

THE WAUKESHA VHP™ SERIES



A Tradition of Performance



# The VHP™ – A

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## **WITH THE VHP,™ QUALITY IS BUILT RIGHT IN**

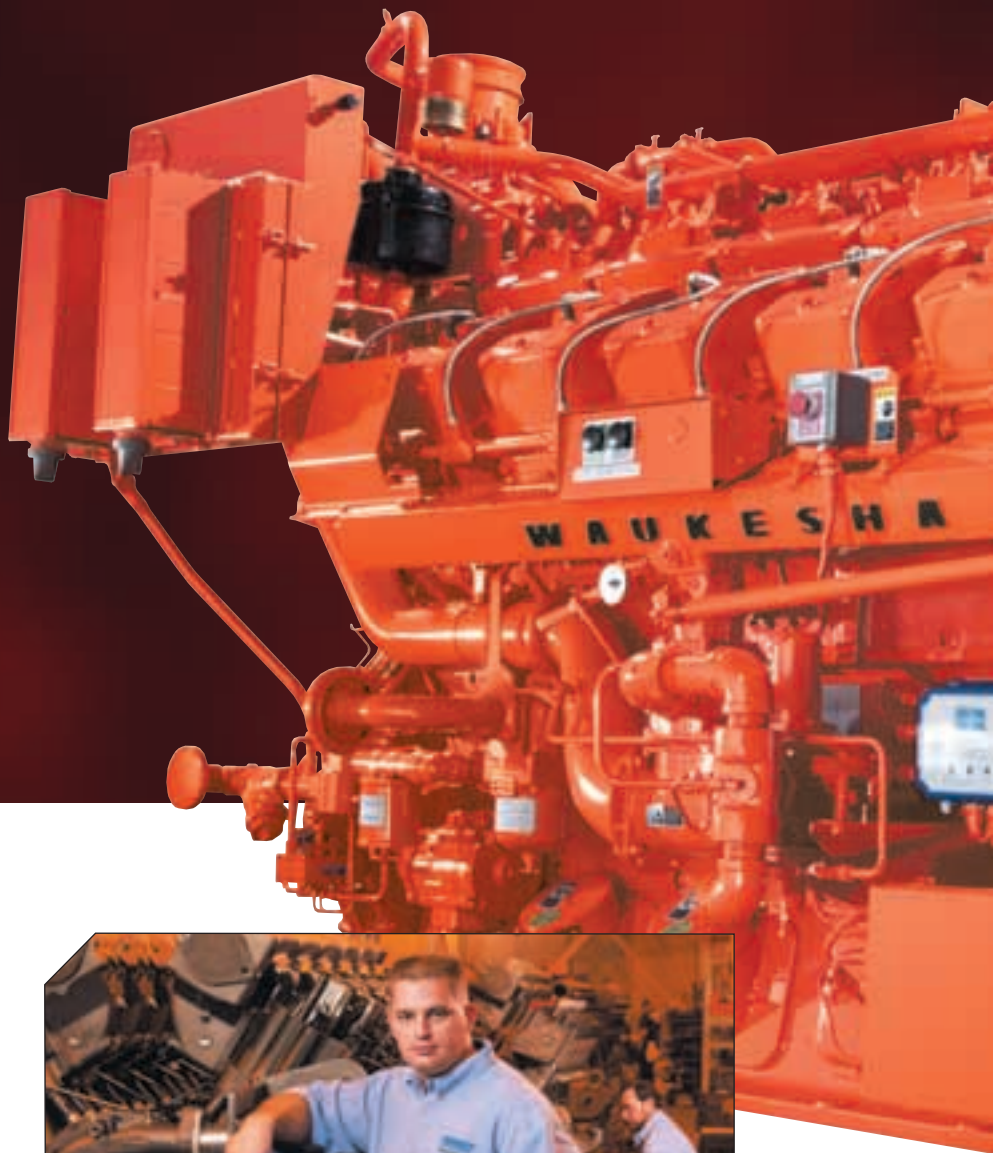
Manufacturing precision contributes to the long service life associated with a Waukesha® engine. State-of-the-art equipment at Waukesha's manufacturing plant assures quality in every VHP component and genuine service part.

### **THE VHP IS A COST-EFFECTIVE ENGINE**

Waukesha Engine designs its products to be cost-effective no matter what the application, making efficient use of every cubic foot of fuel and maintaining constant torque across a wide speed range. The result is an engine family that can be selected to efficiently drive a variety of equipment—whether it's a co-generation system, compressor, pump or chiller.

### **THE VHP IS A FLEXIBLE ENGINE**

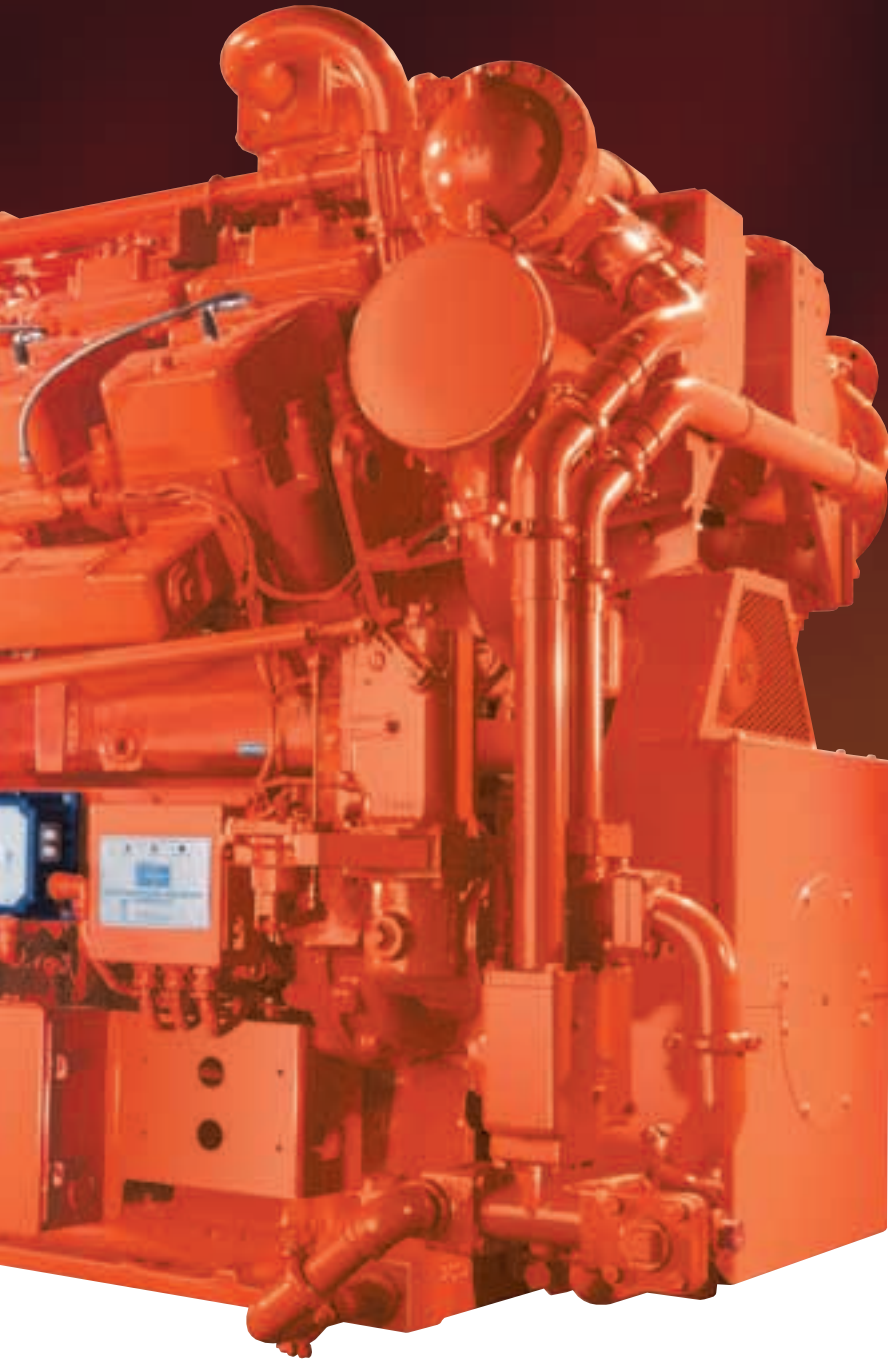
The VHP operates on a variety of fuels including natural, digester and landfill gas, and propane. In many instances, it can be fitted for dual-fuel operation, allowing the choice of a less costly or more available energy supply as the primary fuel with the option of switching to a standby fuel when needed. In addition, low pressure gas supplies in wastewater treatment plants, landfills and some municipalities led to the development of a low pressure fuel system for select VHP GSI, GL and LT models. This fuel system allows operation of fuel pressures below 0.5 psig.



*SINCE ITS INTRODUCTION IN 1966, WAUKESHA ENGINE'S VHP FAMILY HAS CONSTANTLY EVOLVED TO MEET EVER-CHANGING CUSTOMER REQUIREMENTS. | OVER TIME, THIS INTERNAL COMBUSTION WORKHORSE HAS BECOME THE INDUSTRY STANDARD IN PETROLEUM AND CONTINUOUS POWER APPLICATIONS. | TODAY, BACKED BY MORE*

# Proud History

Performance



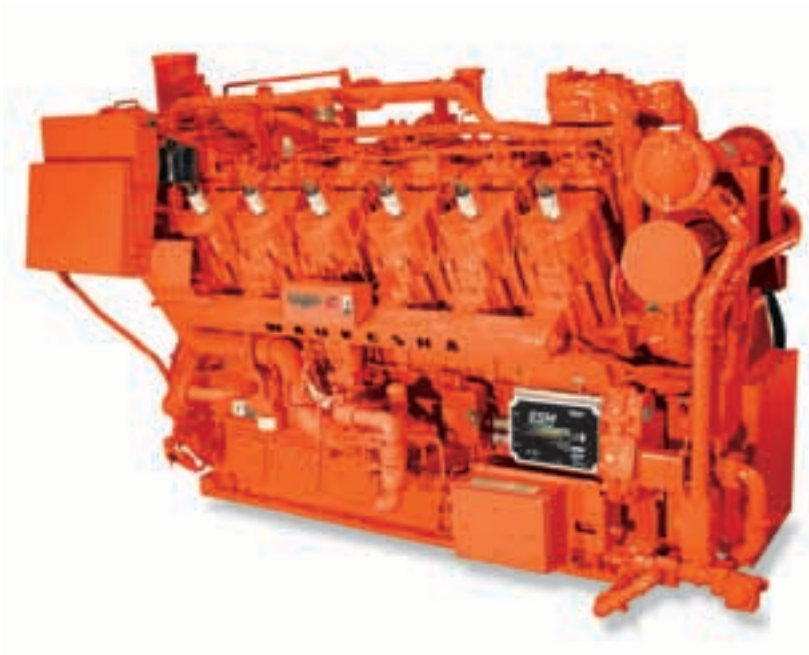
## **INNOVATIVE DESIGN + PRECISION COMPONENTS = A RELIABLE ENGINE**

Over the years, the demand for higher loads and speeds have brought significant improvements in the VHP™ design. For instance, all VHP engines now feature a crankshaft made with a new manufacturing process and a material that's fully 55% stronger to handle today's demands for more power.

### **OTHER TIME-PROVEN FEATURES INCLUDE:**

- Robust connecting rods with an on-center bearing design for even load distribution across the bearing surface and improved component life
- A camshaft profile that ensures consistent valve train operation
- Cross bolting of the main bearing caps to the crankcase which provides a rigid frame for crankshaft support and alignment
- Cylinder liners made of heat-treated bainite cast iron provide greater strength for less flexing and longer wear
- A three-ring piston design offering better expansion characteristics at the crown and greater strength in the pin boss
- Longer thread engagement on the GL and Series Four® spark plug carrier for lower spark plug temperatures and longer spark plug life
- Trouble-free adjusting screws, alloy valves and valve seats that withstand the severe demands of gaseous-fueled engines for longer intervals between top-end overhauls

*THAN 95 YEARS OF RECIPROCATING ENGINE KNOWLEDGE AND EXPERIENCE, THE VHP LINE IS THE BACKBONE OF WAUKESHA'S PRODUCT OFFERING. | AVAILABLE IN A VARIETY OF CONFIGURATIONS INCLUDING MODELS WITH THE REVOLUTIONARY SERIES FOUR® CYLINDER HEAD, THE VHP STORY IS ONE OF QUALITY FROM THE START.*

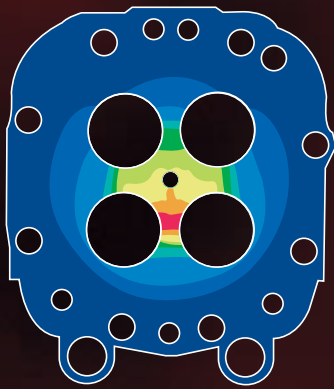


**THE SERIES FOUR® LEGACY: AN EVEN MORE POWERFUL TRADITION**

Waukesha Engine's VHP™ Series Four line-up offers lower-cost horsepower with the simplicity, dependability and low emissions potential of a simple, rich burn design. Our engineers took a “clean sheet” approach in developing this series' cylinder head. We combined the best features of existing Waukesha Engine products with the latest engineering technologies. Finite element analysis and solid modeling were used to create a head that's 33% stronger at increased BMEP levels. The net result of these improvements? A cylinder head that offers higher strength and improved cooling for more power and greater durability – and a design that's even interchangeable with other VHP heads.

**DESIGNED TO KEEP ITS COOL**

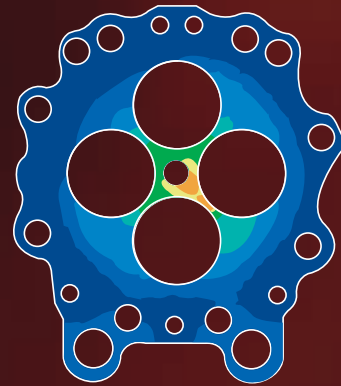
Hot spots around cylinder head components can be costly. They can lead to distortion, misalignment and increased wear and stress which all can reduce component life. Our innovative Series Four head design includes flow-through water passages that are continuous, with no blockages or stagnation. The result is a 25% reduction in thermal gradient across the fire deck ... plus our water-cooled exhaust valve seats run 30% cooler, improving spark plug life by more than 50%.



*Standard Head under GSI Loading*

**CYLINDER HEAD TEMPERATURE (°F)**

- 220.4 - 278.8
- 278.9 - 337.3
- 337.4 - 395.8
- 395.9 - 454.3
- 454.4 - 512.8
- 512.9 - 571.2
- 571.3 - 629.7
- 629.8 - 688.2
- 688.3 - 746.7



*New Series Four® Head under GSI Loading*

## CONFIGURE THE VHP™ TO MEET YOUR NEEDS FOR A CLEAN-BURNING, LOW EMISSIONS ENGINE

Realizing that the permitting process for air quality standards can vary greatly, Waukesha Engine's VHP engines are available in a variety of configurations – rich burn or lean burn ... standard or pre-chamber – and with your choice of two control types. Here are the most popular models:

**GSI:** The VHP GSI rich burn engine can be combined with a catalytic converter to meet the strictest emissions regulations. In addition, the GSI Series provides low-cost maintenance, good fuel tolerance and excellent load response.

**GL:** Waukesha Engine's VHP GL engines provide both low emissions and high efficiency. The GL Series features a pre-chamber combustion system to assure low emissions across a wide load and speed range, without a loss of combustion stability at lean air/fuel ratios.

**LT:** The VHP LT offers the flexibility and reliability of rich burn engines while still meeting regulatory standards for emissions. The LT's open chamber, lean burn combustion provides for low emissions, good fuel tolerance and low cost maintenance.

### EXPANDED PACKAGING

- New oil cooler mounting allows quicker packaging
- Vee-engine auxiliary water pipes mounted above the cylinder heads for easier servicing
- A new junction box provides quick connections for easy removal if necessary

## SIX MORE SERIES FOUR® FEATURES

# 1

A TURBOCHARGER WITH A WATER-COOLED CENTER HOUSING FOR COOLER BEARING TEMPERATURES AND LONGER LIFE

# 2

A REUSABLE ROCKER COVER O-RING AND A NO-HASSLE VALVE SEAT REMOVAL FOR SIMPLIFIED MAINTENANCE

# 3

IGNITION COIL THAT IMPROVES SPARK DELIVERY AND ELIMINATES WATER INTRUSION



# 4

EQUAL-LENGTH CYLINDER HEAD BOLTS – TOGETHER WITH REVISED GASKETING – FOR IMPROVED LOADING AND SEALING OF THE CYLINDER HEAD, LINER AND BLOCK

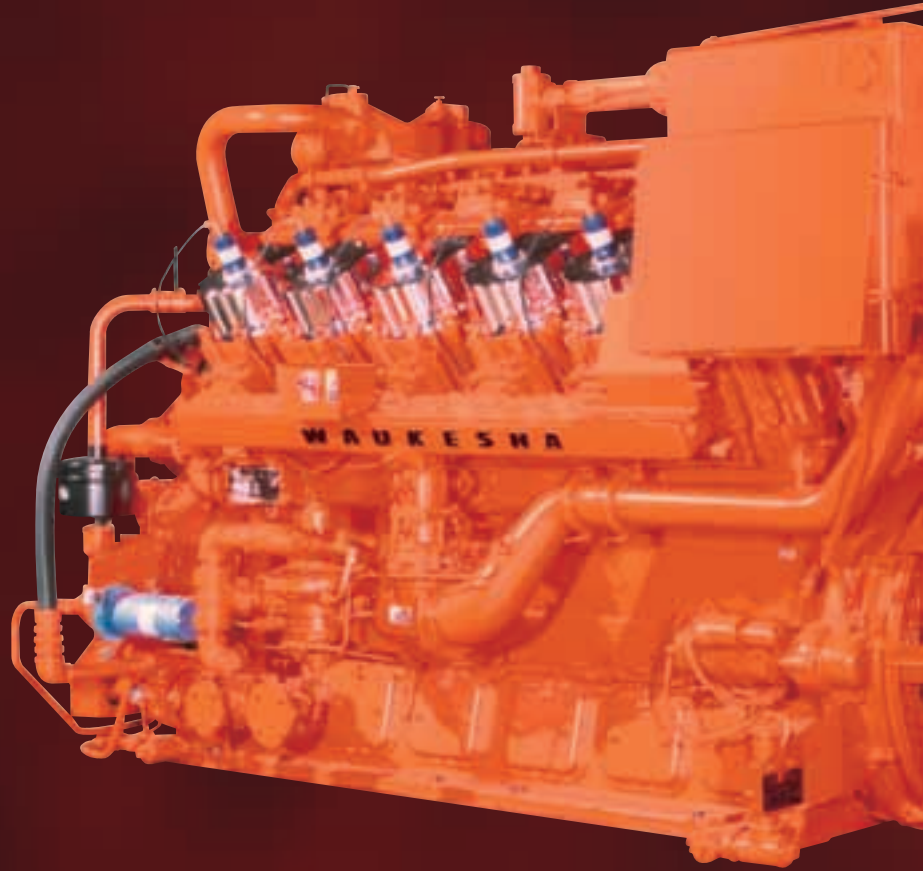
# 5

VALVES THAT ARE ROTATED 45 DEGREES TO REDUCE FLOW LOSSES AND TO INCREASE TUMBLE AND SWIRL OF THE INCOMING MIXTURE FOR MORE RAPID AND COMPLETE COMBUSTION

# 6

A NEW VALVE BRIDGE MECHANISM THAT PROVIDES BETTER VALVE ACTUATION RESULTING IN LESS SIDE LOADING AND WEAR





***A WAUKESHA "ENGENIUS™" ESM™ OPTION FOR YOUR VHP™***

It's a smart move to include an ESM to oversee your VHP engine's performance. The new Waukesha Engenius ESM continuously monitors the engine's speed, pressure, temperatures and other conditions for maximum performance and uptime. The ESM, directed by the Engine Control Unit (ECU), controls ignition timing, speed governing and stop/start functions, providing diagnostic help and fault logging when needed. Easy to use, the ESM can be accessed via satellite, cellular connection, radio frequency or land phone line and can relay the current status of the engine to an internet server, computer, telephone or pager. On-site diagnostics can be done through a laptop for instant engine readings. E-help is also available, offering step-by-step troubleshooting instructions for any alarm or shutdown code on line. Besides self-calibration and diagnostics, the ESM also keeps permanent fault histories of alarms and shutdowns.



**WAUKESHA POWER SYSTEMS**

**PACKAGING FACILITIES**

Distributed generation and CHP Solution |

Continuous duty | Peak shaving duty | Stand-by duty

**MICROSPIN LUBE OIL SYSTEM**

Standard on the Series Four® and available as an option on other VHP™ models, the Microspin bypass lube oil filter is unequalled for engine oil filtration. By removing contaminants as small as 0.5 microns, it helps reduce engine wear and maintenance costs while boosting uptime.

**CUSTOM ENGINE CONTROLS**

Waukesha Engine's standard Custom Engine Control (CEC) Ignition Module provides precise timing and control for reduced emissions and fuel costs. No wearing parts means consistent ignition performance and lower maintenance. The standard CEC Detonation Sensing Module (DSM) adjusts ignition timing automatically on an individual cylinder basis. Detonation sensing optimizes ignition timing with varying load, speed, fuel and ambient conditions while protecting the engine from detonation damage. This can result in better exhaust emissions, fuel economy and more even engine loading.



## VHP™ ENGINES: ON THE JOB, AROUND THE WORLD

Whether the application calls for compressing gas, generating electricity or pumping water, Waukesha Engine VHP engines are there. Chosen for their high uptimes, low maintenance and extreme reliability, our VHP engines are proven performers. Check out these examples:

In the Chicago suburb of Arlington Heights, Northwest Community Hospital has relied on three VHP7100GSI engines for years. In a co-generation system, they provide power and heat to run chillers and to produce steam. Over the course of a year, this 500+ bed hospital will serve more than 20,000 inpatients, handle more than 16,000 surgical cases and deliver 2,750 newborns. From 9 a.m. to 10 p.m. each day, the Waukesha® engines supply 3.5 megawatts of power (about 70% of its needs), saving more than \$700,000 in energy charges annually.



In the oil fields of Colombia, more than 100 Waukesha® engines – mostly VHPs – provide power, move gas and oil, and pump water at remote sites around the country. Whether operating in the hot equatorial plains or in the cold high altitudes, the engines work around-the-clock and are only shut down one week per year for annual maintenance. Operations managers feel their Waukesha® engines are an excellent choice because they can provide availability above 98%.



Waukesha



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