

NUMBER
108-13013

PRODUCT SPECIFICATION

COPALUM* STRANDED/SOLID TERMINALS AND SPLICES

1.0 SCOPE

This specification contains performance requirements and test procedures for the qualification of AMP* COPALUM stranded/solid terminals and splices. Terminals and splices covered by this specification are intended for the termination of solid or stranded aluminum or copper wire, sizes 20 AWG to 600 MCM.

2.0 APPLICABLE DOCUMENTS

2.1 The following specifications and standards form a part of this specification to the extent specified herein.

2.1.1 Military Specifications.

MIL-C-50	Brass, Cartridge, Strip
MIL-T-10727	Tin Plating, Electrodeposited

2.1.2 Federal Specifications.

QQ-C-576	Copper
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2.1.3 Test Specifications.

MIL-C-45662	Calibration of Standards
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes

3.0 REQUIREMENTS

3.1 Design and Construction. Terminals and splices shall be of the design, construction, and physical dimensions specified on the applicable AMP Product Drawing.

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LTR	REVISION RECORD	DR	CHK	DATE	COPALUM STRANDED/SOLID TERMINALS AND SPLICES			

- 3.2 Materials and Finish. The materials used in the construction of these terminals and splices and the finish or plating of the product shall be as specified on the applicable AMP Product Drawing.
- 3.3 Functional Characteristics.
- 3.3.1 Wire Range. Terminals and splices shall be manufactured in different sizes to accommodate wire sizes 20 AWG through 600 kcmil.
- 3.3.2 Recommended Wire. Terminals and splices shall satisfactorily terminate stranded or solid, aluminum or copper wire. Conductors may be either rectangular, square or round configuration. Strict attention shall be paid to Instruction Sheets when splicing aluminum conductors to copper conductors.
- 3.3.3 Crimping Tools. Crimping tools shall be of both hand and power operated types, having straight or scissors action.
- 3.4 Performance. Terminals and splices shall be designed to meet the performance requirements specified herein. To verify compliance to this specification, representative samples shall be subjected to the tests specified in Table I.
- 3.4.1 Voltage Drop. When measured as specified in Paragraph 4.6.2, the Voltage Drop measurement of each sample shall be recorded every 50 cycles from the 50th to the 500th cycle. The voltage drop across each termination shall not increase by more than 10 percent at any point throughout the test, from the 50th to the 500th cycle. In addition, at each measurement interval, all voltage drop values shall be within ± 10 percent of the average of the voltage drop measurements for that group.
- 3.4.2 Tensile Strength. Terminals and splices shall not break or become separated from the wire or cable at a value less than 75% of the average tensile strength of the wire being tested. The methods used for testing samples and obtaining wire strength values are described in Paragraph 4.6.3.

SHEET

2 OF 7

AMP INCORPORATED
Harrisburg, Pa.

LOC

A

NO.

108-13013

REV

C

NAME

COPALUM STRANDED/SOLID
TERMINALS AND SPLICES

3.4.3 Current Cycling. When tested as specified in Paragraph 4.6.4, the temperature of each terminal or splice shall not increase more than 10°C (18°F) at any test point throughout the test from the 50th to the 500th cycle. In addition, at each measurement interval, the temperature of each termination shall be within ±10°C (18°F) of the average of the temperatures of that group.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 General Provisions. The quality provisions specified herein shall be employed in the manufacturing and testing of this product to insure that normal production units continue to meet the performance requirements of this specification.

4.2 Classification of Test.

- (A) Qualification Inspection (See 4.4)
- (B) Quality Conformance Inspection (See 4.5)

4.3 Test Conditions.

4.3.1 Measurements. Measurements shall be taken with instruments that have been calibrated in accordance with specification MIL-C-45662.

4.3.2 Laboratory Conditions. Unless otherwise specified, normal laboratory temperature, humidity, and atmospheric pressure shall be considered acceptable for test purposes.

4.4 Qualification Inspection.

4.4.1 Sample Selection. Terminals selected for test purpose shall be representative of current design and construction. Preparation of test samples shall be conducted in accordance with AMP Instruction Sheets governing assembly and crimping technique.

4.4.2 Test Procedure. Qualification Inspection shall be conducted in accordance with Table I in the sequence specified.

SHEET 3 OF 7			AMP INCORPORATED Harrisburg, Pa.	
	LOC A	NO. 108-13013	REV C	
NAME COPALUM STRANDED/SOLID TERMINALS AND SPLICES				

4.4.3 Sample Preparation.

- 4.4.3.1 Terminals. Five test samples shall be prepared for each wire size, each test sample consisting of a 15 inch length of wire with a terminal crimped to each end.
- 4.4.3.2 Splices. For each wire size, five splices shall be crimped to the ends of 15 inch lengths of wire, attaching them together in chain fashion.

TABLE I

Qualification Inspection Sequence	
Test or Examination	Test Sequence
Examination of Product	1
Voltage Drop	2-4*
Tensile Strength	5
Current Cycling	3

* Every 50 cycles, from the 50th to the 500th cycle.

4.5 Quality Conformance Inspection.

- 4.5.1 Sample Selection. Unless otherwise specified, sampling procedures shall be in accordance with MIL-STD-105. Sampling and Acceptable Quality Levels shall be as specified in the applicable AMP Quality Engineering Procedure. Dimensional requirements shall be in accordance with the applicable AMP Product Drawing.
- 4.5.2 Test Procedure. Terminals supplied in accordance with this specification shall meet the requirements for Quality Conformance Inspection, Table II. Examination and test shall be conducted in the order specified.

SHEET 4 OF 7	 AMP INCORPORATED Harrisburg, Pa.	
	LOC A	NO. 108-13013
NAME COPALUM STRANDED/SOLID TERMINALS AND SPLICES		REV C

TABLE II

Quality Conformance Inspection	
Test or Examination	Test Method
Examination of Product Tensile Strength	Quality Engineering Procedure Paragraph 4.6.3

4.6 Test Methods.

4.6.1 Examination of Product. Test samples shall be visually examined before and after crimping to assure proper manufacturing and assembly in accordance with the manufacturer's drawings and crimping instructions.

4.6.2 Voltage Drop. The voltage drop shall be measured across terminations while the specified test current is flowing through the samples. Measurements shall be taken as follows, after sample temperature has returned to ambient room temperature.

4.6.2.1 Terminals. One voltmeter probe shall be located on each terminal of a test sample at the intersection of the tongue and barrel. The measurement includes two terminations and the length of wire between them.

4.6.2.2 Splices. One voltmeter probe shall be located in the center of each of two adjacent splices. The measurement includes two terminations and the length of wire between them. Four measurements will be obtained from each group of samples.

4.6.2.3 Test Current. The following test currents shall be used to obtain the voltage drop measurements.

<u>Wire Size</u>	<u>Test Current (Amperes D.C.)</u>
20 to 10	5
8 to 2	20
1/0 to 600 MCM	50

SHEET 5 OF 1			AMP INCORPORATED Harrisburg, Pa	
	LOC	A	NO.	108-13013
NAME		COPALUM STRANDED/SOLID TERMINALS AND SPLICES		
			REV	C

The voltage drop across test samples shall meet the performance requirements specified in Paragraph 3.4.1.

4.6.3 Tensile Strength. Test samples shall be placed in a standard tensile testing machine, and an axial force applied between the connectors and the wire at a rate of 1 inch per minute travel. The following details shall apply.

4.6.3.1 Terminals. The tensile force shall be exerted from the tongue of one terminal to the tongue of the other terminal on a test sample.

4.6.3.2 Splices. The test chain shall be cut midway between each splice and the ends of the wire soldered so that an equal force is applied to each strand. The soldered wire ends shall be placed in the jaws of the tensile machine.

4.6.3.3 Control Wire. The average breaking strength of the wire or cable used for testing shall be determined from three 10 inch lengths of the same wire as that used in sample preparation. The ends of stranded wires shall be soldered so that an equal force is applied to each strand.

The tensile force shall be applied to the test samples until a terminal or splice breaks or becomes separated from the wire. Samples shall meet the performance requirements of Paragraph 3.4.2.

4.6.4 Current Cycling. Test samples shall be assembled and tested in the following manner.

4.6.4.1 Terminals. Test samples shall be bolted back-to-back using steel bolts, nuts, and washers of the proper size for the terminal stud hole. The flat washers shall be placed against the terminal tongue, and a steel spring lock washer between the nut and flat washer. The bolt shall not extend more than 1/8 inch beyond the nut.

SHEET				AMP INCORPORATED Harrisburg, Pa.	
6 OF 7		LOC	A	NO.	108-13013
NAME		COPALUM STRANDED/SOLID TERMINALS AND SPLICES			
				REV	C

- 4.6.4.2 Splices. The specified lengths of wire shall be attached together in chain fashion by crimping a splice to each end of the wires.
- 4.6.4.3 Lead-in Wire. Three foot lengths of the same size and type of wire shall be used to connect the test sample chain to the power supply.
- 4.6.4.4 Thermocouple Placement. For control wire temperature measurements, a thermocouple shall be embedded in the strands or conductor bundle of one of the lead-in wires 18 inches from the terminal or splice. For sample temperature measurements on terminals or parallel splices, thermocouples shall be attached to the wire barrels in the center of the crimp area. On butt splices, thermocouples shall be attached in the window area between the two wire barrels.
- 4.6.4.5 Testing. Test specimens shall be placed in a draft-free room at the normal ambient temperature. The test current shall be established by adjusting the power supply so that sufficient current flows through the sample chain to raise the control wire temperature to $150^{\circ} \pm 3^{\circ}\text{C}$ ($296 - 307^{\circ}\text{F}$). Stabilization has occurred when three consecutive temperature measurements taken at 5 minute intervals indicate a change of less than 3°C . Using this test current, 500 "current on/current off" cycles shall be performed, each cycle consisting of the following time durations.

Wire Size	"Current on" (minutes)	"Current off" (minutes)
#20 thru 2/C	45	15
3/0 thru 600 kcmil	90	30

Forced air cooling shall be used, if necessary, to cause the sample chain temperature to return to room ambient, or as close as possible, in the allotted "current off" period. Temperature measurements shall be made during the final 10 minutes of the "current on" period of the first cycle, then every 25 cycles to 250, then every 50 cycles to the 500th cycle. Samples shall meet the performance requirements of Paragraph 3.4.3.

SHEET

7 OF 7

AMP INCORPORATED
Harrisburg, Pa.

LOC

A

NO.

108-13013

REV
C

NAME

COPALUM STRANDED/SOLID
TERMINALS AND SPLICES