RAILROAD & DIESEL STARTER
BATTERY USER MANUAL

Rolls

BATTERY ENGINEERING

Recommended charging, equalization and preventive maintenance procedures for Rolls flooded deep cycle Railroad & Diesel Starter batteries.

RAILROAD &
DIESEL STARTER

Rolls

MARINE

MOTIVE POWER

RENEWABLE
ENERGY

AGM

RAILROAD / DIESEL STARTING BATTERY INSTALLATION AND OPERATING INSTRUCTIONS

SAFETY

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

- Assign battery and charger care to properly trained personnel.
- This battery contains 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 plain water only and obtain medical attention immediately. Special deluge showers and eye wash basins are required.
- Batteries produce hydrogen during charge. Keep open flames away. Do not check electrolyte level with a cigarette lighter or match. Use a flashlight or permanent lights. 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 is of ample strength and 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 battery from 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, when acid is spilled on the floor. Check local regulations regarding disposal of neutralized waste.

RECEIVING BATTERIES

Immediately upon receipt of shipment, examine the outside of the packing for signs of rough handling before accepting battery from carrier. Wet spots on the shipping pallet may be an indication of leaking cells broken in shipment.

If there is evident damage, the receipt should be signed and both copies (carrier's and receiving copies) marked "Damaged Shipment". The carrier should be called immediately and asked to make a "Carrier's Inspection for Damage Report".

If "concealed" damage is later detected, the carrier should be called immediately and request to make a "Concealed Damage Report". After inspection by the carrier, arrangements should be made with the local Rolls Battery Dealer or Distributor to have the battery repaired or replaced before placing it in service.

NEVER ADD ELECTROLYTE UNLESS THE ELECTROLYTE HAS BEEN SPILLED.

Qualified repair personnel should only do adding of electrolyte. We recommend that electrolyte should be removed from the locomotive shop.

UNEQUAL SPECIFIC GRAVITY AND CELL VOLTAGES

Probable cause:

1. Overfilled with water
2. Operating cell with cracked container
3. Acid not adjusted properly after cell change
4. Operating cell with vent caps removed
5. Sealing compound leaks (old style)
6. Operating battery with broken cell cover
7. Neutralizing material in cell
8. Over discharge
9. Dirty battery top
10. Cells operated with low electrolyte level
11. Sediment space filled (old style)
12. Defective cell

INITIAL FRESHENING CHARGE

The rule of thumb for charging rates is as follows:

1. Initial rate may be as high as 20 percent of the 8-hour rate.
2. The finish rate (2.35 VPC or when the battery begins to gas freely) maybe as high as 5 percent of the 20-hour rate.
3. Do not let the battery temperature exceed 46°C (115° F)

Remove vent caps from each cell and check to see that the electrolyte level is above the perforated, plastic element protector. During shipment of the battery, low temperatures and/or normal shock and vibration often results in a drop in the electrolyte level. If the level is below the element protector, add water until the protector is covered. If it is obvious that electrolyte has spilled out of any cells, replace it with electrolyte of the same specific gravity as found in the other cells of the battery.

Replace vent caps and give battery a freshening charge of 3 to 6 hours or by continuing the charge until there is no increase in specific gravity for three hydrometer readings taken at one-hour intervals.

CONTINUE CHARGING AND MAKE FINAL ADJUSTMENT OF THE ELECTROLYTE LEVEL TOWARD THE END OF THE CHARGE.

Upon completion of the freshening charge, the normal fully charged specific gravity should be 1.245 to 1.255 at 27°C (77° F).

INSTALLING BATTERY (BLOCKING)

Negligence in properly blocking battery in compartment is apt to permit shifting and may cause damage. All trays should be securely blocked, but care should be taken to avoid over tight wedging. Clearance of about 1/8" should be left between the blocking and the battery trays.

If reusing old block ensure it is dry and not water logged.

TERMINAL CONNECTIONS

Make original connections clean and tight. Inspect terminal connections regularly and keep them clean and tight.

Terminal Torque	Terminal Torque
NM	Ft/Lbs
33	25

VOLTAGE REGULATOR

The battery is only one part of a total system. All of the parts of which are inter-related and interdependent. The battery simply stores energy in a chemical form for use when the generating system is not running. It is not a source of power, but merely a reservoir. The battery supplies power for starting but, as soon as the engine is running, the generating system must replace the power withdrawn from the battery.

Input from the generating system to the battery is controlled by the voltage regulator. It is important to make sure that the regulator is known to be in satisfactory operating condition and adjusted to the correct operating voltage.

If the voltage regulator is not in good operating condition or is adjusted to an incorrect operating voltage, the battery will not function satisfactorily because the charge it receives will be insufficient (undercharged) or excessive (overcharged). In severe cases of bad regulation and overcharging, failure can take place within a year. Overcharge is indicated by faster water loss than normal.

A bad regulator or one set too low can cause undercharge - a condition that will literally starve the battery to death. In this case, more power is drawn out of the battery than is replaced.

As a result, the battery gradually runs down until it is so low that it fails completely. Undercharge is indicated by decreasing electrolyte specific gravities.

The correct operating or battery float voltage to be set on the regulator is that which will maintain the battery in a fully charged condition. This correct setting depends on two factors - operating temperature and locomotive work schedule. It is recommended that voltage regulator adjustments be made while the engine is at operating speeds.

Correct battery float voltage at different environmental temperatures are as follows:

Temperature	Float Voltage (Volts/Cell)
Greater than 27° C (80°F)	2.25-2.30
10° C (50°F) to 27° C (80°F)	2.30-2.33
Less than 10° C (50°F)	2.33-2.38

The effect of locomotive work schedule on the correct float voltage is determined with experience. If battery is used for starting very frequently, float voltages should be set at the higher end of the range indicated at the appropriate temperature; similarly, for infrequent battery usage, float voltages should be set at the lower end of the range.

VENTILATION

As explained, gases produced from a charging battery are explosive. Clean all ventilating openings to remove any collection of dirt or dust that might prevent the free circulation of air.

WATER ADDITION

All flooded lead acid batteries, in the course of normal operation, generate hydrogen and oxygen from water in the electrolyte.

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. Normally, it should not be necessary to add water to the battery more than once every 30-90 days in the summer and once every 60-90 days in the winter.

If the gravity reading shows a continual lowering, or consistently remains 10 to 20 points below the fully charged gravity, 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 1/2 volt at a time. Recheck the battery after each adjustment to see if an additional change in regulator setting is necessary.

The maximum electrolyte level, with the battery on charge, is at the bottom of the vent well. It should always be maintained between there and the top of the perforated, plastic element protector. However, such things as cold temperature or extended open circuit stands will cause the level to drop without the loss of electrolyte or water from the cells. Under these conditions, do not adjust the level without first charging the battery for 3-6 hours. Before charging, make sure the electrolyte covers the plates under the element protector. Otherwise, electrolyte overflow may result.

When adding water, always use distilled water or water that is known to be free of abnormally high amounts of impurities. Contact Rolls Battery Technical Support or your local Dealer if you have questions or are unsure of your water quality.

SPECIFIC GRAVITY

Read the specific gravity of the electrolyte BEFORE adding water, otherwise the reading will be low. Return all electrolyte to the cell from which it was taken.

EFFECT OF TEMPERATURE ON SPECIFIC GRAVITY:

Variations in temperature affect the specific gravity of the electrolyte and temperature corrections should be made. One point (.001) should be added to the hydrometer reading for every 1.6°C (3°F) above 25°C (77°F) and one point should be subtracted for every 3°F below 25°C (77°F). Make a record of the reading.

EFFECT OF ELECTROLYTE LEVEL ON SPECIFIC GRAVITY:

Variations in solution height affect the specific gravity of electrolyte. Normally water is consumed in the operation of a battery and electrolyte levels will decrease, causing a slight increase in specific gravity. For every 1/8" decrease in electrolyte level of these batteries there will be an approximate increase of .003 in specific gravity. The specific gravity should be 1.250 when the battery is fully charged and the electrolyte level is at the maximum.

CLEANING

Keep vent caps in place during use and charging. Remove only to observe levels, make water additions, take temperatures, or take specific gravity readings with a hydrometer. The battery can be washed off with water if dusty. Keep vent caps in place. If electrolyte has accumulated on top, wash with an approved neutralizing solution. Follow with a rinse using clear water. Dispose of all waste materials in an environmentally safe manner.

STORAGE OF SPARE BATTERIES

GENERAL CARE: Spare charged (wet) batteries should be cleaned regularly. A clean, cool, dry place, free from dust and debris should be selected for storage.

TESTING: Spare charged (wet) 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. Temperature affects the need for charges. Usually a charge is required every three (3) months.

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 and has shown no further rise for two (2) consecutive hourly readings.

DISCHARGE TEST: Cell voltages and specific gravity readings are affected by temperature. When taking specific gravity measurements, it is important to correct for temperature to get a true reading. As a rule of thumb, specific gravity will change by 0.003 with every 10°F change in temperature above or below 25°C(77°F).

Below 25°C (77°F) subtract from readings and above 25°C (77°F) add to the readings. As an example a reading of 1.265 at 19°C (67°F) corrected for temperature would be 1.262 and a reading of 1.265 at 30°C (87°F) corrected for temperature would be 1.268.

Battery capacity is 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 and shorten battery life.

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 volts per cell. By noting the time lapse between the time the battery is put on discharge and time the voltage drops below termination value, will indicate whether the battery is delivering rated capacity.

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

B. During the test, individual cell voltages and overall battery voltages are recorded at intervals. The first should be 15 minutes after starting the test and then at each hourly interval, from starting time, until voltage of any one cell reaches 1.80 volts.

C. After conditions as per above have been reached voltage should be under constant observation and taken at 15 minute intervals.

D. Record the time when each cell voltage goes below termination value.

E. Stop the test discharge when the average of the cell voltages reach termination value 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 volts.

F. Record the cell voltages just prior to termination of 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 and delivered 80 percent or more of its capacity, return the battery to service.

If the battery failed to reach 80 percent of its capacity and the after charging specific gravities did not reach manufacturers specifications the battery may be sulfated. See section 4 sulfated battery.

SULFATED BATTERY

How many times have you heard the expression, “the battery won’t take a charge” or “the battery won’t hold a charge”? More often than not, the culprit is hardened sulfate on the battery plates. Below we will attempt to explain what that means, what the causes are, and some measures to prevent the sulfate from permanently damaging your battery.

Let’s look inside a battery cell. Basically, there are the positive plates, the negative plates, separators to keep the plates apart, and electrolyte (sulfuric acid and water).

In normal use, battery plates are getting sulfated all the time. 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 re-converted 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. This is why the state of charge can be determined with the use of a hydrometer.

If a battery is left standing in a discharged condition the lead sulfate will become hard 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.

All cells of a sulfated battery will give low specific gravity and voltage readings. The battery will not become fully charged after normal charging. An internal inspection will disclose negative plates having a slate-like feeling, with sulfated negative-plate material being hard and gritty and having a sandy feeling when rubbed between thumb and forefinger. The internal inspection should be made after a normal charge, since a discharged plate is always somewhat sulfated. A good fully charged negative plate is spongy and springy to the touch and gives a metallic sheen when stroked with the fingernail, or knife. A sulfated positive plate is a lighter brown color than a normal plate.

When hard sulfate is present, the battery shows a false voltage, higher than it’s true voltage, fooling the voltage regulator into thinking that the battery is fully charged. This causes the charger to prematurely lower it’s 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.

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 - volts per cell and a low current rate (approximately 5 amps for small batteries and 10-amps for larger ones) until the specific gravity of the electrolyte starts to rise. (This indicates that the sulfate is breaking down.) Be careful not to let the internal temperature of the battery rise above 46°C (115°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. This time needed to complete this recharge depends on how long the battery has been discharged and how hard the sulfate has become.

The next time your batteries don't seem to be taking or holding a charge, check the specific gravity with a hydrometer. If all cells are low even after a long time on charge, chances are you've got some hardened sulfate that has accumulated on the plates. By following the instructions outlined above, the problem may be corrected.

OTHER CAUSES OF A SULFATED BATTERY ARE AS FOLLOWS:

A. LOW ELECTROLYTE LEVEL

If the electrolyte level is permitted to drop below the tops of the plates the exposed surfaces will harden and become sulfated. In this case the damage is usually permanent.

B. ADDING ACID

If acid is added to a cell in which sulfation exists, the condition will be aggravated.

C. HIGH SPECIFIC GRAVITY

Normally the higher the fully charged specific gravity of a cell the possibility of sulfation to occur and the more difficult to reduce.

D. HIGH TEMPERATURE

High temperatures accelerate sulfation. This is more noticeable in an idle, partially discharged battery.

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

1. Repeat procedure in section 2 - charging.
2. Repeat procedure in section 3 - discharge test.
3. If this procedure does not result in at least 80% capacity, repeat steps 1 and 2 again. If no improvement, discontinue test and replace batteries.
4. If there is improvement but 80 percent capacity is not reached, continue repeating steps 1 and 2 until 80 percent capacity is reached or no improvement.
5. 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. If the latter is correct adjust electrolyte.

CELL REPLACEMENT - NEW STYLE - WELDED CONNECTIONS

1. Remove vent caps.
2. Remove lead nuts and bolts.
3. Run knife along edge of terminals to separate silicon sealant from terminal.
4. Remove plastic fasteners around cover (if used) with a screwdriver.
5. Tap the bottom corners of cover with a hammer and remove cover (most times the cover can be removed without tapping with a hammer).
6. Blow into each cell to drive out any accumulated gas. Stand back as far as possible and pass a lighted torch over each cell opening. Any remaining gas will be driven out without doing damage to the battery.
7. Replace vent caps.
8. Drill with # 53 hollow post drill where the connectors join the cell on each side of the cell to be removed.
9. With 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 out using the sling.
10. If replacing with new dry charged cell when complete follow activating instructions.
11. If replacing with a used cell from another battery use the electrolyte from the used cell.
12. If the old connectors are to be used clean with a wire brush, neutralize and dry. Clean the inside hole of the connector with a knife.
13. Using the # mu-71 torch weld the connectors. Before doing so repeat step #6.
14. Remove the vent caps and replace the outer cover. When replacing the outer cover insure that the rubber rings on the vent well openings are aligned properly. Equally push on the rubber rings when replacing the cover. When the cover is almost in place tap on the top of the cover. The cover will snap in place. Replace plastic fasteners (if used).
15. Replace vent caps, lead nuts and bolts. Reseal around terminals with silicon.
16. If the cell is dry add electrolyte. See activating instructions.
17. Place battery on charge at the finishing rate until the gravity and voltage balance with the other cells.

SHELF LIFE - WET BATTERIES

New batteries in storage for more than 60 days should be given an initial freshening charge. (See page 2)

RAILROAD / DIESEL STARTER PRODUCT 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. But should a problem arise, you can be confident that you're covered better than any other battery warranty in the business.

Rolls Battery, herein referred to as the Company, warrants that batteries sold by it are 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". ALL SHIPMENTS SHOULD BE THOROUGHLY INSPECTED FOR DAMAGE BEFORE SIGNING THE DELIVERY SLIP.

The Company will replace or, at its option, repair any Rolls Railroad Battery sold by it that fails to conform to the warranty stated above on a NO CHARGE BASIS as follows:

SERIES 4000

Failure within 24 months from the date placed in service yields FREE REPLACEMENT, not including freight charges from the factory to the applicable destination. After the first 24 months of service, defective batteries will be adjusted for a period of up to 60 months prorated from the date first in service at prices in effect at time of adjustment.

SERIES 5000

Failure within 36 months from the date placed in service yields FREE REPLACEMENT, not including freight charges from the factory to the applicable destination. After the first 36 months of service, defective batteries will be adjusted for a period of up to 60 months prorated from the date first in service at prices in effect at time of adjustment.

To claim a manufacturing warranty, proof of purchase must be presented, showing the date of purchase and the battery's serial number. The battery must be tested by an Authorized Battery Outlet for actual defect, and upon confirmation of the defect, the warranty will be administered.

The Warranty does not cover shipping damage, cracked covers, cracked cases, bulged cases from heat, freezing or explosion, discharged batteries, 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

	EXIDE TYPE	GNB TYPE	CROWN TYPE	EAST PENN TYPE
8-NS-23P	4LMS-325			DL-4000
8-CH-23P	4LMS-420 4LMS-450	KDZ-2701		DL-4500
8-CH-25P	SIMILAR DIMENSIONS TO 8-NS-23P & 8-CH-23P			
8-NS-33P			MD-525	
8-CH-33P		KDZ-3001		DL-7000
16-CH-25	LMUD-500	KDZ-EM500	UD-519	DL-U500
16-CH-33	LMUD-660	KDZ651	UD-525	DL-U650
16-CH-35				

*Comparison based on voltage, similar 8hr AH rating and dimensions.

CONTACTS

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

Phone: +1 902 597 3767
(+1 800 681 9914)
Fax: +1 902 597 8447
(+1 800 681 9915)
sales@rollsbattery.com

CUSTOMER SERVICE

Ashley Livingston
+1 902 597 4005
ashley@surrette.com

SALES

Sales
+1 902 597 3767
sales@rollsbattery.com

TECHNICAL SUPPORT

Phone: 1.800.681.9914
support@rollsbattery.com