

Blue Bird Electric and Alternative Fuel School Buses

21325 20TH AVE SE, BOTHELL

MIKE GROFF

SEPT 2021



GVWR 33,000lbs
315 HP
Battery Capacity = 155kWh

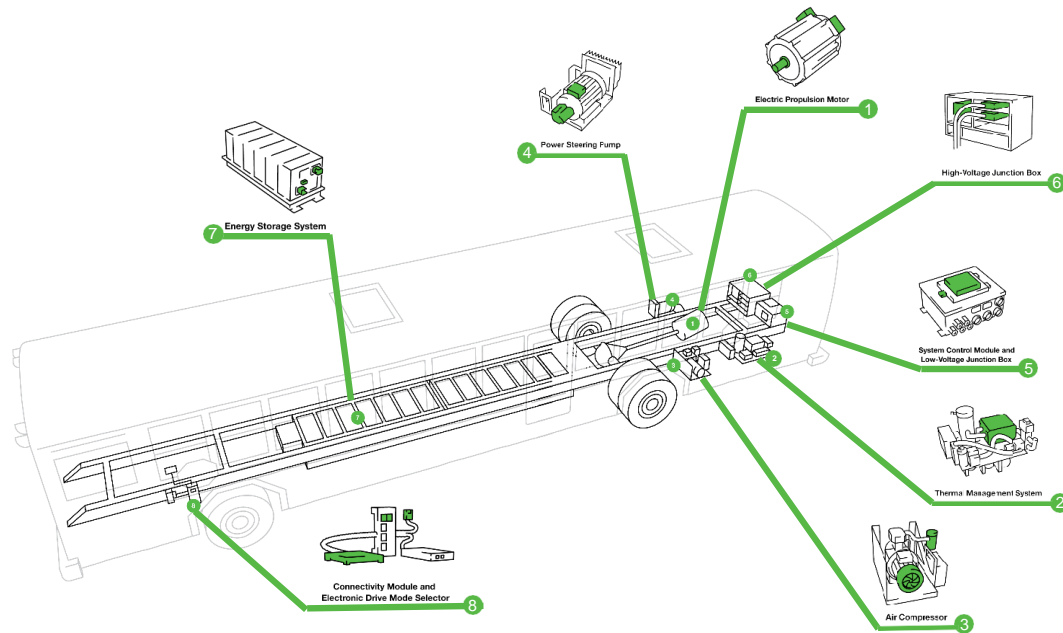
GVWR 36,200lbs
315 HP
Battery Capacity = 155kWh

GVWR 14,500lbs
215 HP
Battery Capacity = 88kWh

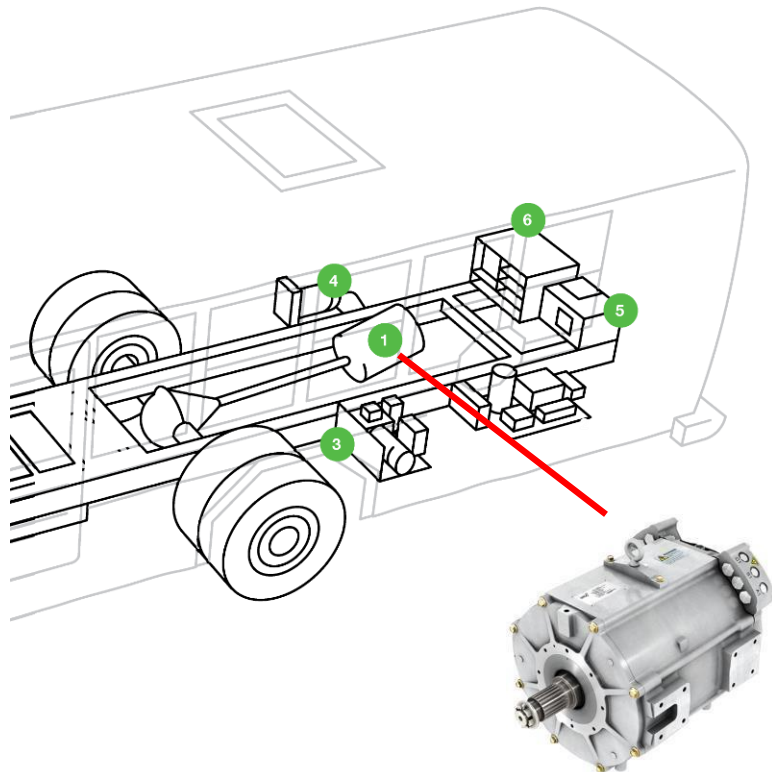
Alternative Fuel Buses

- Northshore School district has a number of fully electric and fully LPG (propane) buses.
- Fully electric buses are “full size”
- Fully LPG buses are “short”
- Orange Cable or orange loomed cable are HIGH voltage / high power cables — in excess of 600V DC current. AVOID AND DO NOT CUT OR COMPROMISE in any way.
- Batteries on these fully electric buses are cooled by coolant — coolant systems and things like power steering fluids are in the rear of the buses. Even fully electric buses still use conventional fluids and systems in some parts.
- On electric buses: (1) 12V DC system powering lights, wipers, other normal systems; (2) 600V DC power system for powertrain.

Major System Components

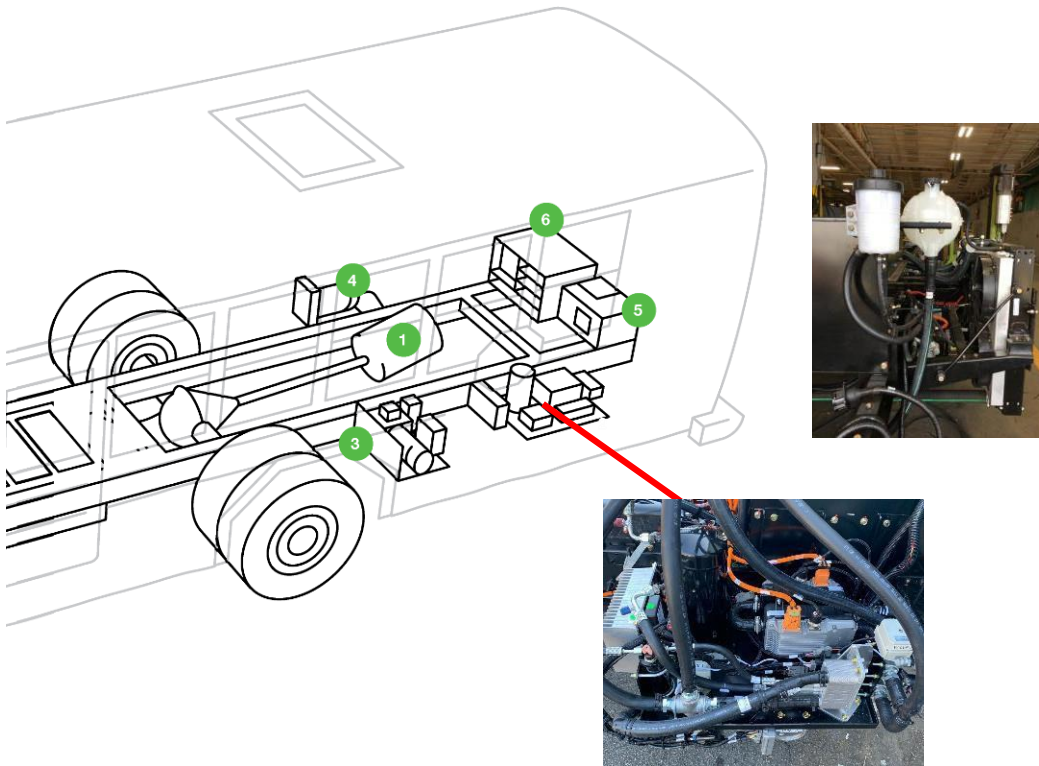


Product – Electric Propulsion Motor



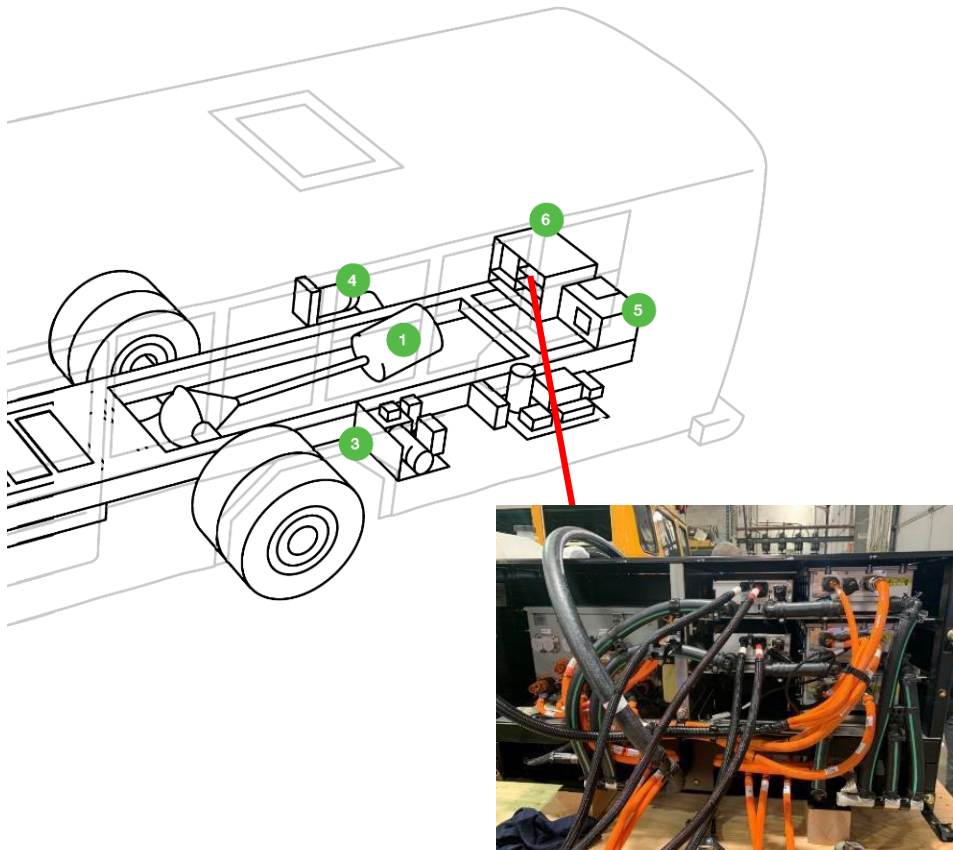
- TM4 SUMO Motor is a six-phase AC permanent magnet induction motor – Standard motor in the EV school bus industry.
- We use model – HV3000-6P
- Requires water cooled inverter to change 600V battery DC to AC current
- Motor rated at 315 HP / 2,176 ft-lb torque;
- No Transmission. Direct coupled to the rear drive axle with short drive shaft
- No transmission means only two gears = forward + reverse
- Drive motor max torque and power at very low RPM's enables acceleration at greater rate than other fuel types

Product – Thermal Management System



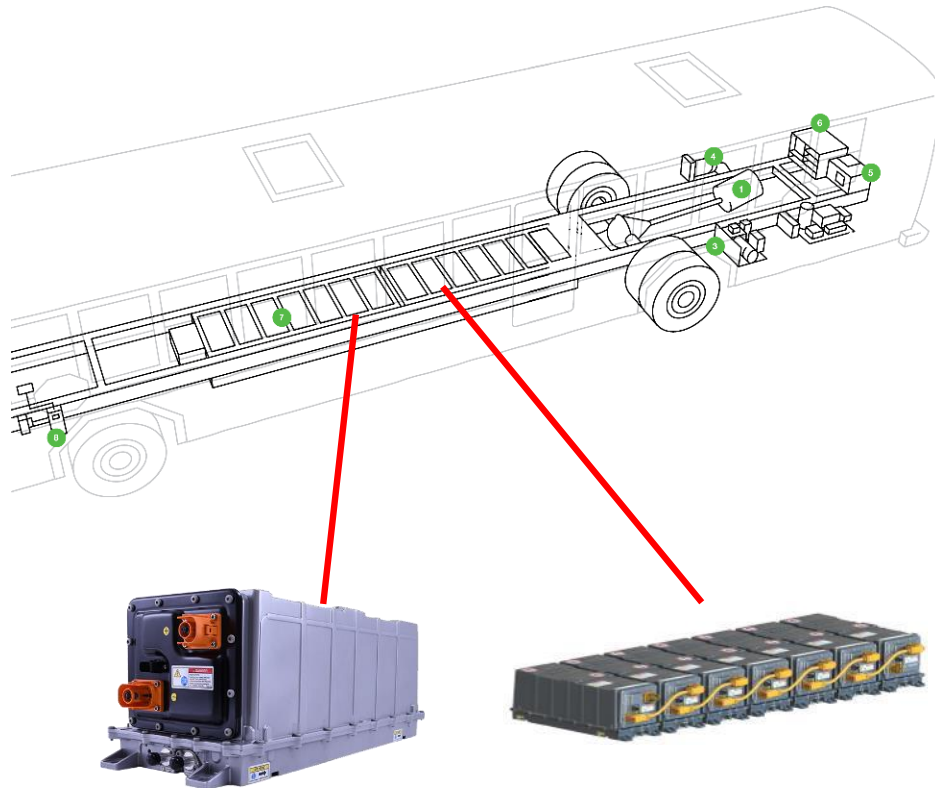
- Responsible for controlling the temperature of the batteries, drive motor, body and HV module
- Batteries must maintain a certain temperature, about 75-80° to maximize efficiency
- Comprised of 3 heater modules. One dedicated 12.5 kilowatt battery heater heats the coolant if the batteries are not warm enough to charge. Two - 12.5 kilowatt heaters are dedicated to the body to include the defroster, entrance heaters and underseat heaters =Total 84,000 BTU
- One - Chiller module chills coolant to cool batteries, motor and HV module when needed.
- The TMS also incorporates the coolant system run by a standard radiator with 4 cooling fans. Same radiator on our gas and propane buses.

Product – High Voltage System



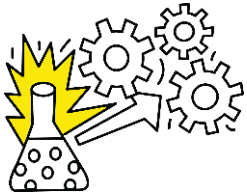
- **Receives HV power from the 14 batteries. Distributes that power to a variety of components...air compressor, power steering pump and main drive motor**
- **Receives power from the on board chargers to send into the HV batteries**
- **Houses both high and low voltage components**
- **Acts as common electrical distribution point for both high and low voltage components**
- **None of the components in this module are serviceable**
- **The T3 and CV use the same high voltage module just mounted in a different place**

Product – Batteries



- Batteries are XALT Energy XPAND Modular Pack (XMP)
- They are referred to as Li-NMC-G batteries, which is Lithium-Nickel Manganese Cobalt-Graphite
- CV and RE use 14 batteries divided into two groups of seven. Each group of seven is called a string
- Each battery weighs 170 pounds and rated at 88.3 Volts each
- Wired in series and parallel to provide 620- 700 volts and roughly 240 amps to power the bus.
- Each battery is cooled or heated with orange Dex-Cool that is controlled by the thermal management system
- Total capacity is 155 kWh

Product – Batteries



- **Batteries are rated for 3,000 charge cycles; Cycle is 0% SOC to 100% SOC**
- **Opportunity charging is only a percentage of a charge**
- **Projected life is 8-10 years with approx. 80% charge capacity**

Range **Type C & D**

Vision Electric

GVWR: Up to 33,000 lbs.
Range: Up to 120 miles



All American RE Electric

GVWR: Up to 36,200 lbs.
Range: Up to 120 miles



Range will be dependent on terrain, driver habits and the use of heating and A/C.

AC Charging, Level 2, SAE J1772



- **Connector** – SAE J1772 Plug. Three pins used to transfer current from EVSE to the bus. Two pins used for communication link between chargers and EVSE.
- **Power Required** – For maximum 19.2 kW/hour charge rate, each EVSE must be supplied with single phase, 240V, 80 amp current with a 100 amp fuse. If only a 50 amp circuit breaker is available, the bus will charge at a rate up to 9.6 kW/hour
- **Charge Time** – Approximately 8 hours
- **Charger Cost** – Approximately \$2,000- \$5,000, for the hardware without installation.



“Regular Bus” — Black Bird



"Regular" diesel bus. Black bird logo towards roof.





FOR OFFICIAL USE ONLY

ELECTRIC VEHICLE
CHARGING STATION
CHARGING
PROTECTION
CHARGEWELL
Made in America
All-Weather



Alternative Fuel
(Green Bird) -
This one is ELECTRIC



(See the fancy cord?
showing you 'electric'
because you have to
plug it in. Even us
fireman can figure
that one out.)

200



BLUE BIRD

Alternative Fuel
(Green Bird) -
This one is LPG





LPG pump with bleed off valves



Master Shut-off Switches on frame

Pulling the black handles down with shut off main power from 600V system. There are (2) separate systems, so you MUST shut off BOTH switches to secure power.



Close-up of Master Off Switch for 600V

Pull the black handle down to secure power. Remember, there are (2) of these, both must be shut off to secure high voltage power.



12v Battery system and shutoff

This system runs items like lighting, wipers, etc. Shutoff switch is the red switch on the left side of the compartment identified by the arrow above.



No touchy, no cutty. Make big boom. Make big spark. Make big hair like from the 80's.



Coolant and Power Steering system for fully electric bus

Located in the rear of the bus. Uses conventional fluids.



Fill location for LPG. These buses in the NSD are the 'short' busses, no current full size LPG busses.



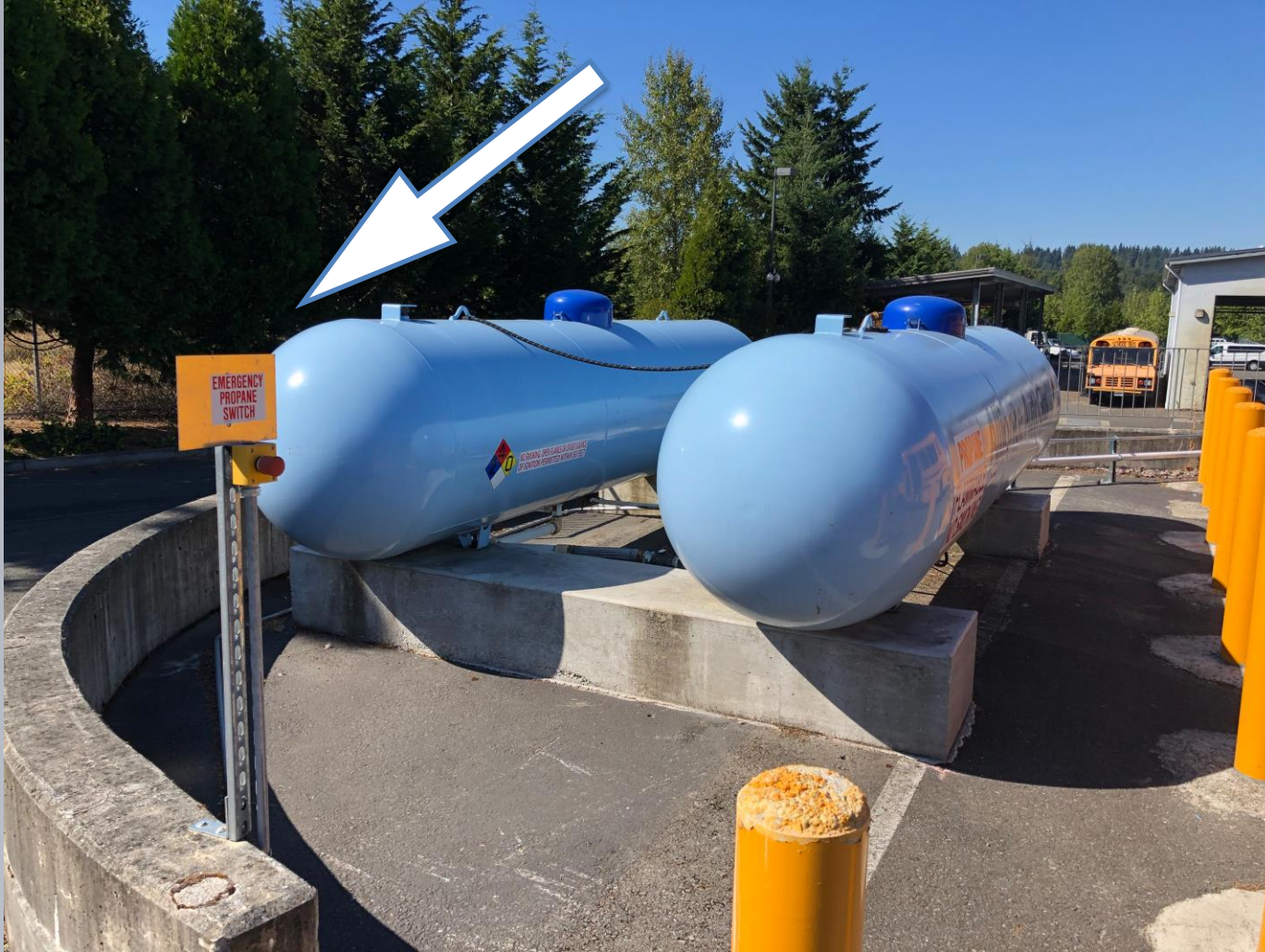
LPG Storage Tanks
(2) 25 gal. propane tanks



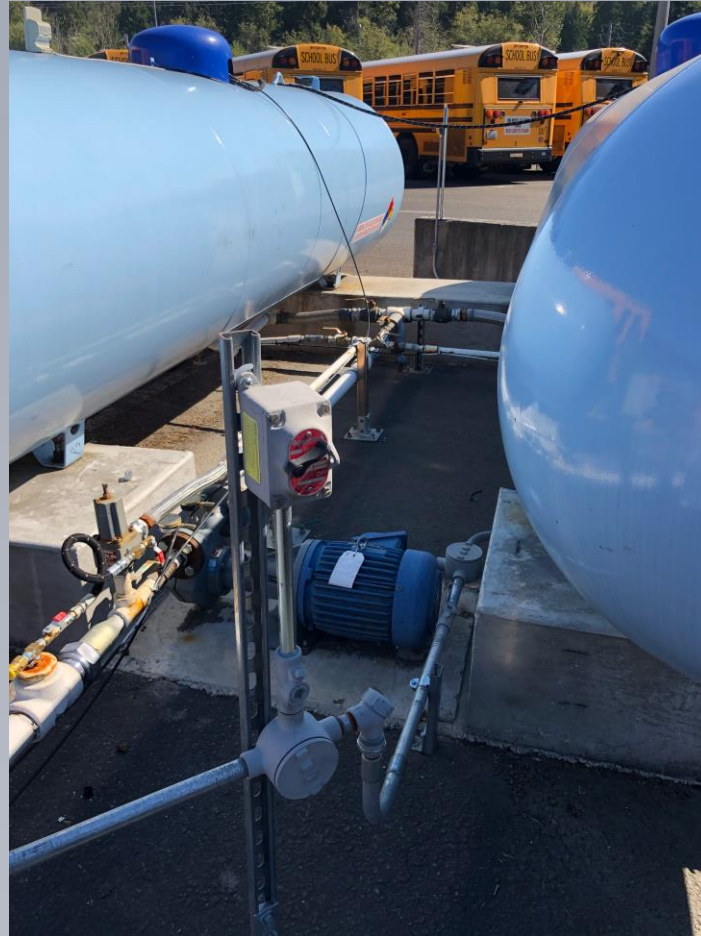
(2) 1,000 gal LPG propane tanks for fueling LPG buses

(2) 1,000 gallon LPG propane tanks

Used for fueling LPG buses for Northshore School District.



ALL emergency switches in the lot will turn off ALL fuel systems. Although this switch 'says' emergency propane switch...it will shut off all fuel systems - gasoline, diesel, propane and electric.



Propane only shut off switch

This shutoff switch will shut off the propane fuel system only. It is a master switch for both tanks. It will cut power to the LPG pump.



LPG Shutoff switch

Close up...again, this switch will shut off the entire LPG fuel system. (shuts down the pump from both 1,000 gal tanks).



Manual shut off valves

1/4 turn valves that can be used to isolate individual LPG lines.



Master Fuel Shutoff Switch

Although the label on this switch says “Emergency Propane Switch”, and of these red-button emergency push boxes will shut off supply to ALL fuel systems in the yard.