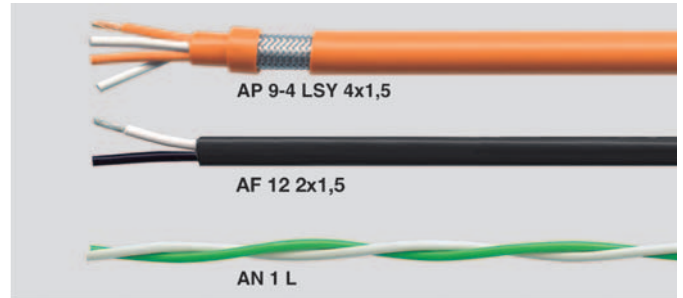
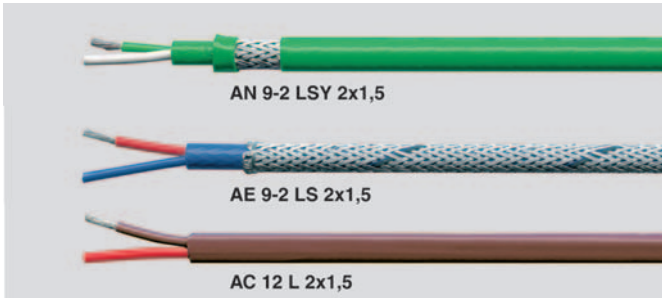


# COMPENSATING CABLES



## Technical data

- Special insulation of PVC, silicone, fluoropolymers, or glass fiber depending on the requirement

- **Conductor resistance** in accordance with DIN 43713

Fe:	0.080 ohm/m
CuNi:	0.327 ohm/m
NiCr:	0.07 ohm/m
Ni:	0.3 ohm/m
PtRh:	0.023 ohm/m
Pt:	0.041 ohm/m

- **Test voltages** for PVC, fluoropolymers and silicone-cables

core/core	500 V
core/screen	500 V
screen/screen	500 V

- **Test voltage** for glass-fiber lines

core/core	500 V
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- **Insulation resistance**

for PVC, silicone and fluoropolymers

min. 10 MOhm x km

- **Operating capacity**

(approx. value) – nF/km

	Stranded 1.5 mm <sup>2</sup>	Solid 1.5 mm <sup>2</sup>	Stranded 0.22 mm <sup>2</sup>
•PVC			
core	135	138	115
pair			
screened	240	245	180
•FEP			
core	60	60	45
pair			
screened	120	120	70
•Silicone			
core	80	70	45

- **Inductivity** (guide value)

for PVC, fluoropolymers and silicone versions < 1 mH/km

- **Corrosiveness of fire gases (halogen-free)**

• **Silicone + glass-fiber**  
test in accordance with VDE 0472 Part 813 and IEC 60754-1

• No development of corrosive gases

## Fire behavior

Self-extinguishing and flame-retardant in accordance with VDE 0482 322-1-2, DIN EN 60332-1-2/IEC 60332-1 (corresponds to DIN VDE 0472 Part 804 test type B)

## Structure

- Conductors made of special materials

- Conductor type: Fe-Cu Ni, SoNiCr-SoNi, SoPtRh-SoPt, Cu-CuNi

- Insulation of PVC, silicone, fluoropolymers or glass-fiber

- Core coding: Single color (see Color table)

- Coding of the pairs, starting at 2 pairs the individual pairs are marked with imprinted numbering

- Jacket material of PVC, silicone, fluoropolymers or glass-fiber braid

- Braided screen of galvanized steel wire (type SY) or Cu-braid (type CY)

## Measuring

For temperature measuring, the temperature-dependent characteristics of materials are taken into consideration, for example, the expansion thermometers or thermocouples, etc. Temperature measuring devices with a thermocouple as transducer usually consist of thermocouple, the connecting line from the connection point to the reference junction, a reference junction with a known temperature and a voltage measuring device.

The connecting line between the thermocouple and the reference junction must have the same thermo-electric properties as the thermocouple itself. The temperature differential is measured between the measuring point and the reference junction. Tolerance of the meter resistances  $\pm 10\%$ .

## Hazardous areas

The compensating cables for thermocouples with plastic insulation can be imprinted with longitudinal colored stripes depending on the type of the thermocouple, as follows:  
Cu/Cu-Ni = brown, Fe/Cu-Ni = dark blue, NiCr/Ni = green, Pt-Rh/Pt = white  
In the case of compensating cables for thermocouples with mineral insulation or with metal braiding, for color coding of the intrinsically safe property, a light blue band of sufficient width must also be woven in.

## Use

For instrumentation and control technology, compensating cables (also referred to as compensation cables) are required for precise temperature measurements. They are used as a thermo-electric extension from the thermocouple to the measurement device.

The compensating cable consists of a positive core and a negative core, that generate the same thermo-electric voltage at connector head temperatures up to +200°C, as the thermocouple in accordance with DIN 43710.

## Materials

(Compensating wires and strands) There is a distinction between original materials and substitutes.

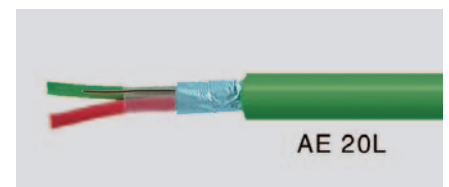
- Compensating wires and strands of **original materials** are made of the same material as the associated thermocouple and they are referred to as thermocable or thermocouple cable.
- Compensating wires and strands of **substitute materials** that consist of alloys and which are not identical to the associated thermocouple are called compensating cables.
  - **Substitute materials** are used for the Type K and Type N thermocouples
  - **Precious metal thermocouples** Type R, Type S, Type B consist of thermal materials.

## Thermocouple cables

Thermocouple cables are made of the same element material as the thermocouple and are tested to the same temperatures. We offer thermocouple cables on customer request only.

## Note

Thermal materials consist of very expensive materials while the substitutes are significantly cheaper.



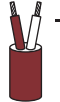


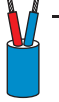
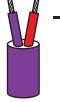
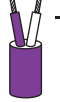
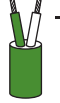
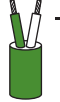
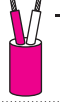

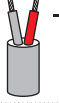


# ■ COLOR CODING AND TEMPERATURE RANGES FOR THERMAL CABLES & COMPENSATING CABLES

Code letter of the thermocouple	Material combination			
	NFC 42-324	BS 4937		
	+	-	Identification	
	(plus)	(minus)	THL	AGL
<b>T</b>	<b>Cu</b>	<b>Cu Ni</b>	<b>TX</b> -25°C to +100°C	<b>TC</b> -25°C to +100°C
<b>U</b>	<b>Cu</b>	<b>Cu Ni</b>		
<b>J</b>	<b>Fe</b>	<b>Cu Ni</b>	<b>JX</b> -25°C to +200°C	<b>JC</b> -25°C to +250°C
<b>L</b>	<b>Fe</b>	<b>Cu Ni</b>		
<b>E</b>	<b>Ni Cr</b>	<b>Cu Ni</b>	<b>EX</b> -25°C to +200°C	<b>EC</b> -25°C to +250°C
	<b>Ni Cr</b>	<b>Ni</b>	<b>KX</b> -25°C to +200°C	<b>KC</b> -25°C to +200°C
<b>K</b>	<b>Ni Cr</b>	<b>Ni</b>		<b>WC</b> 0°C to +100°C
	<b>Ni Cr</b>	<b>Ni</b>		<b>VC</b> 0°C to +100°C
<b>N</b>	<b>Ni Cr Si</b>	<b>Ni Si</b>		<b>VX</b> 0°C to +100°C
<b>R</b>	<b>PtRh 13</b>	<b>Pt</b>		<b>SC</b> 0°C to +200°C
<b>S</b>	<b>PtRh 10</b>	<b>Pt</b>		<b>SX</b> 0°C to +200°C
<b>B</b>	<b>PtRh 30</b>	<b>PtRh 6</b>		<b>BC</b> 0°C to +100°C

The highest application temperature of the insulating materials or the application temperature range of the conductor material limits the application temperature range of the cable. The lower value is valid.

As a rule, intrinsically safe cables have a blue jacket color and an identification stripe assigned to the element.

 ANSI MC 96.1		 DIN IEC 584		 DIN 43710*	
Identification		Identification		Identification	
THL	AGL	THL	AGL	THL	AGL
<b>TX</b> 0°C to +100°C 		<b>TX</b> -25°C to +100°C 			<b>UX**</b> 0°C to +200°C 
<b>JX</b> 0°C to +200°C 		<b>JX**</b> -25°C to +200°C 			<b>LX**</b> 0°C to +200°C 
<b>EX</b> 0°C to +200°C 		<b>EX</b> -25°C to +200°C 			
<b>KX</b> 0°C to +200°C 		<b>KX</b> -25°C to +200°C 			
				<b>KCA**</b> 0°C to +150°C 	
				<b>KCB</b> 0°C to +100°C 	
		<b>NX</b> -25°C to +200°C 		<b>NC</b> 0°C to +150°C 	
				<b>RCA/SCA</b> 0°C to +100°C <b>RCB/SCB**</b> 0°C to +200°C 	
 <b>SX</b> 0°C to +200°C					
 <b>BX</b> 0°C to +100°C		(According to DIN 43710/85)		 <b>BC</b> 0°C to +100°C	

**THL = Thermocouple wire**  
**AGL = Compensating cable**

Example: KCA Compensating cable KCA (plus) ≙ positive core for AGL KC  
KCA (minus) ≙ negative core for AGL KC

\*) DIN 43710 was withdrawn in April 1994. Thus the element types "U" and "L" are no longer standardized.

\*\* standard type

# ■ COMPENSATING CABLES

## Materials for compensating cables

Standards	Element type			Material of the compensating cable		
	Type	Plus pole (+)	Minus pole (-)	Code	Plus pole (+)	Minus pole (-)
DIN 43710	U	Cu	CuNi	UX	Cu	CuNi
	L	Fe	CuNi	LX	Fe	CuNi
DIN IEC 584	T	Cu	CuNi	TX	Cu	CuNi
	E	NiCr	CuNi	EX	NiCr	CuNi
	J	Fe	CuNi	JX	Fe	CuNi
	K	NiCr	Ni	KX	NiCr	Ni
	K	NiCr	Ni	KC 1	Fe	CuNi
	K	NiCr	Ni	KC 2	Cu	CuNi
	R/S	Pt 13/10 Rh	Pt	RC A/SC A	Cu	CuNi
R/S	Pt 13/10 Rh	Pt	RC B/SC B	Cu	CuNi	
NF	T	Cu	CuNi	TX	Cu	CuNi
	E	NiCr	CuNi	EX	NiCr	CuNi
	J	Fe	CuNi	JX	Fe	CuNi
	K	NiCr	Ni	KX	NiCr	Ni
	K	NiCr	Ni	VC	Cu	CuNi
	K	NiCr	Ni	WC	Fe	CuNi
	R/S	Pt 13/10 Rh	Pt	RC/SC	Cu	CuNi
B	Pt 30 Rh	Pt 6 Rh	BC	Cu-ALY	Cu	
ANSI	T	Cu	CuNi	TX	Cu	CuNi
	E	NiCr	CuNi	EX	NiCr	CuNi
	J	Fe	CuNi	JX	Fe	CuNi
	K	NiCr	Ni	KX	NiCr	Ni
	R/S	Pt 13/10 Rh	Pt	RX/SX	Cu	CuNi
	B	Pt 30 Rh	Pt 6 Rh	BX	Cu	Cu

## Properties of the wires for thermocouples and compensating cables

Materials	Main components approx. %				Density at 20°C	Spec. resistance at 20°C	Resistance value (guide value) in ohm/m	
	Cu	Ni	Mn	Other	$\frac{g}{cm^3}$	$\mu ohm \cdot cm$	mm $\varnothing$ 0.20	mm $\varnothing$ 1.38
CuNi	55	44	1	-	8.85	49	15.60	0.328
SoNi	51	45	2	Fe2	8.85	51	16.26	0.341
NiCr	-	Rest	-	Cr 10	8.7	72	22.90	0.481
Ni	-	95	MnAlSi	5	8.55	27	8.59	0.180
SoPt	95	3	2	-	8.9	12	3.82	0.0802
ECu	In accordance with DIN 46 431				8.9	1.7	0.54	0.011
Fe	-	-	-	-	7.85	12	3.82	0.08
BPX	97	-	3	-	8.9	12.5	3.98	0.084