

Defueling NGVs: Ensuring Safety

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For natural gas vehicle (NGV) technicians, there likely will come a time when defueling a vehicle is required. Defueling is necessary when a compressed natural gas (CNG) fuel system component has failed, or when a CNG fuel storage cylinder has sustained level 2 or 3 damage and must be removed from the vehicle for repair or replacement.



While the term “defueling” might sound simple, it can be one of the more dangerous operations NGV technicians perform, and technicians must be adequately trained on this procedure. Defueling a natural gas vehicle requires (1) a defueling receptacle on the vehicle; (2) a defueling nozzle and gas pressure regulation system; and (3) a place to put the fuel removed from the vehicle.

The easiest and safest way to defuel a natural gas vehicle is to use a pre-installed defueling receptacle. However, the only natural gas vehicles that typically have a defueling receptacle as standard equipment are transit buses. All other NGVs, unless uniquely specified during the vehicle order process, do not come from the manufacturer with a defueling receptacle.

In the case of a vehicle without a defueling receptacle, the technician must create an alternative method for defueling the vehicle. The technician must disassemble a partially-pressurized fuel line fitting, and while the pressure can be minimized, it cannot be completely eliminated. The significant risk associated with defueling is that the fitting may have been previously stressed and barely holding together, and when torque is applied to loosen the fitting, it is possible that it will fail, causing it to come apart under pressure, which can be dangerous.

Compounding the problem is that NFPA 52: 6.6.5.2 requires that every natural gas vehicle have two check valves in series in the CNG fuel system. The purpose of this requirement is to prevent high-pressure gas from escaping through the fueling receptacle in the unlikely event that the fueling receptacle’s check valve fails. Therefore, the technician must be able to safely bypass the second check valve to defuel the vehicle.

While the following describes the basic processes for defueling a vehicle either with or without a pre-installed defueling receptacle, it is imperative that NGV technicians be fully trained on this procedure. NGVi includes a “How to Defuel a Natural Gas Vehicle” module in all our NGV Technician Safety Training courses.

Vehicle Defueling Without a Defueling Receptacle

While there are other options for providing the ability to defuel a natural gas vehicle, one method requires the technician to disassemble a portion of the high-pressure fuel line and install a defueling receptacle. The first step in this method is to remove as much gas as possible. If defueling is not an emergency situation, the technician should schedule the defueling to occur after the vehicle has consumed the majority of its fuel.

If there is an emergency defueling situation, such as suspected Level 2 or observed Level 3 cylinder damage (CGA C-6.4-2007: 7.3.3), the first step is to close the cylinder valve(s) and run the vehicle engine until it dies. This can take up to six minutes or more, depending on the routing and length of the high-pressure fuel lines.



Once the engine dies, the technician should check and double-check that the fuel pressure has been depleted. To adequately perform this step, a pressure gauge installed in the high-pressure fuel system is required.

Then the technician can disconnect the most accessible fitting between the second check valve and the cylinder valve(s). Once disconnected, a defueling receptacle can be installed in the disconnected fuel line.

After the defueling receptacle is safely installed, the defueling nozzle can be attached to the receptacle and then connected to the defueling panel or vent stack. There are two commercially available models of defueling nozzles today manufactured by OPW Fueling Components and WEH Technologies. These nozzles connect to the defueling receptacle and allow the defueling process to be completed. The accompanying photos above show these products.

Vehicle Defueling With a Defueling Receptacle

The technician must attach a defueling nozzle that is connected to one of the defueling options mentioned below. After this nozzle is connected, the valve that allows system pressure to reach the defueling receptacle must be turned to the “Defueling Enabled” position. (See photo)



Defueling Requirements

Once the vehicle is equipped with the defueling receptacle, there must be an approved place to put the natural gas fuel removed from the vehicle. NFPA 52 sections 6.14.1 – 6.14.3.3 provide a detailed list of requirements to be followed when performing defueling. The technician must

follow these and other applicable rules.

The following are the three most common defueling options.

Defueling With a Defueling Panel (Atmospheric Venting)

The first thing to check when using this method is whether or not it is legal. There may be local air quality regulations regarding the release of methane into the atmosphere. If atmospheric venting is acceptable in the area, then a vent stack apparatus that meets the requirements established in either the Uniform Building Code or the International Building Code must be followed. The local authority having jurisdiction—typically the Fire Marshal—should also be consulted. The vehicle and the fuel system both must be grounded.

Defueling With a Defueling Panel (Compressor Inlet Method)

By far the easiest method, this procedure requires pre-planning and special equipment installed at the CNG fueling station. If there isn't a fueling station at the site where the technician is working on the vehicle, towing the vehicle back to the facility for repair will be required after defueling. In this method, the vehicle is connected through the defueling nozzle to the defueling panel and the compressor at the fueling station extracts the gas from vehicle. The vehicle and its fuel system must be grounded.



Compressor inlet defueling panel

Defueling With a Defueling Panel (Vent –Back to Gas Main Method)

The least common method, venting back to gas main requires pre-planning and specialized equipment. The local gas utility would install special valving, regulation and piping that allows the gas to be put back into distribution system. This process works on the basis of pressure equalization between the vehicle and the utility system, so it is possible that there will still be

pressure in the vehicle's onboard fuel system. As in the other defueling methods, the vehicle and the fuel system both must be grounded during this process.

The bottom line with defueling is that ensuring technician safety requires training and careful attention to using proper procedures. Defueling is not something technicians should "figure out" when it's time to perform it, but requires significant preparation. Every facility that services NGVs should prepare for defueling ahead of time, especially in case emergency defueling becomes necessary.

Basic Rules For Defueling

- Consume as much fuel as possible prior to defueling
- Notify appropriate nearby personnel prior to defueling
- Always ground (earth ground) the vehicle and the fuel system being defueled
- Never defuel indoors
- Always wear personal protective equipment
- Be familiar with evacuation routes