

KOREAN INDUSTRIAL STANDARD

Indicating Thermoelectric Thermometers

1. Scope

This Korean Industrial Standard specifies indication thermoelectric thermometers of analog system (including meters provided with an amplifier or reference function compensating circuit hereinafter referred to as the "thermometers") consisting of the combination of moving coil type indicator and the thermocouples specified in KS C 1602 (Thermocouples).

However, indicators provided with a burn-out⁽¹⁾ circuit are employed only in thermometers with amplifier. For thermometers provided with either one or both of control mechanism and alarming mechanism, this standard applies as practical.

Note⁽¹⁾ The burn-out means such function that allows the indicator to deflect over the maximum or minimum scale value when the thermocouple circuit disconnects.

2. Definitions

For the purpose of this standard, the following definitions apply, and others are in accordance with KS A 3009 [Glossary of Terms Used in Instrumentation (General)].

(1) indicator

A moving coil type indicator. For an indicator with an amplifier, this term means the indicator including the amplifier.

(2) adjusting rheostat

A resistance to adjust external resistance of an indicator to the nominal value.

(3) external resistance

The resistance of the circuit composed of a thermocouple, compensating conductor, lead wire, etc. connected to the measuring terminals of an indicator. For an indicator having an adjusting rheostat inside its measuring terminals external resistance means the above-mentioned external resistance plus the adjusting rheostat.

(4) nominal value of external resistance

the value of external resistance indicated on an indicator.

(5) measuring range of indicator

All range of scale graduated on an indicator.

(6) effective measuring range of indicator

The range in which the accuracy specified in this standard must be guaranteed within the measuring range of an indicator.

Related Standards :

KS A 0006 Standard Atmospheric Conditions for Testings

KS A 3009 Glossary of Terms Used in Instrumentation (General)

KS C 1301 Insulation Resistance Testers (Magneto Generator Operated)

KS C 1302 Insulation Resistance Testers (Battery Operated)

KS C 1303 Electrical Indicating Instruments

KS C 1602 Thermocouples

KS C 1606 Electrical Methods of Temperature Measurements

KS C 1609 Compensating Lead Wires

KS C 3503 Rolled Steel for General Structural Purposes

(7) Scale span

The difference between the maximum scale value and minimum scale value. For example, in an indicator of -200 to 100°C , the scale span is 300°C .

3. Classification

3.1 Class of Indicator

Indicators shall be classified by their accuracy as given in Table 1.

Table 1.

Class of indicator	Letter Symbol
Class 0.5	0.5 or CLASS 0.5
Class 1.0	1.0 or CLASS 1.0
Class 2.0	2.0 or CLASS 2.0

Remarks : 1. "CLASS" may be written in small letters.

2. Class 0.5 does not apply to indicator provided with amplifier or reference junction compensating circuit.

3.2 Principle of Operation

The principle of operation of indicators shall be moving coil type. It may also include such system providing on amplifier or reference junction compensating circuit.

3.3 Measuring Range of Indicator

3.3.1 Temperature Scale

The measuring range of indicators shall, as a rule, be given in Table 2.

Table 2.

Kind of thermocouple combined ⁽²⁾	Measuring range ⁽³⁾	Unit : $^{\circ}\text{C}$
B	0 to 1700, 600 to 1700	
R	0 to 1000, 0 to 1200, 0 to 1400, 0 to 1600, 400 to 1400, 600 to 1600, 800 to 1600	
S		
K (CA)	-200 to 100 , 0 to 300 , 0 to 400 , 0 to 500 , 0 to 600 , 0 to 800 , 0 to 1000 , 0 to 1200 , 300 to 600 , 400 to 800 , 500 to 1000 , 600 to 1200	
E (CRC)	-200 to 100 , 0 to 200 , 0 to 300 , 0 to 400 , 0 to 500 , 0 to 600 , 0 to 800 , 200 to 400 , 300 to 600	
J (IC)	0 to 200 , 0 to 300 , 0 to 400 , 0 to 500 , 0 to 600 , 200 to 400 , 300 to 600	
T (CC)	-200 to 100 , 0 to 300	

Notes ⁽²⁾ The kinds of thermocouples are indicated by the symbols of KS C 1602. However, the symbols in parenthesis are the old symbols and given for reference only.

⁽³⁾ The range for overheating use is included

3.3.2 Double Scale in Temperature and mV

In an indicator with double scale in temperature and mV, the mV scale shall be graduated to indicate the terminal voltage. The mV value almost corresponding to the maximum value of temperature scale shall be taken as the maximum value of mV.

3.4 Effective Measuring Range of Indicator

The effective measuring range of an indicator shall be the whole measuring range of the indicator. However, the effective measuring range shall be limited 25 or more of the maximum scale value for indicators used with thermocouples of R and S, and 1000°C or more for indicators used with thermocouples of B.

4. Performances

4.1 Tolerances

4.1.1 Tolerances of Indicator Itself

The tolerances of an indicator itself shall be such that the error in indication is within the limits given in Table 3 when the indicator is tested through its effective measuring range in accordance with 6.3.1.

However for an indicator provided with reference junction compensating circuit, the error of the circuit is included.

Table 3.

Class of indicator	Tolerances (in % of scale span)
Class 0.5	± 0.5
Class 1.0	± 1.0
Class 2.0	± 2.0

4.1.2 Tolerances of Thermometer

The tolerance of a thermometer is the sum of individual tolerance of the indicator, thermocouple, compensating conductor, etc. Which composed the thermometer.

4.2 Operation and Characteristics

4.2.1 Response

An indicator shall be good in response, and its response time shall be 5 sec. or less when tested in accordance with 6.3.2. However, The response time of an indicator in which the value of thermoelectromotive force corresponding to the scale span is 10mV or less and no amplifier is provided shall be 7 sec. or less.

4.2.2 Hysteresis Error

Hysteresis error of an indicator shall not exceed the relevant limit of Table 4. When tested through the effective measuring range of the indicator in accordance with 6.3.3.

Table 4.

Class of indicator	Allowable limits of hysteresis error (in % of scale span)
Class 0.5	0.4
Class 1.0	1.0
Class 2.0	2.0

4.2.3 Influence of Position

The influence of position on an indicator shall not exceed the relevant limit of Table 5, when tested in accordance with 6.3.4 ⁽¹⁾. In a portable indicator, the influence shall not exceed the relevant limit of Table 5, when further tested in accordance with 6.3.4 ⁽²⁾.

Table 5.

Class of indicator	Allowable limits	
	Deviation caused by 6.3.4 ⁽¹⁾ (in % of scale length)	Difference in indicated values caused by 6.3.4 ⁽²⁾ (in % of scale span)
Class 0.5	2.0	0.5
Class 1.0	2.0	1.0
Class 2.0	4.0	2.0

4.2.4 Drift of Zero Point

The drift of zero point (the minimum scale value for an indicator without zero point) of an indicator shall not exceed the indicator without both amplifier and reference junction compensating circuit in accordance with 6.3.5 ⁽¹⁾, or on the indicator provided with either one or both of such auxiliary means in accordance with 6.3.5 ⁽²⁾.

Table 6.

Class of indicator	Allowable limits (in % of scale length)	
	Amplifier, reference junction compensating circuit	
	Indicator without both means	Indicator providing either or both of the means
Class 0.5	0.2	—
Class 1.0	0.5	0.8
Class 2.0	1.0	1.5

4.2.5 Influence of Ambient Temperature

The influence of temperature on an indicator shall be such that the variation of error shall not exceed the relevant limit of Table 7, when tested in accordance with 6.3.6.

Table 7.

Class of indicator	Allowable limits of variation error (in % of scale span)
Class 0.5	0.3
Class 1.0	0.5
Class 2.0	1.0

4.2.6 Influence of External Magnetic Field

The influence of external magnetic field on an indicator shall be such that the variation of error shall not exceed the relevant limit of Table 8, when tested in accordance with 6.3.7.

Table 8.

Class of indicator	Allowable limits of variation error (in % of scale span)
Class 0.5	2
Class 1.0	4
Class 2.0	4

4.2.7 Influence of external Steel Product

The influence of external steel products on an indicator shall be such that the variation of error shall not exceed the relevant limit of Table 9, when tested in accordance with 6.3.8.

Table 9.

Class of indicator	Allowable limits of variation of error (in % of scale span)	
	Panel use	Portable use
Class 0.5	0.2	0.2
Class 1.0	0.5	0.4
Class 2.0	1.0	0.7

4.2.8 Influence of External Resistance

In an indicator without amplifier, its indicated value differs according to its external resistance and the variation of indicated value is determined by its internal resistance. The internal resistance is tested in accordance with 6.3.9 (1), and the measured value divided by the nominal value of the maximum terminal voltage shall be a value equal to or more than the relevant value of Table 10, and the internal resistance shall be 5 times or more of the nominal value of external resistance.

Table 10.

Kind of thermocouple combined Class of indicator	Minimum value of internal resistance Ω / mV	
	B.R.S	K.E.J.T
Class 0.5	10	5
Class 1.0	5	3
Class 2.0	—	1.5

In an indicator with amplifier, the variation of error shall not exceed the relevant limit of Table 11, when the influence of external resistance is tested in accordance with 6.3.9 (2).

Table 11.

Class of indicator	Allowable limits of variation of error (in % of scale length)
Class 1.0	1.0
Class 2.0	2.0

4.2.9 Influence of Power Source Voltage

The influence of power source voltage on an indicator which utilizes external power source shall be such that the variation of error shall not exceed the relevant limit of Table 12, when tested in accordance with 6.3.10.

Table 12.

Class of indicator	Allowable limits of variation of error (in % of scale length)
Class 1.0	0.5
Class 2.0	1.0

4.2.10 Insulation Resistance

The insulation resistance of an indicator shall be at least 10 M Ω , when tested in accordance with 6.3.11.

4.3.11 Withstand Voltage

The withstand voltage of an indicator which utilizes a.c. power source shall be tested in accordance with 6.3.12, and no electrical damage shall be observed after the test.