FORD **Ranger**

Body and Equipment Mounting Manual



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1.1 About this Publication

1.1.1 South American Region

NOTE: This publication includes various global models and variants sold worldwide, therefore some specific catalogues and versions may not be applicable to your market.

NOTE: It is recommended to review this manual in full. The BEMM is a live document which can be viewed on https://www.fordtechservice.dealerconnection.com/.

It is the vehicle converters responsibility to review the online version for the most current information prior to starting any conversion. For further information please contact your National Sales Company representative, or local Ford Dealer.

1.1.2 Rest of World (excl. South America)

NOTE: This publication includes various global models and variants sold worldwide, therefore some specific catalogues and versions may not be applicable to your market.

It is recommended to review this manual in full. The BEMM is a live document which can be viewed on https://www.fordtechservice.dealerconnection.com/ or https://www.ford.com.au/owners/vehicle-support/ body-equipment-manuals/. It is the vehicle converters responsibility to review the online version for the most current information prior to starting any conversion. For further information please contact your National Sales Company representative, or local Ford Dealer.

In addition to the detail available in this manual, further information related to servicing and maintenance of Ford vehicles is available using a subscription service via https://www.fordserviceinfo.com/ or see your National Sales Company representative, or local Ford Dealer.

1.1.3 Main changes to this publication - June 2026

- 1.12.5 Aids for Vehicle Entry and Exit - Rear view mirrors section updated
- 1.12.5 Aids for Vehicle Entry and Exit - Rear view mirrors Raptor section updated
- 1.13.1 Recommended Body Dimensions - Section updated
- 3.3.1 Selective Catalytic Reduction System - Diesel Exhaust Fluid (DEF) Filler Neck Relocation Kit table updated
- 3.4.2 Fuel Filler Mounting - Section updated
- 4.1 Wiring Installation and Routing Guides - Cable Routing and Fitting Equipment Containing Inductive Loads added
- 4.1.3 Body Control Module (BCM) Location and Connection Points - New Section
- 4.2.2 High Current Supply and Ground Connections - New section
- 4.3.1 Sensor Location - Rear parking aid sensor location updated
- 4.3.2 Sensor and Sensor Holder Painting Requirements - New section
- 4.3.3 Park Aid System Check After Retrofitting - New section
- 4.3.4 Park Aid Sensor Relocation Guideline - New section
- 4.5.1 Rear View Camera - Rear camera datum points with DAT bar added
- 4.5.1 Rear View Camera - Rear camera datum points with style side box added
- 4.6.1 Rear Lighting Signal - Section updated
- 4.6.2 Headlamp Aiming - Section updated
- 4.6.8 Brake (Stop) Lamp - Section updated
- 4.6.9 Position (Park) Lamps - Section updated
- 4.7.3 Advanced Driver Assist Technology - BlueCruise, BLIS and parking aid zones added
- 4.7.4 Blind Spot Information System - BLIS and BlueCruise radar datum points
- 4.8.2 Door Ajar - New section

1.1.4 Main changes to this publication - March 2026

- 1.2.6 CAD Models - Replaces Supplemental Information
- 1.3.3 Emissions Performance & In-service compliance - FPSVHelp@ford.com link added
- 1.4.3 Emissions Performance & In-service compliance - FPSVHelp@ford.com link added

- 1.5.3 Emissions Performance & In-service compliance - FPSVHelp@ford.com link added
- 1.8 Jacking - Jack extension inclusion
- 1.12.5 Aids for Vehicle Entry and Exit - Image updates
- 1.12.20 Recommended Maximum Main Load Area Dimensions - Image update
- 1.12.11 Recommended Maximum Main Load Area Dimensions Raptor - Image update
- 1.12.12 WLTP Frontal Area Calculation - Image update
- 1.12.13 WLTP Frontal Area Calculation Raptor - Image update
- 1.13.1 Recommended Body Dimensions - Extension bar paragraph updated
- 1.13.3 Chassis and Body Dimensions and Weights - Image and table updated
- 1.13.4 Chassis and Body Dimensions and Weights Raptor - Image and table updated
- 2.2 Wheel and Tires - New section
- 3.1.3 HV System De-Energising (PHEV) - Auxiliary battery disconnect and connect added
- 3.2.3 Air Intake - Snorkel kit and Cyclone pre filter added
- 3.3.1 Selective Catalytic Reduction System - Diesel Exhaust Fluid (DEF) filler pipe kit installation process added
- 3.4.3 Fuel Filler Mounting Raptor - Figure table updated
- 3.4.5 Long Range Fuel Tanks - Initial paragraph updated
- 4.2.1 Battery Information - Section updated
- 4.6.1 Rear Lighting Signal - New section
- 4.6.12 Trailer Towing Light Connections - Section updated
- 4.6.19 Handbrake Signal - Section updated
- 4.7 Driver Assist Technology - Related content grouped into one section
- 5.1 Body Structures - Computer-Aided Engineering (CAE) content added
- 5.1.3 Integrated Bodies and Conversions - Wheel guard dimensions updated
- 5.2 Hood Strut - New section
- 5.3.1 Air Bags - Front seat cover content added

1.1.5 Main changes to this publication - February 2026

- 1.1 About this publication - Section update, colour coding removed
- 1.2.1 Introduction - Ford Pro Special Vehicles helpline at FPSVhelp@ford.com updated
- 1.2.6 Supplemental Information - Ford Pro Special Vehicles helpline at FPSVhelp@ford.com updated
- 1.4.6 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) - Ford Pro Special Vehicles helpline at FPSVhelp@ford.com updated
- 1.6.1 Electromagnetic Compatibility - Image update
- 1.8 Jacking - Image updates
- 1.9 Lifting - Cautions update
- 1.10 Noise, Vibration and Harshness - Section update
- 1.12.5 Aids for Vehicle Entry and Exit - Section update
- 1.12.6 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs - Table updated
- 1.12.8 Vehicle Dimensions Key - Table orientation
- 1.12.10 Recommended Maximum Main Load Area Dimensions - Section update
- 1.12.11 Recommended Maximum Main Load Area Dimensions - Raptor - Section update
- 1.13.3 Chassis Cab Body - Basic Dimensions and Weights- Image and table update
- 1.15.3 Vehicle Weights - Vehicles built in Thailand - Table orientation
- 1.15.4 Vehicle Weights - Vehicles built in South Africa - Table orientation
- 1.15.5 Vehicle Weights - Vehicles built in Argentina - Table update
- 1.16.2 Towing - Warnings updated
- 2.1 Suspension System - Cautions updated
- 2.2.2 Brake Hoses - Warning updated
- 3.3.1 Selective Catalytic Reduction System - Diesel Exhaust Fluid - Image updates
- 3.4 Fuel System - Warnings and Cautions update
- 3.4.2 Fuel Filler Mounting - Fuel filler height table update

- 3.4.4 Fuel Filler Vent Hose - (Diesel) - Section update
- 3.4.6 Axle Breather Vent Hose - Section update
- 3.4.7 Axle Breather Vent Hose - Raptor - Section update
- 4.1.2 Wiring Through Cabin Sheet Metal- Section update
- 4.2.1 Battery Information - Battery Management Sensor (BMS) content update
- 4.2.4 Connection of Auxiliary Loads / Accessories - Auxiliary Fuse Box table orientation
- 4.2.5 Charging System - Section update
- 4.2.7 AC Inverter Deactivation - ICE - New section
- 4.5.1 Rear View Camera - Front Camera - Front Protection Bar Limitations - Notes updated
- 4.5.2 Auxiliary Rear View Camera - Blunt cut wire colours updated
- 4.6 Exterior Lights - New Caution
- 4.6.1 Headlamp Aiming - New section
- 4.6.2 Rear Combination lamps - Image update
- 4.6.7 Brake (Stop) Lamps- Section update
- 4.6.10 Loadbox / Tub - Lighting Connections (if available) - New section
- 4.6.13 Interior Lamps - New section
- 5.1.6 Chassis Cab - Section update

1.1.6 Main changes to this publication (PHEV inclusion) March 2025

- 1.1 About this publication - EV Training
- 1.2.4 PHEV Loadbox - All new
- 1.9 Lifting - PHEV inclusion
- 1.11 Vehicle Transportation Aids and Vehicle Storage - HV Battery content
- 1.12.5 Aids for Vehicle Entry and Exit - Rear View Mirror update for body width
- 1.12.6 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs - PHEV inclusion
- 1.13.1 Recommended Body Dimensions - Section update for body width
- 1.15 Load Distribution Calculations - PHEV inclusion
- 3.1 Electrified Drivetrain - All new
- 3.2.1 Electric Drive Assembly - All new
- 3.2.3 Engine / E-Drive Selection for Conversions - PHEV inclusion
- 3.4.5 Long Range Fuel Tanks - Updates
- 3.4.6 Axle breather Vent Hose - Section update
- 3.4.7 Axle breather Vent Hose - Raptor - Section update
- 4.1.3 Precautionary Drill Zones HV Cables - All new
- 4.1.4 Precautionary Drill Zones HV Modules - All new
- 4.2 Battery and Cables - PHEV inclusion
- 4.12.1 Central Locking - Section update
- 5.1.1 Body Structures - General Information - PHEV inclusion
- 5.1.2 No Drill/No Weld Zones PHEV- All new
- 5.1.5 Integrated Bodies and Conversions - PHEV - All new
- 5.1.8 Tipper Bodies - Section update on hardware specifications
- 5.1.9 Tank and Dry Bulk Carriers - Section update on hardware specifications
- 5.1.12 Cargo Management - Load Box Reinforcement Bracket section update
- 5.4 Corrosion Prevention - HV Battery Warnings
- 5.5.8 Long Wheelbase Conversions - PHEV inclusion

1.1.7 EV Training

Ford Customer Service Division (FCSD) develops the training and deploys it to the Ford Dealer Network.

We will forward and/or provide our upfitter partners the information to obtain training through links in Ford Service info https://www.fordserviceinfo.com

1.2 About this Manual

1.2.1 Introduction

This manual has been written in a format that is designed to meet the needs of Vehicle Converters. The objective is to use common formats with the workshop manual which is used by technicians worldwide.

This guide is published by Ford and provides general descriptions and advice for converting vehicles.

It must be emphasized that any change to the basic vehicle which does not meet the enclosed guideline standards may severely inhibit the ability of the vehicle to perform its function. Mechanical failures, structure failure, component unreliability or vehicle instability will lead to customer dissatisfaction. Appropriate design and application of body, equipment and or accessories is key to ensuring that customer satisfaction is not adversely affected.

The information contained within this publication takes the form of recommendations to be followed when vehicle modifications are undertaken. It must be remembered that certain modifications may invalidate legal approvals and application for re-certification may be necessary.

Ford cannot guarantee the operation of the vehicle if non-Ford -approved electrical systems are installed. Ford electrical systems are designed and tested to function under operational extremes and have been subjected to the equivalent of ten years of driving under such conditions.

Not all information in this manual applies to all territories. For availability of options and parts please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact the Ford Pro Special Vehicles helpline at FPSVhelp@ford.com.

1.2.2 How to Use This Manual

This manual covers vehicle conversion procedures.

The pages at the start of this manual list the content, by group. A group covers a specific portion of the vehicle. The manual is divided into five groups:

- General Information
- Chassis
- Powertrain
- Electrical
- Body and Paint

The number of the group is the first number of a section number. Each title listed in the contents links to the relevant section of the manual.

In some sections of the book it may refer you to see additional sections for information. The links have been provided in blue text. Page numbers have also been provided.

There is also an alphabetical index at the back of the manual. As with the contents pages you will be able to link to sections. To do this just click on the page number.

All left and right handed references to the vehicle are taken from a position sitting in the driver seat looking forward unless otherwise stated.

All references to ADR vehicle standards are only applicable to the Australian and New Zealand markets. Where no ADR is specified the EU standard is recommended.

1.2.3 Important Safety Instructions

Appropriate conversion procedures are essential for the safe, reliable operation of all vehicles as well as the personal safety of the individual carrying out the work.

This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Anyone who does not follow the instructions provide in this manual must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or components.

As you read through this manual, you will come across WARNINGS, CAUTIONS and NOTES.

If a warning, caution or note is placed at the beginning of a series of steps, it applies to multiple steps. If the warning, caution or note only applies to one step, it is placed at the beginning of the specific step (after the step number).

WARNING: Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.

CAUTION: Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.

NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory conversion.

WARNING: Any personnel working with or undertaking any modifications to the Ranger Plug-in Hybrid Electric Vehicle (PHEV) must receive training for High Voltage (HV) vehicle systems prior to starting any work.

Working in a High Voltage Electrial Vehicle is only allowed after completion of the appropriate training(s):

"Working on Electric Vehicles" Includes performing mechanical works, performing electrical work and switching activities on these vehicles.

"Electric Vehicle" Includes all possible types such as HEV (Full Hybrids), PHEV (Plug-In Hybrid Electric Vehicle), BEV (Battery Electric Vehicle) or other versions.

"Appropriate Training" means that you as a person who followed the training, has sufficient knowledge about the risks and that you have knowledge about the required safety measures to perform the work in a safe way. The competencies granted by this training are still up-to-date and have not expired.

WARNING: Orange coloured cables are HV system (approximately 400V DC) parts and must not be modified nor rerouted.

1.2.4 PHEV Loadbox

WARNING: The Ford Ranger PHEV load box is not designed to be removed and replaced with an alternative body. High-voltage cables, and other critical systems including the fuel filler and charging ports are integrated with the load box. Defects in the Ford Ranger PHEV which are caused by the removal and replacement of the load box with an alternative body will not be covered under the Ford new vehicle warranty.

1.2.5 Acoustic Vehicle Alerting System - PHEV

WARNING: Do not move or modify the components of the AVAS system. The Acoustic Vehicle Alerting System warning is a legal requirement.

1.2.6 CAD Models

As a convertor, to enable the virtual development of your vehicle, 3D data models in STEP and JT formats can be provided via CoLab upon request at Ford Pro Special Vehicles helpline at FPSVhelp@ford.com.

1.3 Commercial and Legal Aspects

1.3.1 Terminology

NOTE: Any modifications to the vehicle must be noted in the owner's handbook or new descriptive literature included with the owner's documentation.

The term “Vehicle Converter” refers to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and or supplied by Ford. Similar terms such as Vehicle Converter, Upfitter, Body Builder may be referenced in this manual and also refer to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and or supplied by Ford.

The term “Unique component” or similar wording refers to non-Ford specified or after sale components which are fitted by a Vehicle Converter and are not covered by any Ford warranty.

1.3.2 Warranty on Ford Vehicles

Please contact the National Sales Company in the country where the vehicle will be registered for details of the terms of any applicable Ford warranty.

The Vehicle Converter should warrant its design, materials and construction for a period at least equal to any applicable Ford warranty.

The Vehicle Converter must ensure that any alteration made to a Ford vehicle or component does not reduce the safety, function, or durability of the vehicle or any component.

The Vehicle Converter shall be solely responsible for any damage resulting from any alteration made by the Vehicle Converter or any of its agents to a Ford Vehicle Component.

The Vehicle Converter releases Ford from all claims by any third party for any cost or loss (including any consequential damages) arising from work performed by a Vehicle Converter unless Ford has given its prior written consent to such liability.

1.3.3 Emissions Performance & In-service compliance

The emissions regulation 715/2007, as amended by 2018/1832, now includes new requirements for completed vehicles with regards to emissions performance and in service compliance. Ford has developed an emissions envelope that the Vehicle Converter must stay within.

Refer to: 1.13 (page 46).

For further information please contact FPSVHelp@ford.com.

1.3.4 Whole Vehicle Type Approval (2007/46/EC) Regulations

Fitment of Parts and Accessories

NOTE: Ford parts fitted in the plant are covered by the Certificate of Conformity (CoC).

The objective of the 2007/46/EC Whole Vehicle Type Approval (WVTA) legislation or applicable local legislation is to ensure that new vehicles, components and separate technical units put on the market provide a high level of safety and environmental protection. This will help to ensure that all vehicles are not damaged by the fitting or converting of certain parts or equipment, after they have been placed on the market or have entered service.

Vehicle Converters are advised to check whether the fitment of parts require either type approval or Individual Vehicle Approval (IVA) before the vehicle is registered.

- Type Approval requires a Conformity of Production (CoP) inspection to be carried out at the conversion location to demonstrate that all vehicles of the same type will conform to the type approved specification
- IVA requires inspection of an individual vehicle to establish compliance

1.3.5 Legal and Vehicle Type Approval

- All components embodied on Ford vehicles are approved to the applicable legal requirements.
- Ford vehicles have Type Approval for the intended marketing territories.

WARNING: Exception - Incomplete vehicles require further approval when completed by the vehicle converter.

- The Ranger range has Type Approval for many territories, although the full range of vehicles shown in this manual are not necessarily released in all territories. Check with your local Ford National Sales Company representative.
- Significant changes to the vehicle may affect its legal compliance. Strict adherence to the original design intent for brakes, weight distribution, lighting, emissions, occupant safety, front and/or rear under-run compliance and hazardous materials compliance in particular is mandatory.

1.3.6 Alternative Type Approval

If significant changes are made to the vehicle the Body Builder / Vehicle Converter / Upfitter must negotiate with the relevant authority. Any changes to the vehicle operating conditions must be advised to the customer.

1.3.7 Legal Obligations and Liabilities

The Vehicle Converter should consult with its legal advisor on any questions concerning its legal obligations and liabilities.

Ford recommends that the Vehicle Converter and Ford Dealer must understand their individual and joint responsibilities in supplying a safe and compliant motor vehicle fitted with safe and compliant accessories.

1.3.8 General Product Safety Requirement

The Vehicle Converter shall ensure that any vehicle it places on the market complies with all local laws relating to the safe carriage of loads on public roads. The Vehicle Converter shall also ensure that any alteration it makes to a Ford vehicle or component does not reduce its compliance with local design rules.

The Vehicle Converter must provide sufficient Load Restraint tie down points or compartmentalized storage areas that enable the driver to safely carry loads that match the use criteria for which the body was designed.

The Vehicle Converter shall release Ford from all liability for damages resulting from:

- Failure to comply with these Body Equipment Mounting directives, in particular warnings.
- Faulty design, production, installation, assembly or alteration not originally specified by Ford.
- Failure to comply with the basic fit for purpose principles inherent in the original product.

WARNINGS:

Do not exceed the gross vehicle mass, gross combination mass, axle ratings and trailer rating.

Do not change the tire size or load rating.

Do not modify the steering system.

Excessive heat can build up from the exhaust system, in particular from the catalytic converter and from the Diesel Particulate Filter (DPF). Ensure adequate heat shields are maintained. Maintain sufficient clearance to hot parts.

Do not modify or remove heat protection shields.

Do not route any electrical cables with the Anti-lock Brakes System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang electrical cables off existing looms or pipes.

Do not change original location or remove warning labels provided with the base vehicle in view to the driver. Ensure that labels in view to the driver remain in full view to the driver.

NOTE: For further information please contact your local National Sales Company representative, or Local Ford Dealer.

1.3.9 Product Liability

The Vehicle Converter shall be liable for any product liability (whether for death, personal injury, or property damage) arising from any alteration to a Ford vehicle or component made by the Vehicle Converter or any of its agents. Ford shall not be liable for any such liability (except as provided by law).

The Vehicle Converter or equipment manufacturer is liable for the:

- Operational reliability and road-worthiness of the vehicle to its original intent.
- Operational reliability and road-worthiness of any component or conversion, not listed in original Ford documentation.
- Operational reliability and road-worthiness of the vehicle as a whole (for example the body changes and/or additional equipment must not have a negative effect on the driving, braking or steering characteristics of the vehicle).
- Subsequent damage resulting from the conversion or attachment and installation of unique components, including unique electrical or electronic systems.
- Functional safety and freedom of movement of all moving parts (for example axles, springs, propeller shafts, steering mechanisms, brake and transmission linkage).
- Functional safety and freedom of the tested and approved flexibility of the body and integral chassis structure.

1.3.10 Restraints System

WARNINGS:

Modifications to the restraints system are not allowed.

Airbags are explosive. For safe removal and storage during conversion follow the procedures in the Ford workshop manual or consult your local National Sales Company representative.

Do not alter, modify or relocate the airbag, sensor and modules of the restraints system or any of its components.

Attachments or modifications to the front end of the vehicle may affect the airbag deployment timing and result in unsafe deployment of safety devices.

Modifications to the side structure including doors, sills, B and C pillars might affect the side airbag deployment timing and result in unsafe deployment of safety devices.

Refer to: 5.3 Airbag Supplemental Restraint System (SRS) (page 243).

1.3.11 Drilling and Welding

Drilling and welding of frames and body structures have to be conducted following the guidelines within this document.

1.3.12 Minimum Requirements for Brake system

- Changes to the Antilock Brake System (ABS), Traction Control System (TCS) and Electronic Stability Program (ESP), Electronic Brake Booster (EBB) and Driver Assistance Technologies are not permitted.

1.3.13 Road Safety

The respective instructions should be strictly observed to maintain operational and road safety of the vehicle.

1.4 Commercial and Legal Aspects — Europe

1.4.1 Terminology

NOTE: Any modifications to the vehicle must be noted in the owner's handbook or new descriptive literature included with the owner's documentation.

The term “Vehicle Converter” refers to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and or supplied by Ford. Similar terms such as Vehicle Converter, Upfitter, Body Builder may be referenced in this manual and also refer to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and or supplied by Ford.

The term “Unique component” or similar wording refers to non-Ford specified or after sale components which are fitted by a Vehicle Converter and are not covered by any Ford warranty.

1.4.2 Warranty on Ford Vehicles

Please contact the National Sales Company in the country where the vehicle will be registered for details of the terms of any applicable Ford warranty.

The Vehicle Converter should warrant its design, materials and construction for a period at least equal to any applicable Ford warranty.

The Vehicle Converter must ensure that any alteration made to a Ford vehicle or component does not reduce the safety, function, or durability of the vehicle or any component.

The Vehicle Converter shall be solely responsible for any damage resulting from any alteration made by the Vehicle Converter or any of its agents to a Ford Vehicle Component.

The Vehicle Converter releases Ford from all claims by any third party for any cost or loss (including any consequential damages) arising from work performed by a Vehicle Converter unless Ford has given its prior written consent to such liability.

1.4.3 Emissions Performance & In-service compliance

The emissions regulation 715/2007, as amended by 2018/1832, now includes new requirements for completed vehicles with regards to emissions performance and in service compliance. Ford has developed an emissions envelope that the Vehicle Converter must stay within.

Refer to: 1.13 (page 46).

For further information please contact FPSVHelp@ford.com.

1.4.4 Whole Vehicle Type Approval (EU) 2018/858 Regulations

Fitment of Parts and Accessories

NOTE: Ford parts fitted in the plant are covered by the Certificate of Conformity (CoC).

The objective of the (EU) 2018/858 Whole Vehicle Type Approval (WVTA) legislation or applicable local legislation is to ensure that new vehicles, components and separate technical units put on the market provide a high level of safety and environmental protection. This will help to ensure that all vehicles are not damaged by the fitting or converting of certain parts or equipment, after they have been placed on the market or have entered service.

Vehicle Converters are advised to check whether the fitment of parts require either type approval or Individual Vehicle Approval (IVA) before the vehicle is registered.

- Type Approval requires a Conformity of Production (CoP) inspection to be carried out at the conversion location to demonstrate that all vehicles of the same type will conform to the type approved specification
- IVA requires inspection of an individual vehicle to establish compliance

1.4.5 Legal and Vehicle Type Approval

- All components embodied on Ford vehicles are approved to the applicable legal requirements.
- Ford vehicles have Type Approval for the intended marketing territories.

WARNING: Exception - Incomplete vehicles require further approval when completed by the vehicle converter.

- The Ranger range has Type Approval for many territories, although the full range of vehicles shown in this manual are not necessarily released in all territories. Check with your local Ford National Sales Company representative.
- Significant changes to the vehicle may affect its legal compliance. Strict adherence to the original design intent for brakes, weight distribution, lighting, emissions, occupant safety, front and/or rear under-run compliance and hazardous materials compliance in particular is mandatory.

Conversions from Commercial Vehicle N1, N2 to Passenger Car M1

Vehicle Converters of passenger car M1 vehicles need to be aware of the latest Whole Vehicle Type Approval (EU) 2018/858 regulations or applicable local legislation, especially when the base vehicle is a commercial vehicle N1. This affects vehicles which are homologated to meet passenger car M1 regulations.

Guidance to Vehicle Converters for M1 registered vehicles:

- The Vehicle Converter is responsible for checking the vehicle ordered can meet all the regulations for type approval
- Exemptions for certain regulations should be checked with latest regulation and approval authority
- Where possible, order a Passenger Car M1 base vehicle
- If specifying Air Conditioning, check that the base commercial vehicle refrigerant meets the latest completed vehicle regulations
- If Tire Pressure Monitoring System (TPMS) is required, specify this when ordering
- If seat belt warning is required, specify this when ordering
- Special Purpose Vehicles such as ambulances, motor caravans, hearses and wheelchair accessible vehicles may be allowed to use the base vehicle homologation for some regulations

1.4.6 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP)

The WLTP is replacing the NEDC (New European Driving Cycle) test procedure that has been in force since 1992.

WLTP takes into account individual optional equipment for weight, aerodynamics and rolling resistance, which have an impact on the fuel consumption and exhaust emissions. For incomplete and complete conversions, WLTP will now take into account the completed option equipment. Vehicle Converters now have a new responsibility to recalculate the CO2 and fuel consumption for any completed vehicle by either using a tool provided by the OEM or contacting the OEM to obtain new values.

To determine the new values in line with WLTP, registered customers will now be able to access Ford's multi stage WLTP calculation tool via ETIS. For further information and registration please contact Ford Pro Special Vehicles helpline at FPSVhelp@ford.com.

It is advisable to control the weight, but without deteriorating other vehicle attributes and functions, (especially those related to safety and durability). It is also advisable for you to contact your local type approval authority for any questions related to the application of WLTP to multi stage conversions under regulation 2007/46 and single vehicle approvals.

For some incomplete and complete vehicles. Speed limiters have been fitted to ensure robust emissions compliance with WLTP and on road emissions requirements. Where speed limiters have been fitted to ensure emissions compliance they should not be removed or delimited. For further information, please contact Ford Pro Special Vehicles helpline at FPSVhelp@ford.com.

For additional information:

- Refer to: 1.7 Vehicle Duty Cycle Guidelines (page 24).
- Refer to: 1.12 Package and Ergonomics (page 34).
- Please go to http://www.etis.ford.com/BEMM and Register/login
- contact Ford Pro Special Vehicles helpline at FPSVhelp@ford.com

1.4.7 Alternative Type Approval

If significant changes are made to the vehicle the Body Builder / Vehicle Converter / Upfitter must negotiate with the relevant authority. Any changes to the vehicle operating conditions must be advised to the customer.

1.4.8 Legal Obligations and Liabilities

The Vehicle Converter should consult with its legal advisor on any questions concerning its legal obligations and liabilities.

Ford recommends that the Vehicle Converter and Ford Dealer must understand their individual and joint responsibilities in supplying a safe and compliant motor vehicle fitted with safe and compliant accessories.

1.4.9 General Product Safety Requirement

The Vehicle Converter shall ensure that any vehicle it places on the market complies with all local laws relating to the safe carriage of loads on public roads. The Vehicle Converter shall also ensure that any alteration it makes to a Ford vehicle or component does not reduce its compliance with local design rules.

The Vehicle Converter must provide sufficient Load Restraint tie down points or compartmentalized storage areas that enable the driver to safely carry loads that match the use criteria for which the body was designed.

The Vehicle Converter shall release Ford from all liability for damages resulting from:

- Failure to comply with these Body Equipment Mounting directives, in particular warnings.
- Faulty design, production, installation, assembly or alteration not originally specified by Ford.
- Failure to comply with the basic fit for purpose principles inherent in the original product.

WARNINGS:

Do not exceed the gross vehicle mass, gross combination mass, axle ratings and trailer rating.

Do not change the tire size or load rating.

Do not modify the steering system.

Excessive heat can build up from the exhaust system, in particular from the catalytic converter and from the Diesel Particulate Filter (DPF). Ensure adequate heat shields are maintained. Maintain sufficient clearance to hot parts.

Do not modify or remove heat protection shields.

Do not route any electrical cables with the Anti-lock Brakes System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang electrical cables off existing looms or pipes.

Do not change original location or remove warning labels provided with the base vehicle in view to the driver. Ensure that labels in view to the driver remain in full view to the driver.

NOTE: For further information please contact your local National Sales Company representative, or Local Ford Dealer.

1.4.10 Product Liability

The Vehicle Converter shall be liable for any product liability (whether for death, personal injury, or property damage) arising from any alteration to a Ford vehicle or component made by the Vehicle Converter or any of its agents. Ford shall not be liable for any such liability (except as provided by law).

The Vehicle Converter or equipment manufacturer is liable for the:

- Operational reliability and road-worthiness of the vehicle to its original intent.
- Operational reliability and road-worthiness of any component or conversion, not listed in original Ford documentation.
- Operational reliability and road-worthiness of the vehicle as a whole (for example the body changes and/or additional equipment must not have a negative effect on the driving, braking or steering characteristics of the vehicle).
- Subsequent damage resulting from the conversion or attachment and installation of unique components, including unique electrical or electronic systems.
- Functional safety and freedom of movement of all moving parts (for example axles, springs, propeller shafts, steering mechanisms, brake and transmission linkage).

- Functional safety and freedom of the tested and approved flexibility of the body and integral chassis structure.

1.4.11 Restraints System

WARNINGS:

Modifications to the restraints system are not allowed.

Airbags are explosive. For safe removal and storage during conversion follow the procedures in the Ford workshop manual or consult your local National Sales Company representative.

Do not alter, modify or relocate the airbag, sensor and modules of the restraints system or any of its components.

Attachments or modifications to the front end of the vehicle may affect the airbag deployment timing and result in unsafe deployment of safety devices.

Modifications to the side structure including doors, sills, B and C pillars might affect the side airbag deployment timing and result in unsafe deployment of safety devices.

Refer to: 5.3 Airbag Supplemental Restraint System (SRS) (page 243).

1.4.12 Drilling and Welding

Drilling and welding of frames and body structures have to be conducted following the guidelines within this document.

1.4.13 Minimum Requirements for Brake system

- Changes to the Antilock Brake System (ABS), Traction Control System (TCS) and Electronic Stability Program (ESP), Electronic Brake Booster (EBB) and Driver Assistance Technologies are not permitted.

1.4.14 Road Safety

The respective instructions should be strictly observed to maintain operational and road safety of the vehicle.

1.5 Commercial and Legal Aspects — South America

1.5.1 Terminology

NOTE: Any modifications to the vehicle must be noted in the owner's handbook or new descriptive literature included with the owner's documentation.

The term “Vehicle Converter” refers to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and or supplied by Ford. Similar terms such as Vehicle Converter, Upfitter, Body Builder may be referenced in this manual and also refer to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and or supplied by Ford.

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1.5.2 Warranty on Ford Vehicles

Please contact the National Sales Company in the country where the vehicle will be registered for details of the terms of any applicable Ford warranty.

The Vehicle Converter shall be solely responsible for any damage resulting from any alteration made by the Vehicle Converter or any of its agents to a Ford Vehicle Component.

The Vehicle Converter releases Ford from all claims by any third party for any cost or loss (including any consequential damages) arising from work performed by a Vehicle Converter unless Ford has given its prior written consent to such liability.

1.5.3 Emissions Performance & In-service Compliance

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

The emissions regulation 715/2007, as amended by 2018/1832, now includes new requirements for completed vehicles with regards to emissions performance and in service compliance. Ford has developed an emissions envelope that the Vehicle Converter must stay within.

Refer to: 1.13 (page 46).

For further information please contact FPSVHelp@ford.com.

1.5.4 Whole Vehicle Type Approval Regulations

Fitment of Parts and Accessories

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

NOTE: Ford parts fitted in the plant are covered by the Certificate of Conformity (CoC).

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- IVA requires inspection of an individual vehicle to establish compliance

1.5.5 Legal and Vehicle Type Approval

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

- All components embodied on Ford vehicles are approved to the applicable legal requirements.

- Ford vehicles have Type Approval for the intended marketing territories.

WARNING: Exception - Incomplete vehicles require further approval when completed by the vehicle converter.

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1.5.6 Alternative Type Approval

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1.5.7 Legal Obligations and Liabilities

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Ford recommends that the Vehicle Converter and Ford Dealer must understand their individual and joint responsibilities in supplying a safe and compliant motor vehicle fitted with safe and compliant accessories.

1.5.8 General Product Safety Requirement

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- Faulty design, production, installation, assembly or alteration not originally specified by Ford.
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WARNINGS:

Do not exceed the gross vehicle mass, gross combination mass, axle ratings and trailer rating.

Do not change the tire size or load rating.

Do not modify the steering system.

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Do not route any electrical cables with the Anti-lock Brakes System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang electrical cables off existing looms or pipes.

Do not change original location or remove warning labels provided with the base vehicle in view to the driver. Ensure that labels in view to the driver remain in full view to the driver.

NOTE: For further information please contact your local National Sales Company representative, or Local Ford Dealer.

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The Vehicle Converter or equipment manufacturer is liable for the:

- Operational reliability and road-worthiness of the vehicle to its original intent.
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- Operational reliability and road-worthiness of the vehicle as a whole (for example the body changes and/or additional equipment must not have a negative effect on the driving, braking or steering characteristics of the vehicle).
- Subsequent damage resulting from the conversion or attachment and installation of unique components, including unique electrical or electronic systems.
- Functional safety and freedom of movement of all moving parts (for example axles, springs, propeller shafts, steering mechanisms, brake and transmission linkage).
- Functional safety and freedom of the tested and approved flexibility of the body and integral chassis structure.

1.5.10 Restraints System

WARNINGS:

Modifications to the restraints system are not allowed.

Airbags are explosive. For safe removal and storage during conversion follow the procedures in the Ford workshop manual or consult your local National Sales Company representative.

Do not alter, modify or relocate the airbag, sensor and modules of the restraints system or any of its components.

Attachments or modifications to the front end of the vehicle may affect the airbag deployment timing and result in unsafe deployment of safety devices.

Modifications to the side structure including doors, sills, B and C pillars might affect the side airbag deployment timing and result in unsafe deployment of safety devices.

Refer to: 5.3 Airbag Supplemental Restraint System (SRS) (page 243).

1.5.11 Drilling and Welding

Drilling and welding of frames and body structures have to be conducted following the guidelines within this document.

1.5.12 Minimum Requirements for Brake system

- Changes to the Antilock Brake System (ABS), Traction Control System (TCS) and Electronic Stability Program (ESP), Electronic Brake Booster (EBB) and Driver Assistance Technologies are not permitted.

1.5.13 Road Safety

The respective instructions should be strictly observed to maintain operational and road safety of the vehicle.

1.6 Electromagnetic Compatibility (EMC)

1.6.1 Electromagnetic Compatibility (EMC)

WARNINGS:

Do not place objects or mount equipment on or near the airbag cover, on the side of the seatbacks (of the front seats), or in front seat areas that may come into contact with a deploying airbag. Failure to follow these instructions may increase the risk of personal injury in the event of a crash.

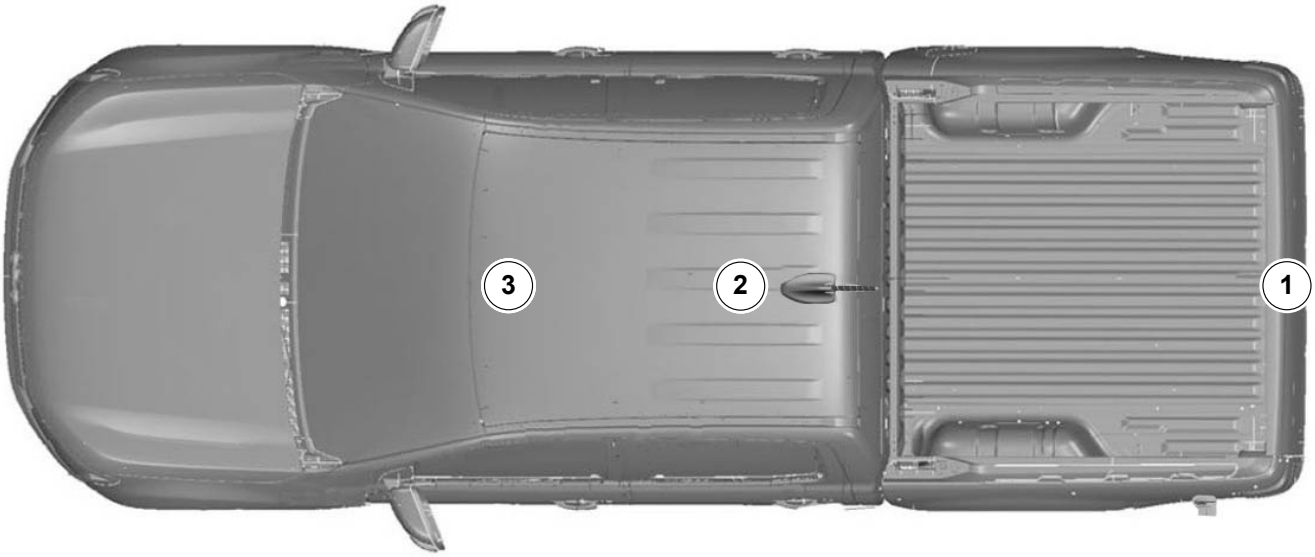
Do not fasten antenna cables to original vehicle wiring, fuel pipes and brake pipes.

Keep antenna and power cables at least 4 in (10 cm) from any electronic modules and airbags.

NOTE: We test and certify your vehicle to meet electromagnetic compatibility legislation. It is your responsibility to make sure that any equipment an authorized dealer installs on your vehicle complies with applicable local legislation and other requirements. Installation of some aftermarket electronic devices could degrade the performance of vehicle functions, which use radio frequency signals such as broadcast radio receiver, tire pressure monitoring system, push button start, Bluetooth connectivity or satellite navigation.

NOTE: Any radio frequency transmitter equipment in your vehicle (such as cellular telephones and amateur radio transmitters) must keep to the parameters in the following illustrations and table. We do not provide any other special provisions or conditions for installations or use.

Truck



E239121

Frequency Band MHz	Maximum Output Power Watts (Peak RMS)	Antenna Position
1-30	50	1
50-54	50	2, 3
68-88	50	2, 3
142-176	50	2, 3
380-512	50	2, 3
806-870	10	2, 3

1.7 Vehicle Duty Cycle Guidelines

NOTE: For further information contact your National Sales Company representative, or local Ford dealer.

It is necessary to take into account the customer usage profile and the anticipated vehicle duty cycles of the modified vehicle in order to choose the appropriate specification of the base vehicle.

It is necessary to select the appropriate drive, engine, gear ratio, gross vehicle mass, gross train mass, axle plates and payloads of the base vehicle to match the customer requirements.

Where possible make sure that the base vehicle is ordered with any necessary plant fit options.

A high numeric gear ratio is recommended for vehicles with customer requirements for:

- High payload
- Trailer tow
- Frequent stop-and-go cycles
- High altitude and gradients
- Terrain conditions such as found on building and construction sites

1.7.1 Vehicle Ride and Handling Attributes

CAUTION: Do not exceed the axle plate, gross vehicle mass, trailer plate and gross trailer mass limits.

Conversions to the base vehicle that change the center of gravity may affect the ride and handling attributes.

NOTE: All vehicles should be evaluated for safe operation prior to sale.

1.8 Jacking

WARNINGS:

Ensure jack screwthread is adequately lubricated before use.

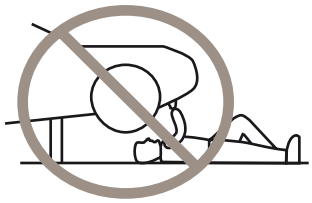
The jack should be used on level firm ground wherever possible.

Switch the ignition off and apply park brake fully before lifting vehicle.

It is recommended that the wheels of the vehicle be chocked, and that no person should remain in a vehicle that is being jacked.

No person should place any portion of their body under a vehicle that is supported by a jack.

WARNING: Do not get under a vehicle that is supported by a jack.



WARNINGS:

The jack supplied with this vehicle is only intended for changing wheels. Do not use the vehicle jack other than when you are changing a wheel in an emergency.

When jacking the Ranger PHEV, the jack must NOT be placed under the High Voltage Battery or the Battery Cradle. The vehicle must only be jacked using the correct jacking locations identified in the Owners Manual.

CAUTION: Make sure that access to the spare wheel is maintained when converting the vehicle or relocating the spare wheel. If vehicle service body or mounted assembly affect the area surrounding the spare wheel, make sure sufficient clearance is left for successful lowering and raising of the spare wheel. Failure to adhere to this requirement may cause damage to the winching mechanism and insecure location of the spare wheel.

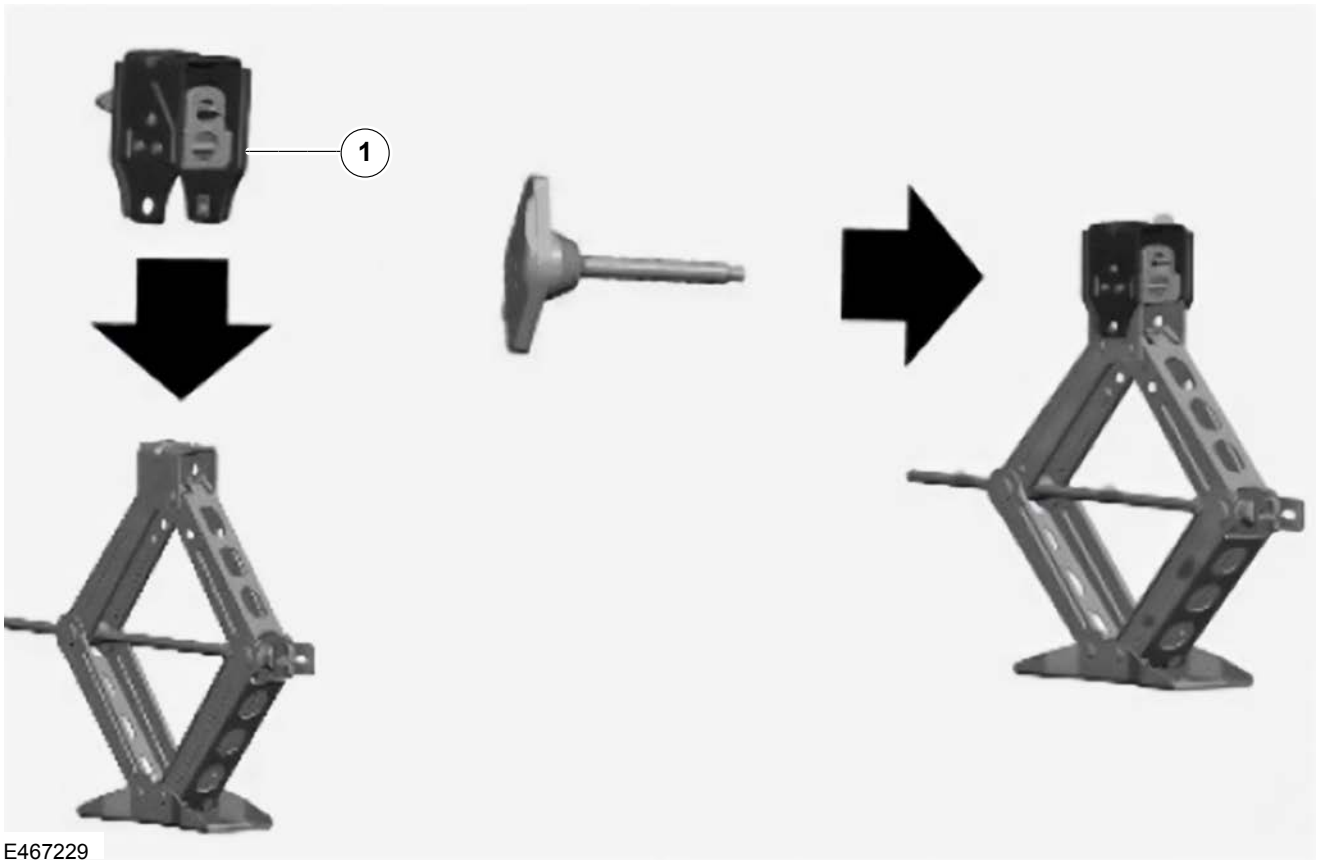
NOTE: When using the vehicle jack, refer to the owner guide for correct operating instructions.

The spare wheel winch is located above the spare wheel and can be accessed from the rear of the chassis frame.

The jack must be assembled and fixed appropriately to the body to ensure safety, durability and accessibility.

Jack Extension

For aftermarket lifted vehicles the Ford jack extension can be utilised to provide increased lift supporting wheel removal.



E467229

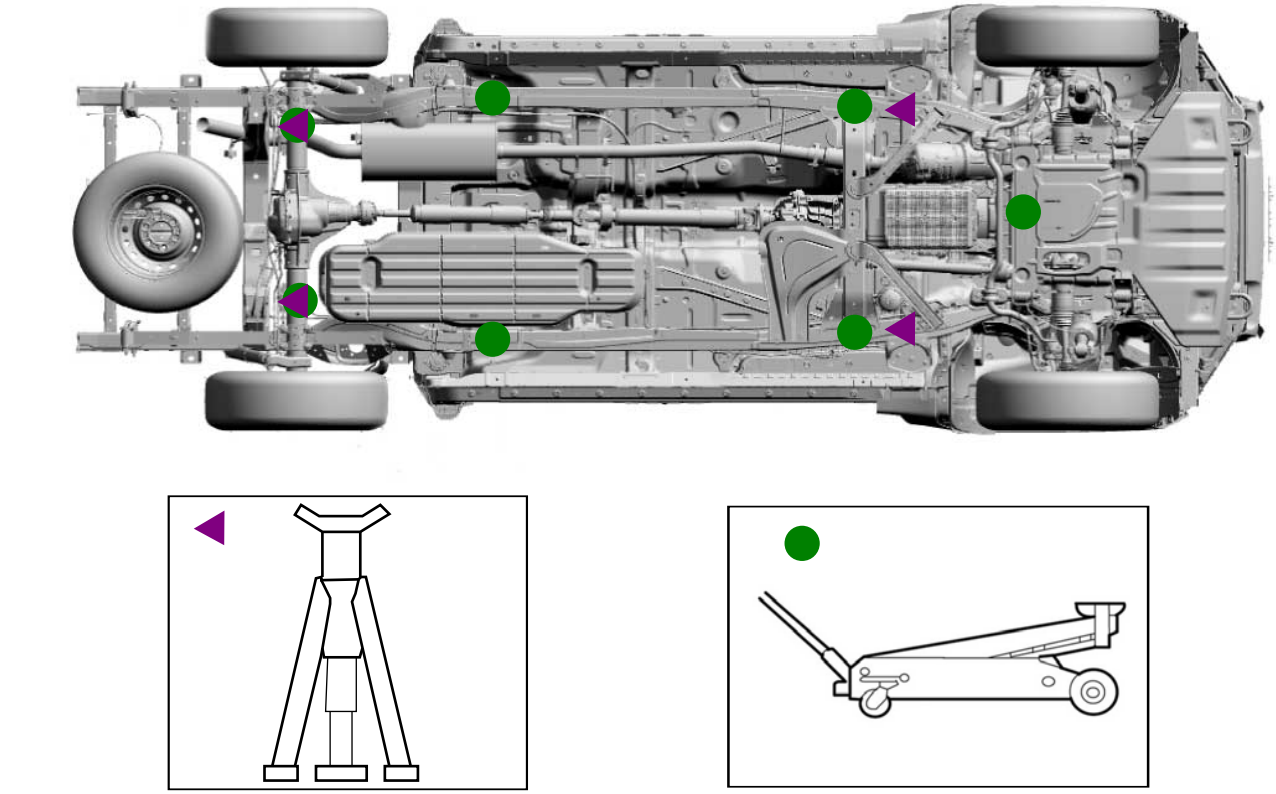
The jack extension may be available in some markets as an accessory that can be purchased from authorised Ford Dealers:

- Part Number: JB3Z-17A914-B

NOTE: Refer to the vehicle owner manual for further information on Changing a Road Wheel.

Refer to: 2.2 Wheels and Tires (page 77).

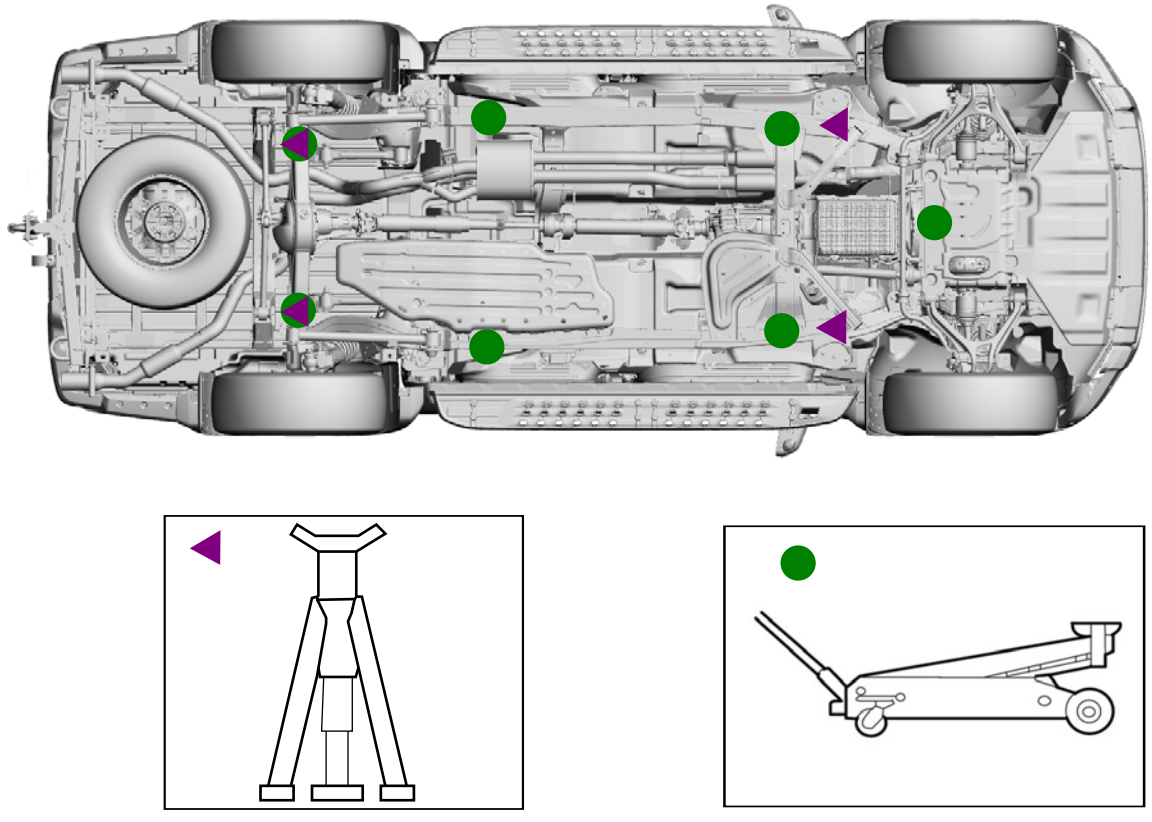
Vehicle Jacking Points and Axle Stand Positions



E363499

CAUTION: Care must be taken to not damage the diesel fuel filter (if equipped) located under the floor in front of the transmission cross member. If care is not taken in placement of the jack or axle stands, damage to the fuel system could result.

Vehicle Jacking Points and Axle Stand Positions - Raptor



E366253

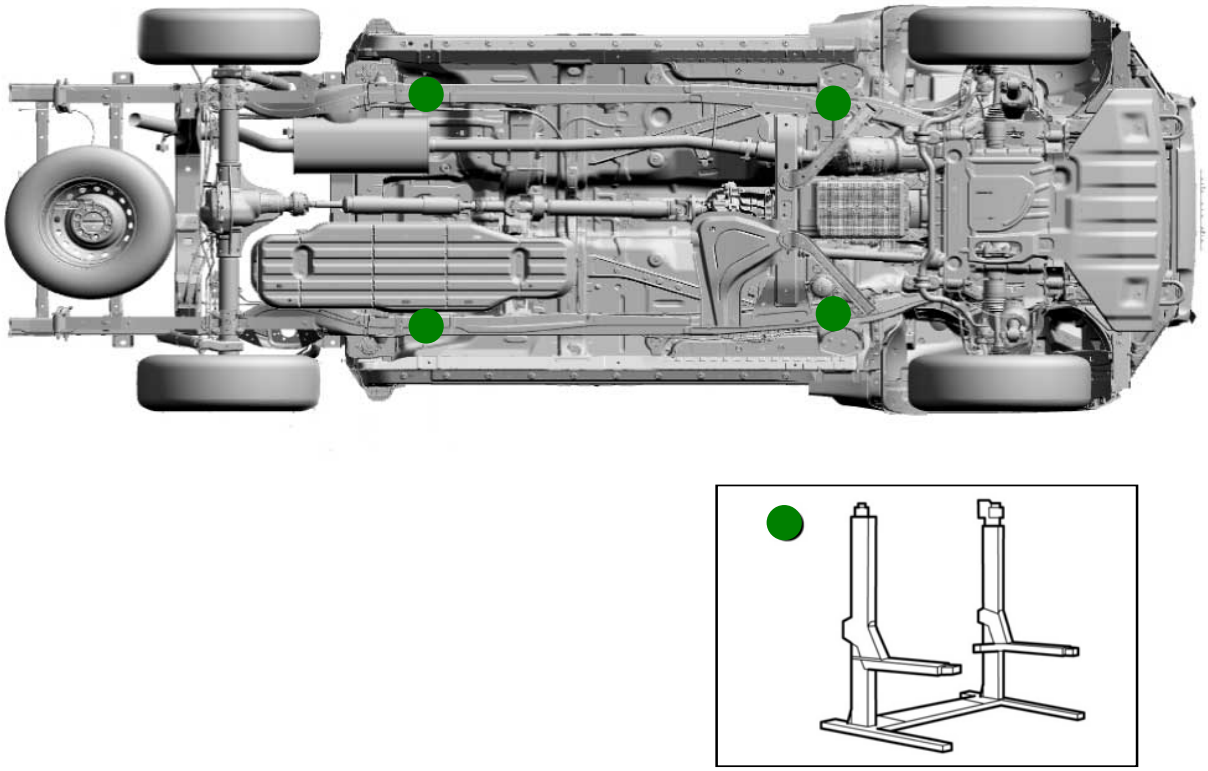
1.9 Lifting

WARNING: When lifting the vehicle with a two post lift for the removal of the engine/transmission or rear axle, make sure the vehicle is secured to the lift using vehicle retention straps to prevent tilting. Failure to follow these instructions may result in serious injury or death.

CAUTIONS:

- **Consider the total weight and also the weight distribution of the vehicle prior to lifting. Ensure the lifting equipment is appropriately rated for the weight of the vehicle and any added accessories, equipment and cargo.**
- **When lifting the vehicle with a two post lift, vehicle lift arm adapters must be used under the lifting points.**
- **When lifting the vehicle with a two post lift, the maximum kerb weight must not be exceeded.**
- **It is important that only the correct lifting and support locations are used at all times.**

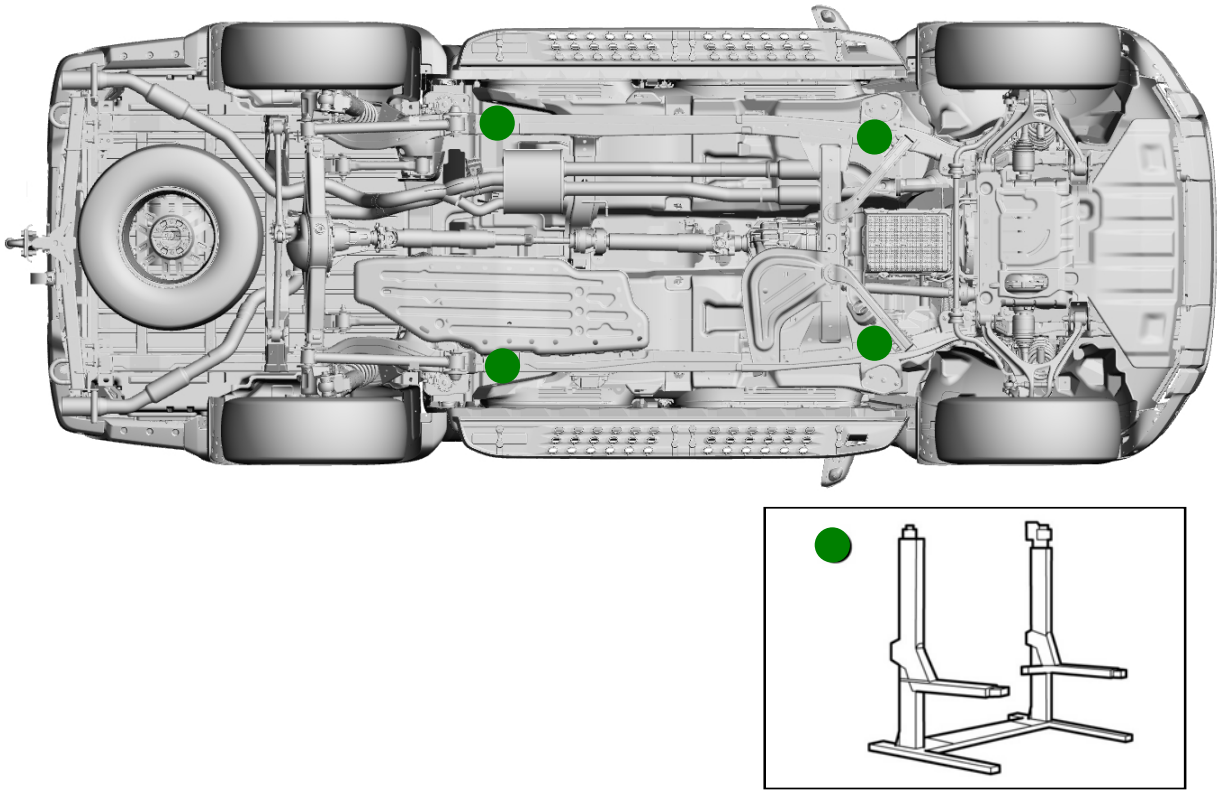
Lifting Points



E363500

- **CAUTION: Care must be taken to not damage the diesel fuel filter (if equipped) located under the floor in front of the transmission cross member. If care is not taken in placement of the lifting pads, damage to the fuel system could result.**

Lifting Points - Raptor

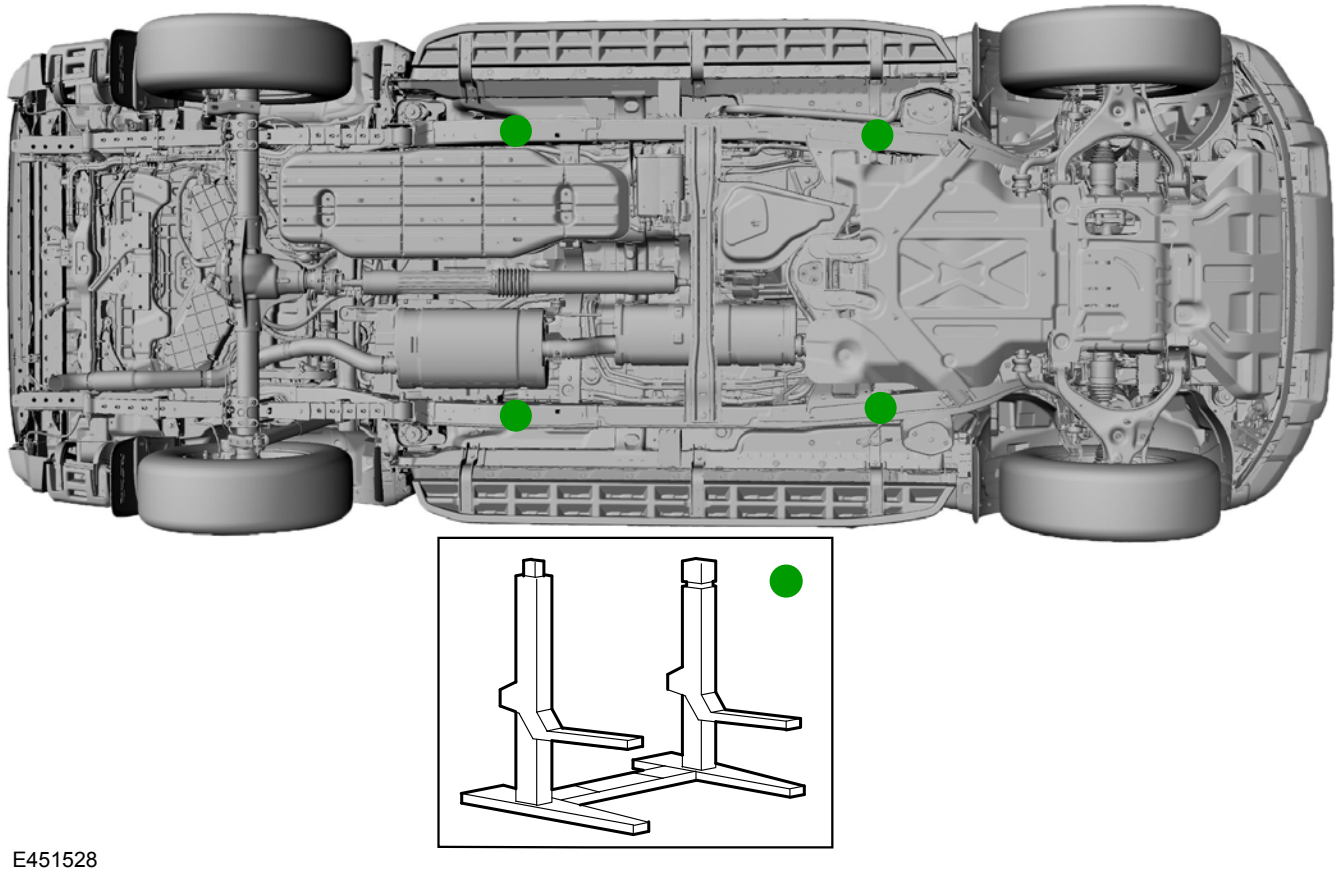


E366254

1.9.1 Ranger PHEV

WARNING: The Ranger PHEV must NOT be lifted using the Battery, Battery Cradle, Side Impact Protection or the electric Drive Assembly as a lifting point.

Lifting Points - PHEV



E451528

1.10 Noise, Vibration and Harshness (NVH)

WARNING: Make sure that the modified vehicle complies with all relevant legal requirements.

Changes to the powertrain, engine, transmission, exhaust, air intake system or tires may influence the exterior noise emissions. Therefore the exterior noise level of the converted vehicle has to be verified.

The interior noise levels should not be deteriorated by the conversion. Reinforce panels and structures as appropriate to avoid vibrations. Consider the usage of sound deadening materials where appropriate.

1.11 Vehicle Transportation Aids and Vehicle Storage

CAUTIONS:

Disconnect the battery if the vehicle is to be stored for more than 30 days.

Make sure that the protective covers are not removed from an incomplete vehicle until the conversion is started.

Make sure that components removed during conversion are kept clean and dry.

Make sure that components removed during conversion are refitted to the same vehicle.

Transport Mode includes a calibration feature to reduce the risk of fuel injector nozzle corrosion. Exiting Transportation Mode prior to upfitting/ conversion increases the risk of early life injector failure. Refer to your local Ford dealer or national sales agent for information on how to activate or deactivate transport mode.

In addition:

- The windscreen wipers should be lifted off the glass and set right up.
- All air intakes should be closed.
- Increase normal tire pressure by 0.5 bar / 7 psi / 50 kpa.
- The hand brake system should not be used.
- Apply suitable wheel chocks to prevent roll away.

A significant risk during storage is deterioration of vehicle bodywork, therefore, appropriate storage procedures must be observed, including periodic inspection and maintenance.

Claims arising from deterioration caused by incorrect storage, maintenance or handling are not the responsibility of Ford.

Vehicle Converters must determine their own procedures and precautions, particularly where vehicles are stored in the open as they are exposed to any number of airborne contaminants.

The following may be considered a sensible approach to storage:

Short Term Storage

- Wherever possible vehicles should be stored in an enclosed, dry, well-ventilated area based on firm, well drained ground which is free of long grass or weeds and where possible protected from direct sunlight.
- Vehicles must not be parked near, under foliage or close to water as additional protection may be necessary for certain areas.

Long term storage:

- Battery to be disconnected but not removed from the vehicle.
- The wiper blades should be removed and placed inside the vehicle. Make sure the wiper arms are suitably prevented from resting on the windscreen.
- Engage first gear and release the parking brake completely. Chock the wheels first if the vehicle is not on level ground.
- Set climate controls to the "open" position to provide ventilation, where possible.
- Where protective film has been applied in manufacture it must be left on the vehicle until prepared for delivery but must be removed after a maximum storage period of six months (film is date stamped to indicate required removal date).
- Make sure that all windows, doors, hood, tailgate and luggage compartment lid are completely closed and the vehicle is locked.
- **Hybrid Battery Systems:** When storing the vehicle greater than 30 days the state of charge should be approximately 50%.

The Pre Delivery Inspection (PDI) is the final opportunity to make sure a battery is fit for purpose prior to the customer taking delivery of their new vehicle. The battery must be checked and appropriate action taken prior to the vehicle being handed over to the customer. Test results must be recorded on the PDI repair order.

Batteries: To make sure the battery is maintained correctly and to assist in preventing premature failure, it is necessary to check and recharge the battery regularly while a vehicle is not in use. Where a battery is left below its optimum charge level for any length of time, it may result in premature failure of the battery.

Battery Drain Prevention: As part of the Vehicle Convertor process and to maximise battery life and prevent premature failure of the Ford batteries, protect and prevent battery discharge during any conversion or whilst the vehicle is in storage. This may include leaving the vehicle in Transport mode as long as possible, reducing the amount of crank cycling around the facility, door ajar events and duration. The voltage MUST be checked when receiving and before shipping. Recharge with an appropriate proprietary battery charger if the vehicle battery voltage is below 12.4V for Standard and Enhanced flooded or 12.3V for AGM. Measure connected to the vehicle at ignition of and no loads active including interior or exterior lights in Off status.

Subsequent stage manufacturers and vehicle alterers who will be working with BEV vehicles should develop a plan to potentially charge these vehicles.

Charging stations are recommended at vehicle storage locations.

Convertors should also consider the vehicle state of charge as it leaves their facility:

- Vehicles should enter the Ford transportation system with the same state of charge they had leaving the Ford assembly plant.
- In other cases, upftters should consider their customer's expectations and transportation arrangements when determining any state of charge requirements.
- If the high voltage battery state of charge is less than 20%, charge vehicle to 40%. This is to ensure the High Voltage Battery state of charge is maintained between 20% and 40%.

Action / Time in storage	Monthly	Every 3 Months
Check vehicle is clean	X	-
Remove external contamination	X	-
Check battery condition - Recharge if necessary	Connected	Disconnected
Visually check tires	X	-
Check interior for condensation	-	X
Run engine until coolant gauge reaches temperature (60 ºC) with aircon switched on, where applicable	-	X

To reduce the likelihood of premature battery failure it is recommended that where:

- A battery is left connected – monthly checks should be carried out.
- A battery has been disconnected – no greater than a 3 monthly check should be carried out.

1.12 Package and Ergonomics

1.12.1 General Component Package Guidelines

WARNING: Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe or anti-roll bars, springs or shock absorbers including mounting brackets.

The Vehicle Converter must ensure that sufficient clearance is maintained under all drive conditions to moving components such as axles, fans, steering, brake system etc.

The Vehicle Converter is responsible for all installed components during the conversion. The durability must be confirmed by appropriate test procedures.

1.12.2 Driver Reach Zones

Controls and/or equipment required to be used while driving should be located within easy reach of the driver so as not to impair driver control.

1.12.3 Driver Field of View

WARNING: Make sure that the modified vehicle complies with all relevant legal requirements.

1.12.4 Conversion Effects on Parking Aids

WARNING: Ensure that monitors mounted in the cabin meet the interior package and safety requirements.

On conversions requiring a rear camera, the reverse signal may be taken as described in the reversing lamps section.

Refer to: 4.6 Exterior Lighting (page 166).

1.12.5 Aids for Vehicle Entry and Exit

Steps

WARNINGS:

Make sure that the modified vehicle complies with all relevant legal requirements.

If this modification alters the homologated dimensions, a new approval may be necessary.

CAUTION: Make sure that reinforcements are installed to maintain the integrity of the original body structure.

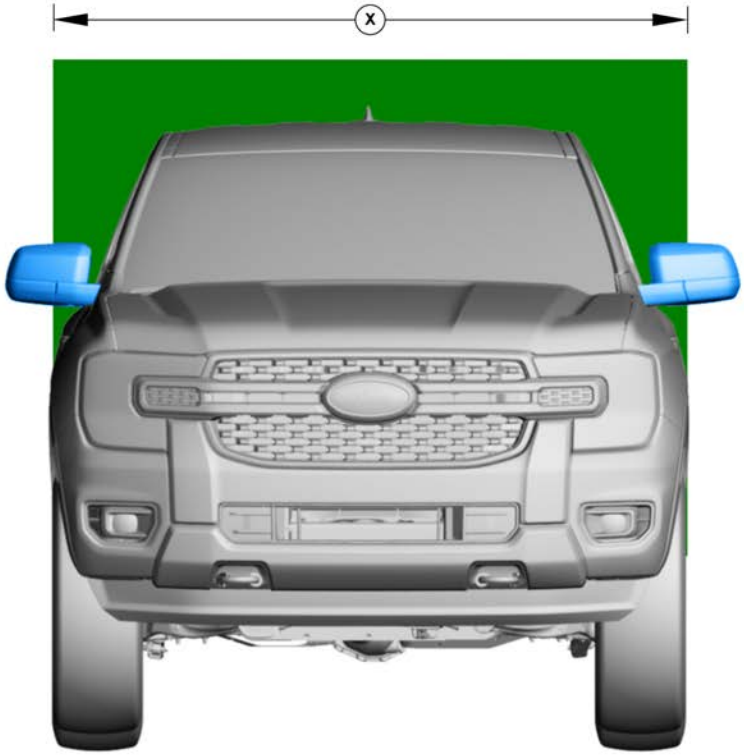
Steps can be ordered as an accessory on the base vehicle. Please check for availability.

Where additional steps are installed the required ground clearance line must be maintained.

The Vehicle Converter must make sure that a movable step is set in the stored position when the vehicle is running. The step surface must be non-slip.

Rear View Mirrors

NOTE: Overall width with exterior rear view mirrors extended is 2208 mm.



E364072

Description	Single Cab	Super Cab	Double Cab
Maximum Body Width (mm)	1930 mm (LR)	1950 mm	1970 mm
	1910 mm (HR)		

LR = Vehicles with low ride height

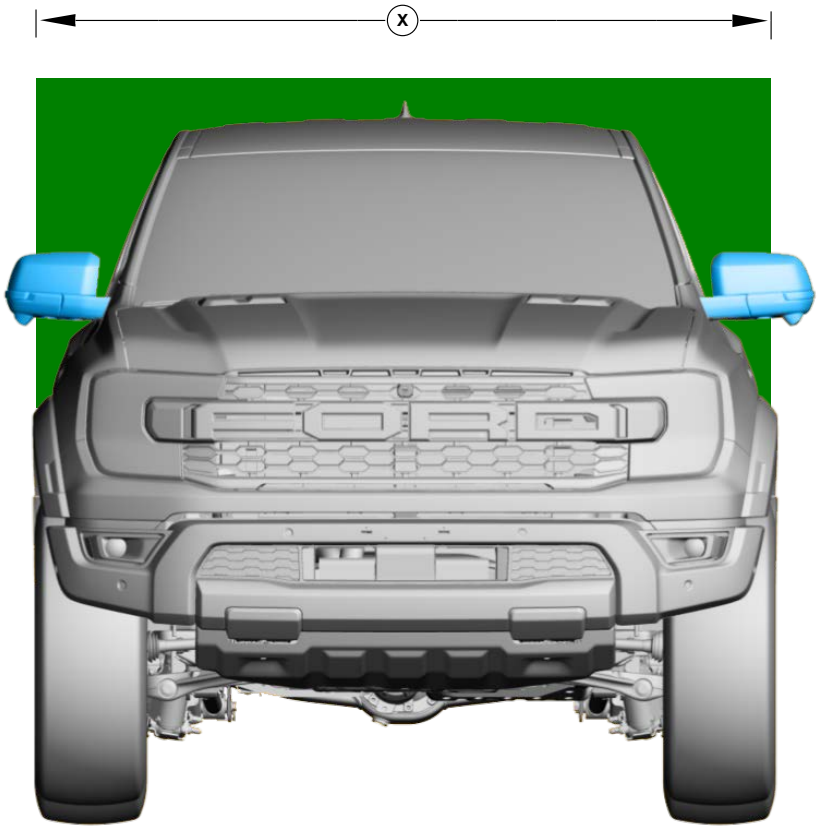
HR = Vehicles with high ride height

NOTE: Beyond these values extended mirrors may be required to comply with rear vision requirements. Refer to ECE R46 / ADR 14 (Indirect Vision) or Local Requirements.

Ford offers approved accessory extendable towing mirrors (compact and full-size) to suit all cab styles and series. These are available in some markets as an accessory that can be purchased from authorised Ford Dealers.

Rear View Mirrors - Raptor

NOTE: Overall width with exterior rear view mirrors extended is 2208 mm.



E377014

Item	Description
X	Maximum Body Width: 1910 mm - beyond this value rear vision compliance should be assessed

NOTE: These values assume a high, flat-sided second-unit body with no allowance for any protrusions such as latches, hinges and handles, etc.

NOTE: Raptor body width restriction is influenced by the tyre and tyre-coverage blocking of indirect vision.

NOTE: Beyond these values extended mirrors may be required to comply with rear vision requirements. Refer to ECE R46 / ADR 14 (Indirect Vision) or Local Requirements.

Ford offers approved accessory extendable towing mirrors (compact and full-size) to suit all cab styles and series. These are available in some markets as an accessory that can be purchased from authorised Ford Dealers.

1.12.6 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

The following vehicles can, as part of a second-stage homologation, have their WLTP values re-calculated, based on your conversion.

Specification Available	WLTP Calculation Available	Multi-Stage Option Available in VISTA (1)	Multi-Stage Option Available in VISTA (2)	Mandatory Speed Limit
170PS Manual	Yes	Vehicle must be ordered as multi-stage	No	130kph/80mph
205PS Auto	Yes	Vehicle must be ordered as multi-stage	No	130kph/80mph
240PS Auto (V6) Diesel	Yes	Vehicle must be ordered as multi-stage	No	130kph/80mph
PHEV	Yes	Yes	Yes	N/A

The following attributes are required as part of the WLTP calculation for completed vehicles:

Mass of the Completed Vehicle

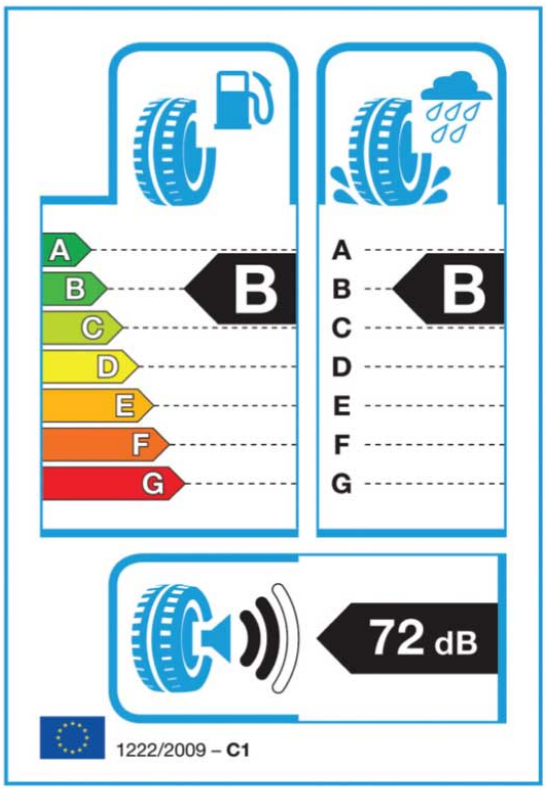
All modifications and changes that effect the actual mass of the vehicle must be taken into account. The definition of actual mass is described under the provisions of regulation 2018/1832 Annex XXI. The actual mass of the completed vehicle needs to be provided for the front and rear axle. This weight split will be important where the completed vehicle has mixed tires between the front and rear.

Frontal Surface Area

All modifications and changes that effect the frontal surface area of the completed vehicle must be taken into account. For further information please see information later in this section.

Tire Rolling Resistance

Any changes in tires fitted to the completed vehicle must be taken into account. The efficiency class and tire class is needed to determine the correct calculation. This can be found on the tire label as per the example below.



E309537

Exceeding Attribute Limits

As a requirement of the Vehicle Converter to use the base vehicle approval, the Vehicle Converter must stay within the defined limits of the BEMM and the Emissions Type Approval applicable to the vehicle. It is the responsibility of the Vehicle Converter to ensure they stay within these defined limits to remain compliant with the emissions performance. If the Vehicle Converter wishes to exceed the limits they must seek clarification with the relevant technical service or type approval authority. In this case, the base approval may become invalid and the Vehicle Converter may need to re-certify the vehicle against the exceeded limits.

1.12.7 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs - Raptor

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

The following attributes are required as part of the WLTP calculation for completed vehicles

Mass of the Completed Vehicle

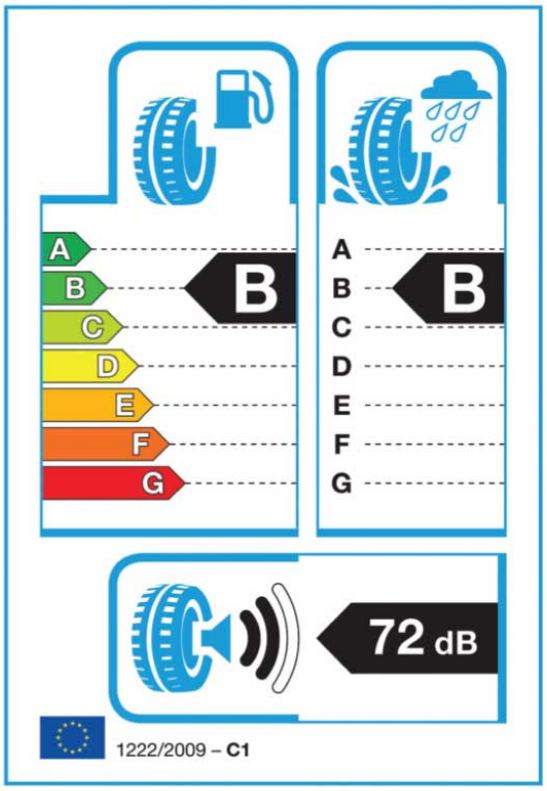
All modifications and changes that effect the actual mass of the vehicle must be taken into account. The definition of actual mass is described under the provisions of regulation 2018/1832 Annex XXI. The actual mass of the completed vehicle needs to be provided for the front and rear axle. This weight split will be important where the completed vehicle has mixed tires between the front and rear.

Frontal Surface Area

All modifications and changes that effect the frontal surface area of the completed vehicle must be taken into account. For further information please see information later in this section.

Tire Rolling Resistance

Any changes in tires fitted to the completed vehicle must be taken into account. The efficiency class and tire class is needed to determine the correct calculation. This can be found on the tire label as per the example below.



E309537

Exceeding Attribute Limits

As a requirement of the Vehicle Converter to use the base vehicle approval, the Vehicle Converter must stay within the defined limits of the BEMM and the Emissions Type Approval applicable to the vehicle. It is the responsibility of the Vehicle Converter to ensure they stay within these defined limits to remain compliant with the emissions performance. If the Vehicle Converter wishes to exceed the limits they must seek clarification with the relevant technical service or type approval authority. In this case, the base approval may become invalid and the Vehicle Converter may need to re-certify the vehicle against the exceeded limits.

1.12.8 Vehicle Dimensions Key

Dimension (mm)	Vehicles with increased ride height (4x2 / 4x4)	Vehicles with low ride height (4x2)
Wheel Base Length	3270	3270
Overall Vehicle Height @ Base Kerb Weight - measured to antenna base		
Single Cab	1873-1884	1784
Super Cab	1866-1878	1775
Double Cab	1875-1887	1781
Overall Vehicle Height - measured to antenna base at MAX rear axle loading conditions		
Single Cab	1823-1834	1727
Super Cab	1803-1815	1707
Double Cab	1805-1817	1707

All dimensions are subject to manufacturing tolerances and refer to minimum specification models and do not include additional equipment.

Height dimensions show the range for the minimum to maximum weight range and are for guidance only.

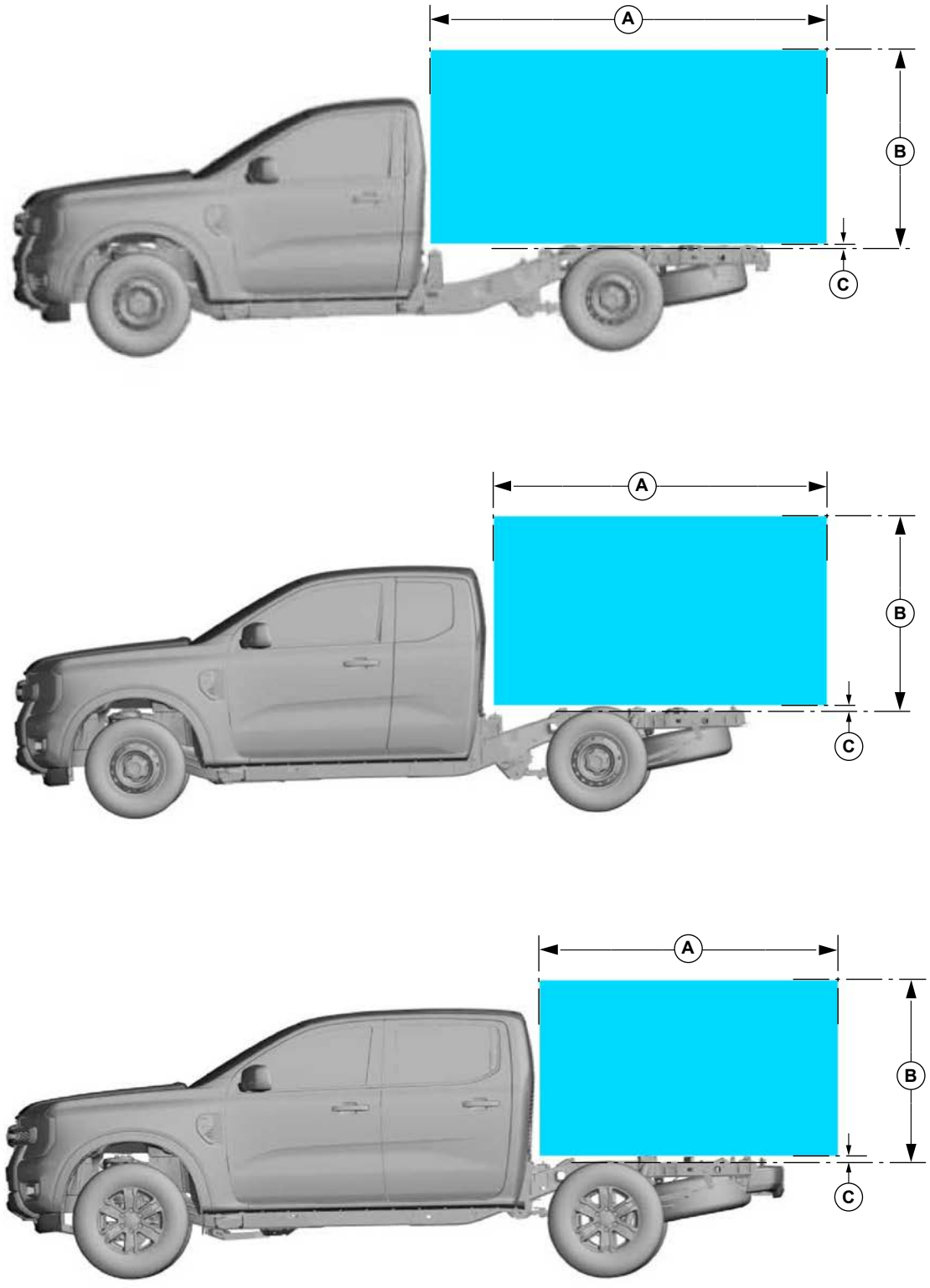
1.12.9 Vehicle Dimensions Key - Raptor

Dimension (mm)	x
Wheel Base Length	3270
Overall Vehicle Height @ Base Kerb Weight - measured to antenna base	
Raptor	1926
Overall Vehicle Height - measured to antenna base at MAX rear axle loading conditions	
Raptor 3.0L EcoBoost	1828
Raptor 2.0L BiT Diesel 213ps	1822

All dimensions are subject to manufacturing tolerances and refer to minimum specification models and do not include additional equipment.

Height dimensions show the range for the minimum to maximum weight range and are for guidance only.

1.12.10 Recommended Maximum Main Load Area Dimensions



E364073

Vehicle	A (mm)	B (mm)	C (mm)
Single Cab	2872	2400	45
Super Cab	2402	2400	45
Double Cab	2104	2400	45

Date of Publication: 06/2026
Composed on:Tue Jul 07 08:04:03 BST 2026

Dimension A does not include the 28mm tray to cabin clearance requirement.

Refer to: 4.3 Parking Aid (page 146).

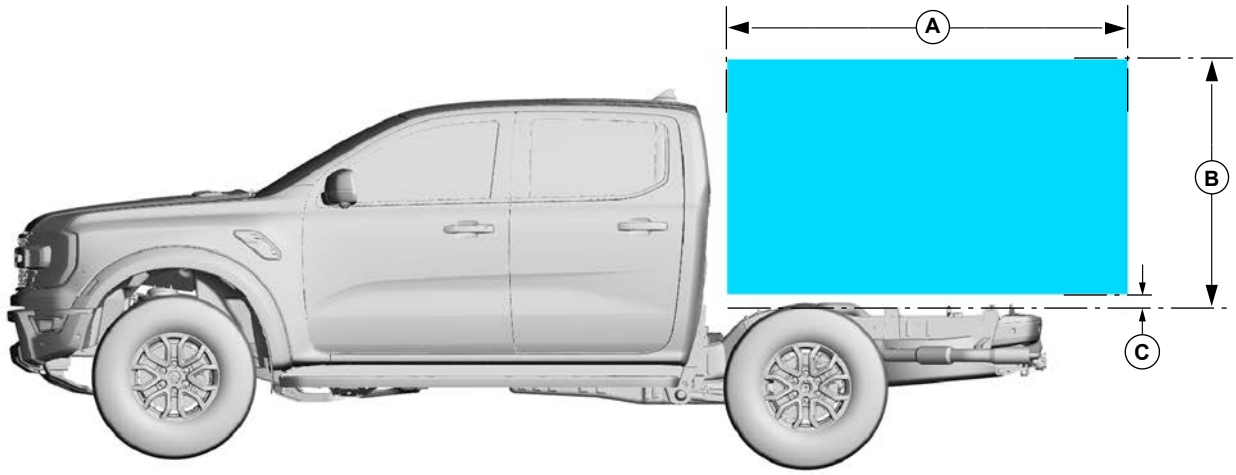
Dimension B is for non-WLTP markets only.

Refer to: 1.12 Package and Ergonomics (page 34).
for WLTP Frontal Area Calculation.

Dimension C is taken from the forward and mid body mounting pads (not rearmost).

Refer to: 5.1 Body (page 207).
for mounting pad heights and general chassis protrusions.

1.12.11 Recommended Maximum Main Load Area Dimensions - Raptor



E378222

Vehicle	A (mm)	B (mm)	C (mm)
Raptor	2104	2400	50

Dimension A does not include the 28mm tray to cabin clearance requirement.

Refer to: 4.3 Parking Aid (page 146).

Dimension B is for non-WLTP markets only.

Refer to: 1.12 Package and Ergonomics (page 34).
for WLTP Frontal Area Calculation - Raptor.

Dimension C is taken from the forward and mid body mounting pads (not rearmost).

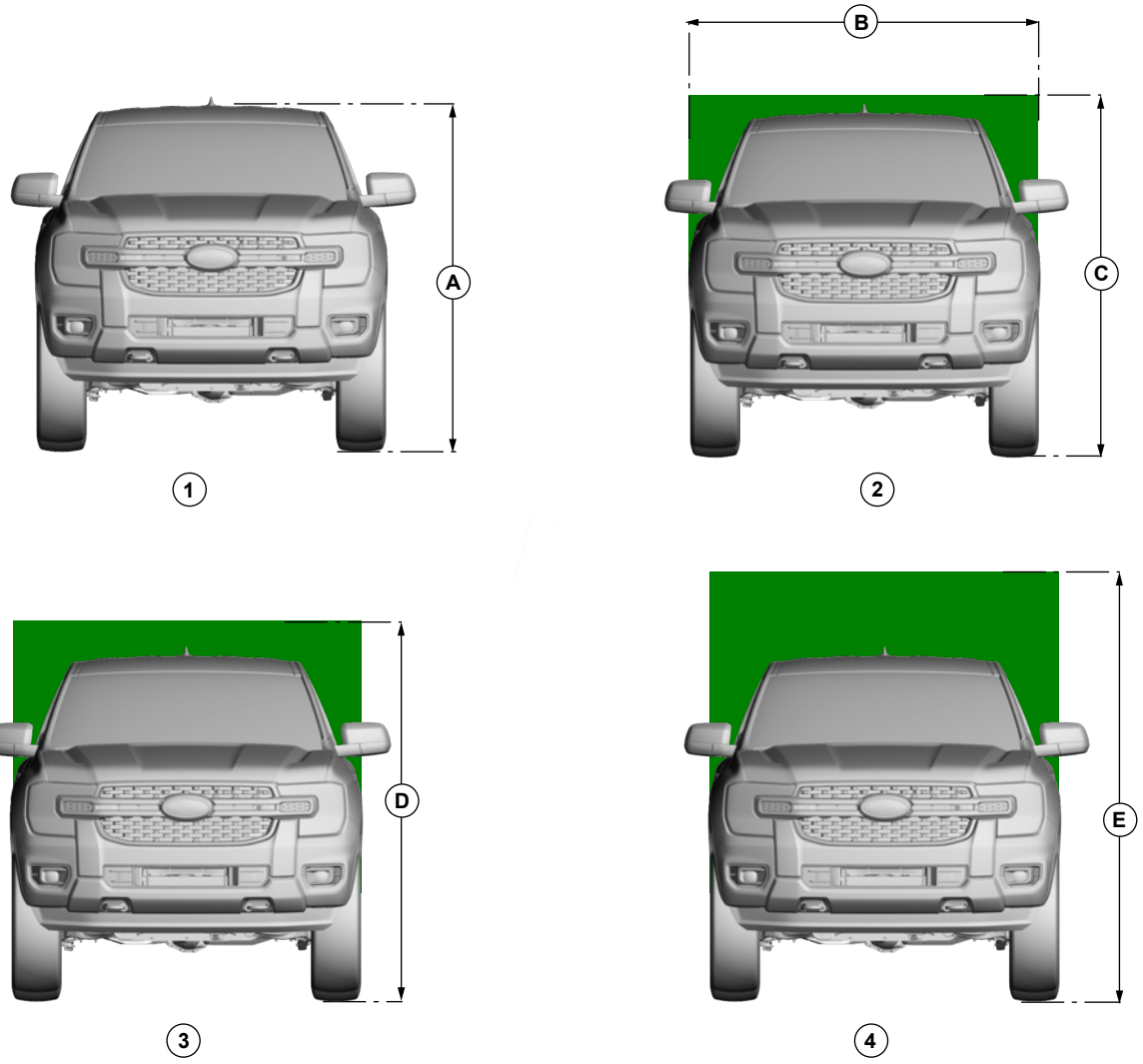
Refer to: 5.1 Body (page 207).
for mounting pad heights and general chassis protrusions.

1.12.12 WLTP Frontal Area Calculation

NOTE: The WLTP calculator can be provided by your National Sales Representative.

NOTE: All standard/optional equipment have already been taken into account, i.e. base vehicle frontal area including mirrors.

Frontal Area Calculation



E364074

Item	Description
1	Base vehicle- Style Side Box
2	Box at Cab Width and Roof Height
3	Box @ 0.5m2 > Base
4	Box @ 1m2 > Base

Vehicle frontal area measurements

Measurement	mm
A	1820 : from aero roof loading line to roof panel
B	1860
C	1839
D	1945
E	2214

Vehicle frontal area configuration

Vehicle frontal area configuration	Af m²	Af m²
1 = Base vehicle with style side box	2.873	-
2 = Box @ Cab Width and Roof Height	3.175	0.302
3 = Box @ 0.5m2 > Base	3.373	0.500
4 = Box @ 1m2 > Base	3.873	1.000

The Vehicle Converter only needs to calculate the frontal area of the mounted unit (AxB) in m².

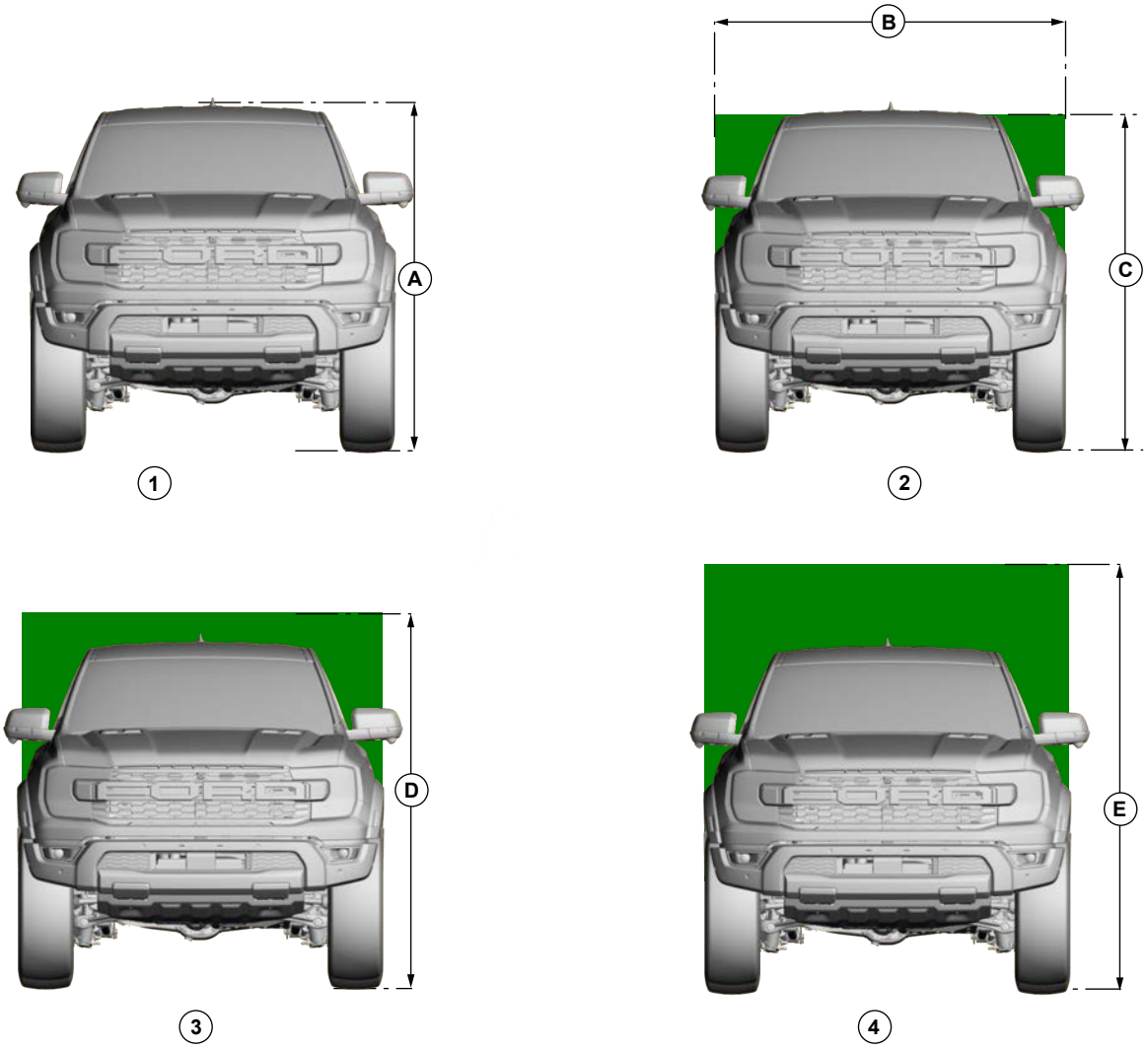
1.12.13 WLTP Frontal Area Calculation - Raptor

NOTE: The WLTP calculator can be provided by your National Sales Representative.

NOTE: All standard/optional equipment have already been taken into account, i.e. base vehicle frontal area including mirrors.

NOTE: Radii on the load box edges shall be no less than 20mm formed.

Frontal Area Calculation



E377016

Item	Description
1	Base vehicle- Style Side Box
2	Box at Cab Width and Roof Height
3	Box @ 0.5m2 > Base
4	Box @ 1m2 > Base

Vehicle frontal area measurements

Measurement	mm
A	≤ 1820
B	1860
C	1839
D	1945
E	2214

Vehicle frontal area configuration

Vehicle frontal area configuration	Af m²	Af m²
1 = Base vehicle with style side box	2.873	-
2 = Box @ Cab Width and Roof Height	3.175	0.302
3 = Box @ 0.5m2 > Base	3.373	0.500
4 = Box @ 1m2 > Base	3.873	1.000

The Vehicle Converter only needs to calculate the frontal area of the mounted unit (AxB) in m².

1.12.14 Registration Plates

Front Registration Plate

WARNINGS:

The mounting of a registration plate to the front of the vehicle must comply with local regulations.

No part of a vehicle registration plate may be obscured by standard equipment, regular production options or equipment, in line with local regulations.

The registration plate must be affixed to the front of the motor vehicle forward of and parallel to the front 'Axle' so that no part of such registration plate is more than 1,300 mm from the ground.

Rear Registration Plate

WARNINGS:

The mounting of a registration plate to the front of the vehicle must comply with local regulations.

No part of a vehicle registration plate may be obscured by standard equipment, regular production options or equipment, in line with local regulations.

The registration plate must be affixed to the rear of the motor vehicle so that no part of such registration plate is more than 1,300 mm from the ground.

1.13 Package and Ergonomics—Specifications

1.13.1 Recommended Body Dimensions

WARNINGS:

Do not modify the wheelbase or add any type of frame extension to vehicles fitted with Electronic Stability Program (ESP).

Ensure that any mass added to the vehicle does not compromise vehicle stability.

NOTE: Extreme rear overhang may encourage unacceptable loading conditions, which could unload the front axle, producing unacceptable handling and braking characteristics. Ensure that the center of gravity of the body and payload does not fall outside of the recommended zone.

NOTE: An excessively high center of gravity could reduce vehicle stability. Ensure that the center of gravity of the body and payload does not fall outside of the recommended zone.

Refer to: 1.15 (page 56).

NOTE: When extending the length of the frame rearward of the rear axle, it is recommended that the overall rear overhang is limited to a maximum of 50% of the wheelbase of the vehicle.

NOTE: If a towball is fitted to the vehicle, the body dimensions must incorporate a towball clearance zone in accordance with local regulatory requirements.

If a conversion requires more than 50% overhang, please contact your local National Sales Company representative, or Local Ford Dealer.

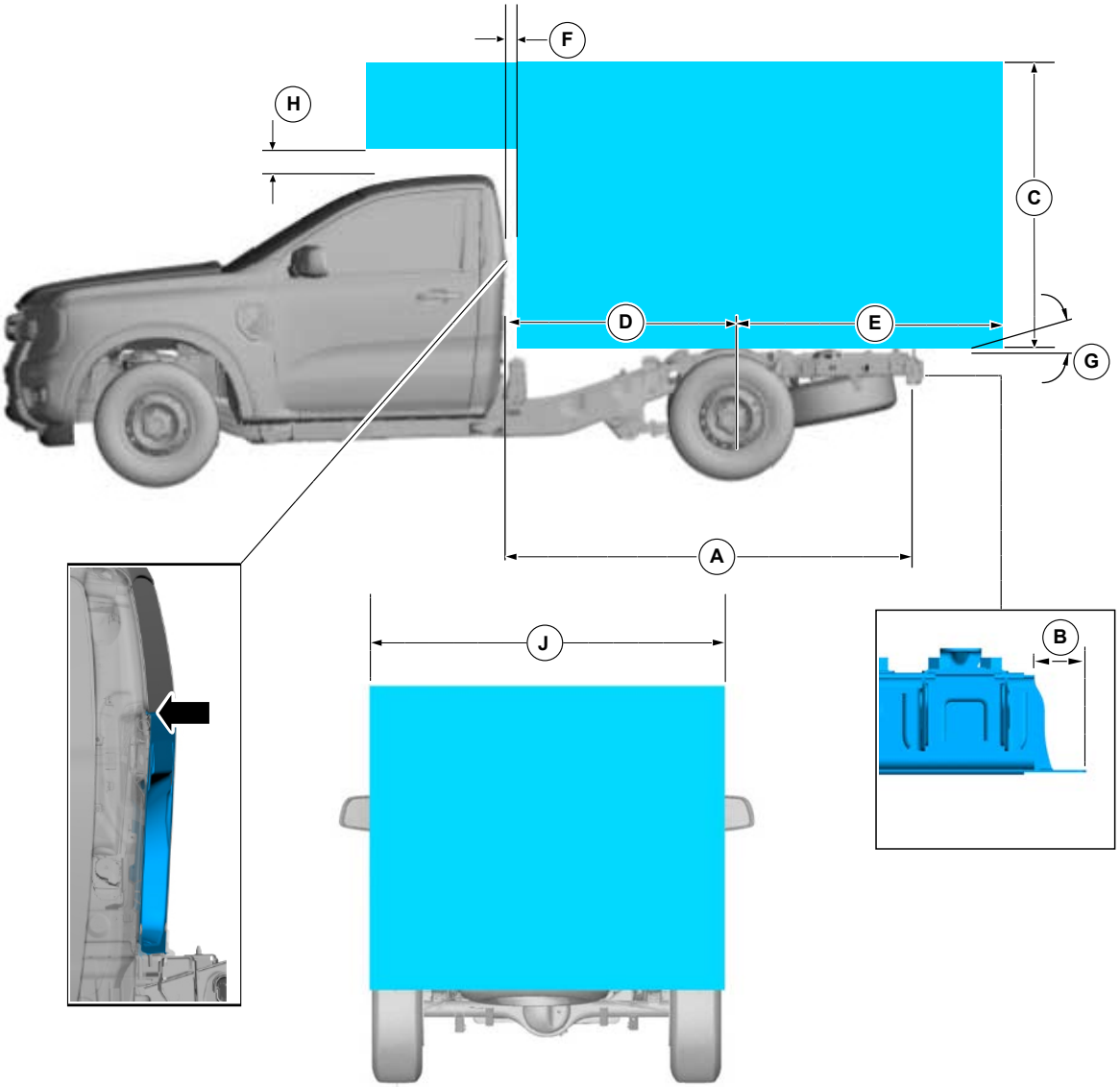
NOTE: To access the wheel winch with a longer tray overhang, an additional extension bar may be required.

At the time of publication the extension bar may also be available in some markets as an accessory that can be purchased from authorised Ford Dealers: **JB3Z-17081-A**

Load carrying structures should not be mounted onto an existing load tray or load box. Body attachment points are provided on the frame.

Refer to: 1.15 (page 56).

Chassis Cab Body - Single Cab Illustrated



E472700

Dimensions - not to exceed for Chassis Cab body Length

Description		Dimension (mm)		
		Single Cab	Super Cab	Double Cab
A	Frame length behind back of cab (not including rear light cross-member)	2286mm	1816mm	1518mm
B	Frame rail tab (not included in main frame length measurements)	50mm		
C	Maximum recommended external body height *	2400 over the top of frame, provided load distribution requirements are met		
D	Front outside of body to rear axle centre line	1265mm	795mm	497mm
E	Maximum recommended rear overhang	(50% of vehicle wheelbase), provided load distribution requirements are met		
F	Clearance between the back of the cab and the body	28mm Minimum		
G	Ensure local lighting legislation is maintained. Refer to: 4.6 Exterior Lighting (page 166).			
H	Clearance between the top of the cab and the body	30mm		
J	Maximum external body width (without side step)	1910mm - beyond this value rear vision compliance must be assessed		

*For WLTP markets this dimensions should be disregarded. Refer to the relevant WLTP dimensions.

Refer to: 1.12 Package and Ergonomics (page 34).

All dimensions (shown in mm) are subject to manufacturing tolerances and refer to min specification models which do not include additional equipment. The illustrations are for guidance only.

The under-run bar and towing attachment must be applicable to local market legislation where required.

1.13.2 Recommended Body Dimensions - Raptor

WARNINGS:

Do not modify the wheelbase or add any type of frame extension to vehicles fitted with Electronic Stability Program (ESP).

Ensure that any mass added to the vehicle does not compromise vehicle stability.

NOTE: Extreme rear overhang may encourage unacceptable loading conditions, which could unload the front axle, producing unacceptable handling and braking characteristics. Ensure that the center of gravity of the body and payload does not fall outside of the recommended zone.

NOTE: An excessively high center of gravity could reduce vehicle stability. Ensure that the center of gravity of the body and payload does not fall outside of the recommended zone.

NOTE: When extending the length of the frame rearward of the rear axle, it is recommended that the overall rear overhang is limited to a maximum of 50% of the wheelbase of the vehicle.

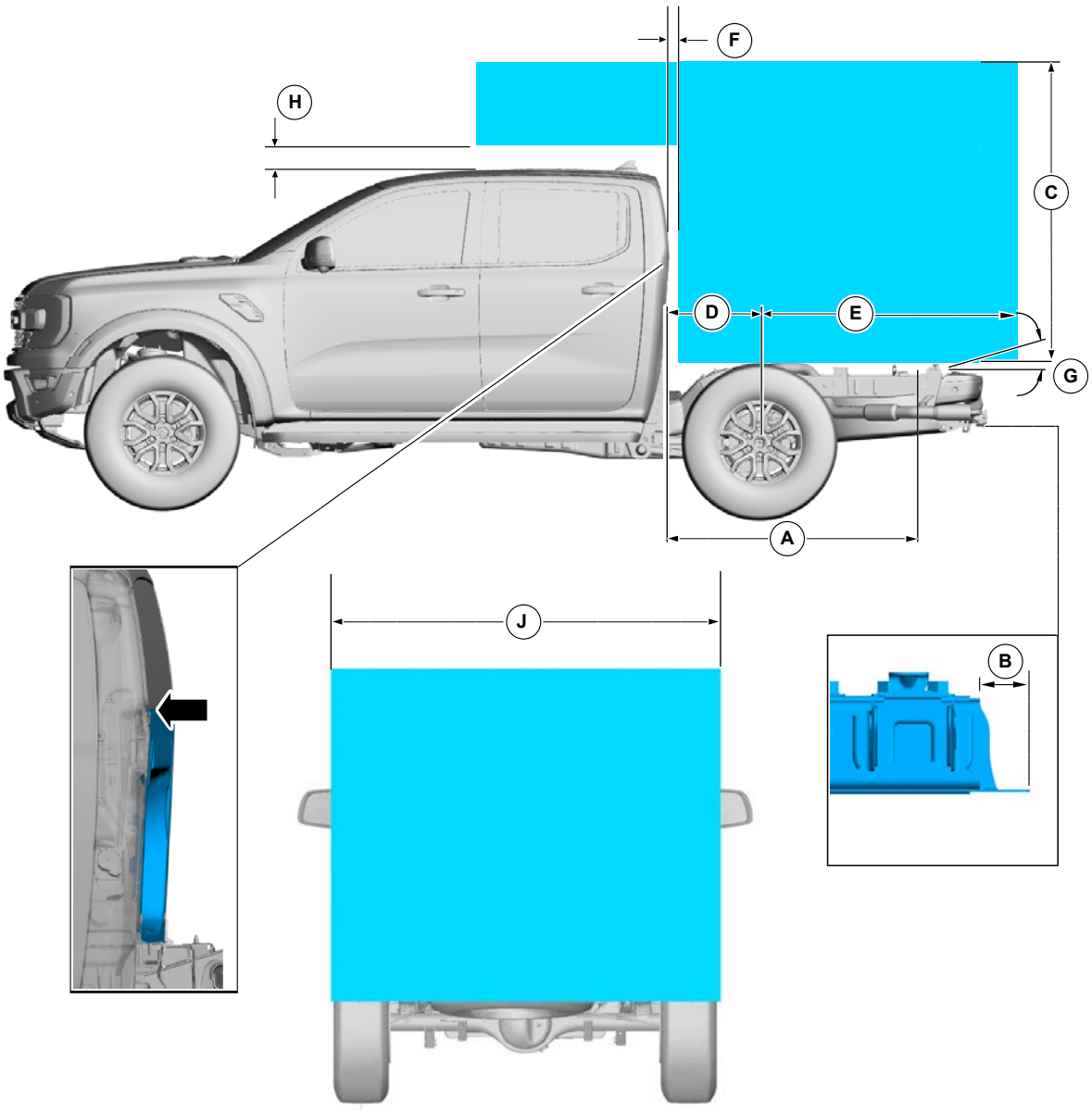
NOTE: If a towball is fitted to the vehicle, the body dimensions must incorporate a towball clearance zone in accordance with local regulatory requirements.

If a conversion requires more than 50% overhang, please contact your local National Sales Company representative, or Local Ford Dealer.

Load carrying structures should not be mounted onto an existing load tray or load box. Body attachment points are provided on the frame.

Refer to: 5.1 Body (page 207).

Chassis Cab Body - Raptor



E473027

Dimensions - not to exceed for Chassis Cab body Length

Description		Dimension (mm)
		Double Cab - Raptor
A	Frame length behind back of cab (not including rear light cross-member)	1498mm
B	Frame rail tab (not included in main frame length measurements)	50mm
C	Maximum recommended external body height *	2400 over the top of frame, provided load distribution requirements are met
D	Front outside of body to rear axle centre line	497mm
E	Maximum recommended rear overhang	(50% of vehicle wheelbase), provided load distribution requirements are met
F	Clearance between the back of the cab and the body	28mm Minimum
G	Ensure local lighting legislation is maintained. Refer to: 4.6 Exterior Lighting (page 166).	
H	Clearance between the top of the cab and the body	30mm
J	Maximum external body width (without side step)	1910mm - beyond this value rear vision compliance must be assessed

*For WLTP markets this dimensions should be disregarded. Refer to the relevant WLTP dimensions.

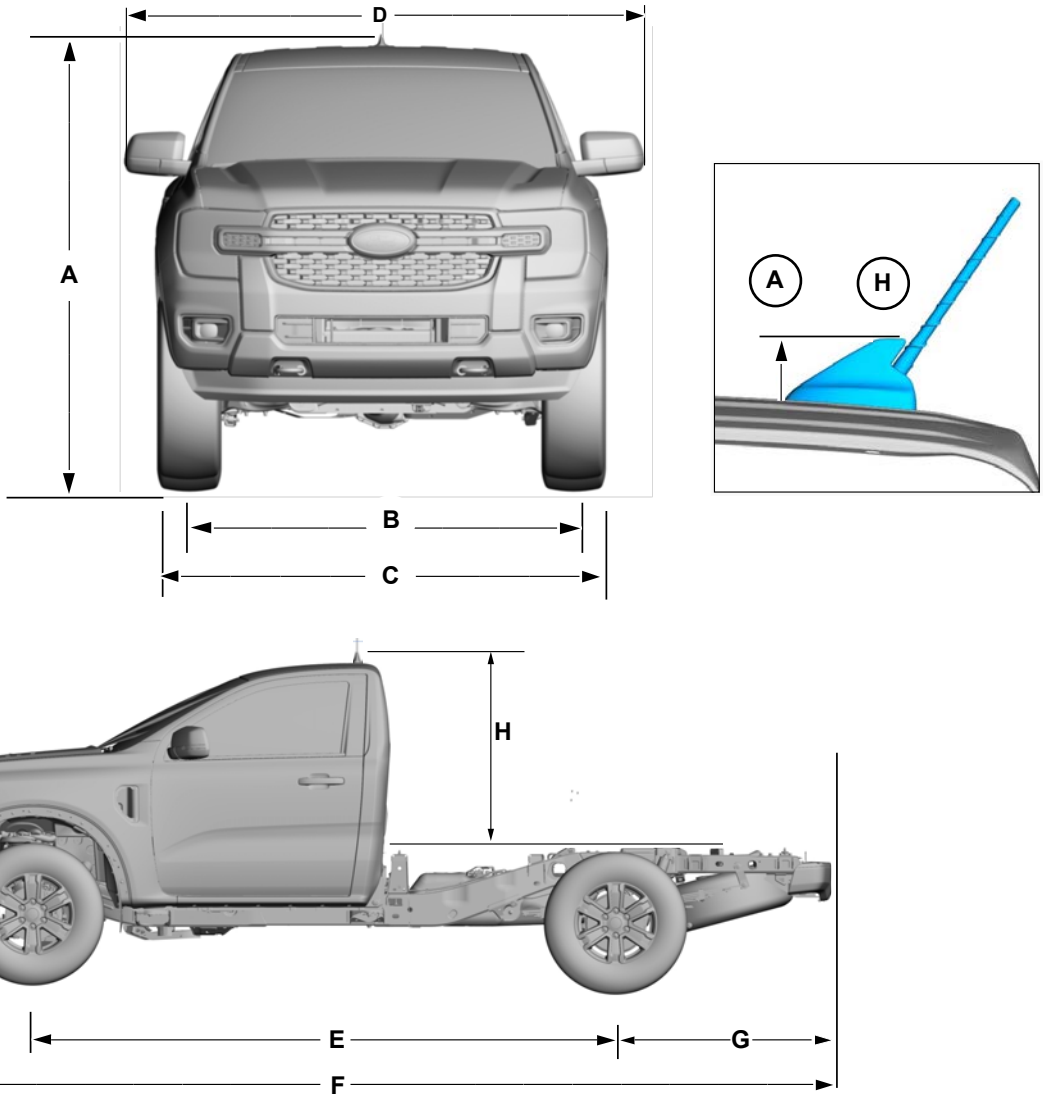
Refer to: 1.12 Package and Ergonomics (page 34).

All dimensions (shown in mm) are subject to manufacturing tolerances and refer to min specification models which do not include additional equipment. The illustrations are for guidance only.

The under-run bar and towing attachment must be applicable to local market legislation where required.

1.13.3 Chassis Cab Body - Basic Dimensions and Weights

Chassis Cab Body - Single Cab Illustrated



E364691

Chassis Cab Body

Description		Single Cab	Super Cab	Double Cab
A	Overall height (mm) - measured to top of antenna base (HR)	1772 - 1781	1772 - 1781	1772 - 1781
B	Track (mm)	1620 (1650 HR)		
C	Overall body - excluding exterior mirrors (mm)	1910		
D	Overall width - including exterior mirrors (mm)	2208		
E	Wheelbase (mm)	3270		
F	Overall length (mm)	5205	5225	5406 **
G	Rear Overhang (mm) - top edge of main rails, not including towbar	1215	1070 ****	1193 *****
H	Chassis mounting to roof line height	1143	1128	1132

HR = Vehicles with high ride height.

** Australian market vehicles with tow bar installed - measured to outer face of hitch receiver.

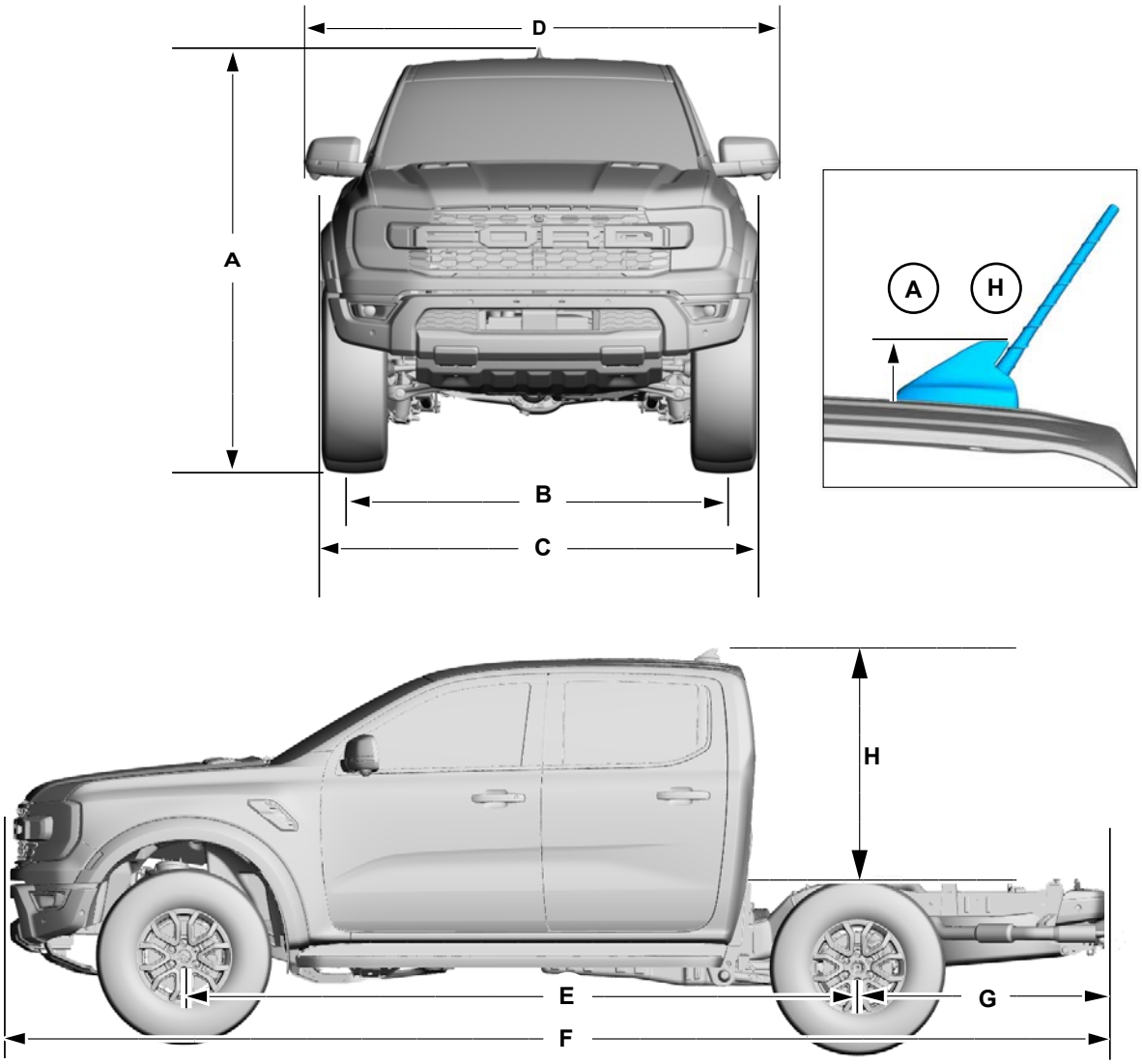
***Vehicles with Tall 4G Connected Antenna

****Single Cab Chassis-cab without bumper

*****Super Cab / Double Cab, without bumper, without Tow bar

1.13.4 Chassis Cab Body - Basic Dimensions and Weights - Raptor

Chassis Cab Body - Raptor



E366515

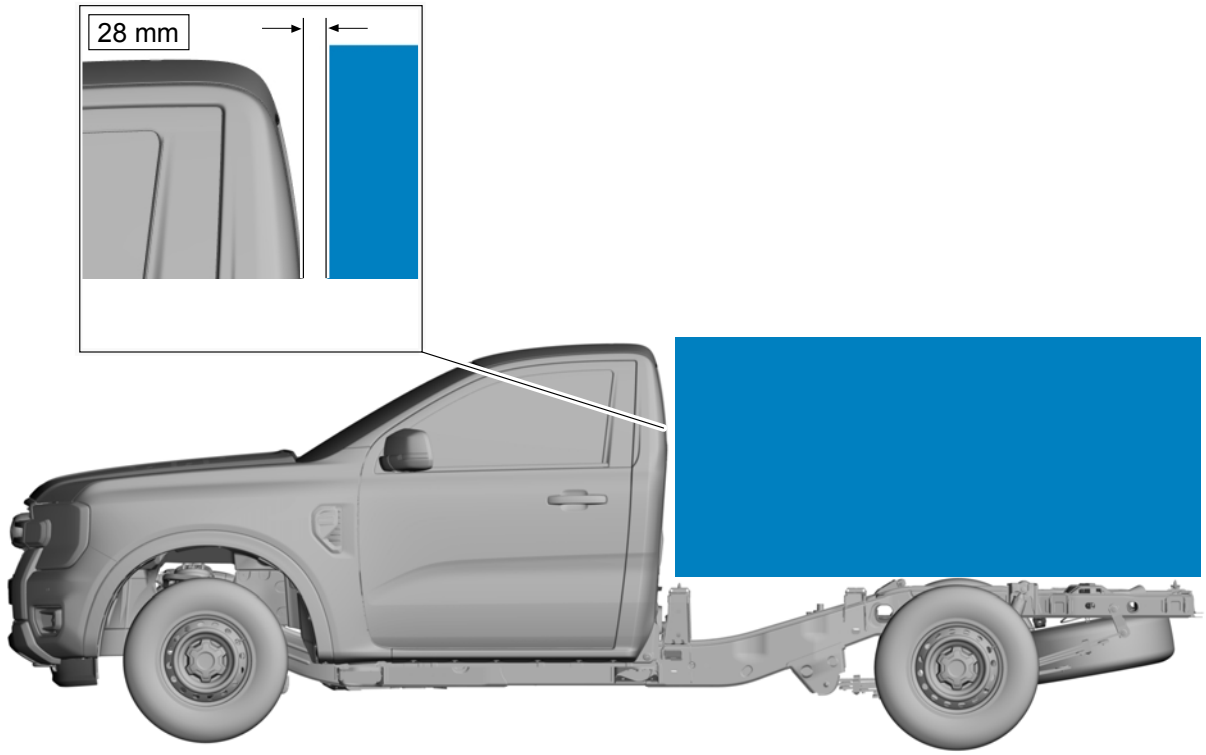
Chassis Cab Body

	Description	Raptor
A	Overall height (to antenna base) (mm)	1926
B	Track - front 4x4 (mm)	1710
C	Overall width - excluding exterior mirrors - without side step (mm)	2028
D	Overall width - including exterior mirrors (mm)	2208
E	Wheelbase (mm)	3270
F	Overall length (no front license plate or bracket) (measured to outer face of tow bar hitch receiver (mm)	5425
G	Rear Overhang with/without rear bumper (mm)	1225/1000
H	Chassis mounting to roof line height	1132

1.13.5 Vehicle Cabin Clearance

NOTE: Single Cab shown, Super Cab, Double Cab and Raptor similar.

Ford recommend minimum gap of 28mm between the vehicle cabin sheet-metal and any canopy, service body or equipment fitted to the vehicle.



E388178

1.13.6 Kerb Mass and Payload

WARNING: Check local legislation for legal requirements.

Details of vehicle kerb mass and payload capacities can be provided by your local National Sales Company representative.

1.13.7 Gross Vehicle Mass and Axle Load Ratings

WARNING: Check local legislation for legal requirements.

Details of gross vehicle axle load ratings can be provided by your local National Sales Company representative.

1.13.8 Front, Rear and Side Under-Run Protection

WARNING: Check local legislation for legal requirements.

Front Under-Run Protection, Rear Under-Run Protection and Side Under-Run Protection must meet the requirements of local design rules.

1.13.9 Rear Under-Run Protection - Cab Chassis Vehicles

WARNING: Check local legislation for legal requirements.

Rear Under-Run Protection must be designed to directive ECE 58 or applicable local legislation where local market regulations require.

1.14 Hardware—Specifications

Material Specification, Strength and Torque

Standard Hardware and Tightening Torques (Nm) Bolts/Studs: ISO 898-1, Nuts: ISO 898-2						
	Grade 4.8		Grade 8.8		Grade 10.9	
Thread Size	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
M4	1.1	1.4	2.4	3.4		
M5	2.2	2.7	4.9	6.7		
M6	3.7	4.7	8.5	11.5	11	15
M8			20	28	25	35
M10			41	55	50	70
M12			68	92	95	125
M14			113	153	150	200
M16			170	230	230	310
M18			250	315	315	400
M20			345	430	435	540
M22			470	590	590	745
M24			600	750	755	945

This torque chart is a recommendation and the converter is responsible for the optimal torque for a specific joint. For specific vehicle torque specification, refer to the relevant Ford Workshop Manual or contact your local Ford dealer or National Sales Agent.

1.15 Load Distribution—Specifications

1.15.1 Load Distribution Calculations - Driver and Passenger Weight Distribution

CAUTIONS:

Do not exceed the axle ratings.

Do not exceed the gross vehicle mass.

Tire manufacturer specification must be maintained.

NOTE: Uneven load distribution could result in unacceptable handling and braking characteristics.

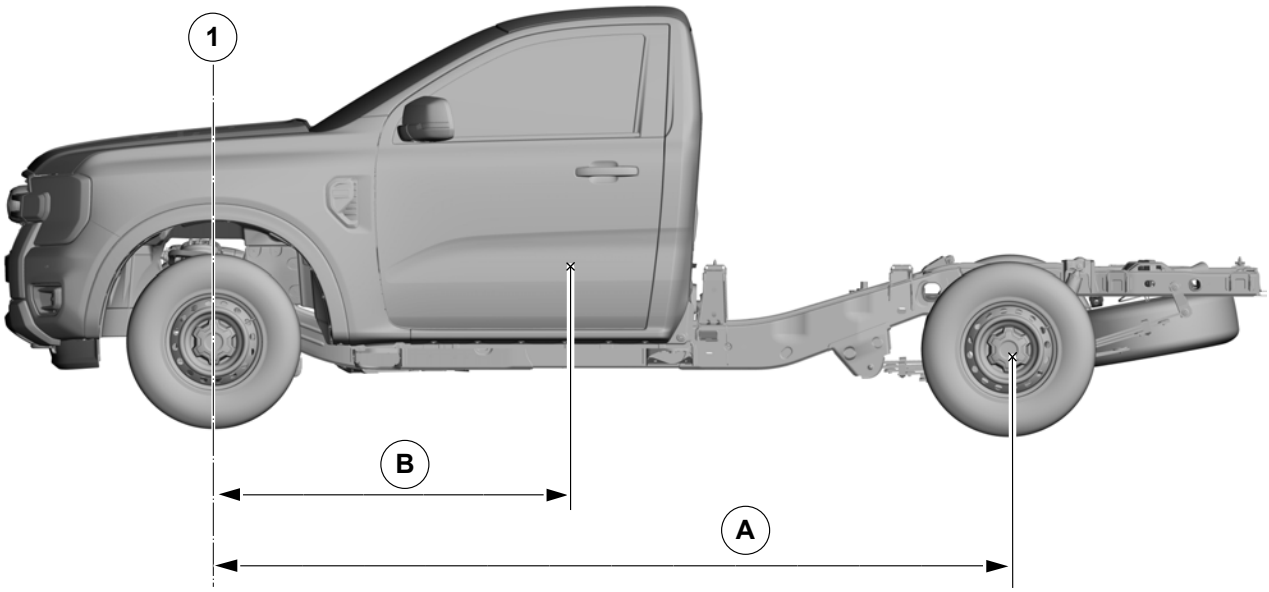
NOTE: Over loading of the vehicle could result in unacceptable ground clearance.

NOTE: The center of mass of the body equipment and the payload it contains should be located within the dimensions given.

NOTE: Avoid one-sided load distribution.

NOTE: For further information please contact your local National Sales Company representative, or local Ford dealer.

Single Cab

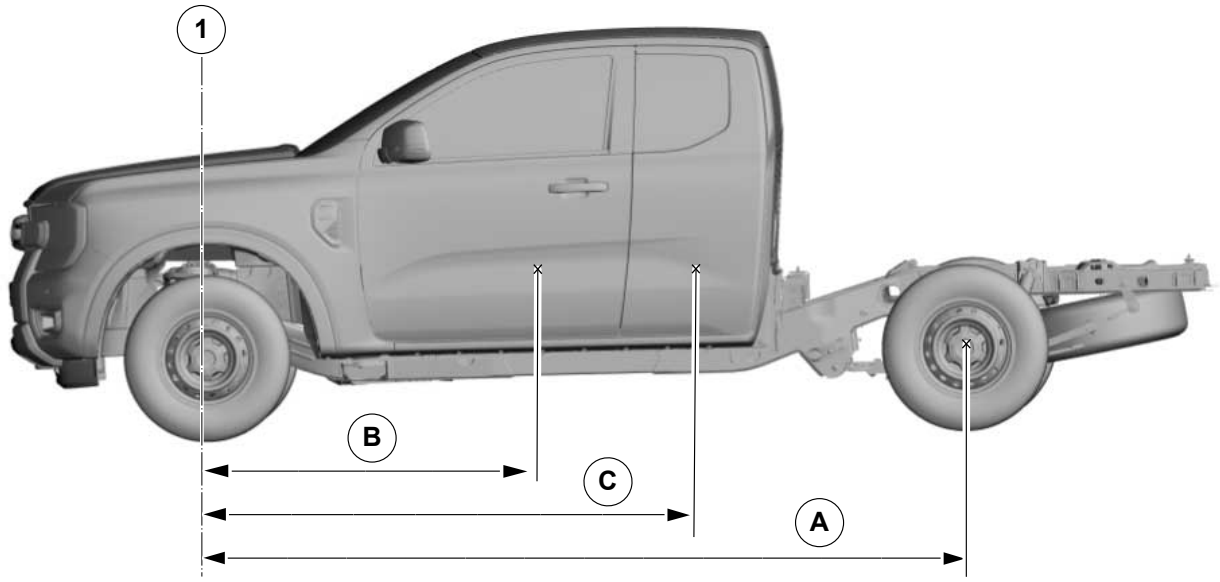


E364702

Single Cab Driver and Passenger Weight Distribution

'A' Wheelbase (mm)	'B' Front row seats and driver (mm)	Weight distribution per person (Kg)		
3270		On Front Axle	On Rear Axle	Total
	1544	40	35	75

Super Cab

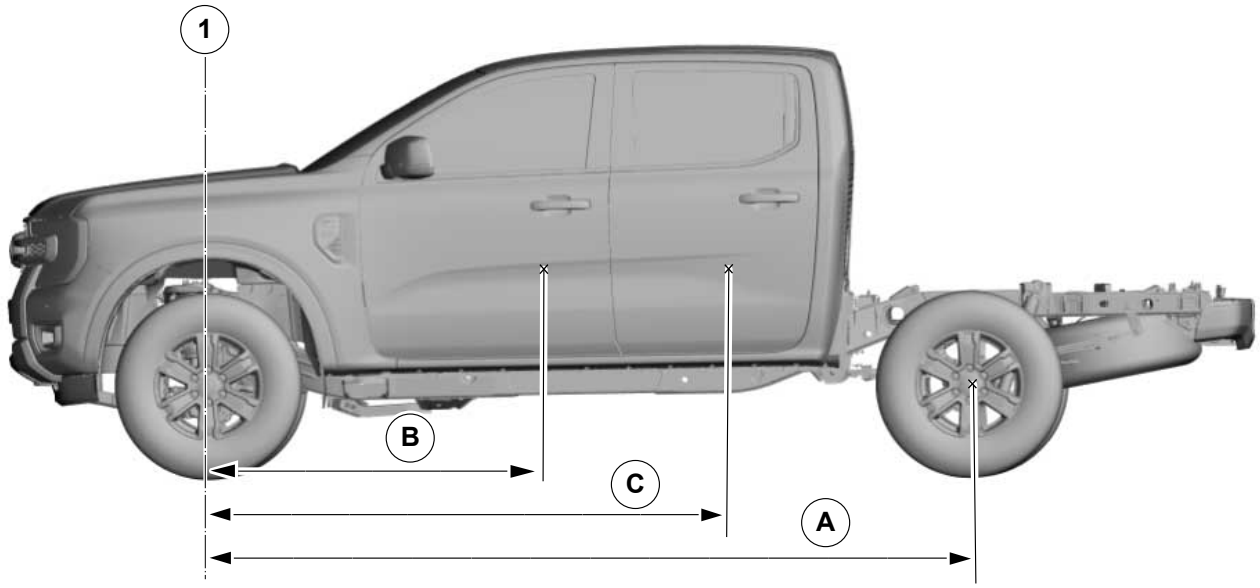


E364703

Super Cab Driver and Passenger Weight Distribution

'A' Wheelbase (mm)	'B' Front row seats and driver (mm)	'C' Second row seats (mm)	Weight distribution per person (Kg)		
3270			**On Front Axle**	**On Rear Axle**	**Total**
	1544	-	40	35	75
	-	2230	24	51	75

Double Cab

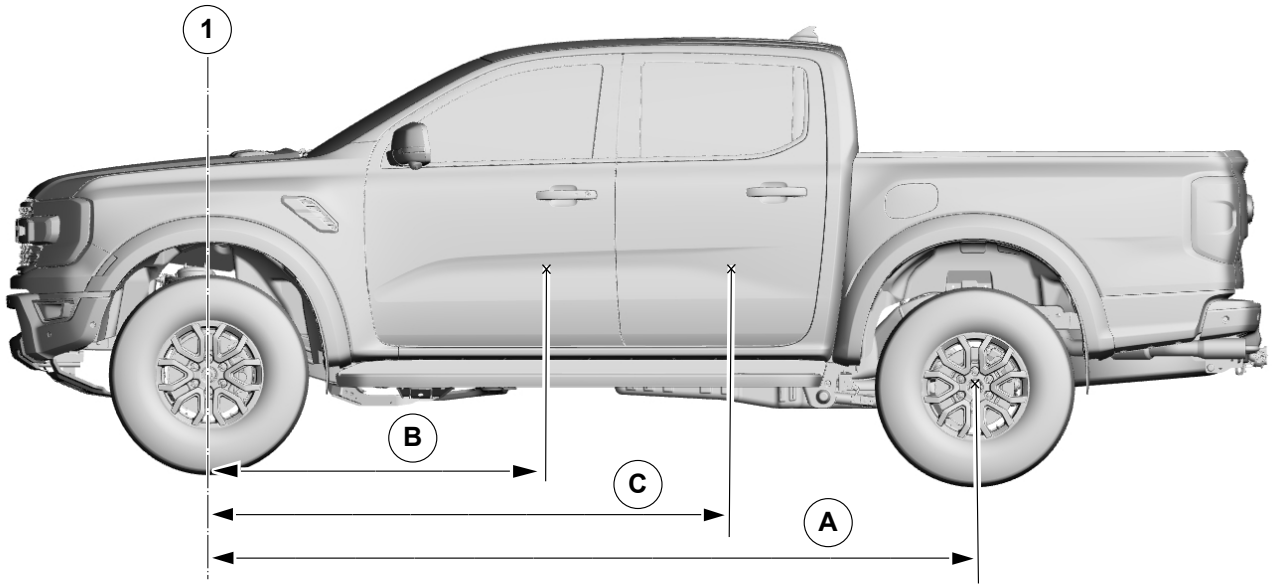


E364704

Double Cab Driver and Passenger Weight Distribution

'A' Wheelbase (mm)	'B' Front row seats and driver (mm)	'C' Second row seats (mm)	Weight distribution per person (Kg)		
3270			**On Front Axle**	**On Rear Axle**	**Total**
	1544	-	40	35	75
	-	2360	21	54	75

Double Cab - Raptor



E366256

Double Cab Driver and Passenger Weight Distribution - Raptor

'A' Wheelbase (mm)	'B' Front row seats and driver (mm)	'C' Second row seats (mm)	Weight distribution per person (Kg)		
3270			On Front Axle	On Rear Axle	Total
	1544	-	40	35	75
	-	2360	21	54	75

1.15.2 Center of Gravity

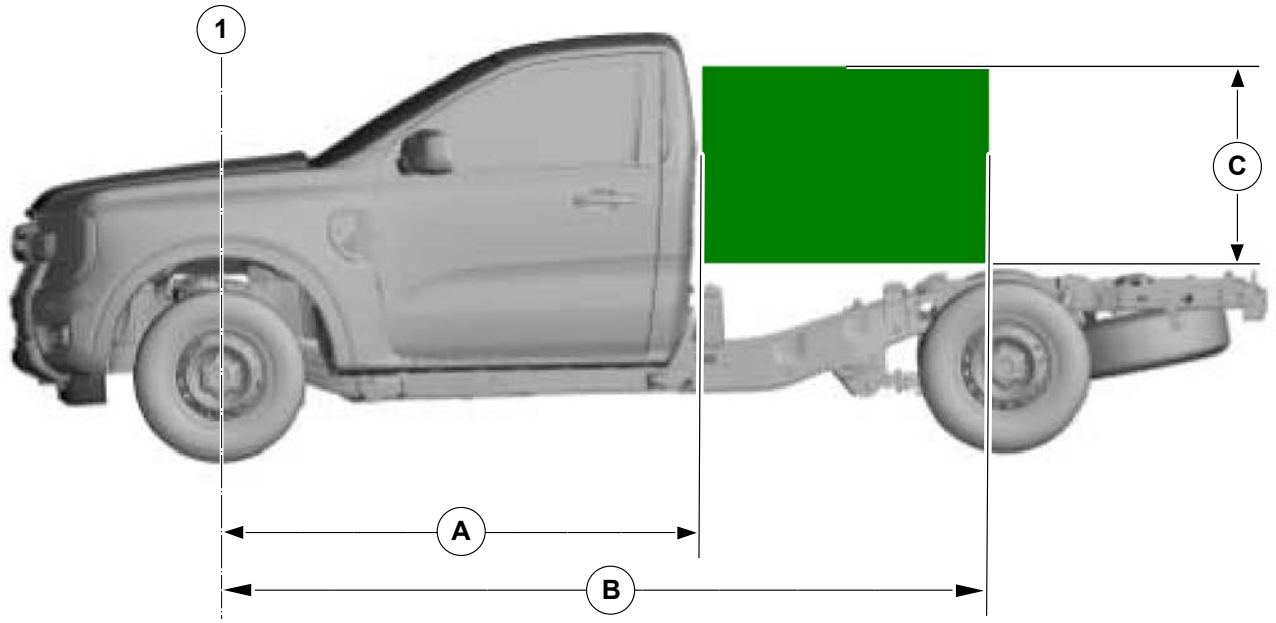
NOTE: Calculations shown are not inclusive of tow bar and other dealer fitted accessories.

The following charts define the recommended Centre of Gravity Position for the mass added to the vehicle by the vehicle converter.

"Added mass" includes all added body equipment and cargo, but excludes passengers seated in standard cab seating.

For double cab vehicles, there is a limit to the added mass that must be observed, in addition to not exceeding the gross axle and train weights.

Single Cab



E364705

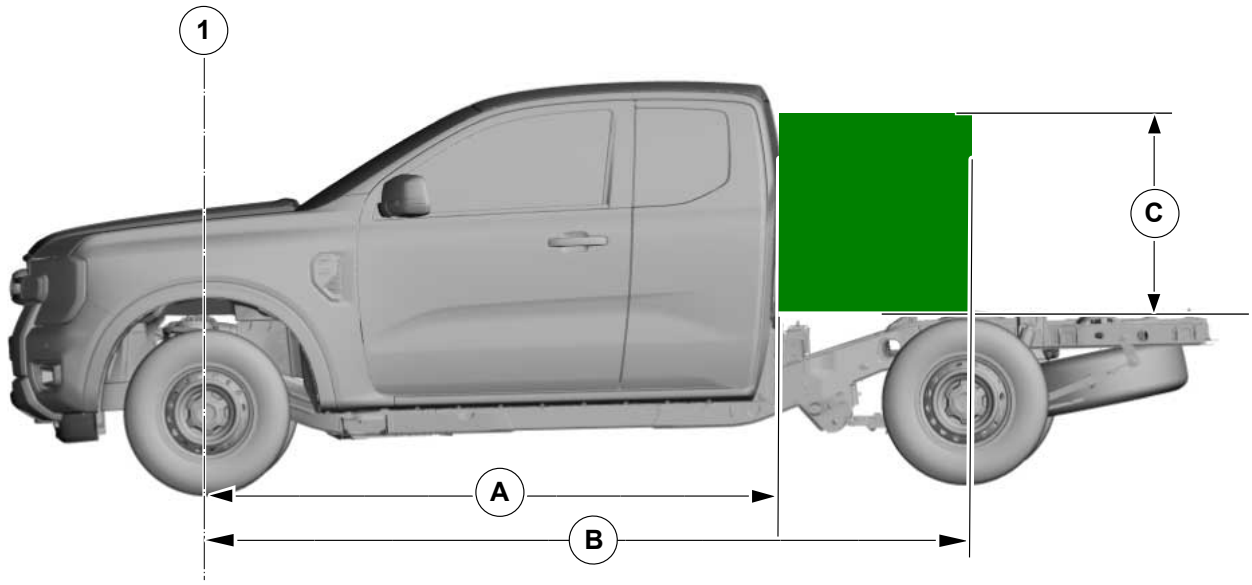
Single Cab Center of Gravity Critical Zone

Model	Recommended C of G location for added mass		
	'A' Min (mm)	'B' Max (mm)	'C' Max (mm)*
4x2	1965	3270	740
4x2 HR	1965	3435	590
4x4	1965	3435	590

HR = Vehicles with high ride height

*Dimension "C" is taken from the body mounting pads.

Super Cab



E364706

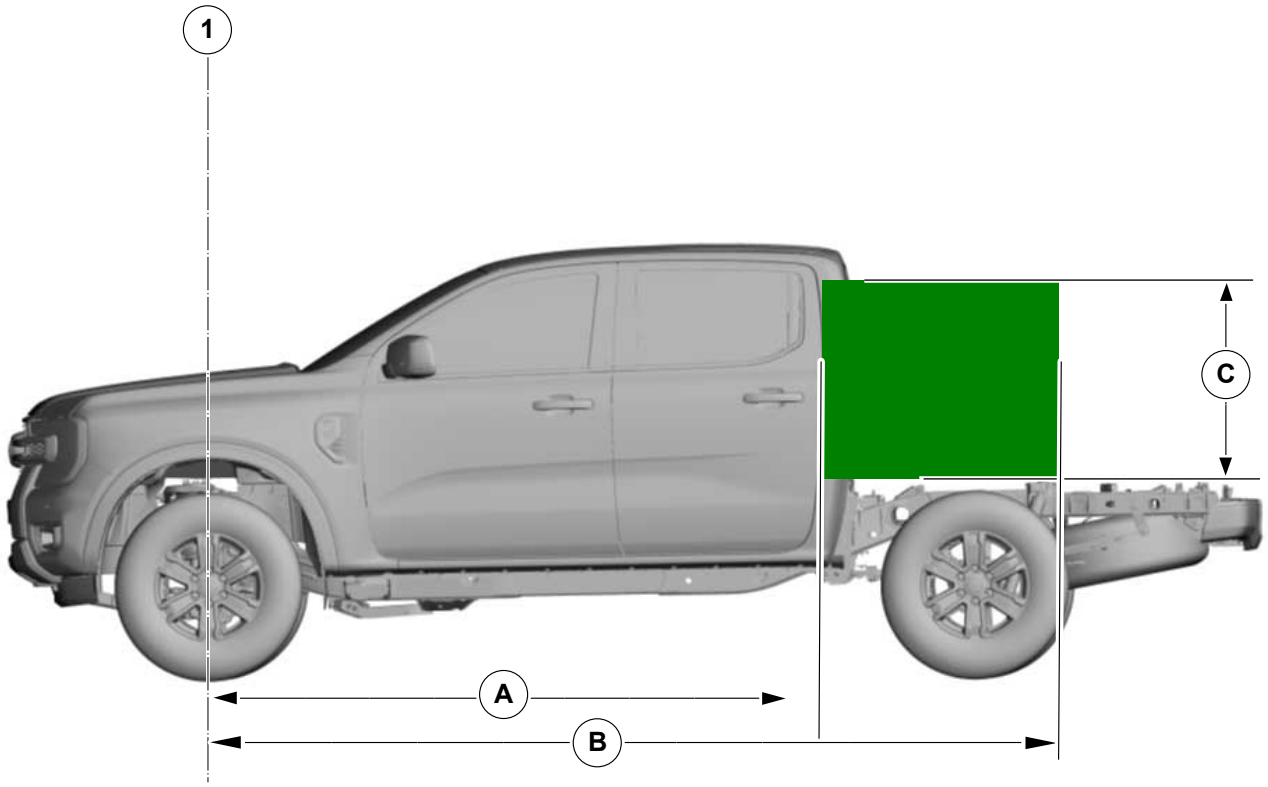
Super Cab Center of Gravity Critical Zone

Model	Recommended C of G location for added mass		
	'A' Min (mm)	'B' Max (mm)	'C' Max (mm)*
4x2	2395	3270	740
4x2 HR	2365	3435	590
4x4	2365	3435	590

HR = Vehicles with high ride height

*Dimension "C" is taken from the body mounting pads.

Double Cab



E364707

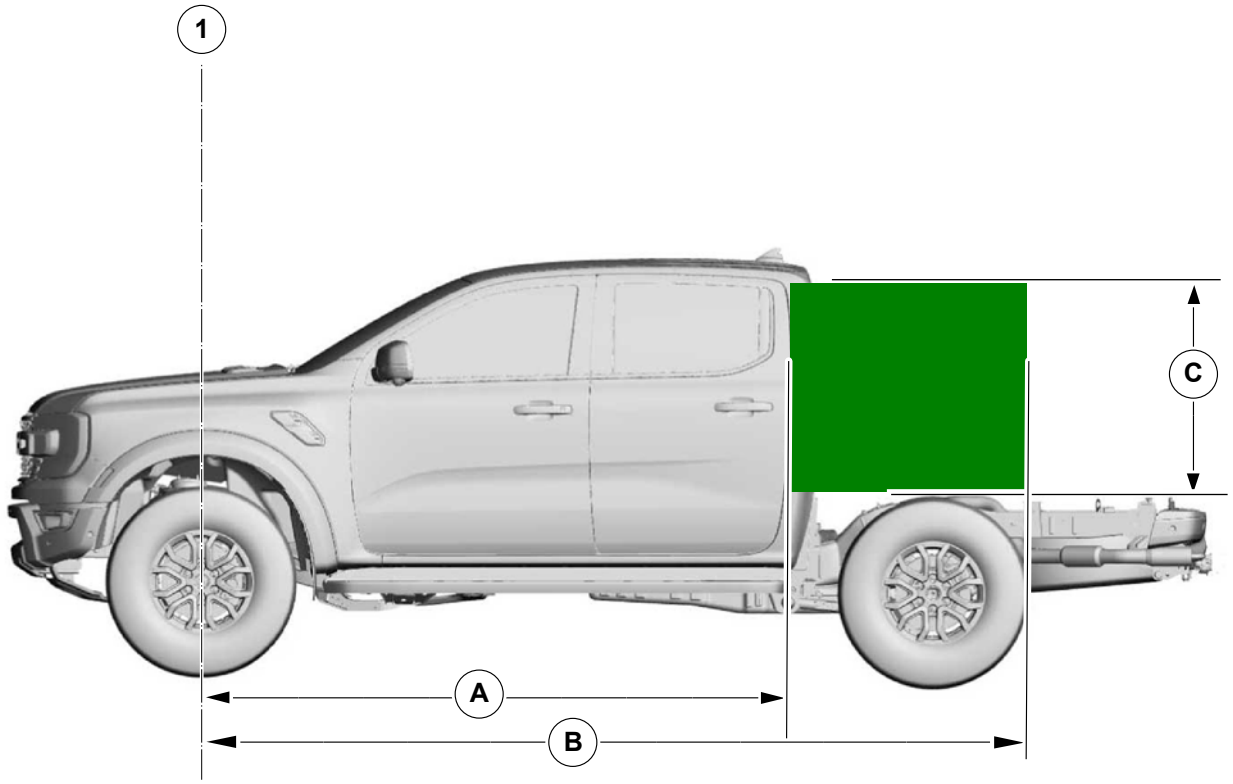
Double Cab Centre of Gravity Critical Zone

Model	Recommended C of G location for added mass		
	'A' Min (mm)	'B' Max (mm)	'C' Max (mm)*
4x2	-	3615	740
4x2 HR	2435	3615	590
4x4	2435	3615	590

HR = Vehicles with high ride height

*Dimension "C" is taken from the body mounting pads.

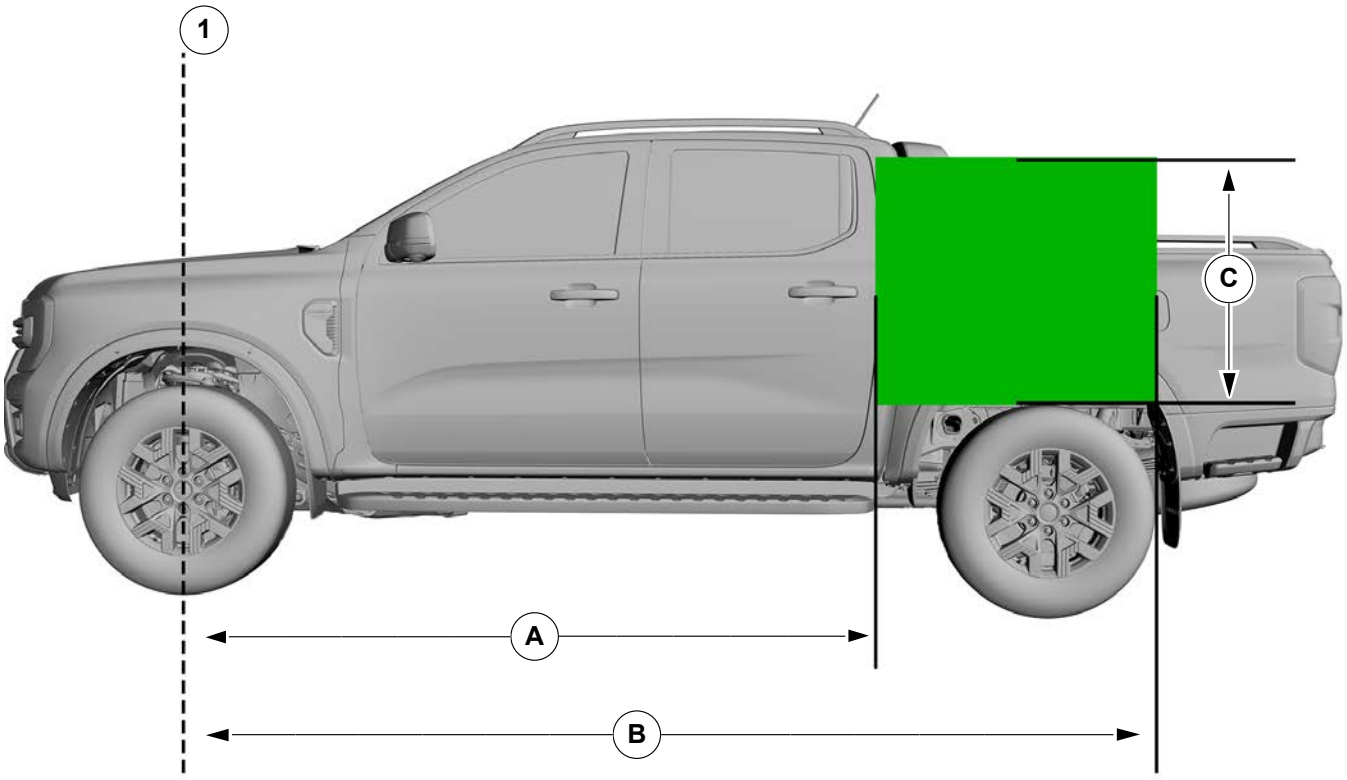
Double Cab - Raptor



E366257

Double Cab Centre of Gravity Critical Zone - Raptor

Model	Recommended C of G location for added mass		
	'A' Min (mm)	'B' Max (mm)	'C' Max (mm)
Raptor	2435	3615	590



E452895

Double Cab Centre of Gravity Critical Zone - PHEV

Model	Recommended C of G location for added mass		
	'A' Min (mm)	'B' Max (mm)	'C' Max (mm)
PHEV	2435	3615	590

1.15.3 Vehicle Weights - Vehicles built in Thailand

NOTE: AUSTRALIA AND NEW ZEALAND ONLY: Subject to Australian and New Zealand State and Territory regulations, all payloads are calculated by deducting the vehicle's Kerb Weight from its Gross Vehicle Mass (GVM). Payload (based on Kerb Weight) is the maximum combined value of occupants, cargo, added options, added structures and tow ball download (when towing). Ranger Raptor payload is calculated by deducting the vehicle's Tare Weight from its Gross Vehicle Mass (GVM). All Chassis Cab payloads, kerb and tare weights exclude weights of tray bodies. Kerb Weight includes the vehicle with a full tank of fuel, without occupants, luggage or cargo and with factory fitted optional equipment included. Minimum Kerb Weight excludes factory fitted optional equipment. Vehicle weights are approximate and subject to individual variances. Vehicles should be weighed before and after adding additional load, accessories or towing a trailer to ensure the maximum Gross Vehicle Mass (GVM), Gross Combined Mass (GCM) and Gross Axle Weight Ratings are not exceeded.

NOTE: All weights are shown in Kilograms (kg).

Engine	Drive	Series	Front Axle Limit	Rear Axle Limit	Gross Limit	Notes
ALL	4x2 LR	All	1300	1710	2850	Not available in Australia / New Zealand
ALL	4x2 HR	BAS, XL (diesel) and XLS	1400	1900	3060	Not available in Australia / New Zealand
ALL	4x2 HR	XL and XLT (2.3 petrol)	1400	1900	3100	Not available in Australia / New Zealand
ALL	4x2 HR	XLT (diesel), SPT,, WT	1400	1959	3140	(excl 20" wheels) (Not available in Australia / New Zealand)
ALL	4x2 HR	XLT (diesel), SPT, WT	1400	1900	3100	(incl 20" wheels) (Not available in Australia / New Zealand)
2.0L SiT Diesel	4x4	BAS; XL; XLS	1450	1959	3190	Not available in Australia / New Zealand
2.0L SiT Diesel	4x4	XLT; SPT	1450	1959	3230	Not available in Australia / New Zealand
2.0L SiT Diesel**	4x2 HR	XL; XLS	1450	1959	3250	Australia / New Zealand Double Cab
2.0L SiT Diesel**	4x2 HR	XL; XLS	1450	1959	3230	Australia / New Zealand Single and Super Cab
2.0L SiT Diesel**	4x4	XL	1450	1959	3250	Australia / New Zealand Double Cab
ALL *	4x2 LR	All	1300	1770	2870	Thailand Single Cab and Super Cab only
2.0L SiT Diesel *	4x4	All	1450	1959	3160	Thailand Single Cab only
2.0L SiT Diesel *	4x2 HR	All	1400	1870	3000	Thailand Super Cab only
2.0L SiT Diesel*	4x4	All	1450	1900	3100	Thailand Super Cab only
2.0L BiT Diesel**	4x2 HR	XLS	1490	1959	3250	Australia / New Zealand Double Cab
2.0L BiT Diesel**	4x2 HR	XLT	1490	1959	3250	Australia / New Zealand Double Cab

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Composed on:Tue Jul 07 08:04:04 BST 2026

Engine	Drive	Series	Front Axle Limit	Rear Axle Limit	Gross Limit	Notes
2.0L BiT Diesel**	4x4	XL	1490	1959	3250	Australia / New Zealand Double Cab
2.0L BiT Diesel**	4x4	XL	1490	1959	3230	Australia / New Zealand Super Cab and Single Cab
2.0L BiT Diesel	4x4	XL; XLS; XLT; SPT	1450	1959	3230	
2.0L BiT Diesel	4x4	WT	1490	1959	3280	(excl 20" wheels)
2.0L BiT Diesel	4x4	WT	1490	1900	3230	(incl 20" wheels)
3.0L V6 Diesel	AWD	XLS; XLT; SPT	1490	1959	3280	
3.0L V6 Diesel	AWD	WT	1490	1959	3350	(excl 20" wheels)
3.0L V6 Diesel	AWD	WT	1490	1900	3300	(incl 20" wheels)
3.0L EcoBoost V6	ALL	Raptor	1520	1700	3130	
2.0L BiT Diesel	ALL	Raptor	1520	1700	3140	
2.0L BiT Diesel	ALL	Raptor	1520	1700	3150	5 passengers - Vietnam only

LR = Vehicles with low ride height

HR = Vehicles with high ride height

BAS = Base

XL = XL

XLS = XLS

XLT = XLT

SPT = Sport

WT = Wildtrak

* = THAILAND ONLY

** = Australia / New Zealand ONLY

1.15.4 Vehicle Weights - Vehicles built in South Africa

NOTE: All weights are shown in Kilograms (kg).

Gross Vehicle Mass Rating

Engine	Drive	Ride Height	Series	Loading Condition	GVMR	GVMR (except RHD EU Stage 6.2 Emis-sions) with 20" Tires	GVM 2P with Stage 6.2 Emis-sions	GVMR 2P Stage 6.2 Emis-sions with 20" Tires
2.0L SiT Diesel 150ps	4x2	LR	ALL	-	2850	-	-	-
2.0L SiT Diesel 170ps	4x2	HR	BAS; XL; XLS	-	3060	-	-	-
2.0L SiT Diesel 170ps	4x2	HR	XLT	-	3140	-	-	-
2.0L SiT Diesel 170ps	4x4	HR	BAS; XL; XLS	-	3190	-	3150	-
2.0L SiT Diesel 170ps	4x4	HR	LTD	-	3250	-	3190	-
2.0L SiT Diesel 170ps	4x4	HR	XLT	-	3230	-	3190	-
2.0L SiT Diesel 170ps	4x4	HR	WT	-	3250	3190	3150	3140
2.0L BiT Diesel 213ps	4x2	HR	XLT	-	3140	-	-	-
2.0L BiT Diesel 213ps	4x2	HR	WT	-	3140	3100	-	-
2.0L BiT Diesel 213ps	4x4	HR	XL; XLS; XLT	-	3230	-	-	-
2.0L BiT Diesel 213ps	4x4; AWD	HR	LTD	-	3280	-	3190	-
2.0L BiT Diesel 213ps	4x4; AWD	HR	WT	-	3280	3230	3190	3140
2.0L BiT Diesel 213ps	AWD	HR	Raptor	5 passen-gers	3140	-	-	-
2.0L BiT Diesel 213ps	AWD	HR	Raptor	2 passenger - EU only	3060	-	-	-
2.3L EcoBoost 270hp	4x2	HR	XL; XLT	-	3100	-	-	-
2.3L EcoBoost 270hp	AWD	HR	WT	-	3230	3190	-	-

Engine	Drive	Ride Height	Series	Loading Condition	GVMR	GVMR (except RHD EU Stage 6.2 Emissions) with 20" Tires	GVM 2P with Stage 6.2 Emissions	GVMR 2P Stage 6.2 Emissions with 20" Tires
PHEV	AWD	HR	All	-	3500	-	3315	-
3.0L V6 Diesel	AWD	HR	LTD; WT; PLT	-	3350	3300	3190	3190

LR = Vehicles with low ride height

HR = Vehicles with high ride height

BAS = Base

XL = XL

XLS = XLS

XLT = XLT

LTD = Limited

PLT = Platinum

WT = Wildtrak

AWD = All Wheel Drive

GVMR = Gross Vehicle Mass Rating

GVM = Gross Vehicle Mass

Stage 6.2 Emissions = Vehicles equipped with Selective Catalytic Reduction System

Gross Axle Weight Rating

Engine	Drive	Series	Front Gross Axle Mass Rating	Rear Gross Axle Mass Rating
All engines	4x2 LR	-	1300	1710
All engines	4x2	BAS; XL; XLS	1400	1900
2.3L EcoBoost 270hp	4x2	XLT	1400	1900
All engines (except 2.3L 270hp XLT)	4x2	XLT; LTD; WT	1400	1959
2.0L SiT Diesel 170ps	4x4	-	1450	1959
2.3L EcoBoost 270hp	AWD	-	1450	1959
2.0L BiT Diesel 213ps	4x4; AWD	XL; XLS; XLT	1450	1959
2.0L BiT Diesel 213ps	4x4; AWD	LTD; WT	1490	1959
3.0L V6 Diesel	4x4; AWD	-	1490	1959
-	-	-	-	1900 *
2.0L BiT Diesel	AWD	Raptor	1520	1700
PHEV	AWD	ALL	1490	2100
PHEV	AWD	ALL	1490	2000**

LR = Vehicles with low ride height

BAS = Base

XL = XL

XLS = XLS

XLT = XLT

LTD = Limited

WT = Wildtrak

AWD = All Wheel Drive

* = 20" Tires (Except Right Hand Drive Stage 6.2 Emissions)

** = Vehicles built as 2P only

1.15.5 Vehicle Weights - Vehicles built in Argentina

NOTE: All weights are shown in Kilograms (kg) and reviewed by South America markets homologation team.

COLOMBIA

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Bi-Turbo Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x2	4x4	4x2	4x4	4x4
Series	XLT	LTD	LTD	XLT	XLT	XL	XL	XL	XLS
Gross Limit	3320	3300	N/A	3270	N/A	3220	3100	N/A	3220
Front Axle Limit	1490	1490	N/A	1450	N/A	1450	1400	N/A	1450
Rear Axle Limit	1959	1900	N/A	1959	N/A	1959	1900	N/A	1959

ECUADOR

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Bi-Turbo Diesel	2.0L Bi-Turbo Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x4	4x2	4x2	4x4	4x4
Series	LTD	LTD	LTD	XLT	xLT	XLS	XL	XL	XLS
Gross Limit	3300	3380	N/A	3270	3270	3100	3100	3220	3220
Front Axle Limit	1490	1490	N/A	1450	1450	1400	1400	1450	1450
Rear Axle Limit	1900	1959	N/A	1959	1959	1900	1900	1959	1959

PARAGUAY

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Bi-Turbo Diesel	2.0L Bi-Turbo Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x4	4x2	4x2	4x4	4x4
Series	LTD	LTD	LTD	XLT	XLT	XLS	XL	XL	XLS
Gross Limit	3300	3380	N/A	3270	3270	3100	3100	3220	3220
Front Axle Limit	1490	1490	N/A	1450	1450	1400	1400	1450	1450
Rear Axle Limit	1900	1959	N/A	1959	1959	1900	1900	1959	1959

URUGUAY

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Bi-Turbo Diesel	2.0L Bi-Turbo Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x4	4x2	4x2	4x4	4x4
Series	LTD	LTD	LTD	XLT	XLT	XLS	XL	XL	XLS
Gross Limit	3300	3380	N/A	3270	3270	3100	3100	3220	3220
Front Axle Limit	1490	1490	N/A	1450	1450	1400	1400	1450	1450
Rear Axle Limit	1900	1959	N/A	1959	1959	1900	1900	1959	1959

CHILE - PERÚ

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x2	4x4	4x2	4x4	4x4
Series	XLS	LTD	LTD	XLT	XLT	XL	XL	XL	XLS
Gross Limit	3380*/ 3300**	3380*/ 3300**	3270	3270	3180	3220	3100	3220	3220
Front Axle Limit	1490	1490	1490	1450	1400	1450	1400	1450	1450
Rear Axle Limit	1959	1959	1959	1959	1959	1959	1900	1959	1959

* = Vehicles with Tire Size of 255/65R18

** = Vehicles with Tire Size of 255/65R20

VENEZUELA

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x2	4x4	4x2	4x4	4x4
Series	XLS	LTD	LTD	XLT	XLT	XL	XL	XL	XLS
Gross Limit	3230	3350	3230	3270	3160	3090	3120	3010	3220
Front Axle Limit	1490	1490	1490	1217	1450	1400	1450	1400	1177
Rear Axle Limit	1959	1959	1959	946	1959	1900	1959	1900	931

BRAZIL

Engine	3.0L Diesel V6	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	6R80	6R80	MT88	MT88
Driveline	4WD	4WD	4WD	4x2	4x4	4x4	4x4
Series	XLS	XLT	LTD	XLS	XLS	XL	XLS
Gross Limit	3320	3320	3380	3100	3220	3220	3220
Front Axle Limit	1490	1490	1490	1400	1450	1450	1450
Rear Axle Limit	1959	1959	1959	1900	1959	1959	1959

ARGENTINA

Engine	3.0L Diesel V6	3.0L Diesel V6	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel	2.0L Diesel
Transmission	10R80	10R80	10R80	10R80	10R80	MT88	MT88	MT88	MT88
Driveline	4WD	4WD	4x4	4x4	4x2	4x4	4x2	4x4	4x4
Series	XLS	LTD	LTD	XLT	XLT	XL	XL	XL	XLS
Gross Limit	3230	3350	3230	3160	3160	3090	3120	3010	3010
Front Axle Limit	1490	1490	1490	1450	1450	1400	1450	1400	1400
Rear Axle Limit	1959	1959	1959	1959	1959	1900	1959	1900	1900

1.16 Towing

1.16.1 Towing Requirements

When a towing device is required, the Vehicle Converter should use a Ford approved tow bar.

1.16.2 Towing

WARNINGS:

Do not exceed the Gross Combination Mass (GCM) or towing capacities for your specific vehicle. Refer to the vehicles owner guide for specifications related to the towing capacities and local regulatory standards.

Ensure that the trailer towball download weight falls within the specified range.

Towing trailers beyond the maximum recommended gross trailer weight exceeds the limit of your vehicle and could result in engine damage, transmission damage, structural damage, loss of vehicle control, vehicle rollover and personal injury.

Do not cut, drill, weld or modify the trailer hitch. Modifying the trailer hitch could reduce the hitch rating.

Do not exceed the maximum vertical load on the tow ball. Failure to follow this instruction could result in the loss of control of your vehicle, personal injury or death.

For towing devices fitted by the Vehicle Converter the following applies:

- Towing capacities must not exceed those of the unmodified vehicle.
- Any modifications to the vehicle must be noted in the vehicle owner guide descriptive literature included with the owners documentation.
- Tow bar installations must meet the requirements of the local regulatory standards.
- Whenever frame drilling is necessary use tube reinforcement.

Refer to: 5.6 Frame and Body Mounting (page 257).

1.16.3 Towing Capacities and Specifications

NOTE: Refer to the vehicles owner guide for specifications related to the towing capacities and local regulatory standards.

2.1 Suspension System

WARNINGS:

Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe or anti-roll bars, springs or shock absorbers including mounting brackets.

The rear leaf springs are pre-stressed in manufacture and should not be altered for rate or height in any way during vehicle conversion. Adding or removing leaves may result in failure or reduced function of the spring as well as other vehicle related issues for which Ford Motor Company cannot be held responsible.

CAUTIONS:

Modifications to the suspension system can cause a deterioration of the vehicle handling characteristics and durability.

When carrying out welding work the springs must be covered to protect them against weld splatter.

Do not touch springs with welding electrodes or welding tongs.

Any modifications to the suspension system will require front wheel alignment and headlamp alignment to be checked and adjusted as required.

NOTE: Do not modify the wheelbase or add any type of frame extension to vehicles fitted with Electronic Stability Program (ESP).

NOTE: Do not damage the surface or corrosion protection of the spring during disassembly and installation.

NOTE: Do not add any additional axles.

2.2 Wheels and Tires

WARNINGS:

Only use M12x1.5 60° cone wheel nuts. Failure to follow this instruction may result in serious personal injury or death.

Retighten wheel nuts within 160KM (100mi) after a wheel is reinstalled. Wheels can loosen after initial tightening. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

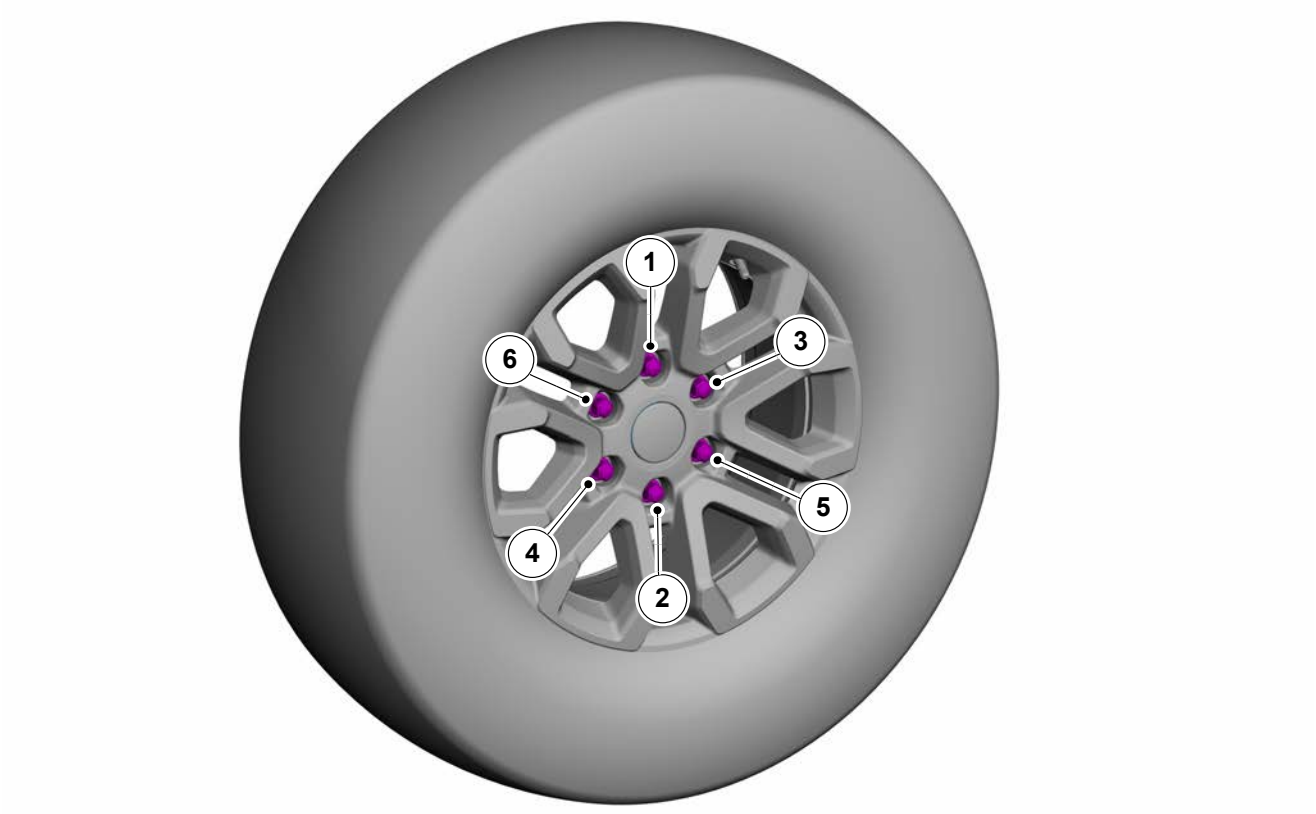
NOTE: Failure to tighten the wheel nuts in a star/cross pattern can result in high brake disc runout, which accelerates the development of brake roughness, shudder and vibration.

NOTE: The wheel nut torque specification is for clean, dry wheel stud and wheel nut threads.

NOTE: Final tightening to be performed with vehicle resting on tires.

NOTE: If replacement wheels are fitted they must be adequately load-rated and also be hub-centric in design. The wheel hub mounting diameter is 93.10mm.

Wheel nut tightening sequence and torque specification



E378900

Item	Torque
Wheel Nuts	135 Nm

- Wheel Nut Part Number: ACPZ-1012-H (stainless steel covered wheel nut, capped. Standard-fit with alloy wheels)
- Wheel Nut Part Number: ACPZ-1012-K (zinc-plated solid wheel nut, with capped end. Accessory option)
- Wheel Nut Part Number: CV6Z-1012-B (zinc-plated solid wheel nut, open-ended / uncapped. Standard-fit with steel wheels)

The use of solid wheel nuts may be a beneficial upgrade where the expected vehicle operation requires repeated and regular removal and refitting of the wheels. All of the above wheel nuts are functionally interchangeable and can be used with the original steel and alloy wheels.

2.3 Brake System

2.3.1 General

The Brake System must be fully functional when the vehicle conversion is completed. The vehicle brake operating modes must be checked, including warning system and parking brakes.

WARNING: Do not restrict the airflow and cooling to the brake system.

NOTE: Do not obstruct the view of the brake fluid reservoir level.

The brake fluid reservoir must remain accessible for servicing and for adding brake fluid.

2.3.2 Brake Hoses

WARNING: Ensure care is taken when removing or securing brake tube attachment points. Damage to the attachment points or brake tube alignment could result in reduced clearance and wear on critical brake components. Replace any damaged items before using the vehicle.

CAUTION: Make sure that the front and rear brake hoses are not twisted and are correctly located away from body and chassis components.

Front and rear brake hoses must not rub, chafe or rest on body or chassis or body components. There must be clearance under all operating conditions, between full compression and extension and full lock to lock.

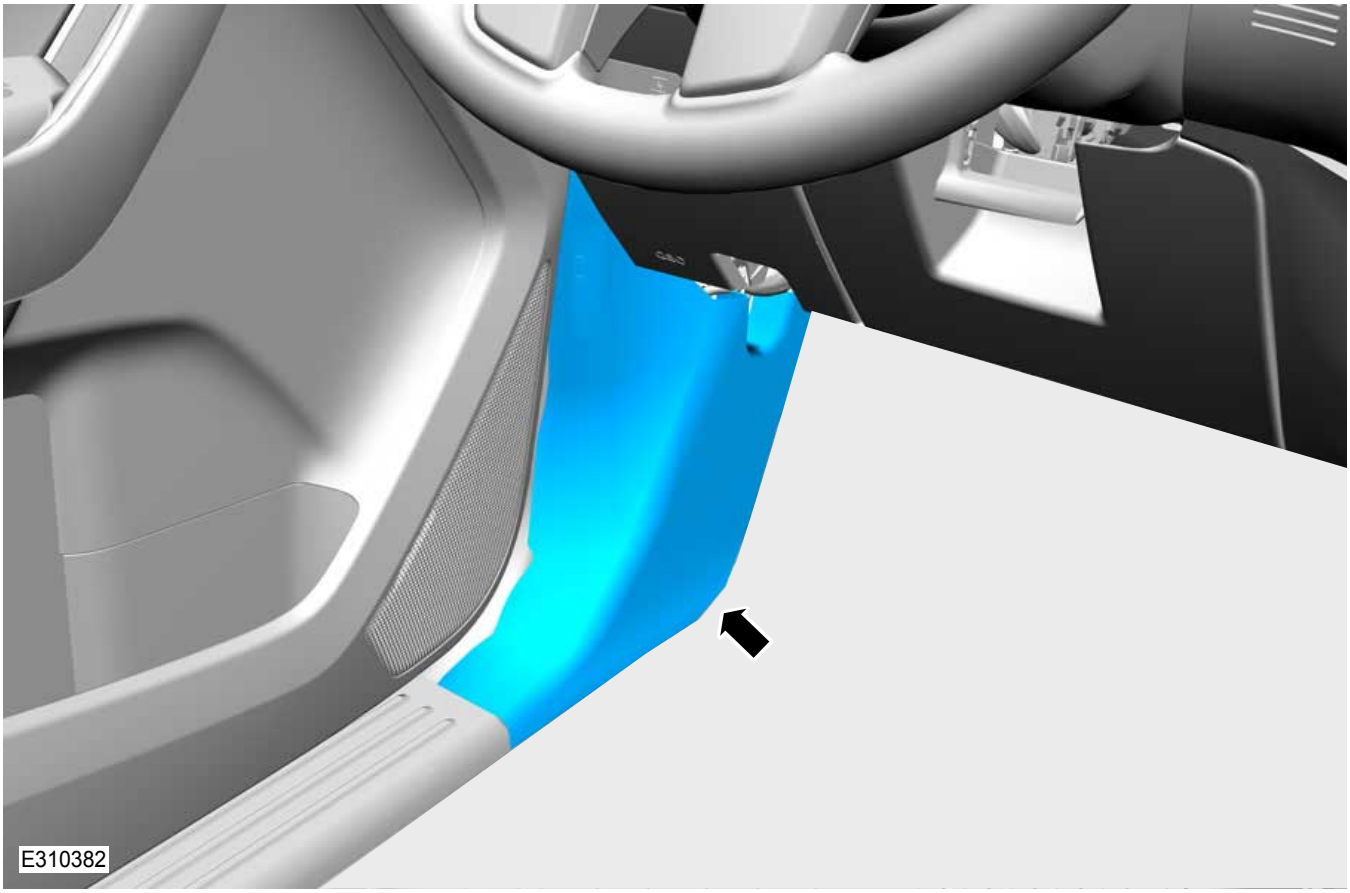
Brake lines must not be used to support or secure any other component.

2.3.3 Trailer Brake Connection

WARNING: A pre-installed trailer brake wire provides a pulsed brake signal of varying frequencies. This pulsed signal is not a direct current (DC) signal. If an aftermarket brake controller is installed, the vehicle owner or installer must ensure that it is compatible with all pulsed signals from the pre-installed trailer brake wire. Failure to ensure compatibility of your brake controller may result in loss of vehicle control, which could result in serious injury or death. If clarification is required on the specifications of the pulsed signals, please contact your Authorised Ford Dealer.

NOTE: The inclusion of the pre-installed trailer brake wire is market dependant and may not be available in all markets or variants. For further information contact your Authorised Ford Dealer or National Sales Agent.

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Composed on:Tue Jul 07 08:04:04 BST 2026



A pre-installed wire is located behind the A-Pillar kick panel and is marked TRAILER BRAKE CONTROLLER (If equipped).

- Wire colour Blue/Grey (BU/GY)

3.1 Electrified Drivetrain

3.1.1 HV Health and Safety - PHEV

WARNINGS:

Do not touch, drill, modify or obscure the orange High Voltage cables, fasteners, channels, strain relief, ground wire or connectors.

Service of the High Voltage system on this vehicle is restricted to qualified personnel. The required qualifications vary by region. Always observe local laws and legislative directives regarding electric vehicle service. Failure to follow this instruction may result in serious personal injury or death.

To prevent the risk of High Voltage shock, always precisely follow all warnings and service instructions, including instructions to de-energize the system. The High Voltage system utilises approximately 400V DC, provided through High Voltage cables to its components and modules. The High Voltage cables and wiring are identified by orange harness tape or orange wire covering. All High Voltage components are marked with 'High Voltage' warning labels and with a 'High Voltage' symbol. Failure to follow these instructions may result in serious personal injury or death.

Any work on the High Voltage system requires the Low Voltage Service Disconnect to be open and locked out. Failure to follow these instructions may result in serious personal injury or death.

Extreme heat, such as paint drying ovens, will cause damage to the High Voltage battery. The High Voltage battery must be removed before using paint drying ovens longer than 45 minutes or with temperatures above 60°C (140°F). Failure to follow this instruction may result in damage to the high voltage battery, which could cause serious personal injury or death in a fire or explosion. Please refer to the Ford workshop manual.

De-energising the High Voltage system does not dissipate the voltage inside the High Voltage battery. The battery pack remains live and dangerous. Contact with the High Voltage battery pack internals may result in serious personal injury or death.

The Powertrain software calibrations must not be modified (this includes the Electric Vehicle Control Module, Primary Drive Control Module, Battery Charge Control Module, Battery Energy Control Module, and the Antilock Braking System Control Module).

Direct contact with High Voltage components by personnel, tools or equipment should generally be avoided, including stepping or leaning on them setting tools on them, etc.

"High Voltage" is defined in UN ECE 100 as:

- Greater than 60 volts for Direct Current (DC) circuits.
- Greater then 30 volts RMS for Alternating Current (AC) circuits.

Subsequent stage manufacturers and vehicle upfitters should NOT plan to connect with or modify the High Voltage system or components in any way. Integration with the vehicle electrical system must be done only with the low voltage (12 volt) electrical system, or with outlet(s) provided with the "Pro Power Onboard" feature (where applicable).

Emergency Response Guides – Information for First Responders may be helpful in developing an emergency response plan in case a vehicle with a HV system is damaged.

The following manufacturing operations are not recommended on vehicles with High Voltage systems:

- Operations generating significant heat near the HV components, especially near the HV battery.
- Paint curing operations above 60°C (140°F) longer than 45 minutes.

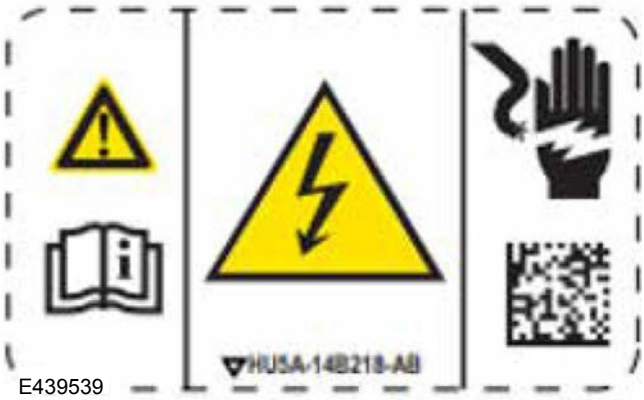
For welding, drilling or cutting, refer to sections:

- Refer to: 5.1 Body (page 207).

High Voltage Labels

On electric vehicle, 'WARNING' labels are located on High Voltage components throughout the vehicle as per the following examples. High Voltage warning symbols are not to be obscured or altered in any way.

HV Lable Example 1



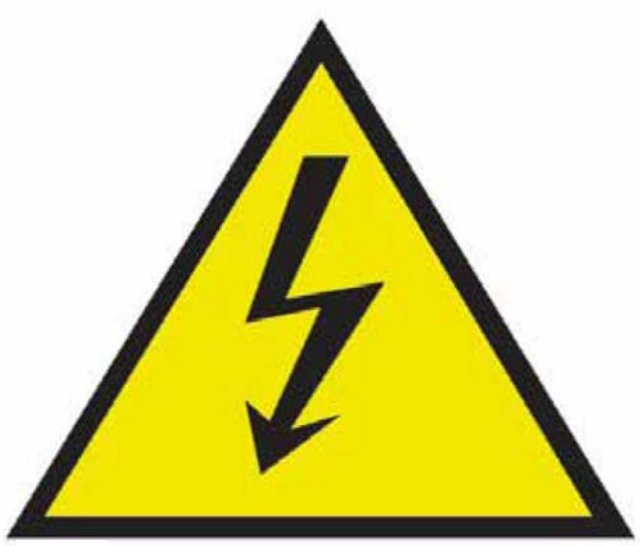
E439539

HV Lable Example 2



E439540

HV Lable Example 3

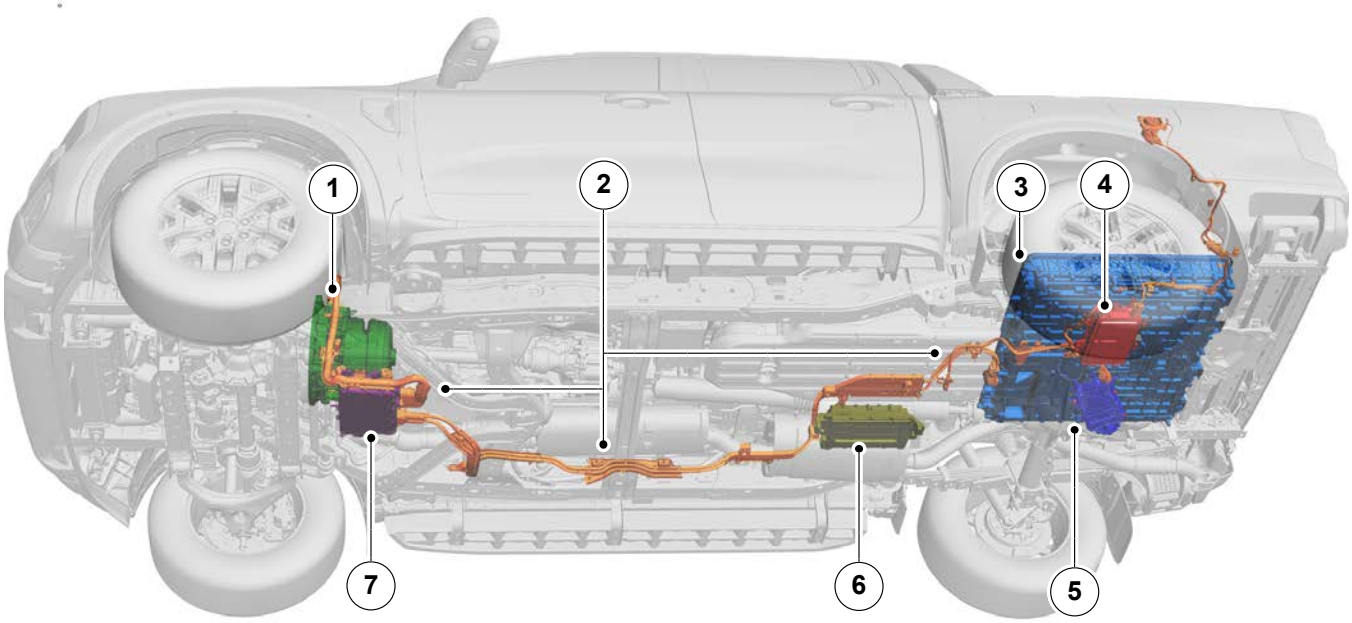


E439541

3.1.2 HV System Overview - PHEV

The High Voltage System on Ranger PHEV consists of a rear mounted High Voltage Battery Pack and a number of HV modules mounted under the battery pack and transmission. The Electric Drive Assembly within the transmission provides drive to the wheels. These are connected by orange High Voltage cables and a system for cooling the components of the High Voltage system.

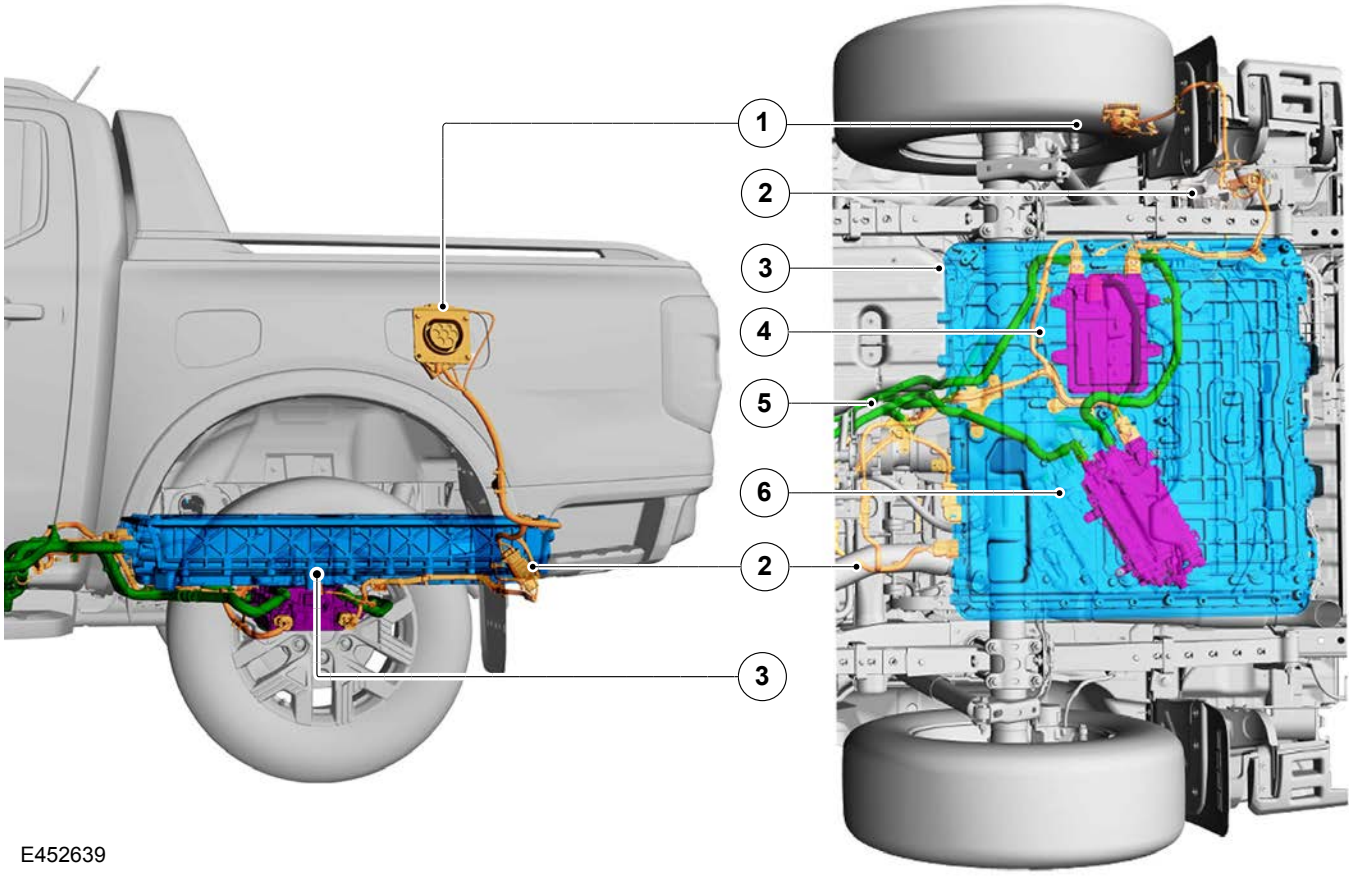
High Voltage System Overview



E451967

Item	Description
1	Electric Drive Assembly (MHT)
2	Orange High Voltage Cables
3	High Voltage Battery Pack
4	SOBDM Charger Module (BCCM)
5	DC-DC Module (Convertor)
6	DC-AC Convertor (OBGI / Inverter)
7	SOBDEM C (HPCM / ISC)

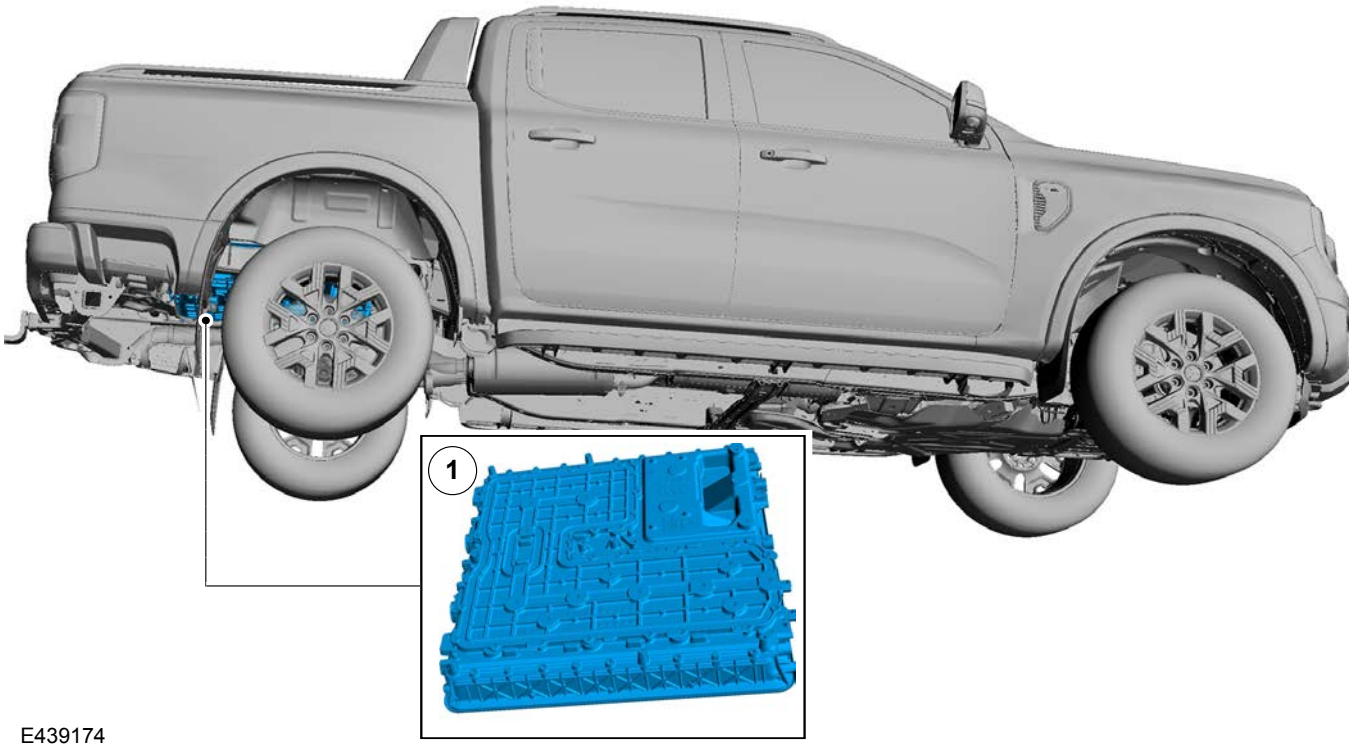
High Voltage System Overview



E452639

Item	Description
1	High Voltage Charge Port Inlet
2	Orange High Voltage Cables
3	High Voltage Battery Pack
4	SOBDM Charger Module (BCCM)
5	Coolant Lines
6	DC-DC Module (Convertor)

High Voltage Battery



E439174

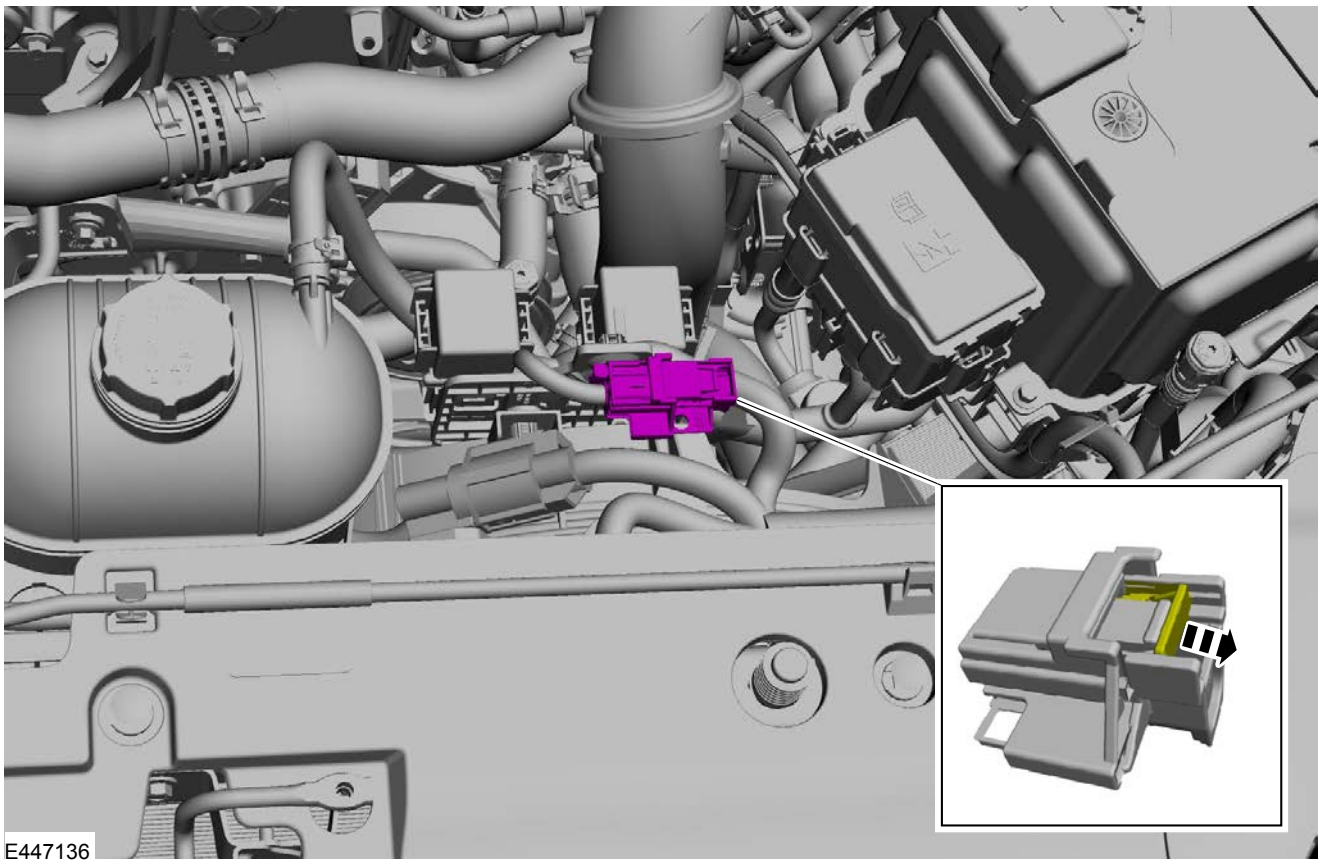
Item	Description
1	HV Battery

3.1.3 HV System De-Energising - PHEV

Please refer to the Ranger PHEV workshop manual for the High Voltage Battery Disconnect and Connect procedure.

WARNING: De-energising the High Voltage system does not dissipate the voltage inside the High Voltage battery. The battery pack remains live and dangerous. Contact with the High Voltage battery pack internals may result in serious personal injury or death.

CAUTION: When the High Voltage system has been de-energised the 12 volt low voltage system will remain live.

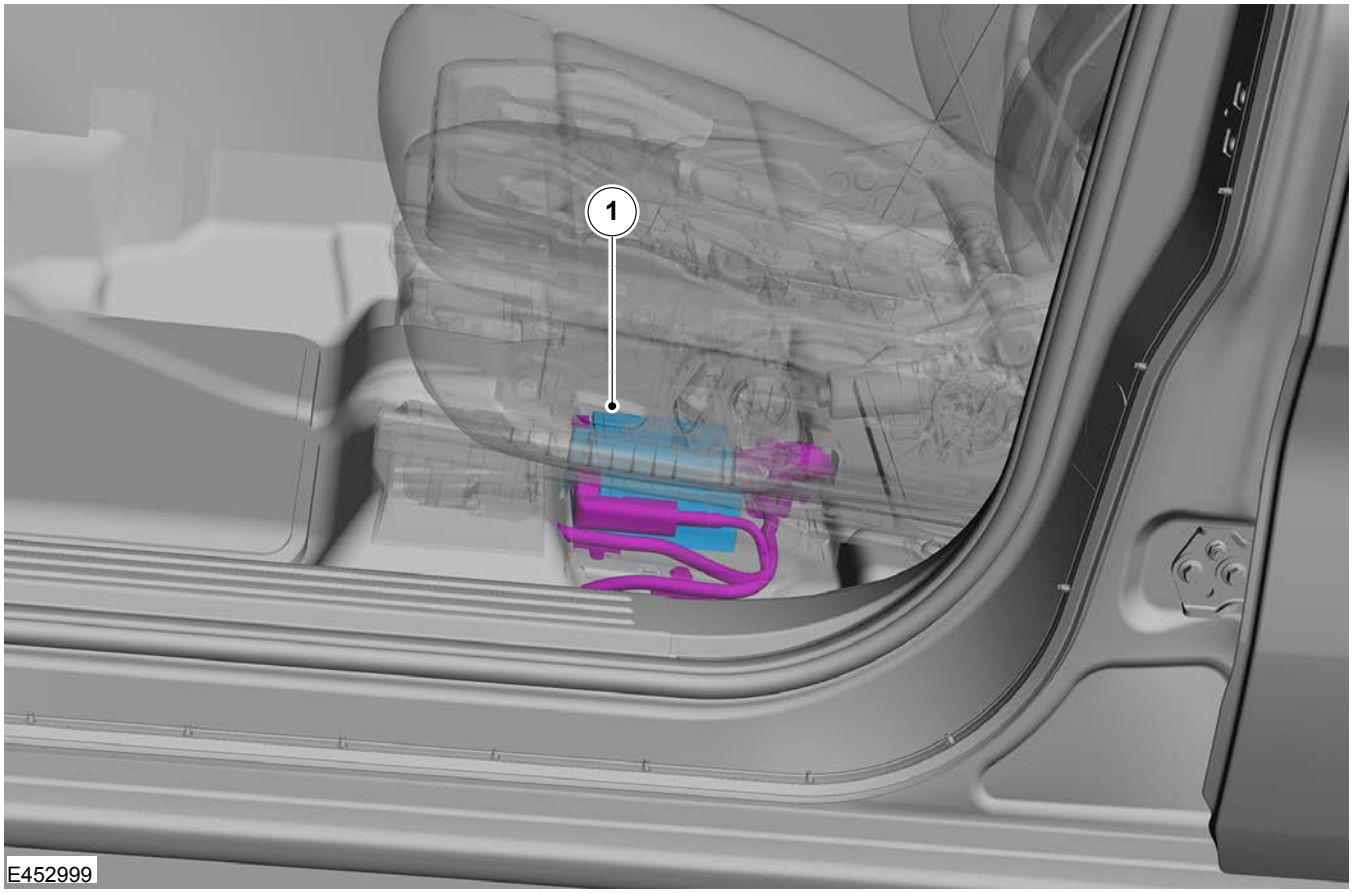


WARNING: PHEV variants have an auxiliary 12V DC AGM battery located under the left front seat. This battery powers critical vehicle systems as a fail-safe. It cannot be removed, modified nor have any additional electrical loads applied to it. Do not connect to nor tamper with this battery.

CAUTIONS:

Maintain existing clearances around the LVSD (Low-Voltage Service Disconnect) pull-plug connector, shown above. It must be easily and quickly accessible at all times.

This auxiliary battery must also be isolated to de-energise the 12V DC vehicle system fully.



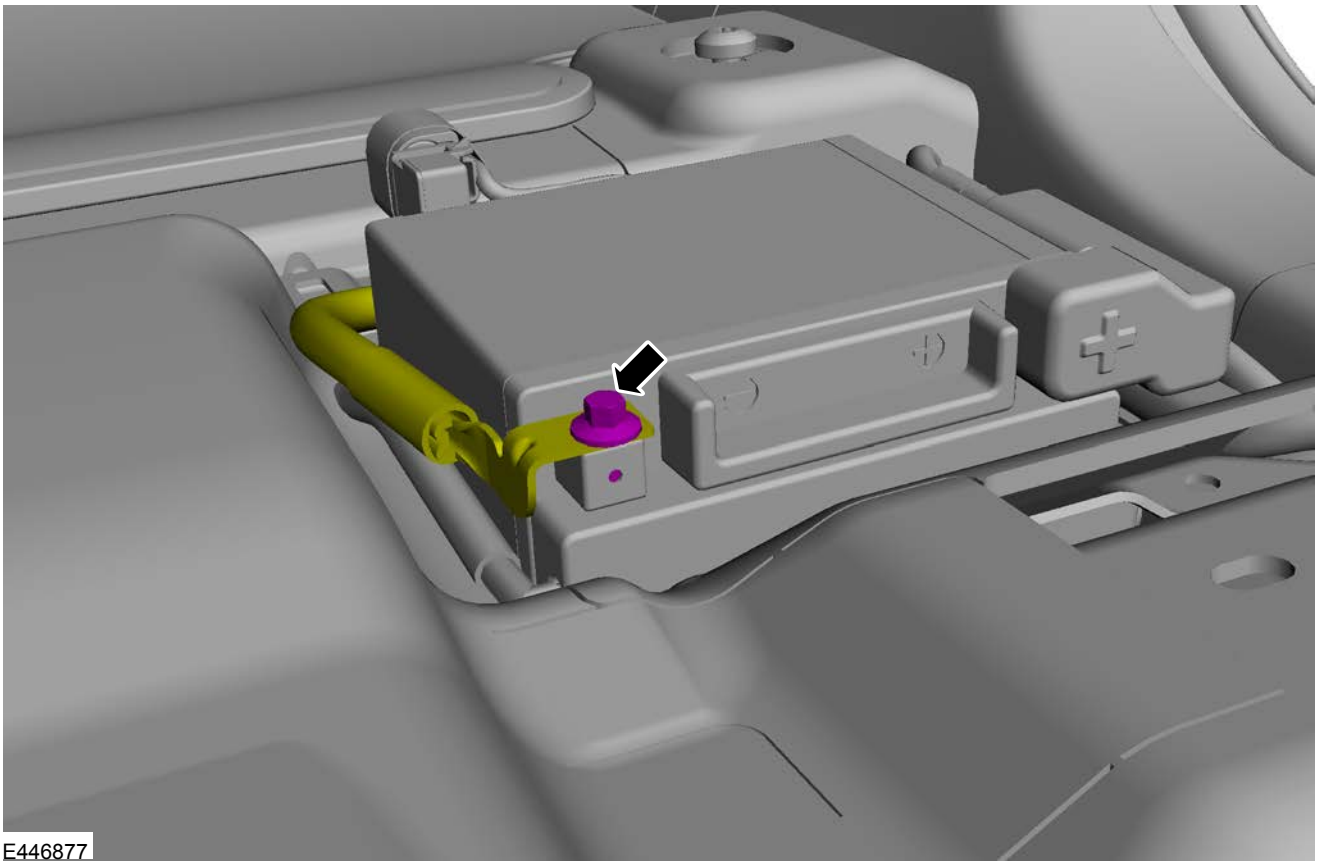
Item	Description
1	Auxiliary Battery - Do not connect to nor tamper with this battery

Auxiliary Battery Disconnect and Connect Procedure



NOTE: The auxiliary battery is located under the LH front seat.

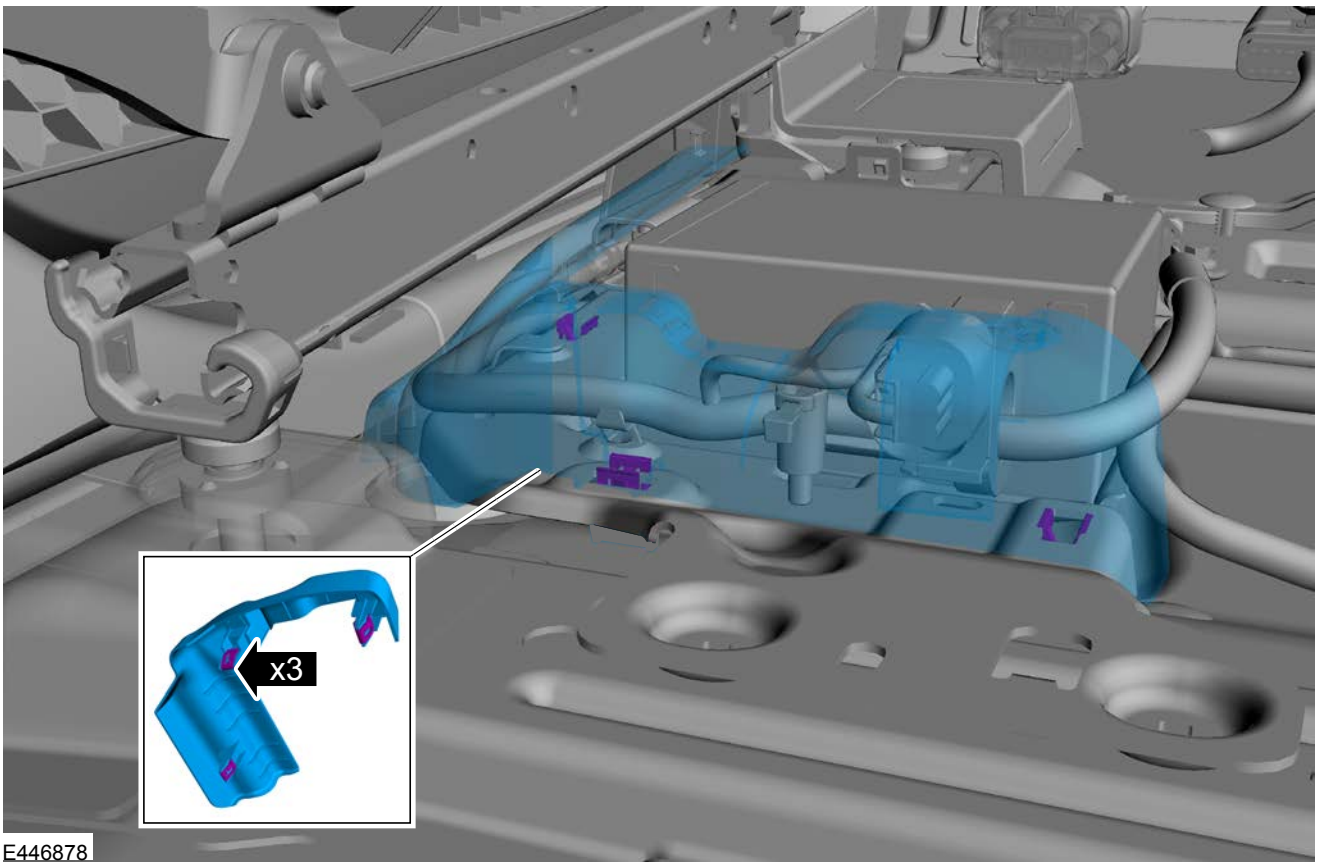
1. Adjust the LH front seat to the rearward position.



E446877

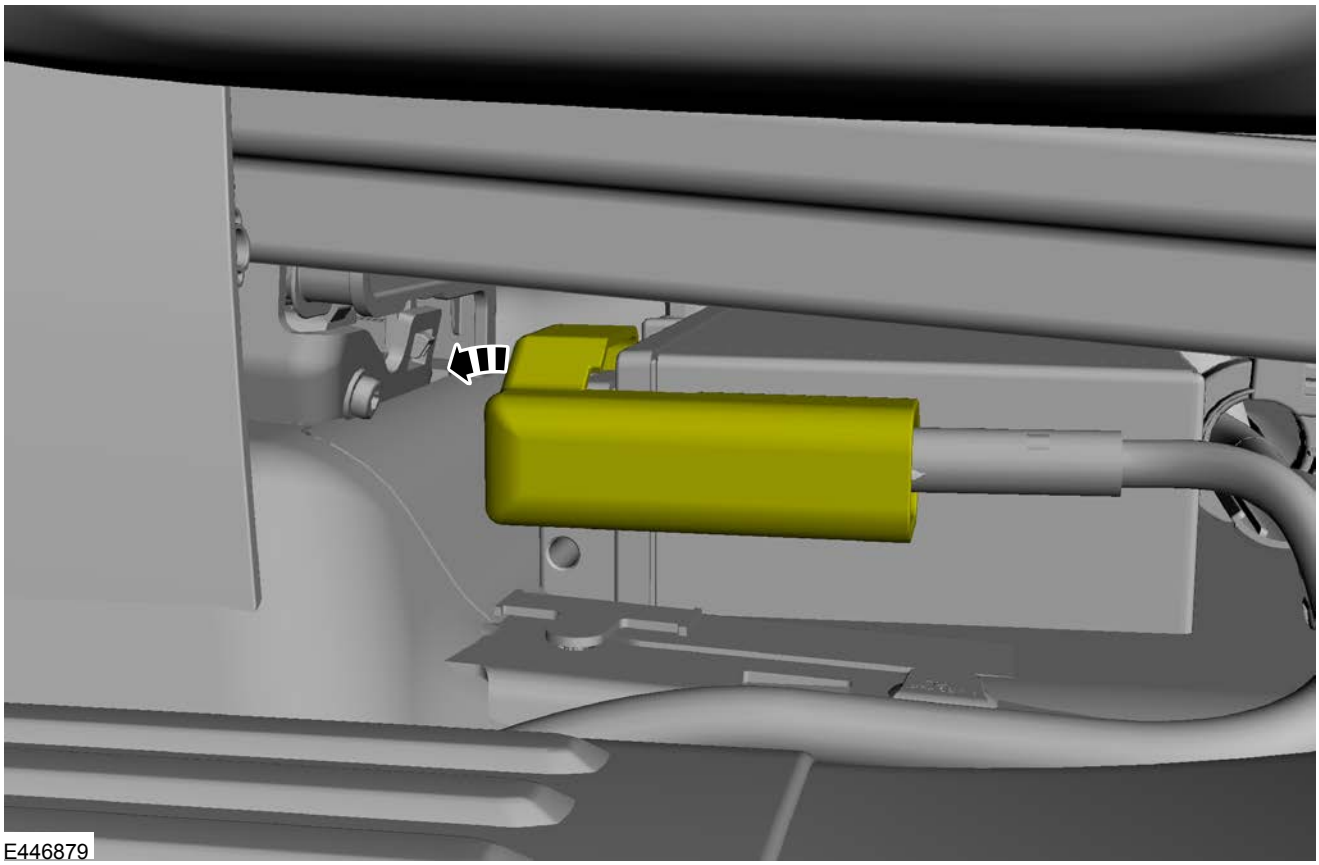
NOTE: Make sure the positive battery terminal cover is in position while removing the negative battery cable clamp to prevent damage from a short to the positive terminal.

2. Remove the bolt and position the negative battery cable aside.
   - Torque 6.2 Nm

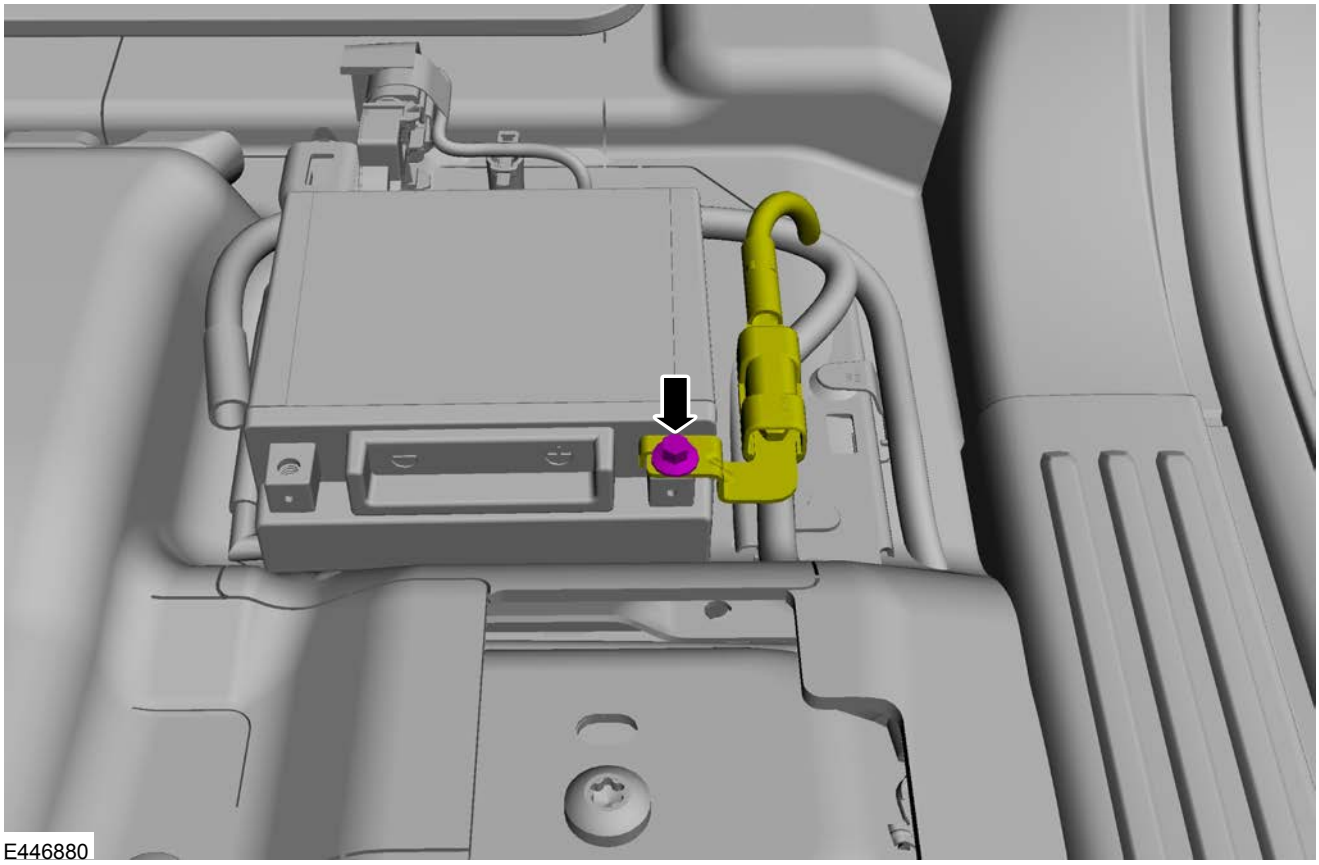


E446878

3. Release the clips and remove the battery positive cable protective cover.


E446879

4. Position the positive battery cable terminal cover aside.


E446880

5. Remove the bolt and position the positive battery cable aside.
   - Torque 6.2 Nm
6. To install, reverse the removal procedure.

3.1.4 HV System Cooling - PHEV

WARNING: Do not modify the High Voltage cooling system.

3.1.5 HV Battery - PHEV

Observe the following precautions when working on or around the High Voltage Batteries.

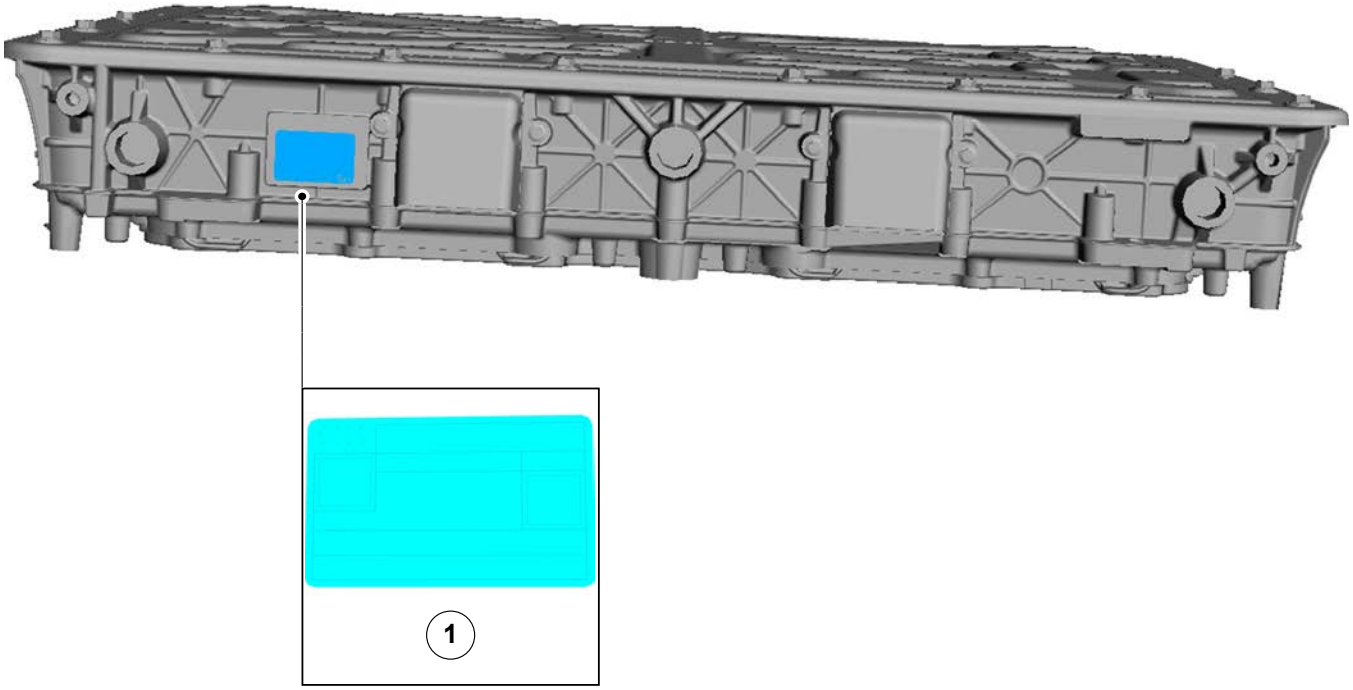
- Do not cut the High Voltage battery case.
- Do not penetrate the batteries or battery case in any way.
- The High Voltage battery pack is located under the vehicle.
- The total voltage of the High Voltage battery pack may be up to approximately 400V DC.
- The battery case is water resistant.
- The battery cells contain liquid electrolyte absorbed in a porous special polymeric film. The electrolyte will not leak from the battery under most conditions. However, if the battery is crushed, it is possible for a small amount of electrolyte to leak.
- If possible, isolate and avoid contact with any electric vehicle components. If contact with the High Voltage system cannot be avoided, Personal Protective Equipment (PPE) such as a splash shield or safety goggles, gloves (butyl), an apron or overcoat and rubber boots are required when handling damaged batteries. Exposure to electrolyte could cause skin and/or eye irritation or burns. If exposed, rinse with large amounts of water for 10-15 minutes.

The high voltage system has a floating return reference, which is designed to completely isolate the HV system from the vehicle chassis and non-HV components and circuits. As part of the safety features built in to the HV system, measurements between the HV bus and vehicle ground are monitored during key 'on' state to detect high voltage leakage or stray current to the chassis.

The power terminals of the high voltage battery are only activated when necessary for vehicle operation, including:

- When the vehicle is in key ‘on’ or ‘accessory’ state.
- When the 12V battery has a low state of charge – the HV battery will activate to charge the 12V battery through the DC to DC convertor, even in the vehicle key ‘off’ state.
- When the vehicle is plugged into a charging station.

HV Battery Serial Number Label



E439428

Item	Description
1	HV Label

HV Battery Venting

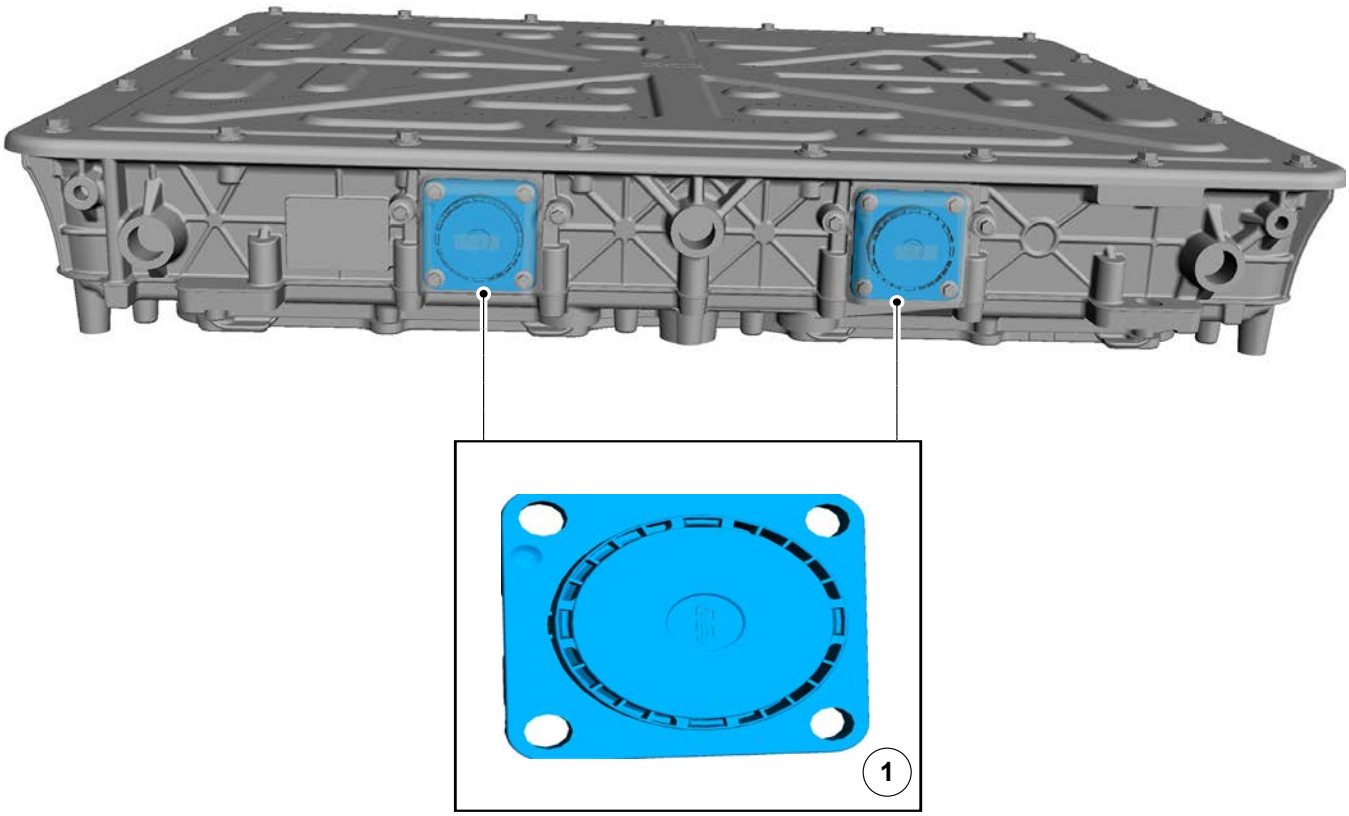
The HV Battery is equipped with an exhaust vent. No additional components nor obstructions (beyond any installed by Ford) shall be located in the same environment as the battery (meaning underbody) and within 150mm of these features. Additionally, no components which may contain combustible liquids or gases at any time shall be added within 300mm of these features.

There shall be no modifications or installed components which confine the air space near the outside of the HV Battery or obstruct the free flow of air about the battery (beyond any installed by Ford).

Any cut outs or openings created between the occupant space and the vehicle underbody shall be sealed such that air is not free to pass from under the vehicle into the occupant space.

If any primary ingress/egress paths for occupant spaces are located above or rearward of the rear axle, a metallic shielding shall be added to obstruct any air flow from the battery towards those ingress/egress paths, and redirect that air flow towards a side/rear area that is not a primary ingress/egress path.

HV Battery Vent Valves



E439429

Item	Description
1	HV Vent Valves

3.1.6 HV Battery Grounding - PHEV

WARNINGS:

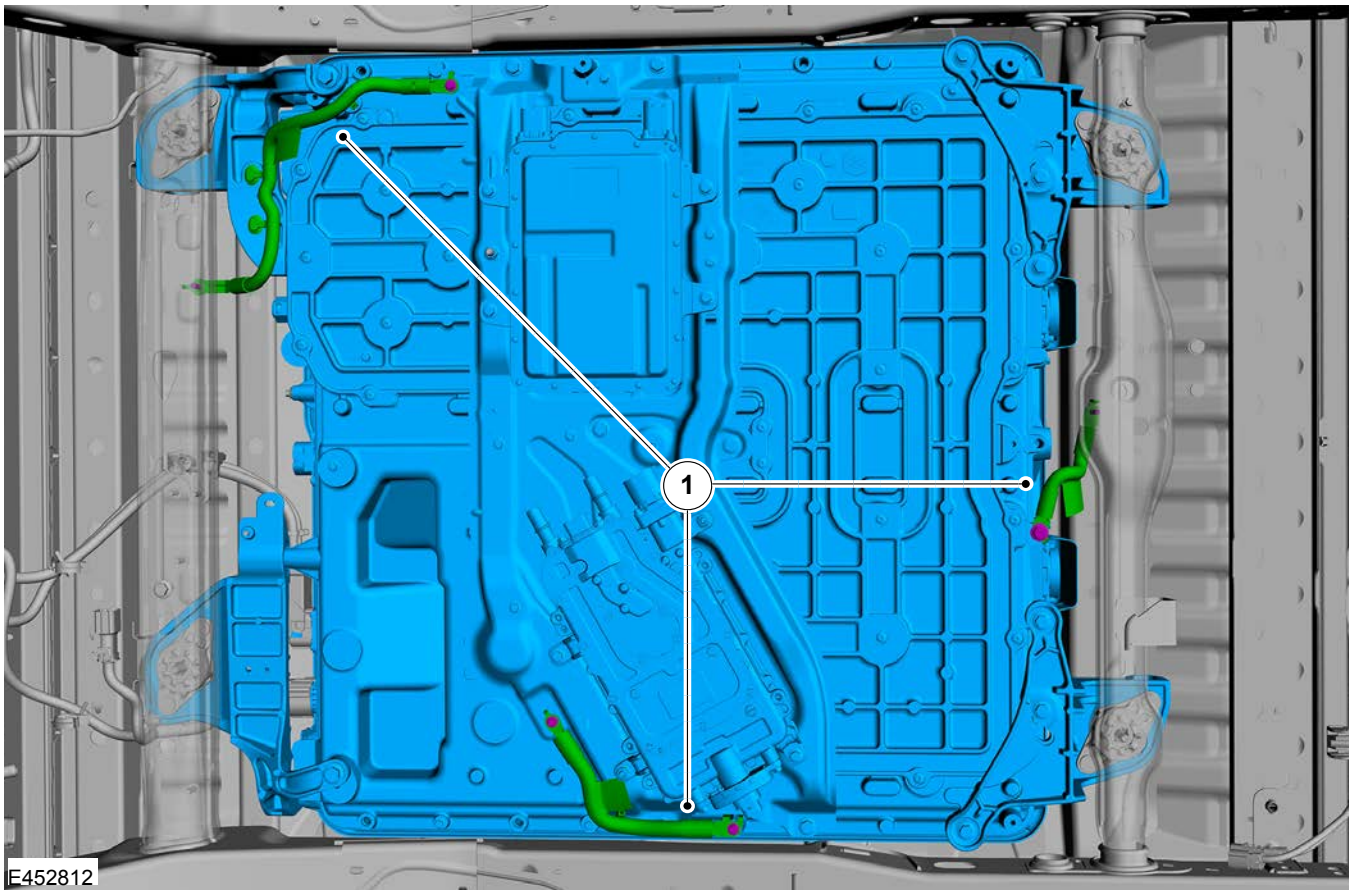
The following illustrations indicate the points where the High Voltage Battery and Cradle are grounded. These points should NOT be used as additional / auxiliary grounding points for the Low Voltage (12V) system.

Electrical ground paths (case grounds, ground straps and/or low voltage wiring) for High Voltage components on the vehicle must not be altered or modified in any way. Do not tamper with or modify any of these HV component fastener joints or ground points.

NOTE: As part of the safety features built in to the HV system, measurements between the HV bus and vehicle ground are monitored using these ground paths. Therefore, HV battery ground paths must not be altered in any way.

NOTE: The complete ground path includes the cradle as well as the attachments to the body rail.

Refer to: 5.1 Body (page 207).



Item	Description
1	HV Battery pack ground cables - Do not connect to nor tamper with these cables

3.1.7 EV Charging - PHEV

NOTE: Mobile chargers provided with vehicles should be reserved for end customer use only, and not used during manufacturing or delivery processes, to prevent damage or loss.

Please refer to the Ranger PHEV Customer Owners Manual.

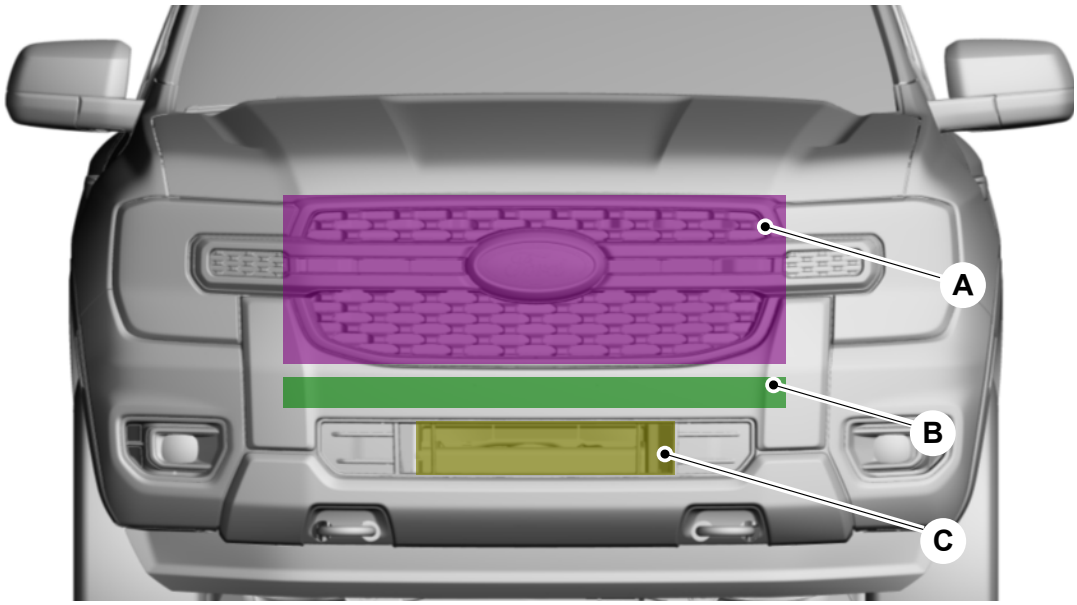
3.2.1 Engine / E-Drive

CAUTION: Do not modify the Electric Drive Assembly.

3.2.2 Engine Cooling Airflow Envelopes

Engine cooling performance is to be maintained by preventing accessories and vehicle additions from intruding on the airflow cooling envelopes.

Base

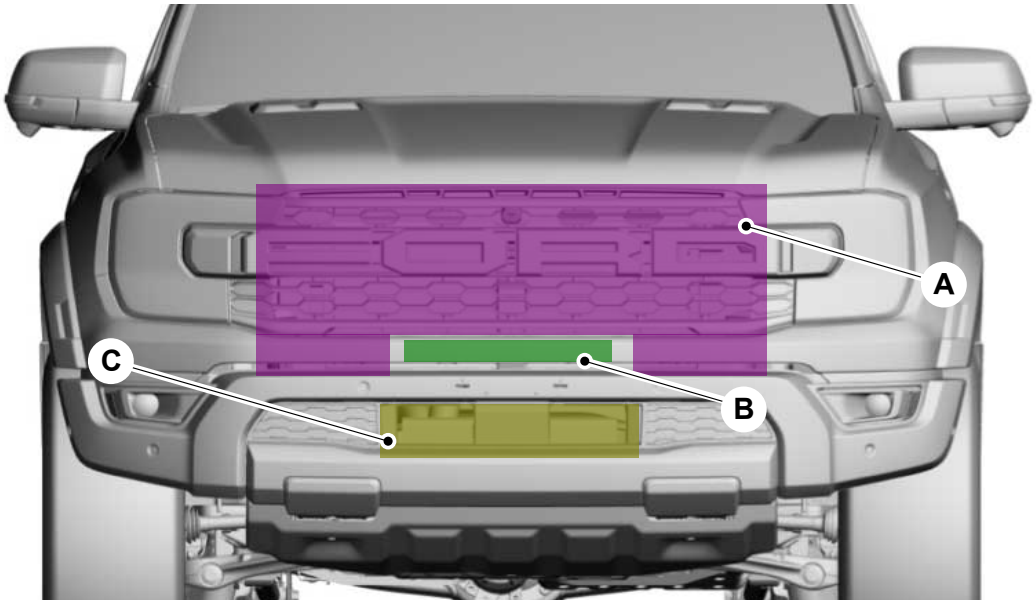


E363030

Item	Description
A	Restriction of cooling airflow within this area may cause a degradation of engine and transmission cooling performance.
B	Restriction of cooling airflow within this area poses a low risk of powertrain cooling performance degradation.
C	Restriction of cooling airflow within this area may cause a degradation of engine performance due to intercooler airflow obstruction.

NOTE: XLT Variant shown, others similar. Excludes Raptor.

Raptor



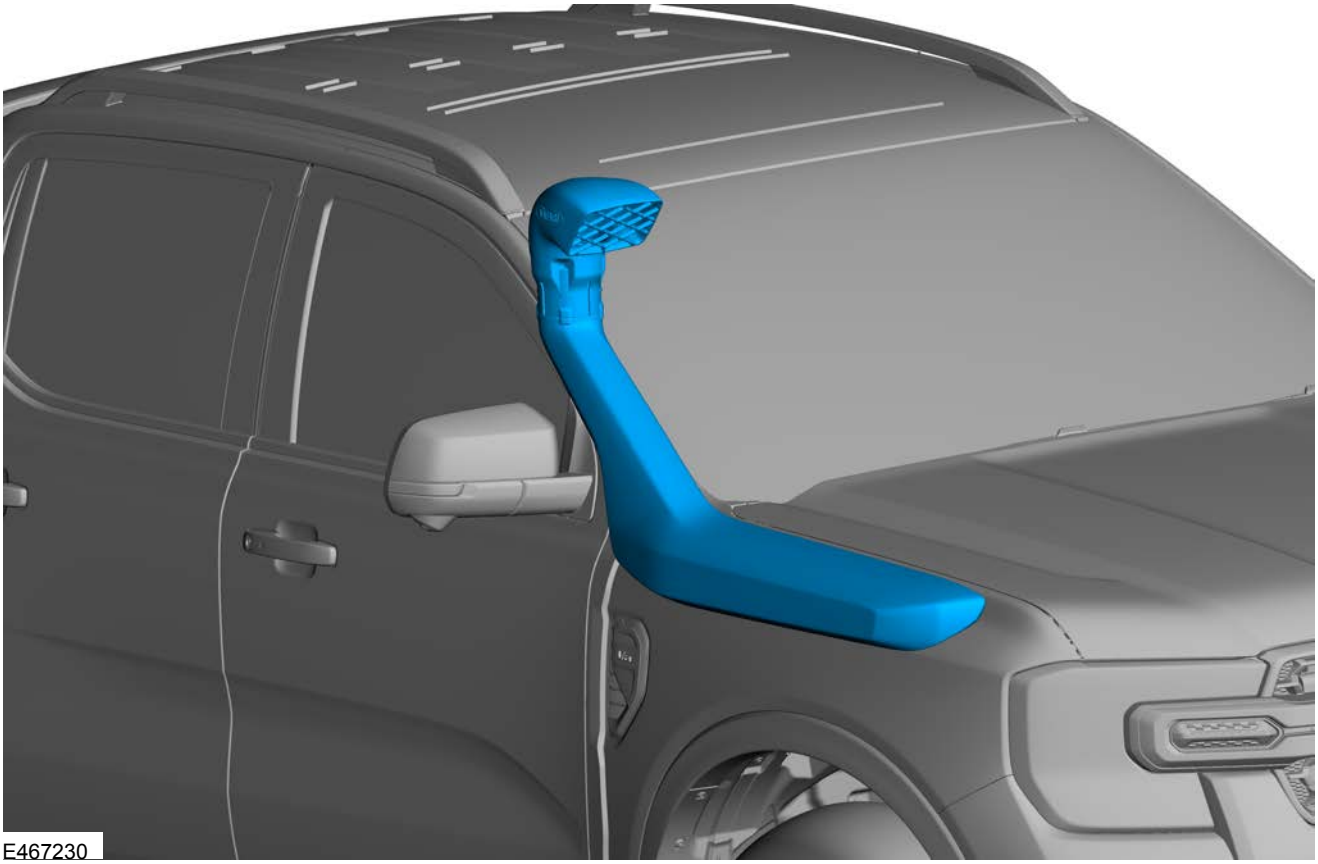
E363031

Item	Description
A	Restriction of cooling airflow within this area may cause a degradation of engine and transmission cooling performance.
B	Restriction of cooling airflow within this area poses a low risk of powertrain cooling performance degradation.
C	Restriction of cooling airflow within this area may cause a degradation of engine performance due to intercooler airflow obstruction.

3.2.3 Air Intake

A Snorkel kit may also be available in some markets as an accessory that can be purchased from authorised Ford Dealers.

- Part Number: VARBSS987HFD



Cyclonic Pre-Filter

WARNING: The fitment of non-approved pre-filters may affect engine performance, fuel efficiency, emissions compliance and engine durability.

For continued driving through dusty conditions Ford advises that the fitment of a cyclonic pre-filter (to replace the Ram head on the snorkel) may be beneficial. As at the time of publication, the Donaldson TopSpin™ cyclonic pre-filter listed below is the correct specification to suit the Ford accessory snorkel (all diesel engines). This component is also applicable to aftermarket snorkels with a Ø3 inch head spigot. A 1mm thick rubber sleeve may be required between the snorkel head and pre-filter for robust mounting.

- Donaldson Part Number: H002425

3.2.4 Engine / E-Drive Selection for Conversions

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

The Vehicle Converter is responsible for specifying the correct emissions engine to the latest E.E.C/E.U. Regulations or applicable local legislation depending on the completed vehicle category and weight. The final weight of a vehicle including the conversion, determines whether a vehicle needs a light-duty or heavy-duty emissions engine.

The weight is based on the Reference Mass defined as the mass in running order, less a 75kg allowance for the driver, add a 100kg uniform mass.

For guidance purposes only, if the Reference Mass used for completed vehicle type approval is:

- Not exceeding 2840kg, a light-duty engine may be specified for N1 and N2 vehicles.

Engine / E-Drive Types

Engine	Emissions / Fuel Type	Max Power kW/RPM	Max Torque Nm/RPM
2.0L SiT TDCi	Eu4 Emissions / Diesel	110kW (149PS) @3500rpm	350Nm (258 ft lbs) @1500-2750rpm
2.0L SiT TDCi	Eu4, Eu5, Eu6 Emissions / Diesel	125kW (169PS) @3500rpm	405Nm (298 ft lbs) @1750-2500rpm
2.0L BiT TDCi	Eu4, Eu5 Emissions / Diesel	154kW (210PS) at 3750rpm	500Nm (369 ft lbs) at 1750-2000rpm
2.0L BiT TDCi	Eu6 Emissions / Diesel	151kW (205PS) at 3750rpm	500Nm (369 ft lbs) at 1750-2000rpm
2.3L EcoBoost 270hp	Eu5 Emissions / Gasoline	222kW (301PS) @5900rpm	452Nm (333 ft lbs)@3350rpm
3.0L Powerstroke V6	Eu5 Emissions / Diesel	184kW (250PS) 3250rpm	600Nm (442 ft lbs) @1750-2250rpm
	Eu6.2 Emissions / Diesel	177kW (240PS) @3250rpm	600Nm (442 ft lbs) @1750-2250rpm
PHEV *	Eu6.2 Emissions / Gasoline and Electric	207kW (281PS) @4600rpm	697Nm (514 ft lbs) @2500rpm

* PHEV is combined ICE and EV.

3.2.5 Engine Selection for Conversions - Raptor

NOTE: The regulations contained in this manual may not be applicable to your market. Search for the current regulations in your country to acquire more information.

The Vehicle Converter is responsible for specifying the correct emissions engine to the latest E.E.C/E.U. Regulations or applicable local legislation depending on the completed vehicle category and weight. The final weight of a vehicle including the conversion, determines whether a vehicle needs a light-duty or heavy-duty emissions engine.

The weight is based on the Reference Mass defined as the mass in running order, less a 75kg allowance for the driver, add a 100kg uniform mass.

For guidance purposes only, if the Reference Mass used for completed vehicle type approval is:

- Not exceeding 2840kg, a light-duty engine may be specified for N1 and N2 vehicles.

Engine Types

Engine	Emissions / Fuel Type	Max Power kW/RPM	Max Torque Nm/RPM
3.0L EcoBoost V6	ULEV 50 Emissions - 98 RON gasoline fuel	302kW (410PS) at 5650rpm	583Nm (430 ft lbs) at 3500rpm
	EU 5 Emissions - 98 RON gasoline fuel	292kW (397PS) at 5650rpm	583Nm (430 ft lbs) at 3500rpm
	EU 6.2 RDE Emissions - 95/ 98 RON gasoline fuel	215kW (292PS) at 5500rpm	491Nm (362 ft lbs) at 2300rpm
2.0L BiT TDCi	Eu4, Eu5 Emissions / Diesel	154kW (210PS) at 3750rpm	500Nm (369 ft lbs) at 1750-2000rpm

3.3 Selective Catalytic Reduction System

3.3.1 Selective Catalytic Reduction System - Diesel Exhaust Fluid (DEF) / Urea / AdBlue®

WARNINGS:

The engine may not start if you tamper with or disable the selective catalytic reduction system.

The engine may not start if the Diesel Exhaust Fluid (DEF) level is low. Make sure it is refilled.

The engine may not start if the DEF is contaminated. Replace the contaminated fluid immediately.

The Selective Catalytic Reduction System helps to reduce exhaust emission levels by injecting DEF into the exhaust system. For proper functioning of this system make sure you refill the DEF periodically.

NOTE: If removing or replacing the load box ensure the filler hose angle and clearances of both the fuel filler and DEF filler are maintained.

Refer to: Fuel System (page ?).

NOTE: Refer to the vehicle owner manual for further information on the DEF system.

Filling the Diesel Exhaust Fluid Tank

WARNING: Do not allow DEF to come into contact with eyes, skin or clothing. Should the fluid come into contact with eyes, flush them with plenty of water and seek medical attention. Clean affected skin with soap and water. If swallowed, drink plenty of water and seek medical attention immediately.

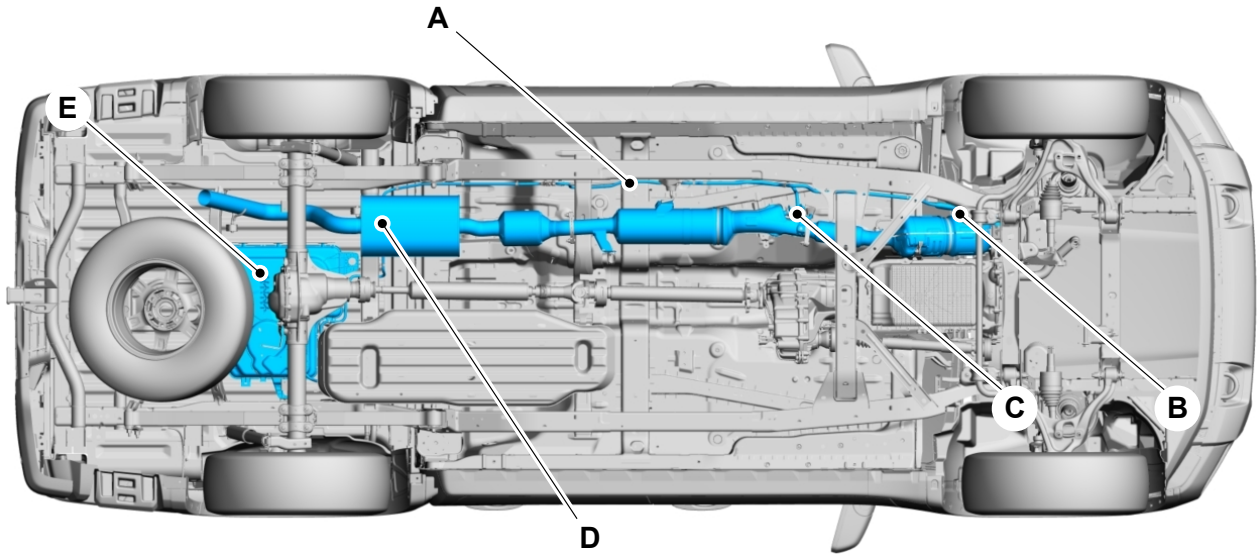
CAUTION: Use only the vented type DEF filler cap that is specific to the vehicle. Use of any other DEF filler cap may cause system damage.



E236052

NOTE: Immediately wash off any DEF that has spilled on to a painted surface with mild soapy water.

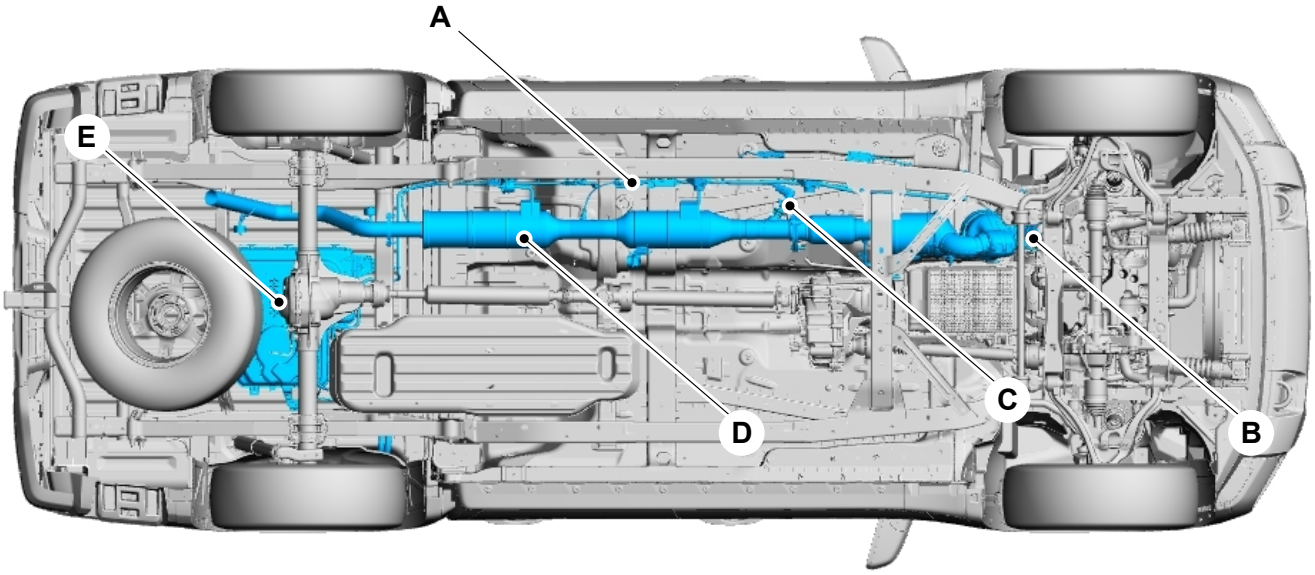
2.0L Diesel



E363643

Item	Description
A	DEF pressure line
B	DEF injector
C	DEF injector
D	Exhaust system with selective catalytic reduction catalyst
E	DEF tank

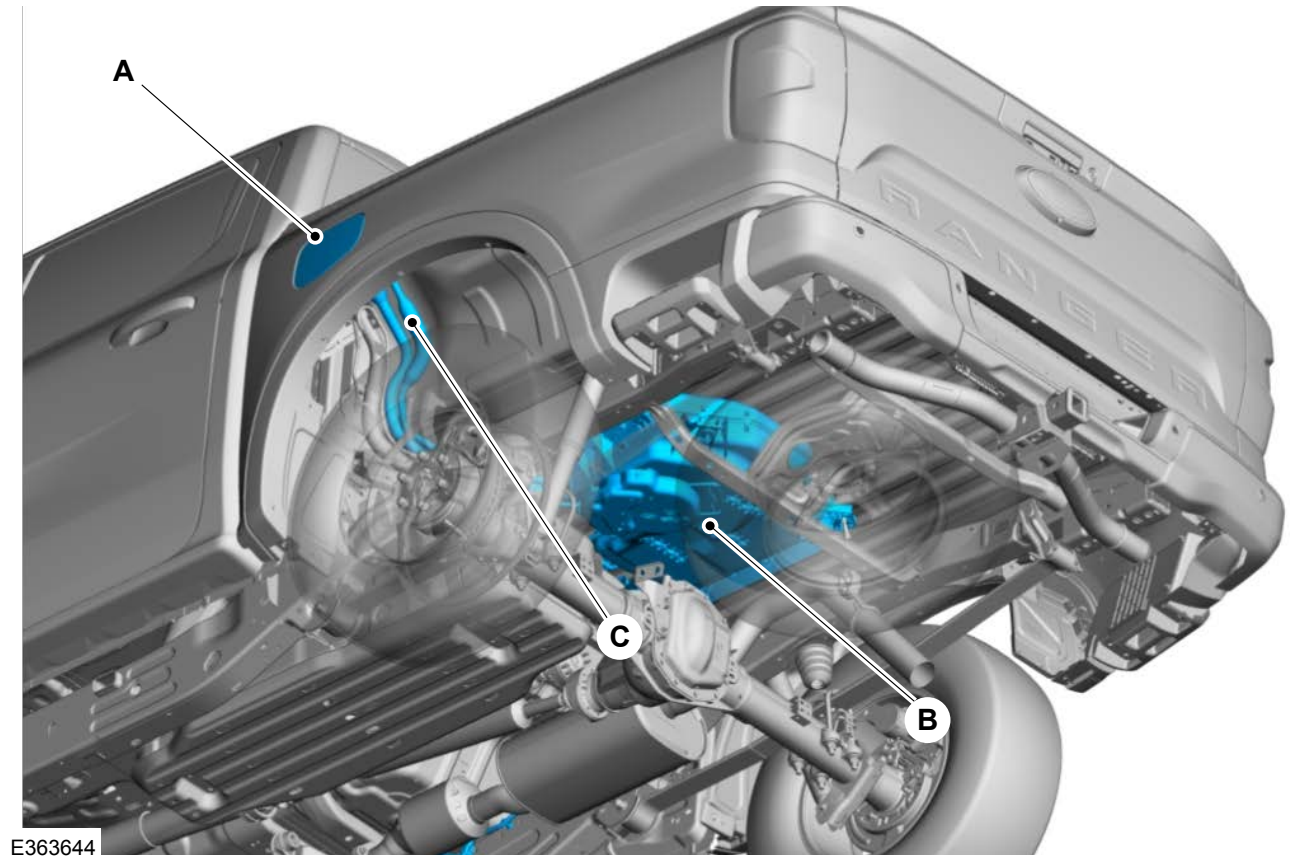
3.0L Diesel



E383512

Item	Description
A	DEF pressure line
B	DEF injector
C	DEF injector
D	Exhaust system with selective catalytic reduction catalyst
E	DEF tank

Diesel Exhaust Fluid (AdBlue) Tank and Filler Tube



Item	Description
A	DEF filler
B	DEF tank
C	DEF filler hose

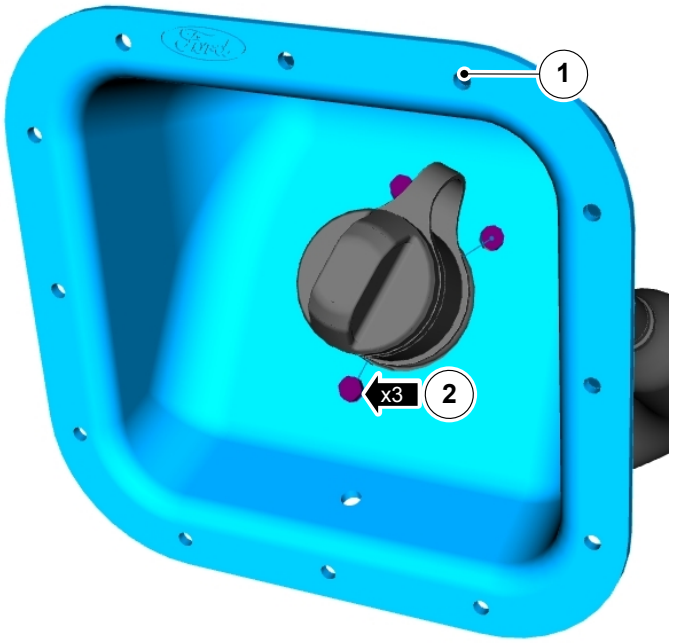
Diesel Exhaust Fluid Filler Mounting - Chassis Cab Vehicles

WARNING: Make sure that the filler neck mounting bracket is made of a conductive material, and that it provides a grounding path for the filler neck to avoid risk of fire.

Suitable mounting fixtures and alignment of the of the diesel exhaust fluid filler cup and filler pipes is required when vehicle modification impacts on the DEF System.

If the vehicle body and mounting bracket does not provide a grounding path for the filler neck, an earth strap must be added, connecting the filler neck to the chassis frame.

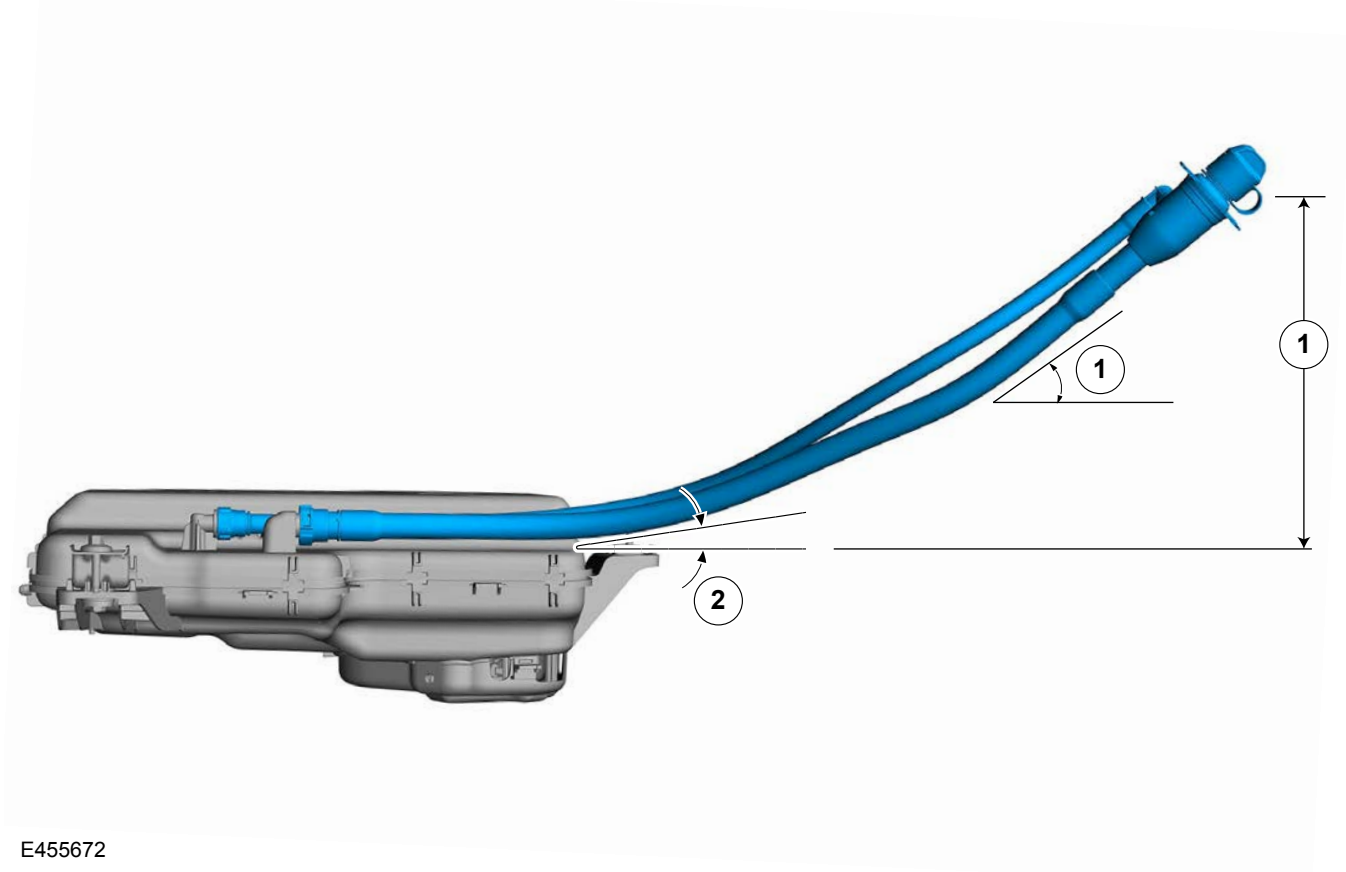
Diesel Exhaust Fluid Filler Mounting Bracket



E367864

Item	Description
1	DEF mounting bracket fixing points.
2	All 3x fixing points on the diesel exhaust fluid filler neck must be utilised and tightened to 5.4 Nm.

Angle of Diesel Exhaust Fluid Filler Neck



E455672

Item	Description
1	A 30º angle at the filler cup and an overall minimum drop of 180 mm should be achieved to ensure adequate flow of diesel exhaust fluid when refilling to prevent flow back.
2	A minimum of 2º angle must be maintained in the entire filler hose and vent hose starting from filler cup to the diesel exhaust fluid tank. This is needed to ensure proper filling operation.

CAUTION: Care should be taken when mounting U-bolts or other hardware to the frame rail as the diesel exhaust fluid line can be trapped and crushed. In order to prevent damage / crushing of the diesel exhaust fluid line, body builders / installers should inspect the underside of the frame rails and verify diesel exhaust fluid hose routing prior to any hardware installation. Ensure that the diesel exhaust fluid line does not interfere with clamping surface. If additional diesel exhaust fluid line slack is required, the diesel exhaust fluid line can be moved within the existing positioning clips by rotating the diesel exhaust fluid line back and forth while gently pulling on the diesel exhaust fluid line. This will provide the slack required for the insertion of the U-bolt strap between the frame rail and the diesel exhaust fluid line.

NOTE: The completed diesel exhaust fluid filler kit must provide a minimum 2º continuous downward slope from filler cup to the tank.

NOTE: Routing of the diesel exhaust fluid filler hoses must ensure no contact with any exhaust components or sharp edges.

NOTE: Routing of diesel exhaust fluid filler hose and vent hose must not contain any sumps. Additional support may be required to prevent the diesel exhaust fluid filler hose sagging which could create a sump. A sump in the pipe can cause spray or spit-back during normal filling operations and may also cause the pooled DEF to freeze inside the pipe and damage the component.

NOTE: No kinking is allowed in the diesel exhaust fluid filler hose.

NOTE: Do not extend the diesel exhaust fluid filler hose outboard of the vehicle body.

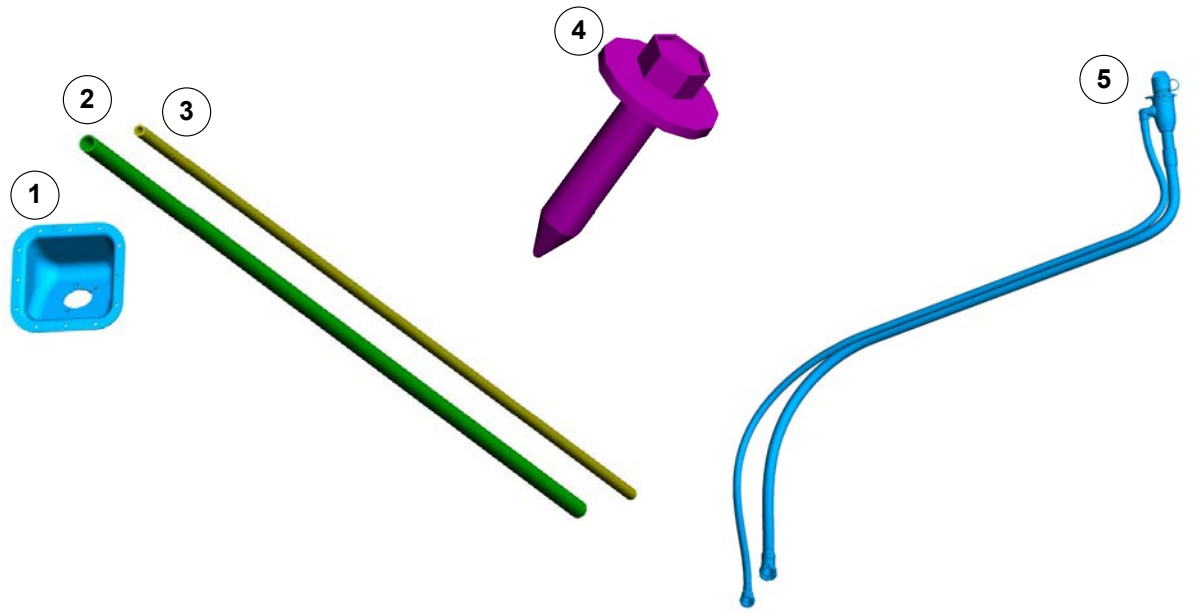
NOTE: If the diesel exhaust fluid filler housing provided with the kit is not used, technician should ensure that the filler cup angle to the horizontal is at least 30º.

NOTE: If the diesel exhaust fluid filler housing provided with the kit is used, the three fasteners are provided in the kit must be used to secure the cup to the housing.

NOTE: At least 9mm clearance between the diesel exhaust fluid filler assembly and the vehicle body must be maintained.

A Ford approved diesel exhaust fluid filler neck relocation kit may be available in your market. Contact your local Ford Dealer or National Sales Representative for availability information.

Diesel Exhaust Fluid (DEF) Filler Neck Relocation Kit (If available)



E459507

The DEF Filler neck relocation kit contains:

Item	Description
1	Filler housing
2	Main filler tube - large diameter EPDM tube, Ø26mm (outer), Ø22mm (inner)
3	Vent tube - smaller diameter EPDM tube, Ø18mm (outer), Ø15.5mm (inner)
4	Screws to attach the filler neck to the housing
5	Standard diesel exhaust fluid filler

The relocation kit may also be available in some markets as an accessory that can be purchased from authorised Ford Dealers:

- Part Number: MB3Z-5K289-A

If required, hoses and tubes in the DEF filler neck relocation kit can be trimmed to suit the required length.

Use zip ties or similar fasteners to retain hoses and tubes within the desired routing path during the vehicle operation.

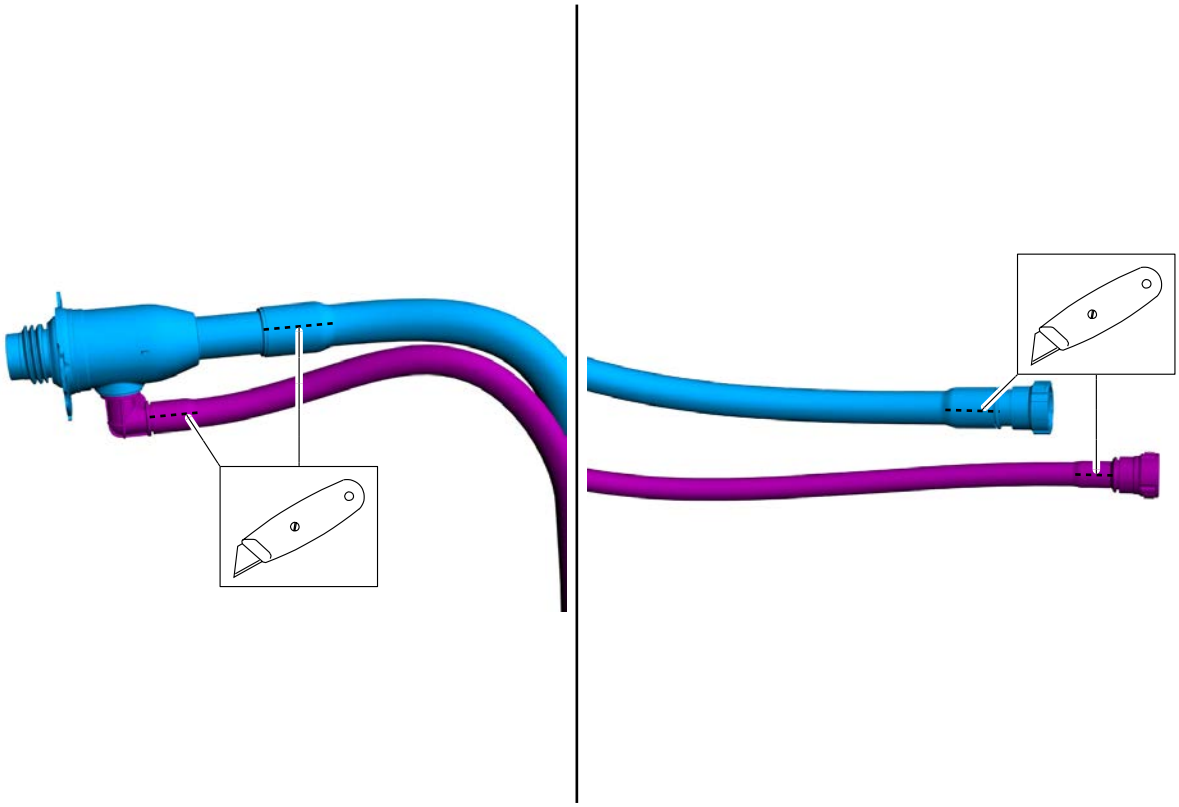
NOTE: The kit does not contain zip ties, hose clamps, or the rivets/screws to attach housing to the vehicle body.

NOTE: Care must be taken when removing the diesel exhaust fluid filler head and connectors from the existing part

Diesel Exhaust Fluid (DEF) Filler Pipe Kit Installation Process

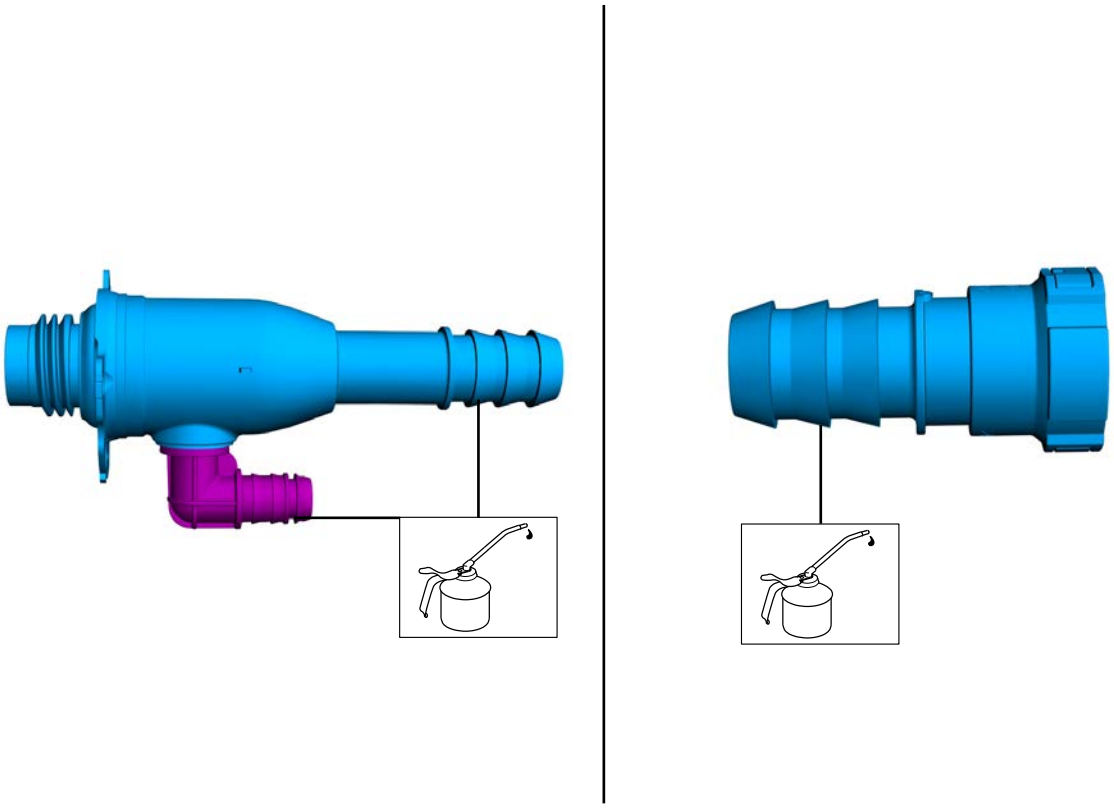
1. Remove the original DEF filler pipe.
2. Cut each hose to the length required to suit the specific installation and routing required. Ensure that the chosen routing follows the recommended guidelines.

NOTE: This step is only to make it easier for the hoses to be removed from the connectors



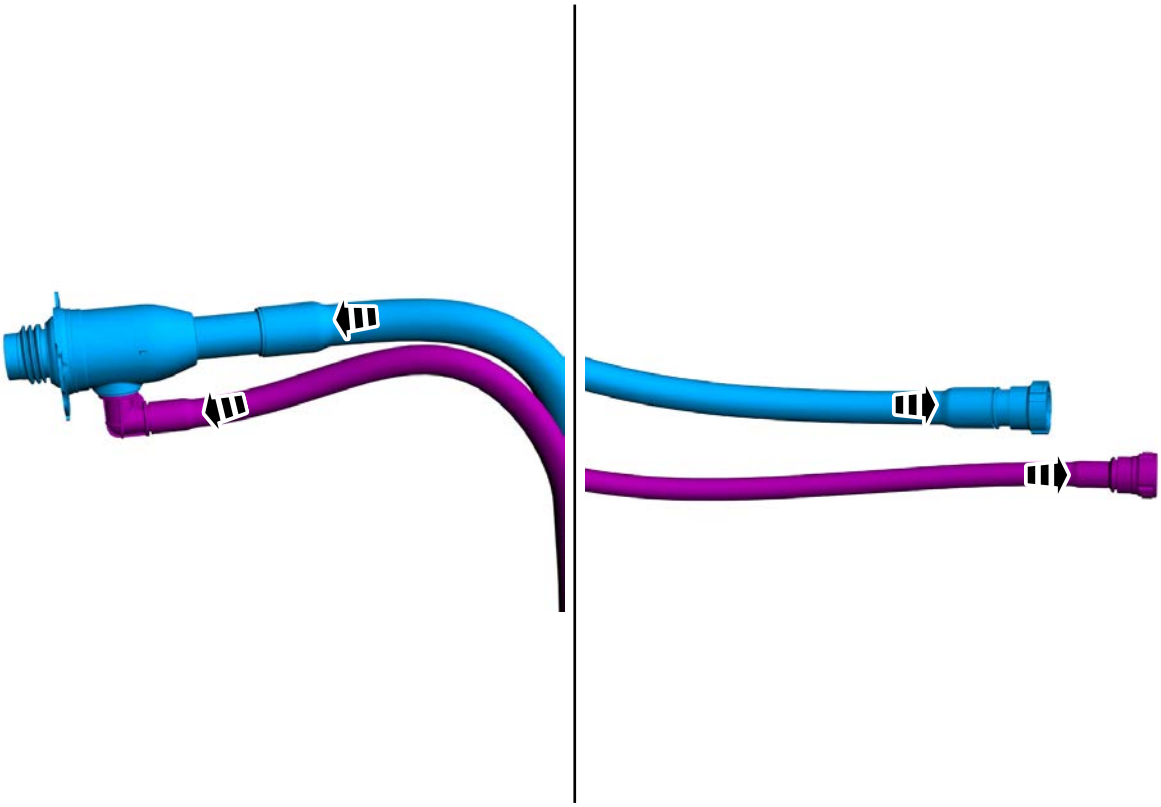
E465426

3. Make a shallow cut as indicated in the original filler pipe rubber hoses. Do not cut through to the connector and damage it. These connectors will need to be reused.



E465424

4. Apply Merpol SH lubricant or a suitable equivalent to the connectors and kit hose internal ends.



E465425

5. Insert the kit hose with the bigger diameter to the filler head and matching tank-end quick connector then insert the kit hose with the smaller diameter to the filler head and matching tank-end quick connector. Ensure the hose ends are fully seated.
6. The revised DEF filler pipe can now be installed in the vehicle. Ensure the DEF filler pipe meets the installation requirements outlined earlier in the section.

3.4 Fuel System

WARNINGS:

Make sure that the modified vehicle complies with all relevant legal requirements.

Do not remove or relocate the fuel cooler (if equipped) when modifying the vehicle.

Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.

Make sure that there are no sharp edges, including fasteners, pointing towards any fuel system component.

The fuel filler pipe must be supported in accordance with the guidelines in this section.

CAUTIONS:

Ensure modifications to vehicle do not obstruct airflow to fuel cooler (where fitted).

Transport Mode includes a calibration feature to reduce the risk of fuel injector nozzle corrosion. Exiting Transportation Mode prior to upfitting / conversion increases the risk of early life injector failure. Refer to your local Ford dealer or national sales agent for information on how to activate or deactivate transport mode.

PHEV variants ultilise the Non-Integrated Refuelling Canister Only System (NIRCOS). This uses an interlock on the fuel filler door to prevent opening while the fuel tank is pressurised. This typically occurs if the vehicle has been operated in EV-mode. A button within the vehicle cabin (near the headlamp switch) must be pressed to purge the system prior to the door opening, allowing access to the (capless) fuel filler. This process can take up to 15 seconds to complete. Refer to the Owner's Manual for further information.

3.4.1 Fuel Filler Pipe Restraining During Shipping

CAUTION: The vehicle must not be operated with the fuel filler pipe in the shipping condition.

The fuel filler pipe is secured to the frame bracket on chassis cab vehicles using a cable tie for shipping of the vehicle only.

3.4.2 Fuel Filler Mounting

CAUTIONS:

Make sure that the filler neck mounting bracket is made of a conductive material, and that it provides a grounding path for the fuel filler neck.

The completed fuel filler pipe system should maintain a minimum of 2° continuous downward slope in the entire filler hose and vent hose between the filler cup and the fuel tank. The fuel filler cup should ideally have a minimum 30° entry angle and be a minimum of 250mm above the fuel tank entry - Intake Check Valve (ICV). This is required to ensure proper filling function under all normal operating conditions. If this cannot be achieved, then fuel filling testing (including high-flow) should be conducted to ensure proper operation. Any limitations should be identified and communicated to the end-user via appropriate labelling at the filler such as "Use of high-flow is not recommended. Fuel spit-back may result." or similar wording as appropriate.

Routing of the fuel filler pipe must ensure no contact with any exhaust components or sharp edges.

No kinking of the fuel filler hose is acceptable.

NOTE: Fasteners for attaching fuel filler pipe to the vehicle body are not supplied by Ford.

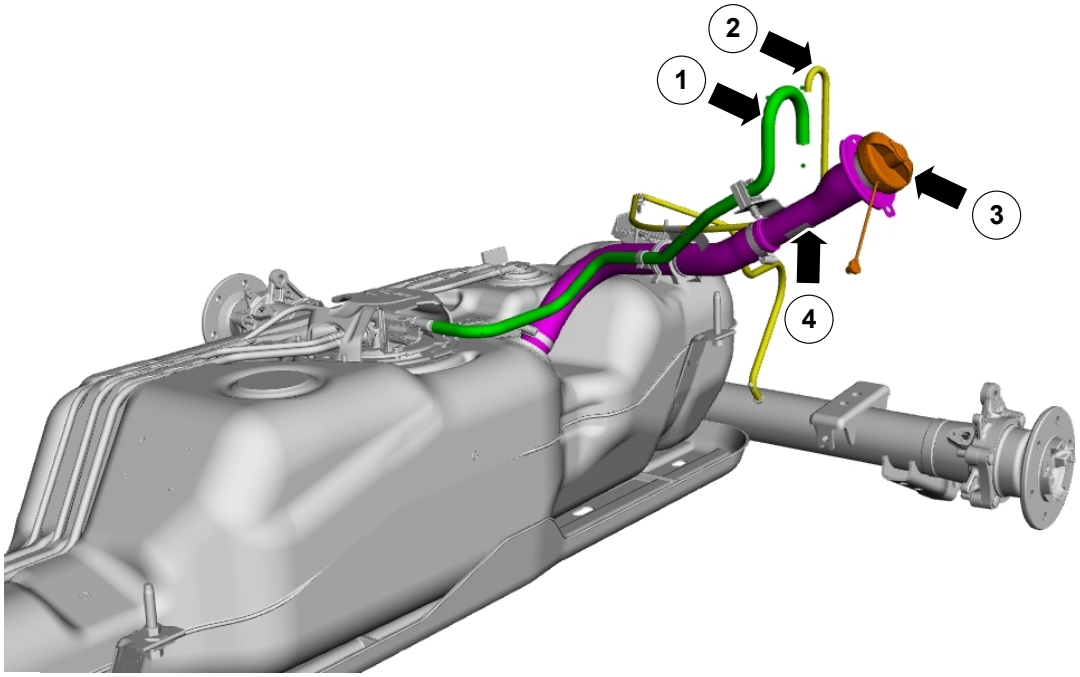
NOTE: Routing of filler hose and vent hose must not contain any sumps. Additional support may be required to prevent hose sagging which could create a sump. A sump in the pipe can cause spray or spit-back during normal filling operations.

If the vehicle body and mounting bracket does not provide a grounding path for the fuel filler neck, an earth strap must be added, connecting the filler neck to the chassis frame.

Do not extend the fuel filler system outboard of the vehicle dimensions or the service body dimensions.

NOTE: If vehicle is equipped with capless filler pipe, and the capless system will not be located inside a filler pocket on converted vehicle, it must be changed to a threaded capped filler pipe system as the capless filler must be protected from dust and dirt. Refer to your national sales agent for supply of a suitable component.

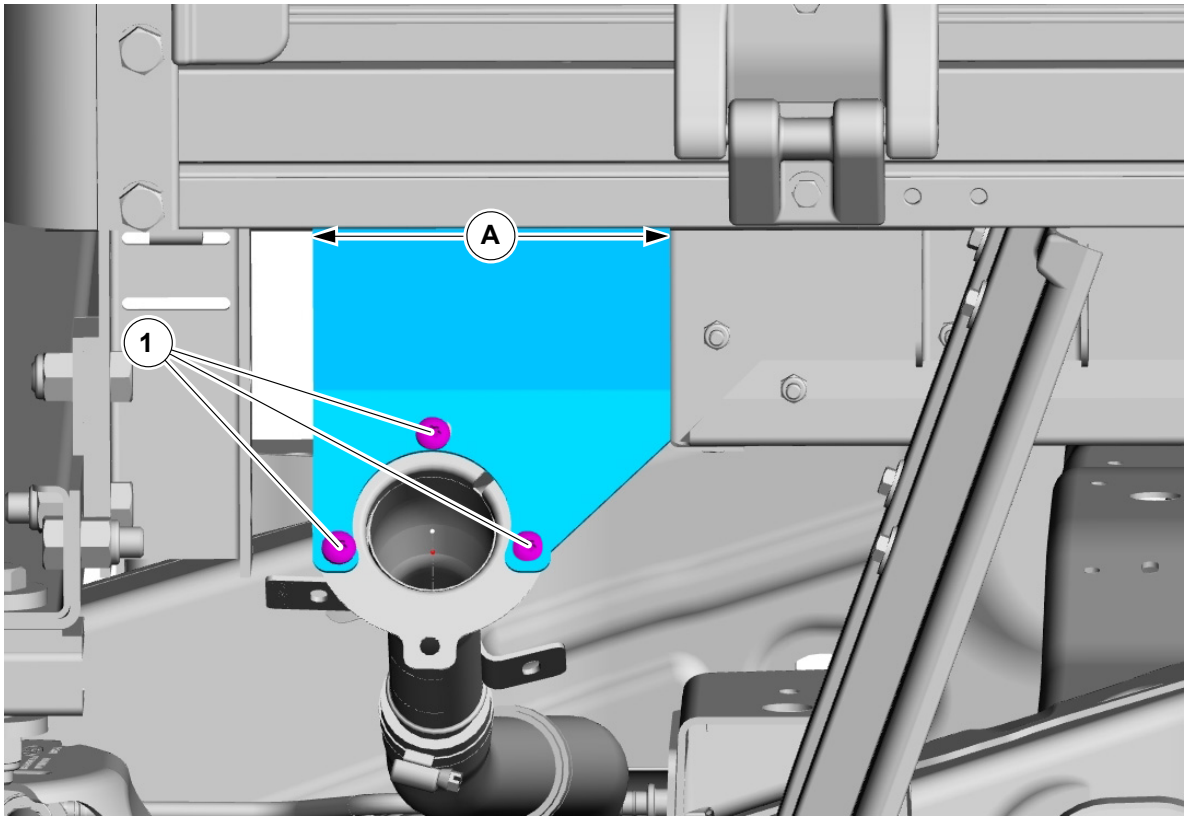
Fuel Filler Overview



E376758

Item	Description
1	Fuel Tank Vent Hose
2	Rear Axle Breather Pipe
3	Fuel Filler Cap
4	Fuel Filler Pipe

Fuel Filler Mounting Bracket



E376926

Fuel Filler Mounting Notes

Item	Description
A	The width of the bracket, where it joins the body to be at least 180 mm
1	All 3x hardware fixation points on the filler neck must be utilised

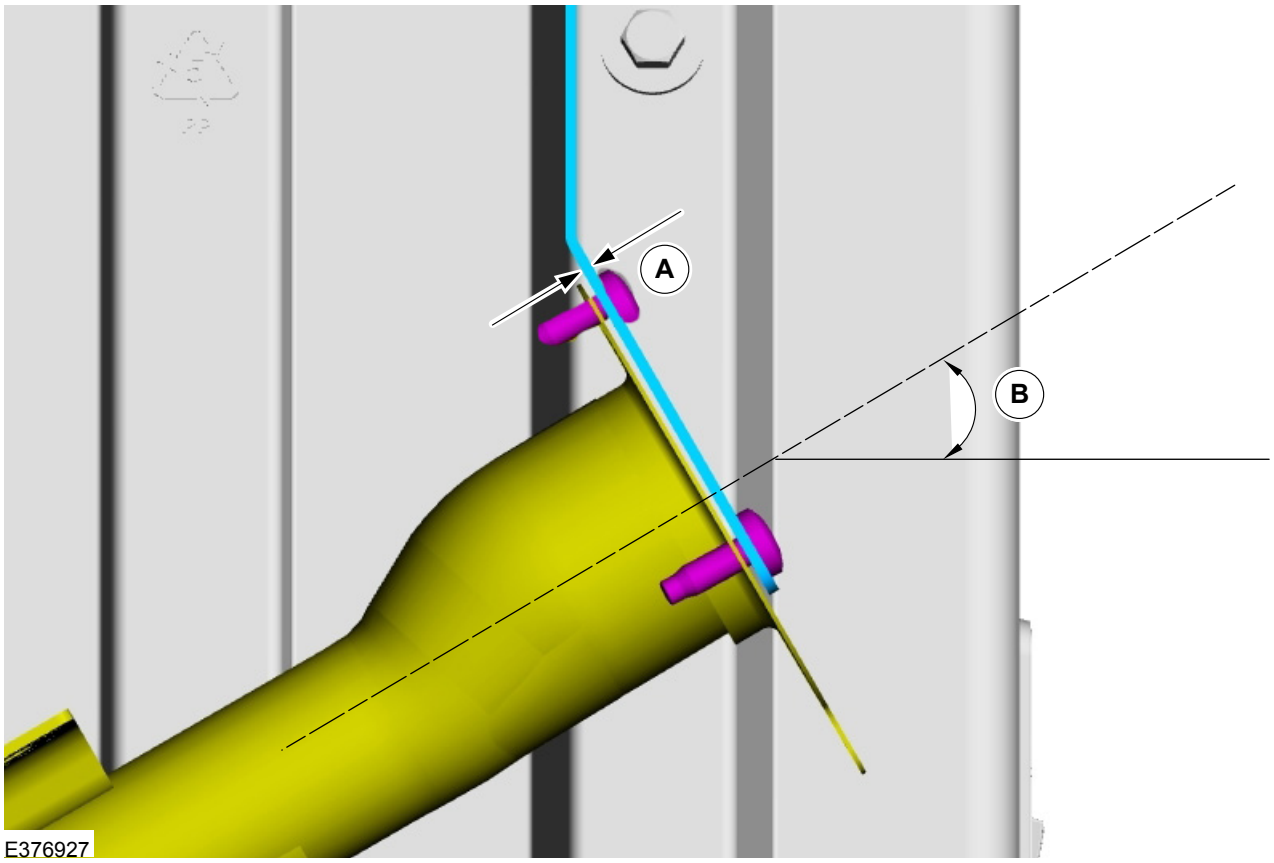
Fuel Filler Neck Assembly

NOTE: The fuel filler neck must be properly grounded to the vehicle body/chassis.

Ford also makes the fuel filler neck assembly available for cab chassis builds as a Ford service part that can be purchased from any authorised Ford Dealer (Diesel only).

- Single and Super Cab - Part Number: MB3Z-9034-J
- Double Cab - Part Number: MB3Z-9034-T

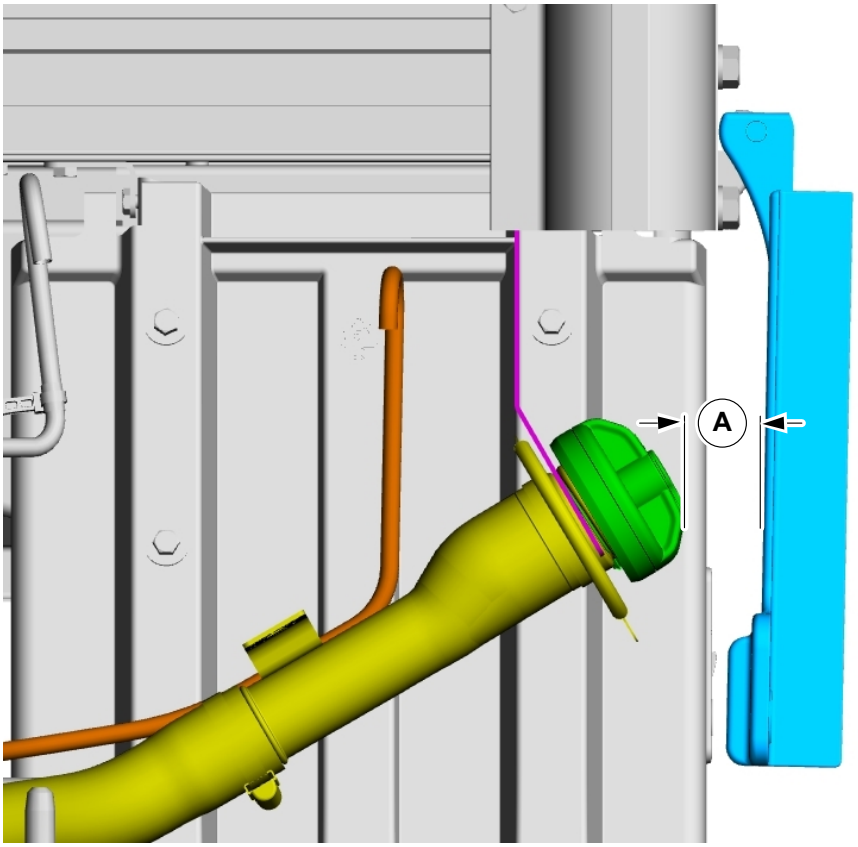
Angle of Filler Neck



Filler Neck Installation Dimensions

Item	Description
A	2mm minimum bracket thickness
B	30° - angle at the filler cup should be achieved to ensure adequate flow of fuel when refilling to prevent flow back

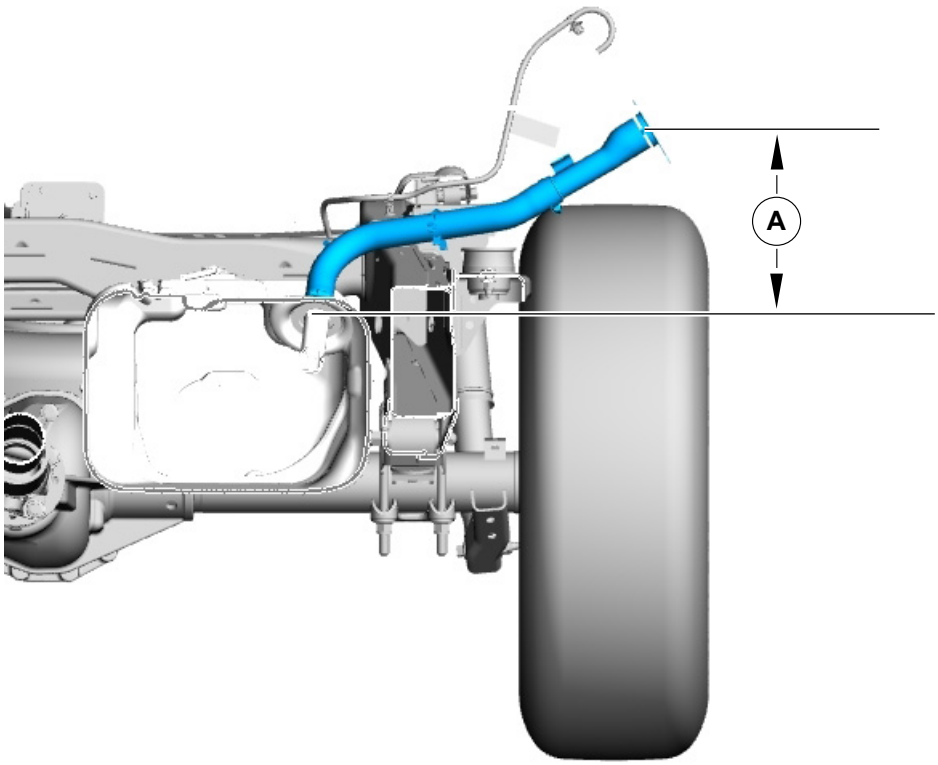
Clearance From Vehicle Body



E376928

Item	Description
A	At least 9mm clearance between the fuel filler cap and vehicle body, in the worst case opening angle if applicable.

Fuel Filler Height - Cab Chassis Vehicles



E363646

Item	Description
A	A filler neck opening height of at least 250mm should be maintained, measured from the fuel tank Inlet Check Valve (ICV) opening center point to the fuel filler pipe opening center point.

3.4.3 Fuel Filler Mounting - Raptor

CAUTIONS:

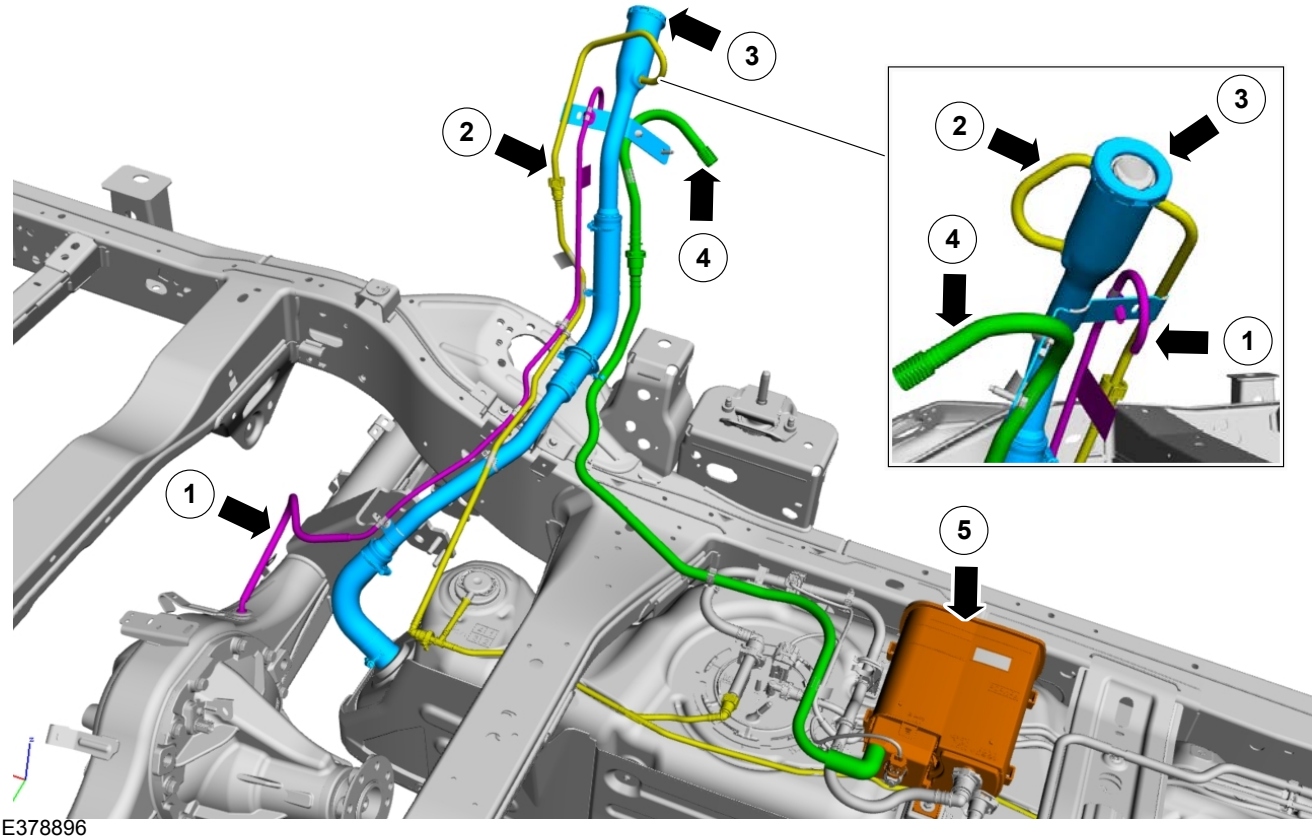
- **Make sure that the filler neck mounting bracket is made of a conductive material, and that it provides a grounding path for the fuel filler neck.**
- **Maintain capless filler neck mounting location exactly per factory installed filler pipe position. Capless filler inlet must be located inside a filler pocket.**
- **Routing of the fuel filler pipe must ensure no contact with any exhaust components or sharp edges.**
- **No kinking of the fuel filler hose is acceptable.**

NOTE: Routing of filler hose and vent hose must not contain any sumps. Additional support may be required to prevent hose sagging which could create a sump. A sump in the pipe can cause spray or spit-back during normal filling operations.

If the vehicle body and mounting bracket does not provide a grounding path for the fuel filler neck, an earth strap must be added, connecting the filler neck to the chassis frame.

Do not extend the fuel filler system outboard of the vehicle dimensions or the service body dimensions.

Fuel Filler Overview - 2.3L EcoBoost and 3.0L EcoBoost



E378896

Item	Description
1	Rear Axle Breather Pipe
2	Fuel Tank Recirculation Line
3	Fuel Tank Filler Pipe (Capless - 3.0L) (Screw Cap - 2.3L)
4	Evaporative Emissions Canister Fresh Air Pipe
5	Evaporative Emissions Canister

CAUTION: Maintain canister fresh air hose mounting location exactly per factory installed fresh air hose position.

3.4.4 Fuel Filler Vent Hose - (Diesel)

- The fuel tank vent hose routing at end will need to have shepherd hook with opening at or above height as described in this document in order to maintain water wading specifications and prevent water ingress into the fuel system.
- The fuel tank vent hose should be protected and positioned away from direct water spray, wheel splash and mud splash, and water drainage holes that may be present.
- The fuel tank vent hose must be either in the position as shown in the view or must be upright with the shepherds hook at the end.
- A length of fuel grade flexible hose should be clipped to the vehicle body. The open-end must be located at least 600 mm (4x2) or 800 mm (4x4 or 4x2 hi-rider)above the ground when the vehicle is fully loaded (higher than 100mm above the body mounting pads on the rear chassis).

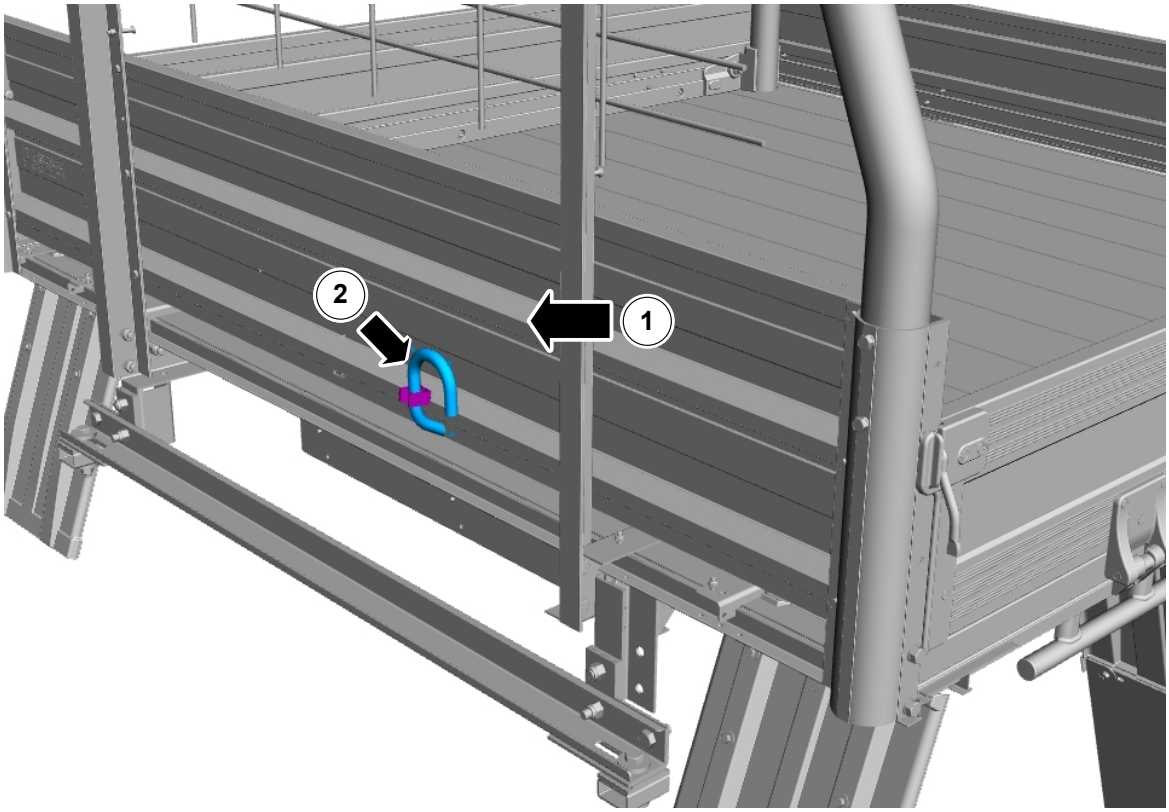
Fuel Filler Vent Breather Shepherds Hook



E376757

NOTE: See your authorised dealer to confirm the correct part number for your vehicle.

Example of Fuel Tank Vent Hose Mounting Location



E376759

Item	Description
1	Front Lower Head Board of a Load Tray (load tray rotated for clarity)
2	Fuel Tank Vent Hose affixed securely.

3.4.5 Long Range Fuel Tanks

NOTE: Long Range Fuel Tanks are not engineered by Ford Motor Company and Ford Motor Company makes no determination as to the fit, finish, quality, safety or durability of these parts.

NOTE: Whilst functionality will be improved by this modification, distance to empty calculations may express some discrepancy compared to standard parts and calculations.

Following installation of a long range fuel tank, distance to empty (DTE) functionality will be inaccurate unless the configuration is amended per below instructions.

To improve system functionality, using FDRS as appropriate:

- Plug FDRS into vehicle
- Allow FDRS to read parameters and show applicable menus

- In Configuration Parameter; Select Fuel Tank Capacity Volume (Tank Size A);
- Select appropriate option following the dialogue selections: Fuel Tank Capacity > Configuration Description
  - Standard 80L
  - 140L Long Range Tank

3.4.6 Axle Breather Vent Hose

The rear differential breather hose is provided already fitted to the vehicle and needs to be mounted and routed appropriately to the second unit body when installed. This breather hose has a clip and 'jiggle' cap fitted instead of a Shepherds hook at the open end, but either execution is acceptable. Where possible, routing the breather hose to the fuel filler is preferred as the fuel tank breather has similar open-end requirements and the clip is designed to attach there.

If the hose needs to be shortened please give some thought to fitting an appropriate 'jiggle' cap or Shepherds hook to the open-end. It may be easier to shorten the hose by disconnecting the flexible hose from the moulded line near the chassis rail and shortening that end (leaving the open-end unaltered). If the hose needs to be extended an appropriate fuel grade flexible hose and joiners should be used. The open end must be protected and positioned away from direct water spray, wheel splash and mud splash, and any water drainage paths that may be present. The open-end must be located at least 600 mm (4x2) or 800 mm (4x4 or 4x2 hi-rider) above the ground when the vehicle is fully loaded (higher than 100mm above the body mounting pads on the rear chassis). Regular clipping points should be used ensuring that the final hose routing allows the total range of suspension travel from full compression to full extension without any contact, rubbing or chafing. The lower section of the hose routing from axle to chassis should ideally not be altered, unless suspension changes put tension on the hose at full downward travel.

3.4.7 Axle Breather Vent Hose - Raptor

The rear differential breather hose is provided already fitted to the vehicle and needs to be mounted and routed appropriately to the second unit body when installed. This breather hose has a clip and 'jiggle' cap fitted instead of a Shepherds hook at the open end, but either execution is acceptable. Where possible, routing the breather hose to the fuel filler is preferred as the fuel tank breather has similar open-end requirements and the clip is designed to attach there.

If the hose needs to be shortened please give some thought to fitting an appropriate 'jiggle' cap or Shepherds hook to the open-end. It may be easier to shorten the hose by disconnecting the flexible hose from the moulded line near the chassis rail and shortening that end (leaving the open-end unaltered). If the hose needs to be extended an appropriate fuel grade flexible hose and joiners should be used. The open end must be protected and positioned away from direct water spray, wheel splash and mud splash, and any water drainage paths that may be present. The open-end must be located at least 850mm above the ground when the vehicle is fully loaded (higher than 100mm above the body mounting pads on the rear chassis). Regular clipping points should be used ensuring that the final hose routing allows the total range of suspension travel from full compression to full extension without any contact, rubbing or chafing. The lower section of the hose routing from axle to chassis should ideally not be altered, unless suspension changes put tension on the hose at full downward travel.

4.1 Wiring Installation and Routing Guides

Cable Routing

Take special care with the routing of existing electrical harnesses within the vehicle, to avoid damage when fitting additional equipment. Also, see section concerning installation of equipment containing an electric motor.

Fitting Equipment Containing Inductive Loads

WARNING: When inductive loads, such as electric motors, are to be fitted consideration of inrush current is needed.

CAUTIONS:

- **All inductive loads must be driven via relays with contacts rated at least 3 times the maximum rated current of the motor.**
- **All inductive loads supply circuits must be individually fused with the proper fuse rating for the motor.**
- **All power wiring must be rated for at least 3 times the rating of the motor and installed as far away as possible from any existing vehicle wiring.**
- **All inductive loads fitted should be fully suppressed to European or applicable local legislation relating to EMC to ensure electrical interference does not affect the vehicle systems.**
- **Add EMC emissions statement to CE approval.**

4.1.1 Wiring Splicing Procedures

NOTE: Contact your local Ford Dealer or National Sales Representative to check the electrical repairing strategy in your market.

TYCO-RAYCHEM crimp splices



E131081

Ford Motor Company strongly advises against the use of wire splicing due to the variable and unpredictable nature of the joint created. However, if it is decided that a wire splice is unavoidable, it must be made using **DuraSeal Heat-Shrinkable, Environmentally Sealed, Nylon-Insulated Crimp Splices** (manufactured by TYCO-RAYCHEM) or a suitable commercially available equivalent. As a further process to improve the splice integrity, the splice should be further sealed with a suitable heat shrink tubing.

For further information, refer to your national sales agent or refer to General Service Bulletin "Wiring Repair Job Aid".

4.1.2 Wiring Through Cabin Sheet Metal

There are four locations provided for additional wiring to pass through the cabin sheet metal.

Wiring Pass Through Locations



E379475

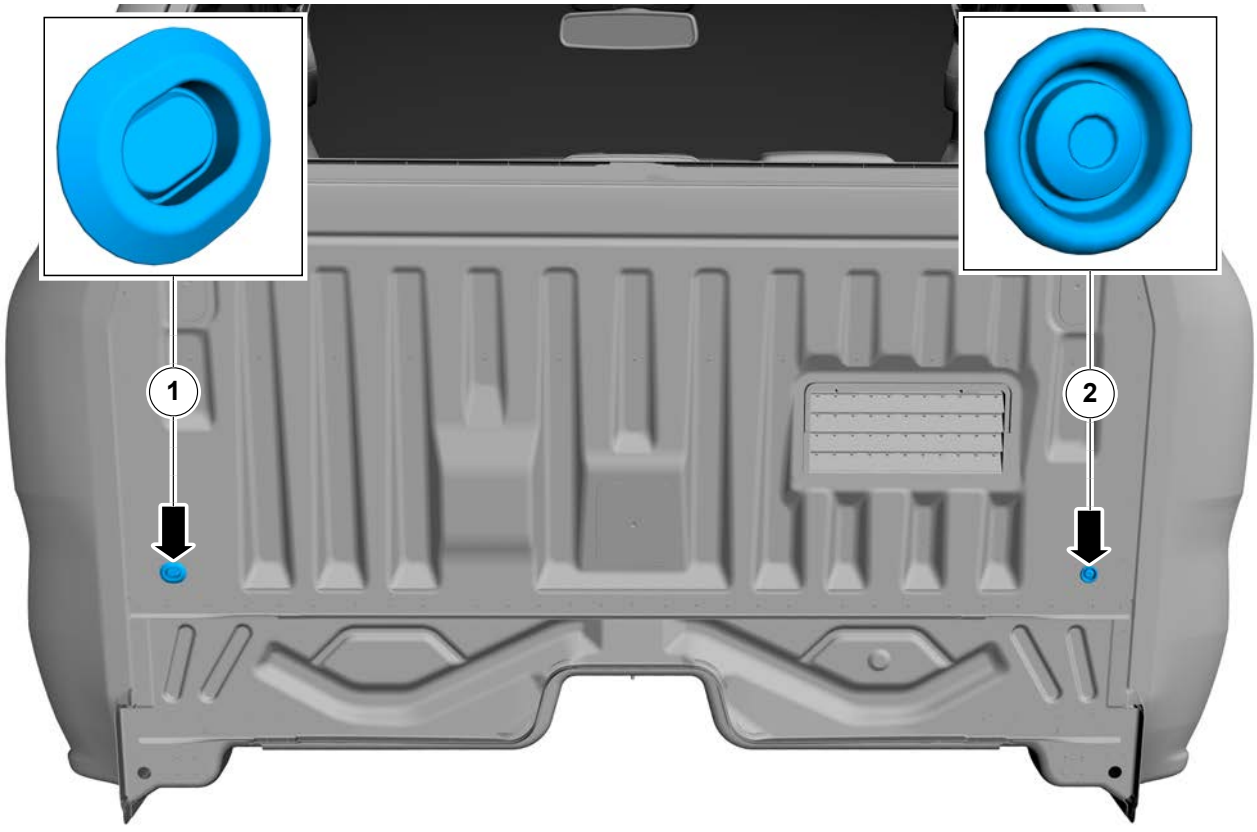
Item	Description
1	Dash Grommet Right Hand Side
2	Dash Grommet Left Hand Side

CAUTIONS:

Electrical harnesses passing through sheet metal must be through protective grommets that also ensure a watertight seal. A windscreen type or silicone sealant should be used. Adhesive or tape is not acceptable.

The grommet pass through must be adequately sealed to prevent corrosion and water ingress.

There are two locations in the dash panel and two locations in the cabin rear wall which have been provided as additional holes to route wires through.



E455997

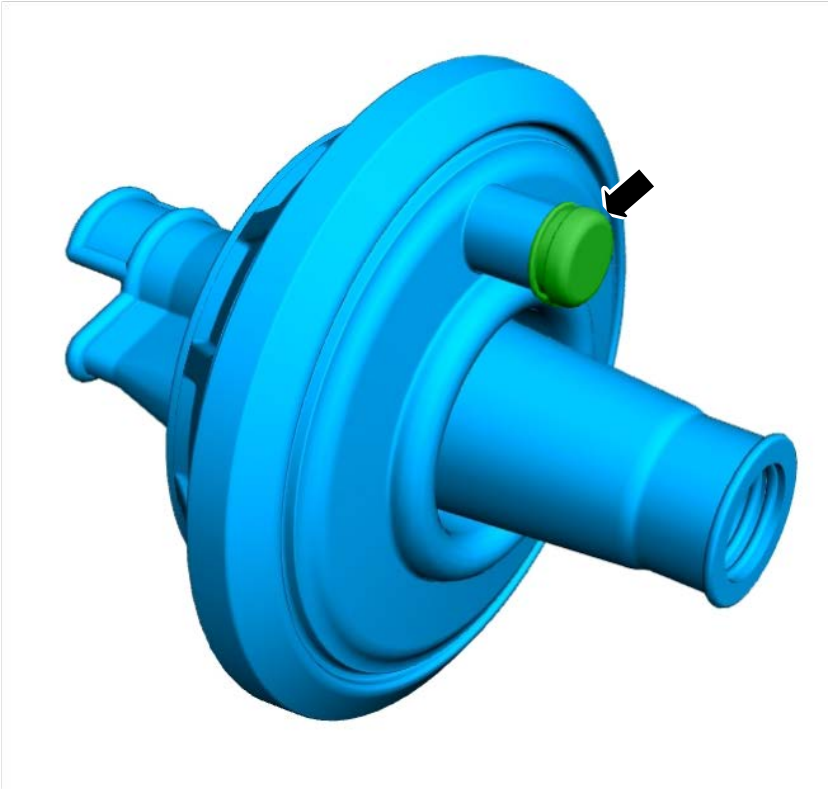
These plugs have a provision where an additional hole can be made using the following steps:

- Check that the immediate surrounding area is free from obstructions and/or components to prevent damage to critical systems.
- Use a suitable tool, for example a sharp knife or spike.
- Make hole in the center of the plug to suit the wires being passed through.
- Pass electrical wiring through the plug as required.
- Apply sealant as required to ensure water-tightness.

As these holes are standard sized, the existing plugs can be replaced with appropriate grommets for the desired wiring being passed through. Ensure that the area remains water tight.

1. LH grommet = Ø19mm x 25mm
2. RH grommet = Ø19mm

Grommet Pass Through Knob



E379476

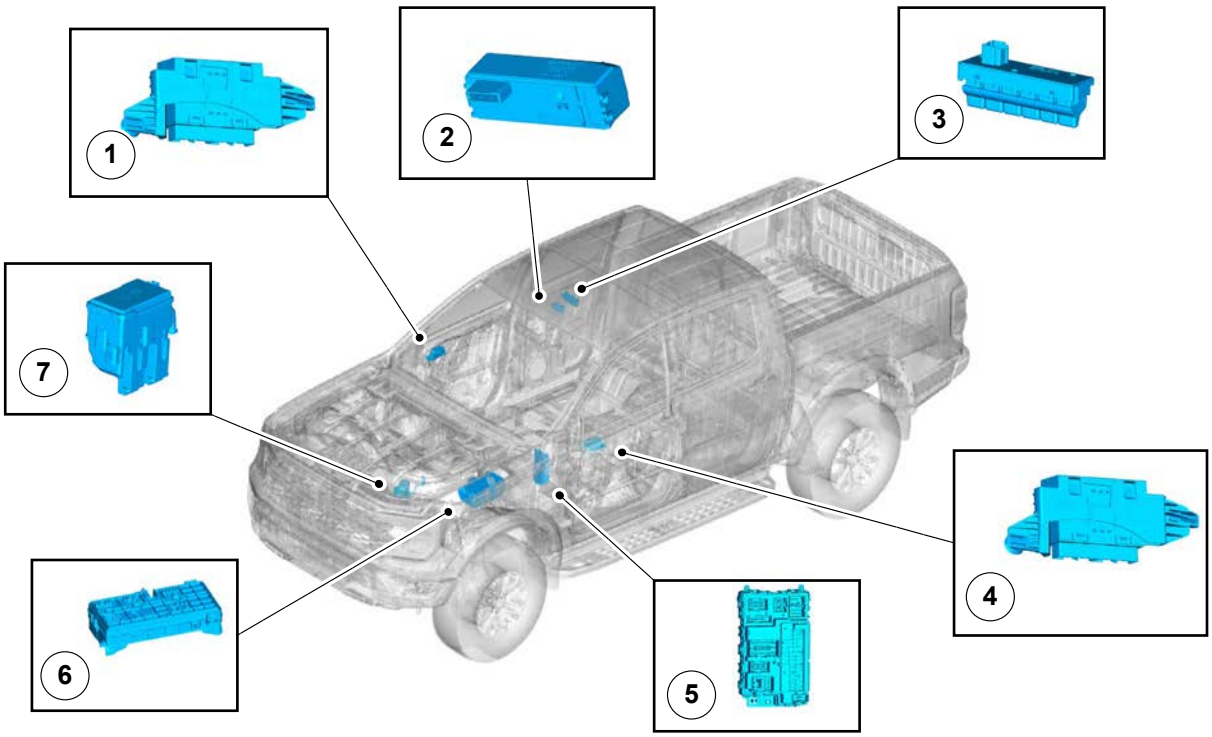
Grommets are a component of the main wiring harness that contains securely bound wire bundles. It is not possible to feed extra wires through with the wire bundle. The grommets have a pass through knob molded into the grommet where an additional hole can be made using the following procedure:

NOTE: The maximum size of additional wire bundle diameter is 8mm.

- Check that the immediate surrounding area is free from obstructions and/or components to prevent damage to critical systems.
- Use a suitable tool, for example a knife or side cutters.
- Cut off or snip the outer end of the pass through knob.
- Pass electrical wiring through the grommet as required.
- Apply sealant as required to ensure water-tightness.

4.1.3 Electronic Modules and Connection Points

Module Controlled Functions - Component Location

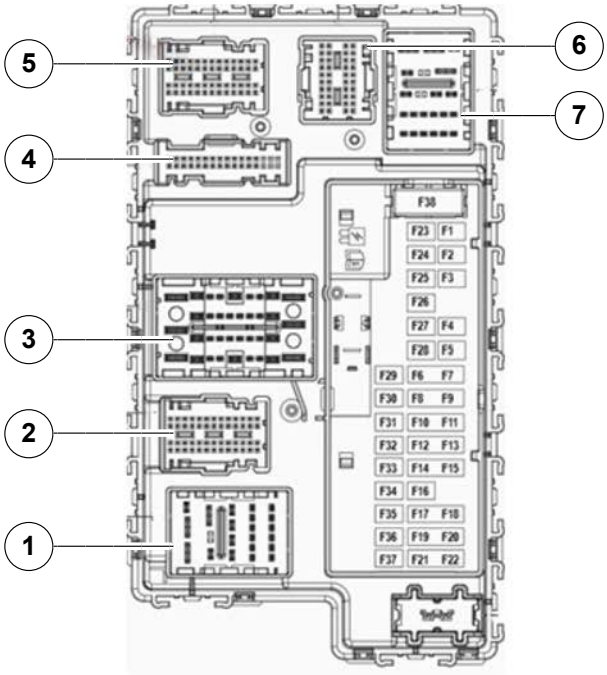


E375505

Item	Description
1	Passenger Door Module
2	Radio Transceiver Module
3	Auxiliary Switches
4	Driver Door Module
5	Body Control Module (BCM)
6	Body Control Module C (BCMC)
7	Auxiliary Relay Box

NOTE: Left Hand Drive vehicle shown, Right Hand Drive vehicle similar.

Body Control Module (BCM) Connection Points



E472701

Item	Description
1	J1 Connector (C2280A)
2	J2 Connector (C2280B)
3	J3 Connector (C2280C)
4	J4 Connector (C2280D)
5	J5 Connector (C2280E)
6	J6 Connector (C2280F)
7	J7 Connector (C2280G)

NOTE: J# numbers are moulded on the BCM for visibility.

4.2 Battery and Cables

4.2.1 Battery Information

If a battery is disconnected, there is no requirement to reprogram the vehicle; the vehicle retains its 'normal' power management setting and remembers exactly what its previous configuration was (although the central locking latches may cycle if a door or lock latch was opened manually in the intervening period). All radio settings will be retained. The clock will need resetting. The window control module will also need to be reset. Refer to the vehicles owner manual for further information.

Battery Voltage Requirements and Testing

All voltages are to be measured with an accuracy of: + /– 5% of published values.

To maximize battery life, at the time of arrival at the vehicle converter, all batteries must have a minimum Open Circuit Voltage (OCV) of not less than 12.75 volts.

When the battery is installed and connected to the vehicle's electrical system with no load, the Closed Circuit Voltage (CCV) must not be less than 12.65 volts. When the vehicle is released to the customer, the CCV must not be less than 12.50 volts.

Surface Charge Dissipation

Prior to carrying out manual voltage checks, it is necessary to establish that the battery voltage is stable and free from surface charges that could be present due to certain engine run conditions making the voltage readings unreliable and inaccurate.

To ensure surface charges are not present the following actions are recommended:

1. Turn on the headlamps for 5 seconds, or the parking lamps for 15 seconds.
2. Turn off all electrical loads (including lamps, fan, heater etc).
3. Wait 10 minutes.

Delayed Vehicles

Vehicles held at the vehicle convertor premises and not in use for longer than 4 days, should have the battery's negative cable disconnected. Before shipping to the customer, the battery negative cable must be re-connected and the voltage re-checked. The voltage should be not less than 12.5 volts.

Battery Charging Procedure

WARNINGS:

Always observe the battery charger equipment manufacturer's instructions.

Do not jump/slave start using a battery charging system from another vehicle.

Do not overfill a battery as this can cause acid leakage that will result in damage to the vehicle and possible personal injury.

CAUTIONS:

Do not rely on the alternator to recharge a discharged battery. It would take in excess of eight hours of continuous driving with no additional loads placed on the charging system.

Make sure that the battery electrolyte reaches the indicated maximum mark.

Connect the battery charger cables to the battery before switching the battery charger on.

Switch the battery charger off before disconnecting the battery charger cables from the battery.

NOTE: Ford batteries generally require no maintenance however, in certain conditions, it is possible for the electrolyte in a battery to fall below the minimum level.

NOTE: The use of the Midtronics GR-590 Battery Management Center, which has been specifically designed for use on silver calcium type batteries is recommended. Once connected to the battery, the battery charger detects the state of battery charge and then applies the appropriate charge rate and duration. When the battery is fully charged, the battery charger switches to stand-by, keeping the battery in a fully charged state preventing excessive gassing and overcharging. The Midtronics DCA-8000 Battery Management Center also incorporates a software program that has the capability to assist in the recovery of deeply discharged (sulphated) batteries.

NOTE: Charging methods and types of battery chargers vary widely. Whichever method is utilized it must be carried out carefully to avoid damage to the battery and possible personal injury. Specific instructions accompanying each battery charger and must be followed exactly. Safeguards provided by the equipment manufacturer should not be disregarded by the operator.

NOTE: A battery which has been stored in a highly discharged state may be slow to accept a charge at first. In such cases the initial charging rate may be so low that the ammeter on some battery testers will not show any indication of charge for 5 to 10 minutes.

NOTE: Batteries should only be stored after charging. Batteries should not be left in discharged state as it results in formation of sulphate crystals that cannot be broken by conventional charging. This degrades the battery performance significantly. Batteries should be connected to trickle chargers during storage. Conventional chargers should not be rated under 10% of Ah rating to prevent excessive gassing. Smart multi stage chargers may also be used for better performance.

NOTE: Automatic battery chargers are also protected against reverse polarity connection and require no adjustment or monitoring.

NOTE: Slow-charging will readily restore a battery to a full state of charge and, since the charging current is relatively low, the possibility of overcharging a battery are minimized. The charge rate used should be approximately equal to 5% of the reserve capacity of the battery being charged (approximately three to six Amps depending on battery size). The charging current should be adjusted 10 minutes after initial setting and again after 1 hour before being left to charge the battery for between 8 and 12 hours.

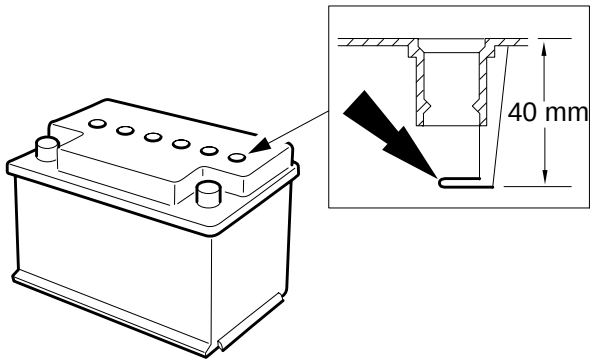
NOTE: A constant voltage battery charger will charge a battery at a set maximum voltage. The voltage used depends upon the design and condition of the battery charger and the age and temperature of the battery. This type of battery charger initially charges at a high rate of current that reduces as battery voltage is restored. When using a constant voltage battery charger, the charging current should be recorded after five minutes and the battery charger switched off when the charging current falls to one–third of the recorded value, or after eight hours whichever occurs first.

NOTE: Multiple battery chargers are designed to charge a number of batteries, simultaneously. Of the two different types of multiple battery chargers available, only those that charge batteries in series should be used and it is important that batteries are of the same or very similar ratings and voltages. Multiple battery chargers that charge batteries in parallel are not recommended.

NOTE: The use of a fast (boost) battery charger is not recommended as it can cause damage to a battery. Fast charging will only restore a battery to a state of charge that will enable it to carry out it's critical function of cranking the engine. Fast charging will not restore a battery to a full state of charge and must therefore be followed by a period of slow charging. Excessively fast charging can cause damage to a battery. For this reason, charging times must be carefully controlled. Fast battery chargers vary widely in design so it is very important to strictly adhere to the equipment manufacturer's instructions. A charge of 30 amps for up to 30 minutes is the most common fast charging application. If the battery is very discharged and requires additional restoration, an additional charge of 20 amps for a period up to one and a half hours should be applied. Fast charging for a period in excess of two hours significantly increases the risk of causing damage to the battery.

NOTE: When connecting and disconnecting the battery from the vehicle, make sure that the battery ground cable is disconnected first and connected last and that all electrical items are switched off.

1. Remove the battery.
2. Disconnect the battery ground cable



DTZ9722102

NOTE: The maximum battery electrolyte level is approximately 40 mm below the very top of the battery casing. This corresponds to a point just below the lower rim of the battery casing.

3. Check that the battery electrolyte reaches the indicated maximum level. Top up with distilled/de-ionized water, as necessary.
4. Connect the positive red clamp from the battery charger to the positive battery terminal.
5. Connect the negative black clamp from the battery charger to the negative battery terminal.
6. Follow the instructions supplied with the battery charger to charge the battery.
7. To disconnect the battery charger, reverse the connection procedure.

Battery Cable Fixing Torque

Refer to the workshop manual for the correct battery terminal fixing torque. See your National Sales Company representative, or Authorized Ford Dealer.

Battery Rules:

WARNINGS:

For vehicles fitted with non-sealed batteries (non-maintenance free), it is essential that regular checks are made to determine that the electrolyte (acid) levels are correctly maintained.

When charging, ensure the battery charger is securely connected to the vehicle ground and not to the battery negative terminal. This is to ensure that the BMS identifies the battery charge.

- For external charging of batteries ensure that the maximum voltage of 14.6V is not exceeded.

Battery Part Numbers and Usage

Ford Plant	Type	Specifications	Size
Thailand / South Africa	Standard Duty Battery	75Ah, 750CCA	H7
	Auto Start - Stop Battery	80Ah, 800CCA, AGM Deep Cycle Technology	H7
	Auto Start - Stop Battery	92Ah, 850CCA, AGM Deep Cycle Technology	H8
South Africa	PHEV Vehicles	80Ah, 800CCA, AGM Deep Cycle Technology	H7
Pacheco / Argentina	Standard Duty Battery	SLI, 75Ah, 750CCA	H7
	Auto Start - Stop Battery	EFB, 80Ah, 760CCA	H7

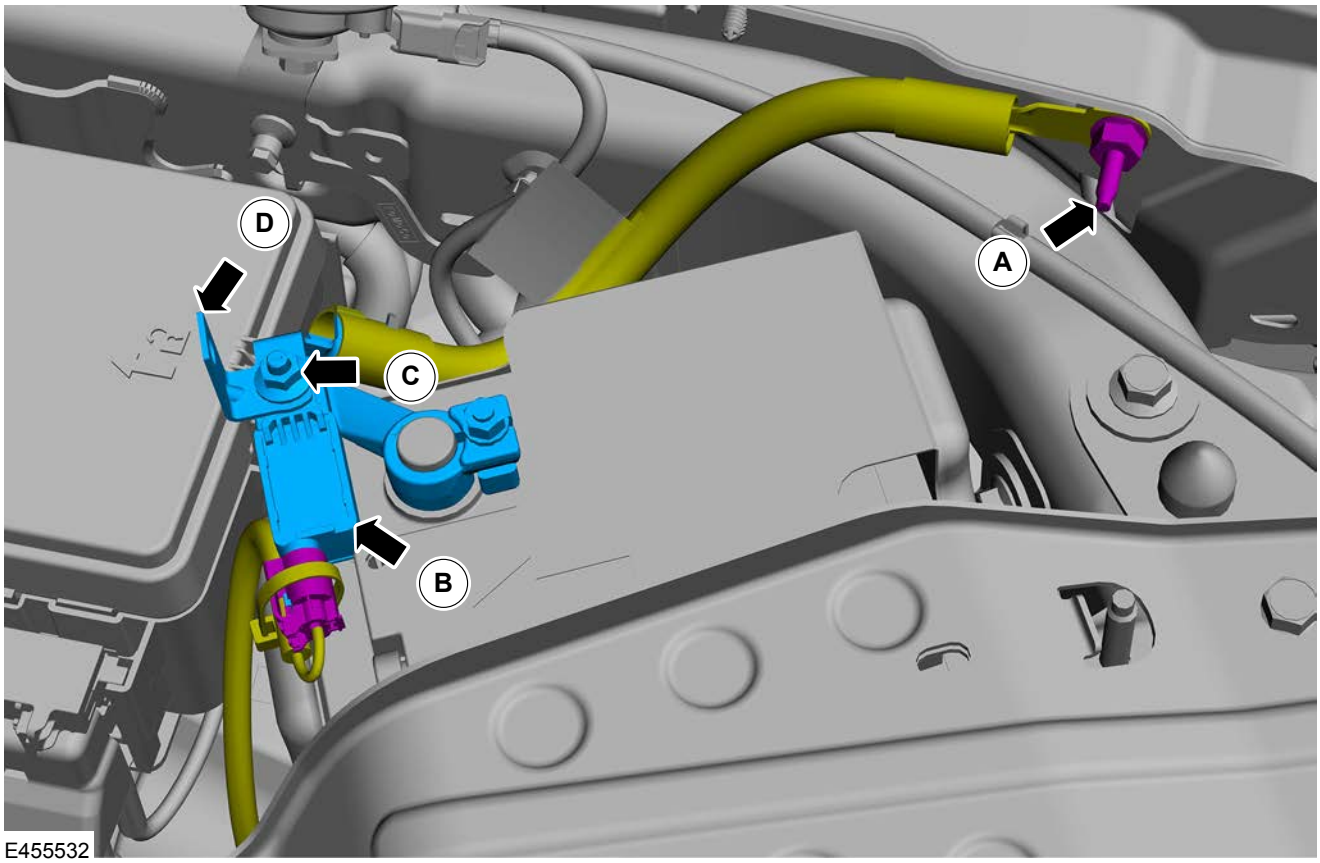
If the battery type on a vehicle is changed to other compatible derivatives it is required to reconfigure the vehicle to the new battery types from the dealer. Central car configuration can be updated at a dealership.

Battery Management Sensor (BMS)

CAUTIONS:

Do not disturb the joint at the BMS (C). This joint is designed as a one-time connection and should not be unscrewed, loosened or modified.

High current loads must be grounded at the provided tab at the BMS (D) (if available) or at the vehicle/chassis ground point (A).



E455532

Item	Description
A	Vehicle / Body Ground
B	Battery Management Sensor
C	Battery Management Sensor Connection - Do Not Disturb
D	High Current Battery Grounding Tab (if available)

For manual isolation of the battery, disconnect the ground cable at the vehicle/body ground point (A) and place the isolator switch between that terminal and the existing ground point. Use an appropriate gauge of wire and switch rating (300A minimum) and minimise the length of the additional cable.

CAUTION: No loads should be connected directly to the battery negative B- post as that would by-pass the Battery Management Sensor which will generate false state of charge (SOC) readings.

NOTE: The Battery Management Sensor (BMS) is connected to the vehicle BCM and will also shut down when the battery is isolated and the BCM is not powered.

CAUTION: On PHEV vehicles the auxiliary battery needs to be disconnected to be fully isolated. Refer to 3.1.3 HV System De-Energising - PHEV

At this point the vehicle (Non-PHEV) is fully electrically isolated from the battery.

NOTE: The addition of an auxiliary battery with a voltage sensitive control system may prevent all batteries (primary and auxiliary) from reaching a full state of charge. This is due to the operation of the Smart Regenerative Charging (SRC) feature, which is designed to reduce fuel consumption. Disabling the SRC feature will allow each battery to reach a full state of charge and therefore optimise electrical system performance. A Ford Dealer can disable SRC using a Ford Diagnosis & Repair System (FDRS) tool. Note that disabling SRC may negatively impact fuel economy.

NOTE: If multiple or high energy drain accessories are fitted to the vehicle's factory fitted primary battery, disabling of the SRC will optimise electrical system performance. Note that disabling SRC may negatively impact fuel economy.

NOTE: No loads should be connected directly to battery NEG B- post as that would by-pass Battery Management Sensor generating false state of charge (SOC) readings.

Ford Ranger vehicles are equipped with a feature using a Battery Management Sensor (BMS). This system measures the battery load in order to efficiently charge the battery while improving the fuel economy and emissions.

It is important to ensure any additional electrical load or accessory is properly grounded to the vehicle's body, in order for the system to identify the additional load. If a connection is made to the battery negative terminal, the Battery Management Sensor will not identify the load or charge. This may cause the battery to be undercharged and consequently not able to re-start the vehicle.

Auxiliary Battery fitted to vehicles with a Battery Management Sensor (BMS)

NOTE: For high loads, a battery isolator should be used cutting off the primary battery at 12.7V (75% SOC) to ensure you can start the vehicle after regular stand time. Examples of high load connections include Winches / Trailer accessories / Fridges etc.

NOTE: Auxiliary loads must always be connected to the vehicle ground and not to the battery negative terminal.

NOTE: Ensure the auxiliary battery connection is safely secured using suitable fixtures to reduce vibration damage or contact with surrounding components.

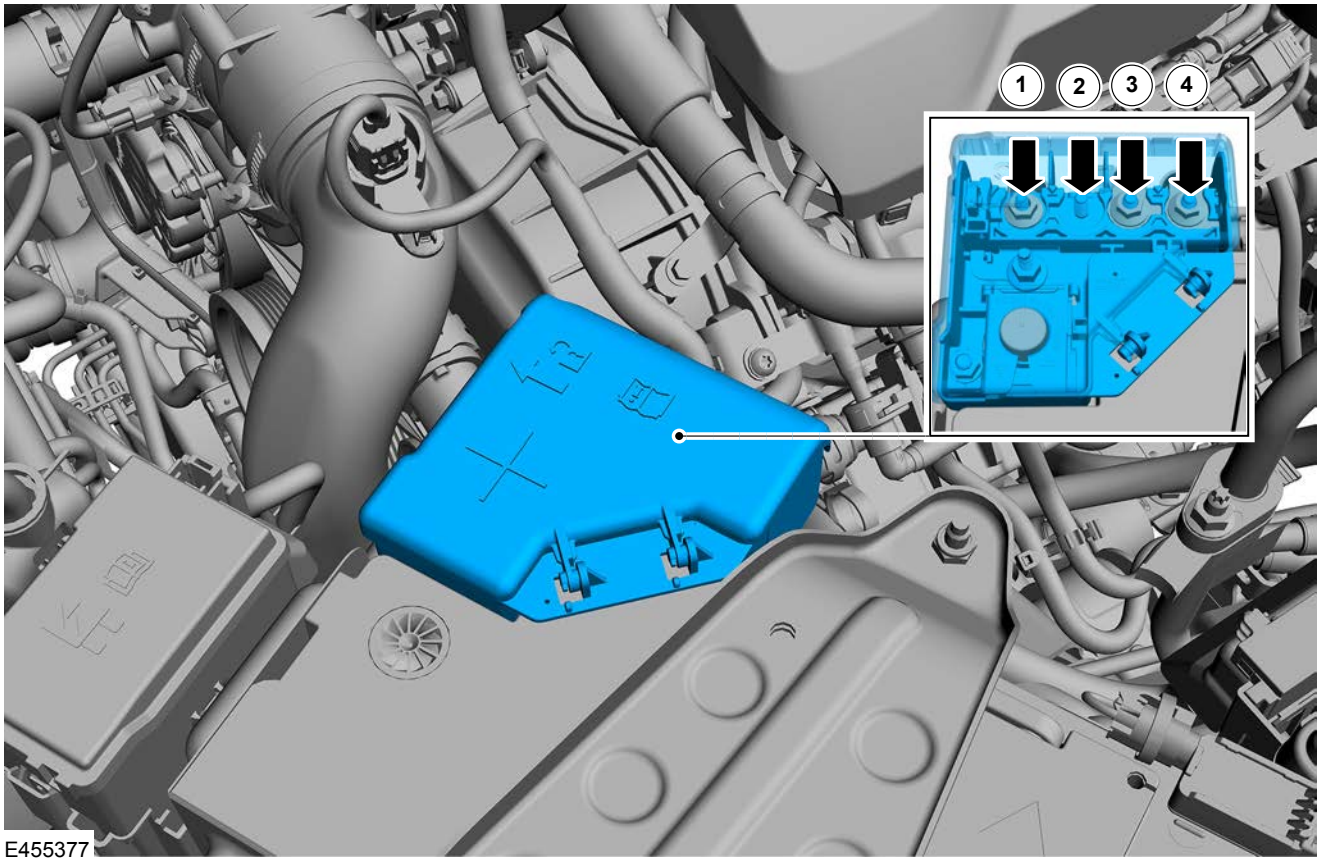
NOTE: Ford offers a Ford Licenced Accessory dual battery kit in some markets (Part Number: VARB4340130). This kit comprises the battery mounting tray and mounts, charge controller and applicable wiring.

For vehicles equipped with Battery Management Sensor, an additional battery can be connected using an in-vehicle battery charger (DC/DC converter) such as the BCDC1220 model from REDARC (www.redarc.com.au) or similar, connected via an additional terminal to the starter post terminal on the B+ using a 30A fused and grounded connection.

NOTE: The maximum thickness of the additional terminal being installed on top of the starter post terminal must be no more than 2.0 mm.

NOTE: If equipped, ensure the existing nut is reused.

B+ Connection



E455377

Item	Description
1	M5 Stud - Upfitter switches (where applicable)
2	M6 - Spare – to be used for aftermarket connections
3	M6 - Starter Motor
4	M6 - Power Distribution Block (PDB)

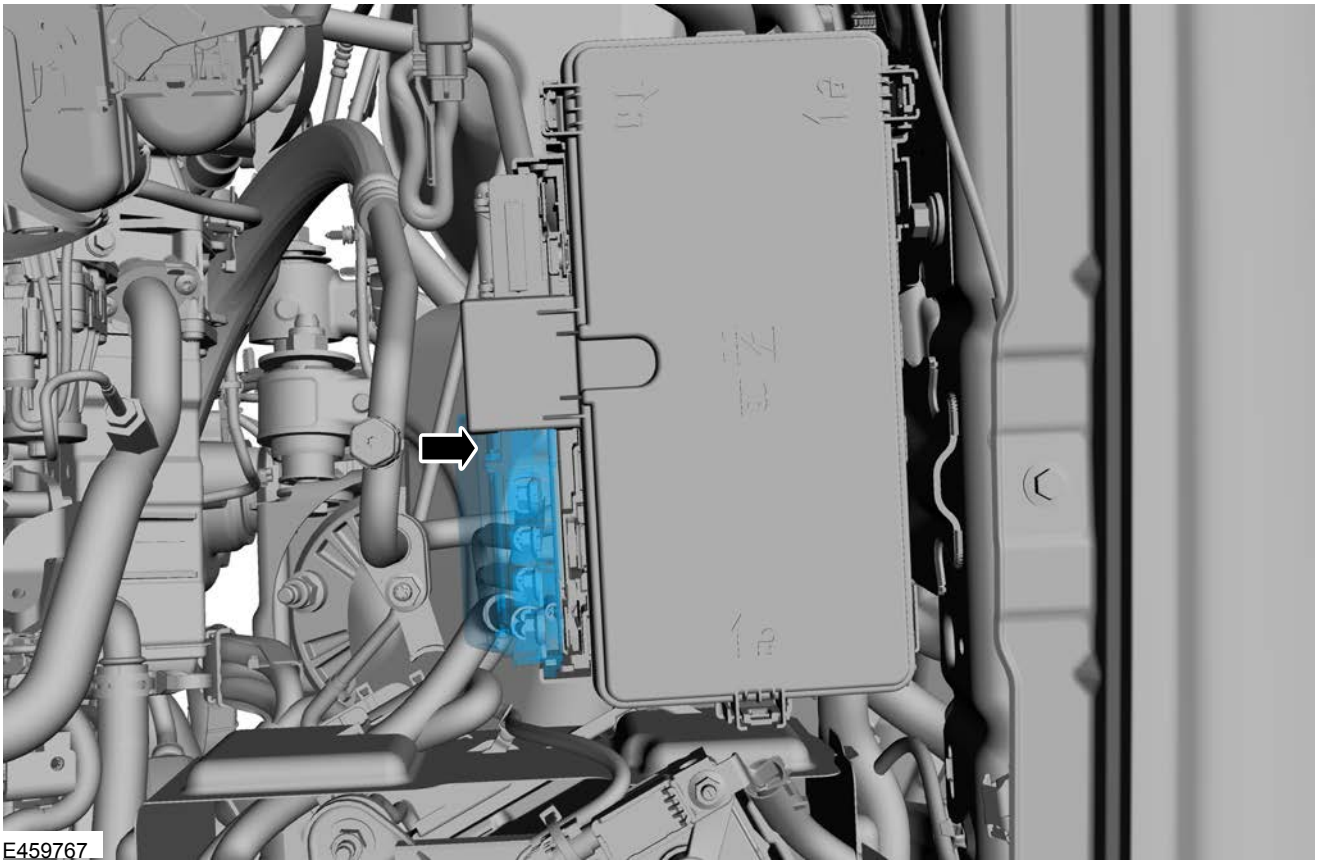
Spare positions on the positive battery fuse block are provided. These empty positions are to be used for auxiliary battery system connection and any aftermarket installations requiring 12v battery feed.

CAUTION: Additional connections at the battery terminal should use 90deg terminals angled down to allow the positive terminal box cover to be refitted correctly.

The M5 terminal connection torque is 5.4Nm, the M6 terminal and PDB connections should be torqued to 9Nm. The battery positive terminal retaining nut should also be torqued to 9Nm.

NOTE: Ensure the fused connection is secured using suitable fixtures to reduce vibration damage or contact with surrounding components.

Additional Battery Connection



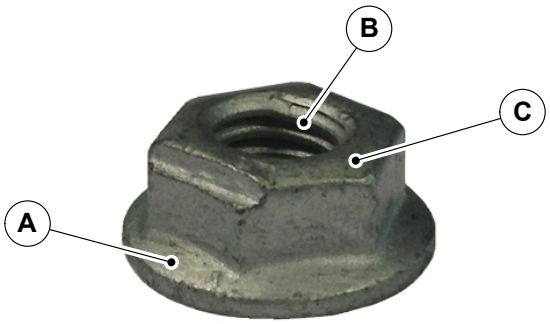
An additional battery connection provision is available on the Power Distribution Block (PDB). This spare M6 stud can be used for auxiliary/second battery or other upfitter connections requiring a 12V battery feed.

4.2.2 High Current Supply and Ground Connections

WARNINGS:

A self-locking crimp hexagonal nut MUST be used for high current terminal stud connections, for battery positive and negative or chassis ground. Do not use locking, split washers or nylon lock type nuts.

It is recommended to only use one eyelet per stud for high current applications. If more than one eyelet per stud is unavoidable, the highest current eyelet feed should be connected closest to the supply terminal. Do not exceed two eyelets or crimp terminals per stud connection.



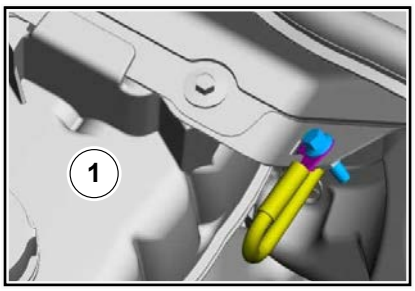
E171315

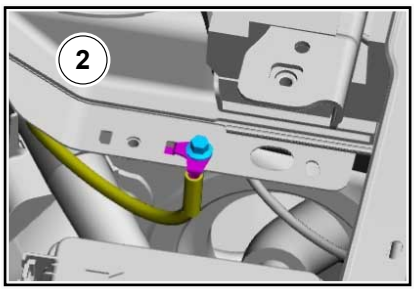
Item	Description
A	Large flange for maximum surface area current flow and large clamp force area.
B	Crimp/locking feature is obtained by deformed female thread only.
C	Finish must be a low resistance material which complies with the Restricted Substance Management Standards (RSMS).

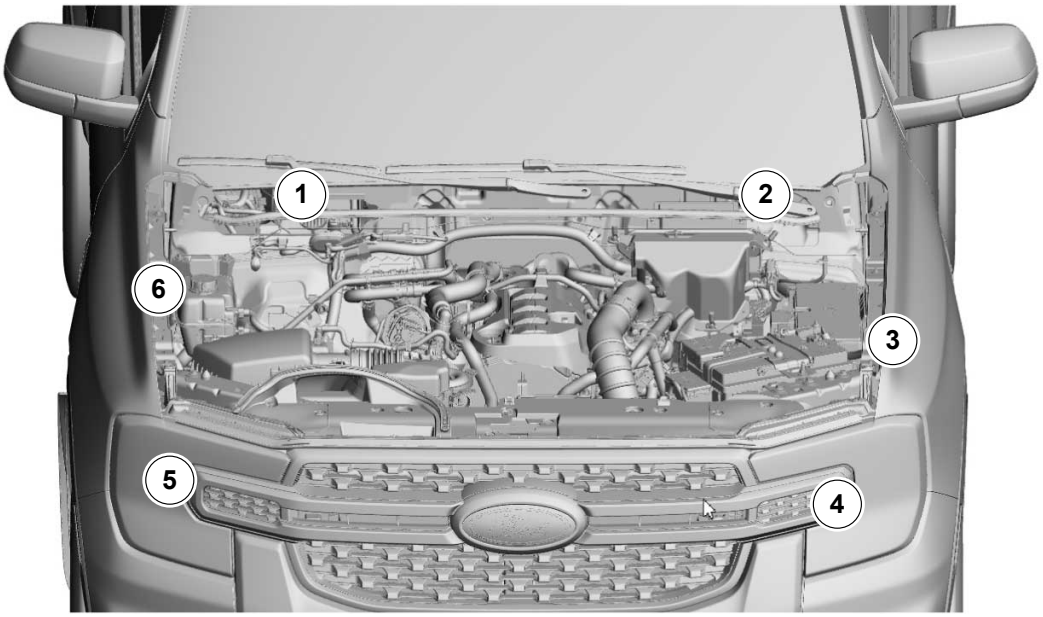
4.2.3 Grounding Points

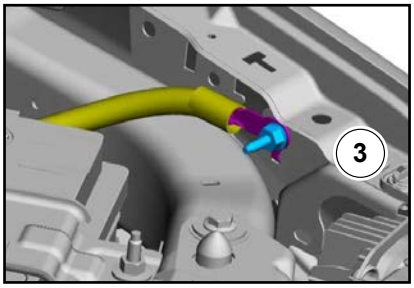
NOTE: Some details in grounding illustrations has been removed for clarity.

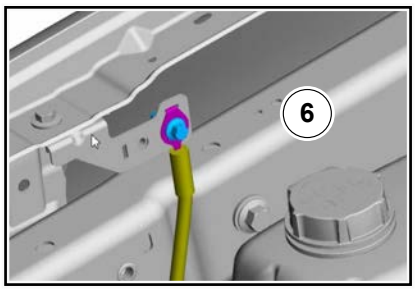
Grounding Points - Engine Bay

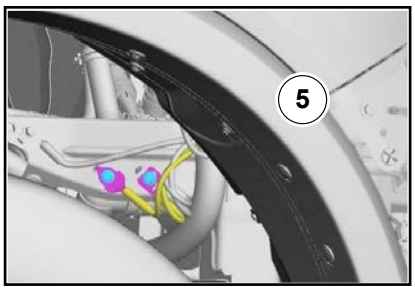


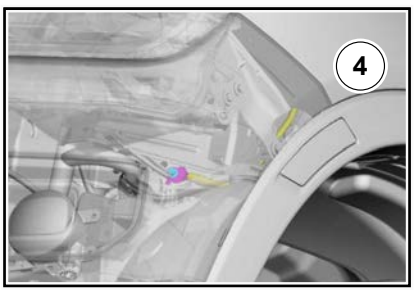










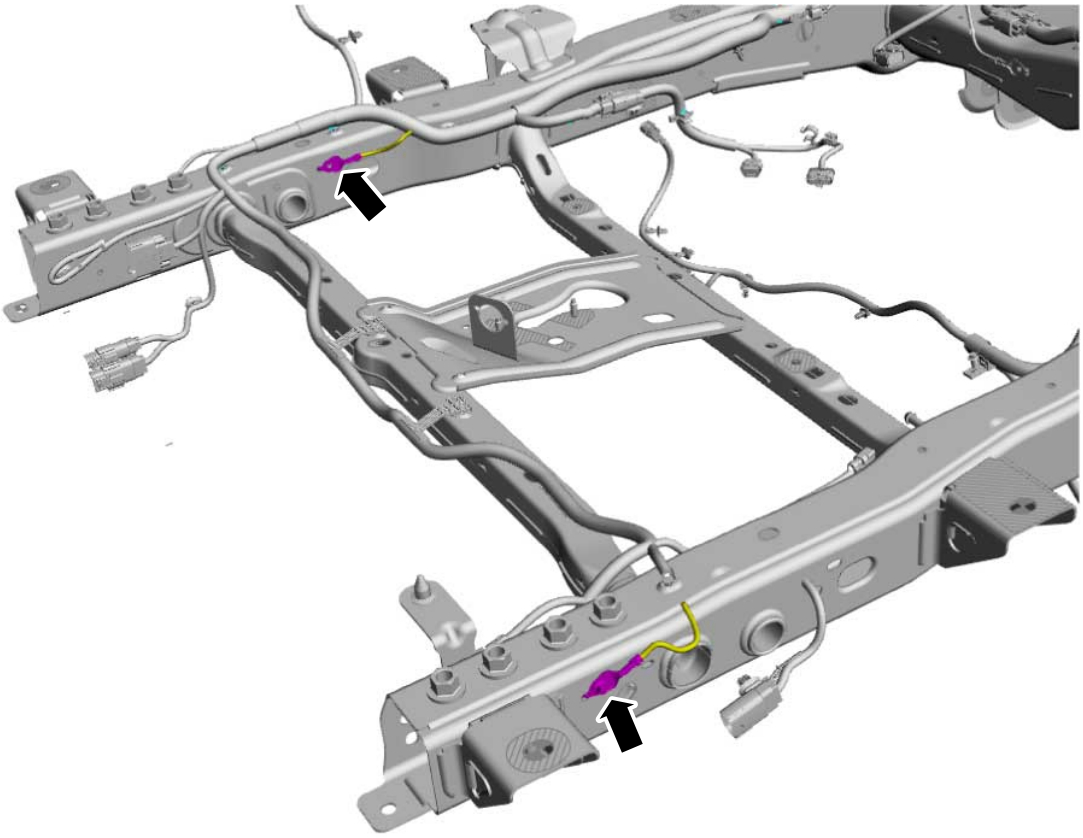


E363588

Item	Description
1	Grounding Point located on cowling
2	Grounding Point located on cowling
3	Grounding Point located on LH fender upper
4	Grounding Point located on sheet metal below vehicle battery
5	Grounding Point located on sheet metal below air cleaner assembly (behind fender liner)

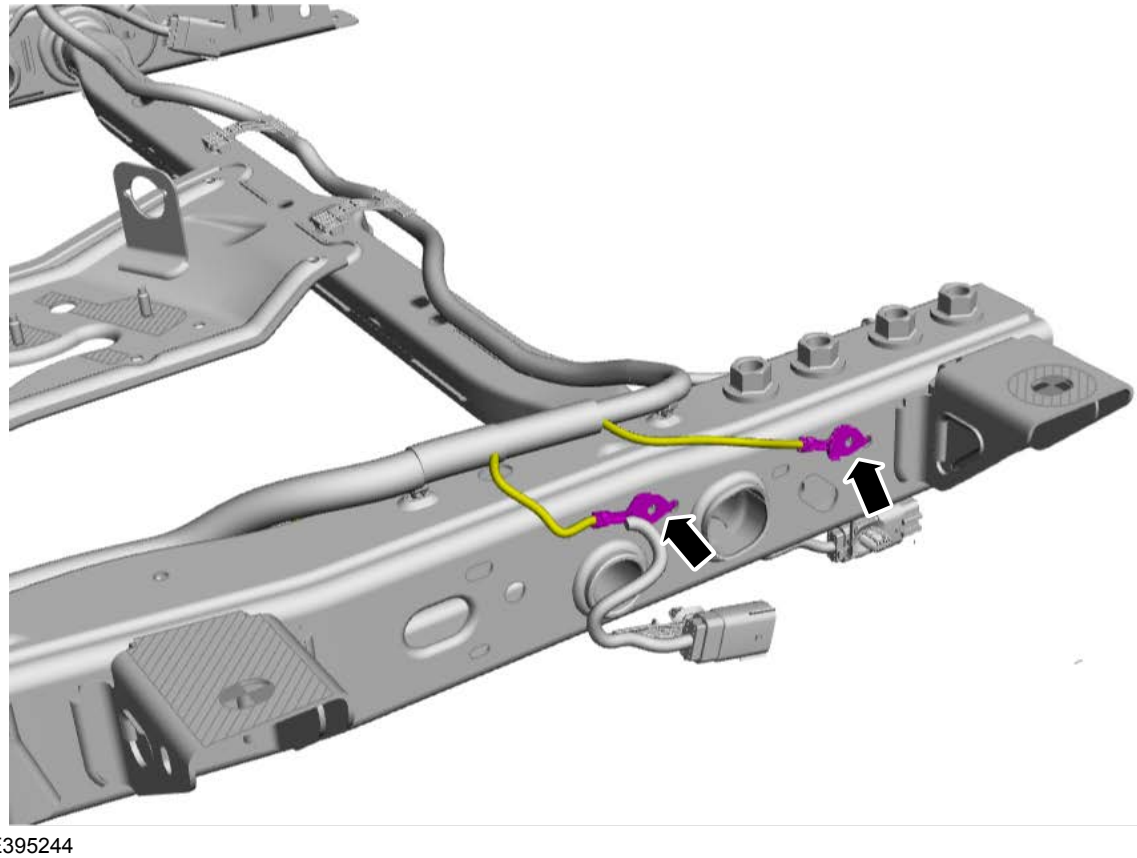
Item	Description
6	Grounding Point located on RH fender upper

Grounding Points - Right Rear Frame



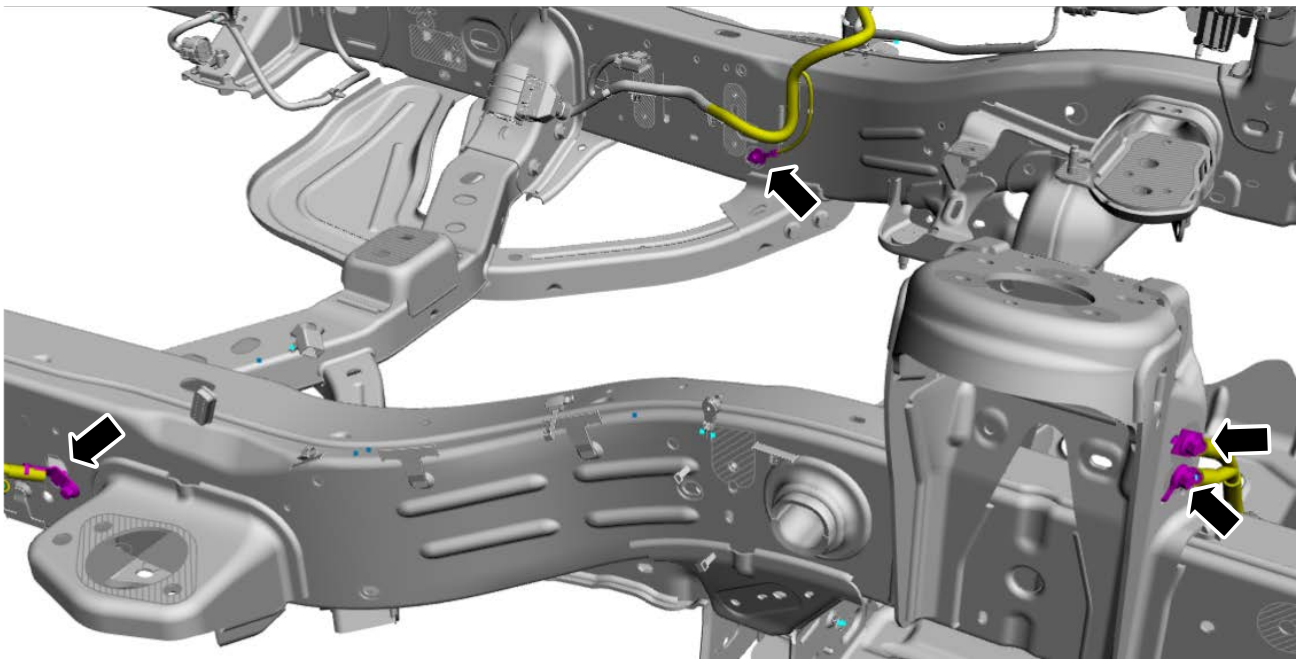
E385753

Grounding Points - Left Rear Frame



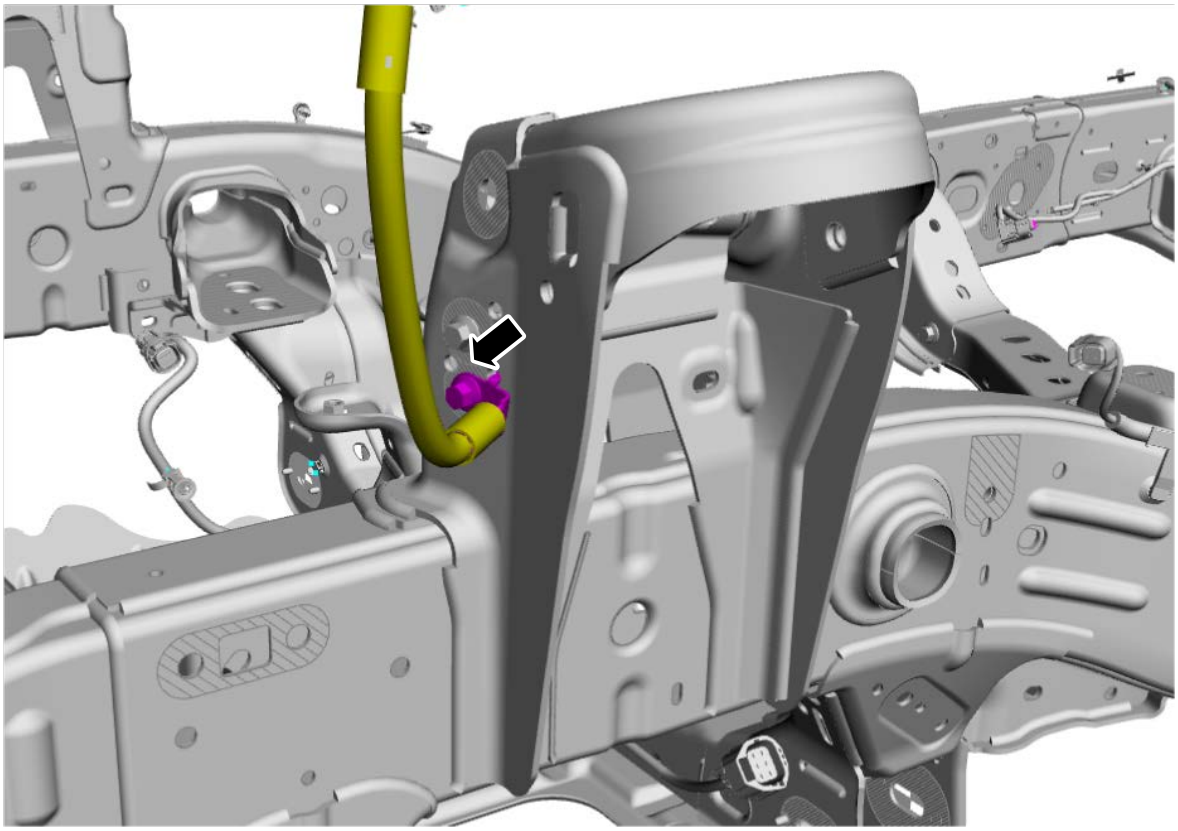
E395244

Grounding Points - Front Frame



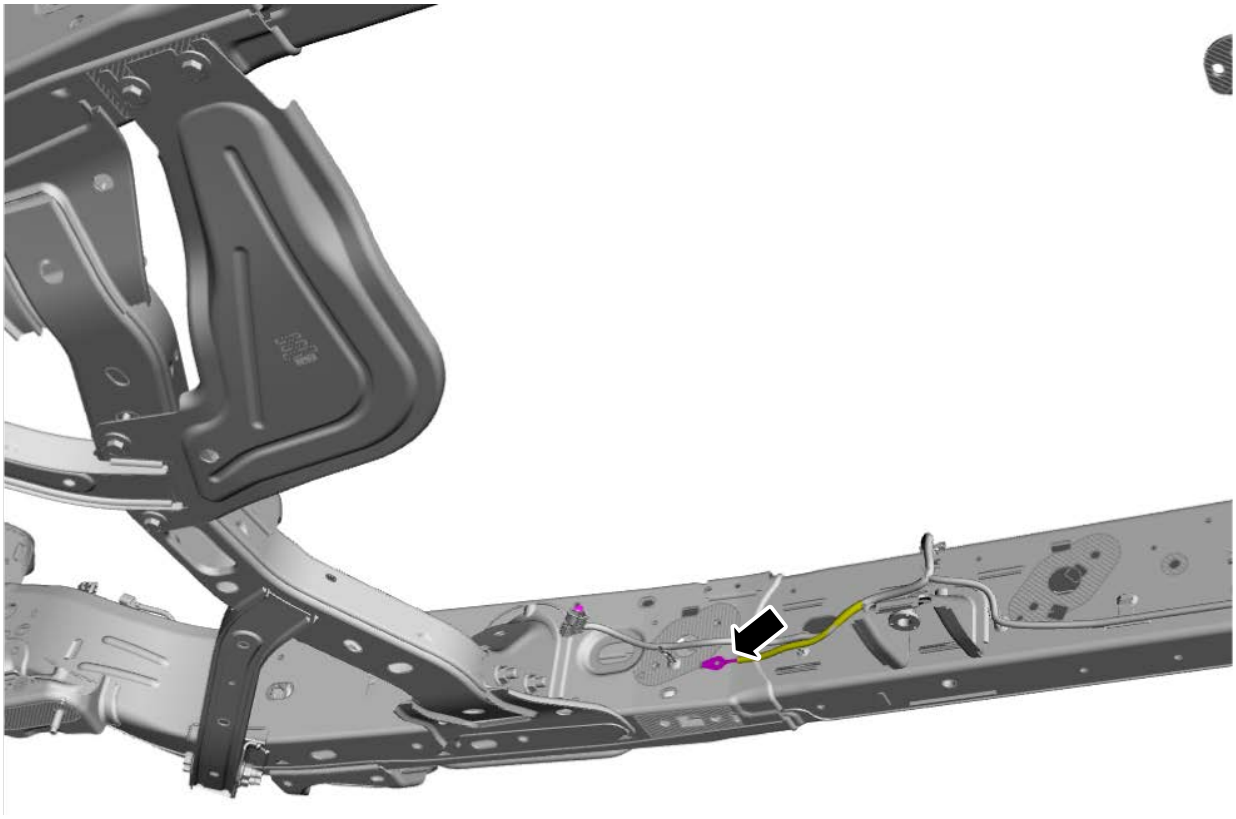
E396143

Grounding Points - Front Left Frame



E396144

Grounding Points - Front Right Inner Frame



E396145

Ground point connections should be tightened correctly. Contact your authorised Ford dealer for the correct torque specifications.

4.2.4 Grounding Points - PHEV

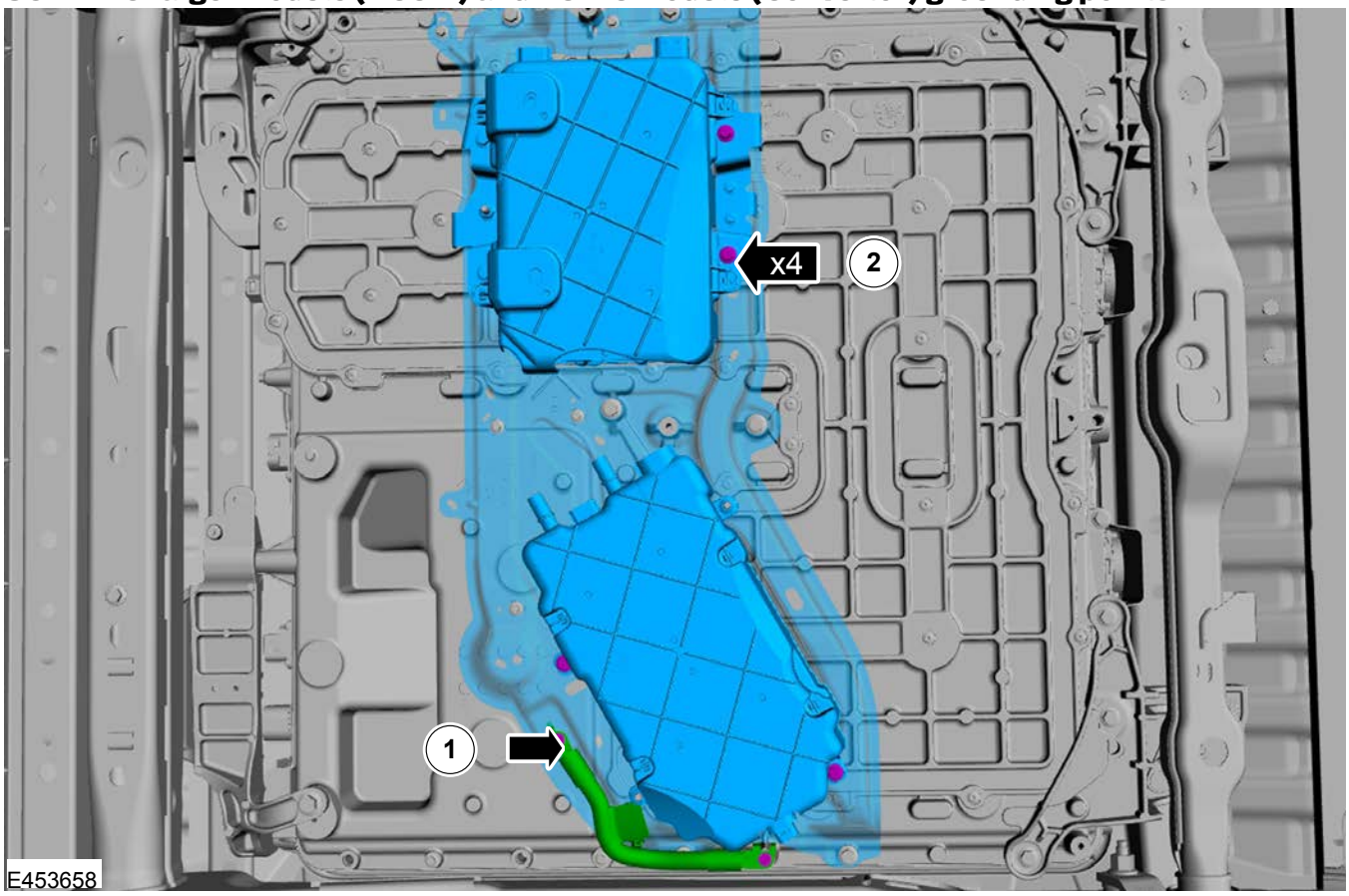
WARNINGS:

Electrical ground paths for High Voltage components (Includes Low Voltage ground points for High Voltage systems) must not be utilised as additional ground points for 12 volt system applications.

All the high Voltage components on the Ranger PHEV are either grounded through the metallic case or through a ground cable/wire or an EMC ground strap. Do not tamper with or modify any of these HV component fastener joints or grounding points.

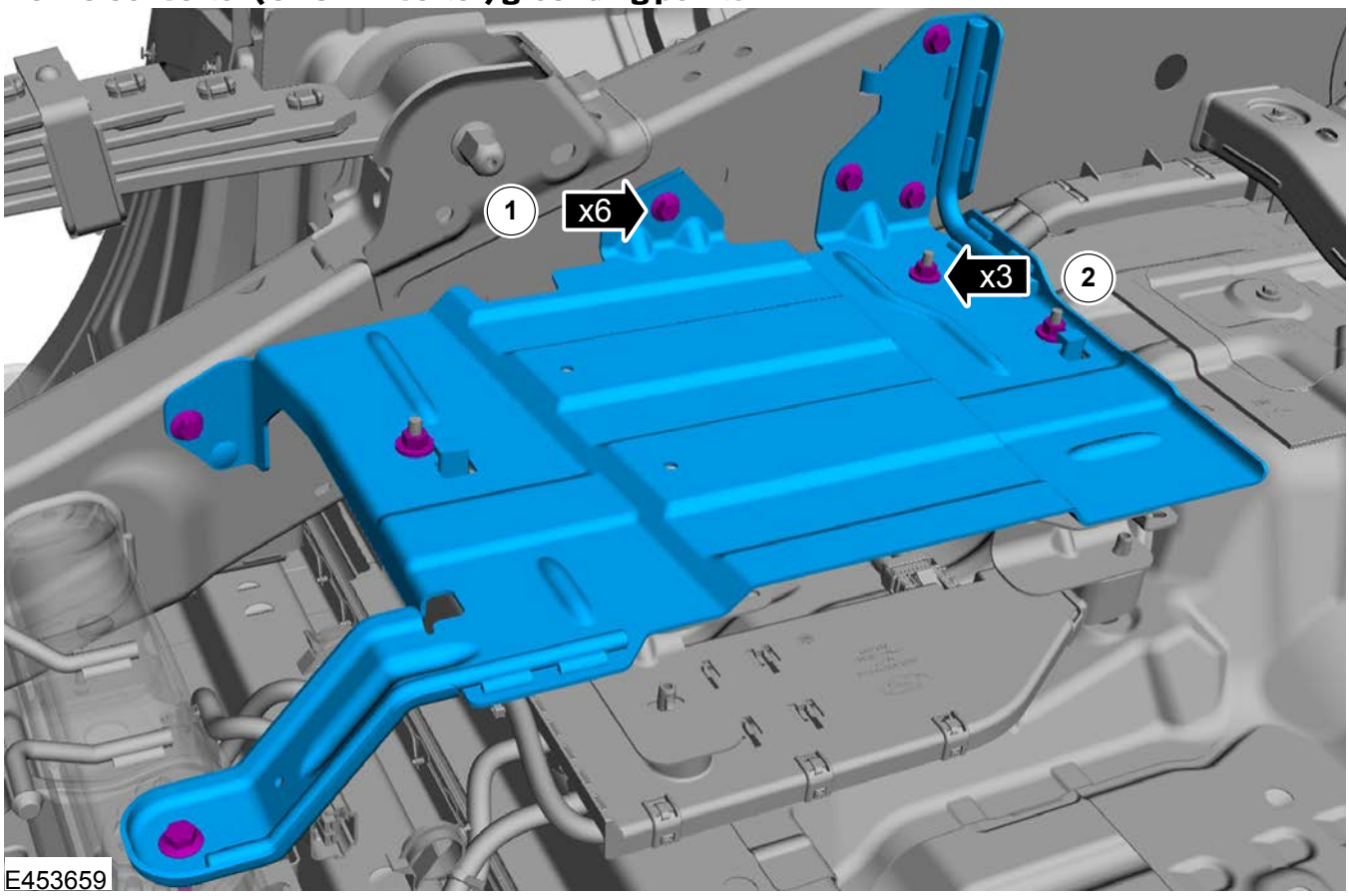
NOTE: Please refer to the following diagrams for some of the PHEV 12V system ground points. Additional ground points can be created by convertors on the body (preferable) or chassis. This may be the use of a welded on stud or nut secured to the body sheet metal. Requirements for a clean surface to weld to, and for corrosion protection afterwards should be followed.

SOBDM Charger Module (BCCM) and DC-DC Module (Convertor) grounding points



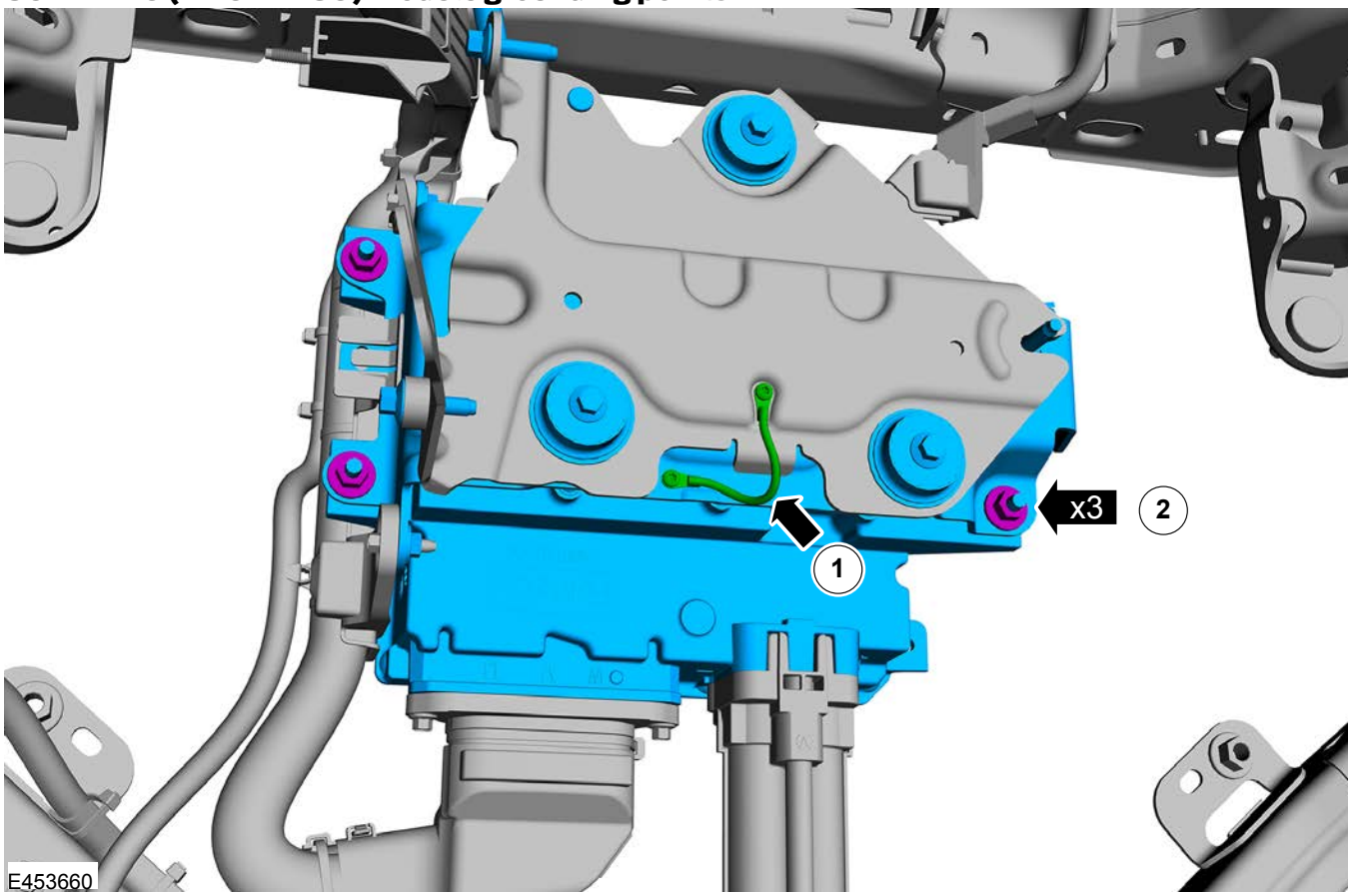
Item	Description
1	BCCM and DC-DC convertor module ground points
2	BCCM and DC-DC convertor module ground cable

DC-AC Convertor (OBGI / Inverter) grounding points



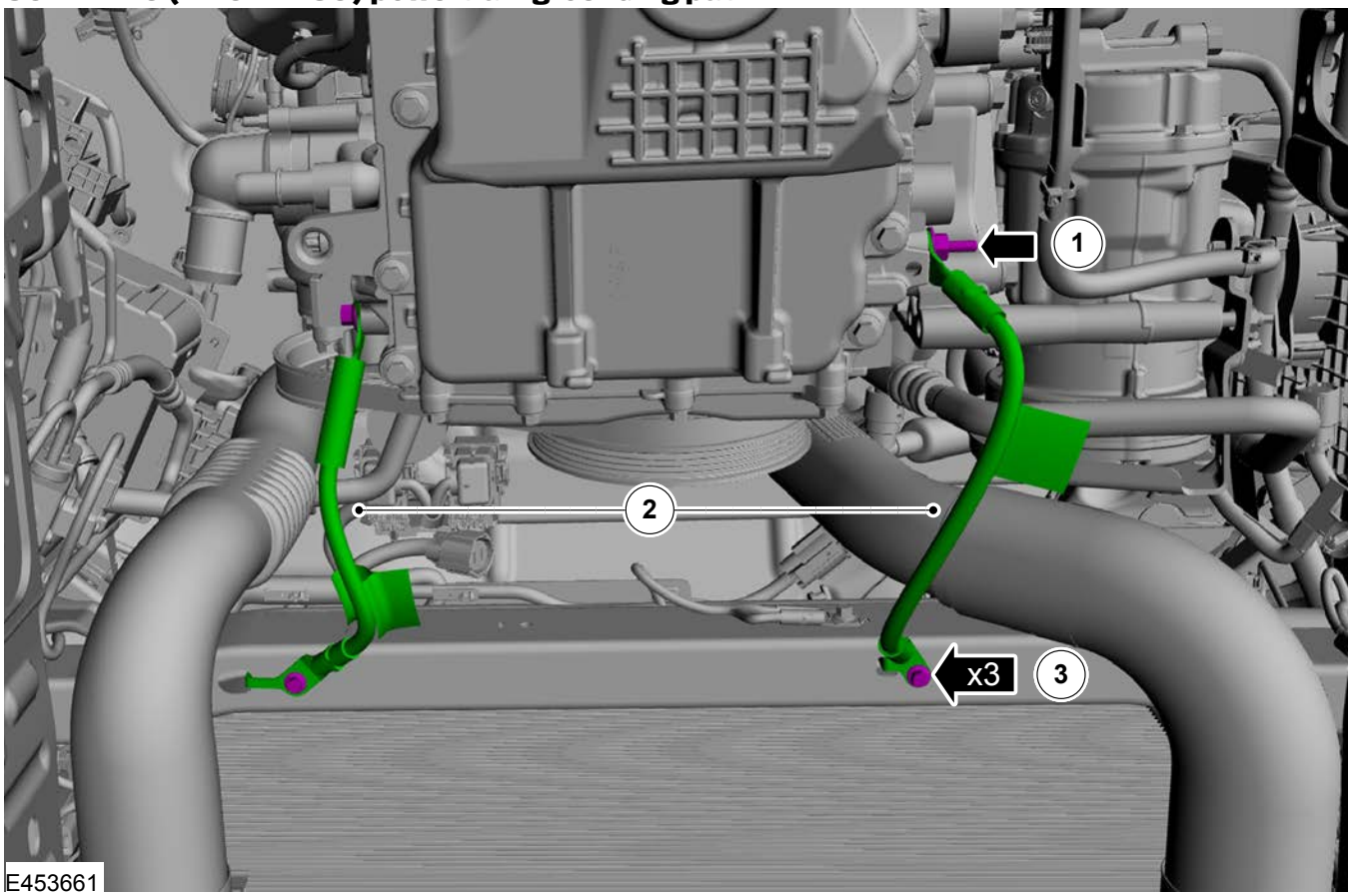
Item	Description
1	DC-AC Convertor (OBGI / Inverter) module grounding bolt points
2	DC-AC Convertor (OBGI / Inverter) module grounding nut points

SOBDEM C (HPCM / ISC) module grounding points



Item	Description
1	SOBDEM C (HPCM / ISC) module grounding cable
2	SOBDEM C (HPCM / ISC) module ground fixings

SOBDEM C (HPCM / ISC) powertrain grounding path



Item	Description
1	SOBDEM C (HPCM / ISC) ground fixing (nut)
2	SOBDEM C (HPCM / ISC) ground cables
3	SOBDEM C (HPCM / ISC) ground bolt points

4.2.5 Connection of Auxiliary Loads / Accessories - Vehicles with Factory Fit Auxiliary Switches, Wiring and Fuse Box

WARNINGS:

Make sure all electrical connections and wiring comply with local regulatory standards.

Under no circumstances should any unfused connections be made directly to any of the vehicle's battery terminals.

NOTE: Auxiliary load grounding points must always be connected to the nominated grounding points and not to the battery negative terminal.

NOTE: Refer to the vehicles owner manual for operational overview of the auxiliary switches.

NOTE: Vehicles fitted with a diesel engine should only use the auxiliary switches when the engine is running. Diesel engine glow plug can cause a reduction in the battery cranking power when the ignition key is in the ON position. Using the auxiliary switches, even for a short time, can cause your battery to drain and prevent the engine from being started.

Vehicles may be fitted with factory fit auxiliary switches, fuses and wiring that allows the installation of electrical accessories that are powered by fuse protected relays. The auxiliary switches, fuses and wiring comprise of:

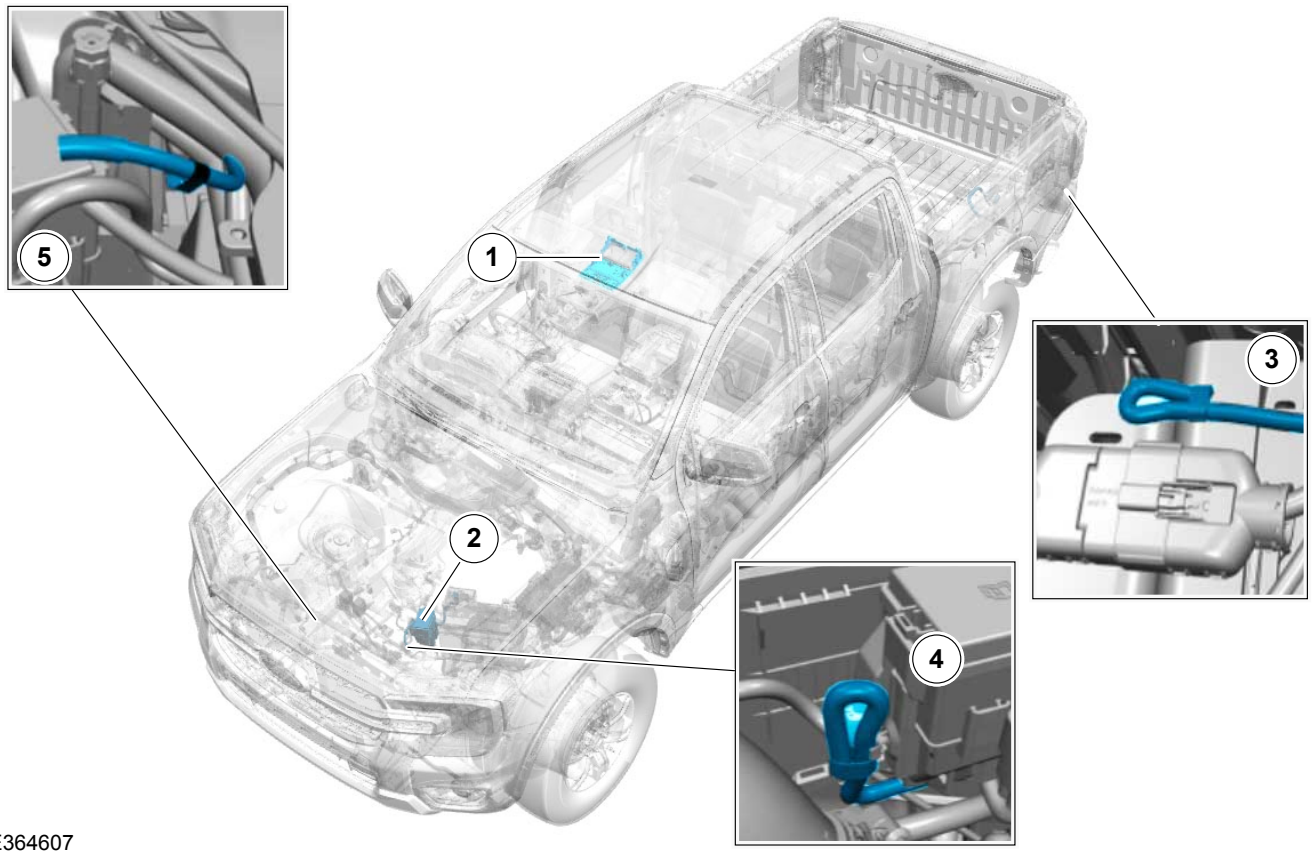
- Auxiliary Switch Panel
- Auxiliary Fuse Box with integrated relays
- Auxiliary Wiring Connections

The auxiliary switches only operate when the ignition is in the ON position.

Locating the Auxiliary Switches, Fuse Box and Wiring

Auxiliary Switches, Fuse Box and Wiring Positions

- A = Located Near to Auxiliary Fuse Box
- B = Auxiliary Fuse Box near to Left Hand Headlamp
- C = Near to Trailer Towing Electrical Connector Point

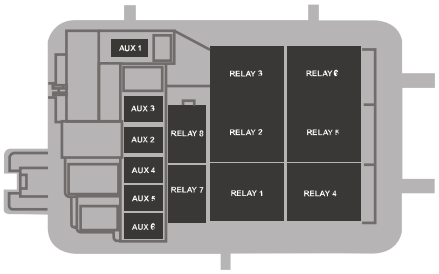


E364607

Item	Description
1	Auxiliary Switch Pack
2	Auxiliary Fuse Box (with relays) - POSITION B
3	Wiring Circuit Located Near to Trailer Towing Electrical Connector Point - POSITION C
4	Wiring Circuit Located Near to Auxiliary Fuse Box - POSITION A
5	Wiring Circuit Located Near to Radiator Support Panel

NOTE: Circuits from the auxiliary fuse box are powered during Run/Start condition. All other wiring is not connected at either end.

Identifying the Auxiliary Fuse Box Connections



Identifying the Auxiliary Fuse Box Connections

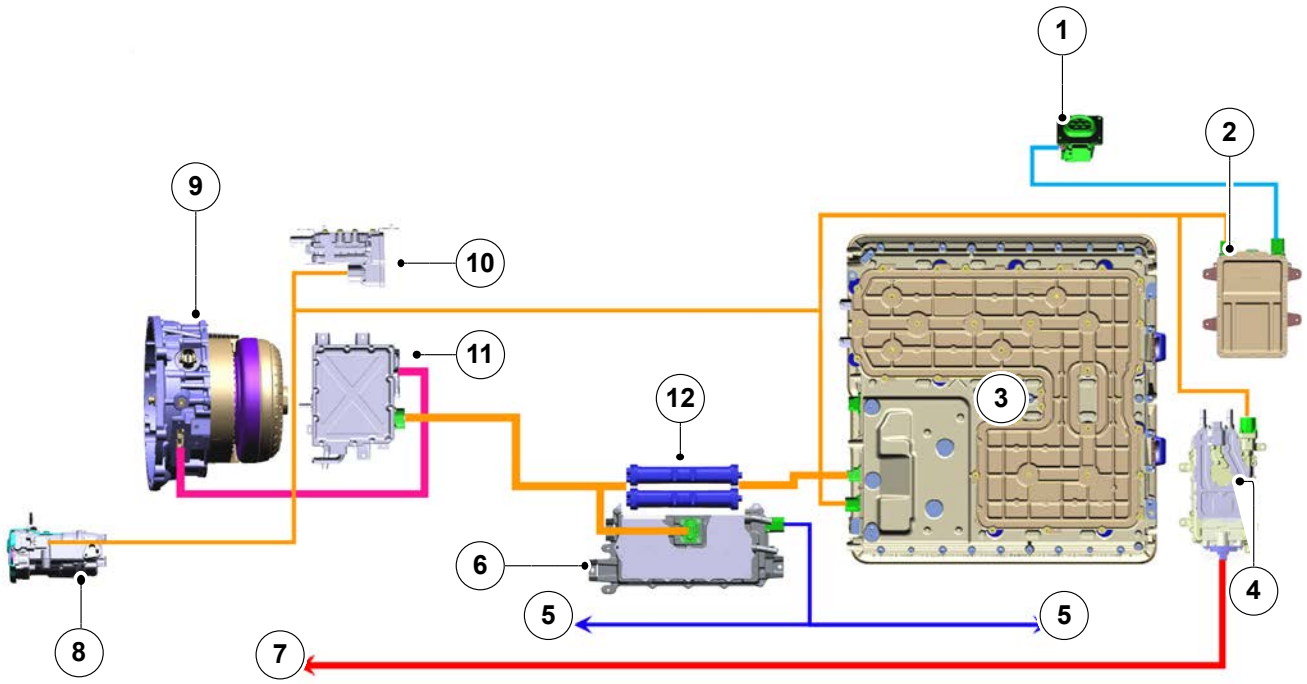
Auxiliary Switches Overhead Console	Wire Color	Wire Size	Fuse	Protected Component	Position	Note
AUX 1	Violet/Green	1.5mm²	5A	Relay 1	B	-
AUX 2	Blue/Green	1.5mm²	15A	Relay 2	B	-
AUX 3	Yellow Orange	1.5mm²	15A	Relay 3	C	-
AUX 4	Brown	1.5mm²	15A	Relay 4	C	-
AUX 5	Green/ Brown	2.5mm²	25A	Relay 5 - Driving Lamps	B	-
AUX 6	Yellow	2.5mm²	25A	Relay 6 - Driving Lamps	A	-
-	-	-	-	Relay 7	-	This relay only works when the high beam headlamps are engaged per federal requirement.
-	-	-	-	Relay 8	-	Auxiliary switch power.
AUX 3 - GROUND	Black/Grey	1.5mm²	-	-	C	-
AUX 4 - GROUND	Black/Green	1.5mm²	-	-	C	-
AUX 6 - GROUND	Black/Yellow	2.5mm²	-	-	A	-

Position A, B and C relate to the image above. Locating the Auxiliary Switches, Fuse Box and Wiring.

4.2.6 Charging System

WARNING: Do not cut into the alternator wires.

Charging overview - PHEV



E452998

Item	Description
1	Charge Port
2	SOBDM Charger Module (BCCM)
3	HV Battery Pack
4	DC-DC Module (Convertor)
5	to 230V AC outlets
6	DC-AC Convertor (OBGI / Inverter)
7	to 12V DC system
8	Electronic A/C Compressor (EAC / ACCM)
9	Electric Drive Assembly (MHT)
10	PTC Heater
11	SOBDEM-C (HCPM / ISC)
12	Splice Tubes

12V DC available power - PHEV

PHEV vehicles have a DC-DC converter in lieu of an engine-driven alternator. Refer to the system layout above. All 12V DC vehicle requirements are supplied via this DC-DC module. This converter is rated to 220A total output (continuous) at 13.6V. The additional power available for auxiliary up-fit varies depending on operating conditions. Refer up-fitter box specifications or fuse rating for any aftermarket accessories use/connection.

NOTE: The DC-DC converter can provide short-term transient outputs up to 330A @ 12.2V (approximately 4kW). This can support in-rush or start-up transient loads that momentarily exceed the rated output of the unit.

Summary of the Available Charging Modes - alternator equipped vehicles - ICE

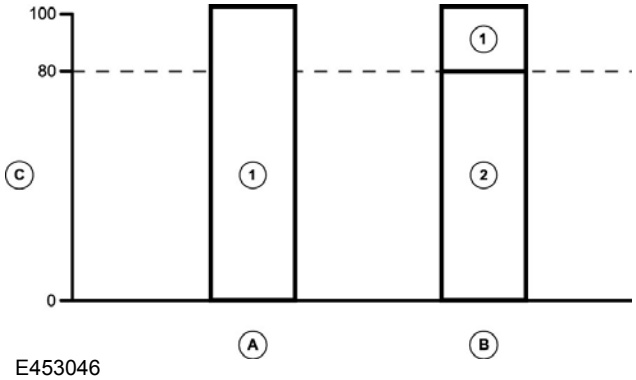
	Charge Mode	Approximate Charging Voltages (Measured at battery post)
SRC	Smart Regenerative Charging - normal charge mode.	Minimum 12.2V - Maximum 14.9V
CC	Conventional Charging - applies a strong charging voltage until the battery is full and maintains alternator voltage above 13.5V unless battery temperature >40°C.The actual voltage at the battery will vary depending on the alternator load.	Minimum 13.5V - Maximum 14.9V

The voltages in the above table are approximate as the charging system is dynamic and can vary the voltage at any time. There is also a refresh mode that is activated periodically if the vehicle stands for more than 30 days. This may take the voltage to 15.2 volts.

Smart Regenerative Charging (SRC)

Smart Regenerative Charging varies alternator output using information from the Battery Monitoring Sensor to reduce fuel consumption. Alternator output can be increased during deceleration to charge the battery without the use of additional fuel. Alternator output can also be decreased to reduce the load on the engine and therefore fuel used. During this condition the battery supports the electrical loads.

By comparison, Conventional Charging aims to charge the battery at a constant level which varies with battery temperature.



E453046

Item	Description
A	Conventional Charging
B	Smart Regenerative Charging (SRC)
C	Battery Charge (%)
1	Minimum 13.5V at battery when charging
2	Minimum 12.2V at battery when charging

Alternator Current Output

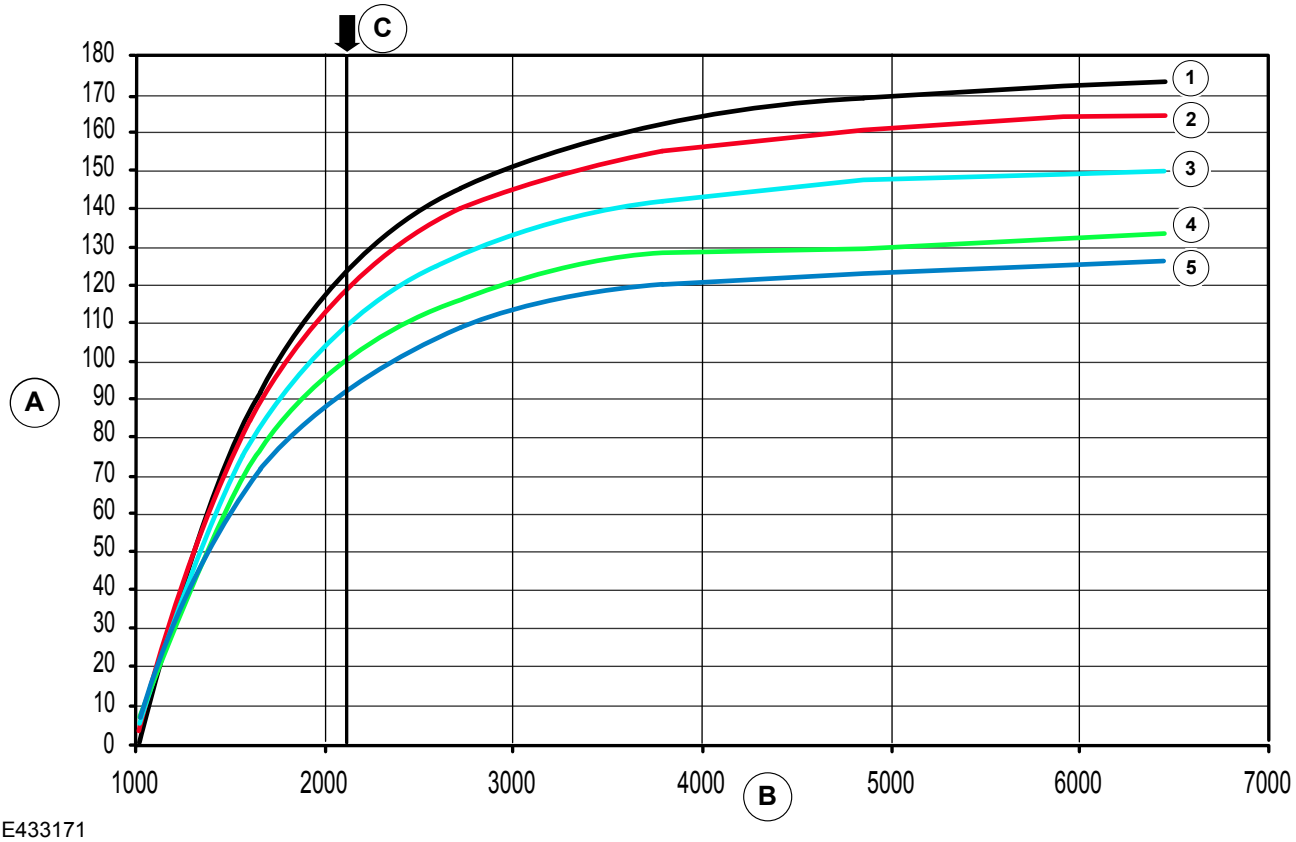
Powertrain	Current Output	Amps @ 80.6°F (27°C)	Pulley Ratio	Pulley type	Voltage regulator type
2.0L Diesel Single Turbo*	155**	100 amps at 750 rpm (min) to 155 amps at 2,500 rpm (max)	2.8	Overrunning Alternator Decoupler (OAD)	Electronic internal
2.0L Diesel Single Turbo*	210	150 amps at 750 rpm (min) to 210 amps at 2,300 rpm (max)			
2.0L Diesel Single Turbo* / 2.0L Diesel Bi-Turbo	250	155 amps at 750 rpm (min) to 250 amps at 2,300 rpm (max)			
3.0L Diesel	250	145 amps at 750 rpm (min) to 250 amps at 2,500 rpm (max)	2.66		
3.0L Gasoline	250	110 amps at 625 rpm (min) to 250 amps at 2,500 rpm (max)	2.43	One Way Clutch (OWC)	

NOTE: RPM speeds shown in table are engine crankshaft speeds, not alternator rotation speed.

(*) Market Dependant

(**) Available up to 2026.25MY

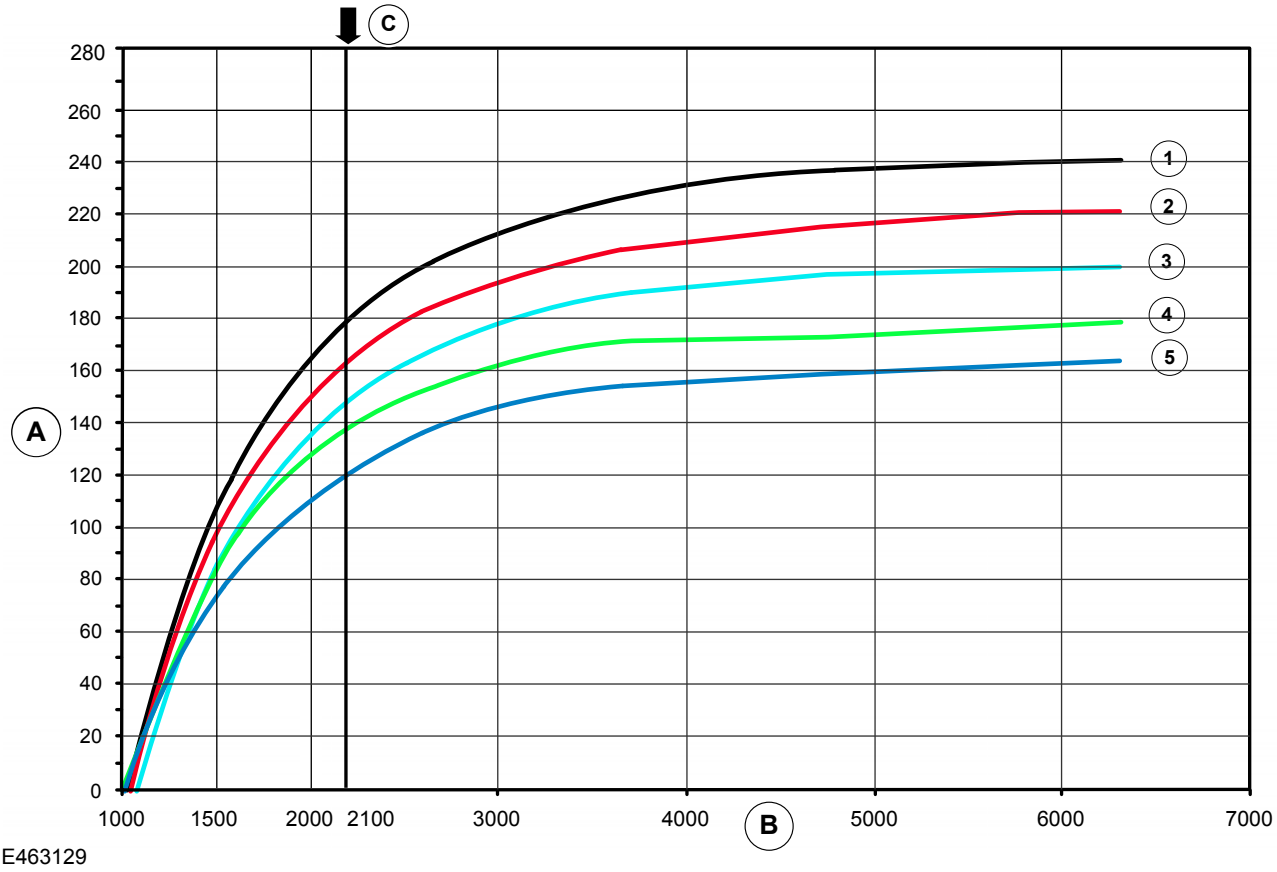
Alternator Output Performance Curve - 155A Current Output



E433171

Item	Description
A	Output Current (Amps)
B	Alternator Speed (RPM)
C	Engine Idle Speed (750rpm @ engine = 2100rpm @ alternator) - 2.0L TDCi
1	Temperature 30°F (0°C)
2	Temperature 80°F (27°C)
3	Temperature 140°F (60°C)
4	Temperature 200°F (93°C)
5	Temperature 240°F (115°C)

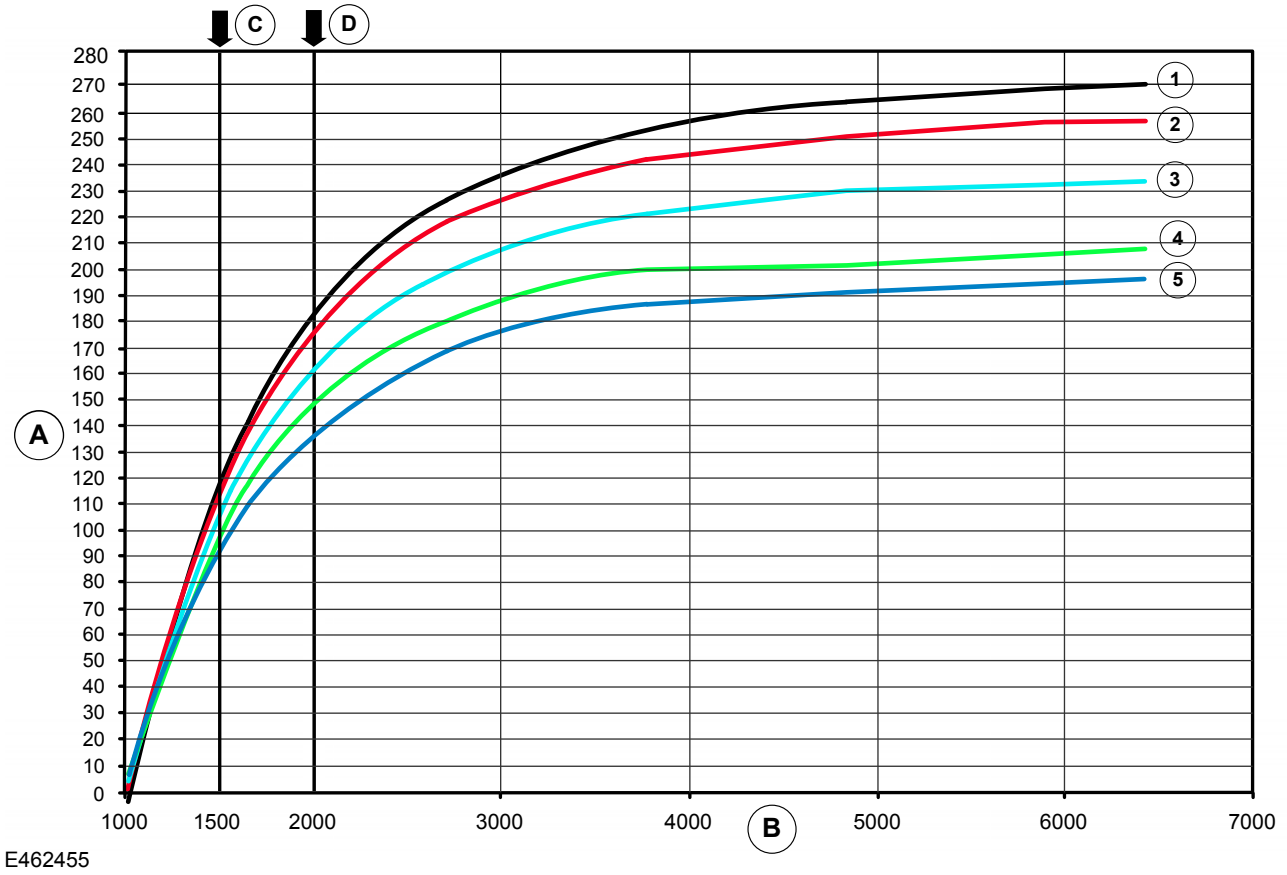
Alternator Output Performance Curve - 210A Current Output



E463129

Item	Description
A	Output Current (Amps)
B	Alternator Speed (RPM)
C	Engine Idle Speed (750rpm @ engine = 2100rpm @ alternator) - 2.0L TDCi
1	Temperature 30°F (0°C)
2	Temperature 80°F (27°C)
3	Temperature 140°F (60°C)
4	Temperature 200°F (93°C)
5	Temperature 240°F (115°C)

Alternator Output Performance Curve - 250A Current Output



E462455

Item	Description
A	Output Current (Amps)
B	Alternator Speed (RPM)
C	Engine Idle Speed (625rpm @ engine = 1500rpm @ alternator) - 3.0L Ecoboost
D	Engine Idle Speed (750rpm @ engine = 2000rpm @ alternator) - 3.0L Power Stroke Diesel
D	Engine Idle Speed (750rpm @ engine = 2100rpm @ alternator) - 2.0L TDCi
1	Temperature 30°F (0°C)
2	Temperature 80°F (27°C)
3	Temperature 140°F (60°C)
4	Temperature 200°F (93°C)
5	Temperature 240°F (115°C)

4.2.7 Ignition Signal



E387821

A Run-Start/Ignition signal is available as a blunt cut wire taped back against the harness branch located behind the kick-panel on the LHS A-Pillar.

The signal can be used via an external relay for a variety of Convertor applications, subject to load required.

- Wire colour White/Green (WH/GN) - 10 Amps

4.2.8 AC Inverter Deactivation - ICE

NOTE: The on-board 230V AC 400W inverter can be deactivated via a fuse removal and by updating the vehicle configuration by downloading and running application Disable/Enable 400W Power Outlet (G2506307) located in the Programmable Features menu tab in FDRS. Failure to follow this process will result in error codes (DTC group: B1330) being logged. Disabling the inverter will deactivate all related power outlets in the cabin and loadbox area (as applicable). Please contact the Ford Pro Special Vehicles helpline at FPSVhelp@ford.com for further information. This is a password-protected process that should be submitted and approved prior to requiring the deactivation.

4.3 Parking Aid

WARNINGS:

To help avoid personal injury, always use caution when in reverse (R) and when using the sensing system.

The system may not detect objects with surfaces that absorb reflection. Always drive with due care and attention. Failure to take care may result in a crash.

Traffic control systems, inclement weather, air brakes, external motors and fans may affect the correct operation of the sensing system. This may cause reduced performance or false alerts.

The system may not detect small or moving objects, particularly those close to the ground.

Modifying tire diameter or wheel offset may cause a reduction in the performance of the Active Park Assist feature, and/or the feature may not function correctly, with the potential cause injury."

Do not use the system with items that extend past the front and rear ends of the vehicle, for example, bike rack accessories. The system is not able to correct for the additional extrusions.

You must remain in your vehicle when the system turns on. At all times you are responsible for controlling your vehicle, supervising the system and intervening, if required. Failure to take care may result in loss of control of your vehicle, serious personal injury or death.

The sensors may not detect objects in heavy rain or other conditions that cause interference.

You are responsible for controlling your vehicle at all times. The system is designed to be an aid and does not relieve you of your responsibility to drive with due care and attention. Failure to follow this instruction could result in the loss of control of your vehicle, personal injury or death.

CAUTION: When the Pickup Box/Tub and Tail Lamps are removed on vehicles with rear parking aid sensors, the rear parking aid feature and Reverse Brake Assist (RBA) will be disabled. The vehicle can be reconfigured to deactivate these features and avoid warning messages in the instrument cluster. See your local Ford Dealer or contact your National Sales Agent for further information.

NOTE: Keep the sensors free from snow, ice and large accumulations of dirt. If the sensors are covered, the system's accuracy can be affected. Do not clean the sensors with sharp objects.

NOTE: If your vehicle sustains damage to the bumper or fascia, leaving it misaligned or bent, the sensing zone may be altered causing inaccurate measurement of obstacles or false alerts.

NOTE: Certain add-on devices installed around the bumper or fascia may create false alerts. For example, large trailer hitches, bike or surfboard racks, license plate brackets, bumper covers or any other device that may block the normal detection zone of the system. Remove the add-on device to prevent false alerts.

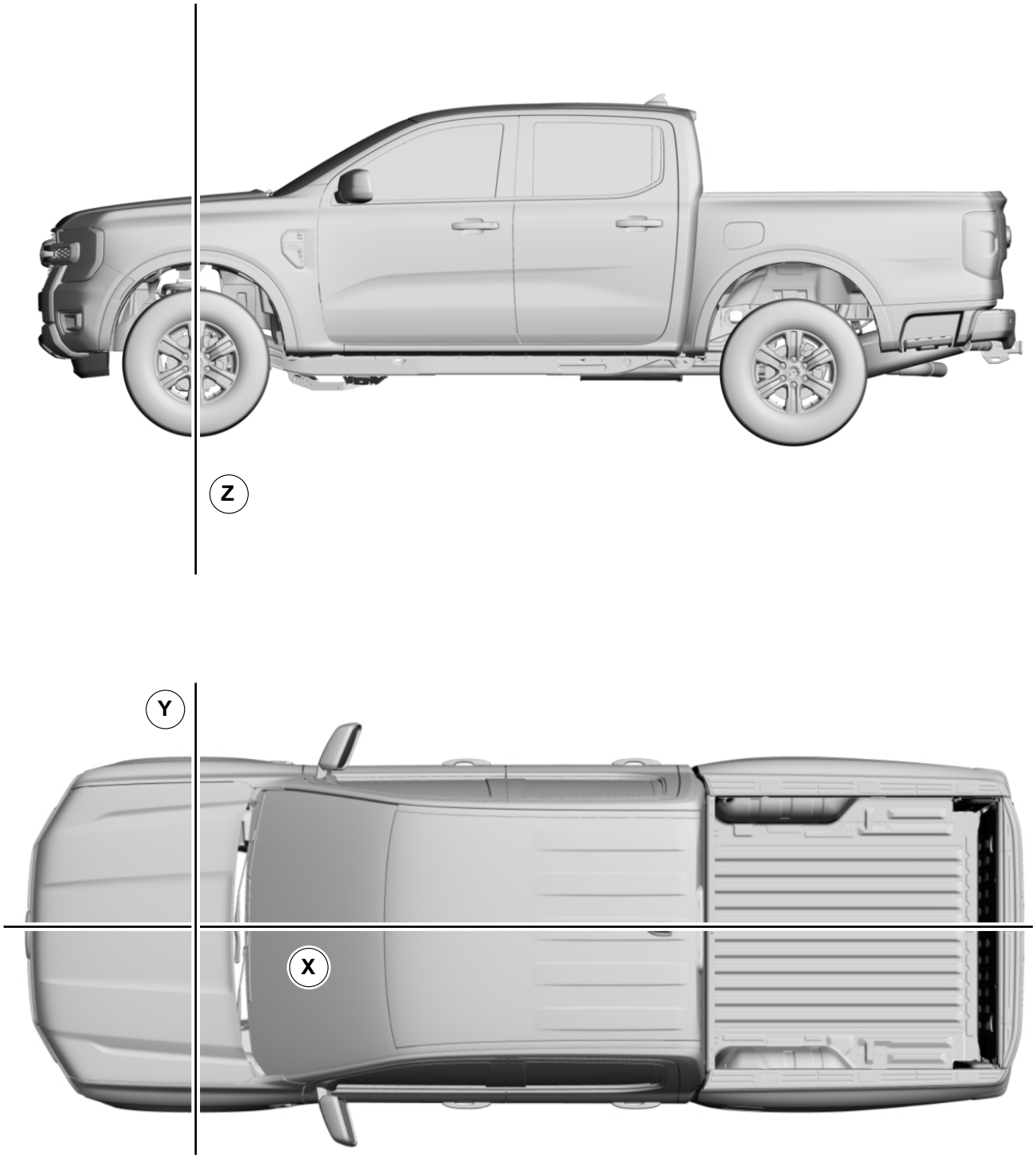
The parking aid sensing system warns the driver of obstacles within a certain range of your vehicle. The system turns on automatically whenever you switch the ignition on. The system can be switched off via the following methods:

- Through the information display menu.
- From the pop-up message that appears once you shift the transmission into reverse (R).
- Using the Parking Aid Button (if equipped).

If a fault is present in the system, a warning message appears in the information display. See the vehicle owner manual for further information on the correct operation of the parking aid system.

Where possible, parking aid sensors should not be moved from the original positions on the X, Y and Z plane. Maintaining the sensors location on these planes is important for correct operation of the system.

Vehicle Location Planes



E363491

4.3.1 Sensor Location

NOTE: Relocated sensors must be installed in the same position as originally fitted in the bumper bar. Make sure that each sensor is installed in the correct corresponding position.

For sensor view zones and angles,

Refer to: 4.7 Driver Assist Technology (page 190).

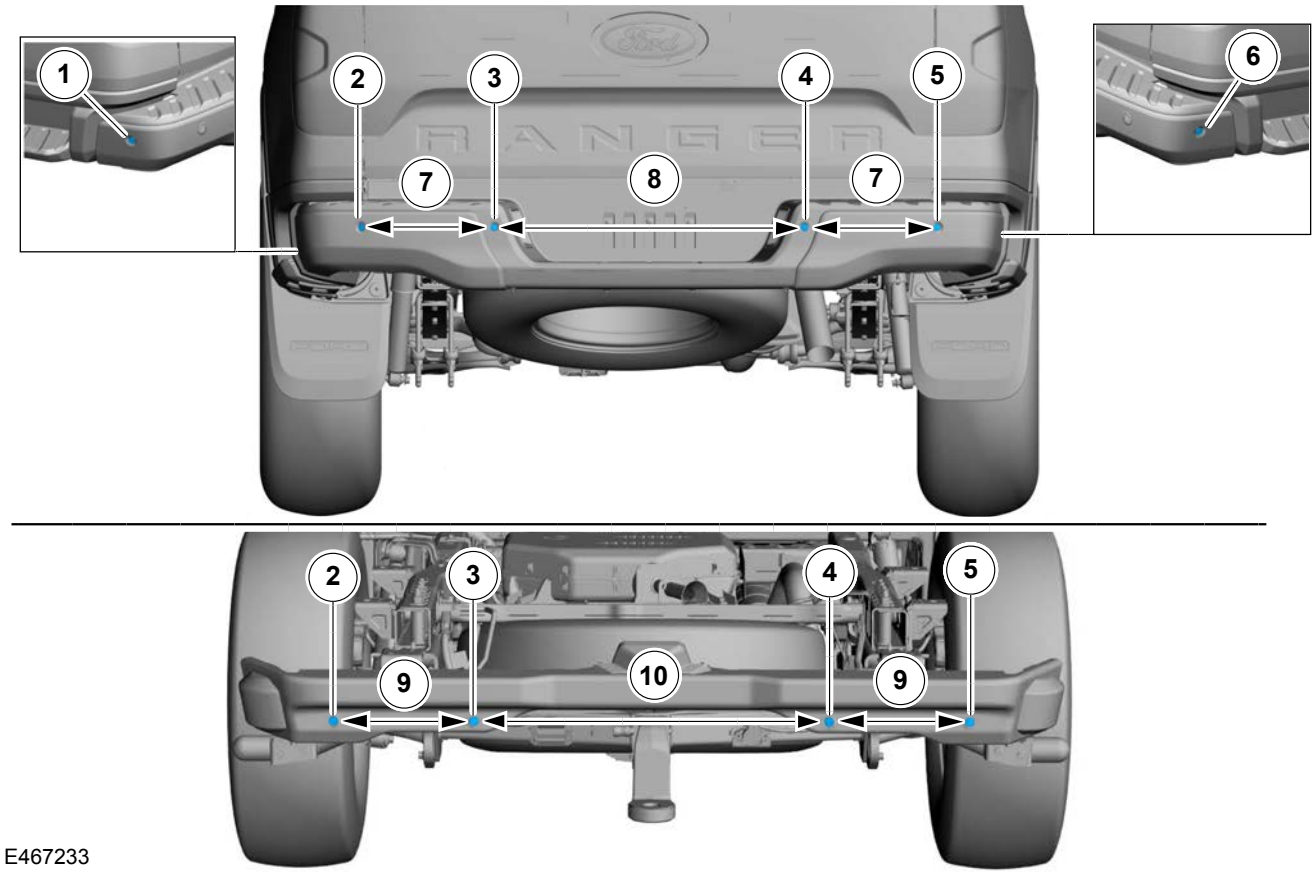
Front Parking Aid Sensor Location



E363492

Item	Description
1	Right Side (if equipped)
2	Front Right Outer
3	Front Right Inner
4	Front Left Inner
5	Front Left Outer
6	Left Side (if equipped)

Rear Parking Aid Sensor Location



E467233

Item	Sensor
1	Left Side Rear Bumper (if equipped)
2	Rear Left Outer
3	Rear Left Inner
4	Rear Right Inner
5	Rear Right Outer
6	Right Side Rear Bumper (if equipped)
7	328mm
8	764mm
9	280mm
10	740mm

Vehicles with Active Park Assist

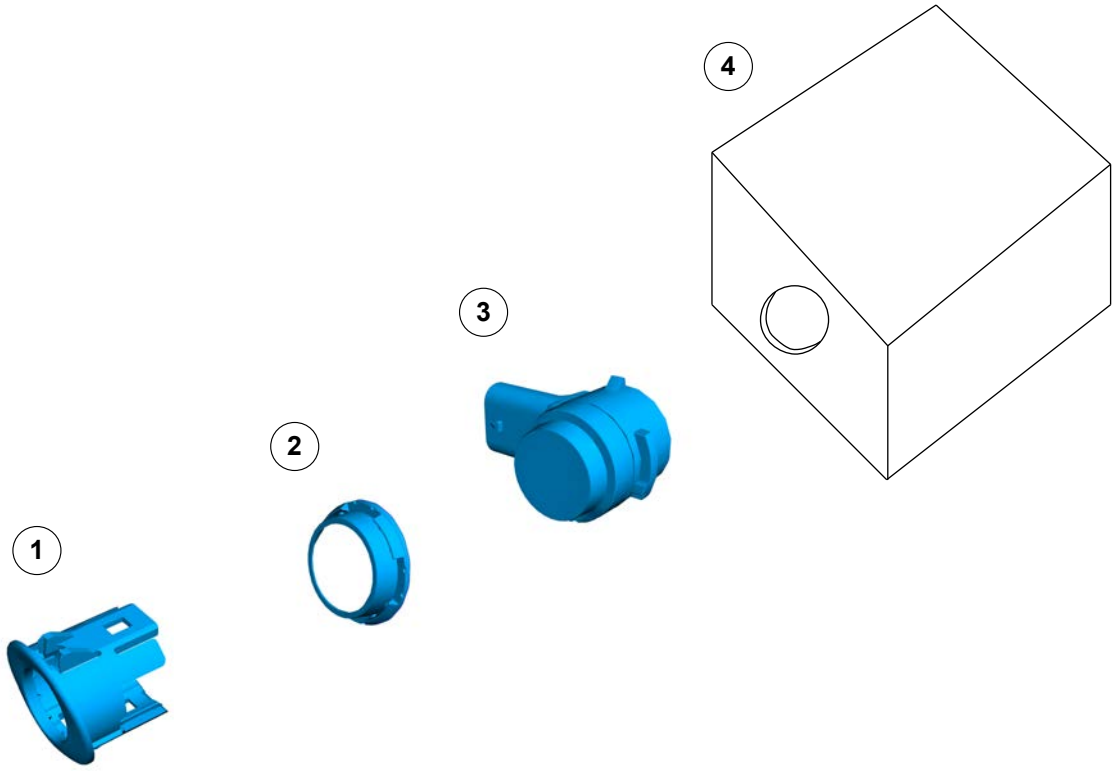
WARNING: If forward facing cameras, rear view camera, side view cameras (mounted in the side mounted rear view mirrors) and or parking aid sensors are obstructed or their position is altered, the Active Park Assist feature may not function correctly, with the potential to cause injury.

Refer to the vehicle owner manual for further information.

4.3.2 Sensor and Sensor Holder Painting Requirements

Before painting, the decoupling ring must be disassembled (ring does not allow any paint on it). A paint box may be used to ensure that only the correct area of sensor is painted.

Sensor Paint Box



E470451

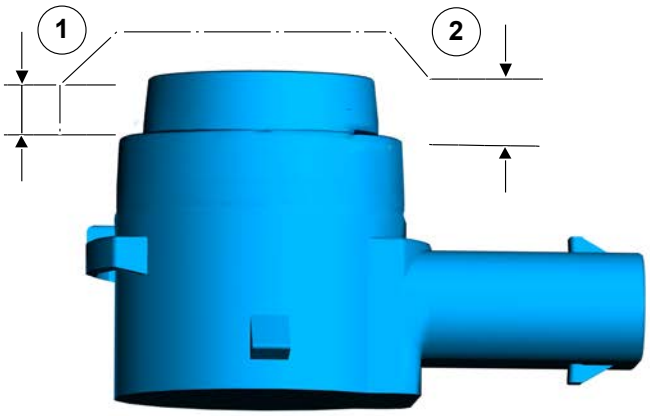
Item	Description
1	Sensor Bezel
2	Decoupling Ring
3	Sensor
4	Sensor Paint Box

The painting area of the sensor is the front, transition radius, and shell surface of the membrane. The shell surface is painted from the front surface to the sides. In spray area, only spray is permissible. A continuous coating layer between membrane and cover is not permissible.

Painting area without spray area is 2-4 mm.

For the spray painting (state-of-the-art), the coating in following detail must be met.

Sensor Paint and Spray Area



E470450

Item	Description
1	Painting Area (2mm to 4mm)
2	Spray Area

Minimum layer thickness coating: The minimal layer thickness stems from the minimum layer thickness of acrylic and minimum layer thickness of the used coating depending on colour and required coverage.

Maximum layer thickness coating must be 160 µm (including acrylic powder layer). Layer thickness can be measured with ECT.

The total layer thickness of the coating can vary between a minimum and a maximum.

The minimum layer thickness is the necessary measure to comply with colour matching and quality.

The maximum layer thickness is a necessary measure to guarantee the functionality of the transducer.

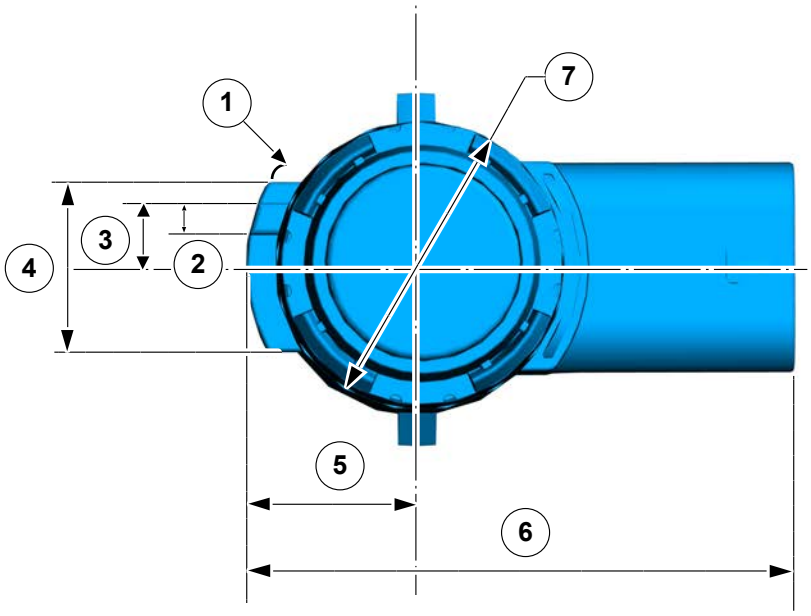
Ensure that the layer thickness of the entire coating area (front, transition radius, shell surface) does not exceed the maximum layer thickness. If the coverage/colour matching and quality of the whole coating area is already achieved at a lower layer thickness, this thickness is permitted.

Coating or coating veils are not permitted beyond the defined area (e.g. plug periphery, plug contacts). Coating and coating veils must not form a strap between membrane and bordering components.

Immersion treatment/power-wash is not permitted without prior sealing of the whole plug.

Parameters	
Acrylic Powder Layer Thickness	30 µm - 5 µm to 45 µm +5 µm
Ideal Storage Conditions	Ambient temperature (l8°C-28°C) without being exposed to UV rays

Sensor Surface Dimensions



E469698

Item	Description
1	Radius 13.75mm
2	2.5mm
3	5mm
4	13.4mm
5	13.75mm
6	Diameter 23mm

Sensor Holder

Overall minimum and maximum holder dimensions must be guaranteed, even with the added paint layers to the sensor interface, to avoid any risk of sensor malfunction.

4.3.3 Park Aid System Check After Retrofitting

1. Place an object 20cm to 30cm away from each sensor. Shift to reverse gear and verify that a red indication on the display is visible and a continuous tone will be requested.
2. Place an object 25cm to 50cm away from each sensor. Shift to reverse gear and verify that a yellow/orange indication on the display is visible and a chime will be requested.
3. Place an object 70cm to 140cm away from each sensor. Shift to reverse gear and verify that a green indication on the display is visible and a chime will be requested.

4.3.4 Park Aid Sensor Relocation Guideline

A Park Aid sensor relocation may impact the compliance with Regulation 158. If a Park Aid sensor relocation is required and rear view camera exists in the vehicle, it is recommended to use the rear view camera to comply with Regulation 158.

If a Park Aid sensor relocation is required and no rear view camera is available for Type Approval, please follow the guidelines below to be able to Type Approve the vehicle with Park Aid sensors.

In relation to the vehicle's original Park Aid sensor positions, sensor relocation should not exceed the following limits:

NOTE: Symmetrical sensor position setup to the vehicle's center needs to be maintained.

- **X-Position:** All sensors can be moved in X-direction as long as the change is equal for all sensors. Additionally, a deviation of maximum 3cm X-direction change between different sensors is tolerable.
- **Y-Position:** Sensors can be moved+/- 2.5cm.
- **Z-Position:** Sensors should not be moved downwards. Sensors can be moved up to 20cm upwards if the position change is equal for all sensors. A deviation of maximum 3cm Z-direction change between different sensors is tolerable for maintaining a symmetrical sensor position.

NOTE: If sensors need to be moved downwards (e.g. into a rear step), this could lead to false warnings caused by reflections from uneven road surfaces.

NOTE: Distance change between sensors, combining X/Y/Z, should never exceed absolute worst case of 5cm.

NOTE: Alpha-angle: No change possible to the horizontal direction of each sensor.

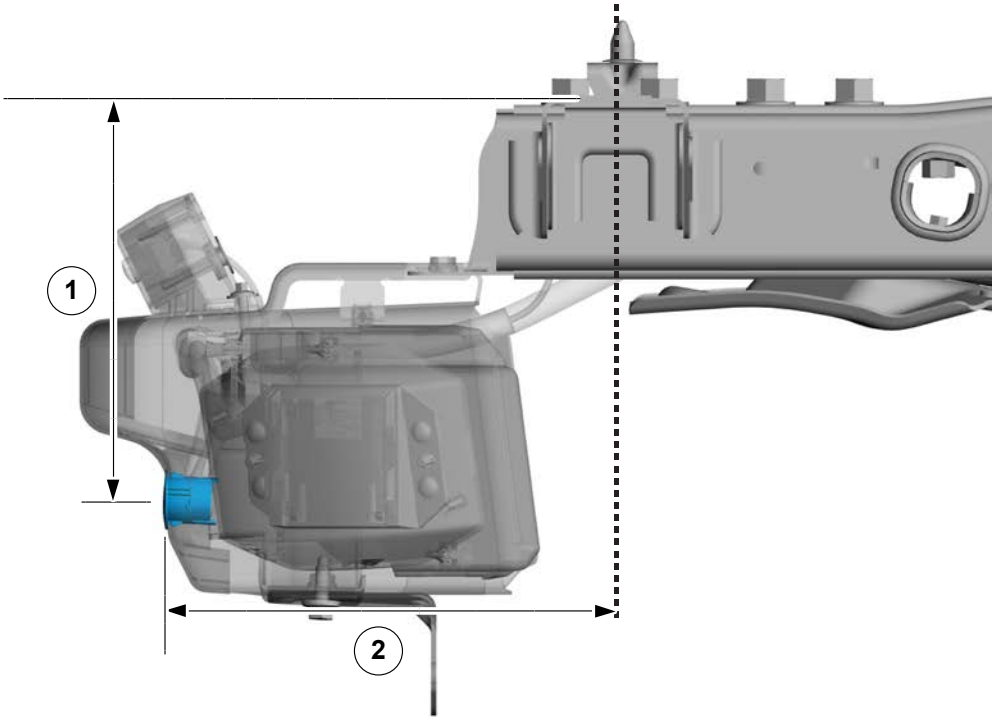
NOTE: Beta-angle: No change possible to the vertical direction of each sensor.

CAUTION: Installation of the sensors into rigid material (especially metal) is not recommended. In case it cannot be avoided, special attention needs to be paid (e.g. considering plastic fixtures, damping improvements).

NOTE: Every sensor relocation could lead to a deterioration of the base Park Aid system performance.

NOTE: If the vehicle is equipped with Reverse Brake Assist (RBA), it uses rear Park Aid sensors and the rear view camera for object detection. A rear Park Aid sensor relocation might lead to deteriorated object detection and consequentially a deterioration of the RBA.

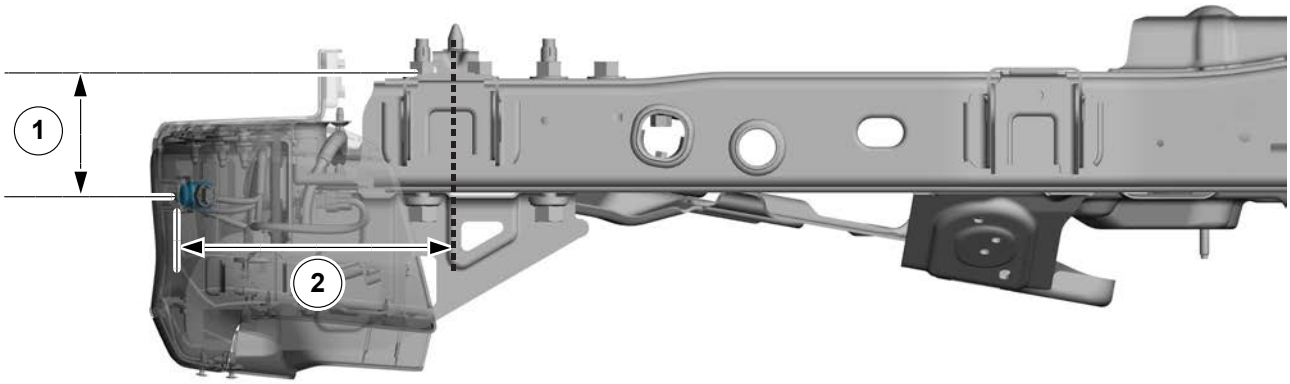
Rear Parking Aid Sensor Datum Points - DAT Bar



E469697

Item	Description	Dimension (mm)
1	Chassis rear mount to center of parking aid sensor	226
2	Center of rear mount to parking aid sensor	254

Rear Parking Aid Sensor Datum Points - Style Side Box



E469700

Item	Description	Dimension (mm)
1	Chassis rear mount to center of parking aid sensor	104
2	Center of rear mount to parking aid (inboard) sensor	256
2	Center of rear mount to parking aid (outboard) sensor	233

4.4 Electronic Engine Controls

4.4.1 Tachograph

WARNING: Do not interface with the CAN for vehicle speed.

A tachograph preparation kit is available for installation on four wheel drive vehicles. For further information please contact your local National Sales Company representative, or Authorized Ford Dealer.

For additional information, refer to 4.4.2 Vehicle Speed Signal.

4.4.2 Vehicle Speed Signal

WARNING: Do not interface with the CAN for vehicle speed.

The vehicle speed signal can be acquired from the Body Control Module. This output may require enabling by a Ford Dealer on some models.

NOTE: If the vehicle speed drops below 2.5MPH (4KPH) the vehicle speed signal may not be distinguishable for the Tachograph.

Square Wave Characteristics

Specifications	
Max High Signal	Battery Voltage
Min High Signal	3.67V
Max Low Signal	1.1V
Min Low Signal	-1.1V
Max Ground Offset	± 1.0V
Rise Time	10µs <= tr <=250µs
Fall Time	10µs <= tf <=250µs
Duty Cycle	50% ± 10%
Pulse Rate	2.2Hz/MPH (1.3808Hz/KPH)

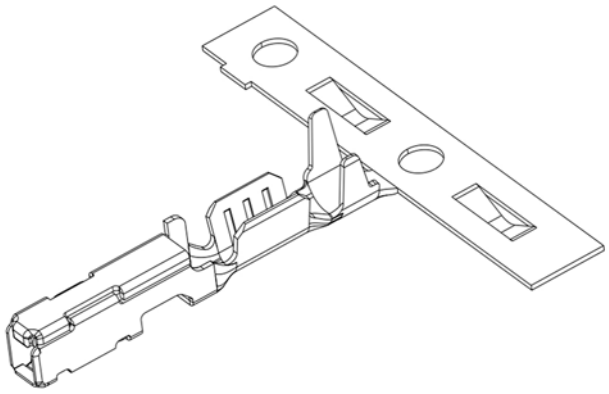
Body Control Module

The vehicle speed signal can obtained on the following connector:

- Body Control Module J5 (Blue connector) Pin 41, no wire assignment currently

A wiring pigtail can be made up and inserted in to the Body Control Module connector to acquire the vehicle speed signal. (0.5mm² wire recommended)

Pigtail Terminal Connector



E434039

NOTE: The vehicle speed signal wiring should be shielded and twisted to reduce EMC effects.

- Wiring terminal service part: DU2Z-14474-AA

4.5 Information and Entertainment System

4.5.1 Rear View Camera

Aftermarket Rear View Camera - Connecting straight to SYNC

NOTE: The display screen does not have a direct input for connection to devices such as cameras. Only vehicles with SYNC radios have the capability to support aftermarket fitment of the rear view camera.

There are three pins on the SYNC module.

- C1-14: Input Camera - Parking Aid Rear Video (+)
- C1-15: Input Camera - Parking Aid Rear Video (-)
- C1-33: Ground: Camera-Parking Aid Rear Video

The cable between the rear view camera and SYNC module needs to be screened twisted pair, preferably of a single run to minimize signal loss.

In addition to this, the vehicle will have certain parameters reconfigured. This needs to be carried out at an authorized Ford dealership to not invalidate warranty.

The display will only provide rear view camera information when reverse gear is engaged.

Rear Brake Assist

NOTE: Do not paint or modify the rear camera or rear bumper as this will impede the Rear Brake Assist functionality.

NOTE: No change to power steering system is supported by Reverse Brake Assist.

NOTE: No modification to the traction control system or ABS system is supported by Reverse Brake Assist.

NOTE: Modification to door latching system or removal of doors may interfere with Reverse Brake Assist.

NOTE: Fitting of accessories to the rear of the vehicle will impede the functionality of Reverse Brake Assist, in these instances the feature should not be used - False Reverse Brake Assist events may occur.

NOTE: Do not obstruct the rear camera.

All Cameras

CAUTION: When the Pickup Box/Tub and Tail Lamps are removed on vehicles with a rear view camera, the feature will be disabled. The vehicle can be reconfigured to deactivate this feature and avoid warning messages in the instrument cluster. See your local Ford Dealer or contact your National Sales Agent for further information.

NOTE: Do not move or modify any camera mounting positions or brackets, as this will impede on camera and Rear Brake Assist functionality.

NOTE: Do not disconnect or remove any cameras fitted to the vehicle.

NOTE: Do not interfere with the full field of view cone of the rear camera.

NOTE: Any object mounted within the field of view cones of the front and side-mirror cameras will obstruct the 360-camera visibility.

NOTE: Any change to track width will result in the dynamic guidelines not being representative of vehicle turning circle.

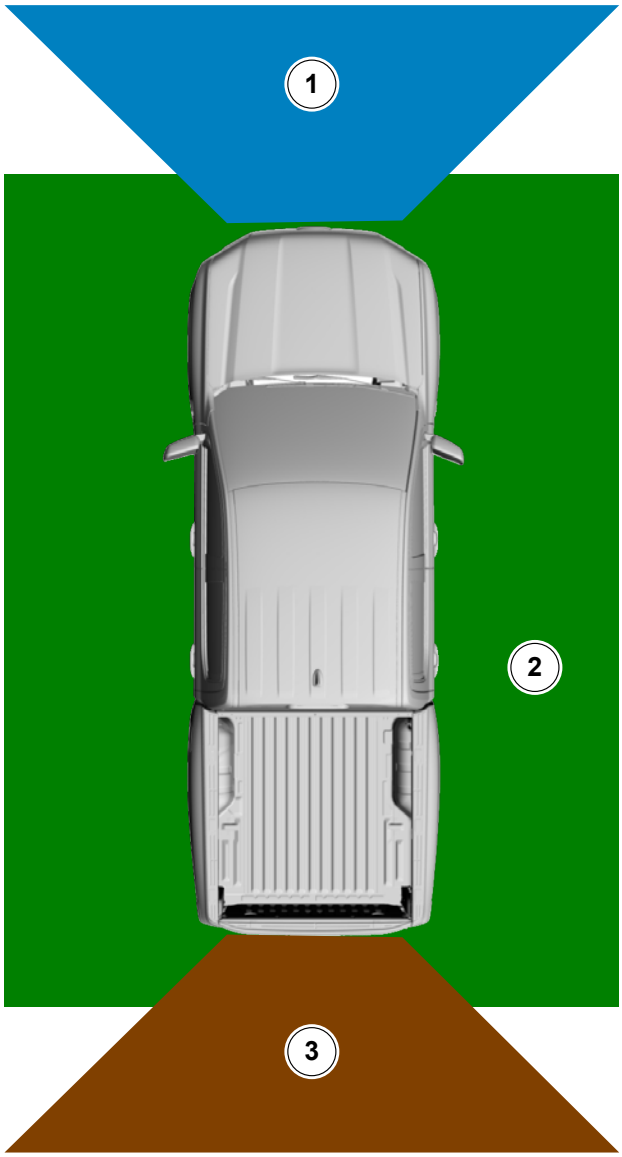
360° Camera

NOTE: Any change to track width will result in the dynamic guidelines not being representative of vehicle turning circle.

NOTE: Attachment of towing extensions to side mirrors may impede on 360 camera visibility.

NOTE: Do not interfere with the full field of view cones of the 360° camera.

NOTE: Any object mounted within the field of view cones of the front and side-mirror cameras will obstruct the 360-camera visibility.



E365399

Item	Description
1	Front Camera Field of View
2	360º Camera Field of View
3	Rear Camera Field of View

Front Camera - Front Protection Bar Limitations

CAUTION: Do not move or modify any camera mounting positions or brackets, as this will impede on camera and Rear Brake Assist functionality.

NOTE: When fitting a Ford Licensed Accessory (FLA) Compatible Bullbar, ensure the "IPMA Front Bumper Calibration" is performed. This will include a Recalibration of the 360-degree camera system to the new location.

NOTE: Any object mounted within the field of view cones of the front and side-mirror cameras will obstruct the 360-camera visibility.

NOTE: Fitment of any accessories on the front bullbar that interfere with the front camera field of view will obstruct part of the camera video and will cause an incomplete or degraded 360 view.

NOTE: Any change to track width may result in the dynamic guidelines not being representative of vehicle turning circle.

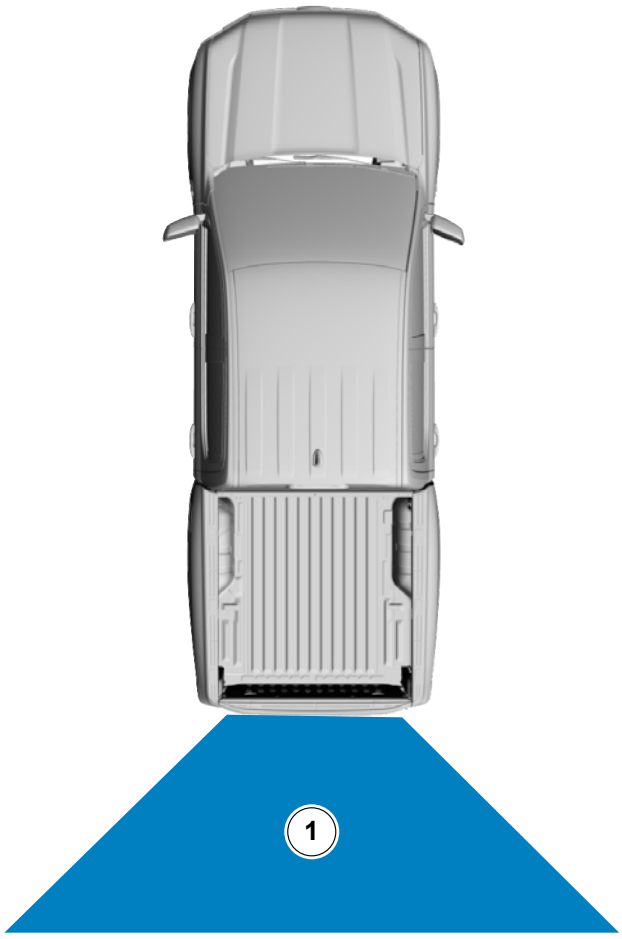
Analog Rear View Camera Equipped Vehicles

NOTE: Do not move or modify any camera mounting positions or brackets, as this will impede on camera and Rear Brake Assist functionality.

NOTE: Do not interfere with the full field of view cone of the rear camera.

NOTE: Any change in vehicle ride height will result in the rear camera guidelines being not representative of vehicle width distances from vehicle.

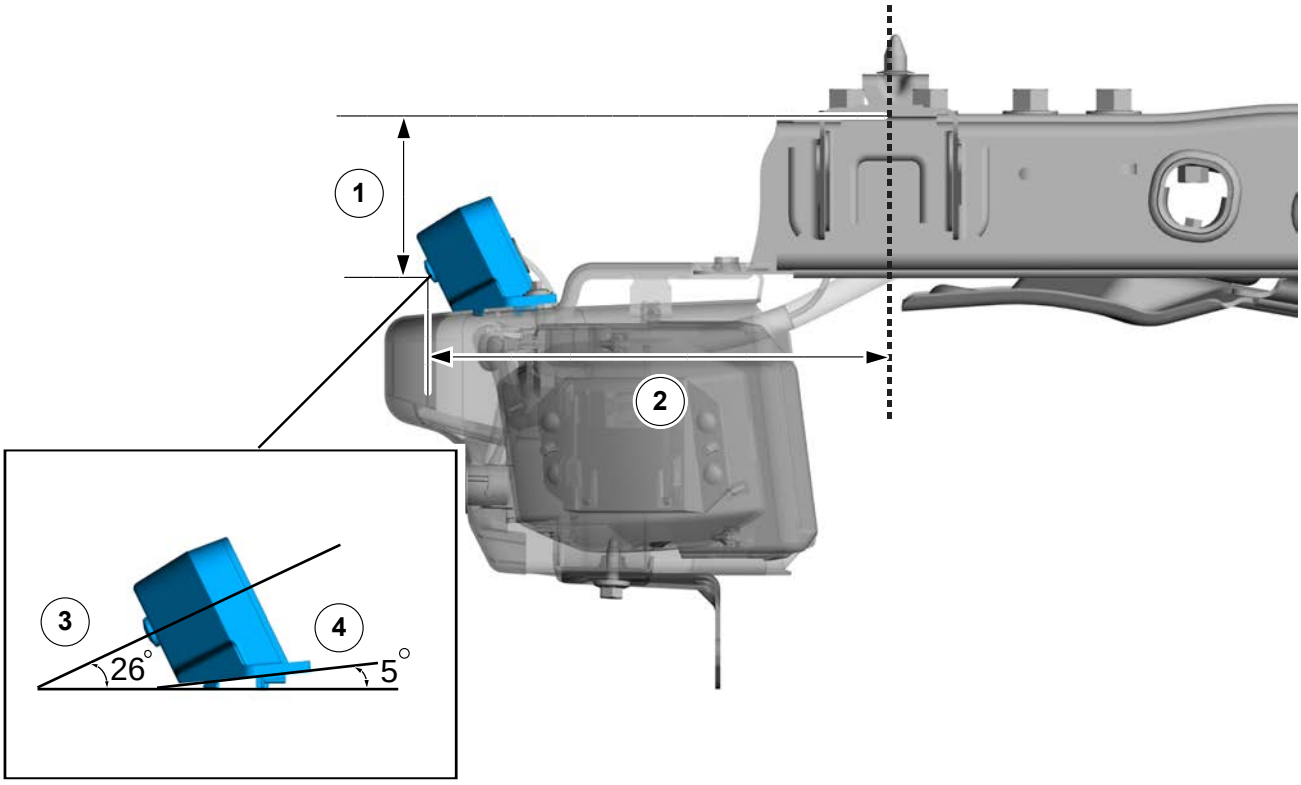
NOTE: Any change to track width will result in the dynamic guidelines not being representative of vehicle turning circle.



E365400

Item	Description
1	Rear Camera Field of View

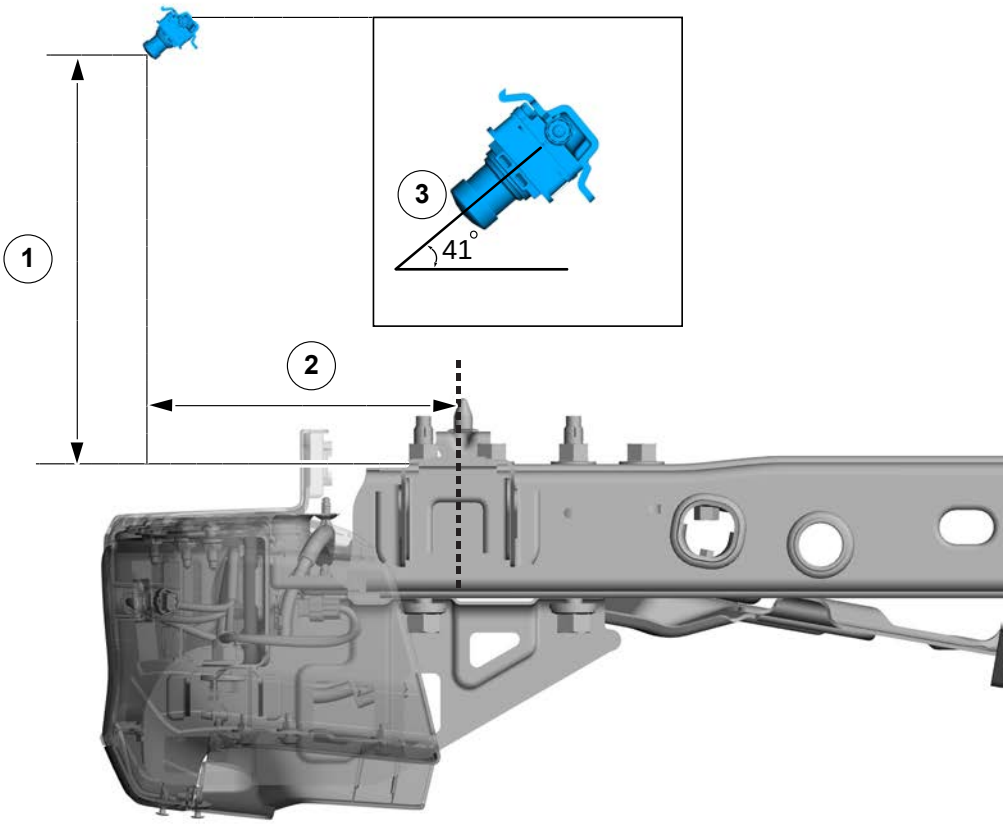
Rear Camera Datum Points - DAT Bar



E469696

Item	Description	Dimension (mm)
1	Chassis rear mount to center of rear camera	99
2	Center of rear mount to rear camera	276
3	Camera angle	26°
4	Camera housing mount angle	5°

Rear Camera Datum Points - Style Side Box



E469699

Item	Description	Dimension (mm)
1	Chassis rear mount to center of rear camera	99
2	Center of rear mount to rear camera	276
3	Camera angle	41º

4.5.2 Auxiliary Rear View Camera

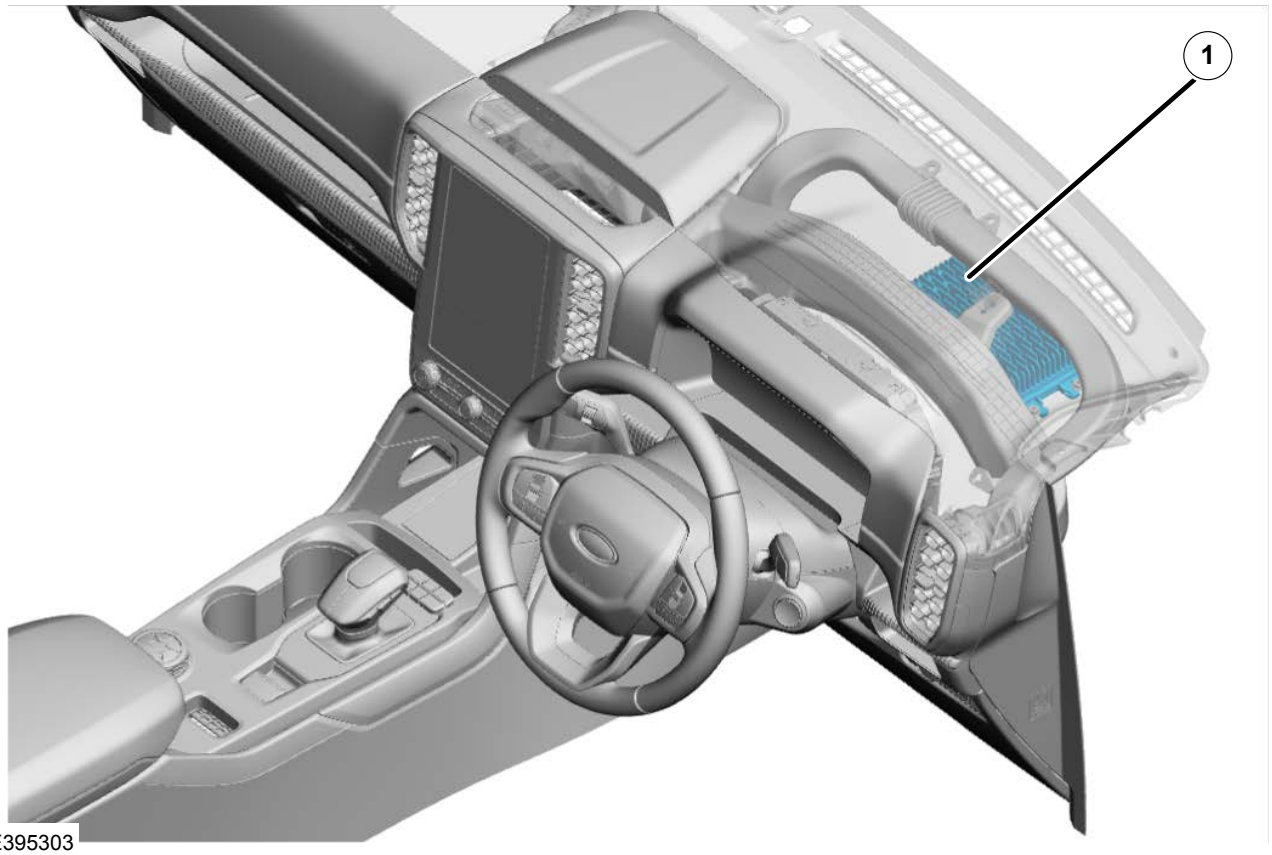
NOTE: Only vehicles with Digital Rear Vision and/or 360 deg Cameras (J3KAH or J3KAR) have the IPMA capability to support aftermarket fitment of an Auxiliary camera (NTSC format).

NOTE: Reprogramming of the APIM and the IPMA using the FDRS will be required to allow the IPMA to display the auxiliary rear view camera whilst the vehicle is moving. See your local Ford Dealer or National Sales agent for further information on the APIM reprogramming.

A compatible Auxiliary Rear View Camera kit is available from Ford in selected regions. See your local Ford Dealer or National Sales Agent.

The Auxiliary Camera Kit (containing the camera, mounting bracket and bezel) is P1WZ-19G490-B. The wiring kit (body and trailer wiring harnesses with instructions) is P1WZ-19G490-A. Available in Australia and New Zealand from August 2024.

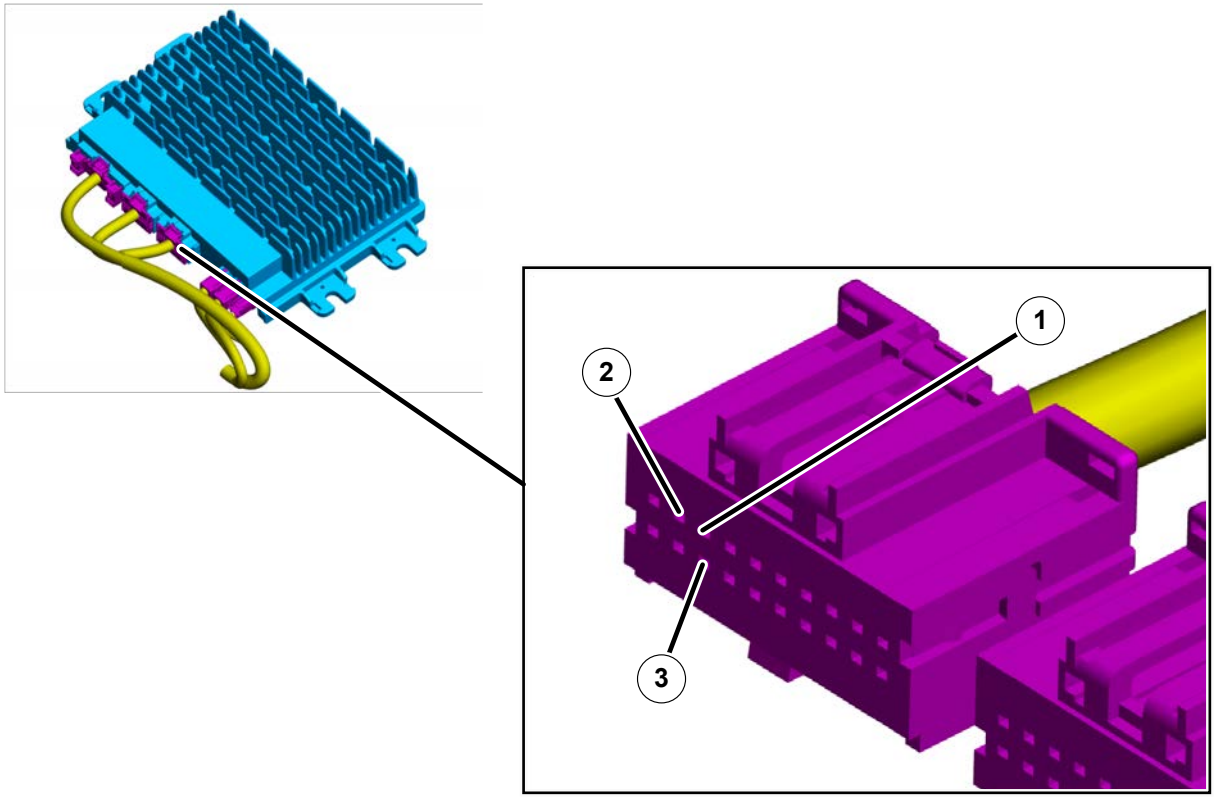
Integration of an auxiliary rear view camera requires the connection of NTSC standardized connections to the IPMA



E395303

Item	Description
1	IPMA (Image Processing Module A)

NTSC standardized connections for an auxiliary rear view camera is via nominated wires located on the Connector C3 of the IPMA.



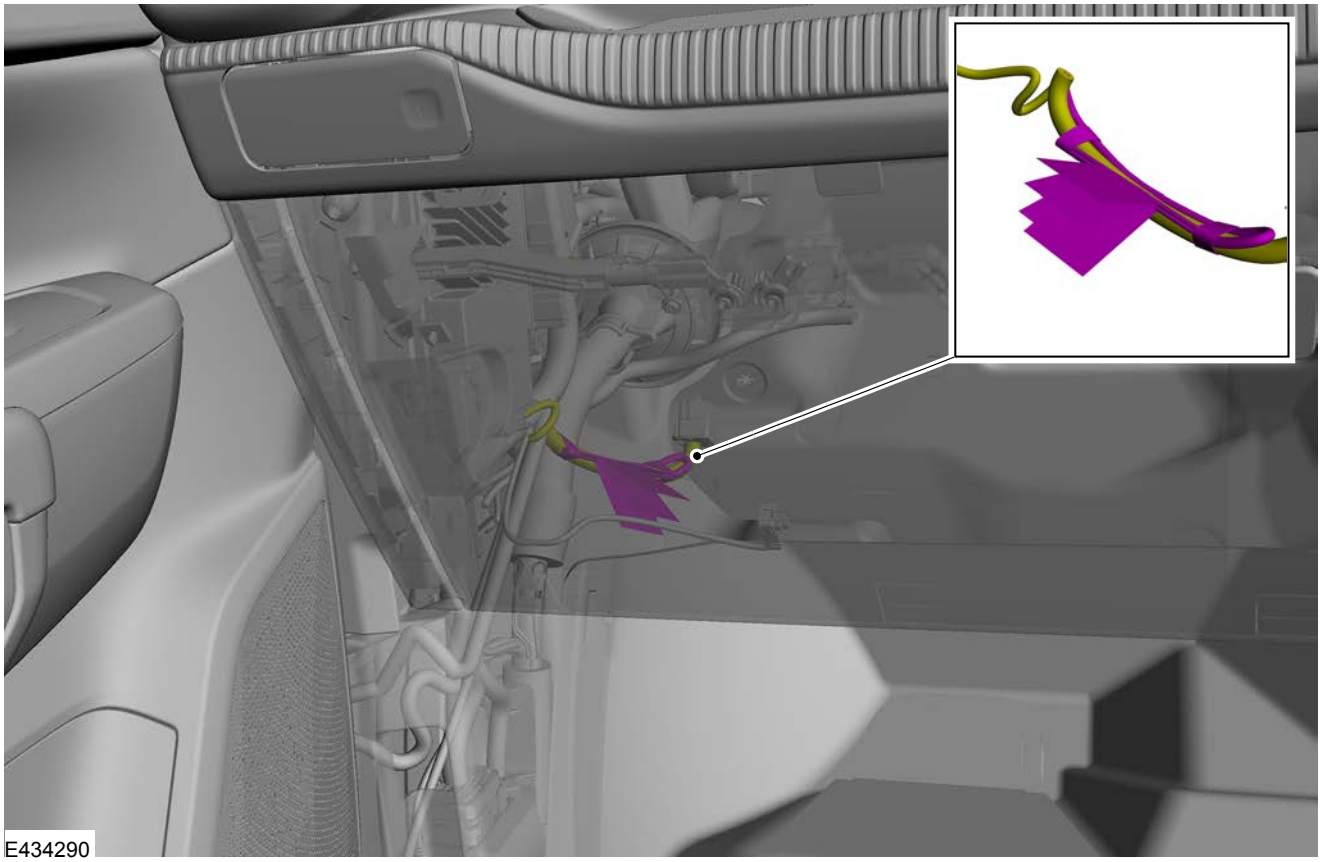
E395304

Item	Description
1	Connector 3, Pin 8 (C3-8) - Auxiliary Camera NTSC Negative (-)
2	Connector 3, Pin 9 (C3-9) - Auxiliary Camera NTSC Positive (+)
3	Connector 3, Pin 18 (C3-18) - optional for shielding/grounding

NOTE: For non-SYNC IV vehicles the following two parts will be needed to connect a non-Ford Camera kit to the IPMA. Please see your Ford Dealer or National Sales Agent to order these parts: Terminal: DU2Z-14474-CA x 3 Connector (shown above): GU5Z-14489-A.

Accessory power for an auxiliary rear view camera can be taken from the battery mounted auxiliary connection terminal or a PBD on an ignition controlled circuit.

Refer to: 4.2 Battery and Cables (page 121).



NOTE: Right Hand Drive vehicle shown, Left Hand Drive vehicle similar.

MY24.5 onwards vehicles built with 360 deg Camera (J3KAH) have auxiliary camera blunt cut wires taped back against the harness behind the glove box near the firewall. There are four labelled wires:

- AUX_CAMERA VIDEO (+) - Wire colour Grey/Violet (GY/VT)
- AUX_CAMERA VIDEO (-) - Wire colour Blue/Orange (BU/OG)
- POWER (+) - Wire colour Yellow/Grey (YE/GY)
- GROUND (-) - Wire colour Black/Yellow (BK/YE)

The Aux Camera button should already be visible in the Camera drop-down of the Sync screen on these vehicles. Earlier build vehicles will require this to be enabled by a Ford Dealer via the "Disable/Enable Trailer Parking Aid Camera" tool in FDRS.

Refer to: 4.2 Battery and Cables (page 121).

4.6 Exterior Lighting

WARNINGS:

Make sure that the modified vehicle complies with all local regulatory standards.

Make sure all electrical connections and wiring comply with local regulatory standards.

CAUTION: Do not use alcohol-based cleaning fluids on or near the tail lamps. Contact with alcohol-based cleaners can cause chemical stress cracking in the lamp lens material. When fitting foils, decals, or wraps, convertors must take appropriate steps (such as masking) to ensure these fluids do not come into contact with the tail lamps.

NOTE: Chassis Cab vehicles are supplied with rear combination lamps and license plate lamps. Where fitted, these lamps must be mounted in accordance with the following guidelines.

Refer to: 4.9 Fuses and Relays (page 206).

4.6.1 Rear Lighting Signal - Vehicles with Loadbox

CAUTION: Attempting to connect aftermarket taillights directly to this circuit may result in non-compliant lighting.

NOTE: For Level 2 and Level 3 taillights the brake (stop) and position (park) functions are on the same circuit (single wire). Both functions are achieved via a 200Hz PWM signal at varying (RMS) voltage levels. Brake (stop) is approximately 14V and Position (park) is approximately 1.4V.

Ford recommends that the separate blunt-cut provisions for brake (Refer to Brake (Stop) Lamps in this section) and position (Refer to Position (Park) Lamps in this section) are used in this situation. Other taillight functions can be taken from the taillight wiring.

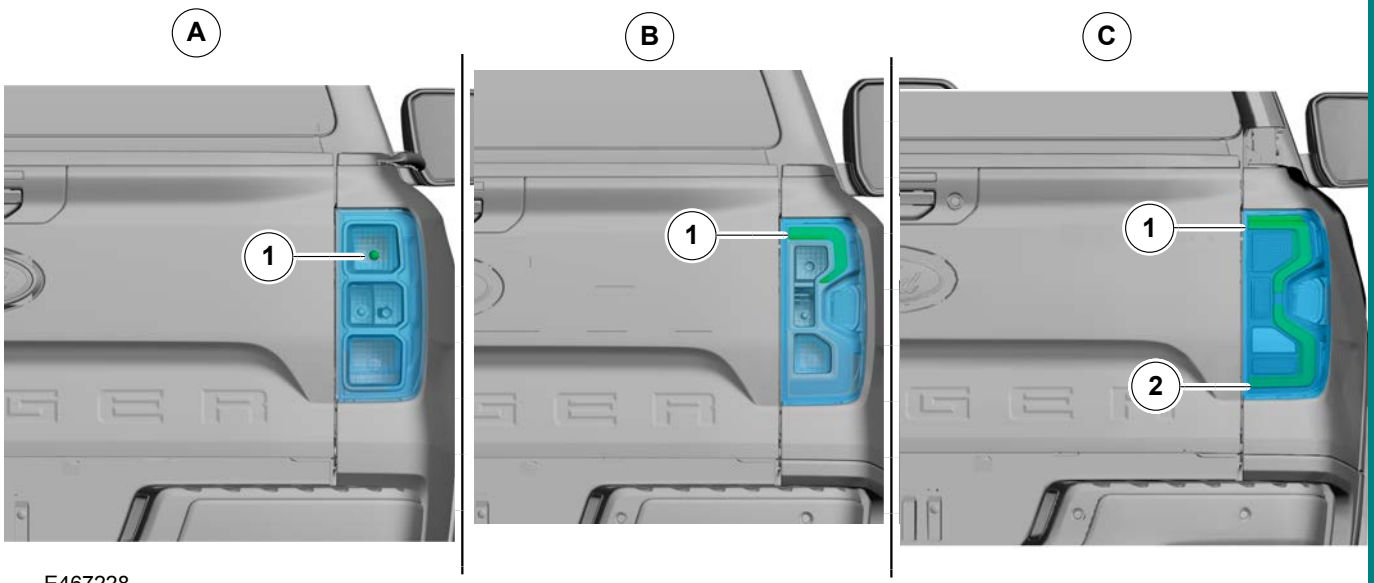
For Level 3 taillights only there is a separate position lamp circuit (for the lower lighting element) which can be used.

Signal Voltage	Bulb	LED
<13.5 ± 0.5V	Battery Voltage	Battery Voltage
>13.5 ± 0.5V	100Hz PWM @ 13.5±0.5 RMS	200Hz PWM @ 13.5±0.5 RMS *

* For Level 3 taillights the direction indicator output is a conventional nominal 12V DC at battery voltage.

Where aftermarket LED taillights are being used in lieu of the original units the use of load resistors may be required to prevent hyper-flash of the direction indicators. Multi-volt (ie. 12/24V) taillights and those with a sequential direction indicator feature are generally not recommended as these may not function as intended on all vehicle types in all markets.

NOTE: For Level 1 and 2 taillights (ie. incandescent direction indicator bulbs) the vehicle detection for a faulty bulb is <5mA. Any current draw above this threshold will not trigger the outage detection warning as it is looking for an open circuit condition. Refer also to ECE R148 for more information regarding lighting outage detection requirements.



E467228

Item	Description
A	Level 1 taillight
B	Level 2 taillight
C	Level 3 taillight
1	Brake (Stop) and Position (Park) Lamp
2	Position (Park) Lamp

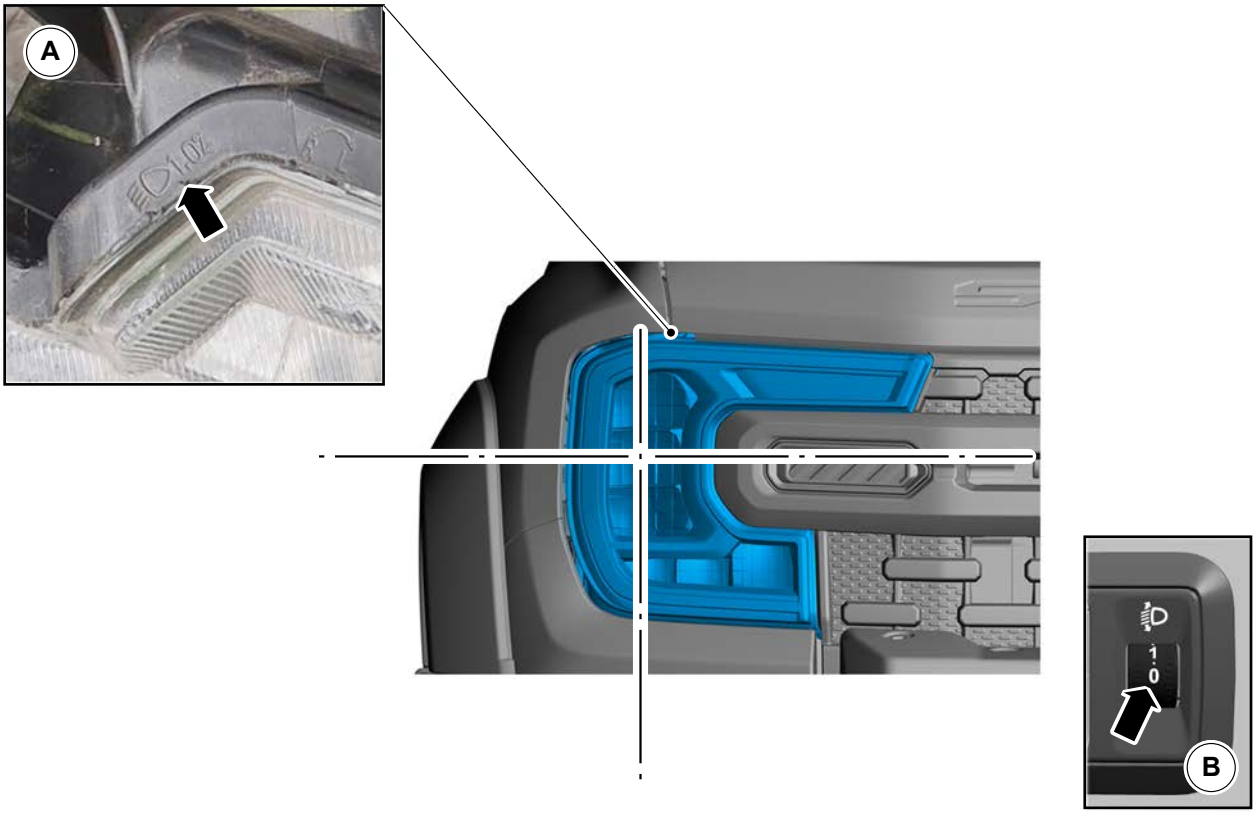
Pin Number	Level 1 Taillight (8 Pin Connector)		Level 2 Taillight (8 Pin Connector) without BLIS	
	Signal	Type	Signal	Type
1	Turn Signal	Bulb	Turn Signal	Bulb
2	Reverse Lamp	Bulb	Reverse Lamp	Bulb
3	Stop Lamp	Bulb	Stop Lamp and Position Lamp	LED
4	-		-	
5	Position Lamp	Bulb	-	-
6	Fog Lamp	Bulb	Fog Lamp	Bulb
7	-		-	
8	Ground		Ground	

Pin Number	Level 2 Taillight (12 Pin Connector) with BLIS		Level 3 Taillight (12 Pin Connector)	
	Signal	Type	Signal	Type
1	Turn Signal	Bulb	Turn Signal	LED
2	Stop and Position Lamp	LED	Stop and Position Lamp	LED
3	Fog Lamp	Bulb	Fog Lamp	LED
4	Reverse Lamp	Bulb	Reverse Lamp	LED
5	ADAS Radar (+)		ADAS Radar (+)	
6	Radar CAN H		Radar CAN H	
7	Ground		Ground	
8	ADAS Radar (-)		ADAS Radar (-)	
9	-		-	
10	-		Park Position	LED
11	-		Turn Indicator outage signal	
12	Radar CAN L		Radar CAN L	

4.6.2 Headlamp Aiming

Prior to checking and/or adjusting the headlamp aim:

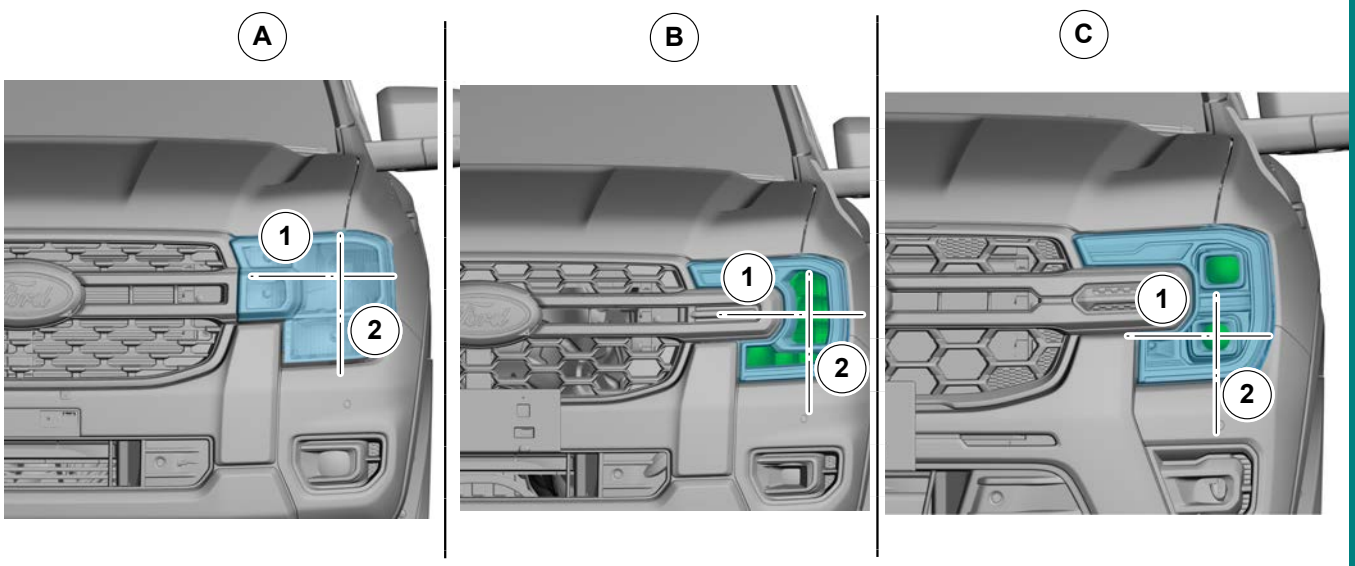
- Ensure that the vehicle is sitting on level ground and at a representative weight and loading distribution (ideally the loading and configuration with the most weight on front axle, least weight on rear axle). Most nose-down attitude.
- Where fitted, zero the headlamp adjuster next to the headlamp switch (per image below).
- Observe the headlamp aim down-angle moulded into the headlamp upper surface (refer images below left). 1.0% example indicates the beam cut-off should drop 10mm for each 1000mm distance from the headlamp.
- Follow the adjustment procedure as defined in the WSM.



E459022

Item	Description
A	Down angle indicator
B	Headlamp leveling switch

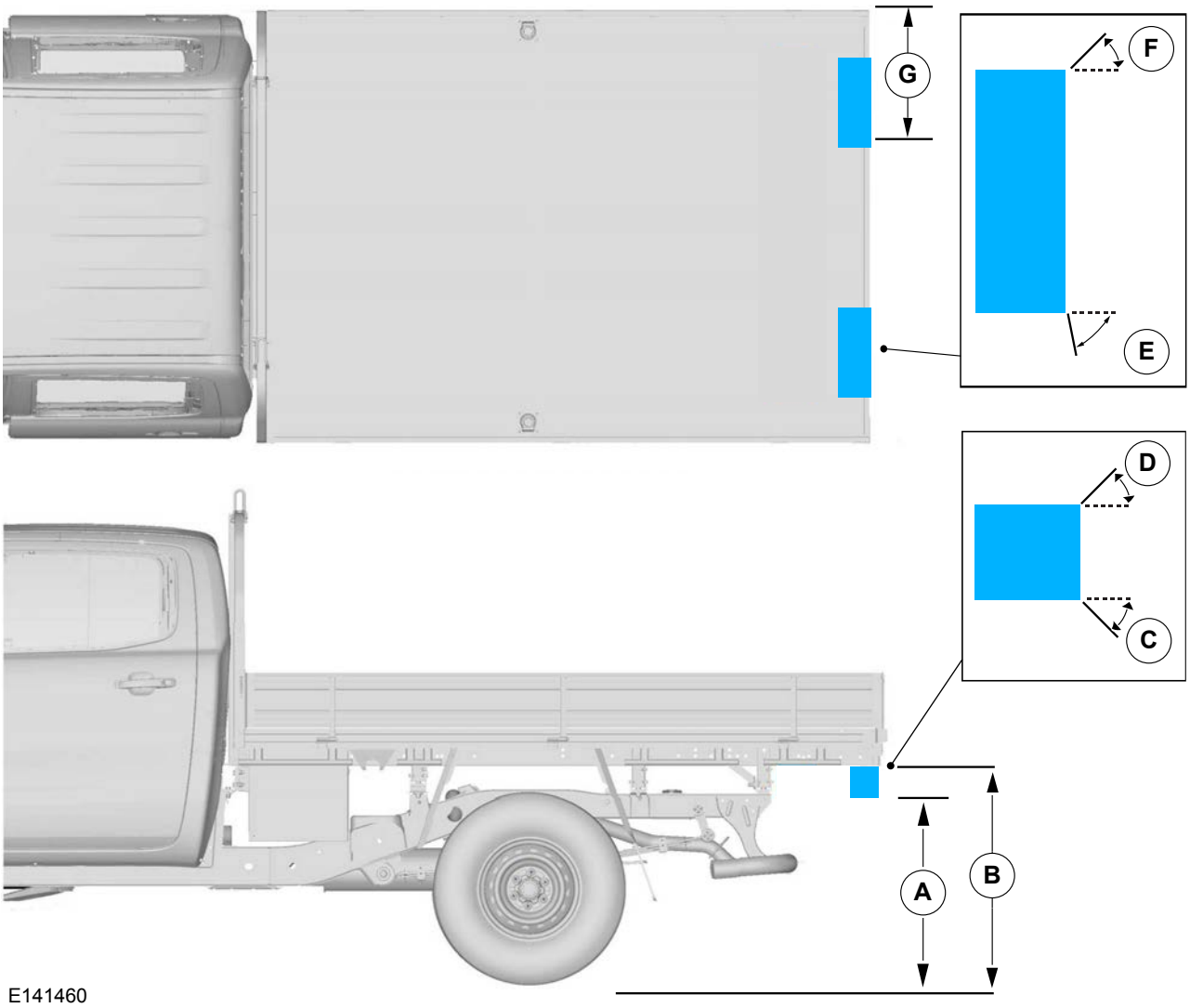
Level 2 headlamp shown.



E467234

Item	Description
1	Horizontal centre line
2	Vertical centre line
A	Level 1 - taken from the headlamp bulb
B	Level 2 - taken from the center of the middle lens
C	Level 3 - taken from the center of the lower projector lens

4.6.3 Rear Combination lamps



E141460

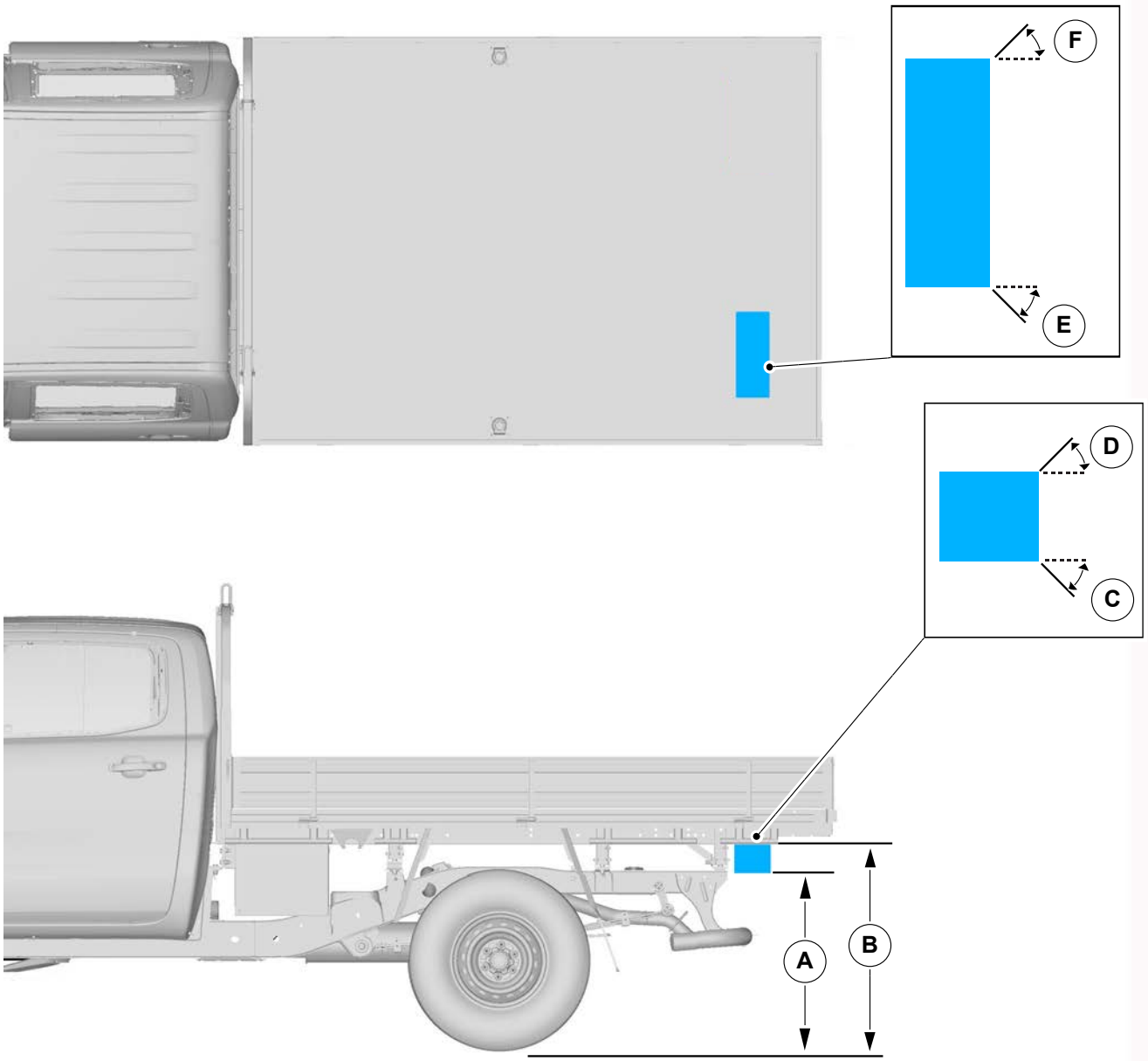
Positioning of Rear Combination Lamps

	Description	Dimension
A	Minimum distance from ground to lower edge of lamp	250mm
B	Maximum distance from ground to upper edge of lamp	1200mm
C	Minimum angle of obstruction free zone downwards of the lamp	15º
D	Minimum angle of obstruction free zone upwards of the lamp	15º
E	Minimum angle of obstruction free zone towards the outside of the vehicle	80º
F	Minimum angle of obstruction free zone towards the centre of the vehicle	45º
G*	Maximum distance from outer edge of vehicle to inner edge of lamp	400mm

* Refer to ECE R48 / ADR43 for more information.

4.6.4 Rear Fog Lamp

NOTE: Where only one rear fog lamp is fitted, it must be positioned on the vehicle centre line, or to the drivers side of the vehicle.

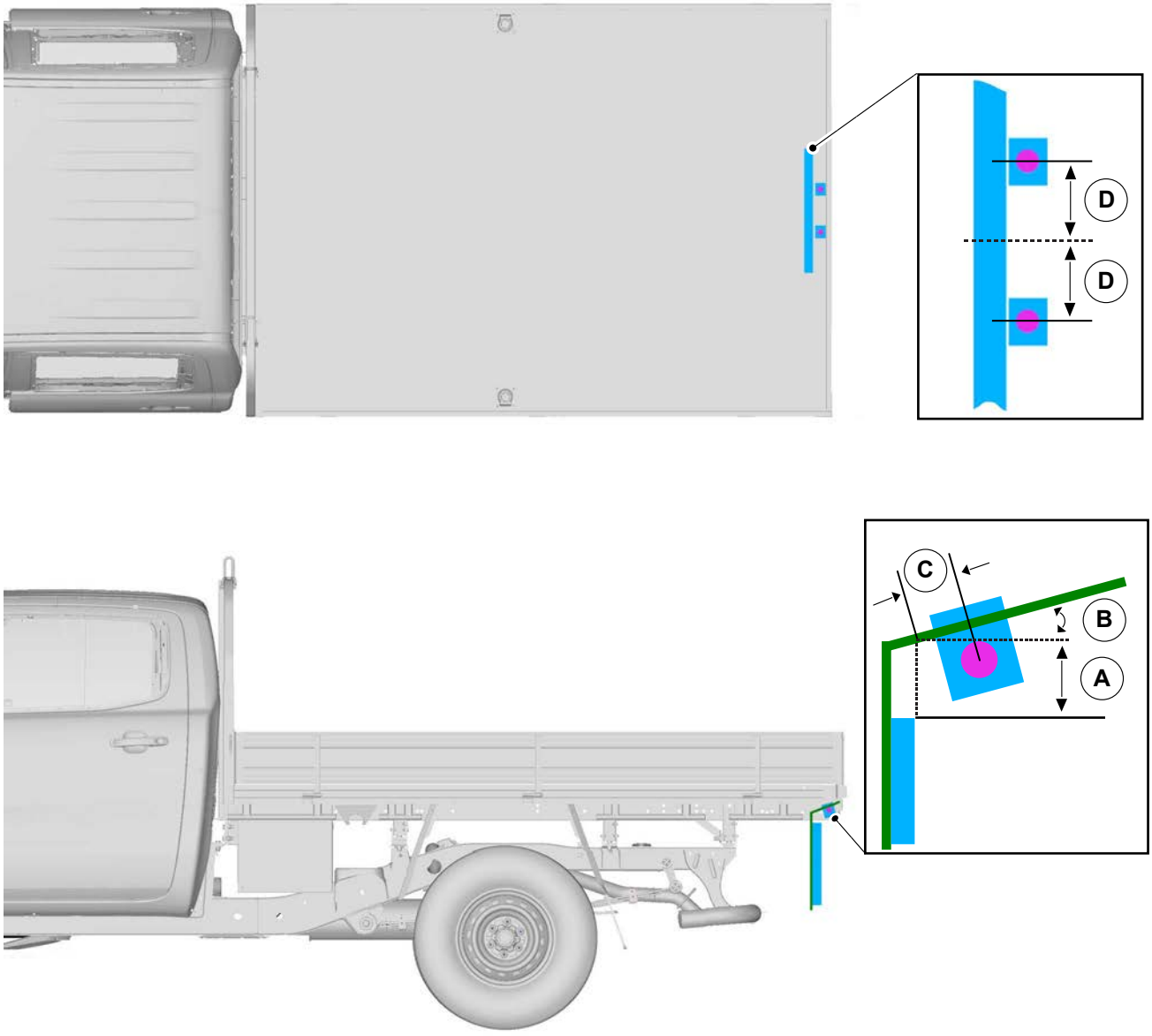


E141472

Positioning of Rear Fog Lamp

	Description	Dimension
A	Minimum distance from ground to lower edge of lamp	250mm
B	Maximum distance from ground to upper edge of lamp	1000mm
C	Minimum angle of obstruction free zone downwards of the lamp	5º
D	Minimum angle of obstruction free zone upwards of the lamp	5º
E	Minimum angle of obstruction free zone towards the outside of the vehicle	25º
F	Minimum angle of obstruction free zone towards the centre of the vehicle	25º

4.6.5 Rear License Plate Lamp



E384684

Positioning of Rear License Plate Lamp

	Description	Dimension
A	Distance from rear face of license plate to centre of lamp along lamp mounting face	35mm
B	Angle between license plate and lamp mounting face	8º
C	Distance between top of rear face of license plate and lamp mounting face	35mm
D	Distance between license plate centre line and centre of lamp	One quarter of licence plate width (min 90mm, max 175mm)

4.6.6 Additional External Lamps

WARNING: Directly splicing into the vehicle wiring in order to install auxiliary lamps or other electrical devices may overload the system and impact the operation of other vehicle systems.

When installing auxiliary tail lamps, Ford recommends that power is provided via the trailer tow module and associated circuitry. For all other additional exterior lamps, power must be taken through an auxiliary fuse box with a suitable switch and / or relay as required.

When installing auxiliary driving lights, power can be provided via a relay energised by the headlamp feed.

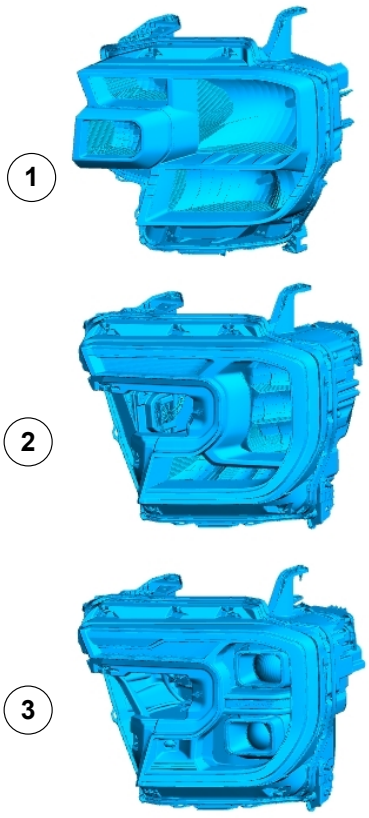
4.6.7 Headlamps - Connection of Auxiliary Driving Lamp Signal

Connection of auxiliary loads to trigger items such as relay driven driving light circuits can be supported.

Three levels of headlamp assembly are available.

NOTE: LH lamp shown, RH lamp similar.

Headlamp Level Identification

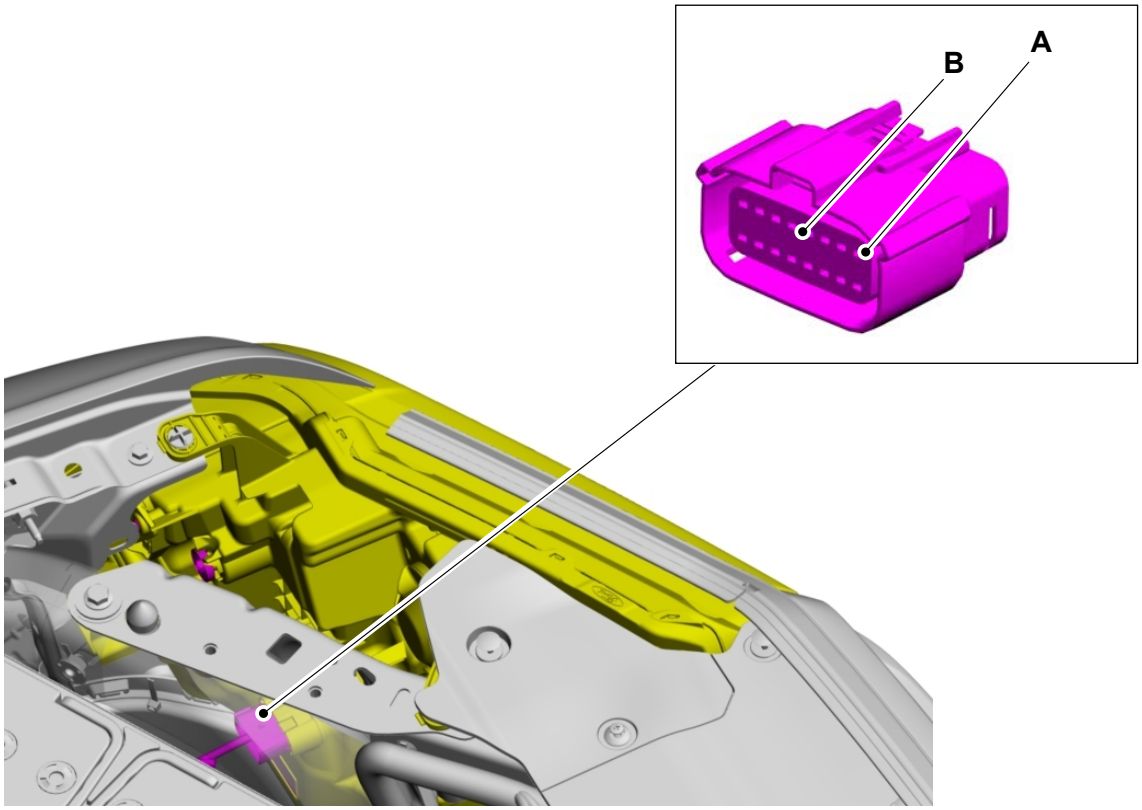


E375898

Item	Description
1	Level 1 (Low Level) Headlamps
2	Level 2 (Mid Level) Headlamps
3	Level 3 (High Level) Headlamps

Connection of auxiliary loads to trigger a relay for solutions such as driving light activation is different for depending on the level of headlamp assembly equipped on the vehicle.

Connection of Auxiliary Loads - Vehicles with Level 1 - Low Level Headlamps



E364521

Item	Description
A	Low beam = Connector C1 Pin 1
B	High beam = Connector C1 Pin 4

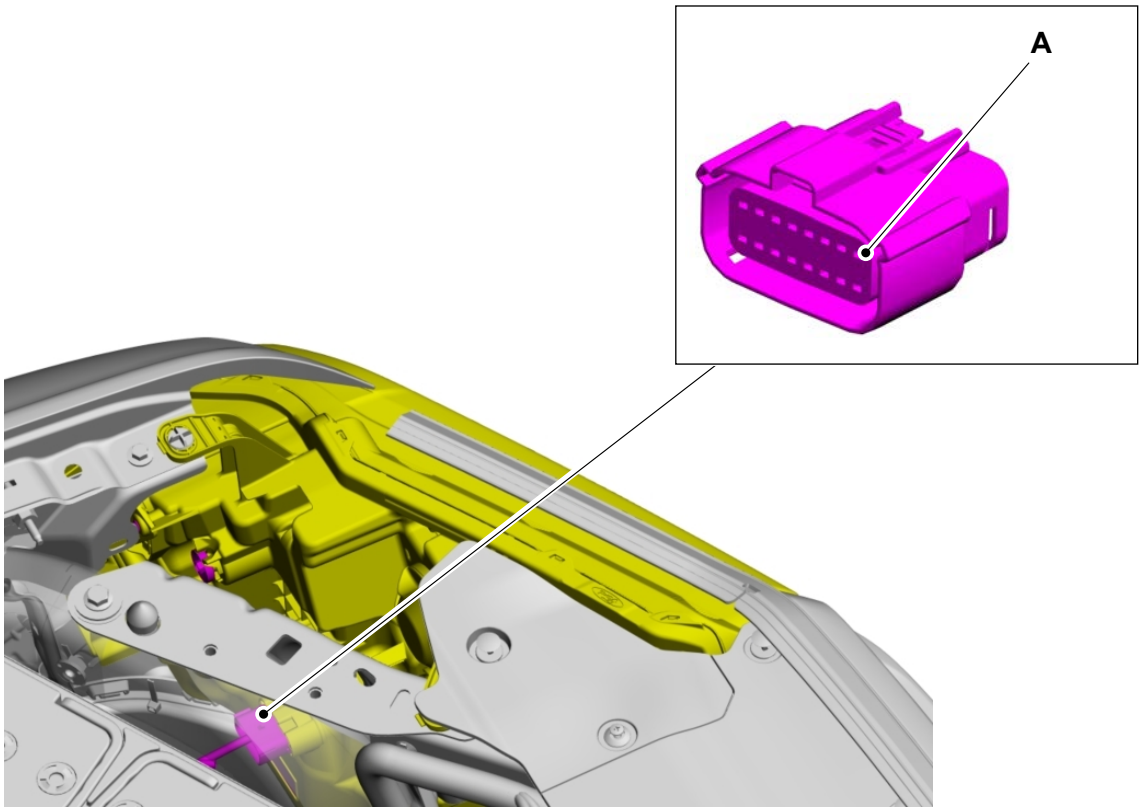
Signals are available on the harness side.

Headlamp Fuse

Lighting Fuses		
F100	20A	Headlamp LH/RH

Connection of Auxiliary Loads - Vehicles with Level 2 - Mid Level Headlamps

Level 2 - Mid Level Headlamps - Low Beam Connection



E375899

Item	Description
A	Low beam = Connector C1 Pin 1

Signals are available on the harness side.

Level 2 - Mid Level Headlamps - High Beam Connection



E375900

CAUTION: Connection of auxiliary loads directly to Level 2 headlamp high beam wiring is not allowable. Damage to the headlamp control components may result.

NOTE: Right Hand Drive vehicle shown, Left Hand Drive vehicle similar.

Connection of auxiliary loads triggered by the Level 2 headlamp high beam being switched on is via a pre-installed blunt cut wire located in the passenger foot well, behind the kick panel on the main harness. A blunt cut wire will be tagged to suit such a connection.

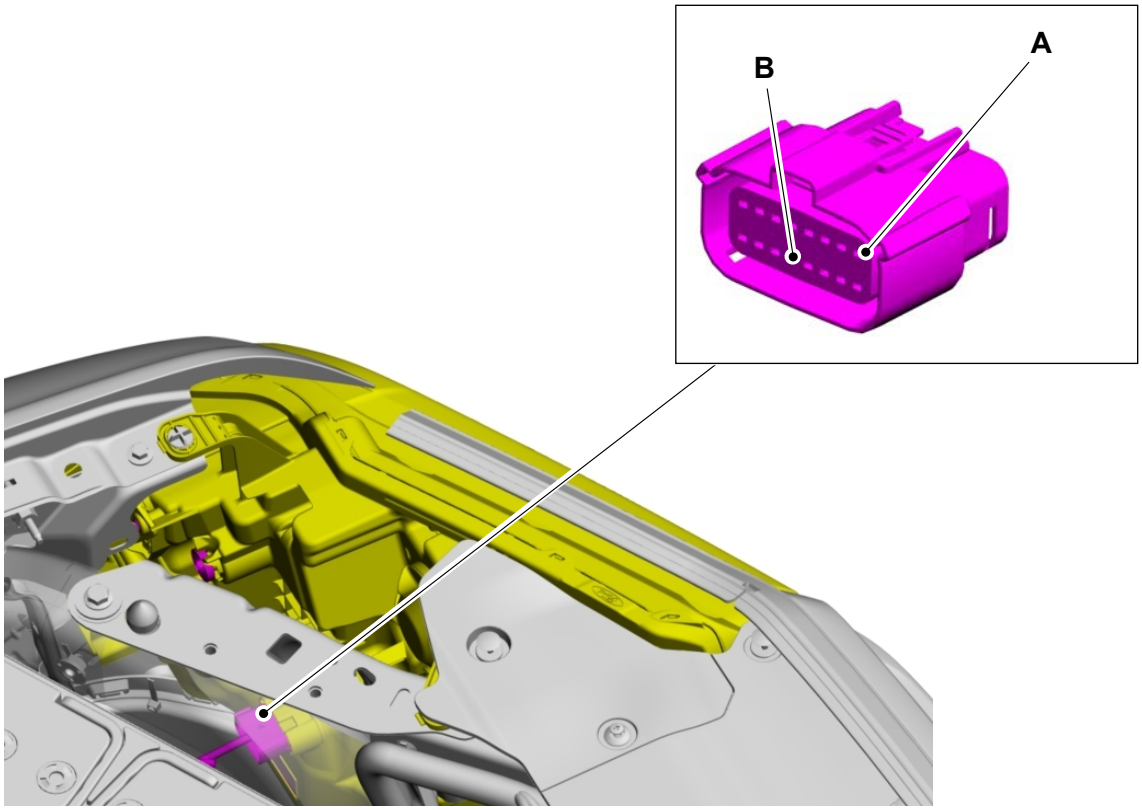
The signal can be used via an external relay for a variety of Convertor applications, subject to load required.

- Wire colour Grey/Brown (GY/BN) - 6 Amps maximum

Headlamp Fuse

Lighting Fuses		
F100	20A	Headlamp LH/RH

Connection of Auxiliary Loads - Vehicles with Level 3 - High Level Headlamps



E376929

Item	Description
A	Low beam = Connector C1 Pin 1
B	High beam = Connector C1 Pin 13

Low beam signal (A) is available on the harness side. High beam signal (B) is available on the headlamp side only. There is no existing wire on the harness side. Insert the appropriate terminal and pigtail wire as required.

A wiring pigtail can be made up and inserted into the Headlamp connector to acquire the High Beam signal (the terminal will accept up to 2mm² wire). This circuit is available at both headlamps.

- Wiring terminal service part: DU2Z-14474-DC (Molex MX150 series)

NOTE: The Glare-Free Lighting function will also control this High Beam signal output. If the system recognises an illuminated area that needs to be masked it will switch this circuit off. The circuit will only be active when full high beam (utilising all lighting elements) is operating. Manual operation of the High Beam function, including flash-to-pass, will also trigger this circuit accordingly.

NOTE: This signal, under no load, will have a constant 12V output at very low current irrespective of high beam status. Pin-point (back-probe) testing via a multi-meter will show a constant 12V and no switching. For the signal to operate correctly it requires a small load to be applied (~60mA minimum). Maximum output is 350mA.

NOTE: Conventional electro-mechanical relays must be used on this circuit. MOS-FET or Optocoupler type relays will not provide the required load to activate the circuit.

Headlamp Fuse

Lighting Fuses		
F100	20A	Headlamp LH/RH

4.6.8 Brake (Stop) Lamps

Provision for additional Brake (Stop) Lamps is available via a blunt cut wire located behind the kick panel on the inside of the vehicle A-pillar.

- Wire colour Yellow/Grey (YE/GY) - 1.75 Amps maximum

This output is a conventional nominal 12V DC feed at battery voltage for vehicles originally specified as cab-chassis (incomplete) vehicles.

This output is limited to 13.5 ±0.5 V via 200Hz PWM for vehicles originally specified with a sheetmetal loadbox (with tailgate). Below 13.5 ±0.5 V the signal is a conventional nominal 12V DC at battery voltage.

- FDDAA = Less Brake Control (**With** Stop Blunt Cut provision)
- FDDAD = Integrated Brake Control (**Without** Stop Blunt Cut provision)
- FDDAE = Brake Control Prep Pack (**Without** Stop Blunt Cut provision)

4.6.9 Position (Park) Lamps



E387821

A Position (Park) lamp signal is available as a blunt cut wire taped back against the harness branch located behind the kick-panel on the LHS A-Pillar.

- Wire colour Blue/Grey (BU/GY) - 4.7 Amps maximum

This output is a conventional nominal 12V DC feed at battery voltage.

4.6.10 Reversing Lamps, Rear View Camera, Reversing Alarm (Manual Transmission)

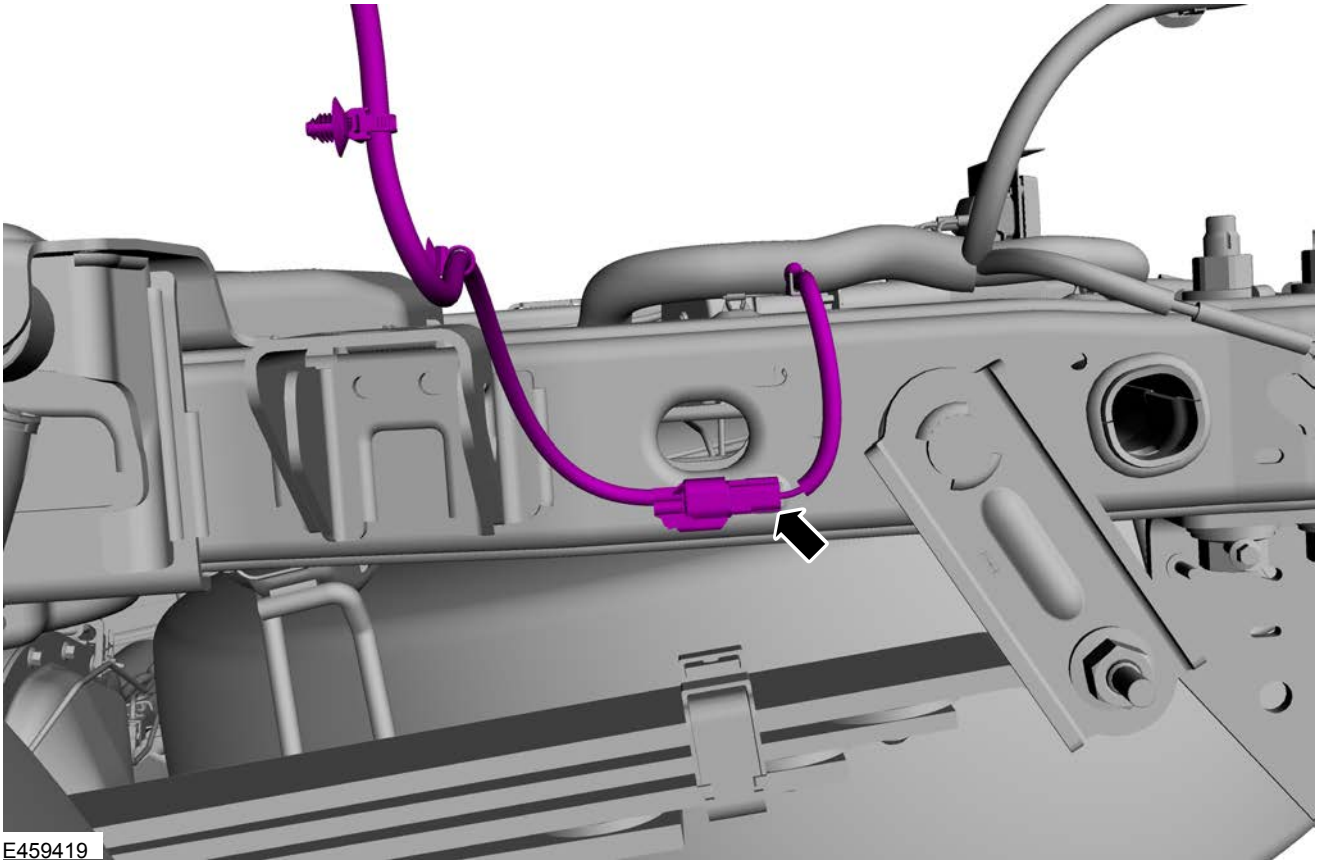
The reverse lamps are activated by the reverse switch on the transmission. A marginal increase in current (via a relay or buffered electrical input) is permissible to provide power to a rear-view camera, auxiliary reverse lighting, or an audible warning device.

4.6.11 Loadbox / Tub - Lighting Connections (if available)

The loadbox / tub lighting circuit is controlled via zone lighting on the centre screen.

- Wire colour White/Green (WH/GN) - 1.6 Amps maximum (both sides combined)

The loadbox / tub light lamp signals are available on each side of the chassis frame.



NOTE: LHS Shown, RHS Similar

4.6.12 Trailer Towing - Lighting Connections

WARNING: Installation of aftermarket trailer tow electrical kits or directly splicing into the vehicle wiring in order to install trailer lamps or other electrical devices may overload the system and impact the operation of other vehicle systems.

Refer to: 2.3 Brake System (page 78).

Ford recommends that all trailer tow electrical connections use the genuine Ford accessory trailer tow kit.



E387821

NOTE: This trailer brake wire provides a pulsed brake signal of varying frequencies, not a direct (DC) signal.

A Trailer Brake signal is available as a blunt cut wire taped back against the harness branch located behind the kick-panel on the LHS A-Pillar.

- Wire colour Yellow/Grey (YE/GY) - 2.1 Amps maximum

Trailers Equipped with LED (light emitting diode) lamps

Most trailers, caravans, camper trailers etc are now fitted with LED lamps. There are many different sizes, configurations & quality in the market place.

The Trailer Tow Module (TTM) can support pure LED trailer lamps as long as each circuit exceeds 500mA, below this and the system will not detect a trailer has been connected and shuts down all outputs (sleep mode). It is recommended to target a 550mA minimum load to allow for system tolerances.

If the LED lamps on the trailer fall outside specific tolerances, customers can experience the following symptoms on the vehicle when LED trailer lamps are connected to the vehicle:

- LED trailer lamps flickering when lamps are not in use
- DAT (Driver Aid Technology) not being disabled
- Rear park sensors (where fitted) continually fire in Reverse gear when a trailer is connected to the vehicle
- Vehicle does NOT acknowledge that a trailer has been connected when it has (either through Icon on centre screen OR message on the instrument cluster Multi-Function display)
- "Check trailer park lamps" OR "Check trailer brake lamps" warnings appear on the instrument cluster Multi-Function display

In order to correct this, supplemental load resistors would need to be used to meet the target system tolerances.

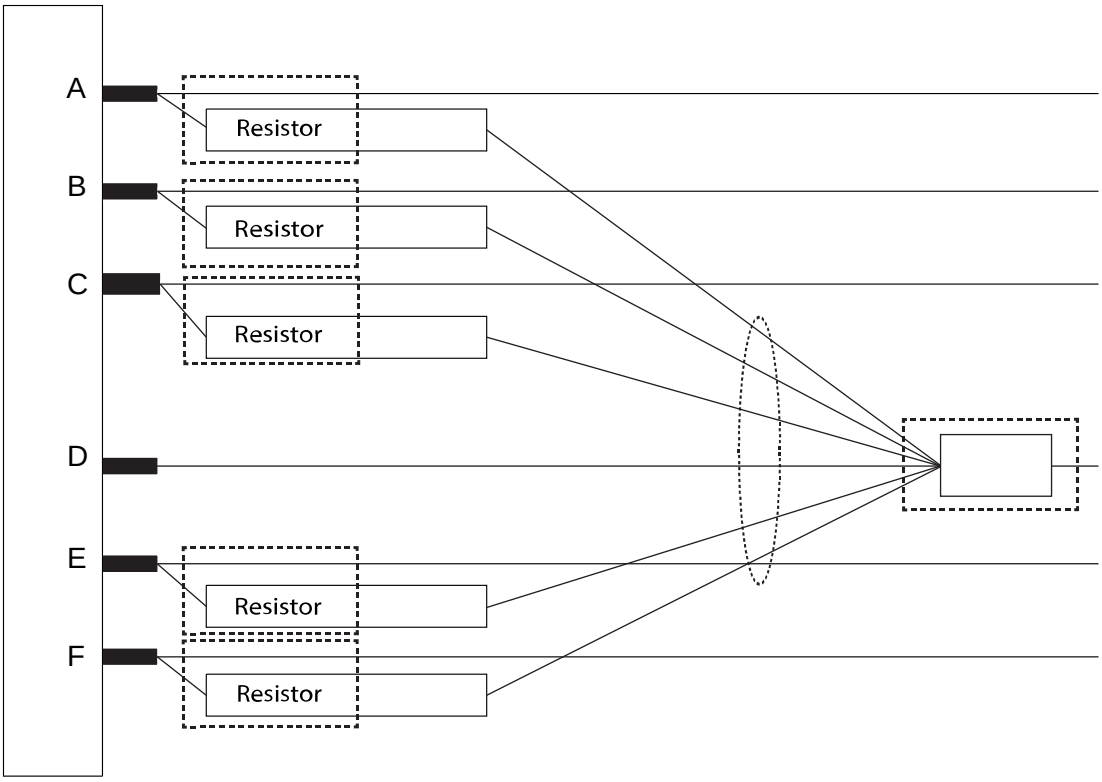
CAUTION: Do not connect the patch harness to the vehicle when the trailer is not connected.

NOTE: A RESISTOR PATCH HARNESS should be used between the vehicle & the trailer to address these issues (12 Pin example below).



E371558

The Resistor Patch Harness consists of multiple 2W, 120 Ohm resistors as shown in the schematic below. This could also be incorporated directly into the trailer-side wiring if a more permanent solution is desired. Do not apply this to the vehicle-side wiring. This should only be in effect when a trailer is connected.



E434083

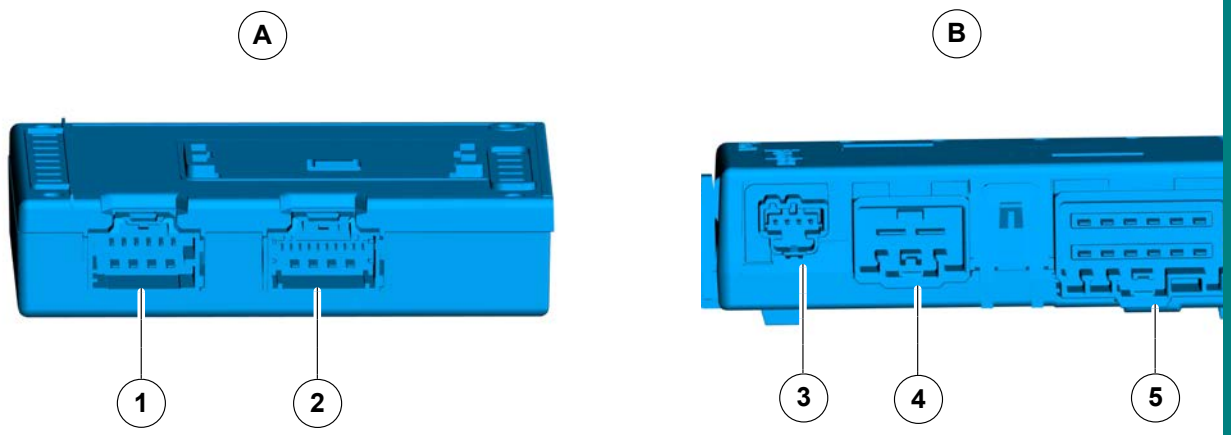
Item	Description
A	LH turn indicator lamp
B	RH turn indicator lamp
C	Stop / brake lamps
D	Ground
E	RH tail lamp (where applicable)
F	Tail lamps (all or LH where applicable)

Trailer Towing Lighting Connection - System Recommendations

NOTE: Not all features and outputs are supported in all markets. Refer to your authorised Ford Dealer for further information.

NOTE: The trailer detect circuit is part of the Ford Trailer Tow module, it can only be implemented on vehicles with power locking and perimeter or CAT 1 alarms.

Each output driver can handle a current of 15A but it is not recommended to always run to this maximum. A higher current is interpreted as short circuit. If a short circuit is detected the related output will be switched off. The following table shows the recommended output maximums per circuit.



E467231

Item	Description
A	Trailer Tow Module (Later type - 2 connector module)
B	Trailer Tow Module (Early type - 3 connector module)
1	J6 Connector (C2498A 10-Pin)
2	J3 Connector (C2498A 14-Pin)
3	B Connector (C2496C 4-Pin)
4	A Connector (C2496B 2-Pin)
5	C Connector (C2496A 12-Pin)

Trailer Tow Module Connections (early type - 3 connector module)

Connector Number	Trailer Tow Connector		Feature	Max Current @ 12.5V
	Colour	Gauge (mm^2)		
A Connector (C2496B 2-Pin)				
1	-	-	Battery +ve Fuse 87 (40A) BJB	-
2	-	-	Battery +ve Fuse 73 (30A) BJB	-
B Connector (C2496C 4-Pin)				
1	-	-	Ground	1
2	-	-	CAN L	0.1
3	-	-	CAN H	0.1
4	-	-	Not used	-
C Connector (C2496A 12-Pin)				
1	Yellow (YE)	1.5	Left Turn Signal	3
2	Green (GN)	1.5	Right Turn Signal	3
3	Brown (BN)	1.5	Position Lamps	7
5	Black (BK)	1.5	Reverse Lamp	4
6	Orange (OG)	2.5	Battery Charging - where used	10
7	Red (RD)	1.5	Stop Lamps	4
8	Grey (GY)	1.5	Fog Lamp	2
9	-	-	Not used	-
10	-	-	Not used	-
11	-	-	Not used	-
12	-	-	Not used	-

For vehicles fitted without a tow bar as standard, a genuine Ford accessory trailer tow electrical kit has been developed to enable a tow bar to be installed. The kit comprises of the trailer towing control module, trailer plug, wiring and associated hardware components. Once the kit is installed, the vehicle must then be configured using a Ford FDRS diagnostic tool. This configuration can be performed by your Ford authorised dealer.

Trailer Towing Lighting Connection - System Recommendations

NOTE: Not all features and outputs are supported in all markets. Refer to your authorised Ford Dealer for further information.

NOTE: The trailer detect circuit is part of the Ford Trailer Tow module, it can only be implemented on vehicles with power locking and perimeter or CAT 1 alarms.

Each output driver can handle a current of 15A but it is not recommended to always run to this maximum. A higher current is interpreted as short circuit. If a short circuit is detected the related output will be switched off. The following table shows the recommended output maximums per circuit.

Trailer Module Connections (later type - 2 connector module)

Connector Number	Trailer Tow Connector		Feature	Max Current @ 12.5V
	Colour	Gauge (mm^2)		
J6 Connector (C2498A 10-Pin)				
1	Yellow (YE)	1.5	Left Turn Signal	3
2	Green (GN)	1.5	Right Turn Signal	3
3	n/a	n/a	Trailer Detect - Perimeter Alarm	-
5	Grey (GY)	1.5	Rear Fog Lamp	2
6	Black (BK)	1.5	Reverse Lamp	4
7	Red (RD)	1.5	Stop Lamps	4
9	Brown (BN)	1.5	Position Lamps	7
J3 Connector (C2498A 14-Pin)				
12	Orange (OG)	2.5	Battery Charging - where used	15
14	Blue (BU)	1.5	Trailer Brake Control	24*
Additional				
n/a	Pink (PK)	2.5	12V Power (B+) - Battery (PAAT)	15**
n/a	White (WH)	2.5	Ground	-
n/a	White (WH)	4.0	Ground	-

All values above represent the engine-on operating condition.

* If the detected current is less than 4A while actively braking the vehicle may show a "Trailer Disconnected" warning (indicating that an element of the trailer braking system may not be functioning correctly).

** 15A is available @ 12.5V. Higher current draws are possible as it is a direct connection to the battery (PAAT) via the PDB, however the voltage drop will increase accordingly. This circuit is fused at 30A.

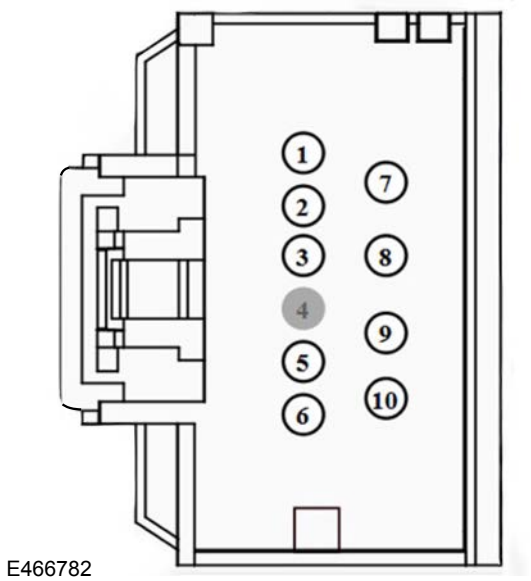
The vehicle power supply system voltage can vary between 7 and 16V during normal operation.

Any equipment connected to these circuits should be robust to this range.

The trailer module can be located:

– (Right Hand Drive) beside the glovebox opening, located above the LH kickpanel.
– (Left Hand Drive) beside the glovebox opening, located above the RH kickpanel.

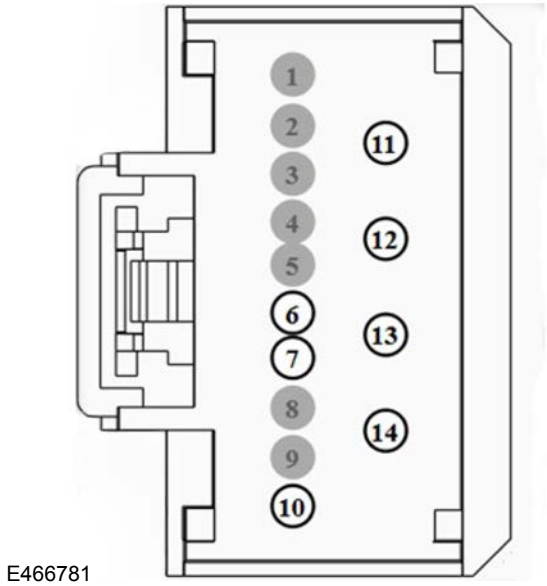
J6 Connector (C2498A 10-Pin) - Harness Side



E466782

NOTE: The Grey Pins in the image indicates unused and empty pins at the connector.

J3 Connector (C2498A 14-Pin) - Harness Side



NOTE: The Grey Pins in the image indicates unused and empty pins at the connector.

For vehicles fitted without a tow bar as standard, a genuine Ford accessory trailer tow electrical kit has been developed to enable a tow bar to be installed. The kit comprises of the trailer towing control module, trailer plug, wiring and associated hardware components. Once the kit is installed, the vehicle must then be configured using a Ford FDRS diagnostic tool. This configuration can be performed by your Ford authorised dealer.

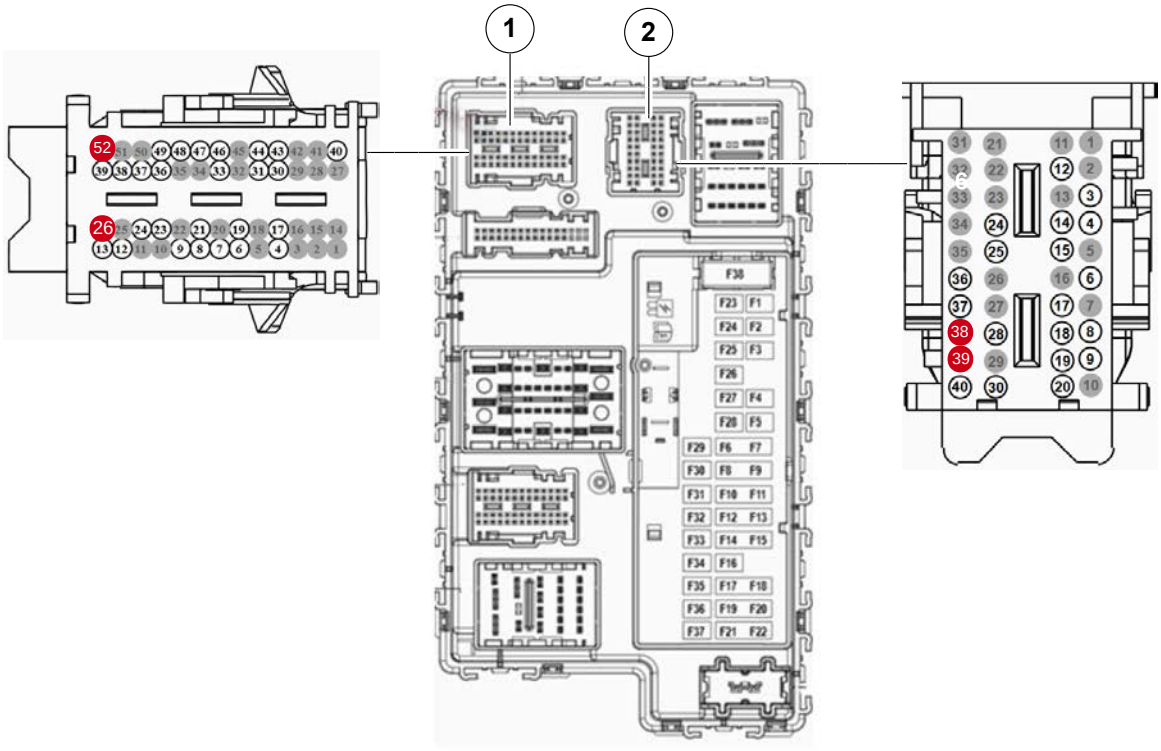
4.6.13 Lamps – Hazard / Direction Indication

The maximum permissible load with the standard system is:

- 3 x 5W – front and rear indicators + side repeaters (Left Hand Side)
- 3 x 5W – front and rear indicators + side repeaters (Right Hand Side)

NOTE: The maximum output of the turn/hazard signal BCM outputs is 3.2 amps.

Turn/Hazard lamp signals are available as an output from the BCM.



E364606

Item	Description
1	BCM Connetor J5 (C2280E)
2	BCM Connector J6 (C2280F)
J5 Pin 52 (C2280E)	RH Rear Turn Signal Output
J5 Pin 26 (C2280E)	LH Rear Turn Signal Output
J6 Pin 38 (C2280F)	RH Front Turn Signal Output
J6 Pin 39 (C2280F)	LH Front Turn Signal Output

4.6.14 Interior Lamps



E387821

An Interior Lamp signal is available as a blunt cut wire taped back against the harness branch located behind the kick-panel on the LHS A-Pillar.

- Wire colour Grey/Violet (GY/VT) - 3.5 Amps maximum

4.6.15 Electrically Operated Door Mirrors

WARNING: Do not tamper with the base system (controlled by Central Junction Box and multiplex architecture) and any feeds taken from the associated wiring or controller.

NOTE: These options are not suitable for aftermarket or converter modification.

4.6.16 Centre High Mount Stop Lamp (CHMSL)

NOTE: When replacing the factory fitted CHMSL with a canopy mounted CHMSL, the same type must be used. Replace a bulb/incandescent type only with a bulb/incandescent. Replace an LED type only with an LED type.

NOTE: The maximum current load that can be applied to the CHMSL circuit is 2.5A for either incandescent globes or LED lamps. Do not exceed the rated load.

Centre High Mount Stop Lamp (CHMSL) usage must comply with ECE R48-04 or local regulations.

When installing a canopy equipped with a CHMSL, a feed for the CHMSL can be taken from the BCM (Connector J5, C2280E Pin 13).

4.6.17 Automatic High Beam Control

NOTE: The automatic high beam control feature will not function, or performance may be degraded if any conversion or installation is in the field of view of the front camera.

NOTE: The automatic high beam control feature will not function, or performance may be degraded if the vehicles ride height is increased, or decreased, or if the pitch of vehicle is modified.

Be aware, when no headlamp switch Auto Position is available (or Auto is not selected on the original switch), auto high beam control (provided with forward vision camera) will not be available or shown in the cluster.

4.6.18 Glare Free High Beam

NOTE: The glare free high beam feature will not function, or performance may be degraded if the vehicles ride height is increased, or decreased, or if the pitch of vehicle is modified.

NOTE: The glare free high beam feature will not function, or performance may be degraded if any conversion or installation is in the field of view of the front camera.

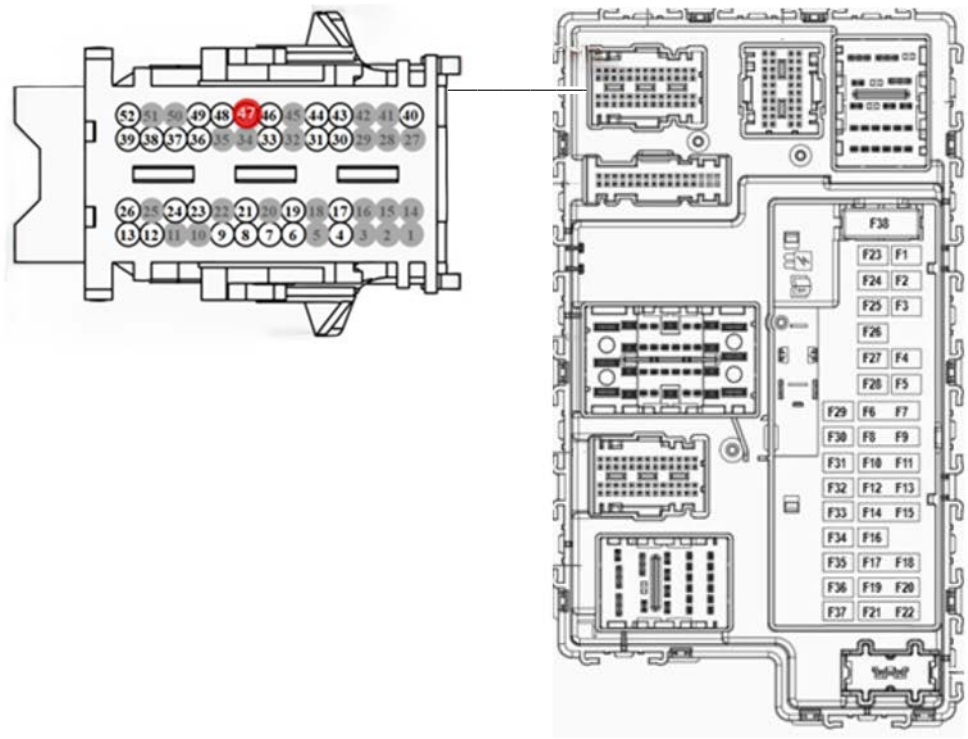
Be aware, when no headlamp switch Auto Position is available (or Auto is not selected on the original switch), glare free high beam (provided with forward vision camera) will not be available or shown in the cluster.

4.6.19 Handbrake Signal

NOTE: On vehicles built with EPB there is no handbrake signal available. This system is controlled via CAN.

NOTE: Vehicles without EPB the handbrake signal can be obtained at the BCM Connector J5 (C2280E - pin 47).

Connector J5 (C2280E - pin 47) - Harness side



E466833

NOTE: The Grey Pins in the image indicates unused and empty pins at the connector.

4.7 Driver Assist Technology

4.7.1 Adaptive Cruise Control

CAUTION: For converted vehicles fitted with adaptive cruise control where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment system functionality is checked by a Ford dealer. For further information refer to Owner's Manual.

NOTE: Do not obstruct the cruise control radar, including the clearance zone. Any obstruction can block the radar from being able to detect objects in front of the vehicle.

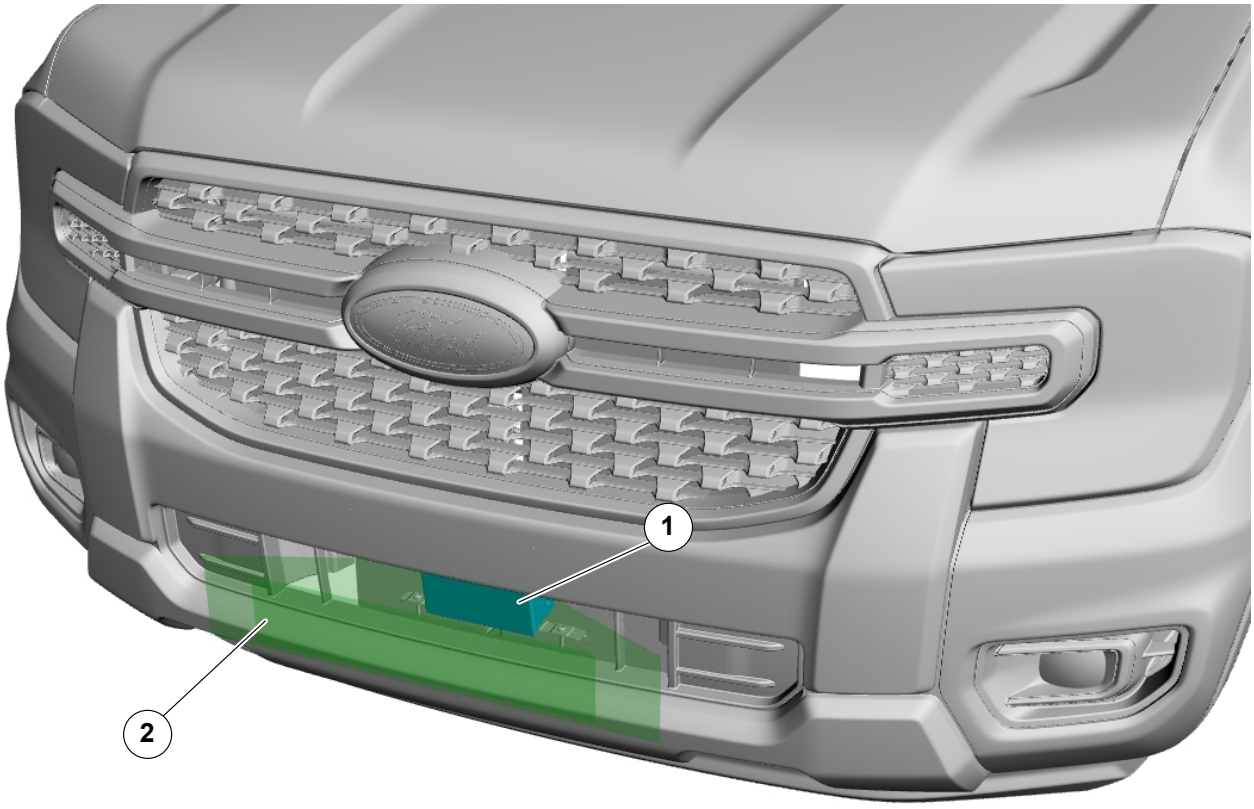
NOTE: Do not paint the front grille of the vehicle as this may affect the functionality of the cruise control radar. Different paint types and colours can have different effects on the radar beam and performance cannot be guaranteed.

NOTE: Do not alter the lower grille design as this will degrade the performance of the cruise control module.

NOTE: Do not move / change the location of radar as this will drastically degrade the performance of the cruise control module and its ability to detect objects reliably.

NOTE: Do not change / alter the mass and shape of the radar in such a way that it will change the radar pitch. Any changes in the radar pitch will deteriorate the efficiency of cruise control module either by decreasing the maximum detection range of the radar, its ability to detect high or low targets or its ability to detect objects without obstruction.

NOTE: Do not change or remove the radar cover as this will impact radar performance. This cover has been specifically designed to have minimal interference with the radar beam. Removing the cover opens the radar to environmental factors such as rain, road spray, snow and mud, and radar performance and long term durability of cannot be guaranteed.



E365398

Item	Description
1	Adaptive Cruise Control Module
2	Adaptive Cruise Control Radar Clearance Zone

4.7.2 BlueCruise

CAUTION: For converted vehicles fitted with adaptive cruise control, where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment and system functionality is checked by a Ford dealer. For further information refer to Workshop Manual or Owner's Manual.

NOTE: Do not obstruct the cruise control radar or front short range radars. If the radars are obstructed, Adaptive Cruise Control or Pre-Collusion Assist functionality may be affected.

NOTE: Do not paint the front grille of the vehicle as this may affect the functionality of the cruise control radar.



Item	Description
1	Radar housed in Left side of the front bumper
2	Radar housed in Right side of the front bumper

4.7.3 Advanced Driver Assist Technology (ADAS)

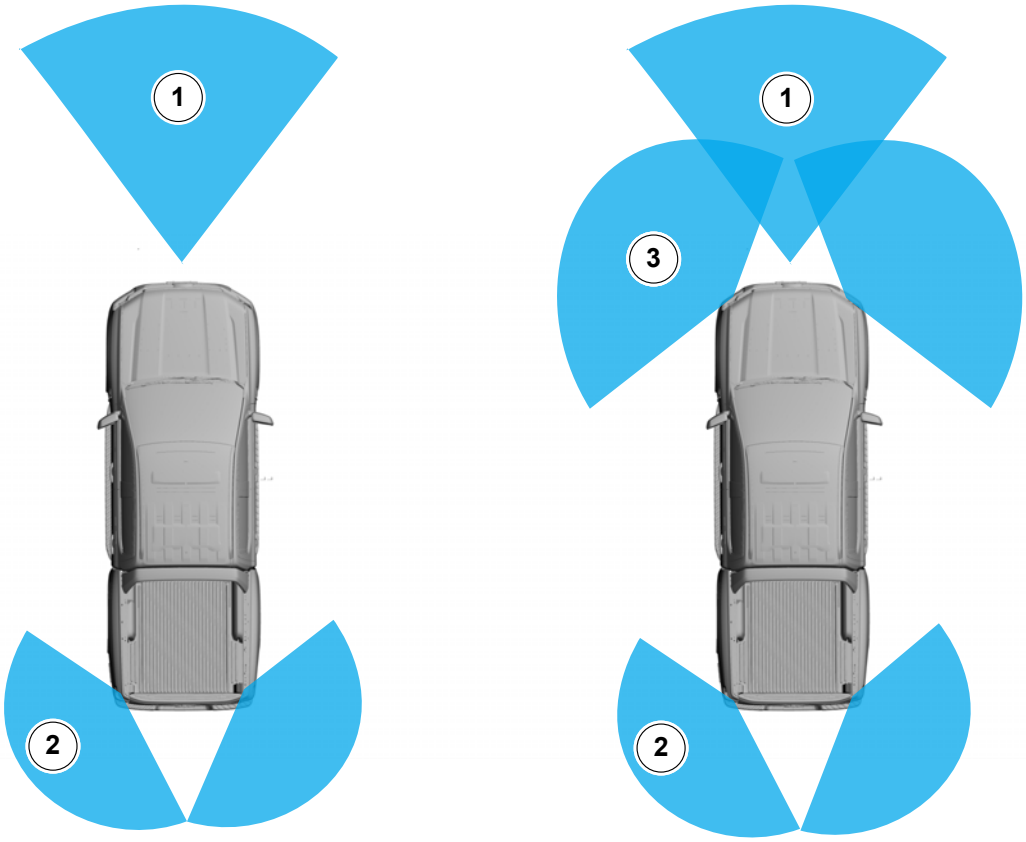
WARNING: Modifications that affect the operation and alignment of driver-assist technologies may cause system malfunction and the potential for road accidents/injury and or death. Do not modify the Ford Driver Assist components.

Ford Driver Assist Technology is a suite of driver-assist technology features that variously utilize a radar and/or camera system. The radar and camera systems help provide features such as:

- Pre-Collision Assist with Automatic Emergency Braking (AEB)
- Forward Collision Warning
- Lane Keeping System
- Lane Departure Warning
- Automatic High Beam
- Glare Free High Beam
- Adaptive Cruise Control with Stop-and-Go and Lane Centering Assist
- Pro Trailer Backup Assist (PTBA)

- BlueCruise™ semi-autonomous
- BLIS (Blind Spot Information System) with cross-traffic alert, trailer-tow monitoring and Lane Change Warning and Aid.

Driver Assist Radar Zones



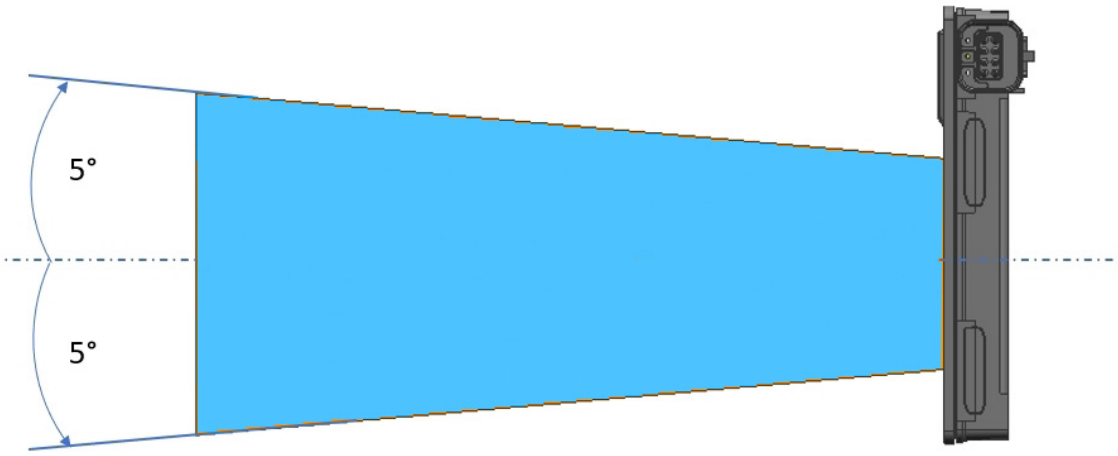
E467232

Item	Description
1	Adaptive Cruise Control Radar - Medium range
2	BLIS Radar - Short range
3	BlueCruise™ Radar - Short range

CAUTION: During any conversion work if the radar and cameras are disconnected and the vehicle battery is also disconnected, the radar and cameras must be re-connected before the vehicle battery is re-connected. Failure to follow these steps will cause error lights and fault codes, you may need to visit a Ford Dealer to have these error codes removed.

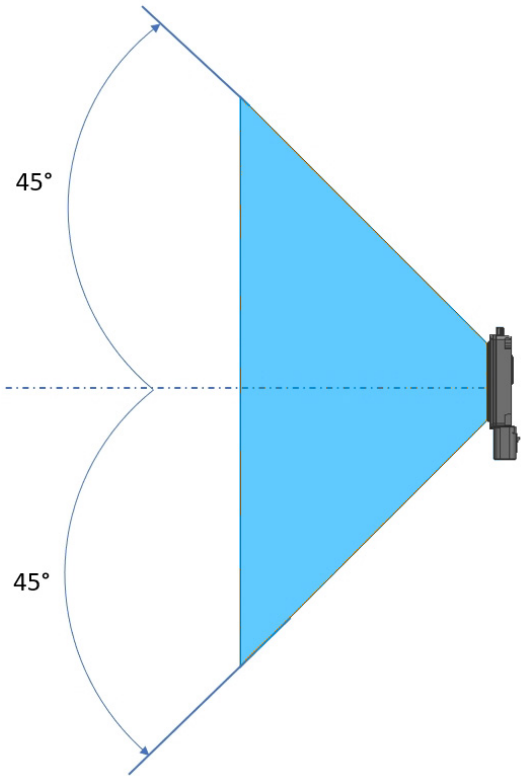
Installed upfitter equipment should not infringe on the radar or camera view zones. The CAD files of the radar and camera view zones are available upon request via the Ford BBAS web site (www.fordbbas.com/contactus) or consulting your local Ford Dealer or National Sales Representative.

Radar View Zone - Side View



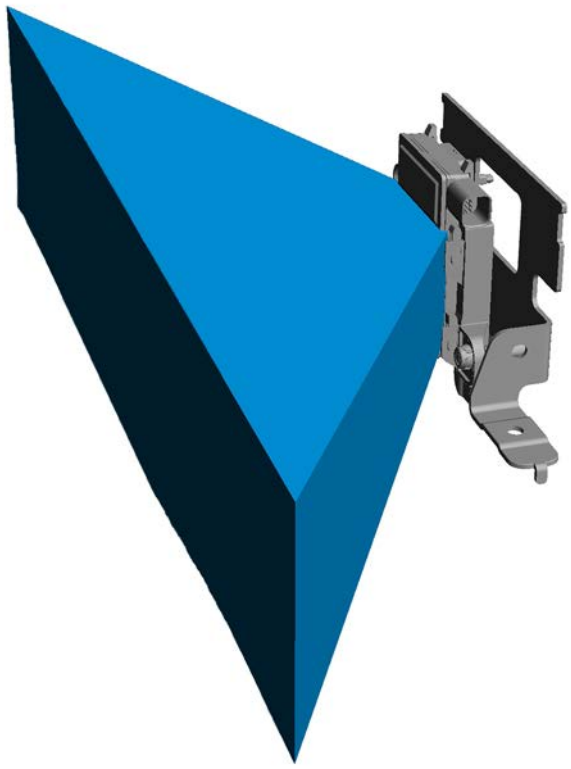
E375774

Radar View Zone - Plan View



E375767

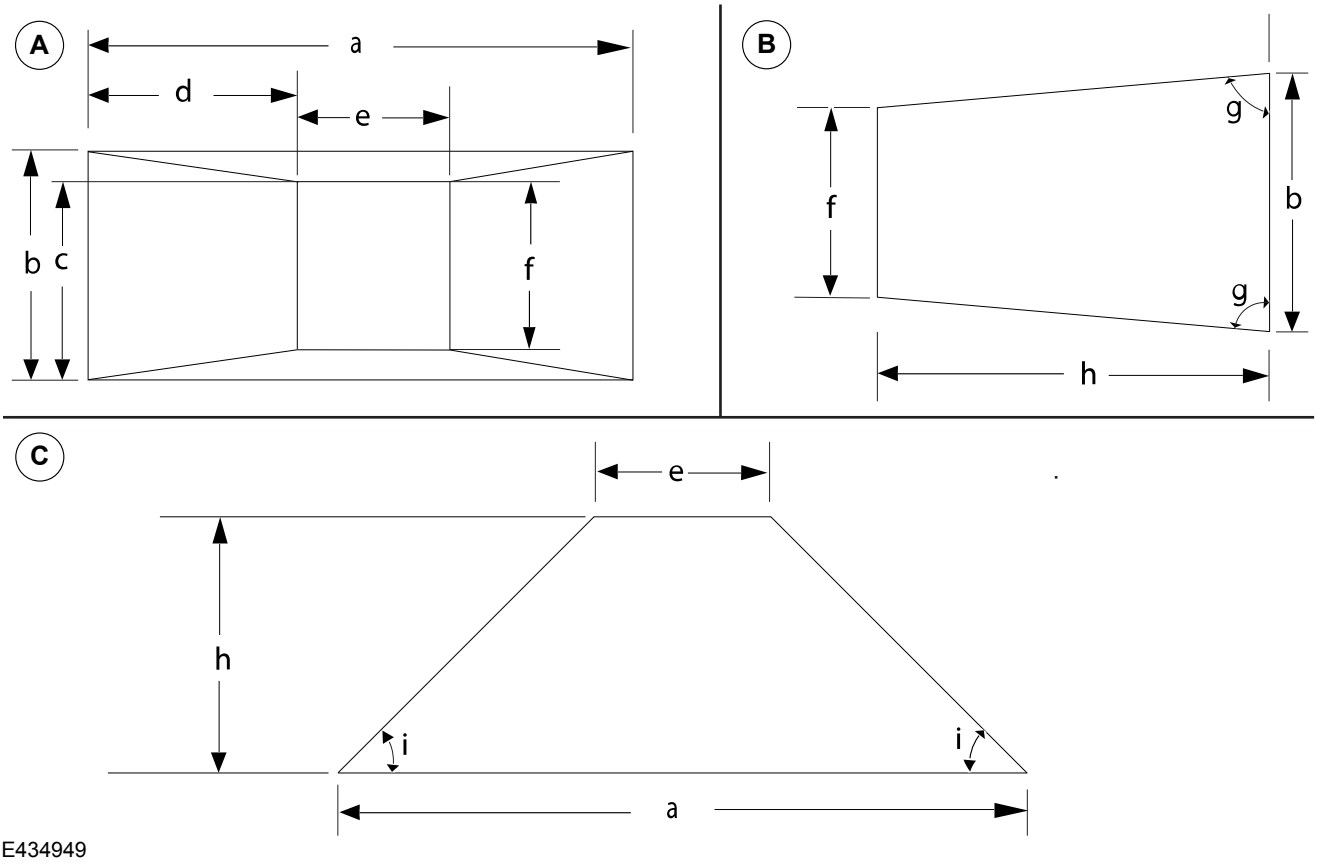
Radar View Zone Template



E434946

Installed upfitter equipment should not infringe on the radar or camera view zones. A template for creating a physical clearance zone is also shown below.

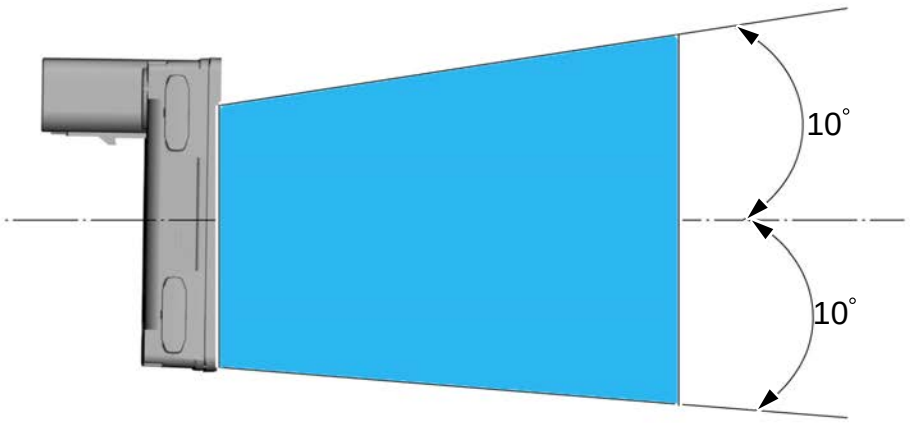
Radar View Zone Template Dimensions



E434949

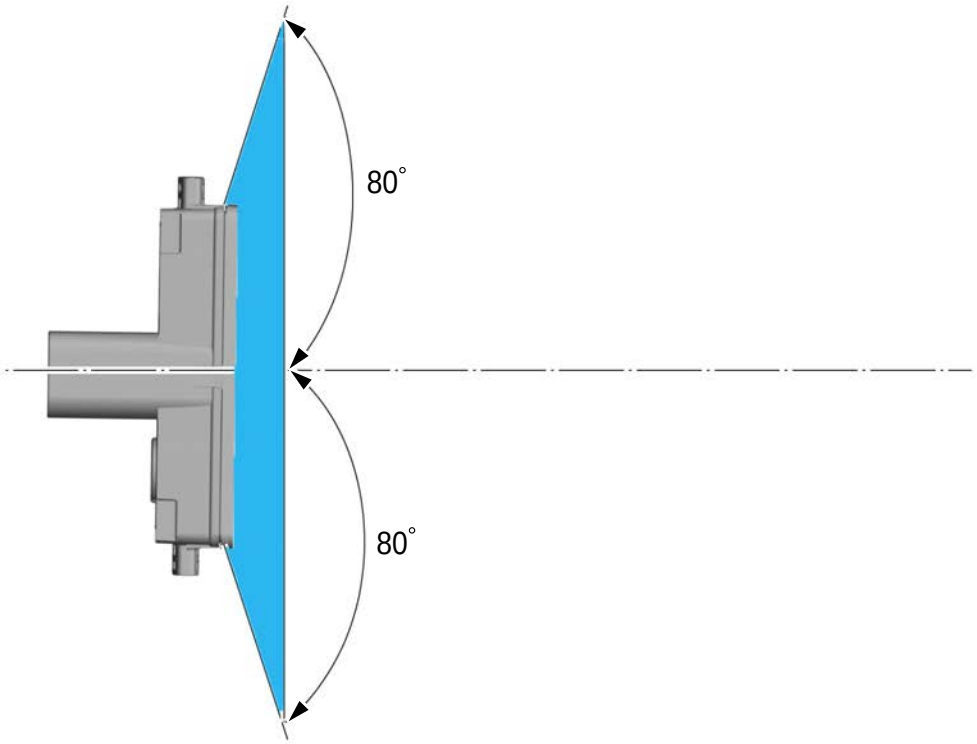
Dimensions	
A	Front View
B	Side View
C	Plan View
a	400 mm
b	90 mm
c	75 mm
d	167 mm
e	67 mm
f	60 mm
g	85 º
h	167 mm
i	45 º

BlueCruise and BLIS Radar View Zone - Side View



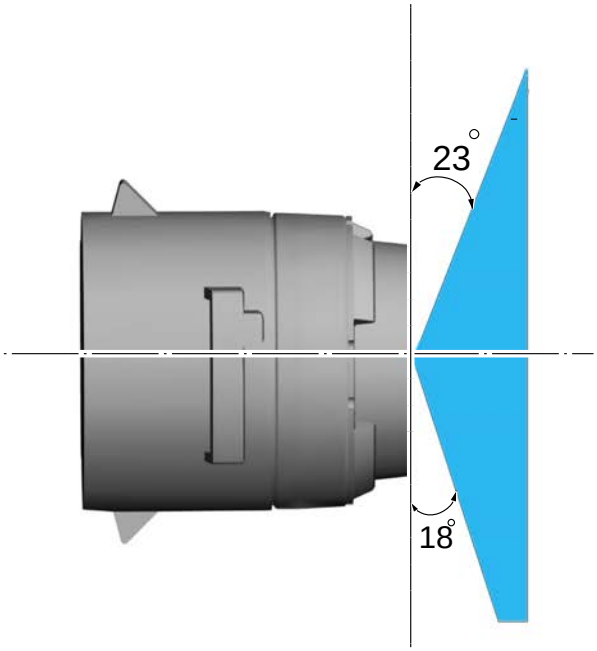
E467235

BlueCruise and BLIS Radar View Zone - Plan View



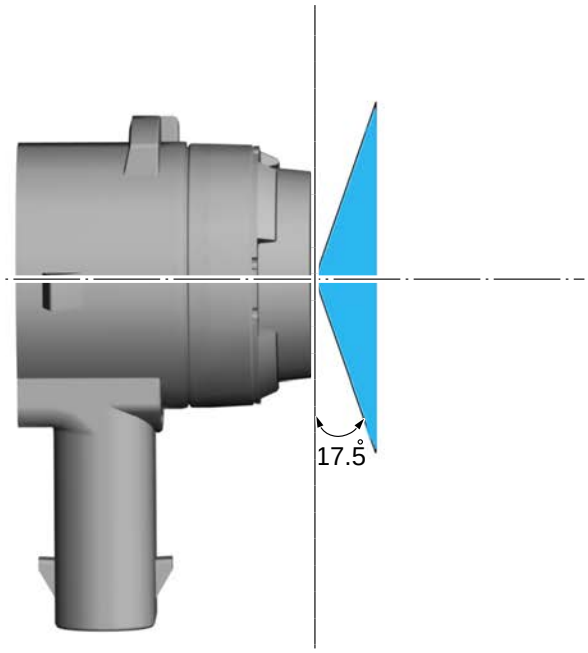
E468590

Parking Aid Sensor - Side View



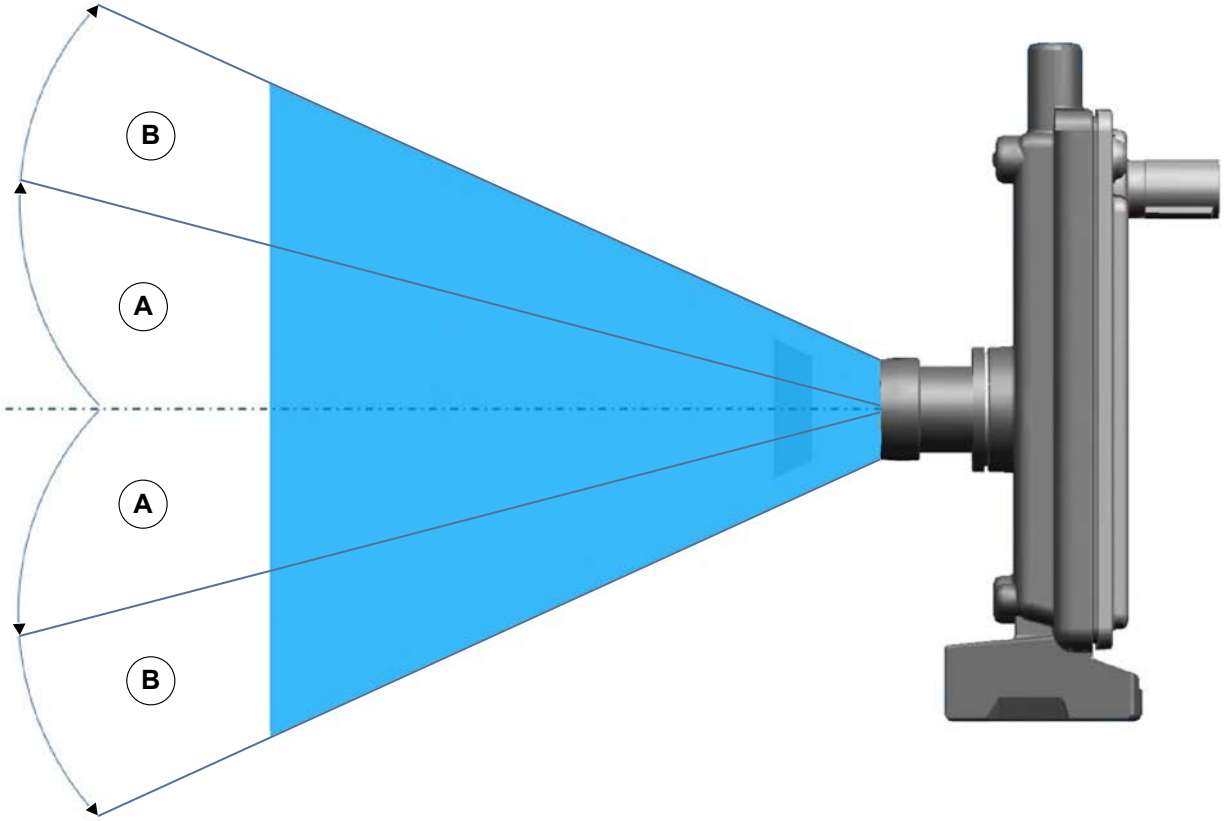
E468591

Parking Aid Sensor - Plan View



E468592

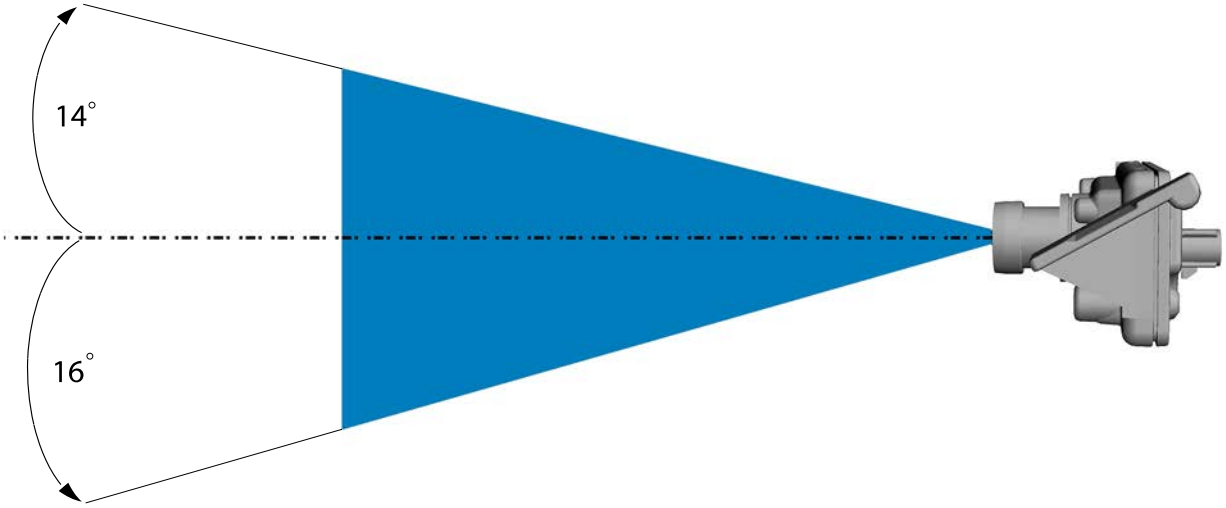
Camera View Zone - Plan View



E433170

Item	Description
A	26° - Without Active Cruise Control
B	50° - With Active Cruise Control

Camera View Zone - Side View



E375766

Refer to the vehicle owner manual for further information on the driver assist features.

4.7.4 Blind Spot Information System

CAUTIONS:

For converted vehicles fitted with Blind Spot Information System (BLIS) feature and Cross Traffic Alert (CTA) where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment is checked by a Ford dealer.

When the Pickup Box/Tub and Tail Lamps are removed on vehicles with Blind Spot Information System (BLIS), the BLIS and Cross Traffic Alert (CTA) features will be disabled. The vehicle can be reconfigured to deactivate these features and avoid warning messages in the instrument cluster. See your local Ford Dealer or contact your National Sales Agent for further information.

NOTE: Do not apply sticker / repair compound to these areas, this can deteriorate the performance of the system and block or impede the radar beam.

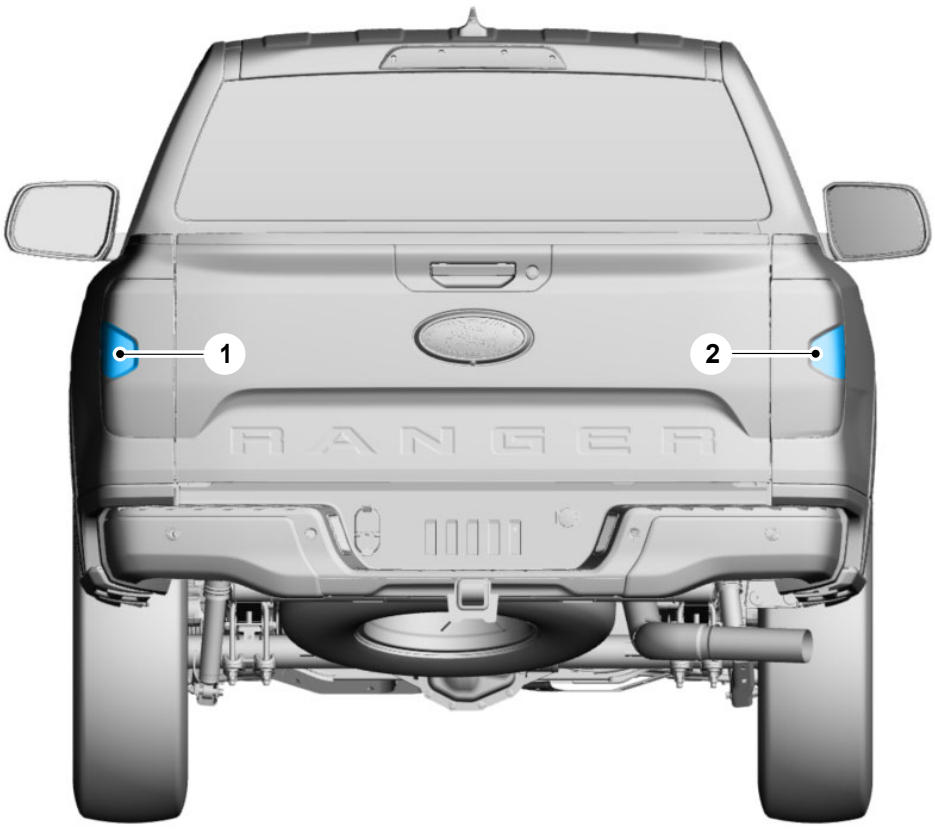
NOTE: The BLIS alert indicator(s) may turn on during heavy rain even though no vehicle(s) has entered the blind zone.

NOTE: If the tail lamps are altered, the BLIS and CTA alert indicator(s) may give false alerts or not detect objects.

NOTE: If the radar beam is blocked or obstructed, the BLIS and CTA alert indicator(s) may give false alerts or not detect objects.

NOTE: If your vehicle has a tow bar with factory equipped trailer tow module and it is towing a trailer, the sensor will automatically turn the BLIS and CTA off if you do not set up and select a valid trailer in the trailer menu. If your vehicle has a tow bar but no factory equipped trailer tow module, it is recommended to turn both off both BLIS and CTA manually. Operating the BLIS feature with a trailer attached but without the Blind Spot Trailer Tow package will cause poor system performance.

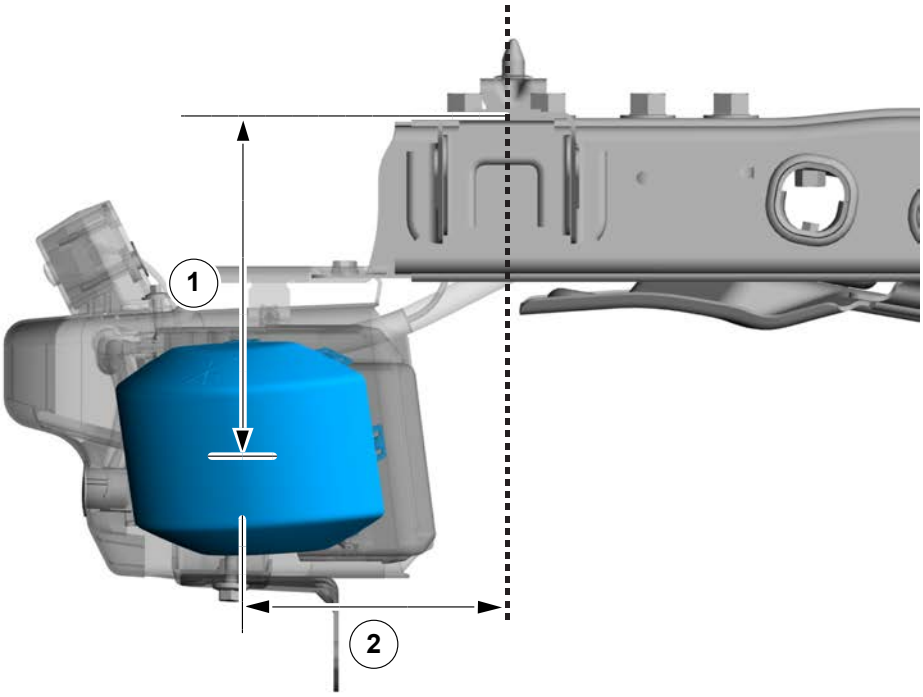
BLIS location



E365396

Item	Description
1	BLIS Radar housed in Left Tail Lamp
2	BLIS Radar housed in Right Tail Lamp

BLIS and BlueCruise Radar Datum Points - DAT Bar



E469695

Item	Description	Dimension (mm)
1	Chassis rear mount to center of radar	210
2	Center of rear mount to center of radar	165

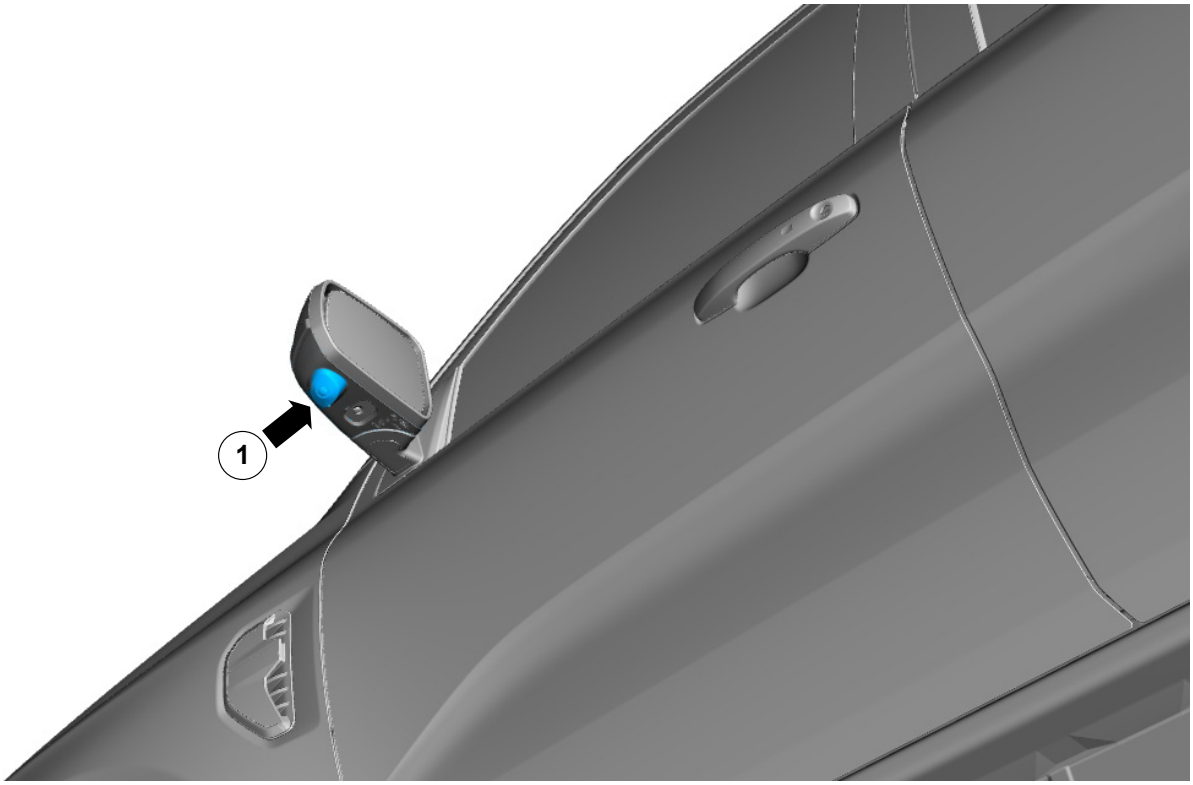
4.7.5 Side View Camera

WARNING: You are responsible for controlling your vehicle at all times. The system is designed to be an aid and does not relieve you of your responsibility to drive with due care and attention. Failure to follow this instruction could result in the loss of control of your vehicle, personal injury or death.

CAUTION: The 360 degree camera system still requires the driver to use it in conjunction with looking out of the windows, and checking the interior and exterior mirrors for maximum coverage.

Side view cameras located on the underside of the exterior rear view mirrors form part of the 360 Degree Camera System. Any modification to the exterior of the vehicle should ensure that the function and installed position of the side view cameras is not impeded.

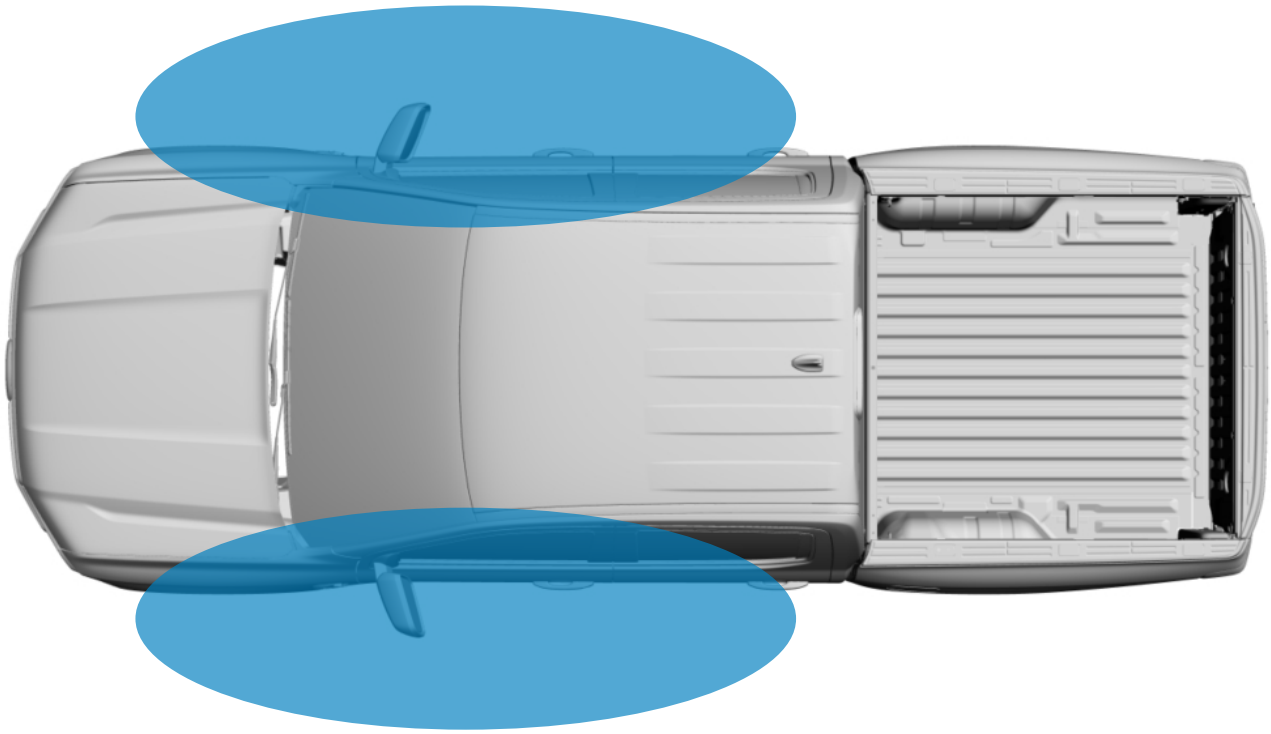
Side View Camera Location



E383021

Item	Description
1	Side View Camera (LH Shown, RH Similar)

Side View Camera View Areas

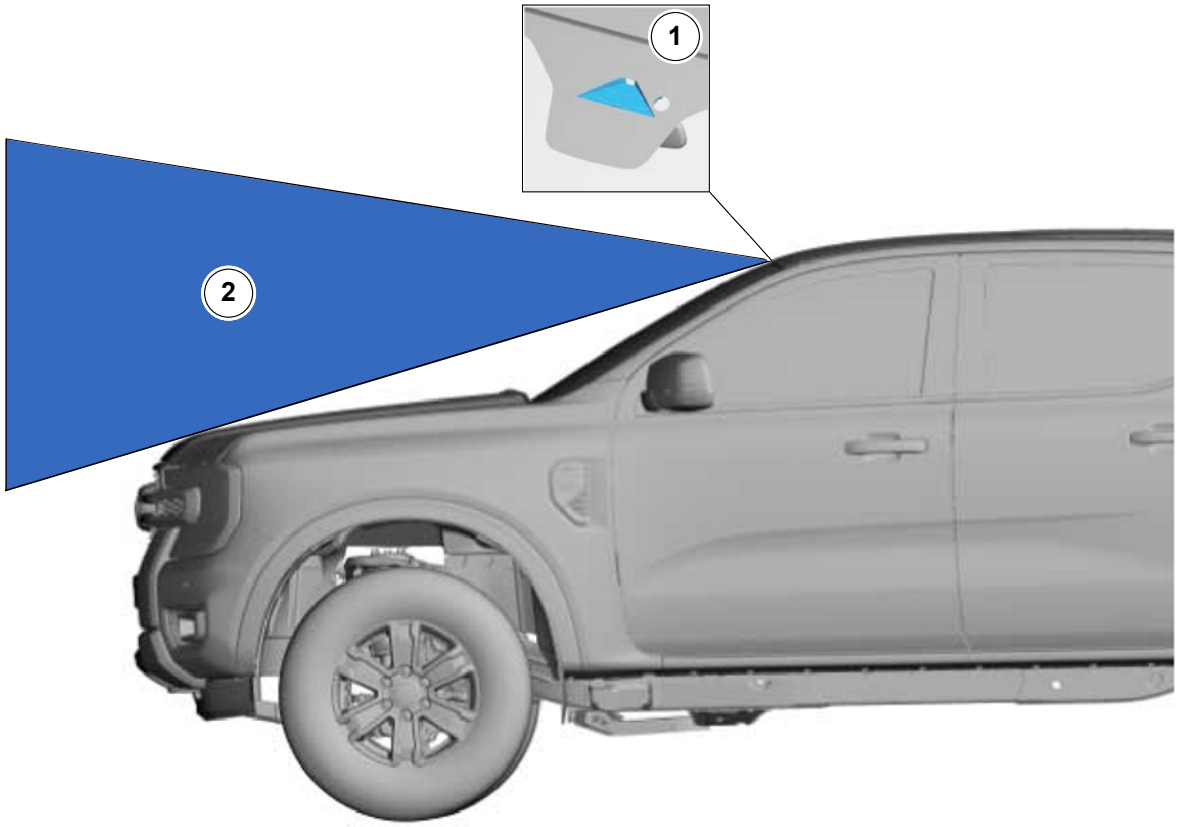


E382634

4.7.6 Lane Keeping System

NOTE: The lane keep alert feature will not function if any conversion or installation is in the field of view of the lane keeping system camera.

NOTE: For converted vehicles fitted with the lane keeping system, where vehicle mass or geometry is significantly altered, a new calibration for the camera needs to be made. See your local Ford dealer or contact your national sales agent for further information.



E365395

Item	Description
1	Lane Keeping System Camera located behind the interior rear view mirror trim
2	Viewing field of view from camera

Lane Centering Assist

NOTE: The lane centering assist feature will not function, or performance may be degraded if any conversion or installation is in the field of view of the front camera.

NOTE: For converted vehicles fitted with the lane centering assist feature, where vehicle mass or geometry is significantly altered, a new calibration needs to be made.

NOTE: The lane centering assist feature will not function, or performance may be degraded if the vehicles ride height is increased, or decreased, or if the pitch of vehicle is modified.

NOTE: The lane centering assist feature will not function, or performance may be degraded if the vehicles track width is modified.

Please refer to the Adaptive Cruise Control in this section for further considerations.

4.8 Handles, Locks, Latches and Entry Systems

4.8.1 Central Locking

NOTE: Additional/auxiliary locks will not be integrated with the vehicle alarm or operate BCM controlled lighting.

The central locking function is controlled by the BCM (located under the instrument panel). The vehicle locks are operated by Field Effect Transistors (FETs) in the BCM.

Note the these signals are also available near the tailgate of vehicles fitted with locking tailgate. It is possible to add an additional / auxiliary lock(s) with the use of relays triggered by the BCM outputs.

BCM Output for Central Locking

BCM Connector	Pin	Function
J3 (C2280C)	35	CTRL MOD. DOOR LOCK # ALL LOCK
J3 (C2280C)	32	CTRL MOD. DOOR LOCK # ALL UNLOCK

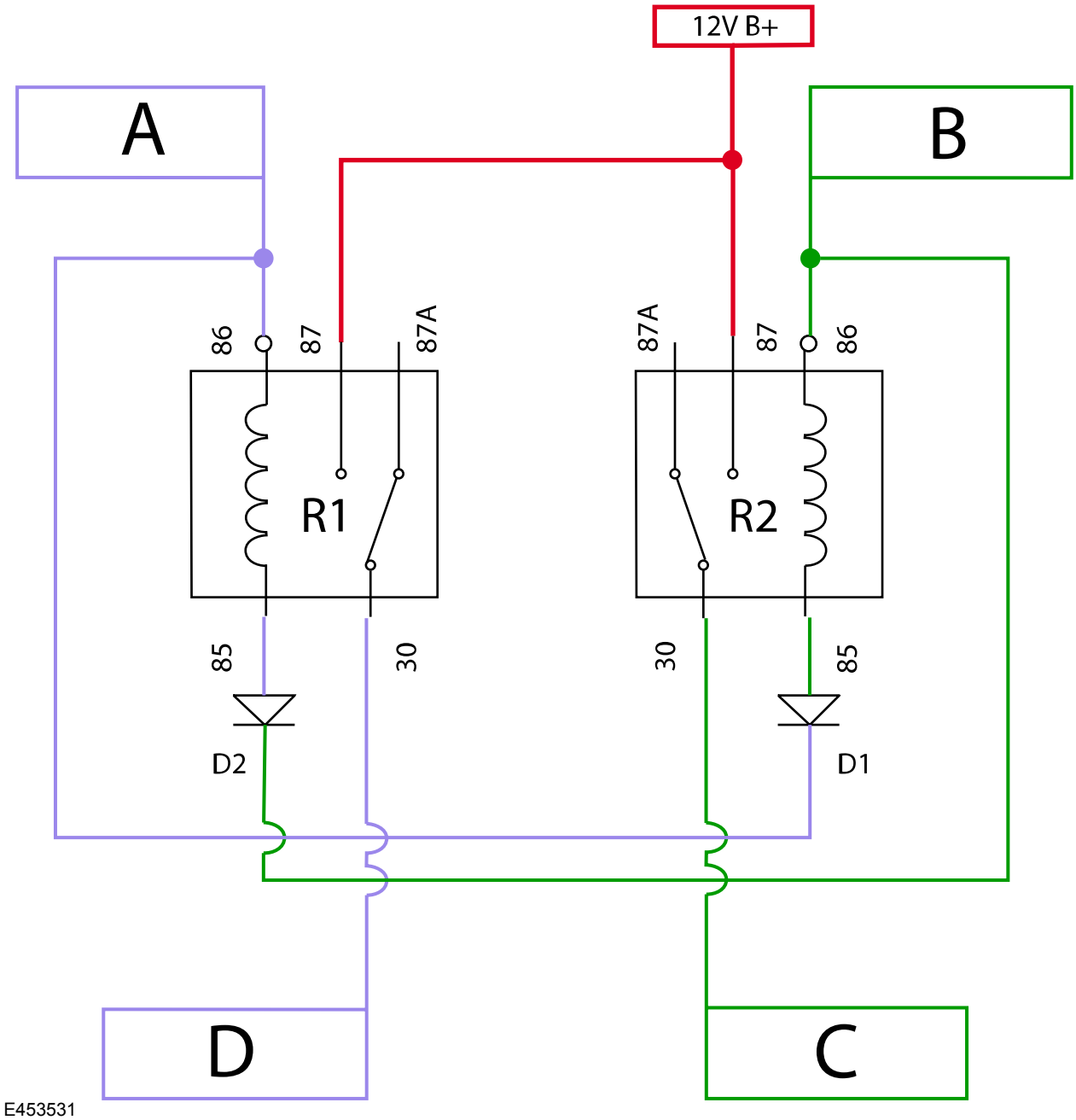
NOTE: The location of additional relays should be considered carefully. A suitable mounting location away from the passenger compartment will allow for more robust functionality and reduced noise. Depending on the functionality required, the pins used will emulate the basic locking/unlocking operation of an existing lock.

12V Power (B+) for the additional relays should be taken from a suitably fused B+ feed. The relays should be sized to suit the auxiliary actuators being used. The BCM outputs are active for 110ms when a lock or unlock command is requested. Relays and auxiliary locking mechanisms should be selected to be compatible with this pulse duration.

In addition to two relays, two diodes are required to prevent signal back-feed into the relays & BCM. Failure to follow these instructions may result in accumulated error codes and eventually lead to permanently reduced or limited BCM functionality. We recommend verifying correct operation after installation and also scanning the vehicle for fault codes. The vehicle needs to be placed in an ignition off state (can be either locked or unlocked) for 15 minutes and then placed in ignition on prior to checking for these codes. The presence of any of the following error codes indicates incorrect installation and further investigation and rectification should be conducted.

DTCs: B1585-11, B1586-11, B1587-11 and/or B1588-11 (“Circuit Short To Ground”)

Schematic diagram showing the required configuration



E453531

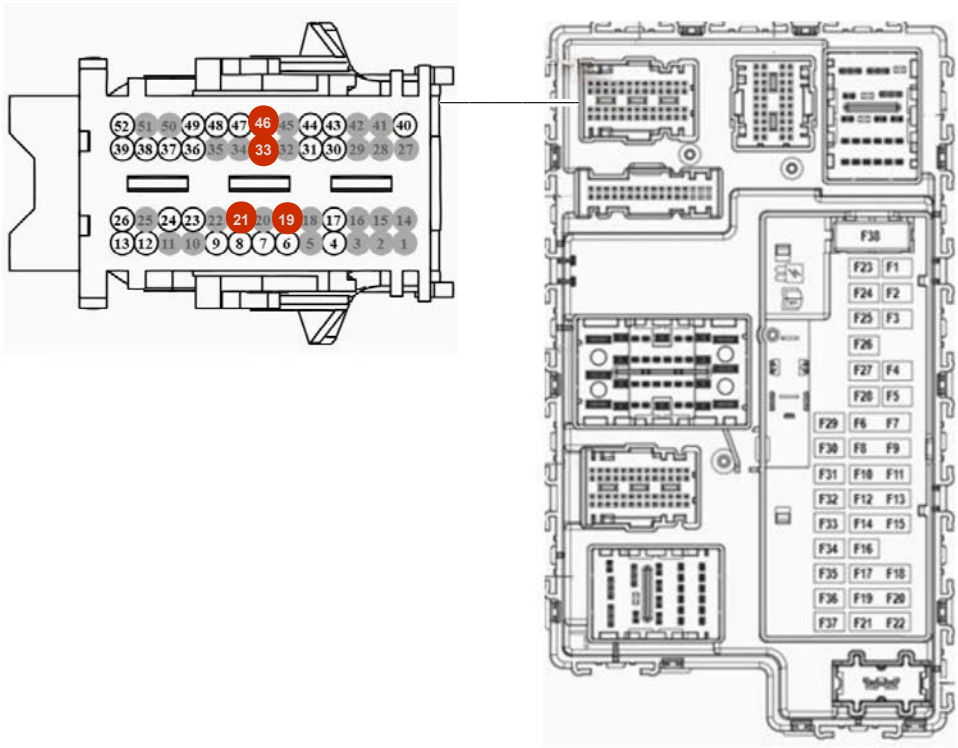
Item	Description
A	Vehicle Lock Signal (BCM J3-35)
B	Vehicle Unlock Signal (BCM J3-32)
C	To Auxiliary Actuator(s) Unlock
D	To Auxiliary Actuator(s) Lock
R1	Lock Relay
R2	Unlock Relay
D1	Diode
D2	Diode

4.8.2 Door Ajar

A Door Open signal is available at the BCM for all cabin doors. These circuits are powered when the doors are closed, and inactive when the doors are open.

These signals can be utilised via external relay modules for a variety of Convertor applications, subject to the load required. The maximum output of these circuits is 13mA with the door switches requiring most of this. Therefore, a relay trigger (optocoupler module or similar) must be used to avoid overloading this circuit. Conventional electro-mechanical relays cannot be used.

NOTE: The location of additional relays should be considered carefully. A suitable mounting location away from the passenger compartment will allow for more robust functionality and reduced noise. 12V Power (B+) for the additional relays should be taken from a suitably fused B+ feed. The relays should be sized to suit the auxiliary actuators being used.



E467236

BCM Connector J5 (C2280E)	Description
19	Left Front Door Ajar
21	Right Front Door Ajar
33	Left Rear Door Ajar (Super and Double Cab)
46	Right Rear Door Ajar (Super and Double Cab)

4.9 Fuses and Relays

4.9.1 Fuses

NOTE: Refer to the vehicle owner's manual for information on the location and rating of electrical system fuses.

5.1.1 Body Structures - General Information

WARNINGS:

All external or internal projections must comply with local regulatory standards.

Do not cut, drill or weld any parts that are load path relevant in case of crash. Vehicle Converter shall confirm any changes comply with general product safety requirements, legal requirements or type approvals.

Extreme heat, such as paint drying ovens, will cause damage to the High Voltage battery. The High Voltage battery must be removed before using the drying ovens longer than 45 minutes or with temperatures above 60°C (140°F). Failure to follow this instruction may result in damaging the High Voltage battery, which could cause serious personal injury or death in a fire or explosion. Please refer to the Ford workshop manual.

The following components, as installed by Ford Motor Company, should not be removed, relocated, altered or modified in any way:

- High voltage battery, battery connectors, battery cradle (carrying structure), outriggers, energy absorption members, brackets and attachment hardware.
- Front end structure, including aluminium extrusion assembly (Megabrace), attachment brackets and attachment hardware.

CAUTION: Load carrying structures should not be mounted onto an existing load tray or load box.

Refer to: 1.13 (page 46).

When carrying out vehicle conversions/modifications the following points should be considered:

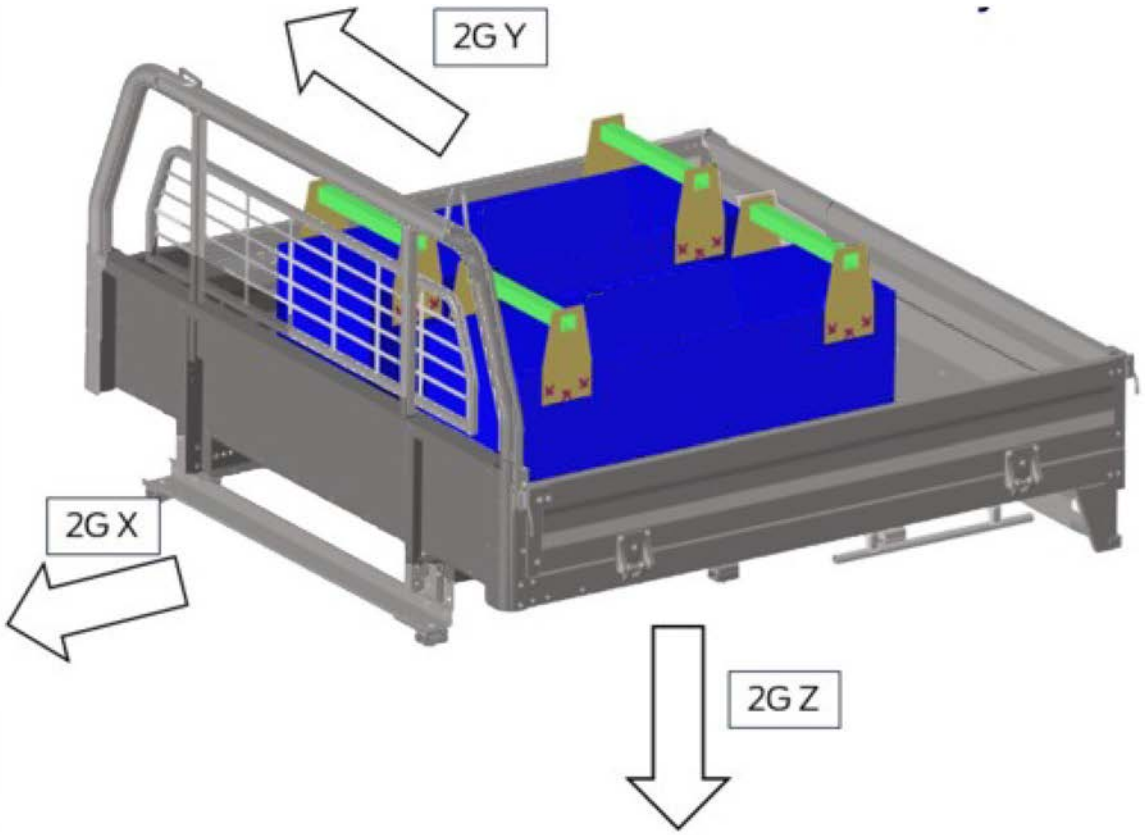
- Make sure that the vehicle structural integrity is maintained.
- Do not drill into closed frame body members.
- Make sure that the design for the body alterations or additional structure disperse the load evenly.

CAUTION: Uneven load distribution could result in unacceptable handling and braking characteristics.

- Re-paint metal edges after cutting and drilling. All metal edges must comply with exterior and interior protection local regulatory standards.
- All fixings through the floor, sides or roof must be sealed.
- Make sure that fixings in the 'B'-pillar area do not encroach on the seat belts or seat belt reels.

Computer-Aided Engineering (CAE)

The following section is provided to guide those modifiers seeking to assess their design formally using CAE methods. It provides our recommendations for model inputs, loading cases and acceptance criteria. It can also be used as a general guide for those seeking to understand the expected operating environment and planning to conduct more simplified analysis. Please note that this guidance is directional and intended only to assist initial design. The varied nature of aftermarket second-unit-bodies and their operating environment dictates that final assessment of suitability remains with the Vehicle Converter. For further information please contact FPSVhelp@ford.com.



E466266

Strength Assessment:

±2.0g in X, Y and Z. Apply loadings individually. Von Mises stress should be less than yield . Engineering judgement can be applied when:

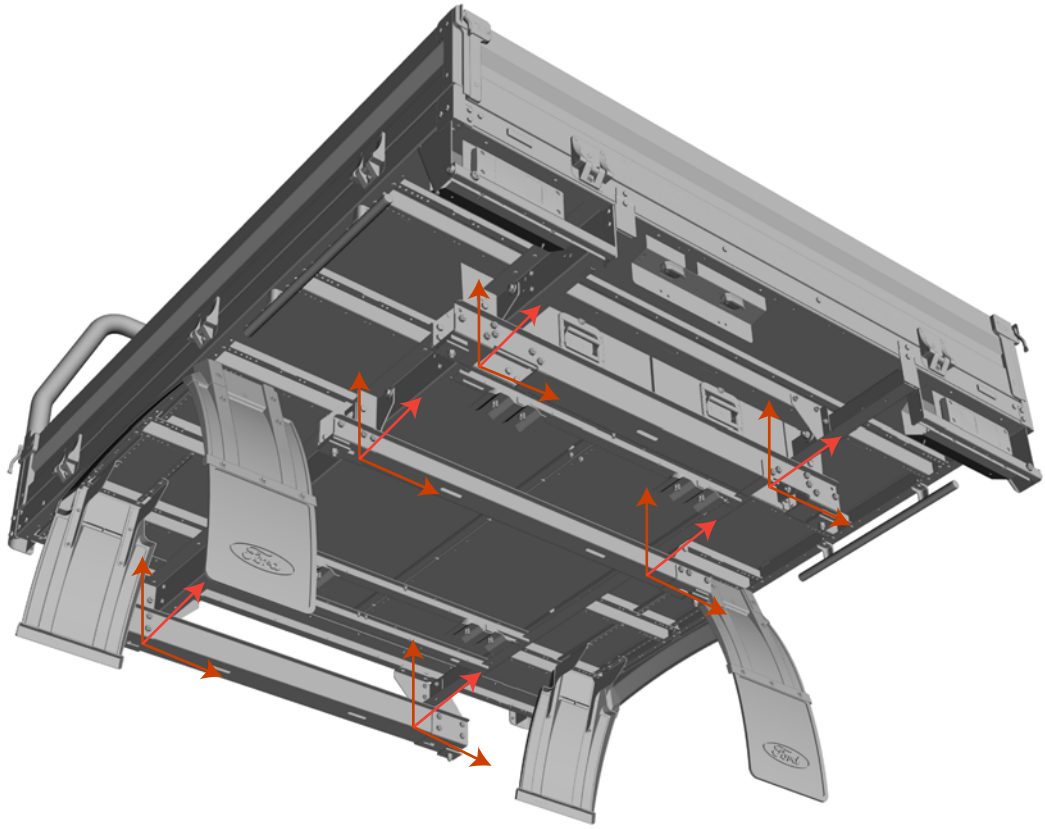
- Local areas are in contact between 2 parts
- Stress is mostly in compression (check negative normal stress)
- Elements are adjacent to rigid elements or constraints

Fatigue Assessment:

±0.4g in X, Y and Z for 1 million cycles minimum for steel [*] or 2.5 million cycles for aluminium [**]. Apply loadings individually.

– [*] Applies if the stress seen during strength loading is >50% of allowable for the material(s) used (eg. >150MPa for 300MPa steel (UTS)). Below that the risk is relatively low due to steel's inherent resistance to fatigue at typical endurance limits.
– [**]Aluminium is not considered fatigue-resistant hence the recommendation is to analyse to 2.5 million cycles to simulate near-infinite life.

In all cases this assumes robust engineering design with no notches, sharp edges, defects, or other undue stress concentrators present.



E466267

Dynamic Load Case (Normal Modes):

NOTE: The second-unit body should be assessed as a separate entity, constrained in X, Y & Z at the fixing points to the frame as shown in the image above.

Calculate the Natural Frequencies for the Second-unit Body + Payload/Cargo up to 20Hz.

There should be no modes at 14Hz or lower in any part of the main structure.

Other Considerations:

Structure in the transverse (y-axis) direction is critical. This is especially true around the forward mounts. Pay attention to the lateral stiffness and resistance to pantograph-type collapse. Use of lateral gussets and robust crossmembers, etc is highly recommended.

In all cases the loadings should be representative of the second-unit body fitted and the payload/cargo considered to be worst-case. Both for weight and Centre of Gravity location.

All analyses should use a linear-elastic solution; no nonlinear contacts or nonlinear material properties.

Specific to Ranger PHEV

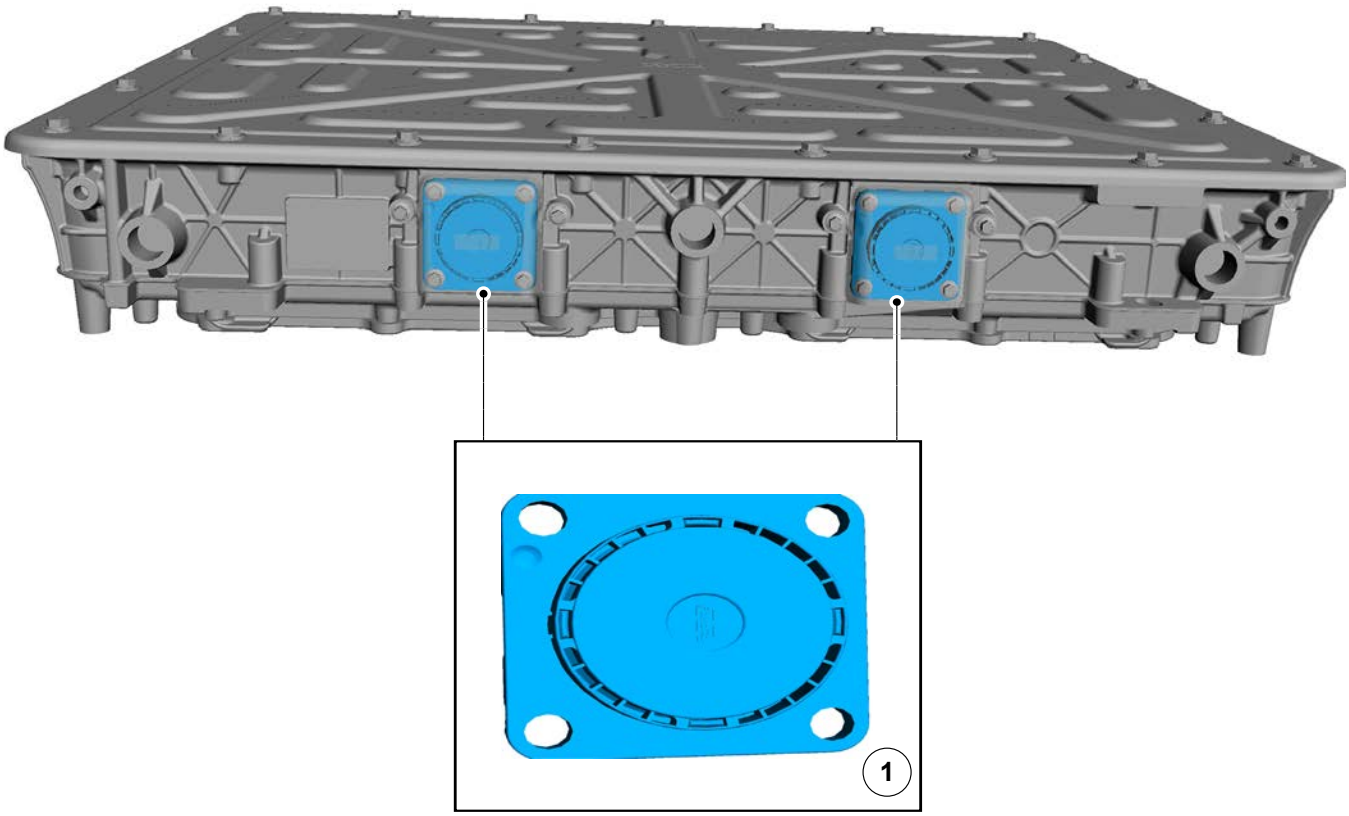
The Ranger PHEV HV Battery is equipped with an exhaust vent. No additional components or obstructions (beyond any installed by Ford) shall be located in the same environment as the battery (e.g. Underbody) and within 150mm of these features. Additionally, no components which may contain combustible liquids or gases at any time shall be added by the Vehicle Convertor within 300mm of these features.

There shall be no modifications or installed components which confine the air space near the outside of the HV Battery or obstruct the free flow of air about the battery (beyond any installed by Ford).

Any cut outs openings created between the occupant space and the vehicle underbody shall be sealed such that air is not free to pass from under the vehicle into the occupant space.

If any primary ingress/egress paths for occupant spaces are located above or rearward of the rear axle(s), a metallic shielding shall be added to obstruct any airflow from the battery towards those ingress/egress paths, and redirect the air flow towards a side/rear area that is not a primary ingress/egress path.

HV Battery Vent Valves - PHEV



E439429

Item	Description
1	HV Vent Valves

5.1.2 No Drill/No Weld Zones - PHEV

WARNINGS:

Do not undertake drilling, welding or any other operation in the red marked zone in order to prevent damage to the components placed underneath the floor. In particular the battery and high voltage system components.

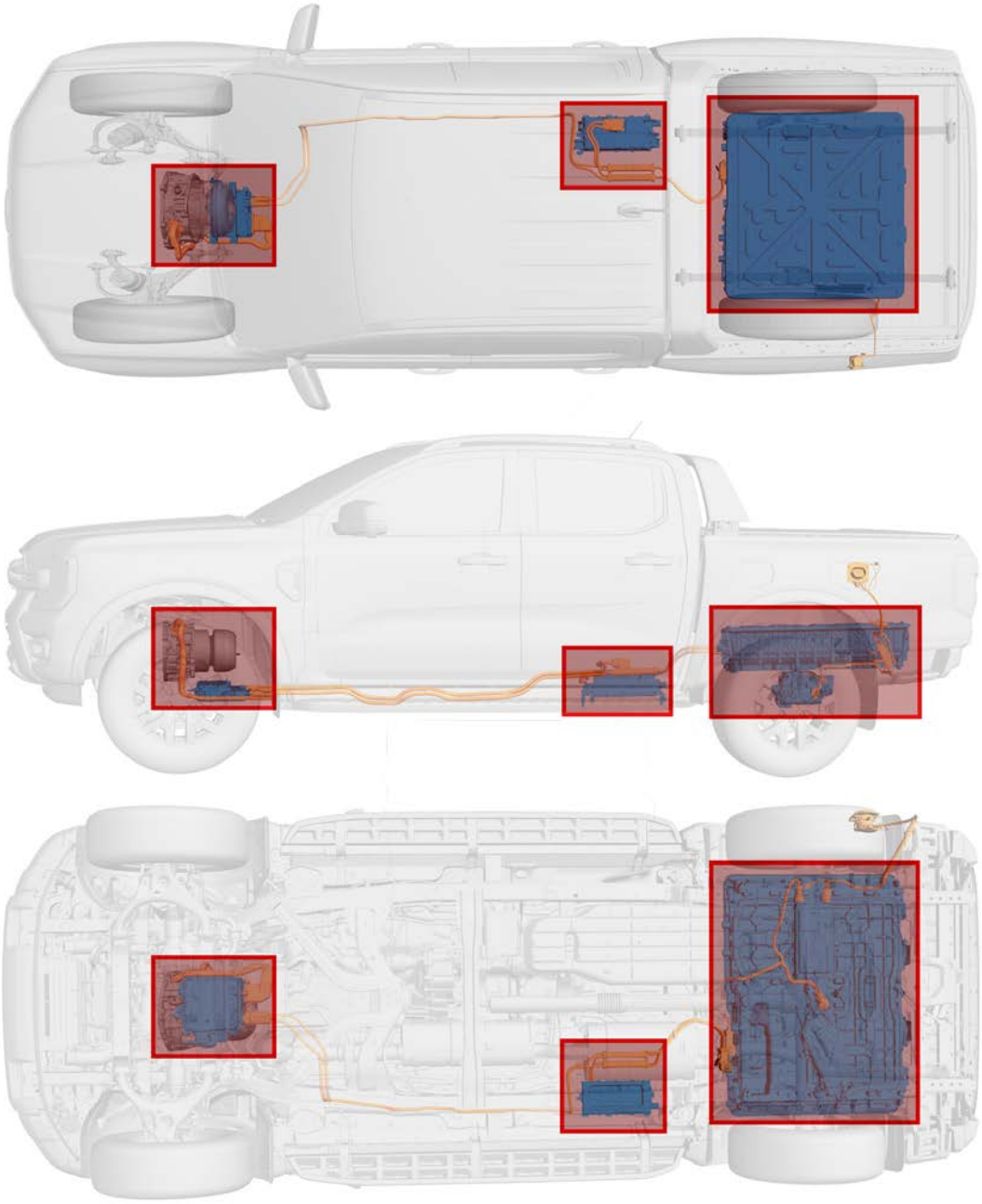
Do not drill the Side Impact Bars or Side Energy Absorption Members.

Do not weld to the High Voltage Battery, casing or cradle.

Do not use ground welding equipment to the Battery, Battery Casing or Battery Cradle.

The existing clearances around the Battery Pack must be maintained in all directions at all times. These clearances are required to allow for dynamic movement. Do not route cables, hoses or anything else between the battery and the vehicle frame / body.

No Drill/No Weld Zones - PHEV



E452479

Whilst it is recommend that no drilling is undertaken in the marked zones in this Section, some limited fixing is permissible on the chassis rail of the Ranger PHEV variant.

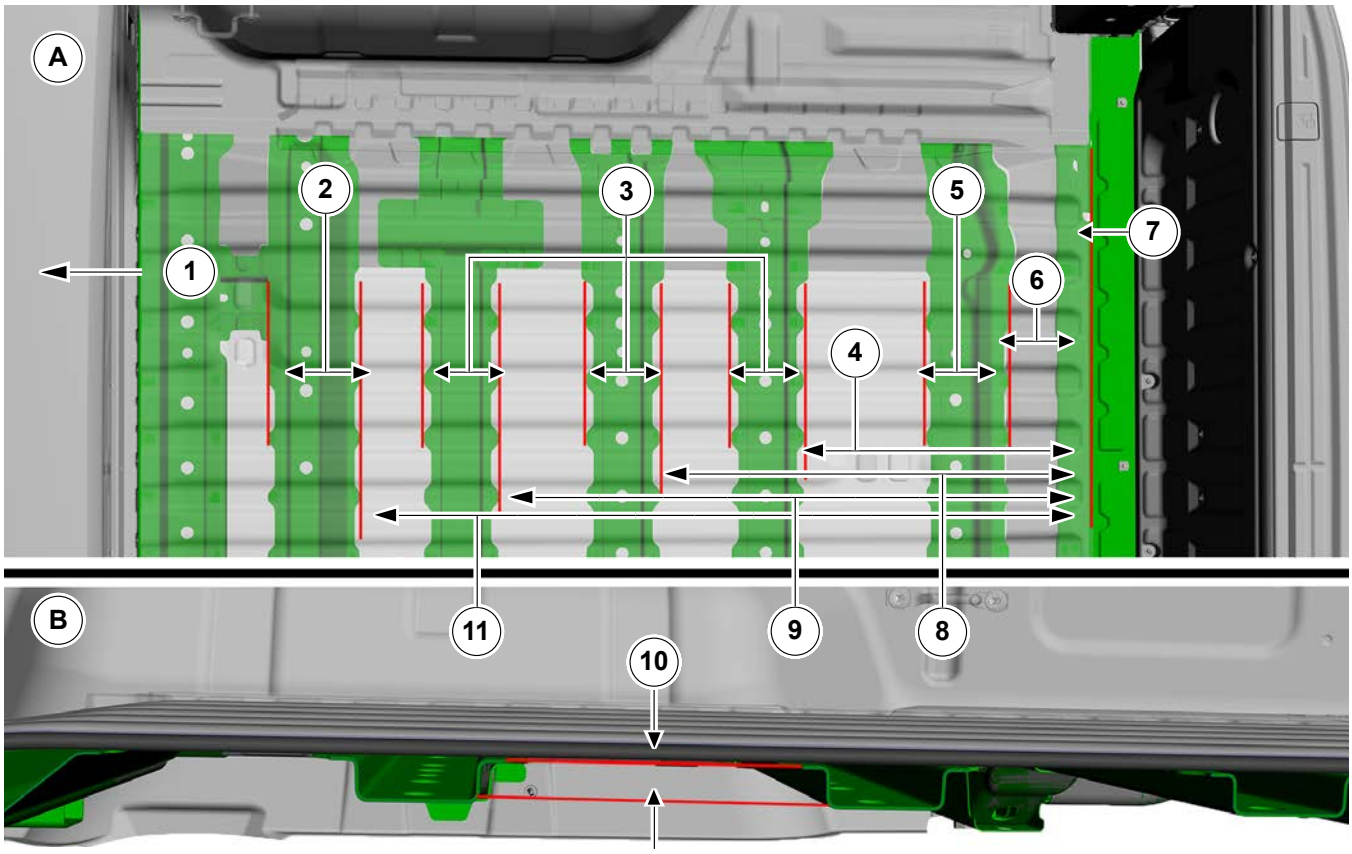
It is Strongly recommended that Ranger CAD is obtained for convertor use and understand vehicle component placement/location of High and Low voltage wire harness routing and coolant line routing. CAD can be obtained from FPSV Technical Support at FPSVHelp@ford.com

WARNING: Drilling should be avoided anywhere on the raised section of the loadbox floor including the tapered sections.

If drilling on this area is unavoidable, ensure the drill bit can not extend more than 20mm through the floor panel. Use a drill stop to limit the drill depth.

Remove all metal swarf from inside the loadbox and on top of the battery pack. Treat the holes to prevent corrosion. All holes must be sealed to prevent any ingress of water.

Any added components or hardware must not protrude below the lower face of the existing loadbox crossmember as indicated in the image below:



E453092

Item	Description
A	Loadbox floor ribs
B	Loadbox floor ribs (cross section)
1	Front of vehicle
2	137mm
3	112mm
4	467mm from Datum line
5	135mm
6	141mm from Datum line
7	Datum Point - front edge of floor lower back panel
8	690mm from Datum line
9	937mm from Datum line
10	Maximum Drilling Depth 20mm
11	1145mm from Datum line

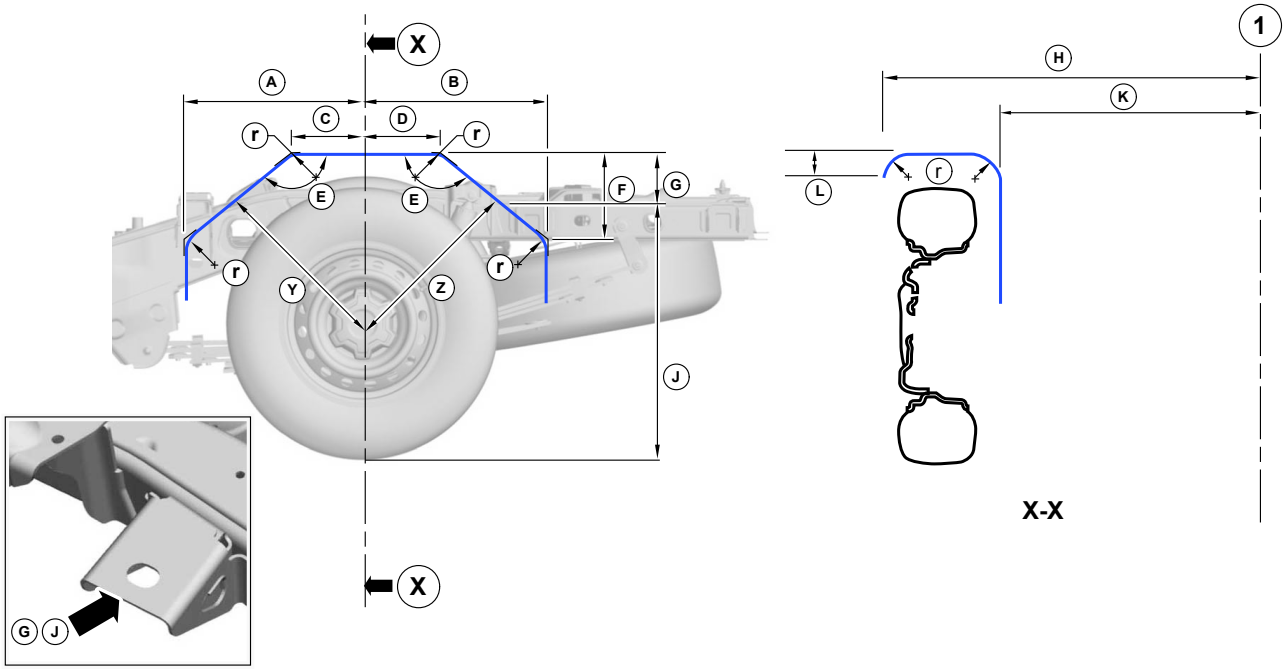
5.1.3 Integrated Bodies and Conversions

WARNING: All wheelhouse coverage must comply with local regulatory vehicle standards.

For integral structures such as ambulances or motor-homes with increased rear overhang built onto the chassis the following applies:

- Reduced departure angles, e.g. rear entry step, should be discussed with the end user / customer. Consider removable components to avoid damage on ferries or low-loaders.
- Unique spare wheel stowage may be required if obscured by rear step, check for accessibility.
- The recommended minimum tyre clearance to mudguard dimensions on conversions are outlined in the following figure and table:

Wheelhouse Envelope



E362803

CAUTIONS:

Wheelhouse dimensions are provided as a guide only.

Wheelhouse envelopes are intended to represent an "open" wheelhouse only.

Changes to wheel and tyre sizes may impact the ride and handling of the vehicle, certain Ford Driver Assist Technology functions and other vehicle attributes. Any change must be in adherence to local regulatory standards. See your National Sales Agent for clarification.

NOTE: Dimensions Y and Z are only applicable when Dimension J is at value.

NOTE: Dimension J is shown from the ground plane with vehicle at kerb weight on flat ground.

Wheel Guard Dimensions				
Tyre Specification	215/70R16	255/70R16	255/70R17 255/65R18 255/55R20	LT265/70R17
A	474	474	474	474
B	458	458	458	458
C	305	305	305	305
D	275	275	275	275
E	110°	110°	110°	110°
F	420	420	420	420
G	217	185	185	192
H	955	955	955	968
J	665	774	774	801
K	635	635	635	635
L	-	30	30	30
r	50mm (max)			
1	Center line of Vehicle			
X	Section through Center of Wheel Guard			
Y	566	566	566	566
Z	525	525	525	525

All dimensions are in millimeters (mm).

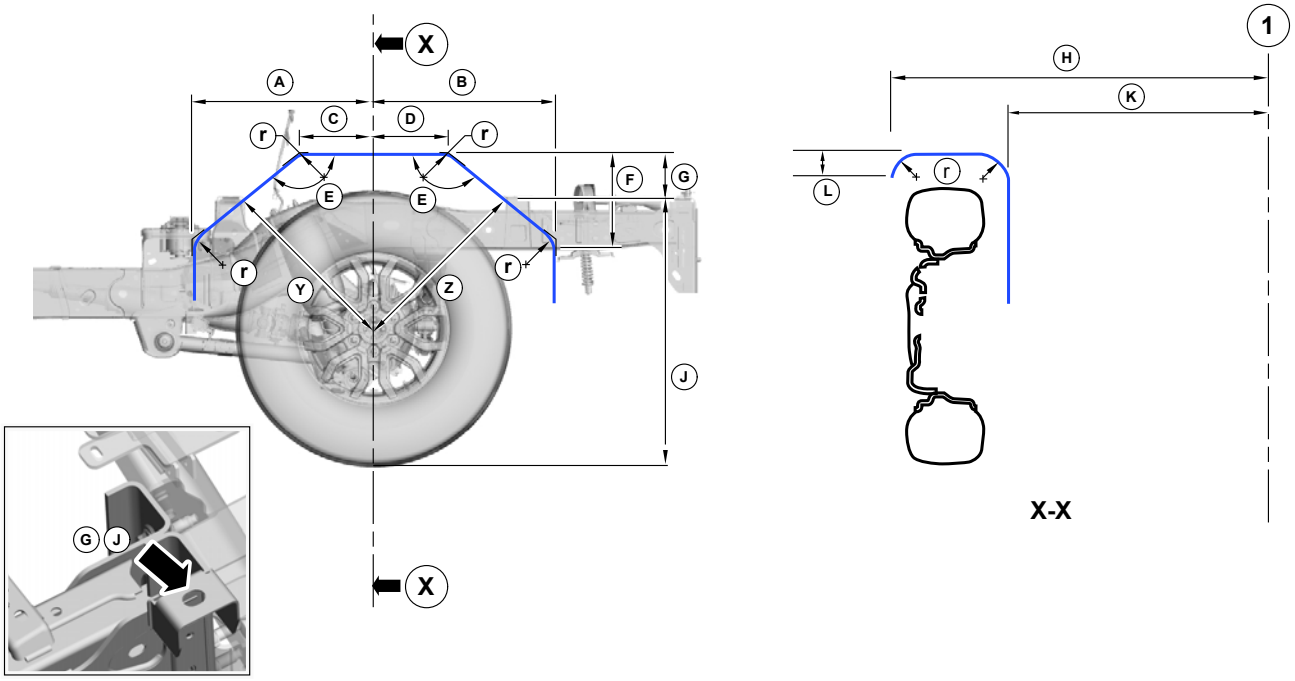
5.1.4 Integrated Bodies and Conversions - Raptor

WARNING: All wheelhouse coverage must comply with local regulatory vehicle standards.

For integral structures such as ambulances or motor-homes with increased rear overhang built onto the chassis the following applies:

- Reduced departure angles, e.g. rear entry step, should be discussed with the end user / customer. Consider removable components to avoid damage on ferries or low-loaders.
- Unique spare wheel stowage may be required if obscured by rear step, check for accessibility.
- The recommended minimum tyre clearance to mudguard dimensions on conversions are outlined in the following figure and table:

Wheelhouse Envelope - Raptor



E370591

CAUTIONS:

Wheelhouse dimensions are provided as a guide only.

Wheelhouse envelopes are intended to represent an "open" wheelhouse only.

Changes to wheel and tyre sizes may impact the ride and handling of the vehicle, certain Ford Driver Assist Technology functions and other vehicle attributes. Any change must be in adherence to local regulatory standards. See your National Sales Agent for clarification.

NOTE: Measurements are taken with vehicle at kerb weight on flat ground.

NOTE: Dimensions Y and Z are only applicable when Dimension J is at value.

Wheel Guard Dimensions	
Tyre Specification	**LT285/70R17**
A	486
B	468
C	305
D	275
E	110°
F	420
G	205
H	1007
J	816
K	636
L	30
r	50
1	Center line of Vehicle
X	Section through Center of Wheel Guard
Y	572
Z	543

All dimensions are in millimeters (mm).

5.1.5 Integrated Bodies and Conversions - PHEV

WARNING: The Ford Ranger PHEV load box is not designed to be removed and replaced with an alternative body. High-voltage cables, and other critical systems including the fuel filler and charging ports are integrated with the load box. Defects in the Ford Ranger PHEV which are caused by the removal and replacement of the load box with an alternative body will not be covered under the Ford new vehicle warranty.

CAUTION: Changes to wheel and tyre sizes may impact the ride and handling of the vehicle, certain Ford Driver Assist Technology functions and other vehicle attributes. Any change must be in adherence to local regulatory standards. See your National Sales Agent for clarification.

5.1.6 Chassis Cab

WARNINGS:

Do not cut, drill or weld any parts that are load path relevant in case of crash. Vehicle Converter shall confirm any changes comply with general product safety requirements, legal requirements or type approvals.

Excessive heat can build up from the exhaust system, in particular from the catalytic converter. Ensure adequate heat shields are maintained.

Uneven load distribution could result in unacceptable handling and braking characteristics.

When carrying out vehicle conversions / modifications the following points should be considered:

- Upfit body mounts must sit flush with and cover the entire surface of the chassis mounts to spread the weight and forces evenly. All provided mounting points on the vehicle chassis must be used.
- For most upfits it is recommended to use rigid (non-flexible) connections at all mounting points. Avoid 'sprung' mounts on sub-frames.
- If the fitted sub-frame is exceptionally rigid, you must use flexible mounts with captive (fail-safe) bolts at the forward location mounts only to allow the vehicle frame to flex naturally. This flexibility should be in the order of approximately 1kN/mm at each mount and restrict total travel (snubbed) to ±12mm in all directions. All mounts other than the two forward location mounts must be rigid.
- Add lateral cross members between each mount pair and/or design your mounts with high lateral stiffness to resist side-to-side forces.

- Position the main longitudinal supports directly over the vehicle chassis whenever possible to minimise the mount offset.
- Minimise the height of the upfitted body over the chassis to lower the overall centre of gravity and to reduce the bending loads on the mounts. Ensure sufficient tyre clearance is maintained. See wheelhouse envelope.

  Refer to: 5.1 Body (page 207).
- Ensure the upfit design accounts for the differences in the heights of the chassis mounts and naturally conforms without any pre-load. Refer to the specific mount height information later in this section.
- Use large, hardened (high-tensile) steel washers (minimum Ø50x5mm or 50x50x5mm recommended) to spread the load between the chassis and mounting hardware. These washers must not deform when installed at correct torque. Consider also using flanged hardware where possible.
- When designing the upfitted body and mountings to the vehicle chassis be advised that the road-load inputs of up to 2g in the x, y, and z directions have been observed during vehicle testing and development at each of the chassis mounting positions. Ensure your mounting leg and overall structure is robust to the equivalent forces and inputs of this magnitude.
- The surfaces where the chassis and mounts meet must not have 'soft' finishes (like powder coating) that can easily chip or degrade. Any degradation may lead to a soft joint and damaged mounts. Hard, galvanic coatings are preferred.
- The minimum requirement is M10 Grade 10.9 bolts with locknuts, tightened to the correct torque at each mounting location. However M12 hardware at a higher torque is recommended for a more robust connection.
- Make sure that the vehicle structural integrity is maintained.
- Do not drill into closed frame body members.
- Make sure that the design for the body alterations or additional structure disperse the load evenly.
- Re-paint metal edges after cutting and drilling. All metal edges must comply with exterior and interior protection local regulatory standards.
- All fixings through the floor, sides or roof must be sealed.

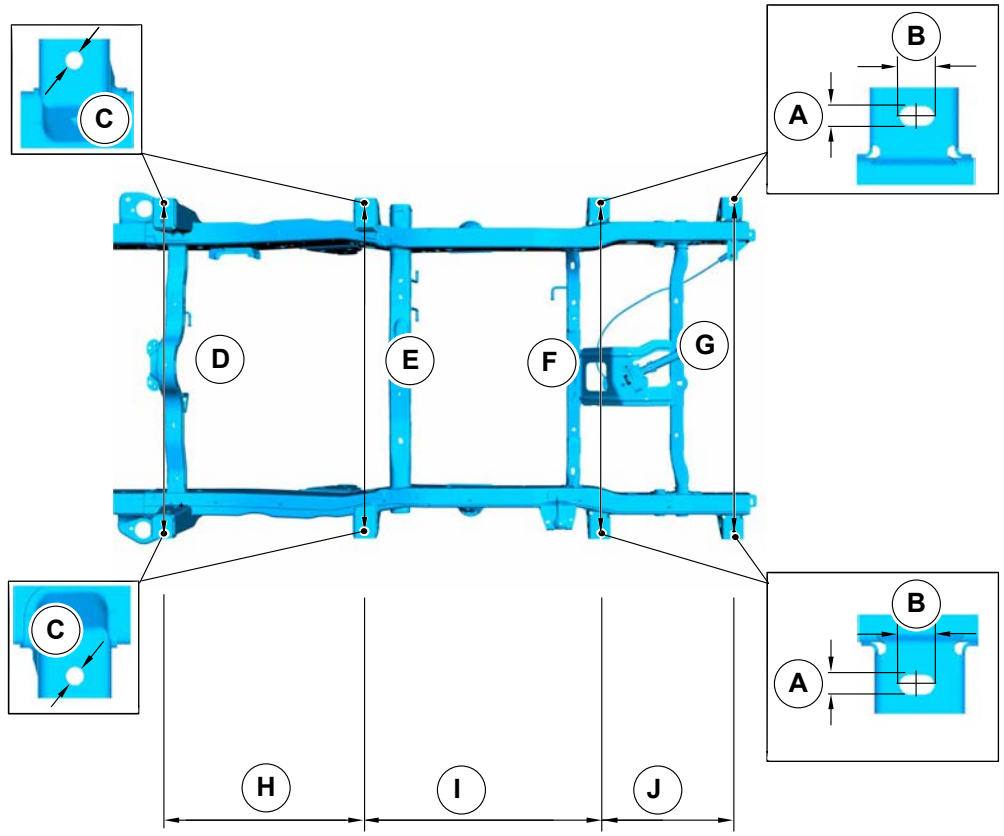
Refer to: 5.5 Corrosion Prevention (page 256).

- Ensure that any additional equipment in the vicinity of the fuel tank will not damage the tank in a crash condition.

For any conversion structure attached to or mounted onto the base vehicle cab structure the following applies:

- Ensure that neither the conversion structure nor the existing vehicle structure get pre-loaded by the assembly process.
- Adhesive jointing is recommended but should be supplemented with mechanical fasteners to prevent initial peel and long term failure.
- Spread bolt loads to minimize local stress.

Body Attachment Holes in Chassis Frame - Single Cab

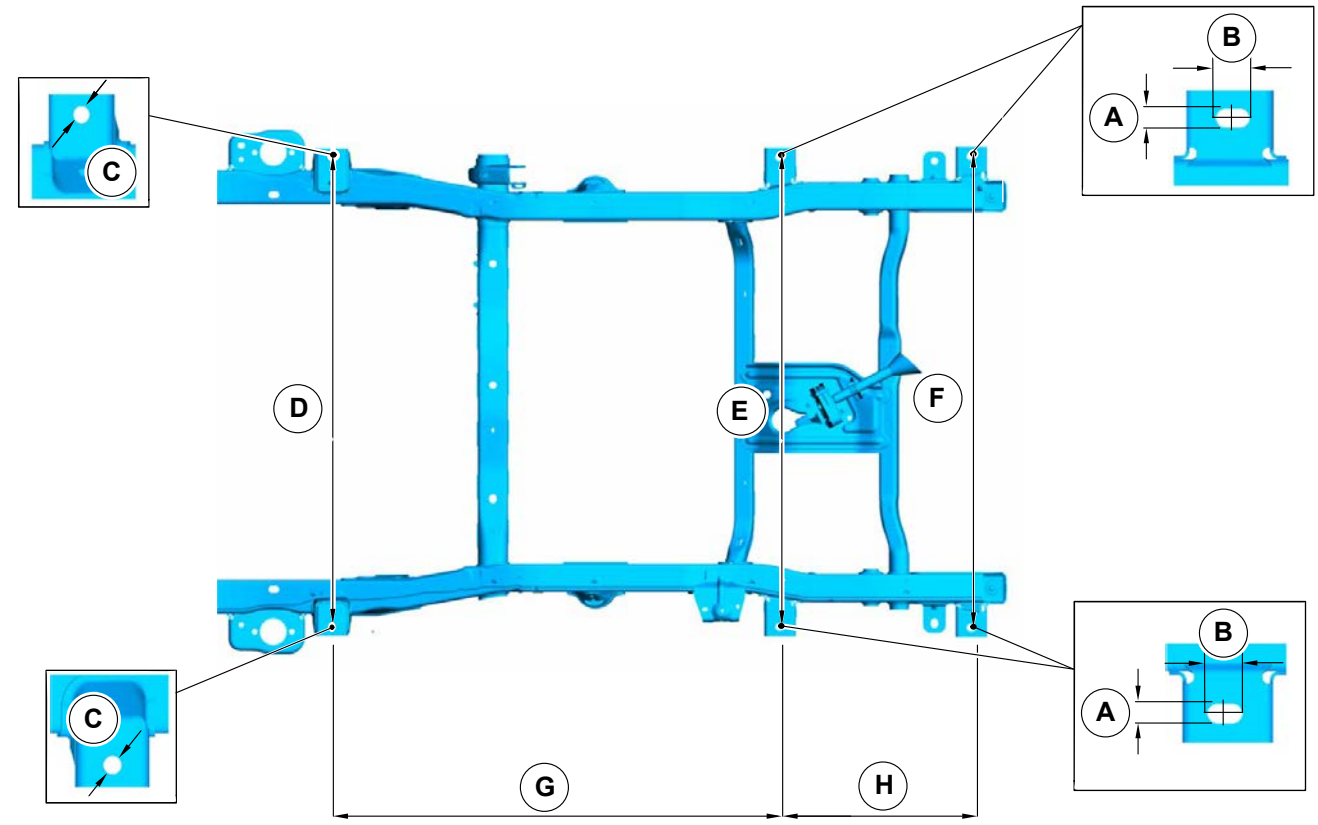


E362797

Dimensions (mm) for Body Attachment Holes in Chassis Frame - Single Cab

Dimension		Dimension	
A	20	F	1244
B	26	G	1248
C	20	H	768
D	1244	I	891
E	1244	J	506

Body Attachment Holes in Chassis Frame - Super Cab

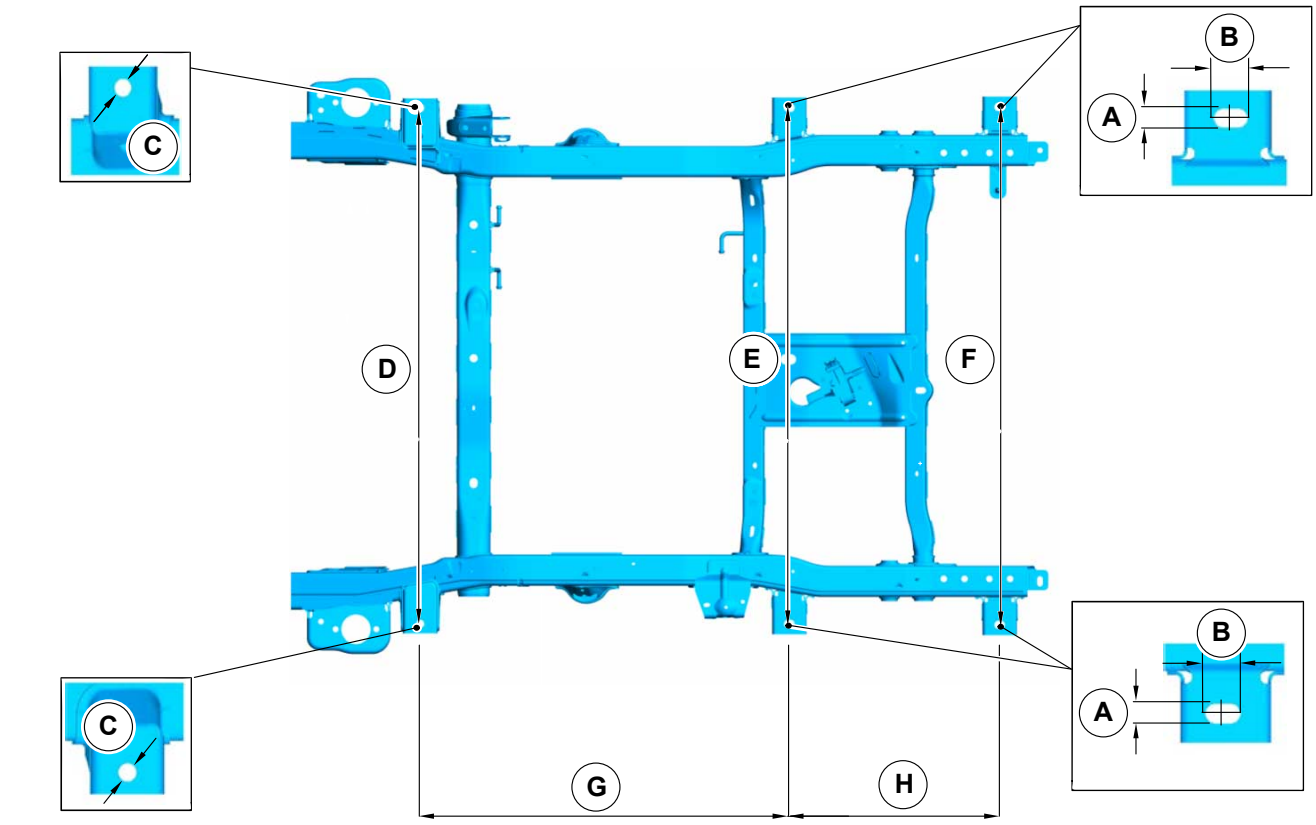


E362798

Dimensions (mm) for Body Attachment Holes in Chassis Frame - Super Cab

Dimension		Dimension	
A	20	E	1244
B	26	F	1248
C	20	G	1188
D	1244	H	506

Body Attachment Holes in Chassis Frame - Double Cab

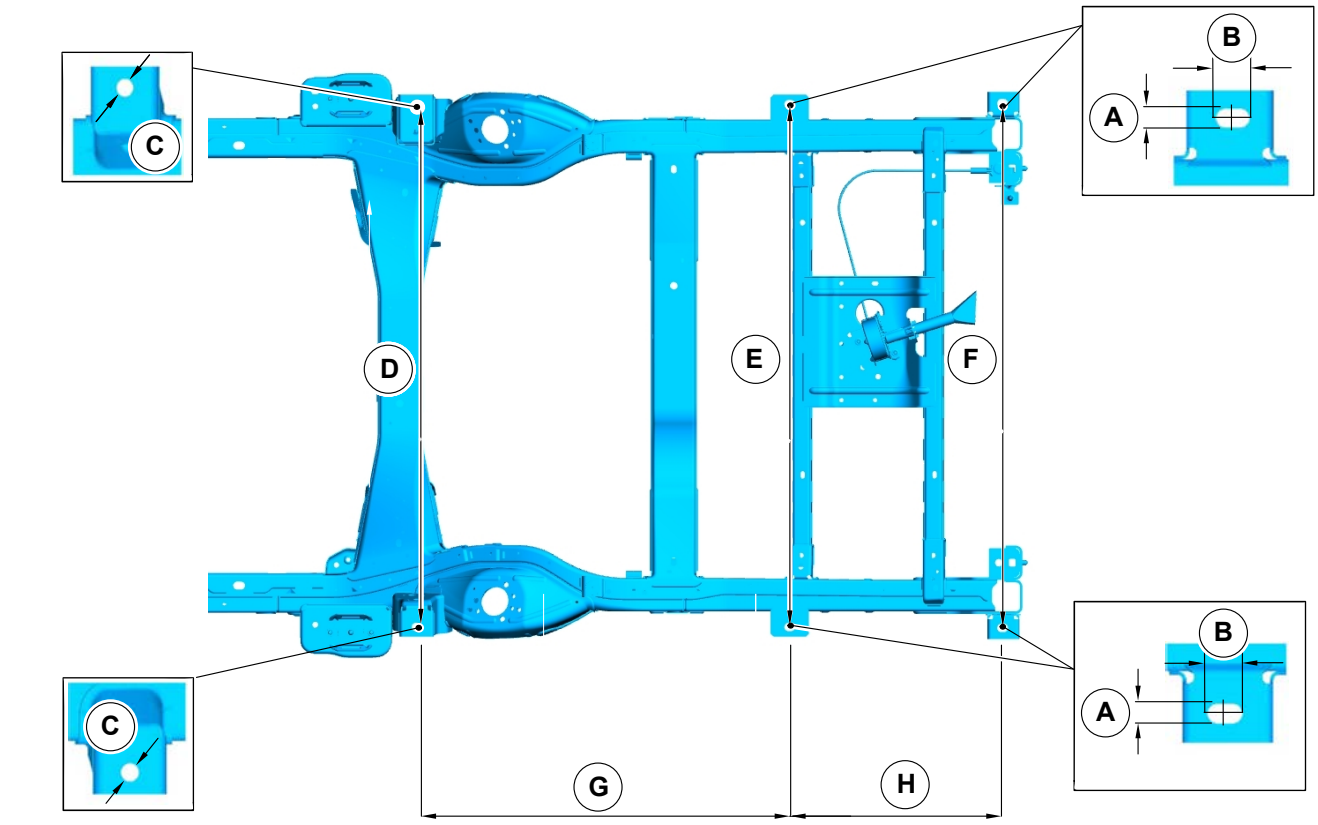


E362799

Dimensions (mm) for Body Attachment Holes in Chassis Frame - Double Cab

Dimension		Dimension	
A	20	E	1244
B	26	F	1248
C	20	G	890
D	1244	H	506

Body Attachment Holes in Chassis Frame - Raptor

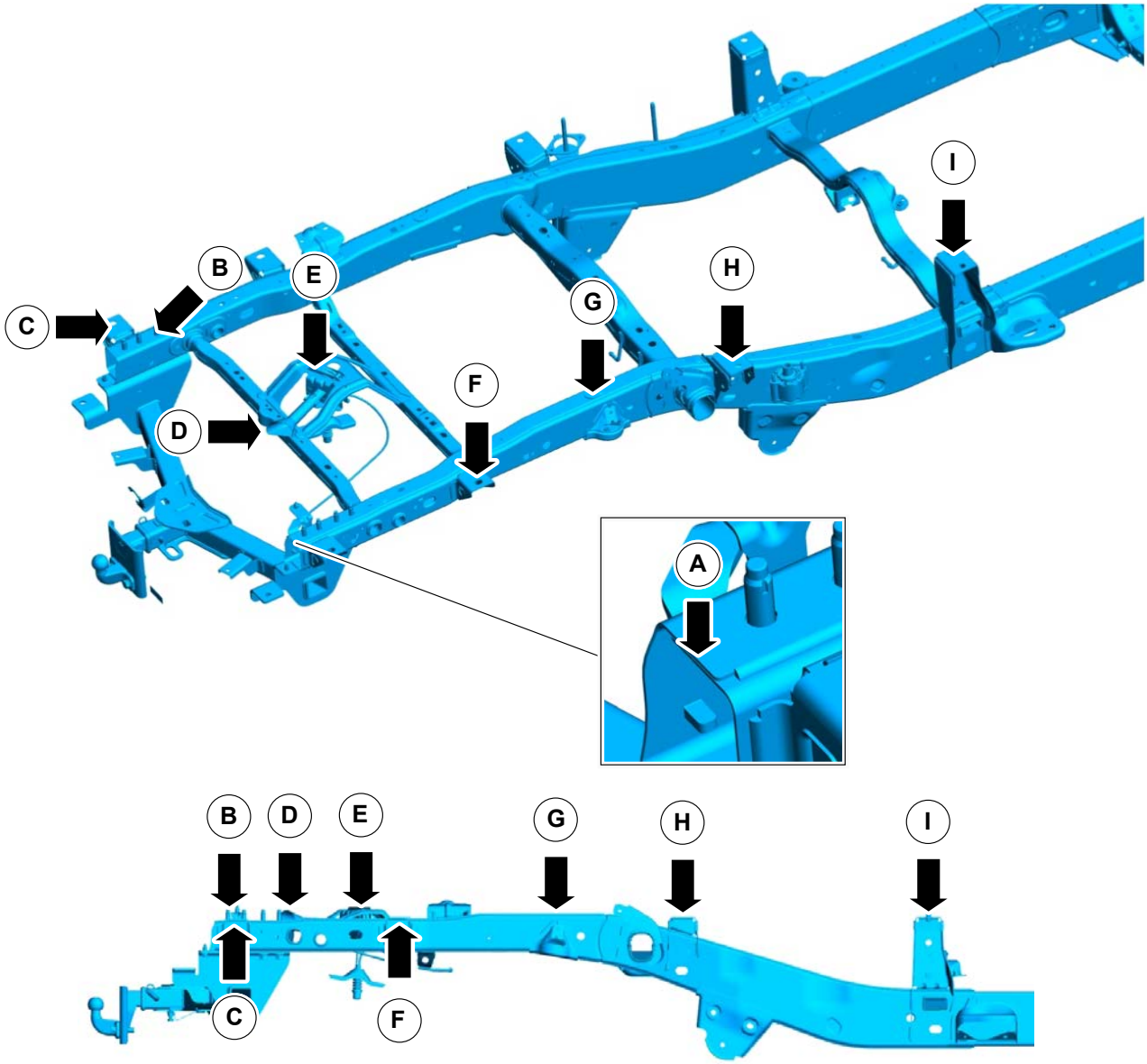


E366255

Dimensions (mm) for Body Attachment Holes in Chassis Frame - Raptor

Dimension		Dimension	
A	20	E	1244
B	26	F	1248
C	20	G	887
D	1244	H	506

Body Mounting Pad Vertical Dimensions - Single Cab



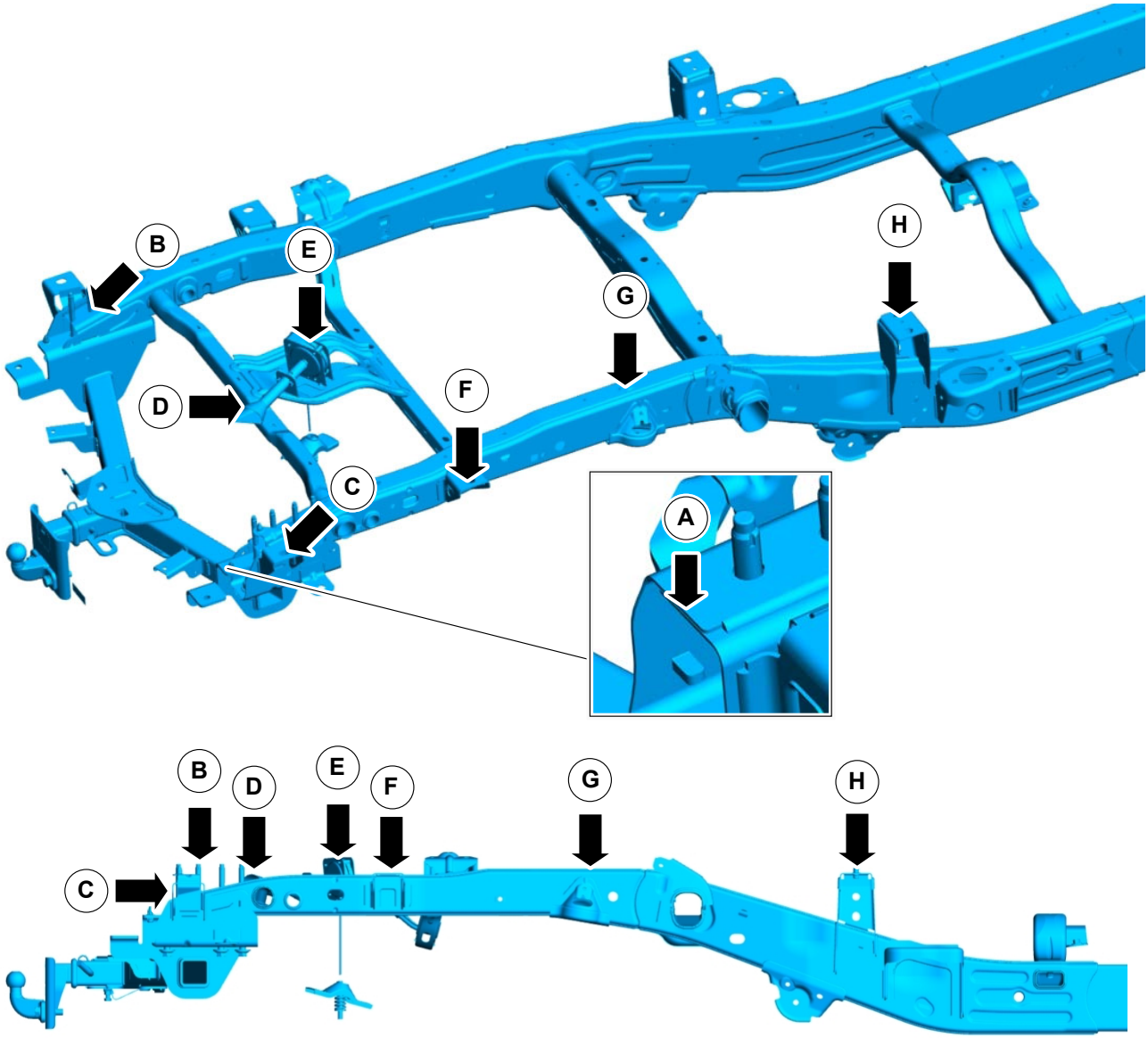
E368452

Dimension	GVM @ RGAWR	MRO	WLTP	Height from A
A	540 LR / 659 HR	656 LR / 776 HR	637 LR / 761 HR	-
B - Towbar Bolts	-	-	-	37
C - Mounting Pad	-	-	-	6
D - Spare Wheel Winch Guide Cone	-	-	-	33
E - Spare Wheel Winch	-	-	-	44
F - Mounting Pad	-	-	-	12
G- Bump Stop	-	-	-	22
H- Mounting Pad	-	-	-	12
I- Mounting Pad	-	-	-	12

All dimensions are in millimeters (mm).

LR = Vehicles with low ride height
HR = Vehicles with high ride height
GVM@RGAWR = Gross Vehicle Mass @ Rear Gross Axle Weight Rating
MRO = Mass in Running Order
WLTP = Worldwide harmonised Light-duty vehicle Test Procedures

Body Mounting Pad Vertical Dimensions - Super Cab



E368453

Dimension	GVM @ RGAWR	MRO	WLTP	Height from A
A	540 LR / 659 HR	656 LR / 776 HR	637 LR / 761 HR	-
B - Towbar Bolts	-	-	-	37
C - Mounting Pad	-	-	-	6
D - Spare Wheel Winch Guide Cone	-	-	-	33
E - Spare Wheel Winch	-	-	-	44
F - Mounting Pad	-	-	-	12
G- Bump Stop	-	-	-	22
H- Mounting Pad	-	-	-	12

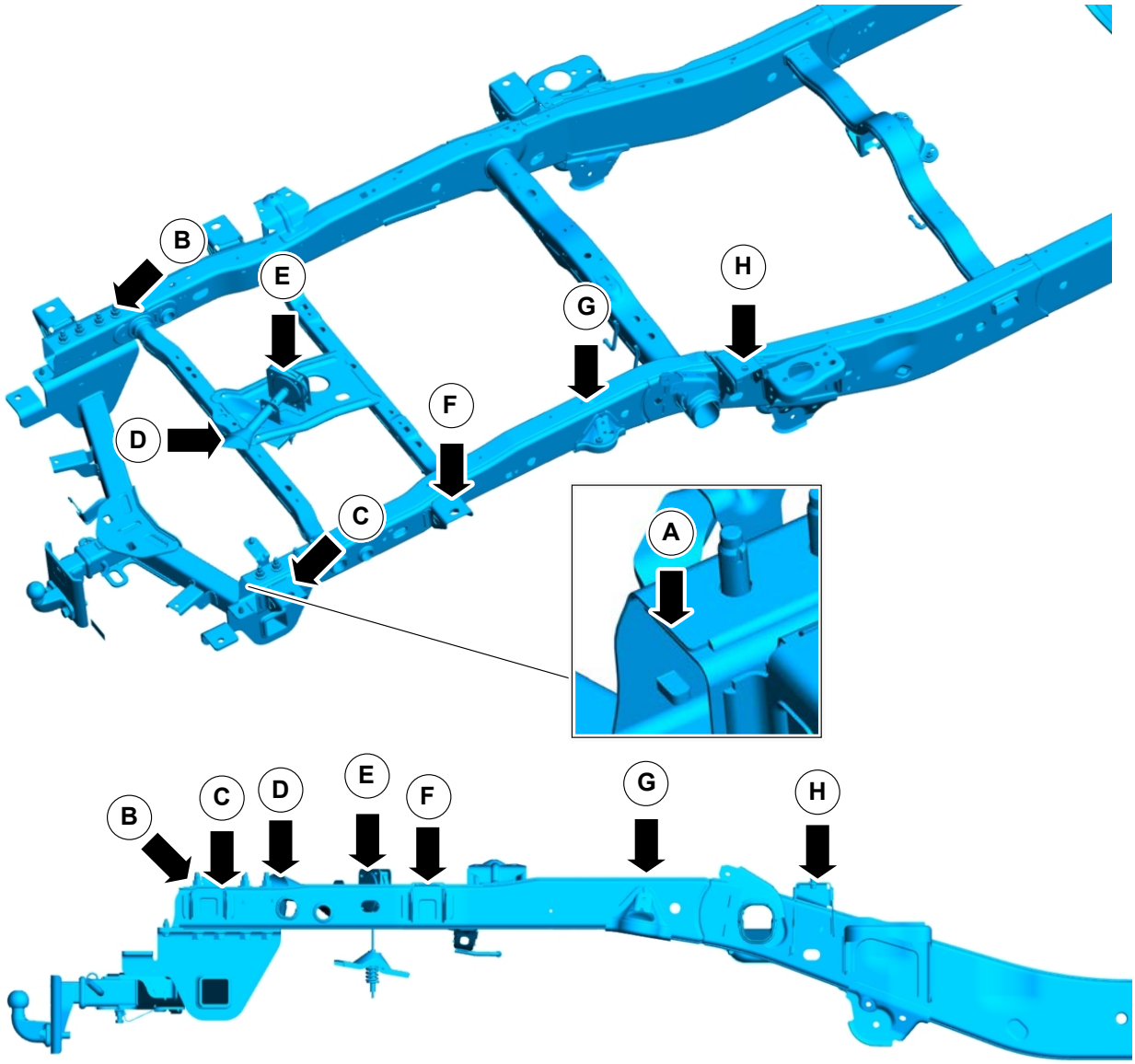
All dimensions are in millimeters (mm).

LR = Vehicles with low ride height

Date of Publication: 06/2026
Composed on:Tue Jul 07 08:04:06 BST 2026

HR = Vehicles with high ride height
GVM@RGAWR = Gross Vehicle Mass @ Rear Gross Axle Weight Rating
MRO = Mass in Running Order
WLTP = Worldwide harmonised Light-duty vehicle Test Procedures

Body Mounting Pad Vertical Dimensions - Double Cab



E368454

Dimension	GVM @ RGAWR	MRO	WLTP	Height from A
A	540 LR / 659 HR	656 LR / 776 HR	637 LR / 761 HR	-
B - Towbar Bolts	-	-	-	37
C - Mounting Pad	-	-	-	6
D - Spare Wheel Winch Guide Cone	-	-	-	33
E - Spare Wheel Winch	-	-	-	44
F - Mounting Pad	-	-	-	12
G- Bump Stop	-	-	-	22
H- Mounting Pad	-	-	-	12

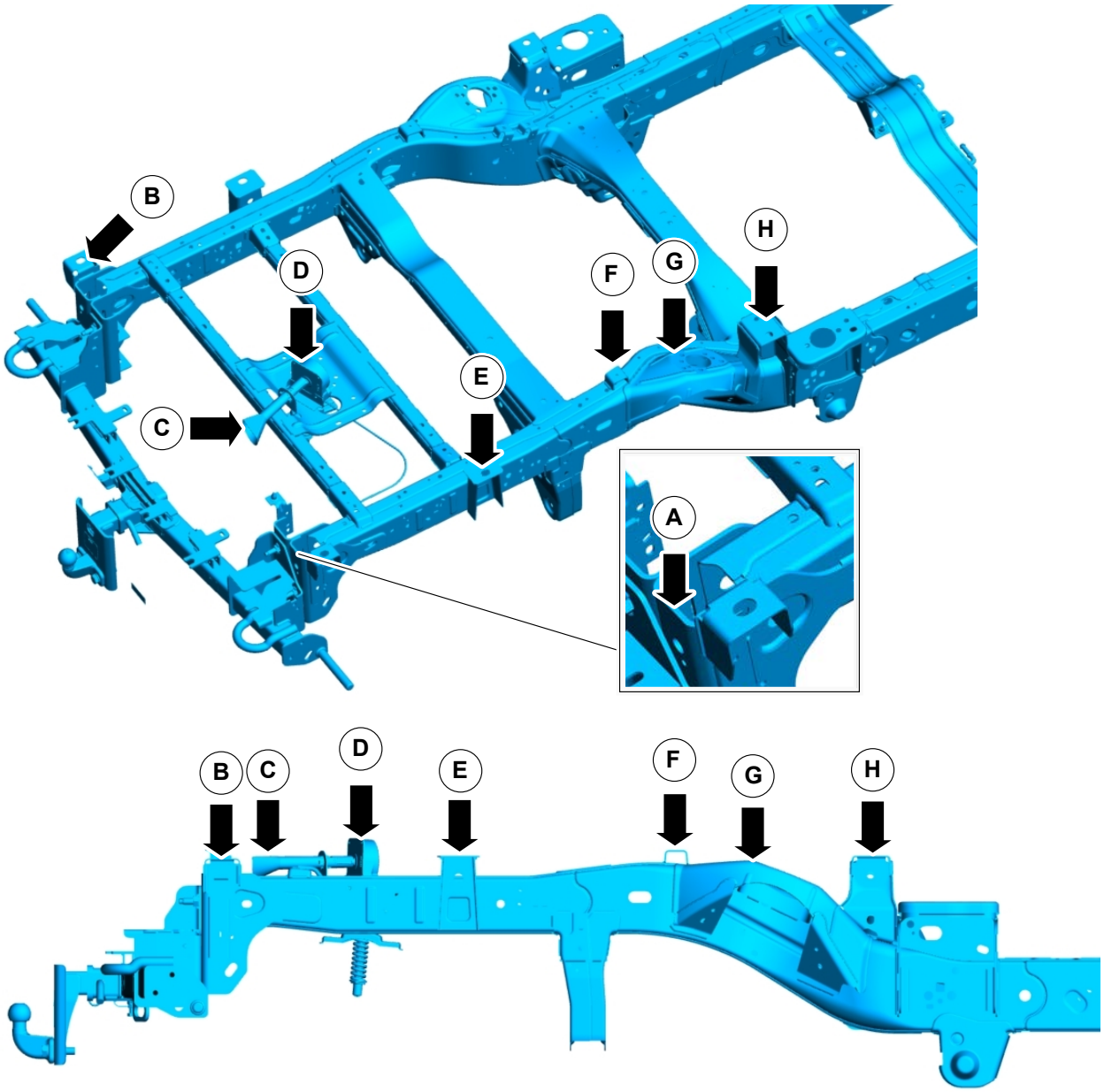
All dimensions are in millimeters (mm).

LR = Vehicles with low ride height

Date of Publication: 06/2026
Composed on:Tue Jul 07 08:04:06 BST 2026

HR = Vehicles with high ride height
GVM@RGAWR = Gross Vehicle Mass @ Rear Gross Axle Weight Rating
MRO = Mass in Running Order
WLTP = Worldwide harmonised Light-duty vehicle Test Procedures

Body Mounting Pad Vertical Dimensions - Raptor



E368451

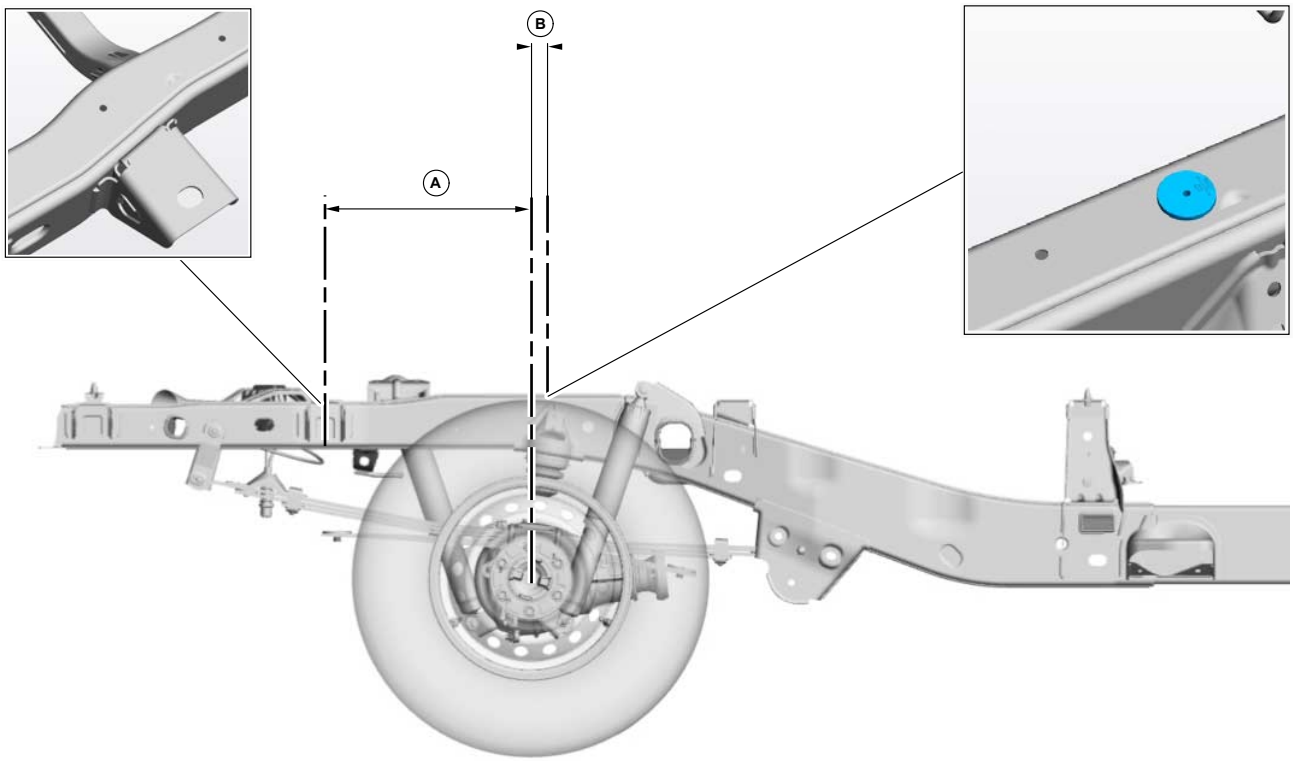
Dimension	GVM @ RGAWR	MRO	WLTP	Height from A
A	633	779	749	-
B - Mounting Pad	-	-	-	32
C - Spare Wheel Winch Guide Cone	-	-	-	49
D - Spare Wheel Winch	-	-	-	75
E - Mounting Pad	-	-	-	38
F- Mounting Pad	-	-	-	54
G- Spring Hat/ Shock Mount	-	-	-	27
H- Mounting Pad	-	-	-	38

All dimensions are in millimeters (mm).

GVM@RGAWR = Gross Vehicle Mass @ Rear Gross Axle Weight Rating

MRO = Mass in Running Order
WLTP = Worldwide harmonised Light-duty vehicle Test Procedures

Frame Feature Centerline Distance - All Cab Styles

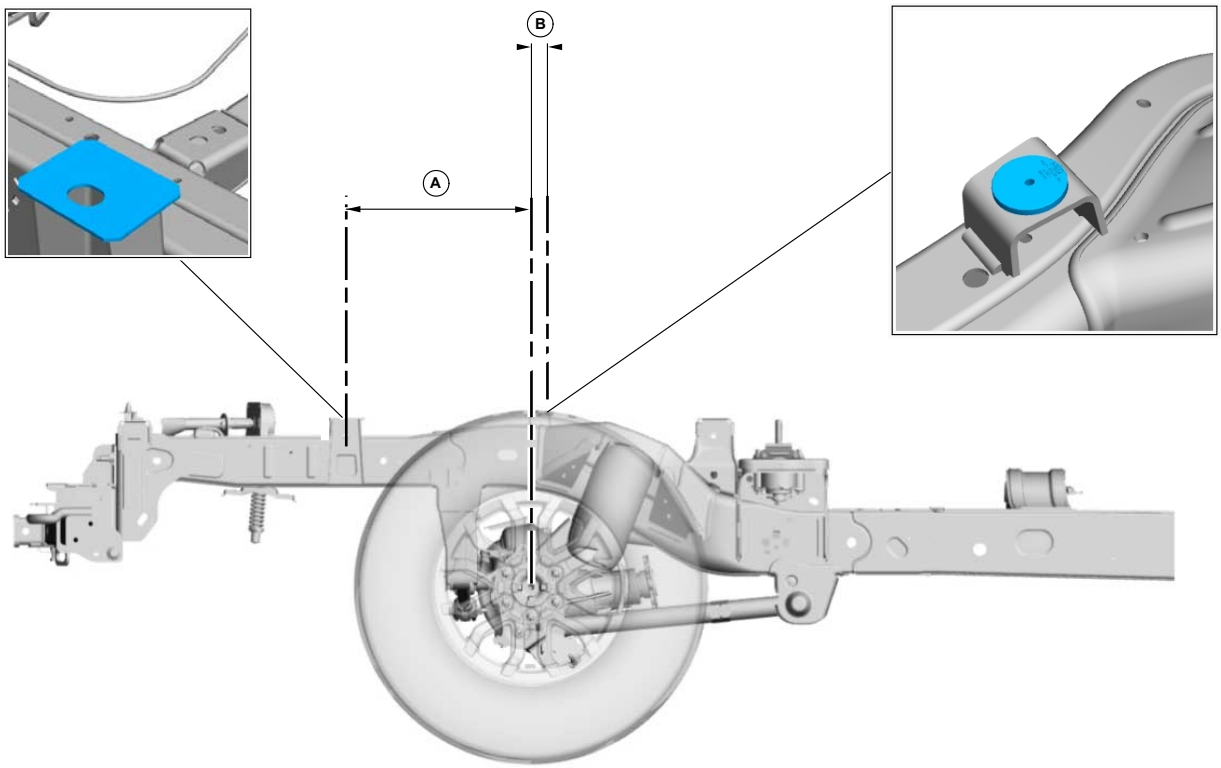


E369749

Dimension	Measurement
A	446
B	23

All dimensions are in millimeters (mm).

Frame Feature Centerline Distances - Raptor



E369752

Dimension	Measurement
A	446
B	23

All dimensions are in millimeters (mm).

5.1.7 Front End Integrity for Cooling, Crash, Aerodynamics and Lighting

Cooling Continuous air flow through the front end and engine compartment is not to be hindered by adding any additional equipment. If uncertain please consult the Ford dealer.

Lighting Do not alter the lighting system.

Crash Do not cut, drill or weld any parts that are load path relevant in case of crash. Do not add material in the crash zone. This could affect the crash sensor calibration.

The side airbag system is not permitted if:

- A swiveling device is fitted on the front seats.
- A side wall or any other additional material or structure is attached to the B-pillar inner and/or outer area.

Static & Dynamic Sealing and Finishing Ensure proper sealing against ingress of water, salt, dust etc. after cutting or drilling the body. Use Ford approved sealing and finishing material, and underbody corrosion protection.

Refer to: 5.5 Corrosion Prevention (page 256).

5.1.8 Tipper Bodies

For tipper conversions single and double Chassis Cab versions except extended rear chassis frame can be used. All variants allow single and three way tipping.

It is recommended to have the tipping system operative only when the engine is running. It is also recommended to have the master control switch in the security of the cab. According routing of wires and hydraulic lines please refer to section hydraulic lift.

Ensure that axle plated weights including the front axle minimum are not exceeded.

For tipper sub-frames please refer to the following guidelines:

Refer to: 5.1 Body (page 207).

- Design for full length continuous frame with mountings for motor, pump unit, reservoir, pivot points and ram.
- Use all mounting points on chassis frame to mount sub-frame.
- Sub-frame must extend to the back of the cab and attach to all mounting locations, with the forward end designed to minimize local frame stress. It is however, preferable to mount the sub-frame onto the mounting brackets with a clearance to the chassis frame top surface.
- Side tipping loads/forces must be resolved by the sub-frame. It is not recommended to strain the chassis frame.

5.1.9 Tank and Dry Bulk Carriers

Due to the high rigidity of tanks it is necessary to isolate the tank and its sub-frame from the chassis frame allowing the chassis frame to naturally flex. Please refer to the following guidelines:

Refer to: 5.1 Body (page 207).

- Mount tank to full length of sub-frame.
- Mount sub-frame to all chassis frame mounting points.
- The forward location mounts must be flexible to allow relative chassis frame to sub-frame deflections.

  Refer to: 5.1 Body (page 207).
- Sub-frame must extend to the back of the cab and not contact chassis frame at forward end under worst case deflection.
- The minimum requirement is M10, Grade 8.8 bolts with washers and self lock nuts for the chassis frame mount bracket at each solid and compliant location. The use of M12 or M14 bolts is recommended.

5.1.10 Genuine Ford Accessory Bull Bar (if available)

The Genuine Ford Accessory bull bar includes brackets which are mounting points for driving lights, aerials, antennas and flags.

WARNINGS:

Follow all accessory manufacturer's instructions when connecting accessories and equipment to the vehicle.

Do not fit a non-Ford approved bull bar to your vehicle as this may interfere with the operation of the restraint system, including the air bag deployment, and could result in injury to yourself and others. Fitment of a bull bar may also void the vehicle's compliance with Australian Design Rules.

Do not modify the front of your vehicle in any way. This could adversely affect deployment of the airbags. Failure to adhere to this warning could result in serious personal injury or death.

After bullbar installation, contact your authorised Ford Dealer to correctly calibrate the Adaptive Cruise Control Radar Module, the Restraint Control Module and the Parking Aid Module. This is required to ensure correct operation of the advanced safety features this vehicle offers.

NOTE: Please refer to the electromagnetic compatibility (EMC) section in this book before installing any aerials.

Antenna Cables Routing

WARNINGS:

Ensure that the antenna cables have sufficient clearance from hot and moving parts.

Do not fasten the antenna cables to original vehicle wiring, fuel pipes and brake pipes.

Keep the antenna and power cables at least 100mm from any electronic modules and airbags and associated wiring.

NOTE: Make sure the sealing integrity is maintained to avoid water ingress into the cabin while routing the cables through the grommet.

Antenna cables should be routed from the engine bay into the cabin area through the existing grommet. There is a service nib provided on the grommet.

Refer to Exterior lighting - Additional external lamps for driving lights cable routing.

5.1.11 Roof Racks

Roof racks may be fitted to all Super and Double cab variants providing the following is satisfied:

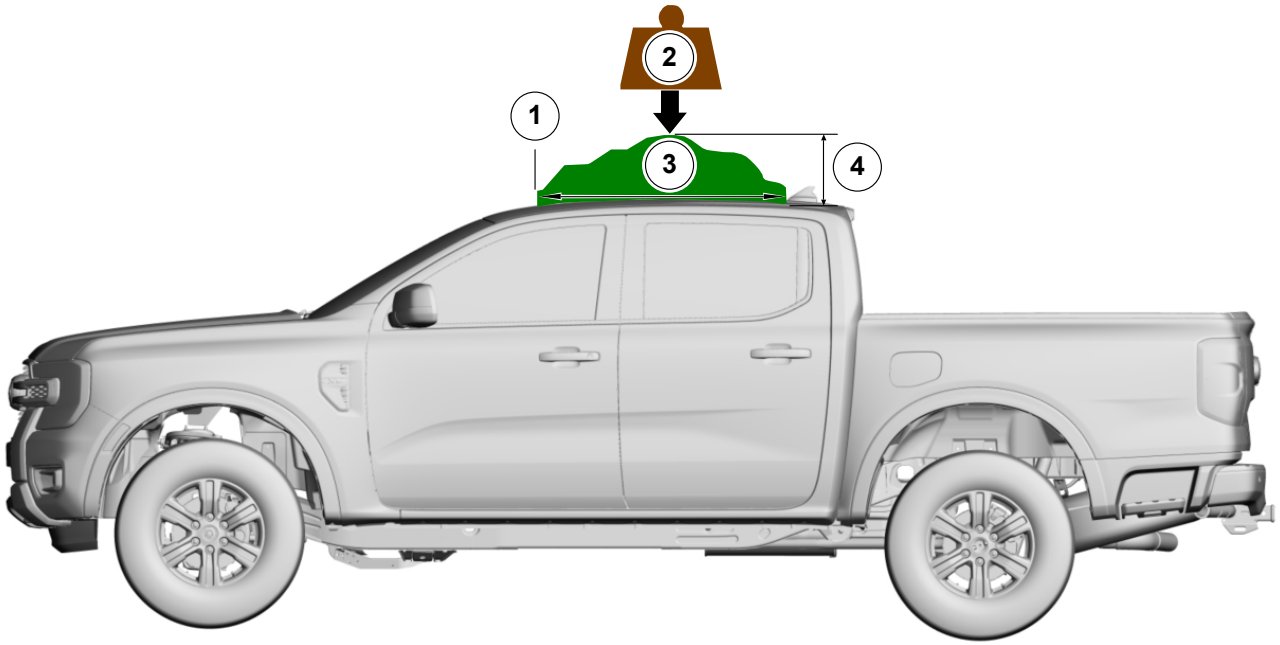
- The carried load does not exceed 85kg (converter to ensure owner's information book identifies this limitation).
- The carried load does not exceed 300mm load height (converter to ensure owner's information book identifies this limitation).
- The load is evenly distributed (converter to ensure owner's information book identifies this limitation).
- The rack and subsequent carried load is supported according to the your local Ford dealer irrespective of rack retaining method.
- Removing or obstructing the radio antenna mast (especially with metal objects) will impact radio performance and mounting anything directly over the mast base will impact GPS performance.

Double Cab / Super Cab

The forgoing limitations are based on ensuring body structure integrity, vehicle handling, braking and plated axle weights. Such considerations must also be applied to any double cab and super cab applications, in particular steering, braking and front axle ratings and the extra continuous loads on the "A" pillar, which should not exceed 60 kg total incremental load.

Ensure that the loaded vehicle operates within its designed Center of Gravity condition. For details please consult the Ford dealer.

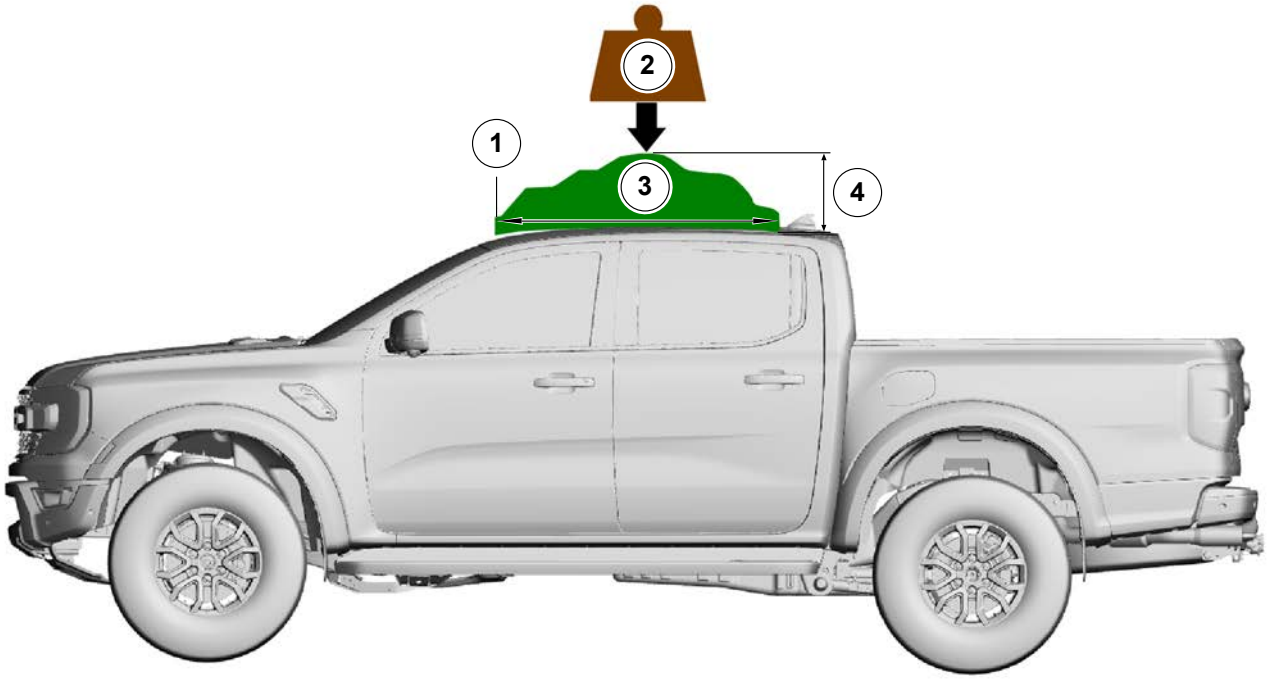
Roof Rack Vehicle Converter Special Fit - Ranger



E362800

Item	Description
1	Rear edge of front attachment point
2	85kg (Dynamic) (Maximum) / 350kg (Static) (Maximum)
3	Maximum roof rack length: within length of drain channel
4	Maximum load height 300mm

Roof Rack Vehicle Converter Special Fit - Raptor



E393361

Item	Description
1	Rear edge of front attachment point
2	80kg (Dynamic) (Maximum) / 350kg (Static) (Maximum)
3	Maximum roof rack length: within length of drain channel
4	Maximum load height 300mm

5.1.12 Cargo Management on Vehicle Tub

WARNING: Only use the recommended attachment points, otherwise damage may occur to the load box.

CAUTIONS:

Weight and load should pass through the recommended structural attachment points.

A minimum clearance of 28mm between the vehicle cab and any fitted service body, load-bearing elevated accessories, canopy, tray or load management structure must be maintained to prevent damage to the vehicle cab structure during operation.

Ranger vehicles built with a cargo "tub" are pre-equipped with mounting positions in the tub side rail to allow the fitment of upfitter cargo solutions such as canopies, sports bars, carry racks etc.

NOTE: Side rail attachment points using M8 threaded fasteners must not be tightened to a torque higher than 25Nm.

Refer to the vehicle's owner manual for information related to factory fit cargo management.

Refer to: 1.13 (page 46).

Load Box Reinforcement Brackets

WARNINGS:

Make sure that all cargo loads are properly balanced and secured.

Accessories extending above the load box side rail and weighing in excess of 45kg may require load box reinforcement brackets to be installed.

CAUTION: To support the structural integrity of the load box when load-bearing elevated accessories are fitted, Ford recommends the installation of load box reinforcement brackets. Examples of these include canopies, ladder racks, cattle cages, carrier cross bars, load-bearing elevated accessories etc. Load box reinforcement brackets are available as a Ford service part.

NOTE: Verify the vehicle build level and whether the load box reinforcement brackets are required.

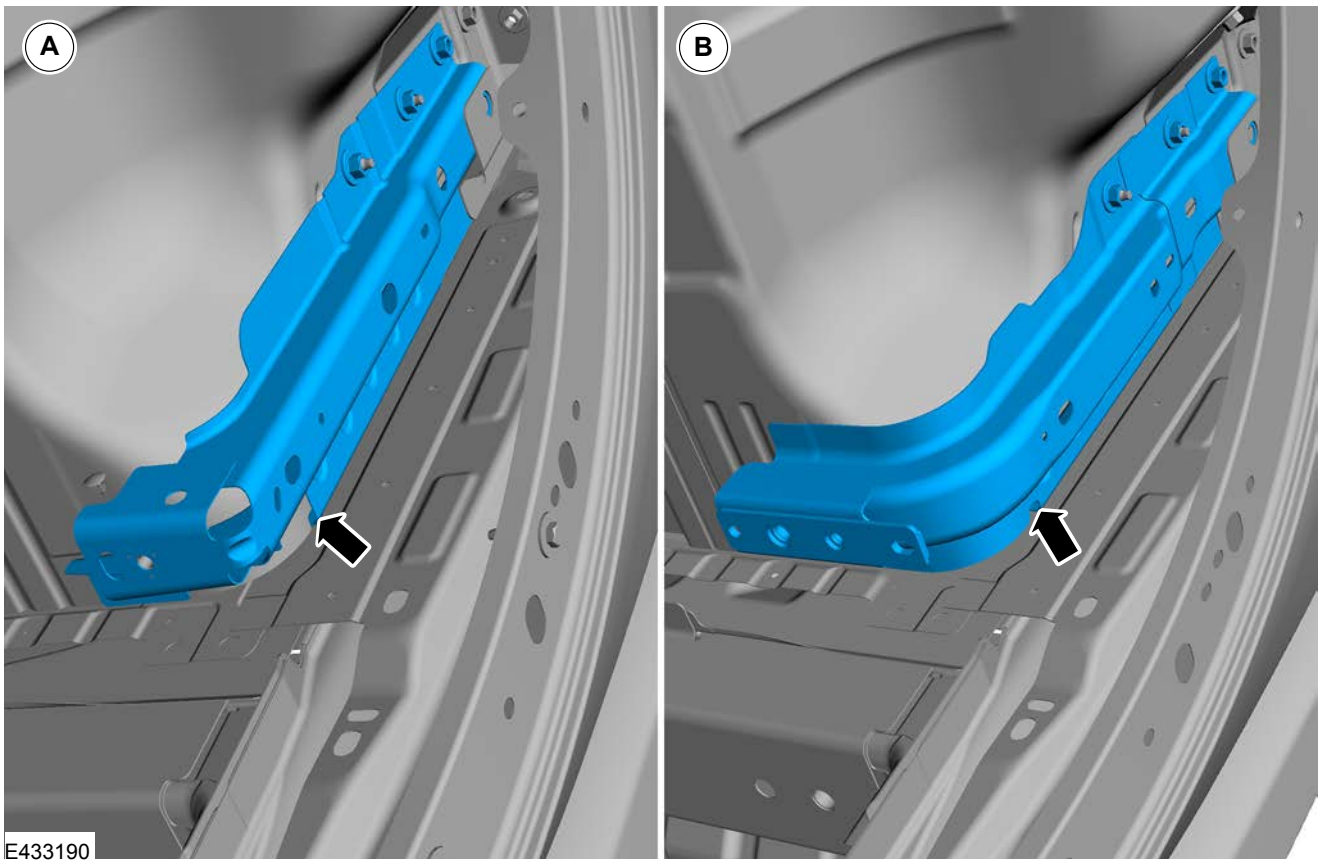
Refer to the graphic below:

The loadbox structure has been revised in later build vehicles. These do not require the load box reinforcement nor can they be fitted.

Approximate build breakpoints by build plant:

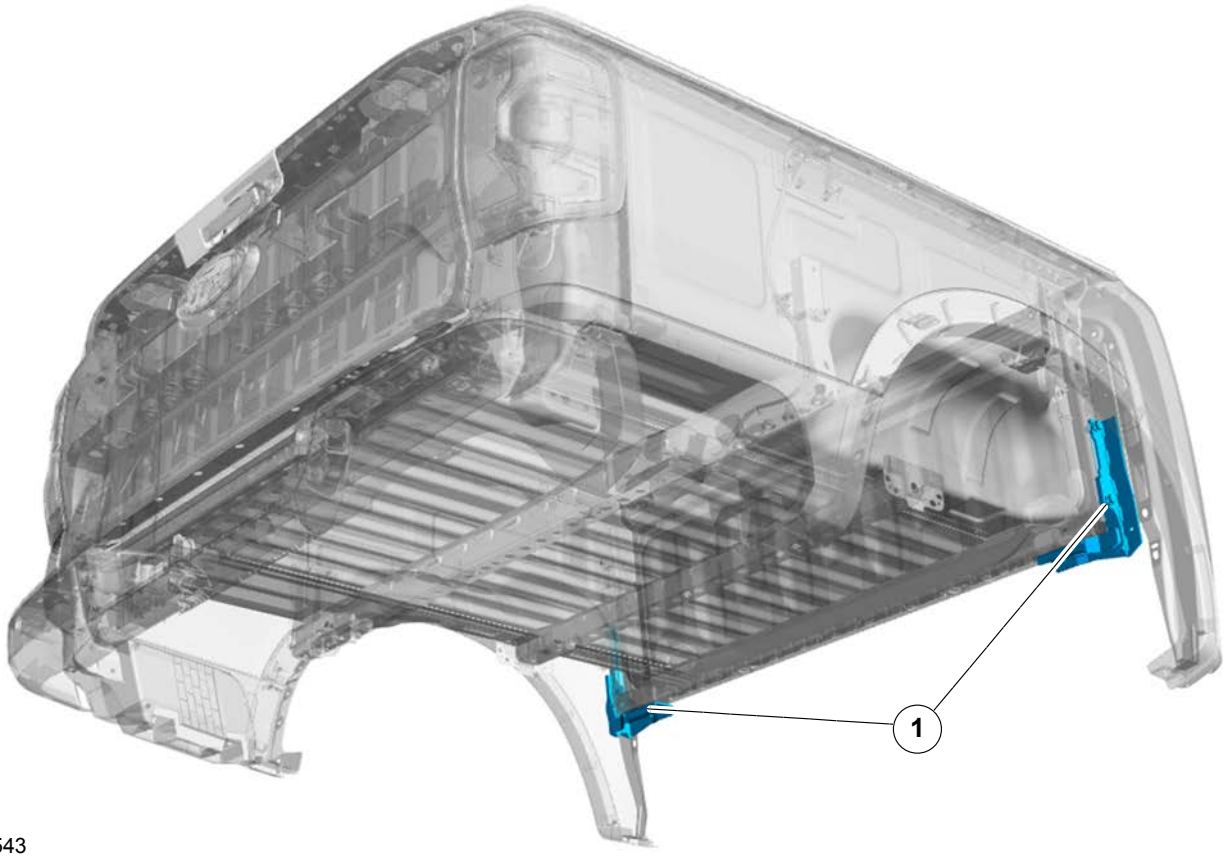
- Thailand - July 2024
- South Africa - November 2024
- South America - January 2025

Load Box Reinforcement Bracket Determination - ICE



Item	Description
A	The load box reinforcement brackets can be installed
B	The load box reinforcement brackets are not required and cannot be installed

Load Box Reinforcement Bracket Location - ICE



E390543

Item	Description
1	Load Box Reinforcement Brackets

These brackets have been developed by Ford to brace the floor to the wall of the load box to ensure that the off-road durability performance of the load box is maintained with the installation of load-bearing elevated accessories.

Ford also makes these load box reinforcement brackets available as a Ford service part that can be purchased from any authorised Ford Dealer:

NOTE: Verify the availability of the load box reinforcement bracket in your market.

- Ranger (Excl. Raptor) Part Number: AMN1WJ27726AA / VN1WZ2627726A
- Ranger Raptor Part Number: AMN1WJ27726BA / VN1WZ2627726B

CAUTION: These reinforcement brackets have been designed specifically for Ford Licensed Accessories and their suitability for use with any aftermarket (non-Ford Licensed) accessories will need to be determined by the aftermarket manufacturer or supplier.

Responsibility for the appropriate use of these brackets in a vehicle which is modified by a body builder or with an alternate accessory manufacturer's products, remains with that party. It is the vehicle modifier's responsibility to ensure that the modification is carried out in such a way as to ensure that durability of the load box is maintained.

Contact your National Sales Agent or your local Ford Dealer for information on the supply and installation of the reinforcement brackets.

Canopy, Ladder Rack or Canoe Rack

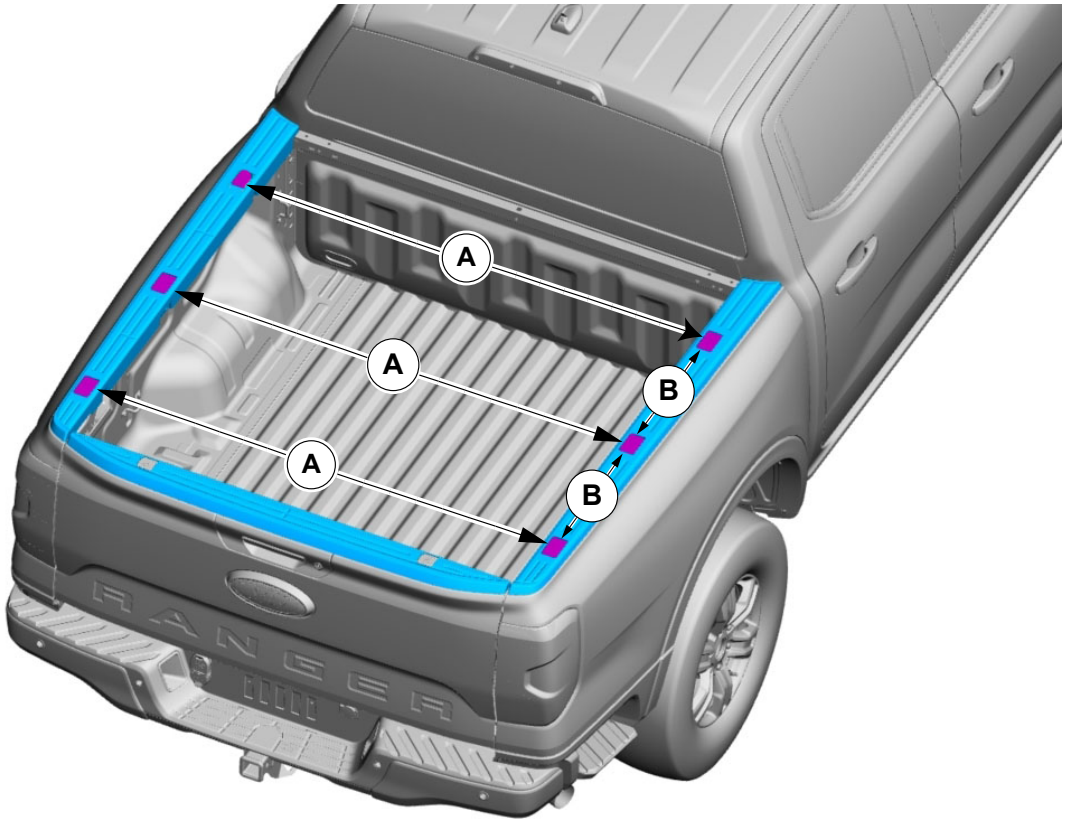
CAUTIONS:

When a canopy, ladder rack, canoe rack or similar load box mounted accessory is fitted, a combination of the indicated mounting points on top of the load box must be used for suitable fixture to the vehicle. Load bearing and heavy vehicle accessories must use cross plane attachment points to ensure secure fitment.

The loadbox upper plastic capping (box top moulding) is not designed to bear significant load. Do not clamp directly to this surface.

Load bearing and heavy vehicle accessories must use cross plane attachment points to ensure secure fitment.

Structural Attachment Points - Double Cab and Super Cab

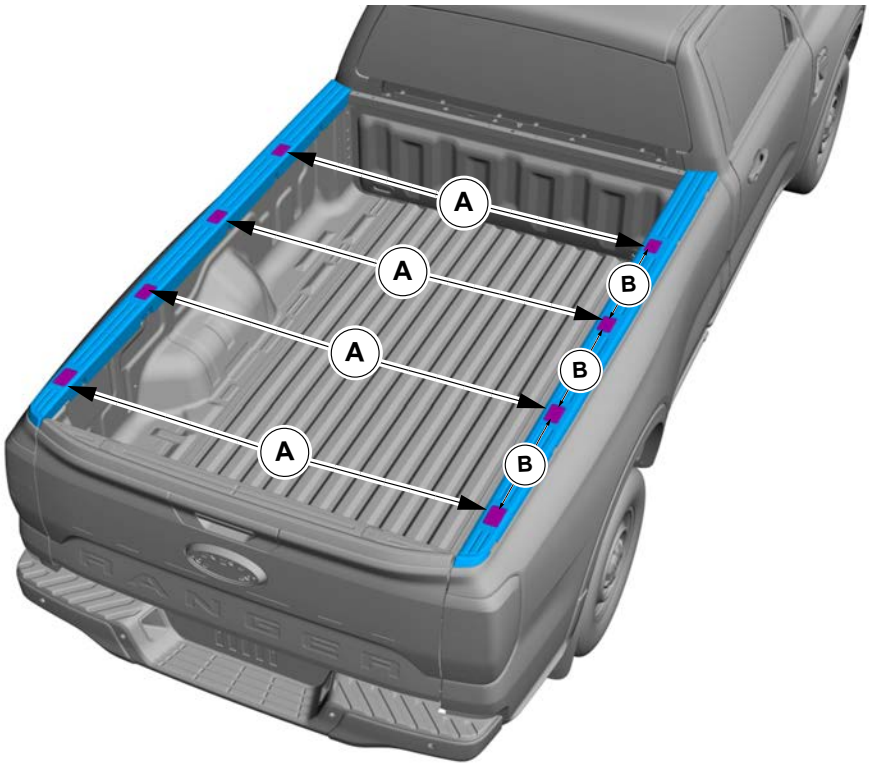


E362801

Item	Measurement
A	1498
B	510

All dimensions are in millimeters (mm).

Structural Attachment Points - Single



E376121

Item	Measurement
A	1498
B	510

All dimensions are in millimeters (mm).

Side Rail Mounting Points



E364788

Item	Description
1	LH cargo mounting rail
2	RH cargo mounting rail

Some vehicles are equipped with side rail mounting rails that incorporate multiple pre-threaded mounting points.

Additional load carrying capabilities and mounting fixtures are outlined in the vehicle owner manual.

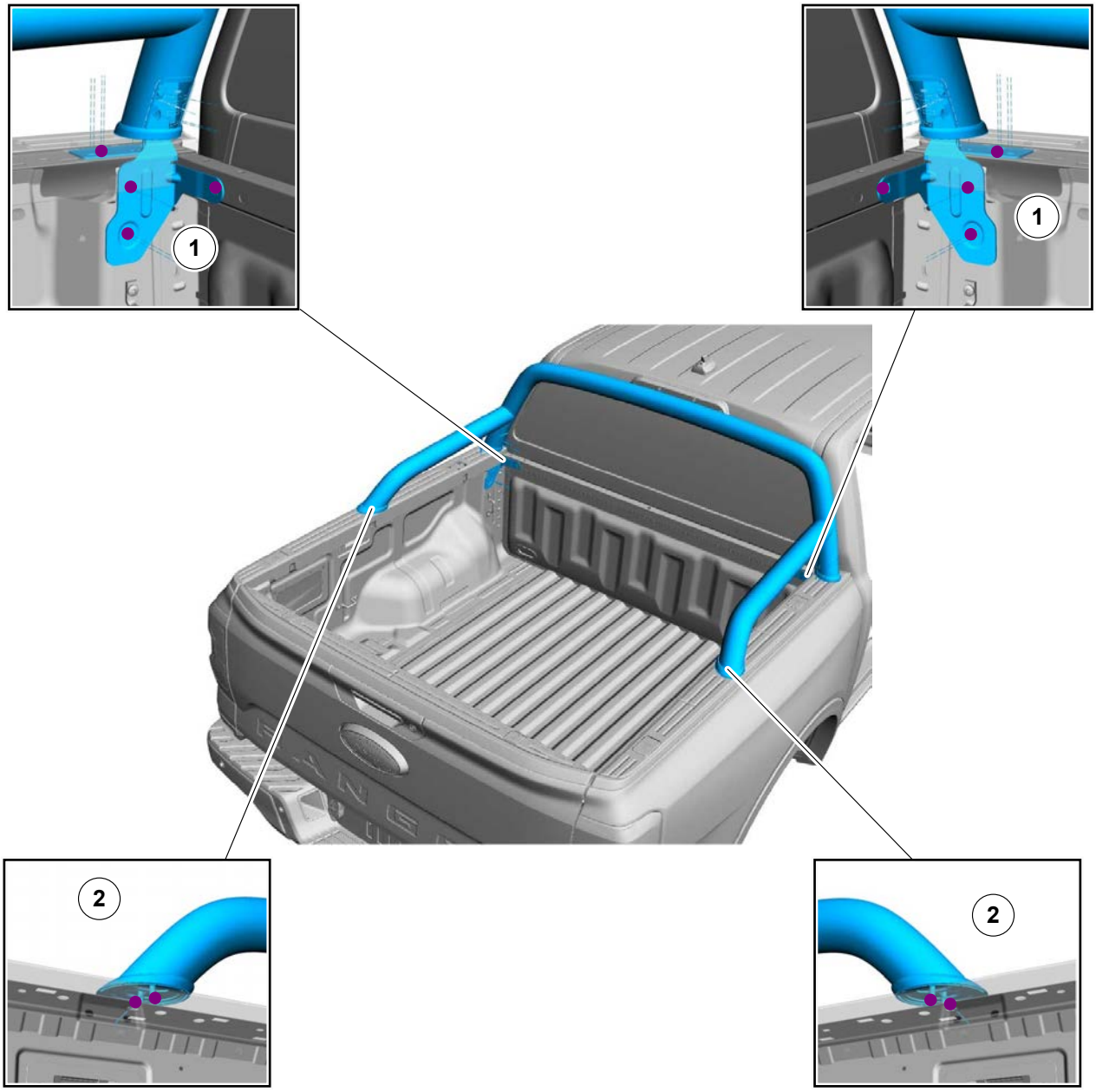
Mounting Point Load Capacities



A	B
Maximum force between directly opposed mounting points is 125Kg	Maximum force between diagonally opposed mounting points is 272Kg

Sports Bar

NOTE: When fitting a sports bar, a combination of the indicated mounting points must be used for suitable fixture to the vehicle.

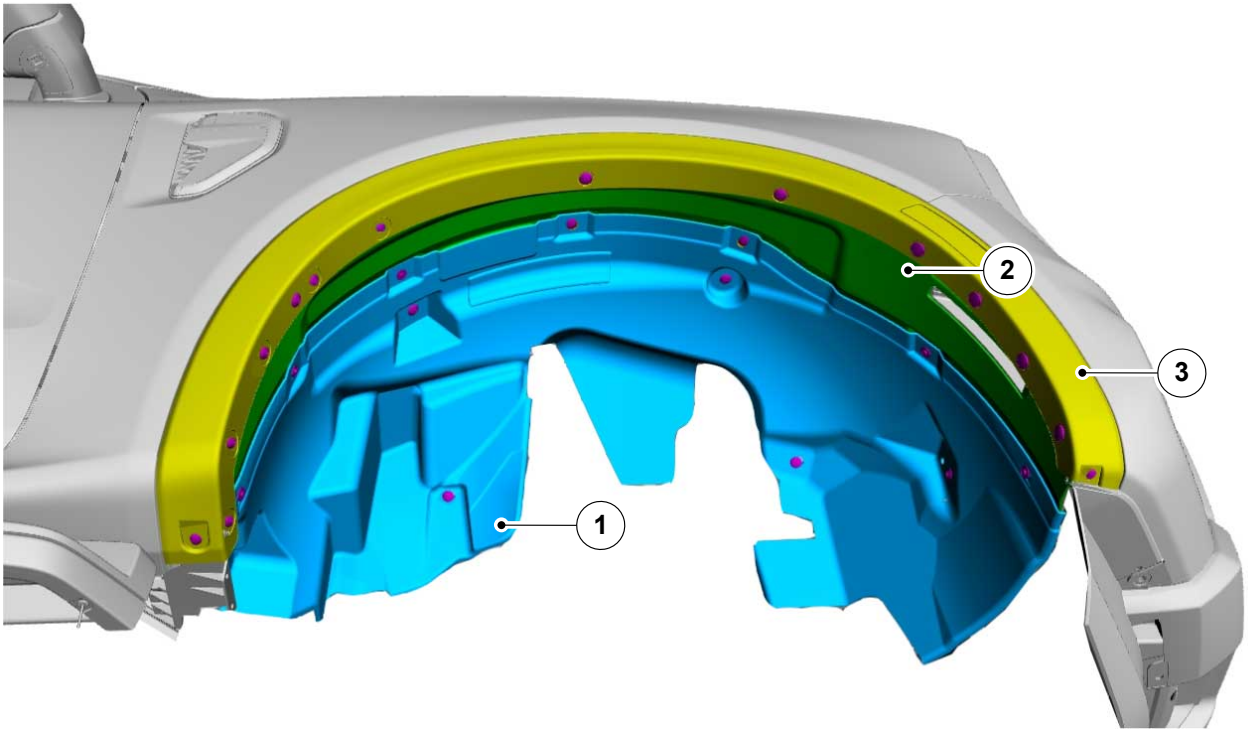


E362802

Item	Description
1	Front structural attachment points - M8
2	Rear structural attachment points - M8

5.1.13 Front Fender Liner

NOTE: RH shown, LH similar.



E368092

Item	Description
1	Fender Liner
2	Front Fender Splash Shield
3	Wheel Opening Molding

To allow access to the engine bay and select accessory mounting fixtures, the front RH and LH fender liners can be removed without removing the wheel opening moldings and the front fender splash shield.

Removal of the wheel opening moldings can be undertaken after removal of the fender liner, by accessing and releasing the wheel opening molding retainers from inside the fender cavity.

Refer to the workshop manual or your National Sales Agency for information on the correct removal and installation procedure to support the inner wheel house liner removal process.

5.2 Front End Body Panels

5.2.1 Hood Strut

CAUTION: Aftermarket hood gas struts may impact the hood hinge joint.

It is not recommended to use aftermarket hood gas struts that connect to the hood hinges as this may degrade the hinge joint, hood alignment and hood mobility.

5.3 Airbag Supplemental Restraint System (SRS)

5.3.1 Air Bags

Front Seats

WARNINGS:

Accessory seat covers not approved by Ford could prevent the correct deployment of the airbags and increase the risk of injuries in a crash.

If installing aftermarket seat covers make sure they are certified as airbag compliant.

Ford offers certified and approved accessory seat covers in grey and black to suit all cab styles. These are available in some markets as an accessory that can be purchased from authorised Ford Dealers.

Side airbags are not compatible with swiveling front seats.

Do not specify the base vehicle with side airbags when planning to retrofit a swiveling device on the front seats and/or an armrest on the outer side of the front seats, this may affect the function and/or deployment of the side airbags.

Pressure based airbag sensors for side airbags are located near the centre top of the front doors inner door sheet metal for all cab styles.

Acceleration based airbag sensors for side airbags are located near the bottom of the C-pillar inner for all cab styles.

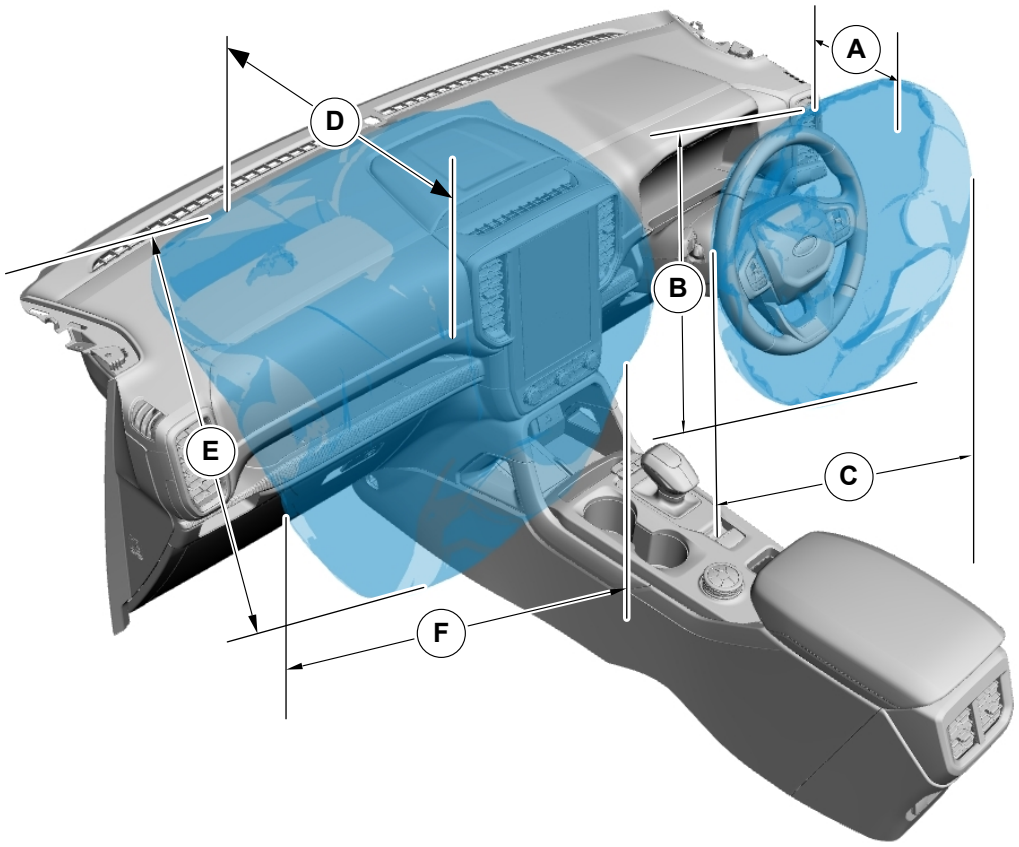
For Super Cab and Double Cab vehicles there are additional acceleration based airbag sensors located on the B Pillar lower just above the seatbelt retractor on Double Cab vehicles and on the forward edge or the rear door on the Super Cab vehicles.

WARNING: Modifications or reinforcements in the area of the sensors may affect the side airbag fire timing and result in uncontrolled side air bag deployment.

Please note that vehicles not equipped with side airbags but equipped with front airbags only are not affected.

Drilling or grinding operations in this area are only permitted when battery cables are disconnected.

Driver and Passenger Front Airbag Deployment Zones



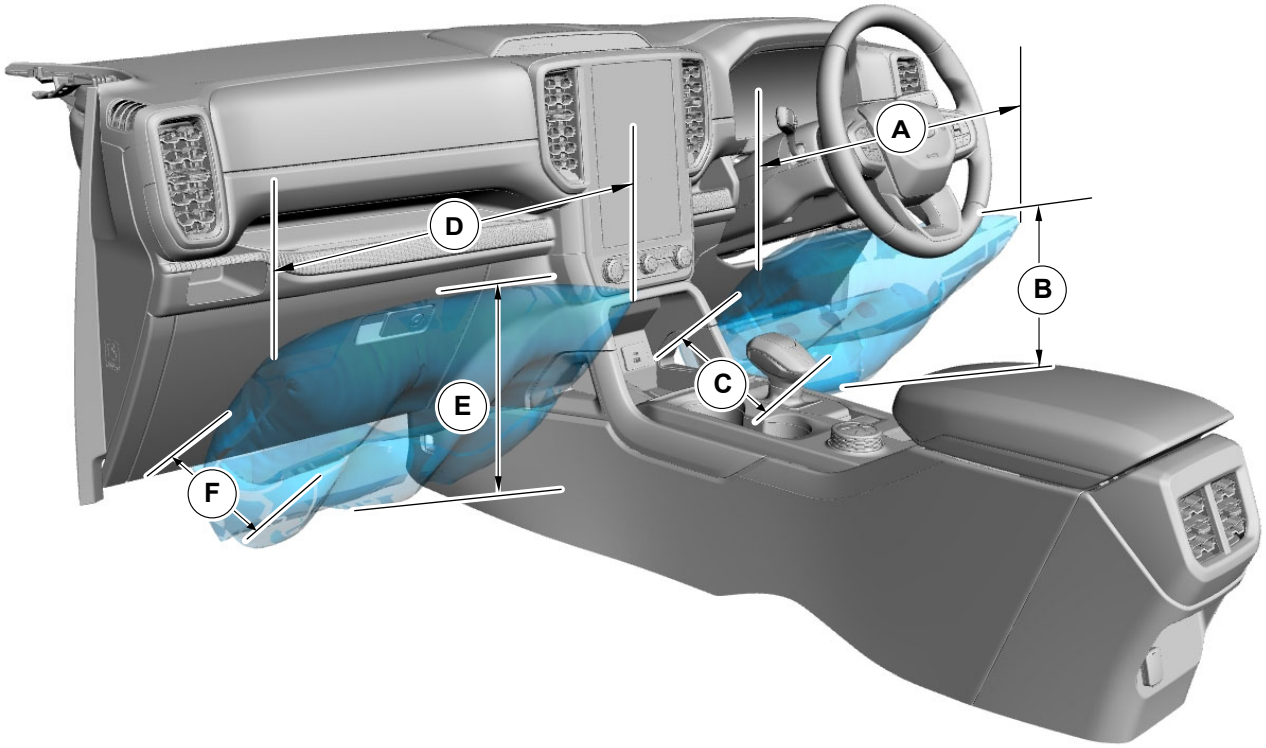
E364184

Dimensions (mm)			
A	268	E*	550
B	530	E**	521
C	525	F*	600
D*	630	F**	527
D**	592	-	-

*120L Single Stage Passenger Airbag (Australia, Europe, New Zealand)

**90L Single Stage Passenger Airbag (Excluding Australia, Europe, New Zealand)

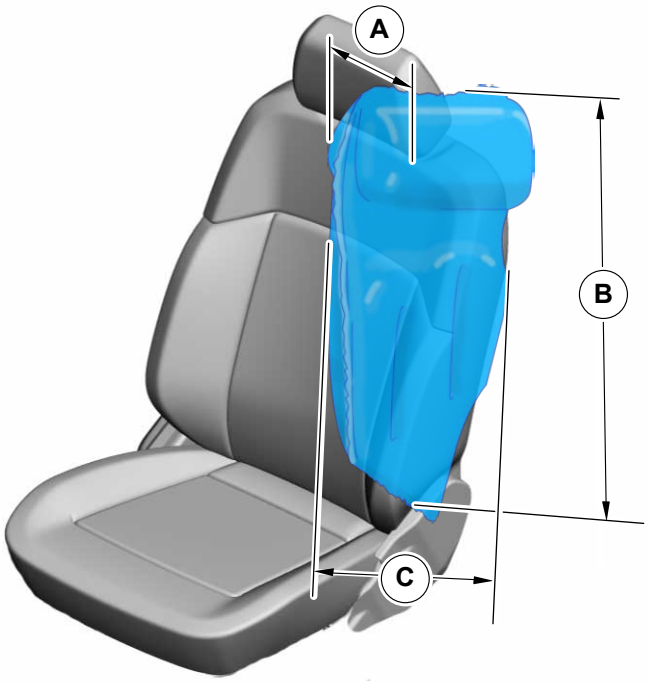
Driver and Passenger Knee Airbag



E363495

Dimensions (mm)			
A	540	D	540
B	400	E	400
C	170	F	170

Far Side Airbag (Centre Airbag)

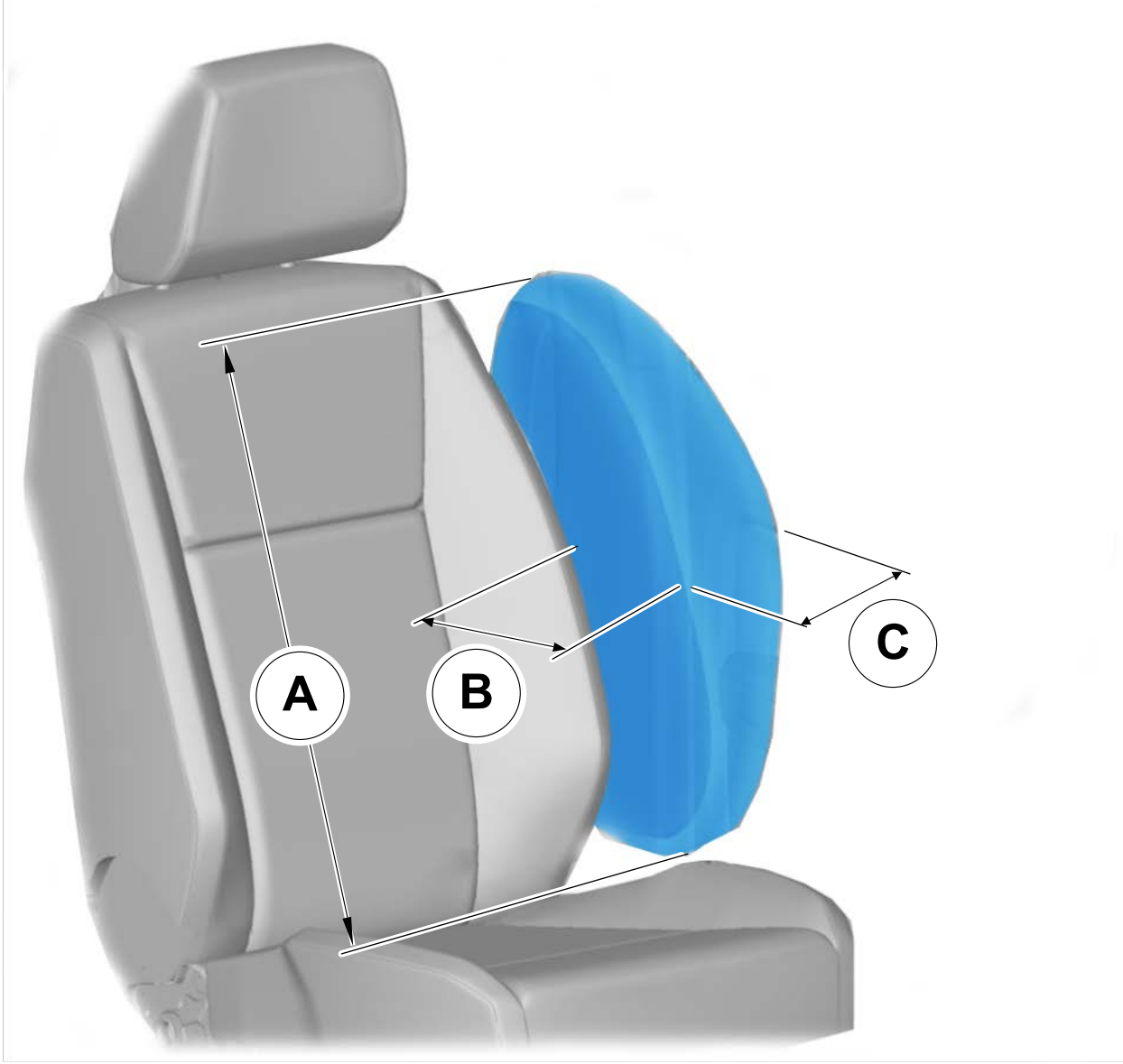


E364200

Dimensions (mm)			
A	350		
B	750		
C	450		

NOTE: LHS shown, RHS Similar.

Side Airbag

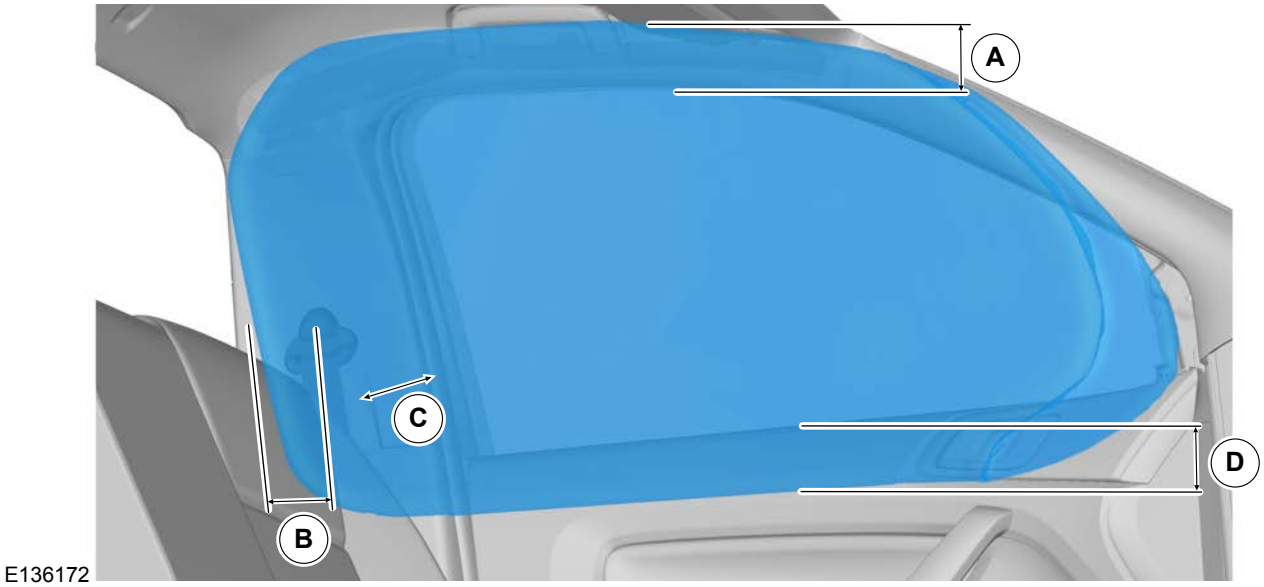


E363732

Dimensions (mm)			
A	550		
B	350		
C	250		

NOTE: LHS shown, RHS Similar.

Curtain Airbag - Single cab



Dimensions (mm)			
A	140	C	250
B	40	D	100

NOTE: LHS shown, RHS Similar.

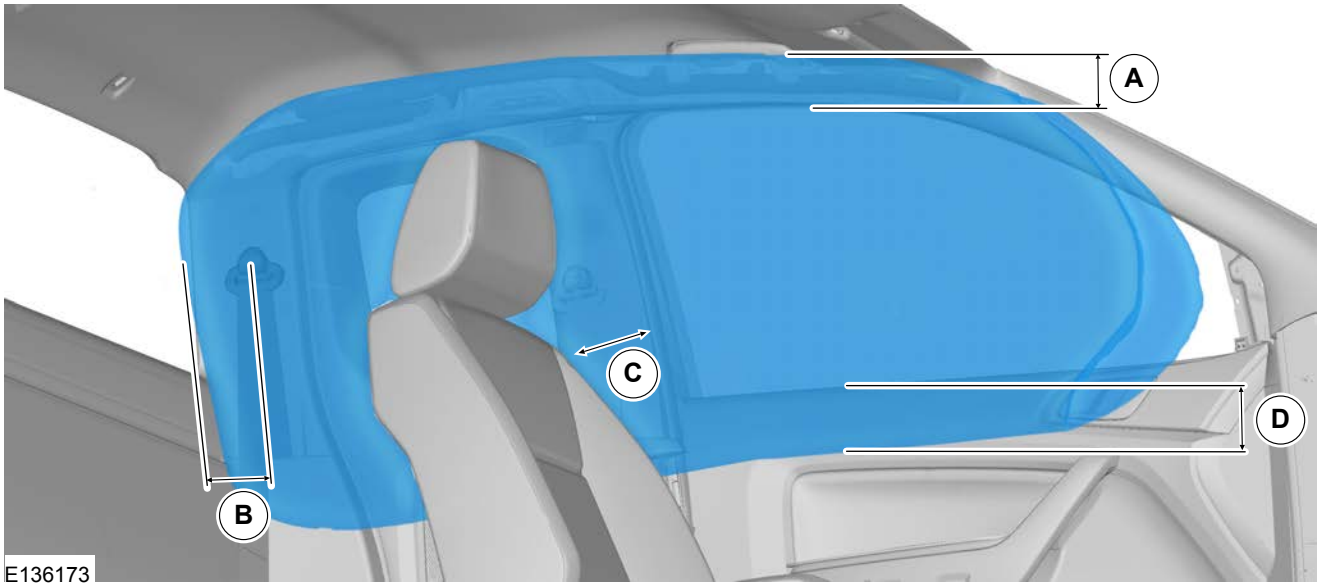
Curtain Airbag - Double cab



Dimensions (mm)			
A	140	C	250
B	40	D	100

NOTE: LHS shown, RHS Similar.

Curtain Airbag - Super cab



Dimensions (mm)			
A	140	C	250
B	40	D	100

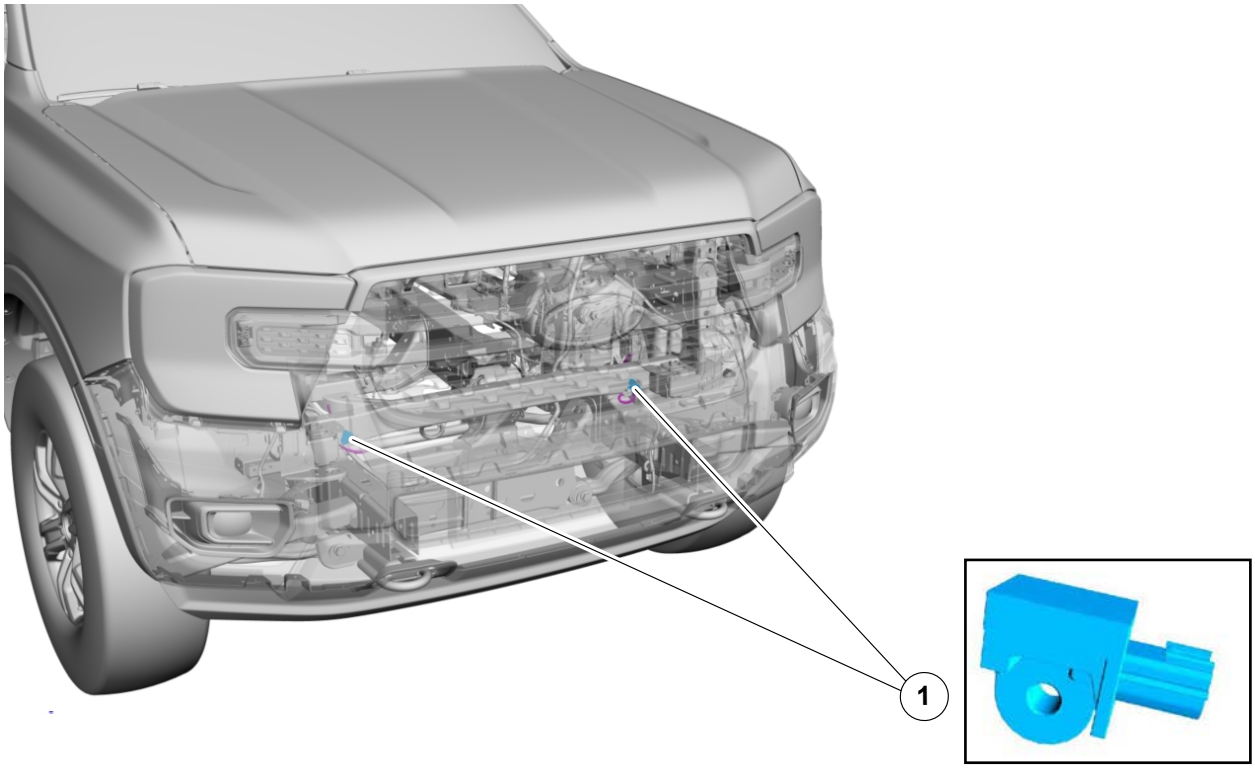
NOTE: LHS shown, RHS Similar.

5.3.2 Supplementary Restraint Sensors (Front)

WARNINGS:

Modifications or reinforcements in the area of the front supplementary restraint sensors may affect their operation.

Modifying or adding equipment to the front end of your vehicle (including hood, bumper system, frame, front end body structure, tow hoots and hood pins) may affect the performance of the airbag system, increasing the risk of injury. Do not modify or add equipment to the front end of your vehicle.



E363494

Item	Description
1	Front SRS Impact Sensors

5.4 Seatbelt Systems

WARNING: Follow the Ford approved removal and installation procedures for the seatbelt system to ensure correct function of the restraints system.

The removal and reinstallation of the seatbelt, retractor or any component of the seatbelt system should be avoided. However if removal and re-installation of the system is required during the conversion, follow the removal and installation guidelines of the seatbelt system as described in the workshop manual. Please consult your local National Sales Company representative for further information.

When removing the seatbelt system, a seatbelt webbing forked retainer should be applied to the webbing 200mm below the tongue stop feature. This prevents a situation where all the webbing runs back into the retractor and the retractor becomes locked.

When reinstalling, fit the retractor to the body first and gently pull the webbing out of the retractor to allow fitment of the D loop. Then remove the forked retainer. If the retractor is locked, allow a small amount of webbing to reel back into the retractor to allow the webbing lock to release. Do not attempt to release the retractor by pulling on the webbing with significant force or by manually interfering with the locking mechanism.

5.4.1 SeatBelts - No Drill Zones

Single Cab - First Row Seat Belt

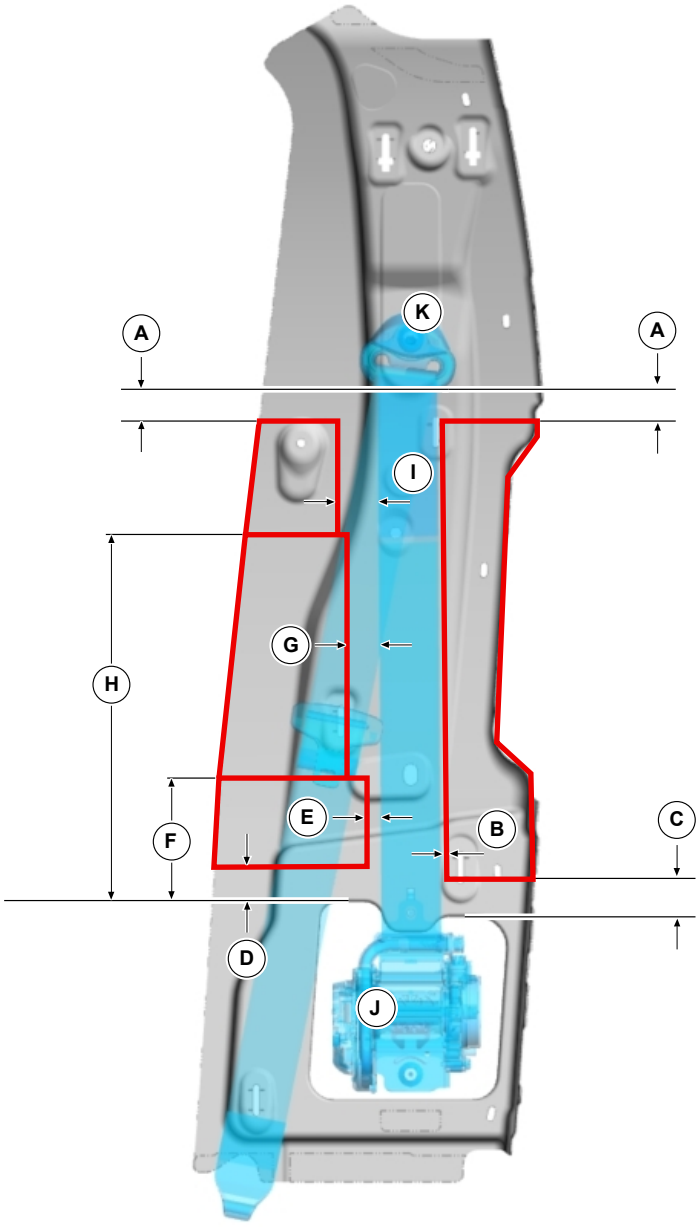
WARNINGS:

Do not drill in right hand/left hand side retractor assembly area.

Drilling is only permitted in the red area indicated.

Retractor damage: If drilling holes near or above the retractor and anchor pretensioner, the mechanisms must be covered to prevent metal shavings/debris from falling into the assembly and causing functional issues.

Webbing damage: Any outfitted hardware must not cut, pinch or interfere with the seatbelt webbing along its entire path (from retractor to D-ring area). Avoid sharp brackets near webbing; all edges must have a minimum radius of 0.5mm. Avoid upfitting parts that may change the belt routing to the occupant.



E385973

Item	-
A	30mm below bottom of D-Ring
B	15mm right of webbing
C	30mm above retractor hole (right hand side)
D	30mm above retractor hole (left hand side)
E	25mm left of webbing
F	100mm above retractor hole (left hand side)
G	35mm left of webbing
H	300mm above retractor hole (left hand side)
I	50mm left of webbing

NOTE: Right hand side shown, left hand side mirrored.

Super Cab - First Row Seat Belt

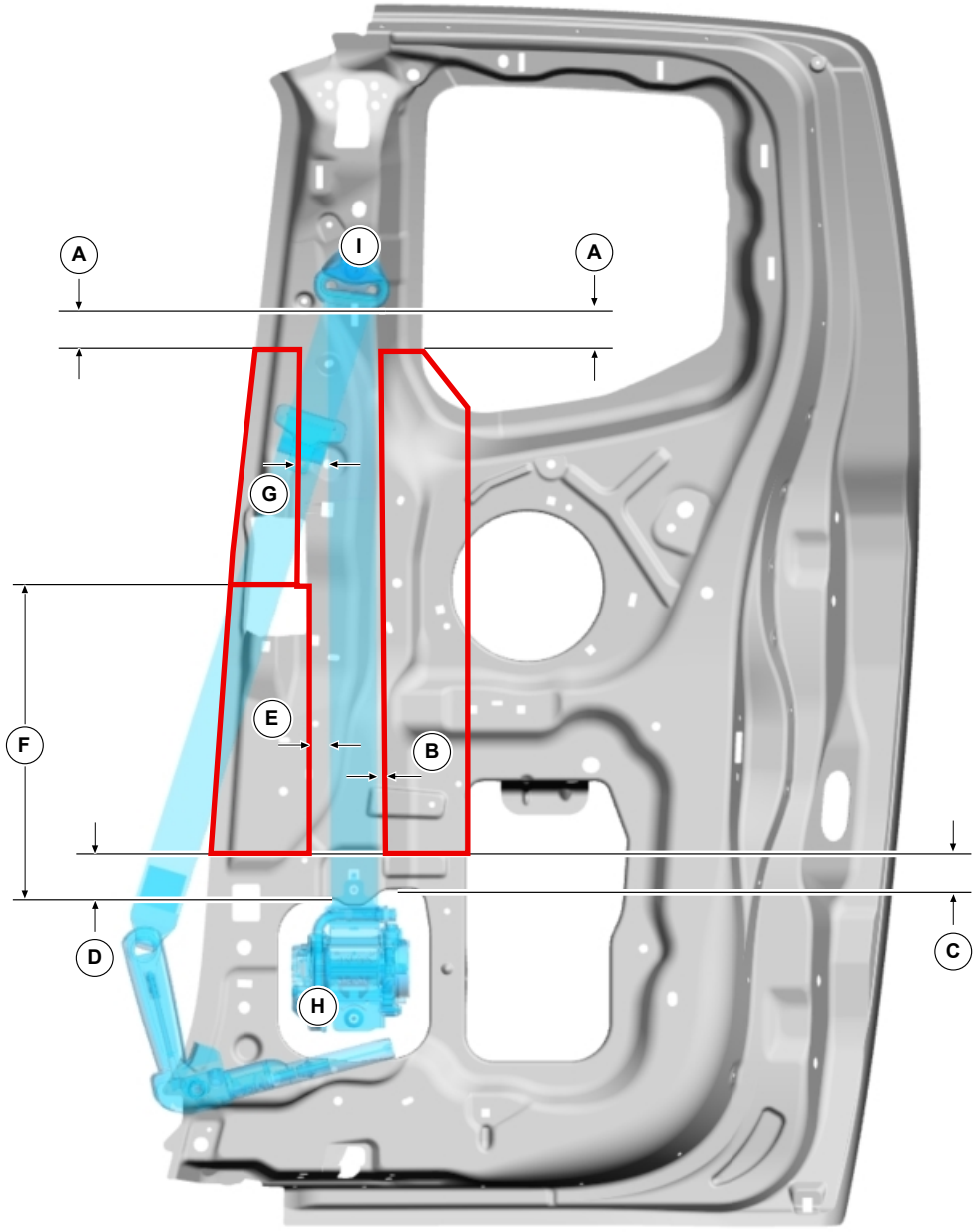
WARNINGS:

Do not drill in right hand/left hand side retractor assembly area.

Drilling is only permitted in the red area indicated.

Retractor damage: If drilling holes near or above the retractor and anchor pretensioner, the mechanisms must be covered to prevent metal shavings/debris from falling into the assembly and causing functional issues.

Webbing damage: Any outfitted hardware must not cut, pinch or interfere with the seatbelt webbing along its entire path (from retractor to D-ring area). Avoid sharp brackets near webbing; all edges must have a minimum radius of 0.5mm. Avoid upfitting parts that may change the belt routing to the occupant.



E387442

Item	-
A	30mm below bottom of D-ring
B	15mm right of webbing
C	30mm above retractor hole (right hand side)
D	30mm above retractor hole (left hand side)
E	25mm left of webbing
F	280mm above retractor hole (left hand side)
G	35mm left of webbing

NOTE: Right hand side shown, left hand side mirrored.

Double Cab - First Row Seat Belt

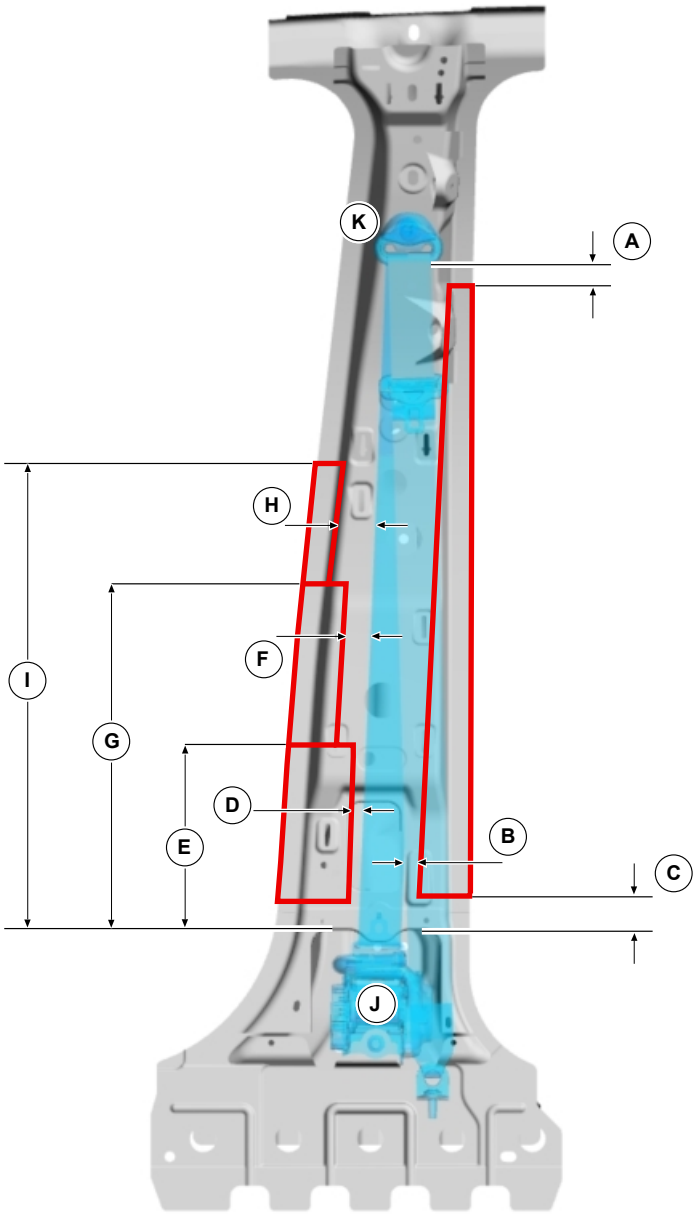
WARNINGS:

Do not drill in right hand/left hand side retractor assembly area.

Drilling is only permitted in the red area indicated.

Retractor damage: If drilling holes near or above the retractor and anchor pretensioner, the mechanisms must be covered to prevent metal shavings/debris from falling into the assembly and causing functional issues.

Webbing damage: Any outfitted hardware must not cut, pinch or interfere with the seatbelt webbing along its entire path (from retractor to D-ring area). Avoid sharp brackets near webbing; all edges must have a minimum radius of 0.5mm. Avoid upfitting parts that may change the belt routing to the occupant.



E385972

Item	-
A	30mm below bottom of D-Ring
B	15mm right of webbing
C	30mm above retractor hole
D	25mm left of webbing
E	220mm above retractor hole
F	35mm left of webbing
G	380mm above retractor hole
H	50mm left of webbing
I	525mm above retractor hole

NOTE: Right hand side shown, left hand side mirrored.

5.5 Corrosion Prevention

5.5.1 General

WARNINGS:

Extreme heat, such as paint drying ovens, will cause damage to the High Voltage battery. The High Voltage battery must be removed before using the drying ovens longer than 45 minutes or with temperatures above 60°C (140°F). Failure to follow this instruction may result in damaging the High Voltage battery, which could cause serious personal injury or death in a fire or explosion.

Do not apply any coating/corrosion prevention treatment to the HV battery pack area and connectors.

Avoid drilling into closed frame body members to avoid the risk of corrosion from swarf.

If drilling is required, however:

- After cutting or drilling operations, de-burr before repainting to protect against corrosion
- Re-paint metal edges and protect against corrosion after cutting or drilling operations.
- Endeavor to remove all swarf from inside the side member and treat to prevent corrosion.
- Apply corrosion protection inside and outside of the chassis frame when coating is damaged by drilling or welding.
- In markets or regions where salt is used to de-ice road surfaces, cavity wax may need to be re-applied to the internal frame section damaged by drilling or welding.

5.5.2 Repairing Damaged Paint

After cutting or reworking any sheet metal on the vehicle the damaged paint must be repaired.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance.

5.5.3 Under Body Protection and Material

WARNING: Do not over-coat or contaminate surfaces of components such as brakes or catalytic converters.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance.

Some proprietary products affect the original coatings. For specifications of corrosion protection materials, please consult your local National Sales Company representative.

5.5.4 Painting Road Wheels

WARNING: Do not paint wheel mating surfaces in contact with other wheels, brake drum or disc, hub and holes or surface under wheel nuts. Any further treatment in these areas may affect the wheel clamp performance and the vehicle safety. Mask the wheel when changing the color or repairing paint.

5.5.5 Galvanic (bi-metallic) Corrosion

When materials with different electrochemical potential come in contact with each other, ensure appropriate measures are taken to isolate electrical contact by use of an insulating material.

5.6 Frame and Body Mounting

5.6.1 Mounting Points and Tubing

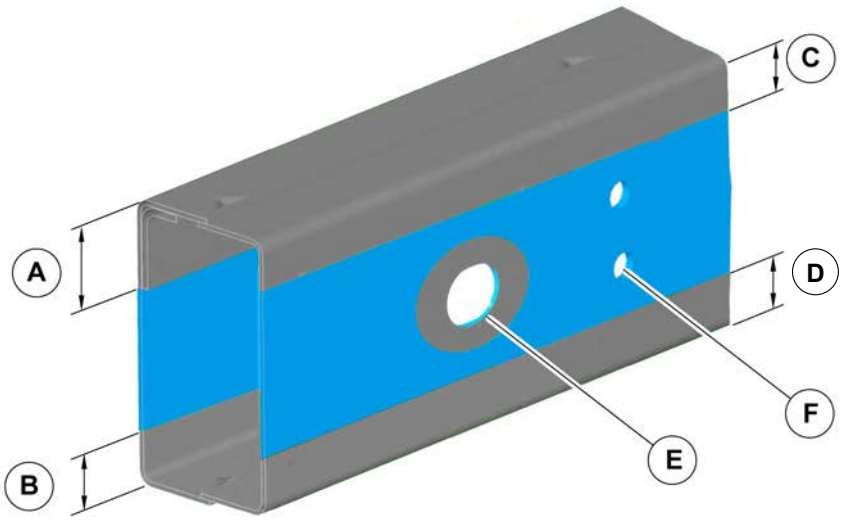
WARNING: Drilling into reinforcements and load paths may have a detrimental affect on crash performance. Vehicle Converter shall confirm any changes comply with general product safety requirements, legal requirements or type approvals

Unused holes on frame maybe a result of the production process and may not necessarily be designed for fixing additional equipment. Always use chassis mounts as shown in sub frame for low floor or other equipment. If additional fixings are required please follow the recommendation given in the figure shown. This does not apply to areas of load applications such as spring fixings or damper fixings.

NOTE: After drilling, deburr and countersink all holes and remove chips from the frame. Follow corrosion prevention.

Refer to: 5.5 Corrosion Prevention (page 256).

Frame Drilling and Welding



E134173

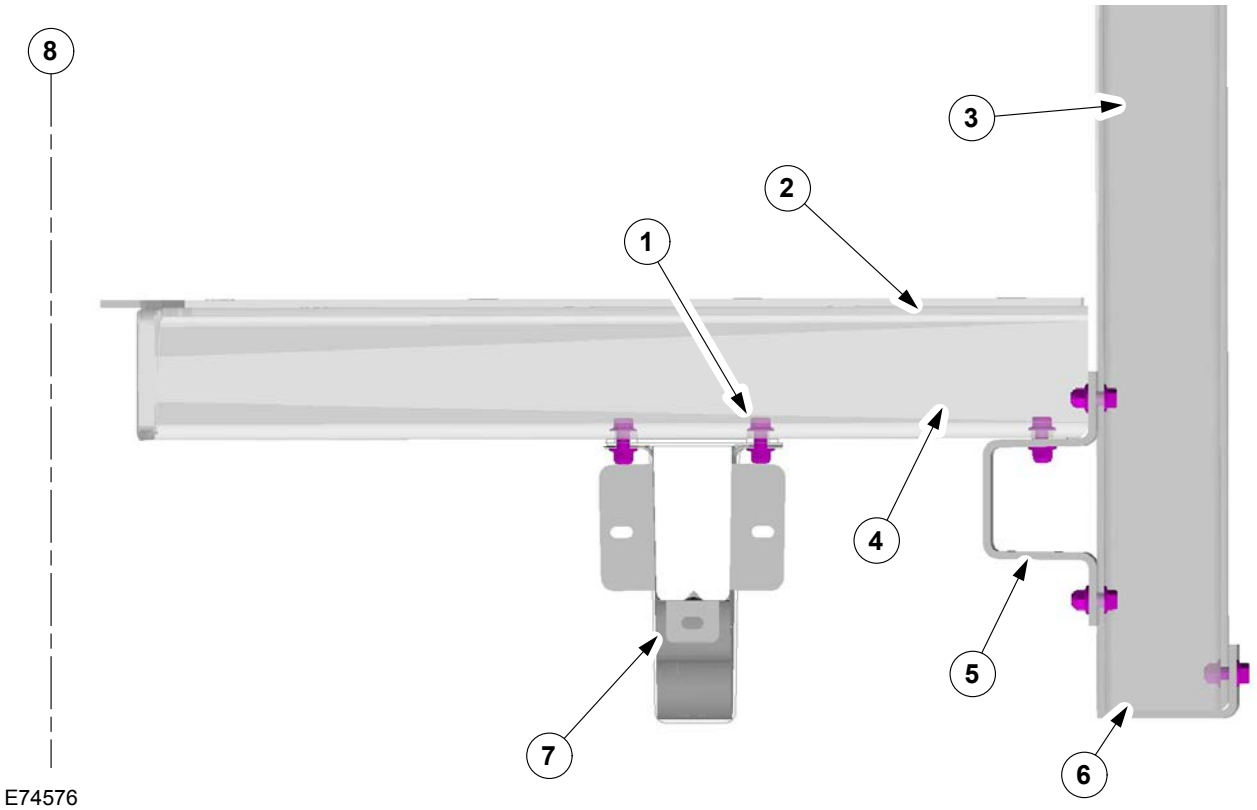
Dimensions (mm) for Body Attachment Holes in Chassis Frame Top Flange

Item	Description
A	45 mm FRONT / 15mm REAR
B	45 mm FRONT / 15mm REAR
C	45 mm FRONT / 15mm REAR
D	45 mm FRONT / 15mm REAR
E	Do NOT enlarge chassis rail holes, or drill within the surrounding area.
F	Do not drill any more than 2 vertical holes in the chassis rail.

1. No welding permitted except as detailed below:
2. To make holes in frames do not use a gas flame. Drill holes using sharp drills.
3. Use cold riveting only when attaching brackets with rivets.
4. Use high tensile bolts and appropriate nuts when bolted attachments are used.
   - Bolt Specifications :
   - Metric – Property class 8.8 or 10.9
   - Japanese – 7T or 9T
   - SAE – Grade 5 or 8
5. Deburr holes after drilling to fit bolts or rivets. Chamfer 1.0mm x 45 degree on the bolt head side of the hole to facilitate bolt seating.
6. Holes must NOT be drilled near side member profile changes.
7. Existing holes in top and bottom flanges must NOT be bored out.
8. No more than two holes are to be drilled in a vertical line down from the frame web.

9. Corrosion protection is to be applied post drilling operations to the vehicle. Corrosion protection & protective coatings for all modifications should conform to all local regulatory standards.
10. Reinforcements should be added to the vehicle structure where appropriate, to avoid excessive load concentrations.
11. DO NOT DRILL or MODIFY extruded (datum) holes/slots
12. No modified or new holes greater than 16.5mm

Typical Design Principle of a Self-Supporting Body Structure



E74576

Item	Description
1	Use all standard locations with 2x M10 fixings
2	Floor panel
3	Body side frames
4	Floor cross members
5	Continuous floor U-profile frame
6	Longitudinal L-profile
7	Chassis frame rail of base vehicle
8	Vehicle center line of base vehicle

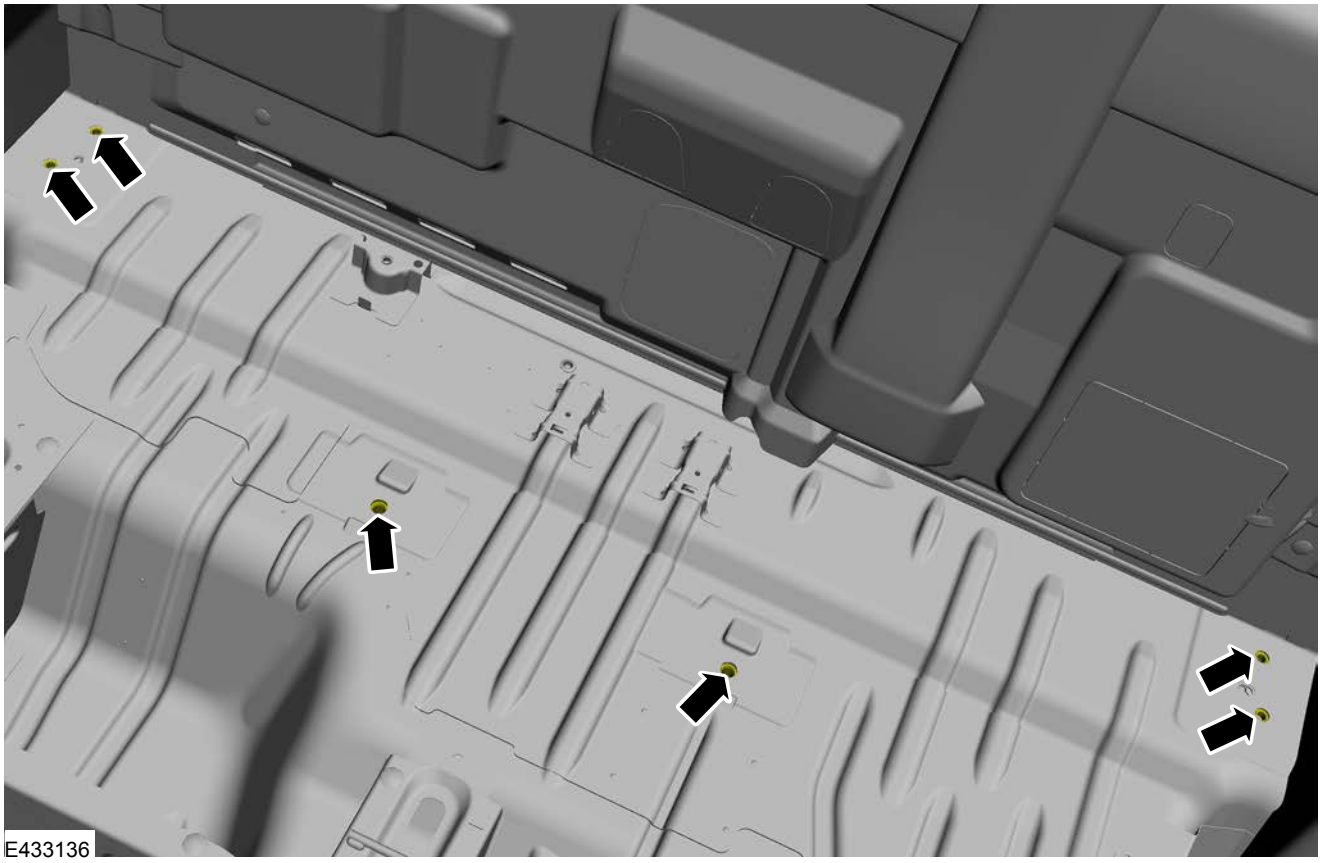
Also see:

Refer to: 5.1 Body (page 207).

5.6.2 Rear Seat Deletion

NOTE: If the rear seat is to be permanently removed as part of the conversion the rear seat fixing positions in the floor must be covered up to prevent noise, dirt and water ingress.

Rear Seat Fixing Positions



5.6.3 Self-Supporting Body Structure

Bodies and structures can be judged as self-supporting providing they maintain the following rules:

- Cross members are used at each chassis mounting point, please refer to figures shown.
- Each cross member has a suitably engineered connection to the body side wall (3) or to the continuous floor frame (5), see figure shown.
- The body side wall or the continuous floor frame supports any overhang beyond the chassis frame, whether on standard frame or extended frame.

Alternatively, the self-supporting body structure can also be designed as shown in figure shown.

- This concept is based on a self-supporting structure where the floor is mounted directly onto the top surface of the chassis frame.
- See figure shown for a generic vehicle cross section where the cross members and opposing out riggers are flush with the surface of the chassis frame side members.
- It is important to the overall function of the vehicle structure that the out riggers are each connected to a continuous longitudinal floor side frame or a structural body side structure assembly.

Low floor-re-work for guidance only:

- Engineer unique cross members and out-riggers spaced at approximately 600mm maximum pitch.
- Out-rigger moment to be re-acted with cross-member between chassis frame with common through bolts where possible.
- Drill frame and add spacer tubes.

  Refer to: 5.6 Frame and Body Mounting (page 257).
- Out-rigger outboard ends should be attached to load bearing body side / floor edge frame or body side structure (including over wheel support).
- Structural wheel box should maintain longitudinal continuity with a rigid attachment to the floor edge frame or to the body side structure.
- Floor boards should be substantially attached to cross members and outriggers, but not to the chassis frame top surface.
- Low floor exhaust heat shields.

5.6.4 Frame Drilling and Tube Reinforcing

The chassis frame may be drilled and reinforcing spacer tubes may be welded in place, providing the following is applied:

- Adhere to all details shown in figure.
- Drill and weld only side walls of the chassis frame.
- Locate and drill holes accurately, using a drill guide to ensure holes are square to frame vertical center line (note: allow for side member draft angle).
- Drill undersize and ream out to size.
- Remove all swarf from inside side member and treat to prevent corrosion.
- Fully weld each end of the tube and grind flat and square, in groups if applicable. Be aware of side member draft angle.
- Apply corrosion protection inside and outside of the chassis frame.

  Refer to: 5.5 Corrosion Prevention (page 256).
- Holes should be in groups of two (2), either vertically spaced at 30 to 35mm from chassis frame top and/or bottom surface, or horizontally at 50mm minimum pitch, 30 to 35mm from top and/or bottom chassis frame surface.
- Always use M10 bolts with grade 8.8 minimum.
- Do not position tubes at the medium chassis frame height, this may create “oil canning” of the deep section side walls.
- Where possible, the outrigger moments should be resolved by matching inner cross members between the chassis side members inline with the outriggers.
- A diameter of 16.5mm is the maximum allowable hole size in the chassis frame side wall, irrespective of the usage.

Avoid drilling into closed frame body members to avoid the risk of corrosion from swarf.

Refer to: 5.5 Corrosion Prevention (page 256).

5.6.5 Ancillary Equipment - Sub Frame Mounting

Typical sub-frames and longitudinal members for flatbed and low or drop-side bodies or equipment exceeding the standard or Regular Production Order frame length should adhere to the following guidelines:

- Flat-beds and low bodies mounted on integral longitudinal members (channel or box section metal – not wood) must use both sides of all frame mounting brackets.
- Longitudinal members must be relieved at the front end if they are to contact the chassis frame top surface, to minimize stress concentrations. It is preferable however, to mount the longitudinal onto the mounting brackets, with a clearance to the chassis frame top surface.
- Each mounting point must use a MINIMUM M12 grade 8.8 bolt .
- Minimum floor heights will require wheel arch boxes to clear the rear tires, see Vehicle Data sheets for relevant tire jounce.

5.6.6 Area for Fitting Additional Body Attachments to the Rear of the Bumper.

NOTE: With the vehicle on level ground and with all measurements taken rear ward of the bumper bar edge: The area designated for the fitting of attachment is defined as 220mm horizontally by 95mm vertical downward to the road surface, with a max width of 1390mm about vehicle center line.

It is not the manufactures recommendation to fit additional body attachments (Tow bars, Steps, Bicycle racks & Carriers) outside of the designated area.

5.6.7 Water Tank on Camper Vehicles

NOTE: It is recommended that a decal or label is fitted adjacent to the filler aperture identifying the correct fluid to be used, for example: 'Water only' for water tanks.

5.6.8 Long Wheelbase Conversions

WARNINGS:

All long wheelbase conversion must adhere to the frame and mounting guidelines referenced in this publication.

All vehicles subject to wheelbase extensions must adhere to the local regulations for emissions, durability and conformity.

CAUTIONS:

All emission control systems must remain operative and fully functioning after LWB conversion has taken place.

Long Wheelbase Conversions are NOT permitted on Ranger RAPTOR variants.

Refer to your local Ford dealer or National Sales Agent for further information.

Fuel System Modifications for Long Wheelbase Conversions

WARNINGS:

All modification to the fuel system must adhere to local regulations.

All modifications of fuel system components such as extension or rerouting of fuel lines and relocation of fuel system components need to be approved by a local regulatory authority.

Exhaust Modifications for Long Wheelbase Conversions

WARNINGS:

All modification to the exhaust system must adhere to local regulations.

Service bodies and load carrying equipment intended to house or transport humans or live animals must be manufactured and installed in such a way that the tailpipe outlet is positioned so that exhaust gas is emitted outside and away from the sealed passenger/animal compartment.

Any modification or added body structure that affects the exhaust system and tailpipe should not cause blocking or obstruction. of the exhaust gas flow.

CAUTIONS:

Acoustic/Silencing devices located in the allowable modification zone may be relocated but not removed and may require approval testing by regulatory authorities to ensure compliance with applicable pass by noise regulations.

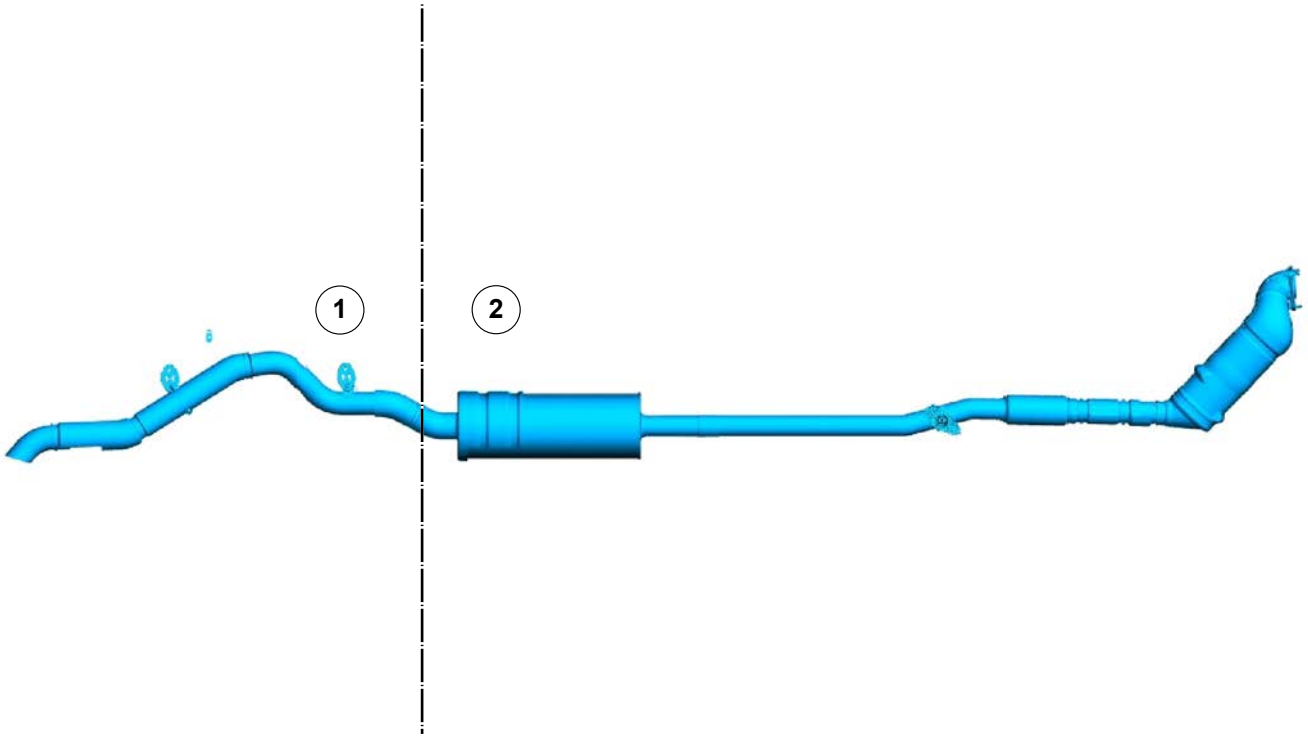
Where possible, utilise existing exhaust isolator mounts for the modified exhaust system.

NOTE: No modifications to the emission control system as part of the exhaust after treatment (Selective Catalytic Reduction System) are allowed, except for those in areas outlined below.

Vehicles equipped with Stage 6.2 Emissions controls require careful consideration and planning around the extension of the exhaust.

Exhaust modifications to support long wheelbase conversions are limited to the section of exhaust downstream from the indicated point in the images below:

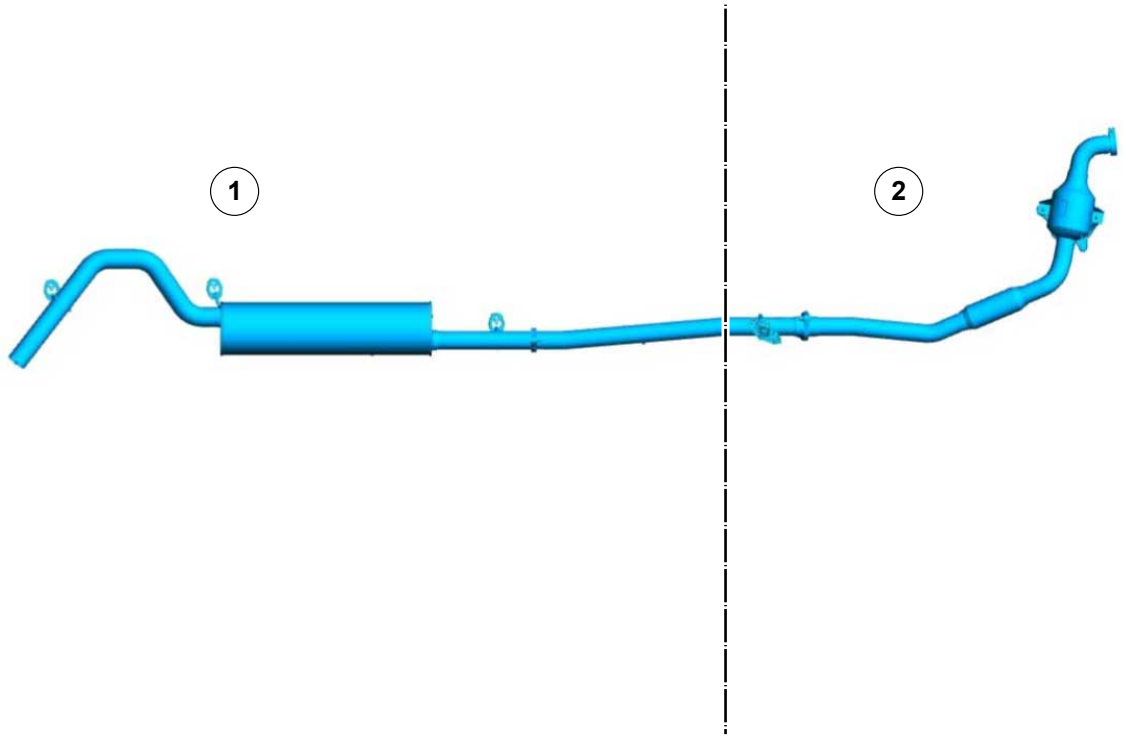
2.3L EcoBoost



E384284

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

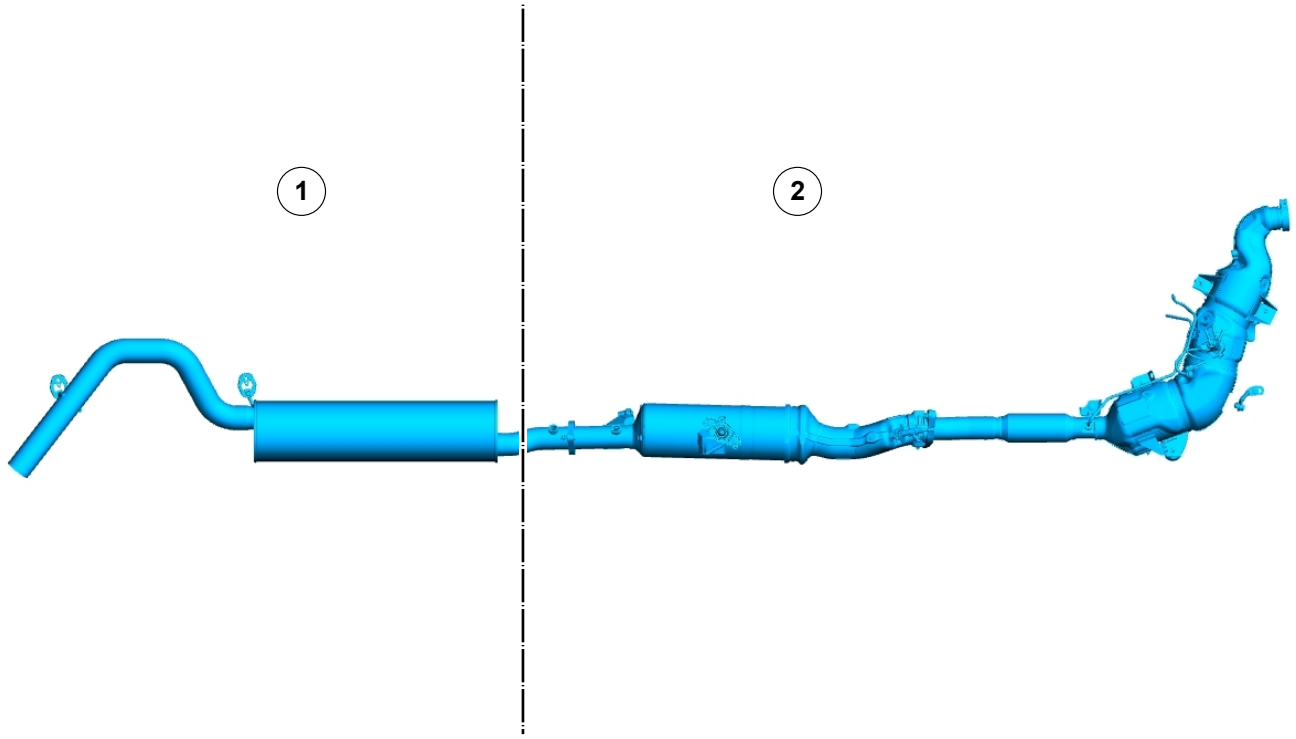
2.0L Single Turbo Diesel Engine - Stage 4 Emissions



E375771

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

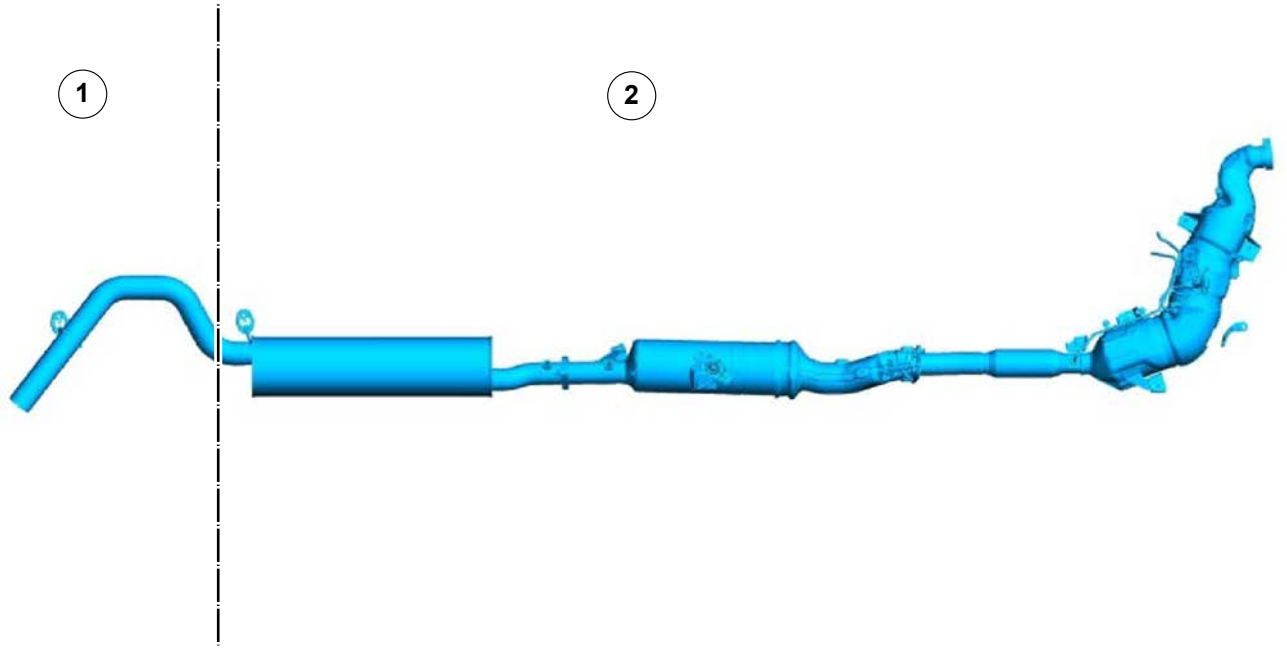
2.0L Single Turbo Diesel Engine - Stage 5 Emissions



E365325

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

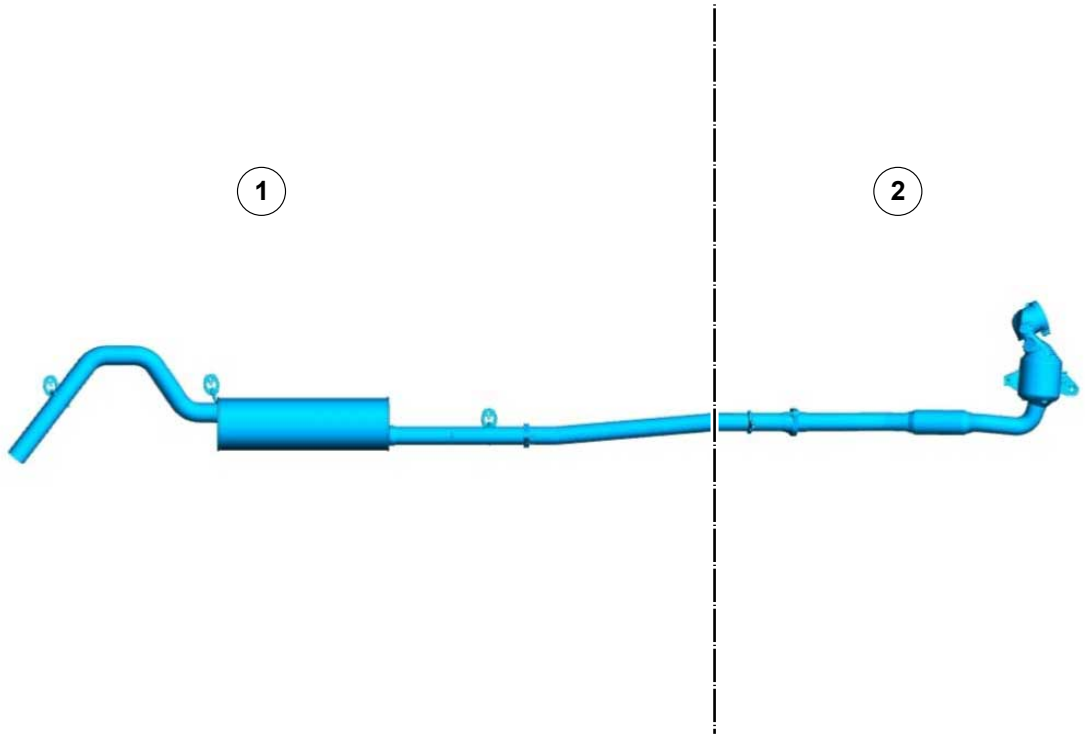
2.0L Single Turbo Diesel Engine - Stage 6.2 Emissions



E384600

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

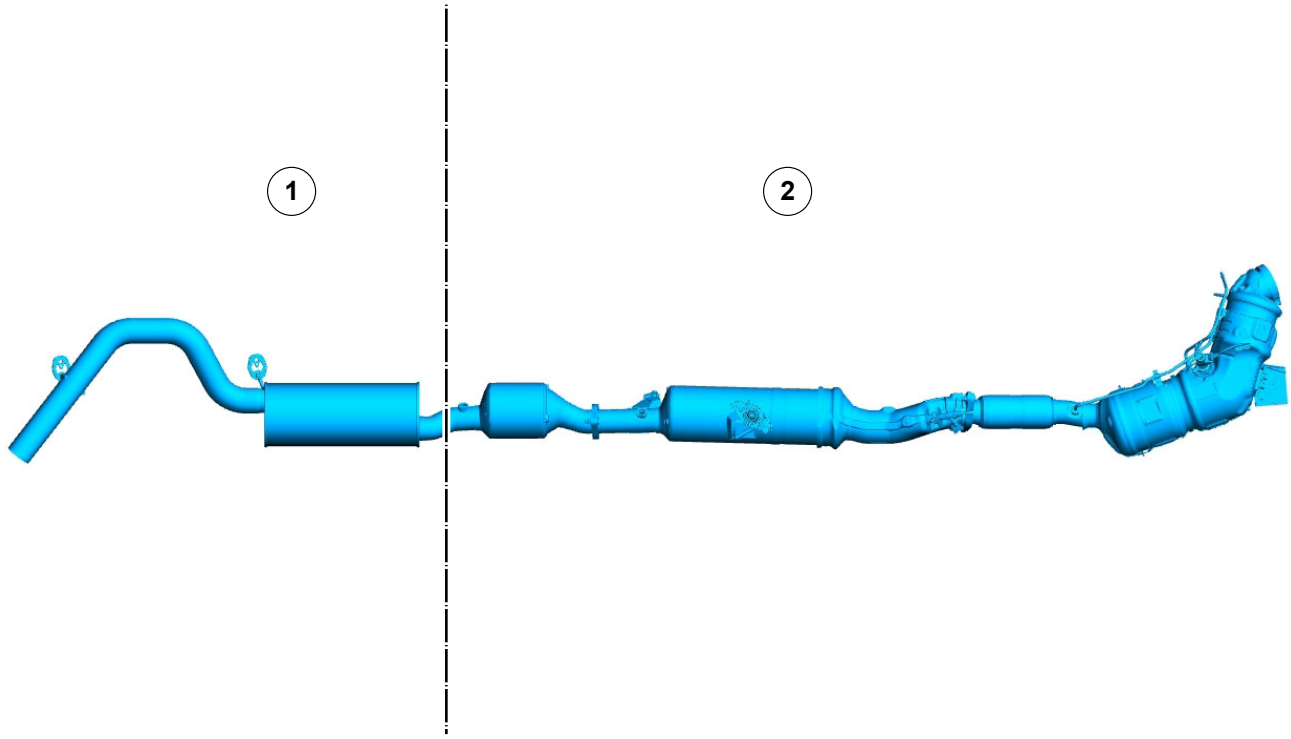
2.0L Bi-Turbo Diesel Engine - Stage 4 Emissions



E375772

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

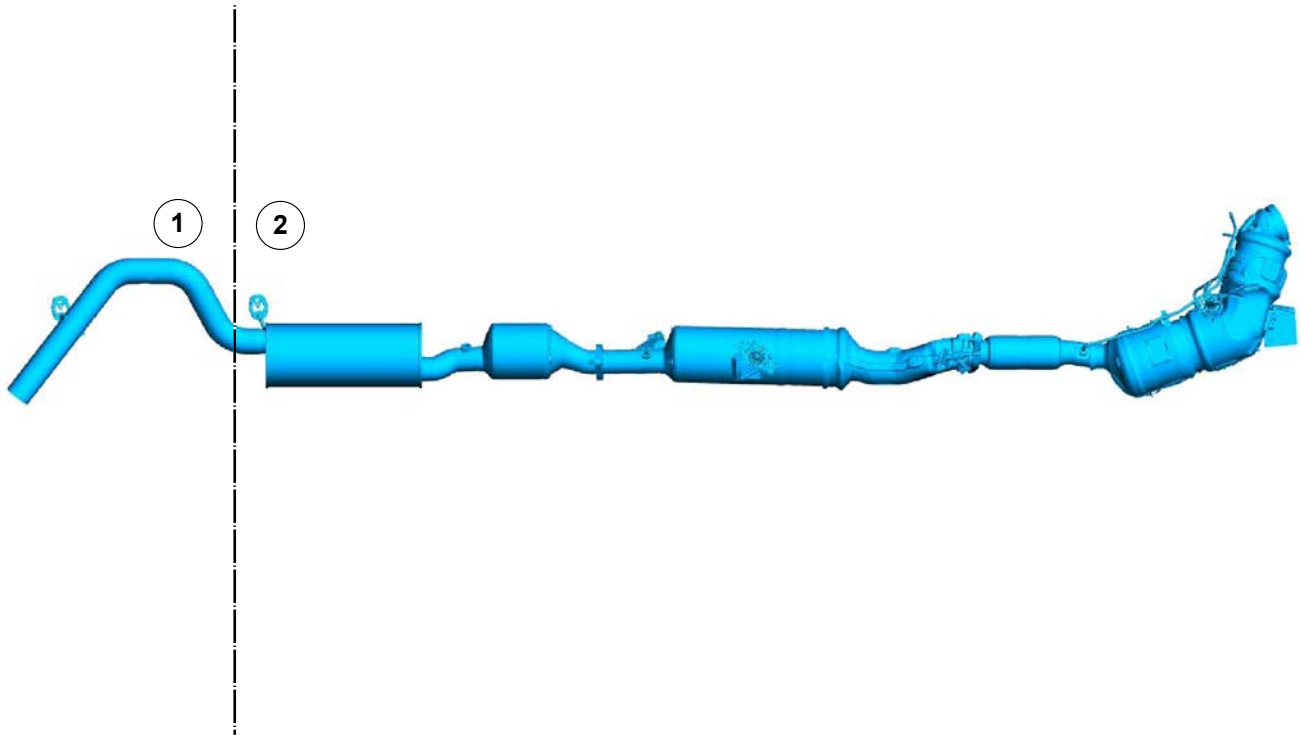
2.0L Bi-Turbo Diesel Engine - Stage 5 Emissions



E365326

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

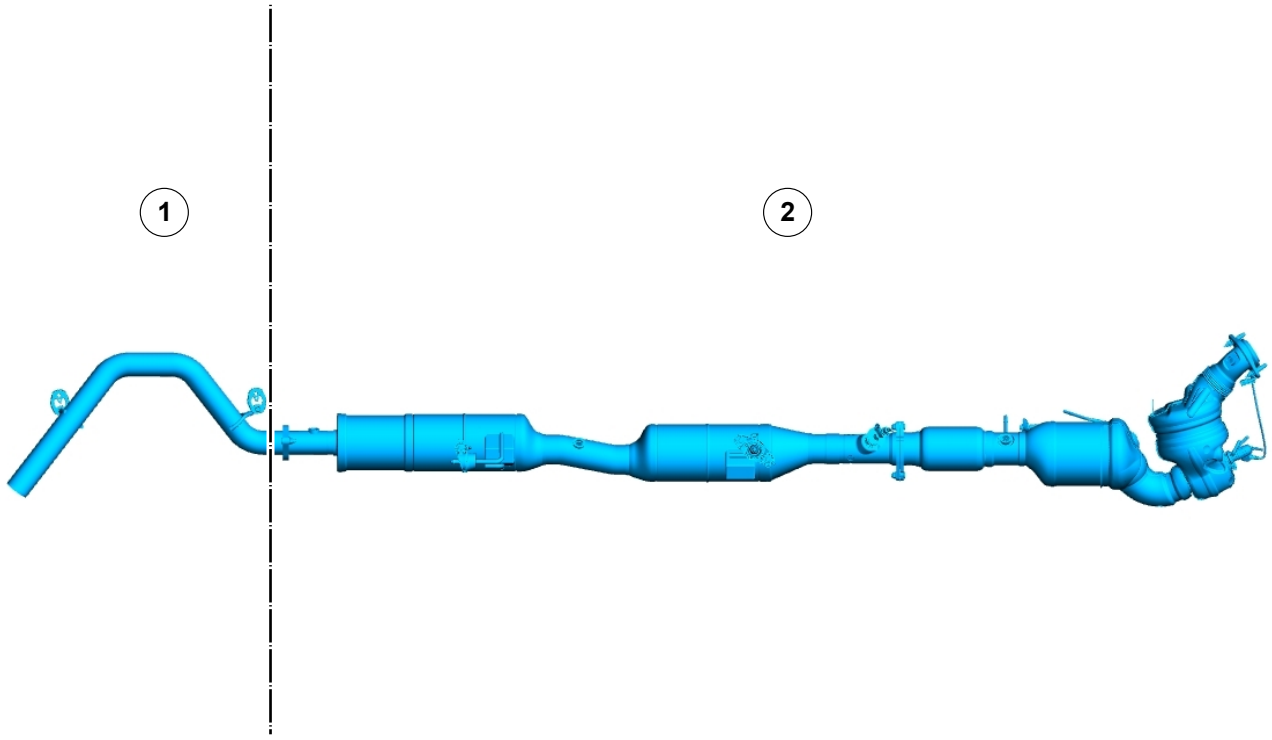
2.0L Bi-Turbo Diesel Engine - Stage 6.2 Emissions



E384601

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

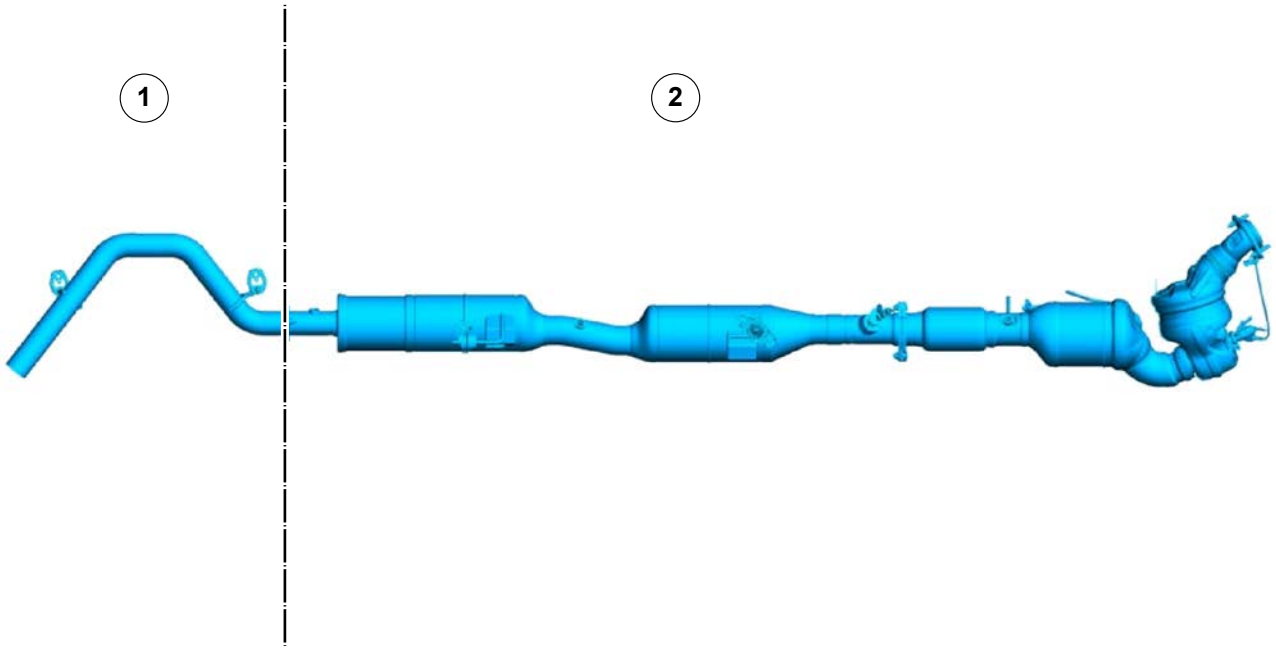
3.0L Turbo Diesel Engine - Stage 5 Emissions



E365327

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

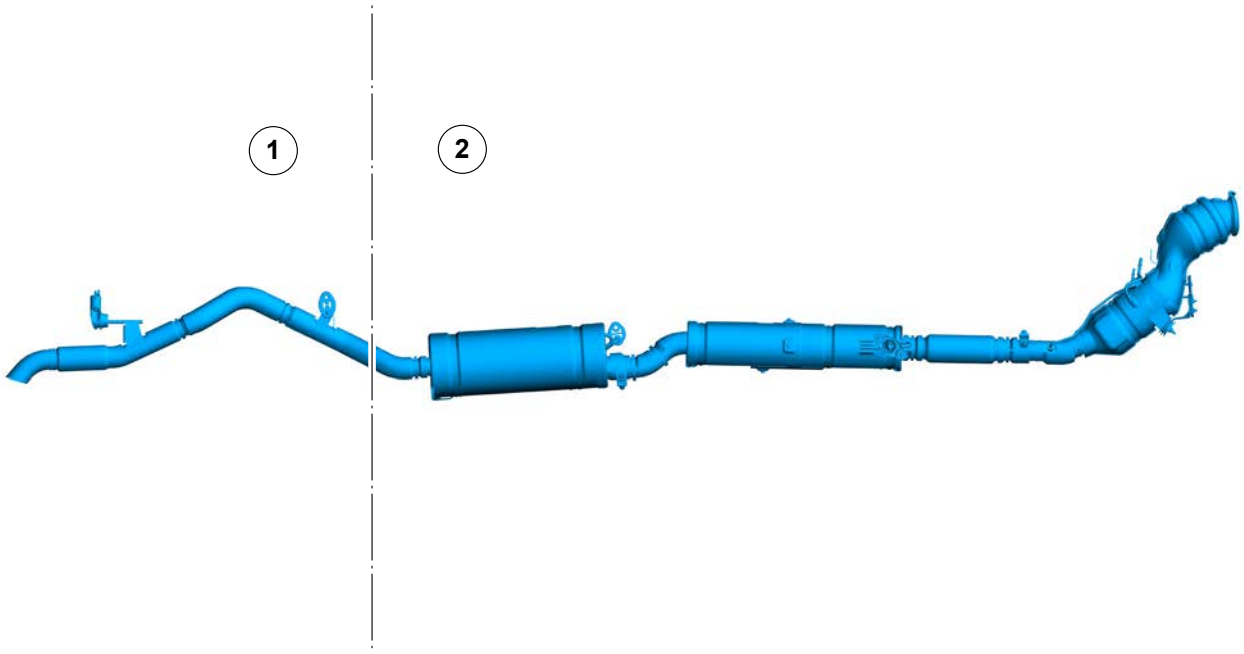
3.0L Turbo Diesel Engine - Stage 6.2 Emissions



E384275

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

PHEV



E442225

Item	Description
1	Modification Zone
2	DO NOT MODIFY Zone

Selective Catalytic Reduction System Modifications for Long Wheelbase Conversions

WARNINGS:

All modification to the Selective Catalytic Reduction System must adhere to local regulations.

All modifications of Selective Catalytic Reduction System components such as extension or rerouting of pressure lines and relocation of system components need to be approved by a local regulatory authority.

Refer to your local Ford dealer or National Sales Agent for further information.

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