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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled[1]

This standard is issued under the fixed designation A 611; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers cold-rolled carbon structural steel (SS) sheet, in cut lengths or coils. It includes five strength levels designated as Grade A with yield point 25 ksi (170 MPa) minimum; Grade B with 30 ksi (205 MPa) minimum; Grade C Types 1 and 2 with 33 ksi (230 MPa) minimum; Grade D Types 1 and 2 with 40 ksi (275 MPa) minimum; and Grade E with 80 ksi (550 MPa) minimum.

1.2 Grades A, B, C, and D have moderate ductility whereas Grade E is a full-hard product with no specified minimum elongation.

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

2. Referenced Documents

2.1 *ASTM Standards:*

A 568/A 568M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for[2]

3. Terminology

3.1 *Definition*:

3.1.1 *structural steel (SS) sheet*—sheet produced to tensile property values as specified or required.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information, as required, to describe the material adequately.

4.1.1 ASTM specification number, date of issue, and grade (if Grades C or D, indicate Type 1 or Type 2),

4.1.2 Copper-bearing steel (if required),

4.1.3 Special requirements (if required),

4.1.4 Name of material (cold-rolled sheet), structural quality,

4.1.5 Finish; matte (dull) finish will be supplied unless otherwise ordered,

4.1.6 Condition (oiled or dry), and

TABLE 1 Chemical Requirements

Element	Composition, %		
	Grades A, B, C, Type 1, and E	Grade D Type 1	Grades C and D Type 2
Carbon, max	0.20	0.20	0.15
Manganese, max	0.60	0.90	0.60
Phosphorus, max	0.035	0.035	0.20
Sulfur, max	0.035	0.035	0.035
Copper, when copper steel is specified, min	0.20	0.20	0.20

4.1.7 Dimensions.

4.1.7.1 As agreed upon between the purchaser and the producer, material ordered to this specification will be supplied to meet the appropriate standard or restricted thickness tolerance table shown in Specification A 568/A 568M.

NOTE 1—Not all producers are capable of meeting all of the limitations of the thickness tolerance tables in Specification A 568/A 568M. The purchaser should contact the producer regarding possible limitations prior to placing an order.

4.1.8 Coil size requirements, and

4.1.9 Cast or heat (formerly ladle) analysis and test report (request, if required).

NOTE 2—A typical ordering description is as follows: ASTM A 611, date, Grade C, Type 1, Cold-Rolled Oiled Sheet, Structural Steel (SS), 0.035 minimum by 36 by 96 in. (0.89 minimum by 914 by 2438 mm) Standard Thickness Tolerance, for Roof Deck.

5. General Requirements for Delivery

5.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 568/A 568M.

6. Chemical Composition

6.1 The cast or heat analysis of the steel shall conform to the requirements prescribed in Table 1.

6.1.1 Unspecified elements may be present. Limits on elements shall be as stated in Table 2.

6.1.1.1 Each of the elements listed in Table 2 shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, the analysis may be reported as <0.02 %. When the amount of vanadium or columbium is less than 0.008 %, the analysis may be reported as <0.008 %.

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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 A01.19 on Steel Sheet and Strip.

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[2] *Annual Book of ASTM Standards*, Vol 01.03.

TABLE 2 Limits on Additional Elements (see 6.1.1)

Copper, max %[A]	Heat analysis	0.20
	Product analysis	0.23
Nickel, max %[A]	Heat analysis	0.20
	Product analysis	0.23
Chromium, max %[A,B]	Heat analysis	0.15
	Product analysis	0.19
Molybdenum, max %[A,B]	Heat analysis	0.06
	Product analysis	0.07
Vanadium, max %	Heat analysis	0.008
	Product analysis	0.018
Columbium, max %	Heat analysis	0.008
	Product analysis	0.018

[A] The sum of copper, nickel, chromium, and molybdenum shall not exceed 0.50 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining unspecified elements will apply.

[B] The sum of chromium and molybdenum shall not exceed 0.16 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining unspecified elements will apply.

7. Mechanical Property Requirements

7.1 *Tensile Tests*:

7.1.1 *Requirements*—Material as represented by the test specimen shall conform to the tensile requirements specified in Table 3.

7.1.2 *Number of Tests*—Two tensile tests shall be made from each heat or from each lot of 50 tons (45 Mg). When the amount of finished material from a heat or lot is less than 50 tons (45 Mg), one test shall be made. When material rolled from one heat differs 0.050 in. (1.27 mm) or more in thickness, one tensile test shall be made from both the thickest and thinnest material regardless of the weight represented.

7.1.3 *Location and Orientation:*

7.1.3.1 Tensile test specimens shall be taken at a point immediately adjacent to the material to be qualified.

7.1.3.2 Tensile test samples shall be taken from the full thickness of the sheet as rolled.

TABLE 3 Tensile Requirements[A]

Grade	Yield Point, min		Tensile Strength, min		Elongation in 2 in. or 50 mm, min, %
	ksi	MPa	ksi	MPa	
A	25	170	42	290	26
B	30	205	45	310	24
C, Types 1 and 2	33	230	48	330	22
D, Types 1 and 2	40	275	52	360	20
E	80[B]	550	82	565	...

[A] For coil products, testing by the producer is limited to the end of the coil. Results of such tests must comply with the specified values. Tensile properties throughout the balance of the coil must not be less than 90 % of the minimum values specified.

[B] On this full-hard product, the yield point approaches the tensile strength and since there is no halt in the gage or drop in the beam, the yield point shall be taken as the yield stress at 0.5 % elongation, under load.

7.1.3.3 Tensile test specimens shall be taken from a location approximately halfway between the center of the sheet and the edge of the material as-rolled.

7.1.3.4 Tensile test specimens shall be taken with the axis of the test specimen parallel to the rolling direction (longitudinal test).

7.1.4 *Test Method*—Yield strength shall be determined by either the 0.2 % offset method or by the 0.5 % extension under load method unless otherwise specified.

7.2 *Bending Properties*—The minimum forming radius (radii) which steel covered by this specification can be expected to sustain is listed in the appendix and is discussed in more detail in Specification A 568/A 568M. When tighter bend radii are required, or curved or offset bends are involved, or when stretching or drawing are also a consideration, the producers shall be consulted.

7.2.1 *Number of Tests*—Two bend tests shall be made from each heat or from each lot of 50 tons (45 Mg). When the amount of finished material from a heat or lot is less than 50 tons, only one bend test shall be made. When material rolled from one heat differs 0.050 in. (1.27 mm) or more in thickness, one bend test shall be made from both the thickest and thinnest material rolled regardless of the weight represented.

7.2.2 *Retests*—If one test fails, two more tests shall be run from the same lot, in which case both tests shall conform to the requirements prescribed in this specification; otherwise, the lot under test shall stand rejected.

8. Finish and Condition

8.1 *Surface Finish*—Unless otherwise specified the sheet shall have a matte (dull) finish.

8.2 *Oiling*—The sheet shall be furnished oiled or dry, as specified.

9. Certification and Reports

9.1 When requested, the manufacturer shall furnish copies of a test report showing the results of the ladle or cast analysis and mechanical property tests made to determine compliance with this specification. The report shall include the purchase order number; ASTM designation number; and heat or lot number correlating the test results with the material represented.

10. Packaging

10.1 *Coil Size*—Small coils result from the cutting of full-size coils for center test purposes. These small coils are acceptable under this specification.

11. Keywords

11.1 carbon steel sheet; cold rolled steel sheet; steel sheet; structural applications

APPENDIX

(Nonmandatory Information)

X1. BENDING PROPERTIES

TABLE X1. Suggested Minimum Inside Radii for Cold Bending[A]

NOTE 1— (*t*) equals a radius equivalent to the steel thickness.
NOTE 2— The suggested radii should be used as minimums for 90° bends in actual shop practice.

Grade	Minimum Inside Radius for Cold Bending
A	½ *t*
B	1 *t*
C Types 1 and 2	1½ *t*
D Types 1 and 2	2 *t*
E	not applicable

[A] Material that does not perform satisfactorily, when fabricated in accordance with the above requirements, may be subject to rejection pending negotiation with the steel supplier.