



Designation: B 565 – 94 (Reapproved 2000)

Standard Test Method for Shear Testing of Aluminum and Aluminum-Alloy Rivets and Cold-Heading Wire and Rods¹

This standard is issued under the fixed designation B 565; 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 test method covers the double shear testing of aluminum and aluminum alloy rivets with round, solid shanks and cold-heading wire and rod.²

NOTE 1—Exceptions to this test method may be necessary in individual specifications or methods for tests for a particular material.

NOTE 2—The values stated in inch-pound units are the standard. The SI values in parentheses are for information only.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 The latest issues of the following documents form a part of this standard to the extent referenced herein:

2.2 ASTM Standards:

B 316/B 316M Specification for Aluminum and Aluminum-Alloy Rivet and Cold Heading Wire and Rods³

B 769 Test Method for Shear Testing of Aluminum Alloys³

B 831 Test Method for Shear Testing of Thin Aluminum Alloy Products³

E 4 Practices for Force Verification of Testing Machines⁴

E 6 Terminology Relating to Methods of Mechanical Testing⁴

3. Terminology

3.1 *General*—The definitions of terms relating to shear testing in Terminology E 6 are applicable to the terms used in this test method.

4. Summary of Test Method

4.1 The test consists of subjecting a length of wire or rod or a rivet in full cross section, or a machined length of rod or rivet, to double-shear loading, with a suitable test jig in a tension testing machine, and determining the shear stress required to fracture the specimen (that is, the shear strength).

5. Significance and Use

5.1 This test method is intended solely for the shear testing of rivets and cold-heading wire and rod, and is not generally recommended for the determination of the shear strength of other products. For rivets, this method is limited to rivets having a shank length equal to or greater than $2d$.

NOTE 3—The results of shear tests of specimens machined from products other than wire, rod, and rivets may be greatly dependent upon the orientation of the specimen within the original test material, and the direction in which the load is applied relative to the grain flow in the specimen.⁵ It is recommended that shear strengths of other products be determined by Test Method B 769 for products greater than 0.250 in. (6.4 mm) and Test Method B 831 for products less than 0.250 in. (6.4 mm). Shear strengths developed by this test method have been shown to vary from those developed by other methods.⁵ If Test Method B 565 is used for shear testing of other products, variables such as those described in Test Method B 769 should be identified and controlled.

5.2 The results of shear tests are dependent upon the relative and absolute lengths of specimen which are sheared out and those which are supported.⁵ The results of tests made in accordance with this method should not be directly compared with those determined in other types of tests in which the methods of loading and supporting the specimen are different.

5.3 The presence of a lubricant on the surfaces of the specimen and jig may result in shear strengths up to 3 % lower than those determined in the absence of lubrication.

NOTE 4—In order to be able to test rivets having shanks as short as $2d$, the supported lengths of the specimen are $\frac{1}{2}d$ (Fig. 1), although it is

¹ This test method is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys, and is under the jurisdiction of Subcommittee B07.05 on Testing. Current edition approved March 15, 1994. Published May 1994. Originally published as B 565–72. Last previous edition B 565–87.

² This product is covered by Specification B 316/ B 316M.

³ Annual Book of ASTM Standards, Vol 02.02.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Kaufman, J. G., and Davies, R. E. "Effects of Test Method and Specimen Orientation on Shear Strengths of Aluminum Alloys," *ASTM Proceedings*, ASTEA, Am. Soc. Testing Mats., Vol 64, 1964.

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

7.3 The maximum clearance between the specimen diameter and the diameter of the test hole in the jig shall not exceed that allowed in Fig. 1.

8. Test Specimen Measurement

8.1 Measure the diameter of the specimen to the nearest 0.001 in. (0.03 mm) for test specimens equal to or greater than 0.1 in. (2.5 mm) in diameter, and to the nearest 0.0005 in. (0.013 mm) for test specimens less than 0.1 in. (2.5 mm) in diameter.

9. Procedure

9.1 Place the specimen in the test jig, assemble as in Fig. 1, and load at a uniform rate until complete failure occurs.

9.2 The cross-head speed during the test shall not exceed 3/4 in. (19.1 mm)/min and the loading rate shall not exceed 100 ksi (689 MPa)/min on the double-shear test cross section.

9.3 Determine the maximum load to fracture the specimen.

9.4 Since lubrication may have an effect on results (see section 5.3), clean the specimens and test fixtures in referee testing (for example, clean ultrasonically in a suitable solvent) and take care to avoid touching the specimen and test-hole area of the shear fixture with the hands after cleaning.

9.5 The mating surfaces of the shear fixture should be visually inspected before use for aluminum buildup around the test holes. Removal of the aluminum can be accomplished with crocus cloth or soaking the test fixture in a caustic soda solution followed by a water rinse and drying. Before referee testing the test fixture should be cleaned in the above manner followed by procedures in 9.4.

10. Calculations of Shear Strength

10.1 Calculate the shear strength from the maximum load as follows:

$$S = \frac{1}{2}P_{\max}/A = \frac{1}{2}P_{\max}/(\pi D^2/4) = 2P_{\max}/\pi D^2 \quad (1)$$

where:

- S = the shear strength, psi (or MPa),
- P_{\max} = the maximum load in the test, lbf (or N), and
- D = the measured diameter of the specimen, in. (or mm).

11. Report

11.1 The report shall include the following for each specimen tested:

11.1.1 The ASTM shear test method.

NOTE 5—In view of the influence of test method on shear test results as indicated in 5.2 it is important to reference the ASTM method in reporting results.

11.1.2 Material and sample identification.

11.1.3 Specimen diameter, in. (or mm).

11.1.4 Maximum load, lbf (or N).

11.1.5 Shear strength, ksi (or MPa).

11.1.6 Test temperature °F (°C).

NOTE 6—For metric equivalents:

1 in = 25.4 mm

1 lbf = 4.448 N

1 ksi = 6.89 MN/m²(MPa)

12. Keywords

12.1 double shear loading; loading jig; shear aluminum rivet

SUMMARY OF CHANGES

This section identifies the principle changes to this standard that have been incorporated since the last issue.

- (1) Test Method B 831 was added to the Referenced Documents and Note 3.
- (2) Footnote 7 was deleted from Paragraph 5.4.
- (3) 6.2 was revised to define the sharpness of the shearing edges, to redefine “interfaces” as “mating surfaces,” and to state a finish for the machined tongue and clevis surfaces.
- (4) 7.2 was revised to include the machined surface finish of the specimen and to insert metric dimensions.

(5) 8.1 was revised to better define “smaller sizes.”

(6) 9.3—The words “by direct reading on the test machine” were deleted.

(7) 10.1—The definition of “D” was changed to be what it really is: the measured diameter of the specimen.

(8) 11.1.1—“ASTM” was added to “shear test method” for clarification.

(9) Fig. 1—A metric equivalent was inserted after 0.005 in.

(10) 11.1.6 was added.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).