
International Standard 6152

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Thermometers for use with alcoholometers and alcohol hydrometers

Thermomètres pour alcoomètres et aréomètres pour alcool

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6152 was developed by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus*, and was circulated to the member bodies in March 1981.

It has been approved by the member bodies of the following countries :

Australia	India	South Africa, Rep. of
Brazil	Italy	Spain
Czechoslovakia	Korea, Rep. of	United Kingdom
Egypt, Arab Rep. of	Mexico	USSR
France	Poland	
Hungary	Romania	

The member body of the following country expressed disapproval of the document :

Netherlands

Thermometers for use with alcoholometers and alcohol hydrometers

1 Scope and field of application

This International Standard specifies short-stem precision mercury-in-glass thermometers for use with alcoholometers and alcohol hydrometers complying with ISO 4801.

2 References

ISO 654, *Short solid-stem thermometers for precision use.*

ISO 656, *Short enclosed-scale thermometers for precision use.*

ISO 4801, *Glass alcoholometers and alcohol hydrometers not incorporating a thermometer.*

3 Type and ranges of thermometers

3.1 The thermometers may be either solid-stem thermometers or enclosed-scale thermometers.

3.2 The designations, ranges, graduation intervals and maximum permissible errors (see 11.1 and 11.2) shall be as detailed in table 1.

NOTE — For explanation of "type", see ISO 654 and ISO 656.

4 Temperature scale

The thermometers shall be graduated in accordance with the Celsius scale as defined in the current definition of the International Practical Temperature Scale (IPTS) adopted by the Conférence Générale des Poids et Mesures, and in accordance with the International System of Units (SI).

5 Immersion

The thermometer shall be graduated, as required by the user, for either complete immersion, i.e. the entire thermometer being immersed in the sample, or for total immersion i.e. the thermometer is immersed in the sample so that the top of the liquid column lies in the same plane as, or not more than two scale divisions above, the surface of the sample.

6 Glass

6.1 The thermometer bulb shall be made of a suitable thermometric glass selected and processed so as to show the characteristics specified in 6.2 to 6.6.

6.2 Stress in the glass of the bulb and stem or sheath shall be reduced to a level sufficient to minimize the possibility of fracture due to thermal or mechanical shock.

Table 1

Designation	Type	Main scale °C	Auxiliary scale °C	Graduation interval °C	Maximum permissible error °C
AH 1	A	− 11 to + 1	—	0,1	0,1
AH 2	A	− 1 to + 11	—	0,1	0,1
AH 3	B	9 to 21	− 0,5 to + 0,5	0,1	0,1
AH 4	B	19 to 31	− 0,5 to + 0,5	0,1	0,1
AH 5	B	29 to 41	− 0,5 to + 0,5	0,1	0,1
AH 6	C	− 38 to − 18	− 1 to + 1	0,2	0,2
AH 7	A	− 22 to + 2	—	0,2	0,2
AH 8	A	− 8 to + 22	—	0,2	0,2
AH 9	B	18 to 42	− 1 to + 1	0,2	0,2
AH 10	A	− 30 to + 15	—	0,5	0,5
AH 11	A	− 5 to + 40	—	0,5	0,5

6.3 The bulb glass shall be stabilized by suitable heat treatment to ensure that the accuracy requirements of 11.1 and 11.2 are met.

6.4 The legibility of the reading shall not be impaired by devitrification or clouding.

6.5 The image of the meniscus shall be distorted as little as possible by defects or impurities in the glass.

6.6 The stem shall be made of a lead glass or other suitable glass with an enamel backing.

7 Liquid filling

The liquid filling shall be mercury free from any contamination likely to interfere with the proper functioning of the thermometer.

8 Gas filling

The space above the mercury shall be filled with a dry inert gas.

9 Construction

9.1 The thermometers shall be straight and their external cross-section approximately circular.

9.2 The top of the thermometer shall be plain rounded or finished with a glass ring or button as required by the user.

9.3 For enclosed-scale thermometers the strip bearing the scale shall be of a non-transparent, dimensionally stable material compatible with the method of fixing the strip. It shall be placed tightly against the capillary tube inside the sheath and shall be firmly and securely fastened at the top of the thermometer, or in any other suitable manner that allows for differential expansion. The fixing shall not obscure the scale.

9.4 The thermometer shall be made from capillary tube which has been so tested as to ensure that the inside of the capillary tube is smooth, and the cross-sectional area of the bore does not show variations from the average greater than 10 %.

The bore shall be of sufficient diameter to ensure that the thermometer complies with sub-clause 10.1.

9.5 There shall be an expansion chamber at the top of the capillary tube. The chamber shall be pear-shaped with the hemisphere at the top. For thermometers with a graduation interval of 0,1 °C and 0,2 °C, the volume above the scale shall be at least equivalent to that occupied by an interval of 50 °C of the scale.

For thermometers with a graduation interval of 0,5 °C, the volume above the scale shall be such that the thermometer will withstand exposure to a temperature of 80 °C without damage.

The commencement of the widening of the capillary tube below the expansion chamber shall be separated from the highest scale line by at least 10 mm.

9.6 Thermometers in which the lower limit of the main scale is above 0 °C shall be provided with a contraction chamber to allow for the inclusion of an auxiliary scale. The contraction chamber shall be elongated and as narrow as possible to avoid the risk of a break in the liquid column at room temperature.

9.7 Dimensions of the thermometer shall be as given in table 2.

NOTE — For explanation of "type", see ISO 654 and 656.

10 Marking

10.1 General

The thermometer shall be such that its indication can easily be read through the wall of a glass jar containing the sample.

NOTE — The bore, scale lines, and figuring often have to be viewed under the poor lighting conditions commonly encountered in the field use of alcoholmeters and alcohol hydrometers.

10.2 Scale lines and figuring

The pattern of graduation shall be as follows :

10.2.1 On thermometers where the smallest scale division is 0,1 °C

- a) every tenth scale line is a long line;
- b) there is a medium line midway between two consecutive long lines;
- c) there are four short lines between consecutive medium and long lines.

10.2.2 On thermometers where the smallest scale division is 0,2 °C

- a) every fifth scale line is a long line;
- b) there are four short lines equally spaced between two consecutive long lines.

10.2.3 On thermometers where the smallest scale division is 0,5 °C

- a) every tenth scale line is a long line;
- b) there are four medium lines equally spaced between two consecutive long lines;
- c) there is one short line midway between two consecutive medium lines or between consecutive medium and long lines.

Table 2

Dimensions in millimetres

Dimensions		Solid-stem			Enclosed-scale		
		Type A	Type B	Type C	Type A	Type B	Type C
Total length	max.	250	250	250	250	250	250
Distance from top of bulb (shoulder) to lower nominal limit of scale	min.	20	—	20	30	—	30
Distance from top of bulb (shoulder) to 0 °C scale line	min.	—	20	—	—	30	—
Length of main scale (nominal limits)	min.	120	95	95	120	80	80
Distance from upper nominal limit of scale to top of thermometer	min.	25	25	—	50	50	—
Distance from 0 °C scale line to top of thermometer	min.	—	—	25	—	—	50
Diameter of stem		5,5 to 8,0	5,5 to 8,0	5,5 to 8,0	8 to 10	8 to 10	8 to 10
External diameter of bulb	min.	5	5	5	4,5	4,5	4,5
	max.	not greater than that of stem			5,5	5,5	5,5
Length of bulb to shoulder	min.	15	15	15	15	15	15
Distance from shoulder of bulb to lower end of parallel-sided capillary tube	max.	5	5	5	5	5	5
Distance from top of bulb funnel to lowest scale line	min.	13	13	13	—	—	—
Distance from bottom of contraction chamber to highest scale line on scale below it	min.	—	5	5	—	—	5
Distance from top of contraction chamber to lowest scale line on scale above it	min.	—	13	13	—	13	13
Distance from highest scale line to bottom of expansion chamber	min.	10	10	10	—	—	—

10.2.4 Every tenth scale line shall be fully figured.

10.2.5 For thermometers with a graduation interval of 0,1 °C and 0,2 °C, the line thickness shall be not less than 0,10 mm and shall be not greater than 0,15 mm. For thermometers with a graduation interval of 0,5 °C, the line thickness shall be not less than 0,10 mm and shall be not greater than 0,20 mm. The lines shall be at right angles to the axis of the thermometer.

10.2.6 For solid-stem thermometers, when the thermometer is held in a vertical position and viewed from the front, the left-hand ends of all the scale lines shall lie on an imaginary vertical line. When the thermometer is viewed such that the right-hand end of the short scale lines align with the left-hand side of the bore, the medium and long lines shall extend across the bore towards the right.

The figures shall be placed slightly to the right of the line in such a way that an extension of the line to which they refer would bisect them. The figures may be placed either parallel or at right angles to the axis of the thermometer as preferred, but shall be so chosen as to ensure that the thermometer complies with 10.1. For solid-stem thermometers, the short scale lines shall be between one and three times the graduation interval. The medium scale lines shall be nominally 1,5 times the length of the short scale lines and the long scale lines shall be nominally 2,5 times the length of the short scale lines.

The scale lines and figures shall be so positioned that the enamel backing in the stem provides a background to the mercury column when it is seen just beyond the left-hand or right-hand end of the short scale lines.

10.2.7 For enclosed-scale thermometers the longest lines shall extend across not less than 0,8 of the width of the strip bearing the scale, and the lengths of the medium and long lines shall be respectively at least 2 mm and 4 mm longer than the short scale lines. The shorter lines shall extend equally on both sides of the capillary when the thermometer is held in a vertical position and viewed from the front. The figures shall be placed immediately above the line to which they refer.

10.2.8 Each end of the scale shall be extended by two to five divisions beyond the scale limits.

10.3 Datum line

On enclosed-scale thermometers where the strip bearing the scale is not fused to the top of the thermometer, an indelible datum line of thickness comparable with that of the scale lines, shall be placed on the right-hand side of the sheath on a level with the lowest (or lowest figured) scale line so that any displacement of the scale can easily be noticed.

10.4 Pigment filling and other durable marking

The scale lines shall be clearly etched and filled with pigment or otherwise durably marked and of uniform thickness. In the case of solid-stem thermometers, the pigment filling in the etched scale lines, or any other durable marking, shall withstand immersion in all mixtures of ethanol and water for at least 24 h. The pigment filling in etched scale lines shall be dark.

11 Accuracy

11.1 Instrument error

The maximum permissible instrument error, when the thermometer is vertical and immersed as specified in clause 5, shall be as given in table 1.

11.2 Interval error

The maximum permissible difference between the errors at any two points which are fifty divisions apart shall not be more than one scale division.

12 Inscriptions

The following inscriptions shall be durably and legibly marked on the thermometer :

- a) temperature scale indication : the official symbol “°C”; an abbreviation of the name Celsius, (for example “C”) is also permitted;
- b) immersion : “complete” or “total” or a suitable abbreviation;
- c) gas filling, for example “nitrogen filled”, or a suitable abbreviation, if required by the purchaser;
- d) identification of the bulb glass, preferably by means of a coloured stripe or stripes, or by an inscription on the thermometer;
- e) manufacturer's identification number, the last two digits of which may indicate the year of manufacture;
- f) vendor's and/or maker's name or readily identifiable mark;
- g) specification number, for example “ISO 6152” or national equivalent;
- h) designation as in table 1, for example “AH 1”.