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Standard Specification for Wrought Alloy Steel Rolls for Cold and Hot Reduction[1]

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1. Scope

1.1 This specification covers homogeneous wrought hardened alloy steel rolls for use in cold or hot reduction of flat rolled ferrous and nonferrous products.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 788/A 788M Specification for Steel Forgings, General Requirements

A 956 Test Method for Leeb Hardness Testing of Steel Products

E 18 Test Methods for Rockwell Hardness of Metallic Materials

E 92 Test Method for Vickers Hardness of Metallic Materials

E 140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness

E 448 Practice for Scleroscope Hardness Testing of Metallic Materials

3. Ordering Information

3.1 The purchaser shall specify in the inquiry, contract, or order the complete dimensions, hardness range, surface finish, and use. Any other requirements shall also be specified.

3.2 Material supplied to this specification shall conform to the requirements of Specification A 788/A 788M, which outlines additional ordering information, manufacturing requirements, testing and retesting methods and procedures, marking, certification, product analysis variations, and additional supplementary requirements.

4. Process

4.1 The steel shall be made by the electric-furnace process. Additional refining by vacuum arc remelt or electroslag is permitted.

5. Manufacture

5.1 The forged rolls shall receive their hot mechanical work under a press or hammer of ample capacity to work the metal throughout its section. However, 6-in. (152-mm) diameter or less rolls may be produced from rolled bars.

6. Discard

6.1 Sufficient discard shall be made from each ingot to secure freedom from piping and undue segregation.

7. Chemical Requirements

7.1 Unless specified by the purchaser, the chemical requirements shall be at the discretion of the manufacturer.

8. Heat Treatment

8.1 The method of heat treatment and hardening shall be at the option of the manufacturer.

9. Hardness Requirements

9.1 The manufacturer shall supply rolls to the hardness ranges agreed upon by the purchaser and the manufacturer.

9.2 A hardness range of either 5 points Shore scleroscope or 100 numbers Vickers hardness is permissible.

10. Hardness Testing

10.1 Each roll shall be tested for hardness and shall be within limits specified on the order. The Shore forged roll scleroscope ($HFRS_C$ or $HFRS_D$), Rockwell hardness tester, Vickers hardness penetrator, or Leeb hardness tester (in accordance with Test Method A 956) may be used to determine compliance with the hardness range specified. The approximate relationship between Shore $HFRS_C$ scleroscope and diamond pyramid hardness is shown in Table 1.

10.2 The stage of processing at which hardness testing is conducted and the number and location of tests may be agreed upon by the purchaser and the manufacturer.

[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 A01.06 on Steel Forgings and Billets.

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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.

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TABLE 1 Approximate[A] Relationship Between Shore HFRS$_c$ Scleroscope and Diamond Pyramid Hardness for Wrought Hardened Alloy Steel Rolls

NOTE 1—This table is recommended for rolls over 6 in. (152 mm) in diameter. There is a tendency for rolls smaller than 6 in. in diameter with the same Vickers hardness to show lower scleroscope readings.

NOTE 2— For scleroscope hardness determinations, the calibration to standard reference blocks, and the verification of instrument are a constant necessity. See details recommended in Practice E 448.

NOTE 3—For Rockwell and Vickers hardness determinations, reference may be made to Test Methods E 18 and Test Method E 92.

NOTE 4—For hardness conversion tables for metals, see Tables E 140.

Shore HFRS$_c$ Scleroscope Hardness	Vickers Hardness[B]	Shore HFRSc Scleroscope Hardness	Vickers Hardness[B]
65	420	86	685
66	432	87	698
67	445	88	710
68	457	89	723
69	470	90	735
70	482	91	748
71	495	92	761
72	508	93	774
73	520	94	787
74	533	95	800
75	545	96	812
76	558	97	825
77	571	98	837
78	584	99	850
79	597	100	862
80	610	101	875
81	622	102	888
82	635	103	900
83	647	104	913
84	660	105	926
85	672		

[A] The above hardness conversions cover an approximate relationship. The expected range of results on 95 % of hardness measurements is as follows:
Conversion from Vickers hardness to shore HFRSc scleroscope hardness, ± 3.7 Shore.
Conversion from Shore HFRSc scleroscope hardness to Vickers hardness, ± 43 HV.

[B] Vickers hardness measurements are based on a load of 30 kgf. The Vickers penetrator was calibrated with a dead-weight Vickers hardness tester.

10.3 A sufficient number of hardness tests shall be made to ensure the required uniformity, both longitudinally and circumferentially.

11. Soundness

11.1 The material shall be free of injurious imperfections.

12. Workmanship

12.1 The roll shall conform to the dimensions and surface finish specified by the purchaser.

13. Marking

13.1 Each roll shall be permanently identified with marking by the manufacturer on the end face of the journals, unless otherwise specified.

14. Report

14.1 The manufacturer shall furnish a report of the hardness test. The type, model, and instrument used shall be reported. In the case of the Vickers hardness readings, the load shall be reported.

15. Inspection

15.1 The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy him that the material is being produced and furnished in accordance with this specification. All tests and inspections shall be made at the place of manufacture, unless otherwise specified, and shall not interfere unnecessarily with the manufacturer's operations.

16. Rejection

16.1 A roll that fails to comply with the requirements of this specification shall be subject to rejection, and the manufacturer shall be notified.

17. Keywords

17.1 cold and hot reduction; wrought alloy steel rolls

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