Thermometers

Technical Information

Temperature is an indicator of the thermal condition of a homogenous material or body. It expresses the energy of motion that is contained in the molecules of the material.

Transmission of temperature from one body to another, e.g. process medium and thermometric sensor, requires close physical contact between both bodies to achieve thermal equilibrium.

Conventional temperature measurement is based on the property of certain materials to alter their physical shape or volume proportional to the temperature applied. The most commonly used principles in the WIKA-production are highlighted below.

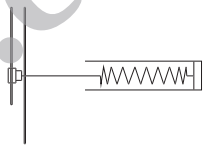
1. Bimetal Thermometers

Temperature measurement is made by means of a bimetal system inside the thermometric sensor. The bimetal consists of two inseparably joined metal strips. Either metal features a thermal expansion coefficient that differs from the other. This causes the strip to attain a particular curve that is proportional to the temperature variation. The actual bimetal system consists of a bimetal strip that is either

- helically or
- spirally

wound, as the size of the sensor and the temperature to be measured demands. Any temperature variation influences the bimetal in such a way as to rotate an axis attached. This rotation is indicated by means of a pointer on a dial scale.

WIKA bimetal thermometers are available to measure temperatures from -70 °C up to +600 °C with an accuracy in compliance with Class 1 and 2 of DIN 16 203.

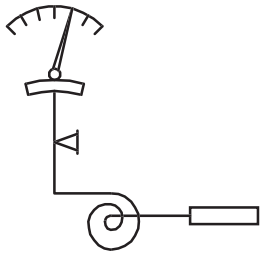


2. Gas Actuated Thermometers

The thermometric system consists of thermometric sensor bulb, transmitting capillary and case containing a bourdon tube element. The system is pressure-filled with a suitable agent. This is pressurised inert gas.

Any temperature variation will effect the internal pressure of the system. This pressure variation is measured by the bourdon tube system and indicated on a dial scale in terms of temperature units. Variations of the ambient temperature are compensated for by means of a bimetal device inside the case.

WIKA gas actuated thermometers are available to measure temperatures from -200 °C to +700 °C with an accuracy in compliance with Class 1 of DIN 16 203.



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Limit of error in °C per DIN 16 203

Applicable for expansion and bimetal dial thermometers.

Scale range in °C	Measuring range in °C	Limit of error [1] in °C	
		class 1	class 2
-20…+40	-10…+30		
-20…+60	-10…+50	1.0	2.0
-30…+50	-20…+40		
-40…+40	-30…+30		
-40…+60	-30…+50	1.0	2.0
0…+60	+10…+50		
0…+80	+10…+70	1.0	2.0
0…+100	+10…+90	1.0	2.0
0…+120	+20…+100	2.0	4.0
0…+160	+20…+140	2.0	4.0
0…+200	+20…+180	2.0	4.0
0…+250	+30…+220	2.5	5.0
0…+300	+30…+270		
0…+350	+50…+300	5.0	10.0
0…+400	+50…+350		
0…+500	+50…+450	5.0	10.0
0…+600	+100…+500	10.0	15.0

1) DIN 1319 part 3 refers for definition of limit of error.

Conversion reference

How to calculate K

from Celsius: $K = °C + 273.15$
Fahrenheit: $K = \frac{5}{9}\,(°F + 459.67)$
Rankine: $K = \frac{5}{9}\,°R$
Réaumur: $K = \frac{5}{4}\,°Ré + 273.15$

How to calculate °C

from Fahrenheit: $°C = \frac{5}{9}\,(°F - 32)$
Kelvin: $°C = K - 273.15$
Rankine: $°C = \frac{5}{9}\,°R - 273.15$
Réaumur: $°C = \frac{5}{4}\,°Ré$

How to calculate °F

from Celsius: $°F = \frac{9}{5}\,°C + 32$
Kelvin: $°F = \frac{9}{5}\,K - 459.67$
Rankine: $°F = °R - 459.67$
Réaumur: $°F = \frac{9}{4}\,°Ré + 32$

How to calculate °R

from Celsius: $°R = \frac{9}{5}\,°C + 491.68$
Fahrenheit: $°R = °F + 459.67$
Kelvin: $°R = \frac{9}{5}\,K$
Réaumur: $°R = \frac{9}{4}\,°Ré + 491.68$

How to calculate °Ré

from Celsius: $°Ré = \frac{4}{5}\,°C$
Kelvin: $°Ré = \frac{4}{5}\,K - 218.52$
Fahrenheit: $°Ré = \frac{4}{9}\,(°F - 32)$
Rankine: $°Ré = \frac{4}{9}\,°R - 218.52$

Basic points of thermo-dynamic temperature scales

Unit	Symbol	Reference value	
		absolute zero	triple point of water
Kelvin	K	0	273.16
Degree Celsius	°C	-273.15	0.01
Degree Fahrenheit	°F	-459.67	32.01
Degree Rankine	°R	0	491.68
Degree Réaumur	°Ré	-218.52	0

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WIKA
WIKA Alexander Wiegand GmbH & Co. KG
Alexander-Wiegand-Straße · 63911 Klingenberg
☎ (0 9372) 132-0 · Fax (0 9372) 132-406/414
http://www.wika.de · E-mail: info@wika.de