Designation: B362 – 91 (Reapproved 2020)

Standard Test Method for Mechanical Torque Rate of Spiral Coils of Thermostat Metal[1]

This standard is issued under the fixed designation B362; 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 The test method covers the principles of determining the mechanical torque rate of spiral coils of thermostat metal.

NOTE 1—This test method has been developed particularly to cover the determination of the mechanical torque rate of spiral coils made of thermostat metal for carburetors and manifold heat controls. The method is not limited to thermostat metals and can be used for spiral coils of other materials for which the torque rate must be measured accurately.

1.2 The values stated in inch-pound units are to be regarded as the standard. The metric equivalents of inch-pound units may be approximate.

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 Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

2.1 *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 the differing expansivities of the components, tends to alter its curvature when its temperature is changed.

2.2 *mechanical torque rate, n*—the ratio of torque to deflection. It is a measure of the stiffness of the coil and may have the units of ounce inch or gram centimetre per angular degree.

2.3 *spiral coil, n*—a part made by winding strip on itself.

3. Summary of Test Method

3.1 The test for mechanical torque rate of spiral coils consists of applying a torque, or moment of force, that will not stress the material in excess of its elastic limits, to the coil and measuring the resulting deflection as angular rotation. Of the several methods for obtaining this value, it is preferred that the outer end of the spiral coil be held stationary, but not fixed, and the inner end of the coil be rotated after applying a load to the outer end of the coil at a fixed radius.

4. Significance and Use

4.1 This test method is useful to determine the mechanical force of spiral coils of thermostat metal.

4.2 The mechanical 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 mechanical torque specification.

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

5. Apparatus

5.1 The determination of the mechanical torque rate of spiral coils is subject to many variables and is sensitive to the degree that even different apparatus employing the same test principles will give different results. Therefore it is recommended that the apparatus be standardized. The apparatus shown in Fig. 1 and Fig. 2 and consisting essentially of the following components, has been found satisfactory:

5.1.1 *Specimen Holder*—A specimen holder shall provide for securely holding the inner end of the test specimen. Preferably, the holder or mounting arbor shall be of circular cross section whose diameter is as large as possible without touching the inner turn of the coil under any test conditions of load. The end of the arbor shall be slotted entirely across its diameter, to a depth greater than the width of the specimen, and of a width slightly narrower than the thickness of the specimen. Thus, the inner tab will be a push or snug fit in the slot for its entire width. 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 arbor and the coil will coincide.

[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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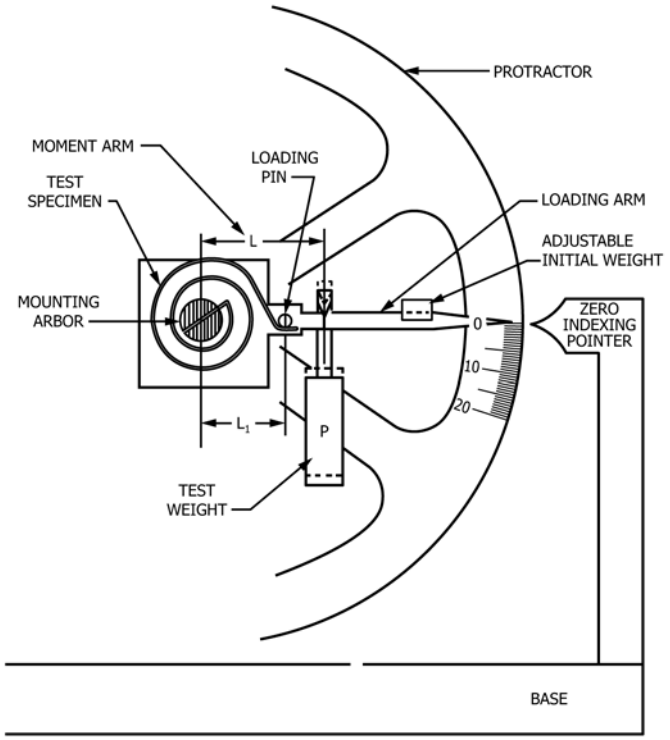

FIG. 1 Schematic Design of Apparatus

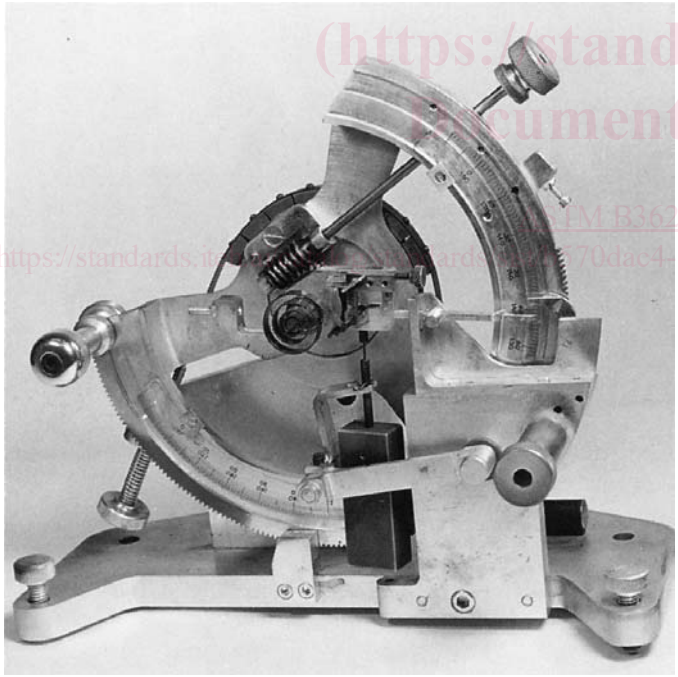

FIG. 2 Typical Design of Apparatus

5.1.2 *Protractor*—The angular deflection due to the test torque shall be measured by a protractor with a minimum division of 0.5 angular degrees.

5.1.3 *Loading Pin*—The loading pin is the member by means of which the load is applied to the outer end of the coil. The pin shall be preferably of circular cross section approximately 3⁄32 in. (2.4 mm) in diameter. The distance from the center line of the mounting arbor to the center line of the loading pin shall be specified.

6. Sampling

6.1 Test for mechanical torque rate of spiral coils shall be taken in a manner to assure representative sampling of the test lot. A lot, for quality control purposes, comprises of the finished yield of one bonded coil of material. Sampling shall consist of parts made from each cut of material across the bonded width. Frequency of sampling shall be mutually agreed upon between the manufacturer and the purchaser.

7. Procedure

7.1 *Stabilization*—After all forming operations and before testing, subject the specimen to a stabilizing heat treatment to relieve internal stresses. This treatment shall consist of heating the specimen, while free to rotate, for a prescribed time and temperature. The details of the stabilizing procedure will depend upon the characteristics of the thermostat metal being tested and shall be mutually agreed upon between the manufacturer and the purchaser.

7.2 *Test Routine:*

7.2.1 Place the test specimen on the mounting arbor centering the inside diameter of the coil on the arbor. To minimize frictional effects vibrate the apparatus.

7.2.2 *Initial Torque*—Apply an initial torque to the coil to establish initial conditions prior to applying the test torque. The initial torque shall be in accordance with the following table and shall be known to an accuracy of ±2 %.

Initial Torque, oz·in. (g·cm)	Test Torque, oz·in. (g·cm)
0.5 (36)	1 to 4 (72 to 288) incl
1.0 (72)	over 4 to 12 (over 288 to 864)

Record the angular position of the indicating pointer while under the initial torque.

7.2.3 *Test Torque*—Apply the test torque and record the angular position of the indicating pointer. The test torque shall be as large as possible without causing turns of the coil to touch, or without exceeding the elastic limits of the material. In closely wound low-torque rate coils where turns may touch, this fact shall be noted in the report. The test torque in ounce inches (or gram centimetres) shall be known to an accuracy of 0.5 %.

7.2.4 Remove the test torque and check the initial reading obtained with the initial torque. If any deviation is found, reapply the test weight until two consecutive values of the deflection due to the test torque are the same.

7.2.5 The angular rotation in degrees shall be known to an accuracy of 0.25°. During the test, the temperature shall be held constant.

8. Calculation

8.1 Calculate the mechanical torque rate by multiplying the test weight by its moment arm and dividing the product by the angular deflection produced by the test torque, as follows:

$$M = PL/A$$