

Extension and compensation cables for thermocouples

GENERAL - DEFINITIONS

Extension and compensation cables are used to electrically connect the inactive ends of the wires of a thermocouple to the cold weld junction, where the wires of this couple do not reach this cold weld junction.

- **Extension cables**

Extension cables are manufactured with wires of the same composition as the wires of the corresponding couples. They are coded with the letter "X" placed after the thermocouple code, for example "JX".

- **Compensation cables**

Compensation cables are manufactured with wires of different stranding or material to the wires of the corresponding thermocouples. They are marked by the letter "C" placed after the thermocouple code, for example "KC". Different alloys can be used for the same type of thermocouple. They can be distinguished by extra letters, for example KCA and KCB.

PRINCIPLE OF USE

In most cases, thermocouples are relatively far from measurement, monitoring and recording apparatus.

Extension or compensation cables are then used to connect the thermocouple to the apparatus. They transmit the data given by the thermocouple (see figures 3 and 4).

These cables have identical properties to thermocouples but in an area with reduced temperature and different tolerances than for the thermocouples (see table).

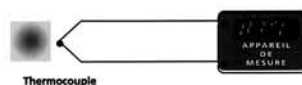


Figure 3
(set-up with direct connection)

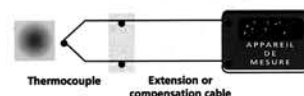


Figure 4
(set-up with extension or compensation cable)

MAIN TYPES OF EXTENSION AND COMPENSATION CABLES AND TOLERANCES

The tolerance of an extension or compensation cable is the maximum extra difference given in microvolts, due to the presence of an extension or compensation cable in the temperature measurement circuit.

The table below gives the tolerances of the extension and compensation cables within the temperature range given in the column "Cable temperature range".

This table also gives, in brackets, the equivalent and approximative tolerances in degrees Celsius. The emf-temperature ratio not being linear, the tolerance in degrees Celsius depends on the temperature of

the measurement junction of the thermocouple.

The figures indicated in the table are those corresponding to the "Temperature of the measurement junction" in the last column.

In most cases, the error given in degrees Celsius will be greater for the low temperatures of the measurement junction.

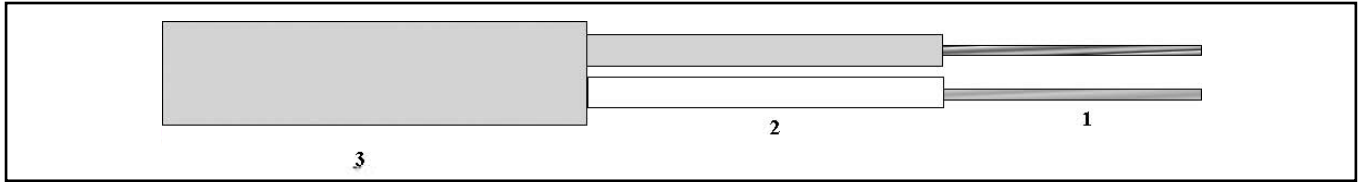
Type of cable	Materials	Tolerance class		Cable temperature range	Measurement junction temperature	
		1	2			
Extension	JX	Iron / Copper-Nickel J	JX1 : ± 85 µV (± 1.5 °C)	JX2 : ± 140 µV (± 2.5 °C)	-25 °C to +200 °C	500 °C
	TX	Copper / Copper-Nickel T	TX1 : ± 30 µV (± 0.5 °C)	TX2 : ± 60 µV (± 1.0 °C)	-25 °C to +100 °C	300 °C
	EX	Nickel-Chromium / Copper-Nickel E	EX1 : ± 120 µV (± 1.5 °C)	EX2 : ± 200 µV (± 2.5 °C)	-25 °C to +200 °C	500 °C
	KX	Nickel-Chromium / Nickel Alloy	KX1 : ± 60 µV (± 1.5 °C)	KX2 : ± 100 µV (± 2.5 °C)	-25 °C to +200 °C	900 °C
	NX	Nickel-Chromium-Silicium / Silicium-Nickel	NX1 : ± 60 µV (± 1.5 °C)	NX2 : ± 100 µV (± 2.5 °C)	-25 °C to +200 °C	900 °C
Compensation	KCA	Iron / Copper-Nickel	-	± 100 µV (± 2.5 °C)	0 °C to +150 °C	900 °C
	KCB	Copper / Copper-Nickel	-	± 100 µV (± 2.5 °C)	0 °C to +100 °C	900 °C
	NC	Nickel-Chromium-Silicium / Nickel-Silicium	-	± 100 µV (± 2.5 °C)	0 °C to +150 °C	900 °C
	RCA	Copper / Copper-Nickel R	-	± 30 µV (± 2.5 °C)	0 °C to +100 °C	1000 °C
	RCB	Copper / Copper-Nickel R	-	± 60 µV (± 5.0 °C)	0 °C to +200 °C	1000 °C
	SCA	Copper / Copper-Nickel S	-	± 30 µV (± 2.5 °C)	0 °C to +100 °C	1000 °C
	SCB	Copper / Copper-Nickel S	-	± 60 µV (± 5.0 °C)	0 °C to +200 °C	1000 °C
	BC	Copper / Copper Alloy	-	± 40 µV (± 2.5 °C)	0 °C to +150 °C	1400 °C

Notes

1. The temperature range of the cables can be reduced to values lower than those indicated in the table, due to the temperature limit of the insulation.
2. A cable made up of two copper conductors can be used with B-type thermocouples. With cables whose temperature ranges between 0°C and +100°C, the maximum extra difference is 40 µV. The temperature equivalent is 3.5°C when the temperature of the measurement junction of the thermocouple is 1400°C.
3. Extension cables of tolerance class 2 - JX2, TX2, EX2, KX2 and NX2 - are commonly known as compensation cables and designated by the codes JC, TC, EC, KC and NC.
4. The type of metal can also be identified by the various registered trademarks.
Examples: JX: Iron / Constantan* - KX: Chromel* / Alumel* etc.

Thermocouple Compensating Wire

COUPLIX KCA-MY2-Y2



- 1 – Core : extension KCA made of Iron (+) and copper-nickel (-)
- 2 - Insulation : PVC 105°C
- 3 - Sheath : PVC 105°

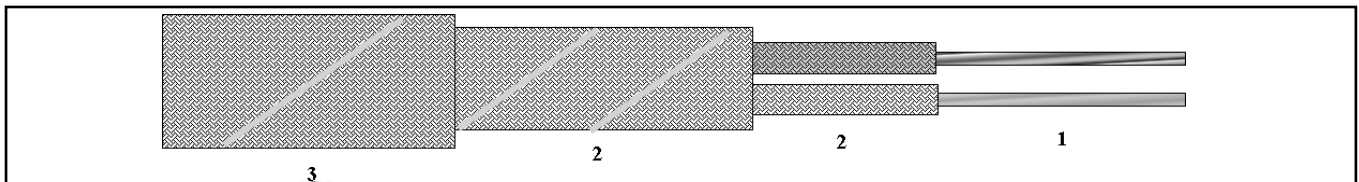
Technical data :

Thermal : Continuous working temperature : -30°C to +105°C
 Temperature range of calibration (IEC584) : 0 to +150°C

Construction details :

Nominal cross section mm ²	Nominal stranding	Shape	Colour code	Nominal diameter of conductor mm	Nominal dimensions of cable mm
2X0.50	7 / 0.30	Flat	IEC	1.8	2.6 x 4.4
2X0.50	7 / 0.30	Round	IEC	1.8	4.5
2X0.75	11 / 0.30	Flat	IEC	2.3	2.9 x 5.2
2X0.75	11 / 0.30	Round	IEC	2.3	6.0
2X1.50	21 / 0.30	Round	IEC	2.8	7.0

COUPLIX⁰ KCA-BEMV-VS



- 1 – Core : extension KCA made of Iron (+) and copper-nickel (-)
- 2 - Insulation : Impregnated glass fiber lappings and/or braid
- 3 - Tinned copper braid

Technical data :

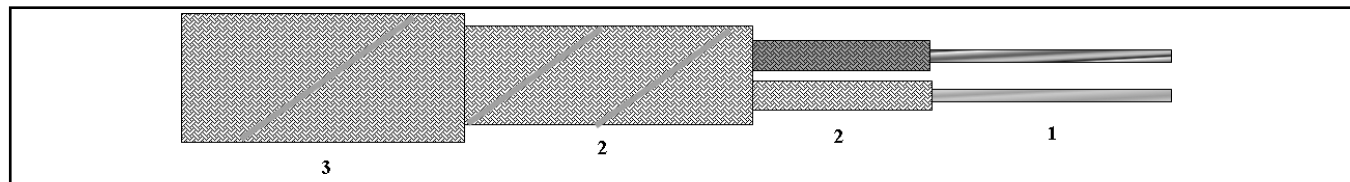
Thermal : Continuous working temperature : -60°C to +280°C
 Temperature range of calibration (IEC584) : 0 to +150°C

Construction details :

Nominal cross section mm ²	Nominal stranding	Shape	Colour code	Nominal diameter of conductor mm	Nominal diameter of cable mm
2X0.22	3 / 0.30	Round	IEC	1.5	3.8
2X0.75	11 / 0.30	Round	IEC	2.0	5.6
2X1.5	21 / 0.30	Round	IEC	2.1	6.2

Thermocouple Compensating Wire

COUPLIX⁰ SCA-BEMV-VS



- 1 – Core : extension SCA made of copper (+) and copper-nickel S (-)
- 2 - Insulation : Impregnated glass fiber lappings and/or braid
- 3 - Tinned copper braid

Technical data :

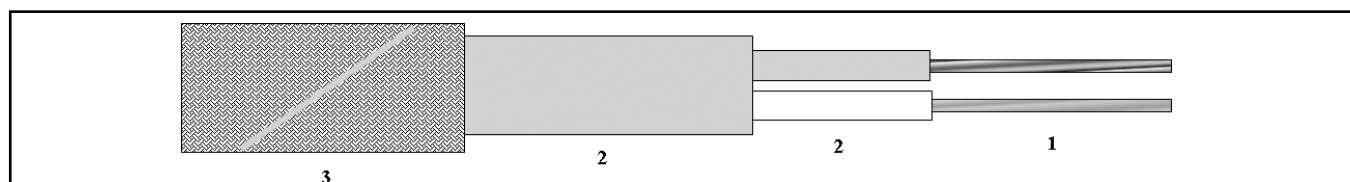
Thermal : Continuous working temperature : -60 °C to +280 °C

Temperature range of calibration (IEC584) : 0 to +100 °C

Construction details :

Nominal cross section mm ²	Nominal stranding	Shape	Colour code	Nominal diameter of conductor mm	Nominal diameter of cable mm
2X0.75	11 / 0.30	Round	IEC	2.0	5.6
2X1.5	21 / 0.30	Round	IEC	2.1	6.2

COUPLIX⁰ KCA-BEMC-CS



- 1 – Core : extension KCA made of Iron (+) and copper-nickel (-)
- 2 - Extruded silicone rubber
- 3 - Tinned copper braid

Technical data :

Thermal : Continuous working temperature : -60 °C to +200 °C

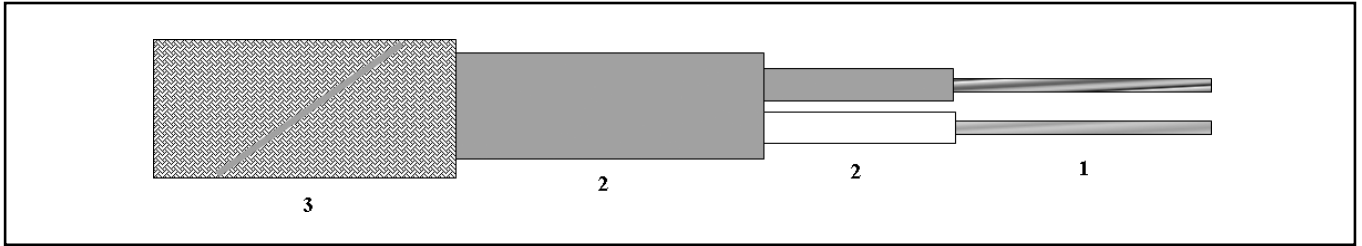
Temperature range of calibration (IEC584) : 0 to +150 °C

Construction details :

Nominal cross section mm ²	Nominal stranding	Shape	Colour code	Nominal Diameter of conductor mm	Nominal diameter of cable mm
2X0.75	11 / 0.30	Round	IEC	2.4	6.8
2X1.5	21 / 0.30	Round	IEC	2.7	7.6

Thermocouple Compensating Wire

COUPLIX® SCA-BEMC-CS



- 1 – Core : extension SCA made of Copper (+) and copper-nickel S (-)
- 2 - Extruded silicone rubber
- 3 - Tinned copper braid

Technical data :

Thermal : Continuous working temperature : -60°C to +200°C

Temperature range of calibration (IEC584) : 0 to +100°C

Construction details :

Nominal cross section mm ²	Nominal stranding	Shape	Colour code	Nominal Diameter of conductor mm	Nominal diameter of cable mm
2X0.75	11 / 0.30	Round	IEC	2.4	6.8
2X1.5	21 / 0.30	Round	IEC	2.7	7.6

Properties :

Insulation/ jacket	Humidity resistance	Abrasion resistance	Chemical agressions resistance	Alternative flexion resistance	Hydrocarbon resistance
-MY2-Y2 (PVC/PVC)	Good	Good	Good	Good	Good
-BEMV-VS (glass fiber/TCB)	Adequate	Good	Good	Good	-
-BEMC-CS (silicone rubber/TCB)	Good	Good	Good	Excelant	-