



# Standard Specification for ASTM Liquid-in-Glass Thermometers<sup>1</sup>

This standard is issued under the fixed designation E1; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 This specification covers liquid-in-glass thermometers graduated in degrees Celsius or degrees Fahrenheit that are frequently identified and used in methods under the jurisdiction of the various technical committees within ASTM. The various thermometers specified are listed in **Table 1**. The inclusion of an IP number in **Table 1** indicates, where appearing, that the thermometer specification has been jointly agreed upon by the British Institute of Petroleum (IP) and ASTM.

1.2 This specification also covers adjustable-range enclosed-scale thermometers, graduated in degrees Celsius, which are used in ASTM methods.

1.3 The enclosed-scale thermometers are commonly called Beckmann thermometers. They are suitable for measuring small temperature differences not exceeding 6 °C within a larger range of temperature. The thermometers are unsuitable for measuring Celsius- or kelvin-scale temperatures unless they have been compared with standard instruments immediately before use.

1.4 An alphabetic list of the ASTM Thermometers included in this standard is given in **Table 2**.

1.5 A list of ASTM Thermometers is given in **Table 3** to facilitate selection according to temperature range, immersion, and scale-error requirements.

NOTE 1—For a listing of thermometers recommended for general laboratory use, the Scientific Apparatus Makers Association Specifications for General Purpose Glass Laboratory Thermometers may be consulted.<sup>2</sup>

NOTE 2—It has been found by experience that these ASTM Thermometers, although developed in general for specific tests, may also be found suitable for other applications, thus precluding the need for new thermometer specifications differing in only minor features. However, it is suggested that technical committees contact Subcommittee E20.05 before choosing a currently specified thermometer for a new method to be sure

the thermometer will be suitable for the intended application.

1.6 The thermometers found in **Table 1** contain mercury, mercury thallium eutectic alloy, or toluene or other suitable liquid colored with a permanent red dye. For low-hazard precision non-mercury alternatives to E1 thermometers, see Specification **E2251**.

1.7 **WARNING**—Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website: <http://www.epa.gov/mercury/faq.htm> - for additional information. Users should be aware that selling mercury and/or mercury containing products into your state may be prohibited by state law.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

**E77** Test Method for Inspection and Verification of Thermometers

**E344** Terminology Relating to Thermometry and Hydrometry

**E563** Practice for Preparation and Use of an Ice-Point Bath as a Reference Temperature

**E2251** Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

## 3. Terminology

3.1 **Definitions**—The definitions given in Terminology **E344** apply.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

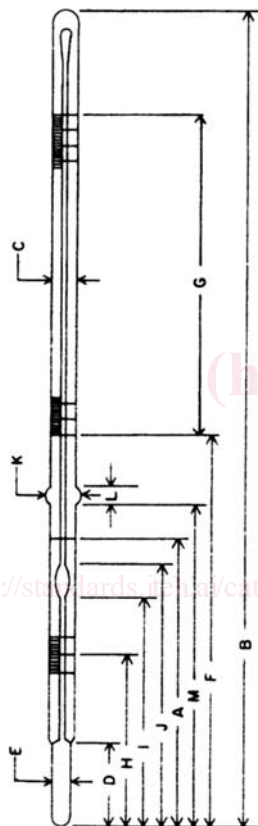
<sup>1</sup> This specification is under the jurisdiction of ASTM Committee **E20** on Temperature Measurement and is the direct responsibility of Subcommittee **E20.05** on Liquid-in-Glass Thermometers and Hydrometers.

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<sup>2</sup> Available from SAMA Group of Assocs., 225 Reinekers, Ste. 625, Alexandria, VA 23314.

**TABLE 1 Specification for ASTM Thermometers**

All dimensions are in millimeters.  
See Table 4 for Verification and Calibration Temperatures.



- Explanatory Notes:**
- <sup>A</sup> An expansion chamber is provided for relief of gas pressure to avoid distortion of the bulb at higher temperatures. It is not for the purpose of joining mercury separations and under no circumstances should the thermometer be heated above the highest temperature reading.
  - <sup>B</sup> Toluene or other suitable liquid colored red with a permanent dye shall be used as the actuating liquid.
  - <sup>C</sup> Under certain test conditions, the bulb of the thermometer may be 28 °C (50 °F) above the temperature indicated by the thermometer, and at an indicated temperature of 371 °C (700 °F) the temperature of the bulb is approaching a critical range in the glass. It is therefore not desirable to use this thermometer under such conditions at indicated temperatures above 371 °C (700 °F) without checking the ice point.
  - <sup>D</sup> Longest graduation lines at 155 °C, 160 °C, 162 °C, 164 °C, 165 °C, and 170 °C, with arrows at 162 °C and 164 °C.
  - <sup>E</sup> The length of the enlargement, and the distance from the bottom of the enlargement to the bottom of the bulb shall be measured with the test gage shown in Fig. 1.
  - <sup>F</sup> Long, narrow shape.
  - <sup>G</sup> The test temperature shall be indicated by an arrow whether the graduation corresponding to that point is numbered or not.
  - <sup>H</sup> Long, narrow shape; mercury shall be in the chamber at 0 °C (32 °F).
  - <sup>I</sup> The thermometer shall be made to be mounted in a brass ferrule consisting of a tubular bushing 8.0 mm in outside diameter with a flanged head approximately 12 mm in diameter so that the upper extremity of the 8.0 mm diameter is located 90 mm from the bottom of the bulb.
  - <sup>J</sup> To be marked on the glass stem at least 90 mm from the bottom of the bulb.
  - <sup>K</sup> Glass button finish, see 6.2.1.
  - <sup>L</sup> Long, narrow shape; mercury shall be near bottom of the chamber at 0 °C.
  - <sup>M</sup> For kinematic viscosity thermometers, the ice-point reading shall be taken within 1 h after being at the test temperature for not less than 3 minutes. The ice-point reading shall be expressed to the nearest 0.01 °C or 0.02 °F and applied as explained in Test Method E77, Section 13.
  - <sup>N</sup> Thermometers made to these specifications conform also with the requirements for the titer test thermometer of the American Oil Chemists Society and the Association of Official Agricultural Chemists, except for the special inscription.
  - <sup>O</sup> Capillary clearances must conform to Section 8.
  - <sup>P</sup> Mercury shall be near middle of chamber at 0 °C.
  - <sup>Q</sup> The stem may be either the plain front or lens front type. If the thermometer is of the lens front type, the cross section of the stem shall be such that it will pass through an 8-mm ring gage but will not enter a 5-mm slot gage.
  - <sup>R</sup> A suitable mercury-thallium alloy shall be used as the actuating liquid.
  - <sup>S</sup> The expansion chamber shall be of the long narrow type in length. The length of unchanged capillary between the nearest graduation mark and the expansion chamber shall be not less than 10 mm.
  - <sup>T</sup> Mercury shall be near the bottom of the chamber at 0 °C.
  - <sup>U</sup> The length of unchanged capillary between the nearest graduation mark and contraction chamber shall be not less than 10 mm.
  - <sup>V</sup> Change in correction over any 5 °F interval shall not exceed 0.10 °F.
  - <sup>W</sup> Expansion chamber shall be of the long narrow type and there shall be not less than 10 mm of unchanged capillary between the base of the chamber and the top graduation.
  - <sup>X</sup> Mercury shall be in the chamber at 32 °F.
  - <sup>Y</sup> Over any interval of 2 °C the change in correction shall not exceed 0.02 °C.
  - <sup>Z</sup> Over any interval of 4 °F the change in correction shall not exceed 0.05 °F.
  - <sup>AA</sup> Special finish, see 6.2.2.
  - <sup>BB</sup> The bulb diameter shall not be more than 0.5 mm greater than the stem.
  - <sup>CC</sup> The stem shall be of the lens front type. The cross section of the stem shall be such that it will pass through a 8.0-mm ring gage but will not enter a 5.0-mm slot gage. A minor diameter of 4 mm is permissible provided that the major diameter is not less than 7 mm.
  - <sup>DD</sup> Bulb bottom shall be essentially hemispherical.

*EE* Immersion line shall be omitted.  
*FF* For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.  
*GG* The immersion line shall be visible in the case opening after assembly. The immersion shall be measured from the bottom of the bulb rather than from the bottom of the armor. See 6.2.2.  
*HH* The stem shall be either the round or lens-front type.  
*II* Contraction chamber to be long narrow type.  
*JJ* Over any interval of 1 °C the change in correction shall not exceed 0.01 °C. The correction at the lowest temperature of the nominal range shall not change by more than 0.02 °C immediately after the thermometer has been heated for 15 min at a temperature 30 °C higher, and allowed to cool naturally in air.  
*KK* The capillary bore shall be large enough in relation to the bulb to ensure that (without tapping) jumping of the meniscus does not exceed one half of the smallest scale division, when the temperature is rising at a uniform rate not exceeding 0.05 °C/min.  
*LL* The thermometer is to be calibrated for 100-mm immersion for the main scale, the ice point is to be calibrated for total immersion.  
*MM* Bulb shape ellipsoidal (see Fig. 2).  
*NN* This thermometer may be furnished with an optional ring top. See 6.2.3. Addition of a ring top will increase the total length by an amount equal to the outside diameter of the ring.  
*OO* The stem shall be of the lens front type. The cross section of the stem shall be such that it will pass through a 7.0 mm ring gage.

| IP No.                            | ASTM No. | 1C-99          | 1F-99 <sup>FF</sup>                 | 62C           | 2C-99                               | 2F-99 <sup>FF</sup>        | 73C                                  | 3C-99                               | 3F-99 <sup>FF</sup>                |
|-----------------------------------|----------|----------------|-------------------------------------|---------------|-------------------------------------|----------------------------|--------------------------------------|-------------------------------------|------------------------------------|
| Name                              |          |                | Partial Immersion<br>3              |               | Partial Immersion<br>3              | Partial Immersion<br>3     |                                      | Partial Immersion<br>3              | Partial Immersion<br>3             |
| Reference Fig. No.                |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Range                             |          | -20 to + 150°C | 0 to 302°F                          | -5 to + 300°C | 20 to 580°F                         | -5 to + 400°C <sup>C</sup> |                                      | 20 to 760°F <sup>C</sup>            |                                    |
| For test at                       |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| A Immersion, mm                   |          |                | 76                                  |               | 76                                  |                            |                                      | 76                                  |                                    |
| Graduations:                      |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Subdivisions                      |          | 1°C            | 2°F                                 | 1°C           | 2°F                                 | 1°C                        | 1°C                                  | 2°F                                 | 2°F                                |
| Long lines at each                |          | 5°C            | 10°F                                | 5°C           | 10°F                                | 5°C                        | 5°C                                  | 10°F                                | 10°F                               |
| Numbers at each                   |          | 10°C           | 20°F                                | 10°C          | 20°F                                | 10°C                       | 10°C                                 | 20°F                                | 20°F                               |
| Scale error, max                  |          | 0.5°C          | 1°F                                 | 1°C           | 2°F                                 | 1°C                        | 1°C to 301°C<br>1.5°C above<br>301°C | 2°F to 574°F<br>3°F above<br>574°F  | 2°F to 574°F<br>3°F above<br>574°F |
| Special inscription               |          |                | ASTM<br>1C-99 or 1F-99<br>76 MM IMM |               | ASTM<br>2C-99 or 2F-99<br>76 MM IMM |                            | ASTM<br>3C-99 or 3F-99<br>76 MM IMM  | ASTM<br>3C-99 or 3F-99<br>76 MM IMM |                                    |
| Expansion chamber:                |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Permit heating to                 |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| B Total length, mm                |          | 200°C          | 317 to 327                          |               | 385 to 395                          |                            |                                      | 410 to 420                          |                                    |
| C Stem OD, mm                     |          |                | 6.0 to 7.0                          |               | 6.0 to 7.0                          |                            |                                      | 6.0 to 7.5                          |                                    |
| D Bulb length, mm                 |          |                | 19 to 25                            |               | 10 to 15                            |                            |                                      | 10 to 15                            |                                    |
| E Bulb OD, mm                     |          |                | 5.0 to 6.0                          |               | 5.0 to 6.0                          |                            |                                      | 5.0 to 6.0                          |                                    |
| Scale location:                   |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Bottom of bulb to line at         |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| F Distance, mm                    |          | 0°C            | 111 to 118                          | 0°C           | 100 to 110                          | 0°C                        |                                      | 100 to 110                          | 32°F                               |
| G Length of graduated portion, mm |          |                | 170 to 200 <sup>O</sup>             |               | 225 to 265 <sup>O</sup>             |                            |                                      | 250 to 290 <sup>O</sup>             |                                    |
| Ice-point scale:                  |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Range                             |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Bottom of bulb to ice-point, mm   |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| H Distance, mm                    |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Contraction chamber:              |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| I Distance to bottom, min, mm     |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| J Distance to top, max, mm        |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| Stem enlargement:                 |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| K OD, mm                          |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| L Length, mm                      |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |
| M Distance to bottom, mm          |          |                |                                     |               |                                     |                            |                                      |                                     |                                    |

<sup>A</sup> An expansion chamber is provided for relief of gas pressure to avoid distortion of the bulb at higher temperatures. It is not for the purpose of joining mercury separations and under no circumstances should the thermometer be heated above the highest temperature reading.  
<sup>B</sup> Under certain test conditions, the bulb of the thermometer may be 28°C (50°F) above the temperature indicated by the thermometer, and at an indicated temperature of 371°C (700°F) the temperature of the bulb is approaching a critical range in the glass. It is therefore not desirable to use this thermometer under such conditions at indicated temperatures above 371°C (700°F) without checking the ice point.  
<sup>O</sup> Capillary clearances shall conform to Section 8.  
<sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.

**TABLE 1 Continued**

|                                   | 5C-86                                | 5F-86 <sup>FF</sup>                  | 6C-86                               | 6F-86 <sup>FF</sup>                 | 7C-86                             | 7F-86 <sup>FF</sup>             |
|-----------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|-------------------------------------|-----------------------------------|---------------------------------|
| IP No.                            | 1C                                   |                                      | 2C                                  |                                     | 5C                                |                                 |
| Name                              | Cloud and Pour                       | Cloud and Pour                       | Low Cloud and Pour <sup>B</sup>     | Low Cloud and Pour <sup>B</sup>     | Low Distillation                  | Low Distillation                |
| Reference Fig. No.                | 3                                    | 3                                    | 3                                   | 3                                   | 4                                 | 4                               |
| Range                             | -38 to +50°C                         | -36 to +120°F                        | -80 to +20°C                        | -112 to +70°F                       | -2 to +300°C                      | 30 to 580°F                     |
| For test at                       |                                      |                                      |                                     |                                     |                                   |                                 |
| A Immersion, mm                   | 108                                  | 108                                  | 76                                  | 76                                  | total                             | total                           |
| Graduations:                      |                                      |                                      |                                     |                                     |                                   |                                 |
| Subdivisions                      | 1°C                                  | 2°F                                  | 1°C                                 | 2°F                                 | 1°C                               | 2°F                             |
| Long lines at each                | 5°C                                  | 10°F                                 | 5°C                                 | 10°F                                | 5°C                               | 10°F                            |
| Numbers at each                   | 10°C                                 | 20°F                                 | 10°C                                | 20°F                                | 10°C                              | 20°F                            |
| Scale error, max                  | 0.5°C                                | 1°F                                  | 1°C to -33°C<br>2°C below -33°C     | 2°F to -28°F<br>4°F below -28°F     | 0.5°C to 150°C<br>1°C above 150°C | 1°F to 300°F<br>2°F above 300°F |
| Special inscription               | ASTM<br>5C-86 or 5F-86<br>108 MM IMM | ASTM<br>5C-86 or 5F-86<br>108 MM IMM | ASTM<br>6C-86 or 6F-86<br>76 MM IMM | ASTM<br>6C-86 or 6F-86<br>76 MM IMM | ASTM<br>7C-86 or 7F-86            | ASTM<br>7C-86 or 7F-86          |
| Expansion chamber:                |                                      |                                      |                                     |                                     |                                   |                                 |
| Permit heating to                 | 100°C                                | 212°F                                | 60°C                                | 140°F                               | A                                 | A                               |
| B Total length, mm                |                                      | 225 to 235                           |                                     | 225 to 235                          | 380 to 390                        | 380 to 390                      |
| C Stem OD, mm                     |                                      | 6.0 to 8.0                           |                                     | 6.0 to 8.0                          | 6.0 to 8.0                        | 6.0 to 8.0                      |
| D Bulb length, mm                 |                                      | 7 to 10                              |                                     | 7 to 10                             | 10 to 15                          | 10 to 15                        |
| E Bulb OD, mm                     |                                      | <5.5 and ≥stem                       |                                     | <5.0 and ≥stem                      | <5.0 and ≥stem                    | <5.0 and ≥stem                  |
| Scale location:                   |                                      |                                      |                                     |                                     |                                   |                                 |
| Bottom of bulb to line at         | -38°C                                | -36°F                                | -70°C                               | -94°F                               | 0°C                               | 32°F                            |
| F Distance, mm                    |                                      | 120 to 130                           |                                     | 100 to 120                          | 100 to 110                        | 100 to 110                      |
| G Length of graduated portion, mm |                                      | 65 to 85 <sup>o</sup>                |                                     | 70 to 100 <sup>o</sup>              | 225 to 255 <sup>o</sup>           | 225 to 255 <sup>o</sup>         |
| Ice-point scale:                  |                                      |                                      |                                     |                                     |                                   |                                 |
| Range                             |                                      |                                      |                                     |                                     |                                   |                                 |
| Bottom of bulb to ice-point, mm   |                                      |                                      |                                     |                                     |                                   |                                 |
| Contraction chamber:              |                                      |                                      |                                     |                                     |                                   |                                 |
| I Distance to bottom, min, mm     |                                      |                                      |                                     |                                     |                                   |                                 |
| J Distance to top, max, mm        |                                      |                                      |                                     |                                     |                                   |                                 |
| Stem enlargement:                 |                                      |                                      |                                     |                                     |                                   |                                 |
| K OD, mm                          |                                      |                                      |                                     |                                     |                                   |                                 |
| L Length, mm                      |                                      |                                      |                                     |                                     |                                   |                                 |
| M Distance to bottom, mm          |                                      |                                      |                                     |                                     |                                   |                                 |

|                    | 8C-86                             | 8F-86 <sup>FF</sup>             | 9C-86              | 9F-86 <sup>FF</sup> | 10C-86                          | 10F-86 <sup>FF</sup>                |
|--------------------|-----------------------------------|---------------------------------|--------------------|---------------------|---------------------------------|-------------------------------------|
| IP No.             | 6C                                |                                 | 15C                |                     | 16C                             |                                     |
| Name               | High Distillation                 | High Distillation               | Low-Pensky-Martens | Low-Pensky-Martens  | High-Pensky-Martens             | High-Pensky-Martens                 |
| Reference Fig. No. | 4                                 | 4                               | 5                  | 5                   | 5                               | 5                                   |
| Range              | -2 to +400°C <sup>C</sup>         | 30 to 760°F <sup>C</sup>        | -5 to +110°C       | 20 to 230°F         | 90 to 370°C                     | 200 to 700°F                        |
| For test at        |                                   |                                 |                    |                     |                                 |                                     |
| A Immersion, mm    | total                             | total                           | 57                 | 57                  | 57                              | 57                                  |
| Graduations:       |                                   |                                 |                    |                     |                                 |                                     |
| Subdivisions       | 1°C                               | 2°F                             | 0.5°C              | 1°F                 | 2°C                             | 5°F                                 |
| Long lines at each | 5°C                               | 10°F                            | 1°C and 5°C        | 5°F                 | 10°C                            | 25°F                                |
| Numbers at each    | 10°C                              | 20°F                            | 5°C                | 10°F                | 20°C                            | 50°F                                |
| Scale error, max   | 1°C to 300°C<br>1.5°C above 300°C | 2°F to 570°F<br>3°F above 570°F | 0.5°C              | 1°F                 | 1°C to 260°C<br>2°C above 260°C | 2.5°F to 500°F<br>3.5°F above 500°F |

<sup>A</sup> An expansion chamber is provided for relief of gas pressure to avoid distortion of the bulb at higher temperatures. It is not for the purpose of joining mercury separations and under no circumstances should the thermometer be heated above the highest temperature reading.

<sup>B</sup> Toluene or other suitable liquid colored red with a permanent dye shall be used as the actuating liquid.

<sup>C</sup> Capillary clearances shall conform to Section 8.

<sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.

**TABLE 1 Continued**

| Special inscription                                   | ASTM<br>8C-86 or 8F-86                       | ASTM<br>9C-86 or 9F-86<br>57 MM IMM          | ASTM<br>10C-86 or 10F-86<br>57 MM IMM        |
|---|--|--|--|
| Expansion chamber:<br>Permit heating to               |  |  |  |
| B Total length, mm                                    | 380 to 390                                   | 285 to 295                                   | 285 to 295                                   |
| C Stem OD, mm   | 6.0 to 8.0                                   | 6.0 to 7.0                                   | 6.0 to 7.0                                   |
| D Bulb length, mm                                     | 10 to 15                                     | 9 to 13                                      | 7 to 10                                      |
| E Bulb OD, mm   | <math>\leq 5.0</math> and $\rightarrow$ stem | <math>\leq 5.5</math> and $\rightarrow$ stem | <math>\leq 4.5</math> and $\rightarrow$ stem |
| Scale location:<br>Bottom of bulb to line at          | 32°F   | 32°F   | 200°F  |
| F Distance, mm  | 30 to 40                                     | 85 to 95                                     | 80 to 90                                     |
| G Length of graduated portion, mm                     | 290 to 330 <sup>o</sup>                      | 140 to 175 <sup>o</sup>                      | 145 to 180 <sup>o</sup>                      |
| Ice-point scale:<br>Range                             | 0°C  | 0°C  | 90°C   |
| H Bottom of bulb to ice-point, mm                     |  |  |  |
| Contraction chamber:<br>I Distance to bottom, min, mm |  |  |  |
| J Distance to top, max, mm                            |  |  |  |
| Stem enlargement<br>K OD, mm                          |  | 7.5 to 8.5                                   | 7.5 to 8.5                                   |
| L Length, mm  |  | 2.5 to 5.0 <sup>E</sup>                      | 2.5 to 5.0 <sup>F</sup>                      |
| M Distance to bottom, mm                              |  | 64 to 66                                     | 64 to 66                                     |

<sup>A</sup> An expansion chamber is provided for relief of gas pressure to avoid distortion of the bulb at higher temperatures. It is not for the purpose of joining mercury separations and under no circumstances should the thermometer be heated above the highest temperature reading.

<sup>C</sup> Under certain test conditions, the bulb of the thermometer may be 28°C (50°F) above the temperature indicated by the thermometer, and at an indicated temperature of 371°C (700°F) the temperature of the bulb is approaching a critical range in the glass. It is therefore not desirable to use this thermometer under such conditions at indicated temperatures above 371°C (700°F) without checking the ice point.

<sup>E</sup> The length of the enlargement, and the distance from the bottom of the enlargement to the bottom of the bulb shall be measured with the test gage shown in Fig. 1.

<sup>o</sup> Capillary clearances shall conform to Section 8.

<sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.

**TABLE 1 Continued**

|  |                                 | 14C-86 <sup>FF</sup>    | 15C-86           | 15F-86 <sup>FF</sup> | 16C-86      | 16F-86 <sup>FF</sup> |
|--|---------------------------------|-------------------------|------------------|----------------------|-------------|----------------------|
| Ice-point scale:   |                                 |                         |                  |                      |             |                      |
| Range  |                                 |                         | 60C              |                      | 61C         |                      |
| H  | Bottom of bulb to ice-point, mm |                         |                  |                      |             |                      |
| Contraction chamber:   |                                 |                         |                  |                      |             |                      |
| I  | Distance to bottom, min, mm     |                         |                  |                      |             |                      |
| J  | Distance to top, max, mm        |                         |                  |                      |             | 30 <sup>F</sup>      |
| Stem enlargement:  |                                 |                         |                  |                      |             |                      |
| K  | OD, mm                          |                         |                  |                      |             |                      |
| L  | Length, mm                      |                         |                  |                      |             |                      |
| M  | Distance to bottom, mm          |                         |                  |                      |             |                      |
| <p><sup>A</sup> An expansion chamber is provided for relief of gas pressure to avoid distortion of the bulb at higher temperatures. It is not for the purpose of joining mercury separations, and under no circumstances should the thermometer be heated above the highest temperature reading.</p> <p><sup>c</sup> Under certain test conditions, the bulb of the thermometer may be 28°C (50°F) above the temperature indicated by the thermometer, and at an indicated temperature of 371°C (700°F) the temperature of the bulb is approaching a critical range in the glass. It is therefore not desirable to use this thermometer under such conditions at indicated temperatures above 371°C (700°F) without checking the ice point.</p> <p><sup>D</sup> Longest graduation lines at 155°C, 160°C, 162°C, 164°C, 165°C, and 170°C, with arrows at 162°C and 164°C.</p> <p><sup>F</sup> Long, narrow shape.</p> <p><sup>O</sup> Capillary clearances shall conform to Section 8.</p> <p><sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.</p> <p><sup>MM</sup> This thermometer may be furnished with an optional ring top. See 6.2.3. Addition of a ring top will increase the total length by an amount equal to the outside diameter of the ring.</p> |                                 |                         |                  |                      |             |                      |
| ASTM No.   |                                 | 14C-86                  | 15C-86           | 15F-86 <sup>FF</sup> | 16C-86      | 16F-86 <sup>FF</sup> |
| IP No.   | Name                            | 17C                     | 60C              |                      | 61C         |                      |
| Reference Fig. No.   |                                 |                         |                  |                      |             |                      |
| Range  |                                 | 38 to 82°C              | -2 to +80°C      | 30 to 180°F          | 30 to 200°C | 85 to 392°F          |
| For test at  |                                 |                         |                  |                      |             |                      |
| A  | Immersion, mm                   |                         |                  |                      |             |                      |
|  | Graduations:                    |                         |                  |                      |             |                      |
|  | Subdivisions                    | 0.1°C                   | 0.2°C            | 0.5°F                | 0.5°C       | 1°F                  |
|  | Long lines at each              | 0.5°C                   | 1°C              | 1°F                  | 1°C         | 5°F                  |
|  | Numbers at each                 | 1°C                     | 2°C              | 5°F                  | 5°C         | 10°F                 |
|  | Scale error, max                | 0.1°C                   | 0.2°C            | 0.4°F                | 0.3°C       | 0.5°F                |
|  | Special inscription             |                         | ASTM             | ASTM                 | ASTM        | ASTM                 |
|  |                                 | 14C-86 or 14F-86        | 15C-86 or 15F-86 | 16C-86 or 16F-86     |             |                      |
|  |                                 | 79 MM IMM               |                  |                      |             |                      |
| Expansion chamber:   |                                 |                         |                  |                      |             |                      |
| Permit heating to  |                                 |                         |                  |                      |             |                      |
| B  | Total length, mm                | 100°C                   | 130°C            | 270°F                | 250°C       | 482°F                |
| C  | Stem OD, mm                     |                         |                  |                      |             |                      |
| D  | Bulb length, mm                 | 370 to 380              | 390 to 400       | 390 to 400           | 390 to 400  | 6.0 to 8.0           |
| E  | Bulb OD, mm                     | 6.0 to 8.0              | 6.0 to 8.0       | 6.0 to 8.0           | 6.0 to 8.0  | 9 to 14              |
|  | Scale location:                 |                         |                  |                      |             |                      |
|  | Bottom of bulb to line at       |                         |                  |                      |             |                      |
| F  | Distance, mm                    | 40°C                    | 0°C              | 32°F                 | 30°C        | 86°F                 |
| G  | Length of graduated portion, mm | 115 to 125              |                  |                      |             |                      |
|  | Ice-point scale:                |                         |                  |                      |             |                      |
|  | Range                           | 210 to 240 <sup>O</sup> |                  |                      |             |                      |
| H  | Bottom of bulb to ice-point, mm |                         |                  |                      |             |                      |
| Contraction chamber:   |                                 |                         |                  |                      |             |                      |
| I  | Distance to bottom, min, mm     |                         |                  |                      |             |                      |
| J  | Distance to top, max, mm        |                         |                  |                      |             |                      |
| Stem enlargement:  |                                 |                         |                  |                      |             |                      |
| K  | OD, mm                          |                         |                  |                      |             |                      |
| L  | Length, mm                      |                         |                  |                      |             |                      |
| M  | Distance to bottom, mm          |                         |                  |                      |             |                      |
| <p><sup>O</sup> Capillary clearances shall conform to Section 8.</p> <p><sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.</p>  |                                 |                         |                  |                      |             |                      |

**TABLE 1 Continued**

| ASTM No.  | 17C-86                                   | 17F-86 <sup>FF</sup>                   | 18C-86<br>23C                       | 18F-86 <sup>FF</sup>               | 19C-86                                     | 19F-86 <sup>FF</sup>                       |
|---|--|--|-------------------------------------|------------------------------------|--|--|
| IP No.  |  |  |                                     |                                    |  |  |
| Name  |  |  |                                     |                                    |  |  |
| Reference Fig. No.  |  |  |                                     |                                    |  |  |
| Range   |  |  |                                     |                                    |  |  |
| For test at   |  |  |                                     |                                    |  |  |
| A Immersion, mm   | 19 to 27°C<br>21.1 and 25°C <sup>G</sup> | 66 to 80°F<br>70 and 77°F <sup>G</sup> | 34 to 42°C<br>37.8°C <sup>G</sup>   | 94 to 108°F<br>100°F <sup>G</sup>  | 49 to 57°C<br>50 and 54.4°C <sup>G</sup>   | 120 to 134°F<br>122 and 130°F <sup>G</sup> |
| Graduations:  |  |  |                                     |                                    |  |  |
| Subdivisions  | 0.1°C                                    | 0.2°F                                  | 0.1°C                               | 0.2°F                              | 0.1°C                                      | 0.2°F                                      |
| Long lines at each  | 0.5°C                                    | 1°F                                    | 0.5°C                               | 1°F                                | 0.5°C                                      | 1°F  |
| Numbers at each   | 1°C, except 21                           | 2°F                                    | 1°C                                 | 2°F                                | 1°C, except 54                             | 2°F  |
| Scale error, max  | 0.1°C                                    | 0.2°F                                  | 0.1°C                               | 0.2°F                              | 0.1°C                                      | 0.2°F                                      |
| Special inscription   | ASTM<br>17C-86 or 17F-86                 |  | ASTM<br>18C-86 or 18F-86            |                                    | ASTM<br>19C-86 or 19F-86                   |  |
| Expansion chamber:  |  |  |                                     |                                    |  |  |
| Permit heating to   |  |  |                                     |                                    |  |  |
| B Total length, mm  | 100°C                                    | 212°F                                  | 100°C                               | 212°F                              | 115°C                                      | 240°F                                      |
| C Stem OD, mm   | 270 to 280<br>6.0 to 7.0                 |  | 270 to 280<br>6.0 to 7.0            |                                    | 270 to 280<br>6.0 to 7.0                   |  |
| D Bulb length, mm   | 25 to 35                                 |  | 25 to 35                            |                                    | 25 to 35                                   |  |
| E Bulb OD, mm   | <5.0 and >stem                           |  | >stem                               |                                    | <5.0 and >stem                             |  |
| Scale location:   |  |  |                                     |                                    |  |  |
| Bottom of bulb to line at   |  |  |                                     |                                    |  |  |
| F Distance, mm  | 19°C                                     | 66°F                                   | 34°C                                | 94°F                               | 49°C                                       | 120°F                                      |
| G Length of graduated portion, mm   | 135 to 150<br>67 to 101 <sup>O</sup>     |  | 130 to 150<br>60 to 90 <sup>O</sup> |                                    | 135 to 150<br>67 to 101 <sup>O</sup>       |  |
| Ice-point scale:  |  |  |                                     |                                    |  |  |
| Range   |  |  |                                     |                                    |  |  |
| H Bottom of bulb to ice-point, mm   |  |  |                                     |                                    |  |  |
| Contraction chamber:  |  |  |                                     |                                    |  |  |
| I Distance to bottom, min, mm   |  |  |                                     |                                    |  |  |
| J Distance to top, max, mm  |  |  |                                     |                                    |  |  |
| Stem enlargement:   |  |  |                                     |                                    |  |  |
| K OD, mm  | 60 <sup>H</sup>                          |  | 60 <sup>H</sup>                     |                                    | 60 <sup>H</sup>                            |  |
| L Length, mm  | 8.0 to 10.0                              |  | 8.0 to 10.0                         |                                    | 8.0 to 10.0                                |  |
| M Distance to bottom, mm  | 4.0 to 7.0<br>112 to 116                 |  | 4.0 to 7.0<br>112 to 116            |                                    | 4.0 to 7.0<br>112 to 116                   |  |
| <sup>G</sup> The test temperatures shall be indicated by an arrow whether the graduation corresponding to that point is numbered or not.<br><sup>H</sup> Long, narrow shape; mercury shall be in the chamber at 0°C (32°F).<br><sup>O</sup> Capillary clearances shall conform to Section 8.<br><sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range. |  |  |                                     |                                    |  |  |
| ASTM No.  | 20C-86                                   | 20F-86 <sup>FF</sup>                   | 21C-86                              | 21F-86 <sup>FF</sup>               | 22C-86<br>24C                              | 22F-86 <sup>FF</sup>                       |
| IP No.  |  |  |                                     |                                    |  |  |
| Name  |  |  |                                     |                                    |  |  |
| Reference Fig. No.  |  |  |                                     |                                    |  |  |
| Range   |  |  |                                     |                                    |  |  |
| For test at   |  |  |                                     |                                    |  |  |
| A Immersion, mm   | 57 to 65°C<br>60°C <sup>G</sup>          | 134 to 148°F<br>140°F <sup>G</sup>     | 79 to 87°C<br>82.2°C <sup>G</sup>   | 174 to 188°F<br>180°F <sup>G</sup> | 95 to 103°C<br>98.9 and 100°C <sup>G</sup> | 204 to 218°F<br>210°F <sup>G</sup>         |
| Graduations:  |  |  |                                     |                                    |  |  |
| Subdivisions  | 0.1°C                                    | 0.2°F                                  | 0.1°C                               | 0.2°F                              | 0.1°C                                      | 0.2°F                                      |
| Long lines at each  | 0.5°C                                    | 1°F                                    | 0.5°C                               | 1°F                                | 0.5°C                                      | 1°F  |
| Numbers at each   | 1°C                                      | 2°F                                    | 1°C, except 82                      | 2°F                                | 1°C  | 2°F  |
| Scale error, max  | 0.1°C                                    | 0.2°F                                  | 0.1°C                               | 0.2°F                              | 0.1°C                                      | 0.2°F                                      |
| Special inscription   | ASTM<br>20C-86 or 20F-86                 |  | ASTM<br>21C-86 or 21F-86            |                                    | ASTM<br>22C-86 or 22F-86                   |  |
| Expansion chamber:  |  |  |                                     |                                    |  |  |
| Permit heating to   |  |  |                                     |                                    |  |  |
| B Total length, mm  | 115°C                                    | 240°F                                  | 140°C                               | 285°F                              | 155°C                                      | 310°F                                      |
| C Stem OD, mm   | 270 to 280<br>6.0 to 7.0                 |  | 270 to 280<br>6.0 to 7.0            |                                    | 270 to 280<br>6.0 to 8.0                   |  |

**TABLE 1 Continued**

|                    |   |                               |                               |                               |                               |                               |                 |       |  |
|--------------------|---|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------|-------|--|
| D                  | Bulb length, mm   | 25 to 35                      | 134°F                         | 79°C                          | 174°F                         | 95°C                          | 25 to 35        | 204°F |  |
| E                  | Bulb OD, mm   | ≤5.0 and ≥stem                |                               |                               |                               |                               | ≤5.0 and ≥stem  |       |  |
|                    | Scale location:   |                               |                               |                               |                               |                               |                 |       |  |
| F                  | Bottom of bulb to line at   |                               |                               |                               |                               |                               |                 |       |  |
| F                  | Distance, mm  | 57°C                          | 134°F                         | 79°C                          | 174°F                         | 95°C                          | 25 to 35        | 204°F |  |
| G                  | Length of graduated portion, mm   | 135 to 150                    |                               | 135 to 150                    |                               | 135 to 150                    | 135 to 150      |       |  |
|                    | Ice-point scale:  | 67 to 101°                    |                               | 67 to 101°                    |                               | 70 to 100°                    | 70 to 100°      |       |  |
|                    | Range   |                               |                               |                               |                               |                               |                 |       |  |
| H                  | Bottom of bulb to ice-point, mm   |                               |                               |                               |                               |                               |                 |       |  |
|                    | Contraction chamber:  |                               |                               |                               |                               |                               |                 |       |  |
| I                  | Distance to bottom, min, mm   |                               |                               |                               |                               |                               |                 |       |  |
| J                  | Distance to top, max, mm  | 60 <sup>H</sup>               |                               | 60 <sup>H</sup>               |                               | 60 <sup>H</sup>               | 60 <sup>H</sup> |       |  |
| K                  | Stem enlargement:   |                               |                               |                               |                               |                               |                 |       |  |
| K                  | OD, mm  | 8.0 to 10.0                   |                               | 8.0 to 10.0                   |                               | 8.0 to 10.0                   | 8.0 to 10.0     |       |  |
| L                  | Length, mm  | 4.0 to 7.0                    |                               | 4.0 to 7.0                    |                               | 4.0 to 7.0                    | 4.0 to 7.0      |       |  |
| M                  | Distance to bottom, mm  | 112 to 116                    |                               | 112 to 116                    |                               | 112 to 116                    | 112 to 116      |       |  |
|                    | <sup>G</sup> The test temperatures shall be indicated by an arrow whether the graduation corresponding to that point is numbered or not.  |                               |                               |                               |                               |                               |                 |       |  |
|                    | <sup>H</sup> Long, narrow shape; mercury shall be in the chamber at 0°C (32°F).   |                               |                               |                               |                               |                               |                 |       |  |
|                    | <sup>O</sup> Capillary clearances shall conform to Section 8.   |                               |                               |                               |                               |                               |                 |       |  |
|                    | <sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range. |                               |                               |                               |                               |                               |                 |       |  |
|                    |   | 23C-86                        | 24C-86                        | 25C-86                        | 24C-86                        | 25C-86                        |                 |       |  |
|                    |   | ASTM No.                      | ASTM No.                      | ASTM No.                      | ASTM No.                      | ASTM No.                      |                 |       |  |
| IP No.             | Name  | Engler Viscosity <sup>I</sup> | Engler Viscosity <sup>I</sup> | Engler Viscosity <sup>I</sup> | Engler Viscosity <sup>I</sup> | Engler Viscosity <sup>I</sup> |                 |       |  |
| Reference Fig. No. |   | 7 <sup>K</sup>                | 7 <sup>K</sup>                | 7 <sup>K</sup>                | 7 <sup>K</sup>                | 7 <sup>K</sup>                |                 |       |  |
| Range              |   | 18 to 28°C                    | 39 to 54°C                    | 39 to 54°C                    | 39 to 54°C                    | 95 to 105°C                   |                 |       |  |
| For test at        |   | 25°C                          | 40 and 50°C                   | 40 and 50°C                   | 40 and 50°C                   | 100°C                         |                 |       |  |
| A                  | Immersion, mm   | 90                            | 90                            | 90                            | 90                            | 90                            |                 |       |  |
|                    | Graduations:  |                               |                               |                               |                               |                               |                 |       |  |
|                    | Subdivisions  | 0.2°C                         | 0.2°C                         | 0.2°C                         | 0.2°C                         | 0.2°C                         |                 |       |  |
|                    | Long lines at each  | 1°C                           | 1°C                           | 1°C                           | 1°C                           | 1°C                           |                 |       |  |
|                    | Numbers at each   | 2°C full figures at 25        | 2°C full figures at 40 and 50 | 2°C full figures at 40 and 50 | 2°C full figures at 40 and 50 | 2°C full figures at 100       |                 |       |  |
|                    | Scale error, max  | 0.1°C at 25°C                 | 0.1°C at 40 and 50°C          | 0.1°C at 40 and 50°C          | 0.1°C at 40 and 50°C          | 0.1°C at 100°C                |                 |       |  |
|                    | Special inscription   | ASTM                          | ASTM                          | ASTM                          | ASTM                          | ASTM                          |                 |       |  |
|                    |   | 23C-86                        | 24C-86                        | 24C-86                        | 24C-86                        | 25C-86                        |                 |       |  |
|                    |   | 90 MM IMM <sup>J</sup>        | 90 MM IMM <sup>J</sup>        | 90 MM IMM <sup>J</sup>        | 90 MM IMM <sup>J</sup>        | 90 MM IMM <sup>J</sup>        |                 |       |  |
|                    | Expansion chamber:  |                               |                               |                               |                               |                               |                 |       |  |
|                    | Permit heating to   |                               |                               |                               |                               |                               |                 |       |  |
| B                  | Total length, mm  | 100°C                         | 105°C                         | 105°C                         | 105°C                         | 155°C                         |                 |       |  |
| C                  | Stem OD, mm   | 207 to 217                    | 232 to 242                    | 232 to 242                    | 232 to 242                    | 207 to 217                    |                 |       |  |
| D                  | Bulb length, mm   | 5.5 to 6.5                    | 5.5 to 6.5                    | 5.5 to 6.5                    | 5.5 to 6.5                    | 5.5 to 6.5                    |                 |       |  |
| E                  | Bulb OD, mm   | 13 to 19                      | 13 to 19                      | 13 to 19                      | 13 to 19                      | 13 to 19                      |                 |       |  |
|                    | Scale location:   | 5.5 to 6.5                    | 5.5 to 6.5                    | 5.5 to 6.5                    | 5.5 to 6.5                    | 5.5 to 6.5                    |                 |       |  |
| F                  | Bottom of bulb to line at   |                               |                               |                               |                               |                               |                 |       |  |
| F                  | Distance, mm  | 18°C                          | 39°C                          | 39°C                          | 39°C                          | 95°C                          |                 |       |  |
| G                  | Length of graduated portion, mm   | 108 to 118                    | 108 to 118                    | 108 to 118                    | 108 to 118                    | 108 to 118                    |                 |       |  |
|                    | Ice-point scale:  | 42 to 69°                     | 67 to 94°                     | 67 to 94°                     | 67 to 94°                     | 42 to 69°                     |                 |       |  |
|                    | Range   |                               |                               |                               |                               |                               |                 |       |  |
| H                  | Bottom of bulb to ice-point, mm   |                               |                               |                               |                               |                               |                 |       |  |
|                    | Contraction chamber:  |                               |                               |                               |                               |                               |                 |       |  |
| I                  | Distance to bottom, min, mm   |                               |                               |                               |                               |                               |                 |       |  |
| J                  | Distance to top, max, mm  | 60 <sup>I</sup>               | 60 <sup>I</sup>               | 60 <sup>I</sup>               | 60 <sup>I</sup>               | 60 <sup>I</sup>               |                 |       |  |
| K                  | Stem enlargement:   |                               |                               |                               |                               |                               |                 |       |  |
| K                  | OD, mm  |                               |                               |                               |                               |                               |                 |       |  |
| L                  | Length, mm  |                               |                               |                               |                               |                               |                 |       |  |
| M                  | Distance to bottom, mm  |                               |                               |                               |                               |                               |                 |       |  |



**TABLE 1 Continued**

<sup>I</sup>The thermometer shall be made to be mounted in a brass ferrule consisting of a tubular bushing 8.0 mm in outside diameter with a flanged head approximately 12 mm in diameter so that the upper extremity of the 8.0 mm diameter is located 90 mm from the bottom of the bulb.  
<sup>J</sup>To be marked on the glass stem at least 90 mm from the bottom of the bulb.  
<sup>K</sup>Glass button finish, see 6.2.1.  
<sup>L</sup>Long, narrow shape; mercury shall be near bottom of the chamber at 0°C.  
<sup>O</sup>Capillary clearances shall conform to Section 8.

| IP No.  | ASTM No.                         | 26C-86                                   | 27C-86                           | 28C-86                       | 28F-86 <sup>FF</sup>             |
|---|----------------------------------|--|----------------------------------|------------------------------|----------------------------------|
| Name  |                                  | Stability Test of Soluble Nitrocellulose | Turpentine Distillation          | 31C                          | Kinematic Viscosity <sup>M</sup> |
| Reference Fig. No.  | 9                                |  | 7                                |                              | 6                                |
| Range   | 130 to 140°C                     |  | 147 to 182°C                     | 36.6 to 39.4°C               | 97.5 to 102.5°F                  |
| For test at   | 134.5°C                          |  |                                  | 37.8°C                       | 100°F                            |
| A Immersion, mm   | total                            |  | 76                               |                              | total                            |
| Graduations:  |                                  |  |                                  |                              |                                  |
| Subdivisions  | 0.1°C                            |  | 0.5°C                            | 0.05°C                       | 0.1°F                            |
| Long lines at each  | 0.5°C                            |  | 1°C                              | 0.1 and 0.5°C                | 0.5 and 1°F                      |
| Numbers at each   | 1°C and in full at 130, 135, 140 |  | 2°C from 148                     | 1°C                          | 1°F                              |
| Scale error, max  | 0.2°C                            |  | 0.5°C                            | 0.1°C                        | 0.2°F                            |
| Special Inscription   | ASTM                             |  | ASTM                             |                              | ASTM                             |
|   | 26C-86                           |  | 27C-86                           |                              | 28C-86 or 28F-86                 |
|   |                                  |  | 76 MM IMM                        |                              |                                  |
| Expansion chamber:  |                                  |  |                                  |                              |                                  |
| Permit heating to   | 175°C                            |  | 230°C                            | 105°C                        | 220°F                            |
| B Total length, mm  | 458 to 468                       |  | 296 to 306                       |                              | 300 to 310                       |
| C Stem OD, mm   | 6.5 to 8.0                       |  | 6.0 to 7.0                       |                              | 6.0 to 8.0                       |
| D Bulb length, mm   | 54 to 67                         |  | 10 to 15                         |                              | 45 to 55                         |
| E Bulb OD, mm   | 6.0 to 7.0                       |  | 4.0 to 5.5                       |                              | > stem                           |
| Scale location:   |                                  |  |                                  |                              |                                  |
| Bottom of bulb to line at   | 134.5°C                          |  | 147°C                            | 36.6°C                       | 97.5°F                           |
| F Distance, mm  | 320 to 340                       |  | 100 to 115                       |                              | 145 to 165                       |
| G Length of graduated portion, mm   | 112 to 145 <sup>O</sup>          |  | 131 to 166 <sup>O</sup>          |                              | 40 to 90 <sup>O</sup>            |
| Ice-point scale:  |                                  |  |                                  |                              |                                  |
| Range   |                                  |  |                                  | -0.3 to + 0.3°C <sup>O</sup> | 31.5 to 32.5°F <sup>O</sup>      |
| H Bottom of bulb to ice-point, mm   |                                  |  |                                  |                              |                                  |
| Contraction chamber:  |                                  |  |                                  |                              |                                  |
| I Distance to bottom, min, mm   |                                  |  |                                  |                              | 100                              |
| J Distance to top, max, mm  | 100 <sup>I</sup>                 |  | 40 <sup>I</sup>                  |                              | 125                              |
| K Stem enlargement:   |                                  |  |                                  |                              |                                  |
| OD, mm  |                                  |  |                                  |                              |                                  |
| L Length, mm  |                                  |  |                                  |                              |                                  |
| M Distance to bottom, mm  |                                  |  |                                  |                              |                                  |
| <sup>I</sup> Long, narrow shape; mercury shall be near bottom of the chamber at 0°C.<br><sup>M</sup> For kinematic viscosity thermometers, the ice-point reading shall be taken within 1 h after being at the test temperature for not less than 3 minutes. The ice-point reading shall be expressed to the nearest 0.01°C or 0.02°F and applied as explained in Test Method E77, Section 13.<br><sup>O</sup> Capillary clearances shall conform to Section 8.<br><sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range. |                                  |  |                                  |                              |                                  |
| ASTM No.  | 29C-86                           | 29F-86 <sup>FF</sup>                     | 30F-86 <sup>FF</sup>             | 33C-86                       | 33F-86 <sup>FF</sup>             |
| IP No.  | 34C                              |  |                                  | 20C                          |                                  |
| Name  |                                  | Kinematic Viscosity <sup>M</sup>         | Kinematic Viscosity <sup>M</sup> |                              | Low Aniline Point                |
| Reference Fig. No.  | 6                                |  | 6                                |                              | 3                                |
| Range   | 52.6 to 55.4°C                   | 127.5 to 132.5°F                         | 207.5 to 212.5°F                 | -38 to + 42°C                | -36.5 to + 107.5°F               |
| For test at   | 54.4°C                           | 130°F                                    | 210°F                            |                              |                                  |
| A Immersion, mm   |                                  |  | total                            |                              | 50                               |
| Graduations:  |                                  |  |                                  |                              |                                  |
| Subdivisions  | 0.05°C                           | 0.1°F                                    | 0.1°F                            | 0.2°C                        | 0.5°F                            |
| Long lines at each  | 0.1 and 0.5°C                    | 0.5 and 1°F                              | 0.5 and 1°F                      | 1°C                          | 1°F                              |

**TABLE 1 Continued**

|                                   | 1°C                          | 1°F                         | 1°F                         | 1°F                         | 2°C                     | 5°F                                |
|-----------------------------------|------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|------------------------------------|
| Numbers at each scale error, max  | 0.1°C                        | 0.2°F                       | 0.2°F                       | 0.2°F                       | 0.2°C                   | 0.5°F                              |
| Special inscription               |                              | ASTM 29C-86 or 29F-86       | ASTM 30F-86                 | ASTM 30F-86                 |                         | ASTM 33C-86 or 33F-86<br>50 MM IMM |
| Expansion chamber:                |                              |                             |                             |                             |                         |                                    |
| Permit heating to                 |                              | 220°F                       | 266°F                       | 266°F                       | 100°C                   | 212°F                              |
| B Total length, mm                | 105°C                        | 300 to 310                  | 300 to 310                  | 300 to 310                  | 415 to 425              |                                    |
| C Stem OD, mm                     |                              | 6.0 to 8.0                  | 6.0 to 8.0                  | 6.0 to 8.0                  | 6.0 to 7.5              |                                    |
| D Bulb length, mm                 |                              | 45 to 55                    | 45 to 55                    | 45 to 55                    | 10 to 20                |                                    |
| E Bulb OD, mm                     |                              | ↗stem                       | ↗stem                       | ↗stem                       | ↗stem                   | ↗stem                              |
| Scale location:                   |                              |                             |                             |                             |                         |                                    |
| Bottom of bulb to line at         |                              | 127.5°F                     | 207.5°F                     | 207.5°F                     | -35°C                   | -31°F                              |
| F Distance, mm                    | 52.6°C                       | 145 to 165                  | 145 to 165                  | 145 to 165                  | 100 to 125              |                                    |
| G Length of graduated portion, mm |                              | 40 to 90 <sup>o</sup>       | 40 to 90 <sup>o</sup>       | 40 to 90 <sup>o</sup>       | 240 to 280 <sup>o</sup> |                                    |
| Ice-point scale:                  |                              |                             |                             |                             |                         |                                    |
| Range                             | -0.3 to + 0.3°C <sup>o</sup> | 31.5 to 32.5°F <sup>o</sup> | 31.5 to 32.5°F <sup>o</sup> | 31.5 to 32.5°F <sup>o</sup> |                         |                                    |
| H Bottom of bulb to ice-point, mm |                              |                             |                             |                             |                         |                                    |
| Contraction chamber:              |                              |                             |                             |                             |                         |                                    |
| I Distance to bottom, min, mm     |                              | 100                         | 100                         | 100                         |                         |                                    |
| J Distance to top, max, mm        |                              | 125                         | 125                         | 125                         |                         |                                    |
| Stem enlargement:                 |                              |                             |                             |                             |                         |                                    |
| K OD, mm                          |                              |                             |                             |                             |                         |                                    |
| L Length, mm                      |                              |                             |                             |                             |                         |                                    |
| M Distance to bottom, mm          |                              |                             |                             |                             |                         |                                    |

<sup>M</sup> For kinematic viscosity thermometers, the ice-point reading shall be taken within 1 h after being at the test temperature for not less than 3 minutes. The ice-point reading shall be expressed to the nearest 0.01°C or 0.02°F and applied as explained in Test Method E77, Section 13.

<sup>o</sup> Capillary clearances shall conform to Section 8.

<sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.

|                                   | 34C-86                             | 34F-86 <sup>FF</sup>               | 35C-86                             | 35F-86 <sup>FF</sup>     | 36C-86                   |
|-----------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------|--------------------------|
| IP No.                            | 21C                                |                                    | 59C                                |                          |                          |
| Name                              | Medium Aniline Point               | High Aniline Point                 |                                    |                          |                          |
| Reference Fig. No.                | 3                                  | 7                                  |                                    |                          |                          |
| Range                             | 25 to 105°C                        | 77 to 221°F                        | 90 to 170°C                        | 194 to 338°F             | -2 to + 68°C             |
| For test at                       |                                    |                                    |                                    |                          |                          |
| A Immersion, mm                   |                                    | 50                                 |                                    | 50                       | 45                       |
| Graduations:                      |                                    |                                    |                                    |                          |                          |
| Subdivisions                      | 0.2°C                              | 0.5°F                              | 0.2°C                              | 0.5°F                    | 0.2°C                    |
| Long lines at each                | 1°C                                | 1°F                                | 1°C                                | 1°F                      | 1°C                      |
| Numbers at each                   | 2°C                                | 5°F                                | 2°C                                | 5°F                      | 2°C                      |
| Scale error, max                  | 0.2°C                              | 0.5°F                              | 0.4°C                              | 1.0°F                    | 0.2°C                    |
| Special inscription               | ASTM 34C-86 or 34F-86<br>50 MM IMM | ASTM 34C-86 or 34F-86<br>50 MM IMM | ASTM 35C-86 or 35F-86<br>50 MM IMM | ASTM 36C-86<br>45 MM IMM | ASTM 36C-86<br>45 MM IMM |
| Expansion chamber:                |                                    |                                    |                                    |                          |                          |
| Permit heating to                 |                                    | 302°F                              | 220°C                              | 428°F                    | 85°C <sup>o</sup>        |
| B Total length, mm                | 150°C                              | 415 to 425                         | 415 to 425                         | 415 to 425               | 400 to 410               |
| C Stem OD, mm                     |                                    | 6.0 to 7.5                         | 6.0 to 7.5                         | 6.0 to 7.5               | 6.0 to 7.0 <sup>o</sup>  |
| D Bulb length, mm                 |                                    | 10 to 20                           | 10 to 20                           | 10 to 20                 | 15 to 25                 |
| E Bulb OD, mm                     |                                    | ↗stem                              | ↗stem                              | ↗stem                    | ↗stem                    |
| Scale location:                   |                                    |                                    |                                    |                          |                          |
| Bottom of bulb to line at         |                                    | 77°F                               | 90°C                               | 194°F                    | -2°C                     |
| F Distance, mm                    | 25°C                               | 100 to 115                         | 100 to 115                         | 240 to 280 <sup>o</sup>  | 50 to 60                 |
| G Length of graduated portion, mm |                                    | 240 to 280 <sup>o</sup>            | 240 to 280 <sup>o</sup>            | 240 to 280 <sup>o</sup>  | 290 to 320 <sup>o</sup>  |
| Ice-point scale:                  |                                    |                                    |                                    |                          |                          |
| Range                             |                                    |                                    |                                    |                          |                          |
| H Bottom of bulb to ice-point, mm |                                    |                                    |                                    |                          |                          |

**TABLE 1 Continued**

|  |                                 | 37C-86                  | 38C-86                  | 39C-86                  |
|--|---------------------------------|-------------------------|-------------------------|-------------------------|
| Contraction chamber:   |                                 |                         |                         |                         |
| I  | Distance to bottom, min, mm     |                         |                         | 35 <sup>P</sup>         |
| J  | Distance to top, max, mm        |                         |                         |                         |
| Stem enlargement:  |                                 |                         |                         |                         |
| K  | OD, mm                          |                         |                         |                         |
| L  | Length, mm                      |                         |                         |                         |
| M  | Distance to bottom, mm          |                         |                         |                         |
| <sup>N</sup> Thermometers made to these specifications conform also with the requirements for the titer test thermometer of the American Oil Chemists Society and the Association of Official Agricultural Chemists, except for the special inscription.<br><sup>O</sup> Capillary clearances shall conform to Section 8.<br><sup>P</sup> Mercury shall be near middle of chamber at 0°C.<br><sup>Q</sup> The stem may be either the plain front or lens front type. If the thermometer is of the lens front type, the cross section of the stem shall be such that it will pass through an 8-mm ring gage but will not enter a 5-mm slot gage.<br><sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range. |                                 |                         |                         |                         |
|  | ASTM No.                        | 79C                     | 78C                     | 79C                     |
| Solvents Distillation  |                                 |                         |                         |                         |
| IP No.   |                                 | 3                       | 3                       | 7                       |
| Name   |                                 | Solvents Distillation   | Solvents Distillation   | Solvents Distillation   |
| Reference Fig. No.   |                                 |                         |                         |                         |
| Range  |                                 | -2 to + 52°C            | 24 to 78°C              | 48 to 102°C             |
| For test at  |                                 |                         |                         |                         |
| A  | Immersion, mm                   | 100                     | 100                     | 100                     |
| Graduations:   |                                 |                         |                         |                         |
|  | Subdivisions                    | 0.2°C                   | 0.2°C                   | 0.2°C                   |
|  | Long lines at each              | 1°C                     | 1°C                     | 1°C                     |
|  | Numbers at each                 | 2°C                     | 2°C                     | 2°C                     |
|  | Scale error, max                | 0.2°C                   | 0.2°C                   | 0.2°C                   |
|  | Special inscription             | ASTM                    | ASTM                    | ASTM                    |
| Expansion chamber:   |                                 |                         |                         |                         |
|  | Permit heating to               | 37C-86                  | 38C-86                  | 39C-86                  |
| B  | Total length, mm                | 100 MM IMM              | 100 MM IMM              | 100 MM IMM              |
| C  | Stem OD, mm                     | 80°C                    | 105°C                   | 130°C                   |
| D  | Bulb length, mm                 | 390 to 400              | 390 to 400              | 390 to 400              |
| E  | Bulb OD, mm                     | 6.0 to 8.0              | 6.0 to 8.0              | 6.0 to 8.0              |
|  | Scale location:                 | 15 to 20                | 15 to 20                | 15 to 20                |
|  | Bottom of bulb to line at       | >stem                   | >stem                   | >stem                   |
| F  | Distance, mm                    | -2°C                    | 24°C                    | 48°C                    |
| G  | Length of graduated portion, mm | 125 to 145              | 125 to 145              | 125 to 145              |
|  | Ice-point scale:                | 190 to 235 <sup>O</sup> | 190 to 235 <sup>O</sup> | 190 to 235 <sup>O</sup> |
| Range  |                                 |                         |                         |                         |
| H  | Bottom of bulb to ice-point, mm |                         |                         |                         |
| Contraction chamber:   |                                 |                         |                         |                         |
| I  | Distance to bottom, min, mm     |                         |                         |                         |
| J  | Distance to top, max, mm        |                         |                         |                         |
| Stem enlargement:  |                                 |                         |                         |                         |
| K  | OD, mm                          |                         |                         |                         |
| L  | Length, mm                      |                         |                         |                         |
| M  | Distance to bottom, mm          |                         |                         |                         |
| <sup>O</sup> Capillary clearances shall conform to Section 8.<br><sup>T</sup> Mercury shall be near the bottom of the chamber at 0°C.  |                                 |                         |                         |                         |
|  | ASTM No.                        | 80C                     | 81C                     | 82C                     |
| Solvents Distillation  |                                 |                         |                         |                         |
| IP No.   |                                 | 7                       | 7                       | 7                       |
| Name   |                                 | Solvents Distillation   | Solvents Distillation   | Solvents Distillation   |
| Reference Fig. No.   |                                 |                         |                         |                         |
| Range  |                                 | 72 to 126°C             | 98 to 152°C             | 95 to 255°C             |

TABLE 1 Continued

|  |                                 |                         |                         |                         |                         |
|--|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| For test at  |                                 |                         |                         |                         |                         |
| A  | Immersion, mm                   | 100                     | 100                     | 100                     | 100                     |
|  | Graduations:                    |                         |                         |                         |                         |
|  | Subdivisions                    |                         |                         |                         |                         |
|  | Long lines at each              | 0.2°C                   | 0.2°C                   | 0.2°C                   | 0.5°C                   |
|  | Numbers at each                 | 1°C                     | 1°C                     | 1°C                     | 1°C                     |
|  | Scale error, max                | 2°C                     | 2°C                     | 0.3°C                   | 1°C                     |
|  | Special inscription             | 0.2°C                   | ASTM                    | ASTM                    | ASTM                    |
|  |                                 | 40C-86                  | 41C-86                  | 42C-86                  | 42C-86                  |
|  |                                 | 100 MM IMM              | 100 MM IMM              | 100 MM IMM              | 100 MM IMM              |
| Expansion chamber:   |                                 |                         |                         |                         |                         |
|  | Permit heating to               |                         |                         |                         |                         |
| B  | Total length, mm                | 150°C                   | 180°C                   | 280°C                   | 280°C                   |
| C  | Stem OD, mm                     | 390 to 400              | 390 to 400              | 390 to 400              | 390 to 400              |
| D  | Bulb length, mm                 | 6.0 to 8.0              | 6.0 to 8.0              | 6.0 to 8.0              | 6.0 to 8.0              |
| E  | Bulb OD, mm                     | 15 to 20                | 15 to 20                | 15 to 20                | 15 to 20                |
|  | Scale location:                 | >stem                   | >stem                   | >stem                   | >stem                   |
| Bottom of bulb to line at  |                                 |                         |                         |                         |                         |
| F  | Distance, mm                    | 72°C                    | 98°C                    | 95°C                    | 95°C                    |
| G  | Length of graduated portion, mm | 125 to 145              | 125 to 145              | 125 to 145              | 125 to 145              |
|  |                                 | 190 to 235 <sup>o</sup> | 190 to 235 <sup>o</sup> | 190 to 235 <sup>o</sup> | 190 to 235 <sup>o</sup> |
| Ice-point scale:   |                                 |                         |                         |                         |                         |
|  | Range                           |                         |                         |                         |                         |
| H  | Bottom of bulb to ice-point, mm |                         |                         |                         |                         |
| Contraction chamber:   |                                 |                         |                         |                         |                         |
| I  | Distance to bottom, min, mm     |                         |                         |                         |                         |
| J  | Distance to top, max, mm        |                         |                         |                         |                         |
| Stem enlargement:  |                                 |                         |                         |                         |                         |
| K  | OD, mm                          | 35 <sup>7</sup>         | 35 <sup>7</sup>         | 35 <sup>7</sup>         | 35 <sup>7</sup>         |
| L  | Length, mm                      |                         |                         |                         |                         |
| M  | Distance to bottom, mm          |                         |                         |                         |                         |
| <sup>o</sup> Capillary clearances shall conform to Section 8.        |                                 |                         |                         |                         |                         |
| <sup>7</sup> Mercury shall be near the bottom of the chamber at 0°C. |                                 |                         |                         |                         |                         |
| ASTM No.   |                                 |                         |                         |                         |                         |
| IP No.   | 43C-86                          | 43F-86 <sup>FF</sup>    | 44C-86                  | 44F-86 <sup>FF</sup>    | 45C-86                  |
| Name   | 65C                             | 29C                     | 30C                     | 30C                     | 30C                     |
| Reference Fig. No.   |                                 |                         |                         |                         |                         |
| Range  |                                 |                         |                         |                         |                         |
| For test at  |                                 |                         |                         |                         |                         |
| A  | Immersion, mm                   | 10                      | 6                       | 6                       | 6                       |
|  | Graduations:                    |                         |                         |                         |                         |
|  | Subdivisions                    |                         |                         |                         |                         |
|  | Long lines at each              | 0.1°C                   | 0.05°C                  | 0.1°F                   | 0.1°F                   |
|  | Numbers at each                 | 0.5 and 1°C             | 0.1 and 0.5°C           | 0.5 and 1°F             | 0.5 and 1°F             |
|  | Scale error, max                | 1°C starting at -51°C   | 1°C                     | 1°F                     | 1°F                     |
|  | Special inscription             | 0.1°C                   | 0.1°C                   | 0.2°F                   | 0.2°F                   |
| ASTM   |                                 |                         |                         |                         |                         |
| 43C-86 or 43F-86   |                                 |                         |                         |                         |                         |
| MERC-THAL  |                                 |                         |                         |                         |                         |
| Expansion chamber:   |                                 |                         |                         |                         |                         |
|  | Permit heating to               |                         |                         |                         |                         |
| B  | Total length, mm                | 105°C <sup>s</sup>      | 105°C                   | 220°F                   | 220°F                   |
| C  | Stem OD, mm                     | 410 to 425              | 300 to 310              | 300 to 310              | 300 to 310              |
| D  | Bulb length, mm                 | 7.0 to 8.0              | 6.0 to 8.0              | 6.0 to 8.0              | 6.0 to 8.0              |
| E  | Bulb OD, mm                     | 30 to 40                | 45 to 55                | 45 to 55                | 45 to 55                |
|  | Scale location:                 | 6.0 to 7.0              | >stem                   | >stem                   | >stem                   |
| Bottom of bulb to line at  |                                 |                         |                         |                         |                         |
| F  | Distance, mm                    | -51.6°C                 | 18.6°C                  | 66.5°F                  | 23.6°C                  |
|  |                                 | 60 to 90                | 145 to 165              | 145 to 165              | 145 to 165              |
|  |                                 |                         |                         |                         | 74.5°F                  |
|  |                                 |                         |                         |                         | 77°F                    |
|  |                                 |                         |                         |                         | 74.5 to 79.5°F          |
|  |                                 |                         |                         |                         | ASTM                    |
|  |                                 |                         |                         |                         | 45C-86 or 45F-86        |

**TABLE 1 Continued**

|   | 140 to 225 <sup>o</sup>   | 40 to 90 <sup>o</sup>                    | 40 to 90 <sup>o</sup>                    |
|---|---|--|--|
| G | Length of graduated portion, mm   | 140 to 225 <sup>o</sup>                  | 40 to 90 <sup>o</sup>                    |
|   | Ice-Point scale:  |  |  |
|   | Range   | -0.6 to +0.6 <sup>o</sup> C <sup>o</sup> | -0.3 to +0.3 <sup>o</sup> C <sup>o</sup> |
| H | Bottom of bulb to ice-point, mm   | 31 to 33 <sup>o</sup> F <sup>o</sup>     | 31.5 to 32.5 <sup>o</sup> F <sup>o</sup> |
|   | Contraction chamber:  |  |  |
| I | Distance to bottom, min, mm   | 290 <sup>U</sup>                         | 100                                      |
| J | Distance to top, max, mm  | 310 <sup>U</sup>                         | 125                                      |
|   | Stem enlargement:   |  |  |
| K | OD, mm  |  |  |
| L | Length, mm  |  |  |
| M | Distance to bottom, mm  |  |  |
|   | <sup>M</sup> For kinematic viscosity thermometers, the ice-point reading shall be taken within 1 h after being at the test temperature for not less than 3 minutes. The ice-point reading shall be expressed to the nearest 0.01 <sup>o</sup> C or 0.02 <sup>o</sup> F and applied as explained in Test Method E77, Section 13. |  |  |
|   | <sup>O</sup> Capillary clearances shall conform to Section 8.   |  |  |
|   | <sup>R</sup> A suitable mercury-thallium alloy shall be used as the actuating liquid.   |  |  |
|   | <sup>S</sup> The expansion chamber shall be of the long narrow type 10 to 20 mm in length. The length of unchanged capillary between the nearest graduation mark and the expansion chamber shall be not less than 10 mm.  |  |  |
|   | <sup>U</sup> The length of unchanged capillary between the nearest graduation mark and contraction chamber shall be not less than 10 mm.  |  |  |
|   | <sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.   |  |  |

|                    | 46C-86  | 47C-86                                   | 47F-86 <sup>FF</sup>                     | 48C-86                                   | 48F-86 <sup>FF</sup>                     |
|--------------------|---|--|--|--|--|
| IP No.             | 66C   | 35C                                      |  | 90C                                      |  |
| Name               | Kinematic Viscosity <sup>M</sup>  | Kinematic Viscosity <sup>M</sup>         | Kinematic Viscosity <sup>M</sup>         | Kinematic Viscosity <sup>M</sup>         | Kinematic Viscosity <sup>M</sup>         |
| Reference Fig. No. |   |  |  |  |  |
| Range              | 48.6 to 51.4 <sup>o</sup> C   | 58.6 to 61.4 <sup>o</sup> C              | 137.5 to 142.5 <sup>o</sup> F            | 80.6 to 83.4 <sup>o</sup> C              | 177.5 to 182.5 <sup>o</sup> F            |
| For test at        | 50 <sup>o</sup> C   | 60 <sup>o</sup> C                        | 140 <sup>o</sup> F                       | 82.2 <sup>o</sup> C                      | 180 <sup>o</sup> F                       |
| A                  | Immersion, mm   |  |  |  |  |
|                    | Graduations:  |  |  |  |  |
|                    | Subdivisions  | 0.05 <sup>o</sup> C                      | 0.1 <sup>o</sup> F                       | 0.05 <sup>o</sup> C                      | 0.1 <sup>o</sup> F                       |
|                    | Long lines at each  | 0.1 and 0.5 <sup>o</sup> C               | 0.5 and 1 <sup>o</sup> F                 | 0.1 and 0.5 <sup>o</sup> C               | 0.5 and 1 <sup>o</sup> F                 |
|                    | Numbers at each   | 1 <sup>o</sup> C                         | 1 <sup>o</sup> F                         | 1 <sup>o</sup> C                         | 1 <sup>o</sup> F                         |
|                    | Scale error, max  | 0.1 <sup>o</sup> C                       | 0.2 <sup>o</sup> F                       | 0.1 <sup>o</sup> C                       | 0.2 <sup>o</sup> F                       |
|                    | Special inscription   | ASTM                                     |  | ASTM                                     |  |
|                    | Expansion chamber:  |  |  |  |  |
|                    | Permit heating to   | 46C-86 or 46F-86                         |  | 48C-86 or 48F-86                         |  |
| B                  | Total length, mm  | 105 <sup>o</sup> C                       | 220 <sup>o</sup> F                       | 105 <sup>o</sup> C                       | 220 <sup>o</sup> F                       |
| C                  | Stem OD, mm   | 300 to 310                               |  | 300 to 310                               |  |
| D                  | Bulb length, mm   | 6.0 to 8.0                               |  | 6.0 to 8.0                               |  |
| E                  | Bulb OD, mm   | 45 to 55                                 |  | 45 to 55                                 |  |
|                    | Scale location:   |  |  |  |  |
|                    | Bottom of bulb to line at   |  |  |  |  |
| F                  | Distance, mm  | 48.6 <sup>o</sup> C                      | 119.5 <sup>o</sup> F                     | 80.6 <sup>o</sup> C                      | 177.5 <sup>o</sup> F                     |
| G                  | Length of graduated portion, mm   | 145 to 165                               |  | 145 to 165                               |  |
|                    | Ice-point scale:  |  |  |  |  |
|                    | Range   | -0.3 to +0.3 <sup>o</sup> C <sup>o</sup> | 31.5 to 32.5 <sup>o</sup> F <sup>o</sup> | -0.3 to +0.3 <sup>o</sup> C <sup>o</sup> | 31.5 to 32.5 <sup>o</sup> F <sup>o</sup> |
| H                  | Bottom of bulb to ice-point, mm   |  |  |  |  |
|                    | Contraction chamber:  |  |  |  |  |
| I                  | Distance to bottom, min, mm   | 100                                      |  | 100                                      |  |
| J                  | Distance to top, max, mm  | 125                                      |  | 125                                      |  |
|                    | Stem enlargement:   |  |  |  |  |
| K                  | OD, mm  |  |  |  |  |
| L                  | Length, mm  |  |  |  |  |
| M                  | Distance to bottom, mm  |  |  |  |  |
|                    | <sup>M</sup> For kinematic viscosity thermometers, the ice-point reading shall be taken within 1 h after being at the test temperature for not less than 3 minutes. The ice-point reading shall be expressed to the nearest 0.01 <sup>o</sup> C or 0.02 <sup>o</sup> F and applied as explained in Test Method E77, Section 13. |  |  |  |  |
|                    | <sup>O</sup> Capillary clearances shall conform to Section 8.   |  |  |  |  |
|                    | <sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.   |  |  |  |  |

TABLE 1 Continued

| ASTM No.  |  | 49C-86 | 50F-86 <sup>FF</sup> | 51F-86 <sup>FF</sup> |                      |
|---|--|--------|----------------------|----------------------|----------------------|
| IP No.  |  |        |                      |                      |                      |
| Name  |  |        |                      |                      |                      |
| Reference Fig. No.  |  |        |                      |                      |                      |
| Range   |  |        |                      |                      |                      |
| For test at   |  |        |                      |                      |                      |
| A Immersion, mm   |  |        |                      |                      |                      |
| Graduations:  |  |        |                      |                      |                      |
| Subdivisions  |  |        |                      |                      |                      |
| Long lines at each  |  |        |                      |                      |                      |
| Numbers at each   |  |        |                      |                      |                      |
| Scale error, max  |  |        |                      |                      |                      |
| Special inscription   |  |        |                      |                      |                      |
| Expansion chamber:  |  |        |                      |                      |                      |
| Permit heating to   |  |        |                      |                      |                      |
| B Total length, mm  |  |        |                      |                      |                      |
| C Stem OD, mm   |  |        |                      |                      |                      |
| D Bulb length, mm   |  |        |                      |                      |                      |
| E Bulb OD, mm   |  |        |                      |                      |                      |
| Scale location:   |  |        |                      |                      |                      |
| F Bottom of bulb to line at   |  |        |                      |                      |                      |
| Distance, mm  |  |        |                      |                      |                      |
| G Length of graduated portion, mm   |  |        |                      |                      |                      |
| Ice-point scale:  |  |        |                      |                      |                      |
| Range   |  |        |                      |                      |                      |
| H Bottom of bulb to ice-point, mm   |  |        |                      |                      |                      |
| Contraction chamber:  |  |        |                      |                      |                      |
| I Distance to bottom, min, mm   |  |        |                      |                      |                      |
| J Distance to top, max, mm  |  |        |                      |                      |                      |
| Stem enlargement:   |  |        |                      |                      |                      |
| K OD, mm  |  |        |                      |                      |                      |
| L Length, mm  |  |        |                      |                      |                      |
| M Distance to bottom, mm  |  |        |                      |                      |                      |
| <sup>O</sup> Capillary clearances shall conform to Section 8.   |  |        |                      |                      |                      |
| <sup>P</sup> Mercury shall be near middle of chamber at 0°C.  |  |        |                      |                      |                      |
| <sup>V</sup> Change in correction over any 5°F interval shall not exceed 0.10°F.  |  |        |                      |                      |                      |
| <sup>X</sup> Mercury shall be in the chamber at 32°F.   |  |        |                      |                      |                      |
| <sup>FF</sup> For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range. |  |        |                      |                      |                      |
| ASTM No.  |  | 52C-86 | 54F-86 <sup>FF</sup> | 56C-86               | 56F-86 <sup>FF</sup> |
| IP No.  |  |        |                      |                      |                      |
| Name  |  |        |                      |                      |                      |
| Reference Fig. No.  |  |        |                      |                      |                      |
| Range   |  |        |                      |                      |                      |
| For test at   |  |        |                      |                      |                      |
| A Immersion, mm   |  |        |                      |                      |                      |
| Graduations:  |  |        |                      |                      |                      |
| Subdivisions  |  |        |                      |                      |                      |
| Long lines at each  |  |        |                      |                      |                      |
| Numbers at each   |  |        |                      |                      |                      |
| Scale error, max  |  |        |                      |                      |                      |
| Special inscription   |  |        |                      |                      |                      |
| Expansion chamber:  |  |        |                      |                      |                      |
| Butadiene Boiling Point Range   |  |        |                      |                      |                      |
| Range   |  |        |                      |                      |                      |
| For test at   |  |        |                      |                      |                      |
| Immersion, mm   |  |        |                      |                      |                      |
| Graduations:  |  |        |                      |                      |                      |
| Subdivisions  |  |        |                      |                      |                      |
| Long lines at each  |  |        |                      |                      |                      |
| Numbers at each   |  |        |                      |                      |                      |
| Scale error, max  |  |        |                      |                      |                      |
| Special inscription   |  |        |                      |                      |                      |
| Expansion chamber:  |  |        |                      |                      |                      |
| Permit heating to   |  |        |                      |                      |                      |
| Total length, mm  |  |        |                      |                      |                      |
| Stem OD, mm   |  |        |                      |                      |                      |
| Bulb length, mm   |  |        |                      |                      |                      |
| Bulb OD, mm   |  |        |                      |                      |                      |
| Scale location:   |  |        |                      |                      |                      |
| Bottom of bulb to line at   |  |        |                      |                      |                      |
| Distance, mm  |  |        |                      |                      |                      |
| Length of graduated portion, mm   |  |        |                      |                      |                      |
| Ice-point scale:  |  |        |                      |                      |                      |
| Range   |  |        |                      |                      |                      |
| Bottom of bulb to ice-point, mm   |  |        |                      |                      |                      |
| Contraction chamber:  |  |        |                      |                      |                      |
| Distance to bottom, min, mm   |  |        |                      |                      |                      |
| Distance to top, max, mm  |  |        |                      |                      |                      |
| Stem enlargement:   |  |        |                      |                      |                      |
| OD, mm  |  |        |                      |                      |                      |
| Length, mm  |  |        |                      |                      |                      |
| Distance to bottom, mm  |  |        |                      |                      |                      |
| Capillary clearances shall conform to Section 8.  |  |        |                      |                      |                      |
| Mercury shall be near middle of chamber at 0°C.   |  |        |                      |                      |                      |
| Change in correction over any 5°F interval shall not exceed 0.10°F.   |  |        |                      |                      |                      |
| Mercury shall be in the chamber at 32°F.  |  |        |                      |                      |                      |
| For Fahrenheit thermometers, dimension G (length of graduated portion) shall be measured as the length of graduated portion corresponding to the nominal Celsius range.               |  |        |                      |                      |                      |