

# JOB ROLE – AUTOMOTIVE SERVICE TECHNICIAN

Sector: Automotive  
(Qualification Pack Code : **ASC/Q01402**)



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# **UNIT 5 : Auto Electrical**

## **Session 3: Battery and Its Maintenance**

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# Session Objectives

1. The student will be able to understand and carry out different tests on lead acid battery .
2. Able to identify different faults in lead acid battery, their causes and suggest appropriate remedies .
3. Able to check and clean the battery .
4. Able to use tools and equipment used for checking and cleaning of the battery .

# The Battery is the Heart of the Automotive Electrical System

The battery must be in good useable condition for the rest of the electrical system to function correctly. In this chapter we describe the battery service and testing methods necessary to assure proper battery operation.

# General Precautions while Handling Battery

1. Battery acid is very corrosive. Do not allow it to come in contact with skin, eyes, or clothing. If battery acid gets into your eyes, rinse them thoroughly with clean water and receive immediate medical attention.
2. If battery acid comes in contact with skin, wash with clean water.
3. If the acid is swallowed, drink large quantities of water or milk followed by milk of magnesia and a beaten egg or vegetable oil.
4. When making connections to a battery, be careful to observe polarity, positive to positive and negative to negative.
5. When disconnecting battery cables, always disconnect the negative (ground) cable first.

# General Precautions while Handling Battery

6. Follow manufacturer's instructions when charging battery. Charge the battery in a well-ventilated area. Do not connect or disconnect the charger leads while the charger is turned on.
7. Do not add additional electrolyte to the battery if it is low. Add only distilled water.
8. Do not wear any jewelry or watches while servicing the battery. These items are excellent conductors of electricity. They can cause severe burns if current flows through them by accidental contact with the battery positive terminal and ground.
9. Never lay tools across the battery. They may come into contact with terminals, shorting out the battery and causing it to explode.

# General Precautions while Handling Battery

10. When connecting battery cables, always connect the negative cable last.
11. Avoid any arcing or open flames near battery. The vapors produced by the battery cycling are very explosive.
12. Do not smoke around a battery. Wear safety glasses or face shield when servicing the battery.



# Battery Inspection and Cleaning

To do these jobs, you will need the following equipment and tools.

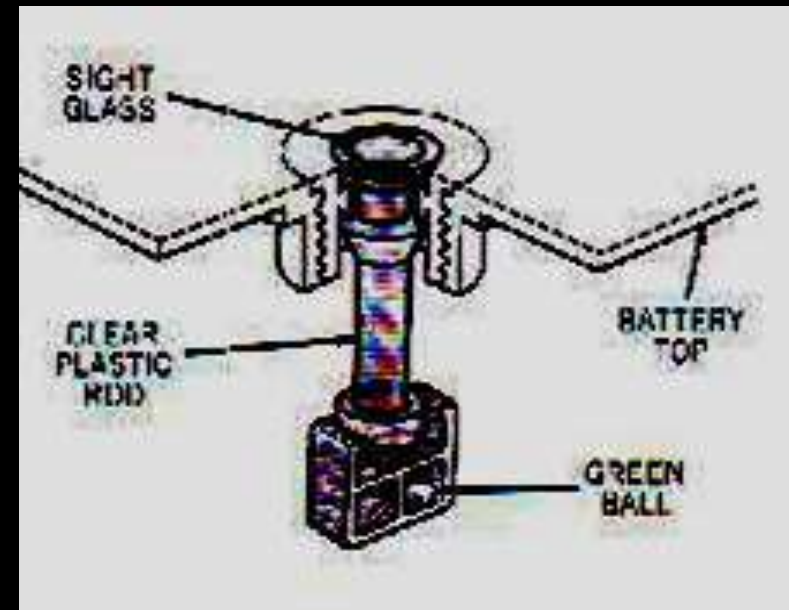
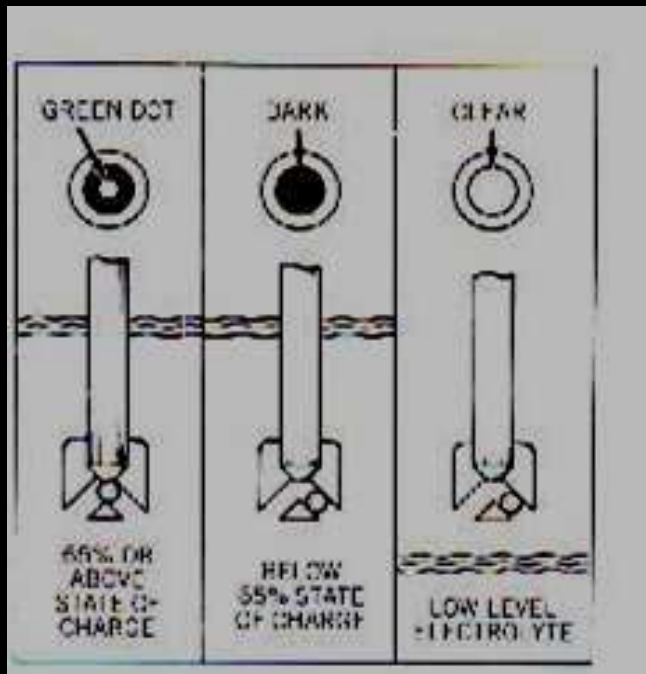
1. A cleaning solution of baking soda and water, or ammonia
2. Stiff bristled cleaning brushes
3. Terminal pliers and wrenches and perhaps a terminal spreader and puller.
4. Terminal and connector scraping and cleaning tools.
5. A battery carrier or lifting strap.
6. Protective coating for the battery terminals (jelly or spray).

# Battery Inspection

1. If the battery has removable cell caps, check the electrolyte level. It should be above the tops of the plates or at the split-ring indicator level in each cell. Add distilled water to raise the electrolyte level, if necessary. Do not overfill the battery.
2. Check for missing or damaged cell caps, replace as required.
3. Check battery terminals, cable connectors, and metal hold-down parts for acid corrosion. Clean as required.
4. Check the cables for broken or corroded wire strands, worn insulation, and defective connectors. Replace defective parts.
5. Check battery case and cover for dirt, grease, or electrolyte condensation that could cause voltage to leak to ground. Clean battery as necessary.
6. Inspect the battery for cracks, loose terminals, and other damage. Replace a damaged battery.

# Battery Inspection

- Check the battery carrier (tray) hold-down parts, and heat shields for looseness or improper installation. Tighten or replace loose or damaged parts.
- If the battery has built-in hydrometer (state-of-charge indicator), check its colour indication for general battery condition.



# Battery Cleaning

Some dirt and corrosion naturally collect on a battery from two general sources:

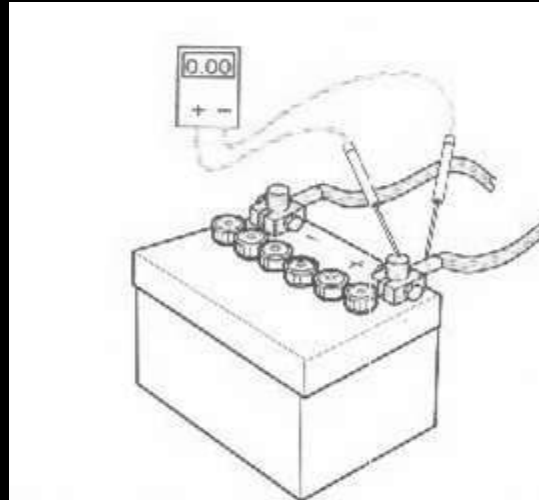
1. High temperature and air movement under the hood cause dirt and grease to collect on any flat surface.
2. Normal battery gassing (hydrogen release) and water evaporation carry electrolyte vapors out of the battery. The vapors condense on the battery top and contain a small amount of sulfuric acid. As acid vapors condense over a period of time. They corrode metal parts.

**Dirt and corrosion cause two general problems:**

1. Dirt and grease form a conductive film that causes voltage to discharge slowly to ground or between the + and – battery terminals.
2. Electrolyte condensation adds to this discharge action because it, too is conductive. Electrolyte condensation contains corrosive  $H_2SO_4$ , which eats away the metal of battery terminals, cable connectors, and hold-down parts. Corrosion on battery terminals and cables adds resistance to the entire electrical system.

When the battery and cables have been completely inspected and any problems have been corrected, the battery is ready to be tested further. Before carrying out any tests on battery ensure that it is fully charged.

**Battery terminal test:** The battery terminal test checks for poor electrical connections between the battery cables and terminals.



Tests Connections for Battery  
terminal test

Continue

## **2. Leakage Test**

If no apparent damage is visible the battery should be subjected to a leakage test using the battery leakage tester. Remove the vent stoppers from the battery and hold the test firmly in a vertical position over each vent in turn. **Apply a pressure of 1 lb./sq. inch by means of the hand pump, this pressure must not fall off by more than 0.05 lb/sq. inch in 15 seconds.** Any battery which fails this test should be rejected.

## **3. Insulation Tests**

Before a battery is used from the charging room it should be tested for insulation resistance between the battery terminals and the metal case using a 250V insulation tester (megger). The minimum permissible reading is 0.5 meg. Ohms.

**Continue**

## 4. State of Charge Test

### A. Specific Gravity Test (Hydrometer Test)

Measuring the state of charge is a check of the battery's electrolyte and plates. It can be determined by testing the specific gravity of the electrolyte using a hydrometer.

1. Remove all battery vent caps.
2. Check the electrolyte level. It must be high enough to withdraw the correct amount of solution into the hydrometer.
3. Squeeze the bulb and place the pickup tube into the electrolyte of a cell
4. Slowly release the bulb. Draw in enough solution until the float is freely suspended in the barrel. Hold the hydrometer in a vertical position.

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# Battery Testing

**Test Result** :- A fully charged battery will have a hydrometer reading of 1.280 at 27° C. Remember, the specific gravity is also influenced by the temperature of the electrolyte and the readings must be corrected to the temperature. If the temperature is above or below the standard temperature 27° C than subtract or add 0.004 specific gravity for every 5° C temperature rise or fall respectively.



# Battery Testing

## Specific Gravity of Electrolyte in Batteries in Warm Climates

Sl. No	Approximate gravity	sp.	State of charge of battery
1.	1.260 – 1.280		Fully charged
2.	1.230 – 1.260		$\frac{3}{4}$ charged
3.	1.200 – 1.230		Half charged
4.	1.170 – 1.200		$\frac{1}{4}$ charged
5.	1.140 – 1.170		About run down
6.	1.110 – 1.140		Discharged

# Battery Testing

## B. Open Circuit Voltage Test

The open circuit Voltage test is used to determine the battery's state of charge. It is used when a hydrometer is not available or cannot be used. To obtain accurate test results, the battery must be stabilized (surface charge removed). If the battery has just been recharged, perform the capacity test, then wait at least 10 minutes to allow battery voltage to stabilize. Connect a voltmeter across the battery terminals, observing polarity. Measure the open circuit voltage. Take the reading to the 1/10 volt.

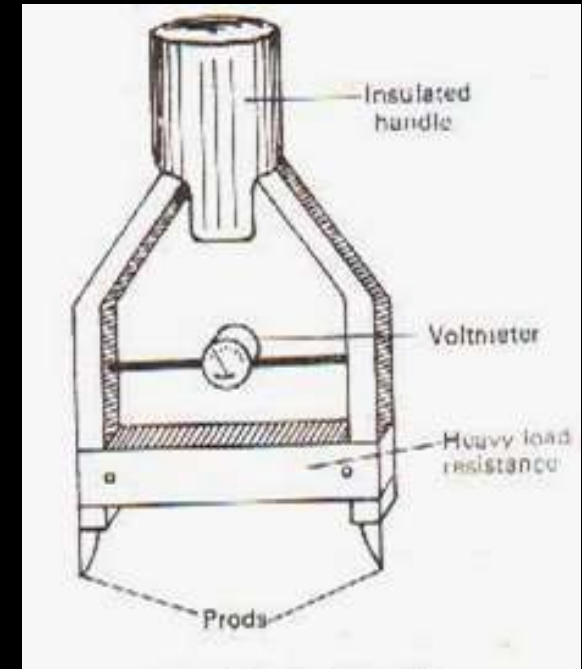
# Battery Testing

The results of the open circuit voltage test indicate the state of charge

Open Circuit Voltage	State of Charge
12.6 or greater	100%
12.4 to 12.6	70 – 100%
12.2 to 12.4	50 – 75%
12.0 to 12.2	25 – 50%
11.7 to 12.0	0 – 25%
11.7 Or less	0%

# Battery Testing

**C. High Discharge Test :-** The state of charge of a battery can be measured with an instrument which inserts a resistance across the cell terminals and the cell voltage reading is obtained on the voltmeter. As the prods are placed on the cell terminals, the resistance places the cell under high discharge and at the same time the voltmeter indicates the cell voltage. The duration of test should be very short because the current flow across the resistance is high – of the order of 100 to 200 A. For a 12-V battery, if each cell is fully charged, the test should show a battery voltage not below 10 V.



# Battery Testing

## D. Capacity Test

The capacity test provides a realistic determination of the battery's condition by checking its ability to perform when loaded. For this test to be accurate, the battery must pass the state of charge or open circuit voltage test. If it does not, recharge the battery and test it again.

In the capacity test, a specified load is placed on the battery while the terminal voltage is observed. A good battery should produce current equal to 50% of its cold-cranking rating (or three times its ampere-hour rating) for 15 seconds and still provide 9.6 volts to start the engine.

## Important Maintenance Points

1. Always top up with distilled water to keep the level.
2. Do not allow to remain in the discharged, condition Always keep them dry and clean and apply grease to all metal parts (only mineral grease, PX – 7 should be used).
3. Always give proper charging and do not overcharge them.
4. Handle with care. Mishandling will cause shedding, breakage and shorting .
5. Whenever suspected, it should be leakage tested.

## Maintenance free Battery

In present days maintenance free battery is used as per the requirement of car. For regularly we have to inspect the followings.

1. Inspect the cable clamps/
2. Battery should not move in its mounting.
3. Inspect the battery health Indicator.
4. Conduct the load test as per the life of the battery and if necessary replace the battery.

# Summary

In this session you have learnt about , The Battery is the Heart of the Automotive Electrical System. The battery must be in good usable condition for the rest of the electrical system to function correctly.

## Battery Cleaning

High temperature and air movement under the hood cause dirt and grease to collect on any flat surface.

Normal battery gassing (hydrogen release) and water evaporation carry electrolyte vapors out of the battery. The vapors condense on the battery top and contain a small amount of sulfuric acid. As acid vapors condense over a period of time. They corrode metal parts.



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