



Standard Guide for Qualification and Control of Induction Heat Treating¹

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1. Scope

1.1 This guide covers the process control and product properties verification of continuous heat treating of material using a quench and temper induction process (surface hardening, surface heat treating, and batch heat-treated products using induction are not considered in this guide). Examples of products covered by this guide may include products covered by API Specifications 20E, 5L, and 5CT.

1.2 This guide indicates some features of induction heat treating compared to furnace heat treating. Induction heat treating processes typically operate at higher temperatures compared to furnace processes.

1.3 This guide addresses the features and requirements necessary for induction heating and ancillary equipment. However, induction equipment may be used in combination with convection heating equipment (for example, gas or electric furnaces).

1.4 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.5 *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:²

- A255 Test Methods for Determining Hardenability of Steel
- A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
- A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

¹ This guide is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.22 on Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications.

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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 Document Summary page on the ASTM website.

A1058 Test Methods for Mechanical Testing of Steel Products—Metric

E7 Terminology Relating to Metallography

E10 Test Method for Brinell Hardness of Metallic Materials

E18 Test Methods for Rockwell Hardness of Metallic Materials

E112 Test Methods for Determining Average Grain Size

E384 Test Method for Microindentation Hardness of Materials

2.2 ASM Standards:³

ASM Handbook Volume 4C Induction Heating and Heat Treatment

2.3 API Specifications⁴

20E Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries

5CT Specification for Casing and Tubing

5L Specification for Line Pipe

2.4 ANSI Standard:⁵

ANSI/NCSL Z540.3 Requirements for the Calibration of Measuring and Test Equipment

3. Terminology

3.1 For definitions of terms used in this guide, refer to Terminologies A941 and E7.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *induction heat treating, v*—process by which an electromagnetic field is used to induce a voltage in an electrically conductive material thereby causing current flow and heat is generated in the electrically conductive material through the Joule heating effect. (See ASM Handbook 4C, p. 18.)

3.2.2 *major rebuild, n*—any rebuild or repair that could alter the temperature uniformity characteristics of an induction heat treat line.

3.2.3 *product, n*—set of similar materials to be heated by passing through induction coils under the same conditions as defined in 6.3 process variables. (Including as examples bar, rod, tube, pipe.)

³ Available from American Society for Metals (ASM International), 9639 Kinsman Rd., Materials Park, OH 44073-0002, <http://www.asminternational.org>.

⁴ Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://www.api.org>.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.