Designation: ~~B389 – 81 (Reapproved 2008)~~ B389 – 81 (Reapproved 2016)

Standard Test Method for Thermal Deflection Rate of Spiral and Helical Coils of Thermostat Metal[1]

This standard is issued under the fixed designation B389; 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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the thermal deflection rate of spiral and helical coils of thermostat metal.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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 become familiar with all hazards including those identified in the appropriate ~~Material~~ Safety Data Sheet ~~(MSDS)~~(SDS) for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:[2]

E77 Test Method for Inspection and Verification of Thermometers

3. Terminology

3.1 *thermostat metal, n*—a composite material, usually in the form of sheet or strip, comprising two or more materials of any appropriate nature, metallic or otherwise, that, by virtue of differing expansivities of the components, tends to alter its curvature when its temperature is changed.

3.2 *thermal deflection rate, n*—the ratio of angular rotation to temperature change. It is a measure of the coil's thermal activity. It may have the units of angular degrees per degree Fahrenheit, or Celsius, and is expressed by the equation $D = (A_2 - A_1)/(T_2 - T_1)$ where A_2 and A_1 are angular positions at temperature T_2 and T_1 respectively.

3.3 *spiral coil, n*—a part made by winding strip on itself. Fig. 1 and Fig. 2 show typical spiral coils, which can be wound with the low-expansive side inside or outside, mounted on the specimen holder.

3.4 *helical coil, n*—a part made by winding strip in a form wherein the plane of the width of the strip is parallel to the axial length. Fig. 3 shows a typical helical coil, which can be wound with the low-expansive side inside or outside, and right-hand or left-hand, mounted on the specimen holder.

4. Summary of Test Method

4.1 The test for thermal deflection rate of spiral and helical coils consists of measuring the angular rotation that a coil undergoes in response to a known temperature change.

5. Significance and Use

5.1 This test method simulates, to a practical degree, the operation of the thermostat metal coil.

5.2 The thermal deflection properties of a coil may vary from lot-to-lot of thermostat metal material. This method is useful for determining the optimum thickness and length of the material for a given deflection specification.

5.3 This method is useful as a quality test to determine acceptance or rejection of a lot of thermostat metal coils.

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[1] This test method is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.10 on Thermostat Metals and Electrical Resistance Heating Materials.

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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~~standard's Document Summary page on the ASTM website.

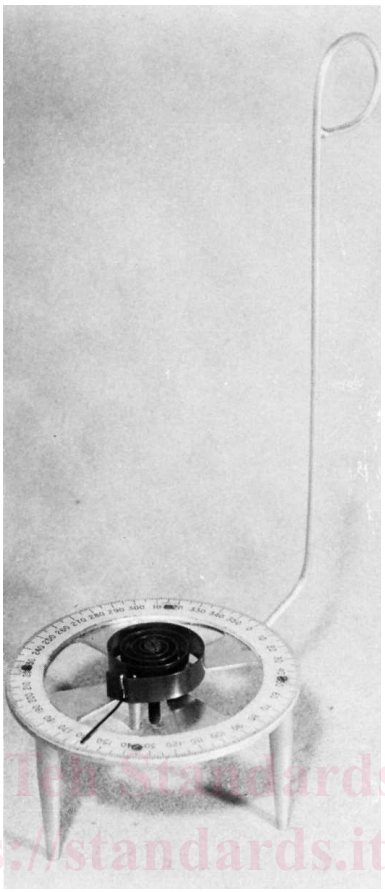

FIG. 1 Spiral Coil

6. Apparatus

6.1 *Temperature Bath*—A stirred liquid bath or uniformly heated enclosure in which the specimen and mounting fixture can be placed shall be used. An adjustable heating source is desirable for maintaining the specimen at the desired temperatures with a variation in temperature throughout the specimen not to exceed 0.5°F (0.3°C).

6.2 *Protractor*—The angular position at each test temperature shall be measured by a protractor with a minimum division of 0.5°.

6.3 *Temperature-Measuring Apparatus*—The apparatus for making temperature measurements shall be of such accuracy that the individual temperatures shall be known to be within ±0.5°F (±0.3°C).

6.4 *Specimen Holder*—The preferred methods of holding spiral and helical coils are as follows:

6.4.1 *Spiral Coils*—The specimen holder for spiral coils shall provide means for securely holding the coil. Although other means of support are possible, the holder or mounting arbor shall be preferably circular cross section whose diameter shall be as large as possible without touching the inner turn of the coil under any conditions of test temperatures. The arbor shall be slotted across its diameter and to a depth greater than the width of the specimen. The width of the slot shall be slightly narrower than the thickness of the specimen so that the inner tab will be a push or snug fit in the slot. The edges of the slot shall be sharp where it intersects the circumference of the arbor. The slot shall be so positioned in the arbor that the center of rotation of the coil and the center of the arbor coincide.

6.4.2 *Helical Coils*—The specimen holder for helical coils shall provide means for securely holding the coil. Although other means of support are possible, the coil shall be held with its axis in a vertical position, the bottom end of the coil secured and the top end allowed to rotate freely with a temperature change. Preferably the end of the coil with the center tab shall be considered the bottom and secured by clamping or press-fitting the tab into a slotted arbor similar to that described in 6.4.1 for spiral coils. The depth of the slot shall be such that the full height of the tab shall be held. If the coils do not have a center tab, the arbor shall contain provisions for attaching the coil with screws, rivets, or by welding. A transmission pointer can be affixed to the top end. The center line of the coil, the transmission pointer, and the protractor shall coincide.

6.4.3 Deviations from these procedures of holding may be necessary when simulating the mounting used in the device for which the coil was designed, or in cases where coils are press fitted on arbors. In these cases, the details of mounting should be mutually agreed upon between the manufacturer and the purchaser.