

# WR□系列工业热电偶

WR □ series of industrial thermocouple

## 安 装 使 用 说 明 书

Installation Manual

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## 一、概述

WR□系列工业热电偶是温度传感器之一，与显示仪表配套，可在相应的温度范围内实现温度检测和控制，广泛应用于航空、石油、冶金、机械、电力、轻工、化工等工业部门和科技领域。

## 二、工业热电偶的选择

- 1、 选用热电偶分度号必须与显示仪表分度号一致。
- 2、 使用热电偶时必须选用与其热电特性相一致的补偿导线。
- 3、 金属保护管不适用于有强烈氧化气氛中使用，高铝质、刚玉质保护管不宜在含有水气和还原气氛中使用。

## 三、工作原理

热电偶的工作原理，是基于 Seebeck(塞贝克)效应，即：如果两种不同成分的均质导体（热电极）组成闭合回路，当两端存在温度梯度时。回路中就有电流通过，那么两端之间就存在 Seebeck 电势—热电势。

注：热电偶的热电动势随温度的升高而增大，其热电势的大小与热电偶的材料和热电偶两端的温度有关，而与热电极的长度、直径无关。

## 四、工业热电偶的基本性能

### 1、 WR□系列工业热电偶的热电极允差（参比端为 0℃）

品种	型号	分度号	允差差级		
			I	II	III
			允差值(±)	允差值(±)	允差值(±)
镍铬—镍硅	WRN	K	1.5℃或 0.4% (t)	2.5℃或 0.75% (t)	2.5℃或 1.5% (t)
镍铬硅—镍硅	WRM	N			—
镍铬—铜镍(康铜)	WRE	E			—
铁—铜镍(康铜)	WRF	J	0.5℃或 0.4% (t)	1.℃或 0.75% (t)	1℃或 1.5% (t)
铜—铜镍(康铜)	WRC	T			—
铂铑 10—铂	WRP	S	1.5℃或 1+(t—1100) *0. 003℃	1.5℃或 0.25% (t)	—
铂铑 13—铂	WRQ	R			—
铂铑 30—铂铑 6	WRR	B	—	—	4℃或 0.5% (t)

注：为被测温度的绝对值℃

## 2、 测量范围

分度号 精度等级 保护管材质		K、N			E		J	T		S、R		B				
		I	II	III	I、II	III	I、II	I、II	III	I	II	II、III				
碳刚 20#		-40~500℃		—	-40~600 ℃	—	-40~600 ℃	-40~350 ℃	—	—		—				
不 锈 钢	Cr25Ti	-40~900℃		—					-200~40 ℃				—	—	—	-200~40 ℃
	1Cr18Ni9Ti	-40~800℃		—												
非 金 属	高铝质	0-1100 ℃	0-1300 ℃	—	—	—	—	—	—	0-1100 ℃	0-1300 ℃	—				
	刚玉质	—		—	—	—	—	—	—	—	—	600-1600 ℃				
锥管形 1Cr18Ni9Ti(最高 使用压力 14.7Mpa		-40~600℃		—	-40~500 ℃	—	—	—	—	—	—	—				

注：K、N、E、T 分度号的热电偶 II、II 级允差只能满足-40℃以上的温度范围，若用户要求延伸到-40℃以上的温度范围，满足 III 级允差，则由供需双方另行协议。

## 3、 WR□系列工业热电偶的绝缘电阻

### (1) 常温绝缘电阻：

A、 对于长度超过 1m 的热电偶，它的常温绝缘电阻值与其长度的乘积应不小于 100MΩ.m。

B、 对于长度等于或不足 1m 的热电偶，它的常温绝缘电阻值应不小于 100MΩ.m。

注:试验电压 500±50V.dc

### (2) 上限温度绝缘电阻

热电偶的上限温度绝缘电阻应不小于下表中规定：

上限温度 $t_m$ ℃	电阻值 MΩ
$100 \leq t_m < 300$	10
$300 \leq t_m < 500$	2
$500 \leq t_m < 850$	0.5
$850 \leq t_m < 1000$	0.08
$1000 \leq t_m < 1300$	0.02

$t_m \geq 1300$	0.02
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注：试验电压为  $10 \pm 1 \text{ V.d.c}$

### WR□系列工业热电偶的热响应时间

保护管直径 (d)	保护管材质	热响应时间 (秒)
$\phi 16$	非金属	$\leq 240$
	金属	$\leq 180$
$\phi 20$	金属	$\leq 240$
$\phi 25$	非金属	$\leq 300$
锥形保护管	金属	$\leq 300$

## 五、 安装

- 1、 热电偶的安装地点，应避免装在炉门旁边或与加热物体距离过近及具有强磁场之外，热电偶的接线盒不可碰到被测介质的容器壁。热电偶参比端（接线盒外）的温度一般不超过  $100^\circ\text{C}$ ，并尽量保持其稳定不变。
- 2、 热电偶的插入深度可按实际需要决定，但浸入被测介质中的长度，一般最少应不小于热电偶保护套管外径的 8~10 倍。
- 3、 热电偶的接线

热电偶在接线时，应先打开接线盒盖。

补偿导线从出线孔的橡胶塞内引出，并拧紧穿线螺栓，注意补偿导线的极形不可接反。

为保护补偿导线不受外来机械损伤和由于外磁场而造成对电子显示仪表的影响，需要时补偿导线应加以屏蔽，并且注意补偿导线不得有曲折迂回等情况。

## 六、 使用中可能发生的故障及其修理。

序号	故障	可能原因	修理方法
1	热电势比实际应有的小（仪表指示偏低）。	1. 热电偶内部电极漏电（短路）。 2. 热电偶接线盒内接线柱短路。 3. 热电偶偶系变质或工作端损坏	1. 将热电极取出，检查漏电原因，若是因潮湿引起，应将热电极烘干，若是绝缘管绝缘不良，则应更换。 2. 打开接线盒清洁接线柱清除造成短路的原因。 3. 把变质部分剪去，重新焊接测量端或重新更换新的热电极。
2	指示仪表无指示	热电偶断路	1. 将感温元件取出，若是测量断路，重新焊接。

			2.若因变质断路，则剪去变质部分，重新焊接测量端或重新更换新的感温元件。
3	仪表指示值不稳定（仪表本身无故障的情况下）	1.接线盒内感温元件和补偿导线接触不良。 2.热电极有断续短路和断接地现象。 3.热电偶安装不牢而发生振动。	1.打开接线盒，重新换好并紧固。 2.取出感温元件，找出断续短路或接地的部分，并加以排除。 3.将热电偶牢固安装。

## 七、 补充说明

- 1、 产品验收。收到本产品后，请及时按产品国家标准或我厂标准规定的出厂检验项目验收。若有质量问题，请于收货之日起一个月内（以用户来函邮戳日期为准）函告我厂，我厂将及时受理。逾期则视为已验收合格。
- 2、 关于热电势和热电阻测试问题。热电势是微电压测试，加上外界影响，温度偏差控制诸多因素， $\mu V$  级测试准确十分困难，加之热电偶固有热电势受温度、机械振动等多种条件影响很难做到固定不变。请各位用户在验收时注意几个问题：（1）采用相应等级标准监测温度（2）标准偶与被测偶的测量端必须在同一等温区（3）保证足够的浸入深度（4）避免因绝缘体或保护管污染和漏电造成测试误差（5）测试时必须温度稳定（6）标准偶与被测偶参比端置于同一冰点（7）连接相同等级的补偿导线。

## I. Overview

WR □ series of industrial temperature sensor is one of the thermocouple, and display instruments supporting, in the corresponding temperature range of temperature detection and control, widely used in aviation, oil, metallurgical, mechanical, electrical, light industry, chemical industry Sectors and technology areas.

## II. the choice of industrial thermocouple

- 1, selected points of the thermocouple, and must show the degree of the same instrument.
- 2, the use of thermocouple to be selected in line with its thermal characteristics of the compensation wire.
- 3, metal tube does not apply to the protection of a strong atmosphere of the use of high aluminium, alumina quality of protection should not contain water vapor in the atmosphere and reducing the use of.

## III. Principle

Thermocouple the working principle is based on Seebeck (Seebeck) effect, that is: If two different components of heterogeneous conductor (hot electrode) of closed-loop, when the temperature gradient at the two ends there. Out through the loop current, then there exists between the two ends of Seebeck potential - thermoelectric potential.

Note: the thermal emf thermocouple with increasing temperature increases, its size and potential of thermoelectric materials and TC thermocouple ends of the temperature, and the hot electrode and the length, diameter has nothing to do.

#### IV. the basic performance of the industrial thermocouple

##### 1, WR □ series of industrial thermocouple hot electrode Tolerance (for reference-0 °C)

Variety	Model	Indexing	Tolerance poor grade		
			I	II	III
			Tolerance value (±)	Tolerance value (±)	Tolerance value (±)
Ni-Cr - nickel-silicon	WRN	K	1.5°C or 0.4% (t)	2.5°C or 0.75% (t)	2.5°C or 1.5% (t)
Ni-Cr silicon - Silicon Nickel	WRM	N			
Ni-Cr - copper-nickel (Kang Tong)	WRE	E			
Rail - copper-nickel (Kang Tong)	WRF	J			—
Copper - copper-nickel (Kang Tong)	WRC	T	0.5°C or 0.4% (t)	1°C or 0.75% (t)	1°C or 1.5% (t)
Platinum and rhodium 10 - Platinum	WRP	S	1.5°C or 1+ (t—1100) *0.003°C	1.5°C or 0.25% (t)	—
Platinum and rhodium 13 - Platinum	WRQ	R			
Platinum and rhodium 30 - platinum and rhodium 6	WRR	B	—	—	4°C or 0.5% (t)

Note: The temperature measured as the absolute value °C

##### 2, measuring range

Indexing Accuracy class Protection of the material		K, N			E		J	T		S, R		B
		I	II	III	I, II	III	I, II	I, II	III	I	II	II, III
Carbon just 20 #		-40~500°C		—	-40~600°C	—	-40~600°C	-40~350°C	—	—	—	—
Stainless steel	Cr25Ti	-40~900°C		—								
	1Cr18Ni9Ti	-40~800°C		-200~40°C								
Non-metallic	High aluminium	0-1100°C	0-1300°C	—	—	—	—	—	—	0-1100°C	0-1300°C	—
	Corun	—		—	—	—	—	—	—	—	—	600-1

	dum qualit y										600℃
Cone-shaped tube 1 Cr18Ni9Ti (maximum pressure on the use of 14.7 Mpa)		-40~600℃	—	-40~5 00℃	—	—	—	—	—	—	—

Note: K, N, E, T points of the thermocouple, II, II-Tolerance can only meet -40 °C over the temperature range, if the user requirements extend to -40 °C over the temperature range to meet the Category III yun Poor, by both supply and demand of a separate agreement.

### 3, WR □ series of industrial insulation resistance thermocouple

(1) at room temperature insulation resistance:

A, for a length of more than 1 m of the thermocouple, it's normal temperature insulation resistance value of the product and its length should be not less than 100 M Ω. M.

B, the length equal to or less than 1 m of the thermocouple, it's normal temperature insulation resistance value should be not less than 100 M Ω. M.

Note: The test voltage  $500 \pm 50V.dc$

(2) maximum temperature insulation resistance

Thermocouple temperature of the ceiling insulation resistance should be not less than provided for in the following table:

Maximum temperature $t_m$ °C	Value M Ω
$100 \leq t_m < 300$	10
$300 \leq t_m < 500$	2
$500 \leq t_m < 850$	0.5
$850 \leq t_m < 1000$	0.08
$1000 \leq t_m < 1300$	0.02

$t_m \geq 1300$	0.02
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**Note: The voltage of  $10 \pm 1$  V.dc**

**WR □ industrial thermocouple series of thermal response time**

Protection of the diameter (d)	Protection of the material	Heat response time (seconds)
$\phi 16$	Non-metallic	$\leq 240$
	Metal	$\leq 180$
$\phi 20$	Metal	$\leq 240$
$\phi 25$	Non-metallic	$\leq 300$
Cone of protection	Metal	$\leq 300$

## V. the installation

**1, the thermocouple locations, should be avoided next to or installed in the Furnace Door and heating objects from the past and with strong magnetic field, the thermocouple junction box can not be met tested medium containers wall.**

**TC-reference (cable box) the temperature of not more than  $100\text{ }^\circ\text{C}$ , and to maintain its stability unchanged.**

**2, TC depth can be inserted into the practical needs of decision, but the immersion medium measured in length, the general should at least not less than thermocouple protection of foreign economic relations of the casing 8 to 10 times.**

**3, the wiring thermocouple**

**Thermocouple in the line, should you open the lid wiring.**

**Compensation wires from the Chuxian hole in the rubber Cypriot extraction, and tighten threading bolts, wire compensation for the attention of the very shape to an anti-**

**Compensation for the protection of wire and without external mechanical damage due to external magnetic field caused by the impact of electronic display instrument, and when necessary compensation should be shielded wires, and pay attention to compensation wire may be twists and turns to return, and so on.**

**VI. may occur in the use of the fault and repair.**

No.	Fault	May be due to	Repair Methods
1	Thermoelectric potential than actual should be small (meter low instructions).	<ol style="list-style-type: none"> <li>1. Thermocouple internal electrode leakage (short circuit).</li> <li>2. Thermocouple cable box Posts short-circuit.</li> <li>3. Thermocouple of eradicating corruption or even damage the work .-</li> </ol>	<ol style="list-style-type: none"> <li>1. Thermoelectric board will be removed to check leakage of reasons, if caused by moisture, heat electrodes should be drying, if the insulation bad insulation should be replaced.</li> <li>2. Posts open the junction box clean the reasons for the removal of short-circuit.</li> <li>3. The degeneration of the cut, re-welding measure to replace or re-new hot electrode.</li> </ol>
2	No direct instructions Instruments	Thermocouple circuit	<ol style="list-style-type: none"> <li>1. Temperature components will be removed, if measured opening and re-welding.</li> <li>2. If degenerate opening, then cut degeneration of the re-welded or re-measuring the temperature of new components.</li> </ol>
3	Instrument instructions of instability (no fault of their own instrument cases)	<ol style="list-style-type: none"> <li>1. Temperature inside wiring components and compensation wire connection is bad.</li> <li>2. Thermal electrodes are intermittent short circuit and ground breaking phenomenon.</li> <li>3. Thermocouple installation of a solid foundation and vibration.</li> </ol>	<ol style="list-style-type: none"> <li>1. Open the junction box, for good and re-tighten.</li> <li>2. Retrieve temperature components, to identify intermittent short circuit or grounding of the section and be excluded.</li> <li>3. Thermocouple will be firmly installed.</li> </ol>

## **VII. added**

**1, product acceptance. After receiving this product, please promptly by national standards or products in our factory standards for factory acceptance test items. If it has quality problems, from the date of the receipt within one month (postmark date of the communication users), I set out plants, I plant will promptly accepted. Late acceptance is deemed to have qualified.**

**2, on the thermoelectric heat resistance testing and potential problems. Potential is a thermoelectric-voltage test, coupled with outside influence, control the temperature deviations many factors,  $\mu$  V-accurate test is very difficult, plus the inherent thermoelectric potential thermocouple temperature, vibration, and other conditions affecting difficult to achieve fixed. Members user acceptance attention when several questions: (1) used to monitor temperature corresponding grades (2) with the dual standards of measurement-even measured in the same, and so must the temperature (3) ensure sufficient depth immersion (4) avoid Insulator, or the protection of the pollution caused by leakage test and error (5) tests the temperature must be stable (6) and measured dual standard dual-placed in the Senate than the same freezing point (7) the same level of compensation for connecting wires.**