



# HYBRIDRIVE<sup>®</sup> SUPPORTS ELECTRICALLY POWERED ACCESSORIES

# 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 loads including conventional electric 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 hybrid transit buses.

Electrically powered accessories enable advanced features like automatic engine stop/start\* as well as limited EV mode driving. 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!

\* Subject to application approval from the Engine OEM.

# CLEANER, QUIETER, MORE EFFICIENT

## GREATER FUEL SAVINGS

- Reducing accessory energy consumption increases system efficiency
- Saving 10-20% 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!

## 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.

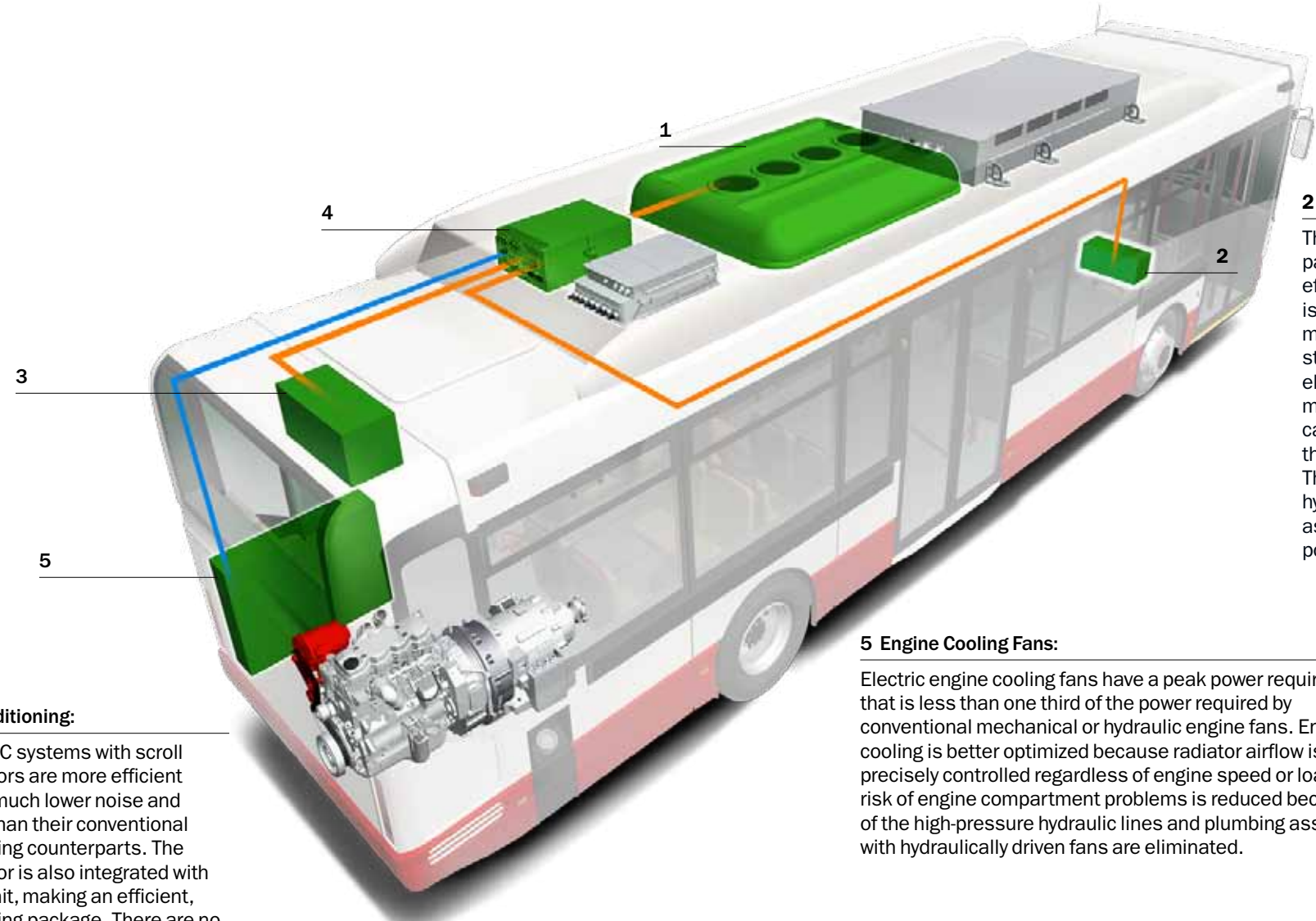
## LOWER OPERATING AND MAINTENANCE COSTS

- 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.

## 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?



### 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.

### 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 90% efficient compared to the 50-65% efficiency typical of a conventional alternator. With 530 amps continuous output, the APS provides more than twice the power of typical conventional alternators. 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. The pump, motor and a small reservoir can be mounted at the front of the bus near the steering box. This eliminates over 80 feet of hydraulic lines along with the associated pumping losses and potential for leaks.

### 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.

# 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%	10% to 20%
<p>*Required for EV and/or engine stop/start modes shp= shaft horsepower</p> <p>** An additional 10% efficiency improvement, over and above the fuel economy improvement is expected with the implementation of engine stop/start</p>		

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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