The Engineering Resource For Advancing Mobility®

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AEROSPACE RECOMMENDED PRACTICE

ARP 1816

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Revised

CHARGER FOR BATTERY POWERED GROUND SUPPORT EQUIPMENT

1. SCOPE:

1.1 This recommended practice describes an industrial battery charger, solid state type, hereafter called charger, for use in charging lead acid batteries in ground support equipment.

2. GENERAL DESCRIPTION:

2.1 The charger shall be fully capable of charging a 100% discharged, specified lead acid battery, automatically, without damage, and in the maximum time of 8 hours or less.

The charger shall be capable of charging any battery of specified voltage from 60% to 100% of charger rated capacity without adjustment. Each charger shall be completely assembled in a steel case and shall be equipped with properly sized charging cables. Each cable shall have a minimum length of 10 feet (3.05 m) and shall have a properly sized and matched battery connector.

3. ELECTRICAL REQUIREMENTS AND STANDARDS:

3.1 The charger shall meet or exceed NEMA standard PV6-1976 and applicable UL standards.

3.2 The charger shall have dual voltage transformers with easy to change transformer terminals. Changeover instructions shall be permanently affixed inside the charger in a readily visible location through the open door. The charger shall be supplied to operate satisfactorily from all of the voltages in any of the groups as specified from Table 1. Three phase chargers are recommended:

TABLE 1

INPUT VOLTAGES

GROUP	VOLTAGE	HZ
1	208/240/480	60
2	480/575	60
3	220/380	50

3.3 The basic charger shall be UL listed except as modified for outdoor use or special options.

3.4 Adequate overload protection shall be provided in both AC and DC lines, as well as for the secondary of the power transformer.

3.5 Transformer Construction: A transformer shall be used as the primary means of minimizing AC shock hazards and the following points shall be considered.

3.5.1 The transformer shall have its primary winding electrically isolated from its secondary winding and shall be varnish impregnated and baked to exclude moisture.

3.5.2 Means shall be provided to prevent the possibility of primary voltage being present in the secondary circuit. This shall be accomplished by either of the following:

3.5.2.1 A grounded electrostatic or Faraday shield shall be placed between the primary and secondary windings. This shield shall be made of copper or aluminum and shall have at least the ampacity of the primary conductor if the primary conductor is smaller than No. 6 AWG (16 mm^2). If the primary conductor is No. 6 AWG (16 mm^2) or larger, the shield shall have an ampacity of at least 50 percent of the primary conductor. If foil is used it shall have a thickness of not less than .25 mm (.010 inch).

3.5.2.2 Coil winding methods which provide isolation between input and output circuits.

3.6 Control voltage shall not exceed 24 volts.

4. REGULATIONS AND EFFICIENCY:

4.1 The charger internal regulation shall compensate for varying AC line and load variations as indicated in Table 4-1 of NEMA PV-6-1976 and regulate DC voltage to a maximum of plus or minus 1%.

4.2 Efficiency over a full charge cycle shall be a minimum of 85% (KWH out/KWH in) for 36 volts and above chargers.

4.3 Power factor shall average a minimum of 0.8 over the full range of output (KW in KVA in).

5. BATTERY CHARGER CONTROLS:

5.1 The charger is to have a system incorporated to reduce the possibility of battery damage due to over-charging or any other conditions. Failure of any components or group of components shall not cause the charger to operate at its high level for an excessive length of time such as to cause permanent damage to the battery or other components or the charger. The charger shall incorporate a tamper proof design to prevent maladjustment by unauthorized personnel.

5.2 Controls shall be provided to insure that the charger is providing the correct charging rate for the battery during the charging period. Factors to be considered in the design of control systems are:

5.2.1 The charger shall start automatically upon connection of the battery without operator action. There shall be sufficient time delay to prevent arcing of the power contacts. In the event of AC power interruption the charger shall automatically resume charging when power is restored.

5.2.2 The charger shall be capable of charging the battery at a rate to provide a full charge in a specific time period without damage to the battery.

5.2.3 Upon reaching full charge the charger will automatically shut off.

5.2.4 Provisions shall be included for a manual or automatic equalizing charge.

5.2.5 Also see SAE document on Battery Connectors.

5.3 The following are optional battery charger controls.

5.3.1 Pilot light to indicate battery has reached the 80% charge level.

5.3.2 Pilot light to indicate the battery has reached 100% charge level.

5.3.3 Programmable 24-hour timer to delay start-up of charger until off-peak power rates are in effect.

5.3.4 Remote control and modified Joint Industrial Congress (JIC) shall be available as factory options.

6. ELECTRICAL COMPONENTS:

6.1 Rectification of the charging current shall be accomplished with silicon diodes in full wave circuitry. Heat sinks shall be provided to prevent any diode from exceeding a temperature of 257°F (125°C) under maximum load and ambient temperature of 122°F (50°C).

6.2 All control components shall be rated for continuous duty.

6.3 All power transformers shall be insulated to a minimum of Class 180 (replaces Class H).

6.4 All diodes, transistors and control devices shall be protected from damage due to:

(a) All self-generated transients

(b) Normal externally applied transients

(c) Turning the charger on or off at any charging rate or with battery disconnected.

(d) Disconnecting the battery at any charging rate.

(e) Shorting the output terminals.

(f) Battery polarity reversal.

6.5 At least a 2-1/2 inch (63.5 mm) DC ammeter of suitable range shall be mounted on the front of the unit.

6.6 The charger shall be equipped with a minimum of 10 feet (3.05 m) of heavy duty flexible cable (UL583, Section 13.1). The battery cables shall be color coded, red = positive, black = negative, and/or suitably identified.

6.7 A pilot light shall be standard on the face of the unit to indicate that the charger is energized.

7. CABINET:

7.1 The charger shall be of unitized construction in a heavy gage steel enclosure having a hinged door, and shall be suitable for floor, wall or stackable mounting with permanent provision for fork lift or hoist handling. (See NEMA-PV-6-1976, Part 5).

7.2 There shall be no ventilation holes in the top surface unless provision is made to prevent any foreign material from entering the case. The case and components shall be arranged to provide natural convection or self-contained forced air cooling.