



Field Service Bulletin
Safely Working on CNG Fuel Systems
ENP-391
Rev B: July 26, 2017

1. Introduction

All compressed natural gas (CNG) fuel systems include a high pressure (3600 psi/248.2 bar) system for fuel storage and a low pressure system (125 psi/8.62 bar) for consumption by the vehicle engine.

Understanding the characteristics of CNG and how the vehicle fuel system works will prevent personal, property and vehicle damage.

This bulletin summarizes the safety rules and procedures for safe maintenance and repair of CNG fuel systems.

Refer to the Attachment, “CNG Pressure Zones” at the end of this bulletin for more details.

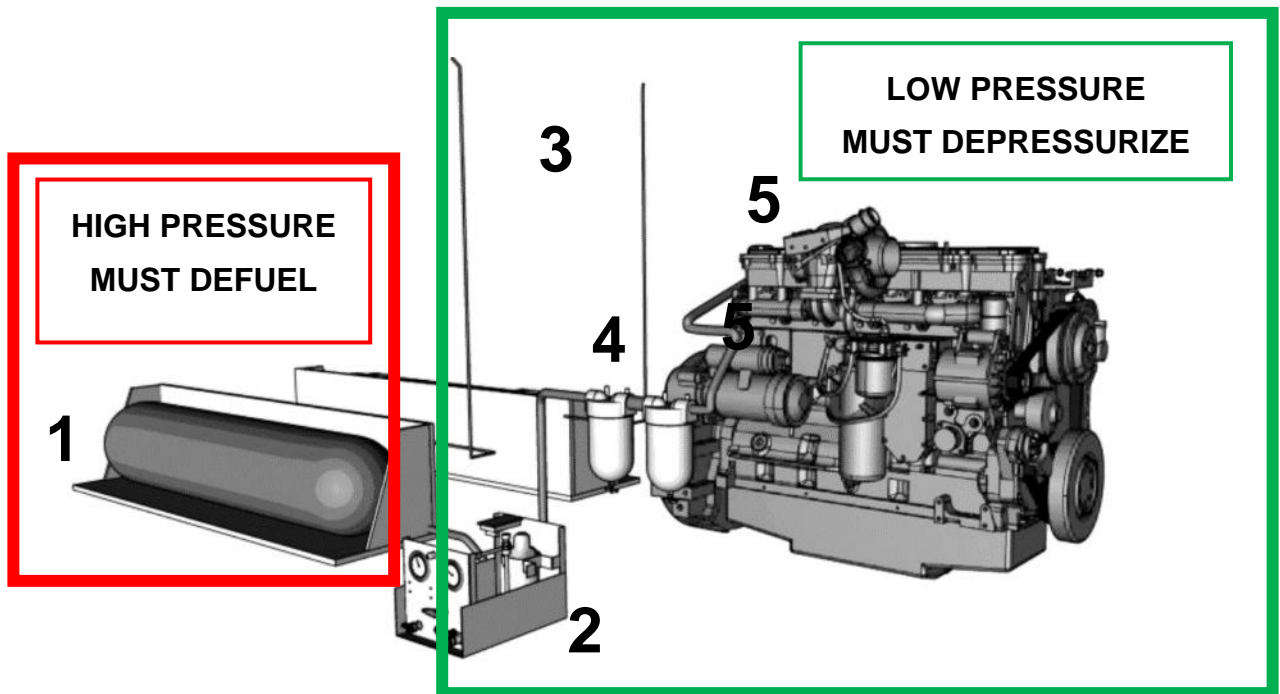


Figure 1. CNG Fuel System Pressure Zones

Red = High Pressure, Green = Low Pressure

(1) CNG storage cylinders (and pressure relief devices, PRDs), (2) fuel management module (FMM), (3) PRD vent stacks, (4) low pressure filters, (5) engine. NOTE: The low pressure filters are part of the vehicle engine, not the fuel system.

Warning Statements Used in this Document

DANGER

Personal injury or death will occur if procedures are not followed.

WARNING

Personal injury or death may occur if procedures are not followed.

CAUTION

Damage to equipment, fuel system or vehicle is possible if instructions are not followed.

2. Compressed Natural Gas Characteristics

Natural gas is flammable; however, it only burns within a narrow range when mixed with air in a ratio of between 5 and 15 percent. CNG will not burn in the highly concentrated form found inside the cylinders.

Natural gas is odorless, tasteless and non-toxic. That is why Mercaptan is injected into the gas – to give it that “rotten egg” odor, which helps leak detection. (Note: In some cases, CNG may not be odorized.)

Natural gas is lighter than air so it rises and diffuses into the atmosphere when released.

- Don't allow sparks, flames, or heated particles to come within six feet (2m) of the vehicle.
- Never attempt to depressurize or vent a system by loosening a fitting.
- Never adjust, remove or tighten a fitting or connector on a fuel system that is under pressure.

3. Depressurize or Defuel?

Depending on where work must be performed, the fuel system must be either depressurized or defueled.

When working on the system downstream from the manual cylinder valve, system pressure can be isolated by closing the manual cylinder valve and **depressurizing** the system. This is shown in the green boxed area in Figure 1.

3.1 When to Depressurize

Components that **can** be isolated and **require depressurization** include:

- | | |
|--------------------------------------|---|
| 1. The FMM ball (main shutoff) valve | 7. Manifold |
| 2. High pressure filter | 8. Fill receptacles |
| 3. Solenoid valve | 9. Defuel receptacles |
| 4. Regulator | 10. Defuel (three-way) valve |
| 5. High pressure gauge | 11. Fuel lines <u>to</u> the FMM |
| 6. Low pressure gauge | |

3.2 When to Defuel

When working on fuel cylinders, the manual shutoff valve mounted on the cylinders and the pressure relief devices (PRDs) – the fuel system must be defueled because there is no way to isolate the high pressure contained in these components. This is shown in the red boxed area in Figure 1.

Components that **cannot** be isolated (always under high pressure) **require defueling** include:

- | | |
|---------------------------|-----------------------------------|
| 1. Fuel cylinders | 3. Pressure relief devices (PRDs) |
| 2. Manual cylinder valves | 4. PRD fuel lines |



- A. This bulletin is a supplement to training in operation and maintenance of CNG fuel systems. Attempting to operate or maintain any CNG fuel system without proper training is dangerous.**
- B. If the vehicle has been in an accident or fire, cylinders and system must be examined by a qualified inspector.**

4. Depressurizing the System

Refer to the text and Figures 2 and 3. To depressurize the system, perform the following steps.

1. Turn the vehicle off.
2. Close all cylinder shutoff valves (turn handle fully clockwise).
3. Make sure the manual shut off-valve on the FMM panel is in the “ON/OPEN” position.
4. Start and run the engine until it stops.

5. Ensure the vehicle is off and that the proper vehicle lock-out procedures are followed, shown in Figure 3. (Remove the ignition key).
6. Check the gauges on the fill panel to verify all the pressure is relieved.
7. Remove the access cover on the rear of the fill panel (if equipped).
8. Relieve the remaining pressure by slowly opening the bleed valve inside or near the FMM.
9. The system is now fully depressurized up to the primary solenoid lock-off valve.

There may be pressure remaining downstream of the solenoid valve. Be careful when loosening fittings for the first time because a small amount of gas may leak out of any fitting downstream of the solenoid lock-off valve, which is normal.

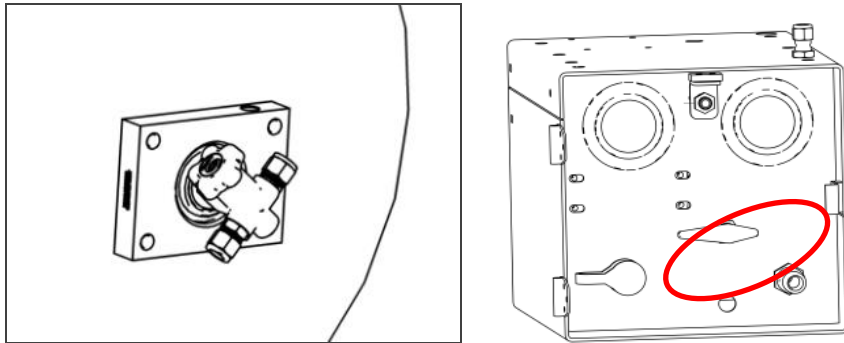


Figure 2. Left: The cylinder manual shutoff valve is mounted on one end of each fuel cylinder. Right: The manual shutoff valve on the FMM panel must be OPEN when depressurizing the system.

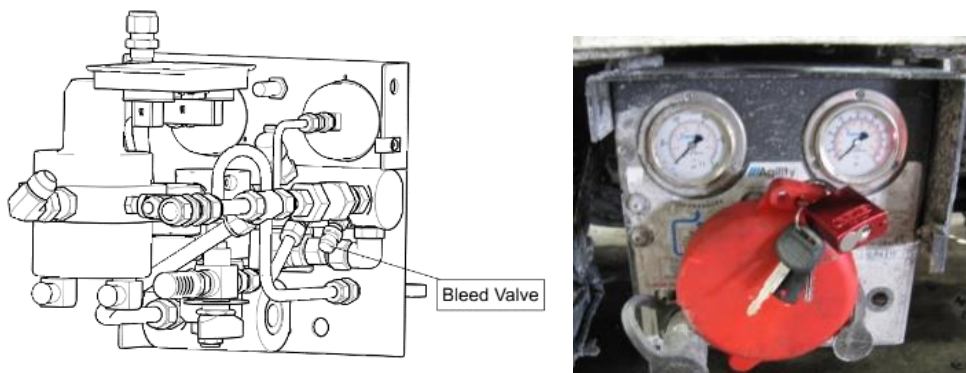


Figure 3. Left: Use the bleed valve at the FMM to release the remaining pressure in the system. Right: Lock-out the system per your facility safety policies require. Removing the vehicle ignition key is one safeguard.

5. Defueling the System

Defueling a CNG fuel system requires careful planning, since the vehicle must be towed, rather than driven to be moved. It is usually best to drive the vehicle to near-empty to minimize the amount of fuel to be vented to the atmosphere.

An Agility Fuel Solutions Pony Tank may be used to supply fuel a vehicle temporarily so it may be driven. See References section.

5.1 Defueling Preparation and Procedures

The best and safest way to defuel a CNG system is to transfer fuel back to a dispensing station, if so equipped. Check with your CNG filling station for specific procedures. The following information is provided in the absence of formal procedures from local authorities. A typical venting facility diagram is shown in Figure 4.



Be sure to vent a CNG tank in an open area with good air circulation with no nearby sources of open flame, ignition or heat. Do not vent the system in an area where flammable gas is permitted to accumulate and potentially ignite.

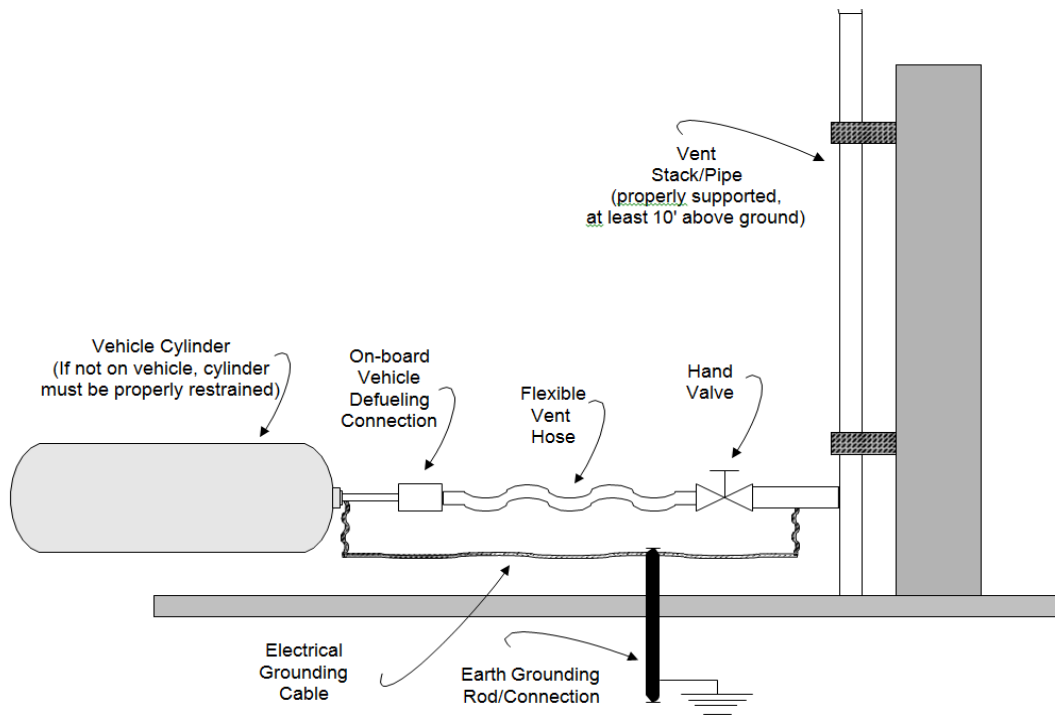


Figure 4. Typical venting facilities include all of these features.

A venting facility should include the minimum equipment:

A vent pipe. This typically consists of a two-inch diameter steel pipe attached to a support structure. The pipe must extend a minimum of two feet higher than the support structure and at least 10 feet above ground level. The vent pipe must be connected to an electrical ground. There should be no ignition sources near the pipe.

An electrical ground connection with a minimum 3 gauge or heavier stranded copper wire attached to a ground rod, or a suitable electrical ground. Other items to include:

- A high pressure electrically conductive flexible hose.
- A hand valve to control the flow of gas.
- A fire extinguisher. The extinguisher should have a rating no less than 20-B:C.
- Large signage indicating “NO SMOKING” and “FLAMMABLE GAS.”

5.2 Defueling Options

There are three common defueling options: Vent to atmosphere, compressor transfer and return to supply. In all cases, both vehicle and the fueling system must be grounded to prevent static electricity build-up.

(a) Vent to Atmosphere

First, verify whether or not this method is legal. There may be local air quality regulations restricting the release of methane into the atmosphere. If atmospheric venting is acceptable in your area, then a venting facility compliant to regulations must be used.

(b) Compressor Transfer

In this defueling method, a compressor at the fueling station extracts the gas from vehicle.

(c) Returning to Supply

The third method returns fuel to a distribution system. When using this process, pressure in the vehicle cylinder and the supply system pressure will equalize, so some pressure may remain in the vehicle fuel system.

5.3 General Defueling Procedure

NOTE: This procedure applies to vehicles equipped with a NGV1-style defuel receptacle.

1. Connect the ground wire from the vehicle to the vent stack system.
2. Attach the defuel hose (see Figure 8) to the vent stack system.
3. Attach the defuel nozzle to the defuel receptacle on the FMM.
4. Ensure the manual shutoff valve is OPEN.
5. Slowly open the defuel valve, and adjust for a slow and steady flow to avoid freeze-up.

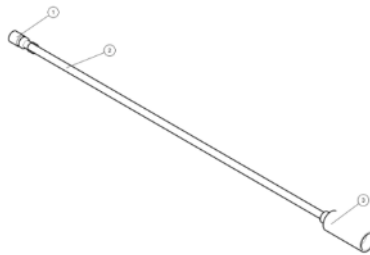


Figure 5. Agility Fuel Solutions 20100021 fuel transfer hose.

6. References

- Agility Fuel Solutions Pony Tank Operation Manual, ENP-005
- Agility Fuel Solutions Pony Pallet Operation Manual, ENP-372
- Agility Fuel Solutions Type 2 Pony Tank Operation Manual, ENP-249
- Agility Fuel Solutions Truck and Tractor CNG Fuel System Operation Manual, ENP-007
- Agility Fuel Solutions CNG System Users' Manual, ENP-314

- Agility Fuel Solutions Field Service Bulletin, Service Facility Fuel Handling Equipment, ENP-380

7. Warranty Information

Does not apply. This is an educational bulletin.

If you have any questions, contact Agility Fuel Solutions Customer Care: +1 949 267 7745, toll free: +1 855 500 2445 or support@agilityfs.com.

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3335 Susan Street Suite 100

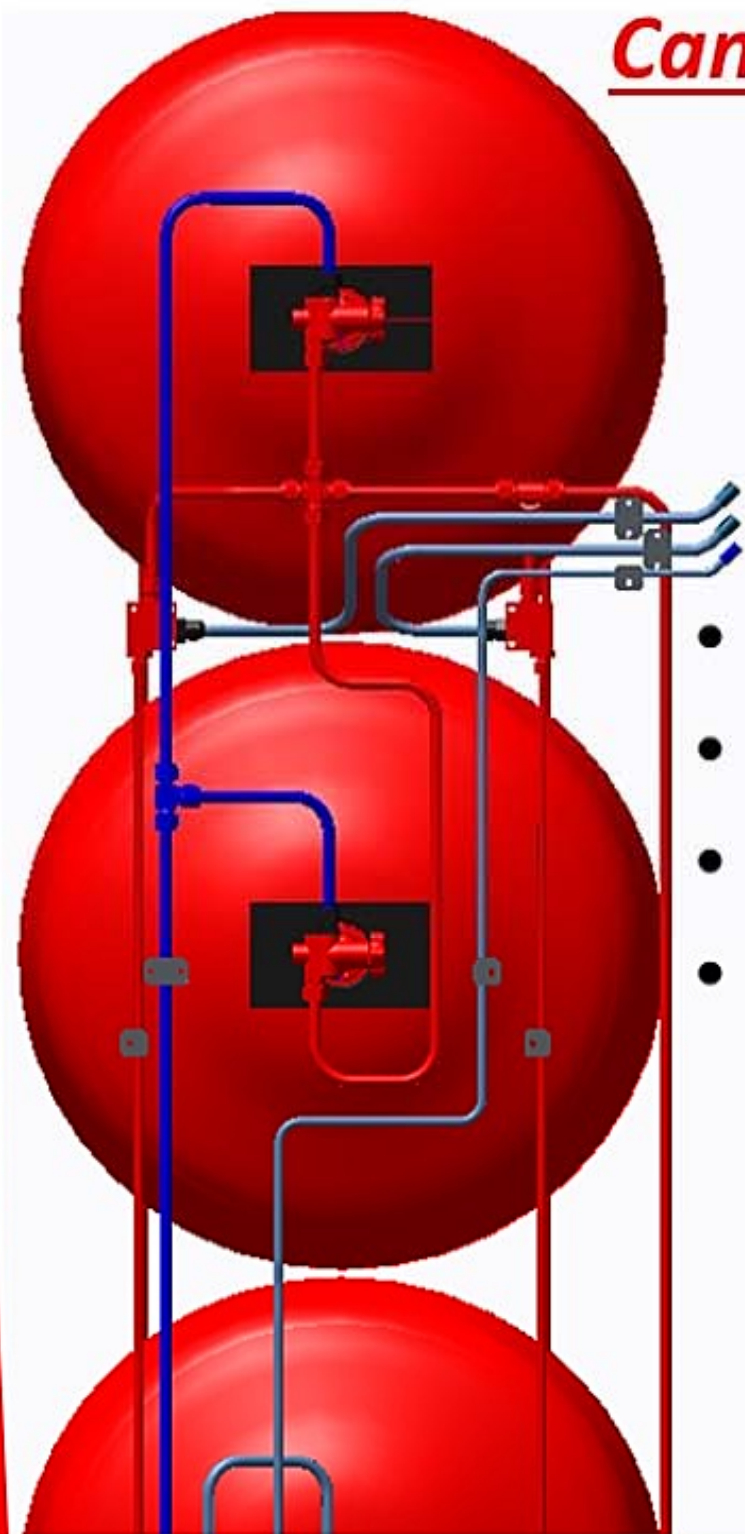
Costa Mesa, CA 92626 USA

www.agilityfuelsolutions.com

Cannot Isolate Pressure:
MUST DEFUEL

***Items in RED Always
Under Pressure***

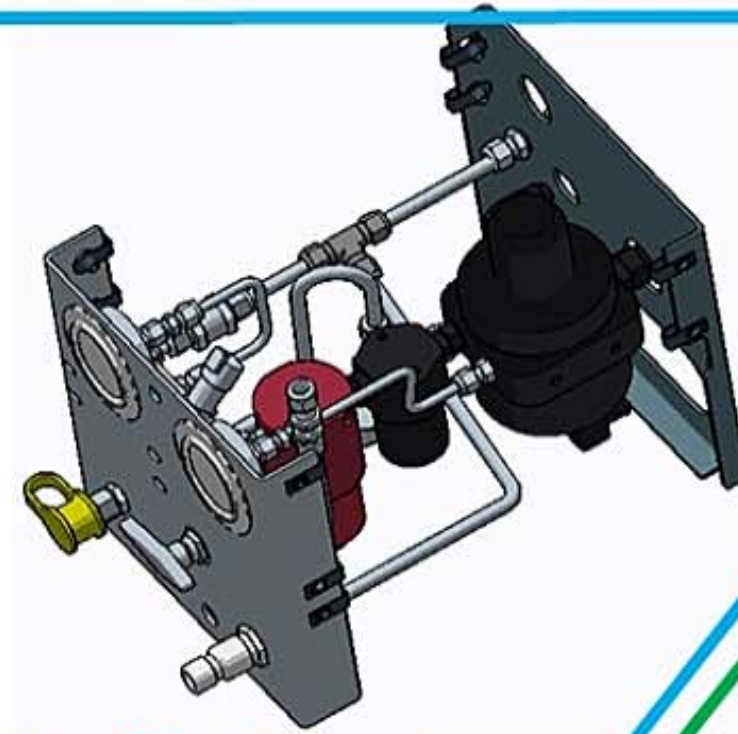
- Cylinders
- Manual Valves
- PRDs
- PRD Lines



High Pressure up to 4,500 psi

Can Isolate Pressure:
DEPRESSURIZE

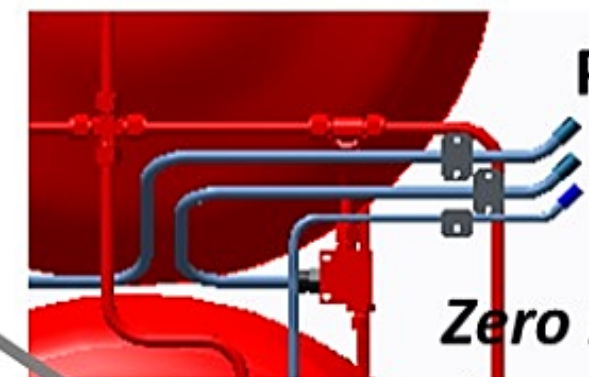
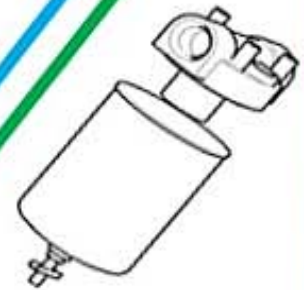
- ***Some Fuel Lines***
- ***Ball Valve***
- ***Filter***
- ***Solenoid Valve***
- ***Regulator***



**Can Isolate
Pressure:**
DEPRESSURIZE

***Low Pressure
Filter***

***Low Pressure to Engine
125 to 135 psi***



***PRD Vent
Lines***

***Zero Pressure
Must be Kept
Capped***

***High Pressure
DEFUEL***

***High Pressure
DEPRESSURIZE***

***Low Pressure
DEPRESSURIZE***

***Zero Pressure
Keep Capped***