



Standard Specification for Steel Bars Subject to Restricted End-Quench Hardenability Requirements¹

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1. Scope*

1.1 This specification covers hot-worked alloy and carbon-boron steels designed to attain restricted depth of hardening in the end-quench test. These steel compositions are identified by the suffix letter “RH” added to the conventional grade number.

1.2 In general, steels with restricted hardenability (RH steels) will exhibit a hardness range not greater than 5 HRC at the initial position on the end-quench hardenability bar and not greater than 65 % of the hardness range for standard H-band steels (Specification A304) in the inflection region. Generally the restricted hardenability band follows the middle of the corresponding standard H-band. An example of the RH band compared with the H band is given for Grade 4140 in Fig. 1.

1.2.1 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 This specification is expressed in both inch-pound units and SI units. However, the material will be supplied to inch-pound units unless the purchase order specifies the “M” specification designation.

2. Referenced Documents

2.1 ASTM Standards:²

A29/A29M Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought
A255 Test Methods for Determining Hardenability of Steel
A304 Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements
E112 Test Methods for Determining Average Grain Size

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.15 on Bars.

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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.

2.2 SAE Standards:³

J 406 Methods of Determining Hardenability of Steels
J 1268 Hardenability Bands for Carbon and Alloy H Steels
J 1868 Restricted Hardenability Bands for Selected Alloy Steels

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *hardenability*—the relative ability of a steel to harden under heat treatment becomes apparent in the degree to which the material hardens when quenched at different cooling rates.

3.1.1.1 *Discussion*—Hardenability is measured quantitatively, usually by noting the extent or depth of hardening of a standard size and shape test specimen in a standardized quench. In the end-quench test the depth of hardening is the distance along the specimen from the quenched end to a given hardness.

4. Ordering Information

4.1 Orders for material under this specification should include the following information, in proper sequence:

- 4.1.1 Quantity (weight),
- 4.1.2 Name of material (alloy or carbon-boron steel),
- 4.1.3 Cross-sectional shape,
- 4.1.4 Size,
- 4.1.5 Length,
- 4.1.6 Grade,
- 4.1.7 End-quenched hardenability (see Section 9),
- 4.1.8 Report of heat analysis, if desired (see Section 7),
- 4.1.9 Special straightness, if required,
- 4.1.10 ASTM designation and date of issue, and
- 4.1.11 End use or special requirements.

NOTE 1—A typical ordering description is as follows: 10 000 lb, alloy bars, round, 4.0-in. diameter by 10 ft, Grade 4140RH, heat analysis required, complete hardenability data required, ASTM AXXX, [AXXXM] dated ____ worm gear.

4.2 The purchaser shall specify the desired grade, including the suffix letters “RH,” in accordance with Table 1.

³ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

*A Summary of Changes section appears at the end of this standard