

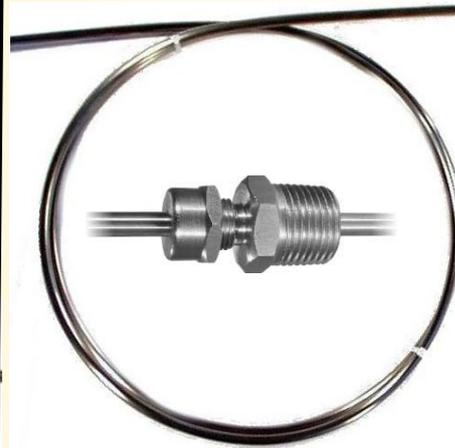
MINERAL INSULATED THERMOCOUPLE (J,K,T,S,...)



- **Bendable sensor during mounting**
- **High flexibility**
(minimum bending: 3 x sheat diameter)
- **Gaztight and other liquid tight**
- **High pressure strength**
- **Great vibrations strength**
- **High length on request**
- **Short reponse time**
- **Application:**
Laboratory
Chemistry industry (reactor)



Cutaway view



- **Models available in ATEX and IECex version**



Bendable thermocouples series on site during implementation, gaztight and liquid tight. High length on request, and diameter at 0.5mm to 8 mm, allowing fast response time.

TECHNICAL SPECIFICATION : (standard execution)

- **Protection sheath:** Bendable mineral insulated sheath stainless steel 316L (or inconel 600),
Insulation: magnesia heavily compacted.
Flexible, it follows difficult and nonlinear ways without bending tools, minimum bending : 3 x sheat diameter.
Reduced floor-space: diameter from 0.5 mm to 8 mm.
Resists to thermal shocks and high pressures(> 600 bars).
A protection sheath is not necessarily required.
Reduced response time due to low thermal density and to electric insulator (magnesia), great temperature conductivity
Utile length : 20mm to more than 50 mètres
Usage Temperature: - 200 to + 1100 °C (following materials and thermocouples)
- **Fastening:** Staight pipe, sliding connection, sliding flange,
Other connection on request
- **Measure element:** K,J,T,S,... thermocouple class 1 single or duplex
Mounting 2 wire or 2x2 wire
Stability of E.M.F.
The conductors are protected against all corrosion who can engender a drift of their characteristics.

Fastening and Mounting Accessory

JPC type
sliding flange

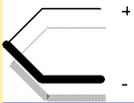


Sliding connection



Compensated connection





MINERAL INSULATED THERMOCOUPLE (J,K,T,S,...)



Standard output, other type on request.

	<p>Mounting type 1 Direct output by stripped wires with resin tightness (260°C)</p>
	<p>Mounting type 2 Cable output: PVC, Teflon, Silicon, .. Tight intermediate junction Ø 6mm, 50mm length</p>
	<p>Mounting type 3 Output by fast locking wire « LEMO » type Size 0 for Ø 1,6mm, 1,9mm, 3mm Size 1-2-3 for Ø 3mm, 5mm, 6mm.</p>
	<p>Mounting type 4 Output by compensated wire Standard or miniature type High temperature option: 260°C</p>
	<p>Mounting type 5 Output by screwable connection « JEAGER » type</p>
	<p>Mounting type 6 Output on MA type (IP54) miniature connecting head.</p>
	<p>Mounting type 7 Output on DAN-Screw (IP65), or Dan-Clip (IP54) with ceramic terminal connection head.</p>
	<p>Mounting type 8 Interchangeable measure element Output on ceramic terminal (B form) 33mm interaxial Supplied with screws and spring for anti-vibration mounting.</p>
	<p>Mounting type 9 Output on ADF head (IP65), with ceramic terminal.</p>

JUNCTION TYPE

The junction used for the realization of thermocouple is called the « HOT JUNCTION »: this welding can be insulated from the protection sheath. Thermocouple will be the ground insulated.

To improve the speed of response time, it's possible to put the hot junction in contact with the sheath, the thermocouple will then be grounded. Mean that measure instruments in connection with this one should be protected.

Visible hot junction realization is possible (reduction of the response time in 10 coefficient)



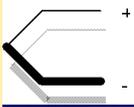
Grounded thermocouple

Visible thermocouple

Insulated thermocouple

Order code

TC	K	i	30	S	/	7	/	L
Mineral insulated Thermocouple	couple type J,K,S,T	sheath type i : stainless steel inc: inconel	Mineral insulated diameter (1/10mm)	Single (by default) or Duplex		Output type from 1 to 9		length (mm)



Electric resistance of wires

Wires resistance (loop) to 20°C								
Couple	Sheath diameter							
	Ø 0,5mm	Ø 1mm	Ø 1,5mm	Ø 2mm	Ø 3mm	Ø 4,5mm	Ø 6mm	Ø 8mm
T	-	15,85	7,02	2,86	1,24	0,55	0,31	0,16
J	-	18,5	8,21	3,34	1,46	0,64	0,36	0,19
K	127	37	17	9	4,3	1,9	1,1	0,6
S	-	13	5,7	3,1	1,6	-	-	-

Resistances for a mineral insulated 2 conductors to add 20% for a duplex mineral insulated (4 conductors)

The tolerances on the conductors resistances are to +/-25% depend of the manufactures.

Using temperature

CHEMISES		COUPLES										
Mineral insulated materials	Maxi. using temp. °C	Maxi. using temp. °C	Value in mV	Mineral insulated diameter and couple types								
				Ø 0,5 mm	Ø 1 mm	Ø 1,5 mm	Ø 2 mm	Ø 3 mm	Ø 4,5 mm	Ø 6 mm	Ø 8 mm	
Stainless steel 304 L	800	350	17,82		T	T	T	T	T	T	T	T
Stainless steel 304 L	800	700	39,13		J	J	J	J	J	J	J	J
Stainless steel 304 L	800	800	33,3		K	K	K	K	K	K	K	K
Stainless steel 316 L	800	700	39,13	J	J	J	J	J	J	J	J	J
Stainless steel 316 L	800	800	33,3	K	K	K	K	K	K	K	K	K
Stainless steel 316 TI	800	700	39,13	J	J	J	J	J	J	J	J	J
Stainless steel 316 TI	800	800	33,3	K	K	K	K	K	K	K	K	K
Stainless steel 321	800	700	39,13	J	J	J	J	J	J	J	J	J
Stainless steel 321	800	800	33,3	K	K	K	K	K	K	K	K	K
inconel 600	1150	1150	46,99	K	K	K	K	K	K	K	K	K
inconel 600	1150	1150	14,37	S	S	S	S	S	S	S	S	S
platinum	1600	1400	14,37		S	S	S	S	S	S	S	S

Response time and insulation voltage

Response time depend on a lot of parameters: thermocouple dimension, it's construction, it's hot junction configuration and the place where the probe will be locate. If the thermocouple immersed in high temperature environnement thermic printing is fast, the response time will be the same that for thermocouple (intrinsic response time). However, if thermic proprieties of environnement are poor (for example static air) the response time can be 100 times higher.

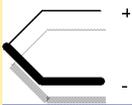
Designation	Conditions	Mineral Insulated cable diameters							
		Ø 0,5 mm	Ø 1 mm	Ø 1,5 mm	Ø 2 mm	Ø 3 mm	Ø 4,5 mm	Ø 6 mm	Ø 8 mm
Response time In water to (per secondes)	Grounded TC	0,025	0,08	0,12	0,2	0,5	0,7	2	2,5
	Ungrounded TC	0,05	0,15	0,24	0,35	0,9	1,35	3,9	5
Voltage for insulation from 1000 MOhms to 20 °C TC insulated		85 V	250 V	500 V	500 V	500 V	500 V	500 V	500 V

Response time provided for information, corresponding to the time constant required for the measure element to reach 63% of total temperature variation.

For visible hot junctions, divide response time values per 10.

Dimensional specifics

	Mineral Insulated cable diameters							
	Ø 0,5 mm	Ø 1 mm	Ø 1,5 mm	Ø 2 mm	Ø 3 mm	Ø 4,5 mm	Ø 6 mm	Ø 8 mm
Approximative weigh / m	1,2	5	11	20	44	101	170	320
Jacket thickness / mm	0,075	0,15	0,23	0,24	0,36	0,54	0,72	0,96
Ø wires / mm	0,06	0,12	0,18	0,3	0,46	0,67	0,9	1,2



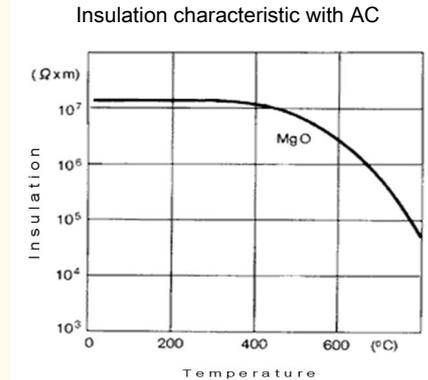
Evolution of the insulation resistance with temperature.

Insulation resistance at ambient temperature (20°C) :

diameter 1 to 2mm : > 1000 Mohms to 50Vdc (50 cm length)
 diameter 3 to 8mm : > 1000 Mohms to 500Vdc (50 cm length)

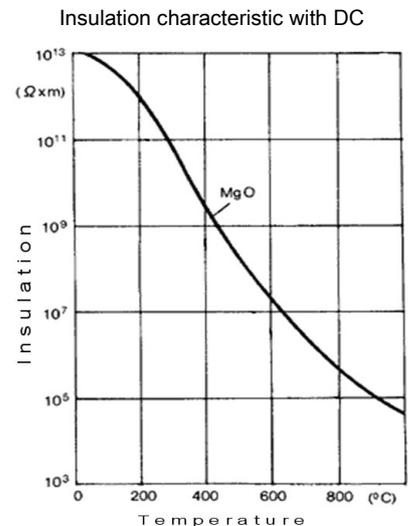
Insulation to 300 °C:

diameter 1mm : > 10 Mohms (50 cm length)
 diameter 2 to 8mm : > 100 Mohms (50 cm length)



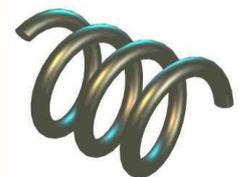
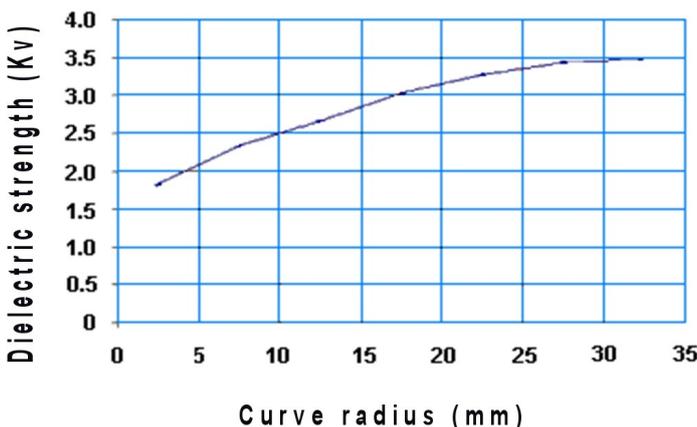
Measurement insulation made at 500 Vac / 50 Hz

Insulation at 500 Vdc in Mohms / 30cm				
Sheath diameter	Temperature	Number of wires		
mm	°C.	2	3	4
8	300	10 ⁸	10 ⁸	10 ⁸
	500	10 ⁶	10 ⁶	10 ⁶
	800	10 ⁵	10 ⁵	10 ⁵
6	300	10 ⁷	10 ⁷	10 ⁷
	500	10 ⁶	10 ⁶	10 ⁶
	800	10 ⁵	10 ⁵	10 ⁵
4,5	300	10 ⁷	10 ⁷	10 ⁷
	500	10 ⁶	10 ⁶	10 ⁶
	800	10 ⁵	10 ⁵	10 ⁵
3	300	10 ⁷	10 ⁷	10 ⁷
	500	10 ⁶	10 ⁶	10 ⁶
	800	10 ⁵	10 ⁵	10 ⁵



Measurement insulation made at 20 Vdc

Evolution of the dielectric strength with mineral insulated curve radius.



Dielectric strenght:
 > 4000 Vac / mm (straight mineral insulated)

Dielectric strenght:
 > 2000 Vac / mm (curved mineral insulated)

The dielectric strenght is independant of the temperature up to 800°C.