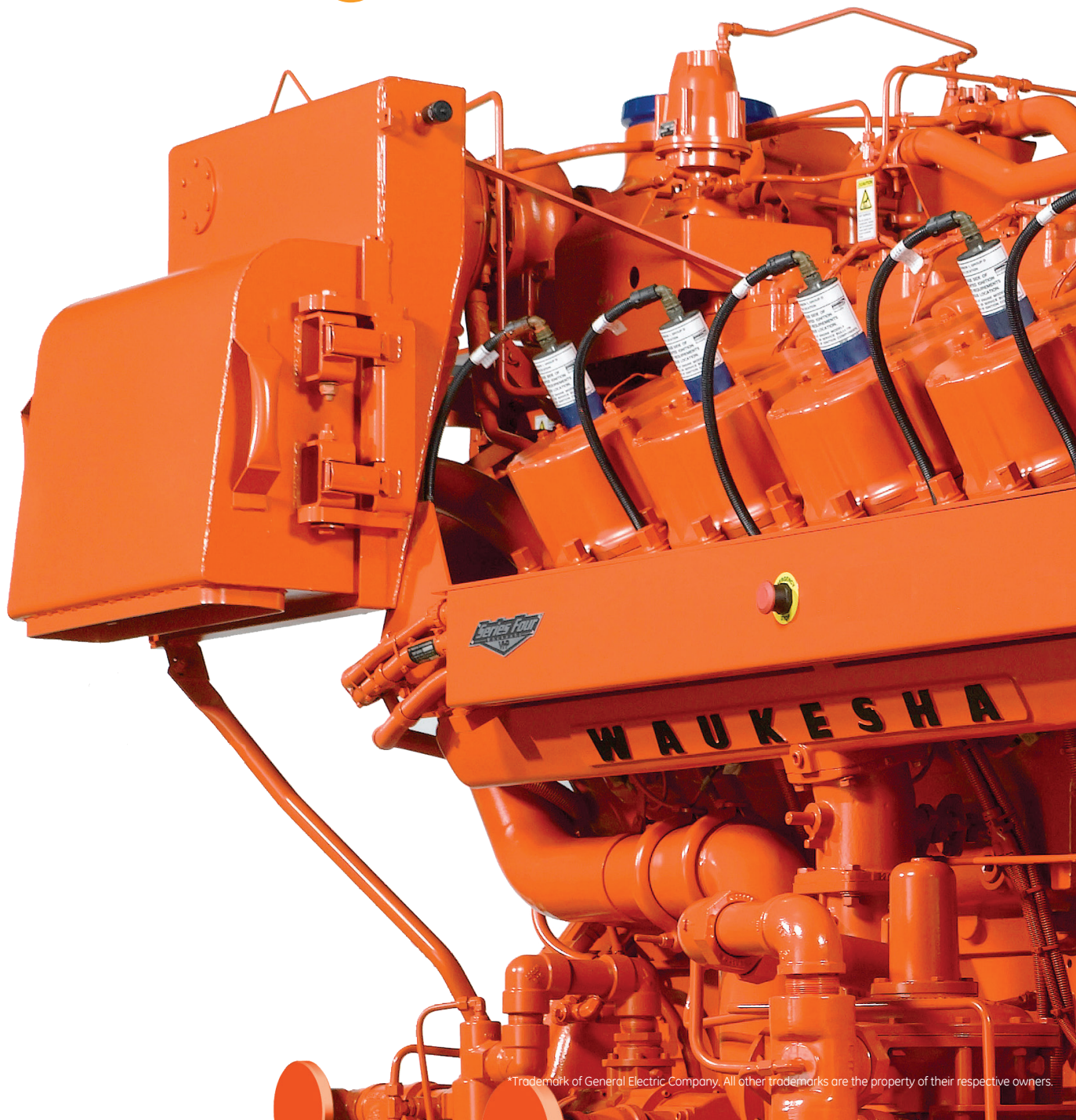


Distributed Power

Waukesha* gas engines
VHP* Series Four*

enhancing the tradition



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VHP Series Four Enhancements

Distributed Power's Waukesha Series Four rich-burn engines have traditionally been the engines of choice for some of the harshest and most demanding gas compression, power generation, and mechanical drive applications across the world.

This tradition has been built on the Series Four engines' ability to reliably produce more power on hot field gases, at high altitudes, and in remote locations, all while providing the opportunity to deliver the lowest available emissions when paired with a 3-way catalyst (NSCR).

Series Four rich-burn engines are known for their application flexibility and reliability. A series of upgrades to the F3524GSI, L5794GSI, L7042GSI S4, and L7044GSI now further enhance the tradition and durability of the Series Four.

Cylinder Head Components & Valves

Rich-burn engines are about heat. The same heat and high-exhaust gas temperature that enables the highly-effective emission reduction capability of a 3-way catalyst must also be managed properly within the cylinder head.

Series Four cylinder heads now incorporate intake and exhaust valves with a new proprietary design for improved seating, sealing, and heat transfer. Both the intake and exhaust valves now use positive valve rotators for better temperature distribution and sealing, resulting in lower wear and longer life.

An improved spark plug carrier sealing system ensures robustness and long life.

These designs have been proven in multiple field tests and have exceeded the goal of running up to full rated load for 24,000 hours. The success of these field tests indicate the extended time-between-overhauls (TBO) capabilities of the new cylinder head design[†]. Frequent monitoring and inspection throughout testing showed cylinder heads to be in excellent condition after more than 30,000 hours of operating time. Exhaust valve recession was measured at less than half of the guideline as published by Waukesha gas engines.

Applies to F3524GSI, L5794GSI, L7042GSI S4, and L7044GSI

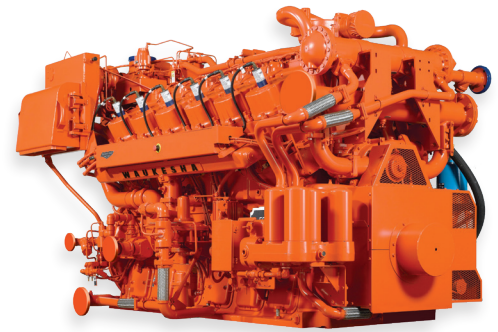
[†]Time between overhauls may vary based on operating conditions and maintenance.



New exhaust valves have a proprietary design to improve robustness and reduce wear rate.



The ESM air/fuel ratio control algorithm was enhanced to optimize the performance of the new fuel pressure regulators.



Enhanced Air/Fuel Ratio Control

A rich-burn engine with a 3-way catalyst (NSCR) provides a scalable emission solution with the lowest overall emissions in the market. With enhancements to the ESM* air/fuel ratio control system, Series Four engines are able to achieve these low emission levels across an even wider range of applications.

An enhanced ESM air/fuel ratio control algorithm was created to optimize the performance of a new fuel pressure regulator. Included in the new algorithm are updated gains in the fuel system to improve the interaction between the regulator, engine, and controls, as well as improved oxygen sensor signal processing specifically matched to Waukesha's oxygen sensor.

Together, the enhanced ESM air/fuel ratio control algorithm and new fuel pressure regulator create up to a 17% wider air/fuel ratio range where 3-way catalyst performance is optimized. The system also maintains the air/fuel ratio set-point across a wide fuel quality range.

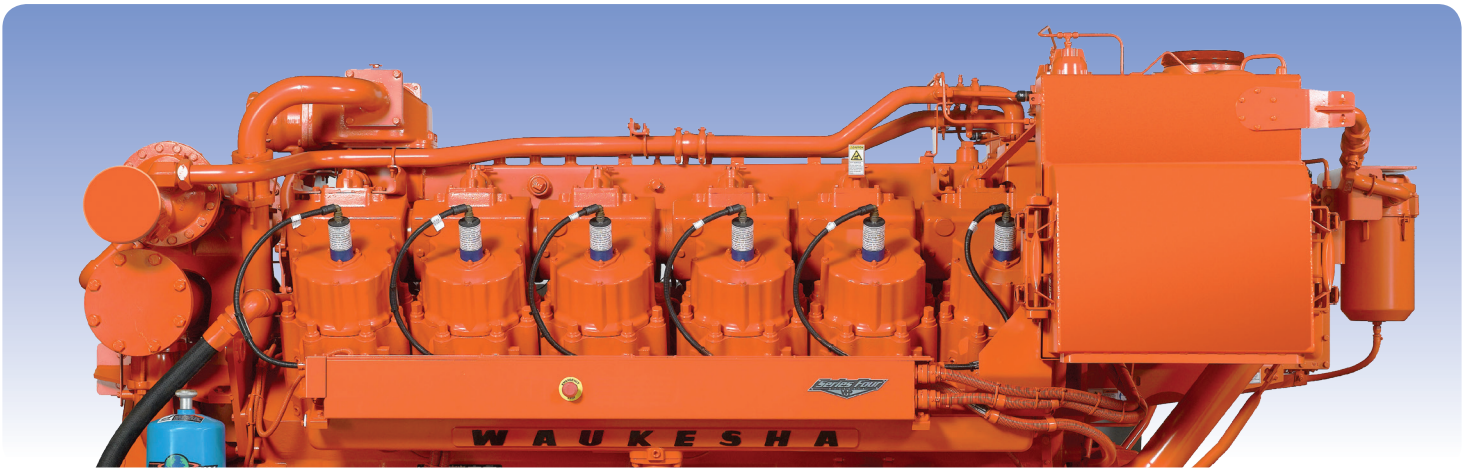
This wider "sweet spot" provides greater confidence in emissions compliance and less frequent adjustment, resulting in lower operating costs.

Fuel pressure regulator applies to all VHP engines.

Improved ESM air/fuel ratio control algorithm applies to F3524GSI, L5794GSI, L7042GSI S4, and L7044GSI



New fuel pressure regulators provide wider air/fuel ratio range where catalyst performance is optimized



Cam Tappet Rollers

An improved cam tappet roller design provides long life with minimal wear. A 3-piece pin/bushing/roller design and optimized oil channels improve lubrication for smooth operation.

Applies to all VHP engines

Pistons and Cylinder Liners

The Series Four piston has been enhanced for improved scuff resistance under even the most challenging operating conditions.

Piston enhancement applies to F3524GSI, L5794GSI, L7042GSI S4, and L7044GSI

Front-End Gear Cover Sealing

Single piece gear housing and gear cover gaskets eliminate gasket joints, providing a highly-engineered sealing system between the crankcase and the front-end gear cover.

Further gasket refinements include higher strength material and an optimized contour, which produces a more uniform sealing pressure. These gasket enhancements, coupled with longer bolts for better clamp load, improve the margin against joint relaxation and minimize opportunities for leaks.

Applies to L5794GSI, L7042GSI, L7042GSI S4, and L7044GSI

Enhancement Features Summary

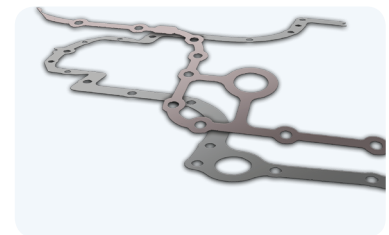
New Feature	F3524GSI	L5794GSI	L7044GSI	L7042GSI S4	L7042GSI	All Other VHP	Service Parts
Series Four Cylinder Head	X	X	X	X			X
ESM Air/Fuel Ratio Control Algorithm	X	X	X	X			X
Gas Regulator	X	X	X	X	X	X	X
Cam Tappets	X	X	X	X	X	X	X
Series Four Pistons	X	X	X	X			X
Front-End Gear Cover Sealing	NA	X	X	X	X		X



Cam tappet rollers provide better lubrication for smoother operation.



New piston design provides optimal scuff resistance



Sealing has been enhanced through the use of a single-piece gasket between the crankcase and the front-end gear cover.

