CNG TIME FILL FUELING PROCEDURE

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Credit: **Marathon Corporation wishes to thank the Capital Region Airport Commission (Richmond International Airport) Richmond Virginia for the use of their facilities and vehicles in the pictures in this document.**

General Fueling Information--Overview

This document is intended to give CNG fueling personnel an understanding of correct procedures and safety measures. There are differences among fueling stations and among CNG vehicles. While this document provides generalized information, any procedures designed for a specific station should override the general information provided herein.

CNG fueling differs from liquid fueling in that CNG utilizes a completely closed pressurized system. The fueling procedure is usually terminated automatically by the dispensing equipment. Unlike liquid fuels, it is unlikely that any spillage would occur. If CNG is released, it is in gaseous form and will dissipate quickly to the atmosphere. Inspite of these safety advantages, CNG is a combustible gas that is handled and stored at high pressures. It should be treated with caution.

General Fueling Information--Nozzles

Although most new CNG vehicles in the United States are designed for 3600 psig (nominal fill pressure), there are still some 3000 psig (nominal fill pressure) vehicles in use in the US, and there are dispensers with both 3600 and 3000 psig hoses.

Fueling personnel need to determine which pressure each vehicle is designed for. Some fueling nozzles and vehicle receptacles will be color coded blue for

3000 psi and yellow for 3600 psi.

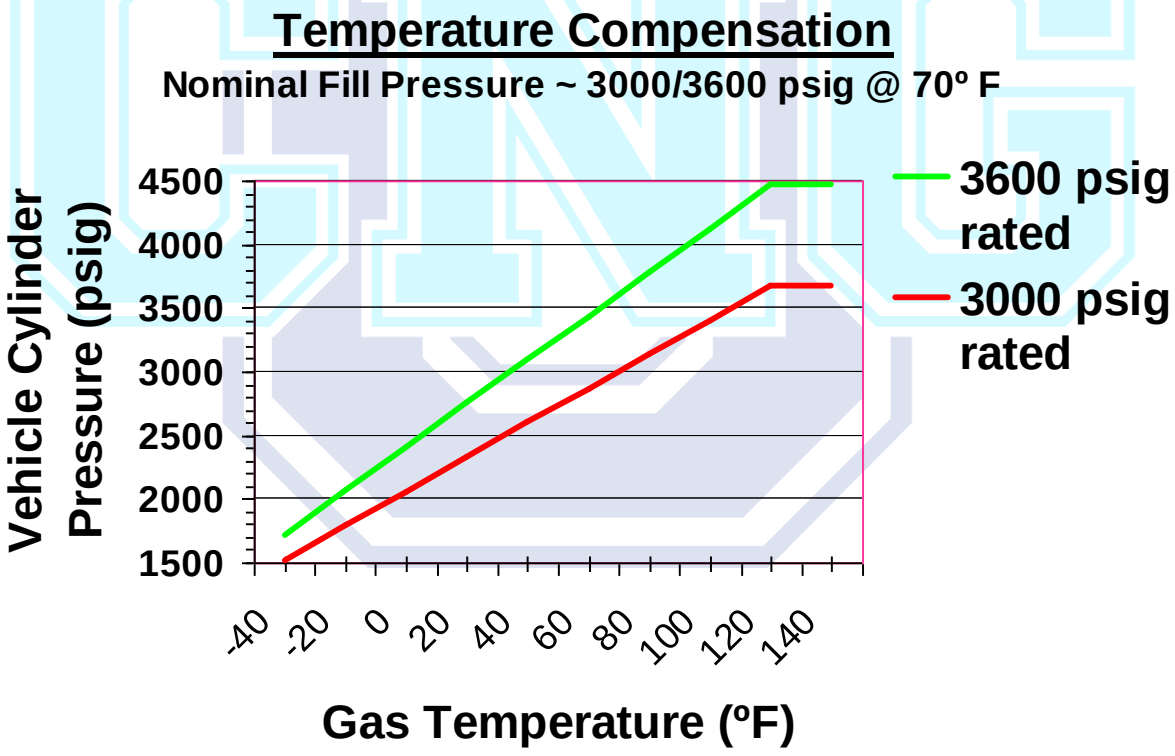
3000 psi nozzles are designed to fuel both 3000 & 3600 psi vehicles. 3600 psi nozzles will fuel only 3600 psi vehicles.

Many CNG fleets fuel only at their own fueling station and therefore there should be no issue of selecting the proper fueling nozzle.

General Fueling Information—Temperature Compensation

Unlike liquid fueled vehicles (which are filled by volume only), CNG vehicles are filled to a particular gas density. This density is a function of pressure, temperature and gas composition. To ensure that vehicles are filled to rated capacity, CNG fueling stations adjust the dispensed pressure to account for changes in gas temperature due to atmospheric temperature changes and for the increase in gas temperature that occurs during fueling.

The chart below indicates the relationship between temperature and pressure of the gas. Note that the gas density at any points on the line is equal. Note also that **when the gas is hot, it is permissible to fuel to as much as 125 percent of the nominal pressure**. Conversely **in cold conditions, the vehicle may receive much less pressure, but the same amount of fuel is dispensed**.



Code prohibits exceeding 125% of nominal fill pressure.
A 3000 psi system allows maximum pressure of 3750 psi.
A 3600 psi system allows maximum pressure of 4500 psi.

General Fueling Information—Safety

As with any motor fuel, any source of ignition should be eliminated in the fueling area. Fueling personnel must observe the following.

1. Extinguish all smoking or flames in the fueling area.
2. Turn the vehicle ignition off, place vehicle in park and lock the parking brake. Leave the vehicle off until fueling is complete.
3. Do not use cellular phones, pagers or other electronic equipment in the fueling area.
4. Familiarize yourself with the locations of all Emergency Shut Down (ESD) buttons which are placed at various locations in the station. The first action in the event of any emergency is to press a CNG ESD button. This will shutdown all CNG station equipment.
5. Inspect fueling hose for any visible damage before fueling. If the hose has any damage, do not use it. Report the damaged hose to a person who has station responsibility.
6. Fueling staff must be trained in the proper fueling procedures for their vehicle and station. This training must identify proper procedures to address all emergency and abnormal fueling conditions.

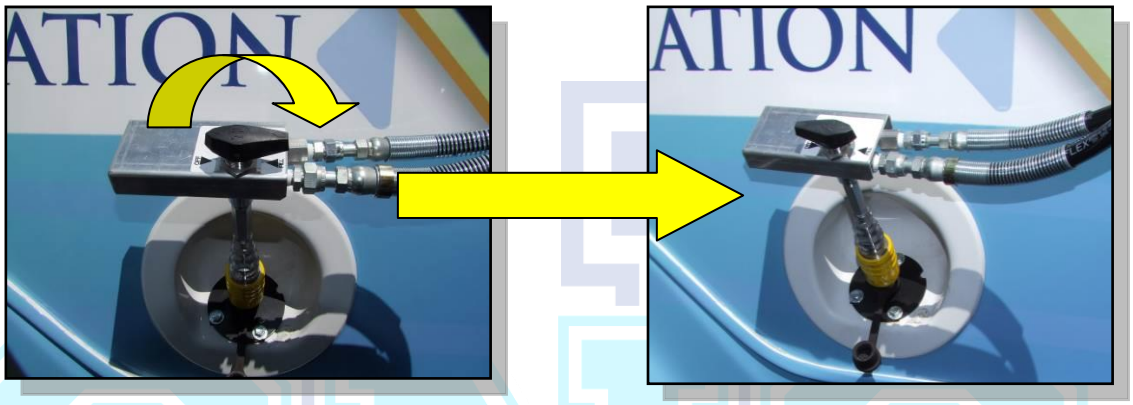
CNG Fueling Procedure--Time Fill

1. Park the vehicle in the correct location to allow fueling without excessive tension on the hose.

2. Open fuel door (if applicable) on the vehicle and remove dust cover from the vehicle receptacle.

3. Ensure the nozzle handle is in the "off" or "vent" position. Remove the fill nozzle from the dispenser. Place the nozzle over the receptacle and press downward until the nozzle "clicks" into the locked position on the vehicle receptacle. It should not be necessary to pull back on the nozzle collar to connect the nozzle to the vehicle receptacle. Test the connection by gently pulling the nozzle away from the receptacle; the nozzle must remain locked onto the receptacle.

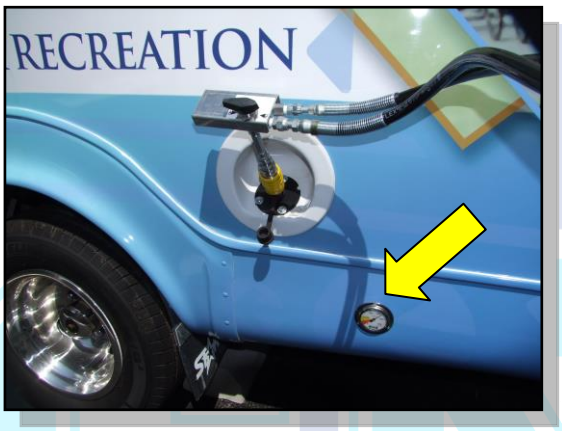
4. Carefully rotate the nozzle valve handle to the full “on” or “fill” position; usually 180º. Fueling personnel should stand to one side of the nozzle, as it is positioned on the receptacle and turned to the fill position.



5. You will hear the gas start to flow. If gas flow stops quickly, check the valve at the time fill dispenser to ensure that it is in the open position (handle in line with tubing)—if it is closed, open the valve by turning it 90 degrees. It is not typically necessary to close this valve at the end of fueling.

6. Gas will continue to flow to the vehicle until the temperature compensation system senses that the vehicle is nearing termination pressure. The fill is automatically terminated when the vehicle is full. Fueling personnel should not prematurely disconnect the nozzle or terminate the fill before the fill is completed. This will result in under filled vehicles.

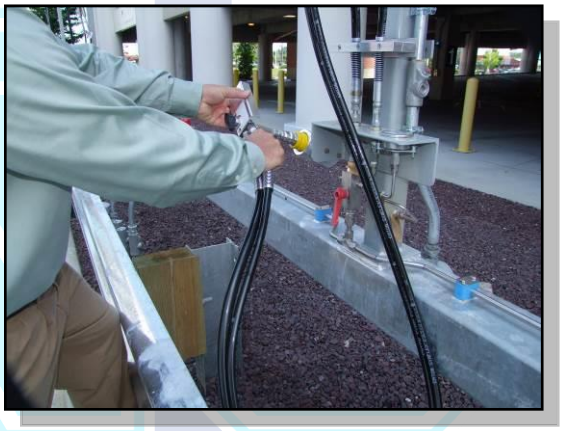
7. Vehicle pressure can be checked using either a vehicle mounted gauge (yellow arrow) or the time fill dispenser mounted gauge (red arrow). Pressure should correspond to the chart provided earlier in this procedure based on the vehicle pressure (3000 psig or 3600 psig) and the ambient temperature.



8. Turn the dispenser off by rotating the fill valve (usually 180 degrees) to the “off” or “vent” position.

9. Disconnect the nozzle from the vehicle receptacle by pulling back on the collar. Fueling personnel should stand to one side of the nozzle, as it is removed from the receptacle. Fueling personnel may notice a small "puff" of gas as the nozzle is disconnected from the receptacle. This is a normal occurrence with the de-pressurizing of the receptacle interface.

10. Hang the dispenser nozzle in its dispenser holster.



11. Replace the dust cover on the vehicle receptacle and close the vehicle fill door (if applicable).

12. In the event of any type of emergency, press a station CNG ESD button and vacate the area of danger. Follow other emergency procedures as posted or instructed.

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