



# **SNS COLLEGE OF TECHNOLOGY**

**(An Autonomous Institution)**

**COIMBATORE-35.**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai.

## **DEPARTMENT OF AUTOMOBILE ENGINEERING**

**COURSE NAME : 19AUB204 – AUTOMOTIVE ELECTRICAL AND ELECTRONICS ENGINEERING**

**II YEAR / IV SEMESTER**

**Unit 1 – Electrical Systems**

**Topic : Various Tests on Batteries, Maintenance and Charging of Batteries**



# TEST CARRIED OUT IN BATTERIES



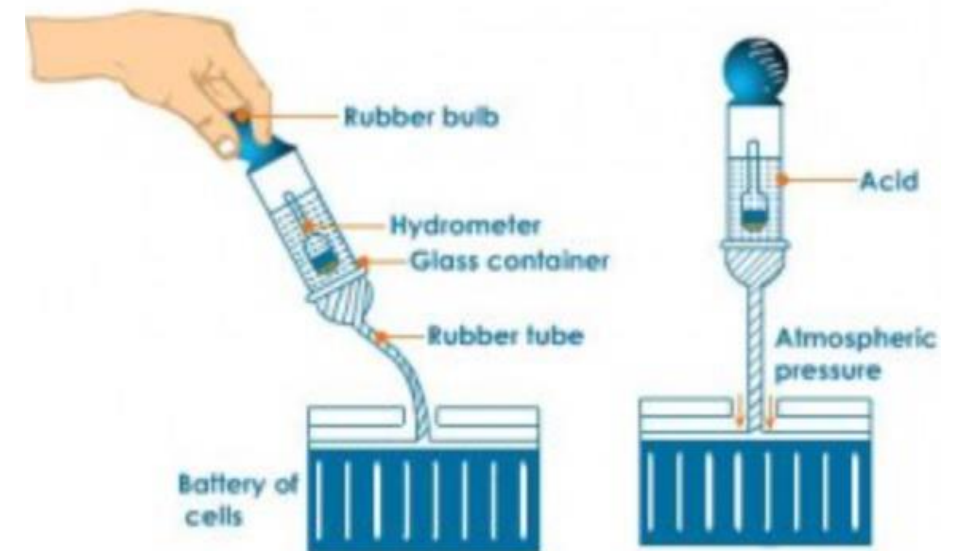
- ❖ Hydrometer Test
- ❖ High Rate Discharge Test
- ❖ Open Circuit Voltage Test



# HYDROMETER TEST



- ❖ A hydrometer test is a specific method used to assess the state of charge (SoC) or state of health (SoH) of lead-acid batteries, which are commonly found in automotive, marine, and stationary applications.
- ❖ This test relies on the principle that the specific gravity of the electrolyte in a lead-acid battery changes with its state of charge.





# HYDROMETER TEST



- ❖ Ensure the battery is fully charged and has been at rest for a few hours to allow for electrolyte equilibrium.
- ❖ You'll need a hydrometer, safety goggles, gloves, and a container for any spilled electrolyte.
- ❖ Insert the hydrometer into each cell and draw electrolyte into the hydrometer. Read the specific gravity value on the hydrometer's scale.
- ❖ The specific gravity readings indicate the state of charge.
- ❖ A fully charged battery typically has a specific gravity between 1.265 and 1.300, depending on the battery type.
- ❖ Lower readings indicate lower states of charge.



# HYDROMETER TEST



- ❖ Ideally, the specific gravity readings should be consistent across all cells. Significant variations may indicate cell imbalance or battery problems.
- ❖ Use the specific gravity readings to assess the battery's state of charge and health. Deviations from expected values can indicate issues such as sulfation, water loss, or cell degradation.
- ❖ Handle the electrolyte with care, as it is corrosive.
- ❖ Wear appropriate protective gear and avoid contact with skin and eyes.
- ❖ Clean any spills promptly.



# HYDROMETER TEST



State of Charge	Specific Gravity as used in Cold and Temperate Climates	Specific Gravity as used in Tropical Climates
Fully Charged	1.265	1.225
75% Charged	1.225	1.185
50% Charged	1.190	1.150
25% Charged	1.155	1.115
Discharged	1.120	1.080



# HIGH RATE DISCHARGE TEST



- ❖ A high-rate discharge test is a type of battery performance test that evaluates how well a battery performs under high current loads for short periods.
- ❖ This test is particularly relevant for applications that require rapid discharge rates, such as electric vehicles, power tools, and uninterruptible power supplies (UPS)





# HIGH RATE DISCHARGE TEST



- ❖ Ensure the battery is fully charged and conditioned before the test.
- ❖ The battery should be at a stable temperature, and its state of charge should be documented.
- ❖ Connect the battery to the load equipment capable of handling high discharge currents.
- ❖ This may involve using specialized equipment such as electronic loads or resistive load banks.
- ❖ Ensure all connections are secure and correctly configured.
- ❖ Determine the discharge rate for the test.





# HIGH RATE DISCHARGE TEST



- ❖ High-rate discharge tests typically involve discharging the battery at rates significantly higher than its nominal or continuous discharge rate.
- ❖ The specific discharge rate will depend on the application requirements and the battery's specifications.
- ❖ During the test, monitor various parameters such as voltage, current, and temperature.
- ❖ These measurements provide insights into the battery's performance under high-rate discharge conditions.
- ❖ Continuous monitoring helps detect any anomalies or issues that may arise during the test.



# HIGH RATE DISCHARGE TEST



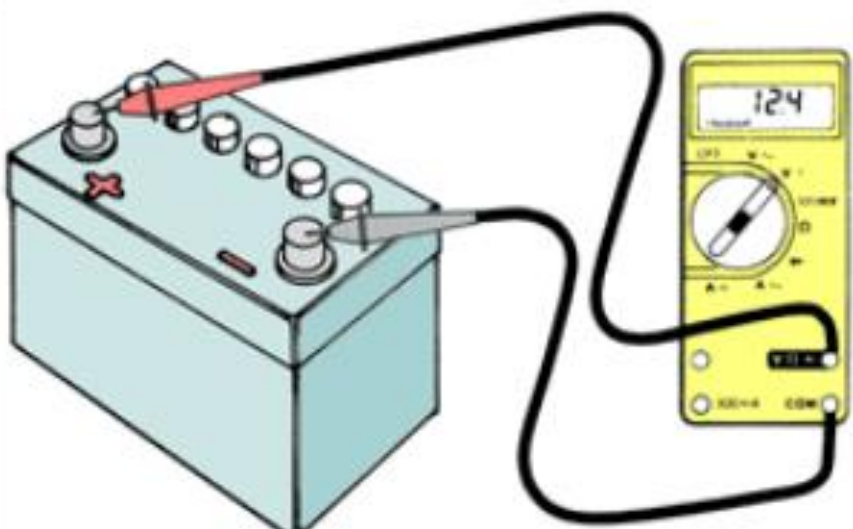
- ❖ Record data throughout the test, including voltage and current readings at regular intervals.
- ❖ This data is essential for analyzing the battery's behavior and performance under high-rate discharge conditions
- ❖ After completing the test, analyze the collected data to assess the battery's performance.
- ❖ Evaluate factors such as voltage stability, capacity under high discharge rates, and temperature rise.
- ❖ Compare the test results with the battery's specifications and performance requirements to determine if it meets the desired criteria.



# OPEN CIRCUIT VOLTAGE TEST



- ❖ Open circuit voltage (OCV) testing is a method used to measure the voltage of a battery when no load is connected to it.
- ❖ This test provides information about the state of charge (SoC) and the general health of the battery.



Voltage	State of Charge
12.6 – 12.9	Fully charged
12.2	Half charged
Below 11.9	Fully discharged



# OPEN CIRCUIT VOLTAGE TEST



- ❖ Ensure the battery has been at rest for a few hours to allow for voltage stabilization.
- ❖ This resting period helps ensure accurate measurements.
- ❖ Disconnect any loads connected to the battery.
- ❖ This ensures that no current is flowing in or out of the battery during the test.
- ❖ Allow the battery to stabilize in an open circuit condition for a sufficient period, typically several hours.
- ❖ This allows the voltage to settle to its true open circuit value.



# OPEN CIRCUIT VOLTAGE TEST



- ❖ Use a voltmeter or multimeter to measure the voltage across the battery terminals.
- ❖ Connect the positive lead of the voltmeter to the positive terminal of the battery and the negative lead to the negative terminal.
- ❖ Record the voltage reading displayed on the voltmeter.
- ❖ This reading represents the open circuit voltage of the battery.
- ❖ Compare the measured voltage to a reference table or the battery manufacturer's specifications to determine the state of charge (SoC) of the battery.
- ❖ Generally, higher voltage values correspond to higher states of charge, while lower voltage values indicate lower states of charge.



# BATTERY MAINTENANCE – LEAD ACID BATTERY



- ❖ Check electrolyte levels regularly if applicable, and add distilled water as needed.
- ❖ Keep terminals clean and free from corrosion. Use a mixture of baking soda and water to clean terminals if corrosion is present.
- ❖ Tighten terminal connections to prevent poor electrical contact.
- ❖ Ensure proper ventilation in battery enclosures to prevent accumulation of explosive gases.
- ❖ Avoid overcharging, as it can lead to water loss and premature failure.
- ❖ Perform equalization charging periodically to prevent sulfation and balance cell voltages.
- ❖ Monitor battery temperature during charging to prevent overheating.



# BATTERY MAINTENANCE – LITHIUM ION BATTERY



- ❖ Avoid exposing lithium-ion batteries to extreme temperatures, both hot and cold.
- ❖ Use chargers specifically designed for lithium-ion batteries and avoid overcharging.
- ❖ Store lithium-ion batteries at a partial state of charge (around 50%) if not in use for an extended period.
- ❖ Do not fully discharge lithium-ion batteries, as it can lead to irreversible capacity loss.
- ❖ Monitor battery temperature during charging and discharging to prevent overheating.
- ❖ Avoid physical damage to lithium-ion batteries, as it can lead to internal short circuits.



# CHARGING A BATTERY



- ❖ Ensure you use a charger that is compatible with the type and size of the battery you are charging.
- ❖ Using an inappropriate charger can damage the battery or even pose safety hazards.
- ❖ Before charging, inspect the battery for any damage or leaks.
- ❖ Ensure the battery terminals are clean and free of corrosion.
- ❖ If necessary, clean the terminals with a mixture of baking soda and water.
- ❖ Connect the charger to the battery, making sure to match the positive (+) and negative (-) terminals correctly.
- ❖ Most chargers have indicators to show proper connection.





# CHARGING A BATTERY



- ❖ Depending on the type of battery and charger, you may have different charging modes available, such as trickle charge, fast charge, or maintenance charge.
- ❖ Select the appropriate mode based on the battery's requirements and the charging conditions.
- ❖ Once the charger is connected and set up correctly, start the charging process.
- ❖ The charger will deliver the necessary current and voltage to the battery to replenish its charge.
- ❖ Keep an eye on the charging progress and monitor the battery temperature if possible.



# CHARGING A BATTERY



- ❖ Some chargers have built-in features to automatically adjust the charging rate based on temperature or battery condition.
- ❖ When the battery is fully charged, the charger may automatically switch to a maintenance or float charge mode to keep the battery topped up without overcharging.
- ❖ If your charger doesn't have this feature, disconnect the charger once the battery is fully charged to prevent overcharging.
- ❖ Once charging is complete, disconnect the charger from the battery and store the battery in a cool, dry place if it's not immediately needed.
- ❖ Proper storage conditions can help extend the battery's lifespan.



THANK YOU !!!