



Designation: ~~B831 – 11~~ **B831 – 14**

Standard Test Method for Shear Testing of Thin Aluminum Alloy Products¹

This standard is issued under the fixed designation B831; 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. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This test method covers single shear testing of thin wrought and cast aluminum alloy products to determine shear ultimate strengths. It is intended for products that are too thin to be tested according to Test Method **B769**.

1.2 The values stated in inch-pound units are to be regarded as standard. The ~~SI~~ values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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 following documents of the issue in effect on the date of material purchase, unless otherwise noted, form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*²

[B565 Test Method for Shear Testing of Aluminum and Aluminum-Alloy Rivets and Cold-Heading Wire and Rods](#)

[B769 Test Method for Shear Testing of Aluminum Alloys](#)

[E4 Practices for Force Verification of Testing Machines](#)

[E6 Terminology Relating to Methods of Mechanical Testing](#)

[E2208 Guide for Evaluating Non-Contacting Optical Strain Measurement Systems](#)

3. Terminology

3.1 *Definitions*—The definitions of terms relating to shear testing in Terminology **E6** are applicable to the terms used in this test method.

4. Summary of Test Method

4.1 This test method consists of subjecting a full thickness or machined rectangular test specimen to single shear force to failure in a test fixture using a tension testing machine. The shear strength is calculated from the maximum force required to fracture the specimen.

5. Significance and Use

5.1 The intent of this test method is to provide a means of measuring the ultimate shear strength of thin aluminum alloy wrought and cast products. It is recognized that the loading conditions developed by this test method, and by most others, are not ideal in that they do not strictly satisfy the definitions of pure shear. However, rarely do pure shear conditions exist in structures.

NOTE 1—Results from this test method are not interchangeable with results from Test Methods **B565** and **B769**. Shear strengths obtained by this test method have been shown to differ from values determined with other methods.³

6. Apparatus

6.1 *Testing Machines*—The testing machines shall conform to the requirements of Practice **E4**. The maximum force used to determine the shear strength shall be within the verified force range of the testing machine as defined in Practice **E4**.

¹ This test method is under the jurisdiction of ASTM Committee **B07** on Light Metals and Alloys and is the direct responsibility of Subcommittee **B07.05** on Testing. Current edition approved Nov. 1, 2011; May 1, 2014. Published January 2012; July 2014. Originally approved in 1993. Last previous edition approved in 2005; 2011 as **B831 – 05**; **B831 – 11**. DOI: [10.1520/B0831-14](https://doi.org/10.1520/B0831-14).

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.

³ Davies, R. E., and Kaufman, J. G., "Effects of Test Method and Specimen Orientation on Shear Strengths of Aluminum Alloys," *Proceedings*, ASTM, Vol 64, 1964.

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

6.2 Loading Device:

6.2.1 The device for applying force to the specimen from the testing machine shall be a clevis of the type shown in Fig. 1 and shall be made of a hardened steel.

7. Test Specimens

7.1 The specimen size shall be 1.5 in. (38.1 mm) wide by 4.5 in. (114 mm) long. The specimen geometry is shown in Fig. 2. The specimen thickness shall be the full product thickness for a product thickness of 0.250 in. (6.35 mm) or less. For a product thickness greater than 0.250 in. (6.35 mm), the specimen shall be machined to a thickness of 0.250 in. (6.35 mm) by machining equal amounts from each side of the product. The minimum specimen thickness that can be reasonably tested will be dictated by the material's ability to resist buckling around the pin hole area during testing.

7.2 The test area to be sheared shall be centered within 0.001 in. (0.025 mm) of the load line of the specimen.

7.3 Measure and record the thickness (t) and length (L) of the area to be sheared. Measurements shall be made as follows:

7.3.1 Measurement of the specimen thickness shall be made at a location between the two slots machined into the specimen. Measurement of the length of the shear area shall be between the ends of the slots machined into the specimen, Fig. 2. For dimensions 0.200 in. (5.1 mm) and over, measure to the nearest 0.001 in. (0.025 mm). For dimensions less than 0.200 in. (5.1 mm) and not less than 0.100 in. (2.5 mm), measure to the nearest 0.0005 in. (0.013 mm). For dimensions less than 0.100 in. (2.5 mm), measure to the nearest 0.0001 in. (0.0025 mm).

7.4 All machined surfaces in the test area shall have a surface finish of 32 $\mu\text{in.}$ (0.80 μm) R_a or less.

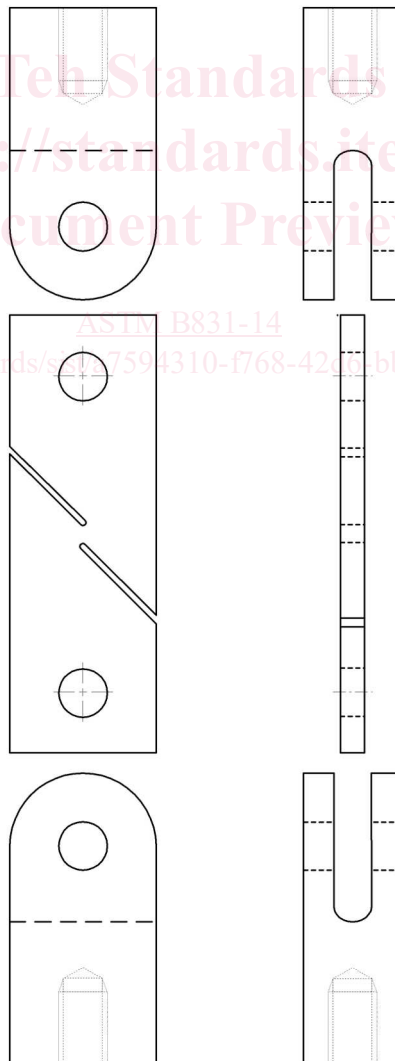
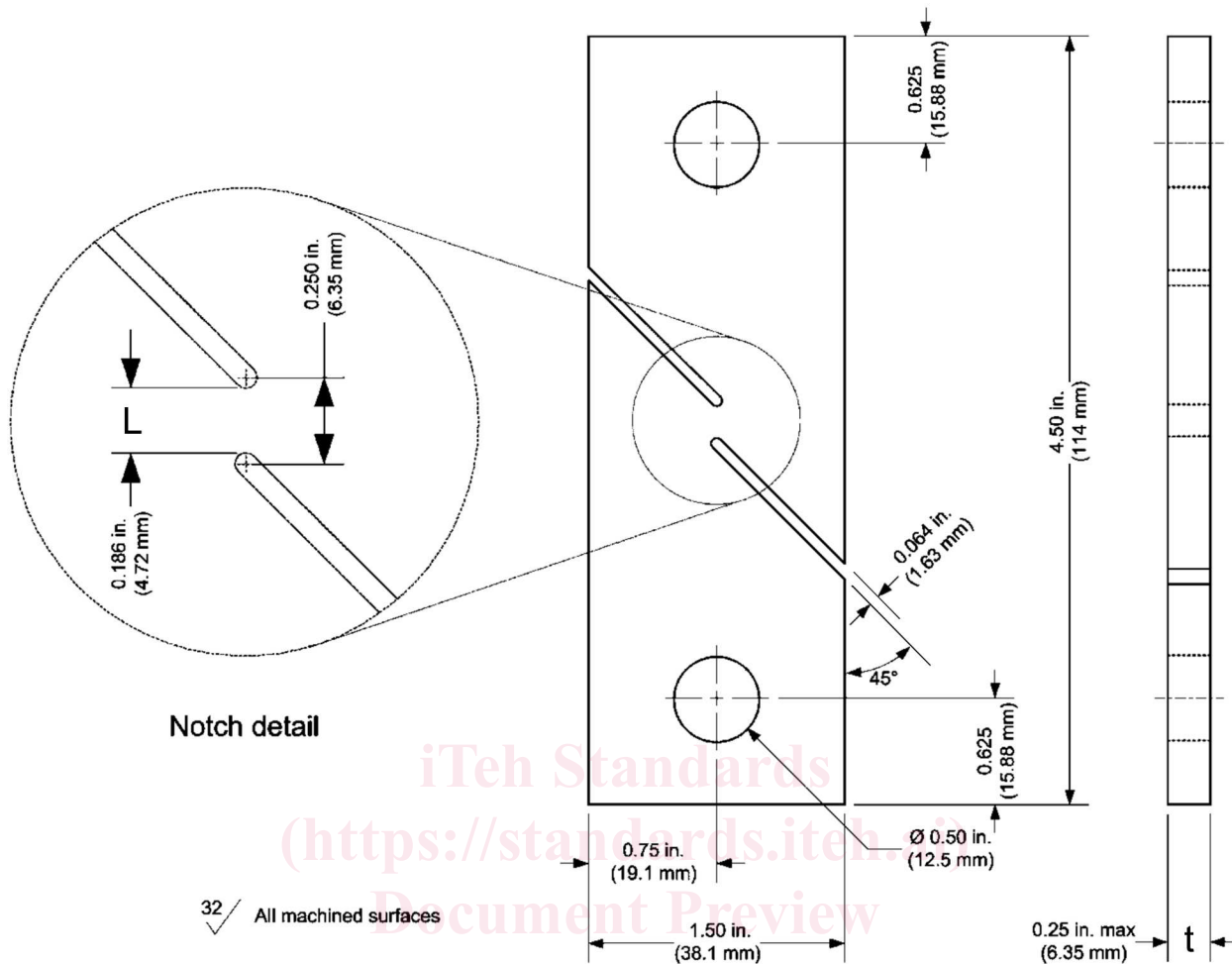


FIG. 1 Slotted Single Shear Test Fixture



iTeh Standards
[\(https://standards.iteh.ai/\)](https://standards.iteh.ai/)
 Document Preview

ASTM B831-14

<https://standards.iteh.ai/catalog/standards/sist/a7594310-f768-42d6-bb79-5c4c3c65fb5d/astm-b831-14>

FIG. 2 Slotted Single Shear Test Specimen

8. Specimen Orientation and Direction

8.1 The shear strength of wrought aluminum materials usually depends on the specimen orientation and the direction in which the load is applied relative to the grain flow in the specimen.³ The specimen orientation and the loading direction should be identified by the following systems.

8.1.1 The reference directions for rectangular shapes are indicated in Fig. 3. These are suitable for sheet, plate, extrusions, forgings, and other shapes having nonsymmetrical grain flow.

8.2 The two-letter code is used in Fig. 3 to describe the specimen orientations and loading directions. The first letter designates the normal to the expected shear plane. The second letter designates the direction of force application or expected fracture direction. The most commonly used specimen orientations and loading directions are T-L and L-T for in-plane shear strength of thin products. This orientation code is identical to that used for cylindrical shear specimens in Test Method B769.

NOTE 2—These orientation codes are analogous to those used for fracture specimens if the first letter is interpreted as the normal to the fracture plane and the second letter is the direction of fracture.

NOTE 3—Typically, cast aluminum products do not exhibit the directionality of wrought products; therefore, the orientation codes are not applicable to castings.

9. Procedure

9.1 *Measurement of Specimens*—Measure the applicable dimensions designated in 7.3 and calculate the cross-sectional area by multiplying the two dimensions ($A = t \cdot L$).