

TECHNICAL BULLETIN

CNG – FREQUENTLY ASKED QUESTIONS

WHAT IS CNG?

Compressed natural gas, or CNG, is natural gas under pressure which remains clear, odorless, and non-corrosive. Although vehicles can use natural gas as either a liquid or a gas, most vehicles use the gaseous form compressed to pressures 3000 to 3600 PSIG.

Natural gas is a naturally occurring hydrocarbon formed over millions of years through the decomposition of organic matter. It is found underground in reservoirs

The main component of natural gas is methane which usually makes up about 90% of "pipeline quality" natural gas. Natural gas is odorless so odorants are often added to give it the familiar rotten egg smell for safety purposes.

WHAT IS LNG?

Liquefied natural gas or LNG is natural gas stored as a super cooled (cryogenic) liquid. The temperature required to condense natural gas depends on its precise composition, but it is typically between -120 and -170°C (-184 and -274°F). The advantage of LNG is that it offers an energy density comparable to gasoline and diesel fuels which results in extended range.

The disadvantage, however, is the high cost of cryogenic storage on vehicles and the major infrastructure requirement of LNG fueling stations, production plants, and transportation facilities. It is therefore currently limited to use on large scale applications only.

HOW IS THE GAS IN A NATURAL GAS VEHICLE STORED?

There are two possibilities:

Compressed natural gas (CNG) is stored under pressure in a tank. This pressure is similar to that used to store air in a scuba tank. This is the most common technology.

Liquefied natural gas (LNG) is very cold and it is stored in an insulated tank, like a thermos, to maintain its low temperature. However, since it is denser than CNG, the storage capacity can be increased.

WILL MY VEHICLE STILL RUN ON GASOLINE AFTER THE CONVERSION?

Conversion kits are available for dedicated CNG and bi-fuel. If you plan on traveling to areas where CNG is not readily available, you will want to specify that you are looking for a bi-fuel system.

WHAT IS A BI-FUEL OR DUAL FUEL VEHICLE?

A dual-fuel system allows the vehicle to run on either natural Gas, as the primary fuel, or gasoline as the reserve fuel. When the Natural Gas runs out, the engine is switched over to gasoline – either manually with a dashboard switch, or automatically – dual fuel vehicles are well suited for applications in which much of the driving is in an urban area, serviced by a CNG fill station, but where occasional long distance trips are required.

WHAT IS A DEDICATED CNG VEHICLE?

Dedicated CNG vehicles run solely on Natural Gas without a gasoline back-up. In some cases the dedicated CNG system produces superior emissions and performance. This fuel option is ideal for urban based fleets such as taxis, mini-buses delivery fleets, and off-road vehicles (forklifts and ice resurfacers) that all have access to refueling facilities.

HOW DOES A NATURAL GAS VEHICLE (NGV) OPERATE?

Natural gas vehicles operate on the same basic principles as gasoline powered vehicles. The fuel is mixed with air and fed into the cylinder where it is then ignited by a spark plug to move a piston up and down. Natural gas can power all the same vehicles currently powered by gasoline and diesel fuel. However, since natural gas is a gas rather than a liquid at standard pressure and temperature, some modifications are required to make an NGV work efficiently. These changes are primarily in the fuel storage tank, fueling receptacle/nozzle, and the engine.

HOW DOES THE MILEAGE AND POWER OF A CNG VEHICLE COMPARE TO A VEHICLE RUNNING ON GASOLINE?

Customers utilizing EPA and CARB certified CNG conversion kits typically notice very little (if any) difference in power and mileage in comparison to when the same vehicle is running on gasoline.

CAN I STILL TAKE MY CNG POWERED VEHICLE TO MY REGULAR AUTO MECHANIC?

Most vehicle maintenance on CNG vehicles is the same as for gasoline powered vehicles. However, there are a few exceptions. For instance, the CNG fuel tanks must be inspected by a certified tank inspector every three years. Also, the CNG systems include a coalescing filter that removes oil from the gas. These should be replaced once per year in normal use. On the other hand, because CNG burns cleaner than gasoline, oil change intervals can be extended. To sum up, unless the vehicle is experiencing problems that are directly related to the CNG fuel system, it can usually be repaired and serviced by a traditional automotive repair shop.

WHAT VEHICLES CAN RUN ON NATURAL GAS?

Passenger cars, light-duty trucks, heavy-duty vehicles, delivery vans, forklifts, ice cleaners, shuttle buses, school and transit buses can all run smoothly on natural gas.

WHO MAKES FACTORY BUILT NGV'S?

Forty-two vehicle and engine manufacturers now produce 93 choices of natural gas vehicles and engines worldwide. In North America, Ford, GM, Honda, Chrysler, Toyota, Volvo, and Cummins are currently offering or testing natural gas passenger cars, vans, and trucks.

WHAT ARE THE BENEFITS OF CNG AS A VEHICLE FUEL?

Long Term Availability

Natural gas is a clean-burning fuel, found in abundance in Canada as a mixture of gases in porous rock formations. It is extracted from the ground, processed to remove impurities and compressed to be stored and transported by pipeline.

Canada is one of the largest producers of natural gas in the world with annual production in 2005 exceeding 6 trillion cubic feet. Furthermore, there are over 1 trillion cubic meters of proven reserves. Major high-pressure pipelines already exist to carry natural gas from its source to natural gas utility companies.

Cost Savings

Evidence shows that natural gas vehicles may require less frequent oil changes and less frequent servicing than conventional technologies.

Environmental Benefits

Natural gas burns cleaner than gasoline or diesel fuel. Its use produces fewer toxic pollutants and greenhouse gas emissions that contribute to climate change. It's also less likely to cause contamination than gasoline because natural gas is a pressurized fuel that must be contained within a sealed system, right up to the time it enters your vehicle. That means it is less likely to escape into the soil or water through careless handling, spills or evaporation.

Safety

Natural gas has one of the safest records of any transportation fuel. There are two primary reasons:

- Natural gas is lighter than air
- Structural integrity of the natural gas vehicle storage system.

Ignition is possible only when gas to air ratio is between 5 – 15% by volume. Its ignition temperature is much higher than the conventional fuel (CNG: 800°C, Diesel: 280°C and Gasoline: 500°C). CNG fuel storage cylinders are generally made of thick-walled aluminum or steel and are subjected to severe tests to withstand both crashes and heat which are far better than the standard gasoline tank of thin sheet metal or plastic.

WHAT ARE THE DISADVANTAGES OF CNG?

Compressed natural gas vehicles require a greater amount of space for fuel storage than convention gasoline power vehicles. Since it is a compressed gas, rather than a liquid like gasoline, CNG takes up more space for each GGE (Gallon of Gas Equivalent). This makes it difficult to design smaller vehicles that look and operate like the vehicles that people are accustomed to.

WHAT IS THE ADVANTAGE OF NATURAL GAS OVER DIESEL?

Natural gas is an inherently cleaner alternative fuel that produces very low particulate and nitrogen dioxide emissions. Utilizing natural gas fuel not only provides greater overall emission reductions, but also supports the goals of fuel diversity and reducing petroleum dependence.

WHAT IS THE PAYBACK FOR CONVERTING TRUCKS TO NATURAL GAS?

This will depend on how many miles you drive and whether you install your own natural gas station or not. If you look at fuel cost savings only, drive 20,000 miles a year, and buy CNG from a public station it would be 3 ½ years for a typical car owner. For a fleet operator that has 10 trucks driving 50,000 miles a year and puts in his own CNG station, payback would be a little over 1 year and each year after that he would save approximately \$100,000.00 in fuel costs.

WHAT ARE THE DIFFERENCES BETWEEN SLOW-FILL (TIME-FILL), FAST-FILL, AND BUFFERED FAST-FILL SYSTEMS

Slow Fill Or Time Fill

Slow fill or time fill systems are used to fill vehicles over longer periods of time which can result in a lower cost compression equipment and without the need for large capacity storage cylinders. It has a far lower initial capital cost than fast fill systems. Time fill systems often fill vehicles overnight when the cost of electricity is lower. Centrally fueled fleets such as school buses, waste hauling, and delivery vehicles are excellent candidates for time fill systems.

Fast Fill System

In a fast fill configuration the CNG compressor takes the low line pressure gas and compresses it up to approx. 4500-6000 PSIG where it is stored in high pressure cylinders. CNG vehicles then pull up to a CNG fast fill dispenser which resembles an ordinary dispenser. Fast fill CNG fueling requires about the same amount of time as fueling with any conventional fuel. Most fast fill CNG systems incorporate a card reader for authorizing, dispensing, and billing the transaction.

Buffered Fast Fill System

A buffered fast fill system provides fast, continuous, high volume fueling. Large compressors run continuously during fueling, filling vehicles, and, in the interval between vehicles, a CNG storage buffer. Unlike fast fill systems, buffer storage is not separated into cascades. This station is suitable for heavy duty, high volume fuel vehicles such as transit buses.

WHAT SIZE OF COMPRESSOR FOR A SLOW FILL SYSTEM WILL I REQUIRE?

To determine this you must first determine the amount of CNG fuel required daily for your CNG fleet. As an example, if a fleet of CNG school buses each average 100 miles per day, get 10 miles per gallon, and are parked at night for up to 12 hours they will require 60 GGE per night (100 miles, divided by 10 mpg = 10 GGE per bus, times 6 buses =

60 GGE total). Since you have 12 hours to accomplish fueling, your system can be a time fill type system and the compressor can be sized based upon your need a compressor capable of delivering 36 GGE over a 12 hour period. Since 127 SCFM equals 1 GGE you will require a compressor with a capacity of 11 SCFM or more (60 GGE x 127 SCFM / 720 minutes).

HOW MUCH STORAGE CAPACITY WILL I NEED?

The amount of storage capacity needed depends on the number of vehicles being fueled, the frequency with which they will be filled, the amount of natural gas that each vehicle requires when it returns, and the time in which it needs to be fueled.