

# Natural Gas as an Alternative



# Compressed Natural Gas cont.

## Conversion Table

1 cf	=	1,000 Btus
1,000 cf	=	1 MCF
1 MCF	=	1,000,000 Btus
1 MCF	=	7.8 GGE
1 GGE	=	124,800 Btus



1. CNG (at 3,600 psi) enters the vehicle through the fill receptacle.
2. CNG passes through the high pressure fuel line to the cylinder. When needed, the CNG passes through the pressure relief valve and electronic shut off valve.
3. The fuel selector, which is mounted on the dash, controls the Bi-fuel system. This allows the driver to switch between CNG and Gasoline without having to turn the vehicle off or make any under the hood adjustments. The selector also displays the CNG fuel level.
4. After passing through the high pressure fuel line, the CNG goes through a high pressure filter which removes harmful contaminants.
5. The CNG enters a pressure regulator, which reduces the pressure from 3,600 psi to a lower pressure that is compatible with the engines capability.
6. The CNG travels through a low pressure fuel line and enters into the fuel rail where CNG is supplied to the CNG injectors.
7. The electronic control module (ECM) controls the amount of CNG injected into the engine.

## How a NGV works

# CNG Fill Receptacle



Fueling a NGV is easier and safer than a gasoline or diesel fueled vehicle. A fast-fill compressor takes about the same amount of time; a slow-fill unit's fill time depends on the size of the compressor. The nozzle simply clicks on the receptacle mounted to the vehicle and is ready to fill. Most receptacles allow complete changeability to any nozzle complying with the NGV1 standard. When the cylinder is full, the dispenser turns off and is ready for disconnect.

# CNG Cylinder (Pressure relief & shut-off valves)



The CNG cylinder stores the compressed gas until the engine has a need for it. It is then taken through the pressure relief and shut-off valves to the high-pressure filter and then to the pressure regulator. CNG cylinders are safer than gasoline or diesel tanks and go through extensive testing before being released from the factory. There are different kinds of cylinders (made of different components) and the capacities vary.

# Cylinders



- Type 1
  - Least expensive
  - All steel
- Type 2
  - Steel liner reinforced by partial (“hoop wrapped”) composite wrap (glass or carbon fiber)
  - Less heavy than Type 1, more expensive
  - Liner & composite both take 50% of stress from internal pressurization
- Type 3
  - Aluminum liner reinforced by full (“full wrapped”) composite wrap (glass or carbon fiber)
  - More light-weight than Type 1 or Type 2, more cost

# Cylinders cont



- Type 4
  - Plastic tight liner reinforced by full (“full wrapped”) composite wrap (glass or carbon fiber)
  - Entire strength of cylinder is composite reinforcement
  - Most lightweight and most expensive
- All CNG vehicle fuel containers must meet federal government requirements
- CNG cylinders are stronger than gasoline tanks and go through severe abuse tests

# Fuel Selector/Fuel Gauge



The fuel selector sends a message to the vehicle's fuel system letting it know whether it should be running on gasoline or CNG. The CNG fuel gauge will inform the operator of the amount of CNG in the cylinder, just like a gasoline gauge.

# High Pressure Line/ High Pressure Filter



Until the CNG passes through the regulator and pressure is reduced, it travels through a high pressure line. The fuel also passes through a high pressure filter that rids the gas from moisture or other harmful components.

# Pressure Regulator



The CNG enters the pressure regulator from the CNG cylinder at a high pressure and then is quickly turned into a low pressure that is compatible with the engine's fuel system. A robust regulator is an essential component of a safe and reliable NGV fuel system.

# CNG Fuel Rail/CNG Fuel Injectors



After traveling through the low pressure fuel line, the CNG enters the fuel rail which supplies the CNG injectors and in turn they supply to CNG to the engine.

# Electronic Control Module



The ECM (electronic control module) controls the sequential multi-port fuel injection pulse widths (amount of CNG the injectors inject into the engine). This system allows each injector to open just before the intake valve opens, instead of all injectors opening all at once. In other words, the CM controls the air-fuel mixture so that when a spark plug ignites the gas, it burns both cleanly and efficiently.

# Conversions

- Same or increased mpg
- Cheaper fuel costs
- No loss of power or torque
- Next to nothing in tailpipe emissions
- Extends the life of the engine
- Reduces regular engine maintenance
- Programmable fuel maps
- 5-10% temperature increase
- Can take anywhere from 4 – 26 hours



# Conversions cont

- Bi-fuel
  - Gasoline system remains intact
  - Can run on either Gasoline or CNG (never burns 2 fuels at once)
  - Can switch with the press of a button
- Dual-fuel
  - Diesel system remains intact
  - Runs on a blend of Diesel and CNG
- Dedicated
  - Gasoline or Diesel system is removed
  - Runs ONLY on CNG

# Natural Gas Compressors

- Increases the pressure, reduces the volume
- GGE = Gasoline gallon equivalent
- Desiccant dryer
  - Helps to dry gas before it is put through the compressor
  - Time between changed depends on the quality of gas



# CNG Stations in the US







