



ARi Industries Inc.



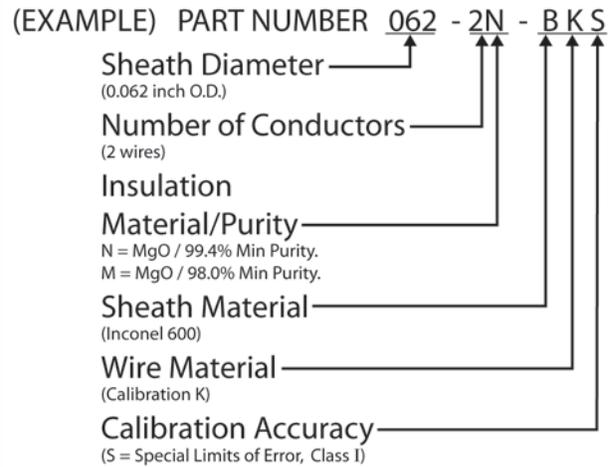
AerOpak[®]
Thermocouple Cable

Exploring New Horizons In Thermal Management



Thermocouple Cable Ordering Information:

- Specify by description.
Example: 1/16 inch Inconel 600 Sheath, Type K mineral insulated cable.
- Specify by part number. The part number is defined per the following:



- Specify total quantity. If cut lengths are required, specify length of each piece. Accuracy of a cut is +/- 1/2% of the length or +/- 1/2 inch (12.7mm), whichever is larger.
- Sizes up to 0.375 inch (9.53mm) can be shipped UPS or FedEx.
- Shipping tolerance for random lengths is +15%,-10% unless specified otherwise.
- Standard shipping coil sizes and weight:

Sheath O.D. (inch)	Sheath O.D. (mm)	Coil O.D. (inch)	Approx. weight @ 100Ft
.020	0.5	20-22	0.2
.040	1.0		0.3
.062	1.6	30	0.9
.120	3.0		2.5
.125	3.2		3.3
.188	4.8	42	7.0
.236	6.0		10.8
.250	6.4		12.3
.313	8.0		19.5
.375	9.5		27.0
.500	12.7	42-48	50.0
.625	15.9	Shipped straight.	75.0
.750	19.0	20 Ft. Maximum Lengths	112.5

ACKNOWLEDGEMENTS

ARI uses registered U.S. trademarks of others throughout this bulletin. The product and names supplied by the owners of these trademarks are well known and a convenient identifier to the user. They are:
 Inconel and Incoloy - Registered U.S. Trademarks of International Nickel Company. Hastelloy X - Registered U.S. Trademark of Cabot Corporation. Chromel and Alumel - Registered U.S. Trademark of Hoskins Mfg. Company.
 AerOpak - Registered U.S. Tradename of ARI Industries, Inc.

Conductor Specifications

For wall thickness and wire size information refer to ASTM E-585

Thermocouple Type	Calibration Temperature Range	Standard Calibration Tolerance °C (whichever is greater)	Special Calibration Tolerance °C (whichever is greater)
T (Cooper – Constantan)	0 – 370°C (32 – 700°F)	±1 or ±0.75%	±0.5 or ±0.4%
J (Iron – Constantan)	0 – 760°C (32 – 1400°F)	±2.2 or ±0.75%	±1.1 or ±0.4%
E (Chromel – Constantan)	0 – 870°C (32 – 1600°F)	±1.7 or ±0.5%	±1 or ±0.4%
K (Chromel – Alumel)	0 – 1260°C (32 – 2300°F)	±2.2 or ±0.75%	±1.1 or ±0.4%
N (Nicrosil – Nisil)	0 – 1260°C (32 – 2300°F)	±2.2 or ±0.75%	±1.1 or ±0.4%
R (Platinum 13% Rhodium – Platinum)	0 – 1480°C (32 – 2700°F)	±1.5 or ±0.25%	±0.6 or ±0.1%
S (Platinum 10% Rhodium – Platinum)	0 – 1480°C (32 – 2700°F)	±1.5 or ±0.25%	±0.6 or ±0.1%
B (Platinum 30% Rhodium – Platinum 6% Rhodium)	870 – 1700°C (1600 – 3100°F)	±0.5	±0.25%

Calibration tolerances per ASTM E230 and IEC 584-1.

Special tolerances per AMS 2750D and BAC 5621K specification available upon request, stock is subject to current availability.

Sheath Specifications

Sheath Material	ARi Symbol	Melting Temperature		Maximum Temperature in Air	
		F	C	F	C
AISI 304 ST/ST	A	2550	1400	1650	900
AISI 310 ST/ST	D	2550	1400	2000	1090
AISI 316 ST/ST	C	2500	1370	1650	900
AISI 347 ST/ST	F	2550	1400	1650	900
AISI 446 ST/ST	AG	2600	1430	2000	1090
INCONEL 600	B ₍₁₎	2470	1350	2000	1090
INCOLOY 800	Y	2525	1385	2010	1100
HASTELLOY X	V	2300	1260	2200	1200

(1) Not recommended for use in sulfur atmosphere

Stocked thermocouple cable showing: Cable O.D., Wire Type, Sheath Material

Cable O.D. (inch)	Cable O.D. (mm)	A 304	C 316	D 310	F 347	B Inconel 600	Y Incoloy 800	V Hastelloy X	MFG Length (Ft)
.020	.5	KN	K			JK			Varies
.040	1.0	JK	J		EJK	EJK		K	1300 – 1400
.062	1.6	JK	JKT	JK	EJK	EJK		K	500 – 600
.120	3.0			K			K	K	900 – 1000
.125	3.2	EJK	EJKT	EJK	JK	EJK	K	K	800 – 1100
.188	4.8	EJK	EJKT	JK	JK	EJK		K	350 – 550
.236	6.0			K		K	K	K	200 – 300
.250	6.4	EJK	EJKT	JKE	JKE	EJK	K	K	200 – 300
.313	8.0		K	K		K	K	K	125 – 175
.375	9.5	JK	JKT	JK		JK		K	90 – 130
.500	12.7			K		K		K	60 – 65
.625	15.9		K			K			25 – 30
.750	19.0					K			25 – 30

Calibration letters in **BOLD** indicate also available in DUPLEX (4-wire construction) from stock



Conductor cables can be manufactured from many ductile materials. Examples:

Wire Material	ARi Symbol	Resistivity Resistance	
		@ 20° C Ohms/CMF	@ #30AWG (0.010" O.D.)
AISI 304	304	430	4.3
AISI 347	347	430	4.3
INCONEL 600	INC	620	6.2
Oxygen Free Copper	CU	10.3	0.10
Nickel Lo Carbon	NIL	60	0.60
Constantan	AQ	294	2.94
Chromel -P	KP	425	4.25
Alumel	AY	177	1.77
27%NI Clad Cu	NCU	15	0.15

MI CABLE SPECIFICATION

Sheath Diameter:	±0.001 inch (±0.0025mm) or 1% of nominal diameter, whichever is greater
Wall Thickness:	10% of sheath diameter as a minimum
Wire Diameter:	15% of sheath diameter as a minimum for 2 wires. 12% of sheath diameter as a minimum for 4 wires 9% of sheath diameter as a minimum for 6 wires
Thermocouple wire calibration:	To meet Standard Limits of Error tolerance on calibration as defined in ASTM E-230. Cable with calibration tolerances meeting Special Limits of Error are identified with the symbol "S" after the calibration symbol in the part number.
Insulation Resistance at room temperature:	AerOpak is shipped with room temperature insulation resistance greater than 1000 megohms@50VDC (sheath diameters of 0.080 inch/ 2.0mm and less), and 1000 megohms@500VDC (sheath diameters of 0.120 inch / 3.0mm and greater).
High Temperature Insulation Resistance:	For 0.040" diameter AerOpak at 600°F (316°C), insulation resistance for one foot length will be in excess of 10 megohms. For 0.62" diameter and larger AerOpak at 600°F (316°C), insulation resistance for one foot length will be in excess of 100 megohms.
Dielectric Strength:	These are reference values for application to conductor cable only. Data is at 60Hz and 70°F (21°C). Straight - 100VAC per mil of insulation thickness. Bent - 45VAC per mil of insulation thickness.
Temperature:	Insulation is usable over a temperature range of -450°F (-270°C) to 3000°F (1650°C) without change of phase or chemical reaction with adjacent metals. Melting temperature of insulation is 4800°F (2640°C). Limiting temperature is associated with metals used.
Pressure:	Can withstand external pressure up to 50,000psi (3500kg/cm ²).
Nuclear:	Insulation can be subjected to a mean neutron flux of 2X10 ¹¹ n.cm ⁻² S ⁻¹ @100°C and a total peak irradiation of 8X10 ¹⁸ n.cm ⁻² with no significant change in characteristics.
Formability:	AerOpak can be bent around a mandrel having a radius equal to twice the sheath diameter without rupturing the sheath or causing loss of insulation resistance.
Fabrication:	AerOpak sheath can be welded, brazed, and soldered without changing insulation resistance and using normal care for the metals and thickness involved.
Storage & Shipping:	Each length of AerOpak cable is sealed at both ends with either a silicone resin, shrink sleeving or both. This can be removed (preferably in a dry atmosphere) by a sharp knife or razor. This seal is suitable for short duration or air shipments. We suggest glob welding the cable ends for Ocean shipments, or when shipping to high humidity destinations.

AerOpak[®] Thermocouple Cable

AerOpak[®] is made as either a thermocouple, and/or a conductor cable wire in compacted ceramic insulation encased in a metallic sheath. Conductor or thermocouple wires can range in quantity from 1 to 10 in wire construction.

Compacted Ceramic Powder - Magnesia is one typical electrical insulating material used between each wire and the outer sheath. Other insulations are available for application-specific needs.

Outer Seamless Metal Sheath - A variety of seamless metallic outer sheath materials provide environmental protection for the insulated conductors or sensor wires inside the cable. Sheath selection is typically application specific to provide the longest life possible.

Custom sizes and custom cable constructions are available - Our sales engineers can assist you in selecting the proper fit to meet today's requirements.



The Quality Standard for Mineral Insulated Cable

- Usable under severe conditions that can destroy other types of thermocouple cable.
- Withstands temperatures up to metal melting points.
- Withstands corrosive conditions that are limited only by the choice of the outer sheath material.
- Can be formed around a solid mandrel that is 2X's the sheath diameter without loss of integrity.
- Can be welded, brazed, or soldered to other metals when proper techniques are used.
- Variety of stock sizes, thermocouple types, and sheath materials available from ARi for immediate shipment.



Available Products

Temperature Sensors

- Mineral insulated cable
- Base metal T/C cable:
 - Type E
 - Type J
 - Type K
 - Type T
- Nobel metal T/C cable:
 - Type B
 - Type R
 - Type S
- Refractory T/C cable:
 - Tungsten Rhenium
 - Type C
 - Type D
- Multipoint T/C assemblies for temperature profiling

- Fan Junction for furnace tube temperature sensing
 - Stainless Steel Sheaths
 - Hastelloy-X Sheaths
- Nuclear grade T/C's
- RTD assemblies
- Thermowell's
- Temperature transmitters

Conductor Cable Assemblies

- MGO insulated conductor cable.
 - 1 to 10 wire designs

Neutron Detectors

- Self Powered Neutron Detectors

Electric Heaters

- Metal sheathed electric heater cable:
 - Stocked sizes
 - Single ended
 - Double ended
 - Custom lengths
 - Multiple circuits
 - Custom formations
 - Heated & unheated sections
 - Vacuum designs
 - High Temp. Heat Tracing
 - Furnace brazed parts
- Tubular heater assemblies.
- Flexible silicone rubber heaters.

Quality System

- ISO-9001-2000 Certified

Testing Options Services offered

- Custom testing available:
 - X-Ray
 - Helium Leak
 - Heat Treating
 - Temperature calibration (traceable to NIST)
- Custom Furnace Brazing

ARi is part of the Okazaki Group, companies who serve a wide variety of worldwide industrial and commercial customers with highly engineered solutions to their process temperature measuring and other thermal management needs. We maintain an ongoing cooperative engineering effort with our parent company. This enterprise results in ever-expanding capabilities, all of which improve our value to you as a supplier and engineering resource.

For all of your thermal management needs, just ask ARi. We are built on a solid foundation of products and services, but we are always exploring new horizons in technology to better serve our customers. We welcome your call.

ARi has representatives worldwide to assist you. Please contact us or visit our website for further assistance.



ARi Industries Inc.

381 Ari Court • Addison, Illinois 60101 USA • Toll-Free: 800-237-6725

Phone: 630-953-9100 • Fax: 630-953-0590 • Web: www.ariindustries.com • Email: sales@ariindustries.com