



Gaseous Fuel Systems for Diesel Engines

About GFS

The **Gaseous Fuel System™ (GFS™)** enables operators of diesel vehicles to substantially reduce operational costs and lower emissions by substituting diesel fuel with lower cost, cleaner burning natural gas. The GFS™ is comprised of patented and proprietary technologies that allow diesel engines to safely operate on gas percentages ranging from 50% to 70% of the total fuel requirement. Engines converted to Gaseous Fuel™ operation exhibit diesel-like performance in such critical areas as power, response and efficiency. A key feature of the GFS™ is its ability to switch fuel modes without interruption in vehicle operation. Conversion to Gaseous Fuel™ operation does not require modification of the engine and can typically be completed in a matter of hours. The GFS™ is compatible with both compressed natural gas (CNG) and liquid natural gas (LNG) fuel storage systems.

Advantages

- Reduced operating costs.
- Fuel flexibility: vehicle can operate 100% diesel if required.
- Does not require modification of the engine.
- Lower cost vs. spark-ignited gas engines.
- Compatible with compressed natural gas (CNG) and liquefied natural gas (LNG) fuel storage systems.
- All high pressure gas components UL listed and/or CSA approved.
- Gas supplied to engine at atmospheric pressure reducing possibility of over fueling.
- Gas concentration in engine combustion air is less than 3% by volume.
- Mixture is non-explosive/non-flammable until compressed in the combustion chamber.
- CNG/LNG on-board systems have excellent safety history.
- Cost Savings based on cost differential between CNG/LNG and diesel. Large cost differentials result in rapid ROI.

Installation Requirements

- 8 to 10 man hours.
- No special tools needed.
- May require some fabrication brackets.
- Commissioning can be done on-road or using chassis dynamometer.

Applications

On-Road: Buses, Refuse Haulers, Delivery and Dump Trucks, Short-Haul and Long-Haul Cargo Carriers.

Off-Road: Locomotives, Earth Moving Equipment, Mobile Cranes, Construction Equipment, Yard Tugs.



System Sizing

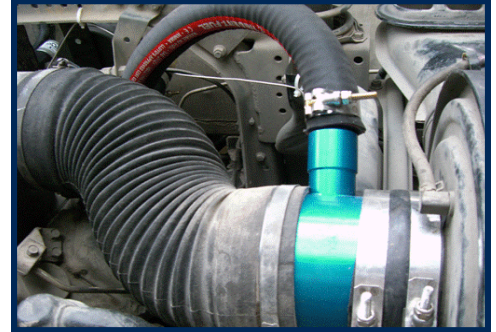
Model	Kilowatt Electric (kWe)	Horsepower (HP)
Series A	Up to 150	UP to 200
Series I	300	Up to 400
Series II	350-600	450-800
Series III	350-1100	850-1400
Series IV	1200-3000	1600-4000



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GFS Kit

- Gas Train
- Diesel Fuel Controller
- Air-Gas Mixer
- Electronic Controller
- Wiring Harnesses
- Optional CNG Level Display
- System Status Indicator



F.A.Q.

Will my engine have to be modified?

GFS is mounted externally so it does NOT require engine modification.

Will the system affect my engine warranty?

Most OEM warranties do not prohibit the use of aftermarket parts or technologies. In brief, the policy of OEM's is that they neither recommend nor endorse aftermarket technologies. However, the use of these products does not automatically void the validity of the engine warranty. If the cause is unrelated to Gaseous Fuel operation, the OEM's have historically honored the warranty and repaired the engine. Additionally, any GFS components that fail within the warranty period will be covered under the GFS warranty policy.

Will my engine lose power after conversion to Gaseous Fuel?

Under normal circumstances, engines converted to Gaseous Fuel operation do not suffer any horsepower losses. Peak horsepower and efficiency levels remain on par with 100% diesel operation.

Will my engine run hotter using natural gas?

The GFS has been designed to maintain OEM specifications for all engine temperatures.

What about efficiency?

The GFS replaces diesel fuel with an equivalent quantity of natural gas (based on the caloric value of each fuel). This results in the same net fuel burn vs. 100% diesel operation.

What are the economic benefits to operating on Gaseous Fuel?

Fuel cost savings (will vary depending on the respective price of each fuel). Engine maintenance savings may also contribute to the economic benefit.

Performance

Compatible Diesel Engines	4 Cycle, Turbocharged, Normally Aspirated, Mechanically Fuel Injected.
Gas Diesel Ratio	Moderate to Heavy Engine Loading: 60%-75%. Lower Average Loads: 50%-60%.
Gas Ratio vs. Duty Cycle	Urban Duty Cycle: 50%-65%. On Highway Duty Cycle: 65-75%.
Air Fuel Ratio	At the maximum Substitution Rate (80%) the intake air is typically less than 3%.
Governing	The GFS allows the original engine governing system to control engine speed.
Power	Typically results in similar levels of stability, HP, torque and response.
Lube Oil	Unless otherwise indicated by gas composition, no changes in lube oil required.
Operating Temperatures	Similar to 100% diesel operation.
Efficiency	Normally equivalent to 100% diesel operation.
Emissions	GFS will typically reduce production of Nitrogen Oxides, Sulfur Oxides, Reactive Hydrocarbons, Carbon Dioxide and particulates.

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