

T310 AND T310-FP TUBULAR MOTIVE POWER BATTERIES AND CHARGING SYSTEMS INSTALLATION AND OPERATING INSTRUCTIONS

POST THESE INSTRUCTIONS IN THE BATTERY MAINTENANCE AREA

Previously Tubular LMX and LMX-FP.

1. SAFETY

1.1 Follow your company's Safety Instructions when working with or near industrial truck batteries. Observe the caution label affixed to the battery. Thoroughly familiarize yourself with industry and government guidelines (OSHA, ANSI) for charging, handling, and maintaining industrial batteries.

1.2 Assign battery and charger care to properly trained personnel.

1.3 This battery contains sulfuric acid electrolyte. 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.

1.4 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.

1.5 Batteries produce hydrogen and oxygen gas during charge. Keep open flames away. Do not check electrolyte level with a cigarette lighter or match. Use a flashlight or permanent lights. Switch on/off away from the top of the battery. Do not smoke or create sparks.

1.6 Lift batteries with a certified/approved hoist, crane, lift truck, or similar equipment. Move batteries with trucks, conveyors, or rollers. Be sure to place a rubber mat or similar insulating material across the tops of coverless batteries when handling. Make sure equipment is of ample strength and properly installed.

DO NOT USE CHAIN OR WIRE ROPE SLINGS

1.7 Never lay metal tools, such as wrenches or screwdrivers, on top of a battery.

1.8 Disconnect the battery from the truck when performing maintenance and repair on motor or electrical system.

1.9 Open or "break" the battery circuit before attempting repairs to the charging plug or receptacles.

1.10 Apply a strong neutralizer, such as baking soda or soda ash, when electrolyte is spilled on the floor. Check local regulations regarding the disposal of neutralized waste.

2. RECEIVING BATTERIES

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

If there is evidence of damage, the receipt should be signed and both copies (carrier's and receiving copies) marked "Shipment Received Damaged". 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 requested to make a "Carrier's Inspection for Concealed Damage Report". After inspection by the carrier, arrangements should be made with the local Stryten Energy representative to have the battery repaired before placing it in service.

BEFORE PLACING BATTERIES IN SERVICE, REVIEW AND FOLLOW THE SAFETY GUIDELINES LISTED IN ITEM 1. SAFETY

3. PLACING IN SERVICE

Verify that the battery weight meets or exceeds the minimum truck weight requirements. Allow the battery to cool or warm to room temperature before charging or adding water. Make sure the battery charger is properly matched to the battery. Use a charger with automatic charger termination controls.

Stryten Energy recommends the use of an SCR charger with an I-E-I charging profile in order to achieve a minimum 45-day watering interval. To achieve a minimum 90-day watering interval, Stryten Energy requires the use of a Stryten Energy charger with a T310 charging profile.

Open the vent caps from each cell and check to see that the electrolyte level is above the plate separators. If it is obvious that the 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 (1.280 – 1.290). Close the vent caps and give the battery a freshening charge until there is no increase in specific gravity for three hydrometer readings taken at one-hour intervals.

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 plate separators, recheck it after 3 hours of charging. If the level remains below the plate separators, add water or electrolyte to the proper level at the end of charging.

Following the first 90 days of service, the battery should reach its normal operating specific gravity of 1.290-1.300 at 77° F (25° C).

IF BATTERIES ARE NOT IN REGULAR USE, KEEP THEM CHARGED. CHECK THE SPECIFIC GRAVITIES MONTHLY AND GIVE A FRESHENING CHARGE (3 OR 4 HOURS AT THE FINISH RATE) IF THE GRAVITIES HAVE FALLEN 0.030 OR MORE; OTHERWISE GIVE A FRESHENING CHARGE EVERY THREE MONTHS.

4. OPERATION

Batteries are rated in ampere-hours (Ahr) and are selected to perform a specific workload within an established period of time. Increasing the workload or time period could result in over discharging, thus shortening battery life. Limit discharging of the battery (to 80% or less) so that specific gravities do not go below 1.180. If truck operation results in only partial discharges (40% or less) and specific gravities are 1.250 or more at the end of the shift, recharging may be deferred and the battery used for another shift, providing the workload is not expected to increase. Hydrometer readings and experience will determine

the frequency of charge intervals under these circumstances.

A battery should always be recharged immediately following a complete discharge. Never allow it to remain in a discharged condition; otherwise, permanent damage may result. A battery is designed to be operated as follows:

8 hours discharge
8 hours charge
8 hours cool-down

T310 Low Maintenance batteries are designed and built to deliver 80% of their rated capacity at 77 °F (25 °C) each cycle.

5. TEMPERATURE

In the operation of motive power lead acid batteries, the electrolyte temperature must not exceed 110 °F (43 °C). If the battery is continuously operated at or above this temperature, the service life of the battery will be severely diminished. Under normal operating conditions, battery electrolyte temperature should be maintained between 60-100 °F (15-38 °C). Following charging, the battery should be allowed to cool-down or rest approximately 8 hours prior to another discharge cycle.

If a battery is ever hot to the touch, allow it to cool to room temperature before charging or discharging. If a battery consistently operates at high temperatures greater than 100 °F (38 °C), contact your local Stryten Energy representative for service.

6. CHARGING

When recharging a fully discharged battery, the starting charge rate will be 3 times higher than the finish charge rate. The charge rate should taper down to the finish rate by the time the battery is 85% charged and may be even lower when fully charged. High “on charge” temperatures or frequent need for water additions are indications of overcharging. Short running times and/or low end-of-charge specific gravities may indicate inadequate recharge. Consult your local Stryten Energy representative on specific charging problems.

The ampere-hour rating of the charger applied to the battery should be within 10% of the ampere-hour rating of the battery.

For T310-FP batteries with onboard charging: The battery should be charged exclusively with the charger provided with the system.

WHEN BATTERY RECHARGE IS REQUIRED, PLUG THE BATTERY CABLE CONNECTOR INTO THE CHARGER CABLE CONNECTOR AND THEN PLUG THE 3-PRONG CHARGER POWER CORD INTO A GROUNDED 120 VOLT 15 AMP 50 HZ OR 60HZ POWER OUTLET

The charger is equipped with an LED indicator to show the progress of the charging cycle.

RED LED shows that the battery is in the initial charging phase.

YELLOW LED shows that the battery has reached 80% of charge.

GREEN LED shows that the battery has reached 100% of charge.

The T310-FP charging algorithm includes an unterminated Float Stage that begins automatically once full charge is complete. The Float Stage holds the battery at 2.28 volts per cell (VPC) until the battery is required for service. The result is that the battery is maintained at full state of charge which helps to prevent self-discharge and sulfation.

WHEN IT IS TIME TO PUT THE BATTERY INTO SERVICE, REMOVE THE BATTERY FROM THE CHARGER BY UNPLUGGING THE CHARGER POWER CORD FROM THE POWER OUTLET AND THEN DISCONNECT THE CHARGER CABLE FROM THE BATTERY CABLE

High “on charge” temperatures or frequent need for water additions are indications of overcharging. Short running times and/or low end-of-charge specific gravities may indicate inadequate recharge. Consult your local Stryten Energy representative on specific charging problems.

If the charger does not work correctly or if it has been damaged, unplug it immediately from the power outlet and contact your local Stryten Energy Industrial Power service representative.

The charger may be provided with a thermal sensor connected to the top of the battery. With this sensor, the charging profile will automatically compensate for variable battery temperatures. Do not disconnect the sensor from the top of the battery or the charger.

The charger is equipped with a two-tone audible alarm. In the event of an alarm condition, the audible alarm will sound and the LED indicator will flash.

Possible alarm conditions are below:

Condition	Alarm Type	Description (Action)
Audible message + RED flash	Battery Presence	Battery disconnected or not in conformity. (Verify the connection and the nominal voltage)
Audible message + YELLOW flash	Thermal Sensor	The thermal sensor is disconnected during the recharge or it is out working range. (Verify the connection of the sensor and measure the temperature of the battery)
Audible message + GREEN flash	Timeout	Phase 1 and/or Phase 2 have a duration in excess of the maximum allowed. (Verify the battery capacity)
Audible message + RED-YELLOW flash	Battery Current	Loss of output Current control. (Failure of the control logic)
Audible message + RED-GREEN flash	Battery Voltage	Loss of output Voltage control. (Battery disconnected or failure of the control logic)
Audible message + YELLOW -GREEN flash	Selection	An unavailable configuration has been selected (Verify the selector’s position)
Audible message + RED-YELLOW-GREEN flash	Thermal	Overheating of semiconductors. (Verify the fan operation).

7. CONNECTIONS

The battery cells are connected in series using welded lead connectors.

8. MAINTENANCE

KEEP RECORDS... Showing specific gravities, equalizing, charging, temperature, cleaning and voltages on a monthly basis. **These records are required to maintain your warranty.**

TEMPERATURE... Under normal operating conditions, the electrolyte temperature should be between 60-100°F (15-38°C). Operating temperatures above 100°F will reduce the battery's service life. Operating temperatures below 60°F result in less capacity and special charging is required.

WATER ADDITIONS...

When using any Stryten Energy M-Series SCR charger with an I-E-I charging profile...After each 45 calendar days of operation to 80% DOD at 5-days per week or when the specific gravity in the cells reaches 1.335 to 1.345, add water at the end of the charging period (when the battery is fully charged and the charger has tapered to its finish rate). See Section 9.

When using a Stryten Energy M-Series SCR200 charger with a T310 charging profile...After each 90 calendar days of operation to 80% DOD at 5-days per week or when the specific gravity in the cells reaches 1.335 to 1.345, add water at the end of the charging period (when the battery is fully charged and the charger has tapered to its finish rate). See Section 9.

EQUALIZE... After every 10 duty cycles to 80% DOD or bi-weekly, if operating at 5 duty cycles per week, and after each water addition.

DEPTH OF DISCHARGE... Do not discharge the battery below 80% of the rated capacity. Over discharging shortens the battery life and voids the warranty

CLEANING... Keep the top of the battery clean and dry. See Section 9.

PREVENTIVE MAINTENANCE SCHEDULE...

(based on five 80% DOD duty cycles per week)

BI-WEEKLY

- Equalize charge the battery

EVERY 45-90 DAYS**

- Check cell electrolyte levels and add water to each cell.
- Record cell electrolyte specific gravities, temperatures, and open circuit voltages after watering and equalization.
- Inspect the cables and charging plugs.
- Clean the top of the cells.

ANNUALLY

- Inspect the charger. Confirm proper output voltage and current. Check for external damage, frayed cables, or worn connectors.
- Clean the exterior of the battery.

**45-days when using any M-Series SCR charger with an I-E-I charging profile. 90-days when using a Stryten Energy M-Series SCR200 charger with a T310 charging profile

TROUBLE SIGNS

The battery temperature rises more than 25 °F (14 °C) during a normal charge.

The cell open circuit voltages vary by 0.15 volts or more and cell specific gravities vary by 0.020 or more after equalizing.

The top of the battery is always wet or one cell requires excessive watering.

9. MAINTENANCE CLEANING

The top of the battery should be kept clean and dry. Keep the vent caps in place during use and charging. Remove the vent cap only to observe electrolyte levels, make water additions, take temperatures, or take specific gravity readings with a hydrometer. If the battery requires cleaning, contact your local Stryten Energy servicing representative. The solution used to clean and neutralize the outside of the batteries should be disposed of in an environmentally safe manner.

10. WATER ADDITIONS

Maintain electrolyte levels above the plate separators, but no higher than 1/8" from the bottom of the vent well. Check the electrolyte level quarterly, or as necessary depending on battery use prior to charging. If the level is not visible (below the plate separators), add just enough water to cover them and then proceed with charging the battery. Otherwise, defer watering the battery until the end of the charging period when the battery is fully charged and the charger has tapered to its finish rate. At that time, add enough water to bring the electrolyte level to 1.2" of the top of the cover. Always use distilled water or water that is known to be free of abnormally high amounts of impurities. Contact your local Stryten Energy representative if you are not sure of your water quality.

BATTERIES MUST BE VISUALLY INSPECTED PER THE SCHEDULE EVEN WITH THE USE OF A WATERING SYSTEM

11. SERVICE AND PARTS

Your local Stryten Energy sales representative has more information regarding the full range of maintenance and repair service available. Stryten Energy can also supply all of your battery, charger, and accessory device replacement part needs.

For more information in the U.S.A. and Canada, call 1-888-563-6300. All others, please contact your local Stryten Energy battery sales representative.

12. RECYCLING

U.S. Federal and State Regulations require that lead acid batteries be handled and disposed of in compliance with strict guidelines. Stryten Energy offers disposal service for lead acid batteries. Call 1-888-438-5865 to arrange a pick-up or to get additional information.