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Standard Specification for STEEL STRUCTURAL RIVETS¹

This Standard is issued under the fixed designation A 502; 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 reappraisal.

1. Scope

1.1 This specification covers three grades of steel rivets in diameters from $\frac{1}{2}$ to $1\frac{1}{2}$ in. (13 to 38 mm), incl, for structural fabricating purposes. Grade 1 is a carbon steel rivet for general purposes. Grade 2 is a carbon-manganese steel rivet suitable, with proper riveting technique, for use with high-strength carbon and high-strength low alloy structural steels. Grade 3 is similar to Grade 2 with enhanced atmospheric corrosion resistance approximately four times that of carbon steel without copper.

NOTE 1—Grade 1 rivets correspond to those formerly made from steel conforming to Specification A 141 for Structural Rivet Steel,² and Grade 2 rivets correspond to those formerly made from steel conforming to Specification A 195 for High-Strength Structural Rivet Steel.² Grade 3 rivets correspond to those made from steel conforming to Specification A 588 for High-Strength Low-Alloy Structural Steel with 50 000 psi Minimum Yield Point to 4 in. Thick.³

1.2 Rivets conforming to this specification may be made by either the hot- or cold-heading process. It is expected that these rivets ordinarily will be hot driven.

NOTE 2—The values stated in inch-pound units are to be regarded as the standard.

2. Process

2.1 The steel for rivets shall be made by the open-hearth, basic-oxygen, or electric-furnace process.

3. Chemical Requirements

3.1 The rivets shall conform to the heat and product analysis requirements for chemical composition given in Table 1.

3.2 Application of heats of steel to which bismuth, selenium, tellurium, or lead has

been intentionally added shall not be permitted.

4. Test Specimens

4.1 Rivets used for testing shall be heat treated in the following manner prior to testing:

4.1.1 *Grade 1*—Normalize by air cooling from above the transformation range.

4.1.2 *Grade 2*—Anneal by heating to 1450°F (790°C), holding for 30 min at temperature and cooling in the furnace.

4.1.3 *Grade 3*—Heat treatment of test samples is not a requirement; however, at the option of the manufacturer, normalizing of test samples is permitted.

5. Mechanical Requirements

5.1 The rivets shall conform to the hardness requirements shown in Table 2. Hardness shall be measured on a transverse section through the shank of the rivet at a point one quarter of the nominal diameter from the axis of the rivet. This transverse section shall be taken at a distance from the end of the rivet which is equal to the diameter of the rivet. Except as noted below, either the Brinell or the Rockwell hardness test may be used. Test procedure shall conform to Methods and Definitions A 370, for Mechanical Testing of Steel Products.⁴ Brinell hardness shall be measured at only one point. Rockwell hard-

¹ This specification is under the jurisdiction of ASTM Committee F-16 on Fasteners.

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² Discontinued; see 1966 *Book of ASTM Standards*, Part 4.

³ *Annual Book of ASTM Standards*, Part 4.

⁴ *Annual Book of ASTM Standards*, Parts 1, 2, 3, 4, 5, and 10.



ness shall be measured at three points, equally spaced about the axis of the rivet, and the hardness shall be taken as the arithmetic average of the three measurements. When use of the Brinell hardness test is prohibited by proximity to the periphery of the section, measurement of hardness shall be made by the Rockwell hardness test.

6. Dimensions

6.1 Dimensions of rivets, unless otherwise specified, shall conform to those of one of the head types provided in American National Standard B18.4 for Large Rivets ($\frac{1}{2}$ Inch Nominal Diameter and Larger).⁵

7. Marking

7.1 Rivet heads shall be marked as follows to identify the grade, and shall also be marked to identify the manufacturer. Marking may be either raised or depressed at the option of the manufacturer.

Grade	Grade Marking
1	none required ^a
2	2
3	3

^a The numeral 1 may be used at the manufacturer's option.

8. Number of Tests and Retests Applicable for Mechanical (Hardness) Testing and Chemical Analysis

8.1 The requirements of this specification shall be met in continuous mass production for stock, and the manufacturer shall make sample inspections to ensure that the product conforms to the specified requirements. Additional tests of individual shipments of material are not ordinarily contemplated. Individual heats of steel are not identified in the finished product.

8.2 When specified in the order, the manufacturer shall furnish a test report certified to be the last completed set of mechanical tests for each stock size in each shipment.

8.3 Additional tests of individual shipments of rivets are not ordinarily required but when such additional tests are specified on the purchase order, a lot for the purpose of selecting test samples shall consist of all rivets in the shipment which have the following common characteristics:

- 8.3.1 One type of head,
- 8.3.2 One nominal diameter, and
- 8.3.3 One nominal length.
- 8.4 From each lot, the number of tests for each requirement shall be as follows:

Number of Pieces in Lot	Number of Samples
800 and under	1
801 to 8 000	2
8 001 to 22 000	3
Over 22 000	5

8.5 If any test specimen shows defective preparation it may be discarded and another specimen substituted.

8.6 Should any specimen fail to meet the requirements of its specified test, double the number of specimens from the same lot shall be tested for the property in which failure was found and all the additional specimens shall meet the specification requirements.

9. Quality Level for Visual Soundness

9.1 *Inspection*—Acceptable quality level (Note 3) for rivets shall be as given in Table 3.

NOTE 3—The acceptable quality level (AQL) provides standards for visual soundness inspection. The standards used, here are those of a recommended practice for large solid rivets formulated by the Industrial Fasteners Institute, June, 1965. That practice is based on Military Standard MIL-STD-105D for Sampling Procedures and Tables for Inspection by Attributes. Table 3 provides levels of quality for various attributes or characteristics and these are given numerical value in Table 4.

9.2 The AQL sampling and inspection shall be conducted in accordance with the sample size, acceptance, and rejection values given in Table 4.

10. Inspection

10.1 If the testing described in 8.3 is required by the purchaser, it shall be specified in the inquiry and contract or order.

10.2 The inspector representing the purchaser shall have free entry at all times, while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this

⁵ Available from American National Standards Institute, 1430 Broadway, New York, N. Y. 10018.



specification. All tests (except product analysis) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

11. Rejection

11.1 Rejections based on requirements specified herein shall be reported to the manufacturer within 30 days after receipt of material by the purchaser.

TABLE 1 Chemical Requirements

	Grade 1		Grade 2		Grade 3 ^b			
	Heat Analysis, %	Product Analysis, ^a %	Heat Analysis, %	Product Analysis, %	Class A		Class B	
					Heat Analysis, %	Product Analysis, %	Heat Analysis, %	Product Analysis, %
Carbon	0.13–0.25	0.11–0.27	0.19–0.30	0.16–0.33	0.10–0.19	0.09–0.20	0.20 max	0.21 max
Manganese	0.30–0.90	0.27–0.93	1.20–1.65	1.14–1.71	0.90–1.25	0.86–1.24	0.75–1.25	0.71–1.29
Phosphorus, max								
acid	0.06	0.070	0.06	0.070	...	...	...	...
basic	0.04	0.048	0.04	0.048	0.04	0.045	0.04	0.045
Sulfur, max	0.05	0.058	0.05	0.058	0.05	0.055	0.05	0.055
Silicon	...	...	0.10–0.30	0.08–0.32	0.15–0.30	0.13–0.32	0.15–0.30	0.13–0.32
Nickel	...	...	...	...	...	...	0.25–0.50	0.22–0.53
Chromium	...	...	...	...	0.40–0.65	0.37–0.68	0.40–0.70	0.37–0.73
Copper	...	...	...	...	0.25–0.40	0.22–0.43	0.20–0.40	0.17–0.43
Copper, when copper bearing steel is specified, min	0.20	0.18	0.20	0.18	...	...	...	...
Vanadium	...	...	...	...	0.02–0.10	0.01–0.11	0.01–0.10	0.11 max

^a Product analysis is not applicable to rivets made from rimmed steel or merchant quality bars.

^b A and B are classes of material used for Grade 3 rivets. Selection of a class shall be at the option of the rivet manufacturer.

TABLE 2 Hardness Requirements

	Grade 1		Grade 2		Grade 3 ^a	
	Min	Max	Min	Max	Min	Max
Rockwell, B	55	72	76	85	76	93
Brinell, 500-kgf (4900-N), 10-mm ball	103	126	137	163	137	197

^a In order to meet the atmospheric corrosion or hardness requirements or both, various combinations of alloying elements will be required. Maximum limits may be specified for the number and amount of alloy elements by mutual agreement between purchaser and producer at the time of ordering.

TABLE 3 Levels of Quality

Defect	Acceptable Quality Level
Crack or burst ^a	10.0
Duds (incompleted rivet or foreign material)	1.0

^a Crack and burst are two names for the same thing. Each designates an abrupt interruption of the periphery of a rivet head by separation of the metal. Such interruptions do not adversely affect structural strength, corrosion resistance, or other functional requirements of the rivet, but are unsightly if they are large. For this reason, a rivet with a crack or burst having an opening at the periphery of the head which is wider than 0.020 in. plus 0.05 times the rivet diameter is considered defective.

TABLE 4 Numerical Values for Levels of Quality

Lot Size	Sample Size	Acceptable Quality Level			
		1.0		10.0	
		Ac- cept- ance ^a	Re- jec- tion ^b	Ac- cept- ance ^a	Re- jec- tion ^b
0 to 50	8	0	1	2	3
51 to 90	13	0	1	3	4
91 to 150	20	0	1	5	6
151 to 280	32	1	2	7	8
281 to 500	50	1	2	10	11
501 to 1200	80	2	3	14	15
1201 to 3200	125	3	4	21	22
3201 to 10 000	200	5	6	21	22
10 001 to 35 000	315	7	8	21	22
35 001 to 150 000	500	10	11	21	22
150 001 to 500 000	800	14	15	21	22
over 500 000	1250	21	22	21	22

^a Defectives in sample permitted for acceptance of lot.

^b Defectives in sample requiring rejection of lot.

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