

JIS

JAPANESE INDUSTRIAL STANDARD

Indicating Thermoelectric
Thermometers

JIS C 1601 — 1983

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Indicating Thermoelectric Thermometers

C 1601-1983

1. Scope

This Japanese Industrial Standard specifies indicating thermoelectric thermometers of analog system consisting of the combination of moving coil type indicators and the thermocouples specified in JIS C 1602 (including meters provided with an amplifier and/or reference junction compensating circuit), hereinafter referred to as the "thermometers". Indicators provided with a burn-out ⁽¹⁾ circuit are, however, 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, beside in conformity with JIS Z 8103, the following definitions apply:

- (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.

Applicable Standards:

JIS C 1102-Electrical Indicating Instruments
JIS C 1301-Insulation Resistance Testers (Magneto Generator Operated)
JIS C 1302-Insulation Resistance Testers (Battery Operated)
JIS C 1602-Thermocouples
JIS G 3101-Rolled Steel for General Structure
JIS Z 8103-Glossary of Terms Used in Instrumentation
JIS Z 8703-Standard Atmospheric Conditions for Testing

Reference Standards:

JIS C 1610-Compensating Lead Wires
JIS Z 8704-Electrical Methods of Temperature Measurements

- (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.
- (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 are 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 indicators provided with amplifier and/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 an amplifier and/or reference junction compensating circuit.

3.3 Measuring Range of Indicator

3.3.1 Temperature Scale The measuring ranges of indicators shall, as a rule, be those given in Table 2.

Table 2

Unit: °C

Kind of thermocouple combined (2)	Measuring range (3)
B	0 to 1700, 600 to 1700
R S	0 to 1000, 0 to 1200, 0 to 1400, 0 to 1600, 400 to 1400, 600 to 1600, 800 to 1600
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 thermocouple are indicated by the symbols of JIS C 1602. The symbols in parentheses 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. Provided that, 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. The response time of an indicator in which the value of thermoelectromotive force corresponding to the scale span is 10 mV or less and no amplifier is provided shall, however, 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, however, 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 span)	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 relevant limit of Table 6, when the test is carried out on 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 allowable limit of Table 7, when tested in accordance with 6.3.6.

Table 7

Class of indicator	Allowable limits of variation of 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 allowable limit of Table 8, when tested in accordance with 6.3.7.

Table 8

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