

# **THERMO ELECTRIC COUPLES**

THERMOCOUPLE  
**WIRES**



# THERMOELECTRIC COUPLES

## Thermocouple Wires

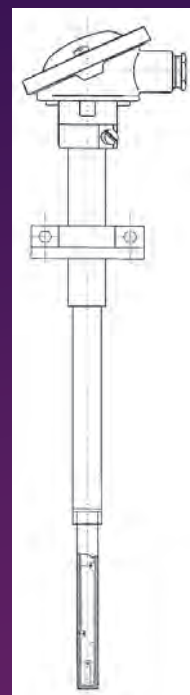
### Assortment

SAFINA, a.s. is a renowned and traditional manufacturer of PtRh thermocouples. It has been dealing with their manufacturing for almost half a century. An extraordinary emphasis is placed on accuracy and reliability of thermocouples during manufacturing process. Each manufactured batch is tested in modern equipped accredited calibration laboratory and is provided with a quality certificate. Measured values are compared to measurement standards, which are based on international norms.

SAFINA, a.s. offers thermoelectric couples in form of individual thermocouple branches (wires) as well as in form of couples produced by connection of both branches. Additionally thermocouples clad in protective ceramic capillary can be supplied on request.

Type	Branch composition	Temperature scope of application (°C)		Tolerance
		Long-term	Short-term	
S	Pt (-)	0-1 300	0-1 600	IEC 584-2 Class 1 or 2
	Pt-10%Rh (+)			
R	Pt (-)	0-1 300	0-1 600	IEC 584-2 Class 1 or 2
	Pt-13%Rh (+)			
B	Pt-6%Rh (-)	0-1 600	0-1 800	IEC 584-2 Class 2 or 3
	Pt-30%Rh (+)			

Scope of offered diameters of manufactured thermocouple wires is from 0.04 mm to 0.80 mm.



### Accuracy of thermoelectric couples

All thermoelectric couples supplied by SAFINA, a.s. are in compliance with the standard EN 60584 - 1 stemming from the international temperature range ITS - 90 and comply with temperature limits defined in the IEC 584 - 2.

### Tolerance classes

1. class for temperatures from 0 to 1100 °C +/- 1 °C  
for temperatures from 1100 to 1600 °C +/- [1 + 0,003\* (t-100)] °C
  2. class for temperatures from 0 to 600 °C +/- 1,5 °C  
for temperatures from 600 to 1600 °C +/- 0,0025t °C
  3. class for temperatures from 600 to 800 °C +/- 4 °C  
for temperatures from 800 to 1700 °C +/- 0,005t °C
- where the t is temperature in °C

(See the table of tolerance values)

### Tolerance values

Temperature (°C)	1. class (+/- °C)	2. class (+/- °C)	3. class (+/- °C)
0-600	1,00	1,50	4,00
700	1,00	1,75	4,00
800	1,00	2,00	4,00
900	1,00	2,25	4,50
1 000	1,00	2,50	5,00
1 100	1,00	2,75	5,50
1 200	1,30	3,00	6,00
1 300	1,60	3,25	6,50
1 400	1,90	3,50	7,00
1 500	2,20	3,75	7,50
1 600	2,50	4,00	8,00
1 700	-	4,25	8,50

## Correct manipulation with thermoelectric couples:

Materials of extreme purity are used for manufacturing of thermoelectric couples. Any contamination with dirt or inconsiderate manipulation has a significant impact on the accuracy of measurement with thermoelectric couple. Following factors, which cause its deterioration at the application, must be taken into account for ensuring of thermocouple accuracy:

- **Contamination by chemical substances vapours**

Vapours of metal and non-metal substances can condensate on the surface of thermocouple in case of measurement with a unprotected couple. The substances diffuse under high temperatures into the surface of thermocouple wires and thus decrease accuracy.

- **Reduction atmosphere**

Platinum atomisation occurs in the reduction atmosphere, which decreases the operating life of thermoelectric couple and its accuracy.

- **Contamination with lubricants and organic substances**

Organic substances are decomposed by heat and create reduction atmosphere acting in the above mentioned way.

- **Selection of suitable type and diameter of thermoelectric couple**

Selection of an optimal type of thermoelectric couple depends on application temperature, atmosphere and required length of operating life, accuracy and sensitivity of the couple.

- **Long-term usage**

Subject to compliance with all aforementioned measures, gradual decrease of the thermoelectric voltage value occurs in thermoelectric couples (type S and R) exposed to high temperatures on a long-term basis. It is caused by diffusion of rhodium into the Pt branch. Unfortunately, this phenomenon cannot be prevented and therefore thermoelectric couples must be regularly checked and exchanged.



## SAFINA a.s.

SAFINA, a.s. enforces EN ISO 9001:2000 and EN ISO 14001:2004 certified standards and places an extraordinary emphasis on quality of its products. Our laboratories guarantee reliable control over quality of materials and precisions and correctness of analytics results. SAFINA,a.s. is concurrently the holder of the European conformity sign CE granted by the British company Lloyd's Register Quality Assurance Ltd. pursuant to the standard EN ISO 13485.



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# THERMOCOUPLE TOLERANCES

## (Reference Junction at 0°C)

### American Limits of Error ASTM E230-ANSI MC 96.1

ANSI Code		Standard Limits**		Special Limits**	
<b>J</b>	Temp. Range	>0 to 750°C	>32 to 1382°F	0 to 750°C	32 to 1382°F
	Tolerance Value	2.2°C or 0.75%	4.0°F or 0.75%	1.1°C or 0.4%	2.0°F or 0.4%
<b>K</b>	Temp. Range	>0 to 1250°C	>32 to 2282°F	0 to 1250°C	32 to 2282°F
	Tolerance Value	2.2°C or 0.75%	4.0°F or 0.75%	1.1°C or 0.4%	2.0°F or 0.4%
	Temp. Range*	-200 to 0°C	-328 to 32°F		
	Tolerance Value	2.2°C or 2.0%	4.0°F or 2.0%		
<b>T</b>	Temp. Range	>0 to 350°C	>32 to 662°F	0 to 350°C	32 to 662°F
	Tolerance Value	1.0°C or 0.75%	1.8°F or 0.75%	0.5°C or 0.4%	1.0°F or 0.4%
	Temp. Range*	-200 to 0°C	-328 to 32°F		
	Tolerance Value	1.0°C or 1.5%	1.8°F or 1.5%		
<b>E</b>	Temp. Range	>0 to 900°C	>32 to 1652°F	0 to 900°C	32 to 1652°F
	Tolerance Value	1.7°C or 0.5%	3°F or 0.5%	1.0°C or 0.4%	1.8°F or 0.4%
	Temp. Range*	-200 to 0°C	-328 to 32°F		
	Tolerance Value	1.7°C or 1.0%	3°F or 1.0%		
<b>N</b>	Temp. Range	>0 to 1300°C	>32 to 2372°F	0 to 1300°C	32 to 2372°F
	Tolerance Value	2.2°C or 0.75%	4.0°F or 0.75%	1.1°C or 0.4%	2.0°F or 0.4%
	Temp. Range*	-270 to 0°C	-454 to 32°F		
	Tolerance Value	2.2°C or 2.0%	4.0°F or 2.0%		
<b>R S</b>	Temp. Range	0 to 1450°C	32 to 2642°F	0 to 1450°C	32 to 2642°F
	Tolerance Value	1.5°C or 0.25%	2.7°F or 0.25%	0.6°C or 0.1%	1°F or 0.1%
<b>B</b>	Temp. Range	800 to 1700°C	1472 to 3092°F		Not Established
	Tolerance Value	0.5%	0.9°F		
<b>G* C* D*</b>	Temp. Range	0 to 2320°C	32 to 4208°F		Not Established
	Tolerance Value	4.5°C or 1.0%	0.9°F		

\* Not official symbol standard designation

\*\* Whichever value is greater

**Note:** Material is normally selected to meet tolerances above 0°C. If thermocouples are needed to meet tolerances below 0°C, the purchaser shall state this as selection of material is usually required.

### IEC Tolerance Class EN 60584-2; JIS C 1602

IEC Code		Class 1	Class 2	Class 3
<b>J</b>	Temp. Range	-40 to 375°C	-40 to 333°C	
	Tolerance Value	±1.5°C	±2.5°C	Not Established
	Temp. Range	375 to 750°C	333 to 750°C	
	Tolerance Value	±0.4% Reading	±0.75% Reading	
<b>KN</b>	Temp. Range	-40 to 375°C	-40 to 333°C	-167 to 40°C
	Tolerance Value	±1.5°C	±2.5°C	±2.5°C
	Temp. Range	375 to 1000°C	333 to 1200°C	-200 to -167°C
	Tolerance Value	±0.4%	±0.75% Reading	±1.5% Reading
<b>T</b>	Temp. Range	-40 to 125°C	-40 to 133°C	-67 to 40°C
	Tolerance Value	±0.5°C	±1.°C	±1°C
	Temp. Range	125 to 350°C	133 to 350°C	-200 to -67°C
	Tolerance Value	±0.4% Reading	±0.75% Reading	±1.5% Reading
<b>E</b>	Temp. Range	-40 to 375°C	-40 to 333°C	-167 to 40°C
	Tolerance Value	±1.5°C	±2.5°C	±2.5°C
	Temp. Range	375 to 800°C	333 to 900°C	-200 to -167°C
	Tolerance Value	±0.4% Reading	±0.75% Reading	±1.5% Reading
<b>R S</b>	Temp. Range	0 to 1100°C	0 to 600°C	
	Tolerance Value	±1°C	±1.5°C	Not Established
	Temp. Range	1100 to 1600°C	600 to 1600°C	
	Tolerance Value	±[1+0.3% x (Rdg-1100)]°C	±0.25% Reading	
<b>B</b>	Temp. Range			600 to 800°C
	Tolerance Value	Not Established	600 to 1700°C	+4°C
	Temp. Range		±0.25% Reading	800 to 1700°C
	Tolerance Value			±0.5% Reading

† Material is normally selected to meet tolerances above -40°C. If thermocouples are needed to meet limits of Class 3, as well as those of Class 1 or 2, the purchaser shall state this, as selection of material is usually required.