RAILROAD & DIESEL STARTER
BATTERY USER MANUAL

Rolls

BATTERY ENGINEERING

Installation, charging and maintenance procedures for Rolls flooded lead-acid Railroad & Diesel Starter batteries.

Rolls

RAILROAD & DIESEL STARTER

TABLE OF CONTENTS

Rolls Battery has been manufacturing deep cycle lead-acid batteries since 1935. Experience and commitment to quality has helped us achieve an unmatched reputation in the industry. Our goal is to provide our customers with a premium product providing dependable performance and long-lasting cycle life. This manual provides the recommended setup, charging, Equalization and preventive maintenance procedures necessary to maximize the life of your Rolls batteries. If you have battery-related questions beyond the contents of this manual, we encourage you to visit our online Technical Support Desk (**support.rollsbattery.com**) for additional information or file a support ticket and our Technical Support team will be happy to assist you.

EQUIPMENT & SAFE HANDLING PROCEDURE

- Goggles, rubber gloves & rubber boots
- Distilled water
- Baking soda, soda ash
- hydrometer, refractometer
- voltmeter, ammeter
- battery charger

To prevent injury, always wear acid-resistant clothing, PVC gloves, goggles and rubber boots. Flooded batteries must always be maintained in an upright position. Always have plenty of water and baking soda on hand in the event of an acid spill during transport.

INSPECTION

When receiving shipment of your batteries, it is important to thoroughly inspect each pallet, battery and packaging. Before signing acceptance of the shipment, remove the shrink-wrap from the pallet and inspect each battery for damage (i.e. cracks, dents, punctures, deformations, acid leaks or other visible abnormalities).

Do not accept shipment if the batteries appear to have been damaged in any way. Confirm that connection terminals are secure and clean. If the battery is dirty, or if any minor amount of acid has spilled onto the case due to loose vent caps, refer to the cleaning instructions in this manual to properly neutralize and clean as necessary. Wet pallets or signs of acid leak on or around the batteries could indicate shipping damage or improperly sealed battery casing. Perform a voltage check to confirm the battery polarity and marking of the terminals are accurate.

In the event of a suspected leak or damage, do not accept the shipment. Contact your battery retailer or Rolls Battery to determine whether the batter(ies) require replacement.

Battery shipments which are known to be damaged, but accepted, will not be replaced under the terms of Rolls Battery manufacturer warranty.

QUICK CHECK LIST

SHIPPING/RECEIVING (MUST INSPECT PRIOR TO DRIVER RELEASE!)

- All parts are included
- No acid spills
- No visual damage to the batteries
- Verify electrolyte levels

INSTALLATION

- Protective equipment should be worn
- All electrical components should be turned off
- Acid spill cleanup material should be readily available

INITIAL CHARGE

- Verify electrolyte levels (add distilled water as necessary)
- Measure specific gravity
- Set up battery charge voltage/current limits

GENERAL

- Safety first!

DISPOSAL PROCEDURE

To reduce environmental impact, bring your spent lead-acid batteries to a certified recycling depot. Lead-acid batteries are 97% recyclable and are the most recycled consumer product in the world. Closed-loop manufacturing and recycling programs allows nearly all components to be recycled or re-purposed. A credit by weight for lead may be offered by recycling depots or facilities for spent batteries.

When processed safely, recycling batteries reduces the release of lead to the environment and conserves natural resources. Recycled lead production takes only 35-40% of the energy necessary to produce primary lead from ore. Lead may be recovered and re-purposed multiple times.

For more information on lead-acid battery recycling, visit **https://batterycouncil.org**

SAFETY

Follow your company's safety instructions when working with or near locomotive starting batteries. Observe the warning label affixed to the battery. Thoroughly familiarize yourself with industry and government guidelines (OSHA, ANSI) for charging, handling and maintaining locomotive starting batteries.

- Assign battery and charger care to properly trained personnel.
- Lead-acid batteries contain sulfuric acid. Avoid contact with skin, eyes or clothing. Wear rubber apron, gloves, boots and goggles or face shield when handling, checking, filling, charging or repairing batteries.
- Keep water readily available for flushing spilled electrolyte from eyes or skin. Use clean water only and obtain medical attention immediately. Special deluge showers and eye wash basins are required.
- Flooded lead-acid batteries produce hydrogen during charge which may ignite. Keep open flames away from the battery at all times. Do not check electrolyte level with a cigarette lighter or match. Use a flashlight or permanent lights if required. Do not smoke or create sparks.

Lift batteries with a hoist, crane, lift truck or similar equipment. Move batteries on trucks, conveyors or rollers. Be sure to place a rubber mat or similar insulating material across tops of batteries without covers when handling.

Make sure equipment used to move the battery is of ample strength to handle the size and weight and is properly installed.

CAUTION: DO NOT USE CHAIN, ROPE OR WIRE SLINGS

- Never lay metal tools, such as wrenches or other material on top of a battery.
- Disconnect the battery from the locomotive when performing maintenance and repair on motor or electrical system.
- Open or "break" battery circuit before attempting repairs to terminal.
- Apply a strong neutralizer, like baking soda, if electrolyte is spilled. Check local regulations regarding disposal of neutralized waste.

PROVISIONS AGAINST ELECTROLYTE HAZARD

Electrolyte and water
Electrolyte used in lead-acid batteries is an aqueous solution of sulphuric acid.

Electrolyte used in NiCd and NiMH batteries is an aqueous solution of potassium hydroxide. Distilled or demineralised water is used when topping up the cells.

Protective clothing
In order to avoid personal injury from electrolyte splashes when handling electrolyte and/or vented cells or batteries, protective clothing shall be worn, such as:

- protective glasses or face shields
- protective gloves and aprons

In the case of valve-regulated or gastight sealed batteries, at least protective glasses and gloves shall be worn.

Accidental contact, "first aid"
Acid and alkaline electrolytes create burns in eyes and on the skin. A source of clean water, from tap or a dedicated sterile reservoir, shall be provided in the vicinity of the battery under charging or maintenance for removing electrolyte splashed onto body parts.

Acid and alkaline electrolytes create burns in eyes and on the skin. A source of clean water, from tap or a dedicated sterile reservoir, shall be provided in the vicinity of the battery under charging or maintenance for removing electrolyte splashed onto body parts.

Eye contact
In the event of accidental contact with electrolyte, the eyes shall be immediately flooded with large quantities of water for an extended period. In all cases, immediate medical attention shall be obtained.

Skin contact
In the event of accidental skin contact with electrolyte, the affected parts shall be washed with large quantities of water or with adequate neutralising solutions. If irritation of skin persists medical attention shall be obtained.

Battery accessories and maintenance tools
Materials used for battery accessories, battery stands or enclosures, and components inside battery rooms shall be resistant to or protected from the chemical effects of the electrolyte.

In the event of electrolyte spillage, the liquids shall be removed promptly from all surfaces with absorbing and neutralizing material.

Maintenance tools such as funnels, hydrometers, thermometers which come in contact with electrolyte shall be dedicated either to the lead-acid or NiCd-batteries and shall not be used for any other purpose.

INSTALLATION

BLOCKING

When installed, locomotive batteries must be properly blocked in the battery compartment as shifting or movement may occur which could cause damage to the battery. All trays should be securely blocked. The battery should be securely and care taken to avoid over tight wedging. Clearance of approximately 30mm (1/8") should be left between the blocking and the battery trays. If reusing old blocking, ensure it is dry and not waterlogged.

TERMINAL CONNECTIONS

Terminal connections must be clean, tight, and properly torqued. Inspect terminals connections regularly as they may loosen over time due to vibration and repeated heating/cooling during the charging process. To prevent terminal damage, calibrate the torque wrench before use to ensure accuracy.

RECOMMENDED TORQUE SETTING		
TERMINAL	N-m	lb-ft
FLAG, PADDLE RR	27 N-m (max: 33 N-m)	20 lb-ft (max: 25 lb-ft)

NOTE: Damage to terminals and/or batteries caused by under/over-torque is often unrepairable and is not covered under manufacturer warranty. Distributors or Dealers may offer replacement or repair, where possible, at the customer's expense.

ELECTROLYTE INSPECTION

It is normal for electrolyte levels in flooded lead-acid battery cells to drop slightly after the initial filling during the manufacturing process. When a new battery is received, electrolyte levels should be checked during the inspection process to ensure the plates are fully submerged. If cells are low, top up with distilled water.
See **ELECTROLYTE-ADDING DISTILLED WATER** on pg. 12 for instructions.

Under normal operation, only distilled water should be added to each cell during routine top up. In the event of a spill, pre-mixed electrolyte may be added by qualified personnel only. Refer to the battery label for the appropriate electrolyte as this varies by model.

NOTE: Electrolyte supply should be removed from the locomotive shop to prevent improper filling.

TEMPERATURE COMPENSATION & SENSOR INSTALLATION

For charge accuracy and safety, many systems use a sensor mounted to the battery to measure cell temperature and adjust charge voltage accordingly. When available, the temperature sensor must be used to avoid improper voltage adjustments.

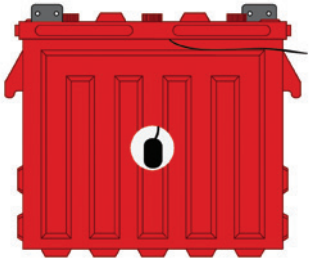
When using chargers that do not feature temperature compensation, voltage settings should be monitored and adjusted based on actual cell temperature. Failure to use or properly install the provided sensor may cause damage due to over/undercharge which is not covered under Rolls Battery manufacturer warranty. As a precaution, this sensor may also trigger a programmed safety charge cut-off as the battery should not exceed an operating temperature of 52ºC (125ºF).

Rolls locomotive & diesel starter models are designed with modular cells with dual-container construction for added durability and spill protection. Individual 2-volt cells are bolted or welded together and housed inside an outer red polypropylene case.

To ensure an accurate temperature reading, the temperature sensor must be mounted directly to the side of an internal cell. See **Figure 1 - Temperature Sensor** below. Do not mount the temperature sensor to the top or side of the outer red case, or to a battery terminal, as these areas will not provide an accurate reading of cell temperature and may cause the voltage regulator to improperly adjust charge voltage.

To access the cell, disconnect the terminal connections and remove the outer cover which snaps on to the case or may use small removable plastic pins. Mount the sensor to the internal cell and run the connecting cable between the case, being careful not to pinch or damage the wire when placing the cover back on. Automotive silicone is used to seal around each terminal to protect against spills, dust & debris. This may be reapplied when the case has been reassembled.

Figure 1 – Temperature Sensor



Dual-Container Locomotive & Diesel Starter Models - Remove case cover. Mount sensor to the side of internal cell below the liquid level. Replace the cover and re-seal around terminals with automotive silicone.

CHARGING

INITIAL REFRESHER CHARGE

Rolls Railroad & Diesel Starter batteries are fully charged and tested as part of the quality assurance processes before shipping. Like other lead-acid batteries, it is normal for these models to self-discharge slightly during transit. The battery will also self-discharge at any time it is not maintained on a float charge or has been disconnected and placed in storage. The rate of self-discharge varies by temperature, increasing in warmer temperatures and at a slower rate in low temperatures.

Before putting the battery into service, it should be placed on an initial refresher charge to ensure all cells are fully charged and balanced.

To begin, note the Amp-Hour rating and recommended charge voltage range on the battery label or product specifications to determine the appropriate charge current and voltage settings. Begin charging the battery at the recommended charge voltage.

When charging begins, the initial charge current will be highest as the battery begins accepting a charge. This may be as high as 20% of the 8-hour rate of the battery.

As the battery reaches full state-of-charge this is referred to as the finish rate. Charge current will reduce to 3% of the 20-Hour rate of the battery, indicating the battery has reached 100% SOC. Battery cells should read 2.35VPC.

VOLTAGE REGULATOR

Rolls Railroad & Diesel Starter models are used to supply power for locomotive engine starting and when the generating system is not running. Once the engine is running, the generating system begins charging to replace the power drawn from the battery. When complete, the battery is held at 100% state-of-charge at the float voltage until it is discharged again.

Input from the generating system to the battery is controlled by the voltage regulator. Much like a typical battery charger, it is important that the regulator is operating properly and charging at the correct voltage. The operating or float voltage

If the voltage regular is not in good operating condition or is adjusted to an incorrect float voltage, the battery will not function as intended. If the voltage is too low the battery will be consistently undercharged. If the voltage is too high the battery will be overcharged which will burn out the cells, shortening cycle life or causing premature failure.

Over time, low voltage settings will result is deficit cycling where more power is drawn from the battery than replaced during charging. This will reduce battery capacity and

shorten the life of the battery considerably. Undercharge is indicated by a decrease in specific gravity readings.

Overcharge is commonly identified by faster and/or excessive water loss due to off-gassing, dark electrolyte due to burning oxide paste or very high specific gravity readings.

The correct float voltage will charge and maintain the battery at full state-of-charge. This is determined by two factors – operating temperature and locomotive work schedule.

When properly installed, a temperature sensor regulates the float voltage, compensating for changes in cell temperature. See Figure 1 – Temperature Sensor for instructions.

RECOMMENDED FLOAT VOLTAGE

The recommended float voltage per cell at varying ambient temperatures are as follows:

TEMPERATURE	FLOAT VOLTAGE		
	VPC	8 VOLT	32 VOLT
GREATER THAN 27°C (80°F)	2.25-2.30 VPC	9.0-9.20V	36.0-36.8V
10°C (50°F) to 27°C (80°F)	2.30-2.33 VPC	9.20-9.32V	36.8-37.28V
LESS THAN 10°C (50°F)	2.33-2.38 VPC	9.32-9.52V	37.28-38.08V

The effect of locomotive work schedule on the correct float voltage is often determined by usage and experience. If the battery is used for starting frequently, such as an auto start/stop where the locomotive may be repeatedly started to warm the engine when not be in use, the float voltage should often be set at the higher end of the range indicated at the appropriate temperature; similarly, for infrequent battery usage, the operating or float voltage should be set at the lower end of the range.

Adjustments in float voltage may be necessary from season to season and in situations where the batteries have become sulfated.

NOTE: It is recommended that float voltage regulator adjustments be made while the engine is at operating speeds.

SPECIFIC GRAVITY

The specific gravity of electrolyte in a battery cell is the most accurate measurement of actual state-of-charge. Specific gravity decreases during discharge and increases again as the battery is charged. To determine if a battery has reached full charge, test a sample of the electrolyte in each cell using a hydrometer or refractometer.

The specific gravity of a fully charged battery will vary according to the pre-mixed electrolyte added during manufacturing. For reference, this is noted on the battery label.

RAILROAD & DIESEL STARTER MODELS	ELECTROLYTE
8V MODELS	1.250 S.G.
32V MODELS	1.265 S.G.

Routine testing of specific gravity in flooded lead-acid batteries provides an opportunity to quickly identify any notable changes in battery performance caused by charge-related issues such as over/undercharging, sulfation buildup, capacity loss, cell/battery performance or failures.

Routine testing and tracking of specific gravity readings is suggested as part of the normal battery maintenance procedures. When monitored regularly, varying or low readings may be identified early on, and charge adjustments made to quickly correct and prevent any further issue or damage.

EFFECT OF TEMPERATURE ON SPECIFIC GRAVITY

Temperature will affect the specific gravity reading of electrolyte. When taking specific gravity readings with a hydrometer or refractometer, it is important to correct for ambient temperature.

To adjust a specific gravity reading for varying ambient temperature, one point (.001) should be added for every 1.6°C (3°F) above 25°C (77°F). Alternatively, one point (.001) should be deducted for every 1.6°C (3°F) below 25°C (77°F).

As an example, a specific gravity reading of 1.265 at 17°C (63°F) corrected for temperature would be 1.260. A specific gravity reading of 1.265 at 30°C (86°F) corrected for temperature would be 1.268.

Battery capacity is also based on each cell having an electrolyte temperature of 25°C (77°F). Temperatures below 25°C (77°F) reduce the battery's effective capacity and lengthen the time to restore to full capacity. Temperatures above 25°C (77°F) will slightly increase capacity but will also increase self-discharge rates as well as cell degradation, shortening battery life.

EFFECT OF ELECTROLYTE LEVEL ON SPECIFIC GRAVITY

Varying electrolyte levels will affect the specific gravity reading of electrolyte. The specific gravity reading will decrease as distilled water is added to cells and will increase as the electrolyte level decreases. Over time, it is normal for the electrolyte level in each cell to drop as water evaporates during the charging process.

For reference, a decrease of 31mm (1/8”) in electrolyte level will typically result in an approximate increase of .003 in specific gravity.

MAINTENANCE

VENTILATION & VENT CAPS

Hydrogen gas is produced when charging flooded lead-acid batteries. To avoid a buildup of gas and/or risk of explosion, proper ventilation is required, and the battery vent caps must be kept clean and properly installed. Remove dust, dirt or other material that may prevent the free circulation of air. The batteries should be inspected, and vent caps removed, cleaned, and replaced periodically as part of the regular maintenance procedure.

A sticky dark gray residue may be visible on the inside of the standard 1/4-turn bayonet, R-Caps or watermiser vent caps on flooded battery cells. This buildup of dirt and dried electrolyte is quite common and, over time, may clog the vent holes preventing the release of hydrogen off-gas during charging. Inspect the caps and clean using a neutralizing baking soda and water solution as necessary.

CLEANING STEPS:

1. Clean the vent caps by soaking in a solution of water and baking soda (100g per litre) in a bucket or small bowl. Let the vent caps sit overnight to neutralize and break down any electrolyte in the caps.

2. Flush the vent caps clean by forcing water through the vent holes. Water should drip freely. A trickle of water should flow from all vent holes, indicating the cap is clear of debris.

3. Allow the vent caps to dry completely. Once dried, shake recombination caps (where supplied) to make sure the condensing beads on the inside of the cap rattle slightly. If you do not hear the beads, let the cap dry for an additional 12 hours or repeat the process above.

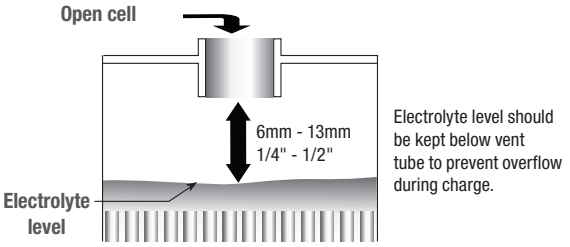
ELECTROLYTE - ADDING DISTILLED WATER

When adding water, always use distilled water or water that is known to be free of impurities. Improper watering may cause internal cell damage. Test water to confirm a PH reading of 7 or less and no Total Dissolved Solids (TDS < 5 PPM). A TDS meter may be used to test and determine an accurate measure of water purity.

Contact Rolls Battery Technical Support or your local Dealer if you have questions or are unsure of your water quality.

NOTE: Only distilled water should be used when topping up cells. Do not add sulfuric acid to flooded battery cells during routine top up. In the case of accidental spill, premixed electrolyte at the appropriate specific gravity may be used to refill cells. See battery label for reference.

Figure 2 – Adding distilled water



CAUTION: Do not add water or electrolyte to cells before initial charging unless the plates are exposed. If so, add distilled water until plates are fully submerged. Please contact Rolls Technical Support if you have any questions or concerns.

NOTE: Routine cell inspection should be completed to maintain adequate electrolyte in all cells during battery operation and storage. If the electrolyte level drops below the top of the plates the exposed surfaces will harden and become sulfated. In this case, capacity loss and cell damage are often permanent.

WATERING INTERVALS

Flooded lead-acid batteries, during normal operation, will generate hydrogen and oxygen from water in the electrolyte and will require refilling periodically.

Gassing or water consumption in a battery is a function of float voltage and operating temperature. Excessive water consumption indicated the voltage regulator setting is too high and should be reduced. Typically, it should not be necessary to add distilled water to the battery more than once every 30-90 days in warmer summer months and once every 60-90 days in cooler winter months.

If a gradual decrease in specific gravity readings is noted, or the readings consistently remain 10 to 20 points below the noted specific gravity at full charge, the voltage regulator is set too low for the locomotive's work schedule, and it should be increased to allow more charge. Do not increase or decrease the voltage regulator setting more than 0.5 volts at a time. Recheck the battery after each adjustment to see if an additional change in is necessary.

NOTE: Select Rolls Battery Railroad & Diesel Starter models have been specifically designed with a larger electrolyte reserve to allow for extended watering intervals (up to 180 days). Refer to the product specifications for the noted electrolyte reserve for each model.

AUTOMATIC WATERING SYSTEMS

Frequent locomotive starts demand aggressive charging of the locomotive batteries, resulting in increased water use. To avoid damage and ensure cranking amps are available, it is important that the proper electrolyte level is maintained in each cell.

Rolls Locomotive Single-Point Watering Systems by Flow-Rite will automatically top up the correct amount of distilled water in each cell in 1-2 minutes is the only single point watering system designed specifically for locomotives. Designed to eliminate the need to lift or remove a battery for watering, the Rolls Locomotive Single-Point Watering System is the only watering system with internal flame arrestors and includes a de-gas chamber to allow normal release of gasses. This system has been specifically designed to allow for electrolyte expansion to avoid dangerous acid spills.

- Installs on all major brands of locomotive starting batteries
- Low profile design fits in locomotive battery compartments
- Acid resistant, polypropylene components and tubing
- Designed to survive extreme temperatures and vibrations

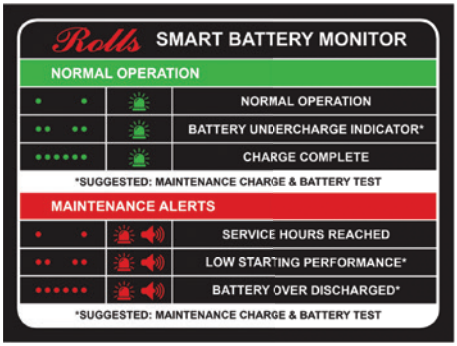
NOTE: To ensure proper operation, routine inspection of watering systems is recommended.

Contact your Rolls Battery distributor or dealer for more information. When requesting pricing, indicate the battery make, model and preferred water supply.

LOCOMOTIVE SMART BATTERY MONITORING SYSTEM

To operate efficiently, locomotives rely on dependable deep cycle batteries for engine starting. Proper charging and maintenance is key to maximizing battery performance including capacity, starting crank Amps and cycle life. Utilizing a simple and easy-to-read LED visual indicator and audible alerts, Rolls integrated Locomotive Smart Battery Monitor offers maintenance crews supportive information relating to battery health as well as state-of-charge and engine starting ability.

Select Rolls 32-volt locomotive models (**16 CH 25R-MON, 16 CH 33R-MON**) are equipped with an integrated Rolls proprietary Locomotive Smart Battery Monitor to track and provide real-time undercharge monitoring, discharge monitoring, impedance monitoring as well as performance & maintenance alerts with simple audio & visual communication.



FEATURES:

BATTERY UNDERCHARGE INDICATOR: Chronic undercharging reduces cycle life and is a specific concern with automatic engine start/stop (AESS) control systems. Rolls Locomotive Smart Battery Monitor alerts where incidents of undercharge may be occurring, helping guide operators to perform regular and restorative maintenance charges to avoid capacity loss and maintain starting performance.

CHARGE COMPLETE: Accurately tracking charge current and battery voltage, Rolls Locomotive Smart Battery Monitor assists in identifying when the battery has reached full state-of-charge and charging may be terminated. A unique LED sequence helps to confirm the charge is complete and the battery is now ready to be put into service.

SERVICE HOURS: Tracking battery age and charge cycles, Rolls Locomotive Smart Battery Monitor features a visual LED & audible alarm to identify batteries in service which have reached their specified or expected end-of-life period. This audio/visual indicator helps to ensure timely battery replacement and safeguard against unexpected fail-to-start events.

LOW STARTING PERFORMANCE: Rolls Locomotive Smart Battery Monitor continually monitors battery starting capability. Using a rising audible alert & LED, the monitor notifies operators of below specification starting performance due to increased battery impedance, suggesting a restorative maintenance charge & testing should be completed.

OVER DISCHARGE ALERT: Unintentional deep discharges reduce battery life and create fail-to-start conditions. Ensuring adequate charging and avoiding heavy discharge will maintain battery capacity and cranking performance. Using a combined LED indicator and continuous audible alarm, Rolls Locomotive Smart Battery Monitor alerts operators during incidents of abnormally low discharge which may lead to a fail-to-start event, suggesting a restorative maintenance charge & testing be performed before use.

SULFATION

When a battery is being discharged the lead active material on the plates will react with the sulfate from the electrolyte forming a lead sulfate on the plates. When there is no lead active material and or sulfate from the electrolyte remaining the battery then is completely discharged. After a battery reaches this state, it must be recharged. During recharge, the lead sulfate is reconverted into lead active material and the sulfate returned to the electrolyte.

When the sulfate is removed from the electrolyte the specific gravity is reduced and the reverse takes place when the sulfate is returned to the electrolyte. The most accurate measure of state-of-charge for flooded lead-acid battery cells is a specific gravity test using a hydrometer or refractometer.

If a battery is left in a discharged condition the lead sulfate will harden and have a high electrical resistance. This is what is normally called a sulfated battery. The lead sulfate may become so hard that normal recharging will not break it down. Most charging sources, engine alternators and battery chargers, are voltage regulated. Their charging current is controlled by the battery's state of charge. During charging, battery voltage rises until it meets the charger's regulated voltage, lowering the current output along the way.

When hard sulfate is present, the battery shows a false voltage, higher than its true voltage, fooling the voltage regulator into thinking that the battery is fully charged. This causes the charger to prematurely lower current output, leaving the battery discharged. Charging at a higher-than-normal voltage and low current may be necessary to break down the hardened sulfate.

Hardened sulfate also forms in a battery that is constantly being cycled in the middle of its capacity range (somewhere between 80% charged and 80% discharged) and is never recharged to 100% SOC. Over time, a portion of the plate's active materials turns into hard sulfate. If the battery is continually cycled in this manner, it will lose more and more of its capacity until it no longer has enough capacity to perform the task for which it was intended. An equalizing charge, applied routinely every three to four weeks, should prevent the sulfate from hardening.

In both cases, the fact that the battery "won't take a charge" is a result of improper charging procedures which allowed the sulfate to harden. In most instances, it is possible to salvage a battery with hardened sulfate. The battery should be charged from an outside source at 2.6 to 2.7 VPC and a low current rate (approximately 10-Amps) until the specific gravity of the electrolyte starts to rise. (This indicates that the sulfate is breaking down.)

To prevent cell damage, be careful not to let the cell temperature of the battery rise above 51°C (125°F). If it does, turn the charger off and let the battery cool. Then, continue charging until each cell in the battery is brought up to full charge, verified by specific gravity readings. The time needed to complete this recharge depends on how long the battery has been discharged and how hard the sulfate has become.

If a battery does not seem to be taking or holding a charge, test the specific gravity of each cell with a hydrometer or refractometer. If all cells are reading low even after an extended charge, it is likely that hardened sulfate that has accumulated on the plates. By following the instructions outlined above, the problem may be corrected.

OTHER CAUSES OF SULFATION:

LOW ELECTROLYTE LEVEL - If the electrolyte level in a cell drops below the top of the plates the exposed surfaces will dry, harden and become sulfated. In this case, cell damage and capacity loss is usually permanent.

ADDING ELECTROLYTE - If premixed electrolyte is added to a sulfated cell, the condition will be aggravated.

HIGH SPECIFIC GRAVITY – High specific gravity of electrolyte increases the accumulation of sulfation. Batteries which reach a full state-of-charge, as measured by specific gravity on a regular (weekly) basis, are much less likely to experience sulfation buildup.

HIGH TEMPERATURE – High operating temperatures will also accelerate sulfation buildup. This is often noticeable in an idle, partially discharged battery.

TREATING SULFATED BATTERIES THAT DO NOT RESPOND TO CHARGING AT A LOW RATE

1. Follow regular charging procedures at the recommended charge voltage & charge rate.

2. Complete a discharge test to determine battery capacity. See pg. 19 for instructions.

3. If there is a gradual improvement but 80% of rated capacity is not reached, continue to repeat steps 1 and 2 until 80% capacity has been reached or no further improvement is noted. If no improvement is noted, discontinue test and replace battery.

4. If the battery has not responded to the above procedure, the battery may be permanently sulfated or the electrolyte may have been spilled or flushed from the cell and replaced with water.

CELL REPLACEMENT – WELDED CONNECTIONS

Depending on the battery model, cells may have bolt-on or welded connections. If a cell replacement is required and the connections are welded, follow the steps below to safely disconnect, remove and replace a cell.

1. Disconnect the battery terminal connections, remove lead nuts & bolts, and each of the cell vent caps.

2. Remove the automotive silicone around each battery terminal by running a knife along edge of terminals to separate silicon sealant from terminal.

3. If plastic fasteners are used on the battery cover, carefully remove with a screwdriver.

4. Remove the battery cover by lifting from the edge. If it is difficult to remove, tap the bottom of the corners with a hammer to lift the edge.

5. With the battery cover removed, blow into each cell to drive out any accumulated hydrogen gas to avoid igniting during the cell replacement. Stand back as far as possible and pass a lighted torch over each cell opening to remove any remaining hydrogen gas. When complete, replace the vent cap on each cell.

6. On the cell to be removed, with # 53 hollow post drill bit, drill a hole where the connectors join the cell on each side to disconnect.

7. Using a 3/16 polypropylene rope, make a sling by slipping the rope under all connectors of the cell to be removed. Slowly lift the cell using the sling to remove.

8. If the defective cell will be replaced with a used cell from another battery, use the electrolyte from the used cell.

9. If the old connectors are to be used again, clean with a wire brush, neutralize and dry. Clean the inside hole of the connector with a knife.

10. Repeat step #6 on the replacement cell. Once completed, use the # mu-71 torch to weld the connectors on the replacement cell.

11. Remove the vent caps from each cell before reinstalling the battery cover. When replacing the battery cover ensure that the rubber rings on all vent well openings are properly aligned. Push down on each ring to ensure a snug fit. When the cover is aligned, tap on the top of the cover to snap it in place and replace the plastic fasteners (if used) to secure.

12. Replace the vent caps, lead nuts and bolts, and reseal around the battery terminals with silicone.

13. Place the battery on charge at the finish rate until specific gravity readings and cell voltages are balanced.

STORAGE

GENERAL CARE:

Spare charged batteries should be cleaned regularly and stored in a clean, cool, dry place, free from dust and debris.

Stored batteries should be recharged every 3 months until the battery is put in service to avoid sulfation buildup and possible freezing in cold temperatures. Electrolyte may freeze if the battery becomes discharged to approximately 50% SOC at -20ºC (-4ºF)

Railroad & Diesel Starter models with Advanced NAM carbon additive may see an increased self-discharge rate of 20-25% per month at 25ºC (77ºF) when not in use. A refresher charge may be necessary every 2-3 months.

TESTING:

Spare charged batteries should be checked quarterly to determine the specific gravity. Batteries should be charged when the specific gravity drops thirty (.030) points below the specified fully charged reading. Self-discharge is affected by ambient temperature. When not in use, it is normal to expect 10-12% self-discharge per month at 25ºC (77ºF) for flooded models. This rate slows as ambient temperatures decrease and increases at higher temperatures. Stored Flooded batteries should be recharged every 3 months until the battery is put in service to avoid sulfation buildup and possible freezing in cold temperatures.

NOTE: battery damage or failure caused by over-discharge, sulfation buildup, electrolyte stratification or excessive electrolyte loss while in extended storage without proper charging is not covered under the manufacturer warranty.

CHARGING:

When charging is required, use the finish rate. Continue charging until gassing occurs. Charging should not be discontinued until the temperature-corrected specific gravity of the lowest cell has risen to the maximum or has shown no further rise for two (2) consecutive hourly readings.

DISCHARGE TEST:

A discharge test may be completed to determine battery health and available capacity.

A test discharge may be made to determine if a battery is delivering its rated capacity. The test is conducted by discharging a fully charged battery at a constant ampere rate until the battery voltage drops to the accepted discharge termination value of 1.75 VPC. By noting the time lapse between the time the battery is put on discharge and time the voltage drops below termination value (7.0V for 8-volt models, 56.0V for 32-volt models), will indicate whether the battery is delivering rated capacity.

1. Record the time at which the discharge test is started.

2. During the test, individual cell voltages and overall battery voltages are recorded at intervals. The first readings should be taken 15 minutes after starting the test and then at each hourly interval, from starting time, until voltage of any one cell reaches 1.75 VPC.

3. Once the first cell voltage reaches 1.75 VPC, cell and battery voltage should be monitored under constant observation and readings taken at 15 minute intervals.

4. Record the time at which the voltage of each cell reaches 1.75 VPC until the terminal voltage of the battery (7.0V for 8-volt models, 28.0V for 32-volt models) is reached.

5. Stop the test discharge when the average of the cell voltages have reach 1.75 VPC and termination value (7.0V for 8-volt models, 28.0V for 32-volt models) and before any single cell goes below 0.5 volts. As an example, when testing a 32 cell set of batteries the test is terminated when the total voltage falls below 56.0V.

6. Record the cell voltages just prior to termination of the test and record the specific gravity of each cell immediately after terminating the test discharge. The readings will determine whether the battery is uniform or if any or more cells are low in capacity.

NOTE: if the battery is uniform (similar specific gravity readings) and delivers 80% or more of its rated capacity, return the battery to service.

If the battery fails to reach 80% of its rated capacity and, after charging, specific gravity readings do not reach the manufacturers specifications or are imbalanced, the battery may be sulfated.

WARRANTY

We build one mean battery and we back them with comprehensive warranties that lead the industry in length of coverage. We're confident that our batteries will perform time after time, year after year. However, should a problem arise, you may be assured that you're covered better than any other battery warranty in the business.

Surrette Battery Company warrants that Rolls-branded batteries sold by it are quality tested, merchantable and free of defects in workmanship and material at the time they are shipped from the Company's factory.

In the event that the Company makes a drop shipment to a distributor's customer, that customer must be instructed to perform an inspection of the goods BEFORE signing the delivery slip. The Company is not responsible for damaged product reported after shipment has been signed "Received in Good Condition".

NOTE: ALL SHIPMENTS SHOULD BE THOROUGHLY INSPECTED FOR DAMAGE BEFORE SIGNING THE DELIVERY SLIP.

The Company will replace or, at its option, repair any Rolls Battery sold by it that fails to conform to the warranty stated above on a NO CHARGE BASIS. For warranty terms, conditions and model-specific details, please refer to the warranty document found on the Rolls Battery website.

A copy of the **Rolls Battery Warranty Claim Form & Battery Test Sheet** is also available for download in PDF format.

To claim a manufacturing warranty, proof of purchase must be presented, showing the date of purchase and the battery's model & date of manufacture (date code). A completed **Rolls Battery Warranty Claim Form & Battery Test** Sheet must also be provided. Upon review, it may be necessary to have the battery returned to the manufacturer or inspected and tested by an authorized battery outlet for actual defect.

All valid claims must be approved by Rolls Battery Technical Support before replacement product may be issued.

The warranty does not cover shipping damage, cracked covers, cracked cases, bulged cases from heat, freezing or explosion, discharged batteries or the use of undersized batteries damaged from electrical equipment. This warranty covers only manufacturing defects.

The Company makes no warranty with respect to its batteries other than the warranty stated above. All implied warranties of merchantability and all expressed and implied warranties of any other kind are hereby excluded.

ROLLS RAILROAD BATTERIES - RR CROSS REFERENCE GUIDE

ROLLS				
MODEL	DESCRIPTION	GE	EXIDE	GNB
8 HHG 21P	8HHG21PR 8V BATTERY			
8 HHG 25P	8HHG25PR 8V BATTERY			
8 HHG 29P	8HHG29PR 8V BATTERY			
8 HHG 31P	8HHG31PR 8V BATTERY			
8 CH 17SP	8CH17SPR 8V BATTERY		4-LMS-11	
8 CH 17ER	8CH17ER 8V BATTERY			
8 NS 23P	8NS23PR 8V BATTERY		4-LMS-325	
8 CH 23P	8CH23PR 8V BATTERY	3X9540	4=LMS-420 4=LMS-450	KDZ-2701
8 CH 23P-QR	8CH23P-QR 8V BATTERY			
8 NS 33P	8NS33PR 8V BATTERY	40090224		
8 CH 33P	8CH33PR 8V BATTERY	84C612573ABP1 3X7884		KDZ-3001
16 CS 15P	16CS15R 32V BATTERY			
16 CH 25P	16CH25R 32V BATTERY		LMUD-500 16-LMUD-530	KDZ-EM500 KDZ-501
16 CH 33P	16CH33R 32V BATTERY		LMUD-660	KDZ651
16 CH 35P	16CH35R 32V BATTERY		16-LUMD-725	

Verify dimensions of battery compartment.

REPLACES

CROWN	JMA	EAST PENN	EMD	FIRST NATIONAL
LP-817				
LP-819				
LP-821				
LP-825				
	JMA-M4513	DL-3000S		4 DS 280
		DL-3000L		
		DL-4000		4 DS 390
MD-517	JMA-M4517	DL-4500		4MIL15DS
		DL-5000		
		DL-6000		
MD-525	JMA-M4525	DL-6500		4MIL25DS
			40125224	
			40105253	
UD-519	JMA-U519	DL-U500	40020109	
UD-525	JMA-U525	DL-U650	40084033	
	JMA-U531			

CONTACTS

Surrette Battery Company Ltd.
PO Box 2020, 1 Station Road
Springhill, Nova Scotia, Canada
B0M 1X0

PHONE:
1 902 597 3767 (local)
1 800 681 9914 (toll free)

FAX:
1 902 597 8447 (local)
1 800 681 9915 (toll free)

CUSTOMER SERVICE:
1 902 597 4005
customerservice@rollsbattery.com

SALES:
1 902 597 3767 (local)
1 800 681 9914 (toll free)
sales@rollsbattery.com

TECHNICAL SERVICE:
1 902 597 3767 (phone)
1 800 681 9914 (toll free)
support@rollsbattery.com

TECHNICAL SUPPORT TICKET:
support.rollsbattery.com

ver.1.5 (07/22)


8959
8959
Rolls

Surrette
BATTERY COMPANY LIMITED

Rolls
BATTERY ENGINEERING

ROLLSBATTERY.COM