

Compensation & Extension Cables

Applications

■ General Information

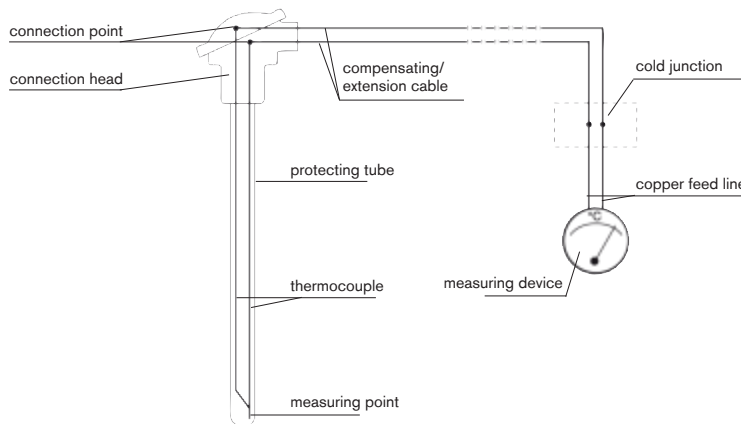
Temperature is an important factor in many areas concerning the environment, scientific research, and production. It is a thermo-dynamic variable that defines the heat content of a material. Material strength changes with alternating temperature. As a consequence, the characteristics of materials have to be examined at different temperatures. To obtain a temperature value, defined temperature parameters are used. Here the parameters can be defined, for example, as the freezing and boiling points of water.

For temperature measurement characteristics of materials have to be taken into account. These include such things as thermal expansion (expansion thermometer), the dependance of the electric resistance on metallic conductors (electrical thermometer) and electromotive force (thermocouple) etc. A temperature measuring device with a thermocouple as a data indicator tends to consist of the thermometer itself with a measuring point, an extension cable, a cold junction with a specified constant temperature and a voltmeter.

The value of the electromotive force (EMF) produced by the thermocouple is determined by the difference between the measuring temperature and the so-called free ends of the thermocouple which are mounted in the connection head. As the connection head is usually relatively close to the measuring point, it is frequently exposed to temperature fluctuations. For this reason, a connection cable with the same thermo-electric properties as the thermocouple is used between the thermocouple and the cold junction.

This link-up provides the compensating/extension cable.

■ Sketch



■ Materials

We differentiate between thermocouple cable and compensating cable. Cables made of original materials are called extension or thermocouple cables, whereas conductor materials made of substitutes are known as compensating cables.

■ Compensating cables

The compensating wires and strands are composed of alloys which do not have to be identical with the corresponding thermocouple. Substitute material means that the thermo-electric characteristics in the allowed temperature range (usually 0 up to +200°C) for the compensating cable must be the same as those of the corresponding thermocouple. They are identified with the letter "C" adapted to IEC 60584. The "C" appears behind the code letter identifying the thermocouple, for example "KC".

■ Extension cables

Extension cables are made of conductors with identical nominal structure to the corresponding thermocouple. They are identified with the letter "X" adapted to IEC 60584, which appears behind the code letter identifying the thermocouple, for example "JX". They are normally tested within a temperature range of 0 up to +200°C.

■ Thermocouple cables

Thermocouple cables consist of the same element material as the thermocouple and are tested for the same temperatures. These SAB special cables are manufactured on customer request. PVC, fiber-glass and SABtex insulated or jacketed compensating and extension cables are not suitable for outdoor use. Exception: PVC jacketed solid conductors can be used for underground laying.

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■ Electrical characteristics

Material	Specific electric resistance at 20°C $\mu \Omega \times \text{cm}$	Resistance in Ω/m	
		mm \varnothing 0.20	mm \varnothing 1.38
Cu Ni	49.0	15.60	0.328
So Ni	51.0	16.26	0.341
Ni Cr	72.0	22.90	0.481
Ni	27.0	8.59	0.180
So Pt	12.0	3.82	0.0802
E-Cu	1.7	0.54	0.011
Fe	12.0	3.82	0.080
BPX	12.5	3.98	0.084
Ni Cr Si	98.0	31.20	0.655
Ni Si	34.0	10.80	0.227
So Ni Si	52.0	16.55	0.347

■ Because the thermal electromotive force values are decisive, the indicated specific resistance and meter resistance figures can only be considered as approximate values, tolerances have to be agreed between producer and customer. Limit deviations within the thermoelectric voltage range can only be guaranteed for positive and negative conductors bought together from SAB BRÖCKSKES GmbH & Co. KG.

The standard DIN 43710 was withdrawn in April 1994, but we continue, also to manufacture compensating and extension cables color coded to DIN 43714.

■ SAB thermocouple code

for thermocouple	EMK at 100°C in mV	cable type	SAB thermocouple code	
			strands	single wire
Type T	4.28	TX	...58	...88
Type J	5.27	JX	...52	...82
Type K	4.10	KCA	...95	...15
Type K	4.10	KCB	...99	...19
Type K	4.10	KX	...54	...84
Type E	6.32	EX	...53	...83
Type R/S	0.65	R/SCB	...97	...17
Type N	2.77	NC	...91	...11

for thermocouple	EMK at 100°C in mV	cable type	SAB thermocouple code	
			strands	single wire
Type L	5.37	LX	...92	...12
Type K	4.10	KCA	...94	...14
Type R/S	0.65	R/SCB	...96	...16
Type U	4.25	UX	...98	...18
Type B	0.00	BC-100	...01	...21
Type B	0.033	BC-200	...02	...22

■ Example

Type A 12 D for thermocouple type J acc. to IEC 60584 = item no. 044512 **82**
Type A 9-4 LSY for thermocouple type L acc. to DIN 43713 = item no. 046204 **92**

■ Note

In addition to our standard compensating cables featured on the following pages, we also produce special cables on customer request and according to practically every recognized foreign standard.

For special compensating cables we would request the following information:

Stranded or solid conductor, no. of conductors, cross-section, element-type, conductor insulation and jacket material, shielding or armor requirements and the temperature range. Minimum order quantity for special cables is 500 m or 1000 m.

■ You will find further information about the safe application of cables in chapter O

Compensation & Extension Cables

Selection Table

		M/8		M/9		M/10		M/11		M/12		M/13		M/14		M/15		M/16		M/17		M/18		M/19	
		Cable Type A 1 L twisted A 1 L single	A 16 L	A 9 L A 9-100 L A 9-075 L A 9-050 L A 9-022 L	A 12 L	A 12 D	A 5 L A 5-075 L A 5-050 L A 5-022 L	A 20 L A 20-022 L	A 20 D	A 9-L	A 9-LSY	hybrid thermocouple cable JX	A 1 LB twisted	A 16 LB	A 15 L A 15-075 L A 15-050 L A 15-022 L	A 3 Ln	A 4 Ln	A 11- Lr A 11-4 Lr	A 11 Dr	A 13 L					
Basic construction	Compensating and extension cables for thermocouples	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	Extension cables for thermocouples FE-CuNi and NiCr-Ni						●																		
	Connection cables for resistance thermometers																								
	Fiber-glass braiding																	●	●	●					
	SABtex											●													
	Shielded						●						●												
	Steel wire armoring											●						●	●	●	●				
Temperature range fixed installation*	+400°C																								
	+300°C																								
	+250°C												●	●	●	●	●	●	●	●	●	●	●		
	+200°C												●	●	●	●	●	●	●	●	●	●	●		
	+180°C												●	●	●	●	●	●	●	●	●	●	●		
	+ 70°C	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	- 25°C	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	- 40°C	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	- 50°C																								
- 90°C																									
Standards and approvals	Halogen-free acc. to IEC 60754-1 + VDE 0482-754-1												●	●	●	●	●	●	●	●	●	●			
	Fire performance: flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
	Fire performance: no flame propagation acc. to IEC 60332-3-24 + VDE 0482-332-3-24 resp. IEC 60332-3-25 + VDE 0482-332-3-25 Cat. C resp. D																								
	Fire performance: acc. to DIN EN 60332-1-2 + IEC 60332-1-2																								
	Corrosiveness of conflagration gases: in compliance with IEC 60754-2 +VDE 0482-754-2 - no development of corrosive conflagration gases												●	●	●	●	●	●	●	●	●	●			
	Smoke density: low (low smoke emission)																								
Characteristics	Shape: round	●		●			●	●	●	●	●	●	●	●	●	●	●		●	●	●	●			
	Shape: oval		●		●	●							●			●	●	●				●			
	Conductor construction: strand	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
	Conductor construction: wire					●		●											●			●			
	Min. bending radius	7.5	7.5	7.5	7.5	12	7.5	7.5	12	7.5	12	12	7.5	7.5	7.5	10	12	10	12	10	12	10			
	Insulation resistance: > 1MΩ x km	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
	Very good chemical resistance																								

from short-time use
 to max.

*The temperature range for flexible application is mentioned on the corresponding catalog page

Compensation & Extension Cables

Selection Table

		Cable Type		M/20	M/20	M/21		M/22	M/22	M/23	M/23	M/24		M/24	M/25	M/25	M/26	M/26	M/27				M/27	M/27	M/28
				A 6 L A 6-022 L	A 6 D	A 15 LC A 15-075 LC A 15-050 LC A 15-022 LC		A 15-02	A 15-G 022	A 3 L	A 4 L	A 18 L A 18-022 L A 19 L A 19-022 L		Th LGS	Th LRS	Th LTS	Th LTV	RTD sensor cable				180 C flex 180 highflex 180 C highflex	180 TW 180 C TW	250 TW 250 C TW	TGV
Basic construction	Compensating and extension cables for thermocouples	●	●	●	●	●	●	●	●	●	●	●	●												
	Extension cables for thermocouples FE-CuNi and NiCr-Ni													●	●	●	●								
	Connection cables for resistance thermometers																			●		●	●	●	
	Fiber-glass braiding						●							●	●	●	●							●	
	SABtex									●	●														
	Shielded			●									●												
	Steel wire armoring										●				●	●	●	●						●	
Temperature range fixed installation*	+400°C									●	●					●									
	+300°C									●	●														
	+250°C	●	●	●	●	●	●	●	●	●	●				●			●						●	
	+200°C																								
	+180°C	●	●	●	●	●	●	●	●	●	●	●	●	●											
	+ 70°C	●	●	●	●	●	●	●	●	●	●	●	●	●											
	- 25°C	●	●	●	●	●	●	●	●	●	●	●	●	●											
	- 40°C	●	●	●	●	●	●	●	●	●	●	●	●	●											
	- 50°C																								
	- 90°C																								
Standards and approvals	Halogen-free acc. to IEC 60754-1 + VDE 0482-754-1	●	●	●	●	●	●	●	●	●	●				●	●									
	Fire performance: flame retardant and self-extinguishing acc. to IEC 60332-1-2 + VDE 0482-332-1-2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●						●	
	Fire performance: no flame propagation acc. to IEC 60332-3-24 + VDE 0482-332-3-24 resp. IEC 60332-3-25 + VDE 0482-332-3-25 Cat. C resp. D									●	●	●	●	●	●	●	●	●						●	
	Fire performance: acc. to DIN EN 60332-1-2 + IEC 60332-1-2																			●		●	●		
	Corrosiveness of conflagration gases: in compliance with IEC 60754-2 +VDE 0482-754-2 - no development of corrosive conflagration gases	●	●	●	●	●	●	●	●	●	●														
	Smoke density: low (low smoke emission)									●	●														
	Characteristics	Shape: round	●	●	●	●	●		●	●			●	●	●	●	●	●	●	●	●	●	●	●	●
Shape: oval										●	●														
Conductor construction: strand		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		●	●	●	
Conductor construction: wire			●																						
Min. bending radius		7.5	12	12	7.5	7.5	10	12	12	12	12	12	12	12	12	12	12	12		10		10	10	12	
Insulation resistance: > 1MΩ x km		●	●	●								●	●												
Very good chemical resistance												●	●												

 from
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*The temperature range for flexible application is mentioned on the corresponding catalog page