SERIES-E: ELECTRIC PROPULSION AND POWER SYSTEM

ENABLING INTEGRATED ELECTRIC ACCESSORIES AND ADVANCED ENGINE OFF FEATURES

BAE SYSTEMS
INSPIRED WORK

Series-E: The “smart” electric is a complete integrated electric propulsion and power system from a single source supplier, BAE Systems. All the bus propulsion and accessory systems are powered electrically from our HybriDrive system, including zero-emission modes of travel. Series-E includes a 200-230 kW motor/generator/battery traction system to provide tractive power for the vehicle and our Accessory Power System (APS2) to provide all power for accessory systems. BAE Systems is a proven systems integrator with 4,500 systems in service around the globe and is transit’s one-stop-shop for vehicle electric propulsion and accessory power needs.

WHAT ARE ELECTRICALLY POWERED ACCESSORIES?

HybriDrive® propulsion and power systems support full electrification of transit bus accessory systems such as air conditioning (A/C), engine cooling, power steering, and compressed air to further enhance the efficiency and performance of your transit bus. The HybriDrive Accessory Power System (APS) is able to provide more than enough electric power for all bus accessory vehicle hotel loads, hybrid cooling systems and engine cooling fans. This is accomplished by converting power from the HybriDrive high-voltage DC system directly to 28 volt DC and optionally 208/230 volt AC power. The 28 volt DC power supply completely replaces the conventional belt-driven alternator found on diesel transit buses.

Electrically powered accessories enable advanced features like automatic engine stop/start as well as limited electric vehicle (EV)operation. This permits driving with low noise and no fuel consumption, a quiet option for short journeys like entering or leaving depots and garages; quiet pull-away from stops in noise-sensitive areas; or driving in tunnels or other emission-sensitive zones. With the engine stop/start feature, full electrical power is available at engine idle or when the engine is defueled. This allows the system to automatically defuel the engine at turn-arounds or other extended stops while still operating interior lighting and air-conditioning systems. The bus automatically reverts to normal mode and restarts the engine if the battery charge becomes too low. Electrically powered accessories have a significant impact on efficiency so you'll be able to drive further in the city with much less crude!

CLEANER, QUIETER, MORE EFFICIENT

GREATER FUEL SAVINGS

- Reducing accessory energy consumption increases system efficiency
- Saving up to10% fuel economy with an additional 10% with engine stop/start functionality. That’s over and above what you are already saving by switching to a hybrid!

LOWER OPERATING AND MAINTENANCE COSTS

- No more belts, guards, alternators or starters!
- HybriDrive solid-state APS is reliably designed to last the life of the vehicle with no scheduled maintenance.
- Electric A/C is self-contained and factory-filled and sealed, eliminating leak-prone refrigerant lines routed to a mechanical compressor in the engine compartment.

ENHANCED SAFETY

- Brushless motors on the electric engine cooling fans offer improved safety with the elimination of high-pressure hydraulic lines in the engine compartment.
- Eliminating belts for the A/C compressor, alternator, and mechanical fan drive, greatly reduces the size of the engine belt guard and the potential for inadvertent contact with a moving belt.

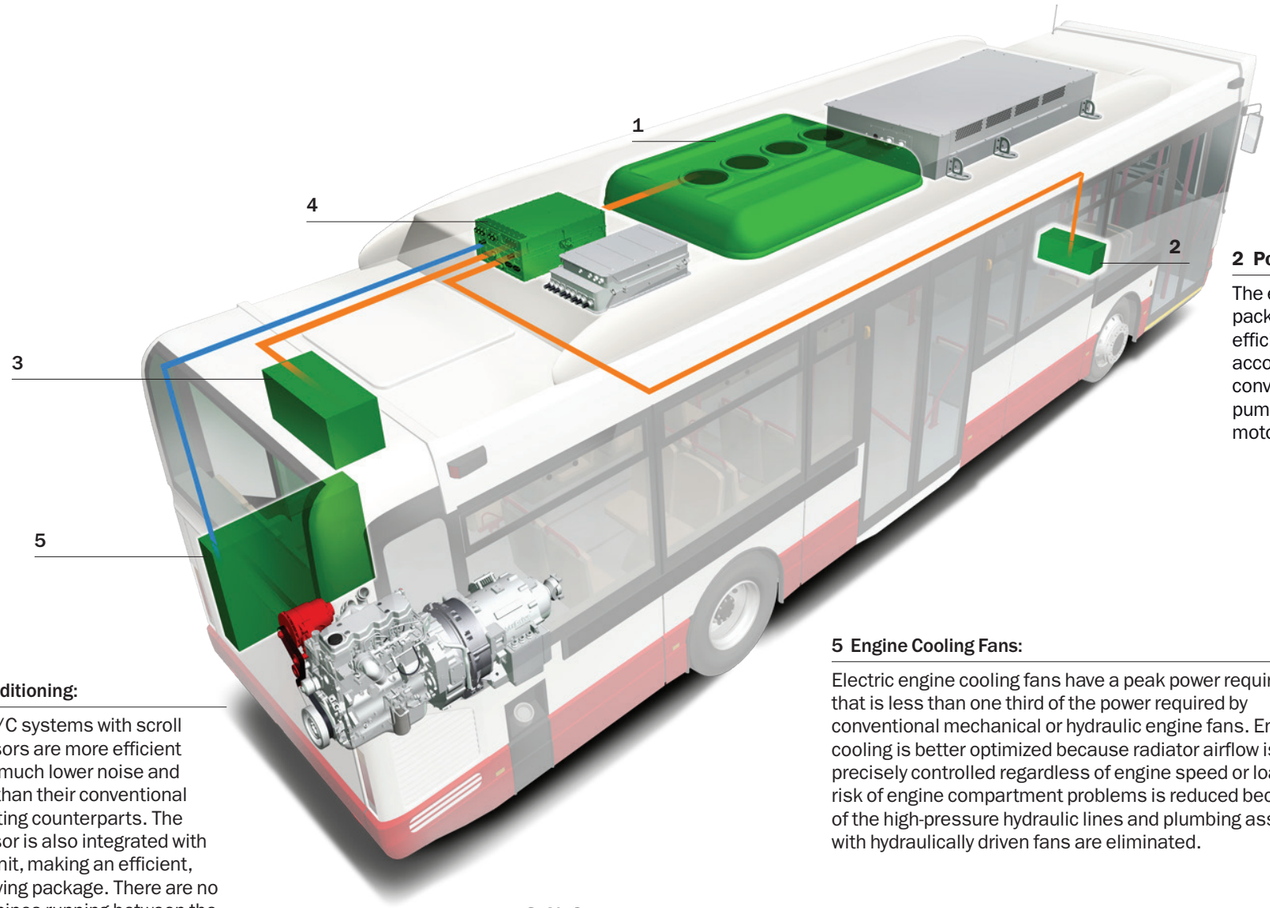
EXTENDED SLI BATTERY LIFE

- Dramatically reduced loads on the vehicle 28 volt battery system extends battery service life and reduces maintenance requirements
- Remote-sensing and temperature compensated voltage regulation at the vehicle batteries extends battery life.

WHAT ARE THE BENEFITS OF ELECTRICALLY POWERED ACCESSORIES COMPARED TO CONVENTIONAL SYSTEMS?

4 Alternator:

The HybriDrive® Accessory Power System (APS) functions as an electronic alternator which replaces the conventional belt-driven alternator, eliminating the drive belt, bracket and bulky alternator from the engine compartment for easier engine service. The APS is more than 85% efficient compared to the 50-70% efficiency typical of a conventional alternator. With 530 amps continuous output, the APS provides more than twice the power of typical conventional alternators at any engine speed. The APS can provide full output at engine idle or even with the engine off, minimizing harsh load cycles on the 24V vehicle batteries during heavy accessory use, such as hot nights with A/C and all lights on.



2 Power Steering:

The electric power steering package is quiet, reliable and efficient. Electric power steering is accomplished by mating a modified conventional hydraulic steering pump with an industrial electric motor.

1 Air Conditioning:

Electric A/C systems with scroll compressors are more efficient and have much lower noise and vibration than their conventional reciprocating counterparts. The compressor is also integrated with the A/C unit, making an efficient, space-saving package. There are no hoses or pipes running between the engine compartment and the roof; no purging or filling refrigerant lines in the shop; and much less chance of refrigerant leaks since the system comes filled and hermetically sealed from the factory. Additionally, the electric system eliminates the large compressor and compressor drive belts, pulleys and brackets in the engine compartment.

5 Engine Cooling Fans:

Electric engine cooling fans have a peak power requirement that is less than one third of the power required by conventional mechanical or hydraulic engine fans. Engine cooling is better optimized because radiator airflow is precisely controlled regardless of engine speed or load. The risk of engine compartment problems is reduced because all of the high-pressure hydraulic lines and plumbing associated with hydraulically driven fans are eliminated.

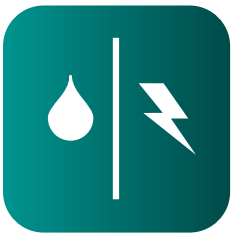
3 Air Compressor:

Electric air compressors, used for decades on trolley buses, light rail and subway systems, are reliable, quiet and efficient. Because most modern units are oil-free scroll type compressors, there is no oil to contaminate the bus air system in the unlikely event of a compressor failure. Additionally, the scroll compressor has much lower noise and vibration when compared to conventional reciprocating units.

ZERO-EMISSION DRIVE MODES

ELECTRIC ACCESSORIES ENABLE VARIOUS ELECTRIC DRIVE MODES:

STOP/START



Stop wasting fuel and emitting exhaust with the engine idling away at bus stops with the HybriDrive Series-E Stop/Start mode of operation. This feature shuts off the engine to reduce engine idling up to 40%. How it works: As the bus approaches the stop, the engine shuts off providing a quieter environment for passengers and passersby, and as the bus pulls away, the engine will restart. This decrease in engine idle time presents fuel savings with no loss of comfort or control to the bus operator.

DEPOT DRIVE

Depot Drive enables bus operators to enter or depart the bus depot without the engine running for short distance travel. (Range <500 yards at speeds < 15 mph). Travelling through the depot on electric power helps air quality, and allows transit agencies to decrease their facilities' heating and air conditioning budget and keep the air clean for their employees

SILENT DRIVE*

Limited EV mobility is possible with HybriDrive Series-E. Silent Drive is extending Depot Drive to include longer electric travel time. If you are interested in Silent Drive, please discuss this possible option with a BAE Systems Regional Sales Manager. Transit agencies interested in this drive mode will be considered after evaluation.

*This mode is only available to beta customers at this time.

ELECTRICALLY POWERED ACCESSORIES SAVE FUEL

Accessories	Mechanically Driven	Electrically Driven
Engine cooling fans	Up to 36 shp	Up to 9.5 shp
Alternator (220A @ 27.5V)	13.5 shp	9.7 shp
Air conditioning	10 to 35 shp	10.7 to 21.5 shp
Air compressor*	0.25 to 0.75 shp unloaded 4 to 12 shp loaded	0 shp unloaded 5.7 shp loaded
Steering pump*	0.5 to 5.8 shp	0.5 to 6.6 shp
Total accessory load	Up to 102 shp	Up to 53 shp
Potential fuel economy improvement	0% baseline	Up to 10% above baseline with EA plus up to an additional 10% with stop/start

*Required for EV and/or engine stop/start modes

shp= shaft horsepower

How can you learn more?
HybriDrive propulsion systems offer two APS power electronics options that support partial to full electrification of accessories. Contact your regional sales manager for details.

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