Optimus Ride Chrysler Pacifica Platform

First Responders Interaction Report

Version 1.1, March 9, 2021

Optimus Ride HQ Contacts

****

****

Introduction

- The purpose of this document is to provide first responders with information needed to safely interact with a Chrysler Pacifica outfitted with an Optimus Ride Automated Driving System (ADS).
- This guide is meant to highlight the differences between an Optimus-ADS-equipped Pacifica and a conventional Chrysler Pacifica.
- The guide details the vehicle and ADS power systems which include both Li-Ion high-voltage batteries and standard Lead Acid 12V batteries.
- Standard safety measures that apply to a non-ADS equipped vehicle should be carried out in accordance with the FCA 2017 Pacifica Hybrid Emergency Response Guide*.

*Full URL:
https://www.nfpa.org/-/media/Files/Training/AFV/Emergency-Response-Guides/Chrysler/Chrysler-Pacifica-PHEV-2017-2018-ERG.ashx?la=en

Table of Contents

Emergency Contact Information

- The point(s) of contact for all vehicle vehicle-related incidents are vehicle operators. Each vehicle will always have at least one certified vehicle operator.
- In the event vehicle operators are not able to act as the Optimus Ride point of contact, first responders may contact Optimus Ride at:

Boston, MA
******
******

Washington, DC / Reston, VA
******
******
******

New York, NY
******
******

Fairfield, CA
******
******

Vehicle Identification

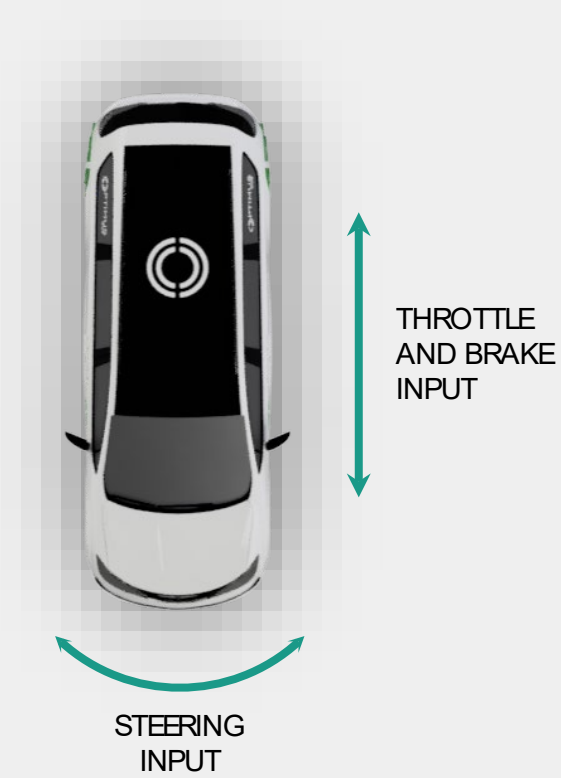
The Optimus Ride autonomous vehicle is a modified Chrysler Pacifica. These vehicles are easily identified by “Optimus Ride” decals on both sides of the vehicle. Individual vehicles are identified by license plate(s) and other jurisdiction-specific identifiers.

Vehicle Registration and Insurance

Vehicle registration and insurance information, along with a copy of this guide, are located in the passenger glove compartment.

Autonomous Capabilities

- The Optimus Ride Automated Driving System is capable of controlling the steering, throttle, and brake as well as various other vehicle functions such as drive mode (i.e. PRNDL) while operating within designated, pre-mapped areas.
- When the Optimus Automated Driving System is generating control inputs to the vehicle without manual input, the vehicle is said to be in autonomous (auto) mode.
- When the Optimus Automated Driving System is disengaged, the vehicle can be driven normally.



Disengaging the Optimus Automated Driving System

Shift and Parking Brake Indicators

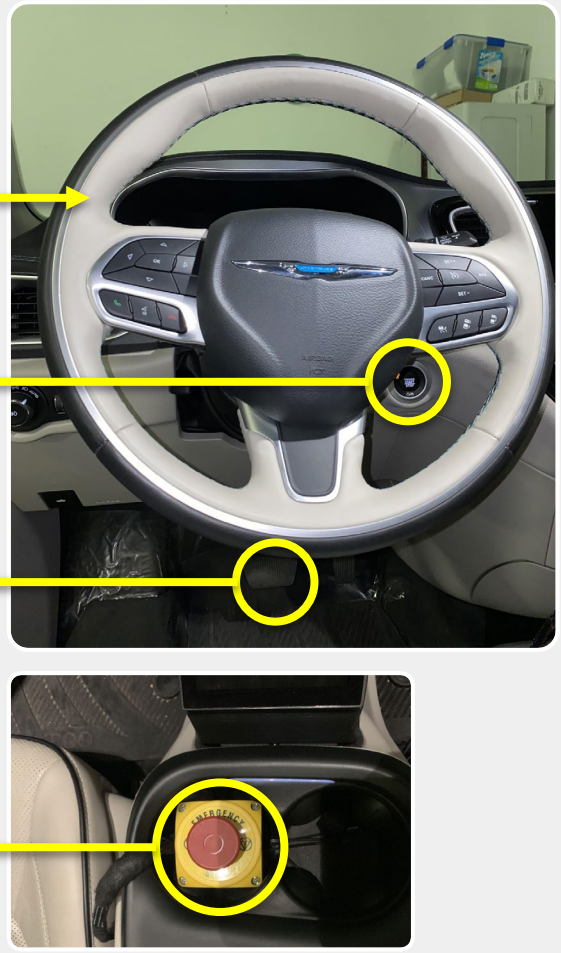
1. The gear shift is located on the center console, to the right of the steering wheel.The vehicle is in park when the blue indicator is lit above the “P”.
2. The vehicle automatically turns on the parking brake when the vehicle is in park and any door is open. This is indicated by a red light.

These are standard, non-ADS procedures.
See the FCA guide for more details.

Disengaging Autonomous Mode

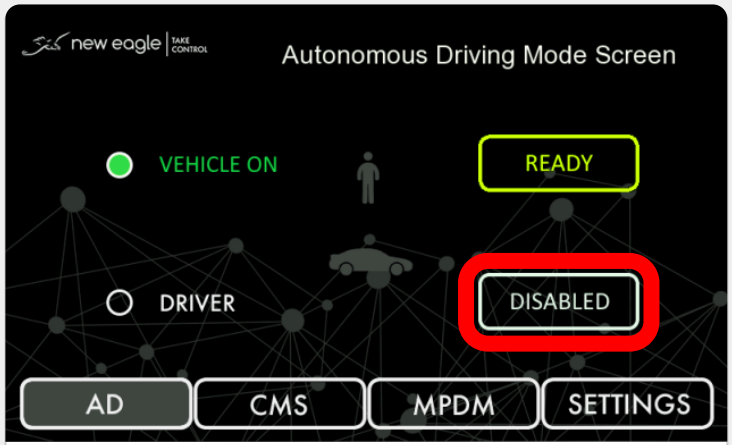
Autonomous mode can be disengaged by any of the following actions:

1. Pressing the brake pedal
2. Pressing the throttle pedal
3. Manually turning the steering wheel
4. Turning the vehicle off
5. Depressing the red E-STOP button located in the cupholder between the driver and front passenger seats



Verifying Autonomous Mode Disengagement

AUTONOMOUS MODE IS **DISENGAGED** IF



Interface Shows DISABLED

This screen is located between the front seats

OR

If Cruise Control is OFF

Indicated by the absence of a speedometer symbol in the upper, right-hand corner of the driver driver-side dashboard

Turning the Vehicle Off

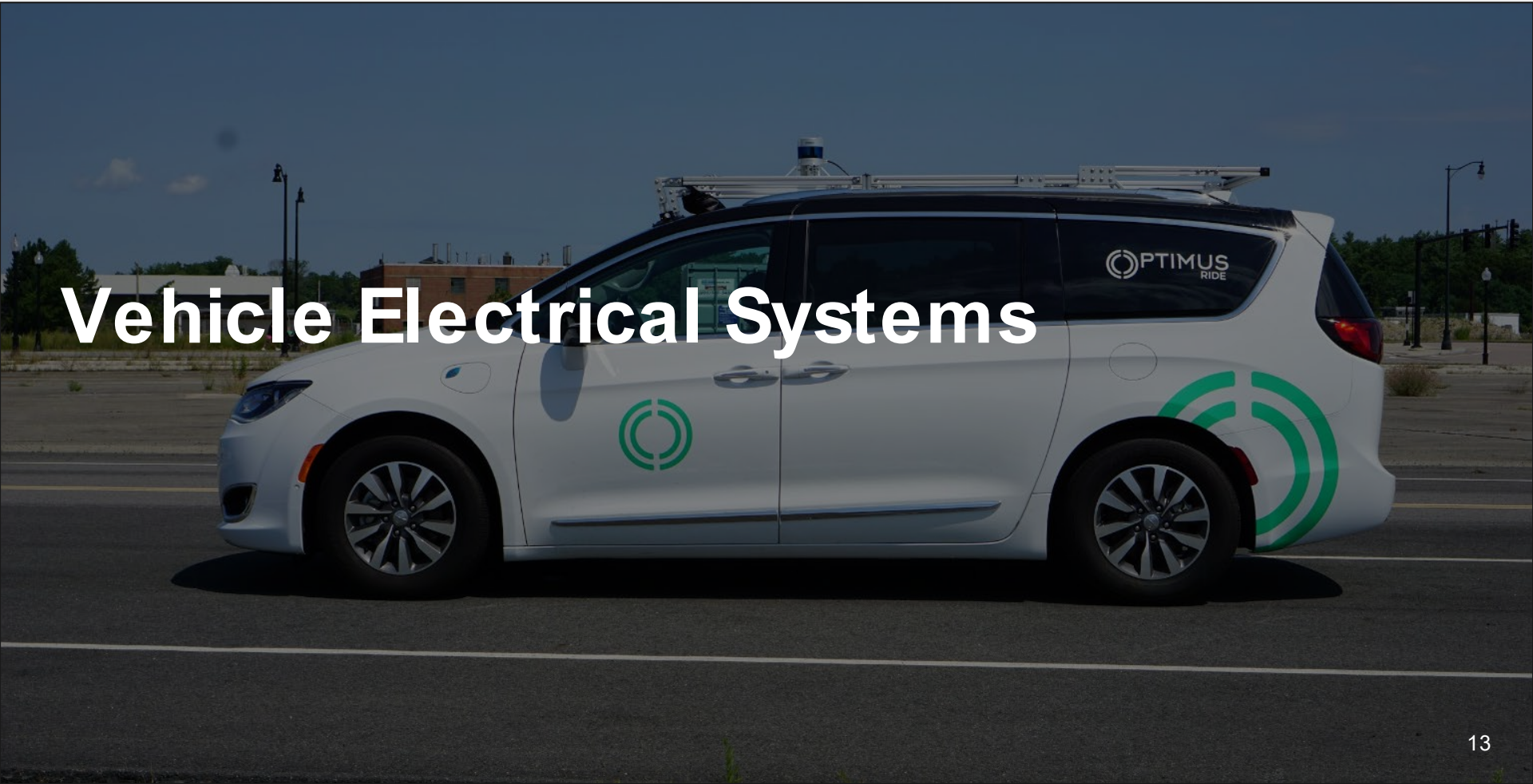
Turn the vehicle off by pressing the ignition button, located to the right of the steering wheel.

OFF indicates the car is **OFF**

RUN indicates the car is **ON**

In the event that the ignition switch does not turn off the vehicle, a 12V low power loop can be disconnected either under the engine hood or in the vehicle trunk.

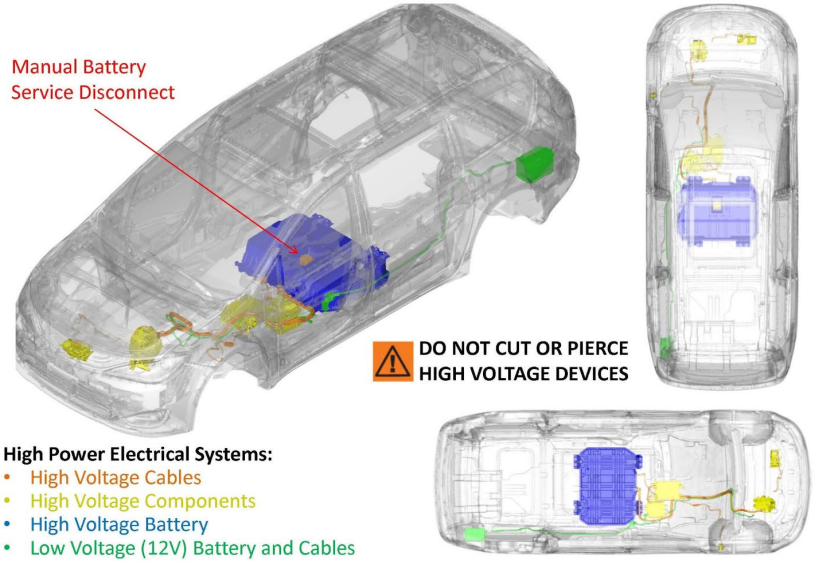
These are standard, non-ADS procedures. See page 14 through 16 for more detail and electrical disconnect information.



Vehicle Electrical Systems

OEM Vehicle Electrical Systems

Electrical Considerations

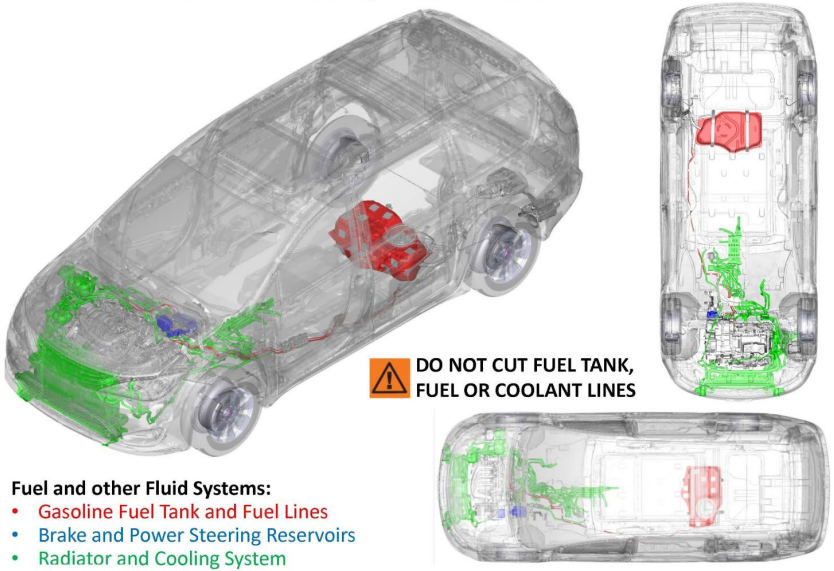


High Power Electrical Systems:

- High Voltage Cables
- High Voltage Components
- High Voltage Battery
- Low Voltage (12V) Battery and Cables

2017 Pacifica Hybrid Emergency Response Guide P.20

Fuel and Fluid Systems Considerations



Fuel and other Fluid Systems:

- Gasoline Fuel Tank and Fuel Lines
- Brake and Power Steering Reservoirs
- Radiator and Cooling System

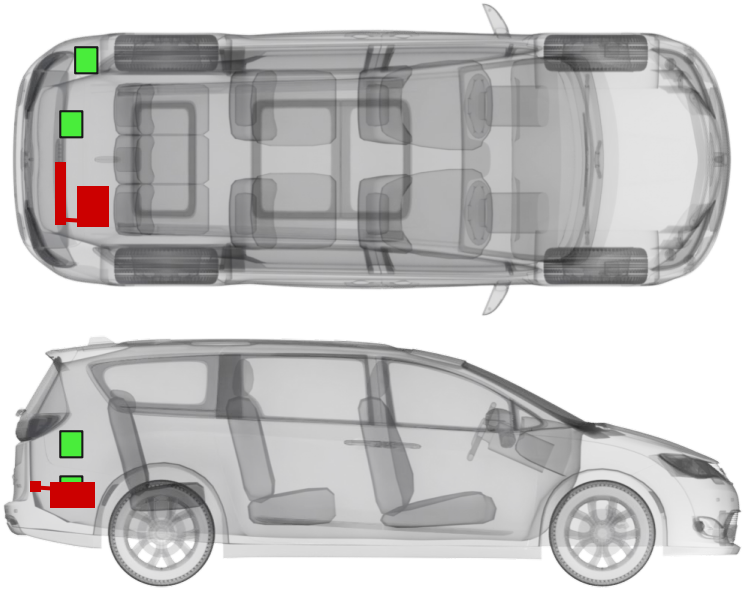
2017 Pacifica Hybrid Emergency Response Guide P.21

*Excerpt from FCA guide. Equipping the vehicle with Optimus ADS does not affect these considerations.

Additional ADS Electrical Systems

- ADS vehicles have modified high high-voltage and low-voltage wiring in the rear of the vehicle. There are two 12V batteries (standard sealed lead-acid car batteries) in the cargo area.
- The modified electrical harness does not alter OEM electrical power disengagement procedures.
- There is a 120V inverter located in the trunk of the vehicle. This may be disabled via a circuit breaker switch located near the standard 120V outlets.

12V Sealed Lead-Acid Batteries



120VAC Inverter / wiring / outlets

12V Sealed Lead-Acid Batteries

OEM Electrical Power Disengagement

High Voltage Devices

Stored HV energy in the HV Battery System (1) is provided to the 'PIM' Power Electronics (2) and delivered as three phase AC power to the Electric Motors for propulsion. The stored HV energy is used by other vehicle components including:

- The 'EAC' HV Air Conditioning Compressor (3)
- The 'BCH' Battery Coolant Heater (4) which maintains battery temperature
- The 'APM' auxiliary Power Module (5) that charges the 12 volt low voltage system & battery

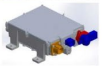
When plugged in, the HV power is supplied by the 'OBCM' On Board Charging Module (6)

(2) PIM

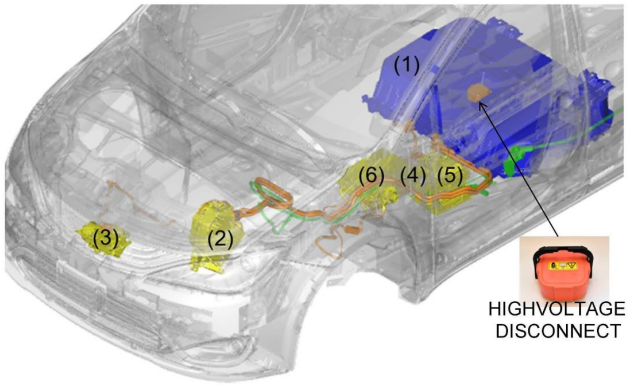
(3) EAC

(4) BCH

(5) APM



(6) OBCM



2017 Pacifica Hybrid Emergency Response Guide P.7

Emergency Disabling of Low and High Voltage Power

Procedure Step 4: (If possible safely)

Remove the Service Disconnect *This will disable High Voltage output from the battery.*

First: Uncover the Service Disconnect access cover.

Second: Unbolt the cover panel over the Service Disconnect.

Third: Remove the Service Disconnect.

Fourth: Reinstall the cover over the empty socket and replace the carpet.

The Service disconnect cover is between the 1st and 2nd row seat

2017 Pacifica Hybrid Emergency Response Guide P.12

*Excerpt from FCA guide. Equipping the vehicle with Optimus ADS does not affect these considerations.

ADS Electrical Power Disengagement

- The ADS may be *disengaged* by any of the methods listed earlier
- The ADS is highly integrated with the vehicle electrical systems and *disconnecting* power is not recommended
- Disconnecting main OEM vehicle power as listed in the previous slide will also disconnect power to the autonomous driving system and disable the vehicle.

Situational Safety Considerations

Wet Location and Firefighting

Wet Location Considerations

A vehicle submerged or flooded with water can result in protective system failures.

Excessive heat and electrolysis may take place resulting in byproducts of hydrogen and oxygen. In salt water chlorine is also a byproduct. These byproducts, trapped and concentrated by the passenger compartment, a garage, or other containment, may be in concentrations that could be explosive or corrosive and could have adverse affects on human health. Action should be taken to assure ventilation of a partially submerged vehicle and any space in which it is contained.

A vehicle **without** impact damage has HV contained to within enclosures or insulation and has HV isolated from the chassis, therefore electrical shock hazard risk is minimal. A submerged or flooded undamaged vehicle has a low electrical shock hazard risk.

A vehicle **with** impact damage presents an increased electrical shock hazard risk. If HV is open to the environment you must stay away from damaged HV components.

Warning: First Responders must use proper Personal Protective Equipment when addressing a damaged Chrysler Pacifica Hybrid vehicle.

2017 Pacifica Hybrid Emergency Response Guide P.16

Fire Fighting Considerations

Fighting electrified driveline vehicle fires poses unique challenges.

- Never cut, pierce or damage any high voltage component as serious injury may result.
- Chemical extinguishers and oxygen denial are not effective in these fires.
- Deluge with water delivered via fire hose at the maximum possible distance is the recommended practice to contain the fire and cool the reagents, minimizing risk of spread and risk of toxic emissions. This should continue after extinguishment until the pack is cool.
- Application of large amounts of water should begin at the first signs of battery smoke as water may absorb some harmful toxic emissions in the smoke.
- Ventilation of the passenger compartment, if occupied, is essential at the first sign of battery heating, smoke or fire. Batteries should be thermally assessed during initial operations and throughout rescue and remediation efforts.
- Damage, abuse, flooding or exposure to heat (such as from a vehicle fire) can initiate thermal reactions which will advance to a significant fire in lithium ion power systems.
- The Battery thermal reactions become self-sustaining at higher temperatures due to the emission of oxygen from certain constituents.
- Ongoing battery fire or heat production can facilitate the re-ignition of combustible automotive components above and adjacent to the pack.
- Lithium-ion automotive batteries can reignite due to ongoing reactions from internal heat.
- For any battery thermal event, NFPA recommends SCBA be required within fifty feet.

Rescue of persons at risk and containment of the fire with prevention of toxic gas emissions should be the goals of fire-fighting efforts.

2017 Pacifica Hybrid Emergency Response Guide P.17

*Excerpt from FCA guide. Equipping the vehicle with Optimus ADS does not affect these considerations.

Extrication and Passive Restraint Devices

Extrication Considerations

Impact event emergencies can require the extrication of victims from damaged vehicles. Determination of the need to extricate and timing must be made by incident command based on standard response practices and procedures.

When victims can be removed safely from an electrified driveline vehicle, **it may be prudent** as consequences of damage to high voltage components may evolve over time.

Potential related hazards to vehicle occupants, beyond medical condition and typical automotive impact event hazards will include:

- Fire, which is sustained by heat from a damaged battery or shorted wiring
- Exposure of high voltage potentials from damage to the isolated HV system
- Toxic gaseous emissions from a thermally active damaged battery
- Vehicle stability, or the lack there-of. Lift points indicated on page 21 should be used to immobilize the vehicle when possible before extrication activities.

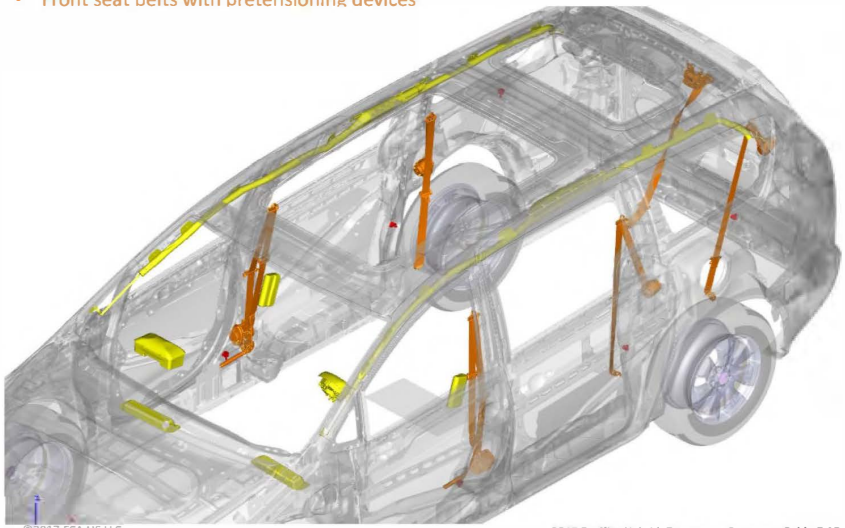
Decisions to extricate must take into account the balance between medical condition and hazard from the state of the vehicle.

Damage to fuel systems, potential hot coolant lines, all high voltage electrical components and cables, the batteries, and potentially active restraint systems must be avoided at all times. See the following pages for location information. (The "Do not cut" illustrations)

Passive Restraint Device Considerations

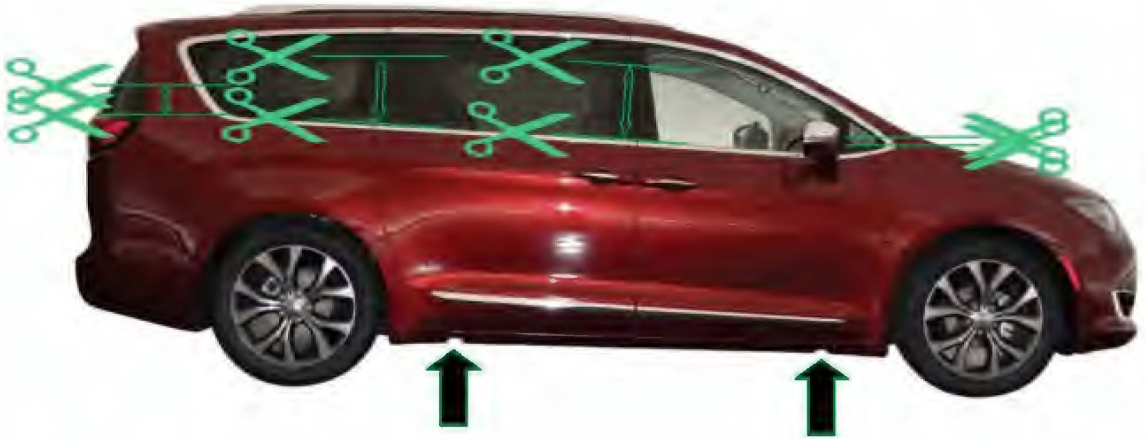
Restraint Systems:

- Front seat belts with pretensioning devices

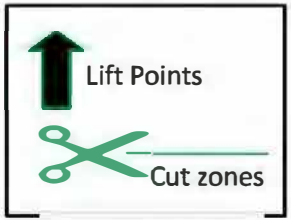


*Excerpt from FCA guide. Equipping the vehicle with Optimus ADS does not affect these considerations.

Recommend Lift and Cut Zones



The areas illustrated are recommended lift and cut zones on the vehicle. Determination of actual lift and cut points must be made by incident command based on the unique situational factors such as possible relocation of the hazards illustrated on the preceding pages as a result of impact events. These are only recommendations.

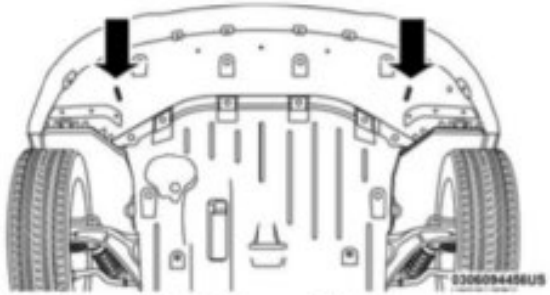


2017 Pacifica Hybrid Emergency Response Guide P.22

*Excerpt from FCA guide. Equipping the vehicle with Optimus ADS does not affect these considerations.

Towing Procedure

- An Optimus Ride employee will contact our preferred towing company on site.
- When possible, tow the car with all four wheels off the road using a flatbed.
- Prior to towing, ensure that the parking brake is off. See page 9 for details.
- If a flatbed is not available, the vehicle should be towed with the front wheels off the ground.
- In all cases, please exercise precaution to avoid damaging external sensors.



Front Recovery Points

Post-incident Handling

Following initial response, certain actions and precautions are necessary. If air bags have deployed, the vehicle cannot be driven again until repaired, as air bag protection will not be available to occupants in the event of a collision. After any collision, the vehicle should be taken to an authorized dealer immediately.

While the Pacifica HV battery is designed for safety, industry-wide experience has demonstrated that the unlikely possibility of delayed ignition or re-ignition of a damaged battery must be considered in post-incident handling. Any battery exposed to accident forces sufficient to deploy air bags or to a vehicle fire requires special precautions until verified as undamaged.

- The vehicle or battery pack must not be stored inside an occupied structure.
- Adequate ventilation must be present at the storage location to prevent buildup of any outgassing.
- Batteries to be recycled must be shipped in accordance with regulations governing the transport of damaged lithium-ion batteries (and never by air).
- Thermal monitoring of any damaged, flooded or burned battery should be performed during storage.
- The manual battery Service Disconnect must not be reinstalled by other than an authorized technician.
- The Service Disconnect socket must be covered/sealed to prevent water or debris entering the battery.

The battery pack in this vehicle uses non-spillable lithium-ion cells, and it is unlikely that electrolyte, which is clear, will escape from the pack in the event of damage. Liquid emissions from damaged packs are typically colored battery coolant, which should be addressed in the same manner as spilled engine coolant.

Do not apply chemical neutralizers used for other battery types or take any other action which could result in battery cell contents being aerosolized.

Do not ingest, inhale, or make bare skin contact with any internal material from the battery cells. In the event of accidental contact of this nature, wash exposed skin thoroughly with soap and water for at least 5 minutes and seek medical attention. In the event of ingestion, seek emergency medical care immediately.

2017 Pacifica Hybrid Emergency Response Guide P.23

*Excerpt from FCA guide. Equipping the vehicle with Optimus ADS does not affect these considerations.