



Standard Guide for Digital Contact Thermometers¹

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^{ε1} NOTE—Changes were made editorially in February 2013.

1. Scope

1.1 This Guide describes general-purpose, digital contact thermometers (hereafter simply called “digital thermometers”) that provide temperature readings in units of degrees Celsius or degrees Fahrenheit, or both. The different types of temperature sensors for these thermometers are described, and their relative merits are discussed. Nine accuracy classes are introduced for digital thermometers; these classes consider the accuracy of the sensor/measuring-instrument unit.

1.2 The proposed accuracy classes for digital thermometers pertain to the temperature interval of -200°C to 500°C , an interval of special interest for many applications in thermometry. All of the temperature sensor types for the digital thermometers discussed are able to measure temperature over at least some range within this interval. Some types are also able to measure beyond this interval. To qualify for an accuracy class, the thermometer must measure correctly to within a specified value (in units of $^{\circ}\text{C}$) over this interval or over the subinterval in which they are capable of making measurements. Those thermometers that can measure temperature in ranges beyond this interval generally have larger measurement uncertainty in these ranges.

1.3 The digital thermometer sensors discussed are platinum resistance sensors, thermistors, and thermocouples. The range of use for these types of sensors is provided. The measurement uncertainty of a sensor is determined by its tolerance class or grade and whether the sensor has been calibrated.

1.4 This Guide provides a number of recommendations for the manufacture and selection of a digital thermometer. First, it recommends that the thermometer’s sensor conform to applicable ASTM specifications. Also, it recommends minimum standards for documentation on the thermometer and informational markings on the probe and measuring instrument.

1.5 The derived SI units (degrees Celsius) found in this Guide are to be considered standard. However, thermometers

displaying degrees Fahrenheit are compliant with this guide as long as all other guidance is followed.

1.6 *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. Some specific hazards statements are given in Section 7 on Hazards.*

2. Referenced Documents

2.1 ASTM Standards:²

- E230 Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples
- E344 Terminology Relating to Thermometry and Hydrometry
- E563 Practice for Preparation and Use of an Ice-Point Bath as a Reference Temperature
- E608/E608M Specification for Mineral-Insulated, Metal-Sheathed Base Metal Thermocouples
- E644 Test Methods for Testing Industrial Resistance Thermometers
- E839 Test Methods for Sheathed Thermocouples and Sheathed Thermocouple Cable
- E879 Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
- E1137/E1137M Specification for Industrial Platinum Resistance Thermometers
- E2181/E2181M Specification for Compacted Mineral-Insulated, Metal-Sheathed, Noble Metal Thermocouples and Thermocouple Cable
- E2593 Guide for Accuracy Verification of Industrial Platinum Resistance Thermometers
- E2846 Guide for Thermocouple Verification

3. Terminology

3.1 *Definitions:* The definitions given in Terminology E344 apply to terms used in this guide.

¹ This guide is under the jurisdiction of ASTM Committee E20 on Temperature Measurement and is the direct responsibility of Subcommittee E20.09 on Digital Contact Thermometers.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.