Compensating and Thermocouple Extension cables

Application

Compensating (also referred to as compensation cables) and thermocouple extension cables are used for temperature sensing in industrial processes. In most cases thermocouples are connected to other processing instruments by connecting cables. Connecting cables are divided into compensating cables and extension cables.

Difference between compensating and T/C extension cable

Compensating cables

Compensation cables are connecting cables with conductors made of substitute materials which only in a limited temperature range have the same thermoelectric properties as the thermocouple itself. Compensating cables are marked with a „C“ behind the identification letter for the thermocouple.
Compensation cables are used to extend the thermocouple types K,N,R,S and B because the substitute materials are reasonably cheaper than the corresponding thermocouple material, particularly for types R, S and B.

Thermocouple Extension cables

T/C extension cables are connecting cables with conductors made of the same element material as the thermocouple. Extension cables therefore are subject to the same accuracy limits as the thermocouples.
Extension cables are marked with an „X“ behind the identification letter for the thermocouple.

Construction

The following criteria must be taken into consideration when selecting the appropriate material: chemical and mechanical resistance against the ambient conditions, temperature range, insulation resistance, flexibility, outside diameter, screening etc. The insulating material of the conductors as well as the sheath material can be made of a variety of materials.
In order to maintain the thermoelectric properties, the maximum working temperature should be limited to the indicated cable temperature range.

Conductor

Conductor can be solid, stranded or flexible

Insulation

PVC

PE

XLPE

Silicone

FEP

PTFE

Fiber glass

Screening

C	Copper wire screen
(St)	Laminated Alu/PETP tape + tinned copper drain wire

Protection against mechanical stress

S	Steel wire braid
SWA	Steel wire armouring

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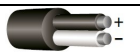
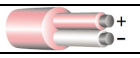
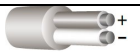
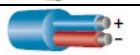
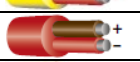
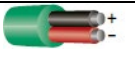
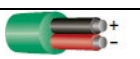
Summary of materials

Thermocouple material			Compensating and extension cable						
						Applied color codes	Tolerance class		Cable temperature range
Type	+	-	Type	+	-	IEC	1	2	
J	Iron	Copper-Nickel	**JX**	Fe	CuNi		±85mV (±1,5 °C)	±140mV (±2,5 °C)	-25 °C to +200 °C
T	Copper	Copper-Nickel	**TX**	Cu	CuNi		±30mV (±0,5 °C)	±60mV (±1,0 °C)	-25 °C to +100 °C
E	Nickel–Chromium	Copper-Nickel	**EX**	NiCr	CuNi		±120mV (±1,5 °C)	±200mV (±2,5 °C)	-25 °C to +200 °C
K	Nickel–Chromium	Nickel	**KX**	NiCr	NiAl		±60mV (±1,5 °C)	±100mV (±2,5 °C)	-25 °C to +200 °C
			KCA	Fe	CuNi			±100mV (±2,5 °C)	0 °C to +150 °C
			KCB	Cu	CuNi			±100mV (±2,5 °C)	0 °C to +150 °C
N	Nickel–Chromium –Silicon	Nickel–Silicon	**NX**	NiCrSi	NiSi		±60µV (±1,5 °C)	±100µV (±2,5 °C)	-25 °C to +200 °C
			NC	Cu	CuNi			±100µV (±2,5 °C)	0 °C to +150 °C
R	Platinum–13 % Rhodium	Platinum	**RCA**	Cu	CuNi			±30mV (±2,5 °C)	0 °C to +100 °C
			RCB	Cu	CuNi			±60mV (±5,0 °C)	0 °C to +200 °C
S	Platinum–10 % Rhodium	Platinum	**SCA**	Cu	CuNi			±30mV (±2,5 °C)	0 °C to +100 °C
			SCB	Cu	CuNi			±60mV (±5,0 °C)	0 °C to +200 °C
B	Platinum–30 % Rhodium	Platinum –6 % Rhodium	**BC**	Cu	Cu				0 °C to +100 °C

Cable temperature and tolerances to IEC 60584 / DIN 43722.
The cable temperature range may be restricted to lower values due to the temperature limitations imposed by the insulating material!

Thermocouple material			Compensating and extension cable					
						Applied color codes	Tolerance class	Cable temperature range
Type	+	-	Type	+	-	ANSI		
J	Iron	Copper-Nickel	**JX**	Fe	CuNi		special: ±1.1 °C - standard: ±2.2 °C	0 °C to +200 °C
T	Copper	Copper-Nickel	**TX**	Cu	CuNi		special: ±0.5 °C - standard: ±1.0 °C	-60 °C to +200 °C
E	Nickel–Chromium	Copper-Nickel	**EX**	NiCr	CuNi		special: ±1.1 °C - standard: ±1.7 °C	0 °C to +200 °C
K	Nickel–Chromium	Nickel	**KX**	NiCr	NiAl		special: ±1.1 °C - standard: ±2.2 °C	0 °C to +200 °C
			VX	Cu	CuNi		±2.2 °C	0 °C to +100 °C
N	Nickel–Chromium –Silicon	Nickel–Silicon	**NX**	NiCrSi	NiSi		special: ±1.1 °C - standard: ±2.2 °C	0 °C to +200 °C
R	Platinum–13 % Rhodium	Platinum	**RX**	Cu	CuNi		±5,0 °C	0 °C to +100 °C
S	Platinum–10 % Rhodium	Platinum	**SX**	Cu	CuNi		±5,0 °C	0 °C to +200 °C
B	Platinum–30 % Rhodium	Platinum –6 % Rhodium	**BX**	Cu	Cu		(+0.0 µV/+0 °C) (–33 µV/–4.2 °C)	0 °C to +200 °C

The identification system of ASTM does not differ between extension and compensating cables; all materials are marked “X”.

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