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Draft Indian Standard

LIQUID-IN-GLASS THERMOMETERS – GLOSSARY
(*Second Revision*)

भारतीय मानक मसौदा

लिक्विड-इन-ग्लास थर्मोमीटर – शब्दावली

(दूसरा पुनरीक्षण)

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FOREWORD

(Formal clause to be added later)

This standard was originally first published in 1963. However, in view of the increasing importance assigned to the use of uniform terminology both at the national and international levels in the field of thermometry involving the use of liquid-in-glass thermometers, the committee responsible for the preparation of the standard, decided to again revise it in 1979. Some of the terms relating to the glass portion of thermometers are covered in IS 1382: 1981 'Glossary of terms relating to glass and glassware (*first revision*)'. Accordingly, reference may have to be made to it in some cases.

In the first revision several new terms were incorporated and attempt was also made to update the definitions with a view to aligning them, as far as possible, with those used by the International Organization for Standardization (ISO), World Meteorological Organization (WMO), International Organization of Legal Metrology (OIML) and World Health Organization (WHO). However, whenever any differences occur between the definitions given in this standard and those given in a material specification, the definitions given in the latter shall prevail for the purpose of that standard.

In this second revision several other editorial changes have been incorporated such as the inclusion of ICS No., Hindi Title, etc. in order to bring out the standard in the latest style and format of the Indian Standards.

Draft Indian Standard
Liquid-In-Glass Thermometers – Glossary
(*Second Revision*)

1 SCOPE

This standard covers the terms and definitions relating to liquid-in-glass thermometers.

2 TERMS AND DEFINITIONS

A

Adjustable Range Thermometer — A thermometer whose temperature range can be adjusted by changing the volume of thermometric liquid in its bulb.

Adjusting Device — The reservoir of an adjustable range thermometer, into which the thermometric liquid is transferred from the main column for setting the temperature range.

Ageing — The process of heat treatment or storage of a thermometer, after which its calibration does not change with time in normal use or when kept in store.

Ambient Temperature — The temperature of the surrounding air.

Angular Twist — A defect in the prismatic capillary tubing as a result of a twist in the bore with relation to its lens front.

Annealing (of Thermometer) — A process to prevent or remove adjustable stresses in glass by controlled heating at or cooling from a suitable temperature.

Attached Scale Thermometer — A solid-stem thermometer attached to a strip on which the scale is marked along with numerals.

B

Beckmann Thermometer — A type of ‘Adjustable Range Thermometer’.

Bent-Stem Thermometer — A thermometer whose stem is bent intentionally to suit some particular application.

BIPM — An abbreviation for ‘*bureau International de Poids et Mesures*’ (International Bureau of Weights and Measures).

Blown Bulb Thermometer — A liquid-in-glass thermometer whose bulb has been formed by blowing out of the glass capillary.

Bore Section — The geometrical shape of the cross section of bore which may be circular or elliptical.

Bubbles — Gaseous inclusions in the thermometric liquid contained in the bulb of a thermometer.

Bulb — The glandular portion at one end of the liquid-in-glass thermometer which contains the main volume of the thermometric liquid.

Bulb Length — The axial distance between the shoulder and the bottom of the bulb.

Bulb Tubing — The glass tubing from which the bulbs of thermometers are made.

C

°C — Abbreviation for ‘Degree Celsius’.

Calibration of Thermometer — The comparison of a thermometer with standard reference thermometers for determining its accuracy.

Calibration Correction — The value algebraically added to the thermometer reading in order to compute the actual temperature.

Calibration Error — The deviation in the indication of a thermometer from the actual temperature observed during calibration.

Calorimeter Thermometers — Liquid-in-glass thermometers for use in calorimetry.

Capillary (of Thermometers) — Transparent glass tubes of round or prismatic cross section, generally provided with a white or yellow opal glass backing with a suitably placed oval or round bore; used for stem of thermometers.

Celsius

- i) Name of the person who was the first to divide the interval between the freezing and boiling points of water, into 100 equal parts.
- ii) The unit of temperature known as ‘Celsius’, by which the temperature is stated in degrees Celsius. *See also* ‘Degree Celsius’.

Clinical Thermometer — A medical thermometer of liquid-in-glass type provided with a maximum indicating device for measuring the temperature of human beings.

NOTE — Shapes and ranges of these thermometers depend on their use.

Clouding — Loss of transparency of the capillary of a thermometer due to devitrification, deposition of vapours, solids, etc.

Comparator Bath — A bath for calibration of thermometers.

Comparator Bath Fluid — The fluid used in the comparator bath.

Complete Immersion (CI) — The condition of immersion of a thermometer such that it is completely immersed in the medium whose temperature is to be measured.

Complete Immersion Thermometer — A thermometer which is meant to be used under conditions of complete immersion.

Conditioning (of Thermometer) — Pre-heating or pre-cooling of the thermometer before use so that it is not damaged on account of thermal shock.

Constriction — That portion of capillary of maximum-indicating thermometer in which the bore has been specially narrowed down to allow passage of the thermometric liquid in only one direction, that is, away from the bulb. The flow in the reverse direction has to be forced, for example, by giving jerks.

Contact Thermometer — A thermometer provided with two or more electrical contacts, for controlling temperature.

Contraction Chamber — An enlargement in the bore of the capillary of a thermometer, provided to suppress a range of temperature above ambient from being shown on the scale, thereby reducing the overall length.

Correction — A value equal but opposite in sign, to the error at a certain point on the, scale of a thermometer. Its algebraic addition to the reading of the thermometer gives the actual temperature.

Curometer — A special hygrometer, used during ‘curing’ in plantations for tobacco leaves, coffee, tea, etc.

D

Dairy Thermometer (Floating) — A floating thermometer used in dairy industry, for measuring temperature of dairy products.

Datum Line — A reference line or dot, on the scale and sheath of enclosed-scale thermometers to locate the scale precisely with respect to sheath.

Deep Sea Thermometer — A protected thermometer mainly meant for measurement of temperature at different depths in the sea. When used along with another unprotected thermometer, it can be used for determining the depth of the sea also.

NOTE — Both the thermometers are accompanied by auxiliary thermometers.

Degree Celsius (°C) — The recognized unit for temperature, temperature difference, and temperature interval.

Depth of Immersion — The length of thermometer that remains immersed in the medium whose temperature is being measured.

Detached Thermometric Liquid — That portion of thermometric liquid which is not in continuation with the thermometric liquid in the bulb.

Distinguishing Mark — The mark, usually an arrow, on certain medical thermometers, to show normal temperature of human beings, cattle, birds, etc.

Double (Multi) Bore — Presence of more than one bore in parallel configuration in a glass capillary.

Drainage — The receding of the thermometric liquid down the bore of the thermometer stem.

Drainage (Receding) Time — The time (in seconds) taken by the thermometric liquid column of a thermometer, in its descent to the ambient temperatures where the thermometer maintained at its maximum nominal temperature in a bath is suddenly pulled out.

Dry Bulb Thermometer — A thermometer used in a psychrometer for indicating ambient temperature.

Dye — Chemical used to colour the organic thermometric liquids to make them easily visible.

E

Emergent Column — The portion of the thermometric liquid column which remains outside the medium at the time of taking its temperature.

Emergent Column Correction — A correction applied to the readings when the liquid column of a total immersion thermometer is not immersed up to the prescribed level or when a partial immersion thermometer is not immersed up to the immersion line in the medium whose temperature is being measured.

Enamelled Back — The white or coloured, opaque surface at the back of the capillary of a thermometer to facilitate location of the thermometric liquid.

Enclosed-Scale Thermometer — A thermometer in which the scale strip is fastened to the capillary and enclosed in a transparent tube called 'sheath'.

Error (in Thermometer Readings) — Difference between the actual temperature and the reading of the thermometer.

Expansion Chamber — A pear-shaped gland at the top of capillary of a thermometer, provided in order to accommodate thermometric liquid in case the thermometer is overheated.

Exposed Stem — That portion of the thermometer which remains above the level of the medium whose temperature is being measured.

Exposed Stem Correction — *See* 'Emergent Column Correction'.

F

Fiduciary Point (Fiduciary Temperature) — An arbitrary temperature for reference and general check up. It is usually 0 °C.

Fiduciary Point Correction — A correction required to be algebraically added to the thermometer reading on account of the shift in the fiduciary point (usually 0 °C).

Figuring (of Thermometer) — The marking of digits and numerals on the scale(s) of a thermometer.

G

Gas-Filled Thermometer — A liquid-in-glass thermometer in which a dried, dust free, inert gas has been filled above the thermometric liquid, in order to increase its boiling point and to reduce evaporation.

General Purpose Thermometer — A popular term for all thermometers whose least count is not less than 0.5 °C.

Graduations (Graduation Lines) — Lines on the scale(s) of a thermometer indicating temperature.

Graduation Interval — The distance (in mm) between two consecutive graduation lines.

H

Hardness (of Constriction) — The force required to push the thermometric liquid through the constriction in a thermometer having a maximum indicating device.

Hygrometer — An instrument having a dry and a wet bulb thermometer to indicate temperature and relative humidity of the ambient air.

I

Ice Point — The temperature 0 °C.

Ice Point Correction — *See* ‘Fiduciary Point Correction’.

Ice Point Equipment — The apparatus used for determining ‘Ice Point Correction’.

Immersion Line (Immersion Mark) — A line or a mark permanently etched on the stem of a partial immersion liquid-in-glass thermometer to indicate the depth up to which the thermometer should be immersed at the time of taking a reading.

Index (for a Thermometer) — The small insert of glass fibre, iron wire, etc., inside the capillary of some thermometers, to enable them to register/indicate the maximum/minimum temperatures since the last adjustment of the index.

Industrial Psychrometer — An instrument for measuring the relative humidity of an industrial atmosphere.

International Practical Temperature Scale (IPTS) — The temperature scale which can be realized by using the instruments and methods specially recommended for this purpose by the International General Conference of Weights & Measures (CGPM) from time to time.

Interval (of Temperature) — A short specified portion of temperature scale.

Interval Error — The maximum error of thermometer in the specified interval of temperature.

K

Kelvin (K) — The unit of temperature known as ‘Kelvin’. It is also the unit of temperature difference and of temperature interval. Its magnitude is the fraction $1/273.16$ of the thermodynamic temperature of ‘Triple Point of Water’.

L

Laboratory Thermometer — Liquid-in-glass thermometer specially designed for use in the scientific and industrial laboratories, for measurement of temperature.

Least Count (Smallest Scale Division) — The temperature interval between two successive graduations of thermometer.

Length of Main Scale — Axial length in mm, of thermometer scale from its maximum nominal temperature mark to its minimum nominal temperature mark.

Limit of Accuracy of Test (Calibration) — The ultimate limit to which the calibration of a thermometer has been actually done.

Liquid-in-Glass Thermometer — A thermometer in which the thermal expansion of a liquid (thermometric liquid) enclosed in glass bulb and capillary is used to indicate temperature.

Loading Material — The heavy material incorporated in a floating thermometer to make it float vertically.

Locator — A mark on certain thermometers to enable them to be so held in the hand that the meniscus of the thermometric liquid becomes visible.

M

Maximum Indicating Device — *See* 'Constriction'.

Maximum and Minimum Thermometer — An attached scale thermometer comprising two thermometers on the same mounting, one being a maximum thermometer and the other a minimum thermometer.

Maximum-Minimum Thermometer — A thermometer which can register maximum as well as the minimum temperature.

Maximum Nominal Temperature — The highest temperature on the main scale which the thermometer is designed to register.

Maximum Thermometer — The Thermometer capable of registering the highest temperature since its last setting.

Medical Thermometer — A thermometer for measuring temperature of human beings and animals.

Minimum Nominal Temperature — The lowest temperature on the main scale which the thermometer is designed to register.

Minimum Thermometer — Thermometer capable of registering the lowest temperature since its last setting.

Mount — A panel for mounting the thermometer.

N

Nip — A small, blunt projection at the back of certain glass thermometers to enable them to be fixed to a mount or scale.

Nominal Range — The range between the minimum nominal temperature and the maximum nominal temperature of the thermometer.

O

Overall Length (of Thermometer) — The distance between extreme ends of the thermometer.

P

Partial Immersion (PI) — The condition of immersion of a thermometer such that it is immersed in the medium whose temperature is being measured, up to the immersion line or mark.

Partial Immersion Thermometer — A thermometer designed for use under conditions of partial immersion.

Pigment — The colouring matter filled in the engravings on a thermometer.

Prismatic Tubing — The capillary tubing with lens front.

Psychrometer — *See* 'Hygrometer'.

R

Reference Thermometer — A thermometer certified by appropriate authority for calibrating thermometers and having a least count less than the thermometer being calibrated.

Ring Gauge — A series of rings of different diameters used as gauges for determining/checking dimensions.

S

Safety Chamber — See 'Expansion Chamber'.

Sample — A collection of items selected from a testing.

Sampling — The process of selecting samples from a lot of identical items for ascertaining their quality from the point of view of accepting or rejecting the lot.

Scale — The graduations and numerals on a thermometer which indicate the temperature. Scales are named as 'main scale', 'fiduciary scale', or 'auxiliary scale', depending on the purpose each one serves, as follows:

- a) *Main Scale* — In 'adjustable-range' and 'differential' thermometers it covers their temperature span; in all other thermometers it covers their temperature range;
- b) *Fiduciary Scale* — Contains 5 to 19 graduation lines on both sides of the 'fiduciary point' and is used for checking any changes in the 'fiduciary point'.
- c) *Auxiliary Scale* — Provided in 'adjustable-range thermometers' to indicate the approximate temperature, and guide in 'setting' the thermometer.

NOTE — The word 'scale' refers to the main scale, unless specified otherwise.

Scale Error — The maximum error, anywhere on the main scale, when the thermometer is calibrated.

Scale Length — See 'Length of Main Scale'.

Scale-Strip — A strip or sheet on which main scale and fiduciary scale have been drawn along with the numerals.

Schedule Mark — An arbitrary number/symbol, assigned to a thermometer of given dimensions, range and least count, in certain Indian Standard Specifications for thermometers.

Sea Surface Thermometer — A thermometer specially designed for measuring the temperature of water at the surface layers of the sea.

Separating Liquid — The liquid separating the two columns of thermometric liquid in the two limbs of maximum-minimum thermometer.

Set (Setting) Temperature — The temperature to which the zero on the main scale of an adjustable-range thermometer is set.

Setting (of Adjustable Range Thermometer) — The process of adjusting the range of temperature of an adjustable-range thermometer so that it lies near the temperature around which small variations of temperature have to be studied.

Sheath — The transparent envelope of an enclosed-scale thermometer.

Sheathed Solid-Stem Thermometer — A solid-stem thermometer, sealed inside a sheath.

Sheathed Thermometer — See 'Enclosed-Scale Thermometer'.

Smallest Scale Division — See 'Least Count'.

Soil Thermometer — Mercury-in-glass enclosed-scale or sheathed solid-stem thermometer specially designed to read the temperature of soil at a particular depth.

Solid-Stem Glass Thermometer (Solid-Stem Thermometer) (Solid-Stem Liquid-in-glass Thermometer) — Liquid-in-glass thermometers in which the scale is marked on its stem.

Stable Bath — See 'Comparator Bath'.

Stable Thermometer Tubes — See 'Ageing'.

Stem — The portion of a thermometer above its bulb registering the rise or fall of thermometric liquid column.

T

Temperature Differential — Temperature difference in a medium with reference to a specified point in it.

Temperature Gradient — Rate of change of temperature with reference to a point.

Temperature Range — See 'Nominal Range'.

Temperature Scale — A scientific system of denoting temperature. Temperature scales are named as '*Absolute Scale of Temperature*', '*Thermodynamic Scale of Temperature*', '*Radiation Scale of Temperature*' or '*International Practical Scale of Temperature (IPTS)*', depending on the system on which they are based, for example:

- a) *Absolute Scale of Temperature* — Based on a system in which some phenomenon can be theoretically and experimentally linked with temperature in an established manner.
- b) *Thermodynamic Scale of Temperature* — Based on principles of thermodynamics. This has for long been assumed to be fully realizable with the help of a '*gas thermometer*' using a so-called '*perfect gas*', that is, the one obeying the '*Boyle-Charles Law*'.
- c) *Radiation Scale of Temperature* — Based on the '*Stephen Boltzman Law*' of radiation; and
- d) *International Practical Scale of Temperature (IPTS)* — Based on the '*Thermodynamic*' as well as the '*Radiation*' scales of temperature. This is an '*Absolute Scale of Temperature*' which can be realized most precisely.

NOTE — The 'SI Units' which are the only legal system of units in this country, have the Kelvin' as one of their base units, but the '*Celsius Scale*' has also been given a limited sanction.

Temperature Span — The range of temperature between two set points.

Thermometer — An instrument for measuring temperature.

Thermometer Glass — Glass used for thermometer bulb, capillary and sheath of thermometers.

Thermometer Reader — An optical aid for reading thermometers.

Thermometer Tubing — Glass tubes used for making thermometers.

Thermometric Liquid — A fluid suitable for use in a liquid-in-glass thermometer.

NOTE

Thermometric liquids generally used are:

Mercury (-38 °C to + 600 °C); Mercury-Thallium alloy (-55 °C to + 600 °C); Alcohol (-80 °C to + 50 °C); Technical Pentane (-200 °C to +30 °C); and Toluene (-90 °C to + 50 °C).

Thermometer Well — A metal/glass jacket into which a thermometer can be fitted to take the temperature of the surrounding medium.

Time Constant (of a Thermometer) — Time taken by a thermometer to acquire 63 percent of the temperature difference between it and the surrounding medium, under prescribed conditions.

Time of Response (of a Thermometer) — Time taken by a thermometer to fully respond to the temperature change, within the limit of accuracy of temperature measurement.

Top Finish (of a Thermometer) — The shape of the top of a thermometer finished to suit its use. Top finishes are named as '*Smooth Top*', '*Ring Top*', '*Button Top*', '*Nip Top*' and '*Metal/Plastics Top*' as follows:

- a) *Smooth Top Finish* — having an approximately hemispherical dome shape;
- b) *Ring Top Finish* — having a ring, eye or hook to enable a thermometer to be suspended;
- c) *Button Top Finish* — having a disc-like top perpendicular to the axis of a thermometer, to provide easy grip;
- d) *Nip Top Finish* — having a small blunt projection to enable a thermometer to be held firmly on a sheet or a scale; and
- e) *Metal/Plastics Top Finish* — having a metal or plastics cap cemented to the top of a thermometer.

Total Immersion (TI) — The condition of immersion of a thermometer such that it is immersed in the medium, whose temperature is being measured, up to the meniscus of the thermometric liquid in the capillary.

Total Immersion Thermometer — A thermometer designed for use under conditions of total immersion.

Triple Point of Water (TPW) — The temperature 0.01 °C at which water exists in all the three states of matter simultaneously, namely, solid, liquid and vapour.

Triple Point of Water Cell — A glass cell used for realizing the triple point of water.

Triple Point of Water Equipment — The entire equipment, including the TPW cell, required for the realization of the triple point of water and calibrating thermometers at that temperature.

V

Veterinary Thermometer — The liquid-in-glass thermometer used for finding the body temperature of birds and animals.

W

Wall Thermometer — An attached-scale thermometer for measuring the ambient temperature.

Wet Bulb Thermometer — A thermometer of shape and size similar to the dry bulb thermometer used in psychrometers, and having a muslin cloth wrapped round its bulb for keeping it wet with water.

Whirling Psychrometer — A wet and dry bulb psychrometer with thermometers having cylindrical bulbs provided with a chain and handle to enable it to be whirled round by hand to make it quickly acquire the ambient temperature.

Z

Zero Correction — *See* 'Fiduciary Point Correction'.

Zero Depression — The change in the reading of a thermometer, at 0 °C a little after it has been continuously used at a temperature close to its maximum nominal temperature for several hours at a stretch.

Zero Error — The zero correction with its algebraic sign reversed.