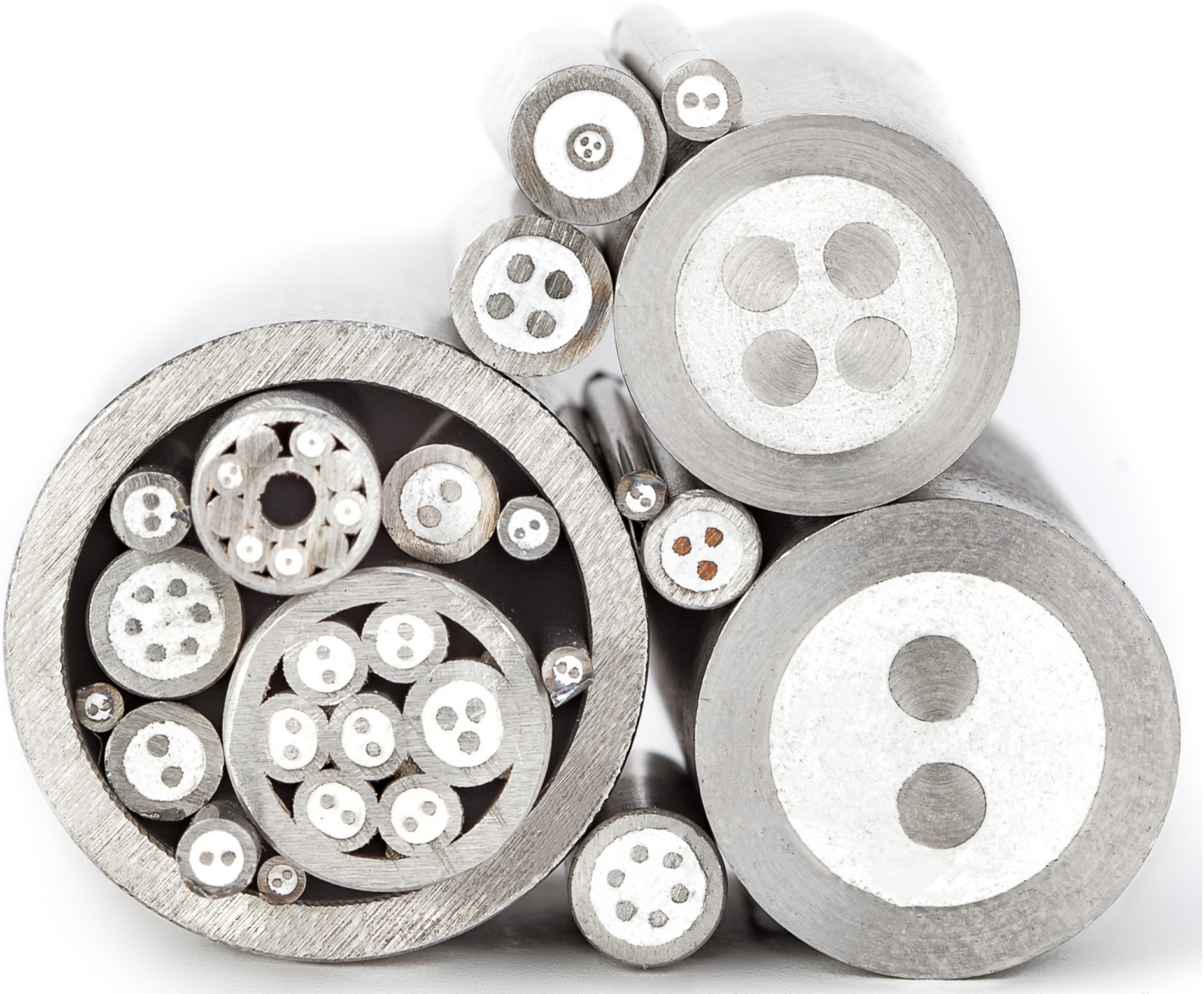
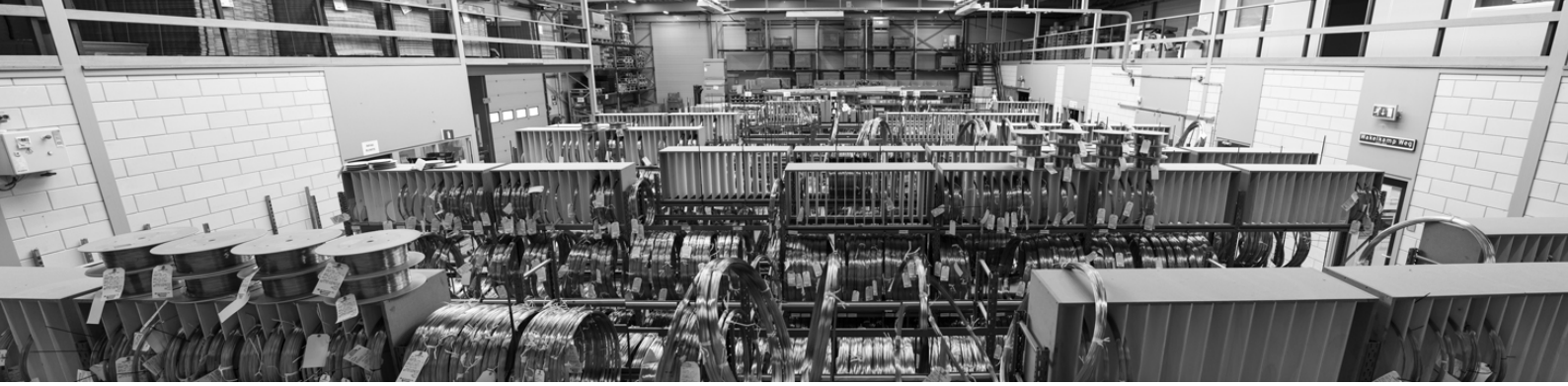
Kamet

Your supplier of
Mineral insulated RTD cable



OKAZAKI MANUFACTURING COMPANY

ARi Industries Inc.



KAMET & MINERAL INSULATED RTD CABLE

Mineral insulated RTD (resistance temperature detector) cables are used in combination with a thin film or wire wound ceramic resistor Pt100 (PT1000/PT500, etc) element. The principle of a RTD is that it measures the temperature using electrical resistance. The resistance value changes as its temperature changes, following a linear curve. By measuring the resistance, the temperature can be determined extremely accurate in a certain set temperature range. This range can vary from -200° C to + 850° C. Since the resistors are very delicate, they are often placed in a mineral insulated RTD cable to ensure protection and stability.

Okazaki Manufacturing Company

We are very proud to have Okazaki Manufacturing Company as our partner for mineral insulated (MI) thermocouple cable, RTD cable and heater cable. Okazaki has experience in producing MI cable since 1954 and has been fine-tuning and perfecting their process ever since. Okazaki works closely with German company Isabellenhütte, and other renowned Japanese companies to guarantee the outcome of class 1 and better for its MI cables. The MI cable that Okazaki produces is sold by Kamet under the trademark AerOpak®. Okazaki is actively promoting further technological development and making efforts to contribute to industrial progress and social advancement. An example of this would be the creation of the world's thinnest MI cable with an outside diameter of 0.08 mm. This achievement has been recognized by the Guinness Book of World Records.

OKAZAKI
MANUFACTURING COMPANY

AerOpak® Mineral insulated RTD cable

Principle of RTD MI cable

AerOpak® is the trademark for our mineral insulated RTD cable. The construction of our AerOpak® mineral insulated cable generally consists of 3 or 4 conductors (sometimes 2, 6 or 8) of conductive alloys (e.g. Copper, Nickel or Constantan). These conductors are usually welded to the legs of a thin film or ceramic wire wound resistance sensor. Since the bending process of mineral insulated RTD cables is easy, the sensor is easily installable at sites with many bends. The conductors are insulated with high quality magnesium oxide and covered with a corrosion resistant sheath material, mostly stainless steel.

Number of conductors

Number of wires	Application
2 wire	Reference sensor, precision not required, easy to make
3 wire	More precision measurement
4 wire	Most precision
6 wire	For use with a dual element to achieve 3 wire precision
8 wire	For use with a dual element to achieve 4 wire precision

The 2 wire RTD structure is the simplest among RTD circuit designs. In this construction, the single lead wires are welded to the ends of the RTD element. Because of resistance in lead wires, connectors as well as the RTD element, this construction always shows some degree of error.
The 3 wire RTD construction is most common. In this construction, two wires are connected with the RTD element on one leg and the third wire links the other leg of the RTD element.
The 4 wire RTD construction is the most complex of the 3 constructions.

Why use a dual element?
Safety first! A dual element is typically used as a back-up measurement in order to increase the reliability of the system. So in the case one sensor fails, there is still the second sensor which provides a reliable outcome of the general measurement.

Why Kamet?

- At Kamet we strive to continuously improve our MI cable by constant testing and reviewing in cooperation with our customers

- Every single coil of each batch is supplied with a 3.1 a certificate to ensure full traceability on all raw materials

- AerOpak® RTD cable can be used for Pt50, Pt100, Pt500 and Pt1000 applications in classes varying from Class A, class B, 1/3DIN B, 1/5 DIN B, and 1/10 DIN B

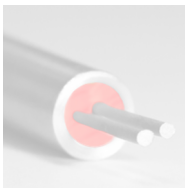
- Kamet is also your supplier of RTD sensors from Heraeus Nexensos and RTD Products. Our close cooperation with these companies ensures us with favourable conditions for our customers.

Outer sheath diameter of the MI cable

120

Number of conductors in cable

4



Type of insulation

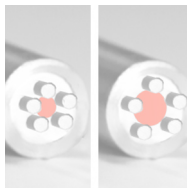
M

Sheath material of the MI cable

C

Conductor wire type

(Ni)



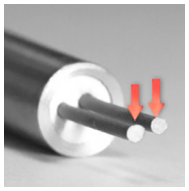
Spacing of conductors

J

Sheath diameter									
Symbols	040	060	062	079	120	177	236	250	313
Standard diameters (mm)	1.0	1.5	1.6	2.0	3.0	4.5	6.0	6.4	8.0
Average weight (gr/m)	5	10	11	18	37	83	147	170	265

Outer sheath diameter of the MI cable

120



Number of conductors in cable

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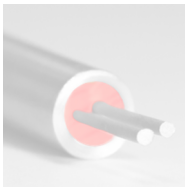

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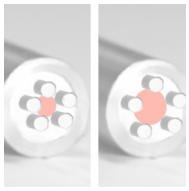
Conductor wire type

(Ni)



Spacing of conductors

J

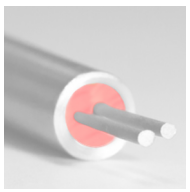
Sheath diameter – normal spaced cables									
Number of conductors	1.0	1.5	2.0	3.0	4.5	6.0	6.4	8.4	8.0
2	n/a	v	v	v	v	v	v	v	v
3	n/a	v	v	v	v	v	v	v	v
4	n/a	v	v	v	v	v	v	v	v
6	n/a	n/a	n/a	v	v	v	v	v	v
8	n/a	n/a	n/a	v	v	v	v	v	v

Outer sheath diameter of the MI cable

120

Number of conductors in cable

4



Type of insulation

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Sheath material of the MI cable

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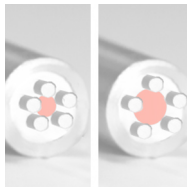
Conductor wire type

(Ni)

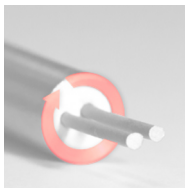


Spacing of conductors

J

Insulation material

Insulation type	symbol	Recommended max operating temperature	Approx melting temperature	Comments
Magnesium Oxide (MgO)	M	1700°C	2800°C	Very hygroscopic and used mostly in compacted sheaths (>99% pure)
Magnesium Oxide (MgO)	N	1700°C	2800°C	Very hygroscopic and used mostly in compacted sheaths (>96.4% pure)



Outer sheath diameter of the MI cable

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Number of conductors in cable

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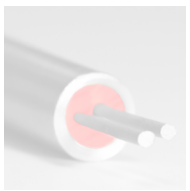

Type of insulation

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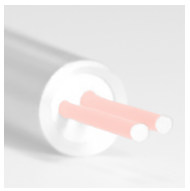
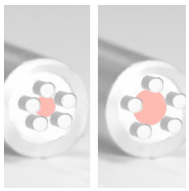
Sheath material of the MI cable

C



Conductor wire type

(Ni)

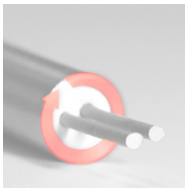


Spacing of conductors

J

Sheath material

Sheath type	symbol	Recommended Max temperature	Melting temperature	Standard sheath diameters
Copper	H	600°C	1080°C	On request
AISI 304	A	900°C	1400°C	On request
AISI 316	C	900°C	1370°C	040, 060, 062, 079, 120, 177, 157, 236”
AISI 321	E	1090°C	1350°C	040, 060, 062, 079, 120, 177, 157, 236”
Inconel 600	B	1175°C	1345°C	On request
AISI 316 Ti	(CT)	900°C	1370°C	> 3mm On request



Outer sheath diameter of the MI cable

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Number of conductors in cable

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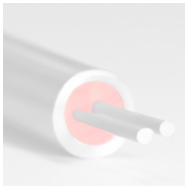

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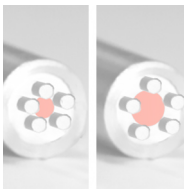
Sheath material of the MI cable

C

Conductor wire type

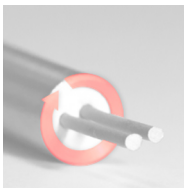
(Ni)



Spacing of conductors

J

Conductor wire type		
Symbol	Wire material	Recommended max. temperature
(Cu)	Copper	400°C
(Ni)	Nickel	600°C
(Aq)	Constantan	650°C
(B)	Inconel 600	1050°C

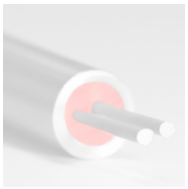


Outer sheath diameter of the MI cable

120

Number of conductors in cable

4



Type of insulation

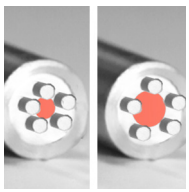
M

Sheath material of the MI cable

C

Conductor wire type

(Ni)

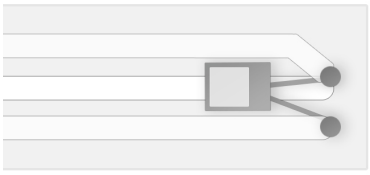


Spacing of conductors

J

Spacing of conductors

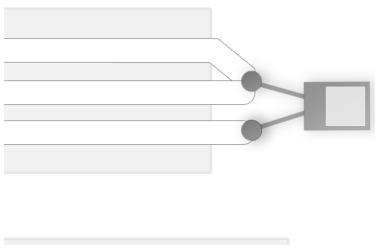
A



The reversed mounted sensor, compared to top mounting, is more robust and can handle shock and vibration a lot better. Typically this sensor can also withstand higher temperature.

Reversed mounted, mostly used in A spaced cables

J



The top mounted sensor compared to reverse mounting has a quicker response time. Also, the production is easier.

Top mounted, mostly used in J-spaced cables

AerOpak MI RTD cable specs

Type A cable - Reversed mounted						
OD (mm)	Tolerance (mm)	Wall thickness (mm)	Conductor diameter (mm)	Distance between wires (mm)	Resistance (Ω/m)	m/Coil
9.00	+/- 0.05	0.90	0.90	3.10	0.50	20
8.00	+/- 0.05	0.80	0.80	2.70	0.50	25
6.40	+/- 0.05	0.64	0.64	2.20	0.50	39
6.00	+/- 0.05	0.60	0.55	2.08	0.50	45
4.80	+/- 0.05	0.48	0.48	1.70	0.70	70
4.50	+/- 0.05	0.45	0.40	1.65	0.70	80
3.20	+/- 0.05	0.32	0.32	1.00	1.40	159
3.00	+/- 0.05	0.30	0.26	1.00	1.40	181

Type J cable - Top mounted						
OD (mm)	Tolerance (mm)	Wall thickness (mm)	Conductor diameter (mm)	Resistance 3/4 conductors (Ω/m)	Resistance 6 conductors (Ω/m)	m/Coil
12.70	+/- 0.05	1.27	1.90	0.70	0.15	20
9.00	+/- 0.05	0.90	1.35	0.70	0.20	40
8.00	+/- 0.05	0.80	1.20	0.13	0.25	51
6.40	+/- 0.05	0.64	0.96	0.16	0.35	80
6.00	+/- 0.05	0.60	0.90	0.20	0.42	91
4.80	+/- 0.05	0.48	0.74	0.28	0.65	142
4.50	+/- 0.05	0.45	0.67	0.35	0.75	162
3.20	+/- 0.05	0.32	0.48	0.50	1.47	166
3.00	+/- 0.05	0.30	0.45	0.60	1.70	189

Recommended Pt sensors to be used with our AerOpak MI cable

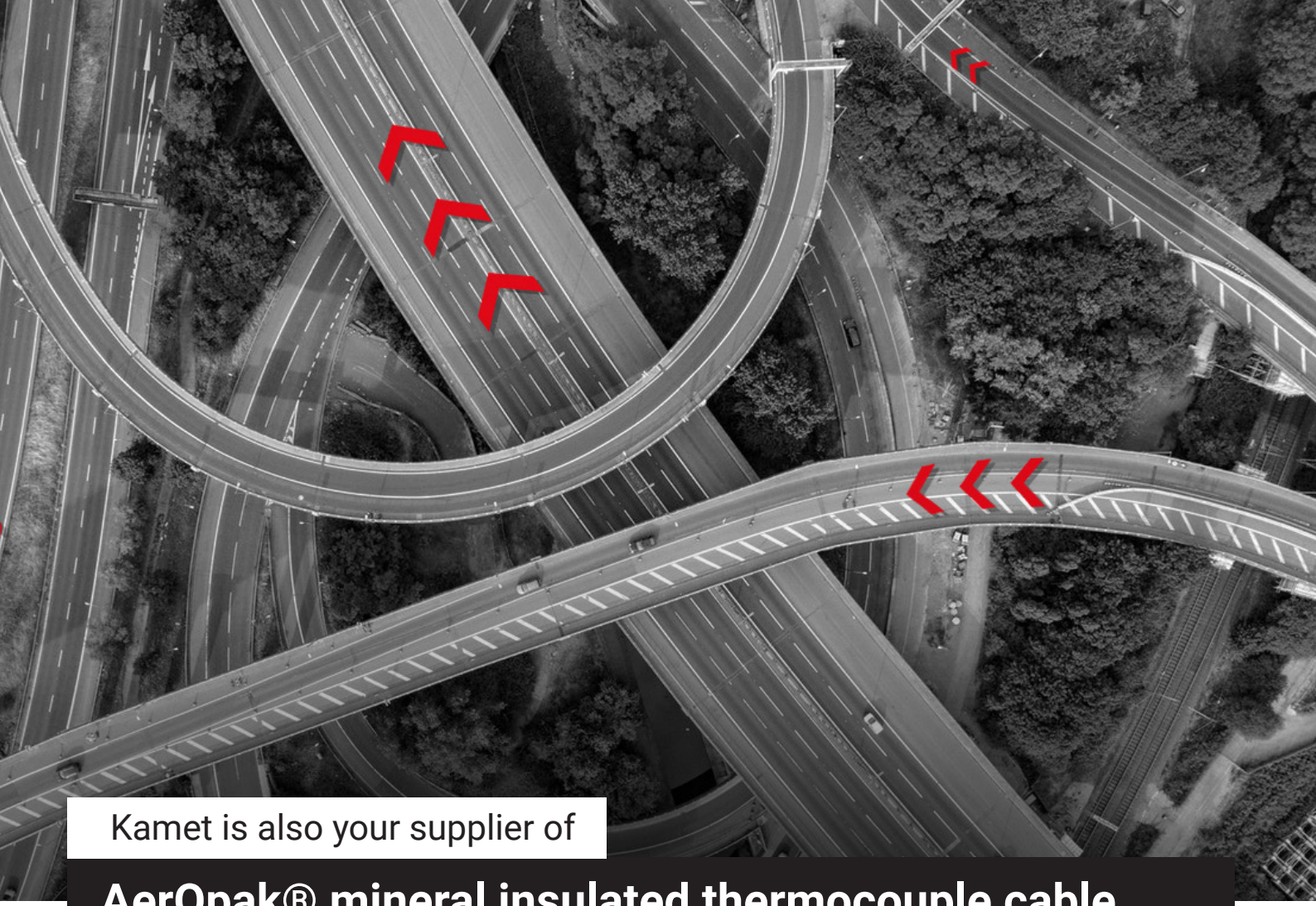
Our AerOpak® RTD MI cables can be used in combination with Pt thin film resistors, produced by Heraeus Nexensos. For higher temperature applications, ceramic Pt resistors are recommended. These ceramic wire wound resistors are produced by our partner RTD products.

Thin film Pt element

Thin film platinum elements are constructed by placing a sensing layer of platinum on a ceramic substrate, covered with passivation glass layers. This results in excellent shock & vibration resistance and protects the Pt sensor element from environmental influences.

Ceramic wire wound Pt element

The platinum wire of a ceramic wire wound Pt100 sensor is wound into a small coil which is inserted into the holes of a high purity alumina tube. The ODs of these high purity alumina tube vary from 0.8mm to 4.5mm, so they are even suitable for the thinnest RTD mineral insulated cables.



Kamet is also your supplier of

AerOpak® mineral insulated thermocouple cable

AerOpak® is the trademark for our mineral insulated thermocouple cable. The construction of our MI cable consists of two conductors (sometimes even four, six or eight) of dissimilar alloys. These conductors are joined on the side on which temperature should be measured (hot junction). Properly joined, a voltage is produced that can be read to determine temperature (Seebeck effect). The conductors are insulated with high quality magnesium oxide and covered with a corrosion resistant sheath material, such as Inconel or Stainless steel. MI cables provide stable temperature measurement readings and are often used for high temperatures (up to 1250°C and even higher) in hazardous environments.

Do you have a question about MI Thermocouple Cable?

Check our website, email Kamet or call us on +31 (0) 85 040 27 00

Kamet

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