



Standard Specification for Tungsten-Rhenium Alloy Thermocouple Wire¹

This standard is issued under the fixed designation E 696; 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 specification covers the requirements for bare, solid conductor, tungsten and rhenium alloy thermoelements having diameters of 0.13 mm (0.005 in.) to 0.5 mm (0.020 in.) supplied in matched pairs. These thermoelements shall be suitable for use either in bead-insulated, bare-wire thermocouples, or in compacted metal-sheathed, ceramic insulated thermocouple material or assemblies.

1.2 This specification covers the thermocouple combinations of tungsten-3 % rhenium versus tungsten-25 % rhenium (W3RE/W25RE) and tungsten-5 % rhenium versus tungsten-26 % rhenium (W5RE/W26RE). All information applies to both combinations unless otherwise noted.

1.3 It is recognized that the alloys described are refractory and are not suitable for use at high temperatures in non-inert atmospheres. All tests and processes described herein must be performed under suitably inert conditions that are non-reactive to tungsten-rhenium alloys.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

- E 8 Test Methods for Tension Testing of Metallic Materials²
- E 207 Test Method for Thermal EMF Test of Single Thermoelement Materials by Comparison with a Reference Thermoelement of Similar EMF-Temperature Properties³
- E 220 Test Method for Calibration of Thermocouples by Comparison Techniques³
- E 344 Terminology Relating to Thermometry and Hydrometry³
- E 452 Test Method for Calibration of Refractory Metal Thermocouples Using an Optical Pyrometer³
- E 988 Temperature-Electromotive Force (EMF) Tables for Tungsten-Rhenium Thermocouples³

3. Terminology

3.1 Definitions:

¹ This specification is under the jurisdiction of ASTM Committee E20 on Temperature Measurement and is the direct responsibility of Subcommittee E20.04 on Thermocouples.

Current edition approved Oct. 10, 2000. Published December 2000. Originally published as E 696-79. Last previous edition E 696-95.

² Annual Book of ASTM Standards, Vol 03.01.

³ Annual Book of ASTM Standards, Vol 14.03.

3.1.1 For definitions used in this standard, see Terminology E 344.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dope, vt*—in this specification, to add potassium, silicon and aluminum compounds to the alloy powders during the preparation to produce a ductile wire. See NASA CR-72884.⁴

3.2.2 *Discussion*—Alloy powders are doped.

4. Ordering Information

4.1 A purchase order for thermocouple material conforming to this specification should specify the following:

4.1.1 *Thermocouple Wire Composition*— May be doped W3RE/W25RE or doped W5RE/W26RE.

4.1.2 *Wire Size*—Specify size with each order.

4.1.3 *Wire Length*—Specify total amount of each wire and minimum continuous length.

4.1.4 *Thermocouple Calibration*—Paired wires shall be furnished to the initial calibration tolerances stated in 5.1.4.2 unless otherwise requested.

4.1.5 *Required Mechanical Properties*— See 5.1.3.

4.1.6 *Instructions for Spooling, Packaging, and Labeling*— Wires shall be supplied on spools of a nominal 100 mm (4-in.) diameter core and boxed individually, unless otherwise requested. Each spool shall be marked to identify the wire composition, diameter, quantity, processor's name, spool designation and customers purchase order number in a manner to identify the pair of wires to be used to form a thermocouple meeting the calibration requirement.

4.1.7 *Tests and Certifications Required from the Processor*—Unless otherwise requested, the processor shall supply a certificate with each order stating the wire composition, size and calibration information.

5. Materials and Manufacture

5.1 Thermocouple Wire:

5.1.1 *General*—The thermoelements shall be tungsten-3 % rhenium and tungsten-25 % rhenium or tungsten-5 % rhenium and tungsten-26 % rhenium, as indicated on the purchase order.

5.1.2 Physical:

5.1.2.1 The diameter of each wire shall be uniform end-to-end to within 0.01 mm (0.0005 in.) for 0.5 mm (0.02 in.)

⁴ NASA CR-72884, "Some Studies on Behavior of W-Re Thermocouple Materials at High Temperatures." Available from National Aeronautics and Space Administration, 400 Maryland Ave. S.W., Washington, DC 20546.