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Designation: D 1062 – 02

Standard Test Method for Cleavage Strength of Metal-to-Metal Adhesive Bonds[1]

This standard is issued under the fixed designation D 1062; 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.

ε[1] NOTE—Editorial changes were made in June 1997.

INTRODUCTION

The accuracy of the results of strength tests of adhesive bonds will depend on the conditions under which the bonding process is carried out. Unless otherwise agreed upon by the manufacturer and the purchaser, the bonding conditions shall be prescribed by the manufacturer of the adhesive. In order to ensure that complete information is available to the individual conducting the tests, the manufacturer of the adhesive shall furnish numerical values and other specific information for each of the following variables:

(*1*) Procedure for preparation of surfaces prior to application of the adhesive, the cleaning and drying of metal surfaces, and special surface treatments such as sanding that are not specifically limited by the pertinent test method.

(*2*) Complete mixing directions for the adhesive.

(*3*) Conditions for application of the adhesive, including the rate of spread or thickness of film, number of coats to be applied, whether to be applied to one or both surfaces, and the conditions of drying where more than one coat is required.

(*4*) Assembly conditions before application of pressure, including the room temperature, length of time, and whether open or closed assembly is to be used.

(*5*) Curing conditions, including the amount of pressure to be applied, the length of time under pressure, and the temperature of the assembly when under pressure. State whether this temperature is that of the bond line or of the atmosphere at which the assembly is to be maintained.

(*6*) Conditioning procedure before testing, unless a standard procedure is specified, including the length of time, temperature, and relative humidity.

A range may be prescribed for any variable by the manufacturer of the adhesive if it can be assumed by the test operator that any arbitrarily chosen value within such a range or any combination of such values for several variables will be acceptable to both the manufacturer and the purchaser of the adhesive.

1. Scope

1.1 This test method covers the determination of the comparative cleavage properties of adhesive bonds when tested on standard shape metal specimens under specified conditions of preparation and testing. It may be used also to compare adhesives used with other metallic materials having any specified surface treatment.

1.2 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

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.*

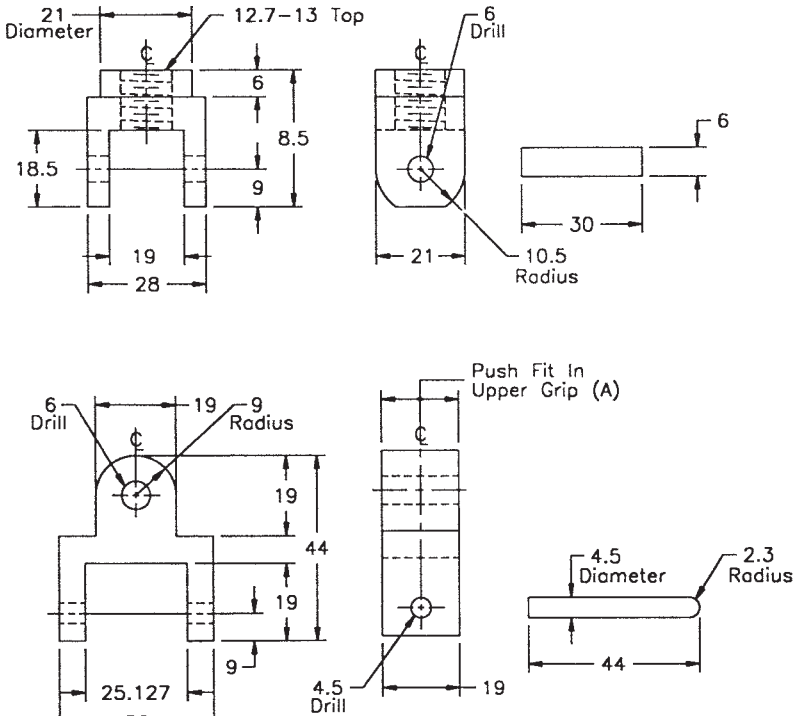
2. Referenced Documents

2.1 *ASTM Standards:*

A 108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality[2]

[1] This test method is under the jurisdiction of ASTM Committee D-14 on Adhesives and is the direct responsibility of Subcommittee D14.80 on Metal Bonding Adhesives. Current edition approved Sept. 10, ~~1996.~~ 2002. Published November ~~1996.~~ 2002. Originally published as D 1062 – 49 T. Last previous edition D 1062 – 9~~2~~6ε1.

[2] *Annual Book of ASTM Standards*, Vol 01.05.



A—Upper grip
B—Pin connecting upper and lower grips
C—Lower grip
D—Pin for attaching grip to specimen

mm	2.3	4.5	6	7.5	9	10.5	12.7	18.5	19	21	28	30	38	44
(in.)	(3⁄32)	(3⁄16)	(1⁄4)	(5⁄16)	(3⁄8)	(7⁄16)	(1⁄2)	(13⁄16)	(3⁄4)	(7⁄8)	(1 1⁄8)	(1 3⁄16)	(1 1⁄2)	(1 3⁄4)

FIG. 1 Details of Test Grips

B 16/B 16M Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines[3]
B 133 Specification for Copper Rod, Bar, and Shapes[4]
B 139/B 139M Specification for Phosphor Bronze Rod, Bar, and Shapes[3]
B 211 Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire[5]
D 907 Terminology of Adhesives[6]
2.2 *Other Documents:*
AISI 1020 [7]

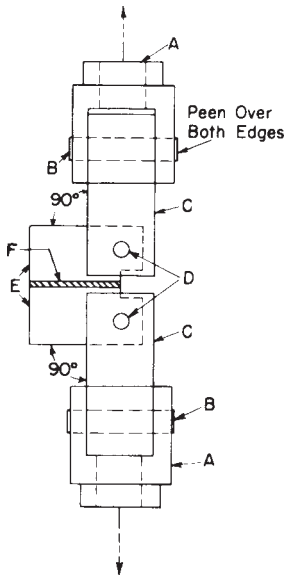
3. Terminology

3.1 *Definitions*—Many of the terms in this test method are defined in Terminology D 907.
3.2 *Definitions of Terms Specific to This Standard:*
3.2.1 *contact failure, n*—in characterizing the locus of an adhesive joint failure, the lack of adhesive being in contact with the substrate.
3.2.1.1 *Discussion*—Contact failure may be due to conditions such as uneven surfaces, poor pressure distribution, or insufficient adhesive in the bondline.

4. Apparatus

4.1 Use a testing machine capable of maintaining the rate of loading specified in 8.2, and consisting essentially of the following:
4.1.1 *Fixed Member*—A fixed or essentially stationary member, carrying one grip.
4.1.2 *Movable Member*, carrying a second grip.
4.1.3 *Grips*, for holding a test specimen between the fixed member and the movable member. The grips are of the self-aligning type; that is, they shall be attached to the fixed and movable member, respectively, in such a way that they will move into alignment as soon as any load is applied, so that the direction of pull is at right angles to the point of adhesion. Recommended grips are shown in Figs. 1 and 2.

[3] *Annual Book of ASTM Standards*, Vol 02.01.
[4] Discontinued; see *1995 Annual Book of ASTM Standards, Vol 02.02*.
[5] *Annual Book of ASTM Standards*, Vol ~~15.06.~~ 02.02.
[6] *Annual Book of ASTM Standards*, Vol 15.06.
[7] Available from American Iron and Steel Institute (AISI), 1101 17th St., NW, Suite 1300, Washington, DC 20036.

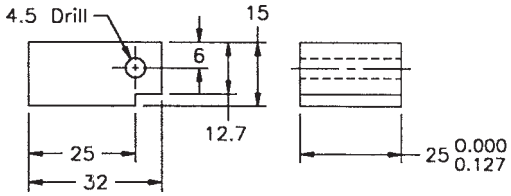


A—Upper grip
B—Pin connecting upper and lower grips
C—Lower grip
D—Pin for attaching grip to specimen
E—Metal pieces
F—Glue line

FIG. 2 Assembly of Grips and Test Specimen for Cleavage Strength Test

5. Test Specimens

5.1 The test specimens consist of metal pieces, conforming to the dimensions and conditions shown in Fig. 3, and glued together as described in Section 6 with the adhesive to be tested. Various metallic materials and surface treatments may be specified to simulate surface conditions. The following grades of metal are recommended for the test specimens, as being representative of a wide range of metallic materials:



mm	(in.)
0.000	(0.000)
0.127	(0.005)
4.5	(3⁄16)
6	(1⁄4)
12.7	(1⁄2)
15	(5⁄8)
25	(1)
32	(1 1⁄4)

NOTE 1—The 1-in. (25-mm) square surface to be glued shall be ground flat and parallel with the opposite surface.

FIG. 3 Metal Piece for Use in Test Specimen

Metal	Designation
Brass	ASTM B 16, C36000; half-hard temper
Copper	ASTM B 133, C11000; hard temper
Aluminum	ASTM B 211, A92024; specify temper
Steel	AISI 1020, G10200 cold-finished bar
Phosphor bronze	ASTM B 139, C54400

5.2 The metal pieces may be reused after testing, provided the adhesive is completely removed from the adhering surfaces and the surfaces are reconditioned.

5.3 Unless otherwise agreed upon by the purchaser and the manufacturer, test at least ten specimens for each adhesive, but in no case less than five.

6. Bonding

6.1 Prepare the areas to be cemented and bond with the procedure outlined by the manufacturer of the adhesive.

6.2 It is important that all squeezeout be carefully removed from the edges of the specimen.

7. Conditioning

7.1 Unless special conditioning procedures are agreed upon by the purchaser and the manufacturer the adhesive is ready for test when it has been applied in accordance with Section 6.

8. Procedure

8.1 Place the specimen in the grips of the testing machine; take care to align the specimen as indicated in Fig. 2.

8.2 Apply tensile load at the rate of 270 to 320 kg (600 to 700 lb)/min, or the crosshead speed of the testing machine shall be such that the load can be accurately weighed but shall not exceed 1.27 mm (0.050 in.)/min when the machine is running idle.

8.3 Record the maximum load in pounds carried by the specimen at failure. Record the percent of cohesion, adhesion, and contact failures.

9. Calculation

9.1 Cleavage strength is the breaking load, expressed in pounds per inch. If possible, report the results to three significant figures.

10. Report

10.1 Report the following information:

10.1.1 Complete identification of the adhesive tested, including type, source, manufacturer's code numbers, form, etc.,

10.1.2 Method of preparing test specimens,

10.1.3 Average thickness of adhesive layer after formation of the joint, within 0.001 in. Describe the method of obtaining the thickness of the adhesive layer. Include procedure, location of measurements, and range of measurements.

10.1.4 Conditioning procedure used,

10.1.5 Conditions of testing room,

10.1.6 Number of specimens tested,

10.1.7 Rate of loading,

10.1.8 Maximum, minimum, and average value of cleavage strength. Optionally, by agreement between the purchaser and the manufacturer of the adhesive, all individual test results or the standard deviation, or both, may also be required in the report.

10.1.9 Average value of the percentage of cohesion failure.

11. Precision and Bias

11.1 ~~A~~The precision and bias statement ~~does not exist~~ for this test method ~~because resources necessary for round-robin testing have~~ has not been ~~fo~~ determined yet~~h~~. Archival and round-robin information is being reviewed, and the results are expected by September 2004.

12. Keywords

12.1 adhesive bonding; cleavage strength