

More Choices, More Fuel Savings With PowerLINE® Gen



For 2013, the PowerLINE® generator set platform has been expanded with two new models that are Carrier Transicold's most fuel efficient to date and also respond to new emissions standards in the United States.

The new models incorporate ecoFORWARD™ technologies that can reduce fuel usage by about one third compared to prior standard units, reducing operating costs and significantly extending distances generator sets can travel before refueling.

New PowerLINE units also comply with the 2013 Tier 4 emissions standard from the U.S. Environmental Protection Agency, which is required for new generator sets used in the United States and Canada. Carrier Transicold customers elsewhere in the world have the opportunity to choose between either the new 2013 models or the previous models, which were designed for compliance with the 2008 U.S. EPA standard known as the Tier 4 *interim* or Tier 4i standard.

"The diesel emissions standards for most of the world differ from the U.S. and Canada," said Charu Mahajan, generator set business manager. "In markets where the Tier 4i standard already meets or exceeds local emissions requirements, we will continue to provide our Tier 4i models for export as long as customer demand continues."

What's New for 2013

A benchmark for the industry, PowerLINE diesel generator sets provide uninterrupted power to operate 460-volt ISO container refrigeration systems when used over land in intermodal applications. They are available in models that either mount underneath a container chassis (UG version) or clip onto the front of a refrigerated container unit (RG).

"Our approach with ecoFORWARD technologies was to take a holistic view of the system to improve overall performance while also achieving emissions compliance," said Mahajan, "The resulting generator sets do much more, while consuming less fuel."

The 2013 models introduce:

- Standard implementation of enhanced FuelWise™ functionality, a fuel saving technology that automatically switches the generator set between two speeds via a simple black box controller.
- A new ultra-high-efficiency 15 kW custom-designed permanent magnet generator (PMG) that pushes efficiency well beyond conventional generators.

While actual fuel consumption depends on real-world conditions, cargo and the specific refrigeration unit used,

Carrier's preliminary testing shows that the fuel savings on the new models ranges from 32 to 34 percent, testing in ambient conditions of 100°F (38°C), resulting in relatively short payback periods.

The new PowerLINE units also weigh about 30 pounds (14 kg) less than the previous units, helping to lighten the transit load.

Common to PowerLINE systems with ecoFORWARD technologies is a familiar 2.2-liter diesel engine based on Carrier Transicold's current engine line with its well-accepted speed sensor and electronic governor, enhancements introduced in 2008.

"Providing customers with a familiar, reliable engine was key," Mahajan said. "This helps our customers, who do not have to learn, operate and deal with complex new engine technology in the field. Equally important for our customers was to improve fuel economy for lower total operating costs."



The new Tier 4 compliant PowerLINE generator set for undermount applications.

Achieving Compliance in North America

Performance improvements from the application of ecoFORWARD technologies reduced the required engine power by more than 20 percent putting the PowerLINE engine within the scope of EPA's Tier 4 standard for non-highway engines rated at 11 to 25 horsepower (8 to 19 kW). Under the EPA regulation for this class, particulate emissions must not exceed 0.4 g/kWh and NOx, and hydrocarbons cannot exceed 7.5 g/kWh. PowerLINE units not only achieve this, but also offer greenhouse gas reductions of up to 34 percent relative to previous standard units, as carbon footprint is commensurate to fuel consumption.

"The 2013 PowerLINE platform is also compliant with California standards upon purchase and for seven years thereafter without further modification," Mahajan said.



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How FuelWise Works

After seven years, the California Air Resources Board (CARB) requires further emissions reductions for the engine class for units operating there. In response, Carrier Transicold is developing an optional engine emissions system (EES) for the 2013 Tier 4 PowerLINE models, designed to achieve compliance with CARB's ultra-low diesel emissions standard known as ULETRU. Tier 4 PowerLINE units will need to be fitted with the EES option by the end of the seventh year, if they are to remain in use in California.

Current PowerLINE Model Line-up

FuelWise

2013 Tier 4 Compliant

- RG15 Clip - ecoFORWARD*
- UG15 Undermount - ecoFORWARD‡

Standard

Tier 4i Export

- RG 15 Clip*
- UG15 Undermount‡

Optional

* Integral fuel tank for the 2013 Tier 4 model is 120 gal. (454 liter), and 130 gal. (492 liter) for the Tier 4i model.

‡ Integral fuel tank: 68 gal. (257 liter); Options: 50 gallon (189 liter), 80 gallon (303 liter).

Export Model Performance

The highly successful Tier 4i PowerLINE models have proven themselves to be workhorses of the industry.

The Tier 4i generation of PowerLINE units brought significant emissions improvements when they succeeded the earlier Tier 2 platform early in 2008. Later that year, the dual-speed feature, known today as FuelWise, was introduced and over the last several years became the most popular option for PowerLINE units.

"Fuel savings of about 27 percent are achievable with the Tier 4i units that leverage FuelWise option," said Mahajan, "Although that's less than our 2013 Tier 4 units with built-in FuelWise functionality, it's still quite significant."

"Therefore, for customers outside of the U.S. and Canada who continue to purchase Tier 4i units, we highly recommend specifying the FuelWise option," Mahajan said.

While actual fuel consumption and commensurate greenhouse gas reductions will depend on real-world conditions, such as cargo and the refrigeration unit is used, important benefits can be achieved with both the new high efficiency Tier 4 models with built-in FuelWise functionality and Tier 4i models with the FuelWise option.

"Regardless of which Carrier Transicold solution our customers choose for a particular region and its emissions standards, they will find that we offer a unit and solution where the investment in fuel-savings technology will result in a relatively short payback period," Mahajan added.

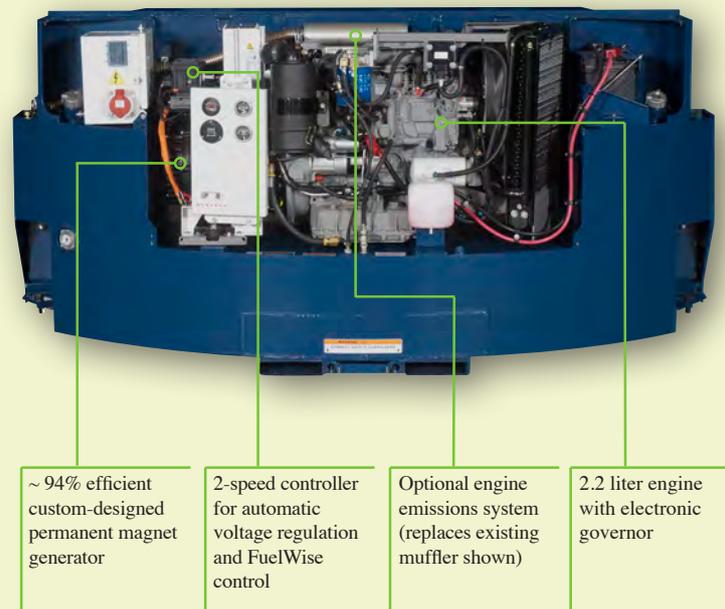
Whether included standard with the 2013 Tier 4 units or chosen as an option on Tier 4i export models, the FuelWise option achieves fuel efficiency by enabling the generator set to run at two speeds: 1800 rpm corresponding to 60 Hz, and 1500 rpm corresponding to 50 Hz.

"Once the engine slows down, the fuel savings begin," said Dave Smith, program manager.

"The original FuelWise option used with the Tier 4i models automatically switched the engine to 1500 rpm after the initial startup period," Smith explained. "In our Tier 4 models with built-in FuelWise functionality the generator set runs at 1500 rpm preferentially with the controller determining when to switch speeds, thus maximizing fuel savings while delivering requisite power and voltage for refrigeration unit operation."

Previously Carrier Transicold tested fuel consumption of Tier 4i PowerLINE units using commodities such as bananas, mangoes and melons at typical refrigerated setpoints. On average, fuel consumption was reduced by 26 to 28 percent using the FuelWise option. The permanent magnet generator of the new Tier 4 models with built-in FuelWise delivers a fuel efficiency boost of approximately 6 percent compared to Tier 4i compliant PowerLINE units fitted with FuelWise option.

"By reducing fuel consumption, distances traveled on a tank are extended and carbon footprint is reduced," Smith added. "Given the cost of diesel fuel and customer interest in environmentally sound choices, we always recommend the FuelWise option for Tier 4i units."



~ 94% efficient custom-designed permanent magnet generator

2-speed controller for automatic voltage regulation and FuelWise control

Optional engine emissions system (replaces existing muffler shown)

2.2 liter engine with electronic governor