



Additional Hazard or Information Sheet

Alternatively Powered Vehicles

Document Overview

Initial information to both inform and assist Incident Commanders in dealing with this subject matter:

Incidents involving Alternatively powered vehicles, e.g. RTCs, fire or vehicles leaking fuel

Alternatively powered vehicles (Hybrid, Electric, Hydrogen and Dual Fuel/LPG)

1 Hazards

- └ Lithium batteries can create hydrogen (water increases intensity of fire)
- └ Explosion risk (battery/fuel tank)
- └ Toxic fumes
- └ High voltage electricity (250volts - 600volts)
- └ Caustic/corrosive (alkaline-potassium hydroxide)
- └ Unexpected movement of vehicle
- └ Highly flammable gas
- └ Extreme cold
- └ Explosion
- └ Flammable atmosphere
- └ Irrespirable atmosphere
- └ Hydrogen burns with an invisible flame

2 Actions

- └ To avoid the vehicle's travel path, approach from the side to disable and immobilise, as the vehicle may appear to be shut off when it is actually in "ready" mode.
- └ Gather information
 - Vehicle markings/badge
 - High voltage cables (orange)
 - Additional battery vents
 - Dashboard "ready" indicator
 - In cab information (Crash Recovery and Auto data.)
 - Identify if high voltage system is damaged (orange cables)
 - Identify if fuel tank/system is leaking
 - Isolate potential ignition sources
 - Visual/audible clues, sound of cylinder leaking etc
 - Use a TIC to assess Hydrogen fuel fires



- ┌ Do not cut or touch any high voltage cables marked in orange. Always treat high-voltage cables as if they were energised.
- ┌ To render the vehicle safe:
 - Approach from the side and Chock the tyres, place the transmission in park or neutral, and engage the parking brake.
 - Remove ignition key to a place of safety
 - Disconnect conventional 12/24v battery.
 - Isolate the high voltage batteries using the service isolator switch if accessible. (Use insulated electrical gloves.) High voltage cable system can remain energised up to 10 minutes after it has been isolated.
- ┌ Due to the additional weight of batteries and fuel systems, stability of a non wheel resting vehicle (roof or side) weight distribution should be taken into account.

3 Further considerations

- ┌ When cutting, always consider the location of high-voltage wiring.
- ┌ Manufacturers recommend a minimum time to allow the high-voltage system to de-energise (residual charge to dissipate). This may vary among manufacturers but are typically between five and ten minutes.
 - Although isolation will shut down the voltage flowing through the system the battery remains fully energised.
- ┌ When dealing with a fire in a hybrid vehicle an offensive strategy can be implemented following a suitable DRA. However, if the battery pack is on fire consider allowing the battery to burn out rather than to attempt extinguishment
 - It is nearly impossible to get enough water directly onto batteries because of their protective shell.
 - If the battery pack is allowed to burn out, it negates the concerns regarding the hazmat properties of the residual electrolyte. Ensure that the battery pack is cooled down enough to prevent re-ignition prior to releasing the vehicle. Consider using a thermal imaging camera (TIC)
 - Beware of high-voltage components following a fire; the effects of fire can render system safety features inoperable so components can remain live after exposure and there is no guarantee that the system is de-energised
- ┌ **Submerged vehicles**
 - Whilst there is little risk of electric shock from touching an electric vehicle (EV)/electric hybrid vehicle (EHV), whether it is in or removed from the water, normal safety precautions should be adhered to, i.e. do not touch high-voltage components or cables.



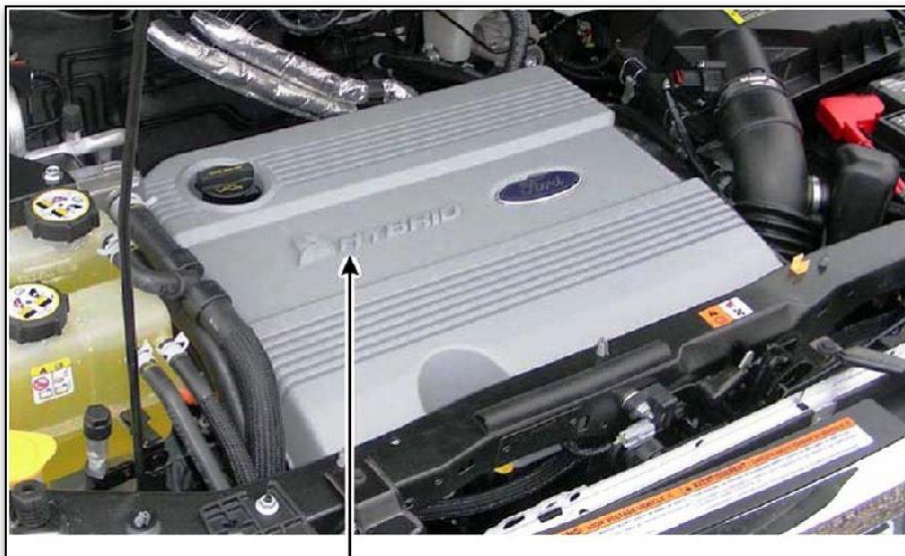
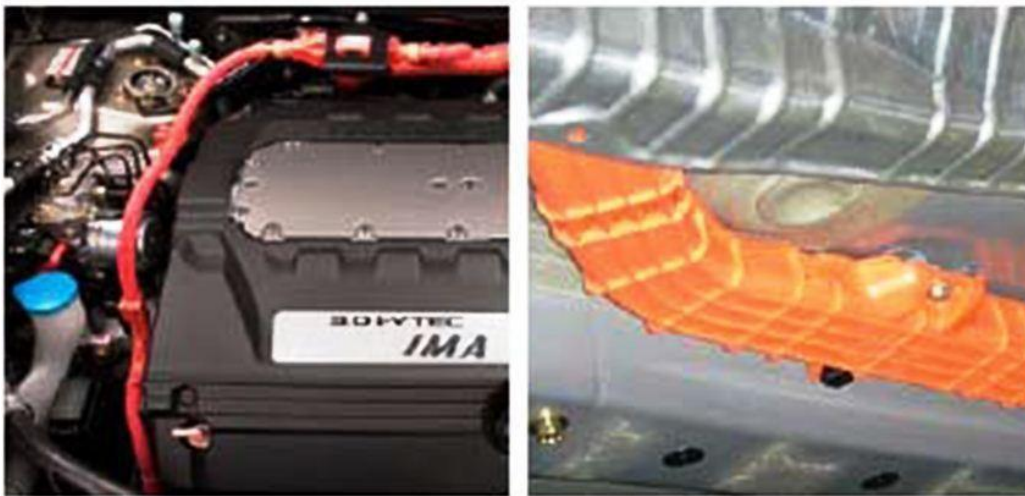
4 Supporting information

Hybrid identification - Hybrid vehicles are very often not identified by badges or signs. However, if they are, they can be on the rear boot or tailgate, rear door trims and under the bonnet on the engine cowling. **Orange cables** under the bonnet or **orange shielding** bolted to the undercarriage; indicate that the vehicle is hybrid (see picture below).

Car models may have an 'h' in their model identification, for example Lexus (LS600h).

When approaching **any** vehicle, great care should be taken until it can be confirmed how the vehicle is powered. Carry out a thorough 360 assessment.

In hybrid vehicles, high voltage cables are mainly substantial in size and primarily identifiable by ORANGE insulation and connectors, but can also be other colours.



Unique hybrid engine appearance cover

FUEL CELL / HYDROGEN VEHICLES

A Hydrogen vehicle is powered by a device called a **fuel cell**, which converts hydrogen to electricity, giving off only heat and water as byproducts

- └ The Hydrogen tanks are usually stored in the bottom of the vehicle, this must be considered for some extrication techniques
- └ Some Hydrogen vehicles may have technical components in the C-pillar such as ventilation channels and low voltage cables
 - Hydrogen gasses are highly flammable and burn with invisible flame at high temperature.
 - If the burning vehicle is in a garage or enclosed area, where possible pull the vehicle out into the open to prevent further spread of fire by the leakage of hydrogen.
 - If the safety valve is triggered and depending on tank size it can take around 5 minutes before the hydrogen tank is empty.



Dual Fuel/Bi Fuel vehicles / LPG, LNG, CNG

- └ LPG – liquefied petroleum gas
- └ LNG – liquefied natural gas
- └ CNG – compressed natural gas

Fire

- 25 meter safety distance for appliance and cordon
- BA must be worn for fire fighting
- Apply cooling to the tank asap
- Do not extinguish a jet of flame from pressure relief valve unless risk critical.
- Fire fight to remove heat source.
- Consider a covering jet.
- Consider defensive fire-fighting strategy, use of available substantial cover and monitors.
- Liaise with HMEPA.

- Consider public evacuation for projectile hazard.

If tank is not directly affected by fire:

- Prioritise actions to protect tank from fire and radiated heat.
- Extinguish fire.

Leak:

Reposition appliances more than 25m from incident. Establish initial 25m cordon (fireball risk):

- Cordon size may need to increase for larger vehicles – liaise with HMEPA.
- Consider wind direction and slope.
- Within cordon BA should be worn.
- Avoid direct contact with Cryogenic substances (LNG).
- Eliminate ignition sources.
- Isolate leak if possible.
- Consider use of a spray to disperse un-ignited vapours. Do not attempt to ignite the escaping gas.
- Consider environmental impacts e.g. pooling, drains, low lying areas, vapour cloud.

RTC

└ Identify any damage to fuel system.

Consider impact of any operations on the integrity of fuel system.

Document References

1. Technical references

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