Designation: D 897 – 00

Standard Test Method for Tensile Properties of Adhesive Bonds[1]

This standard is issued under the fixed designation D 897; 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.

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, including the cleaning and drying of metal surfaces, and special surface treatments which 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. It should be stated 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 tensile properties of the adhesive bonds of metal to metal when tested on standard shape specimens and under defined conditions of pretreatment, temperature, and testing machine speed.

1.2 The values stated in SI units are to be regarded as the standard. The values given 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:*

D 907 Terminology of Adhesives[2]

3. Terminology

3.1 Many of the terms used in this test method are defined in Terminology D 907.

4. Significance and Use

4.1 This test method is primarily comparative. However, it does have application as a discriminator in determining variations in adherend surface preparation parameters and adhesive

[1] This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.80 on Metal Bonding Adhesives.

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[2] *Annual Book of ASTM Standards*, Vol 15.06.

environmental durability. The test method has found applications in controlling surface preparations, primer, and adhesive systems for determining strength properties of tested systems.

5. Apparatus

5.1 *Testing Machine*, capable of maintaining a specified rate of loading and comprising essentially the following:

5.1.1 *Fixed Member*— A fixed or essentially stationary member, carrying one grip.

5.1.2 *Movable Member*, carrying a second grip.

5.1.3 *Grips*, for holding a test specimen between the fixed member and the movable member. Use the self-aligning type. The grips 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 long axis of the test specimen will coincide with the direction of the applied pull through the center line of the grip assembly. While the design of grips of this type is optional, one that has been found satisfactory is shown in Fig. 1.

6. Test Specimens

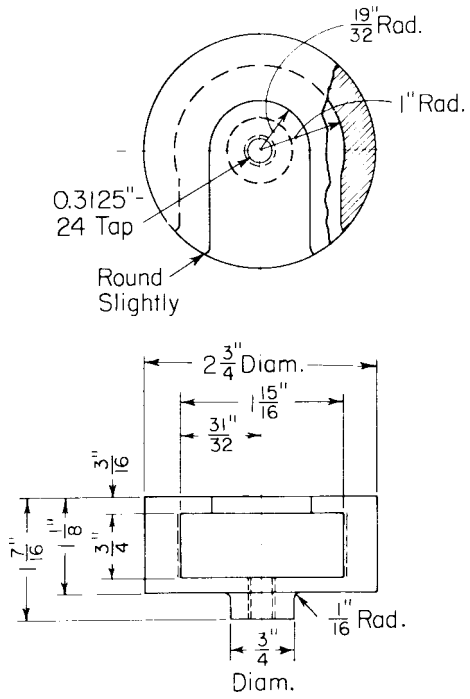
6.1 Use specimens in accordance with Fig. 2. Reuse of the specimens is allowed by resurfacing those surface areas that contained the adhesive. Do this by grinding the adhesive-faced surface flat and parallel. Metals conforming to the following ASTM specifications are recommended: [3,4,5]

Metal	Designation
Brass	ASTM B 16[A], C3600; half-hard temper
Copper	ASTM B 133[A], C11000; hard temper
Aluminum	ASTM B 211[A], A92024; G3
Steel	AISI 1020, G10200; cold-finished bar
Phosphor bronze	ASTM B 139[A], C54400
Magnesium	ASTM B 107[A], Alloy AZ61AF or M1A-F but see D950
Nickel silver	ASTM B 151[A], C77000; quarter-hard

[A] These designations refer to the following ASTM specifications:
B 16, for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines,[3]
B 133, for Copper Rod, Bar, and Shapes,[3]
B 211, for Aluminum-Alloy Bars, Rods, and Wire,[4]
A 108, for Steel Bars, Carbon, Cold-Finished, Standard Quality[5]
B 139, for Phosphor Bronze Rod, Bar, and Shapes,[3]
B 107, for Magnesium-Alloy Extruded Bars, Rods, Shapes, Tubes and Wire [4] and
B 151, for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar.[3]

6.2 Test 10 specimens.

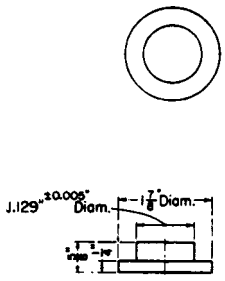
6.3 Discard results if a specimen breaks at a flaw which is remote from the bond line unless such a flaw constitutes a variable, the effect of which is desired to study. Test a substitute specimen to replace the discarded result.



Corrosion Preventive Finish

in.	mm
1/16	1.5
3/16	4.75
0.3125	7.9375
19/32	15.1
3/4	19
31/32	24.6
1	25
1 1/8	28
1 7/16	36
1 15/16	43.3
2 3/4	70

FIG. 1 Test Grips (Cold-Rolled Steel)



Metal Specimen

Metal Specimen

NOTE 1—Surfaces of metal specimens shall be ground flat and parallel. It is preferable to grind all metal specimens at the same time.

in.	mm	in.	mm
1/4	6.4	1.129 ± 0.005	28.68 ± 0.13
5/8	15.9	1 7/8	47.6

FIG. 2 Test Specimen

7. Adhesive

7.1 Prepare areas that are to be cemented in accordance with the recommendations of the manufacturer of the adhesive.

8. Procedure

8.1 Place the specimen in the grips of the testing machine; taking care to align the specimen and the grips with an imaginary line joining the points of attachment of the grips to the machine. Start test loading of the specimen as quickly as possible.

[3] *Annual Book of ASTM Standards*, Vol 02.01.
[4] *Annual Book of ASTM Standards*, Vol 02.02.
[5] *Annual Book of ASTM Standards*, Vol 01.05.

8.2 *Speed of Testing*— For all materials apply a load to the specimen of 544.3 to 635 kg (1200 to 1400 lb)/min, or adjust the crosshead speed of the testing machine so that the load can be accurately determined, but not to exceed 127 mm/min (0.050 in./min) when the machine is running idle.

8.3 *Record*—Record the maximum load carried by the specimen at failure and also the following:

8.3.1 The percentage of cohesion, adhesion, and contact failures (Note 1). This will be based on a visual inspection.

NOTE 1—Cohesive failure may be obtained by observing how much of the failure has occurred in the adhesive itself. That is, if the cement has adhered to the metal test pieces and no voids are visual, it represents a 100 percent cohesive failure. Adhesion failure refers to the lack of adhering to metals being fastened. Contact failure refers to lack of glue lines being in contact due to uneven surfaces, poor pressure distribution, etc.

9. Calculations

9.1 Tensile strength of the specimens is the breaking load. Express the result in grams per square millimetre (pounds per square inch) and if possible report to three significant figures.

9.2 For each series of tests calculate the arithmetic mean of all the values obtained and report as the "average value."

10. Report

10.1 Report the following information:

10.1.1 Complete identification of the material tested, including types, 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 0.025 mm (0.001 in.). Describe the method of obtaining the thickness of the adhesive layer including procedure, location of measurements, and range of measurements.

10.1.4 Testing room conditions,

10.1.5 Number of specimens tested,

10.1.6 Speed of testing, and

10.1.7 Average value of the tensile strength, with an average value of the percentage of cohesion failure for the specimens.

11. Precision and Bias

11.1 Precision and Bias for this test is being determined and will be available by September 2004.

12. Keywords

12.1 adhesive bond; tensile buttons; tensile strength