



Standard Test Method for Conducting Temperature Uniformity Surveys of Furnaces Used to Heat Treat Steel Products¹

This standard is issued under the fixed designation A 991/A 991M; 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 procedures used to conduct a temperature uniformity survey on a furnace used to heat treat steel products. This method is used to determine the capability of the furnace to meet the permissible temperature variation specified in the applicable product specification, or as agreed to by the purchaser and supplier of heat treat services. Survey documentation requirements, and the procedure used to subsequently establish the furnace working zone, are defined in this test method.

1.2 This test method covers heat treat furnaces in any of the following categories:

- 1.2.1 Continuous or semi-continuous conveyance furnaces,
- 1.2.2 Batch furnaces, and
- 1.2.3 Salt or liquid baths and fluidized beds.

1.3 This test method only applies when specified in the product specification or the purchase order.

1.4 Controlling a heat treatment of steel products using thermocouples attached to the extremities of each load is an alternative to performing a furnace survey.

1.5 By mutual agreement between the purchaser and the supplier of heat treat services, more stringent and/or additional requirements may be specified. The acceptance of any such additional requirements shall be dependent on negotiations with the supplier and must be included in the order as agreed upon by the purchaser and supplier.

1.6 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system is to be used independently of the other, without combining values in any way.

1.7 *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.*

2. Referenced Documents

2.1 ASTM Standards:

- E 207 Test Method for Thermal EMF Test of Single Thermoelement Materials by Comparison with a Reference Thermoelement of Similar EMF - Temperature Properties²
- E 220 Test Method for Calibration of Thermocouples By Comparison Techniques³
- E 230 Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples²
- E 608 Specification for Metal-Sheathed Base-Metal Thermocouples²

2.2 SAE Standard:

- AMS 2750 - Pyrometry⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *batch furnace, n*—a heating device in which material may be stationary or oscillating during the processing cycle.

3.1.2 *continuous conveyance furnace, n*—a heating device through which material is moved intentionally at a constant rate during the processing cycle.

3.1.3 *extremities, n*—as referring to furnace working zone; outer boundaries in all three dimensions (length, width, and height) of the material being processed.

3.1.4 *operating range, n*—the expected range of temperature over which a furnace will be controlled to heat treat steel products.

3.1.5 *primary survey, n*—the initial evaluation of the furnace, or an evaluation triggered by the initiation of a major furnace modification.

3.1.6 *secondary survey, n*—an evaluation of the furnace triggered by the expiration of a time requirement.

3.1.7 *semi-continuous conveyance furnace, n*—a heating device through which material is moved intentionally with a predetermined start - stop - start pattern during the processing cycle.

3.1.8 *working zone, n*—the maximum volume and location in the furnace that meet the permissible temperature variation.

¹ This test method is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.13 on Mechanical and Chemical Testing and Processing Methods of Steel Products and Processes.

Current edition approved July 10, 1998. Published September 1998.

² *Annual Book of ASTM Standards*, Vol 14.03.

³ Discontinued; see 1994 *Annual Book of ASTM Standards*, Vol 14.03.

⁴ Available from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.