

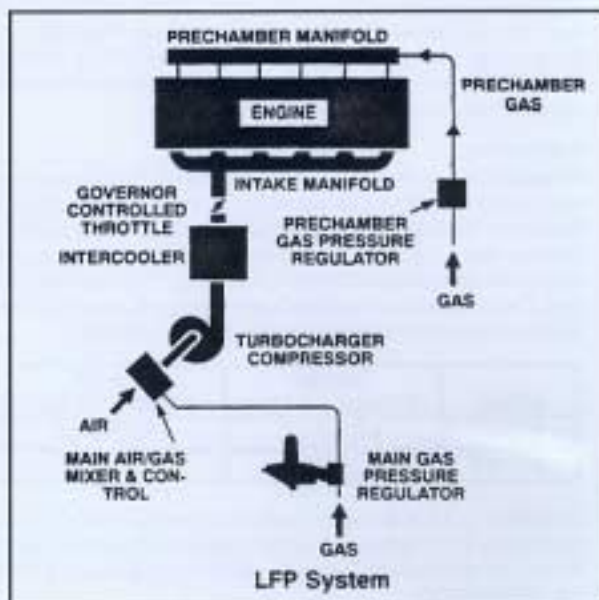
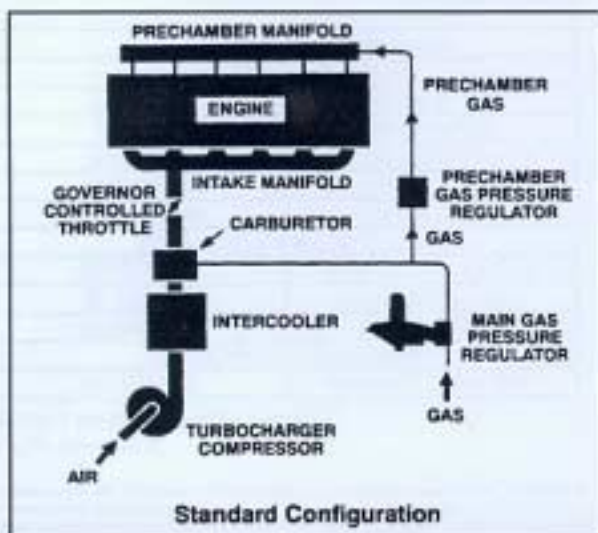
# APPLICATION NOTES

No. WED3/92 Rev. 1

Information from the Application Engineers at Waukesha Engine/Waukesha Power Systems

## LOW FUEL PRESSURE SYSTEM TECHNICAL

In certain areas or applications, adequate fuel supply pressure is not available for operating a turbocharged engine. Typical examples are landfills and sewage treatment plants. Because of the cost of installing, operating, and maintaining a compressor for boosting the fuel pressure, Waukesha Engine developed the Low Fuel Pressure System (LFPS) for these applications. Traditionally a turbocharged engine requires gas (fuel) supply pressures to be greater than the boost pressure produced by the turbocharger. Since the fuel is introduced to the air stream after the air passes through the turbocharger, this pressure differential, or what is commonly referred to as gas over air pressure, allows for proper blending of the fuel and air in the carburetor.



With the LFPS, low gas pressure is utilized by mixing the gas (fuel) with air at atmospheric pressure before the turbocharger. The air/fuel mixture is then drawn through the turbocharger and compressed (boosted) to the required pressure to achieve rated loads.

At this time the LFPS is available for the following models and can be operated at the loads and speeds listed below.

10% overload is allowed 2 hours per 24 hours on all models. Adjustments to ratings for high altitude and high ambient temperature are the same as those applied to engines equipped with standard carburetion. This information can be found in the Technical Data book.

RATING BHP (kWb)				
MODEL	RPM	130°F (54° C) ICW	85°F (29° C) ICW	LHV BTU/CU.FT
L7042GL	1000	1232 (919)	1289 (961)	400 - 900
	1200	1280 (955)	1280 (955)	400 - 900
L5790GL	1000	1012 (755)	1060 (790)	400 - 900
	1200	1052 (785)	1052 (785)	400 - 900
F3521GL	1000	615 (458)	644 (480)	400 - 900
	1200	640 (477)	640 (477)	400 - 900
RATING BMEP-PSI (BAR)				
H24GL	1000-1800	150 (10.4)	160 (11)	400 - 900
F18GL	1000-1800	150 (10.4)	160 (11)	400 - 900
F11GSI	1000-1800	147 (10.3)	147 (10.7)	400 - 900



## VHP-GL SYSTEM REQUIREMENTS

### Fuel System Requirements

#### Main Chamber

VHP-GL engines are not equipped with fuel pressure regulators. A nominal pressure of 6 inches (152 mm) water column is required at the engine's fuel connection. The customer supplied gas regulator(s) should be sized to meet the flow requirements obtained from the heat balance section of the Technical Data book. Fuel flow rates for low btu fuel will be proportionally higher than natural gas flow rates. The selected regulator droop should be less than 1 inch (25.4 mm) of water column at maximum expected load.

Regulator(s) should be mounted as close to the carburetor as possible for optimum engine performance and to minimize pressure drop between the regulator and carburetor. Regulator balance line(s) must be provided to the carburetor, 0.40 inch (10 mm) ID minimum. Pressure taps must be provided for measuring gas over air pressure differential.

#### Prechamber

Although the main chamber can operate with low fuel supply pressure, which can be boosted by the turbo, the prechamber has no means of matching the boost that will be present in the combustion chamber. Therefore, an external compressor must be used to increase the prechamber gas pressure to 30-50 psig (2.0-3.5 bar). The compressor should be sized for the following flow rates which will cover the highest load and speeds available:

MODEL	700-900	500-700
	BTU/CU. FT. LHV	BTU/CU. FT. LHV
VHP-6	4.5 SCFM	6.5 SCFM
VHP-12	9.0 SCFM	13 SCFM

In addition to the flow requirements, two design criteria must be adhered to. First, remove all oil carryover from the down stream side of the compressor. Secondly, cool the compressed fuel below 225°F (107°C).

#### Breather System

The customer must furnish a means to maintain a negative crankcase pressure with the LFP system. Refer to S7232-118 for blower sizing information, and drawing L8041-178 for location and size of the breather connection. Feedback of the crankcase vapors to the combustion air intake is not approved.

#### Custom Lean Burn Control

The Custom Lean Burn Control can be used in limited applications. Consult Sales Engineering for details.

#### Emissions

Emission levels are the same as engines equipped with standard carburetion.

Because the LFPs engine mixes the fuel at ambient conditions, changes in these conditions will affect engine performance. The VHP-GL can tolerate ambient temperature swings of  $\pm 25^{\circ}\text{F}$  ( $\pm 15^{\circ}\text{C}$ ) from the initial carburetion set point before fuel system adjustment is required.

## VGF-GLD AND VSG-GSID REQUIREMENTS

### Fuel System Requirements

VGF and VSG engines are not equipped with fuel pressure regulators. The VGF-GLD requires 8 in. WC (152.4 mm) gas pressure to the engine fuel connection. The VSG-GSID requires .5 psi (3.5 kPa) gas pressure to the engine fuel connection.

Waukesha Engine offers fuel regulators for gas pressure ranging from 0.5 psig to 15 psig for the LFPs option with natural gas fuel. Check the price book for the appropriate code.

The VGF and VSG are open chamber design, therefore, high pressure prechamber supply is not required.

#### Emissions

VGF and VSG emission levels are the same as engines equipped with standard carburetion.

As with the VHP-GL, the VGF can tolerate ambient temperature swings of  $\pm 25^{\circ}\text{F}$  ( $\pm 15^{\circ}\text{C}$ ) from the initial carburetion setting before fuel system readjustment.

## GENERAL REQUIREMENTS FOR LFPs ENGINES

#### Fuel Shutoff Valves

Careful selection of the shutoff valves should be made to avoid any significant pressure loss across the valve. The engine must have the previously mentioned fuel pressure at the engine connection.

#### Fuel Requirements and Limitations

The fuel for the LFP System equipped engine must meet the current version of fuel specification S7884. Consult the Sales Engineering Department if your fuel does not meet these standards. In its current configuration the LFP System cannot be used in dual fuel or infinite blend applications.

#### Customer Connections

For sizes and location of customer connections consult the installation drawings.

DRAWING REFERENCE TABLE	
INSTALLATION DRAWINGS	
VHP 12 cylinder	L8041-178
VHP 6 cylinder	L8045-81
VGF 6 cylinder	L8070-24
VGF 8 cylinder	Not Available
VSG 6 cylinder	Not Available
FUEL SYSTEM INSTRUCTIONS	
VHP 6 and 12 cylinder	SD5612-103
VHP 6 and 8 cylinder	SA7763-16
VSG 6 cylinder	Not Available
BREATHING REQUIREMENTS	
VHP 6 and 12 cylinder	SA7232-118

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Consult your local Waukesha Distributor for system application assistance. The manufacturer reserves the right to change or modify without notice, the design or equipment specifications as herein set forth without incurring any obligation either with respect to equipment previously sold or in the process of construction except where otherwise specifically guaranteed by the manufacturer.



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