



NUMBER: C1810ASD0117.05

DATE: December 2017

TITLE: MY17 - MY18 Revero Recovery Guide

APPLICABILITY: Karma Revero

MARKET REGIONS: North America

PURPOSE: This guide contains recovery procedures for the Karma Revero. Karma Automotive has created these instructions and illustrations showing the suggested recovery procedures to help prevent personal injury and damage to the vehicle when transporting/recovering. It also covers issues which include a vehicle that is immobile for multiple reasons, e.g., discharged battery, a flat tire, a missing key, etc.

PROCESS OVERVIEW:

Vehicle Recovery

1. Recovery Guide Details
2. Emergency Rescue Card / Electrical System Safety Features
3. First Aid
4. Personal Protection Equipment (PPE)
5. High-Voltage Work & Safety Practices
6. Electrical Test Equipment
7. Disable High Voltage Electrical System – Using Manual Service Disconnect (MSD)
8. Emergency Low Voltage Disable Locations
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1. Recovery Guide Details

NOTE, CAUTION, AND WARNING

While reading through this guide, you may come across a NOTE, CAUTION, or WARNING. Each one is there for a specific purpose:

NOTE: Calls for attention to a unique/additional detail or essential information related to the subject procedure.



CAUTION: Identifies a hazard that could damage the vehicle or property.



WARNING: Identifies a hazard, to yourself or others, that could result in severe injury or death.

1.1. Guide Acronyms

A/C – Air Conditioning
 AC – Alternating Current
 APM – Accessory Power Module
 DC – Direct Current
 DIS – Driver Information System /
 Instrument Cluster
 ESS – Energy Storage System
 HV – High Voltage
 HVAC – Heating Ventilation Air
 Conditioning
 HVIL – High Voltage InterLock
 Hz – Hertz
 ICE – Internal Combustion Engine
 LV – Low Voltage
 mA – Milliamps
 MSD – Manual Service Disconnect
 MSDS – Material Safety Data Sheets
 OBCM – On Board Charging Module

PTC – Electrically Operated Fluid Heater
 (Positive Temperature Coefficient)
 PDU – Power Distribution Unit (fuse box)
 RDM – Rear Drive Motor
 SSB – Start/Stop Button
 (Power Mode Button)

PPE – Personal Protection Equipment

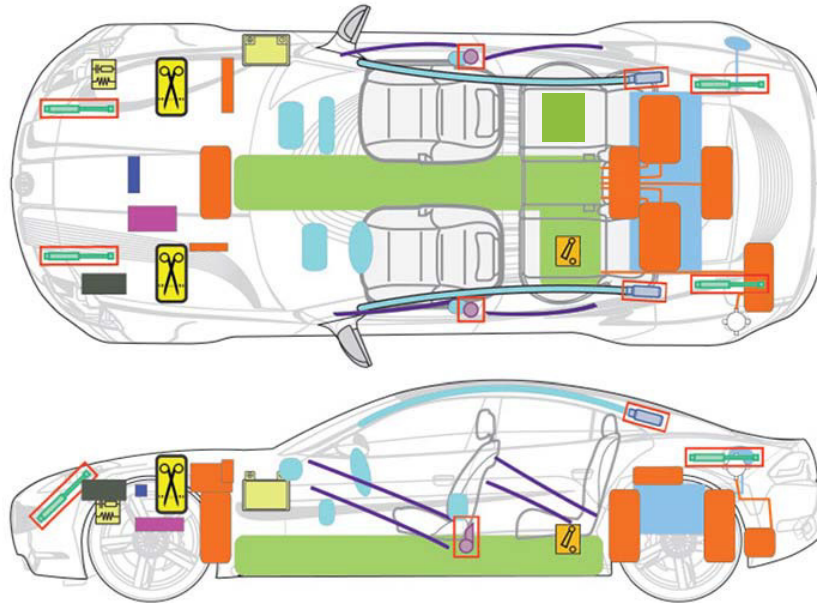
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





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2. Emergency Rescue Card / Electrical System Safety Features / First Aid



	Low voltage disable cut points		High Voltage component		High voltage disconnect points
	Airbag		Structural reinforcements		Hybrid control unit
	Gas generator		Gas filled spring device		12 Volt Battery
	Seatbelt Tensioner		Fuel Tank		High Voltage battery
	HV Charging Connector		PTC		Fusebox
	A/C				



WARNING!

High Voltage system with DC voltage up to 400V. Do not touch high voltage components.

These items can be identified by the orange cables connected to them

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Distinguishing badges:
The emblem and Karma wordmark on the deck lid the Revero Name plate on the fenders.



NOTES:

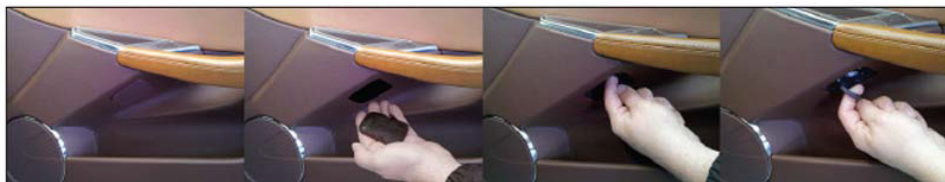
- Airbags triggered in an accident involving high-voltage equipment are energized.
- Turn off the vehicle using the Start/stop button
- 12V battery: Disconnect the negative battery cable by cutting at the label (in accidents with non-deployed airbags.) disconnect the fuse box (if intact pull fuse #10)



Manual Door Opening (Emergency Pull Rings)

In the event of a power failure, each of the doors and the trunk, can be manually opened from the inside of the vehicle by pulling the release cable located below the door handle. The trunk pull is accessed from behind the left rear seat back.

To Access the release cable press the lower edge of the cover below the door handle and remove cover



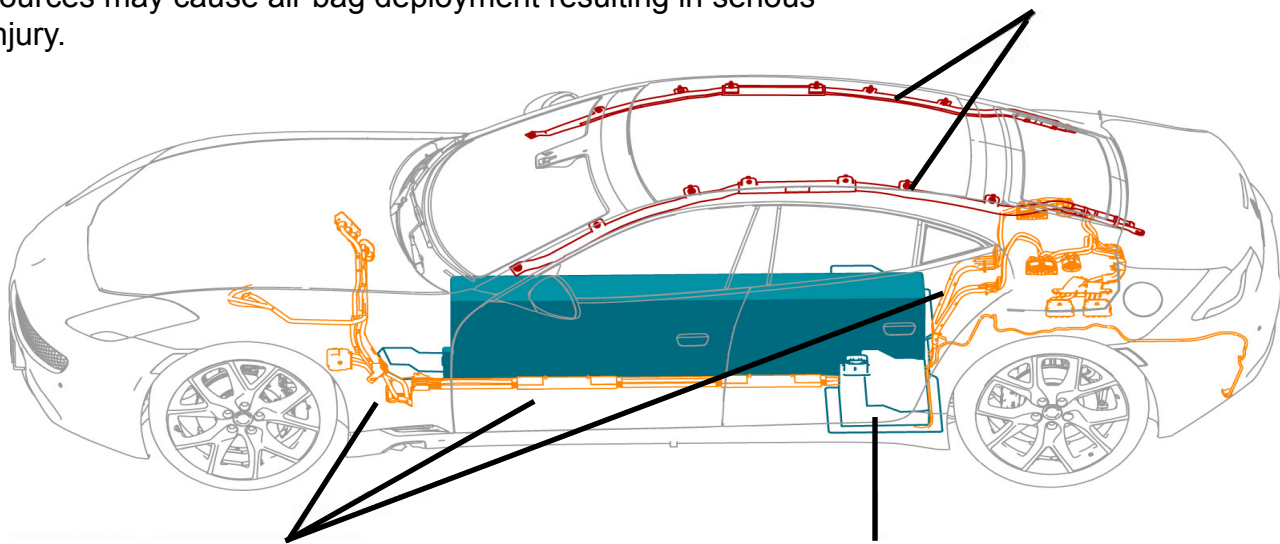
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WARNING: DO NOT cut into the vehicle until the 12v electrical system has been disabled. Cutting into the vehicle prior to disconnecting and isolating the 12v electrical energy sources may cause air bag deployment resulting in serious injury.

DO NOT CUT HERE.
Side Curtain air bags



DO NOT CUT HERE.

High voltage (400 volts) electrical cables are wrapped with orange-colored insulation and are located in the rear compartment, engine compartment, and under the vehicle.

DO NOT CUT HERE.

High voltage battery has 400 volt electrical potential at all times.

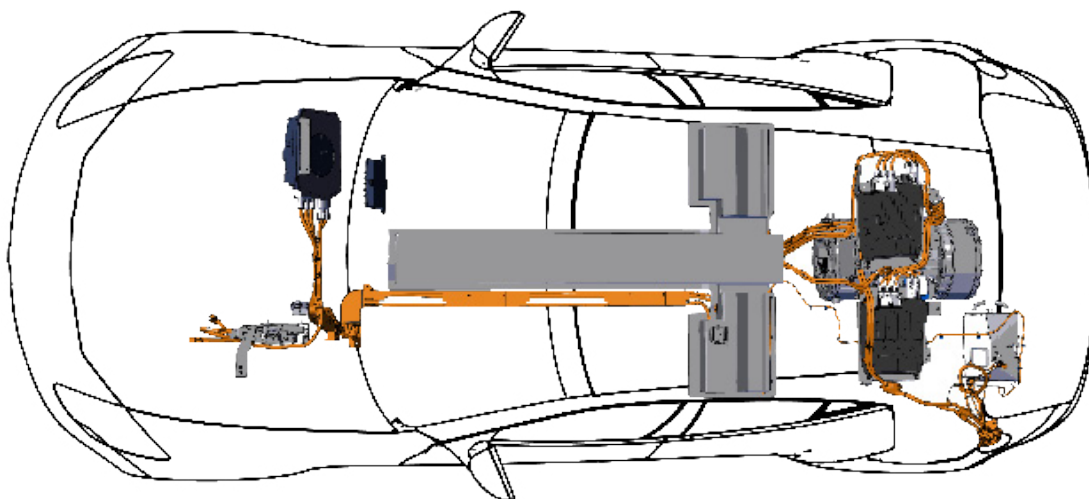
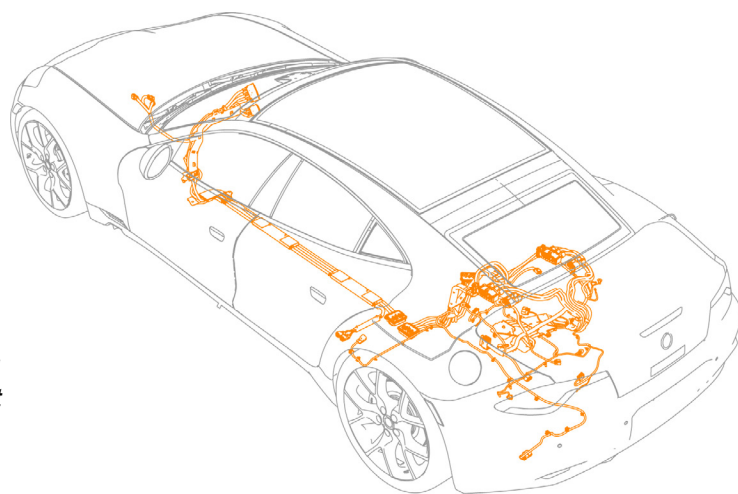
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NUMBER: C1810ASD0117.05**DATE: December 2017****TITLE: MY17 - MY18 Revero Recovery Guide****HIGH VOLTAGE ELECTRICAL DISCONNECT FEATURES**

The High Voltage Interlock (HVIL) circuit opens and disables the high voltage system whenever a high voltage connector is disconnected.

NOTE: All- high-voltage wires and harnesses are wrapped in orange-colored insulation and have a High Voltage interlock connector (except out of the RDM).

The high voltage harness travels the length of the vehicle from under the hood at the generator to the inverters located behind the rear seats. There are three (3) independent HV circuits that run to the A/C compressor, PTC (fluid heater), the Accessory Power Module (APM), the rear inverters, and traction motors.



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Approaching a Damaged Vehicle

Remove all jewelry (watches, necklaces, earrings). Metal objects are conductors of electricity.

Use a non-conductive object (about 1.5 meters / 5 feet long) or safety pole to safely push/pull someone away from the vehicle if they accidentally come in contact with high-voltage.

If the vehicle has any exposed cables, make sure to wear high-voltage rubber gloves and other protective clothing. Do not touch any broken or damaged high-voltage orange-colored cables or connectors. Treat severed cables as if they contain high-voltage.

Be aware of your surroundings and location of fire extinguishers in close proximity and how to contact the fire department.

If the vehicle is experiencing a thermal event, use a class ABC powder-type extinguisher to contain and smother the flames sweeping from the bottom to the top of the flames.

WARNING: *If the lithium battery is punctured, do NOT use water on the battery. However, if water must be used, LARGE amounts of water will be required (e.g. from a fire hydrant) to extinguish the flames.*

If the vehicle is submerged in water, do not touch any high-voltage components or orange-colored cables or connectors while extracting the occupant(s).

Do not remove the vehicle until you are sure the high-voltage battery is completely discharged. A submerged high-voltage battery may produce a fizzing or bubbling reaction. The high-voltage battery will be discharged when the fizzing or bubbling has completely stopped.

Approaching a Damaged Battery

Exposure to electrolyte could cause skin/eye irritation and/or burns. If exposed, rinse with large amounts of water until the soapy feel is gone.

Personal Protective Equipment (PPE) such splash shield or safety goggles, gloves (latex, rubber, or Nitrile) are required when handling damaged batteries.

Insure the area is properly ventilated, such as, opening the vehicle windows and doors.



Class A	TYPICAL FIRE – Wood, Paper, Cloth, Rubber, and most Plastics
Class B	CHEMICAL FIRE – Flammable Liquids, Gasoline, Kerosene, Oil, Grease, Gases, and Solvents
Class C	ELECTRICAL FIRE – Live Electrical Equipment and Wiring

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High-Voltage Battery Pack Warnings

Removing the High-Voltage Manual Service Disconnect (MSD) will disconnect the High-Voltage from the vehicle.

WARNING: *The vehicle must be turned off before removing the MSD. Refer to the "Disable High-Voltage Electrical System" chapter of this document for details on powering down the system.*

The individual cells inside the battery pack will still be charged even though the MSD has been removed.

Do not cut, weld, or screw into the High-Voltage battery case or penetrate the batteries in any way.

The High-Voltage battery pack MSD is located under the lower left-rear seat cushion.

The total voltage of the battery pack is approximately 400 volts (DC).

The battery case is designed to be water resistant.

The ESS has 15 battery packs. Each battery pack contains 21 battery cells. The battery cells contain lithium.

Lithium batteries may produce sparks or explode if punctured. Care must be taken when handling (by hand or with equipment). Do not allow to drop from any lifting equipment.

Lithium-ion batteries contain high-performance Nonophosphate technology.

Incorrectly carrying out repair procedure may result in injury or death.

Never enter a comprised area alone (i.e. vehicle or lab with burning or arcing equipment).

Do not wear jewelry or metal objects around High-Voltage circuits (such as):

- *Rings*
- *Wrist watches*
- *Exposed necklaces*
- *Badges with neck straps*



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Arc Flash Hazards

An arc flash occurs when electrical current passes through the air. Arc Flash most often occurs when a live High-Voltage circuit is unplugged without properly depowering the 12 volt system before removing the Manual Service Disconnect (MSD).

Do not unplug (or plug in) any of the orange-colored connectors with the MSD connected LIVE to the High-Voltage system. Heat generated by an arc flash can reach temperatures as high as 36,000° F (5 times the temperature of the sun).

Approximately 80% of all injuries and fatalities cause by electrical incidents and not caused by electrical shock but by the intense heat, light, and pressure wave (blast) caused by electrical faults.

The arc flash in an electrical fault produces the same type of light radiation from which electric welders protect themselves using faceshield with dark glass, heavy leather gloves, and full-coverage clothing.

The heat produced may cause severe burns, especially on unprotected flesh. An ARC BLAST is produced by vaporizing metallic components can break bones and irreparably damage internal organs.

The degree of hazard present at a particular location can be determined by a detailed analysis of the electrical system and appropriate protection worn if the electrical work must be performed with the electricity ON.



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High Voltage Electrical Disconnect Features

The following diagnostic features describe certain elements that have been incorporated in the Hybrid vehicles that allow for either manual or automatic shutoff of the high voltage electrical system.

The high voltage system is disabled whenever the high voltage Manual Service Disconnect (MSD) is removed. The MSD is protected under a black cover (latched with a tethered pin) is located under the lower cushion in the back seat on the driver's side.

NOTE: *Directions for disconnecting/powering down the HV (high voltage) and LV (low voltage) systems is located in the following sections of this guide.*

In the event of a high-current short-circuit, a high voltage fuse in the MSD will open and disable the HV system.



What To Do

In the event of an emergency, the first step is to create a safer environment.

1. *Attempt to put the vehicle in park. Press "P" on the Drive Selector Unit on the center console.*
2. *Attempt to turn OFF the Power mode (start/stop) button. Press 3x for an emergency shut off if the vehicle will not turn off with a single push.*
3. *Set the park brake button located at the lower left-side of the steering column.*
4. *Exit the vehicle safely*
5. *Contact first responder personnel. Advise them that the vehicle is a Hybrid Electric Vehicle*



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Steps to Discharge the Low & High-Voltage Systems

Follow these steps to discharge the Low and High-Voltage systems:

1. Secure the vehicle - Place the drive selector unit (PRND) switch into the PARK position.
2. Turn off the powertrain by depressing the start/stop (power) button. If the vehicle will NOT turn off, the press the start/stop (power) button three (3) times rapidly to force the vehicle to power down.
3. Disconnect the 12-Volt battery which will disable the High-voltage system

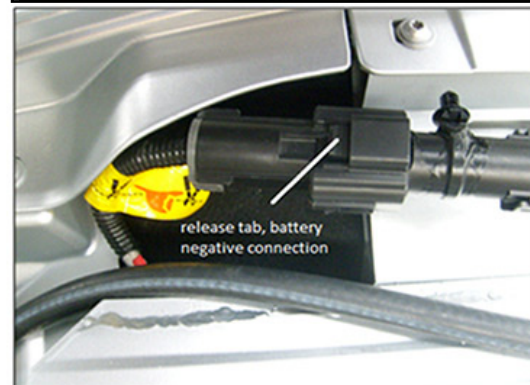


NOTE: Using the Start/Stop Button to power down the HV system will take about 5 minutes for a complete system discharge.

Residual voltage will be present in the High-Voltage circuit due to the energy stored within the capacitors (in the inverters) and the windings (in the traction motors).

In an emergency situation, cut the power cable by the APM which is identified with an “emergency cut label” on the harness.

Cutting the APM cable is NOT necessary for normal vehicle service unless 13+ volts is detected at the APM with the vehicle Start/Stop Button in the OFF position; and the negative battery cable is disconnected.



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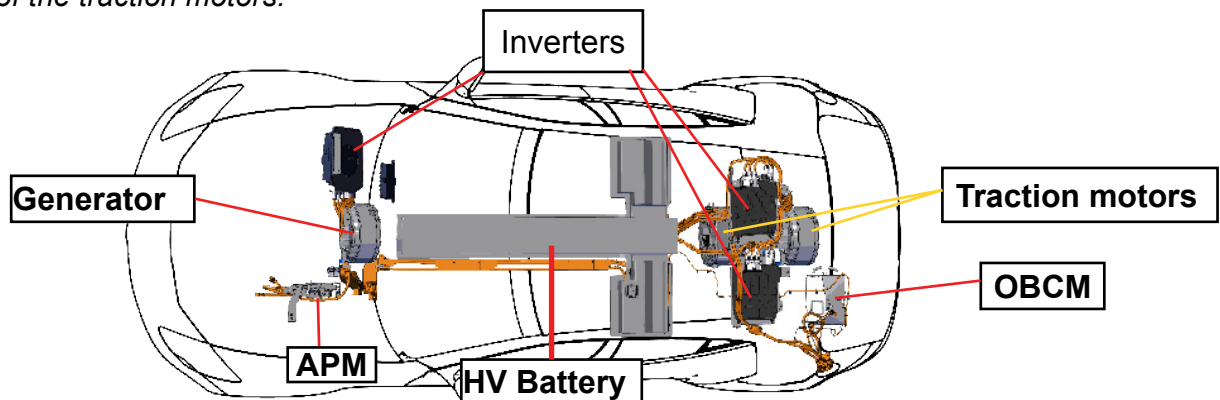
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Energy Storage System (High Voltage Battery) and Inverters

The energy used to power the Revero is stored in a 400 volt Lithium-ion (LiFePO₄) battery mounted along the center of the vehicle. The energy storage system battery shares energy with three (3) different inverters:

- *The front inverter sends Direct Current (DC) to the HV Battery when the Internal Combustion Engine (ICE) is driving the generator. The Front inverter also maintains the HV Battery voltage level. The front inverter is located under the hood on the passenger side of the bulkhead.*
- *Two additional inverters that are mounted in the trunk area (separated by a removable bulkhead panel) located over the Rear Drive Module (RDM). The inverters change between Direct Current (DC) and Alternating Current (AC) depending on the mode of operation. The inverters are used to control the duty cycle of the traction motors.*



The Accessory Power Module (APM) is a DC/DC Converter. The APM is a High Voltage component located under the hood on the driver's side steps 400 volts down to 13-14 volts of power to operate and run the vehicle's 12-volt accessories. The APM has an independent high voltage harness from the energy storage system (HV battery).

NOTE: *The emergency cut location is identified by a label located off the APM.*



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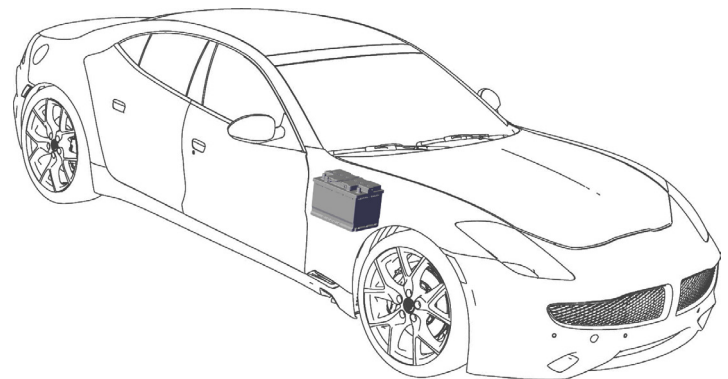
The Start/Stop Button is located where a typical key-ignition switch is located at the right of the steering column. Anytime the Start/Stop Button is in the OFF function the high-voltage system is disabled.

In the event the Start/Stop Button is in the ready function and the high-voltage battery temperature exceeds 60°C (140°F), the thermal sensors (located internal to the high-voltage battery) will automatically disable the high-voltage battery.



Low-Voltage Battery

The hybrid has a 12-Volt maintenance Free Battery which is located in the inner passenger front fender behind the wheel. The Absorbent Glass-Mat (AGM) battery stores 12-Volt power for the vehicle's low voltage system.



Warning Labels

The Revero has been designed with the maximum in driver and technician safety in mind. The vehicle has High Voltage (HV) warning labels and there are several devices that are designed into the hybrid system of the vehicle to minimize any danger from electrical shock.

However, in order to ensure your safety when working around the hybrid powertrain there are critical steps that must be performed when servicing or working around the High-Voltage (HV) system.

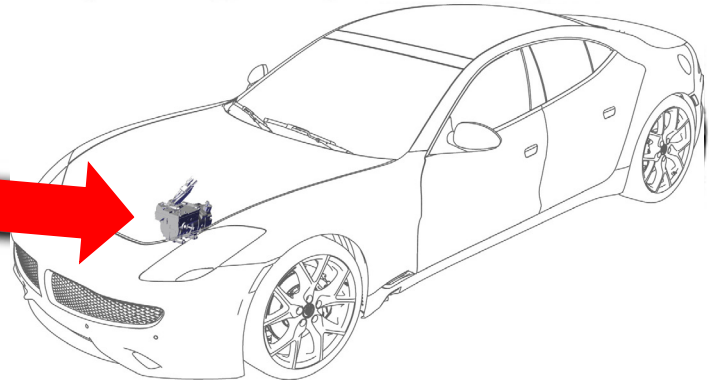
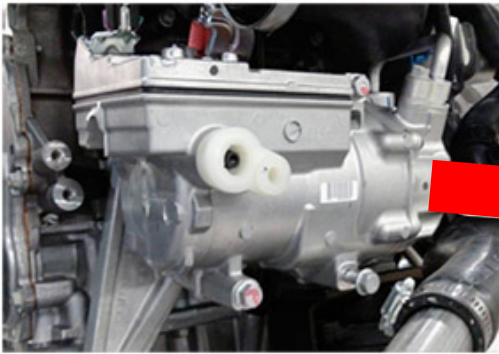


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Air Conditioning Compressor Warnings

The electric air conditioning compressor is located on the driver's side of the internal combustion engine (ICE). The A/C compressor unit has an independent high voltage harness going to the ESS.



WARNING!

The A/C compressor is a high voltage component. Follow proper safety procedures when maintaining the compressor.

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3. First Aid

First Aid

An electric shock occurs when a person comes into contact with an electrical energy source. Electrical energy flows through a portion of the body causing a shock.

Exposure to electrical energy may result in no injury at all or may result in devastating damage or death. Burns are the most common injury from electric shock.



Syptoms

A person who has suffered an electric shock may have very little external evidence of injury or may have obvious severe burns. The person could even be in cardiac arrest.

Burns are usually most severe at the points of contact with the electrical source and the ground. The hands, heels, and head are common points of contact.

Other injuries are possible if the person has been thrown clear of the electrical source by forceful muscular contraction. Consideration should be given to the possibility of a spine injury. The person may have internal injuries especially if he or she is experiencing any shortness of breath, chest pain, or abdominal pain.

Pain in a hand, foot, or a deformity of a part of the body may indicate a possible broken bone resulting from the electric shock.

Conditions for Medical Care

Following a Low-Voltage shock, call the doctor for the following reasons:

- *If it has been more than 5 years since your last tetanus booster*
- *Burns that are not healing well*
- *Burns with increasing redness, soreness, or drainage*
- *Any electric shock in a pregnant woman*

A person shocked by High-Voltage should be evaluated in the Emergency Department. It may be prudent to get pre-hospital care, usually obtained by calling 911.

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First Aid (Continued)

Go to the Emergency Department for the following concerns:

- Any noticeable burn to the skin
- Any period of unconsciousness
- Any numbness, tingling, paralysis, vision, hearing, or speech problems
- Any electric shock if more than 20 weeks' pregnant
- Any other worrisome symptoms



Inhalation: If contents of an opened cell are inhaled, remove source of contamination or move victim to fresh air. Obtain medical advice.

Eye Contact: Contact with the contents of an opened cell can cause burns. If eye contact with contents of an open cell occurs, immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes while holding the eyelids open.

Neutral saline solution may be used as soon as it is available. If necessary, continue flushing during transport to emergency care facility. Take care not to rinse contaminated water into the unaffected eye or onto face.

Skin Contact: Contact with the contents of an opened cell can cause burns. If skin contact with contents of an open cell occurs, remove (as quickly as possible) all contaminated clothing, shoes, and leather goods. Immediately flush with lukewarm, gently flowing water for at least 30 minutes. If irritation or pain persists, seek medical attention.

Clothing: Completely decontaminate clothing, shoes, and leather goods before reuse or discard.

Ingestion: Contact with the contents of an opened cell can cause burns. If ingestion of contents of an open cell occurs, NEVER give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing.

- Have victim rinse mouth thoroughly with water.

WARNING: DO NOT INDUCE VOMITING - If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Have victim rinse mouth with water again. Quickly transport victim to an emergency care facility.

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4. Personal Protection Equipment (PPE)

Personal Protection Equipment is required to work on or around high voltage systems.

PPE equipment consists of; safety glasses, insulating gloves, leather outer gloves, face shield, insulating covers, insulated glove bag (for properly storing high voltage gloves), insulated tools, and high voltage rescue hook (safety pole) (see Figure 3.A).



Figure 3.A

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WARNING!

Only trained emergency personnel and service technicians should be working in areas where there are potential electrical hazards and should be using personal protective equipment (PPE) that is appropriate for the specific work to be performed.

All PPE and electrical tools must be specifically approved, rated, and tested for the levels of voltage of which emergency personnel and service technicians may be exposed.

Fuse handling equipment (insulated for circuit voltage) must be used to remove or install fuses when the fuse terminals are energized. Ropes and hand lines used near exposed energized parts must be non-conductive.

Protective shields, barriers, or insulating materials must be used to protect personnel from shock, burns, or other electrical injuries while that person is working near exposed energized parts that might be accidentally contacted or where dangerous electric heating or arcing might occur.

Protective equipment for the eyes or face must be worn wherever there is a potential danger of electric arcs, flashes, or flying objects resulting from electric explosion. This should include polycarbonate safety glasses with side shields and a full-face shield.

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Use proper approved high voltage gloves for working on and around high voltage components.
These consist of:

- Approved rubber high voltage safety insulating gloves (see Figure 3B).
- Approved leather high voltage safety outer gloves (worn over proper insulating gloves) (see Figure 3C).



Figure 3.B

Figure 3.C



HIGH VOLTAGE GLOVES WARNING!

Failure to follow proper high voltage training procedures and usage of damaged high voltage person protection equipment could lead to serious injury or death. Insulating gloves and outer gloves are to be electrically re-tested in accordance with ASTM standards (tested every six months and ate tested or date of next test should be printed on gloves).

Before wearing approved insulated rubber high voltage safety gloves, confirm they are:

- meet ASTM standards (tested within the last 6 months).
- dry and not soiled with oil or grease.
- free of holes and hold air.
- free of metal fragments.

Before wearing approved outer leather high voltage safety gloves, confirm they are:

- meet ASTM standards (tested within the last 6 months).
- dry and not soiled with oil or grease.
- free of holes and tears.
- free of metal fragments.

Insulating protective equipment found to be defective or damaged must be immediately removed from use.

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WARNING!

Keep covers over live electrical contact points.

Verify the voltages present when working near live electrical contact points.

The area in the immediate vicinity of the workspace must be surveyed and all potential hazards such as ladders, stacked boxes, or doors that may swing into the workspace must be secured to prevent interference with the work being performed. Be mindful of unsafe working conditions such as poor lighting, flammable liquids, or flammable gases.

A clear escape path must be maintained from the work space to an exit from the area.

Minimize hazardous locations – keep the area in which airborne flammable dust, vapors, or gas may be present and would represent a hazard if a source of ignition were present.

Verify there are no metal shavings present around HV connections.

Work safely – do not sneak up and attempt to startle personnel when working in a High Voltage safety zone.

Do not wear loose fitting or conductive apparel such as rings, watches, bracelets, necklaces when working on or near High Voltage components.

Inspect your work area, set up safety cones and a hybrid safety Zone approximately 3 feet around the vehicle. The safety zone should be marked with orange cones before High Voltage service is started.

Only Karma Certified technicians are permitted to service/maintenance the Karma vehicle.

Never work alone on high voltage systems. A co-worker should be in the area.

Perform a thorough visual inspection, check for damaged wiring any exposed copper, pinched harness, cuts or missing insulation, damaged or cracked connectors.

Know where the fire extinguishers, eye wash equipment, or portable defibrillator equipment are located on site.

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6. Electrical Test Equipment

All electrical test equipment must be inspected for damage before use. The equipment must not be used if it is damaged or if its functionality is questionable.

Equipment must be handled in a manner that will not damage the equipment. Prior to each use, electrical test equipment, such as voltmeters, must be verified to be functional. This is accomplished by testing the voltmeter on a known voltage to verify correct readings.

After testing is completed, the voltmeter should again be tested on a known voltage to verify functionality of the voltmeter.

Always Measure the HV circuit to assure that it is de-energized. Check for voltage present at the APM after a 12 volt negative cable disconnect. Use an appropriate DVOM to check for voltage at the cable connection under the red cap on the APM.

If 13+ volts is present at the APM after the negative battery cable disconnect, then the contacts in the ESS may be engaged and the HV circuit is live. Carefully remove the MSD using the appropriate PPE and contact Karma Technical Support (tss@karmaautomotive.com).



Figure 6.A



WARNING!

Always assume the HV circuit is LIVE.

Capacitors on HV DC circuit can maintain HV for a short period after the Start/Stop Button is OFF or the Manual Service Disconnect (MSD) is removed.

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7. Disable High Voltage Electrical System – Using Manual Service Disconnect (MSD)

Electrical System - **HIGH VOLTAGE**

The High Voltage power system supplies 400 volts at 500 amps. In cases of an accident recovery, personal protection equipment (see Step 4) must be used. PPE equipment consists of insulated boots, class 0 (zero) grade protective gloves approved for high voltage protection (approved rubber gloves with leather over-gloves to reduce static), and eye protection.

7.1. Manual Service Disconnect (MSD) - Removal Instructions

7.1.1. To deactivate the high voltage supply to the vehicle, open the left rear door, lift the lower left rear seat cushion to unlatch it. Under the cushion you will find a boxed cover (see Figure A) with a locking pin.

7.1.2. Remove the locking pin and open the cover to expose the Manual Service Disconnect (MSD) (see Figure B).



Figure 7.A



Figure 7.B

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7.1.3. Lift outer handle while pushing in on the lower section of retention tab (as shown in figure 7.C). The outer handle will pivot to a 45 degree angle and stop.



Figure 7.C

7.1.4. Lift outer handle while pushing in on the lower section of retention tab (as shown in figure 7.D). The inner handle ring will raise while the outer handle pivots to a 90 degree angle where it will stop.



Figure 7.D

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7.1.5. Once the outer handle is vertical (90 degree angle) and the inner handle ring has risen to release the retention locks, grasp outer handle and pull the MSD upwards to separate the MSD from the Energy Storage System (ESS). When the MSD cap has been removed, the High Voltage circuit will be shunted in the middle of the battery.



WARNING!

You must wait 5 minutes after the MSD cap has been removed. Although the battery is now isolated from the system, the harness may need 5 minutes to discharge the harness and High Voltage Capacitors internal to the High Voltage components.



Figure 7.E

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8. Emergency Low Voltage Disable Locations

8.1. If access to the MSD cannot be gained, open the hood. On each side under the hood will be a black harness with a clearly visible yellow label, with a scissor illustration. Cut one of the cables at the appointed line, this is a low voltage safe system.



Figure 8A. Right-side low voltage disable location



Figure 8B. Left-side low voltage disable location

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9. Vehicle Exterior Dimensions

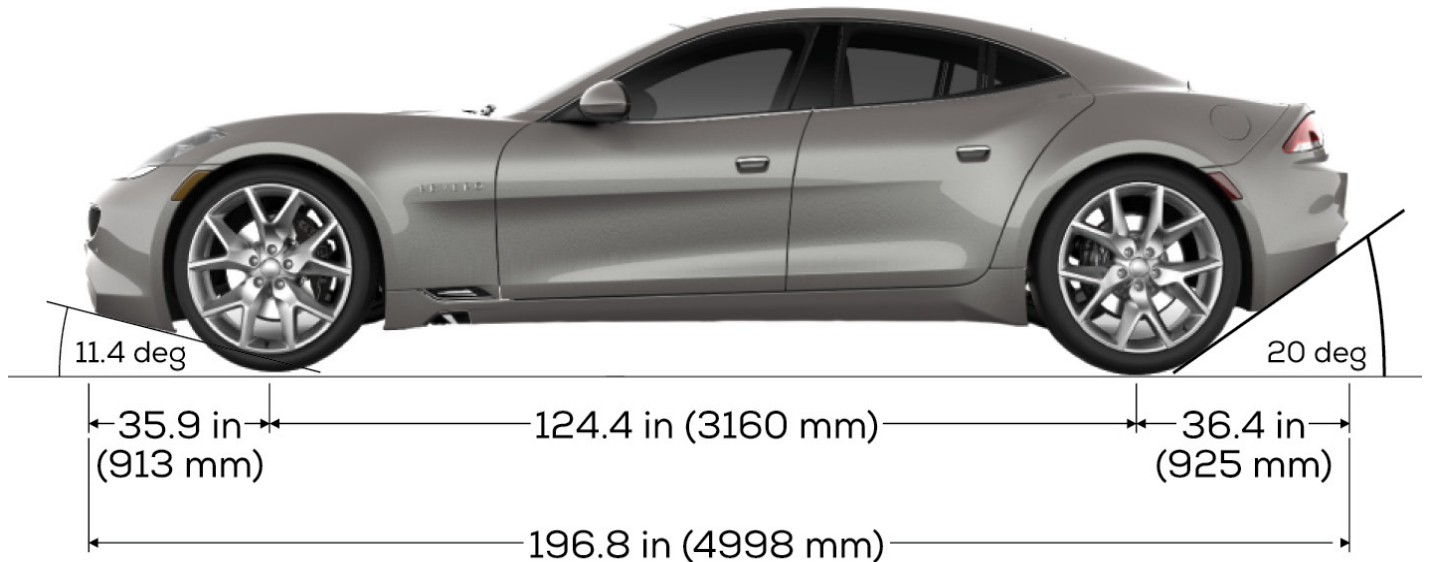
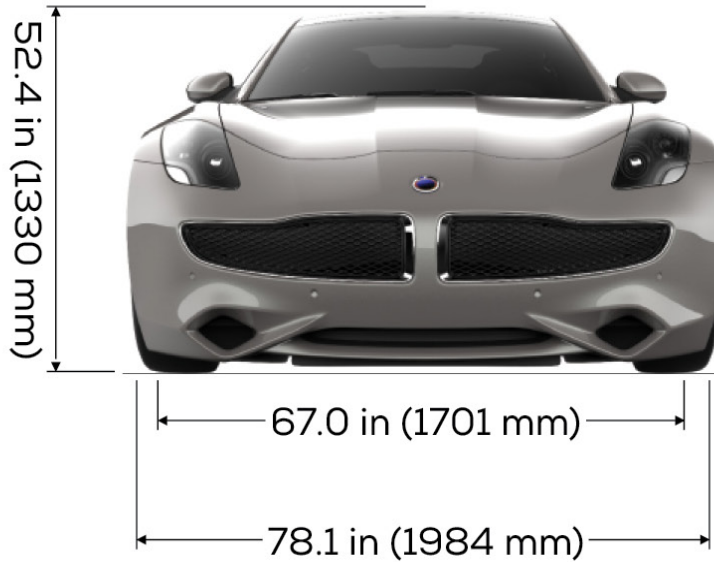
	Exterior Dimension	
Overall Length:	196.7 in. (4996 mm)	
Overall Width:	78.1 in. (1984 mm)	(mirrors folded)
Overall Height:	52.4 in. (1330 mm)	
Ground Clearance - Front:	4.0 in. (102 mm)	
Front Overhang	35.9 in. (913 mm)	
Rear Overhang	36.3 in. (923 mm)	
Wheelbase:	124.4 in. (3160 mm)	
Approach Angle - Front:	10.0 Degrees	
Approach Angle - Rear:	21.0 Degrees	
Front Track:	66.6 in. (1692 mm)	
Rear Track:	67.0 in. (1701 mm)	
Height Clearance with Hood Raised:	85.0 in. (2159 mm)	Assist the hood opening until fully raised
Vehicle Weight:	5400 lbs. (2449 kg)	
Weight Distribution:	Front 47% and rear 53%	

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10. Specialized Recovery Vehicles/Equipment



CAUTION!

Pulling the vehicle with the wheels on the ground, or on a suspended lift, may cause serious damage to the vehicle as well as generating high voltages in the vehicle's electrical components.

The only approved method of recovering or transporting your vehicle is using a flatbed trailer, transporter, or Hiab.

NOTE: Damage caused by any other recovery method will not be covered by the vehicle warranty.

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Only three types of recovery vehicle are permitted to be used on this vehicle. They consist of:

- Flatbed - 19 foot bed length (minimum requirement) (Figure 10A).
- Fully demounted flatbed - 19 foot bed length (minimum requirement) (Figure 10B).
- Hiab (integrated loading crane) - To be used if the vehicle cannot roll freely (Figure 10C).



Figure 10A. Flatbed recovery



Figure 10B. Fully demounted recovery



Figure 10C. Hiab recovery (for completely immobile vehicle)

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11. Recovery Eye

The recovery eye (Figure 11A) can be attached to the front the Karma to initiate pulling vehicle onto a recovery transporter in situations when the vehicle is able to roll freely.

NOTE: The recovery eye is located in the under-floor storage area in the trunk. If electric trunk release doesn't work, see Step 17 for manual access procedure.



Figure 11.B



CAUTION!

The front recovery eye may bind when screwing into position causing it to not fully seat into the receiver located in the front fascia. Please use the procedure below to check integrity of front recovery eye installation. Under no circumstances should the recover eye to be used if the following specification for installation has not been met. Never use the Recovery eye for transporting the vehicle, this can cause serious damage to the vehicle and possible injury. The recovery eye is for recovery only.



WARNING!

Do not use damaged or bent recovery eye.



**DO NOT USE DAMAGED
OR BENT RECOVERY EYE**

Figure 11.B

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11.1. Proper Use of Recovery Eye – Front Location

**WARNING!**

As an additional safety measure to protect against severe injury or death, be sure to use safety chains/straps on every vehicle recovery while loading, transporting, and unloading.

This procedure will prevent losing the vehicle in the event of equipment failure or vehicle breakage at the recovery eye attachment.

Safety chains/straps are intended as a back-up device and should be secured to the subframe.

11.1.1. Remove Recovery Eye Attachment Plug From Front Fascia

The recovery eye front fascia plug has a positioned retaining tab, this can be carefully manipulated from the 2 o'clock position to remove. There is a tether attaching it to the front fascia at the 4 o'clock position. (Figure 11.C and D). Be sure to align the plug properly before reinstallation.



Figure 11.C

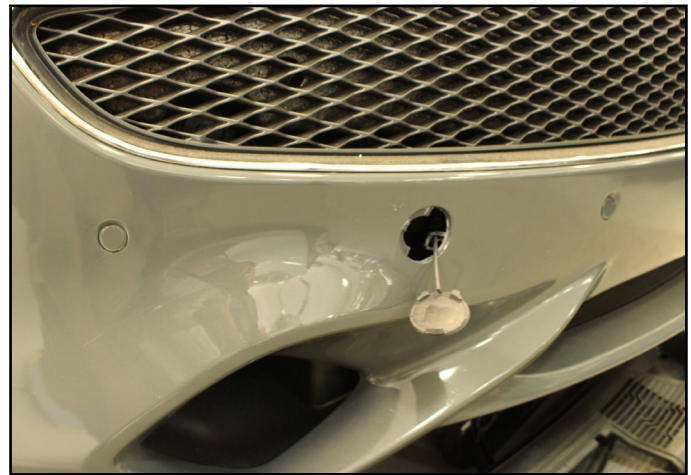


Figure 11.D

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11.1.1.1. Insert screwdriver blade at the 12 O'clock position to align blade with retaining tab of fascia plug (see Figure 11E).

- The suggested tool to remove the front fascia recovery eye attachment cover is a slotted (flat blade) screwdriver with a blade width of 3/8" (or 10mm).

NOTE: Use tools with care to protect the front fascia and fascia plug from paint and part damage.

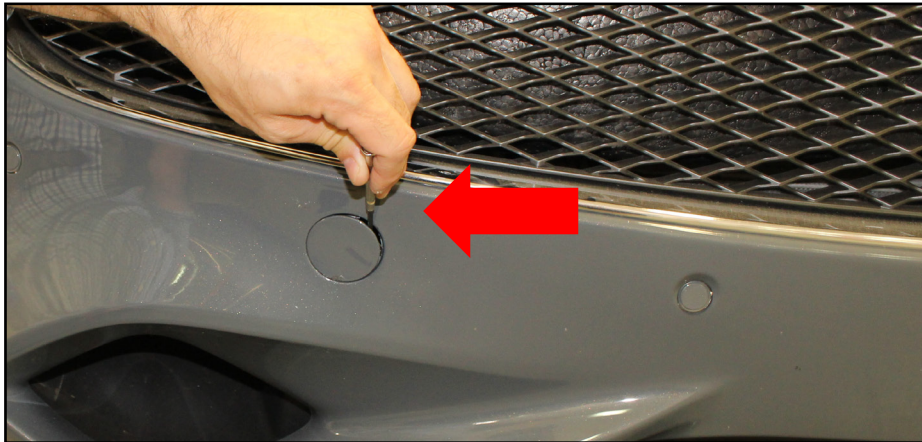


Figure 11.E

11.1.1.2. While placing a finger between the screwdriver shaft and front bumper fascia, simultaneously press screwdriver inward and pry cover outward, taking care not to damage the front fascia cover and plug (Figure 11F).



Figure 11.F

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11.1.2. Insert the recovery eye into its receiver and thread it in 10 complete turns to fully seat it.

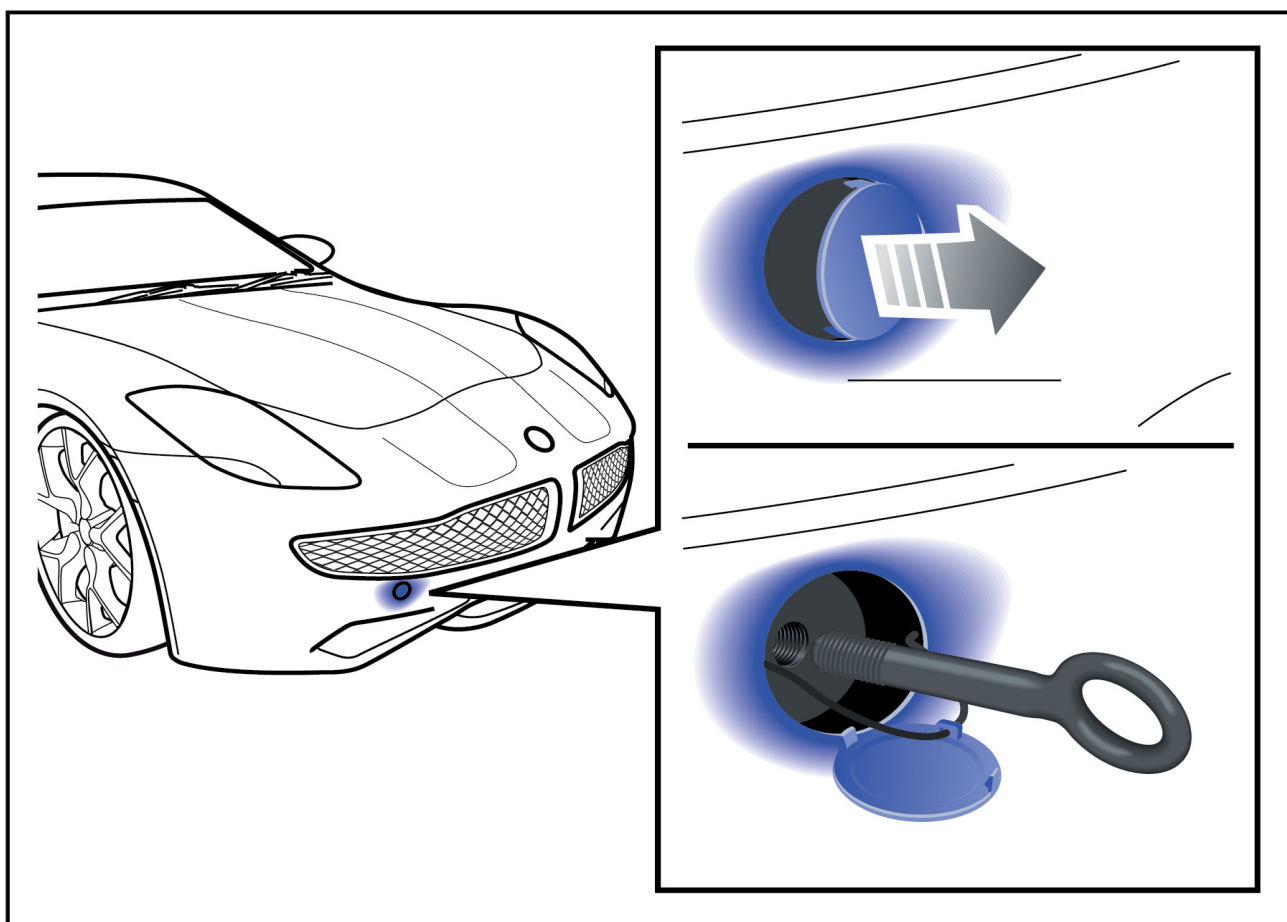


Figure 11.G

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11.1.3. Using the Figure 11H for reference:

- If the recovery eye is seated properly (see **GREEN** check mark) in the recovery eye receiver, the dimension between the front fascia and the tip of the recovery eye should measure 2.6 in (6.63 cm).
- If the dimension between the front fascia and tip of the recovery eye measures more than specified (see **RED X**), the threads of the recovery eye may not be fully engaged or the threads in the receiver may be damaged and rework may be necessary (continue on to following Step 11.2).

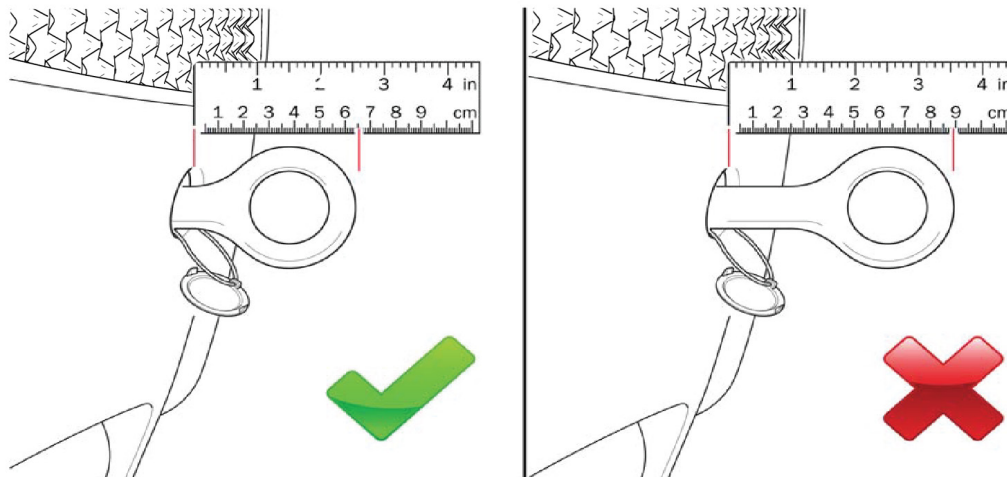


Figure 11.I. Recovery eye shown installed vertically for demonstration purposes only



Figure 11.I. Recovery eye should be in horizontal position before attaching winch cable

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- NOTE:** If recovery eye binds before 10 full turns are achieved;
- Unthread recovery eye and clean out any debris from the recovery eye receiver.
 - Add lubricant to the recovery eye and attempt to thread it into the receiver again.
 - Some leverage on the recovery eye may be necessary.
 - Multiple attempts and additional lubricant may be necessary during this process.



WARNING!

Do not use recovery eye as a tie-down, anchoring point or for tensioning vehicle to flatbed.

Misuse of vehicle recovery eye could result in severe injury to the operator and/or to others and damage to vehicle.

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12. Vehicle Recovery Procedure – For Flatbed Recovery

The Revero is equipped with a recovery eye (located in trunk). When using recovery eye it is only to be used to pull the Revero to the base of the recovery vehicle flatbed. While using the recovery eye, use nylon certified safety strap connected from the winch hook to the right-front (passenger side) lower control arm as a back-up safety measure (as shown in Figure 12B).

- Slot located in right-front control arm for attaching back-up safety strap (Figure 12A).
- Back-up nylon safety strap installed on right-front (passenger side) lower control arm (Figure 12B).



The lower control arms should not be used as a tie-down or to secure the vehicle to the recovery vehicle flatbed, otherwise property damage and/or unsafe recovery of the vehicle may occur.



Figure 12.A



Figure 12.B



Attach certified nylon safety strap to the winch hook and through slot in right-front (passenger side) lower control arm.

Failure to follow safety procedures may result in injury to the operator and/or others and property damage.

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NOTE: For proper use and additional information of recovery eye, see Section 11 of this guide.



RECOVERY EYE WARNING!

Misuse of vehicle recovery eye could result in severe injury to the operator and/or to others and damage to vehicle.



SAFETY STRAP WARNING!

Using a back-up certified heavy-duty nylon safety strap in this procedure will prevent losing the vehicle in the event of equipment failure or vehicle breakage at the recovery eye attachment.

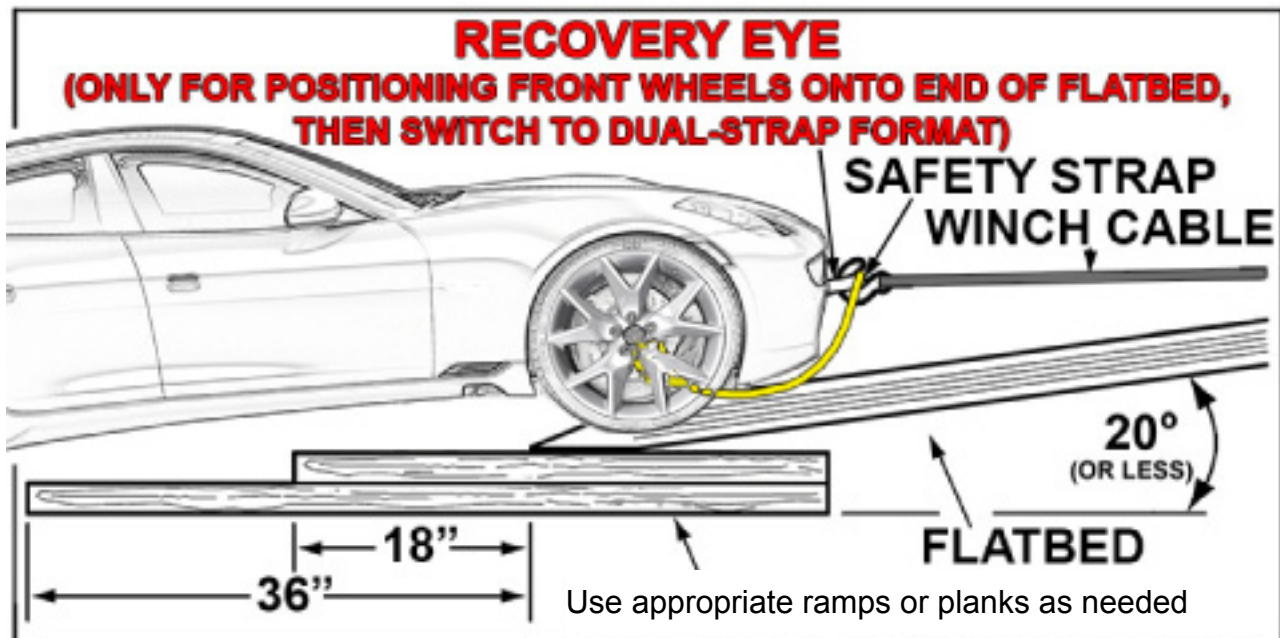


Figure 12.C

12.1. Use appropriate ramps or planks as needed on ground under base of flatbed ramp as shown in Figure 12.C.

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12.2. Ensure securing straps are attached. Press the brake and select N (see close-up photo below (Figure 12D) to allow the vehicle to roll.



Close-up of Gear Selector

Figure 12.D

12.3. Winch Revero onto the ramps and onto the base of the flatbed using the recovery eye, accompanied by a backup heavy-duty nylon certified safety strap looped through the winch hook and right-front (passengerside) lower control arm (as shown in Figure 12A and 12B).

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12.4. Figure 12E shows overhead view of winching the Revero onto the base of recovery vehicle flatbed using the recovery eye.

- The recovery eye location in fascia is offset from centerline of vehicle and requires a minimum distance of 10 feet between the recovery eye and the winch.
- The winch cable must maintain a maximum 15 degree angle between the cable and the centerline of vehicle.

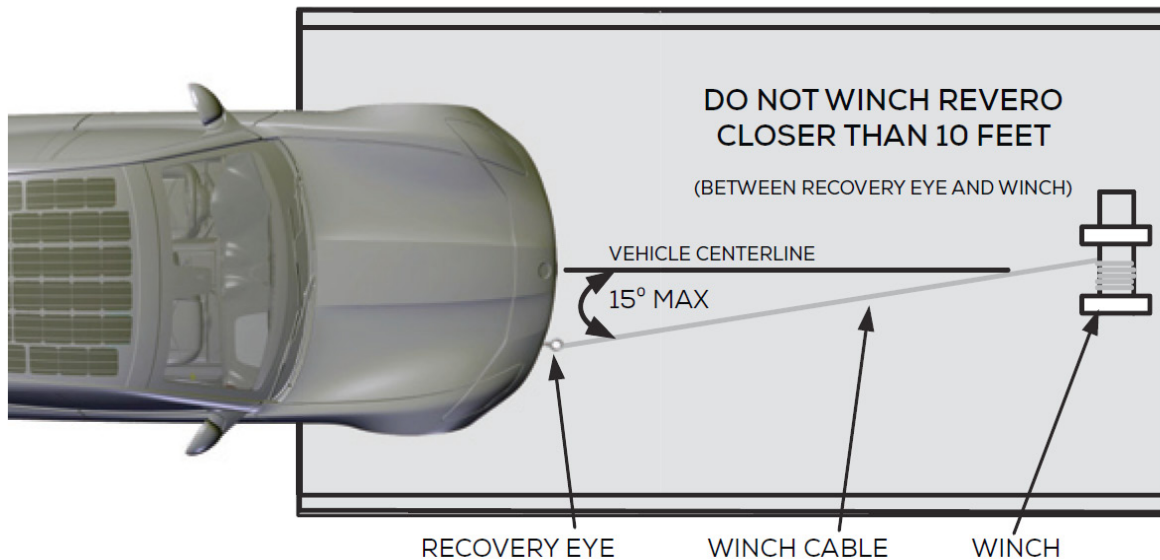


Figure 12.E

12.5. Chock rear tires/wheels to keep the Revero from rolling backward or forward.



Figure 12.F

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12.6. Remove recovery eye and back-up safety strap.

12.7. Use Figures 12F and 12G for reference to swap from the recovery eye to using safety strap format.

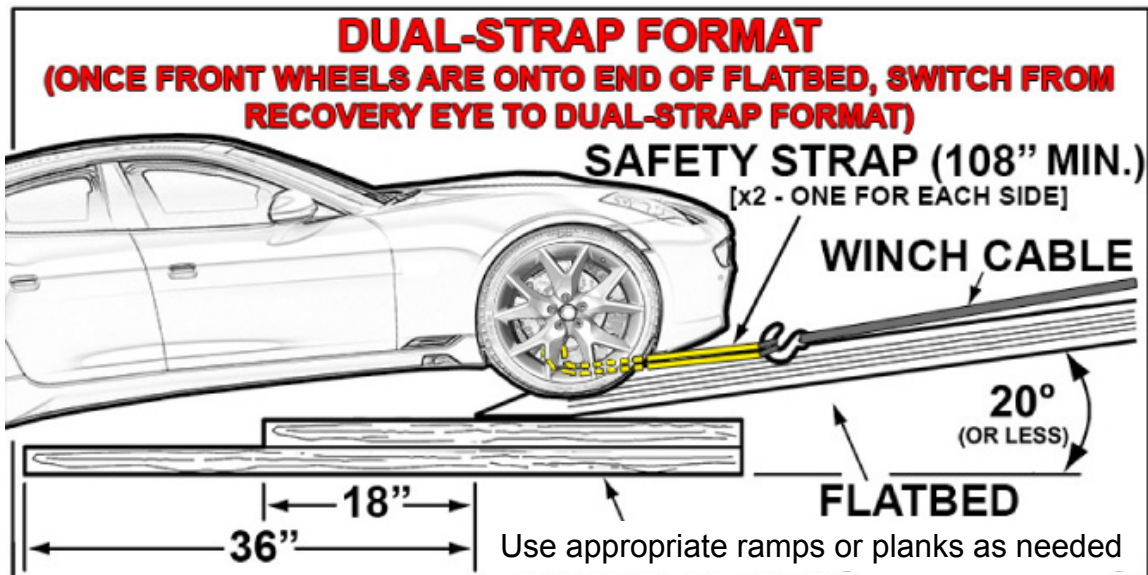


Figure 12.G

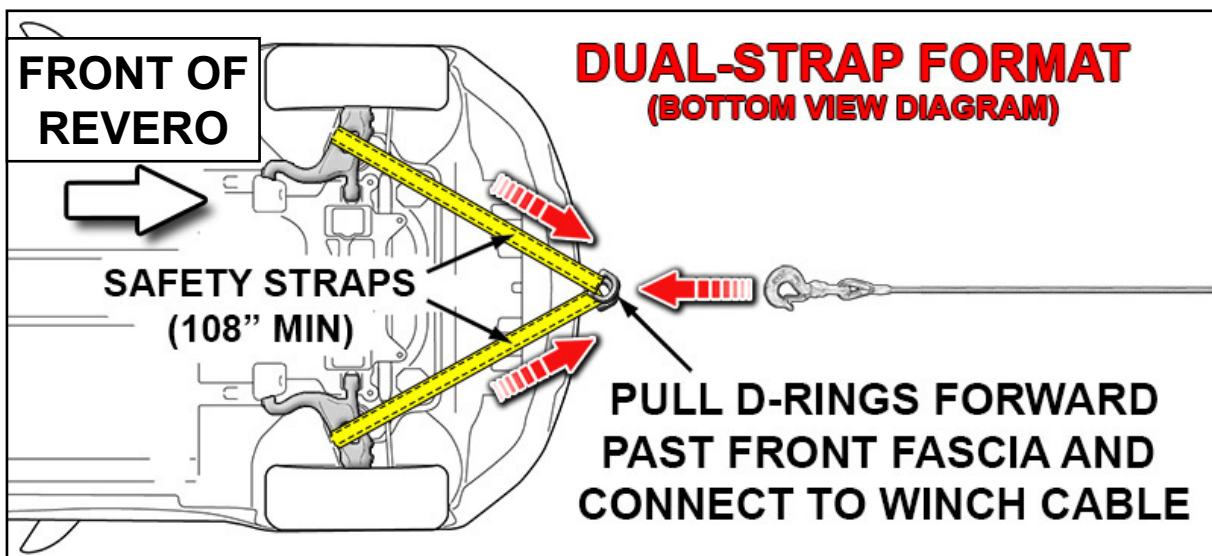


Figure 12.H

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CAUTION!

Use 2.75m (minimum length) of heavy-duty nylon safety straps certified for vehicle recovery routed through front lower control arms (as instructed in this document) are required for recovery of Karma vehicle.

12.8. Loop 108" (minimum length) heavy-duty nylon safety strap certified for vehicle recovery through left-front (passenger side) lower control arm as shown in Figure 12.I. Pull both D-Rings forward past front fascia to center-line of vehicle and attach to winch hook.

CORRECT ROUTING FOR STRAP THROUGH LOWER CONTROL ARM

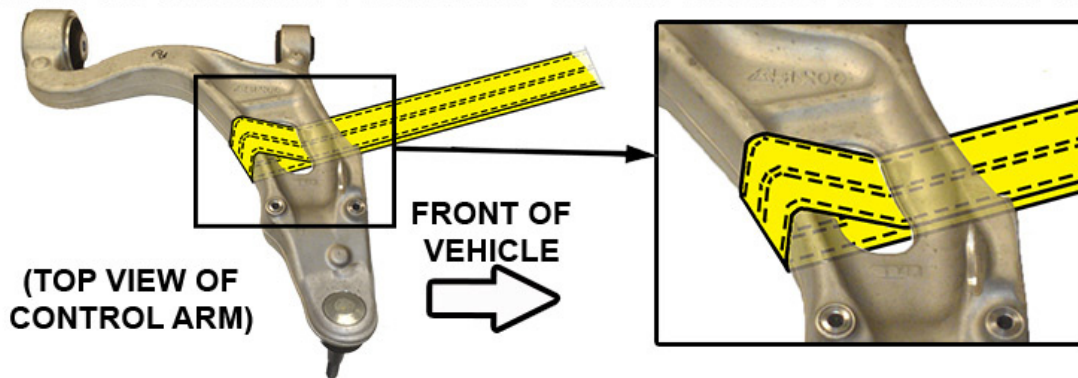


Figure 12.I

12.9. Loop 2.75m (108") (minimum length) heavy-duty nylon safety strap certified for vehicle recovery through right-front (driver's side) lower control arm (see Figure 12I for reference). Pull both DRings forward past front fascia to center-line of vehicle and attach to winch hook.

12.10. Winch vehicle into place and secure vehicle properly.

12.11. Repeat procedure in reverse order when unloading vehicle.



RECOVERY EYE WARNING!

Do not use recovery eye as a tie-down, anchoring point or for tensioning vehicle to flatbed. Misuse of vehicle recovery eye could result in severe injury to the operator and/or to others and damage to vehicle.

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13. Securing the Wheels

Once the vehicle is in position on the transporter or trailer, use chocks (Figure 13A) when securing wheels with tie down straps.

Approved vehicle tie down strap types shown below in Figures 13B through 13D.



Figure 13.A

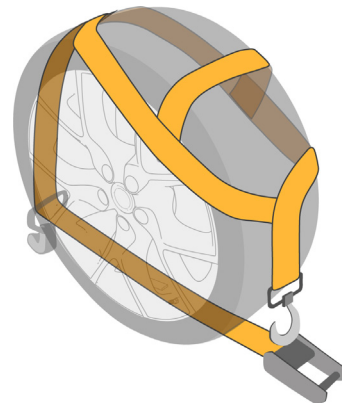


Figure 13.B

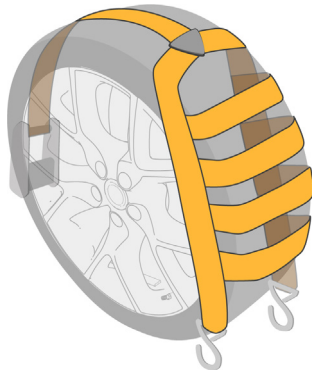


Figure 13.C

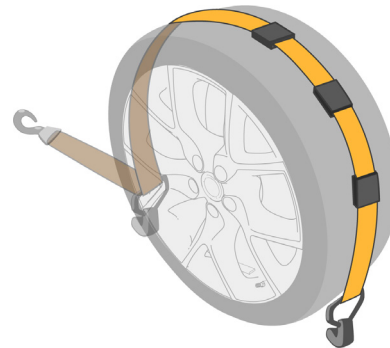


Figure 13.D



CAUTION!

Unless otherwise instructed in this document: attaching straps to the chassis, suspension or other parts of the body can damage the vehicle.

Ensure that metal parts on tie down straps do not contact the vehicle's wheels and/or painted surfaces.

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14. Tire Repair

14.1. Tire Repair Kit

14.1.1. You have been provided with a tire repair kit located in the storage space beneath the trunk floor that allows you to temporarily repair small punctures in the tire. The tire repair kit consists of a canister of tire sealant and a compressor.

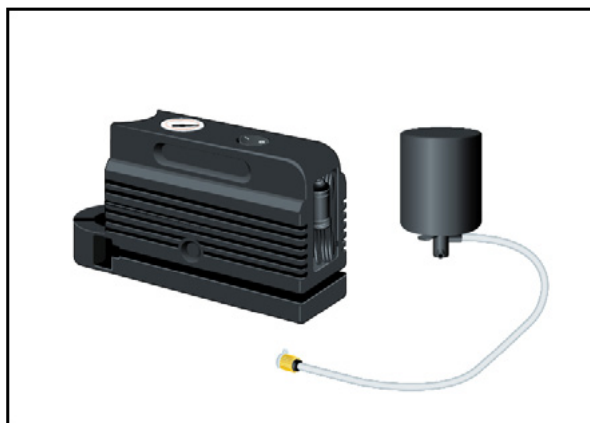


Figure 14.A

NOTE: The canister only contains enough sealant to seal one tire. The tire sealant contains liquid latex and a propellant. When injected into the tire through the valve, the liquid latex penetrates the puncture site and cures to form a temporary repair.

NOTE: The kit can only be used to repair small punctures in the tire tread. In the event of punctures larger than 1/4 inch (6 mm), severe tread damage, a damaged sidewall, ripped tires or tires that have come off the rim, please contact your Roadside Assistance provider. You are advised to have the tire repaired or replaced as soon as possible.



CAUTION!

Do not drive on a deflated tire as this can cause serious damage to the wheel and the vehicle. If the tire is too badly damaged, call Roadside Assistance to have the vehicle transported to a repair facility.

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14.1.2. Tire Sealant

**WARNING!**

Always read and follow the safety and handling instructions on the label adhered to the sealant canister.

The tire sealant supplied as part of the tire repair kit has an expiration date printed on the outside of the canister. Always replaced an expired tire sealant canister. If the tire sealant has passed its expiration date, it may not work as expected when you need to use it in an emergency. The tire sealant should always be replaced with one of the same type and capacity. This tire sealant has been approved for use with your vehicle and will not damage the tire pressure monitoring system sensors. Tire sealant canisters are available from all Karma Automotive Retailers.

NOTE: The sealant/air hose assembly will need to be replaced after each use. See Karma Owner's Manual for REPLACING THE CANISTER/AIR HOSE ASSEMBLY.

**WARNING!**

Under no circumstances should speeds of 90 km/h (55 mph) be exceeded while driving with a repaired tire.

Never drive with a deflated tire, vehicle handling and braking will be compromised.

Always read the directions and warnings on the tire sealant before starting a repair. Follow the directions on the canister exactly and pay attention to the following precautions.

Always keep the tire sealant out of the reach of children.

The tire sealant contains components which are harmful if consumed or inhaled:

If swallowed, do not induce vomiting. Seek medical assistance immediately.

If inhaled, breathe fresh air. If breathing is affected, seek medical assistance immediately.

If the sealant comes into contact with the eyes, immediately flush the eyes with water. If irritation persists, seek medical assistance.

Do not breathe gas, fumes, vapor or spray that may be emitted from the tire sealant. Inhalation can cause drowsiness and dizziness.

Store the tire sealant in its correct location in the trunk. Temperatures in other locations may exceed safe storage conditions.

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14.1.3. Using the tire repair kit.

If possible, stop in a safe place away from traffic. Always ask passengers to wait in a safe area away from traffic. Switch on the hazard warning flashers to alert other road users, then follow these steps.

14.1.3.1. If possible, position the wheel with puncture at the bottom.

14.1.3.2. Release the clear plastic hose from around the base of the tire compressor taking care to ensure the sealant canister remains in place.

14.1.3.3. Detach the 12V power supply connector and plug into one of the vehicle's accessory power supply sockets.

14.1.3.4. Screw the end of the hose to the tire valve.



Figure 14.B

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14.1.3.5 Ensure the compressor is standing upright with the pressure gauge facing up.

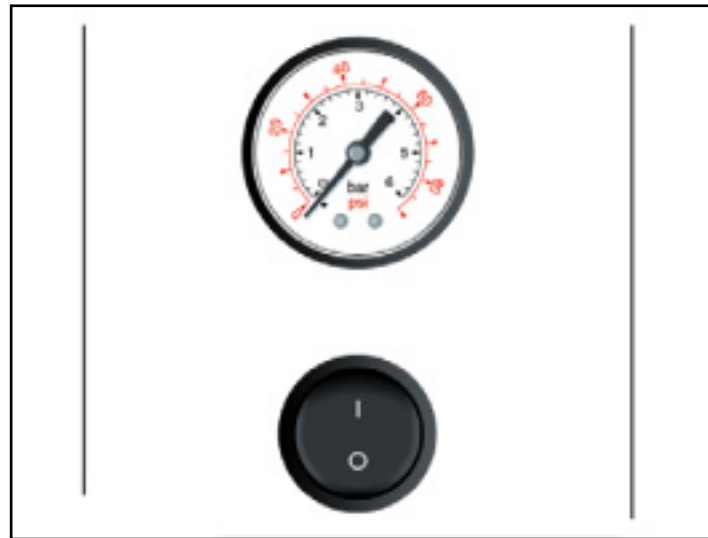


Figure 14.C

14.1.3.6 Turn on the compressor to inject sealant and air into the tire.

NOTE: The pressure gauge will initially show a high pressure while the compressor pushes the sealant into the tire. Once the sealant is completely dispersed into the tire, the pressure will quickly drop and start to rise again as the tire inflates with air only.

14.1.3.7. Monitor the tire pressure gauge and inflate the tire to the recommended tire pressure.

14.1.3.8. Turn off the compressor and remove the hose from the tire valve.

14.1.3.9. Wipe of any excess sealant from the tire valve and wheel rim.

14.1.3.10. If the wheel rim has lifted from the ground, drive immediately for 8 km (5 miles) to distribute the sealant around the tire. Do not exceed 40 km/h (25 mph).

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**WARNING!**

If the required pressure cannot be reached after approximately 25 minutes, or the wheel rim has not risen from the ground, then the tire is too severely damaged for a safe repair. Call Roadside Assistance to have the vehicle transported. Do not drive!

14.1.3.11 Check the tire pressure once again and inflate if necessary using the black hose located in the bottom of the compressor.

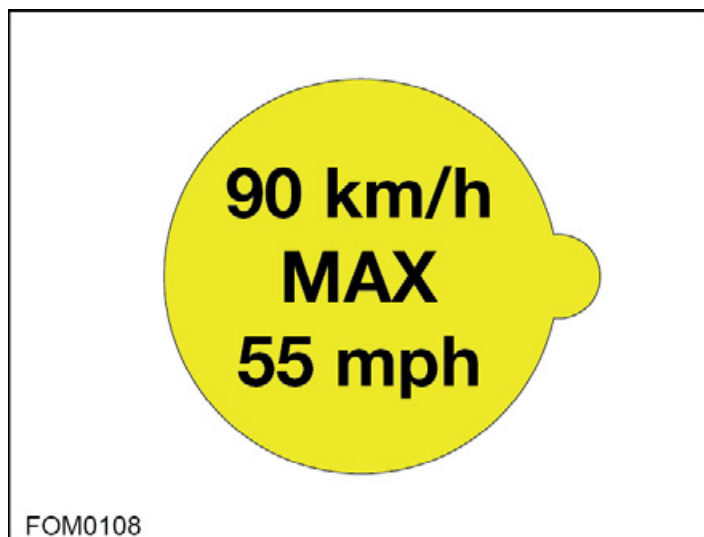


Figure 14.D

14.1.3.12 Apply the warning label supplied with the tire repair kit to a prominent area in the vehicle to remind you not to exceed 90 km/h (55 mph) until the tire has been professionally repaired or replaced.

14.1.3.13. Dispose of the used sealant canister and sealant/air hose assembly at a local Karma Automotive Retailer.

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14.1.3.14. Replace the tire sealant canister and sealant/air hose assembly. See REPLACING THE CANISTER/AIR HOSE ASSEMBLY in the Karma Owner's Manual.

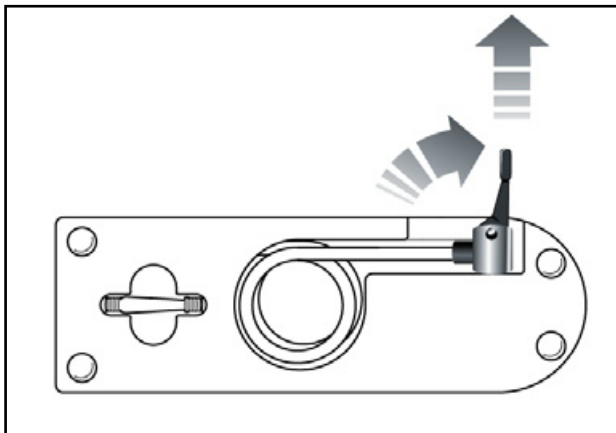


Figure 14.E

14.1.3.15. Release the black air only hose from the sealant canister on the base of the tire compressor.

14.1.3.16. Detach the 12V power supply connector and plug into one of the vehicle's accessory power supply sockets.

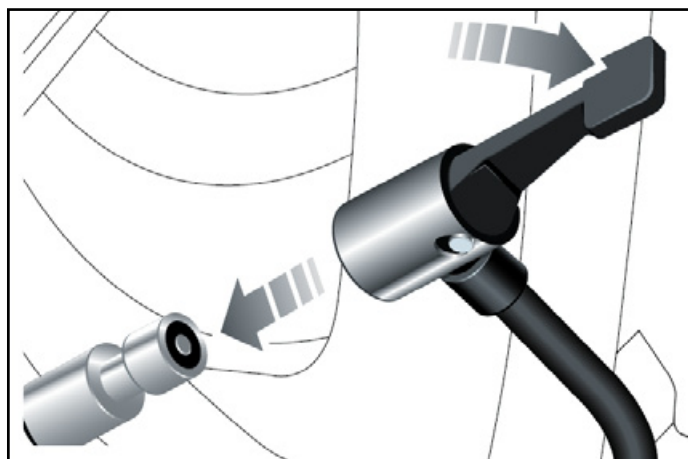


Figure 14.F

14.1.3.17. Attach the air only hose to the tire valve and press the lever down to secure it in place.

14.1.3.18. Ensure the compressor is standing upright with the pressure gauge facing up.

14.1.3.19. Turn on the compressor to inflate the tire.

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15. Revero Jacking Locations

15.1. Jacking locations when using Karma-equipped jack.

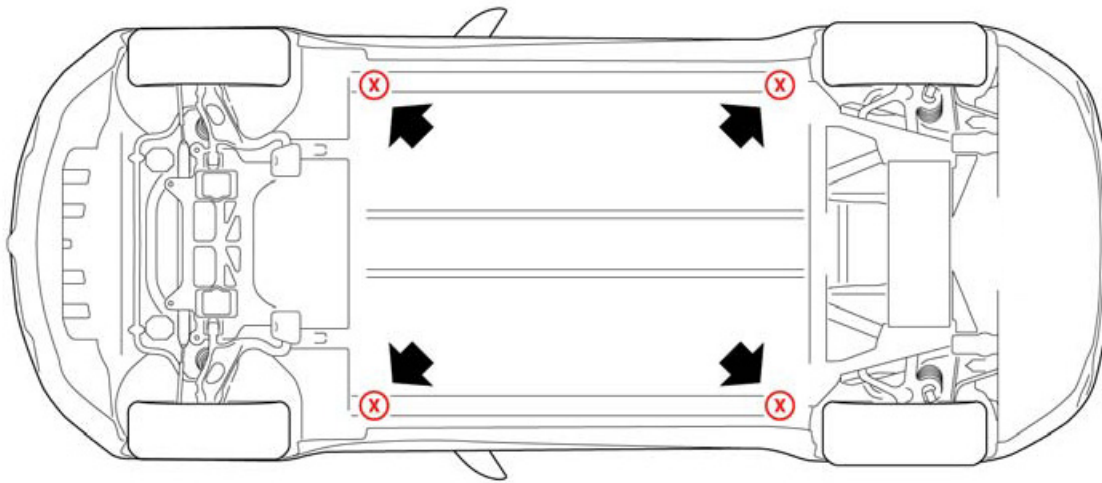


Figure 15A. Jacking locations (bottom view)

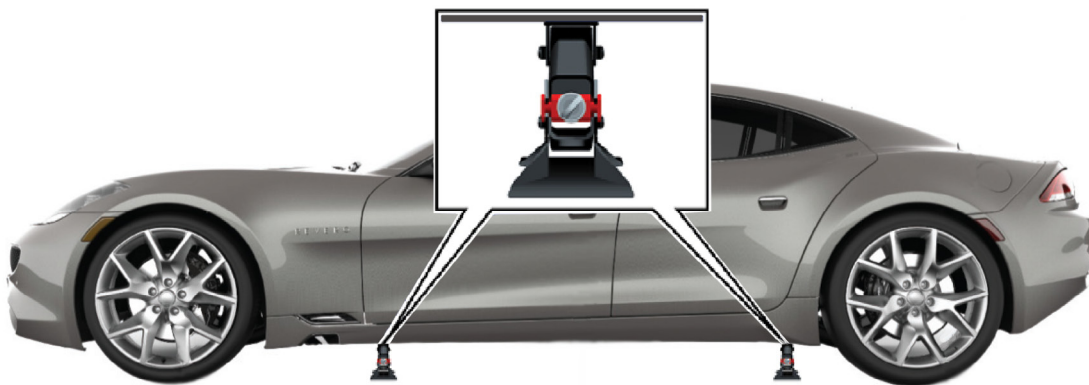


Figure 15B. Jacking locations (side view)

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15.2. Jacking locations when using suitable hydraulic floor jack /trolley jack

- When attempting to lift the vehicle on the front sub-frame, only use the identified areas on left and right sides (shown in blue in Figure 15C).
- Center section of sub-frame is not suitable for a front end lift procedure (shown in red in Figure 15C).

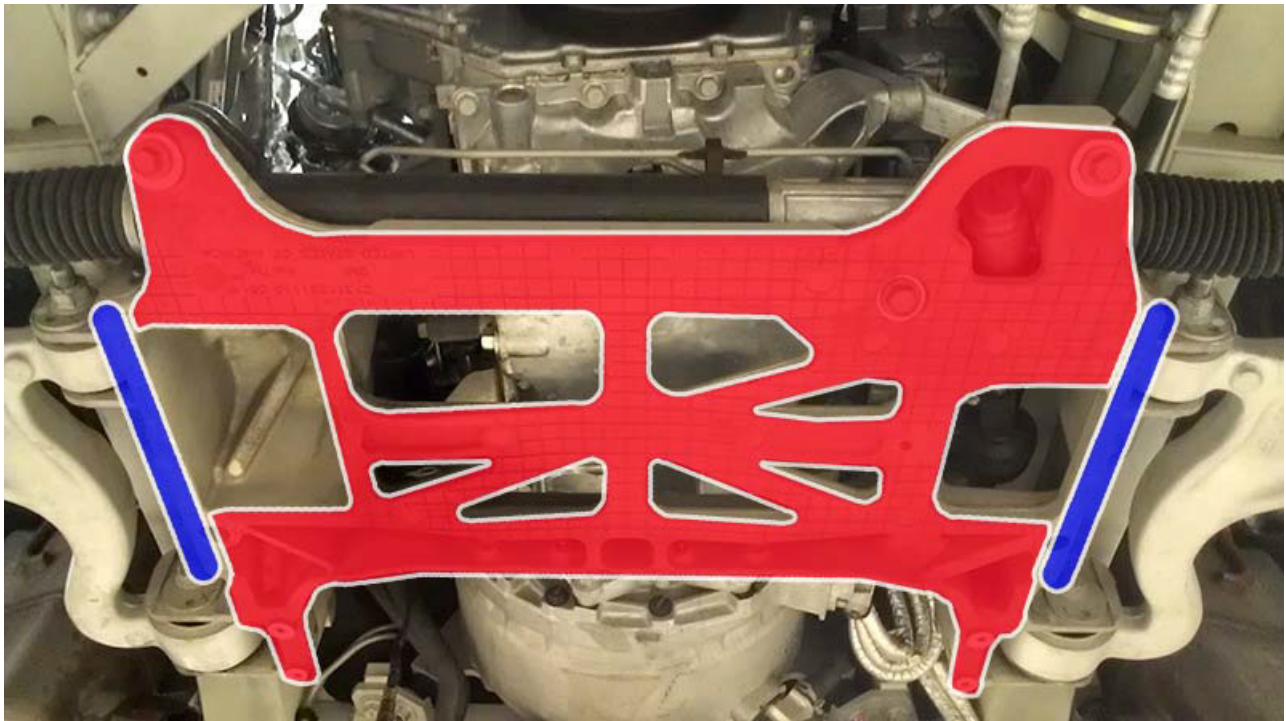


Figure 15.C



CAUTION!

Jacking the vehicle on the chassis is not permitted as there are no visible jacking points on the chassis. Extensive damage to the vehicle may occur if jacking is attempted on the chassis.

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16. Lifting Vehicle on Hoist

Objectives

- To locate the lift points for the Revero and identify potential concerns using improper lift points.

Lifting the vehicle is simple as long as you are cautious where you locate the lift arms under the vehicle. Positioning the arms is very important to maintain the balance of the vehicle on the lift. Always check the balance of the vehicle when removing heavy components such as the engine, rear drive module, or the energy storage system.



Figure 16.A

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When placing the lift arms under the front of the vehicle, be sure to locate them inboard and close to the bulkhead. There is a coolant line on the outboard side of the frame. This line may get crushed if the lift arm is not correctly positioned under the vehicle.



Figure 16.B

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The lift points at the rear of the vehicle should be as far to the rear of the frame as possible. This vehicle should have the lift arm closer to the rear of the frame for balance. There is a coolant line on the outboard side of the frame. Also, there is a rock plate on the inboard side of the frame which may get damaged if the lift arms are improperly positioned.



Figure 16.C

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17. Jumpstart Procedure - Low Voltage

If power to the low voltage (12 volt) system has been depleted e.g. due to client error, lack of use etc. it is permitted to jumpstart the battery.

17.1. Positive Application Point

17.1.1. Open the hood and manually assist the hood to the fully raised position. You must take care to ensure there is sufficient clearance between the top edge of the hood and the ceiling.

17.1.2. Located on the left side under the hood is the Power Distribution Center. The Positive application point is the main power point (circled in red in Figure 17A).



Figure 17.A

17.2. Negative Application Point

17.2.1. The Negative application point is located next to the turbo on the right side of the engine (shown circled in red in Figure 17B).



Figure 17.B

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17.3. Starting Vehicle in Low Voltage Condition.

17.3.1. Connecting jumpstart cables to the positive (Figure 17A) and negative (Figure 17B) points will trigger the security system. To disarm the security system, press the unlock button on the remote or turn on the ignition by pressing the start / stop button, without touching the brake pedal.

17.3.2. After the ignition has been turned on (without pressing the brake pedal), the electronic handbrake can be released by stepping on the brake pedal while pressing the switch inward (see number 20 on Figure 17C below).

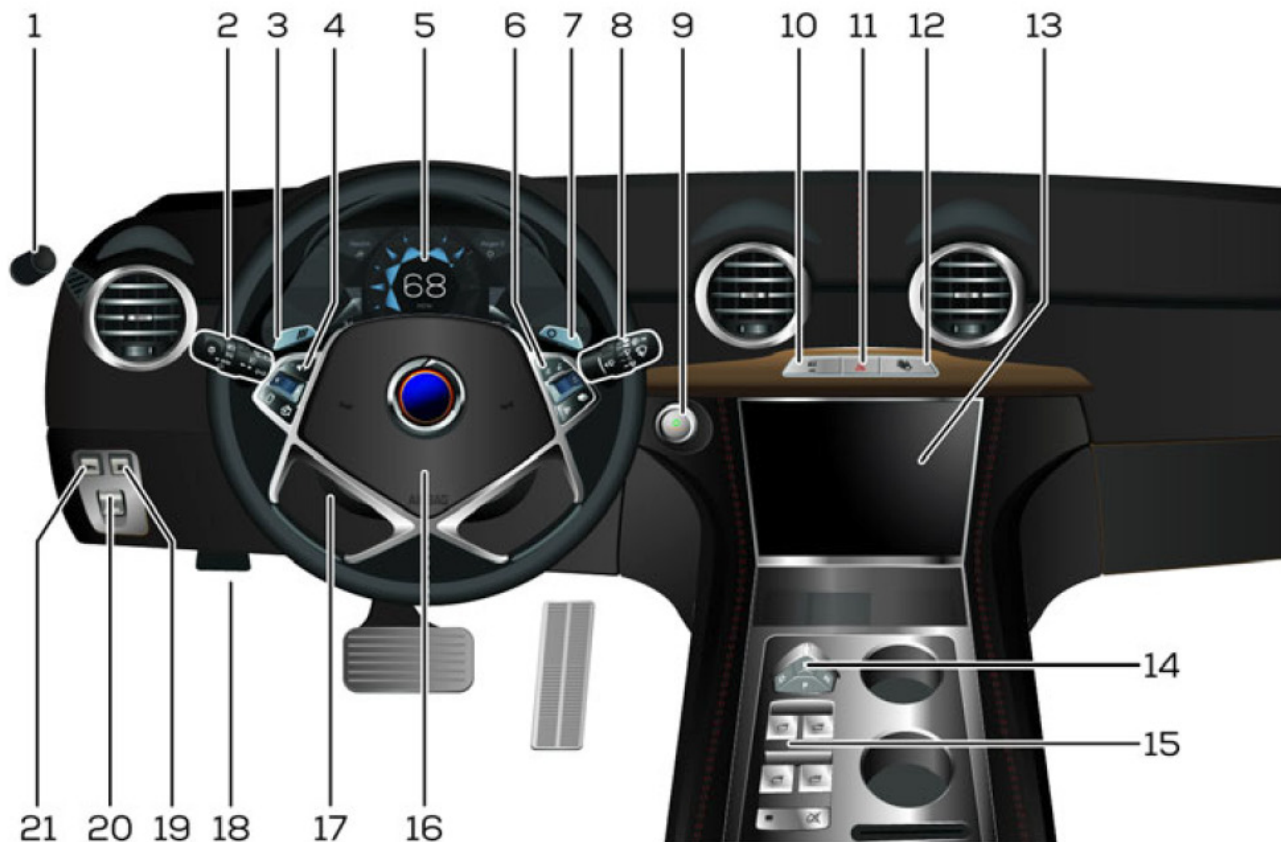


Figure 17.C

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18. Manual Entry to Locked Vehicle - Low Voltage Condition

Perform the following steps if the central locking system will not work.

18.1. Use the blade key if available.

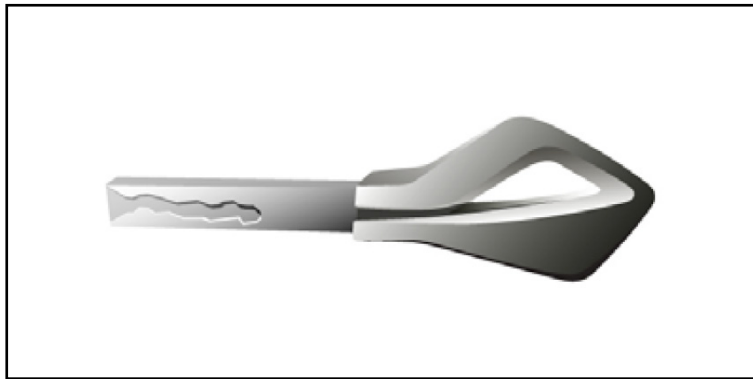


Figure 18.A

18.2. Insert the blade into the lock located on the passenger door handle. Turn the key counterclockwise and release (as shown in below).

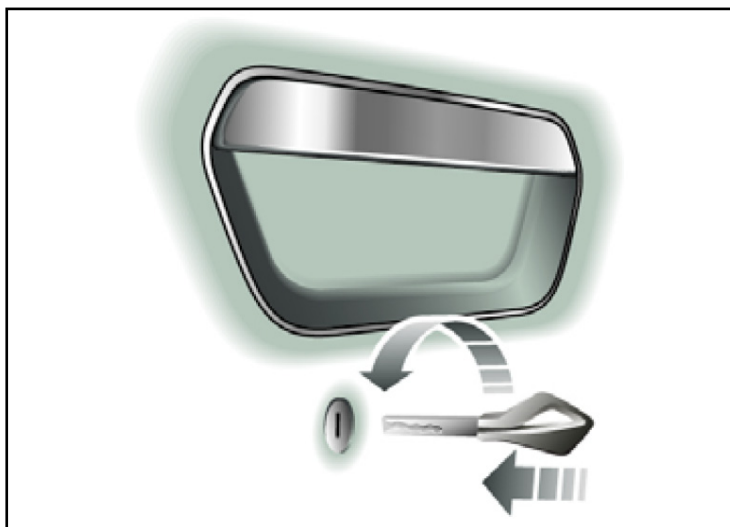


Figure 18.B

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19. Missing Ignition Key Fob

19.1. If a key fob is missing or inoperative, please contact your local Karma Retailer or email TSS@karmaautomotive.com.

20. Emergency trunk access

If there is a power failure to the vehicle, manually enter the vehicle with the bladed key (as instructed in Section 15), then perform the following steps.

20.1. Open the left-rear door, which can be achieved from inside the vehicle by pulling the release cable located below the door handle. Press groove on lower edge of cover below door handle and pull downward on door pull ring.

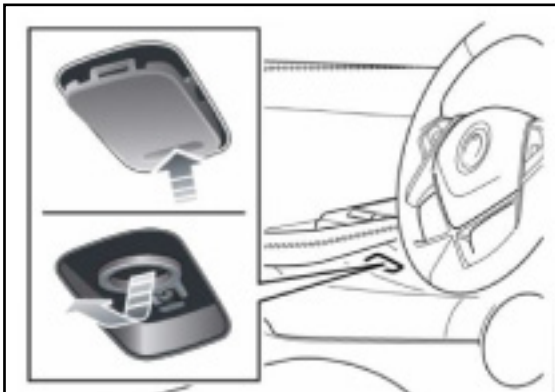


Figure 20.A



20.2. Lift up the left-rear seat-back cushion and the carefully tilt it forward. (Figure 20.B)

20.3. Pull on trunk release pull ring to gain access to the trunk where the recovery eye attachment is located. (Figure 20.C)



Figure 20.B



Figure 20.C

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