



Designation: D3115 – 95 (Reapproved 2014)

Standard Test Method for Explosive Reactivity of Lubricants with Aerospace Alloys Under High Shear¹

This standard is issued under the fixed designation D3115; 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 test method is used to evaluate for explosive reactivity of various lubricants in the presence of aerospace alloys under high shear conditions.

1.2 The values stated in SI units are to be regarded as the standard. In cases where materials, products, or equipment are available in inch-pound units only, SI units are omitted.

1.3 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.4 *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 *ASTM Standards:*²

[B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate](#)

[B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes](#)

2.2 *ANSI Standard:*

[B46.1 Surface Texture](#)³

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.L0.07 on Engineering Sciences of High Performance Fluids and Solids (Formally D02.1100). ASTM Committee F07 on Aerospace and Aircraft maintains a continued interest in this test method and will make use of it in the future.

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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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *explosive reactivity, n*—occurrence of sparks, smoke, or explosive (audible) sounds during this test.

3.1.2 *lubricants, n*—liquid materials used as lubricants or cutting fluids in the presence of aerospace alloys.

4. Summary of Test Method

4.1 A shaped dowel pin made of the test material is rotated at 1760 rpm under a pressure of 689 MPa (1000 psi) for 1 min in a shaped hole (drilled into a block of the test material) containing the test lubricant. Observation for indications of reaction is made.

5. Significance and Use

5.1 Explosive reactivity has resulted when parts made from some light alloys, typically high in aluminum and magnesium, are loaded under shear conditions while in contact with certain lubricants. A typical example is a threaded part, lubricated with a chlorofluorocarbon grease, pulled up normally tight.

6. Apparatus

6.1 *Fluted Ball-End End Mills*,⁴ two, 12.7 ± 0.025 mm (0.500 ± 0.001 in.) in diameter with a 6.35 ± 0.025-mm (0.250 ± 0.001-in.) radius tip, finished to 0.203 to 0.406 μm (8 to 16 μin.) rms.

6.2 *Drill Press*, capable of rotating at 1760 rpm under a 6.89-MPa (1000-psi) load.

6.3 *Drill Chuck*, capacity 12.7-mm (½-in.) end mill.

6.4 *Loading Device*, capable of putting a pressure of 6.89 MPa (1000 psi) on the dowel test pin.

6.5 *Force Gauge*, 1112 N (250-lbf) force.⁵

⁴ Carbide tipped ball-end end mills are available and may be used when working with metals harder than aluminum.

⁵ The sole source of supply of the gauge known to the committee at this time is AMETEK, Inc., Testing Equipment Div., Box 288, Lansdale, PA 19446. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

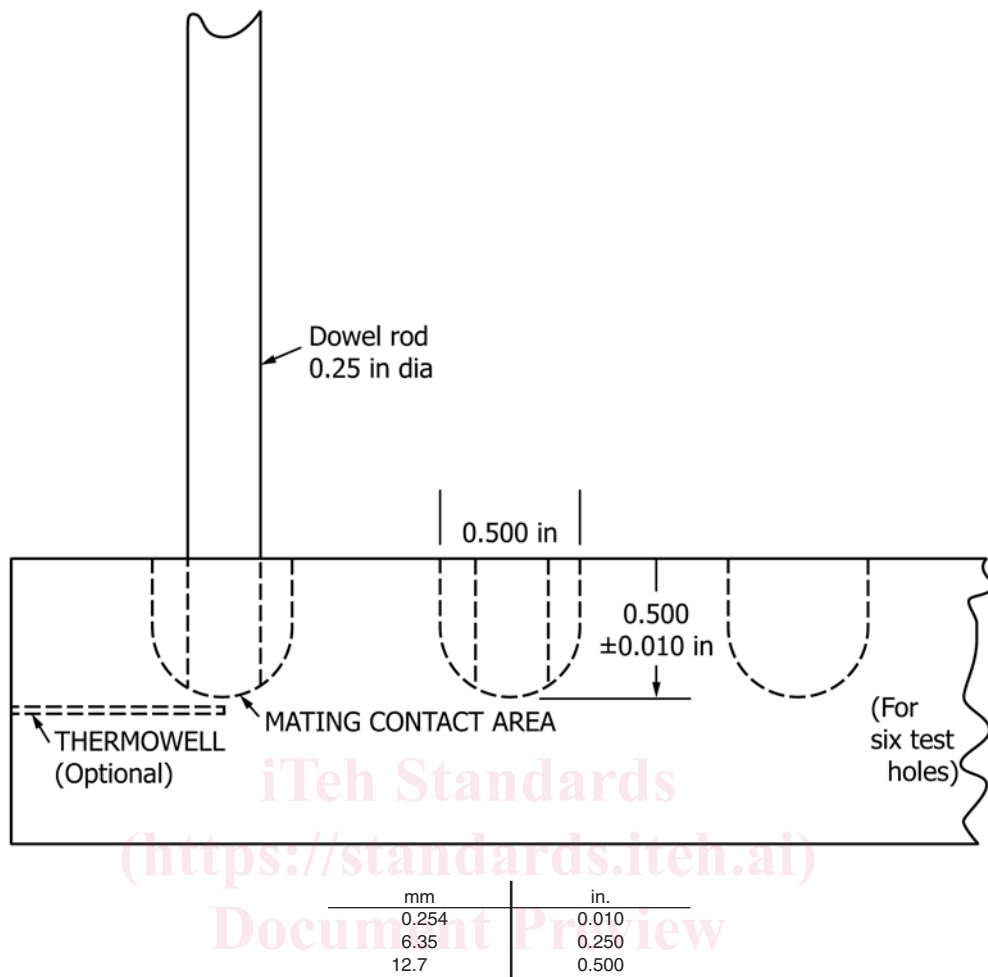


FIG. 1 Block, Drilled for Tests

6.6 *Drill Press Vise*, capable of holding the test block in position.

6.7 *Surface Texture Standards*, conforming to American National Standard for Surface Texture (ANSI B46.1).

6.8 *Transparent Safety Shield*.

6.9 *Thermocouple and Potentiometer*, optional, for measuring hole-bottom temperature.

6.10 *Desiccator*, maintained at $50 \pm 5\%$ relative humidity. Water saturated with $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ at 294 K (70°F) is satisfactory.

7. Materials

7.1 *Blocks*, of the appropriate alloy, 25.4 mm (1 in.) thick by 38 mm (1.5 in.) wide by 165 mm (6.5 in.) long. Unless otherwise specified, use metal conforming to Specification B209, Grade 2024-T4.

7.2 *Dowel Pins*, of the appropriate alloy, 6.35 ± 0.025 mm (0.250 ± 0.001 in.) in diameter by 76 ± 2.5 mm (3.0 ± 0.1 in.) long and the end having a hemispherical surface with a 6.35 ± 0.025 mm (0.250 ± 0.01 -in.) radius and an 0.203 to 0.406 μm (8 to 16- $\mu\text{in.}$) finish. Unless otherwise specified, use metal conforming to Specification B221, Grade 2024-T4.

NOTE 1—Both ends of each dowel pin may be so prepared and each considered a *new* test pin under 9.8 provided that the dimensions are maintained as required.

7.3 *Acetone*, reagent grade.⁶

7.4 *Test Lubricant*, sufficient for at least one test series (that is, 6 mL).

8. Test Specimen

8.1 Prepare the block, as shown in Fig. 1, by drilling six holes with the 12.7 mm (0.500-in.) ball-end end mill to a depth of 12.7 mm \pm 0.254 mm (0.500 ± 0.100 in.) measured to the tip of the hole. The hole centers shall not be less than 12.7 mm (0.500 in.) from the edge of the block or another hole. The ball end mill will create the correct surface finish in the hole when driven at 500 to 600 rpm with no lubricant.

8.1.1 If it is desired to determine the temperature attained during the test, a thermowell shall be cross-drilled to a point

⁶ *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For Suggestions on the testing of reagents not listed by the American Chemical Society, see *Annual Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.