



An Introduction to the Electric School Bus

Reference Guide and Test

INTRODUCTION

I School buses have been around for a long time. Before school buses were an everyday means of transportation, students would ride in makeshift vehicles or horse pulled wagons to be transported to school. When school buses were introduced into the public school system, it was a game changer. But that doesn't mean there hasn't been a lot of trial and error since their introduction into the school system.

II School buses have developed and improved over the years. There have been safety standards that have been implemented to transport students safely. There has been safety equipment manufactured to adhere to those standards. Electric school buses are cleaner, easier to maintain and a more cost effective way to transport students.

III The video covers many important topics that you should know about before operating electric school buses. The video will also help you understand the basic layout of electric buses as well as the features you should know about on them.

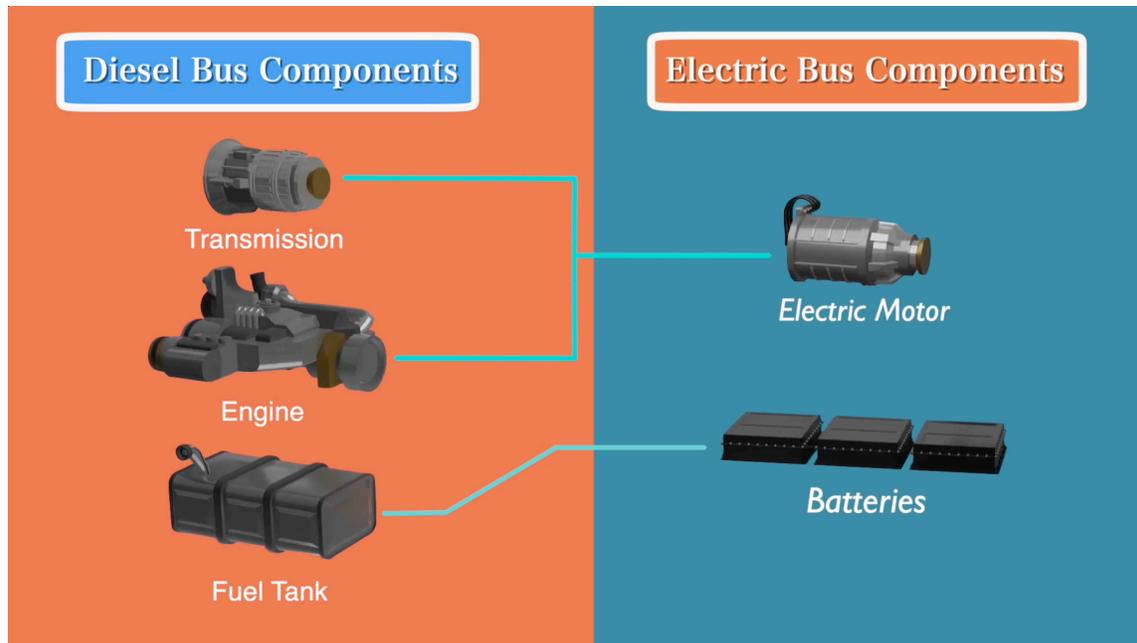
A Basic Understanding of Electric School Buses

1) Electric school buses are being introduced into transportation departments now more than ever. Governments, schools and communities are already seeing the benefits of this. By powering the bus with electricity there aren't harmful pollutants being emitted into the air. This doesn't just make it safer for students, but also for school bus drivers. With 480,000 school buses operating daily in the U.S. you can see why this can have a major impact on air quality.

2) How many times have you breathed in exhaust while performing your daily pre trip inspection? How much carbon pollutants are in the bus's cabin when students are being transported? If those questions can be answered with 'NONE,' it will make it a safer and healthier ride for EVERYONE involved. Electric school buses DO NOT emit pollutants because they are not using fuel.

3) The other thing that electric school buses do not emit? Noise. Or at least very minimal noise. That means noise pollution will be significantly reduced as well.

4) It is a good idea to get a general understanding of how electric buses are powered. An electric bus replaces the traditional combustion engine with an electric motor and batteries. In an electric bus, there is no longer an engine, nor fuel tank. Instead, **the electric motor on the bus serves as the engine and transmission, while the batteries are essentially the fuel tank.** (See picture below)



5) The **range** of an electric bus is the distance the bus can cover before running out of charge. How long this range is depends on a variety of factors, including:

- a) Battery size.
- b) Terrain.
- c) Driving behavior.
- d) Ambient Temperatures
- e) Bus Weight.

6) Many electric buses can also regenerate electricity on their own. Regeneration turns the kinetic energy of a vehicle into electricity to charge its battery and boost efficiency. Some vehicles are regenerating electricity every time the brake is applied, some regenerate while the bus is rolling. And some electric vehicles use both methods to regenerate the batteries.

7) You should take the time to read up on the type of bus you will be operating. Although most electric buses power the bus in the same way, there may be variations with different styles and types of buses. Understanding the basic layout of where batteries are stored, how to read the dash instruments, location of charging ports and where the emergency electrical shut off switch is located, is critical information you should consider before operation of the bus.

Differences Between Diesel and Electric School Buses

8) Electric buses look just like a typical diesel bus. And just like diesel buses, there are a variety

of types of electric buses: Transit, conventional, small buses and everything in between. It is important to note the differences between diesel and electric buses to understand any changes you will need to adjust to.

9) In the video we show the engine compartment of a diesel school bus and then an electric school bus. The electric school bus motor compartment looks empty compared to the diesel. The reason being is that there is no engine. If there is no engine, that means there aren't belts, hoses or pans. It also means there are going to be minimal fluid leaks. So no more oil spills and/or leaks to have to clean.

10) Another difference you will find in the electric motor compartment and around electric buses, are high voltage cables. These will clearly be marked and/or will have bright coloring to distinguish that they are high voltage and should not be touched for any reason.

11) The other major component part that an electric bus does NOT have is the transmission. Although some may have an electric transaxle system. And because there is no transmission, acceleration in electric buses are more seamless with limited jerking or noise.

12) The tires on an electric bus wear less frequently. This is because the batteries that are in the frame of the bus are evenly distributed unlike a diesel bus, where the heaviest part of the bus would be at the front or the rear, because of engine placement.

13) We all know how loud a diesel engine sounds. This can make things difficult to hear when out in the yard or trying to communicate with students. With electric buses there is barely a hum. In fact, electric buses are so quiet, that they are generally quieter than the ambient noise around them. This make it easier to communicate with students while operating the bus.

14) On the opposite side of that, students, parents, the public and even YOU are not accustomed to a bus being so quiet while it is being operated. This means that you will have to be that much more aware when approaching loading zones or bus stop locations. Children can easily be distracted. With the bus being so quiet, they may not even notice the bus has pulled up at all. **MANY electric school bus manufactures have a noise generator that can play tunes on approach to the bus stop.** But not ALL models have this.

15) Another difference is that instead of fuel access, electric buses will have charging ports located in different areas around the bus. Ports will be located in different areas depending on the bus's manufacturer and model. There are also different types of charging stations you may have to familiarize yourself with depending on the manufacturer and model of the bus.

16) Inside the bus is going to typically look like any other bus, with exception to the dash. The

dash is going to have all of the normal light activation switches and basic controls for the most part. However, just like any bus, you will have to get used to the buttons and switches for the bus you will be driving. There will be differences in the dash display that you will also have to adjust to reading.

17) There is one more major difference; If you get into an accident or have some kind of mechanical malfunction with a diesel bus, there is usually a set protocol and procedure to follow. In the event that it happens in an electric bus it will be **EXTREMELY IMPORTANT** for you to know where all of the electrical shut off switches are located. This is not only for yours and the students safety, but also first responders if they need to intervene in an emergency.

Charging, Battery Efficiency and Inspections

18) When you look at the dash of an electric bus, you will see that there will be minor differences for you to consider. All of your gauges, switches and buttons will be primarily the same as you have used in the past with some minor configuration differences. **You need to take the time to familiarize yourself with the configuration for the bus you will be driving.** In addition to your typical gauges and switches, most electric school buses also give you dash readings on battery levels, driving efficiency and more.

19) When looking at the dash instruments, you will see the battery level, which is essentially your fuel. And just like diesel fuel, the battery can run out of power. That is why monitoring battery levels are important, especially when you are getting used to the bus you will be driving. In addition to that, most electric buses also have an efficiency meter. This shows how efficient the bus is being driven. Think of the efficiency meter as a fuel economy gauge as in many newer modern cars. The more power being used, the faster the tank drains.

20) The bulk of the pre and post trip inspections will remain the same. However, one major difference is that electric buses are programmable and offer more control. For instance, while checking the lights on the bus, they can flash the amber warning lights and then the red flashing stop lights. Low and High beam headlights can be checked at the same time as well. By doing this, drivers can be more efficient during their pre trip inspection and require less walk arounds of the bus.

21) The emergency exits will be inspected the same way. Tires will be checked the same. And even the brake inspections will be performed in the same manner. You will not need to check the tailpipe, because there is not one present.

22) Also, just like you inspect the gas cap and fueling compartment, you will need to check the

charging port. There should be no damage present to the charging port and if there ever is, make sure to report it immediately to your supervisor.

23) It is **EXTREMELY** important to understand that there are going to be high voltage cables and wires to look out for. Manufacturers have done a good job at making sure to minimize the amount of exposed wiring or cables. You can also tell the difference because they will be **CLEARLY** marked and/or brightly colored for help identifying them. **Make sure not to touch ANY high voltage wiring FOR ANY REASON and if you see any damage present to them, bring it up to your supervisor immediately.**

24) Instead of diesel replenishing the fuel tank in diesel buses, electricity will replenish the batteries on electric buses. It is important to realize that not all charging stations are going to be exactly the same, although they ultimately all serve the same purpose. **You should take the time to familiarize yourself with the charging station you will be using before attempting to charge the bus.**

25) Each manufacturer and model may have a different charging port location. Some will be in the front of the bus, some on the side of the bus, and some will have the charging port on the rear of the bus.

26) When charging the bus you would simply remove the charging handle from the charging station then walk it over to the charging port. There are going to be cables laying across the ground that you will have to be mindful of. Be sure to watch your step and be aware of this when walking in the bus yard and between buses. Additionally, cables are fairly long, so be sure to have a tight grip when walking the charger cable to the bus.

27) Once plugged in, most charging ports will have lights to indicate the status of the charge. Some buses will even have charging lights on the exterior of the bus. However, all manufactures are going to be different. Make sure you take the time to understand charging statuses for the bus you will be driving.

28) When the bus is about to be driven, you will need to remove the charging cable and place it back onto the charging station. Make sure to be careful when pulling the charging cable from its port. If you do too much wiggling it could potentially damage the port and or the charger. And remember to watch that you don't trip on the cable on the way back to the charging station. You should also make sure the cable is placed on the charger holder to ensure that it not a tripping hazard to anyone else passing through.

Basic Driving Techniques for Electric Buses

29) When preparing to drive any electric vehicle, you must remember this... MOST NON-electric vehicles go through a series of gears due to having a transmission on the vehicle. Now, think of an electric remote control car. They are powered by their battery and acceleration is more seamless because it does not need to go through gear steps. **Electric buses are going to feel more seamless when operating them.** You need to take the time to get used to the feel for the electric bus you will be driving.

30) Steering and braking will mostly feel identical to driving a diesel bus, but there may be a slight difference to the feel of the accelerator when applying it. There **may even be a slight jump when you accelerate from a stop due to the electric traction motor kicking in.**

31) The other thing you can think about while operating electric buses is how to maximize battery efficiency during your routes. For instance, if your bus regenerates electricity while the wheels are in free roll, keep that in mind when approaching downhill grades.

CLOSING

Throughout the video, we have given information that is important to consider before operation of an electric school bus. Knowledge about the charging station you will be using, port locations, emergency shut off switches and the feel of driving the bus is extremely important to know. If you have any questions about the bus you will be driving, be sure to bring them up to your supervisor.

Electric school buses are already making a huge impact. And this is only the beginning. New manufactures, buses and safety features are being thought up daily. School buses have come a long way since the days of transporting students in horse pulled buggies. The future is wide open, and we want you to supply the ride.

TEST QUESTIONS

1) Electric school buses are cleaner, easier to maintain and more cost effective.

TRUE or FALSE

2) Electric buses are really noisy because of the electricity passing through them.

TRUE or FALSE

3) Battery range depends on which factors?

a) Battery Size

b) Terrain

c) Bus Weight

d) Ambient Temperature

e) All of the above

4) There is no need to learn about charging stations since they all do the same thing.

TRUE or FALSE

5) Regeneration turns kinetic energy into electricity.

TRUE or FALSE

6) Make sure to take your hand and feel all of the bright colored cables for damage.

TRUE or FALSE

7) Electric vehicles feel more seamless than a diesel bus when operating them.

TRUE or FALSE

8) Make sure to wiggle the charging handle from the charging port if it feels stuck.

TRUE or FALSE

9) Another upside to electric busses is that they are more programmable offering more control.

TRUE or FALSE

10) There is no reason to place the charging cable on the charging station since all drivers should know the areas they get charged anyway.

TRUE or FALSE

ANSWER KEY

- 1) TRUE**
- 2) FALSE**
- 3) e**
- 4) FALSE**
- 5) TRUE**
- 6) FALSE**
- 7) TRUE**
- 8) FALSE**
- 9) TRUE**
- 10) FALSE**