

**BUREAU OF INDIAN STANDARDS**

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भारतीय मानक मसौदा

**सामान्य प्रयोजन अधिकतम और न्यूनतम थर्मोमीटर — विशिष्टि**

(पहला पुनरीक्षण)

*Draft Indian Standard*

**GENERAL PURPOSE MAXIMUM AND MINIMUM  
THERMOMETERS — SPECIFICATION**

(*First Revision*)

ICS 17.200.20

Glass, Glassware & Laboratoryware Sectional Committee, CHD 10

**Last date for Comments: 11 November 2024**

**FOREWORD**

(*Formal clause to be added later*)

A general purpose maximum and minimum thermometer is used in educational institutions, industries, offices, green houses, etc., for registering extremes of temperature during a given period, usually 24 hours. It also acts as two thermometers each roughly indicating the dry bulb temperature of the ambient air. For more accurate work, however, use is made of two separate thermometers, that is, one indicating the maximum temperature and the other the minimum temperature during a given period (*see IS 5681 'General meteorological thermometers, Liquid-In-Glass - Specification (second revision)'*).

This standard was originally published in 1973. In relation to the Minamata Convention where mercury shall be removed from products by 2025, the committee responsible for formulating this standard decided to revise the standard by providing alternative thermometric liquids in addition to the mercury as liquid-in-glass thermometers are still in use in the country.

In this first revision, Kerosene oil has been added as an alternative thermometric liquid. A sampling plan for lot testing has also been prescribed and several editorial changes such as the inclusion of the Reference clause, Hindi Title, ICS no, BIS certification marking clause, etc. have also been incorporated.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Draft Indian Standard*

**GENERAL PURPOSE MAXIMUM AND MINIMUM  
THERMOMETERS — SPECIFICATION**

*(First Revision)*

**1 SCOPE**

This standard prescribes requirements of general purpose maximum and minimum thermometers.

**2 REFERENCES**

The standards given below contain provisions which through reference in this text, constitute provisions of and necessary adjuncts to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated.

<i>IS No.</i>	<i>Title</i>
IS 321 : 1964	Specification for absolute alcohol
IS 2627 : 1979	Glossary of terms relating to liquid - in - glass thermometers ( <i>first revision</i> )
IS 4610 : 1968	Specification for glass tubes for general purpose and reference thermometers
IS 4825 : 1982	Specification for liquid - In - Glass solid - Stem reference thermometers ( <i>first revision</i> )
IS 5681 : 1992	General meteorological thermometers, liquid - In - Glass - Specification ( <i>second revision</i> )
IS 6274 : 1971	Method of calibrating liquid - In - Glass thermometers
IS 4905 : 2015	Random sampling and randomization procedures (First Revision)

**3 TERMINOLOGY**

For the purpose of this standard, the definitions given in IS 2627 shall apply.

**4 TYPES AND IMMERSION**

General purpose maximum and minimum thermometer shall be of liquid-in-glass solid-stem type, calibrated for full vertical immersion.

**5 REQUIREMENTS**

**5.1 Patterns**

The thermometers shall be of two patterns, namely, Pattern A and Pattern B shown in Fig. 1 and Fig. 2 respectively.

**5.2 Range**

The range of thermometers conforming to Pattern A shall be  $-40\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$  with smallest scale divisions equivalent to  $1.0\text{ }^{\circ}\text{C}$ . For thermometers conforming to Pattern B, this shall be  $-35\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$  with smallest scale divisions equivalent to  $0.5\text{ }^{\circ}\text{C}$ .

**5.3 Materials**

**5.3.1 Glass**

The glass capillary used for the thermometer shall be in accordance with IS 4610. The outer diameter of the capillary being  $(6.0 \pm 0.5)$  mm.

**5.3.2 Thermometric Liquid**

Recommended thermometric liquid is either dyed or undyed alcohol or distilled creosote oil.

**5.3.2.1** When alcohol is used it shall comply with the provisions of Special Grade of IS 321 subject to the following modifications:

a) Aldehydes and ketones - Alcohol shall not contain more than 0.02 percent (m/m) of aldehydes and ketones: calculated as acetaldehyde ( $\text{CH}_2\text{CHO}$ ); and

b) Amines - Alcohol shall give no indication of the presence of amines when tested by adding to 10 ml of alcohol, 10 ml of distilled water followed by 2 drops of a saturated solution of p-nitrophenol in water. Not more than 0.05 ml (1 drop) of 0.1 N sulphuric acid shall be required to discharge any yellow colour produced.

### **5.3.3** *Separating Liquid*

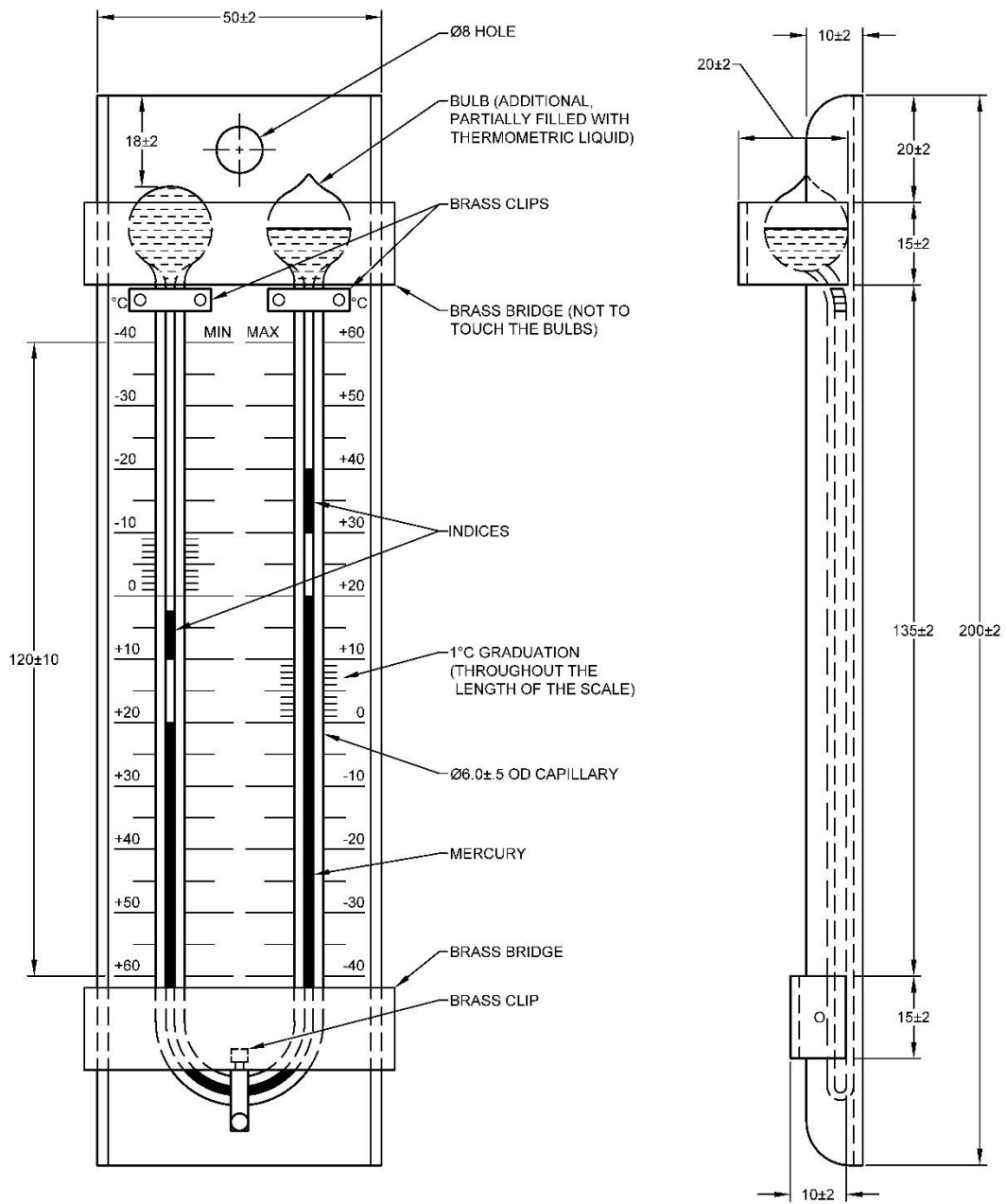
The liquid separating the two columns of the thermometric liquid in the two arms of the U-shaped capillary shall be pure and dry mercury which may be alloyed with 8.5 percent by mass of thallium.

### **5.3.4** *Indices*

The indices shall be made of either steel spring or of dark coloured glass with attached spring.

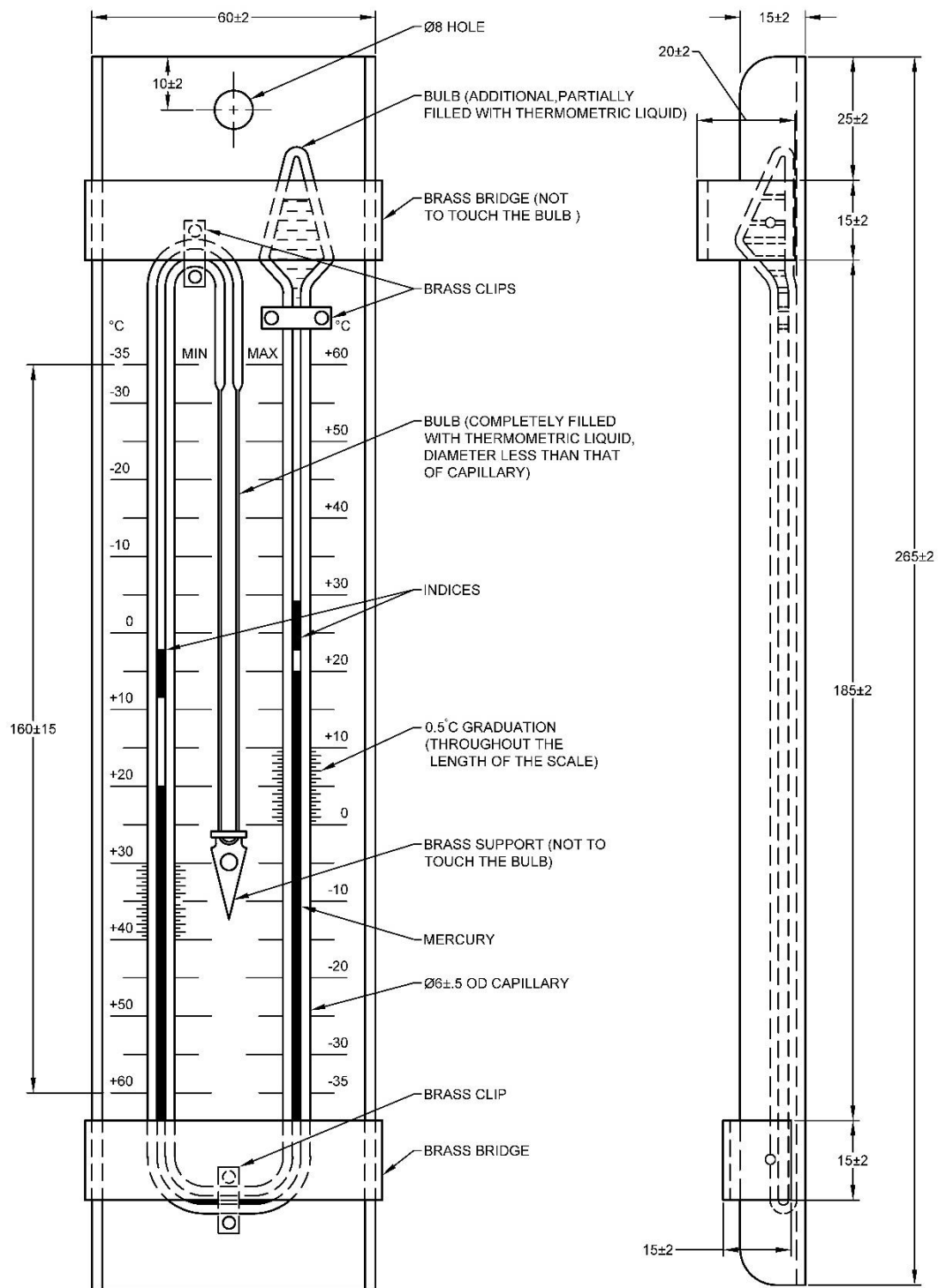
### **5.3.5** *Panel and Frame*

The panel (portion bearing the scales) shall be of metal, opal glass or plastics material and shall be of suitable rigidity and thickness. If a plastics material is used, it shall be of a type known to be stable within the temperature range of the thermometer and shall be capable of withstanding exposure to outdoor weather conditions.



All dimensions in millimetres

FIG. 1 GENERAL PURPOSE MAXIMUM AND MINIMUM THERMOMETER, PATTERN A



All dimensions in millimetres

FIG. 2 GENERAL PURPOSE MAXIMUM AND MINIMUM THERMOMETER, PATTERN B

#### 5.4 Workmanship and Finish

The thermometers shall consist of a U-shaped capillary with a bulb at each end (*see* Fig. 1 and Fig. 2). When fixed securely on the panel, the thermometer shall rest on it evenly without strain and there shall be no possibility of movement of its U-shaped portion relative to the graduated scales.

##### 5.4.1 Bulbs

The two bulbs shall have shapes as shown in Fig. 1 and 2. In Pattern B, the outer diameter of the long bulb shall be less than that of the U-shaped capillary. The bulbs shall be fused to the capillary arms without any constriction to permit unrestricted flow of liquids and when the thermometer is fixed securely, the bulbs shall not touch the panel plate.

**5.4.1.1** The bulb at left (*see* Fig. 1 and Fig. 2) shall be completely filled with thermometric liquid, that is, either alcohol or distilled creosote oil. The additional bulb on the right (*see* Fig. 1 and Fig. 2) shall be filled partially with the same thermometric liquid as in the bulb at left. It shall have sufficient volume to accommodate the thermometric liquid at the highest temperature, that is, + 60 °C.

#### **5.4.2** *Capillary*

The U-shaped glass capillary shall have a semicircular or square U-bend at the bottom (and also in the left arm in Pattern B). It shall have a mercury indicating column with registering indices in each arm. The portion above the mercury column in each arm shall be filled with the same thermometric liquid as in the bulbs.

#### **5.4.3** *Indices*

The indices shall withstand reasonable handling of the thermometer without moving and shall be easily reset by means of a small magnet. They shall be so constructed that they shall be pushed up the capillary arms by the expanding mercury column, but shall remain in position without coming down when the mercury column recedes.

#### **5.4.4** *Panel and Frame*

The panel may be carried in a frame either with or without a hinged hood for shading the bulbs of the thermometer. A suitable arrangement is shown in Fig. 1 and Fig. 2.

**5.4.4.1** The panel (or the frame holding it) shall be provided with a suitable arrangement for hanging the assembly vertically on a wall.

### **5.5** **Dimensions**

The dimensions of the thermometers shall be as prescribed in Fig. 1 and Fig. 2.

**5.5.1** In Fig. 1 dimensions other than the scale length, panel length and width are for guidance only.

### **5.6** **Graduations and Figuring**

The scales on the panel, along each limb of the U-shaped capillary tube shall be graduated at each 1 °C and 0.5 °C interval for Patterns A and B respectively and numbered at each 10 °C interval. Every graduation indicating a temperature equivalent to a multiple of five degrees shall be a medium line. The graduation lines shall extend on both sides of the limbs of the U-shaped capillary tube. The length of the small, medium and long graduation lines shall be 8, 10 and 12 mm respectively on either side of the capillary.

**5.6.1** The figures indicating temperature shall be upright and shall be placed immediately above the graduations to which they refer. Alternatively, they may be placed so as to be bisected by the extension of the lines of graduation to which they refer.

### **5.7** **Reference Line**

The minimum side of the thermometer shall be engraved with a mark or line at 0 °C mark which when placed against the corresponding graduation on the scale shall ensure proper placement of the U-shaped capillary tube along the scales.

### **5.8** **Accuracy**

When tested in accordance with the method prescribed in Annex A, the maximum permissible errors in readings on each scale shall be equivalent to one smallest scale division, that is, 1 °C for Pattern A and 0.5 °C for Pattern B thermometers.

**5.8.1** The maximum permissible difference between the readings on the scales at the meniscus of the mercury columns along the two limbs shall be equivalent to 0.5 °C for Pattern A and 0.25 °C for Pattern B thermometers.

## **6** **MARKING AND PACKING**

### **6.1** **Packing**

The maximum and minimum thermometers shall be packed as agreed to between the purchaser and the supplier.

## 6.2 Marking

6.2.1 The following inscriptions shall be permanently and legibly marked on the panel of each thermometer:

- a) The inscription '°C' near the top of the respective scales;
- b) The words 'Max' and 'Min' along the respective scales;
- c) Letters 'Pattern A' or 'Pattern B', as the case may be;
- d) Maker's name or recognized trade-mark, if any; and
- e) The serial number.

### 6.2.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

## 7 SAMPLING

### 7.1 Lot

7.1.1 All thermometers of the same type in a single consignment and produced under similar conditions of manufacture shall constitute a lot.

7.1.2 Thermometers constituting the sample shall be drawn from each lot separately for deciding the conformity of the lot to the requirements of the specification.

### 7.2 Scale of Sampling

Number of thermometers to be selected at random from the lot shall depend on the lot size and shall be in accordance with col (3) of table 1. In order to ensure randomness of selection, procedures given in IS 4905 may be followed.

### 7.3 Criteria for Conformity

7.3.1 For deciding the conformity of the lot to the requirements of this specification, the test results of each characteristic shall meet the corresponding requirements specified in the relevant clauses.

7.3.2 The lot shall be declared as conforming to the requirements of the specification, if the number of defectives is equal or less than the number given in col (4) of table 1.

**Table 1 Scale of Sampling**  
(Clause 7.2, 7.3.2)

SI No.	Number of thermometers in the lot	Sample size	Acceptance number
(1)	(2)	(3)	(4)
i.	Less than 150	20	1
ii.	151 to 280	32	2
iii.	281 to 500	50	3
iv.	501 to 1200	80	5
v.	1201 and above	125	7

**ANNEX A**  
(Clause 5.8)

**TEST FOR ACCURACY**

**A-1 GENERAL**

Accuracy of general purpose maximum and minimum thermometers is checked at the ice-point and room temperature.

**A-2 APPARATUS**

**A-2.1 Ice-Point Equipment** – same as prescribed in clause **5.1.1** of IS 6274.

**A-2.2 Reference Thermometers** – two (*see* schedule marks 21 and 23 of IS 4825).

**A-3 PROCEDURE**

**A-3.1 Accuracy at Ice-Point**

Prepare the ice-point equipment following the procedure prescribed in Annex B of IS 6274; and when ready, place the assembled thermometer alongside the reference thermometer (schedule mark 21 of IS 4825) in it in a vertical position so that the bulbs and the U-shaped capillary are completely covered under shaved ice. After some time, when the temperature has become stationary, take out the thermometer and note the reading on the minimum side of the scales and compare it with that of the reference thermometer and find out the difference.

**A-3.1.1** Also note the difference, if any, between the readings on the two arms of the U-shaped capillary.

**A-3.2 Accuracy at Room Temperature**

Adjust the indices in both the scales along the U-shaped capillary to touch the mercury column, note the temperatures indicated on both sides.

**A-3.2.1** Compare the temperature indicated by the minimum side with that of a reference thermometer (schedule mark 23 of IS 4825) and find out the difference. Also note the difference, if any, between the readings on the two scales along the U-shaped capillary.