



Electric School Bus Guidebook

Guide 8: Charger O&M

(Operations & Maintenance)



NEW
YORK
STATE

NYSERDA



Properly operating and maintaining chargers can ensure safety and reliability.

A charger, for the purpose of this guide, encompasses all the equipment that transfers electricity to recharge the electric school bus's (ESB) battery. This equipment includes the charging station and mounting systems, charging cables, charge management software, and communications hardware. This equipment will be installed at the school bus operator's facility and will require maintenance and repair. Having a plan that clearly describes procedures for charger operations and maintenance (O&M) can greatly increase charger and ESB reliability.

This chapter of the *Electric School Bus Guidebook* answers these questions:

- What should I consider when operating chargers?
- How can I properly maintain chargers?
- What are the options for servicing chargers?

Charger Operations

This section summarizes the basics of charger operation and charger system management. You should work with your charger manufacturer and/or third-party charging service provider to develop a charging operations plan. Such a plan will clearly describe step-by-step charging and related safety procedures for bus drivers, facilities staff, and all other personnel involved in ESB charging activities. Consider the elements discussed below when developing your charging operations plan.

Connecting an ESB to a Charger

The most regularly handled charger component is the charger connector, which is the device that is plugged into the bus. Plugging the charger connector into the ESB is not complex, but it is important to ensure that the ESB is in the correct location prior to plugging it in. An ESB that is just a few feet away from the proper location may cause the driver to pull and bend the cable to be able to plug it in. Over time, this will damage the cable and could lead to electric shocks or even contribute to fires.¹ It is important to train drivers on the correct way to connect and disconnect the charger connector to avoid frequent replacement of the connector. Carefully read the charging station operator's manual or ask your dealer for a training session on how to plug and unplug the charger connector from the bus.

Properly unplugging the charger connector from the ESB must be done by following the disconnection instructions. Attempting to unplug the charger while a bus is actively charging can damage the charger connector over time. Refer to the charger's manual for instructions on how to end a charging session early. Once the charger connector is removed, it is imperative that the driver puts it back onto the charging station in the correct spot. Every charging station is different, but just like diesel and gasoline refueling nozzles, they all have a spot for the charger connector when not in use. If the charger connector is left on the ground after the vehicle is unplugged, it will likely get run over and may need to be replaced.



Key Activities

Initial actions you can take after reading this chapter include:

- Create an operations plan for your chargers.
- Create a maintenance plan for your chargers.



¹ <https://energy5.com/ensuring-the-safety-of-electric-vehicle-charging>



Credit: Highland Electric

Figure 1: Charging Station with Bollard Protection

Charger Protection

Different charger models include different cable management methods. Charging cables mounted on reels that retract the cable can be useful so that longer cables will not get run over by school buses or become tripping hazards. Another way to protect charging stations is to install bollards, physical barriers placed between the charging station and parking space (Figure 1). These will help ensure that charging stations are not accidentally damaged by ESBs. Note, however, that bollards slightly increase the space requirements needed for the ESBs. See the [Solus Group's EV Fleet Charging for Electric Delivery Vans: Charging Station Considerations](#) for more information on charging station siting considerations.

Charge Management

A third-party service provider can develop and install charge management software to automatically control the charging start and stop times for each ESB in your fleet, helping to minimize charging costs. Such software, which is highly recommended, allows fleets to avoid peak demand charges and delay charging sessions until nighttime, while still plugging vehicles in directly upon return to the depot. If you are using charge management software to charge your ESBs, you will need to provide your charge management provider with several pieces of information including utility billing rate information, ESB route start/end times and dwell times, and ESB battery capacity.

Charger Maintenance

Properly operated chargers will require less frequent maintenance and repair. Each charger manufacturer has recommended preventative maintenance procedures to help prolong charger lifespan. For example, manufacturers will specify a recommended replacement schedule for certain charger components such as power cables and intake and exhaust filters. Fleet managers should also schedule and perform recommended routine maintenance checks on chargers. These checks should include a visual inspection of units for external damage resulting from weather (e.g., corrosion) or vehicles bumping into or running over the charger and cables. Other regular activities should include monitoring for unusual sounds and/or odors coming from power units and fans, and cleaning surfaces of dust and dirt. These checks should be performed on a regular basis, such as monthly inspections.

In addition to preventative maintenance checks, it is important for you to have a plan in place to ensure proper charger repair and reduce charger downtime when operational problems occur. If a charger stops working without warning and no external damage is visible, then the issue could be caused by software, firmware (i.e., permanent software that is programmed to control hardware), or hardware associated with the device. If a charger does not work the first time you plug in a bus, you can troubleshoot by unplugging and plugging the charger back into the bus or turning the power to the charger off and then back on. If the problem persists, contact your charging system service representative to arrange for diagnosis and repair assistance. For fleets whose chargers are operated by in-house staff, contact the equipment manufacturer. For fleets whose chargers are operated by a third-party provider, the provider may be fully responsible for maintaining and repairing chargers.

Extending Charger Warranties and Maintenance

Most charging stations come with a two- to three-year warranty period, but operators should have a maintenance plan in place for the period after the warranty expires. There are four options to provide for extended charger maintenance, summarized below. Regardless of the option selected, repair time for out-of-service chargers will vary based on the nature of the problem, although it may be possible to quickly swap out damaged hardware depending on the vendor.

Charger Company Extended Warranty – Many ESB charging companies offer extended diagnostic, parts, and labor warranties on their equipment. Extended warranties typically last for five years. Under this option it may be possible to bundle warranty costs with ESB purchasing to avoid additional procurement work and capitalize the cost of maintenance. Additionally, extended warranty programs may guarantee a specific level of charger availability, typically expressed as a percentage (e.g., 98% uptime). This can be the least expensive of the extended maintenance plan options, although warranty exclusions may require unexpected out-of-pocket costs and extended repair delays.

Charge Management Provider Warranty – Charge management providers may also offer a service warranty package. This may include in-house diagnostics and external coordination to find parts and third-party service labor.

Maintenance Service Contract – Fleets that do not use “as-a-service” contractors can also purchase third-party charging station “reliability-as-a-service” packages for all major charger brands or from a third-party. Equipment down-time should be particularly low under this option given the focus on reliability. Under a reliability-as-a-service contract, users will typically pay a monthly fee that includes service response within a set time. Maintenance service contracts can cover more repairs than a warranty, including damage from vehicles, snowplows, or other causes, but do not necessarily cover the cost of the parts required to repair equipment.

As-a-Service Contractors – If a district hires an as-a-service contractor for its entire fleet, the contractor may include charging station maintenance in its scope of work. Most or all operational costs are covered under the contract, and can potentially see cost savings by bundling their bus and charger needs.

Additional Resources

[BTCPower DC Fast Charger Installation and Maintenance Manual](#) – Example maintenance guidance from a charging station OEM manual (see page 21).

[Reliability and EV Charging: What Do Fleets Need to Know?](#) – An article written by InCharge Energy regarding charger reliability.

[Solus Group's EV Fleet Charging for Electric Delivery Vans: Charging Station Considerations](#) – Provides a list of considerations when setting up fleet charging at a depot.

[What you need to know about EV Charger Maintenance: A Comprehensive Guide to Essential Upkeep](#) – An article by BENY on charging station maintenance.