

装配式热电偶 Assembly Thermocouple



工业用装配式热电偶作为测量温度的传感器，通常和显示仪表、记录仪表、调节器、PLC和DCS系统配套使用。它可以直接测量各种生产过程中从0℃~1800℃范围内的液体、蒸汽和气体介质以及固体的表面温度。

我公司严格根据国家规定，生产符合IEC国际标准分度号的铂铑30—铂铑6、铂铑10—铂、镍铬—镍硅、镍铬硅—镍硅镁、镍铬—铜镍、铜—铜镍、铁—铜镍等形式热电偶，符合JB/T9238—1999标准。

As a sensor for measuring temperature, industrial assembly thermocouple are usually compatible with display instrument, recording instrument, actuator, PLC and DCS system. It can be used to measure the surface temperature of liquid, steam and gas mediums and solid from 0℃-1800℃ during industrial production.

The thermocouples, such as Rhodium Platinum30-Rhodium Platinum6, Rhodium Platinum10-Platinum, Nickel-chromium-nisiloy, Nickel-Chromium-Silicon-Nickel-Chromium-Magnesium, Nickel-Chromium-Cupronickel, Ferrum-cupronickel and Cuprum-cupronickel, produced by our company based on the national stipulation are in accordance with the IEC International Standard Graduation Mark and JB/T9238-1999 Standard.

热电偶测温原理 Temperature measurement principle of the thermocouple

热电偶是通过测量其热电势来实现测温的，其两热电极是由两种成份不同的均质导体一端相互连接构成的感温元件。在由两种导体组成的闭合回路中，如果两端点的温度不同，则回路中就会产生一定大小的热电势。其热电势的大小只与导体材料的性质以及两端点的温差有关，同导体的截面积和长度无关。

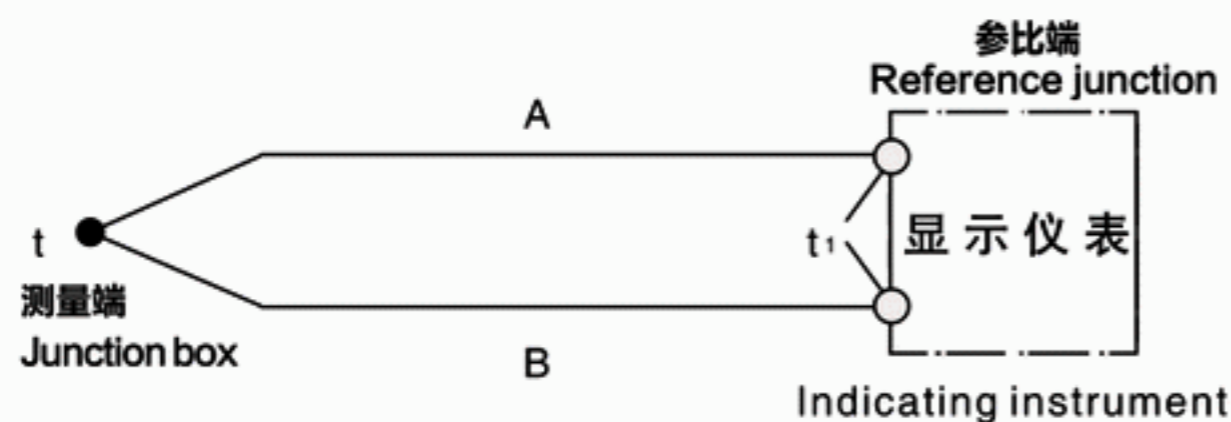
如下图，选用两种不同的金属或合金丝A、B称为热电极，焊接的一端称为测量端，连接显示仪表的一端称为参比端，当测量端和参比端温度不同时，就会产生热电势 $E_{AB}(t, t_1)$ 。当 $t_1 = 0^\circ\text{C}$ 时则有：

$$E_{AB}(t,0) = E_{AB}(t) = f(t)$$

The temperature measuring for thermocouple is achieved through measuring its thermoelectrical potential. Its two thermodes are temperature sensing elements made of equivalent conductors with two different compositions and one connected ends. In the closed loop made of two kinds of conductors, if different temperature arises on the two endpoints, then a certain thermoelectrical potential will be created. The thermoelectrical potential intensity is not related to the sectional area and length of copper conductor but the properties of conductor materials and the temperature of their two endpoints.

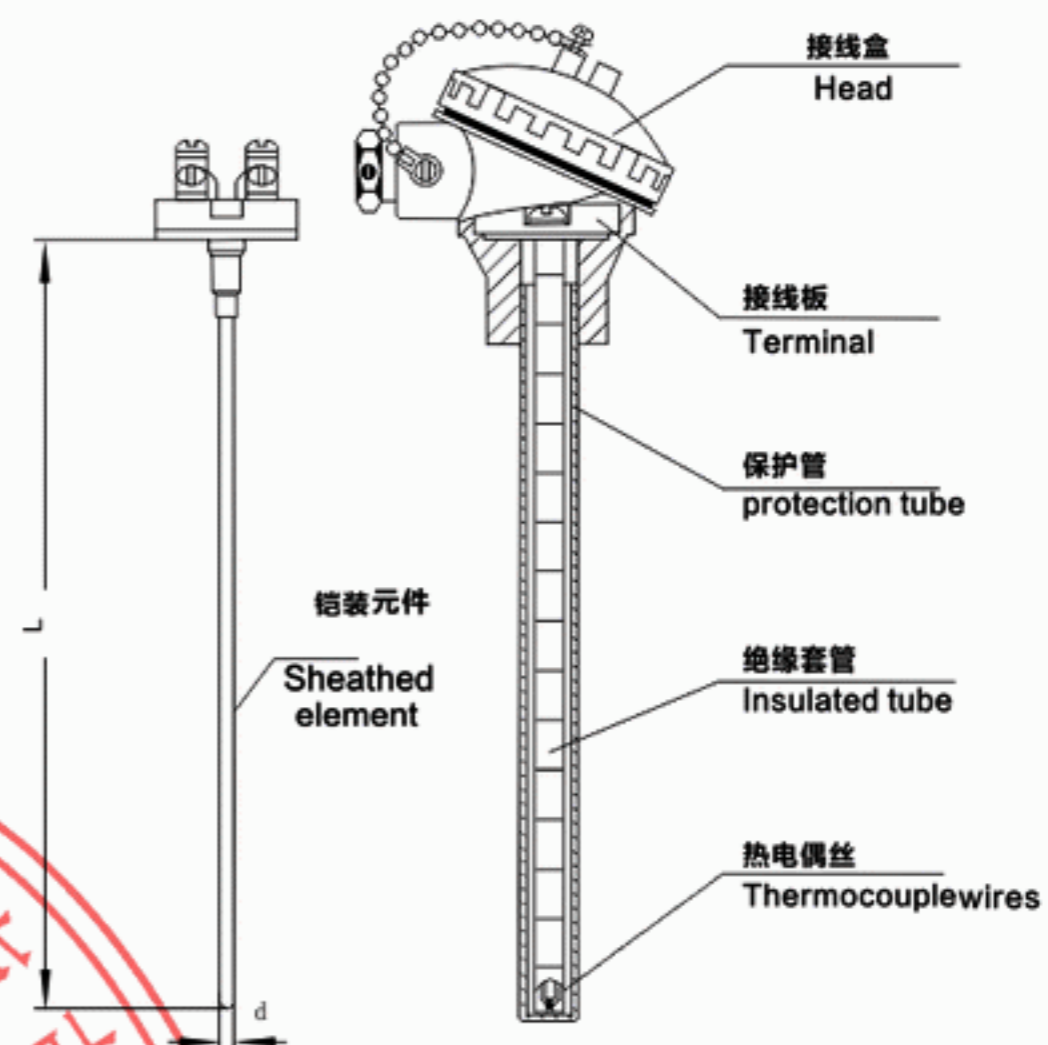
Select two different kinds of wire or alloy wire A and B as thermodes, of which, the welded end is referred to as temperature measurement end, the one connected with the indicating instrument is referred to as reference junction. When the temperature of both ends differs from each

$$E_{AB}(t,0) = E_{AB}(t) = f(t)$$



热电偶测温原理

Temperature measurement principle of the thermocouple



WRK-101

热电偶基本结构

Basic structure of the thermocouple

热电偶特性 Characteristic of the thermocouple

热电偶具有测温范围广，热电性能稳定，结构简单，信号可远传，价格低等优点。

The thermocouple has such advantages as wide scope of temperature measurement, stable thermoelectric property, simple structure, signal available for long distance and low price.

根据不同温区和使用环境的要求，须选用不同型号的热电偶材料和保护管。

It is necessary to select thermocouple materials and protection tube of different type in accordance with requirements of different temperature ranges and application environments.

我公司生产的工业热电偶符合JB/T9238-1999《工业热电偶技术条件》，GB/T18404-2001《铠装热电偶电缆及铠装热电偶》(dit. IEC61515:1995), GB/T16839-1997《热电偶分度表及允差》(dit. IEC584-1 and IEC584-2)等标准。

The industrial thermocouples produced by our company comply with some standards such as JB/T9238-1999 Technical Specification of Industrial Thermocouple, GB/T18404-2001 Sheath Thermocouple Cable and Sheath Thermocouple (dit. IEC61515:1995), GB/T16839-1997 Reference Tables and Tolerances of Thermocouple (dit. IEC584-1 and IEC584-2).

主要技术指标 Key technical indexes

热响应时间 Thermal response time

在温度出现阶跃变化时，热电偶的输出变化至相当于该变化的50%，所需要的时间称为热响应时间，用 $\tau_{0.5}$ 表示。实验介质通常为水。

When the temperature shown step changes, the output variation of the thermocouple shall be at least equivalent to 50% of the variation, and the time that needs is thermal response time, denoted as $\tau_{0.5}$. The experimental medium often is water.

热电偶公称压力 Nominal pressure of thermocouple

一般是指在室温情况下保护管所能承受的静态外压而不破损泄漏。实际上，允许工作压力不仅与温度、保护管材料、直径壁厚有关，还与其结构形式、安装方法、置入深度以及被测介质的流速和种类等有关。

It usually indicates the static external pressure the protection tube is capable of bearing under the room temperature while the protection tube does not break. In fact, the safe working pressure is not only related to temperature, materials of protection tube and wall thickness of diameters, but also related to structural configuration, assembling method, placed depth and the flow rate and type of the mediums to be measured.

热电偶最小置入深度 Minimum inset depth of thermocouple

应不小于其保护管外径的8~10倍（特殊产品例外）。

The minimum placed depth shall not be less than 8~10 times of the external diameter of its protection tube (Excluding special products).

热电偶的绝缘电阻（常温） Insulation resistance of thermocouple (normal temperature)

常温绝缘电阻的试验电压为直流500V ± 50V。测量常温绝缘电阻的大气条件为：温度15~35℃，相对湿度45%~75%，大气压力86~106KPa。

The experimental voltage of insulation resistance at normal temperature is DC 500V ± 50V. The atmospheric condition for measuring normal-temperature insulation resistance is 15~35℃, while the relative humidity is 45%~75% and the atmospheric pressure is 86~106KPa.

a 对于长度超过1米的热电偶它的常温绝缘电阻与其长度的乘积应≥100MΩ。

既： $R_r \cdot L \geq 100M\Omega \cdot m > 1m$

式中：L□□热电偶的长度，m。

a. For the thermocouple longer than 1m, the product of its normal-temperature insulation resistance and length shall not be less than 100 MΩ. That is, $R_r \cdot L \geq 100M\Omega \cdot m > 1m$.

Where: L is the length of the thermocouple, m.

b 对于长度等于或不足1米的热电偶，它的常温绝缘电阻值应不小于100MΩ。

b. For the thermocouple not longer than 1m, its normal-temperature insulation resistance shall not be less than 100MΩ.

热电偶上限温度绝缘电阻 Insulation resistance at upper limit temperature

测量条件为：被加热的长度为300mm或其总长的50%。试验电压为10±1(V·DC)。

Measuring condition: The heated length shall be 300mm or 50% that of the overall length. The test voltage shall be 10±1 (V · DC).

热电偶的上限温度绝缘电阻应不小于下表规定：

The insulation resistance at upper limit temperature shall not less the specifications shown in the table below:

| 上限温度 t_m (°C) Upper limit temperature | 试验温度 t_m (°C) Experimental temperature | 电阻值 MΩ Resistance value |
|--------------------------------------------|---------------------------------------------|----------------------------|
| $100 \leq t_m < 300$ | $t = t_m$ | 10 |
| $300 \leq t_m < 500$ | $t = t_m$ | 2 |
| $500 \leq t_m < 850$ | $t = t_m$ | 0.5 |
| $850 \leq t_m < 1000$ | $t = t_m$ | 0.08 |
| $1000 \leq t_m < 1300$ | $t = t_m$ | 0.02 |
| $t_m > 1300$ | $t = 1300$ | 0.02 |

热电偶类型、测量范围、等级和允差 Type, measuring range, class and tolerance (GB/T16839.2)

| 类别 Model | 代号 Code | 分度号 Graduation Mark | 测量范围(°C) Measuring rang | 精度 Accuracy | 允差 $\Delta t(^{\circ}\text{C})$ Tolerance |
|-------------------------------------------------------------|------------|------------------------|----------------------------|----------------|---------------------------------------------------------------------------------------------------------|
| 铂铑30-铂铑6 Rhodium Platinum30-Rhodium Platinum6 | WRR | B | 600~1700 | 2 | ± 1.5 或 $\pm 0.25\%$ t ± 1.5 or $\pm 0.25\%$ t |
| 铂铑10-铂 Rhodium Platinum10-Platinum | WRP | S | 0~1600 | 1 | ± 1 或 $\pm [1+0.3\%(t-1100)]^{\circ}\text{C}$ ± 1 or $\pm [1+0.3\%(t-1100)]^{\circ}\text{C}$ |
| 镍铬-镍硅 Nickel-chromium-nisiloy | WRN | K | $\square 40\sim+1000$ | 1 | ± 1.5 或 $\pm 0.4\%$ t ± 1.5 or $\pm 0.4\%$ t |
| | | | $\square 40\sim+1200$ | 2 | ± 2.5 或 $\pm 0.75\%$ t ± 2.5 or $\pm 0.75\%$ t |
| 镍铬硅-镍硅镁 Nickel-Chromium-Silicon-Nickel-silicon-magnesium | WRM | N | $\square 40\sim+1000$ | 1 | ± 1.5 或 $\pm 0.4\%$ t ± 1.5 or $\pm 0.4\%$ t |
| | | | $\square 40\sim+1300$ | 2 | ± 2.5 或 $\pm 0.75\%$ t ± 2.5 or $\pm 0.75\%$ t |
| 镍铬-铜镍 nickel-chromium-cupronickel | WRE | E | $-40\sim+800$ | 1 | ± 1.5 或 $\pm 0.4\%$ t ± 1.5 or $\pm 0.4\%$ t |
| | | | $-40\sim+900$ | 2 | ± 2.5 或 $\pm 0.75\%$ t ± 2.5 or $\pm 0.75\%$ t |
| 铁-铜镍 Ferrum-cupronickel | WRJ | J | $\square 40\sim+750$ | 1 | ± 1.5 或 $\pm 0.4\%$ t ± 1.5 or $\pm 0.4\%$ t |
| | | | | 2 | ± 2.5 或 $\pm 0.75\%$ t ± 2.5 or $\pm 0.75\%$ t |
| 铜-铜镍 Cuprum-cupronickel | WRT | T | $\square 40\sim+350$ | 1 | ± 0.5 或 $\pm 0.4\%$ t ± 0.5 or $\pm 0.4\%$ t |
| | | | | 2 | ± 1 或 $\pm 0.75\%$ t ± 1 or $\pm 0.75\%$ t |

注：(1) t为实测温度值。(2) 测量范围仅指偶丝。(3) 同栏两个允差值中取较大者。
 Note: (1) t is the measured temperature value. (2) The measuring range is used only for thermocouple wires. (3) Of the two tolerance values in the same column, the larger one shall be used.

金属保护管材料 Metal protection tube material

| 代号 Code | 材料种类 (牌号/代号) Material type (Brand/Code) | | 使用最高温度 (°C) Maximum application temperature (°C) | | 特性 Characteristics |
|------------|----------------------------------------------|-----------------------------|------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 中国 (GB) (GB) China | 美国 (ASTM) (ASTM) USA | 长期 Long-term | 短期 Short-term | |
| S4 | 0Cr18Ni9 | 304 | 850 | 900 | 铬镍合金; 耐热钢, 耐酸、耐碱。不适用于硫磺、还原性气氛。 Chrome-nickel alloy; heat-resisting steel, acid proof and alkali proof. Not suitable for sulfur and reducing gas. |
| L4 | 00Cr19Ni10 | 304L | 800 | 900 | 铬镍合金; 是304的超低碳钢, 由于含碳量低, 耐晶间腐蚀性优越。 Chrome-nickel alloy; 304 ultra-low-carbon steel with low carbon content and fine inter-crystalline corrosion resistance. |
| C5 | 0Cr25Ni20 | 310S | 1000 | 1150 | 高铬镍合金; 耐热性好, 具有良好的抗氧化、抗渗碳性能和机械性能。 High-chrome-nickel alloy with good heat-resistance and fine anti-oxidation, anti-carburization and mechanical property. |
| S6 | 0Cr17Ni12Mo2 | 316 | 800 | 900 | 铬镍合金; 高温中的耐腐蚀性能好, 耐酸、碱、海水与侵蚀性物质。 Chrome-nickel alloy with good corrosion proof in high temperature and acid proof, alkali proof and seawater proof properties. |
| L6 | 00Cr17Ni14Mo2 | 316L | 800 | 900 | 铬镍合金; 超低碳钢, 耐晶间腐蚀好, 抗氧化物。其余性能同316相似。 Chrome-nickel alloy; ultra-low-carbon steel with fine inter-crystalline corrosion resistance and anti-oxidation properties. Other properties are same as that of 316. |
| MT | 00Cr18Ni12Mo2Ti | 316Ti | 800 | 900 | 铬镍合金; 耐晶间腐蚀和点蚀的性能优良。耐尿素、稀硫酸等各种有机酸。 Chrome-nickel alloy with fine inter-crystalline corrosion resistance and pitting corrosion and good organic acid proof properties, such as carbamide and dilute sulphuric acid. |
| S9 | 1Cr18Ni9Ti | 321 | 800 | 900 | 铬镍合金; 抗氧化性能良好。对磷酸和稀硝酸和醋酸具有良好的耐蚀性。 Chrome-nickel alloy with fine anti-oxidation and good organic acid proof properties, such as phosphoric acid and dilute nitric acid. |
| Nb | 0Cr18Ni11Nb | 347 | 750 | 870 | 铬镍合金; 高温强度好, 耐晶间应力腐蚀性良好。耐酸、碱、盐等介质。 Chrome-nickel alloy with fine inter-crystalline corrosion resistance in high temperature and good medium proof properties, such as acid, alkali and salt. |
| N6 | 1Cr15Ni75Fe8 | Inconel600 | 1050 | 1250 | 镍铬铁合金; 最适合高温氧化, 还原性气氛。抗氯离子应力腐蚀能好。 Nickel-chromium-iron alloy; especially suitable for high temperature oxidation and reducing gas with good anti-chlorion stress corrosion property. |
| IN8 | 0Cr20Ni32AlTi | Inconel800 | 1100 | 1100 | 高镍铁合金; 耐硫、氰化物和熔融的中性盐, 耐二氧化碳的混合气体。 High chromium-iron alloy with good sulfide, cyanide and fusing neutral salt proof and fine mixed gas of carbon dioxide proof properties. |
| HB | 0Ni65Mo28Fe5V | Hastelloy B | 500 | 800 | 镍铁钼合金; 在沸点下任何浓度和盐酸都有良好的耐蚀性, 耐酸、氢氟酸。 Ferro-nickel-molybdenum alloy with good acid corrosion proof property for hydrochloric acid and hydrofluoric acid. |
| HC | 0Cr15Ni60Mo16W5Fe5 | Hastelloy C | 1000 | 1090 | 镍铬铁钼合金; 耐氧化性硝酸等、高于常温的次氯酸盐溶液等的腐蚀。 Nickel-chromium-iron alloy with good hypochloric acid solution corrosion proof property above the normal temperature, such as oxidized nitric acid. |
| 5M | Ni70Cu28 | Monel K500 | 150 | 200 | 镍铜合金; 耐氢氟酸、硫酸、盐酸、抗海水和大多数碱性物质性能优异。 Nickel-copper alloy with fine acid proof, alkali proof and seawater proof properties, such as hydrofluoric acid, sulfuric acid, hydrochloric acid and most alkaline matters. |
| Ni | Ni9990 | Nickel 201 | 150 | 200 | 耐浓碱 (纯碱、烧碱) 腐蚀特别优异, 中性和微酸性溶液以及有机溶剂。 With special fine concentrated base proof (soda and sodium hydroxide), neutral solution, sub-acid solution and organic solvent proof properties. |
| Ti | TA(1~3) | Grade(1~3) | 150 | 200 | 耐湿氯气, 浓硝酸。抗对含Co2的海水、海生物、海洋大气的腐蚀。 With fine wet chlorine gas, aquafortis proof and anti-seawater with Co2, marine growth and marine atmosphere prosperities. |
| G3 | GH3030 | - | 1050 | 1125 | 镍基高温合金; 高温下具有良好的力学性能、抗氧化和抗热腐蚀性能。 Ni-base superalloy with fine mechanical property, oxidation resistance and anti-hot corrosion in high temperature. |
| G9 | GH3039 | - | 1100 | 1200 | 镍基高温合金; 高温下抗氧化能力强、足够的持久强度和冷热疲劳性能。 Ni-base superalloy with fine oxidation resistance and long time strength and thermal fatigue behavior. |

非金属保护管材料 Material of nonmetal protection tube

| 代号 Code | 材料种类 (成份/代号) Type of material (constitution/symbol) | 使用最高温度 (°C) Highest application temperature (°C) | | 特性 Characteristics |
|------------|-----------------------------------------------------------------------|--------------------------------------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | 长期 Long term | 短期 Short term | |
| SO | 石英 (SiO ₂) Quartz | 1000 | 1100 | 耐高温、膨胀系数低, 耐热震性、化学稳定性和电绝缘性能好, 急冷, 急热强度差。 high temperature resistant, lower coefficient of expansion, good chemical stability and electric insulativity, poor rapid cooling and heating strength. |
| F4 | 聚四氟乙烯 (PIFE) Polytetrafluoroethylene | 250 | 280 | 具有优异的化学稳定性和力学强度, 广泛适用于各种腐蚀介质的温度测量。 excellent chemical stability and mechanical strength, widely applicable to measuring temperatures for corrosive mediums. |
| F46 | 聚全氟乙丙烯 (FEP) Fluorinated Ethylene Propylene | 200 | 230 | 具有F4优良的耐腐蚀化学稳定性, 冲击性能特好, 成型好, 熔融粘接好。 excellent corrosion-proof chemical stability of F4, good impact property, good formability and fine molten adhesion. |
| A8 | 高铝质 (85%~90%Al ₂ O ₃) High aluminum texture | 1500 | 1600 | 有耐高温剧变性能。气密性好, 化学性稳定, 高温下绝缘良好。急冷, 急热强度差。 resistant to high-temperature change, good airtightness, stable chemistry, fine insulation under high temperature, poor rapid cooling and heating strength. |
| A9 | 刚玉质 (99%Al ₂ O ₃) Corundum texture | 1600 | 1700 | 有耐高温剧变性能。气密性良好, 化学性稳定, 高温下绝缘良好。急冷, 急热强度差。 resistant to high-temperature change, good airtightness, stable chemistry, fine insulation under high temperature, poor rapid cooling and heating strength. |
| SN | 氮化硅 (Si ₃ N ₄) Silicon nitride | 1000 | 1100 | 在高温下具有较好的抗铝液的冲刷能力, 机械性能好, 适用于铝液的温度测量。 good anti-scour to aluminium pad under high temperature, good mechanical properties, applicable to measuring the temperature of aluminium pad. |
| SC | 碳化硅 (99%SiC) Silicon carbide | 1600 | 1650 | 耐火度和硬度很高。导热性、热膨胀、耐压性以及导电性等方面具有优势。 high refractoriness and hardness, dominant heat conductivity, thermal expansion, pressure resistance and conductivity. |
| MS | 二硅化钼 (MoSi ₂) Molybdenum disilicide | 1600 | 1700 | 高温抗氧化性优良。抗腐蚀性、热稳定性、气密性良好。具有耐高温剧变的性能。 fine antioxygenic property under high temperature, good corrosion resistance, thermal stability and airtightness, resistant to high-temperature change. |

陶瓷保护管直径和长度规格

Diameter and length specification of porcelain protection tube

| 直径 Diameter | | 长度规格L × I Length specification | | | | | | | | |
|------------------------------------|---------------------------|-----------------------------------|-----|-----|-----|-----|-----|-----|------|------|
| | | | | | | | | | | |
| φ16 (单套管) Single shell-tube | 总长度L Total length | 300 | 350 | 400 | 450 | 550 | 650 | 900 | 1150 | 1650 |
| | 插入长度I Insertion length | 150 | 200 | 250 | 300 | 400 | 500 | 750 | 1000 | 1500 |
| φ20 (单套管) Single shell-tube | 总长度L Total length | - | - | 400 | 450 | 550 | 650 | 900 | 1150 | 1650 |
| | 插入长度I Insertion length | - | - | 250 | 300 | 400 | 500 | 750 | 1000 | 1500 |
| φ25 (双层套管) Double shell-tube | 总长度L Total length | - | - | - | - | 550 | 650 | 900 | 1150 | 1650 |
| | 插入长度I Insertion length | - | - | - | - | 400 | 500 | 750 | 1000 | 1500 |

小型铂铑热电偶 Small-sized platinum-rhodium thermocouple

| 型号 Model | 分度号 Graduation Mark | 测量范围 (°C) Measuring Range(°C) | 热相应时间 $\tau_{0.5}(s)$ Thermal Response Time $\tau_{0.5}(s)$ | 保护管材料 Protection Tube Material | L(mm) |
|-------------|---------------------------|-------------------------------------|-------------------------------------------------------------------------|-----------------------------------------|-------|
| WRR-100 | B | 0~1600 | ≤45 | 刚玉质 Corundum | 225 |
| WRP-100 | S | 0~1300 | | 高铝质 High Al ₂ O ₃ | |

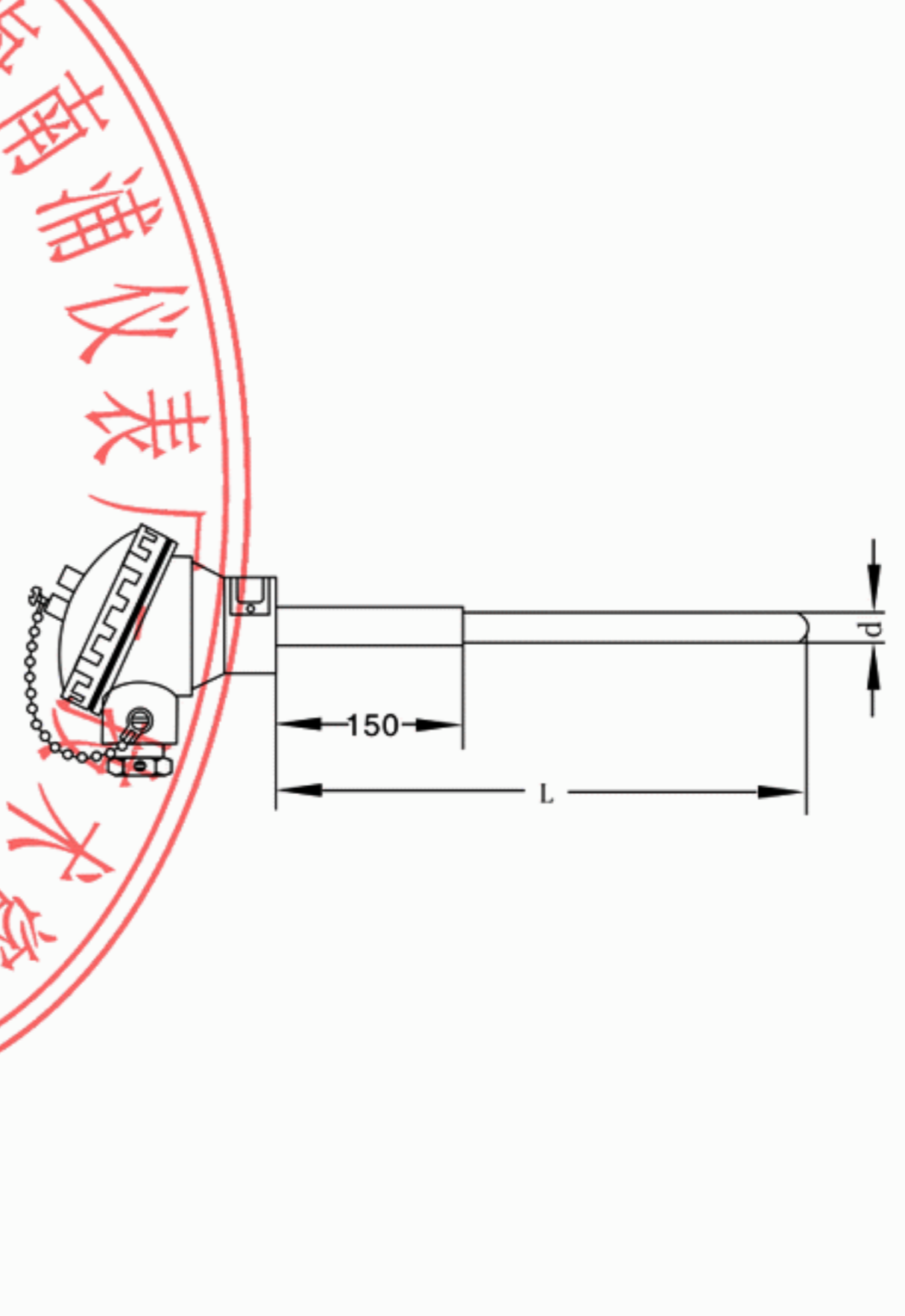


注：贵金属热电偶丝直径为：φ0.5mm。

Note: The diameter of noble metal thermocouple is φ0.5mm.

无固定装置式热电偶（瓷保护管） Non-fixed device thermocouple (ceramic protection tube)

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测温范围 Measuring Range °C | 规格 Specification | | 热响应时间 Thermal Response Time $\tau_{0.5}(s)$ |
|--------------------------------------------------------------------|-----------------------|---------------------------|----------------------------------|----------------------|--------------------------------------------|---------------------------------------------------------|
| | | | | 直径 Diameter mm | 保护管材料 Protection tube material | |
| 单支铂铑30-铂铑6 Single rhodium platinum 30- rhodium platinum 6 | WRR-130 | B (LL-2)* | 0~1600 | φ16 | 刚玉质 Corundum | ≤120 |
| | WRR-131 | | | φ25 | | ≤240 |
| 双支铂铑30-铂铑6 Twin rhodium platinum 30- rhodium platinum 6 | WRR ₂ -130 | | | φ16 | | ≤120 |
| | WRR ₂ -131 | | | φ25 | | ≤240 |
| 单支铂铑10-铂 Single rhodium platinum 10-platinum | WRP-130 | S (LB-3)* | 0~1300 | φ16 | 高铝质 High Al ₂ O ₃ | ≤120 |
| | WRP-131 | | | φ25 | | ≤240 |
| 双支铂铑10-铂 Twin rhodium platinum 10-Platinum | WRP ₂ -130 | | | φ16 | | ≤120 |
| | WRP ₂ -131 | | | φ25 | | ≤240 |
| 单支镍铬-镍硅 Single nickel- chromium-nisiloy | WRN-132 | K (EU-2)* | 0~1100 | φ16 | 高铝质 High Al ₂ O ₃ | ≤120 |
| | WRN-133 | | | φ20 | | ≤160 |
| 双支镍铬-镍硅 Twin nickel- chromium-nisiloy | WRN ₂ -132 | | | φ16 | | ≤120 |
| | WRN ₂ -133 | | | φ20 | | ≤160 |



注：（1）长度规格参见6页，非置入部分为20#碳钢、或不锈钢材料。

（2）直径φ25mm为双层瓷套管。

（3）打“*”分度号作特殊规格订货。

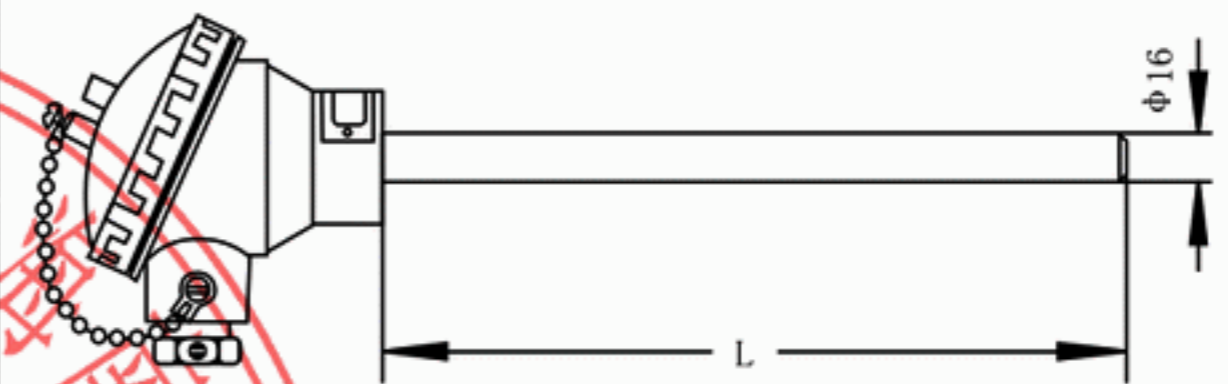
Note: (1) Refer to Page 6, Table 5 for length specification. Non-placed part is of carbon steel 20# or stainless steel.

(2) Diameter φ25mm is of two-layer porcelain bushing.

(3) That of “*” is the order of special specification.

无固定装置式热电偶 (金属保护管) Non-fixed device thermocouple (metal protection tube)

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测温范围 Measuring Range °C | 保护管材料 Protection tube material | 规格 Specification |
|----------------------------------------------------------------------|-----------------------|---------------------|-------------------------|--------------------------------|-----------------------|
| | | | | | 总长 Overall length Lmm |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-130 | K (EU-2)* | 0~800 | 1Cr18Ni9Ti | 250 300 350 |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -130 | | 0~1000 | 0Cr25Ni20 | |
| 单支镍铬-铜镍 Single nickel-chromium-cupronickel | WRE-130 | E (EA-2)* | 0~600 | 1Cr18Ni9Ti | 400 450 |
| 双支镍铬-铜镍 Twin nickel-chromium-cupronickel | WRE ₂ -130 | | | | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-silicon-nickel-silicon-magnesium | WRM-130 | N | 0~800 | 1Cr18Ni9Ti | 550 |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-silicon-nickel-silicon-magnesium | WRM ₂ -130 | | 0~1000 | 0Cr25Ni20 | 650 900 |
| 单支铁-铜镍 Single ferrum-cupronickel | WRJ-130 | J | 0~500 | 1Cr18Ni9Ti | 1150 |
| 双支铁-铜镍 Twin ferrum-cupronickel | WRJ ₂ -130 | | | | 1650 |
| 单支铜-铜镍 Single cuprum-cupronickel | WRT-130 | T | -40~+350 | | 2150 |
| 双支铜-铜镍 Twin cuprum-cupronickel | WRT ₂ -130 | | | | |



注: (1) 热响应时间 τ 0.5 < 90s。

(2) 保护管材料参见5页。

(3) 打“*”分度号作特殊规格订货。

(4) 保护管选用0Cr25Ni20, 型号后面加“H”, 例: WRN-130H。

Note: (1) Thermal Response Time τ 0.5(s) is less than 90s.

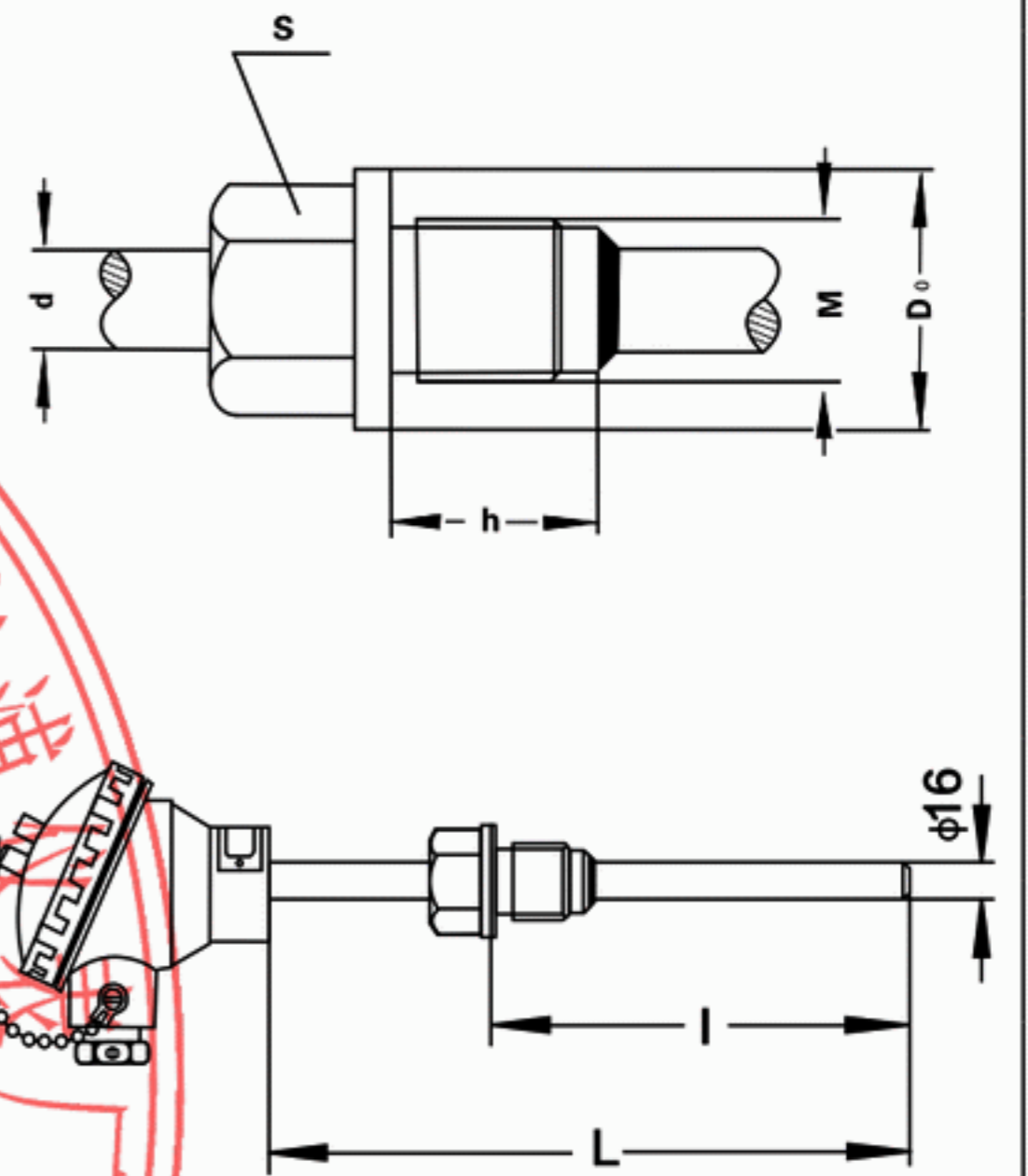
(2) Refer to page 5, table 3 for protection tube material.

(3) That of “*” is the order of special specification.

(4) The protection tube shall use 0Cr25Ni20, and be remarked a “H” be hind the model, for example WRN-130H.

固定螺栓式热电偶 Fixed bolt thermocouple

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测量范围 (°C) Measuring Range(°C) | 热响应时间 $\tau_{0.5(s)}$ Thermal Response Time $\tau_{0.5(s)}$ | 保护管材料 Protection Tube Material | 规格 Specification | d | M | h | s | D0 | 公称压力 Nominal pressure |
|----------------------------------------------------------------------|-----------------------|---------------------|-------------------------------|-------------------------------------------------------------|-------------------------------------------------------|------------------|-----|----------------|----|----|-----|-----------------------|
| | | | | | | L × I | | | | | | |
| 单支铂铑30-铂铑6 Single rhodium platinum 30-rhodium platinum 6 | WRR-230 | B | 0~1600 | ≤120 | 钢玉质 Corundum | 250×100 | φ10 | M27×2 G3/4" | 32 | 32 | φ40 | 10 Mpa |
| 双支铂铑30-铂铑6 Twin rhodium platinum 30-rhodium platinum 6 | WRR ₂ -230 | | | | | 300×150 | | | | | | |
| 单支铂铑10-铂 Single rhodium platinum 10-platinum | WRP-230 | S | 0~1300 | ≤120 | 高铝质 High Al ₂ O ₃ Ceramic | 350×200 | φ12 | M27×2 G3/4" | 32 | 32 | φ40 | 10 Mpa |
| 双支铂铑10-铂 Single rhodium platinum 10-platinum | WRP ₂ -230 | | | | | 400×250 | | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-232 | K | 0~1100 | ≤120 | 高铝质 High Al ₂ O ₃ Ceramic | 450×300 | φ16 | M27×2 G3/4" | 32 | 32 | φ40 | 10 Mpa |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -232 | | | | | 550×400 | | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-233 | K | 0~1100 | ≤120 | 高铝质 High Al ₂ O ₃ Ceramic | 450×300 | φ16 | M27×2 G3/4" | 32 | 32 | φ40 | 10 Mpa |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -233 | | | | | 550×400 | | | | | | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-silicon-nickel-silicon-magnesium | WRM-232 | N | 0~1200 | ≤90 | 高铝质 High Al ₂ O ₃ Ceramic | 650×500 | φ20 | M33×2 G1" | 35 | 36 | φ48 | 10 Mpa |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-silicon-nickel-silicon-magnesium | WRM ₂ -232 | | | | | 900×750 | | | | | | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-silicon-nickel-silicon-magnesium | WRM-233 | N | 0~1200 | ≤90 | 高铝质 High Al ₂ O ₃ Ceramic | 900×750 | φ20 | M33×2 G1" | 35 | 36 | φ48 | 10 Mpa |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-silicon-nickel-silicon-magnesium | WRM ₂ -233 | | | | | 1150×1000 | | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-230 | K (EU-2)* | 0~1000 | ≤120 | 1Cr18Ni9Ti 0Cr25Ni20 | 1650×1500 | φ20 | M33×2 G1" | 35 | 36 | φ48 | 10 Mpa |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -230 | | | | | 2150×2000 | | | | | | |
| 单支镍铬-铜镍 Single nickel-chromium-cupronickel | WRE-230 | E (EA-2)* | 0~600 | ≤120 | 1Cr18Ni9Ti | 2150×2000 | φ20 | M33×2 G1" | 35 | 36 | φ48 | 10 Mpa |
| 双支镍铬-铜镍 Twin nickel-chromium-cupronickel | WRE ₂ -230 | | | | | 2150×2000 | | | | | | |



注：(1) 保护管材料参见第5页，长度参见第6页。

(2) 打“*”分度号作特殊规格订货。

(3) 公称压力：10MPa。

(4) 型号后加(K)，内芯元件为铠装元件。例：WRN-230(K)。

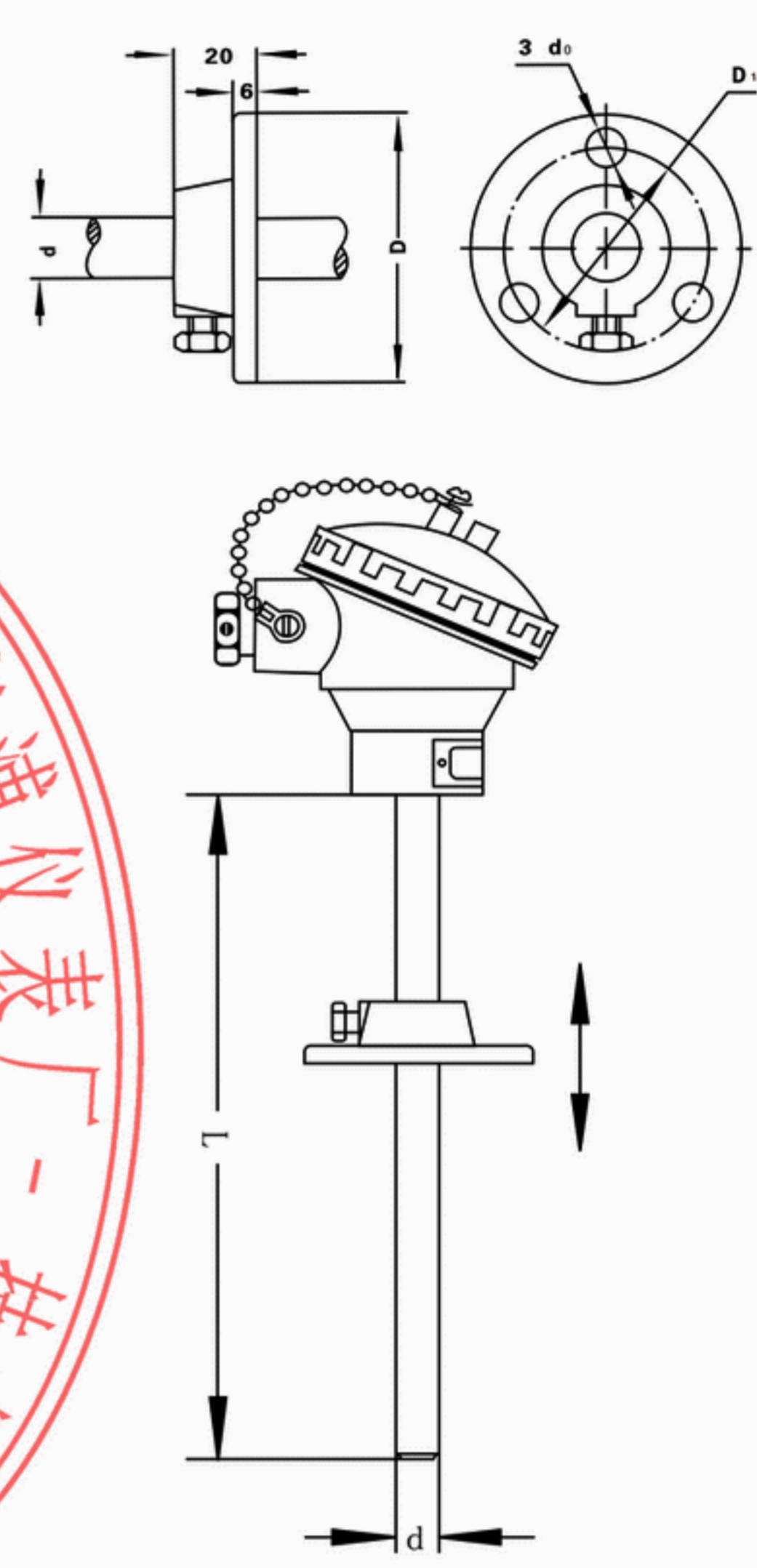
Note: (1) Refer to page 5, and page 6, for protection tube material.

(2) That of “*” is the order of special specification.

(3) Nominal pressure is 10MPa.

(4) Model with suffix (K), its inner core is sheathed element. For example WRN-230 (K).

活动法兰式热电偶 Flexible flange thermocouple

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测量范围 (°C) Measuring Range(°C) | 热响应时间 $\tau_{0.5(s)}$ Thermal Response Time $\tau_{0.5(s)}$ | 保护管材料 Protection Tube Material | 规格 Specification |  | | | | |
|----------------------------------------------------------------------|-----------------------|---------------------|-------------------------------|-------------------------------------------------------------|----------------------------------------------------|------------------|--------------------------------------------------------------------------------------|-----|-----|----|--------------------------|
| | | | | | | L × I | | | | | |
| 单支铂铑30-铂铑6 Single rhodium platinum 30-rhodium platinum 6 | WRR-330 | B | 0~1600 | ≤120 | 钢玉质 Corundum | 250×100 | d | D | D1 | d0 | 公称压力 Nominal pressure |
| 双支铂铑30-铂铑6 Twin rhodium platinum 30-rhodium platinum 6 | WRR ₂ -330 | | | | | 300×150 | | | | | |
| 单支铂铑10-铂 Single rhodium platinum 10-platinum | WRP-330 | S | 0~1300 | ≤120 | 高铝质 High Al ₂ O ₃ Ceramic | 350×200 | φ10 φ12 φ16 φ20 φ22 φ25 | φ70 | φ54 | φ6 | 常压 Normal pressure |
| 双支铂铑10-铂 Twin rhodium platinum 10-platinum | WRP ₂ -330 | | | | | 400×250 | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-332 | K | 0~1100 | ≤90 | 高铝质 High Al ₂ O ₃ Ceramic | 450×300 | φ10 φ12 φ16 φ20 φ22 φ25 | φ70 | φ54 | φ6 | 常压 Normal pressure |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -332 | | | | | 550×400 | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-333 | | | | | 650×500 | | | | | |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -333 | | | | | 900×750 | | | | | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-silicon-nickel-silicon-magnesium | WRM-332 | N | 0~1200 | ≤90 | 高铝质 High Al ₂ O ₃ Ceramic | 1150×1000 | φ10 φ12 φ16 φ20 φ22 φ25 | φ70 | φ54 | φ6 | 常压 Normal pressure |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-silicon-nickel-silicon-magnesium | WRM ₂ -332 | | | | | 1650×1500 | | | | | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-silicon-nickel-silicon-magnesium | WRM-333 | | | | | 2150×2000 | | | | | |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-silicon-nickel-silicon-magnesium | WRM ₂ -333 | | | | | | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-330 | K (EU-2)* | 0~1000 | ≤90 | 1Cr18Ni9Ti 0Cr25Ni20 | 1150×1000 | φ10 φ12 φ16 φ20 φ22 φ25 | φ70 | φ54 | φ6 | 常压 Normal pressure |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -330 | | | | | 1650×1500 | | | | | |
| 单支镍铬-铜镍 Single nickel-chromium-cupronickel | WRE-330 | E (EA-2)* | 0~600 | ≤90 | 1Cr18Ni9Ti | 1150×1000 | φ10 φ12 φ16 φ20 φ22 φ25 | φ70 | φ54 | φ6 | 常压 Normal pressure |
| 双支镍铬-铜镍 Twin nickel-chromium- | WRE ₂ -330 | | | | | 1650×1500 | | | | | |

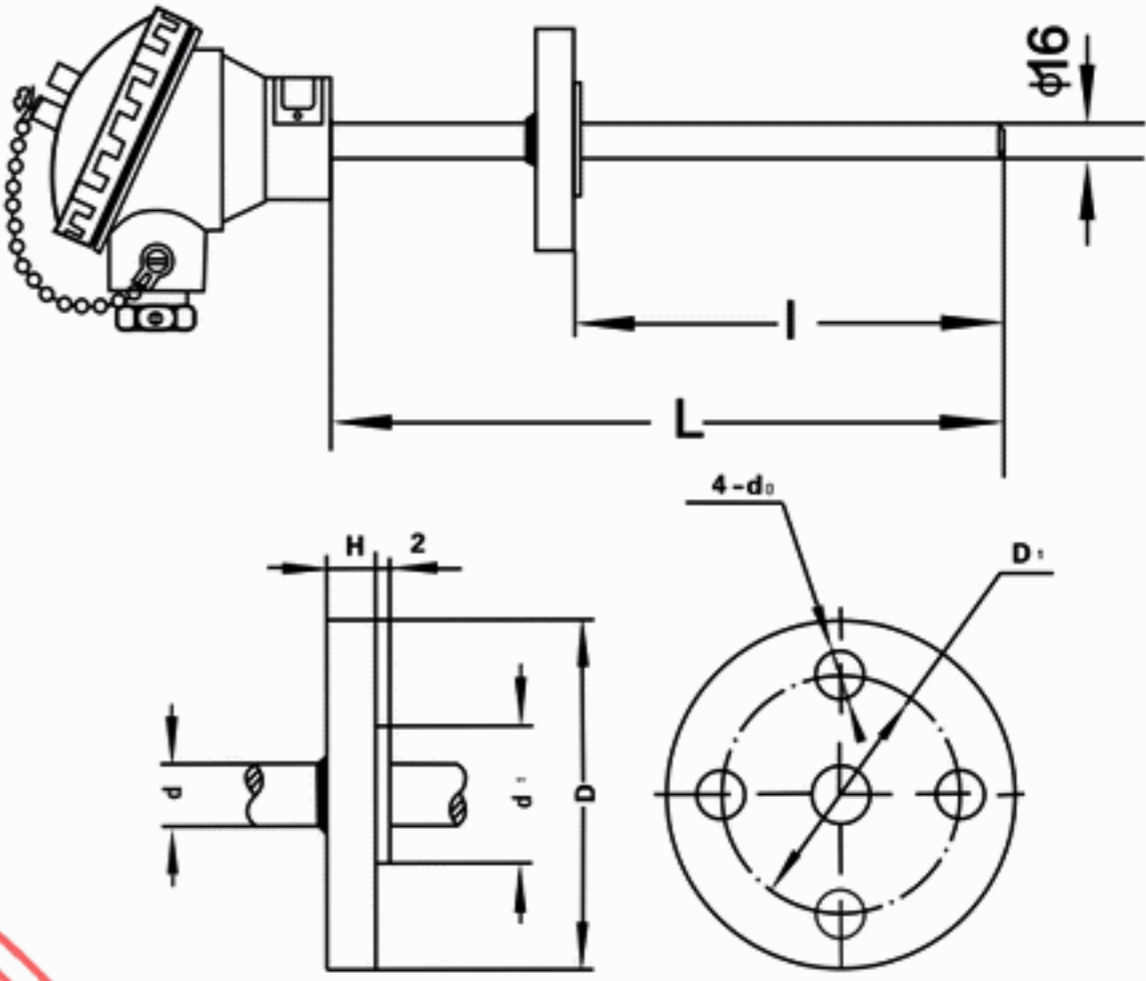
(1) 打“*”分度号作特殊规格订货。

(2) 型号后加(K), 内芯为铠装元件。例: WRN-330(K)。

(1) That of “*” is the order of special specification.

(2) Model with suffix (K), its inner core is sheathed element. For example WRN-330 (K).

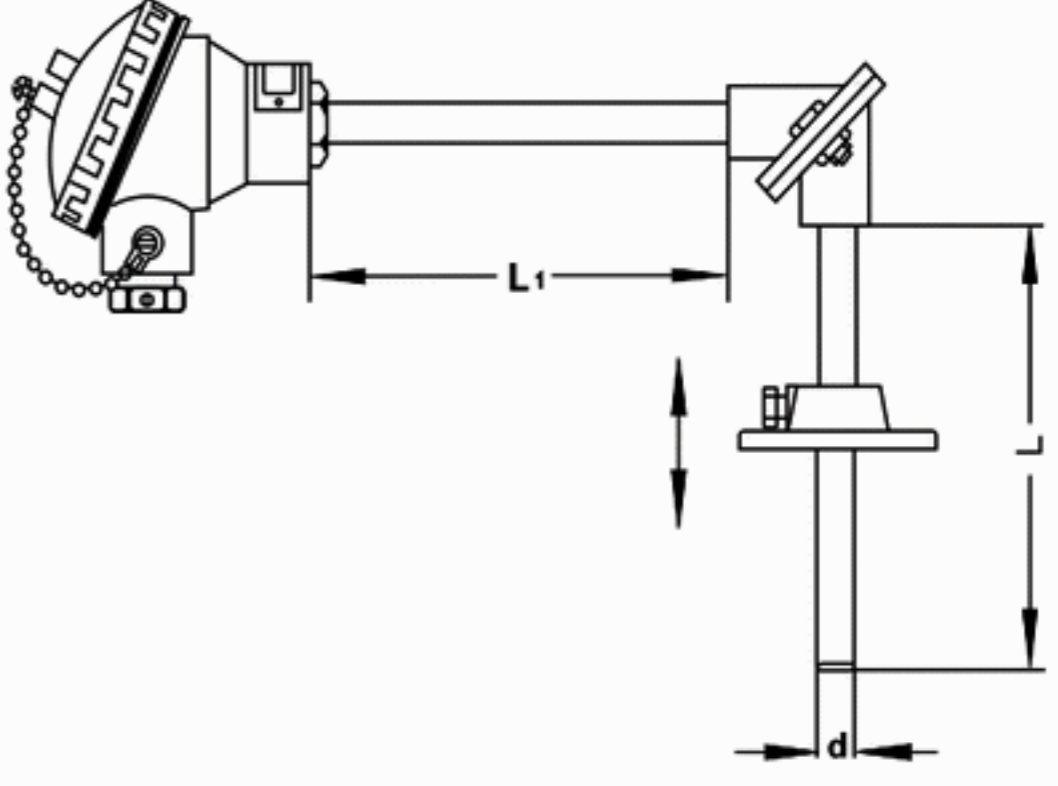
固定法兰式热电偶 Fixed flange thermocouple

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测量范围 (°C) Measuring Range (°C) | 热响应时间 $\tau_{0.5(s)}$ Thermal Response Time $\tau_{0.5(s)}$ | 保护管材料 Protection Tube Material | 规格 Specification | |  | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------------------------------------------------|-----------------------|---------------------|--------------------------------|-------------------------------------------------------------|--------------------------------|------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------|----|----|---|----|--------------------------|--------|-----|-----|-----|----|-----|---------|---------|------|-----|-----|----|---------|------|-----|-----|----|--|--|
| | | | | | | L × I | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-430 | K | 0~800 | ≤90 | 1Cr18Ni9Ti | 250×100 | | <table border="1"> <thead> <tr> <th>d</th> <th>D</th> <th>D1</th> <th>d1</th> <th>H</th> <th>d0</th> <th>公称压力 Nominal pressure</th> </tr> </thead> <tbody> <tr> <td>φ8 φ10</td> <td>φ95</td> <td>φ65</td> <td>φ45</td> <td>16</td> <td rowspan="2">φ14</td> <td rowspan="2">2.5 Mpa</td> </tr> <tr> <td>φ12 φ16</td> <td>φ105</td> <td>φ75</td> <td>φ55</td> <td>16</td> </tr> <tr> <td>φ20 φ25</td> <td>φ115</td> <td>φ85</td> <td>φ65</td> <td>18</td> <td></td> <td></td> </tr> </tbody> </table> | d | D | D1 | d1 | H | d0 | 公称压力 Nominal pressure | φ8 φ10 | φ95 | φ65 | φ45 | 16 | φ14 | 2.5 Mpa | φ12 φ16 | φ105 | φ75 | φ55 | 16 | φ20 φ25 | φ115 | φ85 | φ65 | 18 | | |
| d | D | | D1 | | d1 | H | d0 | | 公称压力 Nominal pressure | | | | | | | | | | | | | | | | | | | | | | | | | |
| φ8 φ10 | φ95 | φ65 | φ45 | 16 | φ14 | 2.5 Mpa | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| φ12 φ16 | φ105 | φ75 | φ55 | 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| φ20 φ25 | φ115 | φ85 | φ65 | 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -430 | | 0~1000 | | 0Cr25Ni20 | 300×150 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-nickel-silicon-magnesium | WRM-430 | N | 0~800 | ≤90 | 1Cr18Ni9Ti | 350×200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-silicon-nickel-silicon-magnesium | WRM ₂ -430 | | | | 0~1000 | 0Cr25Ni20 | 400×250 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 单支镍铬-铜镍 Single nickel-chromium-cupronickel | WRE-430 | E | 0~600 | ≤90 | 1Cr18Ni9Ti | 450×300 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 双支镍铬-铜镍 Twin nickel-chromium-cupronickel | WRE ₂ -332 | | | | | | | | | 550×400 | | | | | | | | | | | | | | | | | | | | | | | | |
| 单支铁-铜镍 Single ferrum-cupronickel | WRJ-430 | J | 0~500 | ≤90 | 1Cr18Ni9Ti | 650×500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 双支铁-铜镍 Twin ferrum-cupronickel | WEJ ₂ -430 | | | | | | | | 900×750 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 单支铜-铜镍 Single cuprum-cupronickel | WRT-430 | T | -40~+350 | ≤90 | 1Cr18Ni9Ti | 1150×1000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 双支铜-铜镍 Twin cuprum-cupronickel | WRT ₂ -430 | | | | | | | | 1650×1500 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | 2150×2000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

注：(1) 公称压力：2.5MPa。(2) 型号后加(K)，内芯为铠装元件。例：WRN-430(K)。

Note: (1) Normal pressure: 2.5MPa. (2) Model with suffix (K), its inner core is sheathed element. For example WRN-430 (K).

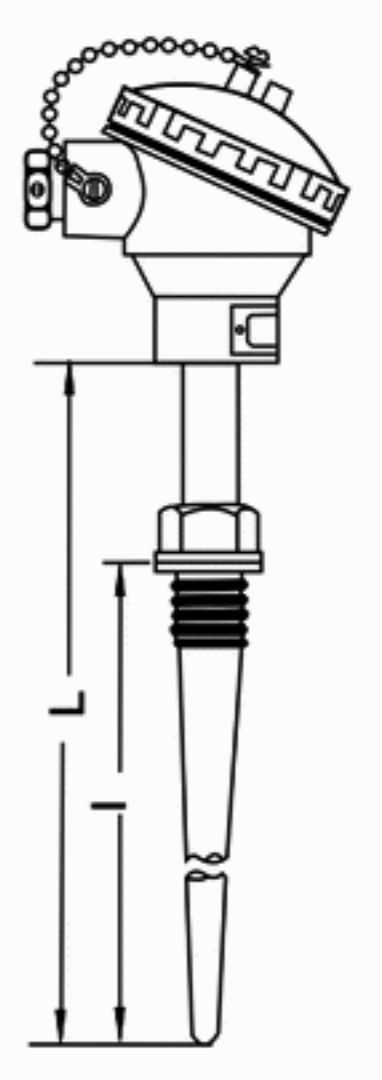
活动法兰角尺式热电偶 Flexible flange L-square thermocouple

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测量范围 (°C) Measuring Range (°C) | 热响应时间 $\tau_{0.5(s)}$ Thermal Response Time $\tau_{0.5(s)}$ | 保护管材料 Protection Tube Material | 规格 Specification | |  |
|--------------------------------------------------------------|-----------------------|---------------------|--------------------------------|-------------------------------------------------------------|--------------------------------|------------------|----------|---------------------------------------------------------------------------------------|
| | | | | | | d | L × I | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy | WRN-530 | K | 0~800 | ≤90 | 1Cr18Ni9Ti | φ16 | 500×500 | |
| 双支镍铬-镍硅 Twin nickel-chromium-nisiloy | WRN ₂ -530 | | | | | | 0~1000 | |
| 单支镍铬硅-镍硅镁 Single nickel-chromium-nickel-silicon-magnesium | WRM-530 | N | 0~800 | ≤90 | 0Cr25Ni20 | φ16 | 1000×500 | |
| 双支镍铬硅-镍硅镁 Twin nickel-chromium-nickel-silicon-magnesium | WRM ₂ -530 | | | | | | 0~1000 | |
| 单支镍铬-铜镍 Single nickel-chromium-cupronickel | WRE-530 | E | 0~600 | ≤90 | 1Cr18Ni9Ti | φ16 | | |
| 双支镍铬-铜镍 Twin nickel-chromium-cupronickel | WRE ₂ -530 | | | | | | | |
| 单支铂铑10-铂 Single Rhodium Platinum 10-Platinum | WRP-530 | S | 0~1300 | ≤120 | 刚玉质 | φ20 | | |
| 双支铂铑10-铂 Twin Rhodium Platinum 10-Platinum | WRP ₂ -530 | S | | | | | | |

注：(1) 公称压力为常压。(2) 型号后加(K)内芯为铠装元件。例：WRN-530(K)。

Note: Nominal pressure is ordinary pressure. (2) Model with suffix (K), its inner core is sheathed element. For example WRN-530 (K).

固定螺栓锥形保护管热电偶 Fixed bolt taper protection tube thermocouple

| 热电偶类别 Category | 产品型号 Model | 分度号 Graduation Mark | 测量范围 (°C) Measuring Range (°C) | 热响应时间 $\tau_{0.5}(s)$ Thermal Response Time $\tau_{0.5}(s)$ | 保护管材料 Protection Tube Material | 规格 Specification |  |
|----------------------------------------------------------------------------------------------|------------------------------------------|---------------------|--------------------------------|-------------------------------------------------------------|--------------------------------|------------------|--------------------------------------------------------------------------------------|
| | | | | | | L × I | |
| 单支镍铬-镍硅 Single nickel-chromium-nisiloy 双支镍铬-镍硅 nickel-chromium-nisiloy | WRN-630 (K) WRN ₂ -630 (K) | K | 0~600 | ≤45 | 1Cr18Ni9Ti | 225 × 75 | |
| | WRN-630A(K) WRN ₂ -630A(K) | | | | | 250 × 100 | |
| | WRN-630B(K) WRN ₂ -630B(K) | | | | | 300 × 150 | |
| | WRN-630B(K) WRN ₂ -630B(K) | | | | | 350 × 200 | |
| 单支镍铬-铜镍 双支镍铬-铜镍 Single nickel-chromium-cupronickel Twin nickel-chromium-cupronickel | WRE-630(K) WRE ₂ -630(K) | E | 0~600 | ≤45 | 1Cr18Ni9Ti | 400 × 250 | |
| | WRE-630A(K) WRE ₂ -630A(K) | | | | | 450 × 300 | |
| | WRE-630B(K) WRE ₂ -630B(K) | | | | | 500 × 350 | |
| | WRE-630B(K) WRE ₂ -630B(K) | | | | | 550 × 400 | |
| | | | | | | 600 × 450 | |
| | | | | | | 650 × 500 | |

注: (1) 公称压力: 30MPa。流速 ≤ 80m/s

(2) 选用英制G1" 螺栓, 内芯铠装元件, 应在型号后加A。例如: WRN-630A(K)

(3) 选配齿形垫片, 应在型号后加B, 例如: WRN-630B(K)。齿形垫片参见93页, 图152。

Note: (1) Normal pressure: 30MPa. Flow rate ≤ 80m/s.

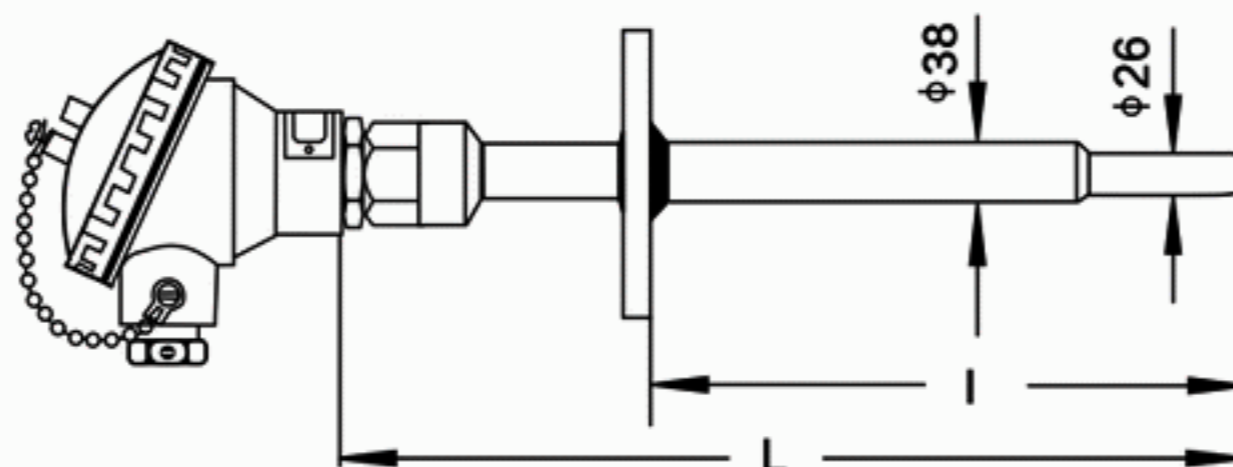
(2) "A" shall be attached to the model if British system G1" bolt and sheat elements for inner core is selected for use, for example: WRN-630A(K).

(3) When serrated washer is used, B should be added after model, for example: WRN-630B(K). Refer to page 93, Fig 152 for specification of serrated waster.

拱顶热电偶 Dome thermocouple

WRP型拱顶热电偶是为了适应高炉拱顶温度的检测, 而进行设计制造的新型热电偶。热电偶保护管选用进口Sic再结晶材料能够满足高炉测温的特殊要求。在构造上, 有密封、耐震动、可以垂直安装和有快速装卸的法兰结构。

WRP-type dome thermocouple is a new thermocouple designed and manufactured to be adapted to measuring the temperature of the dome of blast furnace. The thermocouple protection tube, made of imported Sic recrystallized material can meet the special requirements that are needed to measure the temperature of blast furnace. For the structure, it has a flange structure which is sealed, and quake-resistant and can be installed vertically and assembled or disassembled quickly.



主要技术指标 Major technical indexes

分度号: S(铂铑10-铂) Graduation symbol: S (platinum rhodium 10—platinum)

测温范围: 0~1300℃ Measuring range: 0~1300℃

公称压力: 0.3MPa Nominal pressure: 0.3MPa

热响应时间: $\tau < 0.5 < 360S$ Thermal response time: $\tau < 0.5 < 360S$

允许误差 $\Delta t: \pm 1.5^\circ C$ 或 $0.75\%t$ Permissible error $\Delta t: \pm 1.5^\circ C$ or $0.75\%t$.

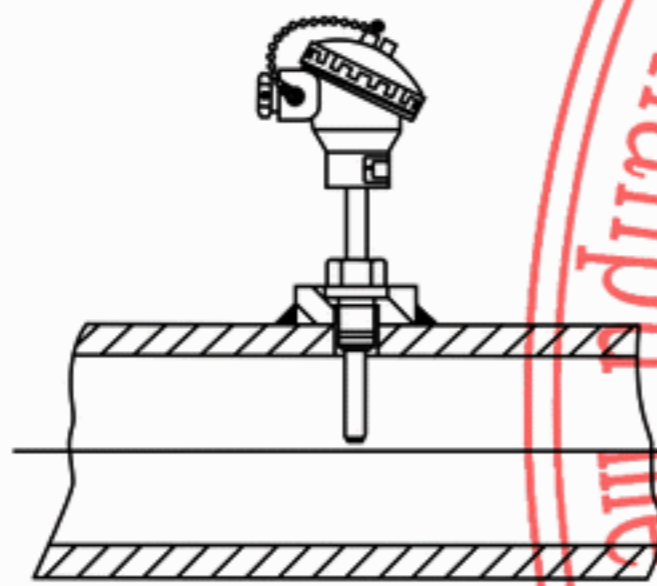
规格长度 $L \times l: 1400 \times 1250、1750 \times 1600mm$

Length $L \times l: 1400 \times 1250, 1750 \times 1600mm$

装配式热电偶 热电阻安装示意图

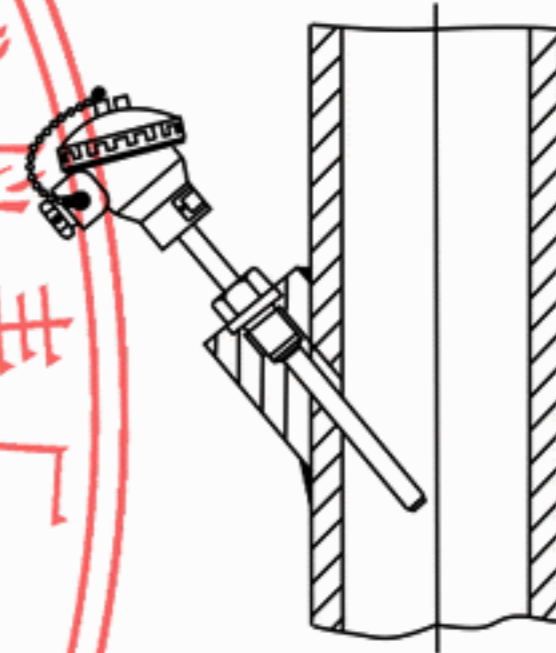
Scheme of installation of Assembly thermocouple and thermal resistance

a



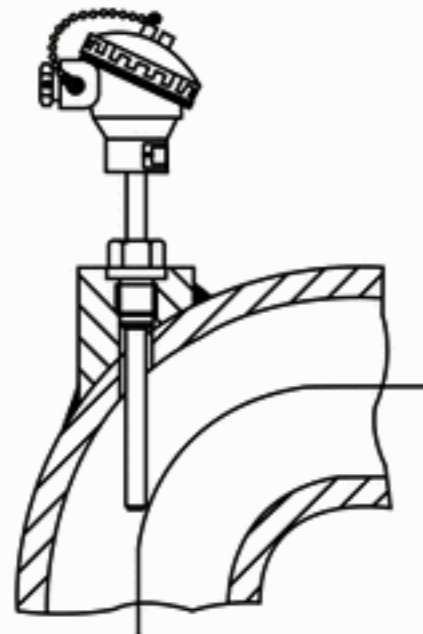
垂直管道轴线的安装方法
Installation method vertical to pipe axis

b



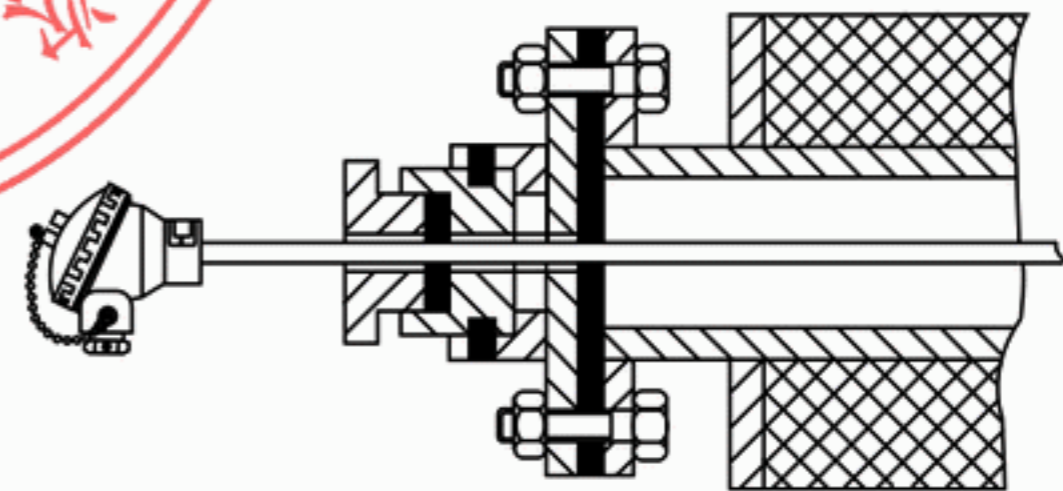
倾斜管道轴线的安装方法
Installation method slant to pipe axis

c



在弯曲管道上的安装方法
Installation method on curved pipe

d



锅炉烟道中的密封安装方法
Sealed Installation method of boiler chimney