Thermocouple type × sheath material chart

Issued 24 October 2026. Upper temperature figures in °C from WIKA, ASTM E230, IEC 60584-1, Rössel, JUMO, the DIN 43724 table (Morgan), Endress+Hauser and Omega, each named. Each cell is the lower of the type's and the tube's published figures, labelled with its source; rules on page 2.

Type upper end, °C	C 799 alumina WIKA 1,600 · DIN 43724 (Morgan) 1,600 · Rössel 1,600 · E+H 1,800	C 610 mullite WIKA 1,500 · DIN 43724 (Morgan) 1,400 · Rössel 1,600 · E+H 1,500	C 530 (porous) WIKA 1,600 · DIN 43724 (Morgan) 1,350 · Rössel 1,500 · E+H 1,400	1.4571 (316Ti) WIKA 800 · Rössel 800	1.4841 (310/314) WIKA 1,150 · Rössel 1,200 · E+H 1,100	1.4749 (446) WIKA 1,150 · Rössel 1,100 · E+H 1,100	1.4762 WIKA 1,200 · Rössel 1,200	Inconel 600 (2.4816) E+H 1,100 · Omega 1,149 · Rössel 1,200
K IEC cl. 2 1,200 · ASTM 1,260	**1,200–1,260 °C** set by thermocouple	**1,200–1,260 °C** set by thermocouple	**1,200–1,260 °C** set by thermocouple **Outer tube only** · WIKA, JUMO	**800 °C** set by tube **Usual pairing** · WIKA	**1,100–1,200 °C** set by tube **Usual pairing** · WIKA	**1,100–1,150 °C** set by tube **Usual pairing** · WIKA	**1,200 °C** set by tube **Usual pairing** · WIKA	**1,100–1,200 °C** set by tube
N IEC cl. 2 1,200 · ASTM 1,260	**1,200–1,260 °C** set by thermocouple	**1,200–1,260 °C** set by thermocouple	**1,200–1,260 °C** set by thermocouple **Outer tube only** · WIKA, JUMO	**800 °C** set by tube **Usual pairing** · WIKA	**1,100–1,200 °C** set by tube **Usual pairing** · WIKA	**1,100–1,150 °C** set by tube **Usual pairing** · WIKA	**1,200 °C** set by tube **Usual pairing** · WIKA	**1,100–1,200 °C** set by tube
J IEC cl. 2 750 · ASTM 760	**750–760 °C** set by thermocouple	**750–760 °C** set by thermocouple	**750–760 °C** set by thermocouple **Outer tube only** · WIKA, JUMO	**750–760 °C** set by thermocouple **Usual pairing** · WIKA	**750–760 °C** set by thermocouple **Usual pairing** · WIKA	**750–760 °C** set by thermocouple **Usual pairing** · WIKA	**750–760 °C** set by thermocouple **Usual pairing** · WIKA	**750–760 °C** set by thermocouple
E IEC cl. 2 900 · ASTM 870	**870–900 °C** set by thermocouple	**870–900 °C** set by thermocouple	**870–900 °C** set by thermocouple **Outer tube only** · WIKA, JUMO	**800 °C** set by tube	**870–900 °C** set by thermocouple	**870–900 °C** set by thermocouple	**870–900 °C** set by thermocouple	**870–900 °C** set by thermocouple
T ASTM 370	**370 °C** set by thermocouple	**370 °C** set by thermocouple	**370 °C** set by thermocouple **Outer tube only** · WIKA, JUMO	**370 °C** set by thermocouple	**370 °C** set by thermocouple	**370 °C** set by thermocouple	**370 °C** set by thermocouple	**370 °C** set by thermocouple
R IEC cl. 2 1,600 · ASTM 1,480	**1,480–1,600 °C** set by thermocouple **Recommended** · WIKA, JUMO	**Not recommended** JUMO	**1,350–1,600 °C** sources differ on which **Outer tube only** · WIKA, JUMO	**800 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,200 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,150 °C** set by tube **With ceramic inner tube** · Rössel	**1,200 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,200 °C** set by tube **With ceramic inner tube** · Rössel
S IEC cl. 2 1,600 · ASTM 1,480	**1,480–1,600 °C** set by thermocouple **Recommended** · WIKA, JUMO	**Not recommended** JUMO	**1,350–1,600 °C** sources differ on which **Outer tube only** · WIKA, JUMO	**800 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,200 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,150 °C** set by tube **With ceramic inner tube** · Rössel	**1,200 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,200 °C** set by tube **With ceramic inner tube** · Rössel
B IEC cl. 2 1,700 · ASTM 1,700	**1,600–1,700 °C** sources differ on which **Recommended** · WIKA, JUMO	**Not recommended** JUMO	**1,350–1,600 °C** set by tube **Outer tube only** · WIKA, JUMO	**800 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,200 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,150 °C** set by tube **With ceramic inner tube** · Rössel	**1,200 °C** set by tube **With ceramic inner tube** · Rössel	**1,100–1,200 °C** set by tube **With ceramic inner tube** · Rössel
C Omega 2,315 (hydrogen, inert gas, vacuum)	**Not rated by these sources**			**Not in air (Omega)**				

How to read a cell

WIKA and Omega both limit a thermocouple assembly by its lowest-rated part, so each cell is the lower of the type's and the tube's published upper figures, and says which one sets it. A range means the sources differ. Thinner wire lowers the type's limit (ASTM E230 by gauge). Ceramic and steel figures are for clean air unless a rule says otherwise.

Rules behind the labels

Recommended (types R, S, B): WIKA: above 1,200 °C use gas-tight ceramic, preferably high-purity C 799. JUMO: for platinum thermocouples both the insulating rod and the tube must be KER 710 (C 799).

Not recommended (types R, S, B): JUMO: for platinum thermocouples both the insulating rod and the protection tube must be KER 710 (C 799); in reducing gas 0.2% SiO2 is enough to form brittle platinum silicides.

Outer tube only (types K, N, J, E, T, R, S, B): WIKA: C 530 is used as an outer tube with a gas-tight inner tube. JUMO: a gas-permeable tube can't be used alone in reducing gas.

With ceramic inner tube (types R, S, B): Rössel: platinum thermocouples in metal tubes generally get a ceramic inner tube against metal-ion contamination.

Usual pairing (types K, N, J): WIKA: metal tubes (up to 1,200 °C depending on the steel) generally carry a base-metal thermocouple, K, J or N.

Type C (tungsten-rhenium): Omega (tungsten-rhenium wire page H-15): types G, C and D "can be used to 4200°F (2315°C) in hydrogen or inert-gas atmospheres and in a vacuum. They deteriorate rapidly under oxidizing conditions and should not be used in air or atmospheres containing oxygen." No source in this set pairs type C with any tube material below.

Type T: not in WIKA's TE 65.80 table, so no IEC 60584-1 figure is given here; ASTM E230 gives 0 to 370 °C.

Atmosphere notes

C 799: WIKA: not resistant to alkali vapours, only partly resistant to temperature changes. E+H and the DIN 43724 guideline (Morgan, to 1,500 °C) allow alkali vapours.

C 610: JUMO: not in reducing atmospheres; becomes noticeably conductive above 1,000 °C. WIKA: not resistant to alkali vapours.

Steels: Steel figures are for clean air. Resistance to sulphur, carburisation and low-oxygen gas differs by steel (WIKA TE 65.80 p. 10).

Inconel 600: E+H: protection tube, recommended max. for continuous use in air, not in sulphur-bearing atmospheres. Omega (OMEGACLAD) and Rössel (p. 15, standard versions -270 to +1200 °C): mineral-insulated sheath, not a tube.

Sources

WIKA data sheet TE 65.80 (11/2020): types and ranges p. 3, tube materials pp. 2 and 10

ASTM E230 tables as reproduced by Tempco, catalog page 14-103

Omega tungsten-rhenium thermocouple wire, page H-15 (type C)

Omega OMEGACLAD sheath selection guide, pages Z-17 to Z-18 (Inconel 600 MI sheath)

Rössel-Messtechnik, Praxis der Thermoelemente, pages 15-16

JUMO Typenblatt 90.1000, pages 4-5

Morgan Haldenwanger, Ceramic tubes brochure: DIN 43724 sheath tube table (DIN 43724 is withdrawn)

Endress+Hauser TI00251T (16.25), protection tube materials, pages 14-16

What we make

GY Alumina makes alumina protection tubes and insulators: C799 alumina (99.5% Al2O3) as standard. Where a drawing names C 610, we supply 95% white alumina or our standard C799 alumina; we don't make C 530 or metal tubes. In air our tubes are used up to 1,750 °C hanging vertically and 1,650 °C lying horizontally. For a quotation, send the thermocouple type, the working temperature and atmosphere, OD x ID x length and the quantity.

Live chart with notes / Protection tube material selector / Request a protection-tube quotation