



AFV/EV Safety Training: Towing and Roadside Assistance

Instructor's Manual



National Alternative
Fuels Training Consortium

A Program of

 West Virginia University

The high velocity jet can create high intensity noise, alerting emergency response personnel to a gas leak problem and/or its location. If the gas jet comes in contact with a spark, a high temperature jet fire or “torch fire” can cause serious burns and structural damage. Remember, however, that the gas-to-air mixture has to be within the 5% to 15% range for ignition to take place.

IMPORTANT NOTE:

If the flame is extinguished without stopping the fuel flow, the air/fuel mixture may reignite.

To extinguish a CNG fire, you should do the following:

- Cut off the fuel flow if you can access it without danger to yourself or others. This will usually extinguish a natural gas fire by depriving it of the source of fuel.
- With small fires, use dry chemical or carbon dioxide.
- For large fires, use water spray or fog. Move containers from fire area if you can do it without risk.

Use high expansion foam to reduce the intensity of the fire.

To extinguish an LNG fire, you should do the following:

- Cut off the fuel flow if you can access it without danger to yourself or others. This will usually extinguish a natural gas fire by depriving it of the source of fuel.
- With small fires, use dry chemical or carbon dioxide.
- Use high expansion foam to reduce the intensity of the fire.

LNG reacts violently when water is applied; the reaction warms the liquid to boiling, creating more gas vapor. Adding water to an LNG liquid fire will intensify it.

Propane Vehicle Fires

Propane has a low flash point (the lowest temperature at which it can vaporize to form an ignitable mixture in the air). Once a fire starts, it can burn at a very high temperature. If the fire has been burning for a sustained period of time, the fire can be very difficult to suppress because of the heat. Flames can burn in a strong wind and be stretched out away from their source by a number of feet. Concentrate on keeping the fire from spreading into other areas or neighboring objects. Keep away from pressure relief device vents until the fire is extinguished.

To extinguish a propane fire, you should do the following:

- With small fires, use dry chemical or carbon dioxide.
- For large fires, use water spray or fog. Move containers from fire area if you can do it without risk.
- Ensure that the fire has been successfully suppressed. Propane fires burn very hot and can smolder. This type of fire may continue to burn after it appears the fire has been successfully suppressed.
- If the flame is extinguished without stopping the fuel flow, the air/fuel mixture may reignite.
- Direct water flow at the point of flame impingement so that the internal tank pressure of the burning tank drops to the point where the pressure relief valve closes and the tank valve can be manually closed.

Hydrogen and Hydrogen-Powered Vehicle Fires

Because hydrogen flames are nearly invisible in daylight and hard to detect, special flame detectors should be utilized at all times (see Figure 82). A UV optical sensor that detects a pale blue flame is an excellent piece of equipment to have on hand to sense the presence of a hydrogen flame. If this is not available, the next best “tool” is a common straw broom (see Figure 83).



Figure 82: A thermal conductivity sensor, catalytic combustion sensor, or electrochemical sensor can be helpful in detecting an alternative fuel fire, as many of these fuels have flames that are nearly invisible. Source: NAFTC.

burn until the hydrogen completely vents to the atmosphere. During this time, crews may utilize a water stream or fog pattern from a maximum distance to prevent exposures or to control the path of smoke, taking care not to extinguish hydrogen-fed flames. Small fires can be extinguished with carbon dioxide or dry chemical extinguishers. Daylight fires can be detected by heat waves. If fire is extinguished before all the gas burns off, watch for gas pockets that may suddenly reignite.

When dealing with a hydrogen fuel cell electric vehicle, the high-voltage battery can release dangerous gases even after the fire is extinguished. Also, remember that an FCEV's high-voltage battery **ALWAYS** has voltage.

IMPORTANT NOTE:
If the fire is large, evacuate the area and let hazmat contain it.



Figure 83: Hydrogen flame detected by broom. Source: AFDC.

The flame may appear yellow if there are impurities in the air like dust, sodium from ocean spray, etc. A pure hydrogen flame will **NOT** produce smoke.

The best way to handle a hydrogen fire is to let it burn under control until the hydrogen flow can be stopped or the fire is burned out. If the hydrogen gas has ignited, call 911 and stay back a safe distance and allow the hydrogen gas-fed fire to

Electric Drive Vehicle Fires

In the case of a high-voltage battery pack fire, use only a Class ABC powder type fire extinguisher. **NEVER** open a sealed battery pack. A Type 1 Class D fire extinguisher may be used to smother the fire. Another option is to let the battery burn itself out. Take special precautions to avoid direct contact with the skin and eyes and ingestion or inhalation of acid mist. A light water spray can be used to abate toxic chemicals in the air.

Also, with electric drive vehicles, it is important to remember that even though conventional gasoline remains the primary fuel for many of these vehicles hydrogen powers fuel cell electric vehicles.

IMPORTANT NOTE:

Remember that high-voltage batteries are located within a protective case. **DO NOT** attempt to remove the cover or cut into the battery to extinguish the fire. Batteries in some electric vehicles contain an electrolyte that is very corrosive. Lead acid batteries have a sulfuric acid-water solution as the electrolyte. NiMH batteries contain potassium hydroxide as the electrolyte solution.

Towing Procedures

Use wheel-lift or car carrier equipment with proper tie-down devices (see **Figure 84**). Additional ramping may be required when loading onto a car carrier. Before beginning a tow of an alternative fuel or advanced technology vehicle, it is recommended that you first review the information in the vehicle Owner's Manual, as each vehicle can have unique instructions.

For towing information on specific makes and models of alternative fuel and advanced technology vehicles, refer to Owner's Manual and/or the vehicle manufacturers' (OEM) Emergency Response Guide from OEM website.

NOTE:

It is the towing equipment operator's responsibility to assess the proper loading, tie-down and service procedure to be used in any given circumstance.



Figure 84: Flatbed tow trucks are commonly used in transporting alternative fuel vehicles. Source: AP Images.

Towing an Alternative Fuel Vehicle

Towing an alternative fuel vehicle is the same as towing conventional vehicles. The two main considerations are the fuels and tanks. Be sure to check for spills or leaks and always be aware of the type of fuel tank or cylinder and its location. **NEVER** connect any equipment to an alternative fuel tank or cylinder.

Spills and leaks can occur with alternative fuel and advanced technology vehicles, as with any other vehicles. See section on alternative fuels Spills and Leaks for additional information starting on page 46.

Information on Alternative Fuel Vehicle Fuel Storage and Components can be found starting on page 41.

Towing an Advanced Technology Vehicle (Electric Drive)

Electric drive vehicles have many unique features, and there are a lot of differences, even between the different manufacturers, so rule number one is not to assume you can tow all electric drive vehicles the same way.

IMPORTANT NOTE:

Electric drive vehicles have varying recommended ways for towing. **DO NOT** assume they are all the same.

Unique features that can impact towing:

- **ALWAYS** assume the vehicle has power and high voltage exists. There is no guarantee that the high-voltage system, airbags, or fuel pump are disabled.

See information on Disabling the High-Voltage System starting on page 40.

- These vehicles commonly have a smart key. Locate the smart key and remove it at least 25 feet (7.62 meters) away from the vehicle to avoid any chance of the vehicle being restarted.
- For many electric drive vehicles, the OEM has not approved a wheel lift procedure. Car carrier equipment is the overall manufacturer's preferred method of transporting most electric drive vehicles. Additional ramping may be required when loading onto a car carrier.
- Often an eyebolt is provided to assist with car carrier loading. The eyebolt threads into a receiver in the front bumper. If the eyebolt is not available, nylon straps can be placed around the lower control arms as a means of attaching to the vehicle. Wheel strap tie-downs are recommended for securing the vehicle as there are no accessible reinforced slots in the body (see **Figure 85**).



Figure 85: Wheel strap tie-downs are often recommended for securing the vehicle. Source: AP Images.

- On some automatic transmission vehicles, there may be a shift interlock override. An override may be provided on or near the shifter area. For some models, this may also be located under the cup holders by the gear shift. In most cases, the override can be accessed by using a screwdriver type tool to remove the plug. Once removed, press the release button while attempting to shift the vehicle out of park.
- Some electric drive vehicles have no conventional neutral in the transmission, which will make pushing the disabled vehicle more difficult because the electric motor/generator system is also being turned. Also, if towing it from the front with its rear drive wheels rolling, the electric motor will continue spinning. Because the vehicle isn't on and its liquid cooling system active, friction from that spinning could heat the motor to the point of destruction if the vehicle is towed for some distance. This could also cause a problem if the vehicle is flat-towed by a tow strap. In that case, it could generate electricity that could overheat the motor/generator. Hybrid electric vehicles will not generate electricity unless they've been turned on, which requires a charged 12-volt battery.
- Some electric drive vehicles may also utilize an electronic parking brake. If this is the case, an electric motor is used to apply and release the parking brake. The key is often required to release the parking brake. Keep in mind, though, that there may not be a way to override the system. Use caution and avoid pressing the brake button if you do not have access to the key, as you may set the brake and then not be able to release it. To determine if a specific vehicle model has an electronic parking brake override, please refer to the vehicle's Owner's Manual.
- In all cases, avoid contact with the **ORANGE** or **BLUE** cables, as they house high-voltage wiring. Some wiring for the high-voltage electrical system runs under the vehicle.

Roadside Assistance

Jumpstarting

Jumpstarting alternative fuel vehicles is basically the same as jumpstarting conventional vehicles. However, jumpstarting advanced technology vehicles (electric drive vehicles) has some differences that the towing service provider needs to understand.

The following safety precautions are intended to help protect your personal safety and prevent damage to the advanced technology vehicle you are jumpstarting.

IMPORTANT NOTE:

Before performing a jumpstart on an advanced technology vehicle, it is recommended that you first refer to the vehicle Owner's Manual, if available, or the OEM's Emergency Response Guide.

The major considerations when jumpstarting an advanced technology vehicle include:

- 1) The vehicle very likely uses a keyless starting system, or smart key system. This, combined with the minimum starting and/or running noise of electric drive vehicles, can pose some potential safety issues.
- 2) Very often the 12-volt battery is located in the back of the vehicle, or in other areas such as under the seat, instead of its standard under-the-hood location;
- 3) Many electric drive vehicles have a "boosting pin" located in the underhood fuse panel, or "jump pins" located under the hood near the fuse panel, to be used for jumpstarting the vehicle.

If the vehicle uses a keyless starting system, take possession of the key fob before beginning a jumpstart procedure and remove it at least 25 feet away from the vehicle. This will prevent the vehicle from being started prior to the towing provider being ready.

If the vehicle is not equipped with boosting pins or jump pins, you should follow normal jumpstarting procedures even though you may be connecting to the 12-volt battery in the trunk, or other areas of the vehicle. If this is the case, you will most likely have to remove carpeting and/or other battery access covering.

If the trunk of the vehicle with a discharged battery will not open, try removing the metal key from the key fob to unlock the trunk.

To jumpstart using a boosting pin, lift the plastic fuse box cover to reveal the positive boost pin. Make the ground connection on the engine. Then follow normal jumpstarting procedures.

To jumpstart using a jump pin, keep in mind that sometimes the positive pin may only have a contact surface on one side. Ensure that you are connecting your jumper cables properly. With other vehicles, the positive pin is under a red cover. Then follow normal jumpstarting procedures.

DO NOT attempt to perform a jumpstart on the 12-volt battery at the same time that the high-voltage battery pack is being charged. Doing so may damage the vehicle or charging equipment and could cause an injury.

IMPORTANT NOTE:

Jumpstarting provides power to the 12-volt system to allow the electrical systems to operate. The electrical systems must be operating to allow the high-voltage battery pack to be charged. Jumpstarting does not charge the high-voltage battery. If the vehicle is pure electric, the high-voltage battery pack must be charged before the vehicle can be driven.

IMPORTANT NOTE:

The high-voltage battery pack is separate from the 12-volt system. The high-voltage battery pack should never be compromised. If the issue is with the high-voltage battery pack, the vehicle should be towed to a trained automotive service provider.

WARNING!

If done incorrectly, jumpstarting can lead to a 12-volt battery explosion, resulting in severe injury or death. It could also damage your vehicle. Always follow standard jumpstarting safety procedures.

Starting the Vehicle

After the jumpstart connection is made, if the power switch does not switch to READY to drive position, or the vehicle will not remain running, the 12-volt battery may have to be replaced. Tow the vehicle to a trained automotive service provider.

IMPORTANT NOTE:

Most electric drive vehicles cannot be used as a booster vehicle because they cannot supply enough power to start a gasoline engine.

IMPORTANT NOTE:

A common misconception with hybrid electric vehicles (runs on fuel plus battery power) is that the electric motor will provide enough power to get you to a gas station if you run out of gas – but this is not always true. Many hybrids completely shut down if they run out of gas. There's no coasting—even if the main battery is fully charged. Some do, however, continue to run on battery power but not for long; maybe two miles if you are lucky.

For additional information on specific alternative fuel and advanced technology vehicles, refer to the Quick Reference Guide (QRG), or refer to Owner's Manual or OEM Emergency Response Guide from OEM website.

Changing a Flat Tire

Some alternative fuel or advanced technology vehicles may not have a spare tire (see **Figure 86**). Electric drive vehicles are usually equipped with an inflator kit, which is normally stored in a compartment on the driver's side of the rear cargo area. Follow the instructions provided in the kit. Always refer to Owner's Manual or the specific OEM Emergency Response Guide, usually available for download from the OEM website, for more information.



Figure 86: Not all alternative fuel vehicles have a spare tire. Source: AP Images.

Converted vehicles may place tanks, batteries, or other conversion devices in or near the spare tire area. Use caution when looking for the spare tire.

Lock-outs

For most alternative fuel and advanced technology vehicles, unlocking the vehicle is a standard process and will vary little from conventional vehicles. However, if the vehicle is an electric drive vehicle, be sure the vehicle is turned off before attempting to unlock the door. Electric drive vehicles are extremely quiet and it may appear the vehicle is off while it is running idle.

Fuel Service

When responding to an alternative fuel or advanced technology vehicle fuel service call, it is important that the dispatcher gather as much information about the type of vehicle as possible, specifically how it is fueled.