METHOD 211A

TERMINAL STRENGTH

1. PURPOSE. This test is performed to determine whether the design of the terminals and their method of attachment can withstand one or more of the applicable mechanical stresses to which they will be subjected during installation or disassembly in equipment. These stresses must be withstood by the component part without sustaining damage which would affect either the utility of the terminals or the operation of the component part itself. Evidence of damage caused by this test may not become evident until subsequent environmental tests are performed, such as seal, moisture resistance, or life. Procedures are established in this method for testing wire-lead terminals, flexible-flat-strip or tab-lead terminals, and rigid-type terminals which are threaded or have other arrangements for attaching conductors. The forces applied consist of direct axial, radial or tension pulls, twist, bending torsion, and the torque exerted by the application of nuts or screws on threaded terminals. These applied stresses will disclose poor workmanship, faulty designs, and inadequate methods of attaching terminals to the body of the part. Other evidence of damage may be disclosed by mechanical distortion of the part, breaking of seals, cracking of materials surrounding the terminals, or changes in electrical characteristics, such as shorted or interrupted circuits and changes in resistance values.

2. TEST CONDITIONS.

2.1 Selection. In this method there are five test conditions, A, B, C, D, and E. The selection of test conditions to perform the terminal-strength test depends on the type of terminal to be tested. The individual specification shall specify the test condition required. The following is included as a guide to be used, as applicable:

Test condition A:	Pull test - also known as a tension or tensile test for terminals. It is usually applicable to most types of terminals.
Test condition B:	Flat-terminal bend test - also known as a bend test. It is applicable to flexible-flat-strip or tab-lead terminals which can be bent by finger pressure.
Test condition C:	Wire-lead bend test - also known as a lead-fatigue, bend, or flexibility test. It is applicable to solid-wire-lead terminals of limited ductility, such as nickel-alloy-type leads and those used in hermetically-sealed component parts.
Test condition D:	Twist test - also known as a torsion test. It is usually applicable to ductile, solid-wire-lead terminals intended for wraparound connections.
Test condition E:	Torque test - It is applicable to rigid-type terminals having either external screw threads or threaded inserts which are located at the center of the terminal, or to other non-wire, rigid-type terminals which should withstand the turning moment that results from a force applied from an off-center point on the terminal.

3. PROCEDURE. One or more of the following test condition letters shall be specified in the individual specification:

3.1 Test condition A (pull test).

3.1.1 Method of holding. If the method of holding or clamping is pertinent, it shall be specified in the individual specification.

3.1.2 Applied force. The force applied to the terminal shall be 1/2, 1, 2, 3, 5, 10, or 20 pounds, as specified in the individual specification.

3.1.3 Direction of applied force. The point of application of the force and the force applied shall be in the direction of the axes of the terminations, as shown on figure 211-1.

3.1.4 Duration of applied force. The force shall be applied gradually to the terminal and then maintained for a period of 5 to 10 seconds.

3.2 Test condition B (flat-terminal bend test).

3.2.1 Starting position of terminal. Prior to the test, the terminal shall be observed to determine if it is oriented in its normal or unbent position, or if it is permanently bent out of position, as could occur as a result of prior testing.

3.2.2 Bending cycle. If the method of bending is not critical, the terminals may be bent by finger pressure through a bending cycle of three bends, as shown on figure 211-2. The bending cycle shall start with a 45° bend to one side of the normal position. If the terminal is already bent to an angle between 0° and 45° to one side of the normal position prior to test, it shall be bent in the same direction until an angle of 45° is achieved. The terminal shall then be bent 90° in the opposite direction to a point 45° on the opposite side of the normal position, and then back 45° to normal. If the method of bending is critical, the individual specification shall specify the method of bending and any fixture required to control the point of application. The rate of bending shall be approximately 3 seconds per bend in each direction.

3.2.3 Number of bending operations. The number of bending operations shall be two or five, as specified in the individual specification.

3.3 Test condition C (wire-lead bend test).

3.3.1 Preparation of specimen. A load of 1/4, 1/2, 1, 5, or 10 pounds, as specified in the individual specification, shall be suspended from the terminal. The load selected shall be that closest in value to one-half the load applied during the pull test. The body of the component part shall be held with a suitable clamping or attaching device, so that the terminal is in its normal position with respect to the component part. The load shall be suspended at a point within 1/4 inch from the free end of the terminal.

3.3.2 Bending cycle. The body of the component part shall be slowly inclined so as to bend the terminal through 90° and then return it to normal position, as shown on figure 211-3. This entire action shall be limited to one vertical plane. A bend through 90° and return to normal position shall be defined as one bend. Consecutive bends shall be in the same direction. The load shall be restricted such that the bend starts 3/32 ±1/32 inch from the body of the component part. The rate of bending shall be approximately 3 seconds per bend in each direction.

3.3.3 Number of bending operations. The number of bending operations shall be three.

3.4 Test condition D (twist test).

3.4.1 Preparation of specimen. The solid-wire-lead terminal shall be bent 90° at a point 1/4 inch from its juncture with the body of the component part, as shown on figure 211-4. The radius of curvature of the 90° bend shall be approximately 1/32 inch. The free end of the terminal shall be clamped at a point 3/64 ±1/64 inch away from the bend, as shown on figure 211-4.

3.4.2 Application of torsion. The body of the component part or the clamped terminal shall be rotated through 360° about the original axis of the bent terminal, in alternating directions, for a total of three rotations 1080°, at the rate of approximately 5 seconds per rotation.

3.5 Test condition E (torque test).

3.5.1 Direction and application of torque. The torque shall be applied clockwise and then counterclockwise in a plane perpendicular to the axis of the terminal, as shown on figure 211-5.

3.5.2 Duration of applied force. The force shall be applied gradually to the terminal and then maintained for a period of 5 to 15 seconds.

3.5.3 Screw-thread terminals. When testing screw-thread terminals, the torque, in accordance with the terminal size, shall be applied to the centerline of the terminal assembly, as follows:

Screw-thread terminals	Torque (pound-inches)
No. 4	3.0
No. 6	5.0
No. 8	11.0
No. 10	15.0
No. 12	24.0
1/4 inch	32.0

3.5.4 Other non-wire, rigid-type terminals. When testing other non-wire, rigid-type terminals, the applied torque is dependent on the equivalent diameter of the external portion of the terminal assembly. The equivalent diameter is defined as equal to twice the distance from the terminal axis to the point of normal wire connection, as shown in the examples on figure 211-6. The torque shall be applied in accordance with the equivalent diameter, as follows:

Equivalent diameter (inch)	Torque (ounce-inches)
1/16 or less	0
>1/16 to 1/8 inclusive	8
>1/8 to 3/16 inclusive	18
>3/16 to 5/16 inclusive	40
>5/16 to 1/2 inclusive	80
>1/2	As specified in the individual specification

4. MEASUREMENTS. Measurements to be made before and after the test, as applicable, shall be as specified in the individual specification.

5. SUMMARY. The following details are to be specified in the individual specification:

   a. Test condition letter(s) (see 3).

   b. If test condition letter A is specified:

      (1) If pertinent, the method of holding or clamping (see 3.1.1).

      (2) Whether applied force shall be 1/2, 1, 2, 3, 5, 10, or 20 pounds (see 3.1.2).

   c. If test condition letter B is specified:

      (1) If critical, the method of bending and fixture required (see 3.2.2).

      (2) Whether number of bends shall be 2 or 5 (see 3.2.3).

   d. If test condition letter C is specified:

      (1) Whether the load shall be 1/4, 1/2, 1, 5, or 10 pounds (see 3.3.1).

   e. If test condition letter E is specified:

      (1) Torque to be applied to non-wire, rigid-type terminals when equivalent diameter is greater than 1/2 inch (see 3.5.4).

   f. Measurements before and after test, as applicable (see 4).

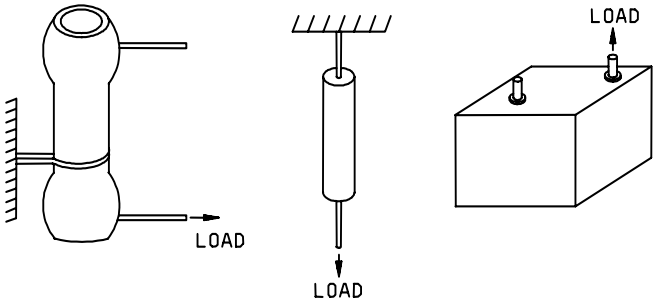


FIGURE 211-1. Test condition A.

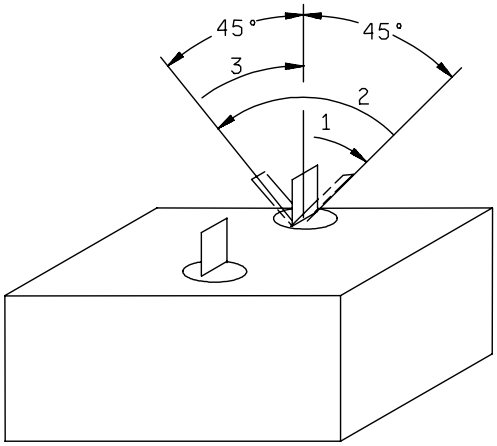


FIGURE 211-2. Test condition B.

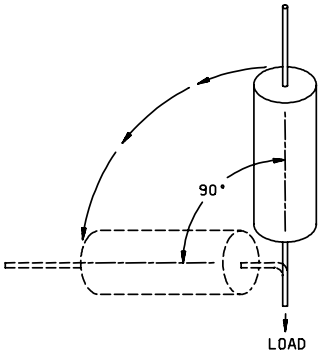
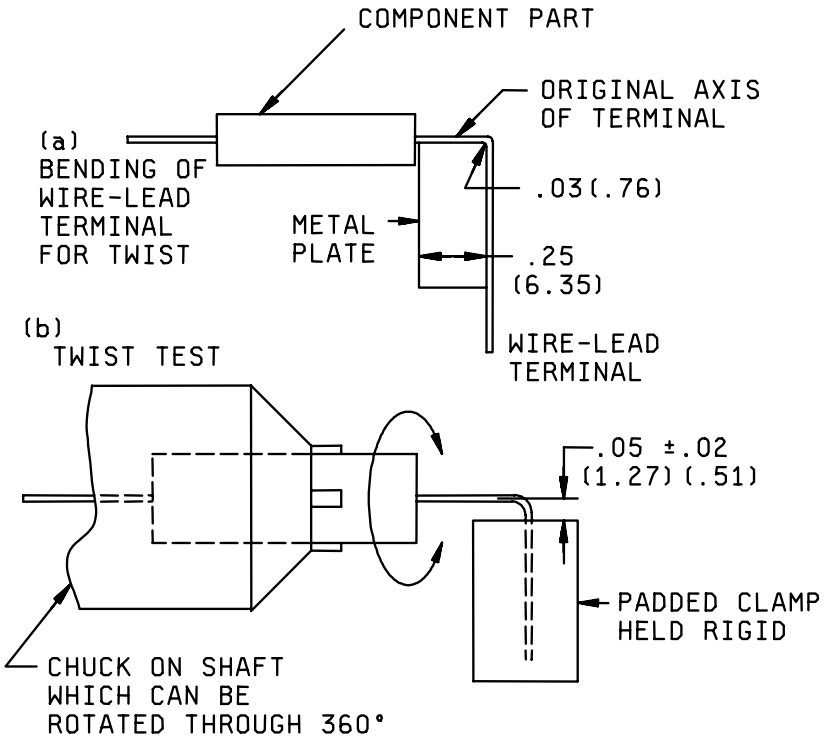


FIGURE 211-3. Test condition C.



STEP 1. Bend lead with fingers, over rounded edge of metal plate as shown in (a).
STEP 2. Center component part in chuck; secure lead in clamp as shown in (b).
STEP 3. Rotate chuck part through 360° at a rate of approximately 5 seconds per 360° rotation. Successive rotations shall be in alternate directions. A total of three such 360° rotations shall be performed. During this test, the chuck shall rotate around an axis which is fixed with respect to the padded clamp, or vice versa. The chuck shall have no appreciable end play during rotation.

NOTE: Metric equivalents are in parentheses.

FIGURE 211-4. Test condition D.

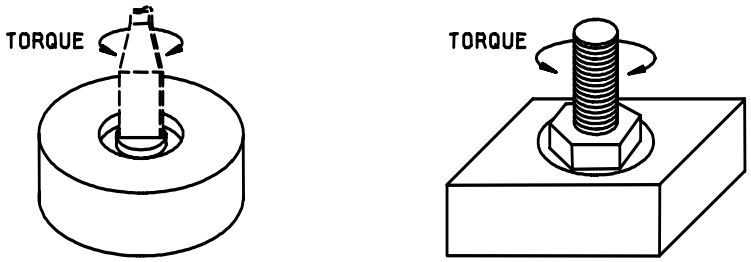
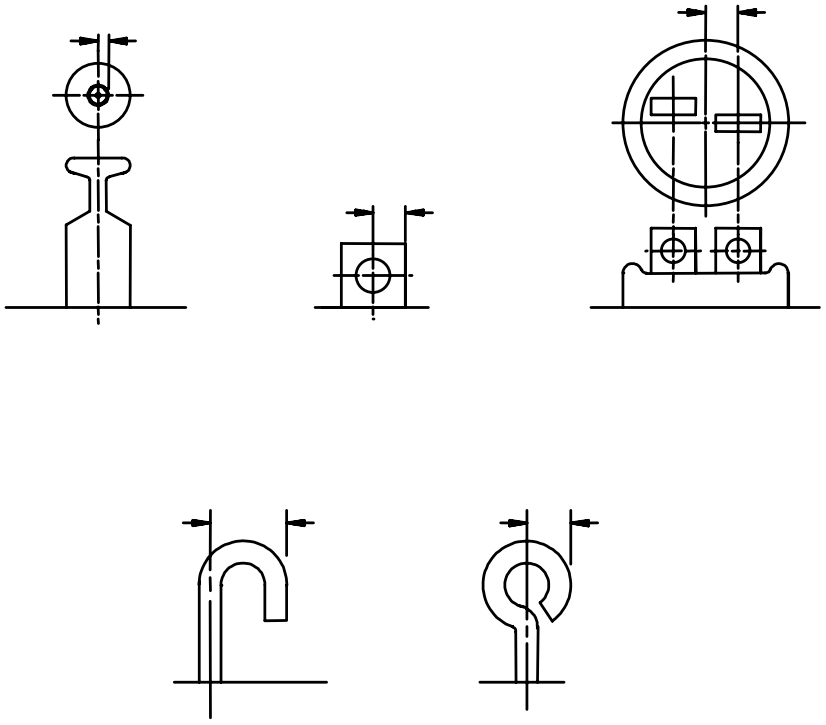


FIGURE 211-5. Test condition E.



NOTE: Equivalent diameter is twice the distance between the lines indicated by the arrows.

FIGURE 211-6. Method of determining equivalent diameter.