Designation: B76 – 90 (Reapproved 2018)

# Standard Test Method for Accelerated Life of Nickel-Chromium and Nickel-Chromium-Iron Alloys for Electrical Heating[1]

This standard is issued under the fixed designation B76; 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[2] covers the determination of the resistance to oxidation of nickel-chromium and nickel-chromium-iron electrical heating alloys at elevated temperatures under intermittent heating. Procedures for a constant-temperature cycle are provided. This test method is used for internal comparative purposes only.

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 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. Significance and Use

2.1 This test method is used by producers of electrical heating alloys to measure the cyclic oxidation resistance of these alloys.

2.2 Because of the effect of the environment, design, and use, the life values obtained from this test method may not correlate with that of an appliance or industrial heating unit.

## 3. Test Panel

3.1 *Size and Location*—The dimensions of the test panel shall be similar to those shown in Fig. 1. The test panel shall be located in a position free from drafts of air.

NOTE 1—The enclosure shall fit tightly on the panel and the glass slide shall fit snugly to prevent leakage of air at this point during the operation of the test, as even a slight draft of air in contact with the specimen will cause excessive variation in length of life. A screen of 40 wire mesh, 0.010-in. (0.025-mm) wire diameter, market grade, may be used as a cover over the individual stations.

3.2 *Upper Terminal*—The upper terminal shall consist of a binding post attached to a rod passing through another binding post or through the upper bus bar. This provides for adjustment laterally and vertically, as shown in Fig. 1.

3.3 *Lower Terminal*—A 10-g weight shall be attached to the lower end of the specimen. A flexible silver foil (approximately 0.375 in. (9.52 mm) wide and 0.0015 in. (0.038 mm) thick) connected to the 10-g weight shall constitute the lower terminal.

NOTE 2—Experiments have shown that with high temperatures alloys of nickel-chromium and nickel-chromium-iron are subject to plastic flow when under relatively light load. The weight specified in 3.3 does not cause appreciable increase in length during the test.

## 4. Apparatus

4.1 The test apparatus shall be similar to the requirements specified in 4.2 to 4.8, inclusive, and shall be connected as shown in Fig. 2.

4.2 *Power Supply*—The transformer or motor generator set shall be capable of delivering a controlled voltage of from 10 to 20 V to the circuit. It shall have a continuous current capacity of at least 20 A/specimen.

4.3 *Voltage Control*—The automatic voltage control shall be capable of maintaining across the bus bars a constant voltage within ±0.5 %.

NOTE 3—It has been found impossible to make accurate tests without voltage control, as changes in line voltage were sufficient to cause considerable variation in the results obtained (see Annex A1).

4.4 *Variable Transformer*—The transformer shall be capable of adjusting the voltage across the specimen so that current is

[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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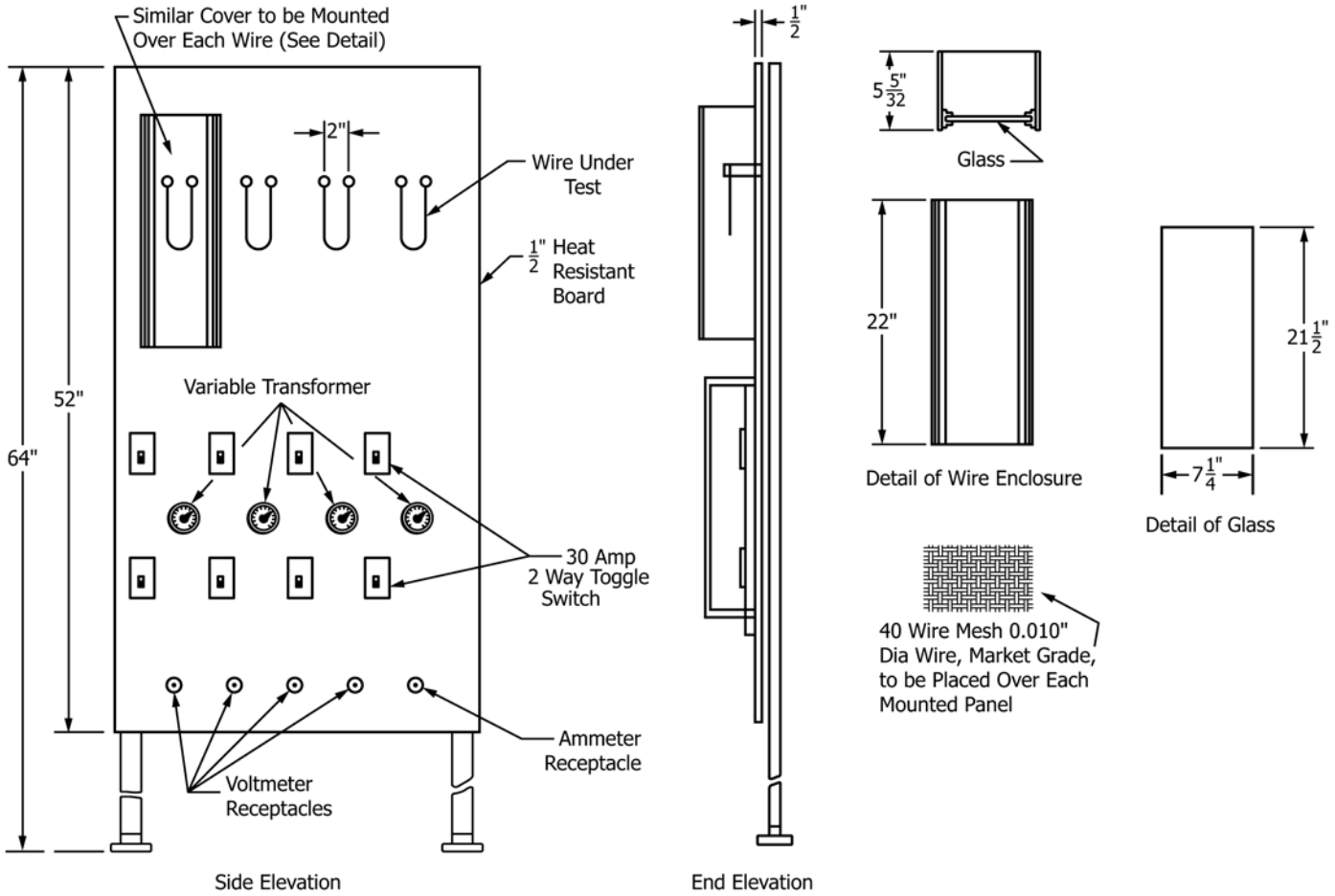
[2] Further information on this test method is given in a paper by F. E. Bash and J. W. Harsch, "Life Tests on Metallic Resistor Materials for Electrical Heating," *Proceedings*, ASTEA, American Society for Testing and Materials. Vol 29, Part II, 1929, p. 506.




| Metric Equivalents | | | | | | |
|---|---|---|---|---|---|---|
| in. | ½ | 5⁵⁄₃₂ | 7¼ | 21½ | 52 | 64 |
| mm | 12.7 | 131.0 | 184.2 | 546.1 | 1321 | 1626 |

**FIG. 1 Test Panel for Accelerated Life Test**

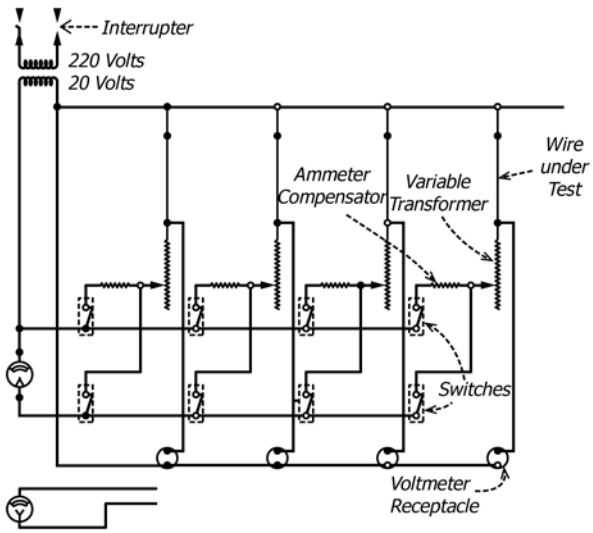



**FIG. 2 Electrical Circuit Diagram for Accelerated Life Test**

controlled to approximately 0.25 % of desired value, and shall have a continuous current rating of approximately 25 A.

4.5 *Ammeter and Voltmeter*—The ammeter and voltmeter shall have an accuracy of 1 % of normal test deflection (approximately 15 A and 15 V, respectively). For alternating current the range used shall be such as to give a reading above the lower fifth of the scale range. The ammeter has appreciable resistance. A compensating resistance shall be cut into the circuit to replace the resistance of the ammeter so that the overall resistance of the circuit is not changed. This resistance shall be inserted in series with the blade of the upper switch shown in Fig. 2.

4.6 *Optical Pyrometer or Infrared Thermometer*—The optical system shall be such as to provide a magnification of at least four diameters. This may be accomplished by the use of a special lens or combination of two standard lenses in the objective to provide a short focal length and the desired magnification. (See Annex A1.) These instruments must have an accuracy of ±10°F and NIST traceability.