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GILLIG

Type 3 CNG Cylinder Defueling with Electric Solenoid Cylinder Valves

Procedure applies to systems equipped with the following Agility Fuel Solutions assemblies:

Fuel Management Module (FMM) p/ns		
20866000	20866500	20866600
20866700	20867000	20867500
20867600	20868000	20868500
20868600	20868700	20869000
20869500	20869600	20869700
20870000	20870500	20870600
20870700	20871000	20871500
20871600	20871700	20892000
20893000	20894000	20895000
20896000	20897000	

Roof Mount (RM) p/ns	Description
25501000	Roof Mount, 144 DGE, 2036 L, 8 Tanks
25503000	Roof Mount, 162 DGE, 2415 L, 8 Tanks
25503000-002	Roof Mount, 162 DGE, 2415 L, 8 Tanks
25505000	Roof Mount, 126 DGE, 1657 L, 8 Tanks
25507000	Roof Mount, 144 DGE, 2036 L, 8 Tanks
25509000	Roof Mount, 162 DGE, 2415 L, 8 Tanks
25509000-002	Roof Mount, 162 DGE, 2415 L, 8 Tanks
25511000	Roof Mount, 126 DGE, 1657 L, 8 Tanks
25513000	Roof Mount, 144 DGE, 2036 L, 8 Tanks
25515000	Roof Mount, 162 DGE, 2415 L, 8 Tanks
25517000	Roof Mount, 126 DGE, 1657 L, 8 Tanks

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1. Introduction

On Agility Fuel Solutions LLC ("Agility®") compressed natural gas (CNG) cylinders equipped with electric solenoid cylinder valves, verification that cylinder pressure is fully exhausted is required before any removal, replacement, tightening or loosening is performed on any valve, pressure transducer, PRD, tubing or fitting connected to the cylinders. This verification is required to confirm the electric solenoid cylinder valves opened properly during the defueling process and allowed the cylinder to be depressurized and defueled.

This procedure describes two methods to defuel the cylinders, lines and valves. Both methods include a procedure to verify the electric solenoid cylinder valves opened properly during defueling and that the cylinder pressures are fully exhausted. Either method can be used.

1. How to remove the solenoid valve components and then fully exhaust the pressure in the cylinder if the solenoid valve did not open properly when energized during defueling.
2. How to defuel the CNG system and cylinders if no battery power is available.

1.1. Warning Messages and Symbols Used in this Bulletin

⚠ DANGER

Will cause or death severe injuries if procedures are not followed.

⚠WARNING

Could cause or death severe injuries if procedures are not followed.

⚠CAUTION

Could cause minor or moderate injuries if procedures are not followed.

NOTICE

Practices not related to physical injury. Includes procedures to prevent vehicle damage as well as hints to help an operation or procedure go smoothly.

Critical Characteristic.

Procedure directly affects safety of vehicle users, people nearby and maintenance personnel; or regulatory compliance.

2. Affected Units

Gillig buses equipped with Agility® roof mount CNG fuel systems including Type 3 CNG cylinders and Emer™ Mark 100 Series electric solenoid valves as follows:

Agility® p/n			
25501000	25505000	25509000-002	25515000
25503000	25507000	25511000	25517000
25503000-002	25509000	25513000	

3. System Defuel Procedures

⚠ DANGER **⚠ WARNING**

A. This procedure should be performed only by CNG qualified personnel.

B. This procedure involves venting gas to atmosphere: please consult local codes and regulations to determine if this is legal in your area.

C. Full cylinder pressure [as much as* 3600 psi (25MPa) *or greater] is present at the cylinder solenoid valve, PRDs and tubing. System components must not be under pressure during servicing to prevent serious injury or death.

D. Defueling must be performed in a well ventilated area and must comply with any fire or building code requirements, including use of electrical grounding and vent piping.

To fully defuel all the CNG lines and defuel the cylinders, choose the appropriate method from the following procedures to perform prior to removing or disconnecting a cylinder valve, PRD, tubing or fitting directly connected to the cylinder. These procedures will ensure the plumbing and the cylinders are depressurized.

⚠ WARNING **⚠ CAUTION**

A. Use a slow flow when transferring fuel to reduce static electricity/electrostatic discharge and to avoid freezing.

B. Atmospheric venting of natural gas to depressurize a cylinder must be done with care. Improper equipment or procedures raise the risk of fire. Before depressurizing, ground the venting orifice to an approved electrical ground system.

3.1. Basic Rules for Defueling

1. Only CNG qualified personnel should attempt these processes.
2. Consume as much fuel as possible prior to defueling.
3. Only use an approved storage container for the fuel removed from the vehicle.
4. Notify nearby personnel prior to defueling.
5. Always ground the vehicle and the fuel system.
6. Never defuel indoors.
7. Always wear personal protective equipment.
8. Be familiar with evacuation routes.

3.2. Defueling Requirements

Use an approved storage vessel to store natural gas fuel removed from the vehicle. There are three common defueling options:

1. Vent to atmosphere
2. Compressor transfer
3. Return to supply

In all cases, both the vehicle and the fueling system must be grounded to prevent static electricity build-up.

3.2.1. Vent to Atmosphere

First, verify whether this method is legal. Local air quality regulations may restrict 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.

3.2.2. Compressor Transfer

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

3.2.3. Return 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.

3.2.4. Typical Venting Facility

The following information is provided in the absence of formalized procedures from local authorities and governing bodies. *Figure 1* is an example of a typical venting facility.

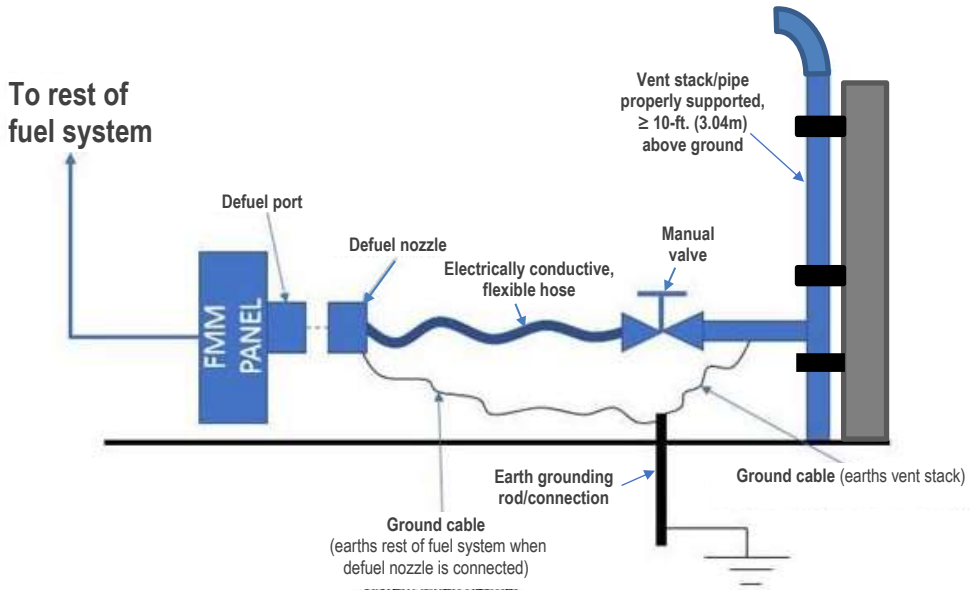

Figure 1. Typical atmospheric venting equipment.

A Venting Facility Should Include the Following Minimum Equipment

1. **Onboard defueling connection** installed on the vehicle. Consult vehicle original equipment manufacturer (OEM) for further information.
2. **Vent pipe** typically a two-in. (51mm) diameter steel pipe attached to a support structure. The pipe must extend a minimum of two ft. (0.6m) higher than the support structure and a least 10 ft. (3m) above ground level. The vent pipe must be connected to an electrical ground. There should be no ignition sources in proximity to the pipe. *Figure 1*
3. **Electrical ground connection** with a minimum 3 gauge or heavier stranded copper wire attached at one end to a ground rod, or an equally suitable electrical ground. The other end should be securely fastened to both the venting pipe and cylinder valve. *Figure 1*
4. **High pressure electrically conductive flexible hose**. *Figure 1*
5. **Manual valve** to control the flow of gas. *Figure 1*

Additional Equipment

1. Portable fire extinguisher in an easily accessible location at the defueling facility. The extinguisher should have a rating no less than 20-B:C.
2. Large signage indicating “NO SMOKING” and “FLAMMABLE GAS.”
3. Flame arrestor downstream of the hand valve.

⚠WARNING **⚠CAUTION**

Freestanding cylinders must be restrained prior to venting. Cylinders will contract and move if gas is released at a rapid rate.

3.3. Standard Defueling Procedure

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

Refer to *Figures 2, 3* and *4*. The defuel receptacle is equipped with a one-way check valve, which must be safely bypassed to perform the defuel process. The Agility transfer hose is equipped with a matching defueling nozzle (*Figure 2*) that safely mates with the defueling receptacle. Use the instructions provided with the defueling nozzle.

Figure 2. BDN defueling nozzle and ground connection.

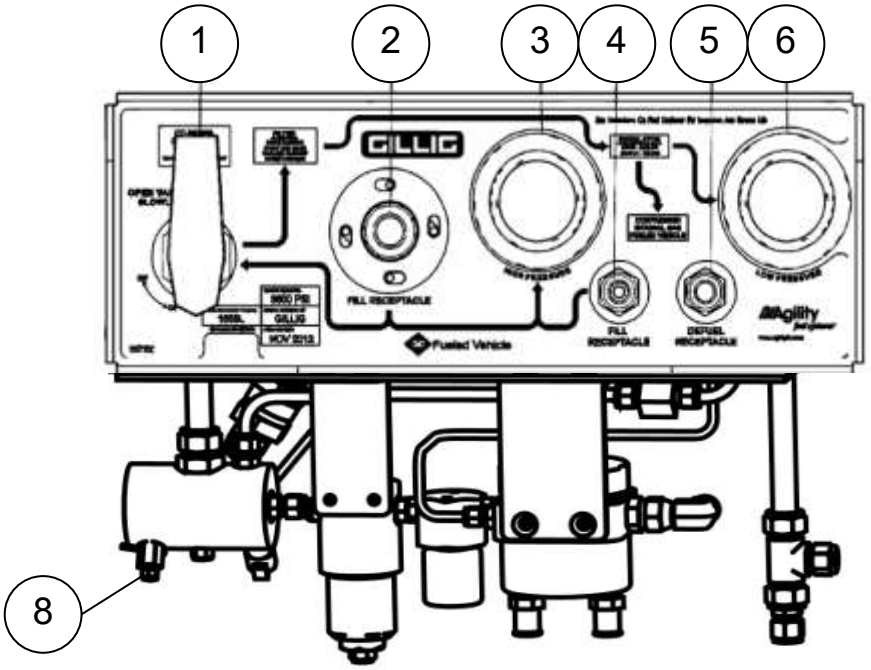

Figure 3. Fuel Management Module (FMM) faceplate: (1) 1/4-turn shut off valve, (2) transit (fast) fill receptacle, (3) high pressure (HP) gauge, (4) fill receptacle, (5) defuel receptacle, (6) low pressure (LP) gauge, (8) bleed valve.

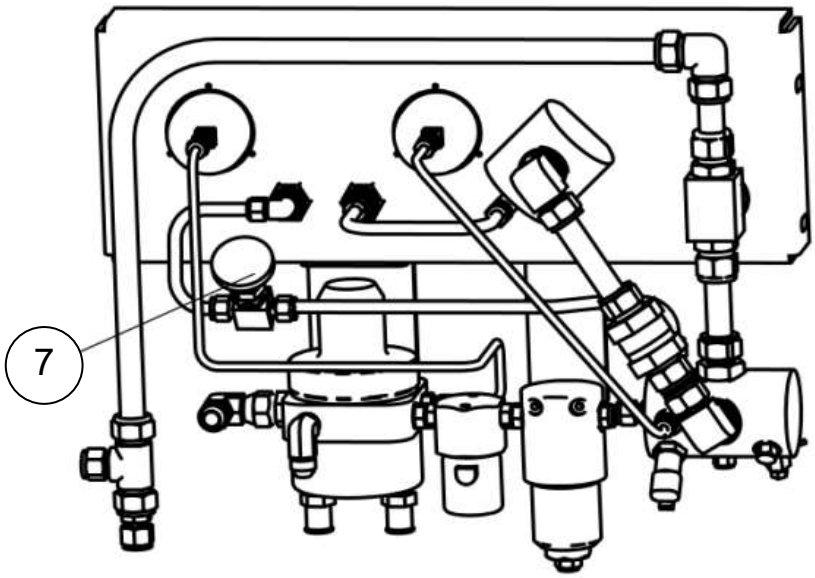

Figure 4. FMM panel, rear. (7) defuel valve.

3.3.1. Defuel Nozzle Connection

1. Connect vehicle ground wire to vent stack system. *Figure 1*
2. Attach defuel hose to vent stack system. *Figure 1*
3. Turn FMM 1/4-turn shut off valve (1) to the OFF/CLOSED position. *Figure 3*
4. Fully open the defuel valve (7) by turning fully counterclockwise. *Figure 4*
5. *If possible:* Run engine to use up fuel in the FMM and related lines.
6. Slowly open the bleed valve (8) in the FMM to bleed any remaining pressure in the fuel manifold and defuel lines. *Figure 4*
7. Close the bleed valve (8) and close the defuel valve (7). *Figures 3 and 4*
8. Attach the defuel nozzle (*Figure 2*) to the defuel receptacle (4) on the FMM. *Figure 3*
9. Turn FMM 1/4-turn shut off valve (1) to the ON/OPEN position. *Figure 4*

3.3.2. Defueling Method 1: Defuel with Audible Test Method

An audible test verifies electric solenoid function and cylinder depressurization. This method requires electric power to actuate the electric solenoid cylinder valves.

1. Complete all nine steps in *Section 3.3.1. Defuel Nozzle Connection* above.
2. Close all cylinder manual valves on all cylinders.
3. Energize all the electric solenoid cylinder valves. To energize the solenoid valves, verify battery disconnect switch is in the ON position and use the defuel switch located inside the rear run box (located in the engine compartment behind an access panel) to energize the solenoid valves. Confirm all manual cylinder valves are closed.
4. Slowly open defuel valve (7), turning it fully counterclockwise to open. *Figure 4.* Use the defuel nozzle to defuel the supply line system. *Figure 2*
5. Once the CNG supply lines have been defueled, verify FMM high pressure (HP) gauge (3) reads zero *(Figure 3)*, and open bleed valve (8) and leave the bleed valve open during this procedure. *Figure 4*
6. If all cylinders are to be tested and defueled, start with cylinder #1 and work in order to test all cylinders. If only some of the cylinders are to be defueled and tested leave the manual valves closed on the cylinders which are not to be defueled. Cylinders where the manual valves are not opened will NOT be defueled and will remain pressurized.
7. When performing this test confirm the following:
   a. Electrical solenoid valves are energized.
   b. Defuel nozzle is connected so the system can defuel.
   c. Bleed valve (8) on the FMM is open to prevent pressure build up in the fuel supply plumbing. *Figure 4*
   d. HP gauge (3) on the FMM reads zero. *Figure 3*

8. Starting with cylinder #1 or the first cylinder to be tested, slowly open the manual valve. Listen for the sounds of gas flowing out of the cylinder, as soon as the flow of gas is detected, close the valve. Gas flow indicates the solenoid valve has opened properly and is functioning properly.
   a. If no gas flow is detected, continue to open the manual valve until fully opened. If gas flow is not heard, the solenoid valve is not functioning properly.
   b. Close the manual valve, record that this solenoid is not functioning and will require disassembly to depressurize the cylinder.
   c. Repeat this test of slowly opening the manual valve, listening for gas flow and closing the valve on all cylinders requiring defueling.
   d. Carefully note any cylinders where the solenoid valve is failed closed and not allowing the cylinder to defuel. All cylinders where the solenoid valve fails to open properly will require disassembly to depressurize the cylinder.
9. Once all electric solenoid cylinder valves have been tested, close the bleed valve (8) on the FMM. *Figure 4*
10. Close manual cylinder valves on all cylinders with failed solenoid valves.
11. Open the manual cylinder valves on all cylinders to be defueled with functioning solenoid valves.
12. Verify defuel nozzle *(Figure 2)* is properly connected and proceed to defuel the cylinders with functioning solenoid valves. Slowly open the defuel valve and adjust for a slow and steady flow to avoid freeze up. *Figure 4. Refer to Section 3.3.1.*
13. On all cylinders where no gas flow was heard (which means the solenoid valve is failed), the solenoid valve must be disassembled and manually vented to depressurize the cylinder*. Refer to Section 4. Solenoid valve disassembly, and Section 5. for solenoid valve function test and cylinder venting after valve disassembly.*
14. Once the defueling procedure on the cylinders with functioning solenoid valves is complete and cylinders with non-functioning solenoid valves have been dissembled and vented manually, verify the HP gauge (3) reads zero (*Figure 3*) and open the bleed valve (8). *Figure 4.* The fuel lines and cylinders with opened manual cylinder valves are now depressurized.
15. It is now safe to remove, replace or adjust cylinder valves, PRDs or associated tubing on all cylinders with opened manual cylinder valves.

⚠WARNING

Any cylinders on which manual valves were not opened remain pressurized.

16. When work on the CNG system is completed, close the bleed valve (8). *Figure 4*

⚠CAUTION

***Torque bleed valve nut to* 4 ft-lbs *to* 5 ft-lbs (5.42Nm *to* 6.78Nm).**

17. Close defuel valve (7). *Figure 3*
18. Remove defueling nozzle. *Figure 2*

3.3.3. Defueling, Method 2: Defuel Using Valve Disassembly

In this procedure, solenoid valves are disassembled to verify valve function and depressurization. This method requires electrical power to actuate the electric solenoid cylinder valves.

1. Complete all steps in *Section 3.3.1. Defuel Nozzle Connection.*
2. Confirm all manual valves on all cylinders to be defueled are open to allow these cylinders to defuel. Manual valves should remain closed on all cylinders which are not to be defueled.
3. Verify FMM 1/4-turn manual shut off valve (1) is in the ON/OPEN position. *Figure 3*
4. Defuel the CNG supply plumbing and cylinders.
   a. When defueling, all electric solenoid cylinder valves should be energized (open).
   b. Verify battery disconnect switch is ON.
   c. To energize the cylinder solenoid valves for defueling, use the defuel switch inside the rear run box (located in the engine compartment behind an access panel).
5. Slowly open defuel valve (7) and adjust for a slow and steady flow to avoid freeze up. *Figure 3*
6. Continue defueling until the HP gauge (3) on the FMM reads zero *(Figure 3)*, then open the bleed valve (8) on the FMM and leave it open during this procedure. *Figure 4*
7. If all cylinders are to be tested and defueled, start with cylinder #1 and work in order to test all cylinders.

   ⚠WARNING

   If only some of the cylinders are to be defueled and tested, leave the manual valves closed on cylinders which are not to be defueled. Cylinders where the manual valve is not opened will NOT be defueled and will remain pressurized.
8. Turn off the defuel switch in the rear run box to turn off power to the electric cylinder solenoid valves.
9. Refer to *Section 4, Solenoid Valve Disassembly,* and *Section 5, Solenoid Valve Function Test and Cylinder Venting After Valve Disassembly.*
10. Disassemble and test each solenoid valve. If the valve is functioning correctly, there will be no gas pressure in the cylinder and no gas will flow out of the disassembled valve. Carefully test each valve.
11. Any valves which exhaust gas in Step 9 have failed closed and must be replaced before putting the bus back in service.
12. On all valves which exhaust gas in Step 6, leave the manual valve open to fully exhaust all the pressure in the cylinder. Leave the manual valve in the fully open position.
13. Reassemble the valves which function properly after testing and replace any that are failed closed. Reassemble solenoid valve.

14. Once all the valves on the cylinders to be defueled have been tested and all cylinders with a failed closed valve have been manually vented, the cylinders have been depressurized and work can be done on the cylinder valves, PRDs or associated plumbing.
15. Before putting the bus back in service complete a leak test and solenoid function test.
16. Perform a leak test with leak detection fluid. Repair any leaks.
17. Test for proper solenoid valve function:
    a. Start engine and allow engine to idle for at least two minutes.
    b. Operate cylinder solenoid test switch. This will de-energize the electric solenoid cylinder valve causing the valves to close.
    c. Pressure on the HP gauge (5) should drop and within ten minutes the engine should stall due to lack of fuel. *Figure 3*
    d. If the engine does not stall, one or more solenoid valves are not functioning correctly. The valve system will require additional testing to determine which valves are not functioning correctly and require replacement.
18. Once the leak test and solenoid test are complete, the bus can be returned to service.

3.3.4. Defueling When No Battery Power is Available

If electrical power is not available to actuate the electric solenoid cylinder valves, the recommended procedure is to restore battery power on the vehicle so the solenoid valves can function.

This procedure requires disassembly of the solenoid valves.

1. Fully close the manual cylinder valves on all cylinders. Verify all manual valves are fully closed by turning fully clockwise.
2. Verify FMM 1/4-turn valve is in the ON/OPEN position. *Figure 3*
3. Using the defueling nozzle, slowly open the defuel valve to depressurize the CNG tubing and the fuel manifold. When the HP gauge (3) reads zero, open the bleed valve (8) on the fuel manifold. *Figures 3 and 4*
4. Verify the following:
    a. FMM 1/4-turn shut off valve (1) is in the ON/OPEN position. *Figure 3*
    b. HP gauge (3) reads zero. *Figure 3*
    c. Bleed valve (8) is open and no gas is being vented from the bleed valve. *Figure 4*
5. After the CNG system tubing has been depressurized, disassemble each solenoid valve per *Section 4*.
6. After solenoid valve disassembly, reassemble solenoid valve without the plunger and spring (refer Step 7) and defuel the cylinders using the defuel nozzle as described in *Section 3.3.1.*
7. To reassemble the solenoid valve without the plunger and defuel using the defuel nozzle, perform the following:

a. Reassemble valve stem to valve body and leave out plunger and spring. *Figures 8 and 9*

b. Torque valve stem to 25.8 ft-lbs (35Nm). *Figure 12*.

c. Leaving the plunger out overrides solenoid function and allows gas to flow through the solenoid valve without electrical power.

8. Before proceeding:
   a. Verify all cylinders to be defueled have the spring and plunger removed
   b. Verify all stems have be reinstalled and properly torqued to 25.8 ft-lbs (35Nm).
   c. Verify the pressure on the HP gauge (3) continues to read zero. *Figure 3*
9. Close bleed valve (8) and defuel valve (7). *Figures 3 and 4*
10. Verify defuel nozzle is properly connected. *Figure 2*
11. Verify FMM 1/4-turn valve (1) is in the ON/OPEN position. *Figure 3*
12. Slowly open the manual cylinder valves on all cylinders to be defueled. Listen and smell for any signs of gas leakage. No leakage should occur. If any leakage is detected, close the manual cylinder valves and repair the leaks.
13. When all the manual cylinder valves are open, verify the cylinder pressure reading on the HP gauge (3). *Figure 3*
14. Using the defuel valve (7) to adjust the defuel flow rate, proceed to defuel the system. *Figure 3*
15. Once the HP gauge (3) reads zero, slowly open the bleed valve (8) to vent any residual pressure. *Figures 3 and 4*
16. When the HP gauge (3) reads zero and no gas is venting from the bleed valve (8), system defueling is complete. *Figures 3 and 4*

⚠WARNING

Only cylinders with the manual valve open and the solenoid plunger removed will be depressurized. Any cylinders with the manual cylinder valve closed or the plunger installed in the solenoid will remain pressurized.

17. After completing all repairs before repressurizing the system, the plunger and spring must be reinstalled.
18. When work is completed, the valve may be reassembled or replaced as needed.
19. Before putting the unit back in service, complete a leak test and a solenoid valve function test.
20. Perform a leak test and repair any leaks. Perform the leak test in three stages:
    a. Slowly pressurize the cylinders to around 100 psi (689kPa) and check for leaks at all solenoid valves and any fuel line connections that were disconnected. Test using a leak detection fluid.

b. Next, slowly pressurize the cylinders to approximately 1000 psi (6.89MPa) and check for leaks especially around the solenoid valves and line connections that were disassembled. Use a leak detection fluid.

c. Finally, fill the system to full service pressure and complete the final leak test.

21. Using the solenoid test switch check for proper solenoid valve function:

    a. Start engine and allow the engine to idle for at least two minutes

    b. Operate the cylinder solenoid test switch. This will de-energize the electric solenoid cylinder valve causing the valves to close.

    c. The pressure on the high pressure gauge should drop and within ten minutes the engine should stall due to lack of fuel.

22. If the engine does not stall, one or more solenoid valves are not functioning correctly. The valve system will require additional testing to determine which valves are not functioning correctly and require replacement.

23. Once the leak test and solenoid test are complete, the bus can be returned to service.

4. Solenoid Valve Disassembly

Solenoid valve disassembly is done to either confirm the valve has functioned correctly and allowed the cylinder to defuel or is used to allow defueling the cylinder if the solenoid has failed closed.

⚠WARNING

The fuel cylinder may still be under pressure. To prevent serious injury, verify the manual valve is fully closed and do NOT loosen or remove the PRD.

4.1. Remove Solenoid Valve Internal Parts

1. Before starting any work, confirm manual cylinder valve is fully closed (yellow knob). Confirm by turning the knob clockwise until the knob stops turning. *Figure 5*
2. Verify pressure in the CNG system has been fully exhausted and the pressure reads zero on the HP gauge (3). *Figure 3*
    a. Confirm FMM 1/4-turn manual shut off valve (1) is in the ON/OPEN position. *Figure 3*
    b. Verify HP gauge reads zero. *Figure 3*
    c. Confirm FMM bleed valve (8) is fully opened. *Figure 4*
3. Disconnect wire harness from valve.
4. Visually inspect fuel lines connected to the failed valve.
5. Clean any dust from the fuel lines and end fittings using a dry rag, or with a rag with water.

NOTICE

Do NOT use any cleaning solvents or soap, as they can cause corrosion to the fittings.

If any dust or debris gets into fuel lines or fittings, it may cause leaks or plug the fuel system.

6. Disconnect fuel and PRD vent lines from the valve and save them for re-installation on the new valve.
7. Using a 22mm or 7/8-in. wrench, remove the top cap from the solenoid coil. *Figure 5*

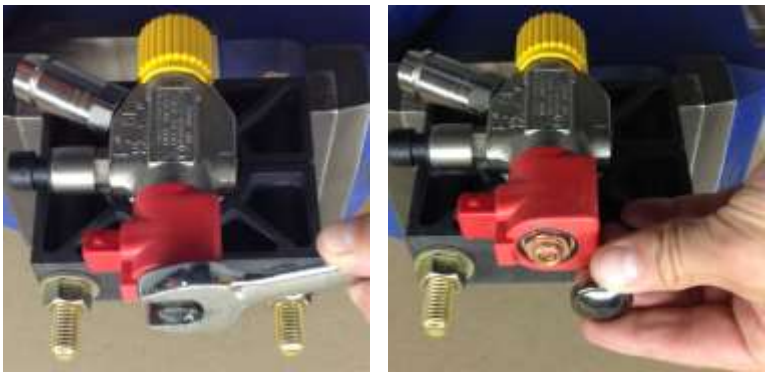

Figure 4. Begin valve disassembly by removing cap from coil.

8. Using a 17mm or 11/16-in. wrench, remove the brass bushing from the solenoid coil. Holding the center stem with a slotted screwdriver will simplify the disassembly. *Figure 6*

Figure 5. Remove brass bushing.

9. Remove solenoid coil, it will slide off. *Figure 7*
10. Remove spring washer from the valve stem. *Figure 7*

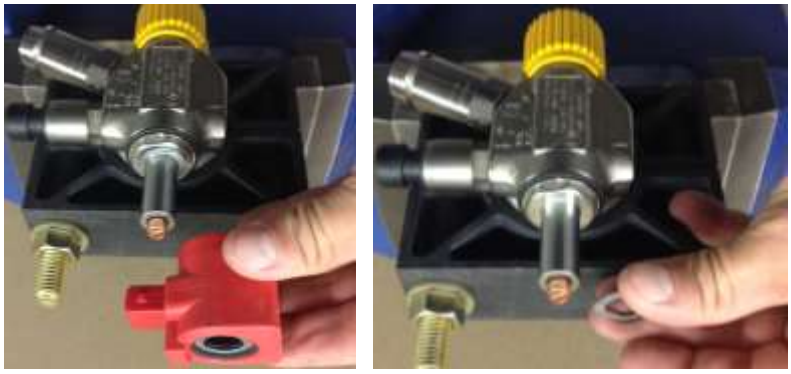

Figure 6. Left: Coil slides off valve stem. Right: Remove spring washer.

⚠WARNING

The stem is a pressurized component: severe injury could result if the previous procedures have not been properly performed. The (yellow) manual valve handle on the valve MUST be closed.

11. Using a 24mm or 15/16-in. wrench, remove the stem of the solenoid coil. Turn very slowly being aware of any gas leaks: if there are any gas leaks, tighten the stem and contact Agility® (DO NOT REMOVE STEM). The stem has a thread locker on the threads. *Figure 8*

    ⚠WARNING

    If the stem feels very stiff coming out (feels like cross-threading), tighten the stem and contact Agility®.

    ⚠WARNING

    Valve stem may become a projectile without warning: take proper precautions.

Figure 7. Remove valve stem.

12. Remove solenoid internals consisting of two pieces: spring and plunger. *Figure 9*

Figure 8. Remove spring and plunger.

13. The valve is now ready to defuel. *Figures 10 and 11*

Figure 9. Two views of the disassembled valve.

Figure 11. Solenoid valve components.

5. Solenoid Valve Function Test and Cylinder Venting After Valve Disassembly

WARNING

With the solenoid valve disassembled, the only thing preventing gas flow is the manual valve.

- ***a. Secure the area around the cylinders and verify that no loose equipment is in the area. Remove all tools, rags, etc.***
- ***b. Any objects not securely attached to the roof may cause serious injury when defueling begins.***
- ***c. Open ports on the valve are live and high pressure gas up to 4500 psi (31.0MPa) may flow out of the disassembled valve when the manual cylinder valve is opened. Do not place hands or any part of your body above or near the open ports of the valve.***

Use the following procedure to:

- Confirm the cylinder is depressurized
- To depressurize the cylinder if the solenoid has failed closed

1. Slowly turn (yellow) manual valve knob counterclockwise to open. If the cylinder is pressurized, gas will vent out the open valve ports.
2. If gas **DOES** come out when the valve is opened the cylinder is NOT depressurized, and the solenoid valve has failed closed. Solenoid valve replacement is required once the cylinder is fully depressurized.
3. Monitor the rate of defueling using the cylinder valve knob. As the cylinder pressure drops, the valve can be opened further to increase the rate of defueling.
4. Allow the gas to flow until the gas stops flowing. When the gas stops flowing, slowly open the valve until fully open. Once the gas stops flowing with the valve fully open the cylinder is fully depressurized.

6. Solenoid Valve Reassembly after Passing Function Test

When reassembling the valve, torque to specifications as indicated and apply thread locker as shown in *Figure 12*.

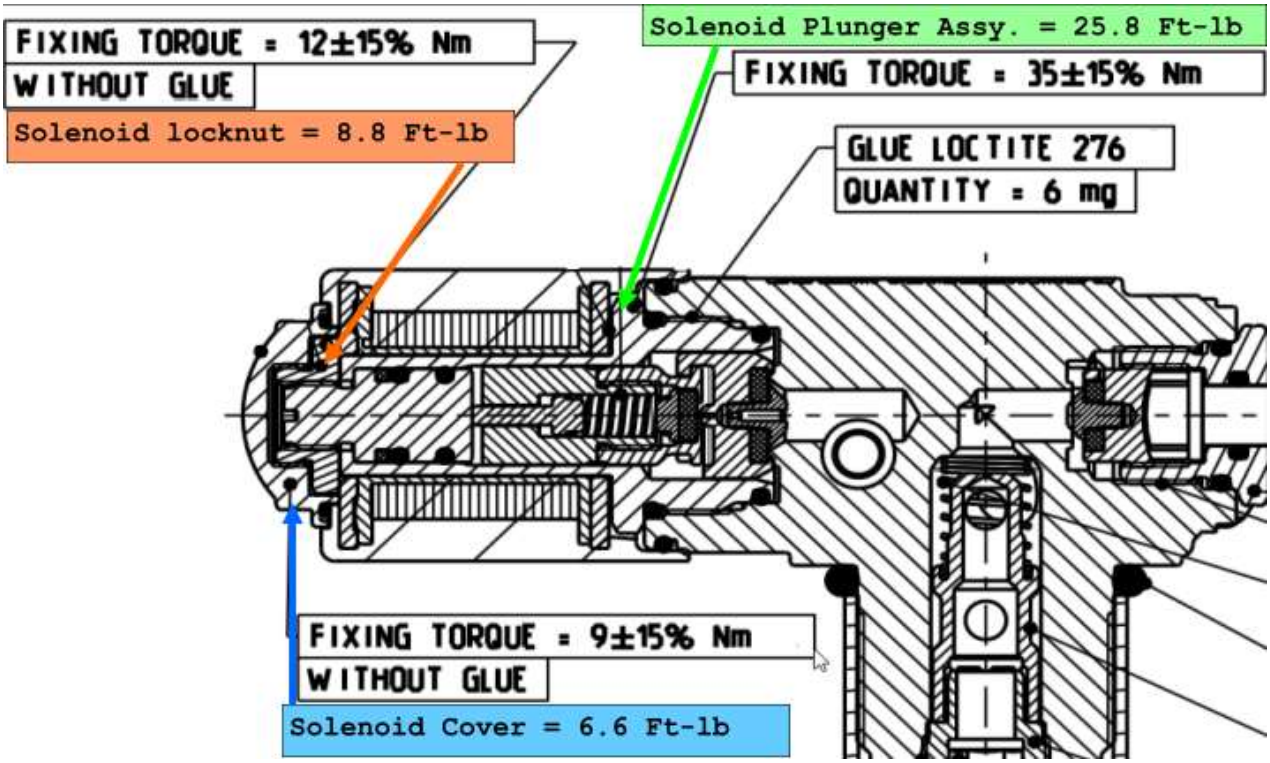

Figure 10. Solenoid valve torque specifications.

7. Remove and Replace Solenoid Valve

Removal of the valve requires a special tool. However, standard tools may be used if special care is taken.

1. Using a 3/4-in. wrench, remove the valve by the valve body. DO NOT USE A WRENCH ON THE SEATING SURFACES OF THE VALVE FITTINGS (machined brass ports on either side of valve). *Figure 13*

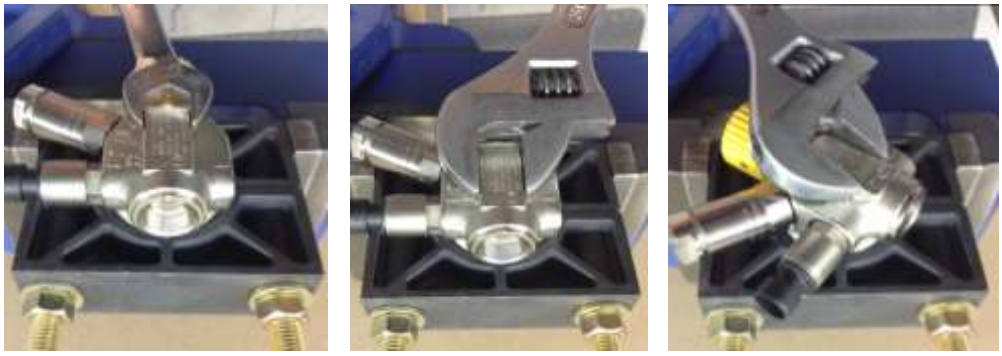

Figure 11. An adjustable wrench may be used to remove valve from cylinder.

2. To gain more leverage on the valve body, a large adjustable wrench may be used. *Figure 13*
3. Turn wrench counterclockwise to remove valve. *Figure 13*
4. Before installing the valve, lubricate the O-ring with non-petroleum-based lubricant such as Parker Super O-Lube®, Krytox® or equivalent.
5. Install new valve.

⚠CAUTION

***Torque valve to* 100 ft-lbs *to* 140 ft-lbs (135.6Nm *to* 189.8Nm).**

6. Valve orientation might not be the same as the original valve requiring the cylinder to be turned to re-orient the valve; follow procedure in *Section 8: Re-orient Cylinder.*

8. Re-orient Cylinder

1. Disconnect PRD vent plumbing.

NOTICE

These PRD vent tubes are not pressurized and may be removed.

C

Always use two wrenches when removing fitting nuts from fittings, and do not loosen the PRD fitting in the end of the cylinder.

2. Once all fuel tubes have been removed from both ends of the cylinder, loosen the 1/2-in. neck block bolts on the valve end of the cylinder using a 3/4-in. wrench.

NOTICE

It is not necessary to touch the neck block bolts on the PRD end of the cylinder.

3. Spin the cylinder by hand to achieve the desired valve position.
4. Test-fit all fuel tubes to ensure proper alignment.
5. C

***Tighten 1/2-in. neck block bolts to* 85 ft-lbs *to* 90 ft-lbs (115.2Nm *to* 122.0 Nm).**

6. Loosen and re-orient the (#8 JIC) elbow fitting on the PRD end of the cylinder.
7. Re-install all fuel tubes and PRD tubes.
8. Pressure test per *Gillig/Agility Fuel Solutions Operation Manual, ENP-044.*

9. Solenoid Valve Function Tests

Usually the first indication of a valve failed closed is reduced vehicle range. If a failed in-cylinder solenoid valve is suspected, perform the following troubleshooting steps to isolate the problem.

⚠CAUTION

System pressure should be at least* 1200 psi (8.27MPa) *when conducting these tests.

9.1. Test for a Failed Closed Solenoid

1. Confirm manual valves on all cylinders are open.
2. Disconnect the electrical connector to all cylinder solenoid valves. OR
   Use the cylinder valves on the rear run box.
3. Start the engine and run the engine until it stalls. If the vehicle continues to run without significant pressure drop (as observed on the 0-5000 psi HP gauge on the FMM), then one or more cylinders have solenoid valves may have failed open. Skip to *Section 9.2.*
4. Verify the fuel tubes are empty by confirming a zero reading on the HP gauge (3) on the FMM. *Figure 3*
5. Open bleed valve (8) on the FMM and leave open. *Figure 4*
6. Apply 24V to a single cylinder solenoid valve. If the valve opens and fuel can be heard rushing through the fuel tubes, disconnect the 24V power supply: The cylinder solenoid valve is operational.
7. If no fuel is heard coming out of the cylinder, confirm there is 24V at the solenoid coil. *Figure 5*
8. If 24V is applied, remove and replace the solenoid coil with a different coil and repeat the process.
9. If no fuel is heard coming out of the cylinder, it is likely that the valve has failed internal parts and should be replaced per the procedure in *Section 4*.
10. If fuel is heard coming out of the cylinder after the second coil is used, then the first coil has failed and must be replaced.
11. If a valve has failed closed, the vehicle shall be removed from service and the valve replaced.
12. After the first cylinder valve has been evaluated, repeat Steps 1 through 10 for each cylinder.

9.2. Test for a Failed Open Solenoid

1. Shut off manual valves on all cylinders.
2. Start vehicle and run the engine until it stalls.
3. De-energize all solenoid valves – ignition key in the OFF position.
4. Slowly open the manual valve on each cylinder. If fuel can be heard rushing through the cylinder into the fuel lines, the valve has failed open and must be replaced.

⚠WARNING **⚠CAUTION**

A failed open or failed closed solenoid valve must be replaced before putting the vehicle back in service.

If you have any questions, contact Agility Fuel Solutions Customer Care:

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ECN	REV	AUTHOR	APPROVED	DATE	DESCRIPTION
--	I	C.Grasso	CCG Team	6/3/2020	ADDED: Notes specifying OEM defuel switch is located behind an access panel in the engine compartment.
--	H	C.Grasso	CCG Team	5/4/2020	ADDED: Metric values; ADDED: “Type 3” to title. REVISED: Warning message definitions.
--	G	C.Grasso	CCG Team	8/21/2019	UPDATED: Figure 1
--	F	W.Yoshida	C.Forsberg	3/14/2018	
--	E	W.Yoshida	C.Forsberg	8/25/2015	Original title: “Manual Bleed Down of CNG In-Tank Solenoid Valves”; revised Sections 3.12 and 4.2
--	D	W.Yoshida	C.Forsberg	7/1/2015	Added section if no battery power available (Section 3.12)
--	C	W.Yoshida	C.Forsberg	6/11/2015	Added Section 3.12, added Fig. 12, torque specs
--	B	W.Yoshida	C.Forsberg	3/5/2015	New title, more general edits
--	A	W.Yoshida	C.Forsberg/Y.Coy	4/25/2012	Various edits, added diagrams
--	-	W.Yoshida	C.Forsberg/Y.Coy	6/10/2013	Initial Release