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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 651

SOLID-STEM CALORIMETER THERMOMETERS

1st EDITION

February 1968

For each individual country the only valid standard is the national standard of that country.

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BRIEF HISTORY

The ISO Recommendation R 651, *Solid-stem calorimeter thermometers,* was drawn up by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus,* the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question by the Technical Committee began in 1957 and led, in 1961, to the adoption of a Draft ISO Recommendation.

In December 1963, this Draft ISO Recommendation (No. 715) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Argentina	France	Poland
Australia	Greece	Spain
Austria	Hungary	Switzerland
Belgium	India	Turkey
Brazil	Israel	U.A.R.
Bulgaria	Italy	United Kingdom
Canada	Japan	U.S.A.
Chile	Korea, Rep. of	U.S.S.R.
Colombia	Netherlands	Yugoslavia
Czechoslovakia	New Zealand	

No Member Body opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1968, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 651 February 1968

SOLID-STEM CALORIMETER THERMOMETERS

1. SCOPE

This ISO Recommendation specifies requirements for a series of short-range solid-stem thermometers for use in bomb calorimetry and for other purposes where an accurate measurement of a change of temperature is required. The thermometers are not provided with auxiliary scales at 0 °C and are therefore not suited to the absolute measurement of temperature (which is not normally required in calorimetry), unless they are checked against a standard thermometer immediately before use.

2. TYPE OF THERMOMETER

The thermometers should be of the mercury-in-glass solid-stem type with enamel back.

3. TEMPERATURE SCALE

The temperature scale to which the thermometers refer is the International Practical Scale of Temperature, adopted by the Conférence Générale des Poids et Mesures in 1960 as the revised edition of the International Temperature Scale of 1948.

4. IMMERSION

The thermometers should in general be adjusted for use at total immersion (i.e. the reading should be correct when the thermometer is immersed at least to the end of the liquid column in the medium whose temperature is required to be measured) in a vertical position, but adjustment for use at partial immersion should be optional at the request of the user. On partial immersion thermometers, a line should be etched at least halfway round the stem of the thermometer at the level to which it is intended to be immersed.

5. GLASS

The glass should be selected so that the finished thermometer shows the following characteristics :

5.1 Strain in the glass should be reduced to a level sufficient to minimize the possibility of fracture due to thermal or mechanical shock.

5.2 The correction of the thermometer reading at the lowest temperature of the nominal range should not change by more than 0.02 degree Celsius immediately after the thermometer has been heated for 15 minutes at a temperature 30 degrees Celsius higher than the lowest temperature and allowed to cool naturally in air.

5.3 The accuracy of the reading should not be impaired by devitrifying or clouding during manufacture.

5.4 The meniscus should be distorted as little as possible by defects or impurities in the glass.

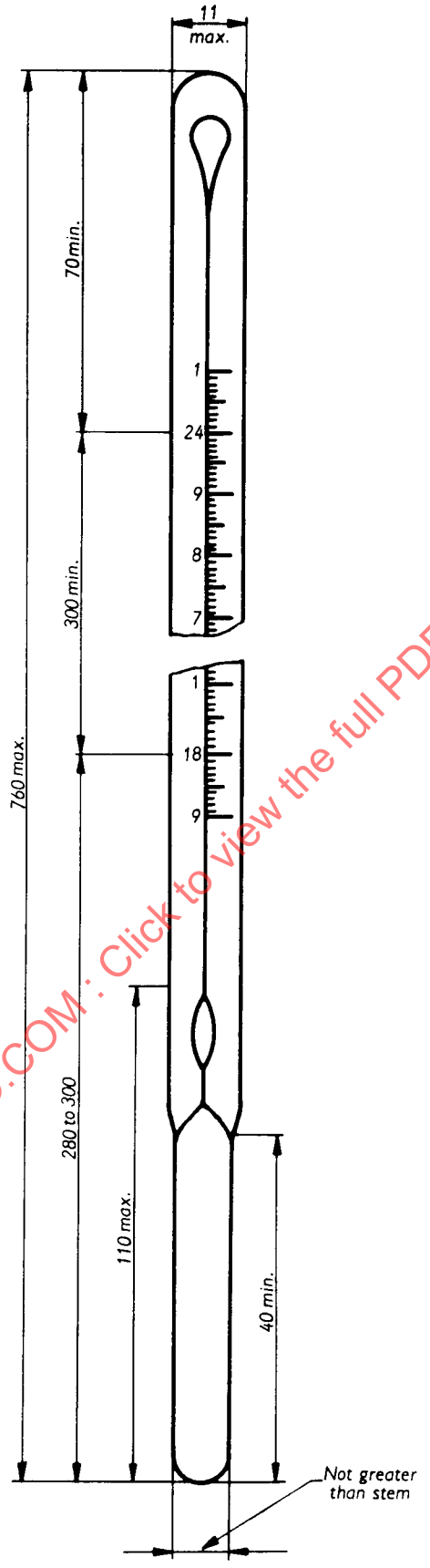

FIG. 1 – **Solid-stem calorimeter thermometer**
Dimensions in millimetres

6. GAS FILLING

Above the thermometric liquid, thermometers may be either vacuous or gas-filled; in the latter case, only a dry, inert gas should be used. The indication of a gas-filled thermometer, when the meniscus is at the top of the scale, should not change by more than 0.01 degree Celsius, when the temperature of the gas above the mercury is changed by 30 degrees Celsius.

NOTE. – If the bulb is sufficiently rigid for the thermometer to comply with clause 7.3, this requirement should be satisfied, if the internal gas pressure does not exceed 1/2 atm (normal atmosphere), when the thermometer is registering its highest temperature.

7. CONSTRUCTION

7.1 Shape

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

7.2 Top finish

The top of the thermometer should have a rounded finish, unless otherwise specially required.

7.3 Capillary tube

The inside of the capillary tube should be smooth. The cross-sectional area of the bore should not show variations from the average greater than 5 %, and the bore should be wide enough to ensure that, without tapping, jumping of the meniscus does not exceed one half of the graduation interval, when the temperature is rising at a uniform rate not exceeding 0.05 degree Celsius per minute. In the case of thermometers adjusted for use at partial immersion, the volume of mercury contained in the capillary tube between the immersion line and the lowest figured graduation line should not exceed the equivalent of 2 degrees Celsius.

7.4 Expansion chamber (safety chamber)

The capillary tube should have an enlargement at the top of sufficient size to allow heating of the thermometer to 60 °C (or 70 °C in the case of thermometers STCal/0.01/42 and STCal/0.01/45). This expansion chamber should be pear-shaped with the hemisphere at the top. It should be so shaped that the meniscus remains in the narrow portion at temperatures up to 40 °C.

7.5 Contraction chamber

A contraction chamber should be provided so that the mercury does not recede into the bulb at 0 °C. It should be elongated and as narrow as possible and should be separated from the bulb by not less than 3 mm of capillary tube.

7.6 Enlargement of the bore

No enlargement of the bore should be so located as to produce any variation in the cross-section of the capillary tube in the scale portion.

7.7 Dimensions

The dimensions of the thermometers should be as given in Table 1 below and Figure 1, page 4.

TABLE 1. – **Dimensions** (see also Fig. 1)

Dimensions in millimetres

Total length	max.	760
Distance from bottom of bulb to top of contraction chamber	max.	110
Distance from bottom of bulb to lower nominal limit of scale		280 to 300
Length of main scale (nominal limits)	min.	300
Distance from upper nominal limit of scale to top of thermometer	min.	70
Diameter of stem	max.	11
External diameter of bulb		not greater than that of stem
Length of bulb to shoulder	min.	40

8. GRADUATION AND FIGURING

8.1 The scales and graduation interval of the thermometers should be as given in Table 2 below:

TABLE 2. – **Graduation**

Designation	Graduation interval	Nominal scale range
	degrees Celsius	°C
STCa1/0.01/15	0.01	9 to 15
STCa1/0.01/18	0.01	12 to 18
STCa1/0.01/21	0.01	15 to 21
STCa1/0.01/24	0.01	18 to 24
STCa1/0.01/27	0.01	21 to 27
STCa1/0.01/30	0.01	24 to 30
STCa1/0.01/33	0.01	27 to 33
STCa1/0.01/36	0.01	30 to 36
STCa1/0.01/39	0.01	33 to 39
STCa1/0.01/42	0.01	36 to 42
STCa1/0.01/45	0.01	39 to 45