INTERNATIONAL

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~~An American National Standard~~ Designation: A 660 – 96 (Reapproved 2005)

Standard Specification for Centrifugally Cast Carbon Steel Pipe for High-Temperature Service[1]

This standard is issued under the fixed designation A 660; 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[2] covers carbon steel pipe made by the centrifugal casting process intended for use in high-temperature, high-pressure service. Pipe ordered under this specification shall be suitable for fusion welding, bending, and other forming operations.

1.2 Several grades of carbon steels are covered. Their compositions are given in Table 1.

1.3 Supplementary requirements (S1 to S9) of an optional nature are provided. The supplementary requirements call for additional tests to be made, and when desired shall be so stated in the order, together with the number of such tests required.

1.4 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:* [3]

A 530/A 530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe
E 94 Guide for Radiographic Testing
E 114 Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method
E 125 Reference Photographs for Magnetic Particle Indications on Ferrous Castings
E 142 Method for Controlling Quality of Radiographic Testing
E 186 Reference Radiographs for Heavy-Walled (2 to 4½-in. (51 to 114-mm)) Steel Castings
E 381 Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings
E 446 Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness

2.2 *ANSI Standards:*

B36.10 American Standard for Welded and Seamless Wrought Steel Pipe[4]
B46.1 Surface Texture[4]

2.3 *MSS Standards:*

SP-54 Quality Standard for Steel Castings—Radiographic Inspection Method[5]

3. Ordering Information

3.1 Orders for material under this specification should include the following, as required, to describe the desired material adequately:

3.1.1 Quantity (feet, metres, or number of lengths),

3.1.2 Name of material (centrifugally cast pipe),

3.1.3 Grade (Table 1),

3.1.4 Size (outside or inside diameter and minimum wall thickness),

3.1.5 Length (specific or random), (Permissible Variations in Length Section of Specification A 530/A 530M~~/A530M),~~),

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~~[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys, and is the direct responsibility of Subcommittee A01.09 on Carbon Steel Tubular Products.~~

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[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 A01.18 on Castings.

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[2] For ASME Boiler and Vessel Code applications see related Specification SA-660 in Section II of that Code.

[3] 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* ~~, Vol 01.01.~~volume information, refer to the standard's Document Summary page on the ASTM website.

~~[4] Annual Book of ASTM Standards, Vol 03.03.~~

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

~~[5] Annual Book of ASTM Standards, Vol 03.01.~~

[5] Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602.

TABLE 1 Chemical Requirements

	Composition, max,%		
	Grade WCA	Grade WCB	Grade WCC
~~Carbon~~	~~0.25[A]~~	~~0.30~~	~~0.25[B]~~
Carbon	0.25[A]	0.30	0.25[B]
~~Manganese~~	~~0.70[A]~~	~~1.00~~	~~1.20[B]~~
Manganese	0.70[A]	1.00	1.20[B]
~~Phosphorus~~	~~0.035~~	~~0.035~~	~~0.035~~
Phosphorus	0.035	0.035	0.035
~~Sulfur~~	~~0.035~~	~~0.035~~	~~0.035~~
Sulfur	0.035	0.035	0.035
~~Silicon~~	~~0.60~~	~~0.60~~	~~0.60~~
Silicon	0.60	0.60	0.60

[A] For each reduction of 0.01 % below the specified maximum carbon content, an increase of 0.04 % manganese above the specified maximum will be permitted up to a maximum of 1.10 %.

[B] For each reduction of 0.01 % below the specified maximum carbon content, an increase of 0.04 % manganese above the specified maximum will be permitted to a maximum of 1.40 %.

3.1.6 End finish (Ends Section of Specification A 530/A 530M~~/A530M),~~),

3.1.7 Optional Requirements (Sections 7.2, 8.2, 8.3, 11.1, Section 12 and S1 to S9 (Supplementary Requirements),

3.1.8 Test report required (Certification Section of Specification A 530/A 530M~~/A530M),~~),

3.1.9 Specification designation, and

3.1.10 Special requirements.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 530/A 530M~~/A530M~~ unless otherwise provided herein.

5. Materials and Manufacture

5.1 *Machining*:

5.1.1 All centrifugally cast pipe shall have both the inner and outer surfaces machined.

5.1.2 After heat treatment, the pipe shall be machined to a finish with a roughness value no greater than 250 µin. (6.35 µm) arithmetical average deviation (AA), terms as defined in ANSI B46.1 unless otherwise specified.

5.2 *Heat Treatment*:

5.2.1 All pipe shall receive a heat treatment proper for its design and chemical composition.

5.2.2 Castings shall be heat treated after they have been allowed to cool below the transformation range.

6. Temperature Control

6.1 Furnace temperatures for heat treating shall be effectively controlled by pyrometers.

7. Chemical Requirements

7.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 1.

7.2 *Product Analysis*:

7.2.1 At the request of the purchaser, a product analysis shall be made by the manufacturer on every heat.

7.2.2 The results of these analyses shall be reported to the purchaser or his representative, and shall conform to the requirements specified in Table 1.

7.2.3 If the analysis of one of the tests specified in 7.2.1 does not conform to the requirements specified, an analysis of each pipe from the same heat may be made, and all pipes conforming to the requirements shall be accepted.

8. Mechanical Requirements

8.1 *Tensile Properties*:

8.1.1 The material shall conform to the requirements as to tensile properties prescribed in Table 2.

8.1.2 *Transverse or Longitudinal Tension Test*—One test shall be made on a specimen from one end of one length of pipe representing each heat in each heat-treatment lot.

8.2 *Flattening Test*:

8.2.1 A flattening test shall be performed when requested by the purchaser or when stated by the purchaser on the order that the pipe is to be upset, swaged, expanded, bent, or formed by some other operation.

8.2.2 A flattening test need not be performed on heavy wall pipe which is not to be upset, swaged, expanded, bent, or formed in some other manner.

8.2.3 When required by 8.2, a test shall be made on specimens cut from one end of each length of pipe.