

INCOLOY® alloy 330 (UNS N08330/W. Nr. 1.4886) is an austenitic alloy with good high-temperature strength and corrosion resistance. It has a solid solution composition and is not hardenable by heat treatment. Its high nickel and chromium provide good resistance to oxidation and carburization. Its oxidation resistance is enhanced by the silicon content.

The alloy's strength and oxidation resistance at elevated temperatures make it a useful material for industrial heating furnaces; for muffles, retorts, conveyor systems, baskets and boxes, and various fixtures.

Physical Properties

Density, lb/in ³	0.292
g/cm ³	8.08
Melting Range, °F	2520-2590
°C	1380-1420
Specific Heat (32-212°F), Btu•lb•°F.....	0.11
(0-100°C), J/kg•°C	460
Poisson's Ratio at 70°F (20°C)	0.340
Permeability at 70°F (20°C) & 200 oersteds (15.9 kA/m)	1.02

Limiting Chemical Composition, %

Nickel	34.0-37.0
Chromium.....	17.0-20.0
Iron	Balance*
Carbon.....	0.08 max.
Silicon.....	0.75-1.50
Manganese.....	2.0 max.
Phosphorus	0.030 max.
Sulfur	0.030 max.

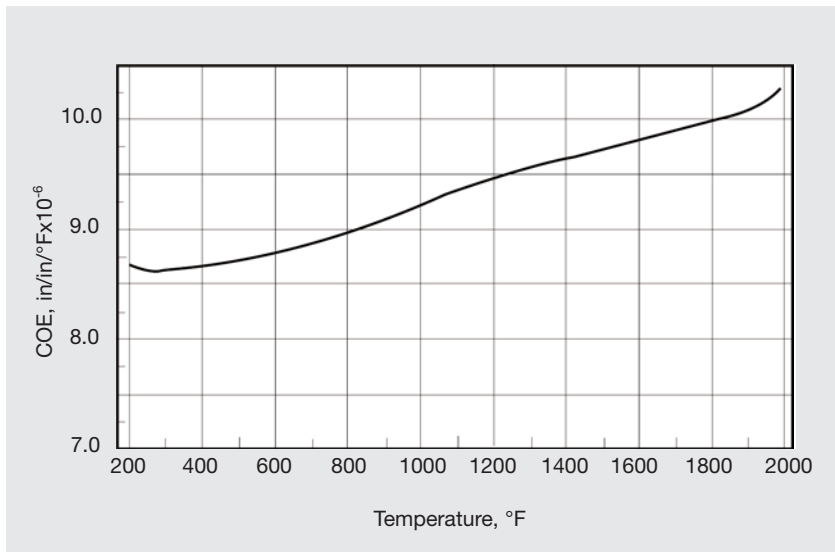
*Reference to the 'balance' of a composition does not guarantee this is exclusively of the element mentioned but that it predominates and others are present only in minimal quantities.

Publication Number SMC-023

Copyright © Special Metals Corporation, 2004 (Sept 04)

INCOLOY and INCONEL are trademarks of the Special Metals Corporation group of companies.

The data contained in this publication is for informational purposes only and may be revised at any time without prior notice. The data is believed to be accurate and reliable, but Special Metals makes no representation or warranty of any kind (express or implied) and assumes no liability with respect to the accuracy or completeness of the information contained herein. Although the data is believed to be representative of the product, the actual characteristics or performance of the product may vary from what is shown in this publication. Nothing contained in this publication should be construed as guaranteeing the product for a particular use or application.



Coefficient of expansion data.



INCOLOY® alloy 330

Thermal and Electrical Properties

Temperature		Thermal Conductivity		Electrical Resistivity	
°F	°C	Btu-in/ft ² -h-°F	W/m-°C	ohm-circ mil/ft	μΩ-m
75	24	86	12.4	612	1.017
400	204	108	15.6	649	1.079
800	427	134	19.3	688	1.144
1200	649	162	23.4	721	1.199
1600	871	198	28.6	744	1.237
1800	982	216	31.2	749	1.245

Modulus of Elasticity

Temperature		Tensile Modulus	
°F	°C	10 ³ ksi	GPa
70	20	28.5	197
1600	870	19.5	134
1800	980	18.0	124

Room Temperature Mechanical Properties

Form and Condition	Tensile Strength		Yield Strength (0.2% Offset)		Elongation
	ksi	MPa	ksi	MPa	%
Plate, hot-rolled & annealed	80-85	552-586	30-43	207-296	40-45
Sheet, cold-rolled & annealed	80-90	552-621	32-42	221-290	35-45
Rod, hot-finished & annealed	80-90	552-621	35-45	241-310	38-45

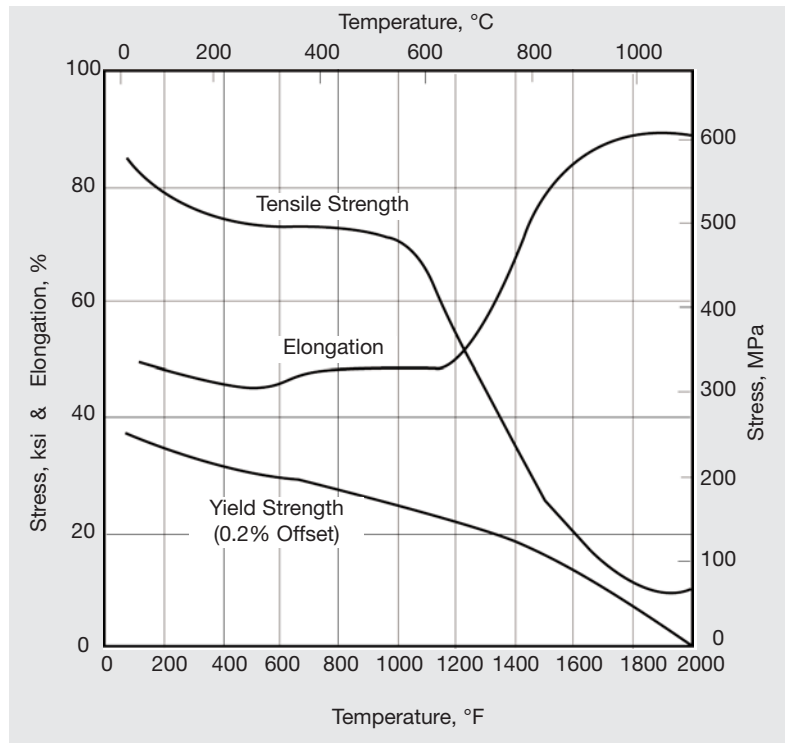
Values are composites for various product sizes and are not suitable for specification purposes.

Impact Strength

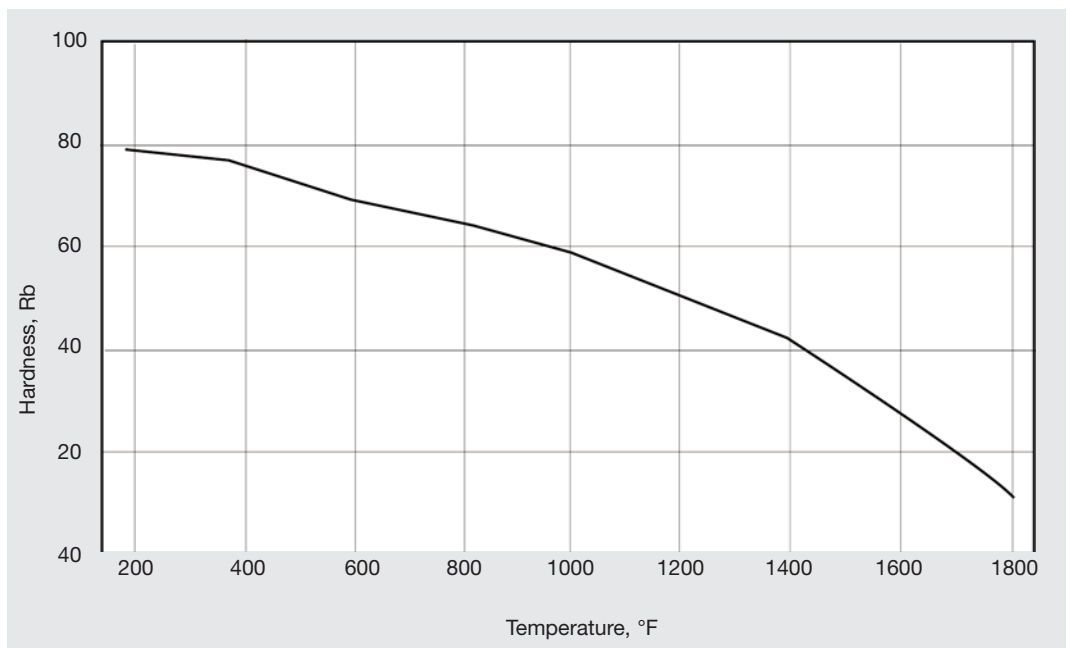
Material Condition	Test Temperature		Charpy V-Notch Impact Strength	
	°F	°C	ft-lbf	J
Annealed	75	25	>240	>325
	1400	760	167	226
Exposed to 1400°F (760°C) for 1000 h	75	25	96	130
	1400	760	130	176

High Temperature Mechanical Properties

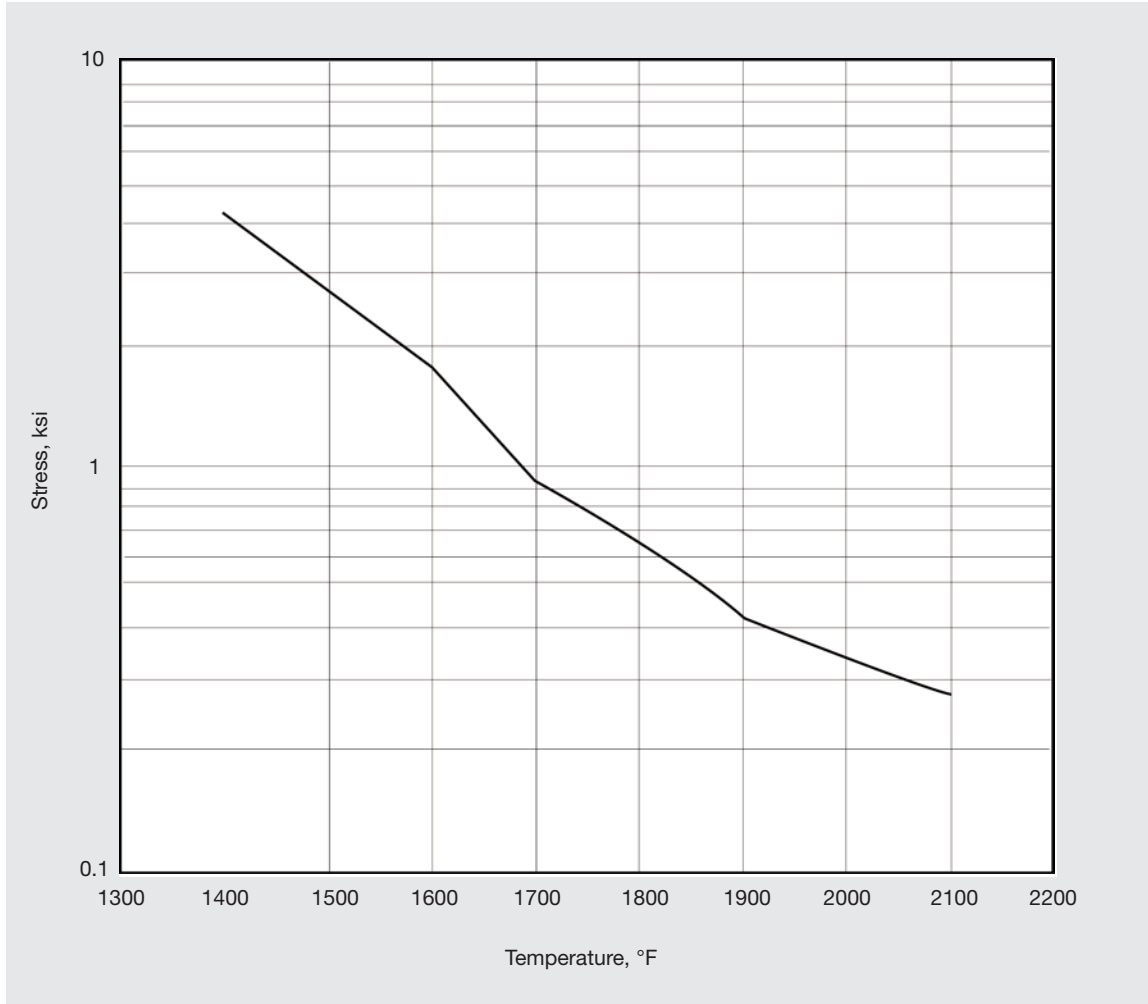
Tensile Properties of Annealed Material



Hardness at Elevated Temperature

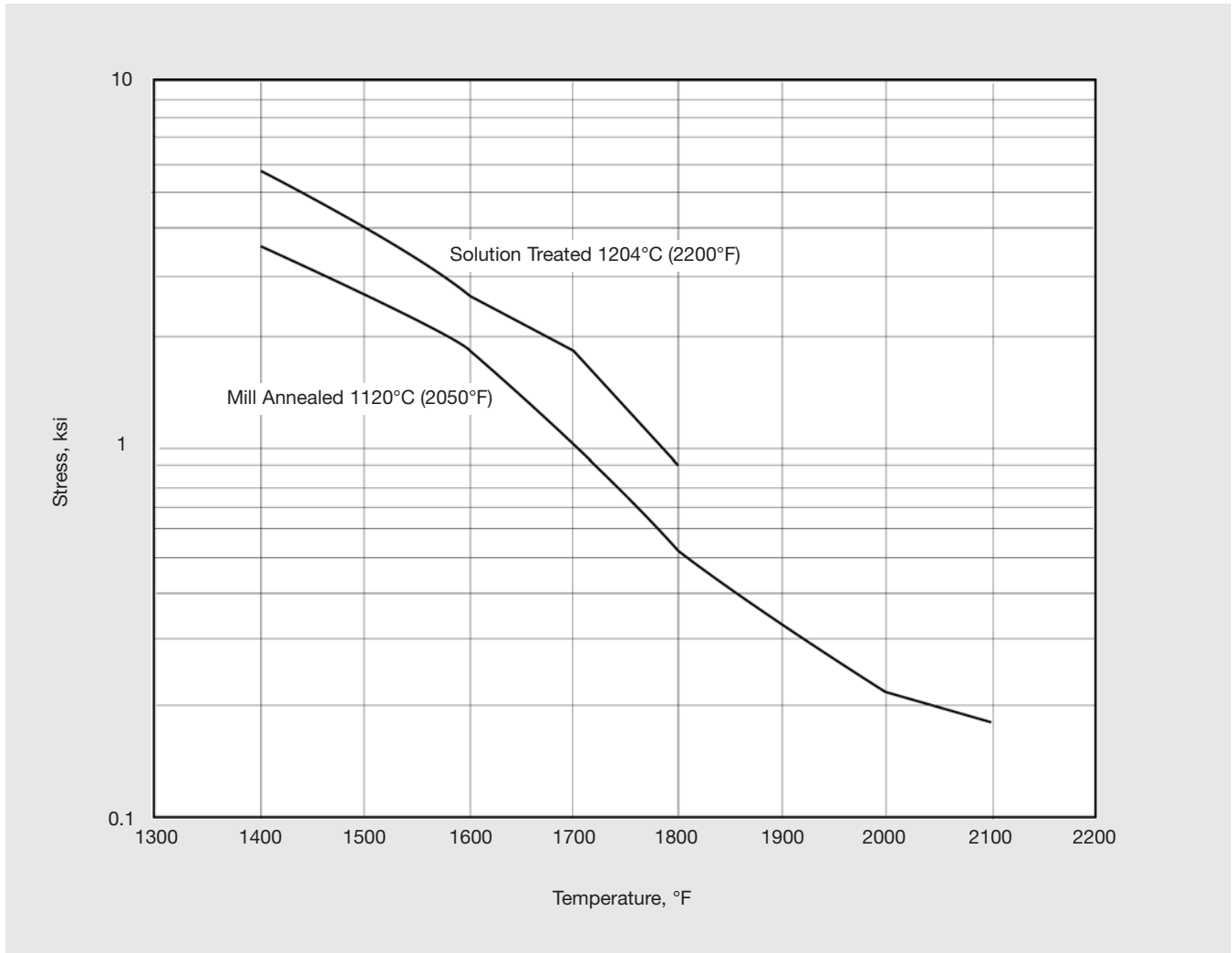


High Temperature Mechanical Properties (continued)



Stress to produce rupture in 10,000 hours (Mill Annealed 1120°C/2050°F)

High Temperature Mechanical Properties (continued)

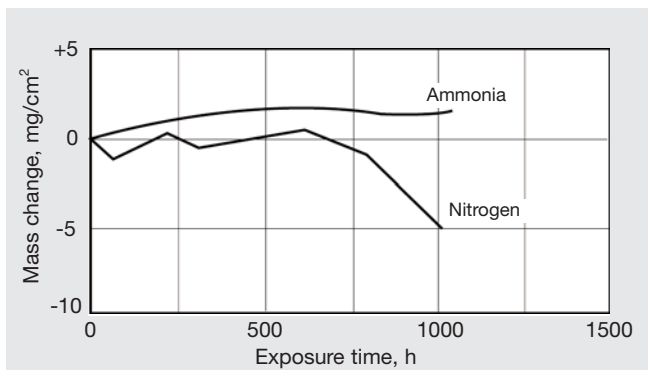


Stress to produce 0.0001%/hr secondary creep rate

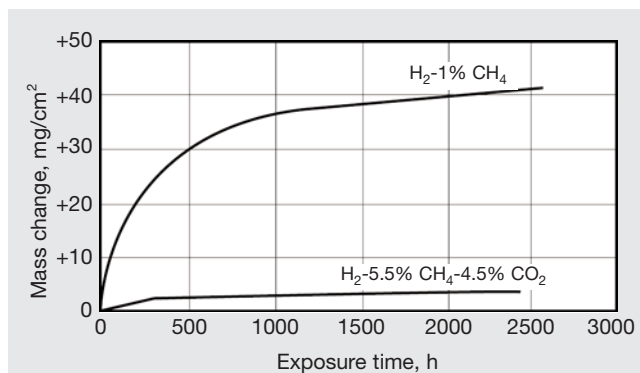
INCOLOY® alloy 330

Corrosion Resistance

INCOLOY® alloy 330 offers a high level of corrosion resistance, particularly to oxidation, carburization and nitridation. In aqueous environments, the alloy's chromium content provides resistance to oxidizing conditions while its nickel content imparts resistance to reducing conditions. The high nickel also gives INCOLOY alloy 330 good resistance to chloride-ion stress-corrosion cracking.



Mass change in ammonia and nitrogen at 2000°F (1093°C).



Mass change H₂-5.5% CH₄-4.5% CO₂ and H₂-1% CH₄ at 1832°F (1000°C).

Resistance to Oxidation (non-adjusted laboratory air)

Temperature		Mass Change (mg/cm ²) in				
°F	°C	200 h	500 h	1000 h	1500 h	2000 h
1600	871	+0.24	-0.10	-0.37	-0.44	-0.89
1800	982	+1.58	+1.51	-0.44	-1.76	-3.32
2000	1093	+0.14	-0.39	-43.48	-	-

Laboratory test results in a range of media

Environment, Temperature & Time	Mass Change (mg/cm ²) in		Metal Loss	Max. Attack
	Underscaled	Descaled	microns	microns
Air-2% SO ₂ -5% H ₂ O 700°C (1292°F), 1000 h	+0.27	-0.15	-	-
Air-2% SO ₂ -5% H ₂ O 850°C (1562°F), 1000 h	-1.23	-3.20	0.00	55.88
Air-2% SO ₂ -5% H ₂ O 1000°C (1832°F), 1000 h	-2.03	-7.35	-	236.2
Air-5% H ₂ O Vapor Isothermal 1000°C (1832°F), 1000 h	+2.49	-7.69	-	-
Air-10% H ₂ O, 2 h cycles 1093°C (2000°F), 102 h	-26.49	-34.28	27.94	78.74
Air-10% H ₂ O, 2 h cycles 982°C (1800°F), 102 h	-0.35	-2.91	-	-
Air-10% H ₂ O, 2 h cycles 816°C (1500°F), 102 h	+0.08	-0.11	0.00	0.00
Air-5% H ₂ O Vapor Isothermal 1177°C (2150°F), 1000 h	-180.5	-	254	371
N ₂ -5% H ₂ Isothermal 1177°C (2150°F), 1000 h	2.81	-	2.54	256

Welding

INCOLOY alloy 330 is weldable by conventional processes. Shielded-metal-arc welding should be done with INCO-WELD A welding electrode; gas-shielded-arc welding with INCONEL filler metal 82. Acceptable welds have been made in relatively heavy sections with these welding products. For additional strength and corrosion resistance up to 2100°F (1150°C), INCONEL filler metal 617 and INCONEL welding electrode 117 may be used.

Fabrication

INCOLOY alloy 330 is readily hot- or cold-formed using standard procedures for stainless steels and nickel alloys. The range for hot forming is 1750 to 2100°F (954 to 1149°C).

Machining

Machining of INCOLOY alloy 330 requires more power than similar operations on mild steel and should be performed by techniques that minimize work hardening.

Available Products and Specifications

INCOLOY alloy 330 is designated as UNS N08330 and W. Nr. 1.4886. Standard product forms include tube, sheet, strip, plate, round bar, forging stock, hexagon, wire and wire rod.

Bars and shapes - ASTM B 511, ASME SB 511

Billets and bars - ASTM B 512, ASME SB 512

Pipe and tube - ASTM B 535/ASME SB 535, ASTM B 546/ASME SB 546, ASTM B 710/ASME SB 710, ASTM B 739/ASME SB 739, ASTM B 829/ASME SB 829

Plate, sheet and strip - ASTM B 536, ASME SB 536, SAE AMS 5592

Bars, wire, forgings and rings - SAE AMS 5716

Other - ASTM B 366/ASME SB 366



www.specialmetals.com



U.S.A. Special Metals Corporation

Billet, rod & bar, flat & tubular products

3200 Riverside Drive
Huntington, WV 25705-1771
Phone +1 (304) 526-5100
+1 (800) 334-4626
Fax +1 (304) 526-5643

Billet & bar products

4317 Middle Settlement Road
New Hartford, NY 13413-5392
Phone +1 (315) 798-2900
+1 (800) 334-8351
Fax +1 (315) 798-2016

Atomized powder products

100 Industry Lane
Princeton, KY 42445
Phone +1 (270) 365-9551
Fax +1 (270) 365-5910

Shape Memory Alloys

4317 Middle Settlement Road
New Hartford, NY 13413-5392
Phone +1 (315) 798-2939
Fax +1 (315) 798-6860

United Kingdom

Special Metals Wiggin Ltd.

Holmer Road
Hereford HR4 9SL
Phone +44 (0) 1432 382200
Fax +44 (0) 1432 264030

Special Metals Wire Products

Holmer Road
Hereford HR4 9SL
Phone +44 (0) 1432 382556
Fax +44 (0) 1432 352984

China

Special Metals Pacific Pte. Ltd.

Room 1802, Plaza 66
1266 West Nanjing Road
Shanghai 200040
Phone +86 21 3229 0011
Fax +86 21 6288 1811

Special Metals Pacific Pte. Ltd.

Room 910, Ke Lun Mansion
12A Guanghua Road
Chaoyang District
Beijing 100020
Phone +86 10 6581 8396
Fax +86 10 6581 8381

France

Special Metals Services SA

17 Rue des Frères Lumière
69680 Chassieu (Lyon)
Phone +33 (0) 4 72 47 46 46
Fax +33 (0) 4 72 47 46 59

Germany

Special Metals Deutschland Ltd.

Postfach 20 04 09
40102 Düsseldorf
Phone +49 (0) 211 38 63 40
Fax +49 (0) 211 37 98 64

Hong Kong

Special Metals Pacific Pte. Ltd.

Unit A, 17th Floor, On Hing Bldg
1 On Hing Terrace
Central, Hong Kong
Phone +852 2439 9336
Fax +852 2530 4511

India

Special Metals Services Ltd.

No. 60, First Main Road, First Block
Vasantha Vallabha Nagar
Subramanyapura Post
Bangalore 560 061
Phone +91 (0) 80 2666 9159
Fax +91 (0) 80 2666 8918

Italy

Special Metals Services SpA

Via Assunta 59
20054 Nova Milanese (MI)
Phone +390 362 4941
Fax +390 362 494224

The Netherlands

Special Metals Service BV

Postbus 8681
3009 AR Rotterdam
Phone +31 (0) 10 451 44 55
Fax +31 (0) 10 450 05 39

Singapore

Special Metals Pacific Pte. Ltd.

24 Raffles Place
#27-04 Clifford Centre
Singapore 048621
Phone +65 6532 3823
Fax +65 6532 3621

Affiliated Companies

Special Metals Welding Products

1401 Burriss Road
Newton, NC 28658, U.S.A.
Phone +1 (828) 465-0352
+1 (800) 624-3411
Fax +1 (828) 464-8993

Canada House
Bidavon Industrial Estate
Waterloo Road
Bidford-On-Avon
Warwickshire B50 4JN, U.K.
Phone +44 (0) 1789 491780
Fax +44 (0) 1789 491781

Controlled Products Group

590 Seaman Street, Stoney Creek
Ontario L8E 4H1, Canada
Phone +1 (905) 643-6555
Fax +1 (905) 643-6614

A-1 Wire Tech, Inc.

A Special Metals Company
4550 Kishwaukee Street
Rockford, IL 61109, U.S.A.
Phone +1 (815) 226-0477
+1 (800) 426-6380
Fax +1 (815) 226-0537

Rescal SA

A Special Metals Company
200 Rue de la Couronne des Prés
78681 Epône Cédex, France
Phone +33 (0) 1 30 90 04 00
Fax +33 (0) 1 30 90 02 11

DAIDO-SPECIAL METALS Ltd.

A Joint Venture Company
Daido Shinagawa Building
6-35, Kohnan 1-chome
Minato-ku, Tokyo 108-0057, Japan
Phone +81 (0) 3 5495 7237
Fax +81 (0) 3 5495 1853