

TIGER TEAMS TECHNICAL ASSISTANCE

CNG Fuel Transfer

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"Best Practices" # CNG-01



 In Case of Fire

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Introduction

The fueling procedure demonstrated on this compact disk (CD) was developed for the Washington Metropolitan Area Transit Authority by Marathon Technical Services, under subcontract to the National Renewable Energy Laboratory (NREL). It is presented here for information purposes only and should be used as an example of a vehicle-to-vehicle fueling procedure. Individual situations and equipment may vary from fleet to fleet. The U.S. Department of Energy, NREL, and its subcontractors are not responsible for damage or injury that may occur as a result of performing this procedure.

The procedure demonstrated here involves the distribution of compressed natural gas (CNG) at high pressure. Severe injury or death can result from failing to follow this procedure correctly. Do not attempt to transfer CNG without receiving hands-on training from a qualified professional. All personnel using this procedure should be trained, qualified, and competent in CNG fueling methods. Before attempting this procedure, personnel should contact local fire, police, and other applicable authorities to obtain required permits and learn how to comply with fire, traffic, and other state and local regulations.

Training in the proper use of a fire extinguisher is also required. Once proper training has been completed, read the contents of this entire CD before attempting to transfer CNG from one vehicle to another.



Fuel Transfer Procedure

The fuel transfer procedure should be completed in an open outdoor area free of traffic, bystanders, power lines, overhead structures, and equipment that could trap or ignite gas. This fuel transfer procedure should not be carried out on a public street or highway.

Make sure there are no sources of ignition (including cell phones and two-way radios) within 25 feet of both vehicles during the entire fuel transfer procedure. Make sure the engines in both vehicles are off, transmissions are in “park,” and parking brakes are set.

Warning signs should be displayed on the vehicles when the fuel transfer procedure is being performed. Magnetic signs were to be used in the procedure demonstrated on this CD. However, the panels on the buses used were not magnetic. Therefore, buses should be tested in advance and, if required, alternative fastening methods should be obtained.

Before you begin:

- ✓ All equipment must be stored in an appropriately sized plastic storage bin for easy transport and protection from damage.
- ✓ Both vehicles must be equipped with grounding straps.
- ✓ Fueling personnel must wear personal safety equipment and long-sleeved shirts and long pants.
- ✓ All required CNG fueling permits must be in place.



Fuel Transfer Equipment

Site and Procedure



Four pairs of wheel chocks



Fuel transfer hose



Hose bleed adapter



Warning signs



Traffic control pylons or triangles



20BC fire extinguisher

Personal



Safety glasses



Gloves



Hearing protection



Reflective safety vest





Two-way radio or cell phone

Caution: Two-way radios and cell phones should be used at least 25 feet away from fuel transfer site.



Viewing the Demonstration

The following demonstration can be viewed by clicking on the video clips, which are identifiable by their thick orange borders.

To start the video, click on the picture. To pause, click  .
To restart, click  .

From time to time, you'll also come across this symbol:

This indicates a troubleshooting tip.



To read the tip, click on the symbol.



Fuel Transfer Demonstration

STEP 1: Set out traffic control pylons to direct traffic away from the fuel transfer site.



Fuel Transfer Demonstration

STEP 2: Use chock blocks to secure both rear wheels of both vehicles.



Fuel Transfer Demonstration

STEP 3: Lay out the fuel transfer hose to ensure that it will reach the fueling receptacles on both vehicles.



Fuel Transfer Demonstration

STEP 4: Visually inspect the entire hose for imperfections.



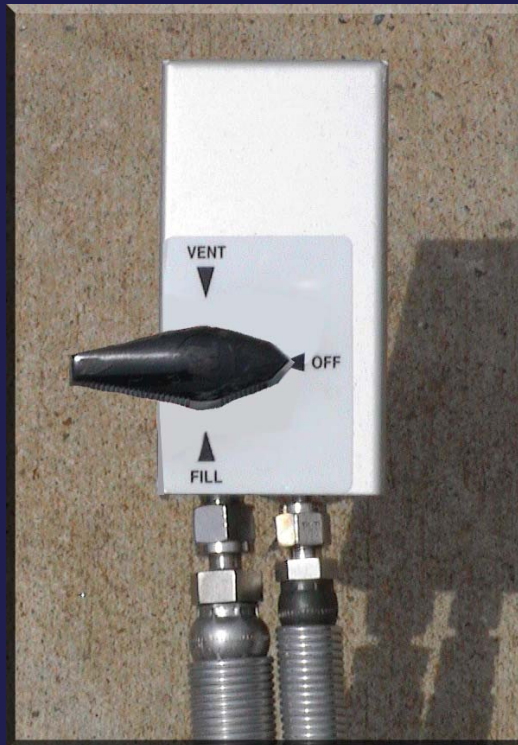
Fuel Transfer Demonstration

STEP 5: Set the fire extinguisher in an accessible position near the midpoint of the fueling hose.



Fuel Transfer Demonstration

STEP 6: Make sure that the three-way valve on each end of the fuel transfer hose is in the “off” position.



Fuel Transfer Demonstration

STEP 7: Open the fueling door of the recipient vehicle (the vehicle with the lower initial pressure).



- Remove the dust cap on the NGV-1 fueling receptacle in the recipient vehicle.
- Connect the fueling nozzle to the NGV-1 fueling receptacle. This will be the smaller receptacle if two receptacles are present.
- Read the nozzle manufacturer's operating instructions.

Fuel Transfer Demonstration

STEP 8: Open the fueling door of the donor vehicle and close the main shut-off valve. Remove the dust cap on the NGV-1 fueling receptacle, and connect the defueling nozzle.



DONOR VEHICLE

- If personnel experience difficulty connecting the defueling nozzle to the NGV-1 fueling receptacle, make sure that the lever is fully retracted.



Fuel Transfer Demonstration

STEP 9: Disengage the pin on the defueling nozzle and push the lever toward the vehicle. Re-engage the pin to lock the lever in the forward position.



DONOR VEHICLE

Fuel Transfer Demonstration

STEP 10: Energize the donor vehicle solenoid valves. The procedure to this will vary by bus design but may include activating a “defueling” or “ignition-on” switch. You may also have to activate the “fuel proximity” switch on the fuel door.
Note: A jumper is used in this demonstration.



DONOR VEHICLE



Ignition-on switch



Fuel proximity switch

Fuel Transfer Demonstration

STEP 11: Slowly open the main shut-off valve on the donor vehicle.



- Make sure the gas is not flowing from the vent before opening the valve completely.
- Slowly turn the three-way valve to the “fill” position.
Note: The hose is now pressurized.



Fuel Transfer Demonstration

STEP 12: Slowly turn the three-way valve on the recipient vehicle to the “fill” position. Allow the gas to flow from the donor vehicle to the recipient vehicle until the two vehicles’ pressures have equalized (no more flow noise) or the desired pressure has been reached in the recipient vehicle.



Fuel Transfer Demonstration

STEP 13: Once fueling is complete, turn the main shut-off valve to the closed position on the recipient vehicle.

Note: The fuel transfer hose is still fully pressurized.



- Vent the nozzle by slowly turning the three-way valve to the “vent” position
- Disconnect the nozzle, replace the dust caps, and return the main shut-off valve to the open position.



Fuel Transfer Demonstration

STEP 14: De-energize the solenoid valves by deactivating the defueling switch, the “ignition-on” switch, and/or the proximity override.



DONOR VEHICLE

- Turn the main shut-off valve on the donor vehicle to the closed position.
- Release the check-valve bypass on the defueling nozzle by pressing down on the lever and disengaging the pin.
- Vent the nozzle by slowly turning the three-way valve to the “vent” position.
- Disconnect the nozzle, replace dust cap, and return the main shut-off valve to the “open” position.

Fuel Transfer Demonstration

STEP 15: Depressurize the hose by attaching the hose bleed adapter to the fueling nozzle on the donor vehicle end of the transfer hose.



- Make sure that the needle valve on the vent adapter is completely closed and vent discharge is directed away from the operator and bystanders.
- Turn the three-way valve on the nozzle to the “fueling” position.
- Slowly open the needle valve on the adapter until there is a moderate gas flow from the valve.
- Allow the trapped gas to bleed off slowly until there is no more flow from the vent. The needle valve may need to be opened more as the pressure inside the hose drops.

Fuel Transfer Demonstration

STEP 16: Stow the hose, hose bleed adapter, and safety equipment in the storage container.

STEP 17: Remove and stow the chock blocks and traffic control pylons (or triangles), and resume normal vehicle operation.

End of demonstration.



In Case of Fire...

1. Clear bystanders from the area.
2. Notify the fire department from a safe location.
3. If safe to do so, close the valves feeding gas to the fire (donor vehicle solenoid valves, check-valve bypass on defuel nozzle, or main shut-off valve on either vehicle).
4. If the fire is not associated with the CNG system, attempt to extinguish it with the fire extinguisher.

If the fire continues to burn, evacuate the area!





Troubleshooting Tip #1

WHAT TO DO IF: There is flow from the vent when the donor vehicle's main shut-off valve is opened...

1. Close main shut-off valve on donor vehicle.
2. Ensure that both three-way valves are in the "off" position.
3. Resume fuel transfer procedure.



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Troubleshooting Tip #2

WHAT TO DO IF: The transfer hose components leak...

1. Close main shut-off valve on both vehicles.
2. Ensure that both three-way valves are in the “off” position.
3. Remove transfer hose from both vehicles, depressurize hose ([see Step 15](#)), and repair leak.
4. Resume fuel transfer procedure.



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Troubleshooting Tip #3

WHAT TO DO IF: The breakaway disengages...

1. Close both vehicles' main shut-off valves, turn the three-way valves to the "off" position, and disconnect both sections of hose from the vehicles.
2. Bleed both sections of hose with the hose bleed adapter ([see Step 15](#)).
3. Reconnect the breakaway following manufacturer's instructions.
4. Resume transfer procedure.



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Troubleshooting Tip #4

WHAT TO DO IF: The NGV-1 receptacle check valve leaks from either vehicle...

1. Close main shut-off valve.
2. Wait two to five minutes.
3. Open the main shut-off valve slowly.
4. If the problem persists, close the main shut-off valve again and replace the NGV-1 fueling receptacle.



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How to Use This CD

Acrobat Reader 5 or higher is required to view the contents of this CD. Included in the “Installs” folder of this CD are the Acrobat Reader 5.05+Search installation programs for both [Mac](#) and [PC](#) platforms. The video demonstrations require an installed media player capable of decoding .avi files (e.g. QuickTime, Windows Media Player).

Navigation buttons on the pages are available to quickly navigate the entire CD. Additionally, Bookmarks can be displayed in the Navigation Pane by pressing the Bookmarks tab to the left. The procedures outlined in this CD include video clips and troubleshooting tips that can be viewed by clicking on them. Enhance your browsing experience by becoming familiar with Acrobat Reader’s tools. See the Quick Reference below for a few tools most applicable to this CD.

Acrobat Reader Navigation: Quick Reference

Show / Hide: Navigation Pane
Toggle default display of Bookmarks On or Off. Click on a Bookmark to jump to another location.

First Page:
Goes to first page of active document.

Last Page:
Goes to last page of active document.

Previous / Next Page:
Goes to the Previous / Next page of active document.

Previous / Next View:
Goes to Previous / Next page viewed (like **Back** and **Forward** buttons of a browser).

Actual Size:
Click to display page at 100% magnification.

Fit In Window:
Click to jump to full-page view. This is the default view for this CD.

Fit Width:
Click to fit page width into display area.

Zoom Tool:
Select the Zoom-In tool and click to increase page view in increments, or draw a marquee around the desired magnification area.

Find Button:
Searches for text within the active document only.



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Sponsored by the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy

Prepared by NREL

NREL is a U.S. Department of Energy National Laboratory
Operated by Midwest Research Institute • Battelle • Bechtel
Contract No. DE-AC36-99-GO10337

Subcontract No. KLCI-1-31027-01

NREL/EL-540-32829
October 2002

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