

MIL-C-4928A(USAF)  
20 Sep 1968  
 SUPERSEDING  
 MIL-C-4928(USAF)  
 9 March 1955

## MILITARY SPECIFICATION

### CHARGER, BATTERY, SILICON DIODE, TYPE A-1

#### 1. SCOPE

1.1 This specification covers one type of ten-circuit silicon diode battery charger, designated Type A-1.

#### 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 the specification to the extent specified herein.

#### SPECIFICATIONS

##### Federal

QQ-P-416	Plating, Cadmium (Electrodeposited)
TT-L-54	Lacquer: Spraying, Acid-Resistant, (For Aluminum Surface Around Storage Batteries)
PPP-B-601	Boxes, Wood, Cleated-Plywood

##### Military

JAN-P-72	Primer; Synthetic, Lacquer-Resisting
MIL-P-116	Preservation, Methods Of
MIL-D-1000	Drawings, Engineering And Associated Lists
MIL-M-3171	Magnesium Alloy, Processes For Pre- treatment And Prevention Of Corrosion On
MIL-E-5272	Environmental Testing, Aeronautical And Associated Equipment, General Specification For
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification For
MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys
MIL-M-10304	Meters, Electrical Indicating, Panel Type, Ruggedized, General Specification For

FSC 6130

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## STANDARDS

## Military

MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking Of US Military Property
MIL-STD-143	Specifications And Standards Order Of Precedence For The Selection Of
MIL-STD-461	Electromagnetic Interference Characteristics Requirements For Equipment
MIL-STD-838	Lubrication Of Military Equipment
AN3150	Battery - Storage Shielded 24-Volt, 36-Ampere-Hour
AN3151	Battery - Storage, Shielded, 24-Volt, 24-Ampere-Hour

(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 Preproduction. This specification makes provision for preproduction testing.

3.2 Component parts. The charger shall consist of the following major components: transformer, silicon diodes, power cables, controls, cabinet, and auxiliary equipment as necessary to meet the requirements of this specification.

3.3 Material.

3.3.1 Specifications and standards. Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143, except as provided in the following paragraph.

3.3.1.1 Standard parts. AN or MIL standard parts shall be used wherever they are suitable for the purpose and shall be identified by their part numbers. Commercial utility parts, such as screws, bolts, nuts, cotter pins, et cetera, may be used, provided they have suitable properties and are replaceable by the AN or MIL standard parts without alteration and provided the corresponding AN or MIL part numbers are referenced on the drawings and in the parts lists. In applications for which no suitable corresponding AN or MIL part is in effect on date of invitation for bids, commercial parts may be used provided they conform to the requirements of this specification.

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3.3.2 Protective treatment. When materials are used in the construction of the charger that are subject to deterioration when exposed to climatic and environmental conditions likely to occur during service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. The use of any protective coating that will crack, chip, or scale with age or extremes of climatic and environmental conditions shall be avoided.

3.4 Design and construction. The charger shall be designed and constructed so that no parts will work loose in service. It shall be built to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service.

3.4.1 The charger shall be constructed so that adjustments and repairs can be easily made by the personnel of operating units and overhaul bases.

3.4.2 The charger shall be constructed as a stationary unit for floor or wall mounting.

3.4.3 Wiring and connectors. The charger shall include wiring and connectors of standard electrical ratings.

3.4.4 Radio noise suppression. The charger shall comply with the radio noise suppression requirements of MIL-STD-461.

3.4.5 Ratings.

3.4.5.1 Input. The charger shall be capable of operating from a 4-wire, 3-phase, 50/60-cycle, 220/440 volts alternating current (AC) source.

3.4.5.2 Output. The charger shall be provided with 10 charging circuits of continuous direct current (DC) output rating as follows:

<u>Circuit No.</u>	<u>Amperes</u>	<u>Volts</u>
1	12	14
2	12	14
3	6	28
4	6	28
5	3	28
6	3	28
7	6	28
8	6	28
9	12	14
10	12	14

3.5 Performance.

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3.5.1 Operating conditions. The charger shall operate satisfactorily under the following conditions:

- a. Temperatures - Ambient temperatures of  $-20^{\circ}$  to  $+55^{\circ}$  Centigrade (C).
- b. Humidity - Relative humidity up to 100 percent.

3.5.2 Nonoperating conditions. The charger shall satisfactorily withstand ambient temperatures from  $-62^{\circ}$  to  $+71^{\circ}$ C.

3.5.3 Efficiency. The overall efficiency of the charger shall be not less than 55 percent when operating at rated load.

3.5.4 Surge rating. The charger shall be capable of carrying a 400-percent rated current for a duration of 3 seconds at 3 loads per minute for a period of 30 minutes.

3.5.5 Stability. The charger shall be capable of being tilted 30 degrees from its normal position and returning to its normal stationary position upon release.

3.6 Transformer. The transformer shall be of the insulated type having separate high-voltage and low-voltage windings and shall be capable of withstanding twice the rated input voltage plus 1,000 volts root mean square (rms), 60 cycles between the primary winding and the core. The secondary winding shall withstand 500 volts between the winding and the core. Separate transformer secondary windings shall be provided for each of the 10 charging circuits.

\* 3.7 Rectifiers. The rectifiers shall be connected full wave. When continuously operated in an ambient temperature of  $55^{\circ}$ C at full rated load, the temperature of the diodes shall not exceed  $120^{\circ}$ C.

3.8 Charging-rate control. Each of the 10 charging circuits shall have a rheostat or variable transformer suitable for maintaining a specified charging circuit rate when the rectifier line voltage varies  $\pm 5$  percent from the rated line voltage.

3.9 Cabinet. The charger shall be enclosed in a cabinet which is constructed of reinforced sheet steel having a minimum thickness of 0.0478 inch (No. 18 standard gage). Arrangement of components in the cabinet shall provide adequate accessibility for necessary adjustment and repair consistent with good design. Each circuit may be an individual subassembly that is readily removable from the cabinet. An eyebolt shall be in the center of the top of the cabinet for handling the charger by a hoist.

3.10 Power connections.

3.10.1 Input. Screw connections or threaded studs with lock washers shall secure the input circuit wires. The input connections shall be made within the cabinet and shall be provided with a protective cover. The wire entry shall be through a removed portion on the side suitable for either conduit or armored cable.

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3.10.2 Output. Ten single-conductor output power cables shall be provided. The cables shall be stranded copper wire not smaller than No. 14 American Wire Gage (AWG) and at least 6 feet long covered with oil- and acid-resistant insulation. The cables shall have adequate commercial clip-type battery connectors at one end and suitable lugs at the other end.

3.10.2.1 Cable marking. Each cable shall be marked to indicate the following:

- a. Polarity.
- b. Circuit identification.
- c. Output rating.

3.11 Auxiliary equipment. Auxiliary equipment shall be provided as follows:

\* 3.11.1 Ammeter. A DC ammeter, type MR36W005DCAA, shall be in accordance with MIL-M-10304, except that it shall provide a 3-range scale for measurement of 0-5/10/15 amperes. This meter shall be used to measure the current in each of the 10 circuits.

3.11.2 Circuit switch. A totally enclosed switch shall be properly marked to identify each of the 10 circuits and shall facilitate current measurements, as follows:

<u>Circuit No.</u>	<u>Ammeter Range</u>
1	0 - 15
2	0 - 15
3	0 - 10
4	0 - 10
5	0 - 5
6	0 - 5
7	0 - 10
8	0 - 10
9	0 - 15
10	0 - 15

3.11.3 Fan motor. A fan motor, if used, shall have a minimum lubricating period of 6 months and shall incorporate a means to stop operation of the charger in the event of failure of the ventilating system.

3.11.4 Terminals. Separate terminals for each of the 10 charging circuits shall be properly identified and easily accessible.

3.11.5 Terminal panel. A suitably protected terminal panel for AC input connections shall be properly identified and easily accessible.

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3.11.6 Fuses and receptacles. Standard fuses and receptacles shall protect each of the 10 separate circuits against short circuiting, as follows:

<u>Circuit No.</u>	<u>Fuse Capacity</u>
1, 2, 9 and 10	15 amperes
3, 4, 7 and 8	10 amperes
5 and 6	5 amperes

3.11.7 Safety device. A safety device shall protect the battery charger from damage caused by connection of the battery in reverse polarity.

3.11.8 Timers. Automatic means shall terminate the battery charging period. One timer shall be used to turn on the battery charger and to turn off all circuits when the period of time has elapsed for which the timer was set. Individual charging circuits shall be turned on and off by a manual toggle switch after the timer has been turned on and set for the required charging time. Provisions shall be made so that the battery does not discharge into the rectifier at the end of the charging period or in the event of power failure.

3.11.9 Pilot light. A red pilot light on the front of the cabinet shall indicate when the charger is operating.

3.11.10 Wiring diagram. A wiring diagram shall be secured permanently to an easily accessible panel within the charger cabinet. The silk screen method is acceptable.

3.11.11 Operating instructions. Operating instructions shall be secured permanently to the front panel. The silk screen method is acceptable.

\* 3.12 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in manufacturer's part numbers shall be governed by the drawing number requirements of MIL-D-1000.

3.13 Dimensions. The overall dimensions of the charger shall not exceed the minimum dimensions consistent with good design.

3.14 Weight. The weight of the charger shall be held to the minimum weight consistent with requirements specified herein.

3.15 Screw threads. Screw threads shall conform to MIL-S-7742.

\* 3.16 Lubrication. Where required, lubrication shall be in accordance with MIL-STD-838.

3.17 Finish.

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3.17.1 Exterior (exposed) surfaces. All exposed exterior surfaces shall be given one coat of lacquer-resistant primer conforming to JAN-P-72, type I, followed by at least two coats of black acid-resistant lacquer conforming to TT-L-54.

3.17.2 Interior (enclosed) surfaces. All enclosed interior surfaces that are subject to corrosion shall be given a suitable protective treatment to enable them to resist corrosion during normal service life.

3.17.2.1 Aluminum alloy parts. Wherever practicable, aluminum alloy parts shall be anodically treated in accordance with MIL-A-8625.

3.17.2.2 Magnesium alloy parts. Wherever practicable, magnesium alloy parts shall be surface treated in accordance with MIL-M-3171.

3.17.2.3 Cadmium plating. Cadmium plating, if used, shall be in accordance with QQ-P-416, type II or III, as applicable, and of a class that is adequate to achieve the degree of protection required.

3.17.2.4 Steel sheets. All steel sheets shall be adequately protected from rust.

3.18 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.19 Workmanship.

3.19.1 General. The charger, including all parts and accessories, shall be fabricated and finished in a workmanlike manner. Particular attention shall be given to freedom from blemishes, defects, burrs, and sharp edges; radii of fillets, and marking of parts and assemblies; thoroughness of soldering, welding, brazing, painting, and wiring; alignment of parts and tightness of assembly screws and bolts; et cetera.

3.19.2 Cleaning. The charger shall be thoroughly cleaned. Loose, spattered, or excess solder, metal chips, and other foreign material shall be removed during and after final assembly.

#### 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.

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\* 4.2 Classification of tests. The inspection and testing of chargers shall be classified as follows:

a. Preproduction tests. Preproduction tests are those tests accomplished on a sample representative of the production charger to determine that the production charger meets the requirements of this specification.

b. Quality conformance inspection. Quality conformance inspection consists of those tests accomplished on chargers submitted for acceptance under contract.

4.3 Test conditions. Unless otherwise specified, the tests shall be conducted under the following conditions:

a. Ambient temperature of  $25^{\circ} \pm 10^{\circ}\text{C}$ .

b. Ambient pressure of 0 to 2,000 feet altitude.

c. Relative humidity not less than 80 percent.

\* 4.4 Preproduction test.

\* 4.4.1 Preproduction test sample. The preproduction test sample shall consist of one charger (see 6.2.1).

\* 4.4.2 The preproduction test shall consist of the acceptance tests and the following tests:

\* 4.4.2.1 Efficiency. One circuit of the charger, or the maximum of two circuits, shall be connected to a fully discharged battery load of rated value for each circuit. The input and output of the charger shall then be obtained until all 10 circuits have been connected to the load. The efficiency shall be calculated by a summation of the DC output and the summation of the AC input power required, including the no-load power requirement.

\* 4.4.2.2 Reverse polarity test. The charger shall be connected to a battery in reverse polarity. The safety device specified in 3.11.7 shall operate satisfactorily.

\* 4.4.2.3 Surge rating. The charger shall be subjected to a 400-percent rated current for a duration of 3 seconds at 3 surges per minute for a period of 30 minutes. Interruption of current shall be performed on the output side to permit uninterrupted operation of the cooling device. A suitable resistance load shall be used. Neither the charger nor any component part shall be damaged. The charger shall meet the requirements of 3.5.4.

\* 4.4.2.4 Temperature rise. The charger shall be connected to the rated power source and the rated battery load and operated in an ambient temperature of  $55^{\circ}\text{C}$  until thermal equilibrium is reached. The output current shall be maintained at its maximum rated value. Thermocouples shall be placed in the



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silicon diodes in at least three places to determine compliance with the provisions of 3.7. If desired, this test may be combined with the high temperature test of 4.4.2.8.1 provided that the rated battery load is used.

- \* 4.4.2.5 Stability. The charger shall be tested to determine compliance with the requirements of 3.5.5.
  
- 4.4.2.6 Endurance. The charger shall be operated for 300 hours from the rated power source into a suitable resistive load with the output current maintained at maximum rated value for each circuit. Upon completion of this test, the charger shall meet the efficiency requirements specified in 3.5.3.
  
- \* 4.4.2.7 Radio noise suppression. The charger shall be tested in accordance with MIL-STD-461, except that the antenna shall be located at a distance of 5 feet from the test specimen.
  
- \* 4.4.2.8 Environmental. The tests listed below shall be conducted in accordance with the specified procedures of MIL-E-5272. Corrosion or damage resulting from the tests shall be cause for rejection.
  
- \* 4.4.2.8.1 High temperature. The test shall be in accordance with Procedure I, except that following the 50-hour exposure at 71°C, the temperature shall be reduced to 55°C and maintained until stabilization is reached before the charger is operated. The charger shall be operated into a resistive load or the rated battery load with an output current of maximum rated value for each circuit for a period of not less than 1 hour. Upon conclusion of the test, the charger shall meet the efficiency requirements specified in 3.5.3.
  
- \* 4.4.2.8.2 Low temperature. The test shall be in accordance with Procedure II, except that the operating temperature shall be -20°C. Load conditions and efficiency shall be as specified in 4.4.2.8.1.
  
- \* 4.4.2.8.3 Humidity. The humidity test shall be in accordance with Procedure III, except that the duration of the test shall be 240 hours. Load conditions shall be as specified in 4.4.2.8.1.
  
- \* 4.4.2.9 Dielectric. Upon completion of all the environmental tests, the dielectric test specified in 4.5.1.2 shall be conducted using 80 percent or more of the voltage values.
  
- \* 4.5 Quality conformance inspection.
  
- \* 4.5.1 Individual test. Each charger shall be subjected to the following tests:
  - \* 4.5.1.1 Examination of product. The charger shall be examined to determine conformance to this specification with respect to material, workmanship, and marking.

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- \* 4.5.1.2 Dielectric test. The charger shall be subjected for a period of one minute to a dielectric test of twice the rated input voltage plus 1,000 volts rms 60-cycle AC primary to secondary and primary to ground and 500 volts secondary to ground. The insulation shall not fail or be damaged during the test.
- \* 4.5.1.3 Adjustment of controls. The controls shall be moved through all possible positions to determine ease of adjustment. There shall be no binding or scraping in any position.
- \* 4.5.1.4 Charging-rate tests.
  - \* 4.5.1.4.1 With fully charged batteries. Fully charged batteries, one to each circuit, shall be connected to the charging circuits of the charger. The line voltage to the charger shall be varied  $\pm 5$  percent from rated charger voltage. The nameplate charging rate of the battery shall be satisfactorily maintained by the adjustment of the battery charging current controls. The nameplate charging rates of the four standard Air Force batteries are as specified below. However, commercial lead-acid batteries with comparable capacities may be used in lieu of the specified Air Force batteries. The fully charged batteries used in this test shall be as defined in 6.3.1.

<u>Type</u>	<u>Ampere Hour Capacity</u>	<u>Voltage</u>	<u>Charging Rate at Start</u>	<u>Charging Rate at Finish</u>
12-AC-7D	11	24	2	1
AN3150	36	24	6	3
AN3151	24	24	3	1 1/2
D-6A	68	12	12	6

- \* 4.5.1.4.2 With discharged batteries. The test specified in 4.5.1.4.1 shall be repeated using discharged batteries. The discharged batteries used in this test shall be as defined in 6.3.2.
- \* 4.5.1.5 Auxiliary equipment tests. Appropriate tests and inspections shall be made to determine compliance with the requirements of 3.11.
- \* 4.6 Inspection of the preservation, packaging, packing and marking for shipment and storage. Sample items or packs and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5, or the documents specified therein.

## 5. PREPARATION FOR DELIVERY

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

5.1.1 Level A. Each charger shall be preserved and packaged Method IIa of MIL-P-116. Each charger shall be placed in a wood, cleated-plywood unit container conforming to PPP-B-601; type shall be as specified in 5.2.

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5.1.2 Level C. Each charger shall be preserved and packaged in a manner which will afford adequate protection against deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use. This level may conform to the supplier's commercial practice when such meets the requirements of this level.

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

5.2.1 Level A. The unit container specified in 5.1.1 shall be the shipping container and shall conform to PPP-B-601, overseas type. Containers shall be of minimum cube and tare consistent with the protection required. Container closure and strapping shall be in accordance with the appendix to PPP-B-601.

5.2.2 Level B. Level B shall be the same as Level A except containers shall conform to domestic type.

5.2.3 Level C. Each charger packaged as specified in 5.1.2 shall be packed in a manner which affords adequate protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. This level shall conform to applicable carrier rules and regulations and may be the supplier's commercial practice when such meets the requirements of this level.

5.3 Marking. In addition to any special marking required by the contract or order, containers shall be marked in accordance with the requirements of MIL-STD-129.

## 6. NOTES

6.1 Intended use. The Type A-1 charger covered by this specification is intended for use in charging lead-acid storage batteries.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number and date of this specification.
- b. That a preproduction test report in accordance with MIL-STD-831 be submitted to procuring activity.
- c. Selection of applicable levels of preservation, packaging, and packing (see 5.1 and 5.2).

6.3 Definitions. For the purposes of this specification, the following definitions will apply:

6.3.1 Fully charged battery. A fully charged lead-acid battery is a battery which, when charged in accordance with the charging and finishing rates specified in 4.5.1.4.1, shows no rise in the specific gravity when three successive hydrometer readings are taken at hourly intervals. The specific gravity taken during these readings should be within the limits of 1.260 to 1.285.

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6.3.2 Fully discharged battery. A fully discharged battery is a battery which has a specific gravity reading between 1.110 and 1.130 at an ambient temperature of 80° Fahrenheit (F) or corrected to 80°F.

6.4 The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:  
Air Force - 82

Review Activity:  
Air Force - 82

Preparing Activity:  
Air Force - 82

Project No. 6130-F070

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SPECIFICATION ANALYSIS SHEET			Form Approved Budget Bureau No. 119-R004
<b>INSTRUCTIONS</b>			
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.			
SPECIFICATION			
ORGANIZATION		CITY AND STATE	
CONTRACT NO	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT	
		\$	
MATERIAL PROCURED UNDER A			
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT			
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?			
A. GIVE PARAGRAPH NUMBER AND WORDING			
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES			
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID			
3. IS THE SPECIFICATION RESTRICTIVE?			
<input type="checkbox"/> YES <input type="checkbox"/> NO      IF "YES" IN WHAT WAY?			
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)			
SUBMITTED BY (Printed or typed name and activity)			DATE

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REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

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