



Tianjin ZINACA Intelligent Equipment Co., Ltd

ZNC - Armored Thermocouple User Manual

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Product Overview

Armored thermocouples feature high flexibility, high pressure resistance, fast thermal response, and robust durability. Like industrial assembly-type thermocouples, they serve as temperature sensors and are typically used with display instruments, recording instruments, and control instruments. They can also function as the sensing element for assembly-type thermocouples. These thermocouples can directly measure the temperature of liquids, steam, gases, and solid surfaces in various production processes within a range of **-40 to 1200°C**. Their flexible structural design makes them suitable for temperature measurement in confined spaces.

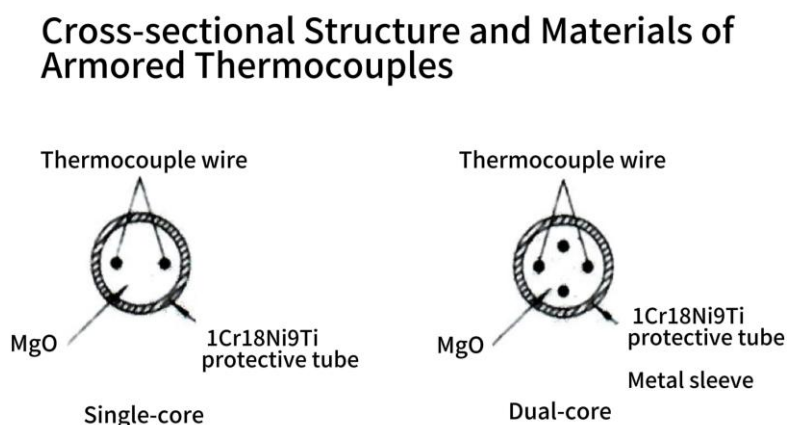
Working Principle

The working principle of armored thermocouples is the same as that of assembly-type thermocouples. Please refer to the previous section for details.

Basic Structure

The structure of an armored thermocouple consists of conductors, magnesium oxide insulation, and protective tubes made of stainless steel grades such as **1Cr18Ni9Ti**, which are manufactured through multiple drawing processes. It mainly includes a junction box, terminal connections, and the armored thermocouple itself, along with various mounting and fixing accessories.

Cross-sectional Structure and Materials of Armored Thermocouples



Measuring Tip (Hot Junction) Structure





Main Technical Specifications:

Protective Tube Material, Outer Diameter, and Maximum Operating Temperature

Product Name	Code	Thermocouple Type	Protective Tube Material	Diameter (mm)	Max Operating Temp (°C) – Long Term	Max Operating Temp (°C) – Short Term
Armored Ni-Cr/Ni-Si Thermocouple Cable	KK	K	0Cr18Ni9Ti	0.25	250	300
				0.5, 1.0	400	600
				1.5, 2.0	600	700
				3.0, 4.0, 4.5, 5.0, 6.0, 8.0	800	900
			0Cr25Ni20	0.25	300	350
				0.5, 1.0	500	600
				1.5, 2.0, 3.0	800	900
				4.0, 4.5, 5.0	900	1000
				6.0, 8.0	1000	1100
			GH3030 or Inconel 600	0.25	300	350
				0.5, 1.0	500	600
				1.5, 2.0, 3.0	800	900
				4.0, 4.5, 5.0	900	1000
				6.0, 8.0	1000	1100
Armored Ni-Cr-Si/Ni-Si-Mg Thermocouple Cable	KN	N	0Cr18Ni9Ti	0.25	250	300
			GH3030 or Inconel 600	0.5, 1.0	500	600
				1.5, 2.0, 3.0	800	900
				4.0, 4.5, 5.0	900	1000
				6.0, 8.0	1000	1100
Armored Ni-Cr/Cu-Ni Thermocouple Cable	KE	E	0Cr18Ni9Ti	0.5, 1.0	400	500
				1.5, 2.0	500	600
				3.0, 4.0, 4.5	600	700



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				5.0, 6.0, 8.0	700	800
Armored Fe/Cu-Ni Thermocouple Cable	KJ	J	0Cr18Ni9 Ti	0.5, 1.0	300	400
				1.5, 2.0	400	500
				3.0, 4.0, 4.5	500	600
				5.0, 6.0, 8.0	600	750
Armored Cu/Cu-Ni Thermocouple Cable	KT	T	0Cr18Ni9 Ti	0.5, 1.0	200	250
				1.5, 2.0, 3.0, 4.0, 4.5	250	300
				5.0, 6.0, 8.0	300	400
Armored Pt-Rh10/Pt Thermocouple Cable	KS	S	GH3039	2.0, 3.0, 4.0, 4.5	1000	1100
				5.0, 6.0, 8.0	1100	1200
Armored Pt-Rh13/Pt Thermocouple Cable	KR	R	GH3039	2.0, 3.0, 4.0, 4.5	1000	1100
				5.0, 6.0, 8.0	1100	1200
Armored Pt-Rh30/Pt-Rh6 Thermocouple Cable	KB	B	GH3039, Rh6	2.0, 3.0, 4.0, 4.5, 5.0, 6.0, 8.0	1200	1300
				4.0, 4.5, 5.0, 6.0, 8.0	1300	1400

Note:

The operating temperature depends on the protective tube diameter and material, the state of the medium, and the thermocouple structure. The values above are for **recommended use only**.

**Thermocouple Tolerance Classes**

Thermocouple Type	Tolerance Value a ($\pm^{\circ}\text{C}$) and Applicable Temperature Range	Class 1	Class 2	Class 3
T-type		0.5 or $0.004 \times$	t	
	Temperature Range	$-40^{\circ}\text{C} \sim 350^{\circ}\text{C}$	$-40^{\circ}\text{C} \sim 350^{\circ}\text{C}$	$-200^{\circ}\text{C} \sim 40^{\circ}\text{C}$
E-type		1.5 or $0.004 \times$	t	
	Temperature Range	$-40^{\circ}\text{C} \sim 800^{\circ}\text{C}$	$-40^{\circ}\text{C} \sim 900^{\circ}\text{C}$	$-200^{\circ}\text{C} \sim 40^{\circ}\text{C}$
J-type		-	-	-
	Temperature Range	$-40^{\circ}\text{C} \sim 750^{\circ}\text{C}$	$-40^{\circ}\text{C} \sim 750^{\circ}\text{C}$	-
K-type		-	-	-
	Temperature Range	$-40^{\circ}\text{C} \sim 1000^{\circ}\text{C}$	$-40^{\circ}\text{C} \sim 1200^{\circ}\text{C}$	$-200^{\circ}\text{C} \sim 40^{\circ}\text{C}$
N-type		-	-	-
	Temperature Range	$-40^{\circ}\text{C} \sim 1000^{\circ}\text{C}$	$-40^{\circ}\text{C} \sim 1200^{\circ}\text{C}$	$-200^{\circ}\text{C} \sim 40^{\circ}\text{C}$
R or S-type	$t < 1100^{\circ}\text{C}$: 1; $t > 1100^{\circ}\text{C}$: $[1 + 0.003 \times (t - 1100)]$	1.5 or $0.0025 \times$	t	
	Temperature Range	$0^{\circ}\text{C} \sim 1600^{\circ}\text{C}$	$0^{\circ}\text{C} \sim 1600^{\circ}\text{C}$	-
B-type		-	$600^{\circ}\text{C} \sim 1700^{\circ}\text{C}$	$600^{\circ}\text{C} \sim 1700^{\circ}\text{C}$

Notes:

1. Tolerance values can be expressed as a deviation in $^{\circ}\text{C}$ or as a function of the temperature in the table (ITS-90 $^{\circ}\text{C}$), whichever is larger.
2. Base metal thermocouple wires usually meet the manufacturing tolerances for temperatures above -40°C as shown in the table. However, E-type, K-type, and N-type thermocouples may not meet Class 3 tolerances at low temperatures. If a thermocouple is required to comply with Class 1 and/or Class 2 **and** also Class 3, this must be explicitly stated when ordering, as wire selection is needed.
3. For T-type thermocouples, a single wire material cannot simultaneously meet both Class 2 and Class 3 tolerances over the entire applicable temperature range. In such cases, it is necessary to reduce the effective temperature range.



Response Time of Sheathed Thermocouple

Sheath Diameter (mm)	Response Time (s)	Junction Type	Insulated Type
φ1.0	0.5	≤0.3	≤0.4
φ2.0	0.5	≤0.4	≤0.5
φ3.0	0.5	≤0.6	≤1.2
φ4.0	0.5	≤0.8	≤2.5
φ5.0	0.5	≤1.2	≤4.0
φ6.0	0.5	≤2.0	≤6.0
φ8.0	0.5	≤4.0	≤8.0

Notes:

- “Junction Type” refers to a thermocouple with a bare or exposed junction.
- “Insulated Type” refers to a thermocouple with an insulated junction.
- Response time is measured in seconds (0.5 s typical).