MILITARY SPECIFICATION

TERMINAL, LUG: SOLDER, COPPER AND PHOSPHOR BRONZE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers copper and phosphor bronze or tin brass strip solder electrical lug terminals.

1.2 Classification. Lug terminals shall be of the following classes:

Class 1 - Stamped copper sheet
Class 2 - Punched copper tubing
Class 3 - Stamped phosphor bronze or tin brass strip (locking type terminal)

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-566	-	Boxes, Folding, Paperboard
PPP-B-601	-	Boxes, Wood, Cleated-Plywood
PPP-B-621	-	Boxes, Wood, Nailed and Lock-Corner
PPP-B-636	-	Boxes, Shipping, Fiberboard
PPP-B-676	-	Boxes, Setup
PPP-T-60	-	Tape: Packaging, Waterproof
PPP-T-76	-	Tape, Packing, Paper(For Carton Sealing)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document, should be addressed to: Commander, U.S. Army ARDEC, ATTN: SMCAR-ESC-S, Picatinny Arsenal, New Jersey 07806-5000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MILITARY

MIL-P-116	-	Preservation, Methods of
MIL-T-10727	-	Tin Plating, Electrodeposited or Hot-Dipped for Ferrous and Nonferrous Metals

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	-	Marking for Shipment and Storage
MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts
MIL-STD-1190	-	Minimum Guidelines, for Level C Preservation, Packing and Marking.
MS Sheet form Standards	-	(see supplement 1)

(Copies of specifications, standards, handbooks, drawings, publications, and other government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

CONSOLIDATED CLASSIFICATION COMMITTEE

Uniform Freight Classification

(Application for copies of these freight classification rules should be addressed to Consolidated Classification Committee, 202 Chicago Union Station, Chicago, IL).

AMERICAN TRUCKING ASSOCIATION, INC.
National Motor Freight Classification No. A-3 and No. 13

(Application for copies of these motor freight classification publications should be addressed to the American Trucking Association, Inc. Traffic Department, 1424 Sixteenth Street, NW, Washington, DC.)

AEROSPACE MATERIAL SPECIFICATION

AMS 4500 - Copper, Sheet, Strip and Plate Soft Annealed (CDA 110)

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

ASTM

ASTM B 188 - Seamless Copper Bus Pipe and Tube
ASTM B 508 - Copper-Alloy Strip for Flexible Metal Hose
ASTM B 591 - Copper-Zinc-Tin Alloys Plate, Sheet, Strip, and Rolled Bar

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Material. The Class 1 lug terminals shall be fabricated of electrolytic copper, sheet, alloy C11000, temper 060, in accordance with AMS 4500. The Class 2 lug terminals shall be fabricated of electrolytic copper tubing, alloy C11000, temper 060, in accordance with ASTM B 188. The Class 3 lug terminals shall be fabricated of phosphor bronze strip (1.3% tin) alloy C50500, annealed, in accordance with ASTM B 508. As an alternative material, copper, strip alloy C42500, annealed, in accordance with ASTM B 591 may be used.

3.2 Design and fabrication. All lug terminals shall be designed for attachment to their appropriate conductor size as shown on the applicable MS sheet form standards (see supplement 1).

3.2.1 Dimensions. Dimensions and tolerances shall be in accordance with the applicable MS sheet form standards (see supplement 1).

3.2.2 Finish. Lug terminals shall be tinned over their entire surface by electrodepositing process, in accordance with MIL-T-10727.

3.2.2.1 Thickness of plating. The minimum thickness of electrodeposit tin plating shall be 0.0005 inches.

3.2.3 Tooth construction for locking type lug terminals. The number of teeth, length of teeth and the free height (thickness of the lug over the teeth) shall be optional with the manufacturer. The teeth shall be uniform in number and symmetrical with respect to the size, shape, and angle of the twist or of the bent edges.

3.3 Performance.

3.3.1 Solderability. The lug terminal electrodeposit finish shall be considered solderable when 95% of the total length of the fillet between the standard wrap wire and the terminal, are tangent to the surface of the terminal free of pinholes and voids. There shall not be a ragged or interrupted line at the point of tangency between the fillet and terminal.

3.3.2 Bending. That portion of Class 1 and 3 lug terminals requiring forming around the conductor and insulation shall be capable of being bent to the shape that they will normally be subjected to in use. The lug terminal shall not exhibit evidence of cracking of the base metal, flaking or peeling of the finish.

3.3.3 Salt spray (corrosion). The lug terminal, after being subjected to the salt spray test, shall show no evidence of corrosion (see 4.3.2.3).

3.3.4 Compression (for class 3 only). The locking type lug terminals shall withstand compression between two steel plates without evidence of fracture of teeth (see 4.3.2.4).

3.3.5 Flattening resistance (for Class 3 only). The locking type lug terminals shall withstand compression between two steel plates without evidence of teeth being flattened with respect to the lug terminal.

3.4 First Article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3 and 6.2).

3.5 Workmanship. Lug terminals shall be manufactured and processed in such a manner as to be uniform in quality and shall be free from burrs and other defects that would affect serviceability or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows.

a. First article inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 First Article Inspection.

4.3.1 Submission. The contractor shall submit a first article sample as designated by the Contracting Officer for evaluation in accordance with provisions of 4.3.2. The first article sample shall consist of 30 lug terminals of each class.

4.3.2 Inspections to be Performed. First article lug terminals and test specimens may be subjected by the Government to any or all of the examinations and tests specified in this detail specification and to any or all requirements of the applicable MS sheet standards. Five sample units shall be examined for all group A inspections (see Table I) and five sample units shall be subjected to each of the group B inspections (see Table II).

4.3.3 Rejection. If any lug terminal or test specimen fails to comply with any of the applicable requirements, the first article sample shall be rejected. The Government reserves the right to terminate its inspection upon any failure of a lug terminal or test specimen in the sample to comply with any of the stated requirements.

Table I - Group A Inspection

Examination	Requirement paragraph	Defect classification	AQL percent defective	Method of inspection
Material	3.1	major	1.5	certification
Dimensions:	3.2.1			
Dia. of holes		major	1.5	gage
Dist. between hole centers		minor	1.5	gage
Length		minor	6.5	gage
Thickness		minor	6.5	gage
Width		minor	6.5	gage
Radius incorrect		minor	6.5	visual
Protective finish missing or inadequate	3.2.2	major	1.5	visual
Workmanship	3.5	minor	6.5	visual

Table II - Group B Inspection

Inspection	Requirement paragraph	Defect classification	No. of test units	Test paragraph
Solderability	3.3.1	major	4	4.4.5.1
Bending	3.3.2	major	4	4.4.5.2
Salt Spray (corrosion)	3.3.3	major	4	4.4.5.3
Compression	3.3.4	major	4	4.4.5.4
Flattening resistance	3.3.5	major	4	4.4.5.5

4.4 Quality Conformance inspection.

4.4.1 Inspection Lot. An inspection shall consist of lug terminals of the same class, produced under the same production processes, and offered for inspection at one time and complying with the provisions for submission of products as specified in MIL-STD-105.

4.4.2 Examination. Examination of lug terminals shall consist of the group A inspection shown in Table I. Statistical sampling and inspection shall be in accordance with MIL-STD-105, inspection level II. The AQL shall be in accordance with Table I.

4.4.3 Testing. Testing shall consist of the group B inspections shown in Table II. No failures shall be allowed for group B inspection. Four sample units shall be subjected to each group B inspection from the first production lot and thereafter once every six months from a current production lot. When failure occurs, the lot shall be rejected and the contractor shall take corrective action. Group B inspection shall continue to be conducted on every subsequent lot until the requirements of group B are met, whereupon, testing every six months may be resumed. Samples subjected to Group B inspection shall not be returned to the lot.

4.4.4 Inspection Equipment. The contractor shall be responsible for having avialable and utilizing correctly, the inspection equipment required to perform the examinations and tests prescribed herein.

4.4.5 Methods of Inspection.

4.4.5.1 Solderability (see 3.3.1). Terminals shall be tested in accordance with method 208 of MIL-STD-202. The following details and exceptions shall apply.

a. Number of terminals to be tested - see 4.3.1

b. Examination of terminations - Method for evaluation of lug terminals

4.4.5.2 Bending. The test specimens shall have their wire or conductor grips shaped around a steel mandrel whose diameter is equivalent to the wire or conductor diameter normally intended for the lug terminal under test. The test specimens shall then be inspected for compliance with the requirements of 3.3.2.

4.4.5.3 Salt spray (corrosion). The salt fog test for corrosion shall be in accordance with Method 101, test condition A of MIL-STD-202. Lug terminals shall be mounted in a horizontal position in a salt fog chamber. Adjoining samples shall be separated by at least 1/4 inch. During this test the lug terminals shall not come in contact with metallic or wooden objects, and the salt fog shall have free access to the samples. At the end of this test the specimens shall be examined immediately to determine compliance with the requirements of 3.3.3.

4.4.5.4 Compression and flattening test for locking type lug terminals. The locking tooth portion of the lug terminal shall be placed between two cold rolled steel plates having a hardness on the Rockwell B scale of 85 to 90. A course-thread bolt (of appropriate size for the lug terminal) is passed through the plates and tightened until the terminal is flat. The nut shall then be turned an additional 1/3 of a turn and held for twelve hours. Upon release, the terminal shall have a minimum height equal to 85% of the free height (3.2.3). There shall be no evidence of fracture of teeth. The teeth shall not be flattened with respect to the lug terminal.

5. PACKAGING

5.1 Preservation. Preservation shall be Level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Terminals shall be cleaned in accordance with MIL-P-116, Process C-1.

5.1.1.2 Drying. Terminals shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative Application. None required.

5.1.1.4 Unit Packs. Unless otherwise specified, identical lug terminals (lug terminals of the same stock number) shall be unit packaged in accordance with Method III of MIL-P-116 in quantities as specified in Table III.

5.1.1.5 Intermediate Packs. Terminals packed as described in 5.1.1.4 shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size and shape, shall be of minimum tare and cube, and shall contain multiples of five unit packages, not to exceed 100 packages or ten pounds. No intermediate packaging is required when the total quantity shipped to a single destination is less than 100 units.

5.1.2 Level C. Terminals shall be packed in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from supply source to the first receiving activity. This package may conform to the supplier's commercial practice for retail distribution when it meets the requirements of MIL-STD-1190.

TABLE III

TERMINAL DESCRIPTION

CLASS	MOUNTING	AWG SIZE OR RANGE	PACKAGE UNIT QUANTITY
1	All designs	20-00	100
2	1 hole	10-00	100
2	2 hole	10-0	100
2	1 hole	000 and 0000	50
2	2 hole	00 and 000	50
2	1 hole	250000 CM	25
2	2 hole	0000	25
2	2 hole	250000 CM	10
2	All designs	Larger than 250000 CM	1
3	All designs	20-12	100

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. The packaged terminals shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirement. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners, and manufacturer's joint with waterproof tape, 2 inches minimum width, conforming to PPP-T-60, Class 1, or PPP-T-76. Containers shall be overpacked in accordance with PPP-B-601, Type overseas, Style A or B, or PPP-B-621, Class 2, style optional. Banding (reinforceing requirements) shall be applied in accordance with the appendix to PPP-B-636, using non-metallic or tape banding only.

5.2.2 Level B. Unless otherwise specified, the packaged terminals shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, and special use requirement. Closures shall be in accordance with appendix thereto. For Army shipments, containers shall be CLASS weather resistant, style optional, special requirement.

5.2.3 Level C. The packaged terminals shall be packed in a shipping container in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity. This pack shall conform to the applicable carrier rules and regulations and may be the supplier's commercial practice when it conforms to the requirements of MIL-STD-1190.

5.3 Marking. In addition to any special marking required by the contract or order, each unit pack, supplementary, intermediate, and exterior container shall be marked in accordance with MIL-STD-129.

5.3.1 Unit Pack Marking. Each unit pack shall have the complete MS part number, the American Wire Gauge (AWG) numerical size or range and the manufacturer's trademark stamped on its surface in accordance with MIL-STD-129.

5.4 General. Exterior containers shall be of minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent possible.

5.5 Inspection. Inspection of military packaging shall be in accordance with MIL-P-116 (see section 4).

6. NOTES

6.1 Intended use. The copper lug terminals are intended for use where normal operating temperatures are maintained in an area using connecting feeder cables to distribution panels. The locking type lug terminals are intended for applications where it is desired to maintain a positive electrical contact when equipment is subjected to vibration.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number and date of this specification.

b. Class of lug terminal desired (see 1.2).

c. Applicable Military Standard Part Number(s).

d. Level of preservation, packaging and packing.

e. Provisions for first article inspection.

6.3 Indirect shipment. The preservation, packaging, packing, and marking requirements (see section 5) apply only to direct purchases by or direct shipments to the Government and are not intended to apply contracts or orders between the supplier and prime contractor.

6.4 Subject term (key word) listing.

Bronze
Compression testing
Copper
Locking teeth
Lug
Phospher
Solder
Strip solder
Terminal lug, electrical
Tin brass

6.5 Changes from previous issue. Asterisks are not in this revision to identify changes in respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - AR
Navy - AS
Air Force - 85

Review activities:

Army - ER, ME, MI
Navy - SH
DLA - GS

User activities:
Army - AT, AV, SM
Navy - MC,
Air Force - 11

Preparing activity
Army - AR

Project No. 5940-B018

INSTRUCTIONS. In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document*(s)* or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO 12062 WASHINGTON D C
POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

Commander
US Army ARDEC
ATTN: SMCAR-ESC-S
Picatinny Arsenal, NJ 07806-5000

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-T-15659H	TERMINAL, LUG: SOLDER, COPPER AND PHOSPHOR BRONZE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
	☐ USER
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)* _____

5. PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE