

ELECTRIC/HYBRID VEHICLE EXTRICATION

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Category:

Administrative

PURPOSE: Vehicles extrication is a process that continually evolves as new makes and models of vehicles come onto the market. Everything from vehicle design to construction materials can change, and those updates may mean a new approach must be used to safely remove occupants from a vehicle. One of the more major changes in recent years is the growing popularity of electric and hybrid cars and trucks. Their unique systems can pose a problem for rescuers who aren't familiar with their design and operation.

DEFINITIONS:

Electric Vehicle (EV): An electric vehicle is a vehicle that runs fully or partially on electricity. E-Vehicles use an electric motor powered by a fuel cell or batteries. (60 -330 Volts DC)
Electric vehicles present a potential for electrocution from energy stored in battery packs.

Hybrid Vehicle: A hybrid vehicle is powered by an internal combustion engine that works in concert with an electric motor. An onboard generator produces electricity, and integral software manages its output, directing it to a battery pack.

Thermal Runaway: An uncontrolled increase of cell temperature caused by exothermic reactions inside the cell. A hazardous condition caused by a chain reaction within a battery cell which can be very difficult to stop once started. Causes of thermal runaway – exposure to excessive temperatures, short-circuit, mechanical destruction, penetration, or impact.

Weight Classification:

- **Small Class** – Curb weight 2965 lbs., Battery Weight 680 lbs.
- **Compact Class** – Curb weight 3406 lbs., Battery Weight 645 lbs.
- **Middle Class** – Curb weight 3551 lbs., Battery Weight 890 lbs.
- **Upper Class** – Curb weight 5048 lbs., Battery Weight 1618 lbs.

The average weight of an electric car is about 4000 lbs, which is 750 lbs heavier than a gas-powered car. Although EV electric motors are only about 60% as heavy as a comparable petrol engine, electric vehicle batteries can weigh between 650 and 3000 lbs.

PROCEDURE:

Size-Up: Upon arrival, the officer in charge shall size-up the situation informing other responding apparatus of the vehicle type involved and the nature of the problem including vehicle fire and/or extrication. This should include the extent of the fire and if it is a compartment fire or includes the electric components of the vehicle. Special attention shall be made to identify any and all placards and/or labels that may provide essential information to the Incident Commander for the safety of all persons involved.

Standard Operating Procedures are meant only to be guidelines. Actual conditions may warrant alternative actions.

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Extrication: For extrication, particularly stabilization or lifting tasks, that involves a trapped occupant, the floorpan-mounted battery box must be considered off limits to rescuers. Do not lift the vehicle by pressing against the battery box. Do not place any stabilization equipment, such as cribbing and struts, in contact battery box. One task that really hits home with responders is jacking or rolling the dash to free occupants. All operations for a floorpan-mounted battery, should be conducted to avoid puncture or otherwise bend the floorpan, due to the battery lying beneath floorpan. Crushing or bending the battery can short out cells that are within the modules of the battery and quickly cause a reaction.

1. Establish a safe work zone through department policy and establish tactical priorities (life, property and environment)
2. If you detect leaking fluids, sparks, smoke, flames, increased temperature, gurgling, or bubbling sounds from the EV battery compartment, assume there is a battery fire and ventilate the passenger area (i.e., roll down windows or open doors).
3. Rapid extrication may be needed for injured or trapped occupants.
4. Evacuate others from the immediate area if any unusual odors or eye, nose, or throat irritation is detected. Wear full PPE, with SCBA and face piece, toxic byproducts will be off gassing.
5. Ensure the vehicle is in park and off (if possible – secure key fob at least 30 feet from vehicle) chock wheels before attempting any extrication.
6. If not visible fire, Thermal Imaging Camera usage should be considered. Be alert! For a potential delayed fire with damaged lithium-ion batteries.
7. DO NOT attempt to pierce the engine or battery compartment of the vehicle to allow water permeation, penetration of HIGH VOLTAGE components could occur.
8. Following extinguishment, use a thermal imaging camera to determine the temperature fluctuation of the high voltage battery before terminating the incident, to reduce re-ignition potential.
9. At least one hose-line shall remain operational until the vehicle is removed from the scene or rendered safe if the vehicle cannot be moved immediately.
10. Place High Voltage (HV) warning tape on all four sides of vehicle.
11. If necessary, place Bio warning tape on all four sides of vehicle.

POST INCIDENT: Brief the towing company an operator on the hazards, including;

- To provide a 50' clear space around the vehicle once stored
- Do not store inside a building.

Safety:

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- Batteries should always be treated as energized and pose an ongoing risk to first responders and incident investigators.
- During overhaul do not make contact with any high voltage components.
- EV motors run silently, never assume power is shut off. Never assume that an EV will not move.

Manufacturers no longer exclusively identify high-voltage hybrid electric cables and connectors by the color orange. It is now possible to have high-voltage wiring color-coded orange, bright blue or even yellow. Some hybrid vehicles use two different colors for their high-voltage electrical system on the same vehicle!

NEVER CUT ANY CABLES IDENTIFIED ABOVE!