Designation: B913 – 05

Standard Test Method for Evaluation of Crimped Electrical Connections to 16-Gauge and Smaller Diameter Stranded and Solid Conductors[1]

This standard is issued under the fixed designation B913; 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 establishes the requirements for a standardized method of evaluating the quality of crimped-type electrical connections to solid or stranded conductors. This test method applies to 16-gauge and smaller diameter copper wire, coated or uncoated.

1.2 This test method is applicable to connection systems intended for indoor use, or for use in environmentally protected enclosures. Additional testing may be required to assure satisfactory performance in applications where high humidity or corrosive environment, or both, may be present.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer, 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]

B8 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B258 Specification for Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors

B542 Terminology Relating to Electrical Contacts and Their Use

3. Terminology

3.1 *Definitions*—Many terms related to electrical contacts used in this test method are defined in Terminology B542.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *crimp*, *v*—to establish an electrical and mechanical attachment between the two members by mechanically deforming one contact member around another. In most cases, one member is a wire or group of wires, the other is a hollow cylinder or partial cylinder that is deformed around the wires.

3.2.2 *crimp barrel, crimp tab*, *n*—the portion of the crimp terminal that is deformed in the crimping operation.

3.2.3 *crimped connection*, *n*—a mechanical and electrical connection between a conductor and a component. The connection is made by compressing (crimping) the component (crimp barrel) or tab(s) of the component about the conductor using a tool specifically designed for the purpose

3.2.4 *crimp terminal*, *n*—an electrical component designed to be electrically and mechanically attached to a wire by deforming a portion of the component in a crimping operation to form an attachment to the wire. The other end of the terminal usually has a ring, fork, spade, tab, or related configuration designed to attach to another connection such as a screw or terminal block.

4. Summary of Test Method

4.1 A test lot of test specimens of the crimp terminal crimped to a short length of wire is prepared. The wire is pulled from a group of the specimens in a tensile pull and the force compared to set requirements based on wire diameter. A separate group of specimens is subjected to an electrical test where resistance stability of the specimen is evaluated during deflection of the wire at the exit of the crimped connection. The group is then aged for 33 days at 118°C and periodically retested in the electrical test. The electrical test results are compared to a standard value based on wire diameter. A test lot passes the evaluation if it passes both the mechanical pull test and the electrical test. In Method B, additional pull tests are

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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.

performed on subgroups of parts during and after the aging test to provide information on progressive degradation in performance.

5. Significance and Use

5.1 This test method establishes the requirements for a standardized method of evaluating the performance of crimped-type electrical connections having solid or stranded conductors.

5.2 In order to achieve a successful crimped connection, the crimping tool must deform the material of the crimp barrel or barrel tab(s) around the conductor. As a consequence, the conductor surfaces are placed under compression by the crimp terminal and areas of contact are established between the conductor and the crimp barrel. These areas provide the desired electrical connection. A reliable crimped connection is one that is capable of maintaining the contact between the conductor and crimp barrel so that a stable electrical connection is maintained when it is exposed to the conditions it was designed to endure during its useful life.

5.3 Evaluation testing is designed to ensure that a particular design crimped connection system consisting of conductor and component and associated tooling is capable of achieving a reliable electrical and mechanical connection. After the evaluation is completed, if any change in the system parts is made, the system should be reevaluated using the same procedures.

5.4 After completion of the evaluation test, the tensile pull strength results may be used to develop acceptance requirements to be used in inspection of subsequent production lots of crimped connections. An example of such an acceptance requirement is shown in Appendix X1.

5.5 The aging test, 33 days exposure at 118°C, has been used in the telecommunications industry to simulate 40 years of service at a moderately elevated temperature of 50°C, an environment that components experience within large banks of telephone equipment. This environment is similar to that seen in a wide range of electronic systems operating indoors containing active components that dissipate power. The test is designed to reproduce the stress relaxation of copper alloys in such service and has been used extensively in evaluating wire wrap connections. It also accelerates other thermally activated processes such as oxidation although their acceleration factors may be different from that of copper stress relaxation.

5.6 The aging test accelerates stress relaxation processes and other thermally activated processes but does not address some other possible hazards such as corrosion. Additional testing may be appropriate if the intended service environment presents such hazards.

6. Interferences

6.1 The wire strain relief included in some crimp terminals may mask the performance of the crimped connection to the wire. The strain relief shall be disabled prior to testing the specimens in this test method.

7. Apparatus

7.1 *Tensile Test Stand, Load cell and grips, or Holding Fixtures*, adequate to measure the force required to pull the crimp terminal off the wire at the speed specified in this test method.

7.2 *Oscilloscope*, with adequate preamplifiers to measure dynamic change of 100 ± 10 μV. An oscilloscope with a recording device is preferred as it can provide a permanent record of the results.

7.3 *Fixture with Two Clamps*, to securely hold the crimp terminal and end of the wire while making an electrical connection to each, and allow for manual deflection of the wire at the exit of the crimp terminal through 15° in all directions. A fixture with two vise-like clamps mounted about 80 mm apart on an insulating base has proved suitable. Spring clips often used with 16 to 24-gauge wire are not adequate; a higher force clamp is needed.

7.4 *dc Power Supply*, capable of providing 100-mA milliamps current through the sample with noise or ripple less than 10 μV on the measured sample

7.5 *Oven*, capable of maintaining a temperature of 118 ± 2°C and with a working volume adequate to contain the crimp test specimens and allow air circulation around them. The oven shall use air from the indoor environment as the air source, no other humidity control is required.

8. Test Specimen

8.1 Prepare the following quantities of test specimens of the crimped connection made with the wire and crimp component to be evaluated. For Test Method A, prepare 64 specimens, for Test Method B, prepare 94 test specimens. For crimped connections that will be manufactured with adjustable crimp dies, prepare 64 (Test Method A) or 94 (Test Method B) test specimens each made with the smallest and largest die setting to which the dies will be set in the manufacture of the actual connections. The wire length beyond the crimp barrel shall be 200 mm (8 in.), minimum. In each test method, the 64 or 94 specimens provide four extra specimens beyond those actually required for testing, the remaining four can be used in test set up or retained as examples of the manufactured test specimens since the testing is destructive. Specifications B8 and B258 define wire gauge (diameter) and wire stranding.

8.2 Document the following items at the time that the specimens are prepared:

8.2.1 Gauge of wire,
8.2.2 Wire conductor stranding,
8.2.3 Wire coating or plating,
8.2.4 Wire manufacturer,
8.2.5 Wire manufacturer's part number for the wire used,
8.2.6 Type of wire insulation,
8.2.7 Terminal supplier name,
8.2.8 Terminal supplier's part number for the terminal,
8.2.9 Crimping tool supplier name,
8.2.10 Crimping tool supplier part number, and