

Fast Charge Application Requirements

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Fast charging of industrial batteries is slowly becoming a main stream charging technology as more and more users realize the operational savings and the increased productivity and safety that this technology offers. Today, many fast charging systems are in operation and are buzzing at manufacturing plants and distributions centers all around the US.

Although the benefits of fast charging in two and three shift operations are paramount, switching to fast charging involves a number of requirements including charger, battery and truck modifications, as well as operational adjustments. This note will present an overview of these requirements.

Charger Requirements

Since fast chargers are high power systems rated at >10kW with charging currents in excess of few hundred Amps, these chargers have various requirements including:

- *AC Input Power*
 - Most of these chargers are fed off a 480VAC three phase line. As such, a 480VAC three phase power needs to be already present or installed.
 - Each 480VAC feed requires a 15A to >100A circuit per charger (10kW-60kW)
- *Cabling and Connectors*
 - One or two connectors and cables are needed. For currents in excess of 300A, two connectors are needed with two sets of cables while for currents less than 300A; one connector is used with a single set of cables (see Fig. 1).
 - Most chargers require some sort of feedback from the battery (analog or digital). As such, connectors with auxiliary contacts are needed, primarily SBX or Euro.



Fig. 1: Fast charger with dual cables & connectors

Battery Requirements

Conventional batteries require some modifications to make them suited for fast charge applications. These modifications involve:

- *Construction Modifications*
 - Double intercell connectors to reduce the IR drop and heat loss associated with the high charging currents.
 - Dual cables in higher gauge ratings (4/0) to handle the higher charging current.
 - Dual connectors with auxiliary contacts (SBX or Euro) to interface with the fast chargers (see Fig. 2).
 - Electrolyte thermistors to control and minimize the temperature rise.
 - Single point watering systems, which is needed as batteries are no longer removed and remain on the truck. Note that watering takes place while the battery is on the truck.
 - Electrolyte Level Monitors to alarm users if a low electrolyte level is detected.

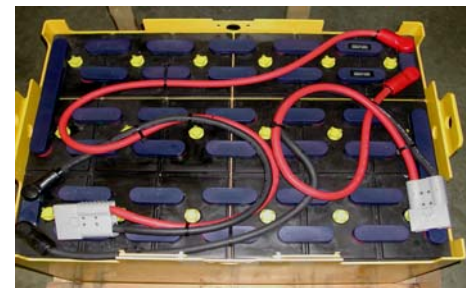


Fig. 2: Fast charge battery with dual cables and connectors

➤ *Optional Equipment*

- Battery monitoring equipment to track battery performance and history as well as provide proper feedback if problems are reported.
- Automatic watering systems, which minimizes spills and mitigates water pressure variations.

Truck Requirements

Trucks need also to be modified to be suited for fast charging. These modifications include:

➤ *Construction Modifications*

- One to two connectors are needed on the truck to interface with the fast charger (see Fig. 3).
- Optional active cooling for reduced battery temperature during operation and charging.

➤ *Operation and Use*

- Properly set lift interrupt to operate within the preferred battery sweet SOC range (20%-80%).
- Largest battery size to ensure maximum capacity and minimize recharge times.



Fig. 3: Truck with dual connectors

Operational Adjustments

From an operational end, certain adjustments need to be made to ensure the success of fast charging including:

➤ *Adequate Fast Charge Opportunities*

- Truck operators need to plug their batteries during all assigned fast charge opportunities to ensure continued service and maintain the battery within the 20%-80% SOC range.
- Ensure batteries receive finish and equalize charges on a regular basis. Normally, fast chargers are programmed to perform finish and equalization charging at set times. However, the batteries need to be connected for the chargers to run these cycles.

➤ *Battery Watering*

- Since fast charge batteries are used much more heavily, frequent watering is required. Watering is normally recommended on a weekly basis after a full charge and equalize cycles are completed.

In summary, potential users are required to make adjustments and tweaking to their existing systems and procedures to reap the benefits of fast charging. Once these systems and procedures are in place, the benefits of fast charging will be rapidly felt.