21.5
MPa..... 148
Elongation, %47

[Annealed]

Tensile Strength, ksi.....58.5
MPa..... 403
Yield Strength [0.2% Offset], ksi.....15
MPa..... 103
Elongation, %50



— Typical usage range



STANDARD
PRODUCT FORMS

Strip, round bar and wire.

MAJOR
SPECIFICATIONS

UNS N02270
ASTM F 3

Werkstoff Nr. 2.4050

LIMITING CHEMICAL
COMPOSITION, %

Ni^a.....99.9 min.
Cu.....0.01 max.
Fe.....0.05 max.
^aPlus Co.

Mn.....0.003 max.
C.....0.02 max.
S.....0.003 max.

Ti0.005 max.
Mg.....0.005 max.
Si.....0.005 max.

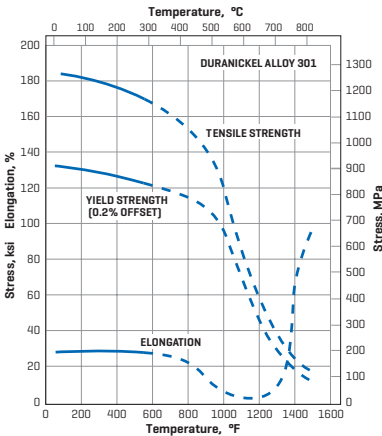
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.322
g/cm³..... 8.91
Melting Point, °F2650
°C1454
Specific Heat, Btu/lb •°F0.110
J/kg •°C..... 460
Permeability..... Ferromagnetic
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in •°F 7.4
20 – 95°C, µm/m •°C..... 13.3
Thermal Conductivity, Btu • in/ft²•h •°F 595
W/m •°C..... 86
Electrical Resistivity, ohm • circ mil/ft45
µΩ •m0.075

TYPICAL MECHANICAL
PROPERTIES

[Annealed]

Tensile Strength, ksi.....50
MPa..... 345
Yield Strength [0.2% Offset], ksi16
MPa..... 110
Elongation, %50



— Typical usage range

MONEL ALLOY 400

A nickel-copper alloy with high strength and excellent corrosion resistance in a range of media, including sea water, hydrofluoric acid, sulfuric acid and alkalies. Used for marine engineering, chemical and hydrocarbon processing equipment, valves, pumps, shafts, fittings, fasteners and heat exchangers.

MONEL ALLOY R-405

The free-machining version of MONEL alloy 400. A controlled amount of sulfur is added to the alloy to provide sulfide inclusions that act as chip breakers during machining. Other characteristics are essentially the same as those of MONEL alloy 400. Used for meter and valve parts, fasteners and screw-machine products.

MONEL ALLOY K-500

A precipitation-hardenable nickel-copper alloy that combines the corrosion resistance of MONEL alloy 400 with greater strength and hardness. It also has low permeability and is nonmagnetic to temperatures as low as -150°F [-101°C]. Used for pump shafts, oil-well tools and instruments, doctor blades and scrapers, springs, valve trim, fasteners and marine propeller shafts.

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

Round bar, hexagon and wire.

MAJOR
SPECIFICATIONS

UNS N04400	AECMA Pr EN 2305
BS 3072 - 3076 [NA13]	SAE AMS 4544, 4574,
ASTM B 127, B 163 - B 165,	4675, 4730, 4731, 7233
B 366, B 564, B 725, B 730,	DIN 17743, 17750 - 17754
B 751, B 775, B 829	Werkstoff Nr. 2.4360,
ASME SB-127, SB-163 - SB-165,	2.4361
SB-366, SB-564, SB-725,	VdTUV 263
SB-730, SB-751, SB-775,	QQ-N 281
SB-829	NACE MR-0175/ISO 15156

UNS N04405	SAE AMS 4674, 7234
NACE MR-01-75	QQ-N 281
ASTM B 164	MIL-N-894
ASME SB-164	

LIMITING CHEMICAL
COMPOSITION, %

Ni ^a63.0 min.	Mn..... 2.0 max.	S..... 0.5 max.
Cu.....28.0 - 34.0	C..... 0.3 max.	
Fe..... 2.5 max.	Si..... 0.024 max.	

^aPlus Co.

Ni ^a63.0 min.	S... 0.025 - 0.060	Si..... 0.5 max.
Cu.....28.0 - 34.0	Mn..... 2.0 max.	
Fe..... 2.5 max.	C..... 0.3 max.	

^aPlus Co.

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

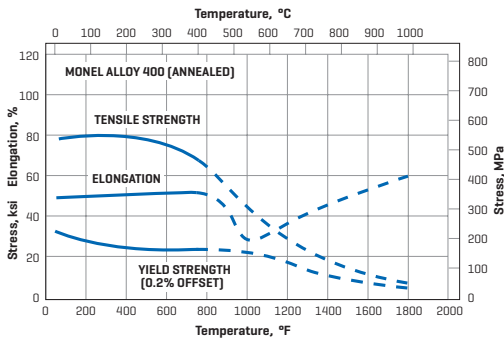
Density, lb/in³.....0.318
g/cm³..... 8.80
Melting Point, °F.....2370 - 2460
°C.....1300 - 1350
Specific Heat, Btu/lb • °F.....0.102
J/kg • °C..... 427
Curie Temperature, °F.....70 - 120
°C.....20 - 50
Coefficient of Expansion, 70 - 200°F, 10⁻⁶ in/in • °F..... 7.7
21 - 93°C, µm/m • °C..... 13.9
Thermal Conductivity, Btu • in/ft² • h • °F.....151
W/m • °C..... 21.8
Electrical Resistivity, ohm • circ mil/ft329
µΩ • m0.547

Density, lb/in³.....0.318
g/cm³..... 8.80
Melting Point, °F.....2370 - 2460
°C.....1300 - 1350
Specific Heat, Btu/lb • °F.....0.102
J/kg • °C..... 427
Curie Temperature, °F.....70 - 120
°C.....20 - 50
Coefficient of Expansion, 70 - 200°F, 10⁻⁶ in/in • °F..... 7.6
20 - 95°C, µm/m • °C..... 13.7
Thermal Conductivity, Btu • in/ft² • h • °F.....151
W/m • °C..... 21.8
Electrical Resistivity, ohm • circ mil/ft307
µΩ • m0.510

TYPICAL MECHANICAL
PROPERTIES

[Annealed]
Tensile Strength, ksi.....80
MPa..... 550
Yield Strength [0.2% Offset], ksi.....35
MPa..... 240
Elongation, %40

[Annealed]
Tensile Strength, ksi.....80
MPa..... 550
Yield Strength [0.2% Offset], ksi.....35
MPa..... 240
Elongation, %40



— Typical usage range

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

MAJOR
SPECIFICATIONS

UNS N05500	Werkstoff Nr. 2.4375
BS 3072 - 3076 [NA18]	QQ-N 286
ASTM B 865	NACE MR-0175/ISO 15156
SAE AMS 4676	ISO 6208, 9723 - 9725
DIN 17743, 17752 -17754	ASME Code Case 1192

LIMITING CHEMICAL
COMPOSITION, %

Ni ^a63.0 min.	Ti0.35 - 0.85	Mn..... 1.5 max.
Cu..... 27.0 - 33.0	Fe..... 2.0 max.	S.....0.01 max.
Al 2.30 - 3.15	C.....0.25 max.	Si..... 0.5 max.

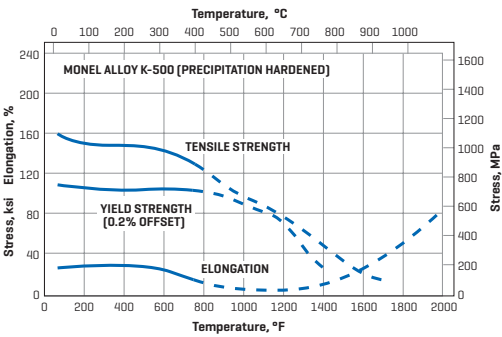
^aPlus Co.

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³.....0.305
g/cm³..... 8.44
Melting Point, °F.....2400 - 2460
°C.....1315 - 1350
Specific Heat, Btu/lb • °F.....0.100
J/kg • °C..... 419
Curie Temperature, °F.....-150
°C..... -100
Permeability at 200 Oersted [15.9 kA/m]1.002
Coefficient of Expansion, 70 - 200°F, 10⁻⁶ in/in • °F..... 7.6
21 - 93°C, µm/m • °C..... 13.7
Thermal Conductivity, Btu • in/ft² • h • °F.....121
W/m • °C.....17.5
Electrical Resistivity, ohm • circ mil/ft370
µΩ • m0.615
Young's Modulus at RT, 10³ ksi26

TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]
Tensile Strength, ksi.....160
MPa.....1100
Yield Strength [0.2% Offset], ksi.....115
MPa..... 790
Elongation, %20



— Typical usage range

INCONEL ALLOY 600

A nickel-chromium alloy with good oxidation resistance at high temperatures and resistance to chloride-ion stress-corrosion cracking, corrosion by high-purity water and caustic corrosion. Used for furnace components, chemical and food processing, nuclear engineering and sparking electrodes.

INCONEL ALLOY 601

A nickel-chromium alloy with an addition of aluminum for outstanding resistance to oxidation and other forms of high-temperature corrosion. It also has high mechanical properties at elevated temperatures. Used for industrial furnaces; heat-treating equipment such as baskets, muffles, and retorts; petrochemical and other process equipment; and gas-turbine components.

INCONEL ALLOY 617

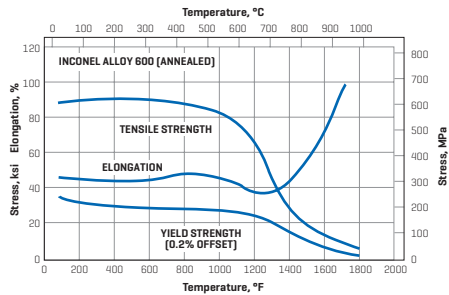
A nickel-chromium-cobalt-molybdenum alloy with an exceptional combination of metallurgical stability, strength and oxidation resistance at high temperatures. Resistance to oxidation is enhanced by an aluminum addition. The alloy also resists a wide range of corrosive aqueous environments. Used in gas turbines for combustion cans, ducting and transition liners; petrochemical processing; heat-treating equipment; and in nitric acid production.

INCONEL ALLOY 625

A nickel-chromium-molybdenum alloy with an addition of niobium that acts with the molybdenum to stiffen the alloy's matrix and thereby provide high strength without a strengthening heat treatment. The alloy resists a wide range of severely corrosive environments and is especially resistant to pitting and crevice corrosion. Used in chemical processing, aerospace and marine engineering, pollution-control equipment and nuclear reactors.

STANDARD PRODUCT FORMS	Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon, wire and extruded section.		
MAJOR SPECIFICATIONS	UNS N06600 BS 3072 – 3076 [NA14] ASTM B 163, B 166 – B 168, B 366, B 516, B 517, B 564, B 751, B 775, B 829 ASME SB-163, SB-166 – SB-168, SB-366, SB-516, SB-517, SB-564, SB-751, SB-775, SB-829 ASME Code Cases 1827, N-20, N-253, N-576	SAE AMS 5540, 5580, 5665, 5687 DIN 17742, 17750 – 17754 Werkstoff Nr. 2.4816 VdTÜV 305 NACE MR-01-75 QQ-W 390 EN 10095 ISO 6207, 6208, 9723 –9725, 4955A	
LIMITING CHEMICAL COMPOSITION, %	Ni ^a72.0 min. Cr.....14.0 – 17.0 Fe.....6.0 – 10.0 ^a Plus Co.	C.....0.15 max. Mn.....1.0 max. S.....0.015 max.	Si.....0.5 max. Cu.....0.5 max.
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in ³0.306 g/cm ³8.47 Melting Range, °F2470 – 2575 °C1354 – 1413 Specific Heat, Btu/lb•°F0.106 J/kg•°C.....444 Curie Temperature, °F-192 °C-124 Permeability at 200 Oersted [15.9 kA/m]1.010 Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....7.4 21 – 93°C, µm/m•°C.....13.3 Thermal Conductivity, Btu • in/ft ² •h•°F103 W/m•°C.....14.9 Electrical Resistivity, ohm•circ mil/ft.....620 µΩ•m1.03	Density, lb/in ³0.293 g/cm ³8.11 Melting Range, °F2480 – 2571 °C1360-1411 Specific Heat, Btu/lb•°F0.107 J/kg•°C.....448 Curie Temperature, °F<-320 °C<-196 Permeability at 200 Oersted [15.9 kA/m]1.003 Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....7.60 20 – 100°C, µm/m•°C13.75 Thermal Conductivity, Btu • in/ft ² •h•°F78 W/m•°C.....11.2 Electrical Resistivity, ohm•circ mil/ft.....717 µΩ•m1.19	

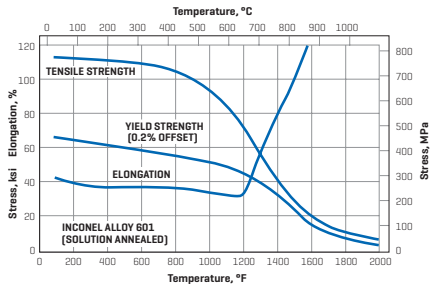
TYPICAL MECHANICAL PROPERTIES	[Annealed] Tensile Strength, ksi.....95 MPa.....655 Yield Strength [0.2% Offset], ksi.....45 MPa.....310 Elongation, %40
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— Typical usage range

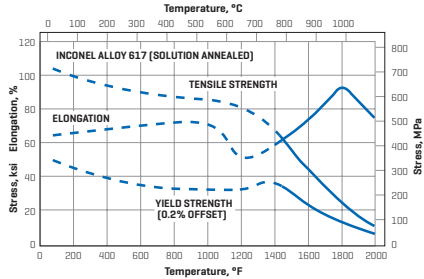
STANDARD PRODUCT FORMS	Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.		
MAJOR SPECIFICATIONS	UNS N06601 ASTM B 166 – B 168, B 751, B 775, B 829 ASME SB-166 – SB-168, SB-751, SB-775, SB-829	ASME Code Case 1500 DIN 17742, 17750 – 17754 Werkstoff Nr. 2.4851 EN 10095 ISO 6207, 6208, 9723-9725	
LIMITING CHEMICAL COMPOSITION, %	Ni.....58.0 – 63.0 Cr.....21.0 – 25.0 Al.....1.0 – 1.7	Fe.....Remainder C.....0.10 max. Mn.....1.0 max.	Si.....0.50 max. S.....0.015 max. Cu.....1.0 max.
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in ³0.293 g/cm ³8.11 Melting Range, °F2480 – 2571 °C1360-1411 Specific Heat, Btu/lb•°F0.107 J/kg•°C.....448 Curie Temperature, °F<-320 °C<-196 Permeability at 200 Oersted [15.9 kA/m]1.003 Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....7.60 20 – 100°C, µm/m•°C13.75 Thermal Conductivity, Btu • in/ft ² •h•°F78 W/m•°C.....11.2 Electrical Resistivity, ohm•circ mil/ft.....717 µΩ•m1.19		

TYPICAL MECHANICAL PROPERTIES	[Solution Annealed] Rupture Strength [1000h] 1200°F / 650°C.....28.0 1400°F / 760°C.....9.1 1600°F / 870°C.....4.3 1800°F / 980°C.....2.1 2000°F / 1095°C.....1.0	ksi MPa ksi MPa ksi MPa ksi MPa ksi MPa
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STANDARD PRODUCT FORMS	Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon, wire and extruded section.		
MAJOR SPECIFICATIONS	UNS N06617 ASTM B 166, B 168, B 546, B 564 ASME SB-166, SB-168, SB-546, SB-564 SAE AMS 5887 – 5889	ASME Code Cases 1956, 1982 Werkstoff Nr. 2.4663a VdTÜV 485 ISO 6207, 6208, 9724 DIN 17744, 17750-17754	
LIMITING CHEMICAL COMPOSITION, %	Ni.....44.5 min. Cr.....20.0 – 24.0 Co.....10.0 – 15.0 Mo.....8.0 – 10.0 Al.....0.8 – 1.5	C.....0.05 – 0.15 Fe.....3.0 max. Mn.....1.0 max. Si.....1.0 max. S.....0.015 max.	Ti.....0.6 max. Cu.....0.5 max. B.....0.006 max.
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in ³0.302 g/cm ³8.36 Melting Range, °F2430 – 2510 °C1330 – 1380 Specific Heat, Btu/lb•°F0.100 J/kg•°C.....419 Coefficient of Expansion, 78 – 200°F, 10 ⁻⁶ in/in•°F.....6.4 20 – 100°C, µm/m•°C11.6 Thermal Conductivity, Btu • in/ft ² •h•°F94 W/m•°C.....13.6 Electrical Resistivity, ohm•circ mil/ft.....736 µΩ•m1.22		

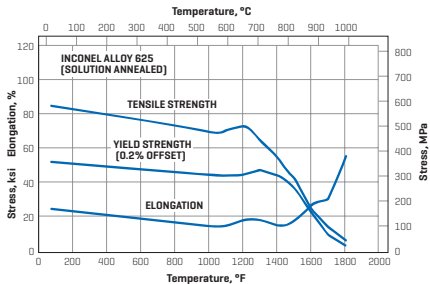
TYPICAL MECHANICAL PROPERTIES	[Solution Annealed] Rupture Strength [1000h] 1200°F / 650°C.....47.0 1400°F / 760°C.....22.0 1600°F / 870°C.....8.4 1800°F / 980°C.....3.6 2000°F / 1095°C.....1.5	ksi MPa ksi MPa ksi MPa ksi MPa ksi MPa
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— Typical usage range

STANDARD PRODUCT FORMS	Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon, wire and extruded section.		
MAJOR SPECIFICATIONS	UNS N06625 ASTM B 366, B 443, B 444, B 446, B 564, B 704, B 705, B 751, B 775, B 829 ASME SB-366, SB-443, SB-444, SB-446, SB-564, SB-704, SB-705, SB-751, SB-775, SB-829 ASME Code Case 1935	SAE AMS 5581, 5599, 5666, 5837, 5869, MAM 5599 BS 3072, 3074, 3076 [NA21] DIN 17744, 17750 – 17754 Werkstoff Nr. 2.4856 NACE MR-0175/ISO 15156 VdTÜV 499, EN 10095 ISO NW6625, ISO 6207, 6208, 9723 – 9725, 4955A	
LIMITING CHEMICAL COMPOSITION, %	Ni.....58.0 min. Cr.....20.0 – 23.0 Mo.....8.0 – 10.0 Nb ^a ...3.15 – 4.15 ^a Plus Co.	Fe.....5.0 max. C.....0.10 max. Mn.....0.50 max. Si.....0.50 max. S.....0.015 max.	Al.....0.40 max. Ti.....0.40 max. P.....0.015 max. Co ^b1.0 max. ^b If determined.
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in ³0.305 g/cm ³8.44 Melting Range, °F2350 – 2460 °C1290 – 1350 Specific Heat, Btu/lb•°F0.098 J/kg•°C.....410 Curie Temperature, °F<-320 °C<-196 Permeability at 200 Oersted [15.9 kA/m].....1.0006 Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....7.1 21 – 93°C, µm/m•°C.....12.8 Thermal Conductivity, Btu • in/ft ² •h•°F68 W/m•°C.....9.8 Electrical Resistivity, ohm•circ mil/ft.....776 µΩ•m1.29		

TYPICAL MECHANICAL PROPERTIES	[Solution Annealed] Rupture Strength [1000h] 1200°F / 650°C.....52.0 1400°F / 760°C.....23.0 1600°F / 870°C.....7.2 1800°F / 980°C.....2.6	ksi MPa ksi MPa ksi MPa ksi MPa
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INCONEL ALLOY 625LCF

A nickel-chromium-molybdenum alloy that was developed as a fatigue-resistant bellows-quality version of INCONEL alloy 625. Alloying, melting and processing of this alloy are specially designed and controlled to provide a sheet product with optimum resistance to low-cycle and thermal fatigue at temperatures up to 1200°F [650°C]. Used in Aircraft exhaust and automotive flexible coupling bellows and expansion joints in various types of process or transport piping.

INCONEL ALLOY 686

An alloy designed for outstanding corrosion-resistance in a wide range of severe environments. The alloy is used in the most severe environments encountered in chemical processing, pollution control, pulp and paper production, and treatment of industrial and municipal wastes. Chemical processing uses include heat exchangers, reaction vessels, evaporators and transfer piping. Air pollution control applications are stack liners, ducts, dampers, scrubbers, stack-gas reheaters, fans and housings.

INCONEL ALLOY 690

INCONEL alloy 690 is a high-chromium nickel alloy with excellent resistance to many corrosive aqueous media and high-temperature atmospheres. The alloy's high chromium content gives it excellent resistance to aqueous corrosion by oxidizing acids (especially nitric acid) and salts, and to sulfidation at high-temperatures. In addition to its corrosion resistance, alloy 690 has high strength, good metallurgical stability and favorable fabrication characteristics.

INCONEL ALLOY 693

A nickel-chromium-aluminum alloy offering the best resistance to metal dusting of any available conventional alloy. Alloy 693 also offers exceptional resistance to oxidation and carburization at temperatures up to 2100°F [1150°C] with excursions to even higher temperatures. The alloy's ability to resist metal dusting is especially useful in systems used to reform hydrogen and generate synthesis gas for various industries, including gas and liquid fuel production. Alloy 693 is protected by U.S. Patent Number 4,882,125.

STANDARD
PRODUCT FORMS

Sheet and strip.

MAJOR
SPECIFICATIONS

UNS N06625, N06626	ASME Code Case 2276
ASTM B 443	W.Nr. 2.4856
ASME SB-443	BS 3072 [NA21]
SAE AMS 5879	

LIMITING CHEMICAL
COMPOSITION, %

Ni.....58.0 min.	Fe..... 5.0 max.	S..... 0.015 max.
Cr20.0 – 23.0	C.....0.03 max.	Al.....0.40 max.
Mo..... 8.0 – 10.0	Si.....0.15 max.	Ti.....0.40 max.
Nb ^a ...3.15 – 4.15	N.....0.02 max.	P..... 0.015 max.
^a Plus Co.	Mn.....0.50 max.	Co..... 1.0 max.

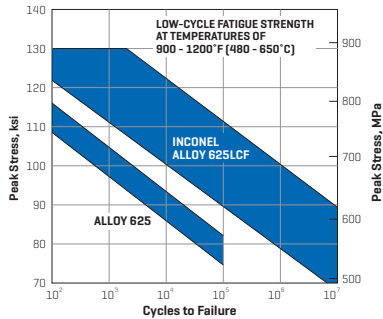
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.305
g/cm ³	8.44
Melting Range, °F.....	2350 – 2460
°C.....	1290 – 1350
Specific Heat, Btu/lb•°F.....	0.098
J/kg•°C.....	410
Curie Temperature, °F.....	<-320
°C.....	<-196
Permeability at 200 Oersted [15.9 kA/m].....	1.0006
Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....	7.1
20 – 100°C, μm/m•°C.....	12.8
Thermal Conductivity, Btu • in/ft ² •h•°F.....	68
W/m•°C.....	9.7
Electrical Resistivity, ohm•circ mil/ft.....	776
μΩ•m.....	1.29

TYPICAL MECHANICAL
PROPERTIES

[Annealed]

Tensile Strength, ksi.....	130
MPa.....	894
Yield Strength [0.2% Offset], ksi.....	68
MPa.....	469
Elongation, %.....	50



Pipe, tube, sheet, strip, plate, round bar, forging stock, hexagon and wire.

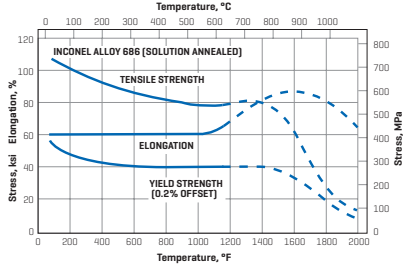
UNS N06686	ASME SB-163, SB-564,
ASTM B 163, B 462, B 564,	SB-574, SB-575, SB-619,
B 574, B 575, B 619, B 622,	SB-622, SB-626, SB-751,
B 626, B 751, B 775, B 829,	SB-775, SB-829, SB-906
B 906, F 467, F 467M, F 468,	VdTUV 515
F 468M	NACE MR-0175/ISO 15156
DIN 17744, 17750 – 17754	SAE/JMS J2295, J2271, J2655,
Werkstoff Nr. 2.4606	J2280, J2485
ASME Code Case 2198	

Cr.....19.0 – 23.0	Fe..... 1.0 max.	Si.....0.08 max.
Mo.... 15.0 – 17.0	C.....0.01 max.	P.....0.04 max.
W.....3.0 – 4.4	Mn.....0.75 max.	Ni..... Balance
Ti.....0.02 – 0.25	S.....0.02 max.	

Density, lb/in ³	0.315
g/cm ³	8.73
Melting Range, °F.....	2440 – 2516
°C.....	1338 – 1380
Specific Heat, Btu/lb•°F.....	0.089
J/kg•°C.....	373
Permeability at 200 Oersted [15.9 kA/m].....	1.001
Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....	6.67
20 – 100°C, μm/m•°C.....	11.97
Electrical Resistivity, ohm•circ mil/ft.....	744.4
μΩ•m.....	1.237

[Annealed]

Tensile Strength, ksi.....	110
MPa.....	758
Yield Strength [0.2% Offset], ksi.....	55
MPa.....	379
Elongation, %.....	60
Hardness [HRB].....	85 – 95



— Typical usage range

STANDARD
PRODUCT FORMS

Pipe, tube, plate, round bar and forging stock.

MAJOR
SPECIFICATIONS

UNS N06690	ASME SB-163, SB-166 –
ASTM B 163, B 166 – B 168,	SB-168, SB-564, SB-829
B 564, B 829	Werkstoff Nr. 2.4642
ASME Code Cases 2083,	ISO 6207, 6208, 9723
N-20, N-525	ISO NW6690

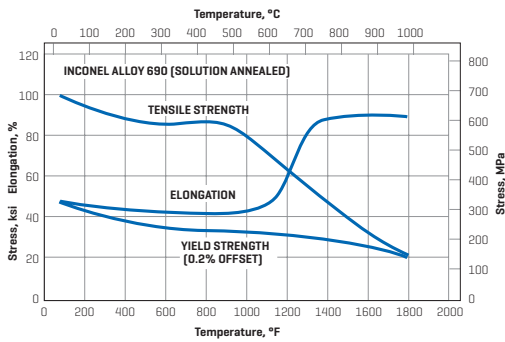
LIMITING CHEMICAL
COMPOSITION, %

Ni ^a58.0 min.	Mn.....0.50 max.
Cr..... 27.0 – 31.0	S..... 0.015 max.
Fe..... 7.0 – 11.0	Si.....0.50 max.
C.....0.05 max.	Cu.....0.50 max.
^a Plus Co.	

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.296
g/cm ³	8.19
Melting Range, °F.....	2450 – 2510
°C.....	1343 – 1377
Specific Heat, Btu/lb•°F.....	0.107
J/kg•°C.....	450
Permeability at 200 Oersted [15.9 kA/m].....	1.001
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [μm/m•°C]	
70-200°F [21–93°C].....	7.80 [14.0]
70-1000°F [21–538°C].....	8.53 [15.4]
70-1600°F [21–970°C].....	9.38 [16.9]
Thermal Conductivity ^A , Btu•in/ft ² •h•°F.....	84
W/m•°C.....	12.1
Electrical Resistivity ^A , ohm•circ mil/ft.....	.691
μΩ•m.....	1.15
Young's Modulus ^A , 10 ⁶ psi.....	30.6
GPa.....	211
Poisson's Ratio ^A	0.29
Hardness ^A , HRB.....	85
^A Room temperature, as aged.	

TYPICAL MECHANICAL
PROPERTIES

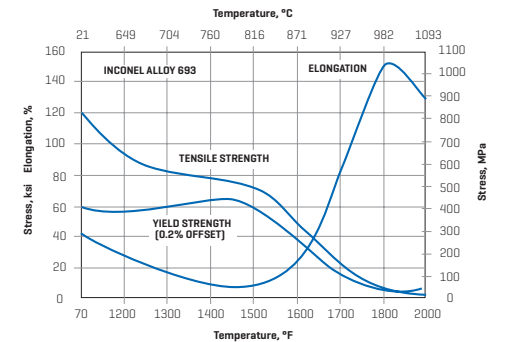


Plate, sheet, strip, bar, seamless tubes and pipes.

UNS N06693
ASTM B 166, B 167, B 168
ASME SB 166, SB 167, SB 168

Ni.... Remainder	Nb.....0.5-2.5	Si.....0.50 max.
Cr..... 27.0 – 31.0	Mn..... 1.0 max.	C.....0.15 max.
Fe.....2.5-6.0	Ti..... 1.0 max.	S..... 0.015 max.
Al.....2.5-4.0	Cu.....0.50 max.	
^a Element determined arithmetically by difference.		

Density, lb/in ³	0.280
g/cm ³	7.77
Melting Range, °F.....	2403 – 2493
°C.....	1317 – 1367
Specific Heat, Btu/lb•°F.....	0.109
J/kg•°C.....	455
Permeability at 200 Oersted.....	<1.005
Electrical Resistivity ^A , ohm•circ mil/ft.....	702.7
Thermal Conductivity ^A , Btu•in/ft ² •h•°F.....	64.3
W/m•°C.....	9.1
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [μm/m•°C]	
70-200°F [21–93°C].....	7.22 [13.04]
Young's Modulus ^A , 10 ³ psi.....	28.5
GPa.....	197
Shear Modulus ^A , 10 ³ psi.....	11.0
GPa.....	76
Poisson's Ratio ^A	0.30
^A Room temperature, as aged.	



INCONEL ALLOY 706

INCONEL alloy 706 is a precipitation-hardenable nickel-iron-chromium alloy that provides high mechanical strength in combination with good fabricability. The properties of the alloy are similar to those of INCONEL alloy 718 [N07718] except that alloy 706 is more readily fabricated, particularly by machining. Primary uses of the alloy are aerospace and land-based gas turbine parts and components, requiring resistance to creep, and stress rupture up to 1300°F [704°C], oxidation resistance and good fabricability.

INCONEL ALLOY 718 & 718SPF

Inconel alloy 718 is a precipitation-hardenable nickel-chromium alloy also containing significant amounts of iron, niobium and molybdenum along with lesser amounts of aluminum and titanium. It combines corrosion resistance and high strength with outstanding weldability, including resistance to post-weld cracking. The alloy has excellent creep-rupture strength at temperatures to 1300°F [700°C]. Used in gas turbines, rocket motors, spacecraft, nuclear reactors, pumps and tooling. INCONEL alloy 718SPF is a special version designed for superplastic forming.

INCONEL ALLOY 725

A nickel-chromium-molybdenum-niobium alloy that is highly resistant to corrosion and is age hardenable for extremely high strength. The strength of this alloy is developed by heat treatment to achieve high ductility and toughness. The alloy is resistant to hydrogen embrittlement and stress-corrosion cracking. Used for hangers, landing nipples, side pocket mandrels and polished bore receptacles in sour gas service. Also used for high-strength fasteners in marine applications.

INCONEL ALLOY 740H

A nickel-chromium-cobalt superalloy age hardened by the precipitation of a gamma prime second phase. Alloy 740H exhibits excellent high temperature strength in the age-hardened condition up to 1500°F [815°C]. With its high contents of chromium and cobalt, alloy 740H offers excellent resistance to oxidation, carburization and sulfidation at elevated temperatures. Alloy 740H is targeted for use as advanced power production boiler tubes.

STANDARD
PRODUCT FORMS

Round bar and forging stock.

MAJOR
SPECIFICATIONS

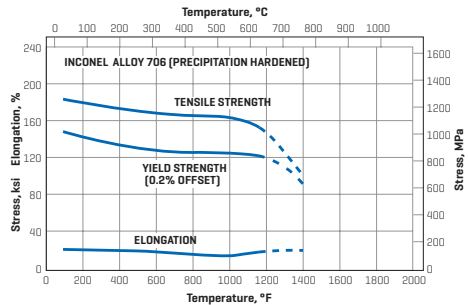
UNS N07906
SAE AMS 5605, 5606, 5701 – 5703

LIMITING CHEMICAL
COMPOSITION, %

Ni ^a39.0 – 44.0	Ti1.5 – 2.0	S..... 0.015 max.
Cr.....14.5 – 17.5	Al0.40 max.	Si.....0.35 max.
Fe.....Remainder	C.....0.06 max.	P..... 0.020 max.
Nb ^b2.5 – 3.3	Cu.....0.30 max.	B..... 0.006 max.
^a Plus Co. ^b Plus Ta.	Mn.....0.35 max.	Co.....1.00 max.

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³ [g/cm³].....0.291 [8.05]
Melting Range, °F [°C].....2434 – 2499 [1334 – 1371]
Specific Heat, Btu/lb•°F [J/kg•°C].....0.106 [444]
Curie Temperature, °F [°C].....<-109 [-78]
Permeability at 200 Oersted [15.9 kA/m]1.011
Coefficient of Expansion, 10⁻⁶ in/in•°F [µm/m•°C]
 70-200°F [21-93°C].....7.40 [13.3]
 70-500°F [21-260°C]8.25 [14.9]
 70-800°F [21-427°C]8.57 [15.4]
 70-1000°F [21-538°C].....8.73 [15.7]
 70-1200°F [21-650°C].....8.97 [16.2]
Thermal Conductivity^A, Btu•in/ft²•h•°F.....87
 W/m•°C.....12.5
Electrical Resistivity^A, ohm•circ mil/ft592
 µΩ•m0.985
Young's Modulus^A, 10⁶ psi [GPa].....30.4 [210]
Shear's Modulus^A, 10⁶ psi [GPa].....11.0 [76]
Poisson's Ratio^A.....0.382
Hardness^A, HRC.....36 – 42
^ARoom temperature, as aged.



— Typical usage range

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon, wire and extruded section.

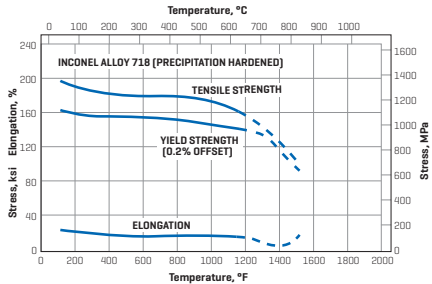
UNS N07718, N07719	ASME Code Cases 1993, 2206,
ASTM B 637, B 670	2222, N-62, N-208, N-253
ASME SB-637, SB-670	NACE MR-0175/ISO 15156
DIN 17744, 17750-17754	AECMA Pr EN 2404,
SAE AMS 5589, 5590, 5596,	2405, 2407, 2408,
5597, 5662 – 5664, 5832,	2952, 2961, 3219, 3666
5914, 5950, 5962	ISO 6208, 9723 – 9725
Werkstoff Nr. 2.4668	

Ni ^a50.0 – 55.0	Ti0.65 – 1.15	Si.....0.35 max.
Cr.....17.0 – 21.0	Al0.20 – 0.80	P..... 0.015 max.
Fe.....Remainder	Co ^c1.0 max.	S..... 0.015 max.
Nb ^b4.75 – 5.50	C.....0.08 max.	B..... 0.006 max.
Mo.....2.80 – 3.30	Mn.....0.35 max.	Cu.....0.30 max.
^a Plus Co. ^b Plus Ta.	^c If determined.	

Density, lb/in³.....0.296
 g/cm³.....8.19
Melting Point, °F.....2300 – 2437
 °C.....1260 – 1336
Specific Heat, Btu/lb•°F.....0.104
 J/kg•°C.....435
Curie Temperature, °F.....-170
 °C.....-112
Permeability at 200 Oersted [15.9 kA/m]1.0011
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in •°F.....7.2
 21 – 93°C, µm/m •°C.....13.0
Thermal Conductivity, Btu • in/ft²•h•°F.....79
 W/m•°C.....11.4
Electrical Resistivity, ohm • circ mil/ft751
 µΩ•m1.25

[Solution Annealed]

Rupture Strength [1000h]	ksi	MPa
1100°F / 595°C.....	110	760
1200°F / 650°C.....	86	590
1300°F / 705°C.....	53	370
1400°F / 760°C.....	24	170



— Typical usage range

STANDARD
PRODUCT FORMS

Round bar and wire.

MAJOR
SPECIFICATIONS

UNS N07725	SMC HA91
ASTM B 805	
ASME Code Case 2217	
NACE MR-0175/ISO 15156	

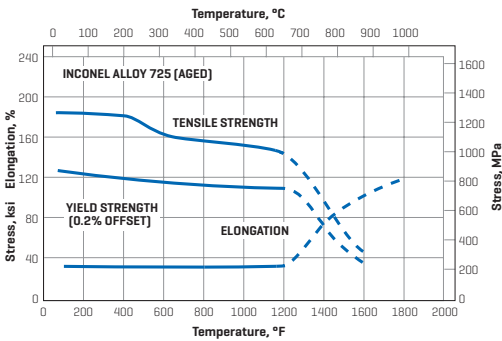
LIMITING CHEMICAL
COMPOSITION, %

Ni.....55.0 – 59.0	Ti1.0 – 1.7	Si.....0.20 max.
Cr.....19.0 – 22.5	Al0.35 max.	P..... 0.015 max.
Mo..... 7.0 – 9.5	C.....0.03 max.	S..... 0.010 max.
Nb 2.75 – 4.0	Mn.....0.35 max.	Fe..... Balance

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³.....0.300
 g/cm³.....8.31
Melting Point, °F.....2320 – 2449
 °C.....1271 – 1343
Permeability at 200 Oersted [15.9 kA/m]<1.001
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in •°F.....7.22
 20 – 100°C, µm/m •°C13.0
Thermal Conductivity, Btu • in/ft²•h•°F.....73.8
 W/m•°C.....10.6
Electrical Resistivity, ohm • circ mil/ft688
 µΩ•m1.144

TYPICAL MECHANICAL
PROPERTIES



— Typical usage range

Bar, seamless tubes.

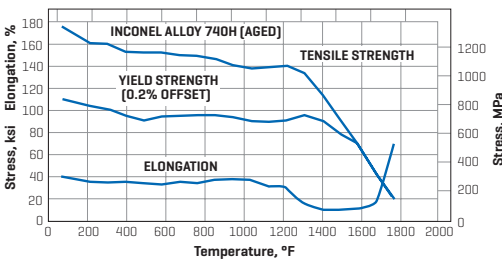
Contact Daxun alloy

Nominal

C.....0.03	Co.....20.0	Mn.....0.30
Ni.....Balance	Al1.0	Fe.....0.7
Cr.....25.0	Ti1.8	Si.....0.5
Mo.....0.5	Nb2.0	

Density, lb/in³.....0.291
 g/cm³.....8.05
Melting Point, °F.....2350 – 2484
 °C.....1288 – 1362
Specific Heat, Btu/lb•°F0.108
 J/kg•°C.....449
Electrical Resistivity, ohm • circ mil/ft702.7
 µΩ•m1.168
Thermal Conductivity, Btu • in/ft²•h•°F.....72.9
 W/m•°C.....10.2
Coefficient of Expansion, 10⁻⁶ in/in•°F [µm/m•°C]
 70-200°F [21-93°C].....6.84 [12.38]
Young's Modulus^A, 10³ psi.....32
 GPa221
Shear's Modulus^A, 10³ psi.....11.5
 GPa.....79
Poisson's Ratio^A.....0.35
Magnetic Permeability<1.005
^ARoom temperature, as aged.

Yield Strength, Room Temperature, Aged, ksi.....111
Tensile Strength, Room Temperature, Aged, ksi.....170
Elongation, Aged, %.....36



INCONEL ALLOY X-750

A nickel-chromium alloy similar to INCONEL alloy 600 but made precipitation hardenable by additions of aluminum and titanium. It has good resistance to corrosion and oxidation along with high tensile and creep-rupture properties at temperatures to 1300°F (700°C). Its excellent relaxation resistance is useful for high-temperature springs and bolts. Used in gas turbines, rocket engines, nuclear reactors, pressure vessels, tooling and aircraft structures.

INCONEL ALLOY 751

A nickel-chromium alloy similar to INCONEL alloy X-750 but with increased aluminum content for greater precipitation hardening. This alloy was designed for use as exhaust valves in internal-combustion engines. In that application, the alloy offers high strength at operating temperatures, high hot hardness for wear resistance, and corrosion resistance in hot exhaust gases containing lead oxide, sulfur, bromine and chlorine.

INCONEL ALLOY 783

An oxidation-resistant low coefficient of thermal expansion [low CTE] superalloy developed for gas turbine applications. The alloy is strengthened by a precipitation-hardening heat treatment made possible by additions of niobium and aluminum. In addition, the aluminum content provides excellent resistance to oxidation at high temperatures. The alloy's density is 5% less than those of superalloys such as INCONEL alloy 718. The combination of low expansion, high strength and excellent resistance to oxidation makes the alloy especially useful for gas turbine and steam turbine components. The low expansion enables closer control of clearances and tolerances for greater power output and fuel efficiency.

INCONEL ALLOY 22

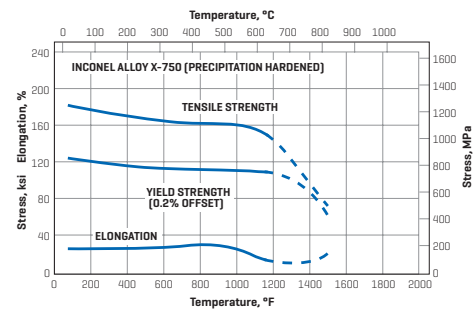
By virtue of its contents of chromium, molybdenum, tungsten and controlled iron, this alloy exhibits excellent resistance to both oxidizing and reducing acid environments, as well as those containing mixed acids. It is particularly useful for resistance to pitting and crevice corrosion in acid-halide environments. Applications include the chemical processing, pollution control, flue gas desulfurization, waste incineration and pulp and paper processing industries.

STANDARD PRODUCT FORMS	Sheet, strip, plate, round bar, flat bar, forging stock, hexagon, wire, tubing and extruded section.	
MAJOR SPECIFICATIONS	UNS N07750 BS HR 505 ASTM B 637 ASME SB-637 Werkstoff Nr. 2.4669 NACE MR-0175/ISO 15156	SAE AMS 5542, 5582, 5583, 5598, 5667 - 5671, 5698, 5699, 5747 EN 10269 ISO 6208, 9723 - 9725

LIMITING CHEMICAL COMPOSITION, %	Ni ^a70.0 min. Cr 14.0 - 17.0 Fe.....5.0 - 9.0 Ti2.25 - 3.75 ^a Plus Co.	Al 0.40 - 1.00 Nb ^b ... 0.70 - 1.20 C.....0.08 max. Mn.....1.00 max. ^b Plus Ta.	Si.....0.50 max. S.....0.01 max. Cu.....0.50 max. Co ^c1.00 max. ^c If determined.
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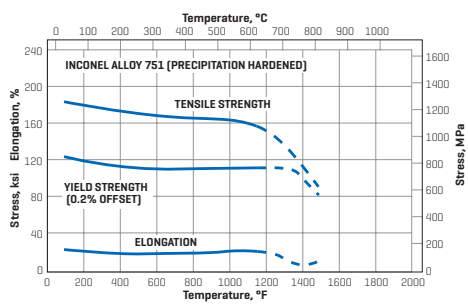
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in ³0.299 g/cm ³ 8.28 Melting Point, °F.....2540 - 2600 °C..... 1390 - 1430 Specific Heat, Btu/lb •°F.....0.103 J/kg •°C..... 431 Curie Temperature, °F.....-193 °C..... -125 Permeability at 200 Oersted [15.9 kA/m] 1.0035 Coefficient of Expansion, 70 - 200°F, 10 ⁻⁶ in/in •°F..... 7.0 21 - 93°C, µm/m •°C..... 12.6 Thermal Conductivity, Btu • in/ft ² •h•°F.....83 W/m•°C..... 12.0 Electrical Resistivity, ohm • circ mil/ft 731 µΩ•m 1.22
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TYPICAL MECHANICAL PROPERTIES	[Precipitation Hardened] Rupture Strength [1000h] 1100°F / 595°C..... 92 630 1200°F / 650°C..... 68 470 1350°F / 730°C..... 37 260 1500°F / 815°C..... 16 110	
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— Typical usage range

[Precipitation Hardened] Rupture Strength [1000h] 1200°F / 650°C..... 40 280 1350°F / 730°C..... 35 240 1500°F / 815°C..... 14 97	ksi	MPa
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— Typical usage range

STANDARD
PRODUCT FORMS

Sheet, round bar, wire and extruded section.

MAJOR
SPECIFICATIONS

UNS R30783
SAE AMS 5940

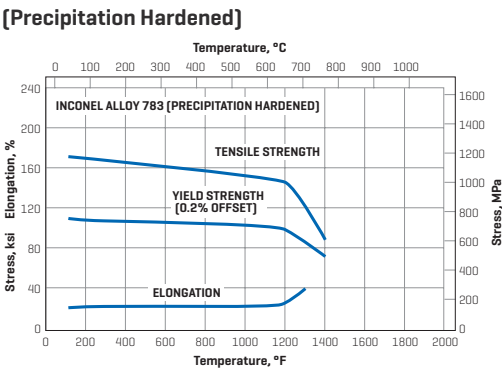
LIMITING CHEMICAL
COMPOSITION, %

Ni..... 26.0 - 30.0 Fe..... 24.0 - 27.0 Co.....Remainder Al 5.0 - 6.0 Nb 2.5 - 3.5	Cr 2.5 - 3.5 Ti 0.1 - 0.4 B...0.003 - 0.012 C..... 0.3 max. Cu.....0.50 max.	Mn.....0.50 max. P..... 0.015 max. S..... 0.005 max. Si.....0.50 max.
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PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³ [g/cm ³] 0.282 [7.81] Melting Range, °F [°C].....2437 - 2565 [1336 - 1407] Specific Heat, Btu/lb•°F [J/kg•°C]..... 0.109 [455] Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C] 70-200°F [21-93°C].....5.60 [10.08] 70-500°F [21-260°C] 5.74 [10.94] 70-800°F [21-427°C] 6.08 [10.67] 70-1000°F [21-538°C] 6.57 [11.83] 70-1200°F [21-650°C] 7.15 [12.87] Thermal Conductivity ^A , Btu•in/ft ² •h•°F [W/m•°C]...70.9 [10.2] Electrical Resistivity ^A , ohm•circ mil/ft [µΩ•m]... 615 [1.021] Young's Modulus ^A , 10 ⁶ psi [GPa]..... 26.8 [185] Shear's Modulus ^A , 10 ⁶ psi [GPa] 9.7 [67] Poisson's Ratio ^A 0.38 Hardness ^A , HRC 30 - 38 ^A Room temperature, as aged.
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TYPICAL MECHANICAL
PROPERTIES

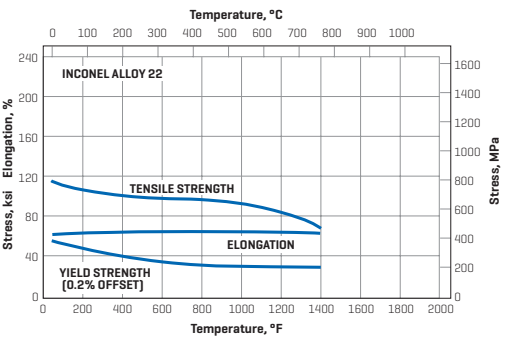


Sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

USN N06022 ASTM B 366, B 462, B 564, B 574, B 575, B 619, B 622, B 626, B 751, B 775, B 829, B 906 ASME SB-366, SB-564, SB-574, SB-575, SB-619, SB-622, SB-626, SB-751, SB-775, SB-829, SB-906	ASME Code Cases 2226, N-621 Werkstoff Nr. 2.4602 ISO 6207, 6208, 9723, 9724 DIN 17744, 17750-17754
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Ni.....Remainder Cr 20.0 - 22.5 Mo..... 12.5 - 14.5 Fe..... 2.0 - 6.0	W..... 2.5 - 3.5 Co..... 2.5 max. C..... 0.015 max. Mn.....0.50 max.	V0.35 max. S.....0.02 max. Si.....0.08 max. P.....0.02 max.
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Density, lb/in ³ [g/cm ³]0.311 [8.61] Melting Range, °F [°C].....2464 - 2529 [1351 - 1387] Specific Heat, Btu/lb•°F [J/kg•°C]..... 0.091 [381] Curie Temperature, °F [°C]..... <-320 [-196] Permeability at 200 Oersted [15.9 kA/m] <1.001 Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C] 70-200°F [21-93°C] 6.90 [12.42] 70-1000°F [21-538°C] 7.46 [13.43] 70-1800°F [21-982°C] 7.84 [14.11] Thermal Conductivity ^A , Btu•in/ft ² •h•°F [W/m•°C]..... 91 [13.2] Electrical Resistivity ^A , ohm•circ mil/ft [µΩ•m]... 730.7 [1.215] Young's Modulus ^A , 10 ⁶ psi [GPa]..... 30.3 [209] Shear's Modulus ^A , 10 ⁶ psi [GPa] 11.0 [75.8] Poisson's Ratio ^A 0.30 Hardness ^A , HRB 86 ^A Room temperature, as aged.
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HASTE ALLOY C-276

A nickel-molybdenum-chromium alloy with an addition of tungsten having excellent corrosion resistance in a wide range of severe environments. The high molybdenum content makes the alloy especially resistant to pitting and crevice corrosion. The low carbon content minimizes carbide precipitation during welding to maintain corrosion resistance in as-welded structures. Used in pollution control, chemical processing, pulp and paper production and waste treatment.

INCONEL ALLOY G-3

A nickel-chromium-iron alloy with additions of molybdenum and copper. It has good weldability and resistance to intergranular corrosion in the welded condition. The low carbon content helps prevent sensitization and consequent intergranular corrosion of weld heat-affected zones. Used for flue-gas scrubbers and for handling phosphoric and sulfuric acids.

HASTE ALLOY X

A nickel-chromium-iron-molybdenum alloy with outstanding strength and oxidation resistance at temperatures to 2200°F [1200°C]. Matrix stiffening provided by the molybdenum content results in high strength in a solid-solution alloy having good fabrication characteristics. Used in gas turbines, industrial furnaces, heat-treating equipment and nuclear engineering.

INCONEL ALLOY NO6230

A carbide strengthened nickel-chromium-tungsten alloy with an exceptional combination of strength, stability and resistance to corrosion at very high temperatures. Alloy NO6230 offers particularly good resistance to oxidation at temperatures greater than 1800°F [980°C]. It also offers good resistance to carburization and nitridation. Potential applications for this alloy include equipment and components for land-based gas turbines, thermal and petrochemical processing, heat treating, and ore refining.

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

Pipe and tube.

MAJOR
SPECIFICATIONS

UNS N10276	ASME SB-366, SB-564,
ASTM B 366, B 462, B 564, B 574,	SB-574, SB-575, SB-619,
B 575, B 619, B 622, B 626,	SB-622, SB-626, SB-751,
B 751, B 775, B 829	SB-775, SB-829
DIN 17744, 17750 - 17754	ASME Code Case 1924
Werkstoff Nr. 2.4819	NACE MR-0175/ISO 15156
VdTÜV 400	ISO 6207, 6208, 9723 - 9725

UNS N06985	ASME SB-366, SB-581, SB-582,
ASTM B 366, B 581, B 582,	SB-619, SB-622, SB-626,
B 619, B 622, B 626,	SB-751, SB-775, SB-829
B 751, B 775, B 829	DIN 17744, 17750 - 17752
NACE MR-0175/ISO 15156	Werkstoff Nr. 2.4619
	ISO 6207, 6208, 9724

LIMITING CHEMICAL
COMPOSITION, %

Ni.....Remainder	W.....3.0 - 4.5	V.....0.35 max.
Mo.....15.0 - 17.0	Co.....2.5 max.	P.....0.04 max.
Cr.....14.5 - 16.5	Mn.....1.0 max.	S.....0.03 max.
Fe.....4.0 - 7.0	C.....0.01 max.	Si.....0.08 max.

Ni.....Remainder	Nb*.....0.50 max.	Mn.....1.0 max.
Cr.....21.0 - 23.5	C.....0.015 max.	P.....0.04 max.
Fe.....18.0 - 21.0	W.....1.5 max.	S.....0.03 max.
Mo.....6.0 - 8.0	Si.....1.0 max.	Co.....5.0 max.
Cu.....1.5 - 2.5	*Plus Co.	

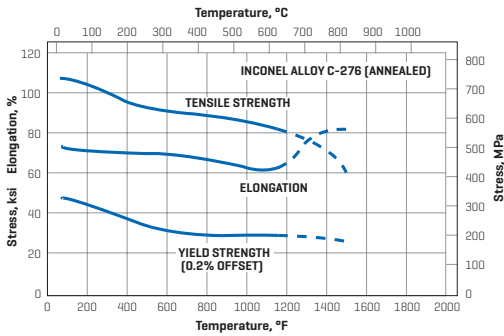
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.321
g/cm ³	8.89
Melting Point, °F.....	2415 - 2500
°C.....	1325 - 1370
Specific Heat, Btu/lb • °F.....	0.102
J/kg • °C.....	427
Coefficient of Expansion, 70 - 200°F, 10 ⁻⁶ in/in • °F.....	6.8
24 - 100°C, µm/m • °C.....	12.2
Thermal Conductivity, Btu • in/ft ² • h • °F.....	67.9
W/m • °C.....	9.8
Electrical Resistivity, ohm • circ mil/ft.....	739.2
µΩ • m.....	1.229
Permeability at 200 Oersted [15.9 kA/m].....	1.0002

Density, lb/in ³	0.294
g/cm ³	8.14
Melting Point, °F.....	2300 - 2450
°C.....	1260 - 1340
Specific Heat, Btu/lb • °F.....	0.108
J/kg • °C.....	452
Coefficient of Expansion, 70 - 200°F, 10 ⁻⁶ in/in • °F.....	8.1
24 - 100°C, µm/m • °C.....	14.6
Thermal Conductivity, Btu • in/ft ² • h • °F.....	69
W/m • °C.....	10.0

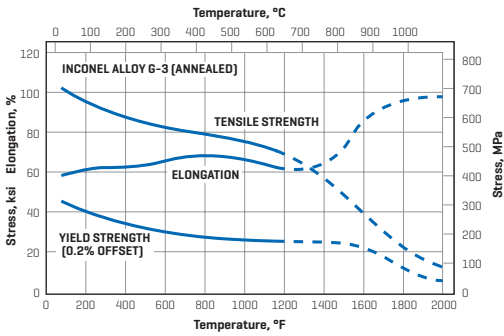
TYPICAL MECHANICAL
PROPERTIES

[Annealed]	
Tensile Strength, ksi.....	100
MPa.....	758
Yield Strength [0.2% Offset], ksi.....	53
MPa.....	363
Elongation, %.....	62



— Typical usage range

[Annealed]	
Tensile Strength, ksi.....	100
MPa.....	690
Yield Strength [0.2% Offset], ksi.....	47
MPa.....	320
Elongation, %.....	50



— Typical usage range

STANDARD
PRODUCT FORMS

Sheet, strip, plate, round bar, flat bar, forging stock, hexagon, wire and extruded section.

MAJOR
SPECIFICATIONS

UNS N06002	SAE AMS 5536, 5587, 5588,
ASTM B 366, B 435, B 572,	5754, 5798
B 619, B 622, B 626,	Werkstoff Nr. 2.4665
B 751, B 775, B 829	NACE MR-0175/ISO 15156
ASME SB-366, SB-435, SB-572,	AECMA Pr EN 2182 - 2185
SB-619, SB-622, SB-626,	BS HR 6, HR 204
SB-751, SB-775, SB-829	ISO 6207, 6208, 9723 - 9725
DIN 17744, 17750-17754	

LIMITING CHEMICAL
COMPOSITION, %

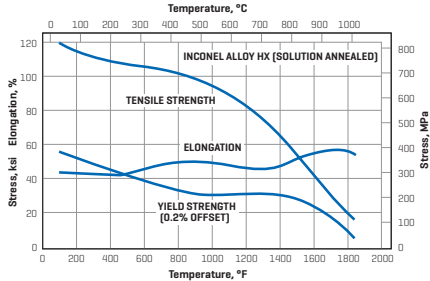
Ni.....Remainder	Co.....0.5 - 2.5	Mn.....1.0 max.
Cu.....20.5 - 23.0	W.....0.2 - 1.0	P.....0.04 max.
Fe.....17.0 - 20.0	C.....0.05 - 0.15	S.....0.03 max.
Mo.....8.0 - 10.0	Si.....1.0 max.	

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

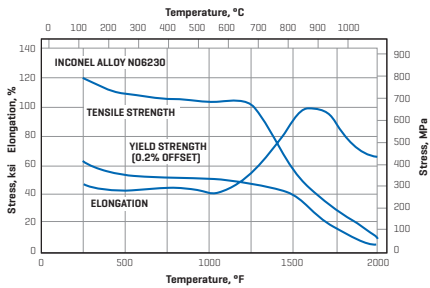
Density, lb/in ³	0.297
g/cm ³	8.22
Melting Point, °F.....	2300 - 2470
°C.....	1260 - 1355
Specific Heat, Btu/lb • °F.....	0.110
J/kg • °C.....	461
Permeability at 200 Oersted [15.9 kA/m].....	1.0110
Coefficient of Expansion, 70 - 200°F, 10 ⁻⁶ in/in • °F.....	7.4
20 - 100°C, µm/m • °C.....	13.3
Thermal Conductivity, Btu • in/ft ² • h • °F.....	80.4
W/m • °C.....	11.6
Electrical Resistivity, ohm • circ mil/ft.....	698
µΩ • m.....	1.16

TYPICAL MECHANICAL
PROPERTIES

[Solution Annealed]	
Rupture Strength [1000h]	ksi MPa
1400°F / 760°C.....	16.0 110
1500°F / 815°C.....	10.5 72
1600°F / 870°C.....	6.5 45
1700°F / 925°C.....	3.8 26
1800°F / 980°C.....	2.2 15



[Annealed]	
Tensile Strength, ksi.....	117 - 122
MPa.....	807 - 841
Yield Strength [0.2% Offset], ksi.....	55 - 62
MPa.....	379 - 427
Elongation, %.....	44 - 48



— Typical usage range

INCOLOY ALLOY 800

A nickel-chromium alloy with good strength and excellent resistance to oxidation and carburization in high-temperature atmospheres. It also resists corrosion by many aqueous environments. The alloy maintains a stable, austenitic structure during prolonged exposure to high temperatures. Used for process piping, heat exchangers, carburizing equipment, heating-element sheathing and nuclear steam-generator tubing.

INCOLOY ALLOY 800H & 800HT

Nickel-iron-chromium alloys that have the same basic composition as INCOLOY alloy 800 but with significantly higher creep-rupture strength. The higher strength results from close control of the carbon, aluminum and titanium contents in conjunction with a high-temperature anneal. Used in chemical and petrochemical processing, power plants for super-heater and reheater tubing, industrial furnaces and heat-treating equipment.

INCOLOY ALLOY 803

Designed for use in petrochemical, chemical and thermal processing applications, the alloy provides an exceptional level of high-temperature corrosion-resistance in oxidation, sulfidation, carburization and nitridation environments. In addition to thermal stability characteristics required to prevent thermal distortion and embrittlement, it exhibits excellent stress-rupture strengths. These characteristics, along with a high resistance to carburization and cyclic oxidation, make this alloy the material of choice for many severe applications including ID-finned pyrolysis tubing in high-severity ethylene furnaces.

INCOLOY ALLOY 825

A nickel-iron-chromium alloy with additions of molybdenum and copper. It has excellent resistance to both reducing and oxidizing acids, stress-corrosion cracking and localized attack such as pitting and crevice corrosion. The alloy is especially resistant to sulfuric and phosphoric acids. Used for chemical processing, pollution-control equipment, oil and gas well piping, nuclear fuel reprocessing, acid production and pickling equipment.

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

MAJOR
SPECIFICATIONS

UNS N08800	ASME SB-163, SA-240,
BS 3072 – 3076 [NA15]	SB-366, SB-407 – SB-409,
ASTM B 163, A 240, B 366,	SA-480, SB-514, SB-515,
B 407 – B 409, A 480, B 514,	SB-564, SB-751, SB-775,
B 515, B 564, B 751,	SB-829
B 775, B 829	ASME Code Cases 1325,
DIN 470	1949, 2339, N-20
Werkstoff Nr. 1.4876	SAE AMS 5766, 5871
VdTÜV 412	NACE MR-0175/ISO 15156
	ISO 9723 – 9725, 6207, 6208

UNS N08810, N08811	ASME Code Cases 1325,
BS 3072, 3073, 3074, 3075,	1949, 1983, 2339,
3076 [NA15]	N-201, N-254
ASTM A 240, A 480, B 163,	DIN 17459, 17460
B 366, B 407 – 409,	Werkstoff Nr. 1.4876, 1.4958,
B 514, B 515, B 564,	1.4959
B 751, B 775, B 829	VdTÜV 412, 434
ASME SA-240, SA-480,	EN 10028-7, 10095
SB-163, SB-366,	ISO 4955A, 6207, 6208,
SB-407 – SB-409, SB-514,	9723, 9725
SB-515, SB-564, SB-751,	
SB-775, SB-829	

LIMITING CHEMICAL
COMPOSITION, %

Ni.....30.0 – 35.0	Mn.....1.50 max.	Al.....0.15 – 0.60
Fe.....39.5 min.	S.....0.015 max.	Ti.....0.15 – 0.60
Cr.....19.0 – 23.0	Si.....1.0 max.	
C.....0.10 max.	Cu.....0.75 max.	

800H Ni.....30.0–35.0	C.....0.05–0.10	Ti.....0.15–0.60
Fe.....39.5 min.	Al.....0.15–0.60	Al+Ti.....0.30–1.20
Cr.....19.0–23.0		

800HT Ni.....30.0–35.0	C.....0.06–0.10	Ti.....0.25–0.60
Fe.....39.5 min.	Al.....0.25–0.60	Al+Ti.....0.85–1.20
Cr.....19.0–23.0		

*By special agreement, this product can be supplied with aluminum + titanium limited to 0.4 – 0.7%.

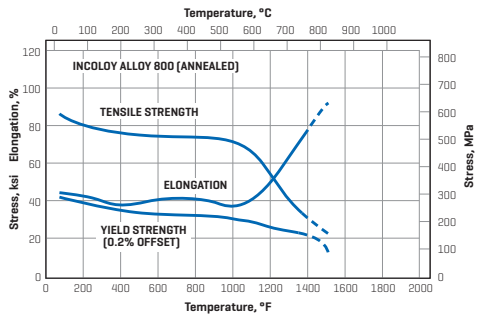
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³ [g/cm ³]	0.287 [7.94]
Melting Range, °F [°C]	2475 – 2525 [1357 – 1385]
Specific Heat, Btu/lb•°F [J/kg•°C]	0.11 [460]
Curie Temperature, °F [°C]	-175 [-115]
Permeability at 200 Oersted [15.9 kA/m]	1.014
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C]	
70–200°F [20–100°C]	7.9 [14.4]
Thermal Conductivity ^A , Btu•in/ft ² •h•°F [W/m•°C]	80 [11.5]
Electrical Resistivity ^A , ohm•circ mil/ft [µΩ•m]	595 [0.989]

Density, lb/in ³ [g/cm ³]	0.287 [7.94]
Melting Range, °F [°C]	2475 – 2525 [1357 – 1385]
Specific Heat, Btu/lb•°F [J/kg•°C]	0.11 [460]
Curie Temperature, °F [°C]	-175 [-115]
Permeability at 200 Oersted [15.9 kA/m]	1.014
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C]	
70–200°F [20–100°C]	7.9 [14.4]
Thermal Conductivity ^A , Btu•in/ft ² •h•°F [W/m•°C]	80 [11.5]
Electrical Resistivity ^A , ohm•circ mil/ft [µΩ•m]	595 [0.989]

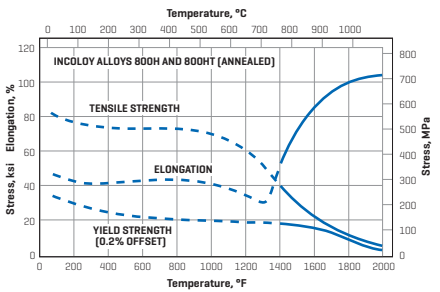
TYPICAL MECHANICAL
PROPERTIES

[Annealed]			
Rupture Strength [1000h]		ksi	MPa
1000°F / 540°C		48	330
1100°F / 595°C		32	220
1200°F / 650°C		21	145
1300°F / 705°C		11	75



— Typical usage range

[Annealed]			
Rupture Strength [1000h]		ksi	MPa
1200°F / 650°C		24.0	165
1300°F / 705°C		15.0	105
1400°F / 760°C		10.0	70
1600°F / 870°C		4.7	32
1800°F / 980°C		2.0	14



— Typical usage range

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, ID finned tube and wire.

MAJOR
SPECIFICATIONS

UNS S35045
ASTM A 182, A 213, A 240, A 249, A 480
ASME Code Case 2304
ASME SA 182, SA 213, SA 240, SA 249, SA 480

LIMITING CHEMICAL
COMPOSITION, %

Ni.....32.0 – 37.0	Mn.....1.50 max.	Al.....0.15 – 0.60
Fe.....Remainder	S.....0.015 max.	Ti.....0.15 – 0.60
Cr.....25.0 – 29.0	Si.....1.0 max.	
C.....0.06 – 0.10	Cu.....0.75 max.	

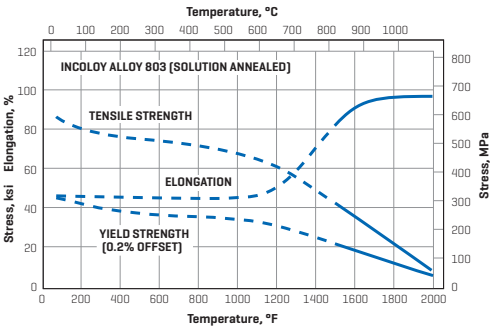
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³ [g/cm ³]	0.284 [7.86]
Melting Range, °F [°C]	2490 – 2555 [1365 – 1400]
Specific Heat, Btu/lb•°F [J/kg•°C]	0.114 [479]
Permeability at 200 Oersted [15.9 kA/m]	1.001
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C]	
70–200°F [21–93°C]	8.31 [15.0]
70–800°F [21–427°C]	9.14 [16.5]
70–1200°F [21–649°C]	9.48 [17.1]
Thermal Conductivity ^A , Btu•in/ft ² •h•°F [W/m•°C]	78 [11.3]
Electrical Resistivity ^A , ohm•circ mil/ft [µΩ•m]	618 [1.03]
Young's Modulus ^A , 10 ⁶ psi [GPa]	28.3 [195]
Shear's Modulus ^A , 10 ⁶ psi [GPa]	10.7 [73.8]
Poisson's Ratio ^A	0.32

^ARoom temperature, as solution annealed.

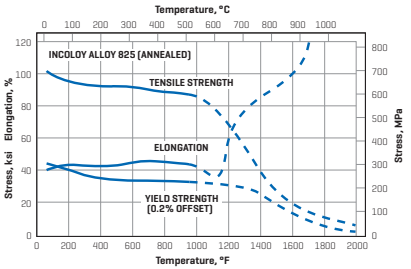
TYPICAL MECHANICAL
PROPERTIES

[Solution Annealed]



— Typical usage range

[Annealed]	
Tensile Strength, ksi	100
MPa	690
Yield Strength [0.2% Offset], ksi	45
MPa	310
Elongation, %	45



— Typical usage range

INCOLOY ALLOY 864

A new high-performance and cost-effective alloy specifically developed for automotive exhaust system flexible couplings. Potentially useful for exhaust gas recirculation tubes and other fabricated exhaust system components.

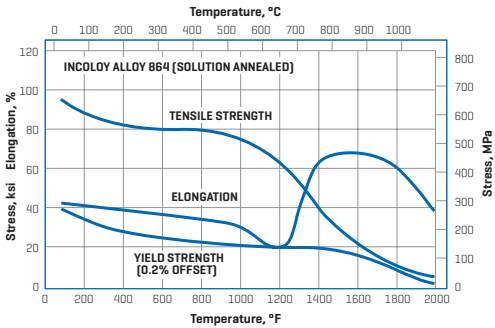
INCOLOY ALLOY 865

INCOLOY alloy 865 (UNS S35115) is an economical, high-performance corrosion-resistant alloy. Developed from the technology of INCOLOY alloy 864, it improved strength, ductility and fatigue resistance at reduced cost. The alloy was designed for automotive applications such as flexible couplings and exhaust gas recirculation (EGR) components. However, with its excellent combination of strength and corrosion resistance, alloy 865 may be evaluated for chemical processing and marine applications.

STANDARD PRODUCT FORMS	Sheet and strip.		
MAJOR SPECIFICATIONS	UNS S35135 ASTM A 240, A 480		
LIMITING CHEMICAL COMPOSITION, %	Ni.....30.0 – 38.0 Fe.....Remainder Cr20.0 – 25.0	Mo.....4.0 – 4.8 C.....0.08 max. Si.....0.6 – 1.0	Mn.....0.01 S.....0.015 max. Ti.....0.4 – 1.0
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in³0.290 g/cm³8.02 Melting Range, °F2467 – 2539 °C1353 – 1393 Permeability at 200 Oersted [15.9 kA/m]1.004 Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C] 70-200°F [21-93°C].....8.15 [14.7] 70-800°F [21-427°C].....8.90 [15.9] 70-1200°F [21-649°C].....9.21 [16.4] Thermal Conductivity ^A , Btu • in/ft²•h•°F.....78.1 W/m•°C11.3 Electrical Resistivity ^A , ohm•circ mil/ft628 µΩ•m1.04 Young's Modulus ^A , 10 ⁶ psi28.3 GPa.....195 ^A Room temperature, as annealed.		

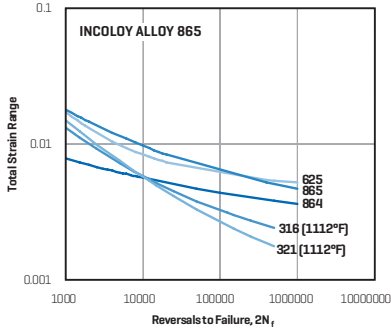
TYPICAL MECHANICAL PROPERTIES

[Solution Annealed]	
Tensile Strength, ksi.....	94
MPa.....	648
Yield Strength [0.2% Offset], ksi.....	40
MPa.....	276
Elongation, %	44



[Annealed]	
Tensile Strength, ksi.....	110
MPa.....	758
Yield Strength [0.2% Offset], ksi.....	54
MPa.....	372
Elongation, %	50
Reduction of Area, %.....	44
Hardness.....	88 HRB

FATIGUE PROPERTIES AT 1000°F [538°C]
LONGITUDINAL STRAIN CONTROLLED



INCOLOY ALLOY 903

A nickel-iron-cobalt alloy with additions of niobium, titanium and aluminum for precipitation hardening. The alloy combines high strength with a low and constant coefficient of thermal expansion at temperatures to about 800°F [430°C]. It also has a constant modulus of elasticity and is highly resistant to thermal fatigue and thermal shock. Used in gas turbines for rings and casings.

INCOLOY ALLOY 907

A nickel-iron-cobalt alloy with additions of niobium and titanium for precipitation hardening. It has the low coefficient of expansion and high strength of INCOLOY alloy 903 but with improved notch-rupture properties at elevated temperatures. Used for components of gas turbines including seals, shafts and casings.

STANDARD PRODUCT FORMS

Sheet, plate, rod, bar and forging stock.

MAJOR SPECIFICATIONS

UNS N19903

LIMITING CHEMICAL COMPOSITION, %

Ni.....36.0 – 40.0	Co.....13.0 – 17.0	Ti1.00 – 1.85
Fe.....Remainder	Al.....0.30 – 1.15	Nb.....2.40 – 3.50

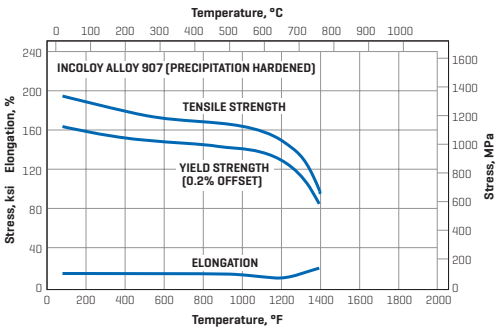
PHYSICAL CONSTANTS AND THERMAL PROPERTIES

Density, lb/in³0.298	
g/cm³8.25	
Melting Range, °F2405 – 2539	
°C1318 – 1393	
Specific Heat, Btu/lb•°F0.105	
J/kg•°C.....442	
Curie Temperature, °F780 – 880	
°C415 – 470	
Coefficient of Expansion, 77 – 800°F, 10 ⁻⁶ in/in•°F.....4.0	
25 – 427°C, µm/m •°C7.2	
Thermal Conductivity, Btu • in/ft²•h•°F.....116	
W/m•°C.....16.7	
Electrical Resistivity, ohm•circ mil/ft.....379	
µΩ•m0.650	

TYPICAL MECHANICAL PROPERTIES

[Precipitation Hardened]	
Tensile Strength, ksi.....	190
MPa.....	1310
Yield Strength [0.2% Offset], ksi.....	160
MPa.....	1100
Elongation, %	14

[Precipitation Hardened]	
Rupture Strength [1000h]	ksi MPa
1000°F / 540°C.....	100 690
1100°F / 595°C.....	85 590
1200°F / 650°C.....	50 340



INCOLOY ALLOY 909

A nickel-iron-cobalt alloy with a silicon addition containing niobium and titanium for precipitation hardening. It is similar to INCOLOY alloys 903 and 907 because it has low thermal expansion and high strength. However, the silicon addition results in improved notch-rupture and tensile properties achieved with less-restrictive processing and significantly shorter heat treatments. Used for gas-turbine casings, shrouds, vanes and shafts.

INCOLOY ALLOY 925

A precipitation-hardenable nickel-iron-chromium alloy with additions of molybdenum and copper. It combines the high strength of a precipitation-hardenable alloy with the excellent corrosion resistance of INCOLOY alloy 825. The alloy has outstanding resistance to general corrosion, pitting, crevice corrosion and stress-corrosion cracking in many aqueous environments, including those containing sulfides and chlorides. Used for surface and down-hole hardware in sour gas wells and for oil-production equipment.

INCOLOY ALLOY 945

INCOLOY alloy 945 [UNS N09945] is a corrosion-resistant, high strength, age hardenable nickel-iron-chromium alloy. Its nickel content provides resistance to stress corrosion cracking. Its combination of nickel, molybdenum and copper gives it outstanding resistance to attack by reducing media, while its high chromium content provides resistance to oxidizing environments. Molybdenum and niobium provide resistance to localized attack such as pitting and crevice corrosion. Niobium, titanium and aluminum react upon heat treatment to precipitate gamma prime and gamma double prime phases that give the alloy its high strength. With this highly desirable combination of properties, alloy 945 is suitable for many demanding applications in oil and gas service. With resistance to sulfide-induced stress corrosion cracking and corrosion in hydrogen sulfide, alloy 945 is ideal for fabrication of down-hole and surface well equipment including tubular products, valves, hangers, landing nipples, tool joints and packers. When cold worked and aged, the alloy provides the properties required for fasteners, pump shafting and high strength piping.

INCOLOY ALLOY 945X

INCOLOY alloy 945X [UNS N09945] offers enhanced strength over that of INCOLOY alloy 945. With increased levels of hardeners in the alloy composition, alloy 945X exhibits a minimum yield strength of 140 ksi. With this higher strength, alloy 945X is especially well suited for high strength oilfield equipment as both bar and mechanical tube products.

The corrosion resistance of INCOLOY alloy 945X is comparable to that of INCOLOY alloy 945. Both alloys are approved to NACE MR0175 Level VII and Level VI-450°F. Thus, alloys 945 and 945X find applications in corrosive sour oil and gas environments containing hydrogen sulfide, free-sulfur, carbon dioxide, chlorides and other aggressive corrodents.

STANDARD
PRODUCT FORMS

Round bar, forging stock and hot-rolled profile.

Tube, round bar, flat bar, forging stock and wire.

MAJOR
SPECIFICATIONS

UNS N19909
SAE AMS 5884, 5892, 5893

UNS N09925
NACE MR-0175/ISO 15156

ASME Code Case 2218

LIMITING CHEMICAL
COMPOSITION, %

Ni.....35.0 – 40.0 Nb4.3 – 5.2 Al.....0.15 max.
Fe.....Remainder Ti1.3 – 1.8 C.....0.06 max.
Co.....12.0 – 16.0 Si.....0.25 – 0.50

Ni.....42.0 – 46.0 Mo.....2.5 – 3.5 Al.....0.1 – 0.5
Fe.....Remainder Cu.....1.5 – 3.0 C.....0.03 max.
Cr.....19.5 – 22.5 Ti1.90 – 2.40

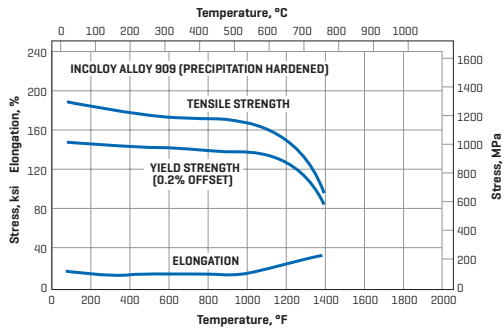
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.296
g/cm³.....8.19
Melting Range, °F2540 – 2610
°C1395 – 1430
Specific Heat, Btu/lb•°F0.102
J/kg•°C.....427
Curie Temperature, °F750 – 850
°C400 – 455
Coefficient of Expansion, 77 – 800°F, 10⁻⁶ in/in•°F.....4.3
25 – 427°C, μm/m•°C7.7
Thermal Conductivity, Btu • in/ft²•h•°F103
W/m•°C.....14.8
Electrical Resistivity, ohm•circ mil/ft.....438
μΩ•m.....0.728

Density, lb/in³0.292
g/cm³.....8.08
Melting Range, °F2392 – 2490
°C1311 – 1366
Specific Heat, Btu/lb•°F0.104
J/kg•°C.....435
Permeability at 200 Oersted [15.9 kA/m]1.001
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in•°F.....7.8
21 – 93°C, μm/m•°C.....13.2
Electrical Resistivity, ohm•circ mil/ft.....701
μΩ•m1.17

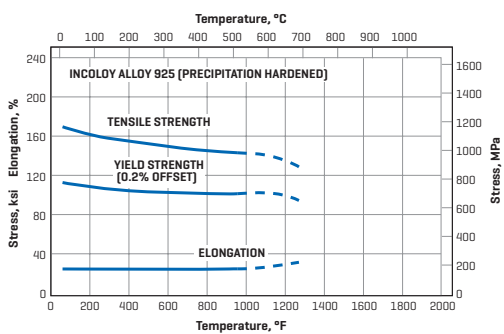
TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1000°F / 540°C.....		130	900
1100°F / 595°C.....		85	590
1200°F / 650°C.....		45	310



— Typical usage range

[Precipitation Hardened]	
Tensile Strength, ksi.....	176
MPa.....	1210
Yield Strength [0.2% Offset], ksi.....	118
MPa.....	810
Elongation, %	24



— Typical usage range

STANDARD
PRODUCT FORMS

Bar, forging stock, tubes.

MAJOR
SPECIFICATIONS

UNS N09945
NACE MR0175 [Approved to Level VII and Level VI at 450°F]

LIMITING CHEMICAL
COMPOSITION, %

Ni.....45.0 – 55.0 Nb2.5 – 4.5 Mn.....1.0 max.
Cr.....19.5 – 23.0 Ti0.5 – 2.5 Si.....0.5 max.
Fe.....Balance Al0.01 – 0.7 P.....0.03 max.
Mo.....3.0 – 4.0 C.....0.005 – 0.04 S.....0.030 max.
Cu.....1.5 – 3.0

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.281
g/cm³.....7.777
Melting Range, °F2317 – 2510
°C1270 – 1377
Permeability at 200 Oersted.....1.003
Coefficient of Expansion, 10⁻⁶ in/in•°F [μm/m•°C]
70-200°F [21-93°C].....7.88 [14.19]
70-800°F [21-427°C].....8.40 [15.12]
70-1200°F [21-649°C].....8.85 [15.93]
Young's [Tensile] Modulus.....28.3 x 10³ ksi
Shear Modulus.....10.8 x 10³ ksi
Poisson's Ratio.....0.31

TYPICAL MECHANICAL
PROPERTIES

[Annealed + Aged]	
Minimum Tensile Strength, ksi.....	150
MPa.....	1034
Minimum Yield Strength [0.2% Offset], ksi.....	130
MPa.....	896
Minimum Elongation, %.....	18
Minimum Reduction of Area, %.....	25
Maximum Hardness.....	42HRC
Minimum Impact Strength [CVN @ - 75°F], ft lbs.....	35
Joules.....	47

[Annealed + Aged]	
Minimum Tensile Strength, ksi.....	165
MPa.....	1138
Minimum Yield Strength [0.2% Offset], ksi.....	140
MPa.....	965
Minimum Elongation, %	18
Minimum Reduction of Area, %	25
Maximum Hardness.....	42HRC
Minimum Impact Strength [CVN @ - 75°F], ft lbs.....	30
Joules.....	41

INCOLOY ALLOY 20

A nickel-iron-chromium alloy with additions of copper and molybdenum. It also contains niobium for stabilization against sensitization and resultant intergranular corrosion. The alloy has excellent resistance to general corrosion, pitting and crevice corrosion in chemicals containing chlorides and sulfuric, phosphoric and nitric acids. Used for tanks, piping, heat exchangers, pumps, valves and other process equipment.

INCOLOY ALLOY 28

INCOLOY alloy 28 (UNS N08028) is a highly corrosion-resistant austenitic alloy offering resistance to a variety of media. The alloy resists attack in reducing media due to its contents of nickel, copper and molybdenum and is resistant to oxidizing species due to its high level of chromium. Alloy 28 offers resistance to general, localized and stress-induced corrosion by chlorides and hydrogen sulfides. Thus, it is widely used in oilfield applications. Tubes are cold worked to high levels of strength for downhole service in deep sour gas wells. With its excellent combination of strength and corrosion resistance, alloy 28 also finds applications in the process industries. It is especially useful for handling phosphoric acid. Due to its resistance to chlorides, alloy 28 tubes may be used in the marine industry for seawater-cooled heat exchangers.

INCOLOY ALLOY 330

A nickel-iron-chromium alloy with an addition of silicon for enhanced oxidation resistance. It has good strength at high temperatures and excellent resistance to carburizing and oxidizing atmospheres. The alloy's austenitic microstructure remains stable during long-time exposure to high temperature. Used in industrial heating for furnace muffles, retorts, conveyor systems and heat-treating baskets and fixtures.

INCOLOY ALLOY 25-6MO

A super-austenitic containing 6% molybdenum and offering excellent corrosion-resistance to neutral and acidic environments containing chlorides or other halides, such as what is found in air pollution control and flue gas desulfurization systems. The molybdenum and nitrogen content provide resistance to pitting and crevice corrosion, while copper enhances resistance to sulfuric acid. The alloy is especially suited for service in high-chloride environments such as brackish water, seawater, caustic chlorides and pulp mill bleach systems.

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

MAJOR
SPECIFICATIONS

UNS N08020	ASME SA-240, SA-480, SB-366,
ASTM A 240, A 480, B 366,	SB-462 – SB-464,
B 462 – 464, B 468,	SB-468, SB-471 – SB-475,
B 471 – B 475, B 729, B 751,	SB-729, SB-751, SB-775,
B 775, B 829, B 906	SB-829, SB-906
DIN 17744, 17750-17754	ISO 6207, 6208, 9723 – 9725

LIMITING CHEMICAL
COMPOSITION, %

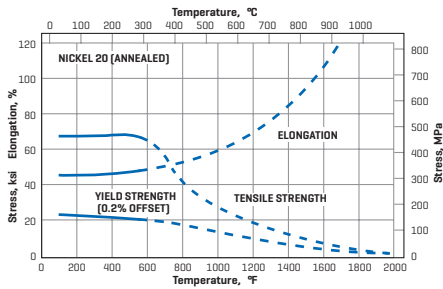
Ni	32.0 – 38.0	Nb+Ta ...	8xC-1.0	Mn.....	2.0 max.
Fe.....	Remainder	Mo.....	2.0 – 3.0	P.....	0.045 max.
Cr.....	19.0 – 21.0	Nb	1.0 max.	S	0.035 max.
Cu.....	3.0 – 4.0	C.....	0.07 max.	Si.....	1.0 max.

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.292
g/cm ³	8.08
Specific Heat, Btu/lb•°F	0.12
J/kg•°C.....	500
Coefficient of Expansion, 77 – 212°F, 10 ⁻⁶ in/in•°F.....	8.2
25 – 100°C, μm/m•°C	14.7
Thermal Conductivity, Btu • in/ft ² •h•°F	85
W/m•°C.....	12.3
Electrical Resistivity, ohm•circ mil/ft.....	651
μΩ•m	1.08

TYPICAL MECHANICAL
PROPERTIES

[Annealed]	
Tensile Strength, ksi.....	90
MPa.....	620
Yield Strength [0.2% Offset], ksi.....	45
MPa.....	300
Elongation, %	40



— Typical usage range

Tube.

UNS N08028	Werkstoff Nr. 1.4563
ASTM B 668, B 709, B 829	NACE MR-01-75
ASME SB-668, SB-709, SB-829	

Ni	30.0 – 34.0	Fe.....	Balance	S.....	0.030 max.
Cr.....	26.0 – 28.0	Mn.....	2.50 max.	Si.....	1.00 max.
Mo.....	3.0 – 4.0	C.....	0.030 max.		
Cu.....	0.6 – 1.4	P.....	0.030 max.		

Density, lb/in ³ [g/cm ³].....	0.29 [8.0]
Specific Heat, Btu/lb•°F [J/kg•°C].....	0.105 [450]
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [μm/m•°C]	
75–200°F [21–93°C].....	8.3 [15.0]
75–500°F [21–260°C].....	8.8 [15.9]
75–800°F [21–427°C].....	9.3 [16.8]
Thermal Conductivity ^A , Btu • in/ft ² •h•°F.....	66
W/m•°C.....	11.4
Electrical Resistivity ^A , ohm•circ mil/ft [μΩ•m]....	594 [0.99]
Young's Modulus ^A , 10 ⁶ psi [GPa]	29.0 [200]
^A Room temperature, as annealed.	

[Annealed]	
Tensile Strength, ksi.....	73
MPa.....	500
Yield Strength [0.2% Offset], ksi.....	31
MPa.....	214
Elongation, %	40
Hardness, [HRB]	70/90

[Cold Worked]	
Tensile Strength, ksi.....	130
MPa.....	896
Yield Strength [0.2% Offset], ksi.....	110
MPa.....	758
Elongation, %	15
Hardness, [HRC].....	33 max.

STANDARD
PRODUCT FORMS

Tube, sheet, strip, plate, round bar, forging stock, hexagon, wire, and wire rod.

MAJOR
SPECIFICATIONS

UNS N08330	ASME SB-366, SB-511, SB-512,
ASTM B 366, B 511, B 512,	SB-535, SB-536, SB-546,
B 535, B 536, B 546, B 710,	SB-710, SB-739, SB-829
B 739, B 829	Werkstoff Nr. 1.4886
SAE AMS 5592, 5716	

LIMITING CHEMICAL
COMPOSITION, %

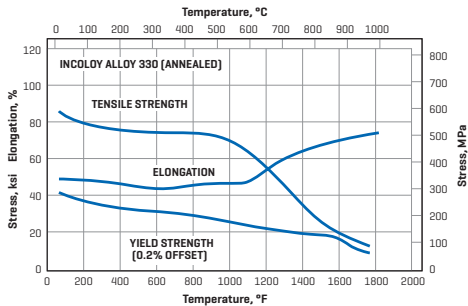
Ni.....	34.0 – 37.0	Si.....	0.75 – 1.50	P.....	0.30 max.
Fe.....	Remainder	C.....	0.08 max.	Si.....	0.30 max.
Cr.....	17.0 – 20.0	Mn.....	2.0 max.		

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.292
g/cm ³	8.08
Melting Range, °F	2520 – 2590
°C	1380 – 1420
Specific Heat, Btu/lb•°F	0.11
J/kg•°C.....	460
Permeability at 200 Oersted [15.9 kA/m]	1.02
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [μm/m•°C]	
75–200°F [24–93°C].....	8.3 [14.9]
Thermal Conductivity, Btu • in/ft ² •h•°F	86
W/m•°C.....	12.4
Electrical Resistivity, ohm•circ mil/ft.....	612
μΩ•m	1.017

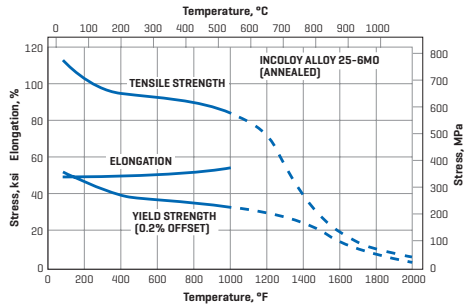
TYPICAL MECHANICAL
PROPERTIES

[Annealed]		
Rupture Strength (1000h)	ksi	MPa
1400°F / 760°C.....	7.0	48
1600°F / 870°C.....	3.1	21
1800°F / 980°C.....	1.25	8.6
2000°F / 1095°C.....	0.78	5.4



— Typical usage range

[Annealed]	
Tensile Strength, ksi.....	100
MPa.....	690
Yield Strength [0.2% Offset], ksi.....	48
MPa.....	330
Elongation, %	42



— Typical usage range

INCOLOY ALLOY 25-6HN

INCOLOY alloy 25-6HN is a super-austenitic stainless steel containing 6% molybdenum with properties enhanced by its content of nitrogen. Its high content of nickel results in thermal stability and resistance to stress corrosion cracking. Designated as UNS N08367, alloy 25-6HN directly competes with alloy AL6XN®1. The same ASTM, ASME and NACE specifications cover the alloys. Alloy 25-6HN offers significantly improved strength and corrosion resistance in most environments over conventional austenitic stainless steels such as AISI 304 or 316L. Typical applications include welded tubes for heat exchangers for both chemical processing and marine applications and for desalination systems, flue gas desulfurization equipment for coal-fired power plants and reaction vessels for pharmaceutical production.

1“AL6XN” is a registered trademark of Allegheny Ludlum Corporation.

INCOLOY ALLOY 27-7MO

An advanced 7% molybdenum super-austenitic stainless steel offering corrosion resistance in most environments superior to 6% molybdenum super-austenitic stainless steels. In many environments, alloy 27-7MO offers resistance approaching or exceeding that of much more highly alloyed materials such as INCONEL alloys 625, 22 and C-276. Applications for this alloy are found in the pollution control, power, marine, chemical processing, pulp and paper, pharmaceutical and oil and gas industries.

INCOLOY ALLOY A-286

An alloy that is precipitation hardenable for high mechanical properties. The alloy maintains good strength and oxidation resistance at temperatures up to about 1300°F [700°C]. The alloy's high strength and excellent fabrication characteristics make it useful for various components of aircraft and industrial gas turbines. Applications include blades, vanes, shafts, tail cones, afterburners, springs and fasteners. This alloy is also used for automotive applications.

INCOLOY ALLOY 890

INCOLOY® alloy 890 [UNS N08890] is the latest addition to the INCOLOY alloy family of heat-resistant alloys. Alloy 890 joins existing INCOLOY products in offering high strength along with excellent resistance to oxidation, carburization and sulfidation at temperatures up to 2200°F [1200°C]. Alloy 890 offers the high chromium content of alloy 803 along with enhanced properties from additions of molybdenum, silicon and niobium. The primary application for alloy 890 is tubes for ethylene pyrolysis furnaces.

STANDARD
PRODUCT FORMS

Sheet, strip, plate, round bar, wire rod and forging stock.

Sheet, plate, bar and wire.

MAJOR
SPECIFICATIONS

UNS N08367	ASME SB688, SA240, SB691,
ASTM B688, A240, B691, B564,	SB564, SB472, SB676,
B472, B676, B675, B804,	SB675, SB804, SB462,
B462, B366	SB366

UNS S31277	ASME Code Case 2458
ASTM A 182, A 213, A 240,	
A 249, A 312, A 479	
ASME SA 182, SA 213, SA 240	
SA 249, SA 312, SA 479	

LIMITING CHEMICAL
COMPOSITION, %

Ni....23.50-25.50	N.....0.18-0.25	Si.....1.00 max.
Cr....20.00-22.00	Cu.....0.75 max.	P.....0.040 max.
Fe.....Balance	C.....0.03 max.	S.....0.030 max.
Mo.....6.00-7.00	Mn.....2.00 max	

Ni.....26.0 - 28.0	N.....0.3-0.4	S.....0.01 max.
Cr.....20.5 - 23.0	Fe.....Remainder	Si.....0.5 max.
Mo.....6.5 - 8.0	Mn.....3.00 max.	C.....0.020 max.
Cu.....0.5-1.5	P.....0.03 max.	

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

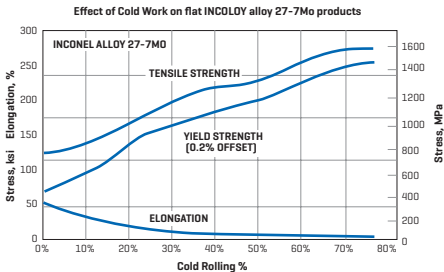
Density, lb/in³0.291
g/cm³ 8.06
Melting Range, °F2470 - 2550
°C1320 - 1400
Permeability at 200 Oersted.....1.003
Coefficient of Expansion, 10⁻⁶ in/in•°F
70 - 200°F 8.66
70 - 800°F 9.05
70 - 1200°F 9.53

Density, lb/in³ [g/cm³]0.289 [8.02]
Specific Heat, Btu/lb•°F [J/kg•°C]0.109 [454]
Permeability at 200 Oersted [15.9 kA/m]1.004
Coefficient of Expansion, 10⁻⁶ in/in•°F [µm/m•°C]
70-200°F [21-93°C] 8.33 [15.0]
Thermal Conductivity, Btu•in/ft²•h•°F [W/m•°C] 69.8 [10.1]
Electrical Resistivity, ohm•circ mil/ft [µΩ•cm]604 [100]
Young's Modulus, 10⁶ psi [GPa]27.7 [191]
Shear Strength, 10⁶ psi [GPa]10.8 [74]
Poisson's Ratio 0.29
Melting Range, °F [°C]2460 - 2530 [1350 - 1390]

TYPICAL MECHANICAL
PROPERTIES

[Annealed]
Tensile Strength, ksi 108
MPa 744
Yield Strength [0.2% Offset], ksi55
MPa 381
Elongation, %48
Hardness90HRB

[Annealed]
Tensile Strength, ksi 120
MPa 827
Yield Strength [0.2% Offset], ksi60
MPa 414
Elongation, %50



STANDARD
PRODUCT FORMS

Sheet, strip, plate, round bar, flat bar, forging stock, hexagon and wire.

MAJOR
SPECIFICATIONS

UNS S66286	BS HR 51, HR 52, HR 650
ASTM A 453, A 638	AECMA Pr EN 2119,
ASME SA-453, SA-638	2171 - 2175, 2303, 2304,
SAE AMS 5525, 5726,	2398, 2399, 2417, 3510
5731, 5732, 5734, 5737,	NACE MR-0175/ISO 15156
5858, 5895, 7235	W. NR. 1.4980

LIMITING CHEMICAL
COMPOSITION, %

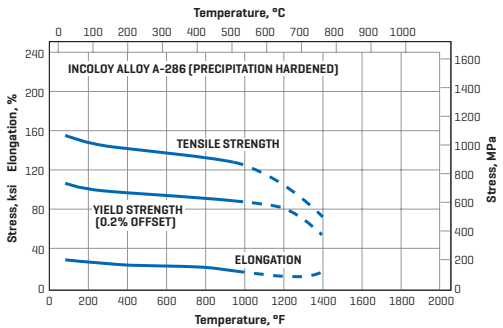
Ni 24.0 - 27.0	Mo.....1.0 - 1.5	Si..... 1.0 max.
Cr..... 13.5 - 16.0	V.....0.10 - 0.50	Al.....0.35 max.
Fe..... Balance	C.....0.08 max.	S..... 0.030 max.
Ti 1.90 - 2.35	Mn..... 2.0 max.	B..... 0.001 - 0.01

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

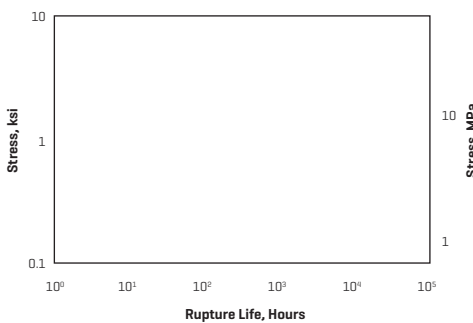
Density, lb/in³0.287
g/cm³7.94
Melting Range, °F2500 - 2600
°C1370 - 1430
Specific Heat, Btu/lb•°F0.100
J/kg•°C 419
Permeability at 200 Oersted [15.9 kA/m]1.007
Coefficient of Expansion, 10⁻⁶ in/in•°F [µm/m•°C]
70 - 200°F [21- 93°C] 9.09 [16.4]
70 - 800°F [21- 427°C]9.61 [17.3]
70 -1400°F [21-760°C]9.67 [17.4]
Thermal Conductivity^A, Btu • in/ft²•h•°F88
W/m•°C 12.7
Electrical Resistivity^A, ohm•circ mil/ft 547
µΩ•m0.910
Young's Modulus^A, 10⁶ psi 29.1
GPa 201
Hardness^A, HRC31
^ARoom temperature, as annealed.

TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]



[Annealed]



NIMONIC ALLOY 75

A nickel-chromium alloy with good mechanical properties and oxidation resistance at high temperatures. Used for sheet-metal fabrications in gas-turbine engines, components of industrial furnaces, heat-treating equipment and fixtures, and nuclear engineering.

NIMONIC ALLOY 80A

A nickel-chromium alloy similar to NIMONIC alloy 75 but made precipitation hardenable by additions of aluminum and titanium. The alloy has good corrosion and oxidation resistance and high tensile and creep-rupture properties at temperatures to 1500°F (815°C). Used for gas-turbine components (blades, rings and discs), bolts, tube supports in nuclear steam generators, die-casting inserts and cores, and exhaust valves in internal-combustion engines.

NIMONIC ALLOY 86

A nickel-chromium-molybdenum alloy with a rare-earth [cerium] addition. It combines good formability and weldability with exceptional resistance to oxidation and scaling at temperatures to 1920°F [1050°C]. Used in gas turbines for sheet-metal fabrications such as combustion chambers and afterburners and in heat-treating furnaces.

NIMONIC ALLOY 90

A precipitation-hardenable nickel-chromium-cobalt alloy having high stress-rupture strength and creep resistance at temperatures to about 1700°F [920°C]. The alloy also has good resistance to high-temperature corrosion and oxidation. Used for blades and discs in gas turbines, hot-working tools and springs.

STANDARD
PRODUCT FORMS

Sheet, strip, plate, round bar, forging stock, wire and extruded section.

MAJOR
SPECIFICATIONS

UNS N06075	AECMA Pr EN 2293, 2294,
BS HR5, HR203, HR403, HR504	2302, 2306 – 2308,
DIN 17742, 17750 – 17752	2402, 2411
Werkstoff Nr. 2.4951, 2.4630	
ISO 6207, 6208, 9723-9725	

LIMITING CHEMICAL
COMPOSITION, %

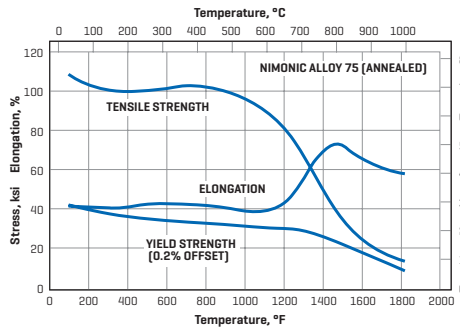
Ni.....Remainder	C.....0.08 – 0.15	Fe.....5.0 max.
Cr.....18.0 – 21.0	Si.....1.0 max.	Mn.....1.0 max.
Ti.....0.2 – 0.6	Cu.....0.5 max.	

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

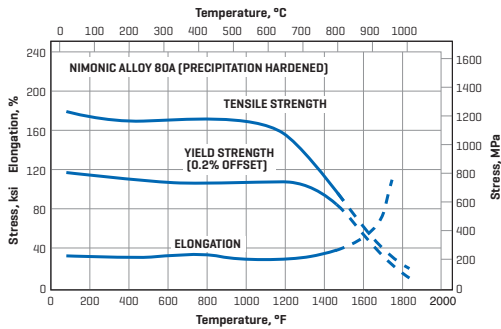
Density, lb/in³	0.302
g/cm³	8.37
Melting Range, °F	2440 – 2520
°C	1340 – 1380
Specific Heat, Btu/lb•°F	0.110
J/kg•°C	461
Coefficient of Expansion, 68 – 212°F 10 ⁻⁶ in/in•°F	6.1
20 – 100°C, µm/m•°C	11.0
Thermal Conductivity, Btu • in/ft²•h•°F	81.1
W/m•°C	11.7
Electrical Resistivity, ohm•circ mil/ft.	656
µΩ•m	1.09

TYPICAL MECHANICAL
PROPERTIES

[Annealed]			
Rupture Strength [1000h]		ksi	MPa
1400°F / 760°C		6.0	40
1500°F / 815°C		3.5	24
1600°F / 870°C		2.2	15
1700°F / 925°C		1.5	10
1800°F / 980°C		1.2	8



[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1100°F / 595°C		94	650
1200°F / 650°C		73	500
1300°F / 705°C		51	350
1400°F / 760°C		32	220
1500°F / 815°C		16	110



STANDARD
PRODUCT FORMS

Sheet, strip, plate, round bar, forging stock, extruded sections and wire.

MAJOR
SPECIFICATIONS

None applicable.

LIMITING CHEMICAL
COMPOSITION, %

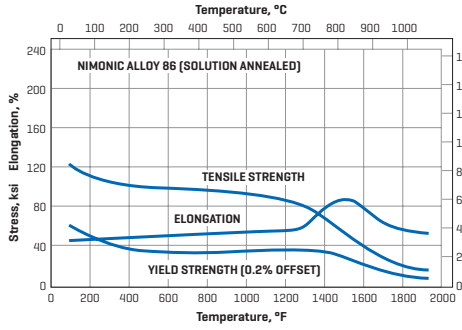
Nominal		
Ni.....65	Mo.....10.0	C.....0.05
Cr.....25.0	Ce.....0.03	

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

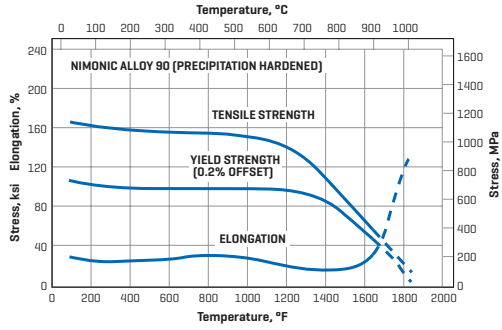
Density, lb/in³	0.309
g/cm³	8.54
Young's Modulus, 10 ⁶ psi	30.5
GPa	210
Coefficient of Expansion, 68 – 212°F, 10 ⁻⁶ in/in•°F	7.1
20 – 100°C, µm/m•°C	12.7

TYPICAL MECHANICAL
PROPERTIES

[Solution Annealed]			
Rupture Strength [1000h]		ksi	MPa
1500°F / 815°C		11.6	80
1600°F / 870°C		7.3	50
1700°F / 925°C		4.1	28
1800°F / 980°C		2.6	18



[Annealed]			
Rupture Strength [1000h]		ksi	MPa
1300°F / 705°C		52	360
1400°F / 760°C		35	240
1500°F / 815°C		22	150
1600°F / 870°C		11	75



— Typical usage range

NIMONIC ALLOY 105

A precipitation-hardenable nickel-cobalt-chromium alloy with an addition of molybdenum for solid-solution strengthening. The relatively high aluminum content enhances both strength [through greater precipitation hardening] and oxidation resistance. The alloy has high creep-rupture properties at temperatures to about 1740°F [950°C]. Used in gas turbines for blades, discs and shafts.

NIMONIC ALLOY 115

A precipitation-hardenable nickel-chromium-cobalt alloy with an addition of molybdenum for solid-solution strengthening. It is similar to NIMONIC alloy 105 but has higher levels of aluminum and titanium for increased strengthening by precipitation hardening. The alloy has high strength and creep resistance at temperatures to about 1850°F [1010°C]. Used for turbine blades in aircraft gas turbines.

NIMONIC ALLOY 263

A precipitation-hardenable nickel-chromium-cobalt alloy with an addition of molybdenum for solid-solution strengthening. It has high strength and corrosion resistance along with good formability and high-temperature ductility in welded structures. The alloy is especially suitable for sheet applications. Used in gas turbines for rings, casings and various sheet fabrications.

NIMONIC ALLOY 901

A nickel-iron-chromium alloy containing titanium and aluminum for precipitation hardening and molybdenum for solid-solution strengthening. The alloy has high-yield strength and creep resistance at temperatures to about 1110°F [600°C]. A substantial iron content enables the alloy to combine high strength with good forging characteristics. Used in gas turbines for discs and shafts.

STANDARD
PRODUCT FORMS

Round and extruded section.

Round and extruded section.

MAJOR
SPECIFICATIONS

BS HR3
Werkstoff Nr. 2.4634

AECMA Pr EN 2179 - 2181

BS HR4
Werkstoff Nr. 2.4636

AECMA Pr EN 2196, 2197

LIMITING CHEMICAL
COMPOSITION, %

Ni.....Remainder	Al4.5 – 4.9	Mn.....1.0 max.
Co.....18.0 – 22.0	C0.12 max.	S0.010 max.
Cr.....14.0 – 15.7	Si1.0 max.	B...0.003 – 0.010
Mo.....4.5 – 5.5	Cu0.2 max.	Zr.....0.15 max.
Ti0.9 – 1.5	Fe1.0 max.	

Ni.....Remainder	Al4.5 – 5.5	Mn.....1.0 max.
Cr.....14.0 – 16.0	C0.12 – 0.2	S0.015 max.
Co.....13.0 – 15.5	Si1.0 max.	B....0.01 – 0.025
Mo.....3.0 – 5.0	Cu0.2 max.	Zr.....0.15 max.
Ti3.5 – 4.5	Fe1.0 max.	

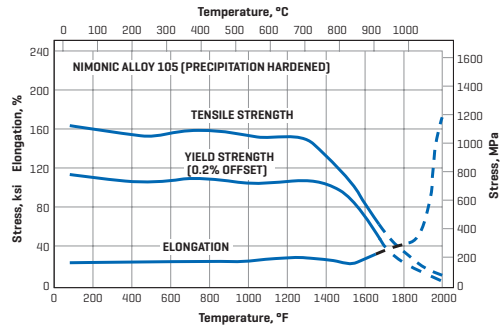
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.289
g/cm³8.01
Melting Range, °F2350 - 2450
°C1290 - 1345
Specific Heat, Btu/lb•°F0.100
J/kg•°C419
Permeability at 200 Oersted [15.9 kA/m]1.0007
Coefficient of Expansion, 68 – 212°F, 10⁻⁶ in/in•°F6.8
20 – 100°C, µm/m•°C12.2
Thermal Conductivity, Btu • in/ft²•h•°F75.51
W/m•°C10.89
Electrical Resistivity, ohm•circ mil/ft788
µΩ•m1.31

Density, lb/in³0.284
g/cm³7.85
Melting Range, °F2300 - 2400
°C1260 - 1315
Specific Heat, Btu/lb•°F0.106
J/kg•°C444
Coefficient of Expansion, 68 – 212°F, 10⁻⁶ in/in•°F6.7
20 – 100°C, µm/m•°C12.0
Thermal Conductivity, Btu • in/ft²•h•°F73.5
W/m•°C10.6
Electrical Resistivity, ohm•circ mil/ft836
µΩ•m1.39

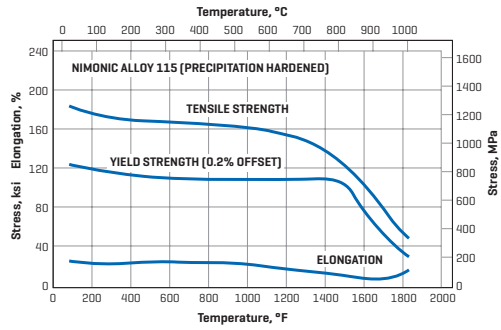
TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1380°F / 750°C		52.6	363
1500°F / 815°C		32.5	224
1600°F / 870°C		19.4	134
1725°F / 940°C		9.0	62
1800°F / 980°C		4.6	32



— Typical usage range

[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1400°F / 760°C		65	450
1500°F / 815°C		45	310
1600°F / 870°C		30	210
1700°F / 925°C		19	130
1800°F / 980°C		12	80



STANDARD
PRODUCT FORMS

Sheet, strip, plate, round bar, flat bar, forging stock, wire and extruded section.

MAJOR
SPECIFICATIONS

UNS N07263
BS HR10, HR206, HR404
SAE AMS 5872
DIN 17744, 17750-17754

AECMA Pr EN
2199 – 2203, 2418
Werkstoff Nr. 2.4650

LIMITING CHEMICAL
COMPOSITION, %

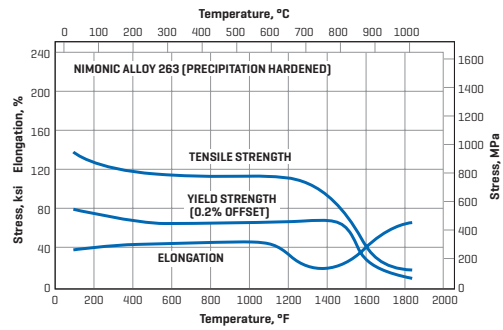
Ni.....Remainder	Al0.60 max.	S0.007 max.
Cr.....19.0 – 21.0	Ti+Al2.4 – 2.8	B0.005 max.
Co.....19.0 – 21.0	C0.04 – 0.08	Cu0.20 max.
Mo.....5.6 – 6.1	Si0.40 max.	Fe0.7 max.
Ti1.9 – 2.4	Mn0.60 max.	

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

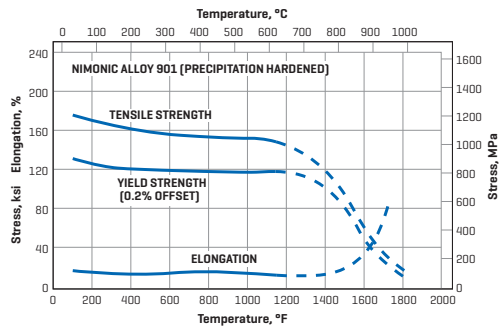
Density, lb/in³0.302
g/cm³8.36
Melting Range, °F2370 - 2470
°C1300 - 1355
Specific Heat, Btu/lb•°F0.110
J/kg•°C461
Permeability at 200 Oersted [15.9 kA/m]1.0008
Coefficient of Expansion, 68 – 212°F, 10⁻⁶ in/in•°F5.7
20 – 100°C, µm/m•°C10.3
Thermal Conductivity, Btu • in/ft²•h•°F81.1
W/m•°C11.7
Electrical Resistivity, ohm•circ mil/ft692
µΩ•m1.15

TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1100°F / 600°C		81.8	564
1290°F / 700°C		38.1	263
1470°F / 800°C		16.8	116
1560°F / 850°C		8.7	60
1650°F / 900°C		5.2	36



[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1000°F / 540°C		116	800
1100°F / 595°C		87	600
1200°F / 650°C		65	450
1300°F / 705°C		44	300
1400°F / 760°C		29	200



— Typical usage range

NIMONIC ALLOY PE11

A nickel-iron-chromium alloy precipitation hardened by titanium and aluminum and solid-solution strengthened by an addition of molybdenum. It was developed as a high-strength sheet alloy for use at temperatures to 1020°F [550°C]. The high iron content provides good workability and also relatively high tensile ductility, especially after welding. Used for components of gas turbines.

NIMONIC ALLOY PE16

A precipitation-hardenable nickel-iron-chromium alloy with an addition of molybdenum for solid-solution strengthening. It has good strength and oxidation resistance at temperatures to about 1380°F [750°C]. The alloy is designed to provide a precipitation-hardened material having excellent hot-working, cold-working and welding characteristics. Used for gas-turbine components and nuclear reactors.

NIMONIC ALLOY PK33

A nickel-chromium-cobalt alloy that is precipitation hardenable and also contains a relatively high [7%] level of molybdenum for solid-solution strengthening. It has an exceptional combination of high-temperature strength, creep resistance and ductility when welded. The alloy is especially suitable for welded sheet structures. Used in gas turbines for flame tubes and other components.

NIMONIC ALLOY MP35N

NIMONIC alloy MP35N is a multi-phase, cobalt-base alloy offering a unique combination of ultra-high strength, toughness and corrosion resistance. Common applications are fasteners, springs and high strength components for marine, oil and gas, and chemical processing service.

STANDARD
PRODUCT FORMS

Sheet, plate, round bar, flat bar, forging stock and wire.

Sheet, plate, round bar, flat bar, forging stock, and extruded section.

MAJOR
SPECIFICATIONS

None Applicable.

BS HR55, HR207

LIMITING CHEMICAL
COMPOSITION, %

Ni.....	37.0 – 41.0	Al	0.7 – 1.0	Co.....	1.0 max.
Fe.....	Remainder	C.....	0.03 – 0.08	B.....	0.001 max.
Cr.....	17.0 – 19.0	Si.....	0.5 max.	Zr.....	0.02 – 0.05
Mo....	4.75 – 5.75	Cu.....	0.5 max.	S.....	0.015 max.
Ti	2.2 – 2.5	Mn.....	0.2 max.		

Ni ^a	42.0 – 45.0	Ti	1.1 – 1.3	Mn.....	0.2 max.
Fe.....	Remainder	Al	1.1 – 1.3	Co.....	2.0 max.
Cr.....	15.5 – 17.5	C.....	0.04 – 0.08	B.....	0.005 max.
Mo.....	2.8 – 3.8	Si.....	0.5 max.	Zr.....	0.02 – 0.04
^a Plus Co.		Cu.....	0.5 max.	S.....	0.015 max.

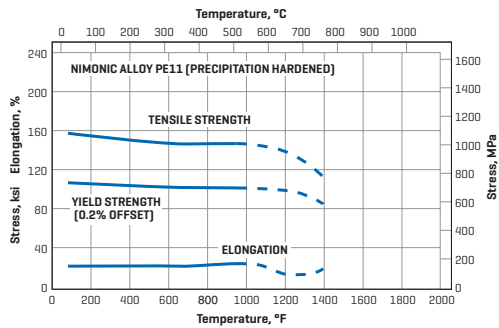
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.290
g/cm ³	8.02
Melting Range, °F	2340 – 2460
°C	1280 – 1350
Specific Heat, Btu/lb•°F	0.104
J/kg•°C.....	436
Permeability at 300 Oersted [23.9 kA/m]	1.021

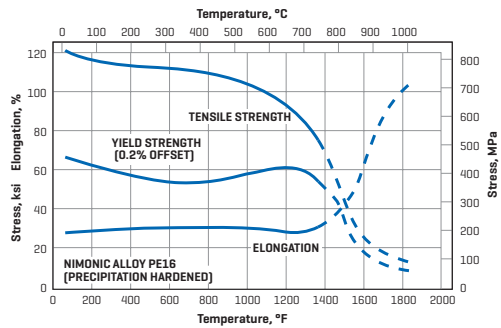
Density, lb/in ³	0.289
g/cm ³	8.00
Melting Range, °F	2390 – 2470
°C	1310 – 1355
Specific Heat, Btu/lb•°F	0.130
J/kg•°C.....	544
Permeability at 200 Oersted [15.9 kA/m]	1.4
Coefficient of Expansion, 68 – 212°F, 10 ⁻⁶ in/in•°F.....	7.7
20 – 100°C, μm/m•°C	13.8
Thermal Conductivity, Btu • in/ft ² •h•°F	81.26
W/m•°C.....	11.72
Electrical Resistivity, ohm•circ mil/ft.....	662
μΩ•m	1.10

TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1200°F / 650°C.....		49	340
1300°F / 705°C.....		36	250
1400°F / 760°C.....		21	140



[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1200°F / 650°C.....		52.6	363
1290°F / 700°C.....		37.0	255
1380°F / 750°C.....		22.5	155



STANDARD
PRODUCT FORMS

Sheet, plate, round bar, flat bar, forging stock, and extruded section.

MAJOR
SPECIFICATIONS

None applicable.

LIMITING CHEMICAL
COMPOSITION, %

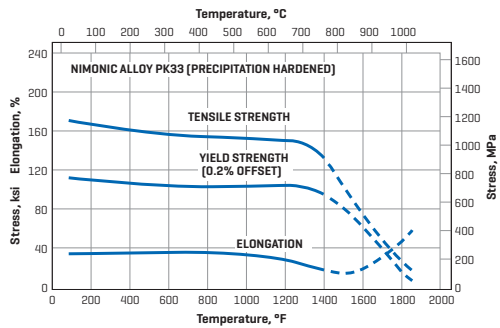
Ni.....	Remainder	Al	1.7 – 2.5	Mn.....	0.5 max.
Cr.....	16.0 – 20.0	C.....	0.07 max.	S.....	0.015 max.
Co.....	12.0 – 16.0	Si.....	0.5 max.	B.....	0.005 max.
Mo.....	5.0 – 9.0	Cu.....	0.2 max.	Zr.....	0.06 max.
Ti	1.5 – 3.0	Fe.....	1.0 max.		

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in ³	0.297
g/cm ³	8.21
Melting Range, °F	2340 – 2450
°C	1300 – 1345
Specific Heat, Btu/lb•°F	0.100
J/kg•°C.....	419
Permeability at 200 Oersted [15.9 kA/m]	1.0005
Coefficient of Expansion, 68 – 212°F, 10 ⁻⁶ in/in•°F.....	6.7
20 – 100°C, μm/m•°C	12.1
Thermal Conductivity, Btu • in/ft ² •h•°F	78.3
W/m•°C.....	11.3
Electrical Resistivity, ohm•circ mil/ft.....	758
μΩ•m	1.26

TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]			
Rupture Strength [1000h]		ksi	MPa
1200°F / 650°C.....		87	600
1300°F / 705°C.....		65	450
1400°F / 760°C.....		44	300
1500°F / 815°C.....		26	180
1600°F / 870°C.....		15	100



[Annealed]	
Tensile Strength, ksi.....	120 – 140
MPa.....	827 – 965
Yield Strength [0.2% Offset], ksi.....	40 – 60
MPa.....	276 – 414
Elongation, %	40 – 60

[Cold Worked]	
Tensile Strength, ksi.....	160 – 260
MPa.....	1103 – 1792
Yield Strength [0.2% Offset], ksi.....	120 – 240
MPa.....	827 – 1655
Elongation, %	10 – 30

[Cold Worked + Aged]	
Tensile Strength, ksi.....	180 – 280
MPa.....	1241 – 1930
Yield Strength [0.2% Offset], ksi.....	170 – 270
MPa.....	1172 – 1861
Elongation, %	10 – 20

NILO ALLOY 36

A nickel-iron low-expansion alloy containing 36% nickel. It maintains nearly constant dimensions over the range of normal atmospheric temperatures, and has a low coefficient of expansion from cryogenic temperatures to about 500°F [260°C]. The alloy also retains good strength and toughness at cryogenic temperatures. Used for standards of length, measuring devices, laser components, bi-metal thermostat strip, thermostat rods and tanks and piping for storing and transporting liquefied gases.

NILO ALLOY 42

A nickel-iron controlled-expansion alloy containing 42% nickel. It has a low and nominally constant coefficient of thermal expansion from room temperature to about 570°F [300°C]. Used for semiconductor lead frames in integrated circuits, bi-metal thermostat strip, thermostat rods, for ceramic-to-metal seals with alumina ceramics and various glass-to-metal seals such as: the core of copper-clad wire for sealing into glass envelopes of electric bulbs, radio valves, television tubes and fluorescent lights.

NILO ALLOY 48

A nickel-iron controlled-expansion alloy containing 48% nickel. Its coefficient of thermal expansion is designed to match that of soft lead and soda-lime glasses. The alloy also has a high inflection point. Used for glass-to-metal seals in radio valves and incandescent electric light bulbs and for industrial thermostats that operate at temperatures up to 840°F [450°C].

NILO ALLOY K

A nickel-iron-cobalt controlled-expansion alloy containing 29% nickel. Its coefficient of expansion, which decreases with rising temperature to the inflection point, matches the expansion rate of borosilicate glasses and alumina ceramics. Used for glass-to-metal seals in applications requiring high reliability or resistance to thermal shock. Examples include: high-power transmitting valves, transistor leads and headers, integrated-circuit lead frames and photography flash bulbs.

STANDARD
PRODUCT FORMS

Pipe, tube, sheet, plate, round bar, forging stock and wire.

Strip, plate and wire.

MAJOR
SPECIFICATIONS

UNS K93600, K93601
DIN 385, 1715
Werkstoff Nr. 1.3912

UNS K94100 Werkstoff Nr. 1.3917
ASTM F 29, F 30
DIN 385, 17745

LIMITING CHEMICAL
COMPOSITION, %

Ni.....35.0 – 38.0	P.....0.025 max.	Mo.....0.50 max.
Fe.....Remainder	S.....0.025 max.	Co.....1.0 max.
C.....0.10 max.	Si.....0.35 max.	
Mn.....0.60 max.	Cr.....0.50 max.	

Limiting
Ni.....42^a P.....0.025 max. Al.....0.15 max.
Fe.....Remainder S.....0.025 max. Co.....1.0 max.
C.....0.05 max. Si.....0.30 max.
Mn.....0.80 max. Cr.....0.25 max.
^aNominal value; adjusted to meet expansion requirements.

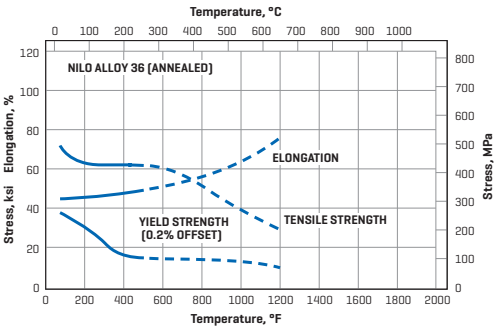
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.293
g/cm³8.11
Melting Temperature [Approximate], °F2610
°C1430
Inflection Point, °F430
°C220
Thermal Conductivity, Btu • in/ft²•h•°F69.3
W/m•°C10.0
Coefficient of Expansion, 68 – 212°F, 10⁻⁶ in/in•°F0.83
20 – 100°C, µm/m •°C1.5
68 – 392°F, 10⁻⁶ in/in•°F1.4
20 – 200°C, µm/m •°C2.6
Electrical Resistivity, ohm • circ mil/ft480
µΩ • m0.800

Density, lb/in³0.293
g/cm³8.11
Melting Temperature [Approximate], °F2615
°C1435
Inflection Point, °F700
°C370
Thermal Conductivity, Btu • in/ft²•h•°F72.8
W/m•°C10.5
Coefficient of Expansion, 68 – 212°F, 10⁻⁶ in/in•°F2.9
20 – 100°C, µm/m •°C5.3
68 – 572°F, 10⁻⁶ in/in•°F2.5 – 3.6
20 – 300°C, µm/m •°C4.5 – 6.5
Electrical Resistivity, ohm • circ mil/ft370
µΩ • m0.610

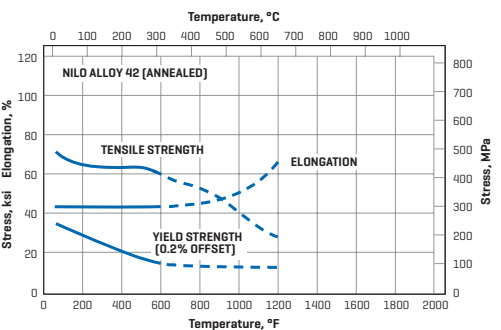
TYPICAL MECHANICAL
PROPERTIES

[Annealed]
Tensile Strength, ksi71
MPa490
Yield Strength [0.2% Offset], ksi35
MPa240
Elongation, %42



— Typical usage range

[Annealed]
Tensile Strength, ksi71
MPa490
Yield Strength [0.2% Offset], ksi36
MPa250
Elongation, %43



— Typical usage range

STANDARD
PRODUCT FORMS

Wire.

MAJOR
SPECIFICATIONS

UNS K94800 Werkstoff Nr. 1.3922,
ASTM F 30 1.3926, 1.3927
DIN 17745

LIMITING CHEMICAL
COMPOSITION, %

Ni.....48 ^a	P.....0.025 max.	Al.....0.10 max.
Fe.....Remainder	S.....0.025 max.	Co.....1.0 max.
C.....0.05 max.	Si.....0.30 max.	
Mn.....0.80 max.	Cr.....0.25 max.	

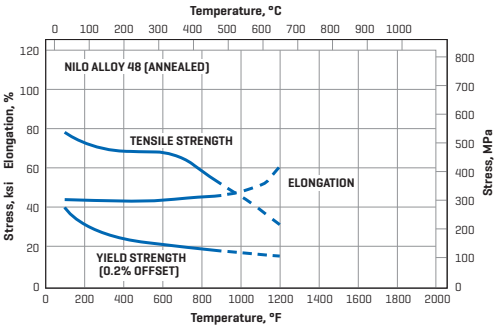
^aNominal value; adjusted to meet expansion requirements.

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³0.296
g/cm³8.20
Melting Temperature [Approximate], °F2640
°C1450
Inflection Point, °F860
°C460
Thermal Conductivity, Btu • in/ft²•h•°F116
W/m•°C16.7
Coefficient of Expansion, 68 – 212°F, 10⁻⁶ in/in•°F4.7
20 – 100°C, µm/m •°C8.5
68 – 752°F, 10⁻⁶ in/in•°F4.6 – 5.2
20 – 400°C, µm/m •°C8.3 – 9.3
Electrical Resistivity, ohm • circ mil/ft280
µΩ • m0.470

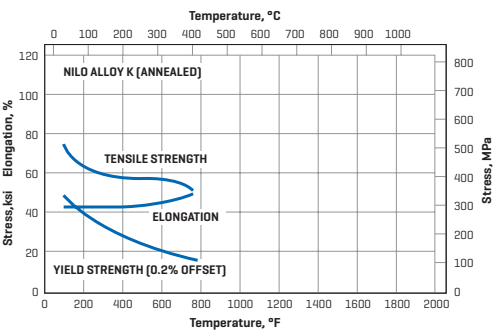
TYPICAL MECHANICAL
PROPERTIES

[Annealed]
Tensile Strength, ksi75
MPa520
Yield Strength [0.2% Offset], ksi38
MPa260
Elongation, %43



— Typical usage range

[Annealed]
Tensile Strength, ksi75
MPa520
Yield Strength [0.2% Offset], ksi49
MPa340
Elongation, %42



— Typical usage range

FERRY ALLOY

A copper-nickel alloy used mainly for its electrical properties. It has medium-range electrical resistivity and a very low temperature coefficient of resistance [TCR]. The low TCR makes the alloy useful for wire-wound precision resistors having operating temperatures up to 750°F [400°C]. A reproducible electromotive force against copper makes the alloy suitable for thermocouples and thermocouple compensating leads.

NI-SPAN-C ALLOY 902

A nickel-iron-chromium alloy made precipitation hardenable by additions of aluminum and titanium. The titanium content also helps provide a controllable thermoelastic coefficient, which is the alloy's outstanding characteristic. The alloy can be processed to have a constant modulus of elasticity at temperatures from -50 to 150°F [-45 to 65°C]. Used for precision springs, mechanical resonators and other precision elastic components.

WASPALLOY

Waspaloy is a nickel-base, age-hardenable superalloy with excellent high-temperature strength and good resistance to corrosion—notably to oxidation. It is used for aerospace and gas turbine engine components at service temperatures up to 1200°F (650°C) for critical rotating applications, and up to 1600°F (870°C) for other, less demanding applications. Applications include compressor and rotor discs, shafts, spacers, seals, rings and casings, fasteners and other miscellaneous engine hardware, airframe assemblies and missile systems.

UDIMET ALLOY 188

A cobalt-base alloy with excellent high temperature strength and good oxidation resistance to 2000°F [1093°C]. The high chromium level coupled with small additions of lanthanum produce an extremely tenacious and protective scale. The alloy also has good sulfidation resistance and excellent metallurgical stability displayed by its ductility after prolonged exposure to elevated temperatures. Fabricability and weldability combine to make the alloy useful in typical gas turbine applications such as combustors, flame holders, liners and transition ducts.

STANDARD PRODUCT FORMS	Strip and wire.		Round bar.	
MAJOR SPECIFICATIONS	ASTM B 267 DIN 17644	Werkstoff Nr. 2.0842		UNS N09902 SAE AMS 5221, 5223, 5225
LIMITING CHEMICAL COMPOSITION, %	Limiting Ni.....Remainder Cu.....55.0* *Nominal		Fe.....1.0 max. C.....0.1 max.	Mn.....1.0 max. Si.....0.5 max.
PHYSICAL CONSTANTS AND THERMAL PROPERTIES	Density, lb/in³.....0.321 g/cm³.....8.89 Melting Range, °F.....2230 - 2320 °C.....1220 - 1270 Specific Heat, Btu/lb•°F.....0.094 J/kg•°C.....394 Temp. Coefficient of Resistance 68 - 212°F, 10 ⁻⁶ ohm/ohm • °F.....17 20 - 100°C, μΩ/Ω•°C.....30 Coefficient of Expansion, 68 - 212°F, 10 ⁻⁶ in/in •°F.....8.17 20 - 100°C, μm/m •°C.....14.7 Thermal Conductivity, Btu • in/ft²•h•°F.....155 W/m•°C.....22.4 Electrical Resistivity, ohm • circ mil/ft.....295 μΩ•m.....0.490		Density, lb/in³.....0.291 g/cm³.....8.05 Melting Range, °F.....2650 - 2700 °C.....1450 - 1480 Specific Heat, Btu/lb•°F.....0.12 J/kg•°C.....500 Curie Temperature, °F.....380 °C.....190 Young's Modulus, 10 ⁶ psi.....24 - 29 GPa.....165 - 200 Modulus of Rigidity, 10 ⁶ psi.....9 - 10 GPa.....62 - 69 Coefficient of Expansion, 70 - 200°F, 10 ⁻⁶ in/in •°F.....4.2 20 - 93°C, μm/m •°C.....7.6 Thermal Conductivity, Btu • in/ft²•h•°F.....84 W/m•°C.....12.1 Electrical Resistivity, ohm • circ mil/ft.....611 μΩ•m.....1.02	
TYPICAL MECHANICAL PROPERTIES	[Annealed] Tensile Strength, ksi.....60 MPa.....415 Yield Strength [0.5% Offset], ksi.....21 MPa.....145 Elongation, %.....32		[Precipitation Hardened] Tensile Strength, ksi.....175 MPa.....1210 Yield Strength [0.5% Offset], ksi.....110 MPa.....760 Elongation, %.....25	

STANDARD PRODUCT FORMS

Round bar, forging stock, extruded section and wire.

MAJOR SPECIFICATIONS

UNS N07001
ASTM B 637
Werkstoff Nr. 2.4654
ISO 9723 – 9725

SAE AMS 5544, 5704, 5706 – 5709, 5828, MAM 5706
AECMA Pr EN 2193 – 2195, 2406, 2958 – 2960, 3220

LIMITING CHEMICAL COMPOSITION, %

Limiting
NiRemainder
Cr.....18.0 – 21.0
Co.....12.0 – 15.0
Mo.....3.50 – 5.00
Ti2.75 – 3.25

Al1.20 – 1.60
Zr.....0.02 – 0.12
B.....0.003 – 0.01
C.....0.02 – 0.10
Fe.....2.00 max.

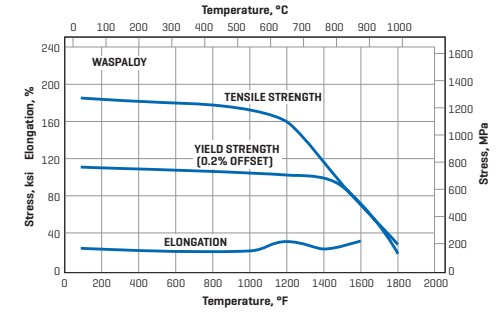
Cu.....0.50 max.
S.....0.030 max.
Si.....0.75 max.
Mn.....1.00 max.
P.....0.030 max.

PHYSICAL CONSTANTS AND THERMAL PROPERTIES

Density, lb/in³ [g/cm³]0.296 [8.19]
Melting Range, °F [°C] 2425 – 2475 [1330 – 1360]
Permeability at 200 Oersted [15.9 kA/m]1.004
Coefficient of Expansion, 10⁻⁶ in/in•°F [μm/m•°C]
70-200°F [21-93°C]6.8 [12.2]
70-1000°F [21-538°C] 7.7 [13.9]
70-2000°F [21-1093°C] 10.4 [18.7]
Electrical Resistivity^A, ohm • circ mil/ft [μΩ • m]722 [1.20]
Young's Modulus^A, 10⁶ psi [GPa] 80.6 [211]
Hardness^A, HRC34 – 40
^ARoom temperature, as aged.

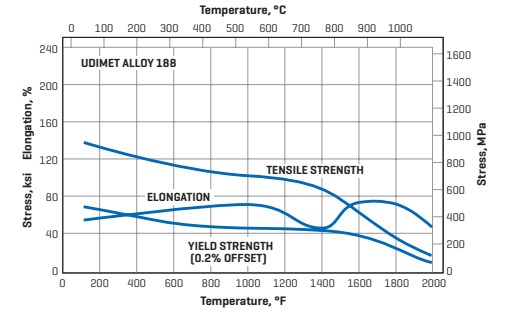
TYPICAL MECHANICAL PROPERTIES

[Precipitation Hardened]			
Rupture Strength (1000h)		ksi	MPa
1200°F / 649°C		89	615
1300°F / 704°C		65	450
1400°F / 760°C		42	290
1500°F / 816°C		26	180
1600°F / 870°C		16	110



— Typical usage range

Rupture Strength (1000h)		ksi	MPa
1300°F / 704°C		35	240
1400°F / 760°C		24	165
1500°F / 816°C		16	110
1600°F / 871°C		10	69
1700°F / 927°C		6	41
1800°F / 982°C		3	25
1900°F / 1038°C		2	15
2000°F / 1093°C		1	9



— Typical usage range

UDIMET ALLOY L-605

A cobalt-base superalloy with good formability, high strength to 1500°F [816°C] and oxidation resistance to 2000°F [1093°C]. The alloy also has good sulfidation resistance and resistance to wear and galling. The alloy is used in the hot sections of aircrafts and in land-based gas turbines in their combustor liners as well as other applications requiring moderate strength and oxidation resistance at high temperatures. The alloy can also be used in industrial furnace applications such as muffles/liners in high temperature kilns.

UDIMET ALLOY 520

A precipitation hardenable nickel-base super-alloy with an exceptional combination of high temperature mechanical properties, corrosion resistance and forgeability characteristics. Developed for use in the 1400–1700°F (760–927°C) temperature range, the alloy has excellent structural stability and unusually good fabricability. Primary application is blading for aircraft and land-based gas turbines.

UDIMET ALLOY 720

A nickel-base alloy solid solution strengthened with tungsten and molybdenum and precipitation hardened with titanium and aluminum. The alloy combines high strength with metallurgical stability, as demonstrated by excellent impact strength retention after long exposures at elevated temperatures. Good oxidation and corrosion resistance combined with high strength make the alloy useful in gas turbine blades and disc applications.

UDIMET ALLOY D-979

An iron-nickel alloy designed for turbine disc applications at temperatures up to 1200–1400°F (649–760°C). Hardened by a complex precipitation of intermetallic phases, the alloy combines corrosion resistance with excellent tensile and stress rupture strength.

STANDARD
PRODUCT FORMS

Forging billet, bar, sheet, plate and wire.

Forging bar.

MAJOR
SPECIFICATIONS

UNS R30605 AMS 5759
AMS 5537, 5796, 5797

PDS 15125A1

LIMITING CHEMICAL
COMPOSITION, %

Limiting
Ni 9.0 – 11.0 Mn.....1.0 – 2.0 S.....0.03 max.
Cr..... 19.0 – 21.0 Si.....0.40 max. Co..... Balance
W..... 14.0 – 16.0 C..... 0.05 – 0.15
Fe..... 3.0 max.

Limiting
C..... 0.02 – 0.06 Mo..... 5.5 – 7.0 W..... 0.8 – 1.2
Cr..... 18.0 – 20.0 Ti 2.9 – 3.25 B... 0.004 – 0.010
Co..... 11.0 – 14.0 Al 1.8 – 2.3 Ni..... Balance

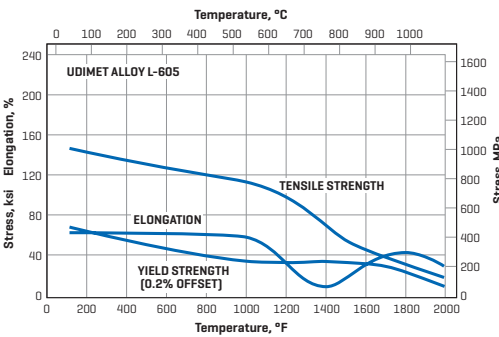
PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³ 0.335
g/cm³ 9.27
Melting Range, °F 2425 – 2570
°C 1330 – 1410
Specific Heat, Btu/lb•°F 0.092
J/kg•°C 385
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in•°F..... 6.83
21 – 93°C, µm/m•°C 12.3
Thermal Conductivity, Btu • in/ft²•h•°F 65
W/m•°C 9.4

Density, lb/in³ 0.297
g/cm³ 8.21
Melting Range, °F 2300 – 2560
°C 1260 – 1405

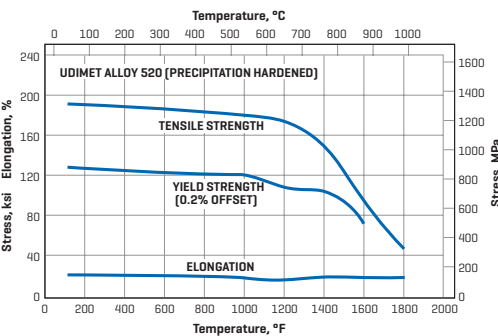
TYPICAL MECHANICAL
PROPERTIES

Rupture Strength [1000h]	ksi	MPa
1200°F / 649°C.....	39	270
1300°F / 704°C.....	32	220
1400°F / 760°C.....	24	165
1500°F / 816°C.....	17	120
1600°F / 871°C.....	10	72
1700°F / 927°C.....	6	44
1800°F / 982°C.....	4	25



— Typical usage range

[Precipitation Hardened]		
Rupture Strength (1000h)	ksi	MPa
1200°F / 649°C.....	85	585
1300°F / 704°C.....	69	475
1400°F / 760°C.....	50	345
1500°F / 816°C.....	33	230
1600°F / 871°C.....	22	150



— Typical usage range

STANDARD
PRODUCT FORMS

Forging billet and bar.

MAJOR
SPECIFICATIONS

EMS 55477 MSRR 7252 MTS 5013
EMS 73105 C50TF105

LIMITING CHEMICAL
COMPOSITION, %

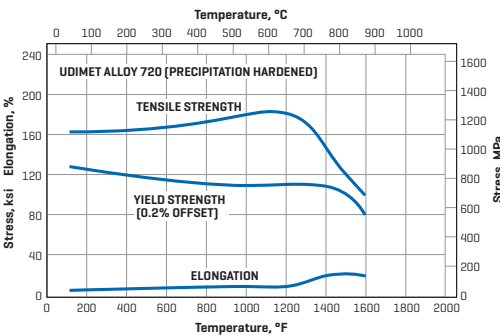
Limiting
Ni..... Balance W..... 1.00 – 1.50 C..... 0.01 – 0.02
Cr..... 15.5 – 16.5 Ti 4.75 – 5.25 Zr... 0.025 – 0.05
Co..... 14.0 – 15.5 Al 2.25 – 2.75 B..... 0.01 – 0.02
Mo.... 2.75 – 3.25

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³ 0.292
g/cm³ 8.08
Melting Range, °F 2180 – 2440
°C 1194 – 1338
Coefficient of Expansion, 70 – 200°F, 10⁻⁶ in/in•°F..... 6.8
21 – 93°C, µm/m•°C 12.24

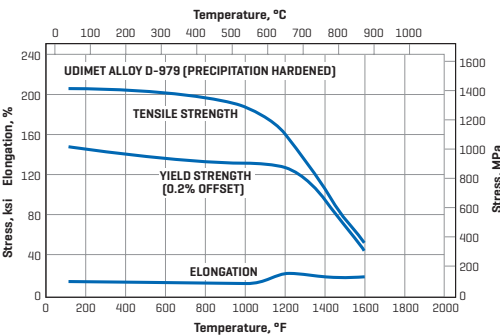
TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]		ksi	MPa
Rupture Strength [1000h]			
1200°F / 649°C	102	700	
1300°F / 704°C	73	500	
1400°F / 760°C	70	480	
1600°F / 871°C	32	219	
1800°F / 982°C	10	68	



— Typical usage range

[Precipitation Hardened]		ksi	MPa
Rupture Strength [1000h]			
1200°F / 649°C	75	515	
1300°F / 704°C	55	380	
1400°F / 760°C	36	250	
1500°F / 816°C	21	145	
1600°F / 871°C	10	69	



— Typical usage range

UDIMET ALLOY R41

A precipitation hardenable nickel-chromium alloy containing significant amounts of cobalt and molybdenum, along with lesser amounts of aluminum and titanium. It exhibits extremely high room and elevated temperature mechanical properties. Excellent corrosion resistance and fabricability have led to wide usage in critical aircraft engine components such as nozzle partitions, turbine blades and wheels, combustion chamber liners and structural hardware.

INCOTHERM ALLOY TD

A nickel-chromium alloy that was originally developed for thermocouple sheathing where high temperature corrosion resistance and strength are required without the use of elements that may cause thermocouple degradation over time, the alloy has now been identified for uses in other high temperature and heat-treating applications. This product has been tailored to provide improved oxidation resistance over stainless steels and higher nickel alloys at temperatures up to 2282°F [1250°C] and possibly beyond. The alloying additions improve oxide scale adherence and reduce the rate of mass change, allowing the alloy to show significant improvements over alloys currently being used in heat treating applications. INCOTHERM alloy TD has excellent resistance to nitridation up to 2151°F [1177°C]. Lacking the alloying elements that form internal nitrides such as Nb or Al, the product exhibits freedom from microstructural degradation in nitrogen-based atmospheres. Because of this excellent resistance to nitridation, the alloy is being evaluated for use in powder metallurgy sintering furnace belts and other thermal processing applications as well as thermocouple sheathing.

STANDARD
PRODUCT FORMS

Forging billet, bar, sheet and plate.

MAJOR
SPECIFICATIONS

UNS N 07041	AMS 5712
AMS 5545	AMS 5713

LIMITING CHEMICAL
COMPOSITION, %

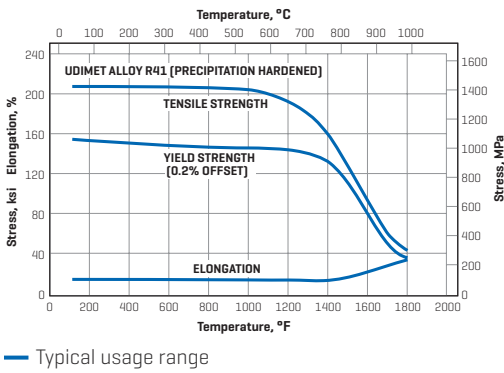
Limiting			
Ni	Balance	Mo.....	9.0 – 10.5
Cr.....	18.0 – 20.0	Al.....	1.40 – 1.80
Co.....	10.0 – 12.0	Ti	3.0 – 3.3
		C.....	0.12 max.
		Fe.....	5.0 max.
		B...	0.003 – 0.010

PHYSICAL CONSTANTS
AND THERMAL
PROPERTIES

Density, lb/in³	0.298
g/cm³	8.25
Melting Range, °F	2250 - 2535
°C	1232 - 1391
Specific Heat, Btu/lb•°F	0.104
J/kg•°C	435
Coefficient of Expansion, 70 – 200°F, 10 ⁻⁶ in/in•°F.....	6.63
21 – 93°C, µm/m •°C.....	11.9
Thermal Conductivity, Btu • in/ft²•h•°F	62
W/m•°C.....	9.0

TYPICAL MECHANICAL
PROPERTIES

[Precipitation Hardened]			
Rupture Strength (1000h)		ksi	MPa
1200°F / 649°C.....		102	705
1300°F / 704°C.....		80	550
1400°F / 760°C.....		50	345
1500°F / 816°C.....		29	200
1600°F / 871°C.....		17	117
1700°F / 927°C.....		11	76



Contact Daxun alloy

Nominal			
Cr	22	Fe.....	1.0 max.
Ni.....	Balance	Mn.....	0.10 max.
Mo.....	3	Al.....	0.10 max.
Si	1.4		
		C.....	0.05 max.
		Rare earth	
		elements.....	0.05

Density, lb/in³ [g/cm³]	0.308 [8.54]
Melting Range, °F [°C].....	2516 - 2552 [1380 - 1400]
Coefficient of Expansion, 10 ⁻⁶ in/in•°F [µm/m•°C]	
70-932°F [21-500°C].....	8.09 [14.56]
70-1112°F [21-600°C].....	8.32 [14.98]
70-1292°F [21-700°C].....	8.66 [15.59]
70-1472°F [21-800°C].....	8.97 [16.15]
70-1652°F [21-900°C].....	9.34 [16.81]
70-1832°F [21-1000°C].....	9.61 [17.30]
Electrical Resistivity, ohm•circ mil/ft [µΩ•m]	698 [1.16]

Mechanical Properties INCOTHERM alloy TD

Temp. [°C]	0.2% YS [MPa]	UTS [MPa]	Elon [%]
22	405	799	51
800	177	279	82
900	75	131	80
1000	39	88	83
1100	20	59	156
1200	10	37	79
1250	8	29	95

SELECTED CONVERSION FACTORS FOR U.S. CUSTOMARY
TO SI METRIC UNITS

To convert from	to	multiply by
atmosphere [760 mm Hg]	pascal [Pa]	1.013 25 x 10 ⁵
Btu [International Table]	joule [J]	1.055 056 x 10 ³
Btu/h	watt [W]	2.930 711 x 10 ⁻¹
Btu/lb•°F	J/kg•°C	4.186 8 x 10 ³
Btu•in/ft²•h•°F	W/m•°C	1.442 279 x 10 ⁻¹
calorie	joule [J]	4.186 8
circular mil	square metre [m²]	5.067 075 x 10 ⁻¹⁰
foot	metre [m]	3.048 000 x 10 ⁻¹
ft²	square metre [m²]	9.290 304 x 10 ⁻²
ft³	cubic metre [m³]	2.831 685 x 10 ⁻²
ft•lbf	joule [J]	1.355 818
ft•lbf/min	watt [W]	2.259 697 x 20 ⁻²
ft/s²	m/s²	3.048 000 x 10 ⁻¹
gallon [U.S. liquid]	cubic metre [m³]	3.785 412 x 10 ⁻³
horsepower [electric]	watt [W]	7.460 000 x 10 ²
inch	metre [m]	2.540 000 x 10 ⁻²
in²	square metre [m²]	6.451 600 x 10 ⁻⁴
in³	cubic metre [m³]	1.638 706 x 10 ⁻⁵
inch of mercury [60°F]	pascal [Pa]	3.375 85 x 10 ³
inch of water [60°F]	pascal [Pa]	2.488 4 x 10 ²
kgf/cm²	pascal [Pa]	9.806 650 x10 ⁴
kip [1000 lbf]	newton [N]	4.448 222 x 10 ³
kip/in² [ksi]	pascal [Pa]	6.894 757 x 10 ⁸
oersted	A/m	7.957 75 x 10
ohm•circ mil/ft	Ω•m	1.662 426 x 10 ⁻⁹
ounce [U.S. fluid]	cubic metre [m³]	2.957 353 x 10 ⁻⁵
ounce-force	newton [N]	2.780 139 x 10 ⁻¹
ounce [avoirdupois]	kilogram [kg]	2.834 952 x 10 ⁻²
pint [U.S. liquid]	cubic metre [m³]	4.731 765 x 10 ⁻⁴
pound-force [lbf]	newton [N]	4.448 222
pound [lb avoirdupois]	kilogram [kg]	4.535 924 x 10 ⁻¹
lbf/in² [psi]	pascal [Pa]	6.894 757 x 10 ³
lb/in³	kg/m³	2.767 990 x 10 ⁴
lb/ft³	kg/m³	1.601 846 x 10
quart [U.S. liquid]	cubic metre [m³]	9.463 529 x 10 ⁻⁴
ton [short, 2000 lb]	kilogram [kg]	9.071 847 x 10 ²
torr [mm Hg, 0°C]	pascal [Pa]	1.333 22 x 10 ²
W•h	joule [J]	3.600 000 x 10 ³
yard	metre [m]	9.144 000 x 10 ⁻¹
yd²	square metre [m²]	8.361 274 x 10 ⁻¹
yd³	cubic metre [m³]	7.645 549 x 10 ⁻¹

GRAIN-SIZE
EQUIVALENTS

ASTM Number	Average Grain Diameter	
	in.	mm
00	0.020	0.508
0	0.0141	0.359
1	0.010	0.254
2	0.007	0.180
3	0.005	0.127
4	0.0035	0.089
5	0.0025	0.064
6	0.0018	0.045
7	0.0012	0.032
8	0.0009	0.022
9	0.0006	0.016
10	0.0004	0.011

MILLIMETRE—INCH
EQUIVALENTS

mm	in	mm	in
1 =	0.039	14 =	0.551
2 =	0.079	15 =	0.590
3 =	0.118	16 =	0.630
4 =	0.157	17 =	0.669
5 =	0.197	18 =	0.709
6 =	0.236	19 =	0.748
7 =	0.276	20 =	0.787
8 =	0.315	11 =	0.827
9 =	0.354	22 =	0.866
10 =	0.394	23 =	0.906
11 =	0.433	24 =	0.945
12 =	0.472	25 =	0.984
13 =	0.512	26 =	1.024

DECIMAL AND METRIC EQUIVALENTS OF FRACTIONS OF AN INCH

in	in	mm	in	in	mm
1/32 =	0.03125	= 0.794	17/32 =	0.53125	= 13.494
1/16 =	0.0625	= 1.588	9/16 =	0.5625	= 14.287
3/32 =	0.09375	= 2.381	19/32 =	0.59375	= 15.081
1/8 =	0.125	= 3.175	5/8 =	0.625	= 15.875
5/32 =	0.15625	= 3.969	21/32 =	0.65625	= 16.669
3/16 =	0.1875	= 4.762	11/16 =	0.6875	= 17.462
7/32 =	0.21875	= 5.556	23/32 =	0.71875	= 18.256
1/4 =	0.25	= 6.350	3/4 =	0.75	= 19.050
9/32 =	0.28125	= 7.144	25/32 =	0.78125	= 19.844
5/16 =	0.3125	= 7.937	13/16 =	0.8125	= 20.637
11/32 =	0.34375	= 8.731	27/32 =	0.84375	= 21.431
3/8 =	0.375	= 9.525	7/8 =	0.875	= 22.225
13/32 =	0.40625	= 10.319	29/32 =	0.90625	= 23.018
7/16 =	0.4375	= 11.112	15/16 =	0.9375	= 23.812
15/32 =	0.46875	= 11.906	31/32 =	0.96875	= 24.606
1/2 =	0.5	= 12.700	1 =	1.0	= 25.4

MULTIPLE AND SUBMULTIPLE UNITS

Unit Prefix	Symbol	Magnitude
micro	µ	0.000 001 [10 ⁻⁶]
milli	m	0.001 [10 ⁻³]
centi	c	0.01 [10 ⁻²]
deci	d	0.1 [10 ⁻¹]
deka	da	10 [10 ¹]
hecto	h	100 [10 ²]
kilo	k	1000 [10 ³]
mega	M	1 000 000 [10 ⁶]
giga	G	1 000 000 000 [10 ⁹]
tera	T	1 000 000 000 000 [10 ¹²]

Daxun alloy Welding Products Company manufactures companion welding products for the full range of its wrought alloys. The covered electrodes and bare filler wires are designed to match the high level of performance delivered by the alloys and to ensure single-source reliability in welded fabrications. The line of welding products also includes high-quality consumables for welding cast irons and for joining dissimilar metals.

COATED ELECTRODES	MAJOR USES	AWS CLASS	MIL-E-22200 TYPE
Nickel Welding Electrode 141	Nickel 200 and Nickel 201; the clad side of nickel-clad steel; joining steels to nickel alloys.	ENi-1	4N11
MONEL Welding Electrode 190	MONEL alloy 400 to itself, to low-alloy and carbon steels, to copper and copper-nickel alloys; surfacing of steels.	ENiCu-7	9N10
MONEL Welding Electrode 187	MONEL alloy 450, weldable grades of cast and wrought 70/30, 80/20, and 90/10 copper-nickel alloys.	ECuNi	CuNi
INCONEL Welding Electrode 182	INCONEL alloys 600 and 601; surfacing of steel; dissimilar combinations of steels and nickel alloys.	ENiCrFe-3	8N12
INCONEL Welding Electrode 112	INCONEL alloys 625 and 601; pit-resistant alloys; dissimilar combinations of steels and nickel alloys; surfacing of steels.	ENiCrMo-3	1N12
INCONEL Welding Electrode 117	INCONEL alloy 617; INCOLOY alloy 800HT; dissimilar combinations of high-temperature alloys.	ENiCrCoMo-1	—
INCO-WELD Welding Electrode C-276	INCONEL alloy C-276; other pit-resistant alloys; surfacing of steels.	ENiCrMo-4	—
INCO-WELD A Electrode	INCOLOY alloys 800 and 800HT; dissimilar combinations of steels and nickel alloys; 9% nickel steel; surfacing of steels.	ENiCrFe-2	—
NI-ROD Welding Electrode	Cast irons, especially for thin sections and machinability.	ENi-CI	—
NI-ROD 55 Welding Electrode	Cast irons, especially thick sections and high-phosphorus irons.	ENiFe-CI	—
NI-ROD 55X Welding Electrode	Cast irons, especially for out-of-position welding and high-phosphorus irons.	—	—
NI-ROD 99X Welding Electrode	Cast irons, especially for out-of-position welding, thin sections, and machinability.	—	—
INCONEL Welding Electrode 152	30% Cr for SMAW of INCONEL alloy 690 and other 30% Cr alloys; specifically designed for nuclear applications.	ENiCrFe-7	—
INCONEL Welding Electrode 122	For SMAW of alloys 622, C-22 and other NiCrMo alloys; excellent pitting and crevice corrosion resistance & resistance to mixed acids. Also for low NOx boiler tube overlay.	ENiCrMo-10	—
INCO-WELD 686CPT Welding Electrode	Maximum resistance to pitting, crevice corrosion & mixed acids; excellent for overlay, welding of clad steels and providing overmatching corrosion-resistant welds for all types of NiCrMo alloys and super duplex stainless steels.	ENiCrMo-14	—
FILLER METALS	MAJOR USES	AWS CLASS	MIL-E-21562 TYPE
Nickel Filler Metal 61	Nickel 200 and Nickel 201; dissimilar combinations of nickel alloys and steels; surfacing of steels.	ERNi-1	RN61 EN61
MONEL Filler Metal 60	MONEL alloys 400, R-405, and K-500; surfacing of steel.	ERNiCu-7	RN60 EN61
MONEL Filler Metal 67	MONEL alloy 450; weldable grades of 70/30, 80/20 and 90/10 copper-nickel alloys.	ERCuNi	RN67 EN67
INCONEL Filler Metal 82	INCONEL alloys 600 and 601; INCOLOY alloys 800 and 800HT; INCO alloy 330; dissimilar combinations of steels and nickel alloys; surfacing of steels.	ERNiCr-3	RN82 EN82
INCONEL Filler Metal 92	Dissimilar combinations of steels and nickel alloys.	ERNiCrFe-6	RN6A EN6A
INCONEL Filler Metal 601	INCONEL alloy 601.	ERNiCrFe-11	—
INCONEL Filler Metal 617	INCONEL alloy 617; INCOLOY alloy 800HT; dissimilar combinations of high-temperature alloys.	ERNiCrCoMo-1	—
INCONEL Filler Metal 625	INCONEL alloys 625 and 601; pit-resistant alloys; dissimilar combinations of steels and nickel alloys; surfacing of steels.	ERNiCrMo-3	RN625 EN625
INCONEL Filler Metal 718	INCONEL alloys 718 and X-750.	ERNiFeCr-2	—
INCO-WELD Filler Metal C-276	INCONEL alloy C-276; other pit-resistant alloys; surfacing of steels.	ERNiCrMo-4	—
INCO-WELD Filler Metal HX	INCONEL alloy HX.	ERNiCrMo-2	—
NC 80/20 Filler Metal	BRIGHTRAY electrical-resistant alloys; INCOLOY alloy DS.	—	—
NI-ROD Filler Metal 44	Cast irons, especially robotic and automatic welding.	ERNiFeMn-CI	—
INCONEL Filler Metal 52	30% Cr for GMAW & GTAW welding of 690 and for overlays on steel; specifically designed for	ERNiCrFe-7	—

FILLER METALS	MAJOR USES	AWS CLASS	MIL-E-00000 TYPE
INCONEL Filler Metal 622	For GMAW, GTAW, and SAW of alloys 622, C-22 and other NiCroMo alloys; excellent pitting and crevice corrosion-resistance and resistance to mixed acids; also for low NOx boiler tube overlay.	ERNiCrMo-10	—
INCO-WELD 725NDUR Filler Metal	Age hardenable 625 version; capable of heat treated ultimate tensile of 180 KSI and Rc 34 hardness.	ERNiCrMo-15	—
INCONEL Filler Metal 625BC	Designed for hot and cold wire GTAW applications for valve body overlay and internal bore cladding operations.	ERNiCrMo-3	—
NI-ROD Filler Metal 99	For GMAW, GTAW & SAW of all types of cast irons; best machinability in first layer or two layer overlays; not recommended for more than two layers.		
NILO CF36 Filler Metal	For GMAW, GTAW & SAW of INVAR and similar low expansion alloys; deposits crack-free welds that are closely matching in CTE to INVAR.		
NILO CF42 Filler Metal	Similar to NILO CF36, but is intended for 42% nickel low-expansion alloys.		
NI-ROD 44HT Filler Metal	For GMAW & GTAW of high temperature ductile irons to each other and to stainless steels.		
NI-ROD FC44 Cored Wire	For FCAW of all types of cast iron with 75A-25 CO2; especially suited to ductile iron welding for maximum strength and ductility of welds.		
INCO-CORED 82DH Cored Wire	For flat position [1G] FCAW welding of INCONEL 600 and similar alloys and dissimilar combinations.		
INCO-CORED 82AP Cored Wire	For all position FCAW welding of INCONEL 600 and similar alloys; also for dissimilar joints involving stainless steels, CrMo steels and carbon steels.		
INCO-CORED 625DH Cored Wire	For flat position [1G] FCAW welding of 625 and lower alloyed NiCrMo materials such as super austenitics, and 4% and 6% Mo containing stainless steels.		
INCO-CORED 625AP Cored Wire	For all position FCAW welding of 625 and lower alloyed NiCrMo materials such as super austenitics, and 4% and 6% Mo containing stainless steels.		
THERMAL SPRAYS	MAJOR USES		
DURANICKEL Thermal Spray 301TSW	For highest bond strength arc-spray build ups and bond coats; for bonding and protective coatings.		
INCONEL Thermal Spray 625TSW	Corrosion-resistant arc-spray coatings used for pulp and paper and other industry applications.		
INCONEL Thermal Spray 72TSW	Most sulfidation-resistant arc-spray product; used extensively in black liquor recovery boilers.		
INCOFLUX	MAJOR USES		
INCOFLUX 5	For SAW butt welding with MONEL FM 60 and butt welding and overlaying of cast iron with NI-ROD FC 55.		
INCOFLUX 6	For SAW with FM 82, 625, 61, CF36, CF42, NI-ROD FM 99 and 44; for limited thickness butt welds and overlays.		
INCOFLUX NT100	Neutral SAW flux for overlays with FM 82, 625, 61 and NI-ROD FM 44 and 99; also used with FM CF36 and CF42.		
INCOFLUX NT110	Neutral SAW flux for overlaying with MONEL FM 60 and 67.		
INCOFLUX NT120	SAW flux for butt welding and overlaying with FMs C-276, 622, and 686CPT.		
INCOFLUX ESS1	High-deposition rate flux for strip overlays with INCONEL weldstrips 82, 625, and INCO-WELD weldstrip 686CPT with ESS processes.		
INCOFLUX ESS2	For electroslog strip welding overlay (ESSW) with INCONEL 52 and 52M Weldstrips.		
INCOFLUX ESS3	For electroslog strip welding overlay (ESSW) with INCONEL 82, 622 and 625 Weldstrips, and INCO-WELD C-276.		
INCOFLUX ESS4	For electroslog strip welding overlay (ESSW) with INCONEL 625 Weldstrips, and INCO-WELD C-276 and 86CPT.		
INCOFLUX SAS1	High deposition rate flux for strip overlays with INCONEL weldstrips 82 and 625.		
INCOFLUX SAS2	For submerged arc strip welding overlay [SASW] with INCONEL 52 and 52M Weldstrips.		
WELDSTRIP	MAJOR USES		
MONEL Weldstrip 60	Weldstrip for producing MONEL 400 type overlays at high-deposition rates with the electroslog surfacing [ESS] and submerged arc strip [SAS] processes.		
Nickel Weldstrip 61	Weldstrip for producing nickel overlays at high-deposition rates with ESS and SAS processes.		
INCONEL Weldstrip 82	Weldstrip for high-deposition rate overlays of 20% Cr INCONEL alloy using ESS and SAS processes.		
INCONEL Weldstrip 625	Weldstrip for high-deposition rate overlays of INCONEL alloy 625 type using ESS and SAS processes.		



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A CENTURY OF ALLOY INNOVATION

For over two decades, Daxun Alloys has been a leading developer and manufacturer of high-performance nickel alloys for demanding applications. Daxun Alloys can produce over 80% of the nickel alloys currently on the market, offering the industry's broadest selection of nickel, Hastelloy, and cobalt alloys and product types. Daxun offers an unmatched range of alloy components and products.