

MIL-T-13513A(AT)
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SUPERSEDING
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MILITARY SPECIFICATION

TERMINAL, LUG; SPLICE, CONDUCTOR (ELECTRICAL,
SOLDERLESS, FOR AUTOMOTIVE USE)

1. SCOPE

1.1 This specification covers crimp-type, solderless, electrical terminals and splices for insulated electrical cable and wire for automotive vehicles.

1.2 Classification. Terminals and splices shall be of the following types:

- Type I - Terminals - Non-waterproof
- Type II - Terminals - Waterproof
- Type III - Splices.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

- QQ-C-450 - Copper, Aluminum Alloy (Aluminum Bronze) Plate, Sheet, Strip, and Bar (Copper Alloy Numbers 606, 612, 613, 614, and 628).
- QQ-C-465 - Copper, Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630, and 642); Rod, Flat Products with Finished Edges (Flat Wire, Strip, and Bar) Shapes, and Forgings.
- QQ-C-502 - Copper Rods and Shapes; and Flat Products with Finished Edges (Flat Wire, Strips and Bars).
- QQ-P-416 - Plating, Cadmium (Electrodeposited).

FSC-5940

MIL-T-13513A(AT)

Military

- MIL-T-10727 - Tin Plating; Electrodeposited or Hot Dipped, For Ferrous and Non-Ferrous Metals.
- MIL-C-13486 - Cable, Special Purpose, Electrical: Low Tension Heavy Duty Single-Conductor and Multi-Conductor.

STANDARDS

Military

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Materials.

3.1.1 Type I and III. Type I terminals and type III splices shall be fabricated of copper or aluminum bronze conforming to QQ-C-450, QQ-C-465 or QQ-C-502, respectively.

3.1.2 Type II. Type II terminals shall be fabricated of materials as specified on Army Drawing 7056700.

3.2 Construction. Splices and type II terminals shall be constructed as specified herein and on Army Drawing 7056700.

3.3 Performance. Terminals or splices, when connected to the intended cable(s) by the applicable crimping tool shall meet the performance requirements specified herein.

3.3.1 Voltage drop.

3.3.1.1 Terminals. The terminals shall meet the "initial" voltage drop as specified in table I.

3.3.1.2 Splices. The splices shall meet the "initial" voltage drop as specified in table I, except that these values shall be increased by 33 percent.

MIL-T-13513A(AT)

Table I. Test Requirements

Cable Size (A.W.G.)	Test Current Amperes \pm 5%	Max. Voltage Drop Millivolts		Mechanical Strength (minimum) pounds
		Initial	After Test	
20	11	7	12	19
18	16	7	12	28
16	22	7	12	37
14	32	6	11	45
12	44	5	8	95
10	69	5	8	150
8	95	5	8	195
6	139	5	8	270
4	165	5	8	350
2	226	5	8	555
1	264	5	8	650
0	307	5	8	760
00	353	5	8	860
0000	460	5	8	1000

3.3.2 Current rating. The terminal or splice temperature shall not exceed by more than 9°F the temperature of the attached conductor stranding when tested as specified in 4.3.5.

3.3.3 Current overload. The terminal or splice temperature shall not exceed by more than 15°F the temperature of the attached conductor stranding when tested as specified in 4.3.6. The value recorded in the subsequent voltage drop test shall meet the "after test" requirements specified in table I.

3.3.4 Mechanical strength. The terminals or splices, when tested as specified in 4.3.7, shall withstand the minimum mechanical strength requirements of table I without breaking or becoming distorted to the extent that they are unfit for further use.

3.3.5 Vibration. The terminals or splices, when tested as specified in 4.3.8, shall show no evidence of mechanical or electrical failure. The results of the voltage drop and mechanical strength tests performed after the vibration test shall show no evidence of leakage.

3.3.6 Waterproofness. Type II terminals, when tested as specified in 4.3.9, shall show no evidence of leakage.

3.4 Crimping tools. The crimping tools used to crimp the terminals or splices onto the conductor wire shall be provided by the terminal manufacturer.

3.5 Protective finish. The terminals or splices shall be tin plated in

MIL-T-13513A(AT)

accordance with type II, .0003 minimum plate thickness - 200 hours, salt spray test of MIL-T-10727 or cadmium plated in accordance with type I, class B of QQ-P-416.

3.6 Identification of product. Each terminal or splice shall have molded or stamped in its surface the manufacturer's name or symbol, and the cable (conductor) size or limiting sizes for which it is designed.

3.7 Workmanship. Workmanship employed in fabricating the terminals or splices shall be of a quality necessary to produce terminals or splices free from all defects which may affect their functioning or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Preproduction inspection. A preproduction sample of one terminal or splice shall be subjected to preproduction inspection by the contractor. The sample shall be representative of item(s) proposed to be furnished under the contract and shall be subjected to the examinations specified in 4.2.2.2 and tests in 4.2.3.1.

4.2.1 Failure. Failure of the preproduction sample to conform to any of the specified requirements, shall be cause for rejection of the item(s). Acceptance of subsequent item(s) shall be withheld by the Government and inspection discontinued until corrective measures have been taken by the contractor to eliminate the defect(s) from production.

4.2.1.1 Quality conformance inspection.

4.2.1.2 Sampling.

4.2.1.3 Lot formation. A lot shall consist of all terminals or splices of one type and size, from an identifiable production period, from one manufacturer, submitted at one time for inspection.

4.2.1.4 Sampling for examination. Samples for quality conformance shall be selected in accordance with MIL-STD-105.

4.2.1.5 Sampling for testing. A representative sample shall be selected

MIL-T-13513A(AT)

in accordance with level S-3 of MIL-STD-105 from each lot that has passed the examination specified in 4.2.2.2.

4.2.2 Examination.

4.2.2.1 Acceptable quality level. Each terminal or splice selected in accordance with 4.2.1.2 shall be examined for conformance to the following acceptable quality levels (AQL) on the basis of percent defective.

<u>Classification</u>	<u>AQL</u>
Major	1.0
Minor	2.5

4.2.2.2 Classification of defects. For examination purposes, defects shall be classified as specified in table II.

Table II. Classification of Defects in accordance with MIL-STD-105

<u>Categories</u>	<u>Defects</u>	<u>Method of Inspection</u>
Major:		
101.	Dimensions affecting interchangeability not within tolerance (see 3.2).	SIE*
Minor:		
201.	Dimensions not affecting interchangeability not within tolerance (see 3.2).	SIE*
202.	Improper marking (see 3.6).	Visual
203.	Faulty workmanship (see 3.7).	Visual**

*Standard Inspection Equipment

**The workmanship shall be such as to assure the item(s) to be free of rust, burrs, cracks, dirt, faulty or incomplete connection or other defects which would affect safety of personnel, serviceability or appearance.

4.2.3 Testing.

4.2.3.1 Quality conformance test. Each sample selected in accordance with 4.2.1.3 shall be subjected to the tests specified in table III using an AQL of 2.5 on the basis of percent defective. The test terminals shall be assembled by the supplier to the proper conductor using applicable tooling.

MIL-T-13513A(AT,

Table III. Order of Quality Conformance Testing

<u>Paragraph</u>	<u>Test</u>
4.3.4	Voltage drop test
4.3.5	Current rating
4.3.6	Current overload
4.3.7	Mechanical strength
4.3.8	Vibration
4.3.9	Waterproofness (Type II only)

4.3.3 Test conditions and equipment. Except where other test conditions are specified, all tests shall be performed in still air, at a temperature of $80 \pm 10^{\circ}\text{F}$. Terminals or splices shall be properly crimped (see 3.4) onto test cables. Voltage drop measurements shall be made only after temperature stabilization of the terminal or splice and attached cable stranding.

4.3.4 Voltage drop test.

4.3.4.1 Terminals. To determine compliance with 3.3.1.1, the terminal and attached cable shall be connected into a circuit adjusted to pass the current specified in table I. The millivolt drop shall be measured from the intersection of the tongue and barrel to a point on the cable $1/4$ inch from the open end of the barrel. When terminals have cable insulation supports, this point shall be $1/8$ inch from the end of the support. The voltage drop and test current values shall be recorded.

4.3.4.2 Splices. To determine compliance with 3.3.1.2, the splice and attached cables shall be connected into a circuit adjusted to pass the current specified in table I. The millivolt drop shall be measured from a point $1/4$ inch from the barrel of one conductor to a point $1/4$ inch distant from the barrel on the other conductor. The millivolt drop and test current values shall be recorded.

4.3.5 Current rating test. To determine compliance with 3.3.2, the terminal or splices and attached cable(s) shall be connected into a test circuit adjusted to pass the current specified in table I. The current shall be continued until the temperature of the terminal or splices and attached cable stranding have stabilized. These stabilized temperature values shall be recorded. The temperature of the splice or terminal shall be measured by means of a thermocouple at the barrel diametrically opposite the crimp. The temperature of the cable stranding shall be measured by means of a thermocouple installed in the stranding at a minimum distance of $2\frac{1}{2}$ inches from the terminal or splice and the power source.

4.3.6 Current overload test. To determine compliance with 3.3.3, 125 percent of the current specified in table I shall be passed through the terminal or splice and attached cable for 2 hours and the stabilized temperatures recorded (see 4.3.5). The samples will then be allowed to return to room temperature

MIL-T-13513A(AT)

after which 200 percent of the current specified in table I shall be passed through the terminal or splice and attached cable for five minutes and the stabilized temperatures recorded (see 4.3.5). Subsequent to these tests, the samples shall be allowed to return to room temperature and tested as specified in 4.3.4.

4.3.7 Mechanical strength. The test specimens shall be placed in a standard tensile testing machine and sufficient force shall be applied to pull the cable out of the terminal or splice, or break the cable, terminal, or splice. The condition of the terminal or splice shall be examined as the minimum mechanical strengths, as specified in table I, are reached to determine compliance with 3.3.4. The tests shall be made at room temperature with the speed of the machine head no less than 4 inches per minute.

4.3.8 Vibration test. To determine compliance with 3.3.5, the terminal or splice and an attached 15 inch length of cable shall be mounted on a vibration table and the end of the cable secured to a stable support 12 inches from the terminal. The terminal or splice shall be vibrated for 1 hour in each of 3 perpendicular planes at an amplitude of 0.030 in. (0.060" in total excursion) and a frequency of 10 to 55 to 10 cycles per second, the frequency range to be accomplished once each minute. Subsequent to this test, the terminals or splices shall be subjected to the tests specified in 4.3.4 and 4.3.7.

4.3.9 Waterproofness test. To determine compliance with 3.3.6, a type II terminal shall be attached to one end of a 6 inch length of cable. No less than 3 inches of the terminal end of the cable shall be immersed in water in such a manner that hydrostatic pressure can be applied. Hydrostatic pressure of 6 psi shall be applied to the water, in which the specimen is immersed, for 6 hours. The cable shall then be cut apart and examined for evidence of leakage through the terminal end.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking. Preservation, packaging, packing and marking shall be in accordance with the Packaging Standard or Packaging Data Sheet for the desired Level of Protection specified (see 6.2).

6. NOTES

6.1 Intended use. Terminals or splices covered by this specification are commonly known as solderless cable lugs and are used with electrical cable for automotive vehicles.

6.1.1 Type I. Type I terminals are intended for use with cable conforming to MIL-C-13486 and similar electrical cable specifications.

6.1.2 Type II. Type II terminals are intended for use with waterproof cable conforming to MIL-C-13486.

MIL-T-13513A(AT)

6.1.3 Conductor splices. Type III conductor splices are primarily intended for use in permanently splicing two conductors.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Type and size (see 1.2 and 3.2).
- c. Army part number and applicable drawings (see 6.2 and 6.3).
- d. Selection of applicable packaging standard or packaging data sheet (see 5.1).
- e. Selection of method and applicable level of Preservation and Packaging and Level of Packing of referenced specification (see 5.1).

6.3 Applicable drawings. Applicable drawings include Army Drawing 7056700, which details a variety of sizes of terminals and Army Drawing 8722729, wiring harness assembly requirements.

Custodian:
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Preparing activity:
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