FLOODED LEAD-ACID BATTERY - MAINTENANCE PRACTICES

1. Description

A. Standard airplane battery is a 24 VDC, 45 ampere-hour (12 cell) lead acid battery, located on the right forward side of the fire wall and is comprised of lead compound plates immersed in a diluted solution of sulfuric acid and water (electrolyte). Each cell, connected in series, has a nominal voltage of approximately 2.0 volts when fully charged. State-of-battery charge can be determined by checking specific gravity with a hydrometer and voltage test.

2. General Precautions and Notes

A. Proper maintenance is essential if the battery is to achieve maximum life and performance. To assure these goals, periodic inspection in the airplane and periodic maintenance is a must.

WARNING: National Electric Code forbids charging batteries installed in airplanes or within 10 feet of fuel tank areas.

CAUTION: Separate lead acid and nickel-cadmium battery facilities, including separate shops and service tools, must be used to prevent electrolyte contamination of acid and alkaline batteries.

CAUTION: To minimize battery discharge during airplane storage or periods of low airplane utilization (more than 5 days), battery should be disconnected and/or circuit breakers disengaged on all items on hot battery bus bar.

B. A battery should never be allowed to remain in a discharged condition for any appreciable time. If allowed to remain in a discharged condition, the lead sulfate will grow into a hard, white crystalline formation known as sulfation. This condition closes the pores in the active material and destroys the plates.

C. Electrolyte level must be maintained above the plates. Failure to do so leaves the plates exposed to air and causes rapid sulfation. Regular checking of the electrolyte level is a necessity and, if low, should be filled with distilled water.

D. When placed on a charge, some lead sulfate, instead of reverting to spongy lead or lead oxide, dislodges from plates in small particles and drops to the bottom as sediment, resulting in irreparable damage. This material is lost for active use. In normal operation, all cells shed a small amount of active material; however, this process is quickened in the case of a sulfated battery, and its life is greatly reduced.

E. A greenish deposit of copper salts may form on terminals and connectors. This corrosion is caused by normal venting or spilled electrolyte and should be removed using a stiff brush, followed by thoroughly washing the area with ammonia and water or a five percent solution of baking soda and water to neutralize any remaining electrolyte. Areas shall then be coated with a thin film of grease or preventive compound to prevent corrosion. Using a voltmeter from the negative terminal to the outside surface, check exterior of battery for acid bridges. A voltage reading indicates an acid bridge which must be removed by a thorough washing and drying.

F. Electrolyte shall be added to an older battery only if electrolyte is lost as a result of spillage. A fully charged battery may have a specific gravity of 1.285 to 1.295 when new, whereas, it may have a fully charged specific gravity of 1.260 to 1.275 when near the end of its life. In this case, electrolyte shall not be added. The plates may be slightly sulfated and the addition of a higher specific gravity electrolyte will only aggravate this condition.

3. Initial Charge for New Batteries

CAUTION: Keep sparks, flames, burning cigarettes or other ignition sources away from battery at all times, and always shield eyes when working near batteries.

A. Preparation for Initial Charge.

NOTE: Although new batteries are received dry-charged and will deliver 75 percent of rated capacity after initial filling of electrolyte, it is essential that battery be given an initial charge to full capacity to ensure its airworthiness before installing in airplane.

(1) Remove seals from battery cells.

CAUTION: Do not use automotive electrolyte to service battery.

(2) Fill each cell with 1.285 specific gravity electrolyte to bottom of split ring.

(3) Using care not to spill electrolyte, gently rock battery from side to side to release any trapped air. Readjust electrolyte as necessary.

(4) Allow battery stand for one hour.

(5) Readjust by adding electrolyte to proper level.

(6) Install vent plugs tightly into each cell.

B. Initial Battery Charge.

CAUTION: Do not allow battery to stand longer than 10 hours before beginning charge.

(1) Charge battery at 3.5 amps until initial gassing begins. Continue charge at 2.5 amps until all cells are gassing freely and charge voltage and specific gravity of electrolyte are constant over three successive readings taken at one hour intervals.

(2) During period of charging, electrolyte temperatures shall be maintained between 60°F and 110°F.

(3) When battery is completely charged, verify specific gravity is between 1.285 and 1.295.

(4) Adjust electrolyte level by removing or adding electrolyte to bottom of split ring, as required.

(5) After charge is complete, neutralize and remove any electrolyte spilled on battery.

4. Battery Inspection

A. Visual inspection of battery in airplane should be done in accordance with time limits set forth in Chapter 5, Inspection Time Limits.

5. Battery Quick-Disconnect Inspection

A. Inspect Battery and Components.

(1) Check for excessively loose handle and locking assembly.

(2) Check for pitted or corroded mating surfaces.

(3) Check for burn marks caused when battery is disconnected under load.

(4) Test for resiliency of mating surfaces of Elcon connector oversized pin.

(a) Insert larger 0.385 inch diameter probe of GO/NO-GO gage into each helix or sleeve to maximum depth. Ensure a snug fit with a removal force greater than one pound.

(b) If connector fails to pass resiliency test, replace connector.

(5) Insert smaller 0.370 inch diameter probe of GO/NO-GO gage into connector to ensure adequate contact is present.

(a) Elcon connector, ensure a snug fit with a nominal removal force of one pound.

(b) Rebling connector, ensure each socket exerts sufficient pressure on pin to hold 0.370 inch diameter GO/NO-GO gage securely when quick-disconnect is inverted with gage pointed downward.

(c) If connector exhibits excessive wear or damage, replace connector.

6. Battery Receptacle Inspection

A. Inspect Connector Pins.

(1) Connector pins shall be inspected for corrosion, pitting or burn marks. If any conditions prevent total electrical contact, surface shall be cleaned.

(2) If cleaning process reduces pin diameter less than 0.370 inch, battery shall be replaced.

7. Servicing Battery

A. For servicing of battery, refer to Chapter 12, Flooded Lead Acid Battery - Servicing.

8. Battery Removal/Installation

A. Remove Battery (Refer to Figure 201).

(1) Ensure battery switch is positioned to OFF.

(2) Open right cowl door. Refer to Chapter 71, Engine Cowling and Nosecap - Maintenance Practices.

(3) Disconnect battery connector from battery.

(4) Pull lever to release battery tray from latch on fire wall.

(5) Swing battery tray away from fire wall.

(6) Cut and remove safety wire from wing nuts.

(7) Remove wing nuts and washers from battery cover; remove battery cover.

(8) Remove vent lines from elbows.

(9) Clean adhesive from elbows and vent lines using isopropyl alcohol.

(10) Remove battery from airplane.

B. Install Battery (Refer to Figure 201).

(1) Clean battery support and battery tray as necessary to ensure proper installation.

(2) Position battery on battery tray, but do not secure.

(3) Connect battery connector to battery and hand tighten.

(4) Install battery cover using washers and wing nuts.

(5) Safety wire wing nuts. Refer to Chapter 20, Safetying - Maintenance Practices.

(6) Apply 14-30 adhesive to vent lines and elbows.

(7) Install vent lines to elbows.

(8) Swing battery aft until lever engages latch on fire wall.

(9) Close right cowl door. Refer to Chapter 71, Engine Cowling and Nosecap - Maintenance Practices.

9. Battery Adjustment/Test

A. General.

CAUTION: Tools or equipment used for servicing nickel-cadmium batteries shall not be used for servicing lead acid batteries. Lead acid batteries shall be completely removed from nickel-cadmium battery service areas. The slightest acid contamination will deteriorate nickel-cadmium batteries.

CAUTION: Do not charge batteries installed in airplane or within 10 feet of fuel tank areas.

(1) All procedures are to be accomplished in a designated service area away from airplane.

B. Tools, Equipment and Materials.

(1) For a list of tools, equipment and materials, refer to Electrical Power - General.

C. Battery Test.

CAUTION: If electrolyte is removed from a discharged cell and replaced with electrolyte of high specific gravity, cell will be in a discharged condition even though hydrometer test indicates a full charge.

(1) Specific gravity of battery may be measured with a hydrometer to determine the state of battery charge. If hydrometer reading is low, charge battery and retest. Hydrometer readings of electrolyte must be compensated for temperature of electrolyte. Refer to Table 201 for various hydrometer readings with an electrolyte temperature of 80°F.

Table 201. Battery Hydrometer Reading at 80°F

READINGS	BATTERY CONDITION
1.280 Specific Gravity	100 Percent Charged
1.250 Specific Gravity	75 Percent Charged
1.220 Specific Gravity	50 Percent Charged
1.190 Specific Gravity	25 Percent Charged
1.160 Specific Gravity	Discharged

NOTE: All readings shown are for an electrolyte temperature of 80°F. For higher temperatures, readings will be slightly lower. For cooler temperatures, readings will be slightly higher. Some hydrometers have a built-in temperature conversion chart and a thermometer. Corrected readings shall agree with Table 201.

NOTE: If a specific gravity indicates battery is not fully charged, charge battery atapproximately 29.0 VDC for 30 minutes or until battery voltage rises to 28.0 VDC. After charging, a load tester will provide more accurateresults. A specific gravity check can be used for charging, but cannot identify cells which short under load or have broken connectors between plates or cells.

D. Battery Charging.

WARNING: When a battery is being charged, hydrogen and oxygen gases are generated. Accumulation of these gases can create a hazardous explosive condition. Always keep sparks and open flame away from battery. Allow unrestricted ventilation of battery area during charging.

(1) Remove battery from airplane and place in a well ventilated area for charging. When battery is fully charged,

electrolyte level must be checked and adjusted by adding distilled water at a level even with horizontal baffle plate or split ring at bottom of filler holes. If battery is extremely cold, allow battery to warm before adding water as level will rise with warming.

(2) Main points of consideration during a battery charge are excessive battery temperature and violent gassing. Test battery with a hydrometer to determine amount of charge. Decrease charging rate or stop charging temporarily if electrolyte temperature exceeds 115°F.

10. Battery Cleaning

A. Tools, Equipment and Materials.

(1) For a list for required tools, equipment and materials, refer to Electrical Power - General.

B. Cleaning Procedures.

(1) Remove battery. Refer to Battery Removal/Installation.

(2) Tighten battery cell filler caps to prevent cleaning solution from entering cells.

(3) Wipe battery cable ends, battery terminals and entire surface of battery with a clean cloth moistened with a solution of bicarbonate of soda (baking soda) and water.

(4) Rinse with clear water, wipe away excess water and allow battery to dry.

(5) Examine vent plugs to ensure gas escape holes are clear of obstruction.

(6) Brighten cable ends and battery terminals using emery cloth or a wire brush.

(7) Coat battery terminals with petroleum jelly or an ignition spray product to reduce corrosion.

(8) Install battery. Refer to Battery Removal/Installation.

Figure 201 : Sheet 1 : Flooded Lead Acid Battery Installation