

FORD **Ranger** 2022 Body and Equipment Mounting Manual



The information contained in this publication was correct at the time of going to print. In the interest of development the right is reserved to change specifications, design or equipment at any time without notice and without incurring any obligations. This publication, or part thereof, may not be reproduced nor translated without our approval. Errors and omissions excepted.

© Ford Motor Company 2022

All rights reserved.

1 General Information

| | |
|---|-----------|
| 1.1 About this Publication..... | 5 |
| 1.1.1 | 5 |
| 1.2 Commercial and Legal Aspects..... | 6 |
| 1.2.1 Terminology..... | 6 |
| 1.2.2 Warranty on Ford Vehicles..... | 6 |
| 1.2.3 Emissions Performance & In-service compliance..... | 6 |
| 1.2.4 Whole Vehicle Type Approval (2007/46/EC) Regulations..... | 6 |
| 1.2.5 Legal and Vehicle Type Approval..... | 6 |
| 1.2.6 Alternative Type Approval..... | 6 |
| 1.2.7 Legal Obligations and Liabilities..... | 7 |
| 1.2.8 General Product Safety Requirement..... | 7 |
| 1.2.9 Product Liability..... | 7 |
| 1.2.10 Restraints System..... | 7 |
| 1.2.11 Drilling and Welding..... | 8 |
| 1.2.12 Minimum Requirements for Brake system | 8 |
| 1.2.13 Road Safety..... | 8 |
| 1.3 Electromagnetic Compatibility (EMC)..... | 9 |
| 1.3.1 | 9 |
| 1.4 Vehicle Duty Cycle Guidelines..... | 11 |
| 1.4.1 Vehicle Ride and Handling Attributes..... | 11 |
| 1.5 Jacking..... | 12 |
| 1.6 Lifting..... | 14 |
| 1.7 Noise, Vibration and Harshness (NVH)..... | 16 |
| 1.8 Vehicle Transportation Aids and Vehicle Storage..... | 17 |
| 1.9 Package and Ergonomics..... | 19 |
| 1.9.1 General Component Package Guidelines..... | 19 |
| 1.9.2 Driver Reach Zones..... | 19 |
| 1.9.3 Driver Field of View..... | 19 |
| 1.9.4 Conversion Effects on Parking Aids..... | 19 |
| 1.9.5 Aids for Vehicle Entry and Exit..... | 19 |
| 1.9.6 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs..... | 21 |
| 1.9.7 Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs - Raptor..... | 22 |
| 1.9.8 Vehicle Dimensions Key..... | 22 |
| 1.9.9 Vehicle Dimensions Key - Raptor..... | 24 |
| 1.9.10 Recommended Maximum Main Load Area Dimensions..... | 25 |
| 1.9.11 Recommended Maximum Main Load Area Dimensions - Raptor..... | 26 |
| 1.9.12 WLTP Frontal Area Calculation..... | 26 |
| 1.9.13 WLTP Frontal Area Calculation - Raptor..... | 28 |
| 1.9.14 Registration Plates..... | 29 |
| 1.10 Package and Ergonomics—Specifications..... | 30 |
| 1.10.1 Recommended Body Dimensions..... | 30 |
| 1.10.2 Recommended Body Dimensions - Raptor..... | 32 |
| 1.10.3 Chassis Cab Body - Basic Dimensions and Weights..... | 35 |
| 1.10.4 Chassis Cab Body - Basic Dimensions and Weights - Raptor..... | 37 |

| | |
|---|-----------|
| 1.10.5 Vehicle Cabin Clearance | 38 |
| 1.10.6 Kerb Mass and Payload..... | 38 |
| 1.10.7 Gross Vehicle Mass and Axle Load Ratings..... | 38 |
| 1.10.8 Front, Rear and Side Under-Run Protection..... | 38 |
| 1.10.9 Rear Under-Run Protection - Cab Chassis Vehicles..... | 38 |
| 1.11 Hardware—Specifications..... | 39 |
| 1.12 Load Distribution—Specifications..... | 40 |
| 1.12.1 Load Distribution Calculations - Driver and Passenger Weight Distribution..... | 40 |
| 1.12.2 Center of Gravity..... | 44 |
| 1.12.3 Vehicle Weights..... | 48 |
| 1.13 Towing..... | 51 |
| 1.13.1 Towing Requirements..... | 51 |
| 1.13.2 Towing..... | 51 |
| 1.13.3 Towing Capacities and Specifications..... | 51 |

2 Chassis

| | |
|-------------------------------------|-----------|
| 2.1 Suspension System..... | 52 |
| 2.2 Brake System..... | 53 |
| 2.2.1 General..... | 53 |
| 2.2.2 Brake Hoses..... | 53 |
| 2.2.3 Trailer Brake Connection..... | 53 |

3 Powertrain

| | |
|---|-----------|
| 3.1 Engine..... | 54 |
| 3.1.1 Engine Cooling Airflow Envelopes..... | 54 |
| 3.1.2 Engine Selection for Conversions - Raptor..... | 55 |
| 3.2 Fuel System..... | 56 |
| 3.2.1 Fuel Filler Pipe Restraining During Shipping..... | 56 |
| 3.2.2 Fuel Filler Mounting..... | 56 |
| 3.2.3 Fuel Filler Mounting - Raptor..... | 61 |
| 3.2.4 Fuel Filler Vent Hose - (Diesel)..... | 62 |
| 3.2.5 Long Range Fuel Tanks..... | 63 |
| 3.2.6 Axle Breather Vent Hose..... | 63 |
| 3.2.7 Axle Breather Vent Hose - Raptor..... | 64 |

4 Electrical

| | |
|--|-----------|
| 4.1 Wiring Installation and Routing Guides..... | 65 |
| 4.1.1 Wiring Splicing Procedures..... | 65 |
| 4.1.2 Wiring Through Cabin Sheet Metal..... | 65 |
| 4.2 Battery and Cables..... | 67 |
| 4.2.1 Battery Information..... | 67 |
| 4.2.2 Connection of Auxiliary Loads / Accessories - Vehicles with Factory Fit Auxiliary Switches, Wiring and Fuse Box..... | 73 |

| | | |
|-------------|---|------------|
| 4.2.3 | Generator and Alternator..... | 76 |
| 4.3 | Parking Aid..... | 77 |
| 4.3.1 | Sensor Location..... | 78 |
| 4.4 | Electronic Engine Controls..... | 81 |
| 4.4.1 | Tachograph..... | 81 |
| 4.4.2 | Vehicle Speed Signal..... | 81 |
| 4.5 | Information and Entertainment System..... | 82 |
| 4.5.1 | Rear View Camera..... | 82 |
| 4.6 | Exterior Lighting..... | 85 |
| 4.6.1 | Rear Combination lamps..... | 86 |
| 4.6.2 | Rear Fog Lamp..... | 86 |
| 4.6.3 | Rear License Plate Lamp..... | 87 |
| 4.6.4 | Additional External Lamps..... | 88 |
| 4.6.5 | Headlamps - Connection of Auxiliary Driving Lamp Signal..... | 89 |
| 4.6.6 | Brake (Stop) Lamps)..... | 93 |
| 4.6.7 | Position (Park) Lamps)..... | 93 |
| 4.6.8 | Reversing Lamps, Rear View Camera, Reversing Alarm (Manual Transmission)..... | 94 |
| 4.6.9 | Trailer Towing - Lighting Connections..... | 94 |
| 4.6.10 | Lamps – Hazard / Direction Indication..... | 96 |
| 4.6.11 | Electrically Operated Door Mirrors..... | 97 |
| 4.6.12 | Centre High Mount Stop Lamp (CHMSL)..... | 97 |
| 4.6.13 | Automatic High Beam Control..... | 97 |
| 4.6.14 | Glare Free High Beam..... | 98 |
| 4.7 | Cruise Control..... | 99 |
| 4.7.1 | Adaptive Cruise Control..... | 99 |
| 4.8 | Driver Assist Technology..... | 100 |
| 4.9 | Blind Spot Information System..... | 103 |
| 4.10 | Side View Camera..... | 104 |
| 4.11 | Lane Keeping System..... | 106 |
| 4.11.1 | Lane Centering Assist..... | 106 |
| 4.12 | Handles, Locks, Latches and Entry Systems..... | 107 |
| 4.12.1 | Central Locking..... | 107 |
| 4.13 | Fuses and Relays..... | 108 |
| 4.13.1 | Fuses..... | 108 |

| | | |
|------------|--|------------|
| 5.2.2 | Supplementary Restraint Sensors (Front)..... | 143 |
| 5.3 | Seatbelt Systems..... | 145 |
| 5.3.1 | SeatBelts - No DRILL ZONES..... | 145 |
| 5.4 | Corrosion Prevention..... | 150 |
| 5.4.1 | General..... | 150 |
| 5.4.2 | Repairing Damaged Paint..... | 150 |
| 5.4.3 | Under Body Protection and Material..... | 150 |
| 5.4.4 | Painting Road Wheels..... | 150 |
| 5.4.5 | Galvanic (bi-metallic) Corrosion..... | 150 |
| 5.5 | Frame and Body Mounting..... | 151 |
| 5.5.1 | Mounting Points and Tubing..... | 151 |
| 5.5.2 | Self-Supporting Body Structure..... | 152 |
| 5.5.3 | Frame Drilling and Tube Reinforcing..... | 153 |
| 5.5.4 | Ancillary Equipment - Sub Frame Mounting..... | 153 |
| 5.5.5 | Area for Fitting Additional Body Attachments to the Rear of the Bumper. | 153 |
| 5.5.6 | Water Tank on Camper Vehicles..... | 154 |
| 5.5.7 | Long Wheelbase Conversions..... | 154 |

5 Body and Paint

| | | |
|------------|--|------------|
| 5.1 | Body..... | 109 |
| 5.1.1 | Body Structures - General Information..... | 109 |
| 5.1.2 | Integrated Bodies and Conversions..... | 109 |
| 5.1.3 | Integrated Bodies and Conversions - Raptor..... | 112 |
| 5.1.4 | Chassis Cab..... | 113 |
| 5.1.5 | Front End Integrity for Cooling, Crash, Aerodynamics and Lighting..... | 126 |
| 5.1.6 | Tipper Bodies..... | 126 |
| 5.1.7 | Tank and Dry Bulk Carriers..... | 127 |
| 5.1.8 | Genuine Ford Accessory Bull Bar..... | 127 |
| 5.1.9 | Roof Racks..... | 127 |
| 5.1.10 | Cargo Management on Vehicle Tub..... | 129 |
| 5.1.11 | Front Fender Liner..... | 135 |
| 5.2 | Airbag Supplemental Restraint System (SRS)..... | 137 |
| 5.2.1 | Air Bags..... | 137 |

1.1 About this Publication

1.1.1

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.

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.motorcraftservice.com/> or see your National Sales Company representative, or local Ford Dealer.

1.2 Commercial and Legal Aspects

1.2.1 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.

1.2.2 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.

1.2.3 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: 1.10 (page 30).

1.2.4 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

1.2.5 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.

1.2.6 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.

1.2.7 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.

1.2.8 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.

1.2.9 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.


1.2.10 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: 5.2 Airbag Supplemental Restraint System (SRS) (page 137).

1.2.11 Drilling and Welding

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

1.2.12 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.




1.2.13 Road Safety

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

1.3 Electromagnetic Compatibility (EMC)

1.3.1

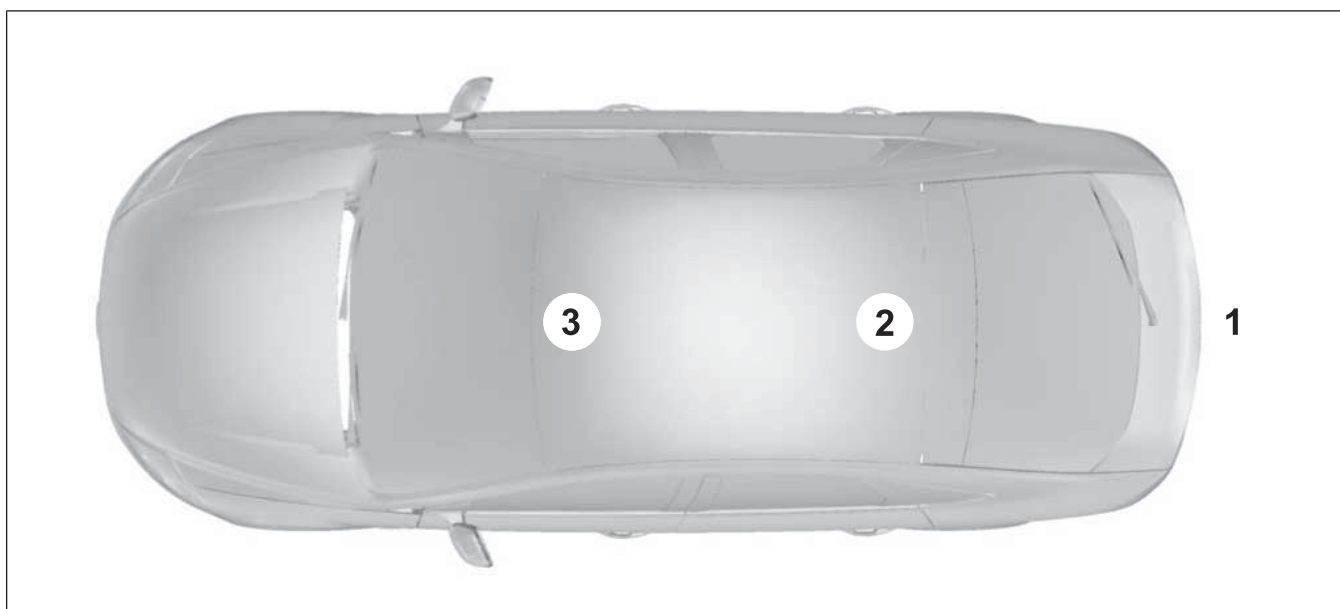
WARNINGS:

-  **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.**

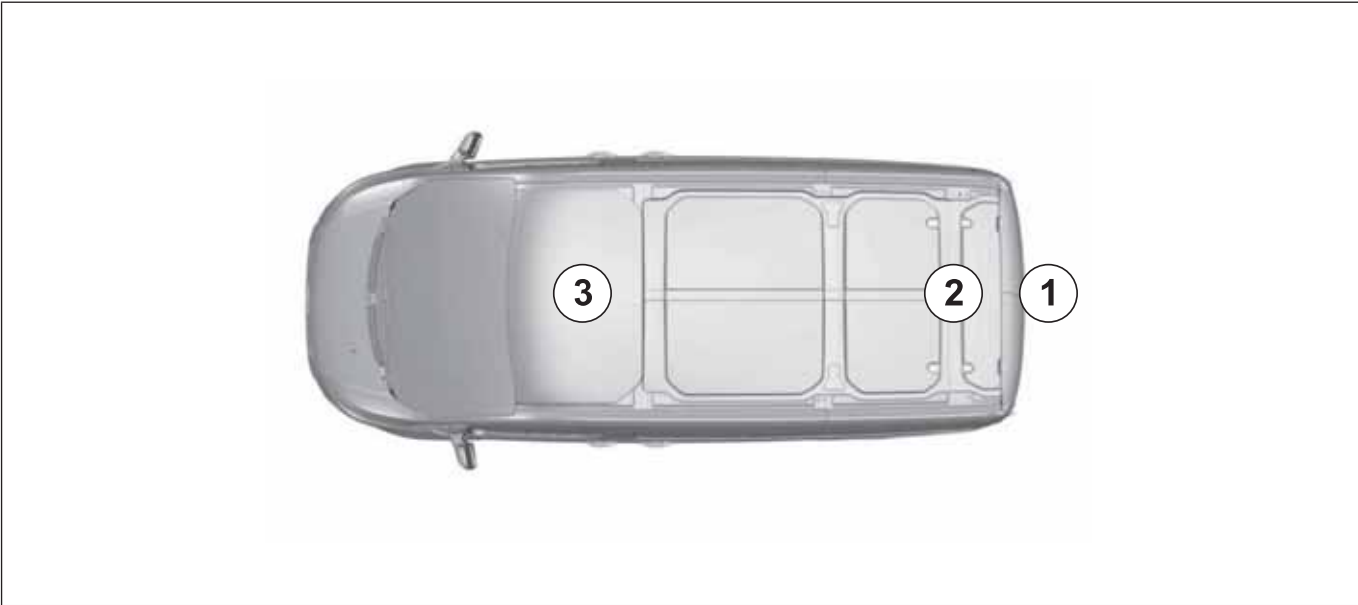
NOTE: We test and certify your vehicle to meet electromagnetic compatibility legislation. It is your responsibility to make sure that any equipment an authorized dealer installs on your vehicle complies with applicable local legislation and other requirements. Installation of some aftermarket electronic 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.

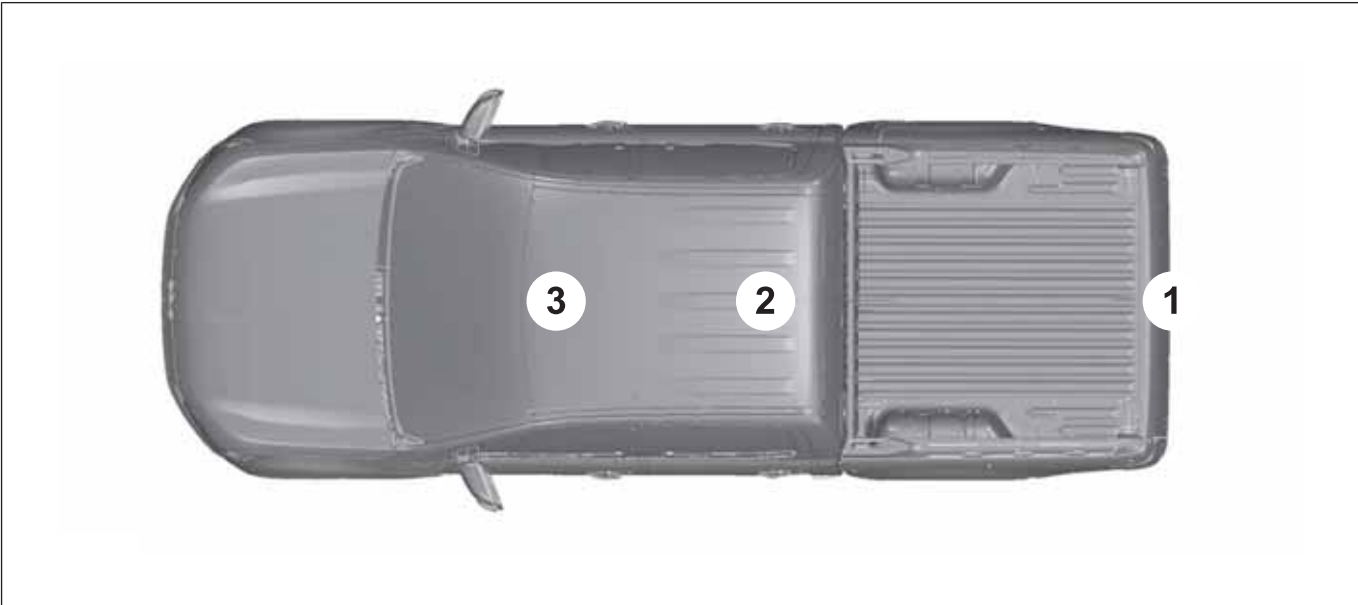
Car



Van



Truck



| 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 |

1.4 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

1.4.1 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.

1.5 Jacking

WARNINGS:

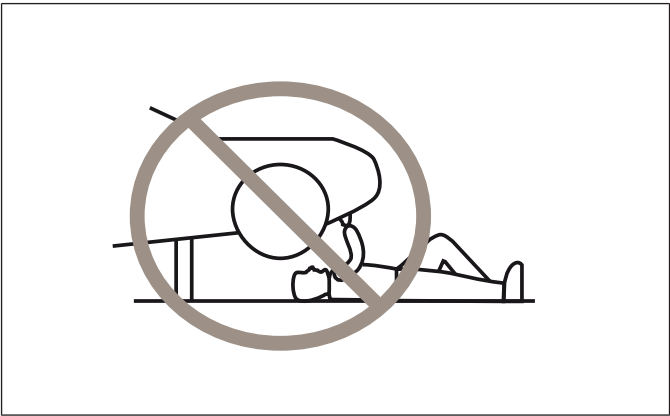
- ⚠ Ensure jack screwthread is adequately lubricated before use.
- ⚠ The jack should be used on level firm ground wherever possible.
- ⚠ Switch the ignition off and apply park brake fully before lifting vehicle.
- ⚠ It is recommended that the wheels of the vehicle be chocked, and that no person should 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.

- ⚠ **WARNING:** 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.
- ⚠ **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.

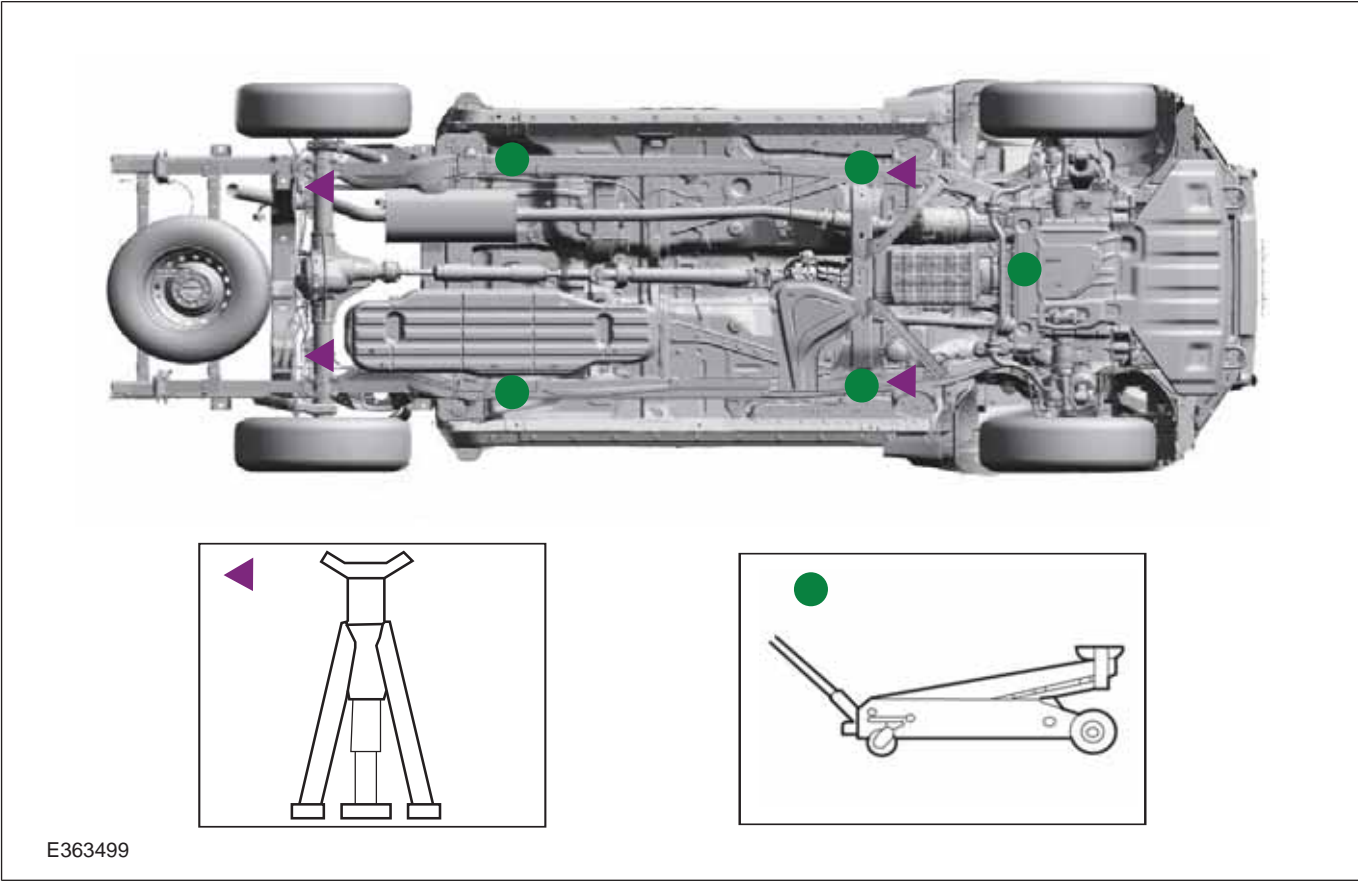
NOTE: When using the vehicle jack, refer to the owner guide for correct operating instructions.

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.



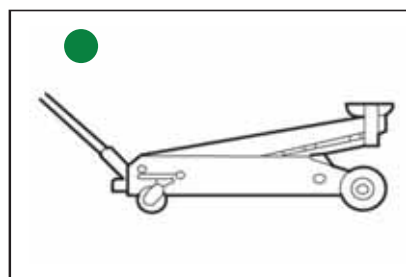
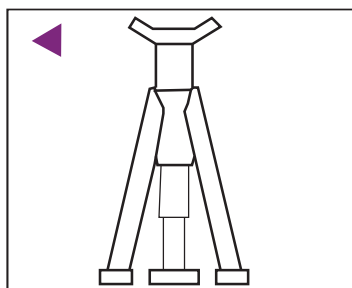
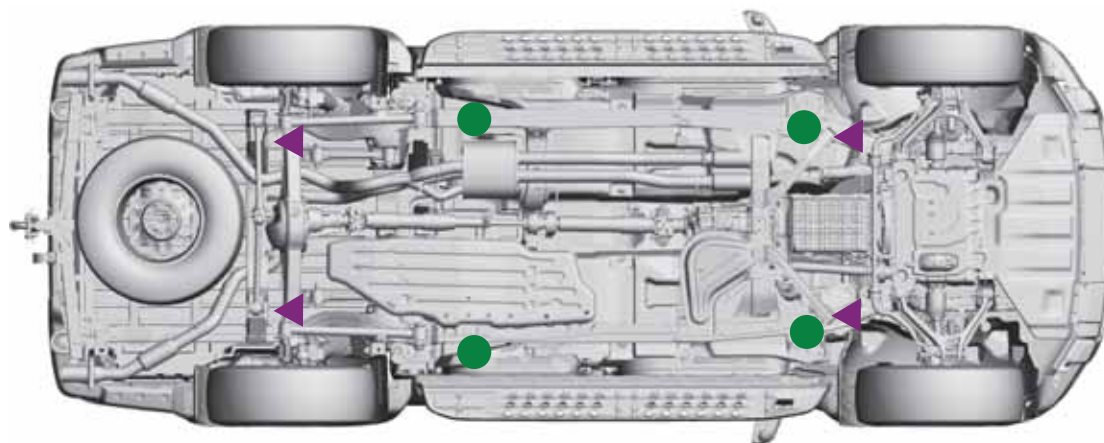
Vehicle Jacking Points and Axle Stand Positions



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



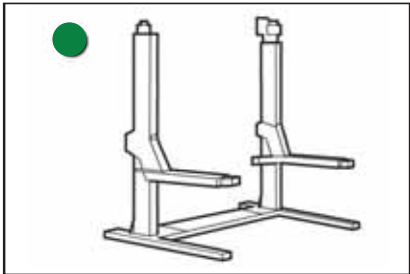
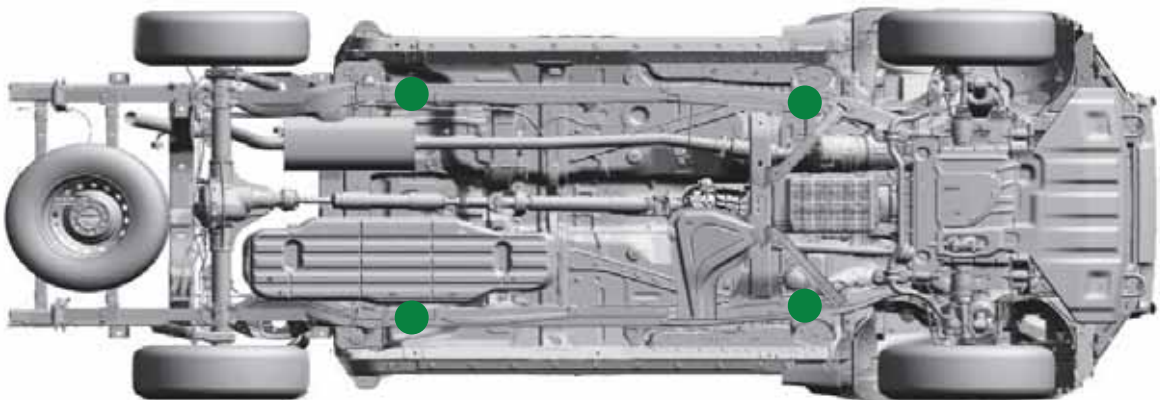
E366253

1.6 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.

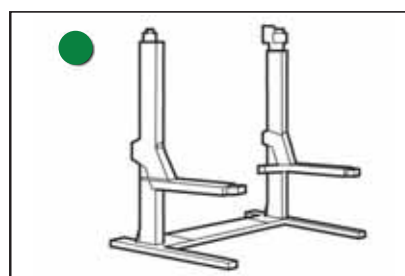
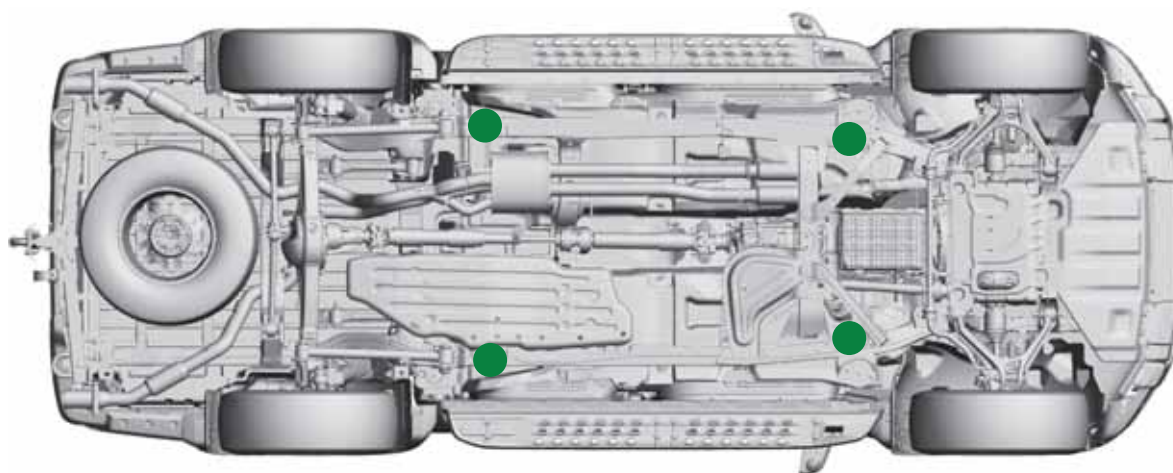
- CAUTIONS:**
- When lifting the vehicle with a two post lift, vehicle lift arm adapters must be used under the lifting points.
 - When lifting the vehicle with a two post lift, the maximum kerb weight must not be exceeded.
 - It is important that only the correct lifting and support locations are used 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

1.7 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 material on panels.

1.8 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 / 7.25 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.

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.


| 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 °C) 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.

1.9 Package and Ergonomics

1.9.1 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.

1.9.2 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.

1.9.3 Driver Field of View

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

1.9.4 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 85).

1.9.5 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

| Item | Description |
|------|-----------------------------|
| X | Maximum Body Width: 1910 mm |

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 |

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

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

Mass of the Completed Vehicle

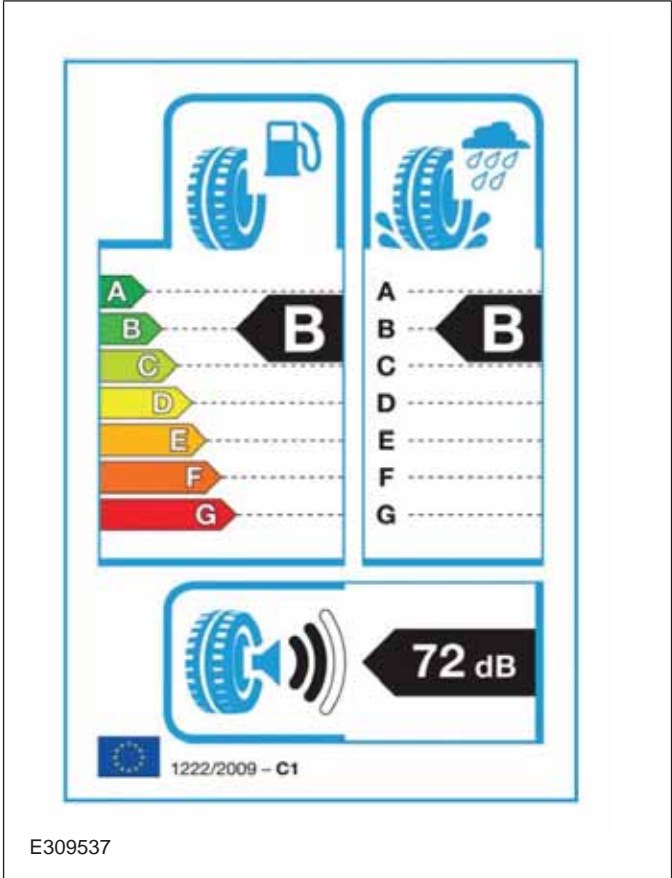
All modifications and changes that effect the actual mass of the vehicle must be taken into account. The definition of actual mass is described under the provisions of regulation 2018/1832 Annex XXI. The actual mass of the completed vehicle needs to be provided for the front and rear axle. This weight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

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

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

Mass of the Completed Vehicle

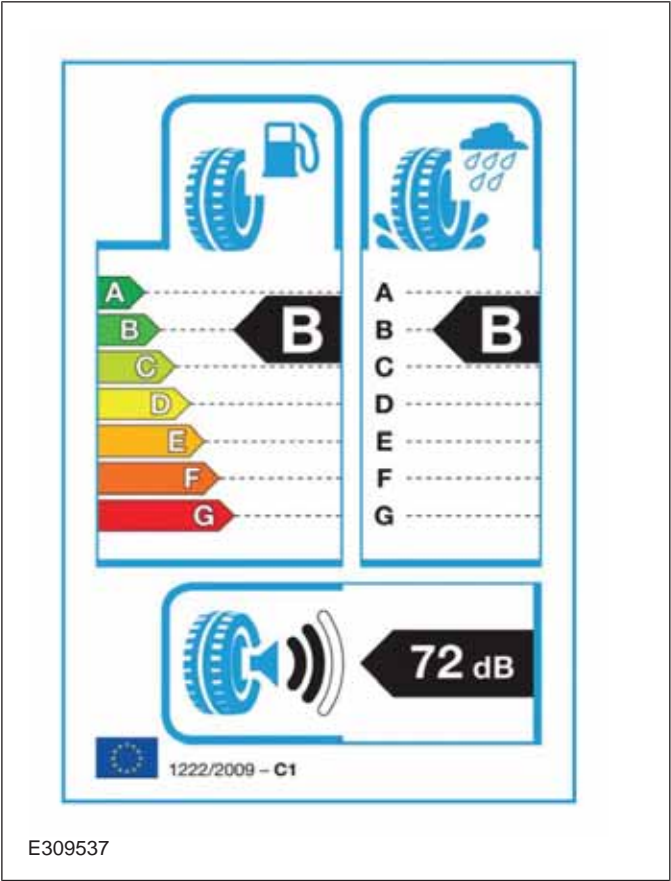
All modifications and changes that effect the actual mass of the vehicle must be taken into account. The definition of actual mass is described under the provisions of regulation 2018/1832 Annex XXI. The actual mass of the completed vehicle needs to be provided for the front and rear axle. This weight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

1.9.8 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 | 1872-1883 | 1781 |
| Super Cab | 1866-1878 | 1772 |
| Double Cab | 1875-1886 | 1780 |
| Overall Vehicle Height - measured to antenna base at MAX rear axle loading conditions | | |
| Single Cab | 1828 | 1729 |
| Super Cab | 1807 | 1707 |
| Double Cab | 1810 | 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.

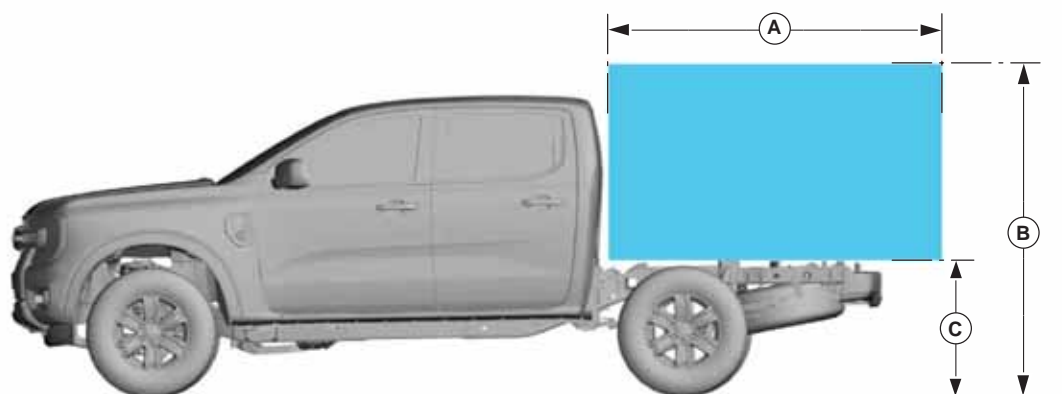
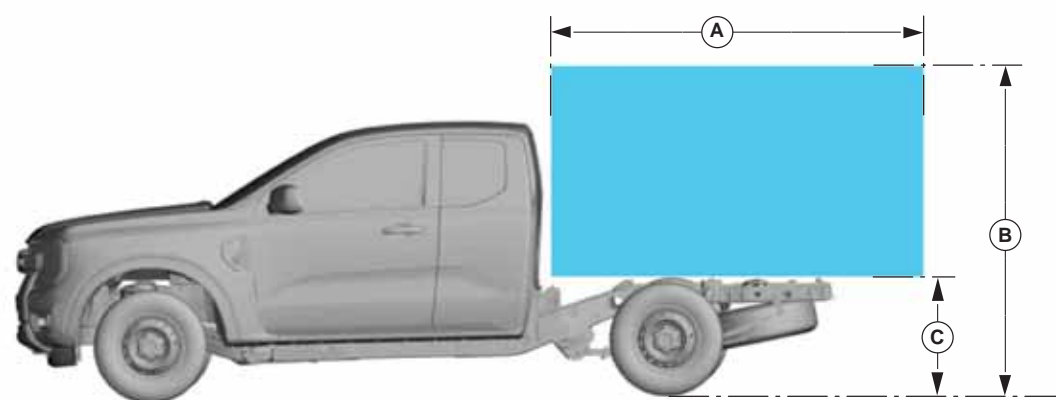
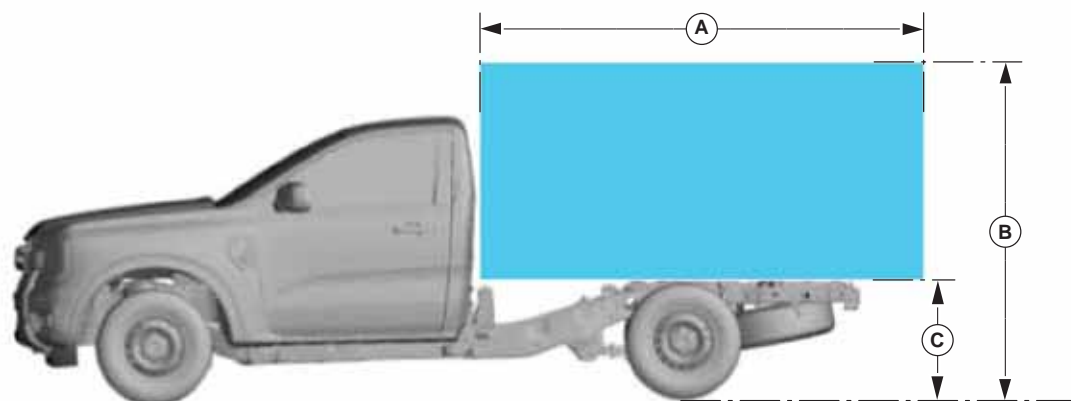
1.9.9 Vehicle Dimensions Key - Raptor

| 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 | 1828 |

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.

1.9.10 Recommended Maximum Main Load Area Dimensions

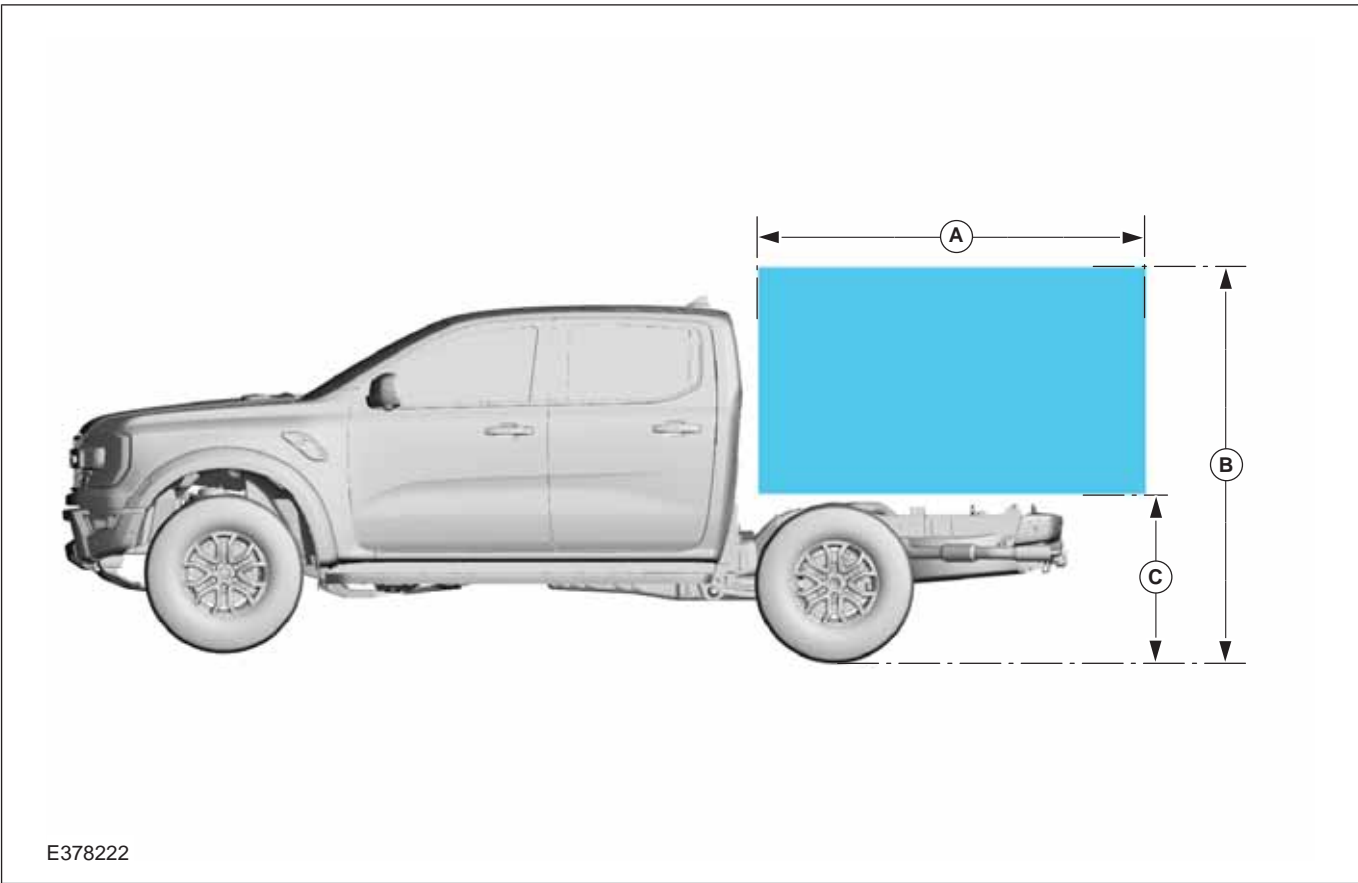


E364073

| Vehicle | A (mm) | B (mm) | C (mm) |
|------------|--------|--------|--------|
| Single Cab | 2872 | 2214 | 755 |
| Super Cab | 2402 | 2214 | 755 |
| Double Cab | 2104 | 2214 | 755 |

* Australian market vehicles include tow bar. Overall length "D" increases to 5406mm.

1.9.11 Recommended Maximum Main Load Area Dimensions - Raptor



| Vehicle | A (mm) | B (mm) | C (mm) |
|---------|--------|--------|--------|
| Raptor | 2104 | 2214 | 755 |

* Australian market vehicles include tow bar. Overall length "D" increases to 5425mm.

1.9.12 WLTP Frontal Area Calculation

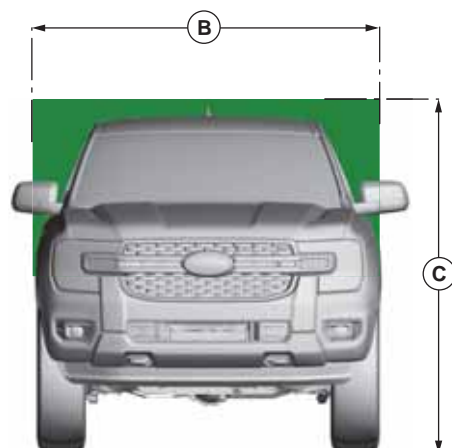
NOTE: The WLTP calculator can be provided by your National Sales Representative.

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

Frontal Area Calculation



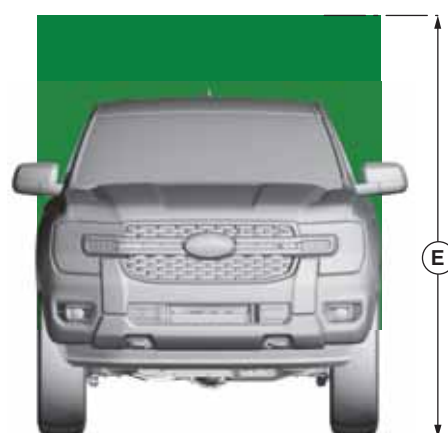
①



②



③



④

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 m ² | Af m ² |
|--------------------------------------|-------------------|-------------------|
| 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.

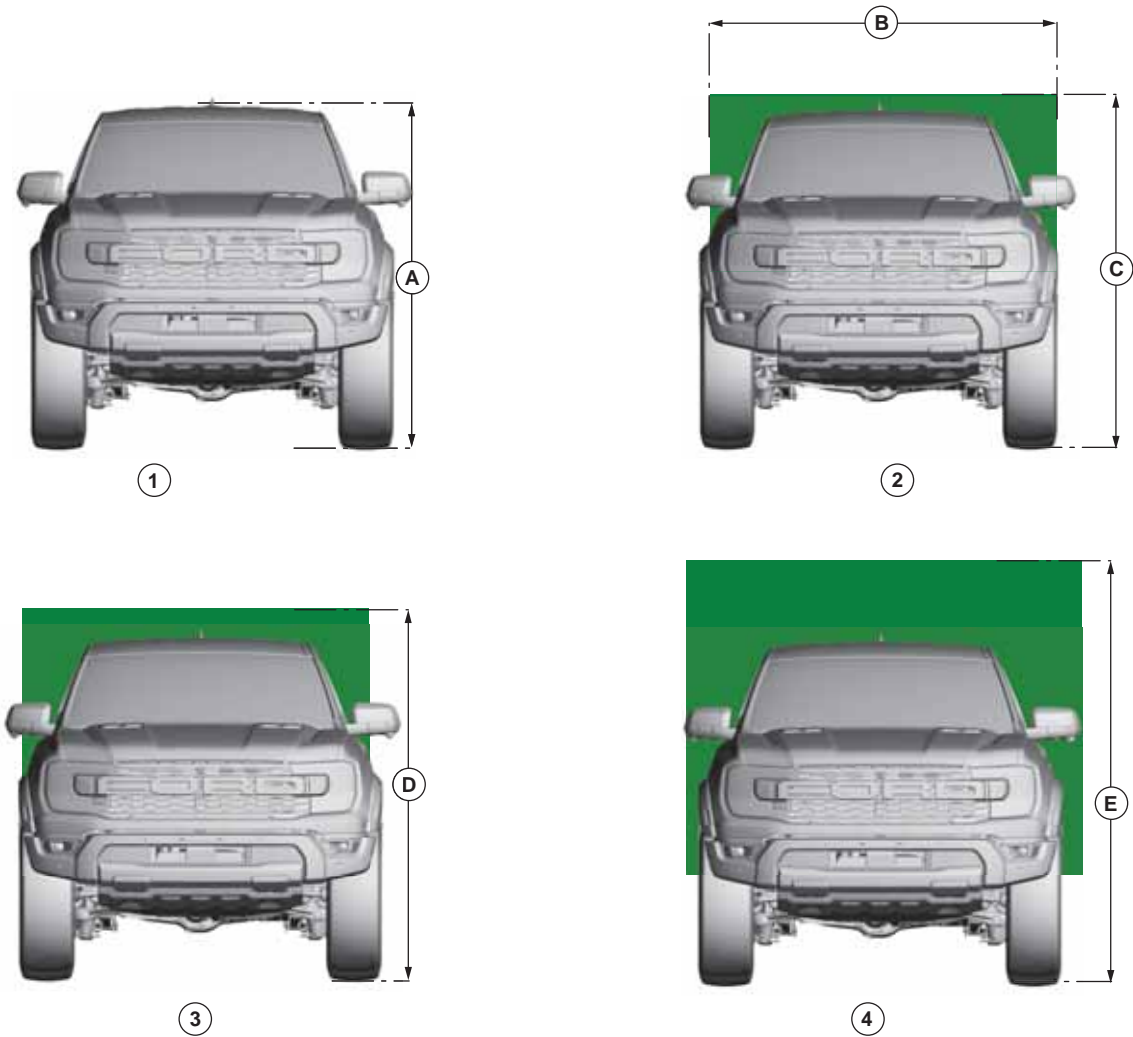
1.9.13 WLTP Frontal Area Calculation - Raptor

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 |

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.

Vehicle frontal area configuration

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

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

1.9.14 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.

1.10 Package and Ergonomics—Specifications

1.10.1 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: 5.1 Body (page 109).

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.

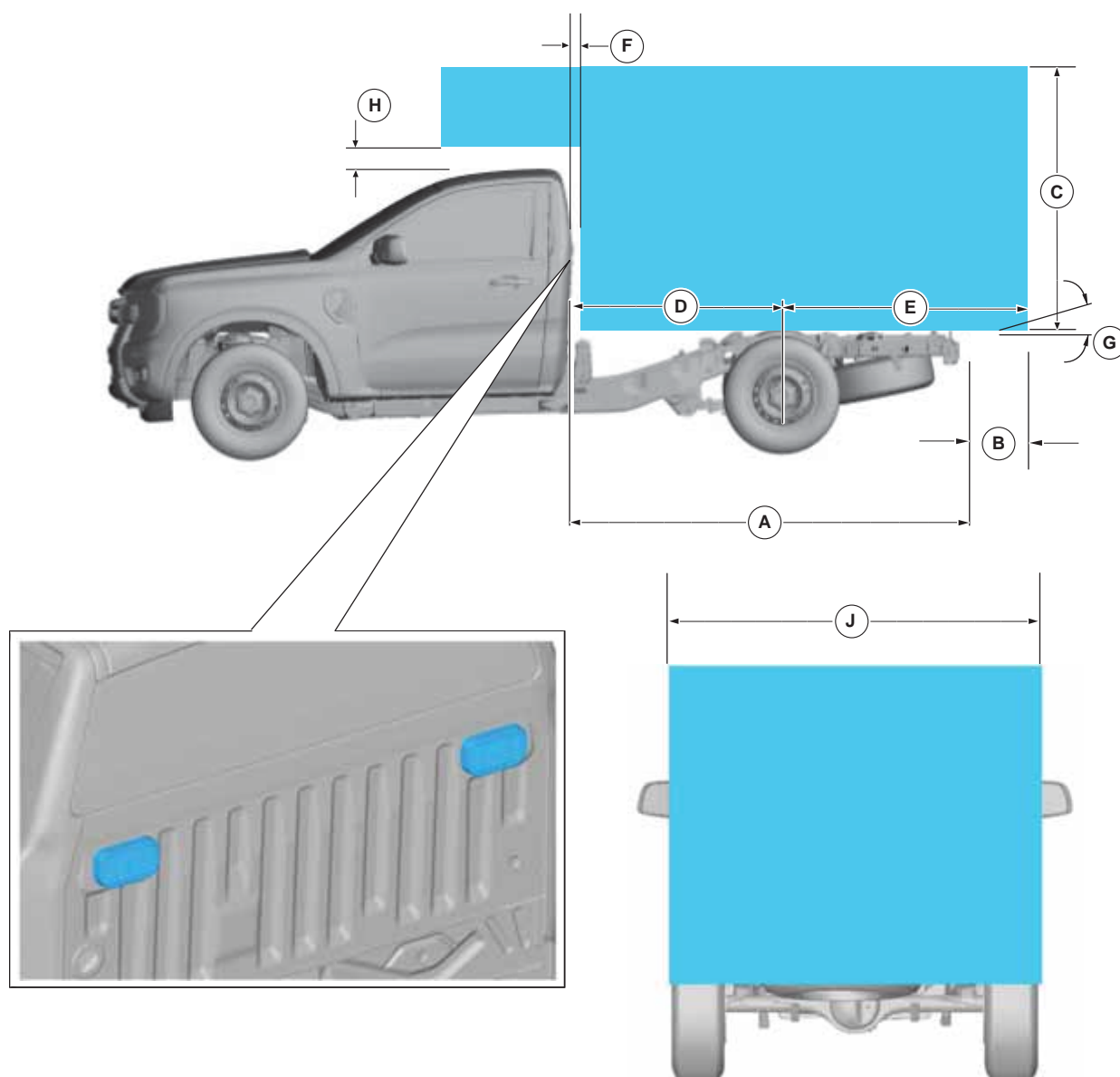
NOTE: If a towball is fitted to the vehicle, the body dimensions must incorporate a towball clearance zone in accordance with local regulatory requirements.

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 109).

Chassis Cab Body - Single Cab Illustrated



E364690

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 | Under run bar and towing attachment legislation to be maintained | | | |
| 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 85). | | | |
| H | Clearance between the top of the cab and the body | 30mm | | |
| J | Maximum external body width (without side step) | 1910 | | |

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

Refer to: 1.9 Package and Ergonomics (page 19).

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.

1.10.2 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.

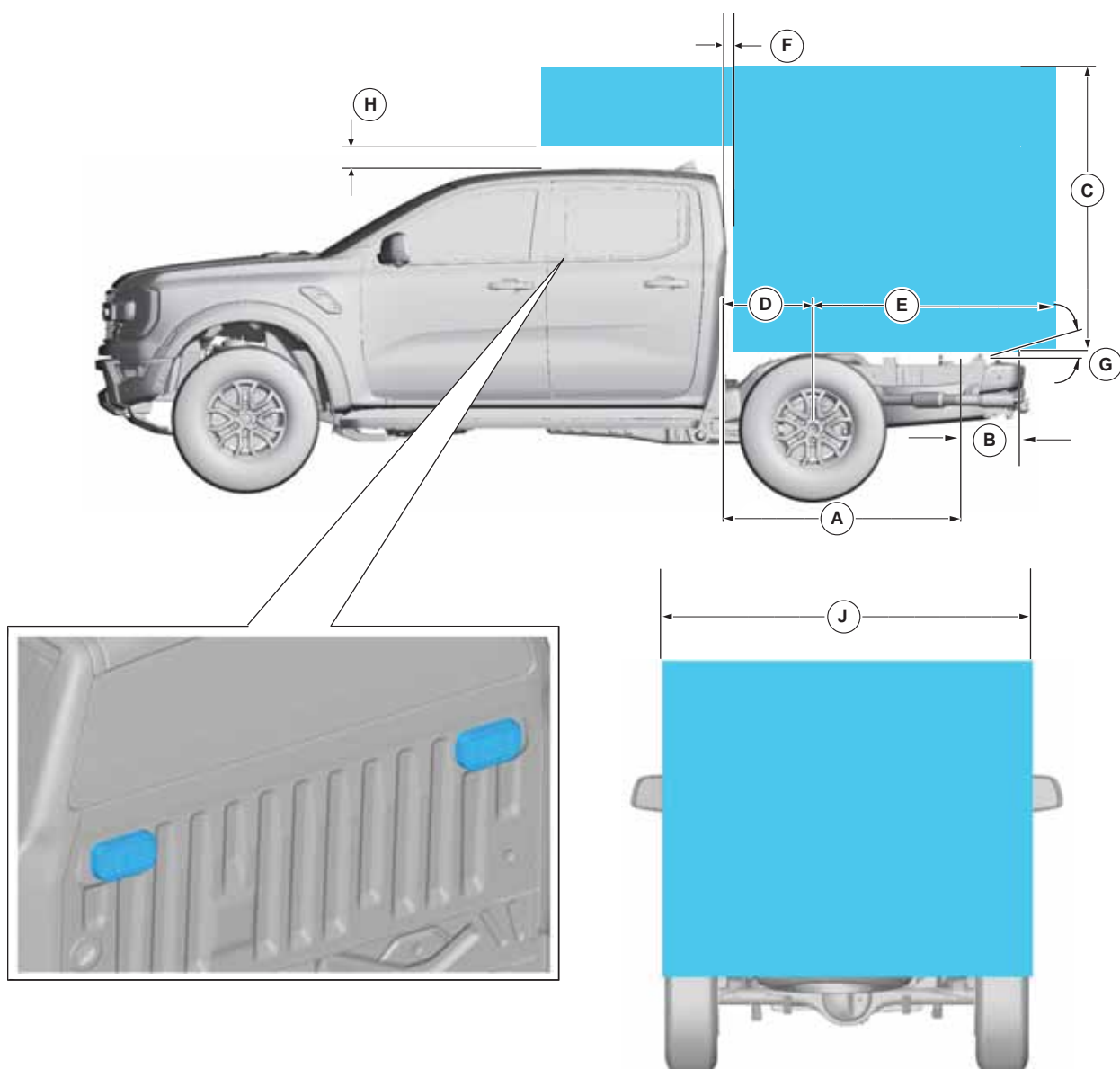
NOTE: If a towball is fitted to the vehicle, the body dimensions must incorporate a towball clearance zone in accordance with local regulatory requirements.

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 109).

Chassis Cab Body - Raptor



E366514

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 | Under run bar and towing attachment legislation to be maintained | |
| 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 85). | |
| H | Clearance between the top of the cab and the body | 30mm |
| J | Maximum external body width (without side step) | 1910 |

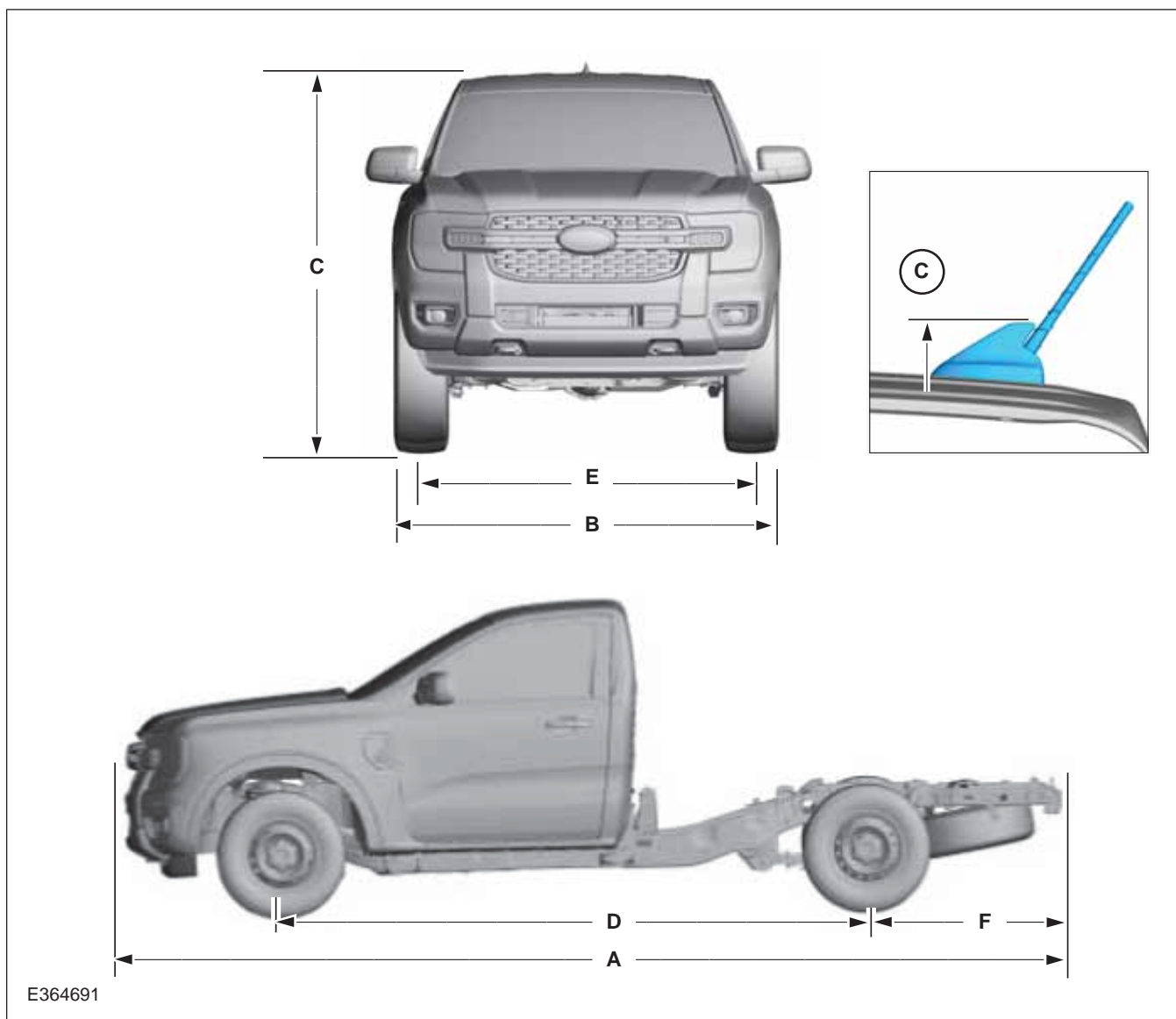
*For WLTP markets this dimensions should be disregarded. Refer to the relevant WLTP dimensions.

[Refer to: 1.9 Package and Ergonomics \(page 19\).](#)

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.

1.10.3 Chassis Cab Body - Basic Dimensions and Weights

Chassis Cab Body - Single Cab Illustrated



Chassis Cab Body

| Description | | Single Cab | Super Cab | Double Cab |
|-------------|---|----------------------------|---------------|---------------|
| A | Overall length (mm) (with rear bumper) / (without rear bumper) / (with tow bar) | 5205 / 5225 / 5406** | | |
| B | Overall width - excluding exterior mirrors - without side step (mm) | 1910 | | |
| C | Overall height (mm) | 1772 - 1781 | 1772 - 1781 | 1772 - 1781 |
| C | Overall height * (mm) (taken to base of antenna mast) | 1872** / 1857 | 1866** / 1853 | 1875** / 1862 |
| D | Wheelbase (mm) | 3270 | | |
| E | Track (mm) | 1620 | | |
| E | Track * (mm) | 1650 | | |
| F | Rear Overhang (mm) (with rear bumper) / (without rear bumper) (without Towbar) | 1215 / 1070****, 1193***** | | |

* Vehicles with increased ride height, 4x2 High Ride and 4x4.

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

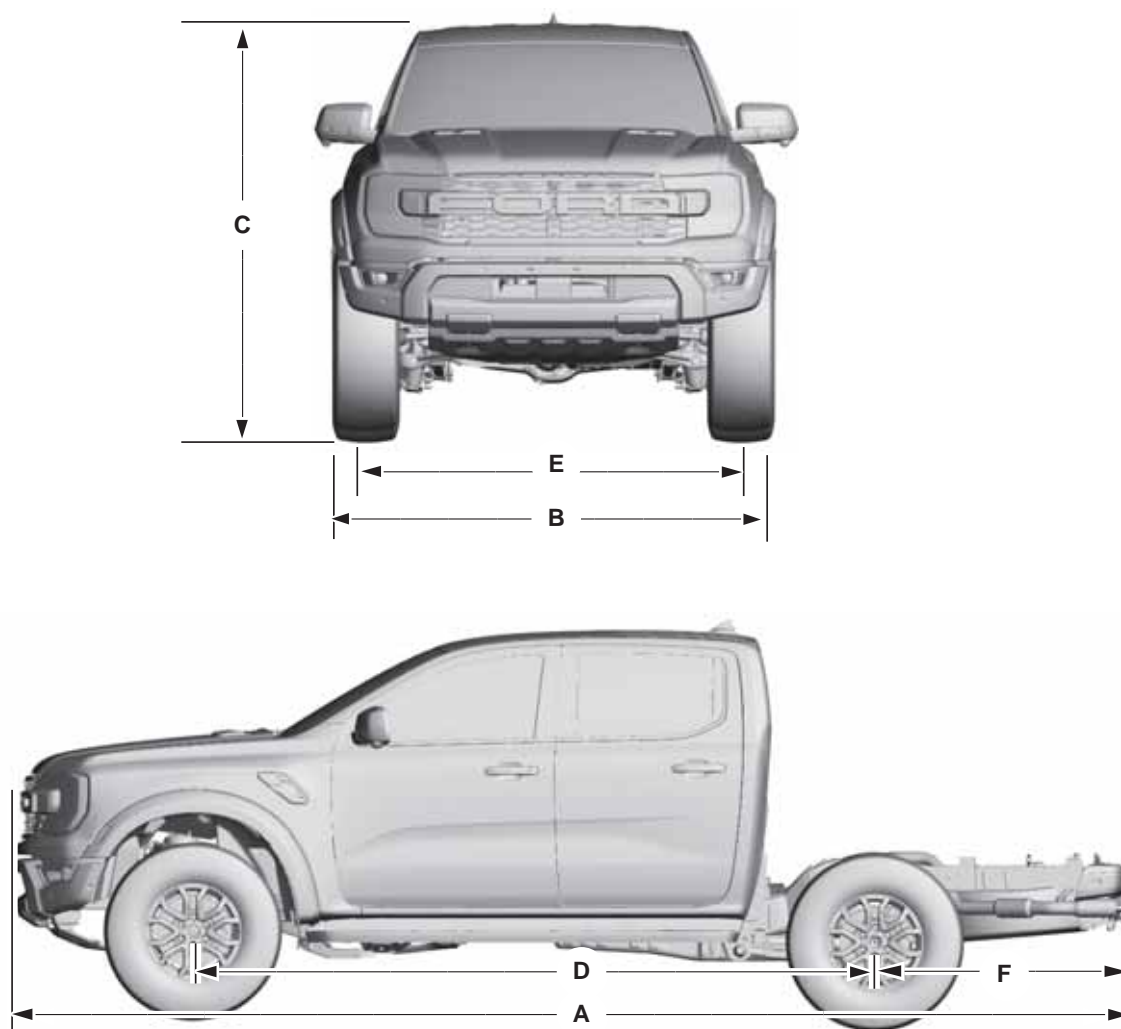
*** Vehicles with Tall 4G Connected Antenna

**** Single Cab Chassis-cab without bumper

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

1.10.4 Chassis Cab Body - Basic Dimensions and Weights - Raptor

Chassis Cab Body - Raptor



E366515

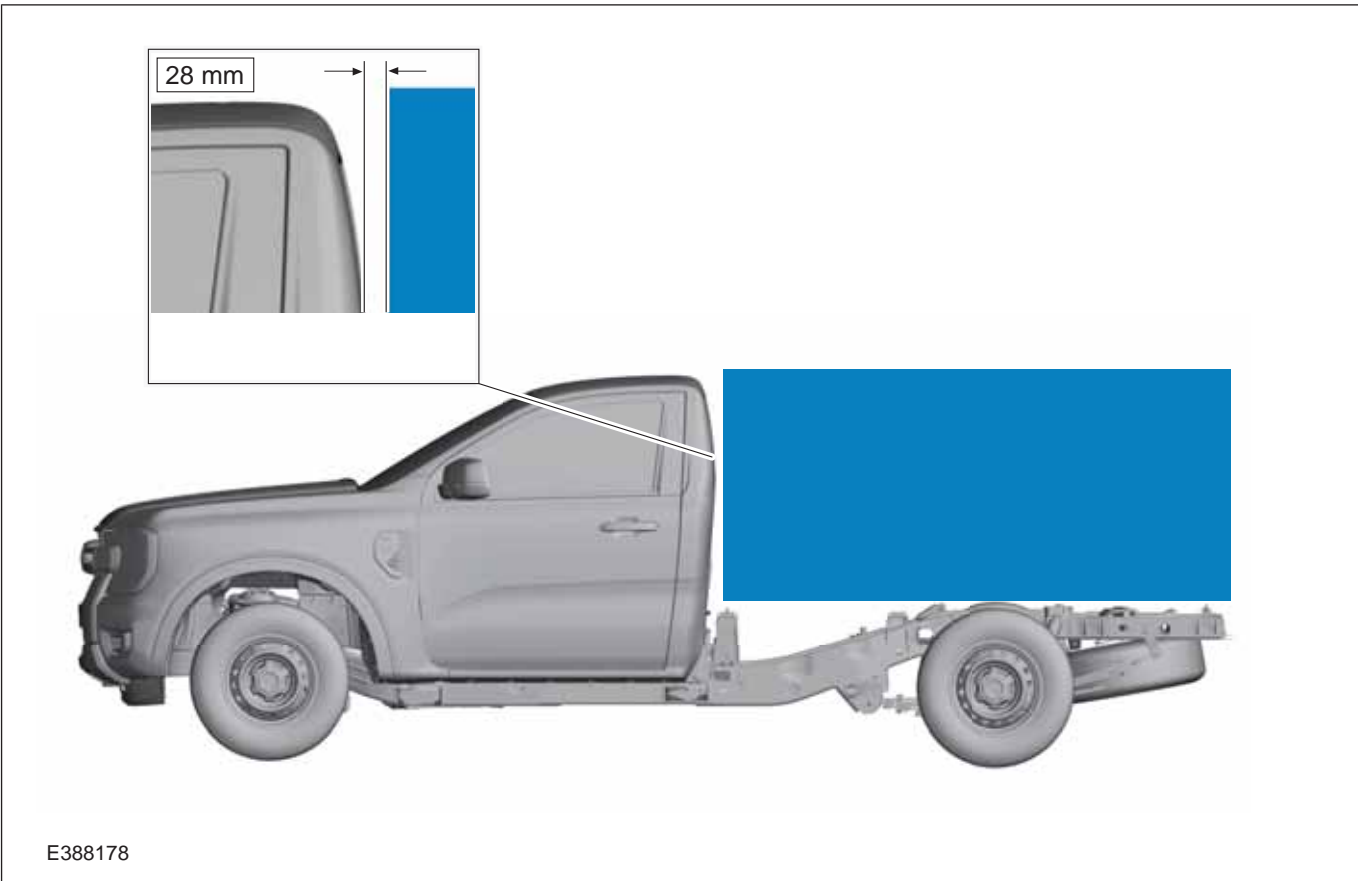
Chassis Cab Body

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

1.10.5 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.



1.10.6 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.

1.10.7 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.

1.10.8 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.

1.10.9 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.

1.11 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.

1.12 Load Distribution—Specifications

1.12.1 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.

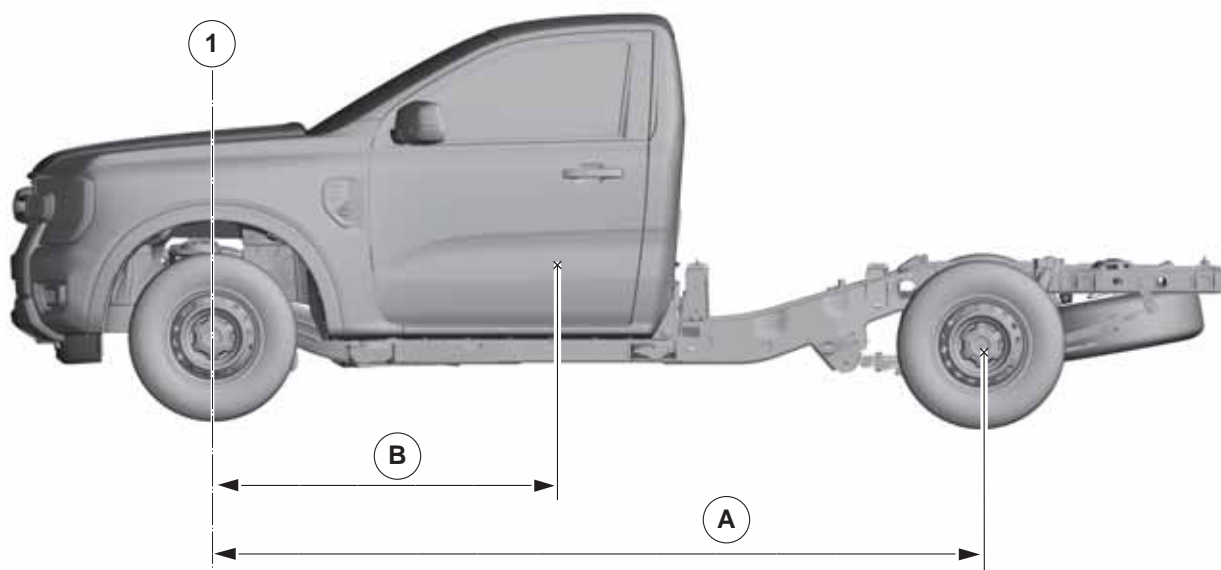
NOTE: Over loading of the vehicle could result in unacceptable ground clearance.

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

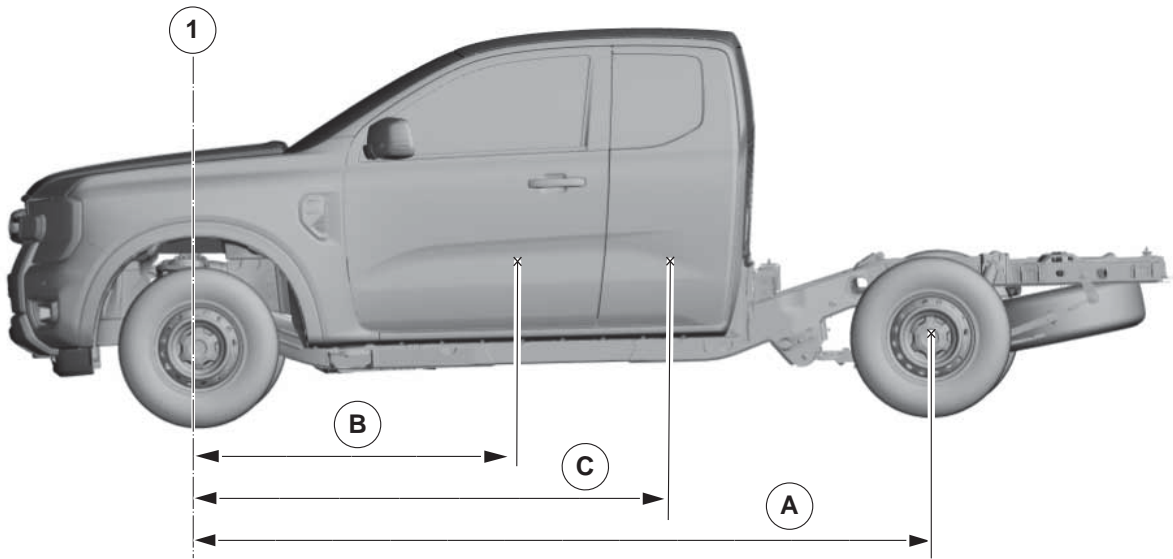


E364702

Single Cab Driver and Passenger Weight Distribution

| 'A' Wheelbase (mm) | 'B' Front row seats and driver (mm) | Weight distribution per person (Kg) | | |
|-----------------------|---|-------------------------------------|--------------|-------|
| | | On Front Axle | On Rear Axle | Total |
| 3270 | 1540 | 40 | 35 | 75 |

Super Cab

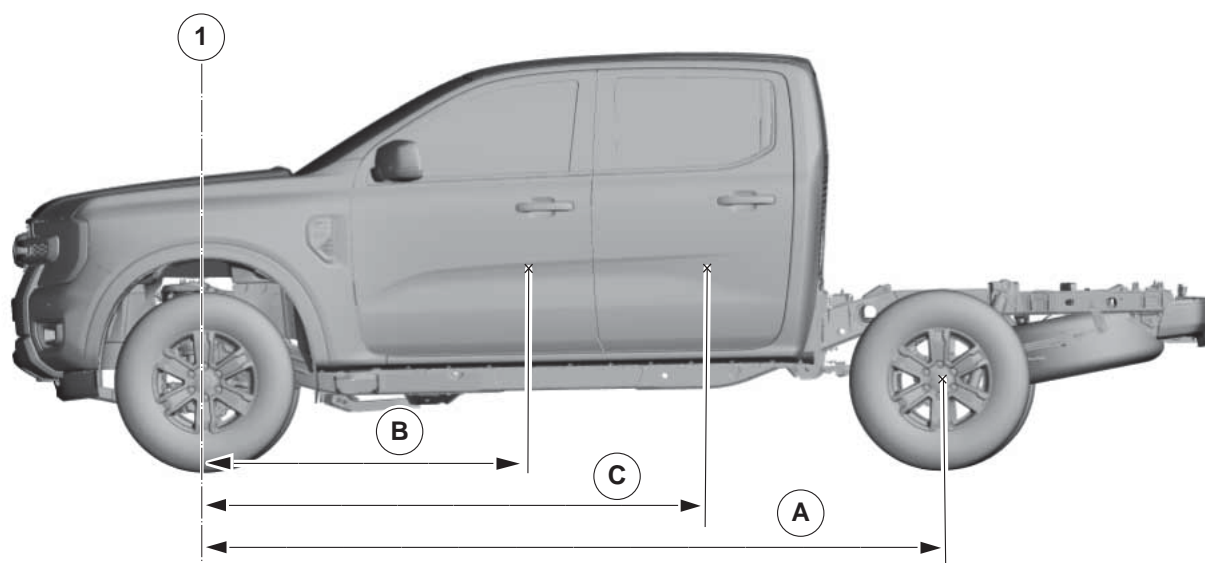


E364703

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) | | |
|-----------------------|---|------------------------------|-------------------------------------|--------------|-------|
| | | | On Front Axle | On Rear Axle | Total |
| 3270 | | | | | |
| | 1540 | - | 40 | 35 | 75 |
| | - | 2230 | 24 | 51 | 75 |

Double Cab

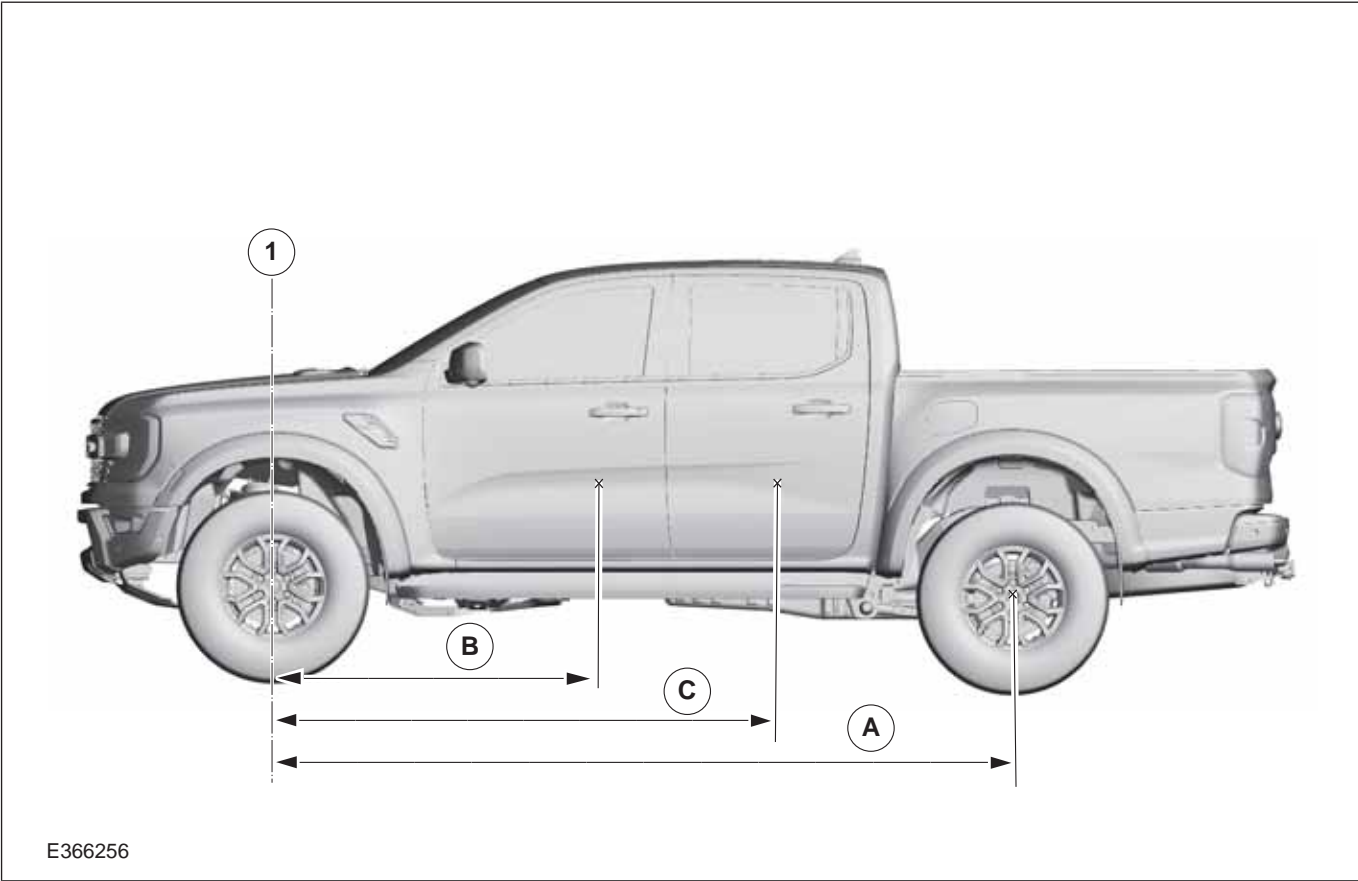


E364704

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) | | |
|-----------------------|---|---------------------------------|-------------------------------------|--------------|-------|
| | | | On Front Axle | On Rear Axle | Total |
| 3270 | | | | | |
| | 1540 | - | 40 | 35 | 75 |
| | - | 2360 | 21 | 54 | 75 |

Double Cab - Raptor



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) | | |
|--------------------|-------------------------------------|---------------------------|-------------------------------------|--------------|-------|
| | | | On Front Axle | On Rear Axle | Total |
| 3270 | | | | | |
| | 1540 | - | 40 | 35 | 75 |
| | - | 2360 | 21 | 54 | 75 |

1.12.2 Center of Gravity

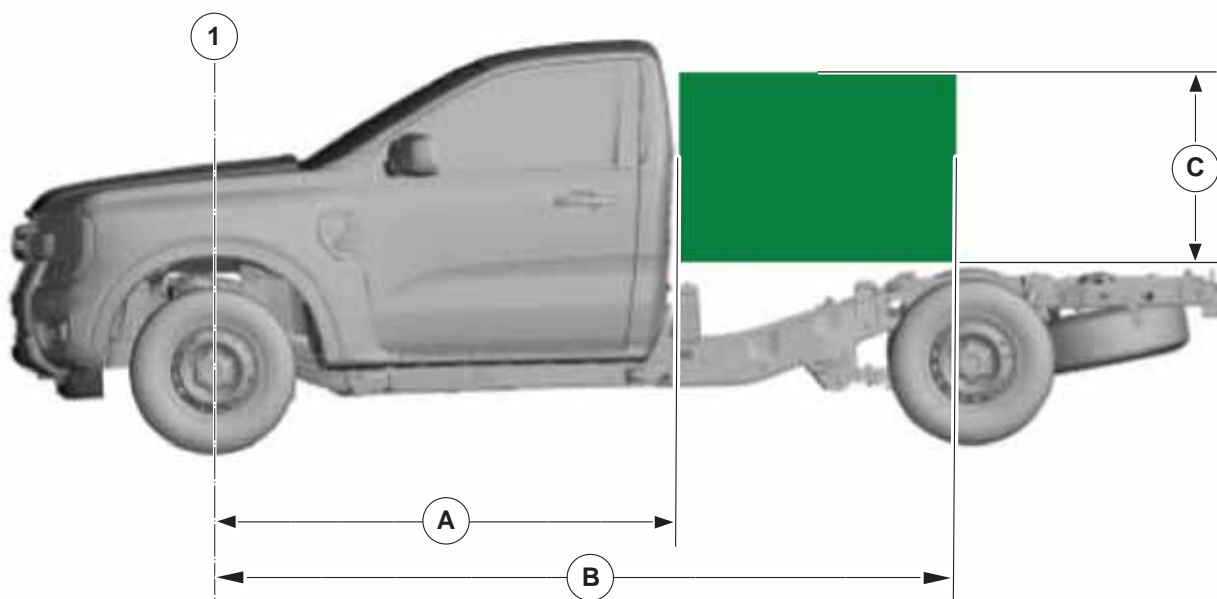
NOTE: Calculations shown are not inclusive of tow bar and other dealer fitted accessories.

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

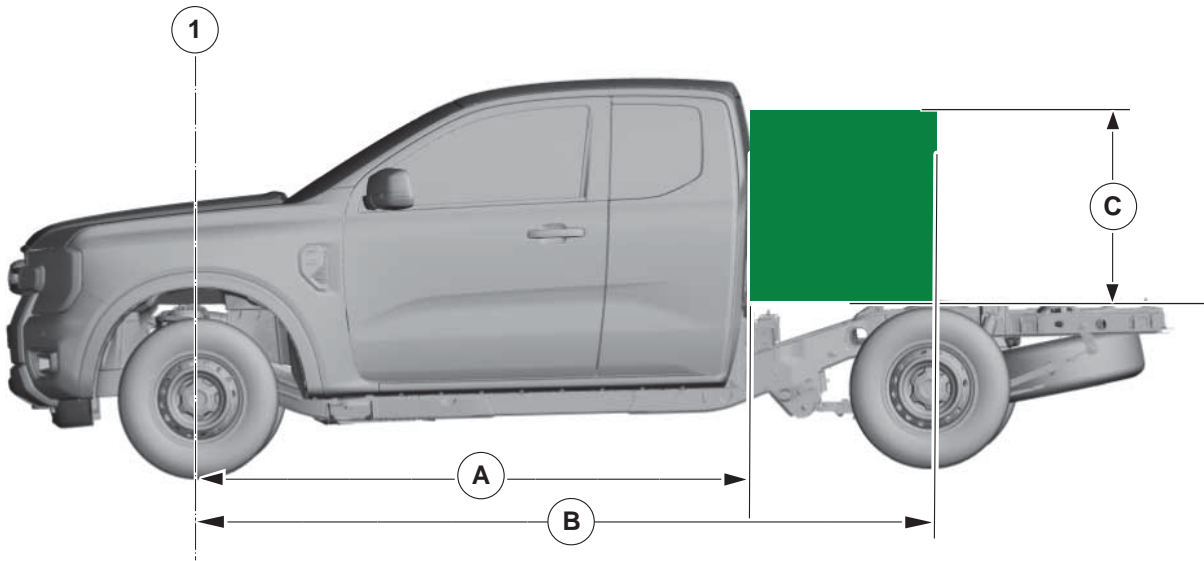
Single Cab Center of Gravity Critical Zone

| Model | Recommended C of G location for added mass | | |
|-------|--|--------------|----------------|
| | 'A' Min (mm) | 'B' Max (mm) | 'C' Max (mm)** |
| 4x2 | 1965 | 3220 | 740 |
| 4x2* | 1965 | 3435 | 590 |
| 4x4 | 1965 | 3435 | 590 |

* 4x2 vehicles with increased ride height.

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

Super Cab



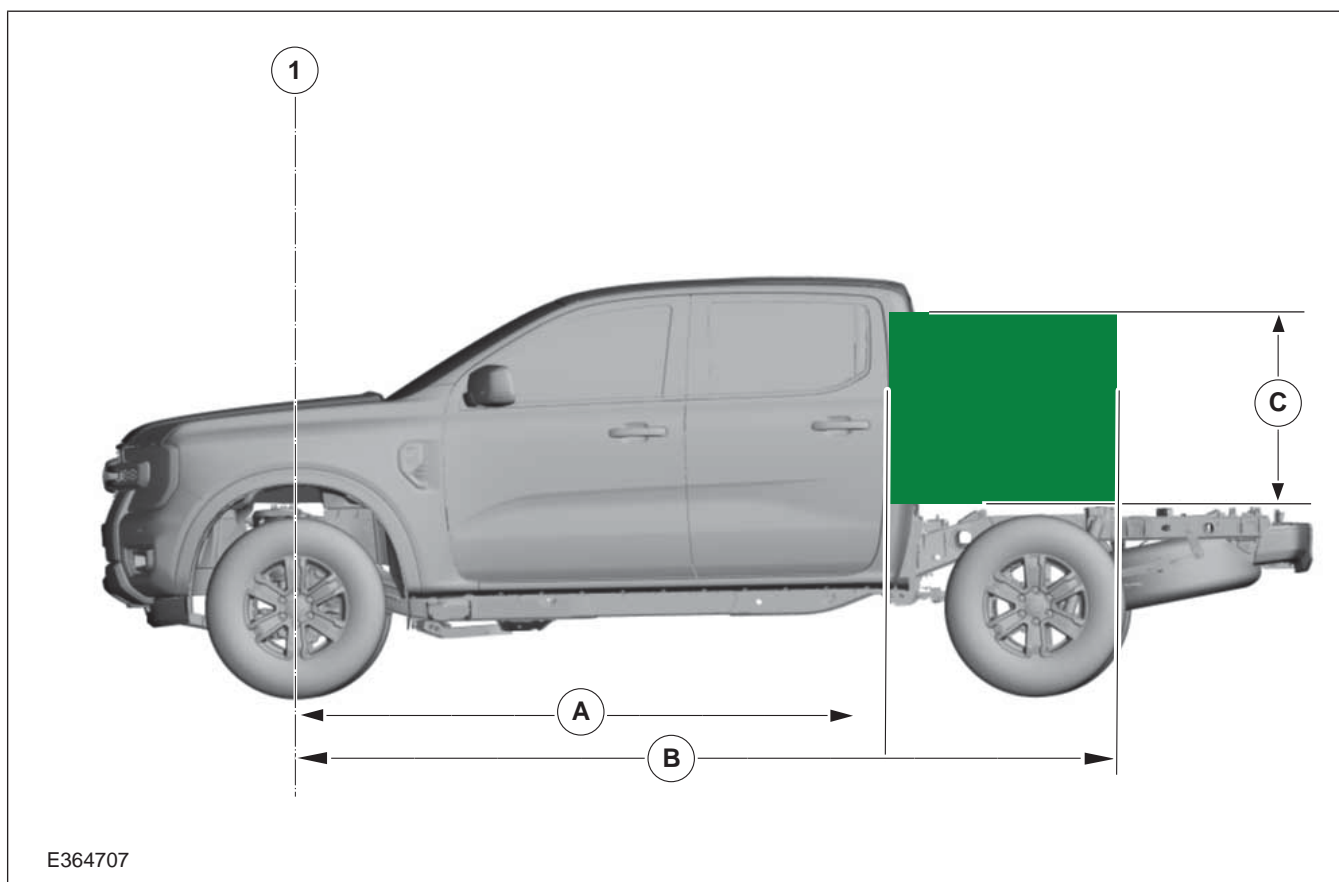
E364706

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* | 2365 | 3270 | 590 |
| 4x4 | 2365 | 3270 | 590 |

* 4x2 vehicles with increased ride height.

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

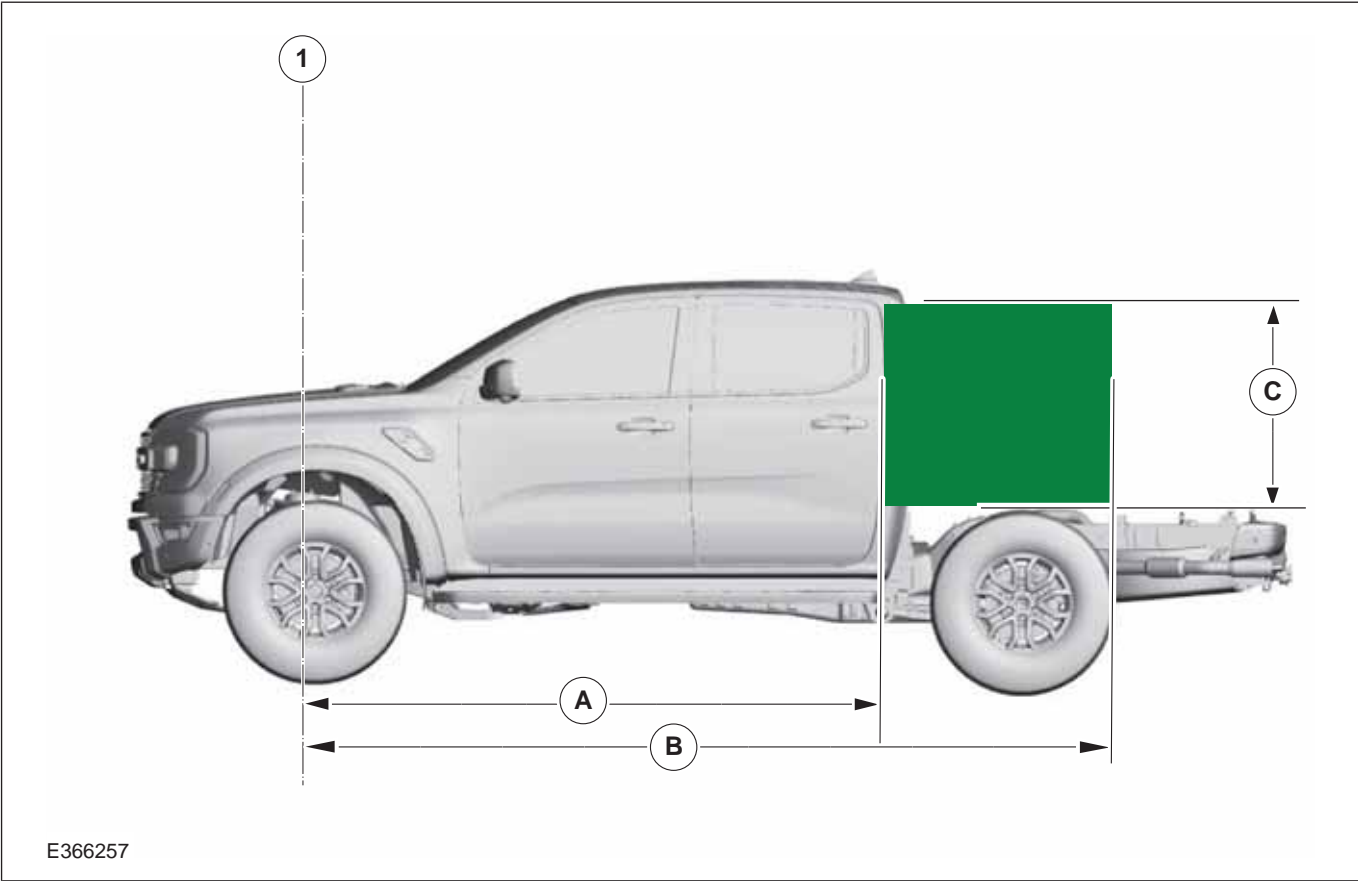
Double Cab**Double Cab Centre of Gravity Critical Zone**

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

* 4x2 vehicles with increased ride height.

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

Double Cab - Raptor



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 |

1.12.3 Vehicle Weights

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 |

| Engine | Drive | Series | Front Axle Limit | Rear Axle Limit | Gross Limit | Notes |
|-------------------|--------|-------------------|------------------|-----------------|-------------|--|
| 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 |
| 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 | |

BAS = Base
XL = XL
XLS = XLS
XLT = XLT
SPT = Sport
WT = Wildtrak
* = THAILAND ONLY
** = Australia / New Zealand ONLY


1.13 Towing

1.13.1 Towing Requirements


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

1.13.2 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: 5.5 Frame and Body Mounting (page 151).


1.13.3 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.**

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 Brake System

2.2.1 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.

2.2.2 Brake Hoses

WARNING: Ensure care is taken when removing or resealing 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.

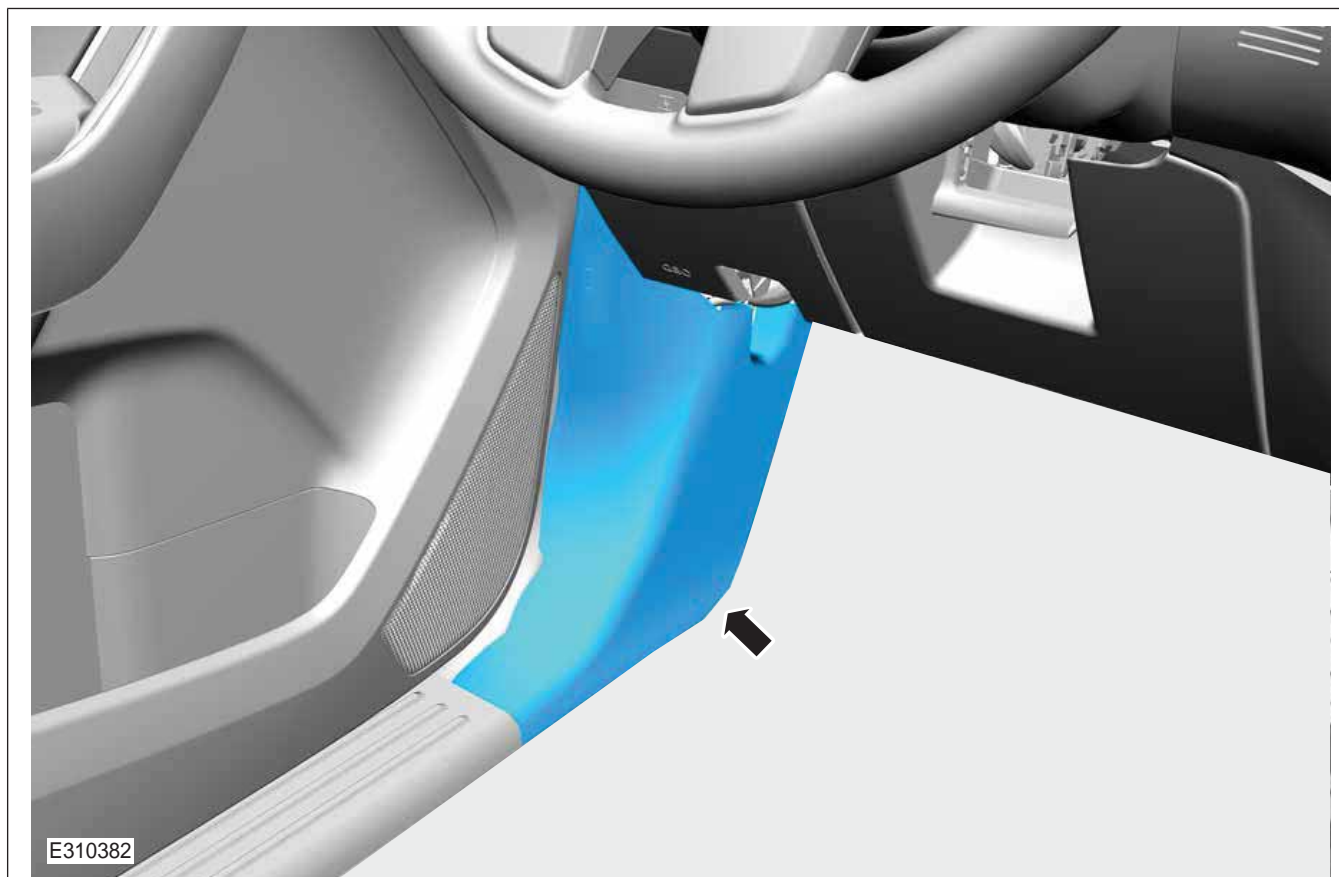
CAUTION: Make sure that the front and rear brake hoses are not twisted and are correctly located away from body and chassis components.

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.

2.2.3 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.



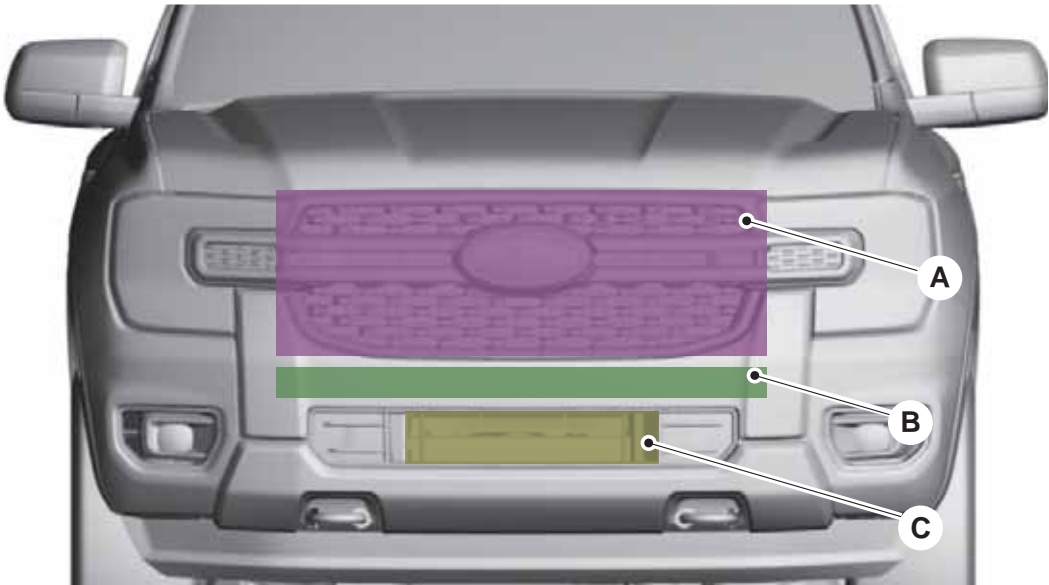
A pre-installed wire is located behind the A-Pillar kick panel and is marked TRAILER BRAKE CONTROLLER.

3.1 Engine

3.1.1 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

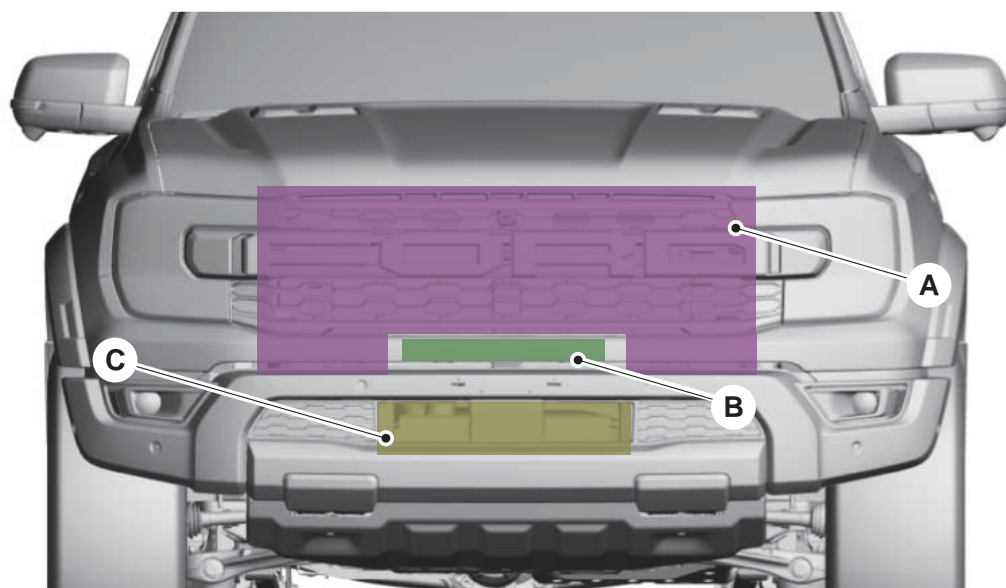


E363030

| 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. |

3.1.2 Engine Selection for Conversions - Raptor

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






| 3.0L EcoBoost | Max Power kW/RPM | Max Torque Nm/RPM |
|---------------------------------------|---------------------------|-------------------------------|
| ULEV 50 Emissions - 98 RON fuel | TBC | TBC |
| EU 5 Emissions - 98 RON fuel | 290kW (395PS) at 5500 RPM | 583Nm (430 ft lbs) at 3000RPM |
| EU 6.2 RDE Emissions - 95/98 RON fuel | 215kW (292PS) at 5500 RPM | 491Nm (362 ft lbs) at 2300RPM |

3.2 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.**

CAUTIONS:

-  **Ensure modifications to vehicle do not obstruct airflow to fuel cooler.**
-  **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.**
-  **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.**






3.2.1 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.

3.2.2 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 must provide a minimum 2.1 deg continuous downward slope from fuel filler cup to fuel tank and should have a minimum entry angle of 30 degrees.**
-  **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.**
-  **The filler neck entry center-point must be at a minimum height of 250mm from Fuel tank ICV center-point and have a minimum entry angle of 30 degrees.**

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

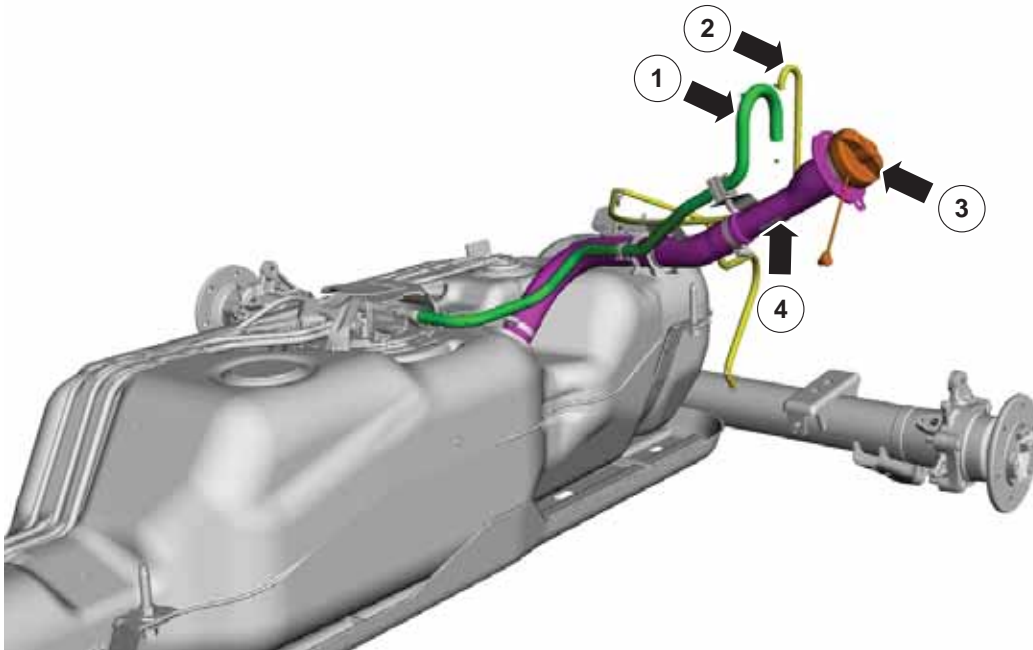
NOTE: Routing of filler hose and vent hose must not contain any sumps. Additional support may be required to prevent hose sagging which could create a sump. A sump in the pipe can cause spray or spit-back during normal filling operations.

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.

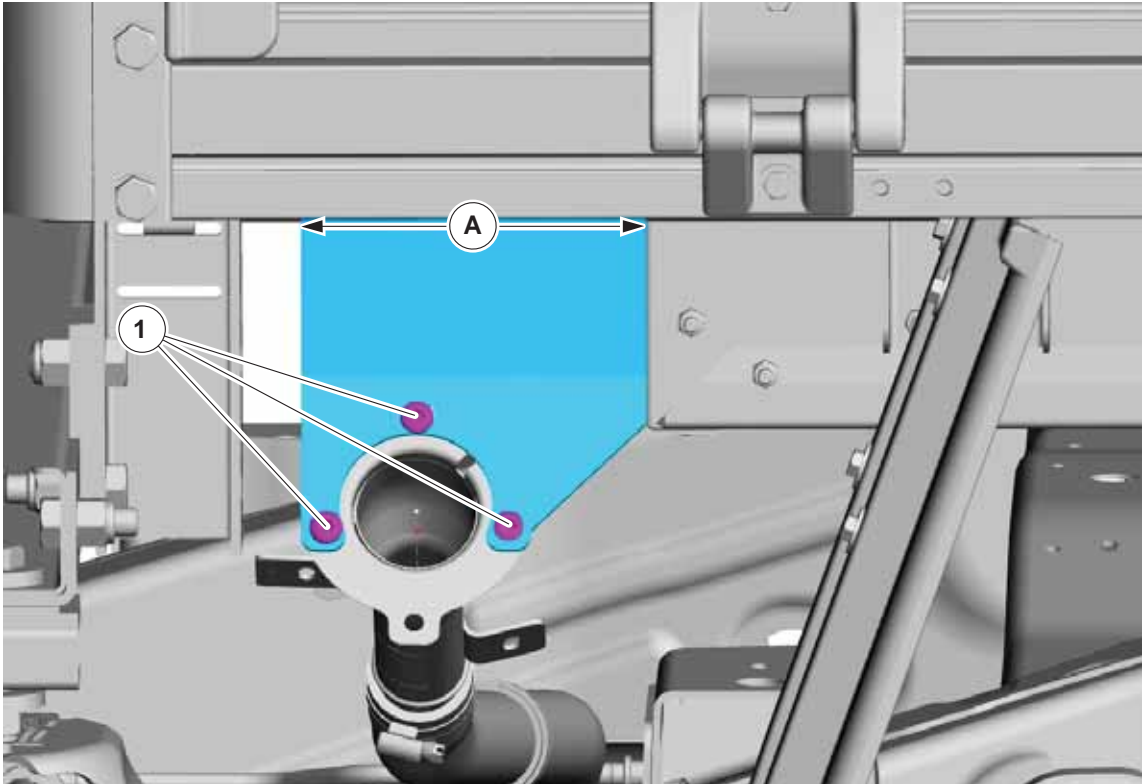
Fuel Filler Overview



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

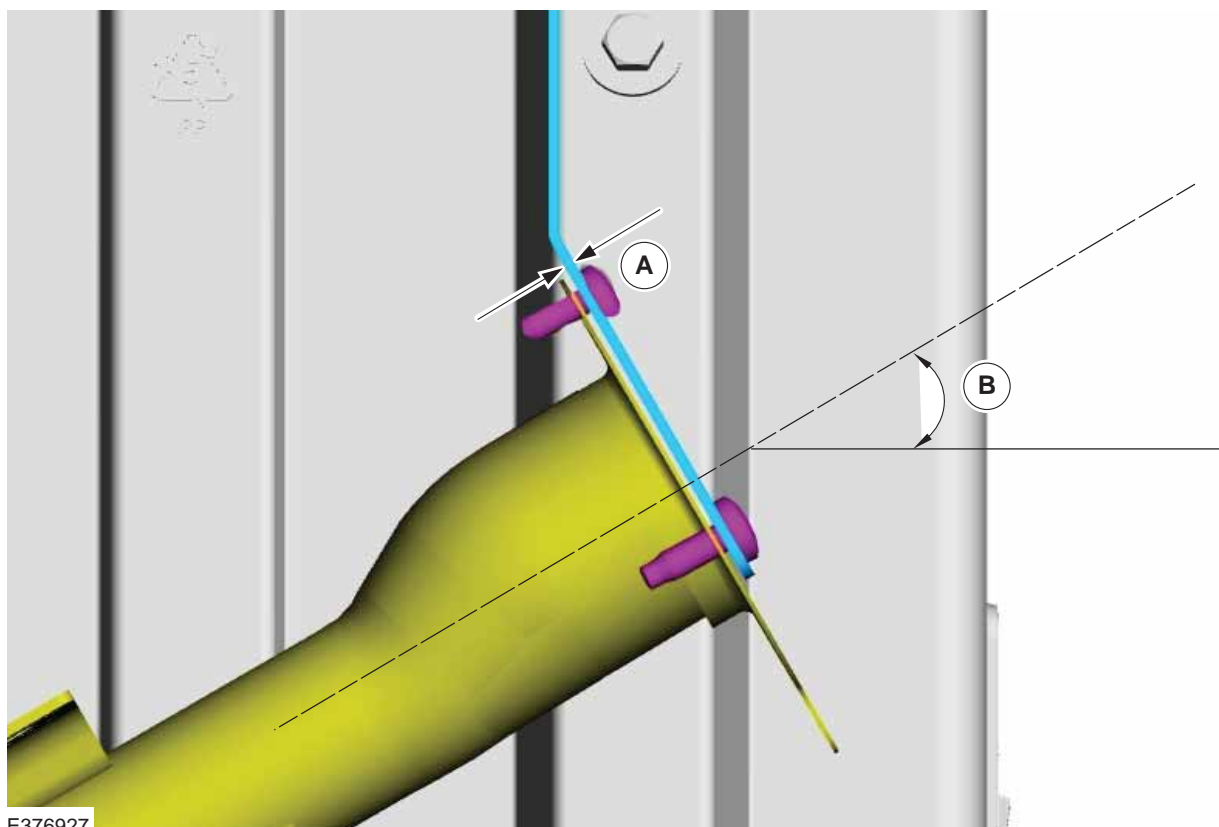


E376926

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 |

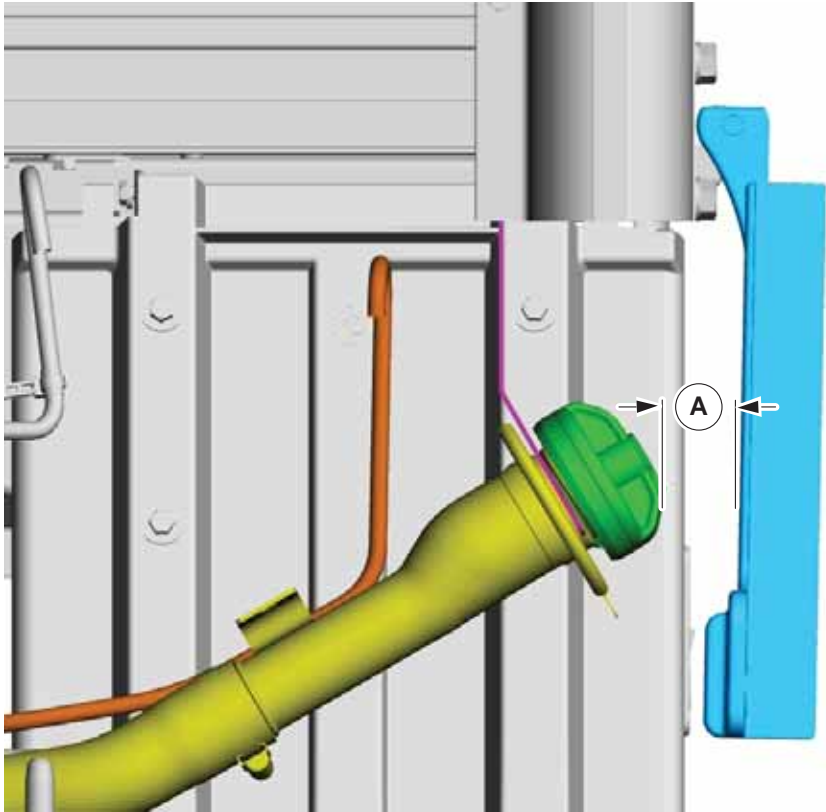
Angle of Filler Neck



Filler Neck Installation Dimensions

| Item | Description |
|------|--|
| A | 2mm minimum bracket thickness |
| B | 30° - angle should be maintained to ensure good flow of fuel when refueling and prevent flow back. |

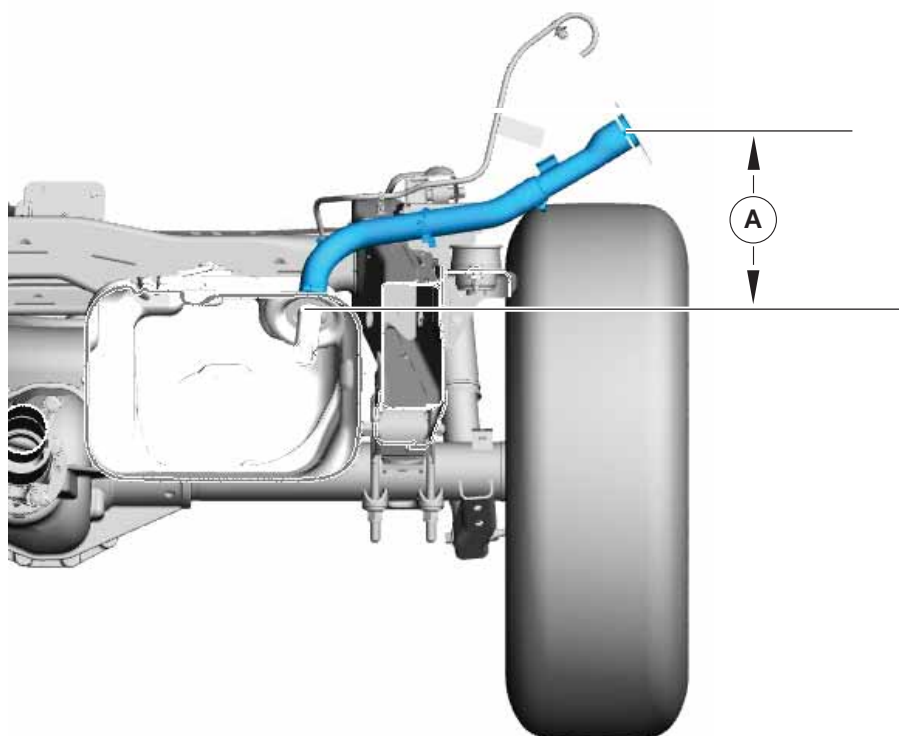
Clearance From Vehicle Body



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 ICV opening centre point to the fuel filler pipe opening centre point. |

3.2.3 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.**

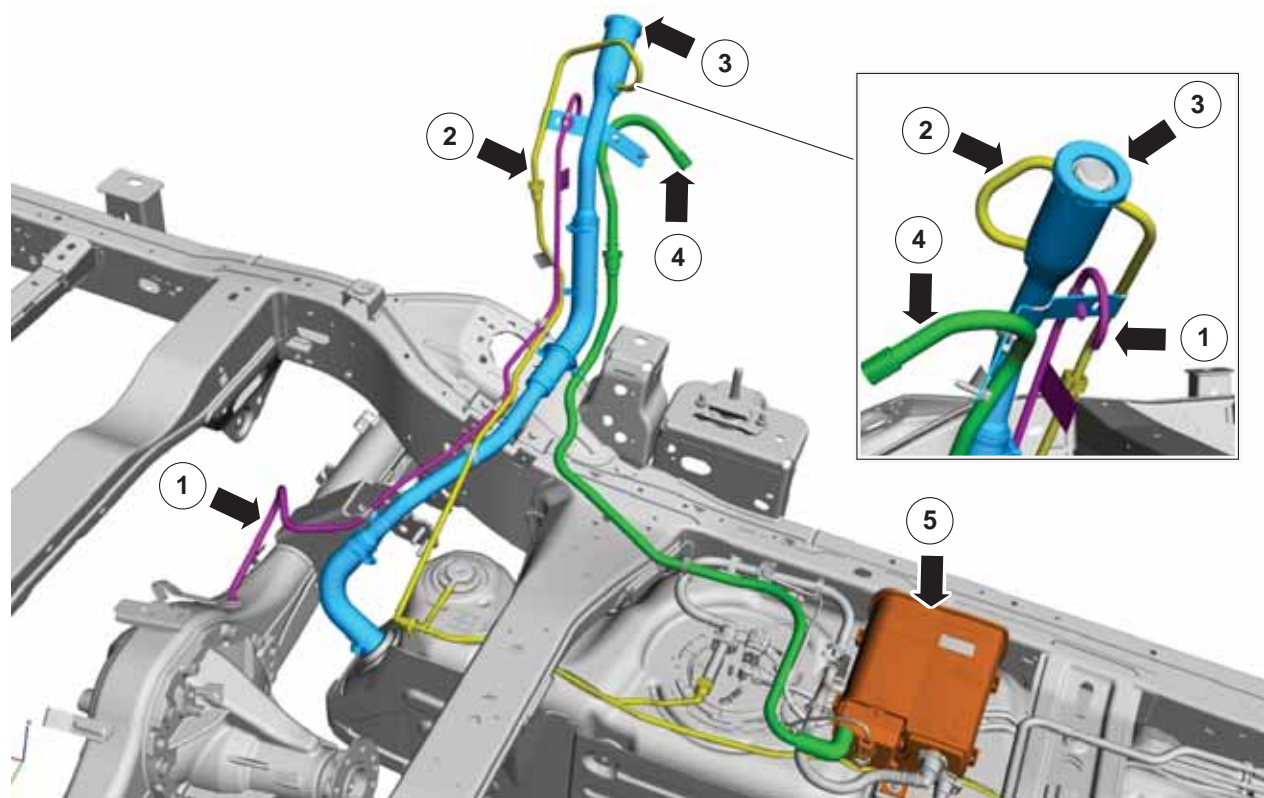
 **No kinking of the fuel filler hose is acceptable.**

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 - 3.0L EcoBoost V6



| Item | Description |
|------|---|
| 1 | Rear Axle Breather Pipe |
| 2 | Fuel Tank Recirculation Line |
| 3 | Fuel Tank Filler Pipe (Capless) |
| 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.

3.2.4 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.
- A length of fuel grade flexible hose should be clipped to the vehicle body, with the open end at least 600 mm (4x2) or 800 mm (4x4 or 4x2 hi-rider) above ground height. It is recommended to measure this height when the vehicle is fully loaded.
- 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.

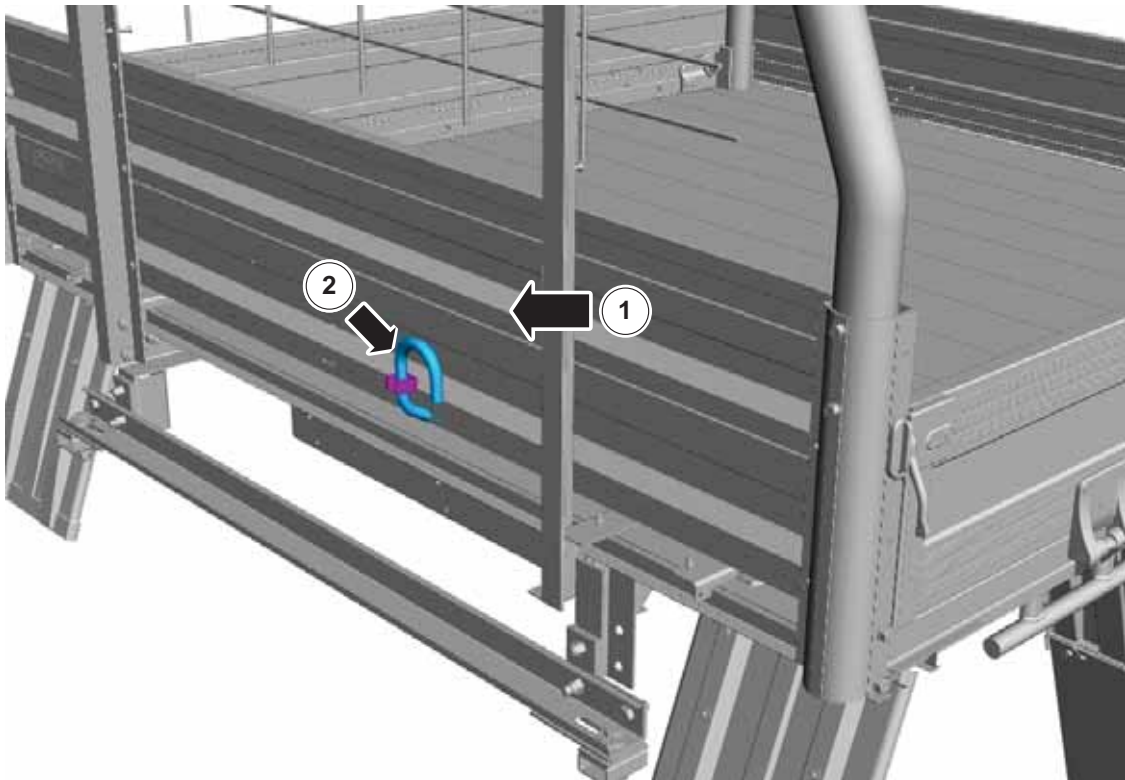
- The fuel tank vent hose must be upright with shepherd hook at end as shown in view. Keep shepherd hook back of filler pipe as shown in view.
- A length of fuel grade flexible hose should be clipped to the vehicle body, with the shepherd hook opening at least 600 mm (4x2) or 800 mm (4x4 or 4x2 hi-rider)above ground height. It is recommended to measure this height when the vehicle is fully loaded.

Fuel Filler Vent Breather Shepherds Hook



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. |

3.2.5 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 reduced.

To improve system functionality, using FDRS (Ford Diagnosis and Repair System) 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
 - 120L Long Range Tank
 - 140L Long Range Tank

3.2.6 Axle Breather Vent Hose

The rear differential breather hose should be mounted to the filler neck/vehicle body. Where required due to the fitment of an auxiliary body, aftermarket additions, or the relocation of the fuel filler, the axle vent hose routing must follow the relocated fuel tank venting. A length of fuel grade flexible hose should be clipped to the vehicle body, with the open end at least 600 mm (4x2) or 800 mm (4x4 or 4x2 hi-rider) above ground height. It is recommended to measure this height when the vehicle is fully loaded. A vent breather cap may be used on the axle breather vent hose.

3.2.7 Axle Breather Vent Hose - Raptor

The rear differential breather hose should be mounted to the filler neck/vehicle body. Where required due to the fitment of an auxiliary body, aftermarket additions, or the relocation of the fuel filler, the axle vent hose routing must follow the relocated fuel tank venting. A length of fuel grade flexible hose should be clipped to the vehicle body, with the open end at least 800 mm above ground height. It is recommended to measure this height when the vehicle is fully loaded. A vent breather cap may be used on the axle breather vent hose.

4.1 Wiring Installation and Routing Guides

4.1.1 Wiring Splicing Procedures

TYCO-RAYCHEM crimp splices



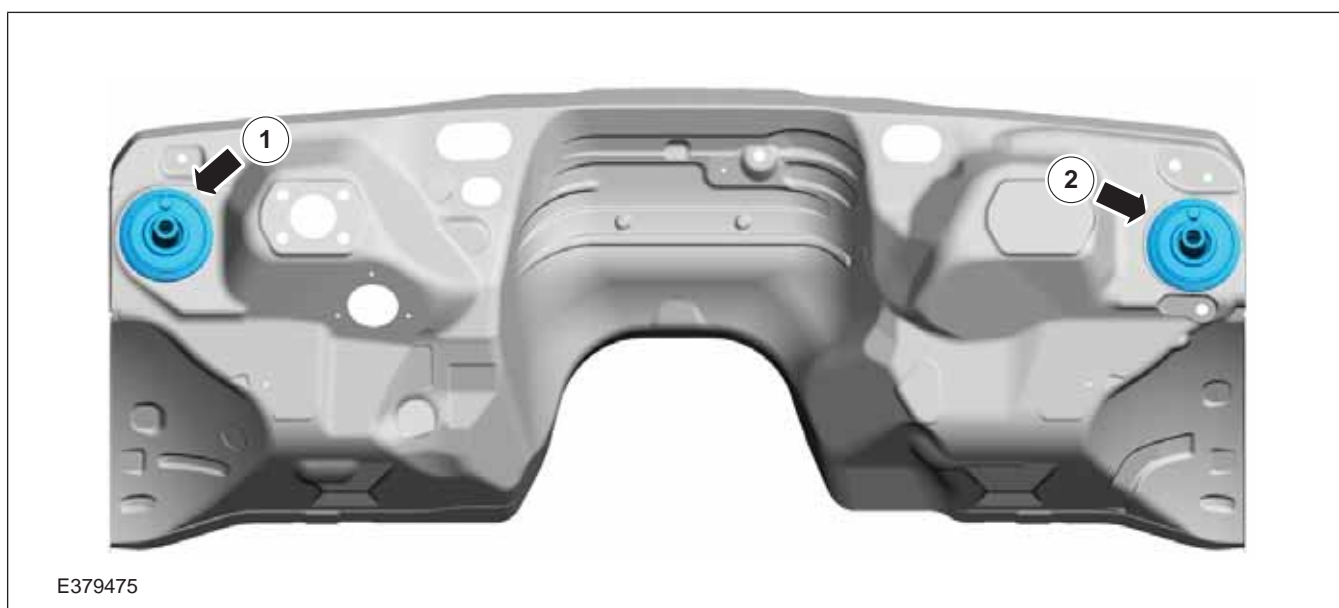
Ford Motor Company strongly advises against the use of wire splicing due to the variable and unpredictable nature of the joint created. However, if it is decided that a wire splice is unavoidable, it must be made using **DuraSeal Heat-Shrinkable, Environmentally Sealed, Nylon-Insulated Crimp Splices** (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

Two locations allow for additional wiring to pass through the front cabin bulkhead sheet metal into the cabin.

Wiring Pass Through Locations



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

CAUTIONS:

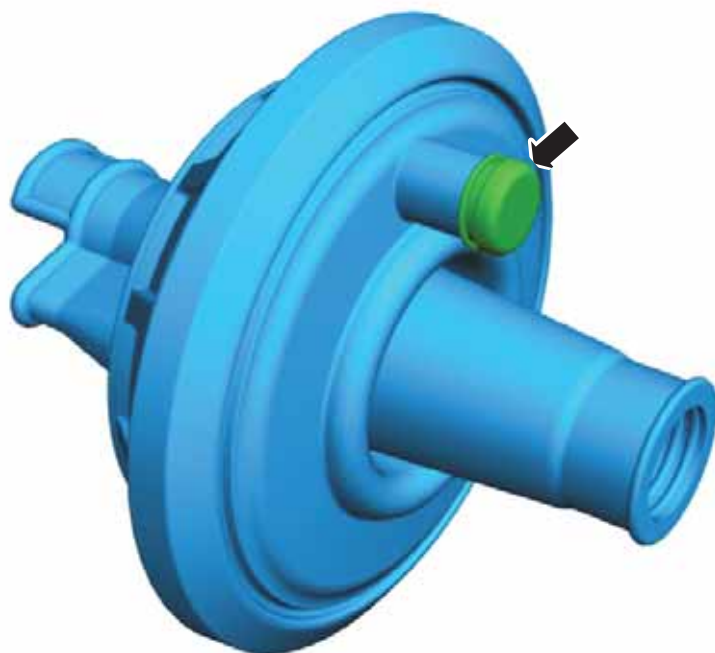
! Electrical harnesses passing through sheet metal must be through protective grommets that also ensure a watertight seal. A windscreen type or silicone sealant should be used. Adhesive or tape is not acceptable.

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

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

There are two locations in the dash panel which have been identified for additional holes to route wires through.

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:

- 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.

4.2 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 vehicle's owner manual for further information.

Battery Voltage Requirements and Testing

All voltages are to be measured with an accuracy of: $\pm 5\%$ 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 converter 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.

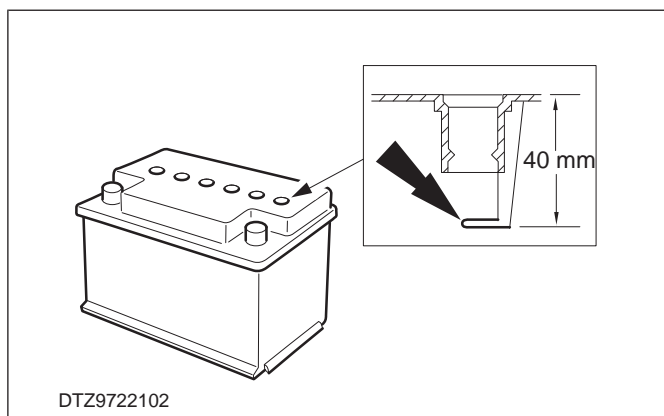
NOTE: A constant voltage battery charger will charge a battery at a set maximum voltage. The voltage used depends upon the design and condition of the battery charger and the age and temperature of the battery. This type of battery charger initially charges at a high rate of current that reduces as battery 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



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 | 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 |

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)

E363586

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 will 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 will negatively impact fuel economy.

NOTE: Ability to disable SRC via the FDRS tool will be part of a future release.

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 called Battery Management Sensor (BMS). This system measures the battery load in order to efficiently charge the battery while improving 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.

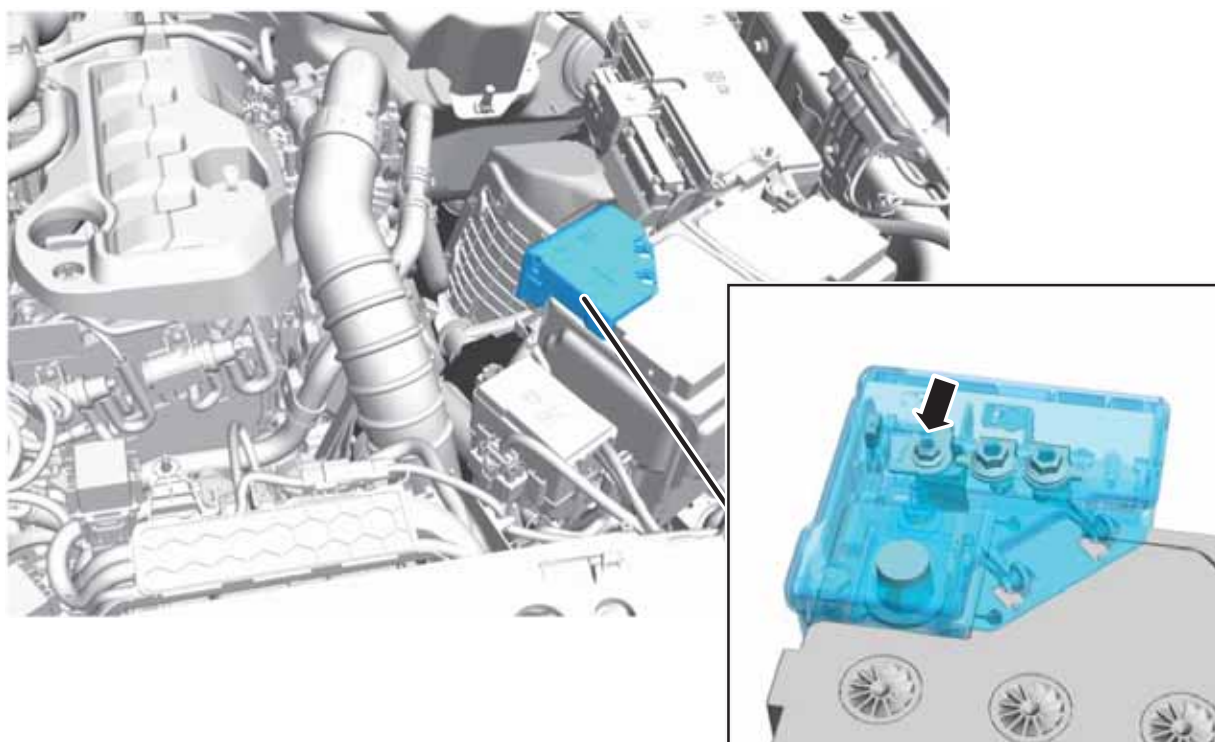
NOTE: Ensure the auxiliary battery connection is safely secured using suitable fixtures to reduce vibration damage or contact with surrounding components.

For vehicles equipped with Battery Management Sensor, an additional battery can be connected using an in-vehicle battery charger (DC/DC converter) such as 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: Ensure the existing nut is reused.

B+ Connection for Auxiliary Battery Charging



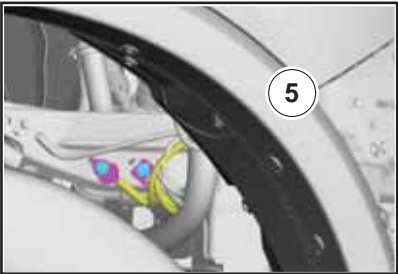
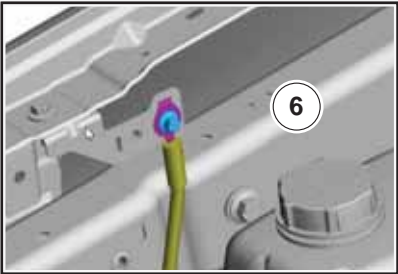
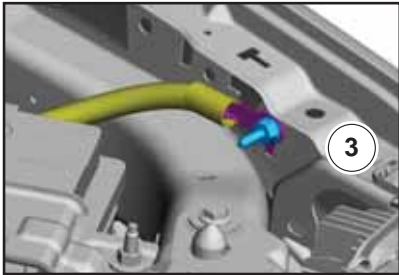
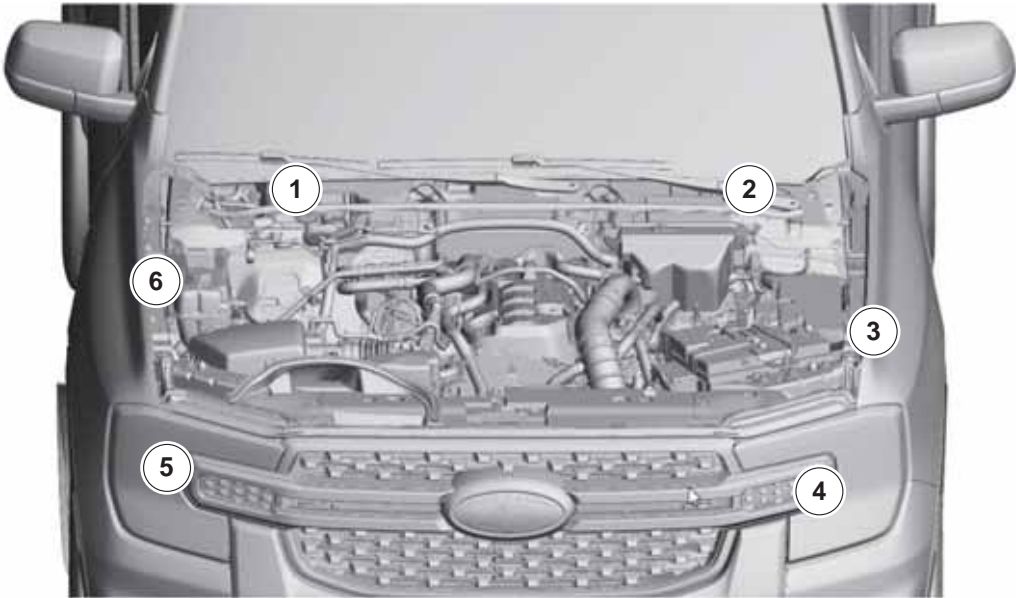
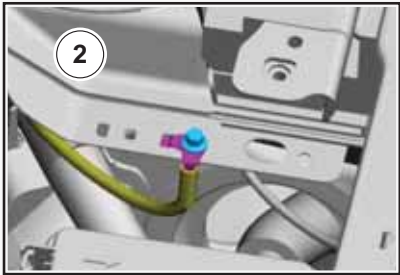
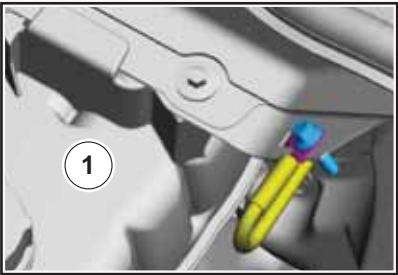
E363587

A spare position is available on the positive battery fuse block. This empty position is to be used for auxiliary battery system connection and any aftermarket installations requiring 12v battery feed.

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

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

Grounding Points



E363588

| Item | Description |
|------|---|
| 1 | Grounding Point located on cowl |
| 2 | Grounding Point located on cowl |
| 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) |
| 6 | Grounding Point located on RH fender upper |

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

4.2.2 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:

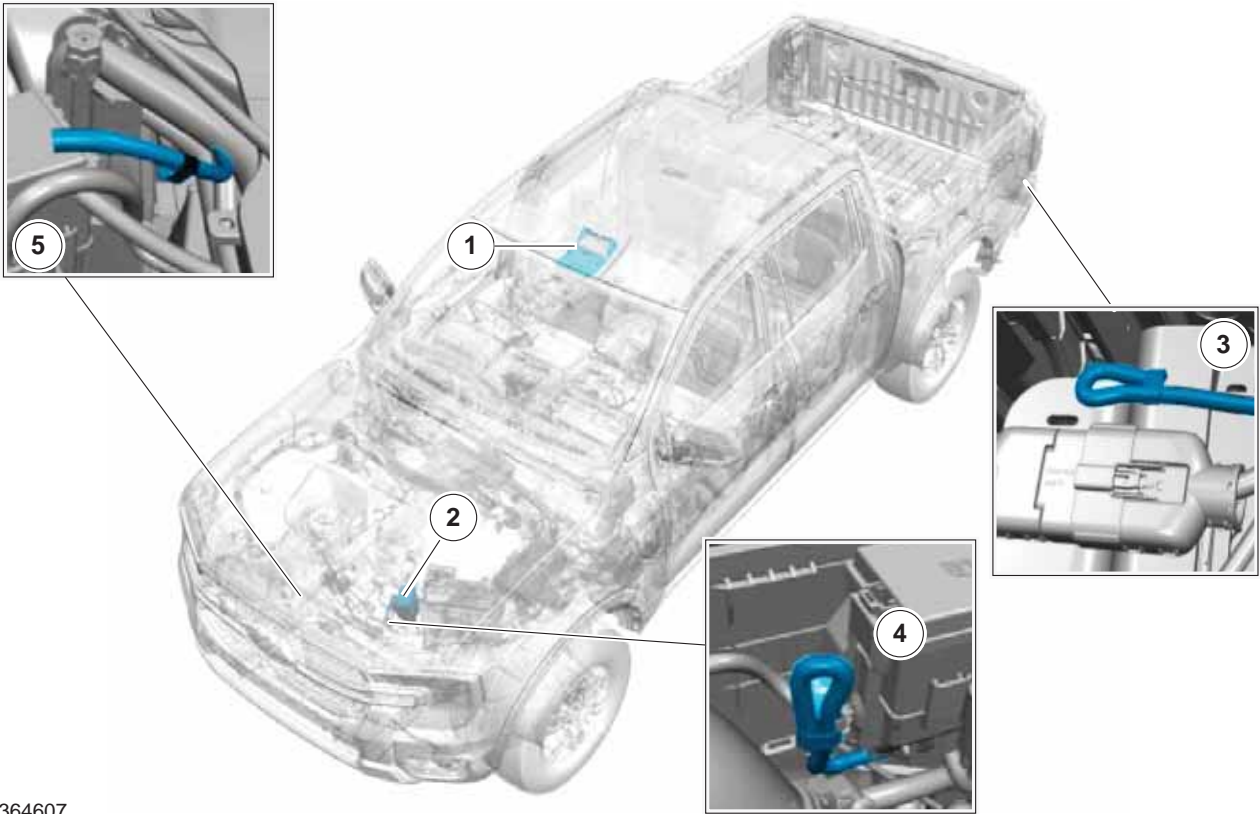
- Auxiliary Switch Panel
- Auxiliary Fuse Box with integrated relays
- Auxiliary Wiring Connections

The auxiliary switches only operate when the ignition is in the ON position, or in the OFF position when accessory delay is active, whether the engine is running or not.

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

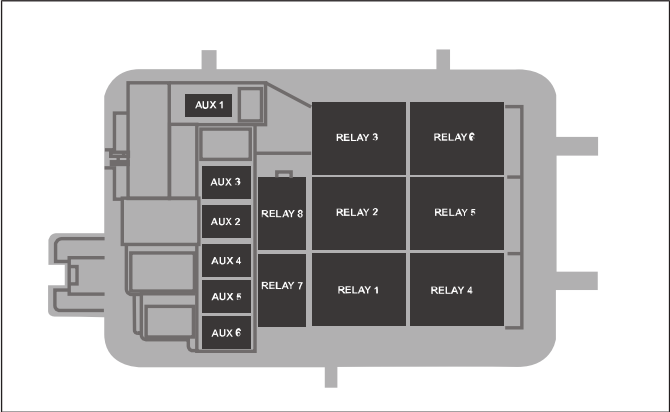


E364607

| 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 | 1.5mm ² | 5A | Relay 1 | B | - |
| AUX 2 | Blue/Green | 1.5mm ² | 15A | Relay 2 | B | - |
| AUX 3 | Yellow Orange | 1.5mm ² | 15A | Relay 3 | C | - |
| AUX 4 | Brown | 1.5mm ² | 15A | Relay 4 | C | - |
| AUX 5 | Green/Brown | 2.5mm ² | 25A | Relay 5 - Driving Lamps | B | - |
| AUX 6 | Yellow | 2.5mm ² | 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 | 1.5mm ² | - | - | C | - |
| AUX 4 - GROUND | Black/Green | 1.5mm ² | - | - | C | - |
| AUX 6 - GROUND | Black/Yellow | 2.5mm ² | - | - | A | - |









4.2.3 Generator and Alternator


Alternator Current Output

See your local authorised dealer to identify the alternator output current specifications for your vehicle.

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.**

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.

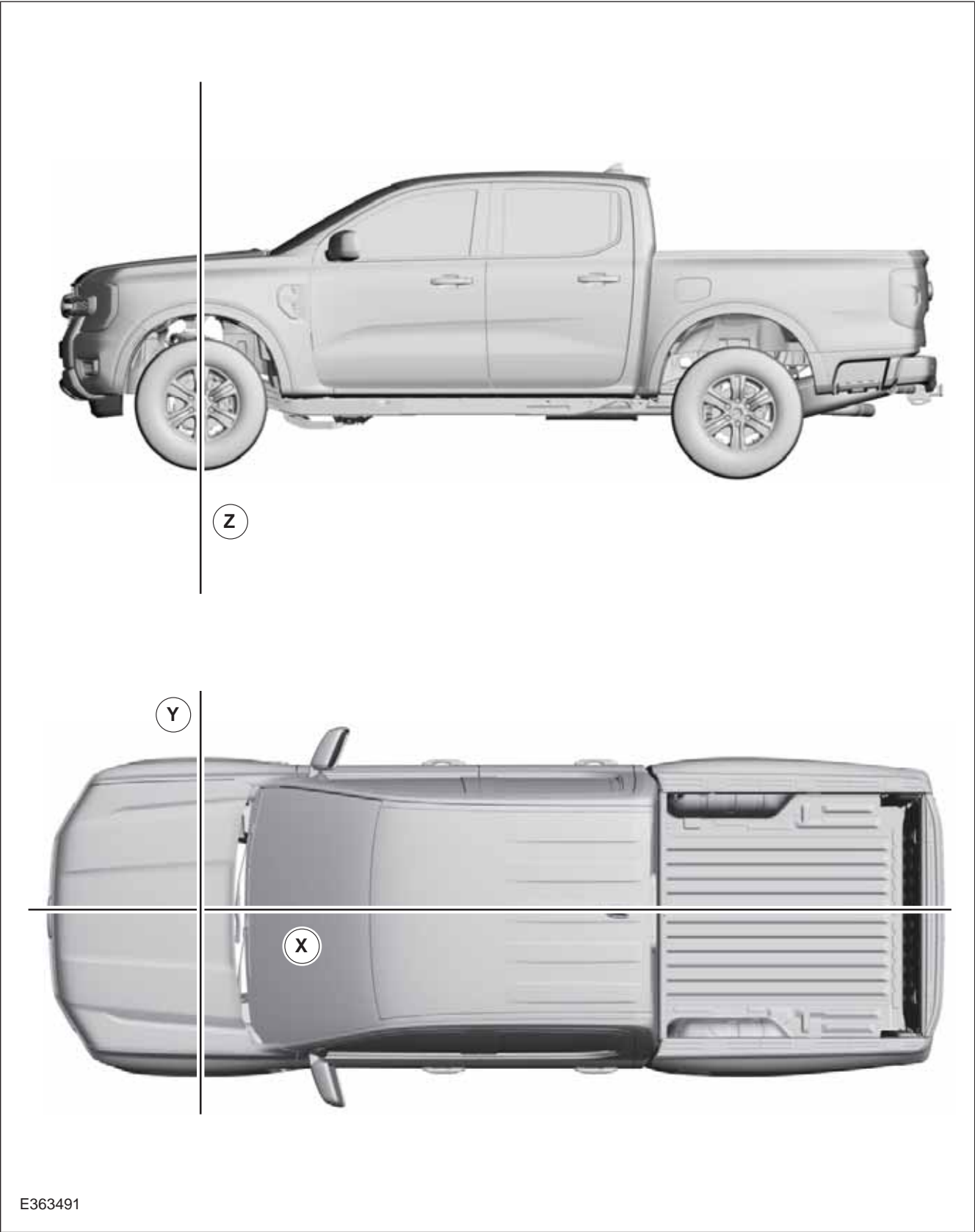
The parking aid sensing system warns the driver of obstacles within a certain range of your vehicle. The system turns on automatically whenever you switch the ignition on. The system can be switched off via the following methods:

- 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



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.

Front Parking Aid Sensor Location



E363492

| Sensor | Number |
|--------------------------|--------|
| Right Side (if equipped) | 1 |
| Front Right Outer | 2 |
| Front Right Inner | 3 |
| Front Left Inner | 4 |
| Front Left Outer | 5 |
| Left Side (if equipped) | 6 |

Rear Parking Aid Sensor Location



E372245

| Sensor | Number |
|--------------------------------------|--------|
| Left Side Rear Bumper (if equipped) | 1 |
| Rear Left Outer | 2 |
| Rear Left Inner | 3 |
| Rear Right Inner | 4 |
| Rear Right Outer | 5 |
| Right Side Rear Bumper (if equipped) | 6 |

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.

4.4 Electronic Engine Controls

4.4.1 Tachograph

 **WARNING: Do not interface with the CAN (controller area network) 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.

4.4.2 Vehicle Speed Signal

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

No option for vehicle speed output is available.

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

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 | 360° 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: 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 bulbar 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 will 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 |

4.6 Exterior Lighting

WARNINGS:



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



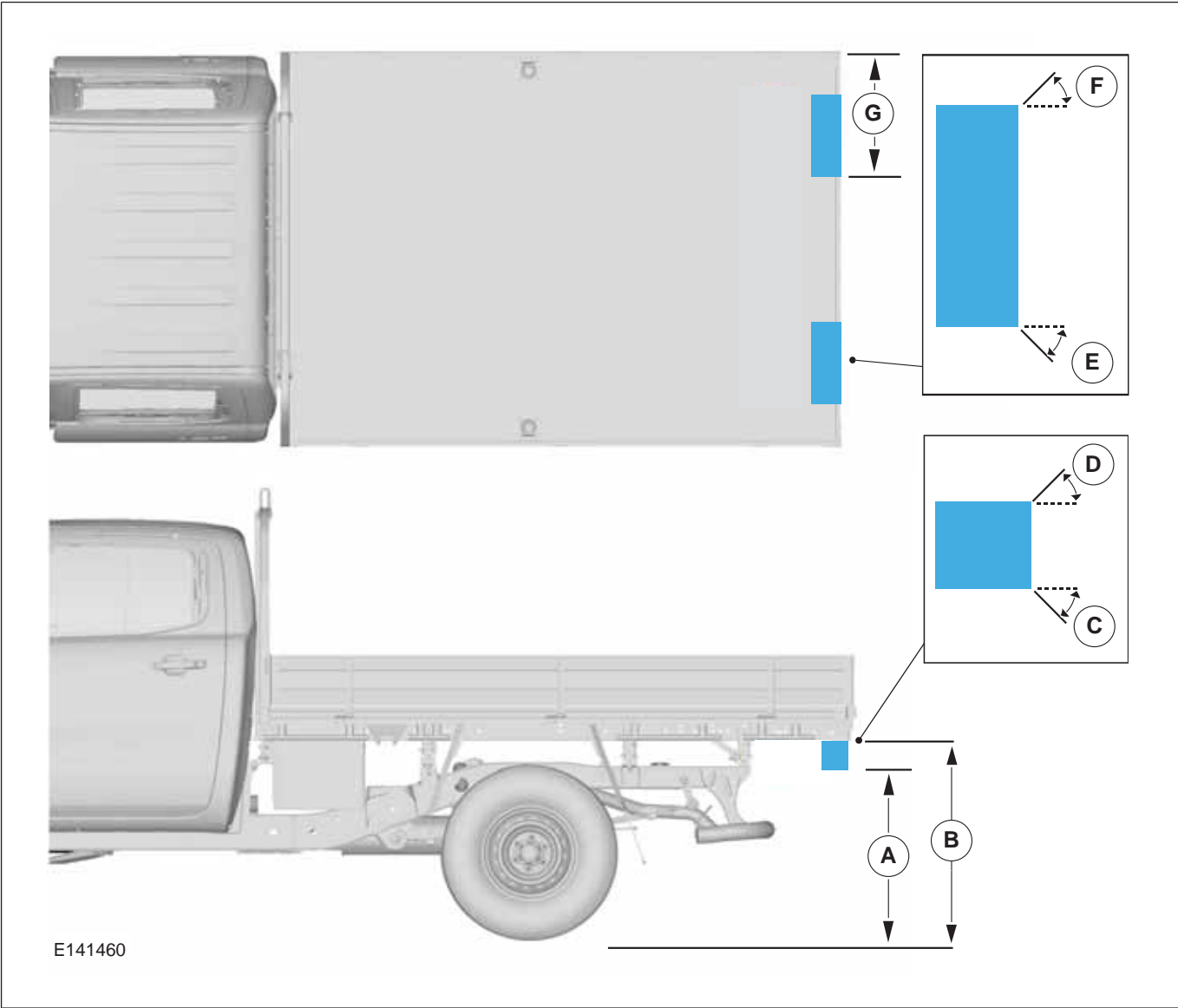
Make sure all electrical connections and wiring comply with local regulatory standards.

NOTE: Chassis Cab vehicles are supplied with rear combination lamps, license plate lamps and fog lamps. Where fitted, these lamps must be mounted in accordance with the following guidelines.

NOTE: Prior to work on any vehicle being undertaken it is critical to identify the vehicle level (low level or high level) by the type of electrical architecture the vehicle at hand is equipped with. Failure to identify the type of electrical architecture present on the vehicle prior to work being undertaken may cause electrical damage or have safety implications.

[Refer to: 4.13 Fuses and Relays \(page 108\).](#)

4.6.1 Rear Combination lamps

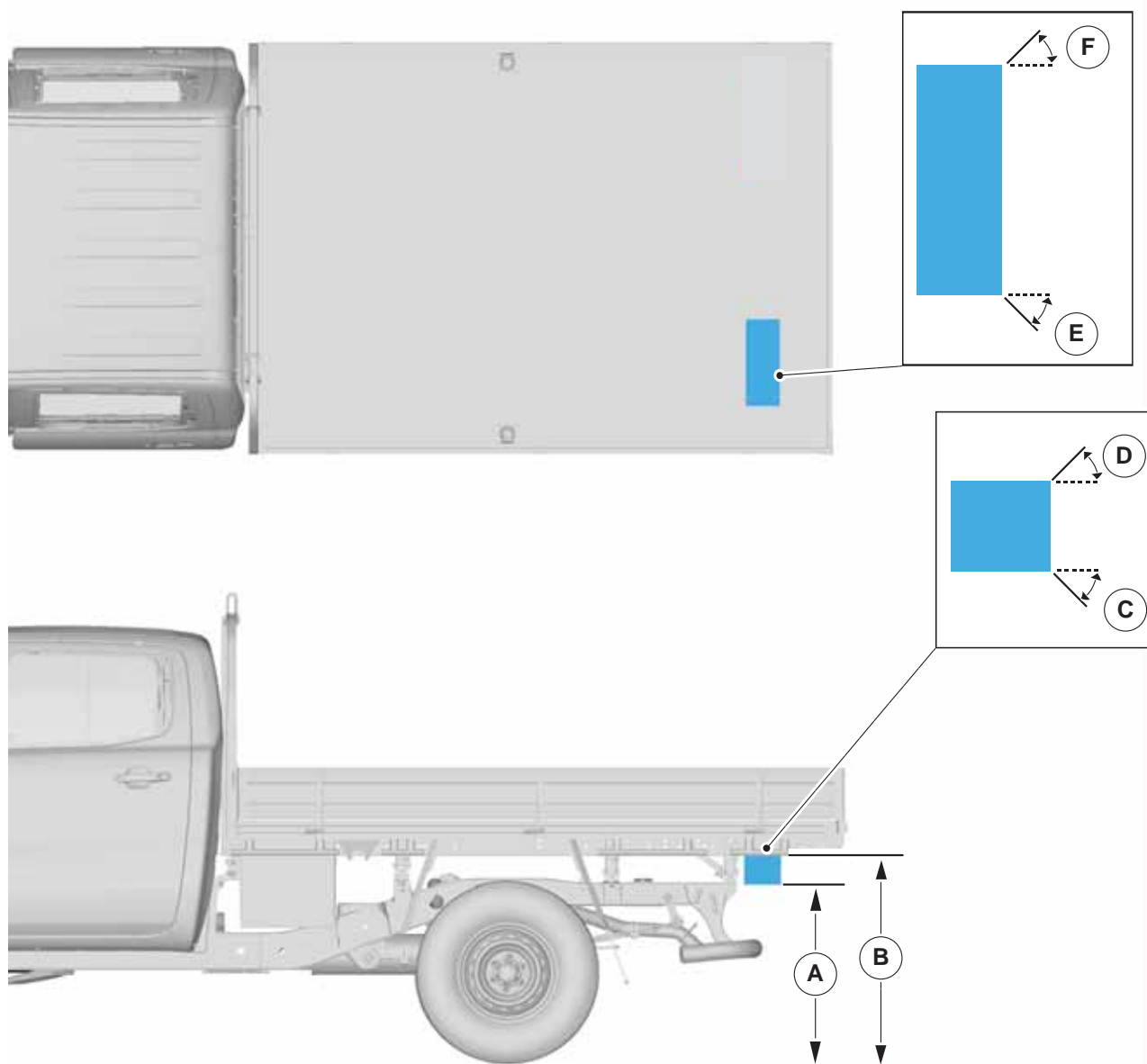


Positioning of Rear Combination Lamps

| 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 | 15° |
| D | Minimum angle of obstruction free zone upwards of the lamp | 15° |
| E | Minimum angle of obstruction free zone towards the outside of the vehicle | 80° |
| F | Minimum angle of obstruction free zone towards the centre of the vehicle | 45° |
| G | Maximum distance from outer edge of vehicle to inner edge of lamp | 400mm |

4.6.2 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.

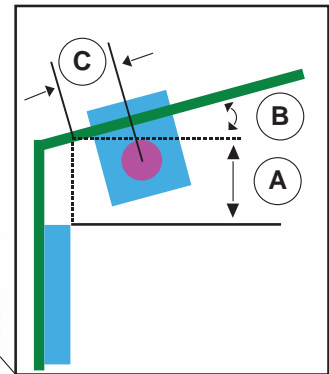
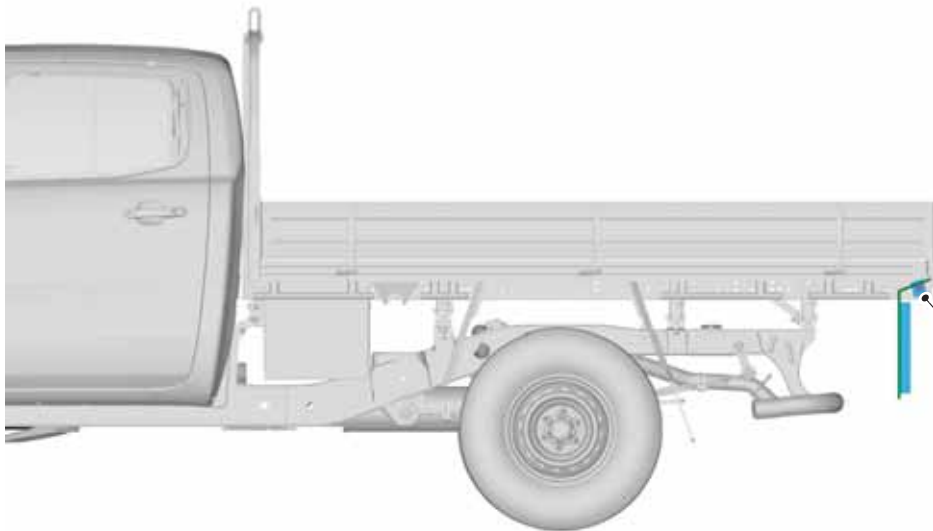
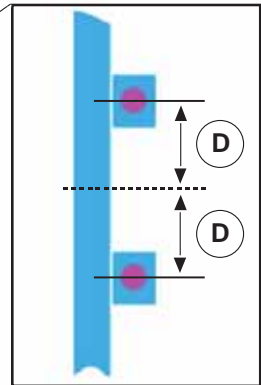
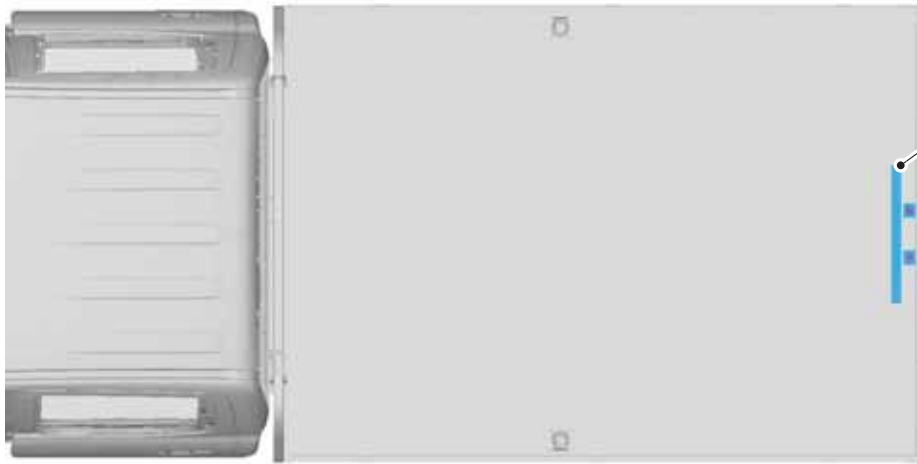


E141472

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 | 5° |
| D | Minimum angle of obstruction free zone upwards of the lamp | 5° |
| E | Minimum angle of obstruction free zone towards the outside of the vehicle | 25° |
| F | Minimum angle of obstruction free zone towards the centre of the vehicle | 25° |

4.6.3 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 | 8° |
| 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) |

4.6.4 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.

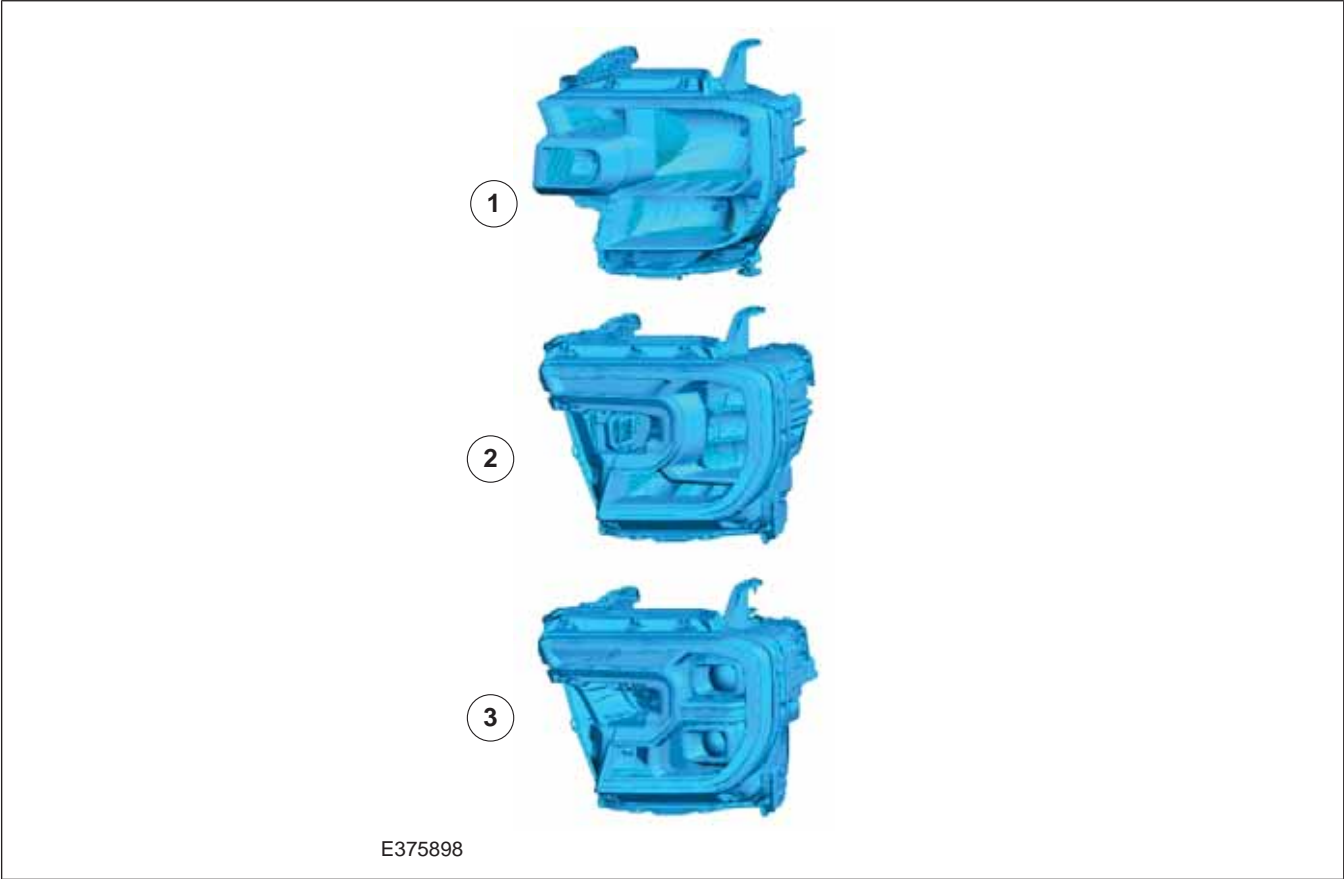
4.6.5 Headlamps - Connection of Auxiliary Driving Lamp Signal

Connection of auxiliary loads to trigger items such as realy driven driving light circuits can be supported.

Three levels of headlamp assembly are available.

NOTE: LH lamp shown, RH lamp similar.

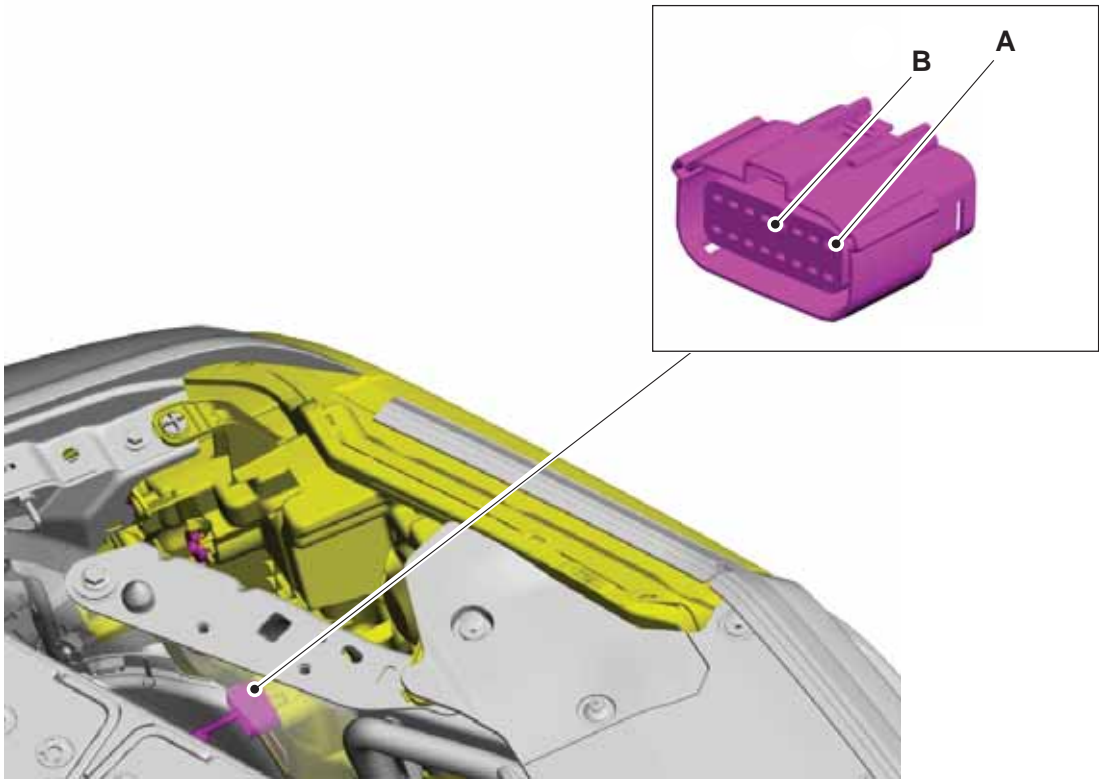
Headlamp Level Identification



| 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

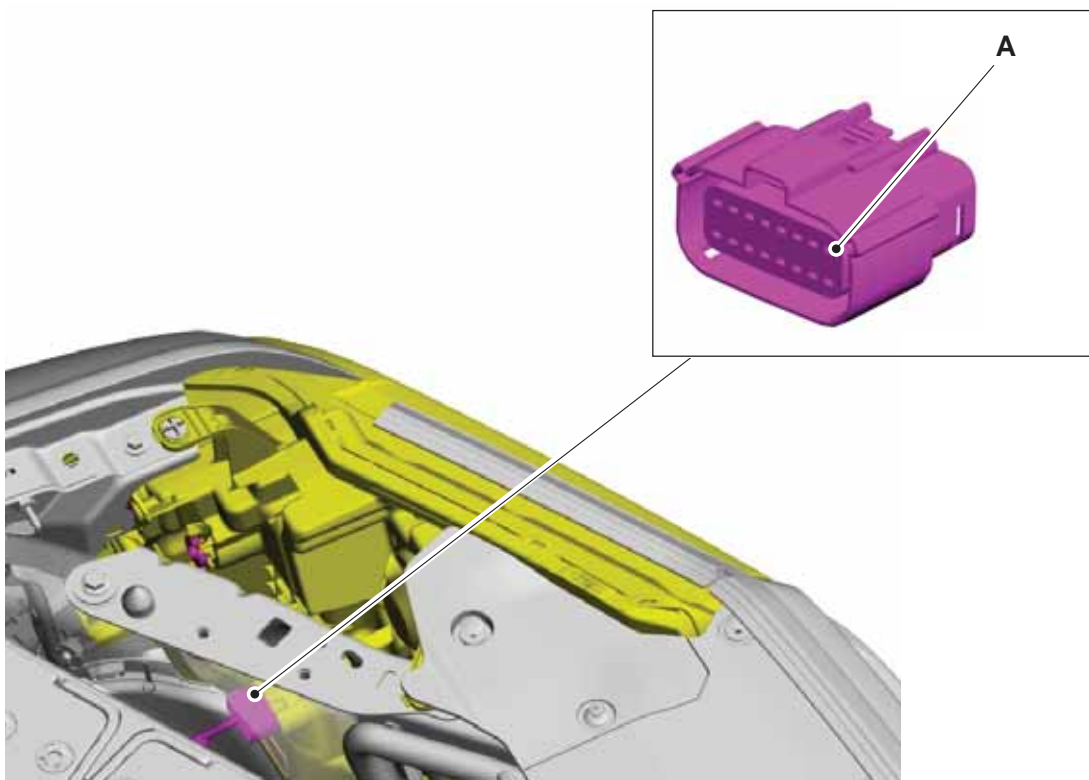


E364521

| Item | Description |
|------|--------------------------------|
| A | Low beam = Connector C1 Pin 1 |
| B | High beam = Connector C1 Pin 4 |

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 |

Level 2 - Mid Level Headlamps - High Beam Connection

E375900



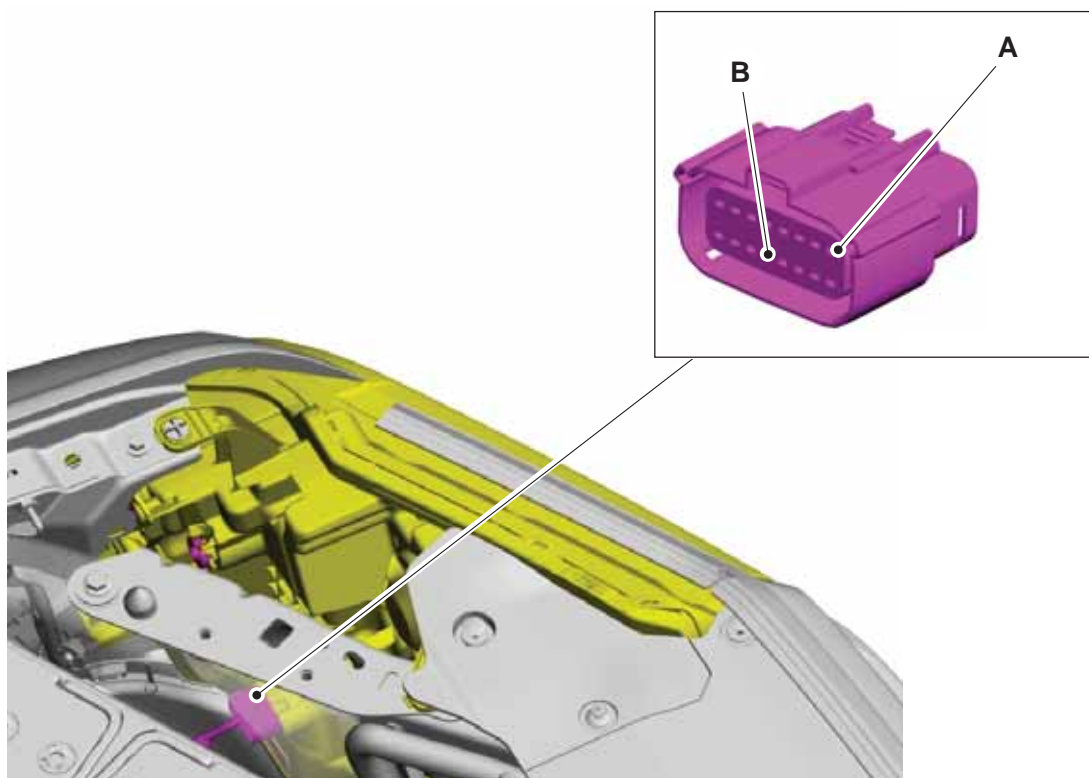
CAUTION: Connection of auxiliary loads directly to Level 2 headlamp high beam wiring is not allowable. Damage to the headlamp control components may result.

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.

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 |

Headlamp Fuse

| Lighting Fuses | | |
|----------------|-----|----------------|
| F100 | 20A | Headlamp LH/RH |

4.6.6 Brake (Stop) Lamps)

Provision for additional Brake (Stop) Lamps is available via a blunt cut wire located near to the Centre High Mount Stop Lamp (CHMSL). The blunt cut wire can support a current load of 1.75 Amps steady state (at 13.5 Volts).

4.6.7 Position (Park) Lamps)

Additional Position (Park) lamps can be connected via jumper harness or a pre-installed and tagged blunt cut wire located in the LHS cowl area, as part of the vehicles existing position lamp circuit wiring. The existing position lamp circuit wiring can support a current load of 3.1 Amps steady state at (at 13.5 Volts).

4.6.8 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.

4.6.9 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.**

Ford recommends that all trailer tow electrical connections use the genuine Ford accessory trailer tow kit.

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: The trailer patch harness is available from your Ford authorised dealer.

NOTE: The FORD dealer network can supply a RESISTOR PATCH HARNESS that connects between the vehicle & the trailer to address these issues (pictured below).



E371558

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 patch harness is available from your Ford authorised dealer.

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 Tow Module Connections

| Component Terminal Number | Feature | Current (A) | | Voltage (V) | |
|---------------------------------|---------------------------------|-------------|-----|-------------|-----|
| | | Min | Max | Min | Max |
| Connector A | | | | | |
| 1 | Left Direction Indicator | 0.5 | 3 | 6 | - |
| 2 | Right Direction Indicator | 0.5 | 3 | 6 | - |
| 3 | Position Lamp | 0.5 | 7 | 6 | - |
| 4 | Not used | - | - | - | - |
| 5 | Reverse Lamp | 0.5 | 4 | 6 | - |
| 6 | Battery Charge Out - where used | - | 10 | 9 | 16 |
| 7 | Stop Lamp | 0.5 | 4 | 6 | - |
| 8 | Fog Lamp | 0.5 | 2 | 6 | - |
| 9 | Not used | - | - | - | - |
| 10 | Not used | - | - | - | - |
| 11 | Not used | - | - | - | - |
| 12 | Not used | - | - | - | - |
| Connector B | | | | | |
| 1 | B(+) Fuse 87 (40A) BJB | - | - | - | - |
| 2 | B(+) Fuse 73 (30A) BJB | - | - | - | - |
| Connector C | | | | | |
| 1 | Ground | - | 1 | 6 | - |
| 2 | CAN L | - | 0.1 | 6 | - |
| 3 | CAN H | - | 0.1 | 6 | - |
| 4 | 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.

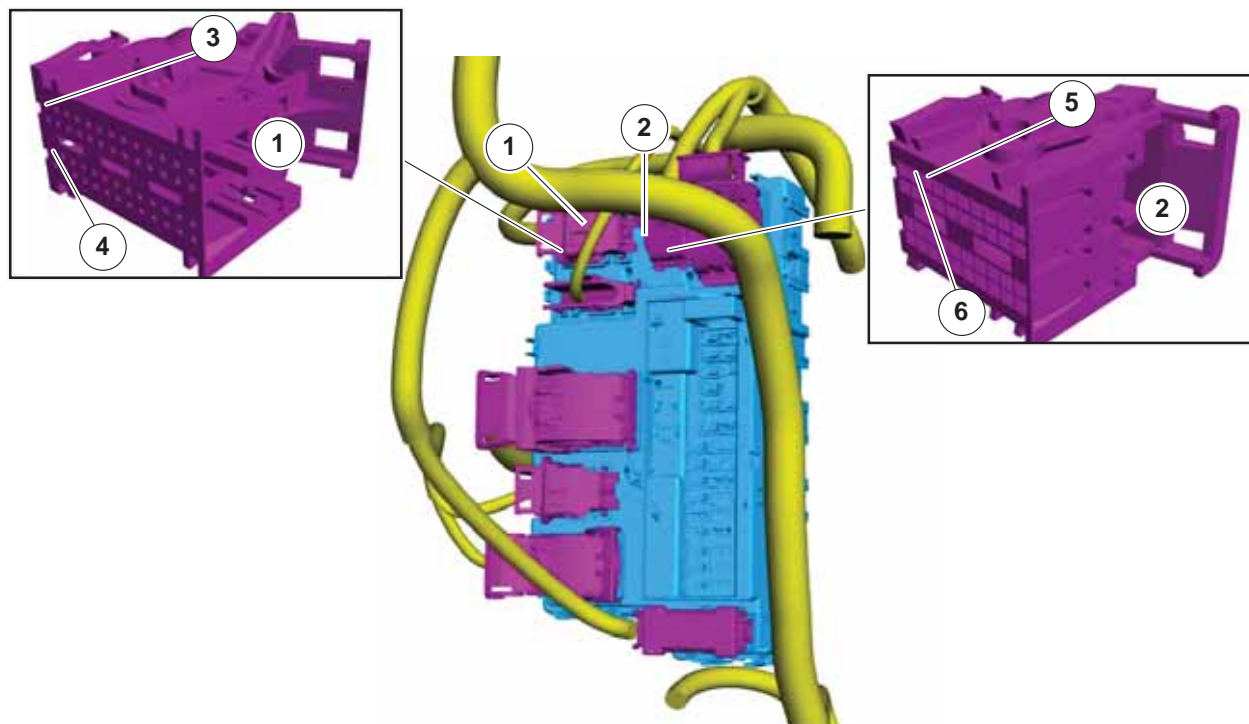
- 3 x 5W – front and rear indicators + side repeaters (Left Hand Side)
- 3 x 5W – front and rear indicators + side repeaters (Right Hand Side)

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.

4.6.10 Lamps – Hazard / Direction Indication

The maximum permissible load with the standard system is:



E364606

| Item | Description |
|------|---|
| 1 | BCM Connector C5 |
| 2 | BCM Connector C6 |
| 3 | RH Rear Turn Signal Output = BCM Connector C5 Pin 52 |
| 4 | LH Rear Turn Signal Output = BCM Connector C5 Pin 26 |
| 5 | RH Front Turn Signal Output = BCM Connector C6 Pin 38 |
| 6 | LH Front Turn Signal Output = BCM Connector C6 Pin 39 |

4.6.11 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.

4.6.12 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 5 Pin 13).

4.6.13 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 vehicle's 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.

4.6.14 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.

4.7 Cruise Control

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.

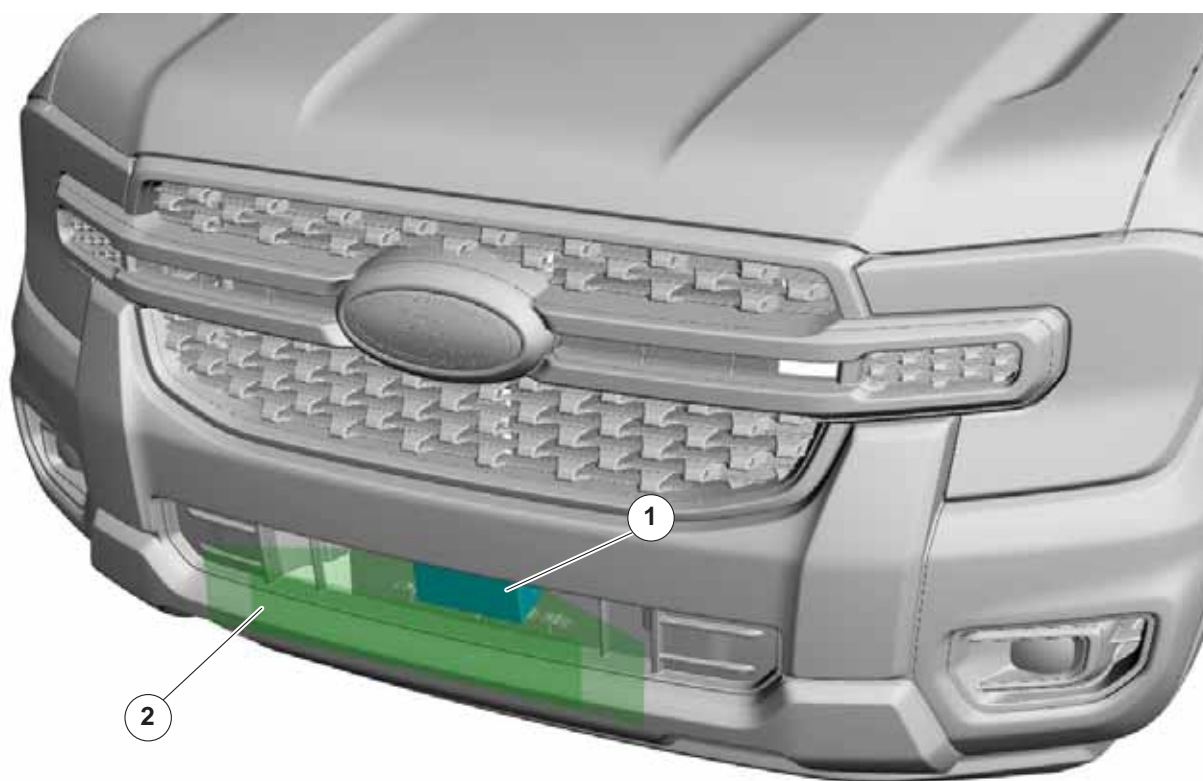
NOTE: Do not paint the front grille of the vehicle as this may affect the functionality of the cruise control radar. Different paint types and colours can have different effects on the radar beam and performance cannot be guaranteed.

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 |

4.8 Driver Assist Technology

⚠ 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.

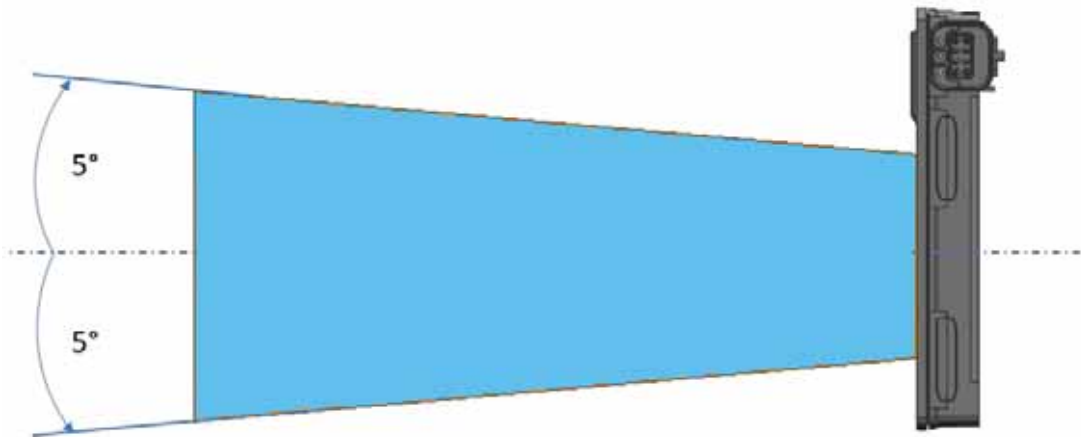
Ford Driver Assist Technology is a suite of driver-assist technology features that variously utilize a radar and/or camera system. The radar and camera systems help provide features such as:

- Pre-Collision Assist with Automatic Emergency Braking (AEB)
- Forward Collision Warning

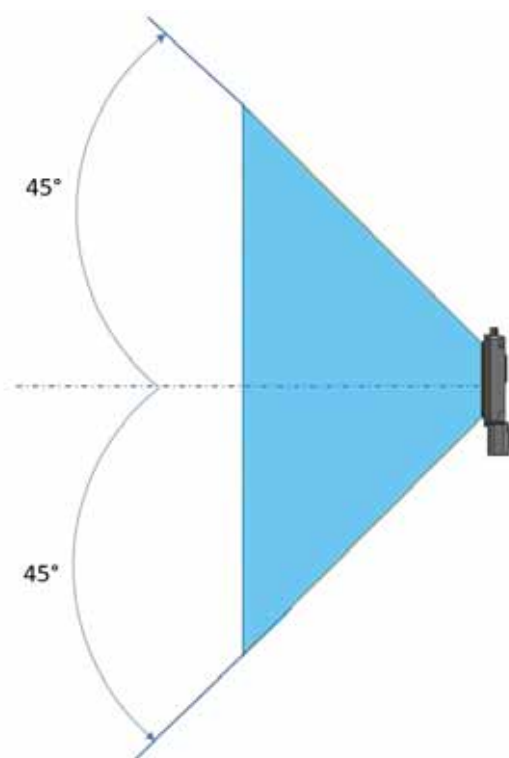
- Lane Keeping System
- Lane Departure Warning
- Automatic High Beam
- Glare Free High Beam
- Adaptive Cruise Control with Stop-and-Go and Lane Centering Assist
- BLIS@ (Blind Spot Information System) with cross-traffic alert, trailer-tow monitoring and Lane Change Warning and Aid.

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).

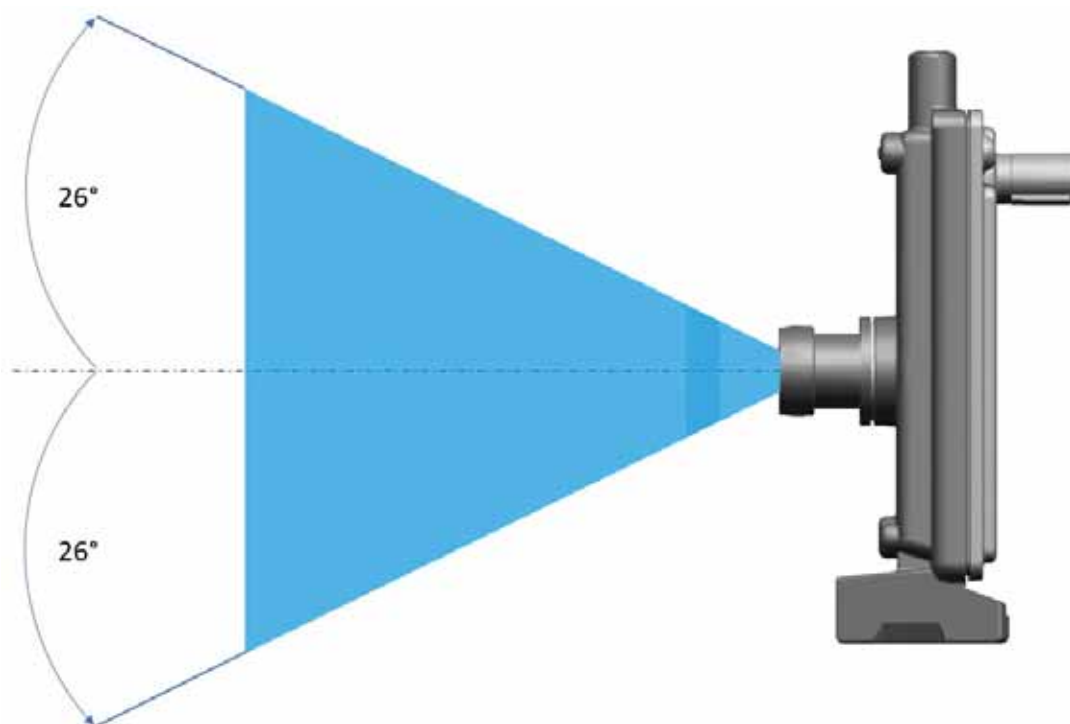
Radar View Zone - Side View



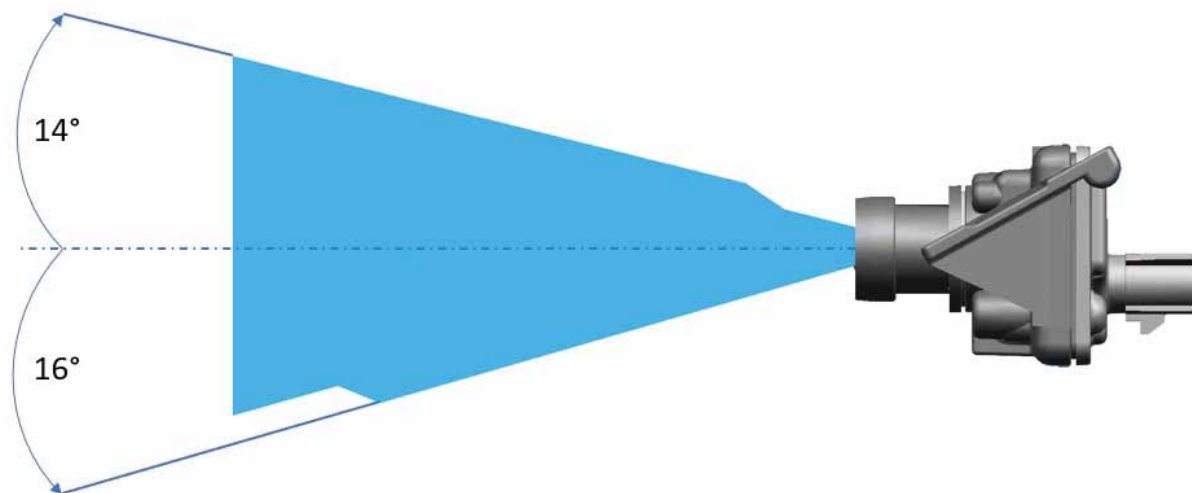
E375774

Radar View Zone - Plan View

E375767

Camera View Zone - Plan View

E375773

Camera View Zone - Side View

E375766

Refer to the vehicle owner manual for further information on the driver assist features.

4.9 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), BLIS and associated features, including safety features, will not be functional. 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 |

4.10 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.

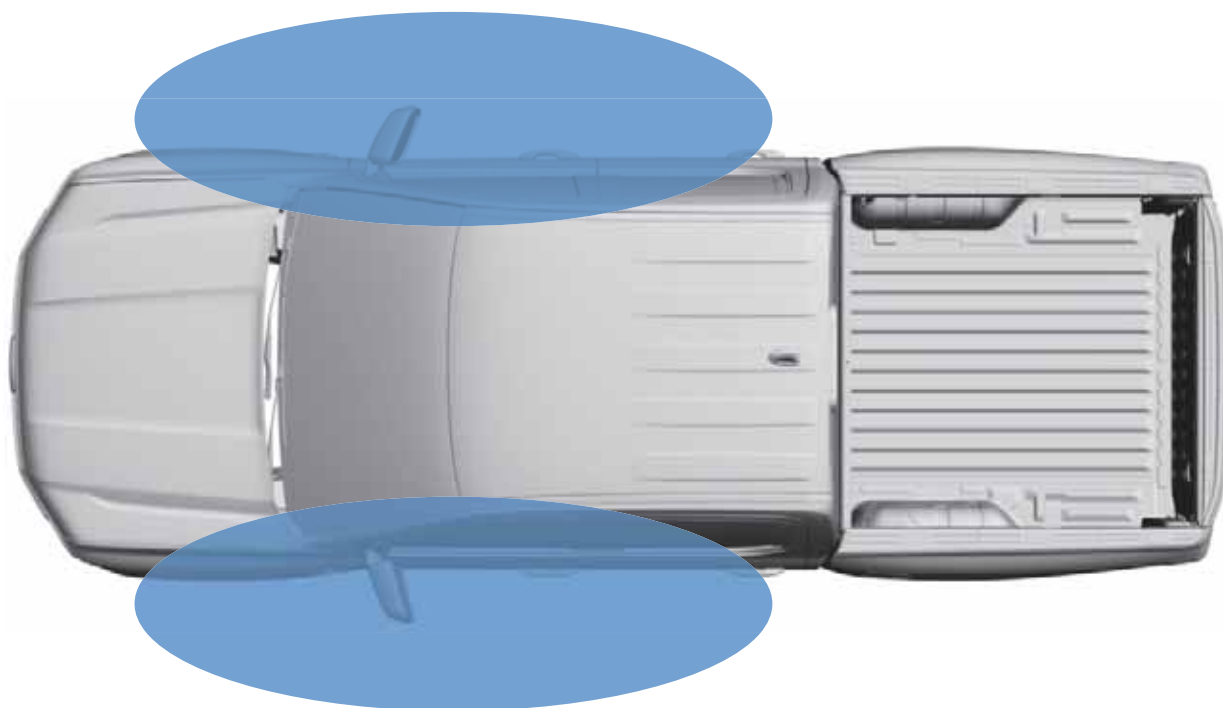
Side view cameras located on the underside of the exterior rear view mirrors form part of the 360 Degree Camera System. Any modification to the exterior of the vehicle should ensure that the function and installed position of the side view cameras is not impeded.

Side View Camera Location



E383021

| Item | Description |
|------|---|
| 1 | Side View Camera (LH Shown, RH Similar) |

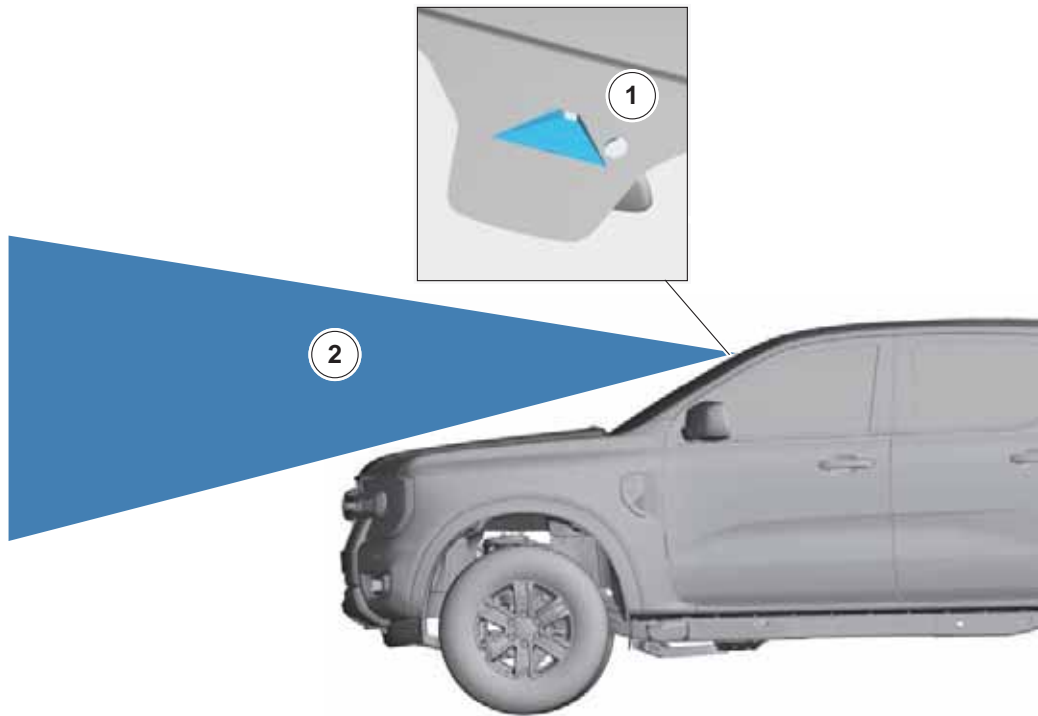
Side View Camera View Areas

E382634

4.11 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 |

Please refer to the Adaptive Cruise Control section for further considerations.

Refer to: 4.7 Cruise Control (page 99).

4.11.1 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.

4.12 Handles, Locks, Latches and Entry Systems

4.12.1 Central Locking

NOTE: Additional locks will not be covered by 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 (FET's) in the BCM – these are only capable of powering one lock each.

It is possible to add an additional lock(s) with the use of relays triggered by the BCM outputs.

NOTE: The location of additional relays should be considered carefully. A suitable mounting location away from the passenger compartment will allow for a safer install and reduced noise in the passenger compartment.

Depending on the functionality required, the pins used will emulate the basic locking/unlocking operation of an existing lock. The coil of the additional relays (i.e. one relay for lock all, one relay for unlock all) should be added across the relevant pin and a suitable ground point. Power (B+) for the additional relays should be taken from a suitably fused B+ feed.

Relay selection for installation of an additional lock(s) must parallel the run time of the BCM surface mount relays.

BCM Output for Central Locking

| BCM Connector | Pin | Function |
|---------------|-----|------------------------------------|
| C3 | 35 | CTRL MOD. - DOOR LOCK # ALL LOCK |
| C3 | 32 | CTRL MOD. - DOOR LOCK # ALL UNLOCK |

4.13 Fuses and Relays

4.13.1 Fuses

NOTE: Refer to the vehicle owner's manual for information on the location and rating of electrical system fuses.

5.1 Body

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.

! CAUTION: Load carrying structures should not be mounted onto an existing load tray or load box.

Refer to: 1.10 (page 30).

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.

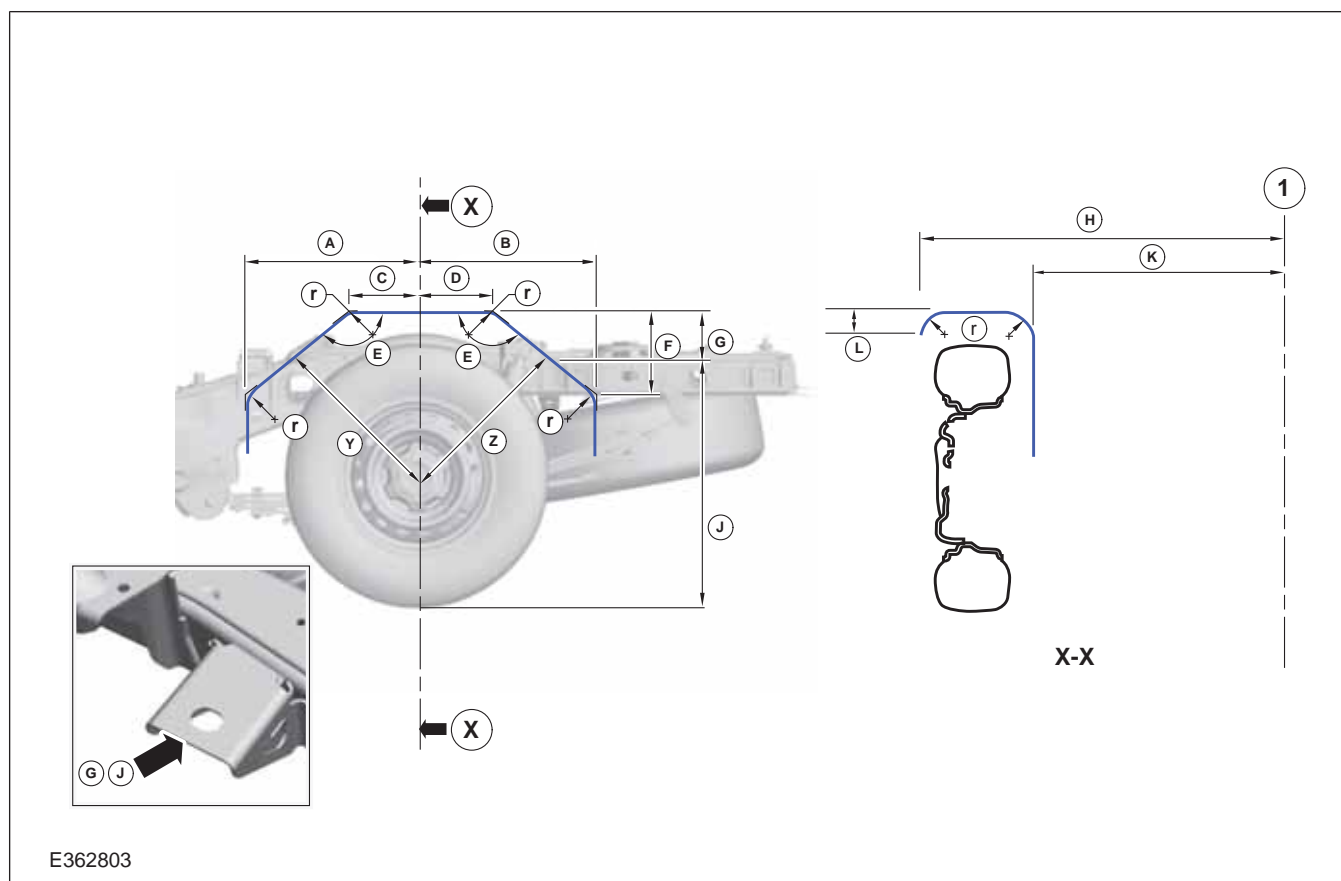
5.1.2 Integrated Bodies and Conversions

! 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



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: All dimensions are in millimetres.

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 | 305mm | 305mm | 305mm | 305mm |
| D | 275mm | 275mm | 275mm | 275mm |
| E | 110° | 110° | 110° | 110° |
| F | 420 | 420 | 420 | 420 |
| G | 217 | 185 | 185 | 192 |
| H | - | - | - | 968 |
| J | 665 | 774 | 774 | 801 |
| K | 635 | 635 | 635 | 635 |
| L | - | 30 | 30 | 30 |
| r | 50mm (max) | | | |
| l | Center line of Vehicle | | | |
| X | Section through Center of Wheel Guard | | | |
| Y | 566 | 566 | 566 | 566 |
| Z | 525 | 525 | 525 | 525 |

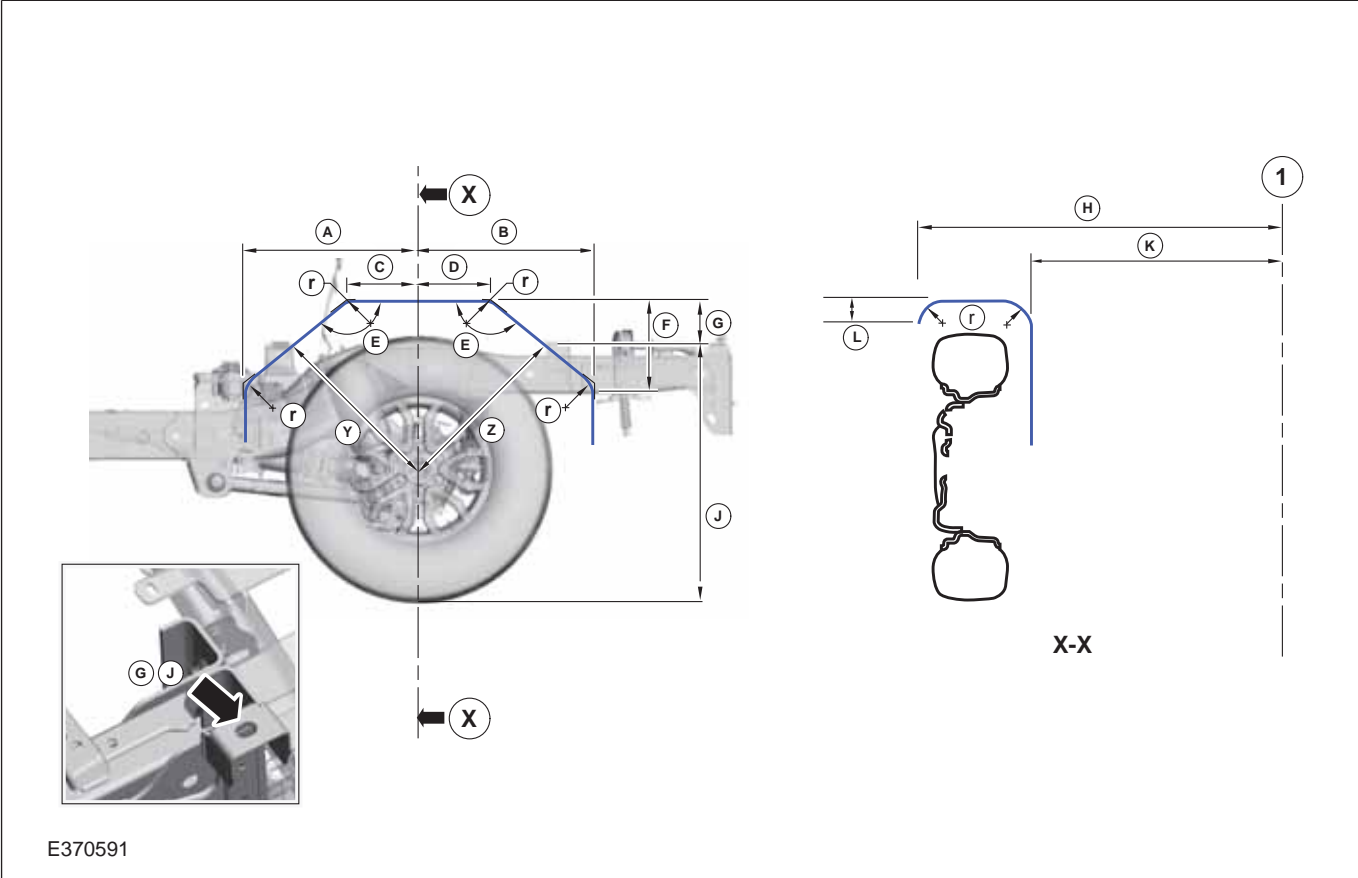
5.1.3 Integrated Bodies and Conversions - Raptor

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



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: All dimensions are in millimetres.

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 | 486mm |
| B | 468mm |
| C | 305mm |
| D | 275mm |
| E | 110° |
| F | 420 |
| G | 205 |
| H | 1007mm |
| J | 816 |
| K | 636mm |
| L | 30 |
| r | 50mm |
| l | Center line of Vehicle |
| X | Section through Center of Wheel Guard |
| Y | 572mm |
| Z | 543mm |

5.1.4 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.



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

When carrying out vehicle conversions / modifications the following points should be considered:

- Make sure that all of the reinforced holes provided in the chassis frame top surface are used for full length bodies or sub-frames, see figures shown.
- 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.

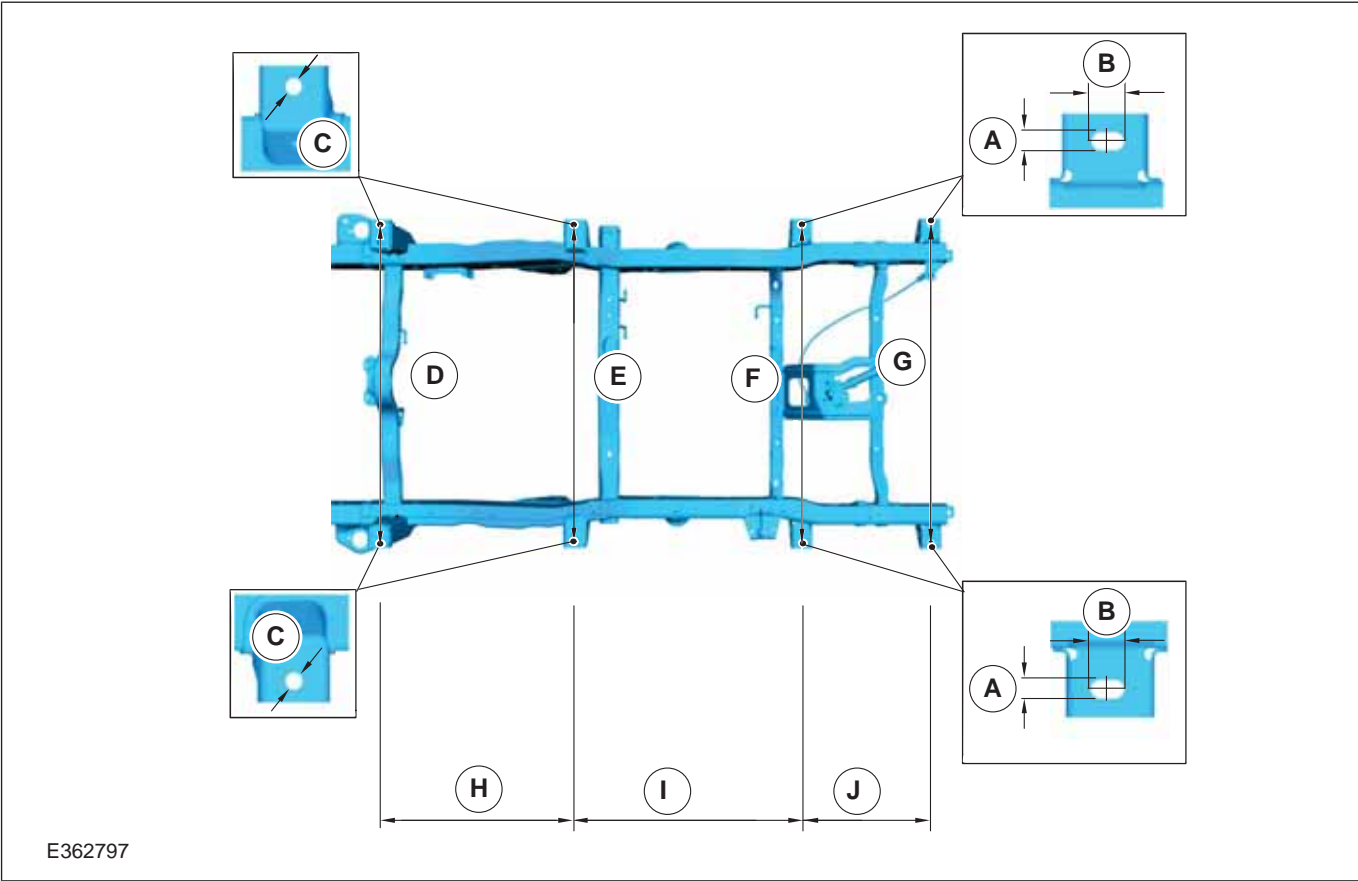
Refer to: 5.4 Corrosion Prevention (page 150).

- 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.

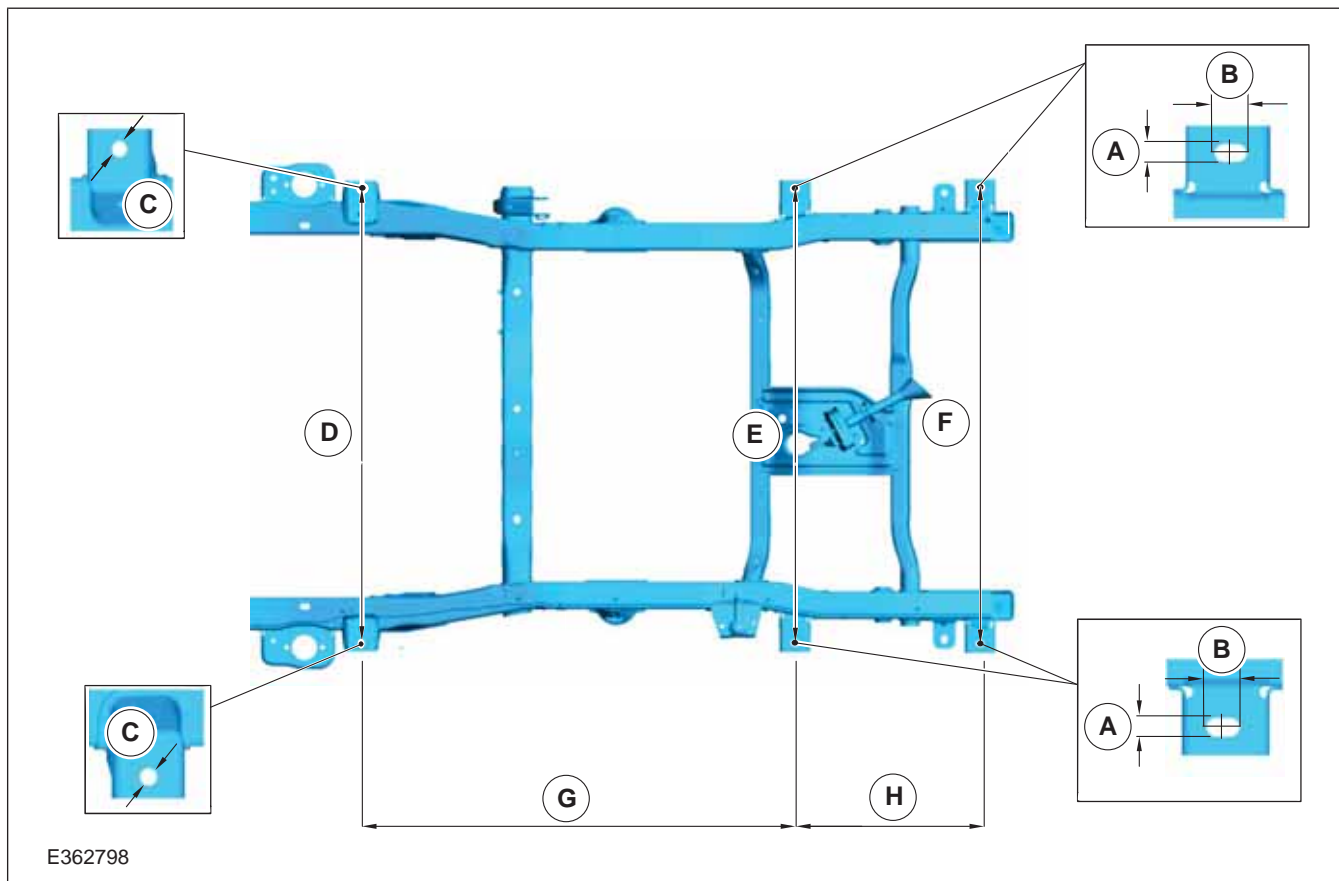
Body Attachment Holes in Chassis Frame - Single Cab



Dimensions (mm) for Body Attachment Holes in Chassis Frame - Single Cab

| Dimension | | Dimension | |
|-----------|------|-----------|-----|
| A | 20 | H | 768 |
| B | 26 | I | 891 |
| C | 20 | J | 506 |
| D | 1244 | - | - |
| E | 1244 | - | - |
| F | 1244 | - | - |
| G | 1248 | - | - |

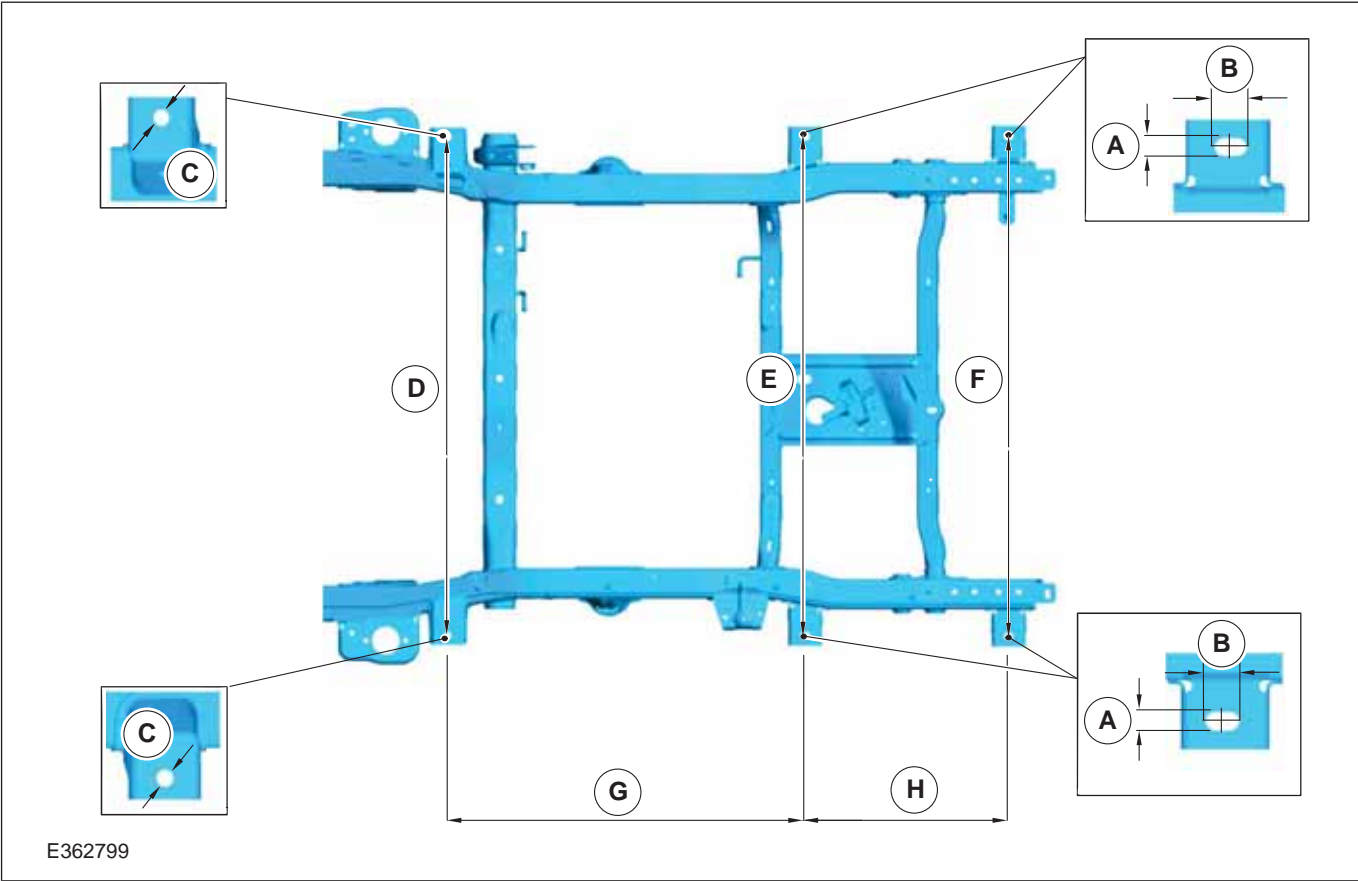
Body Attachment Holes in Chassis Frame - Super Cab



Dimensions (mm) for Body Attachment Holes in Chassis Frame - Super Cab

| Dimension | | Dimension | |
|-----------|------|-----------|------|
| A | 20 | G | 1188 |
| B | 26 | H | 506 |
| C | 20 | - | - |
| D | 1244 | - | - |
| E | 1244 | - | - |
| F | 1248 | - | - |

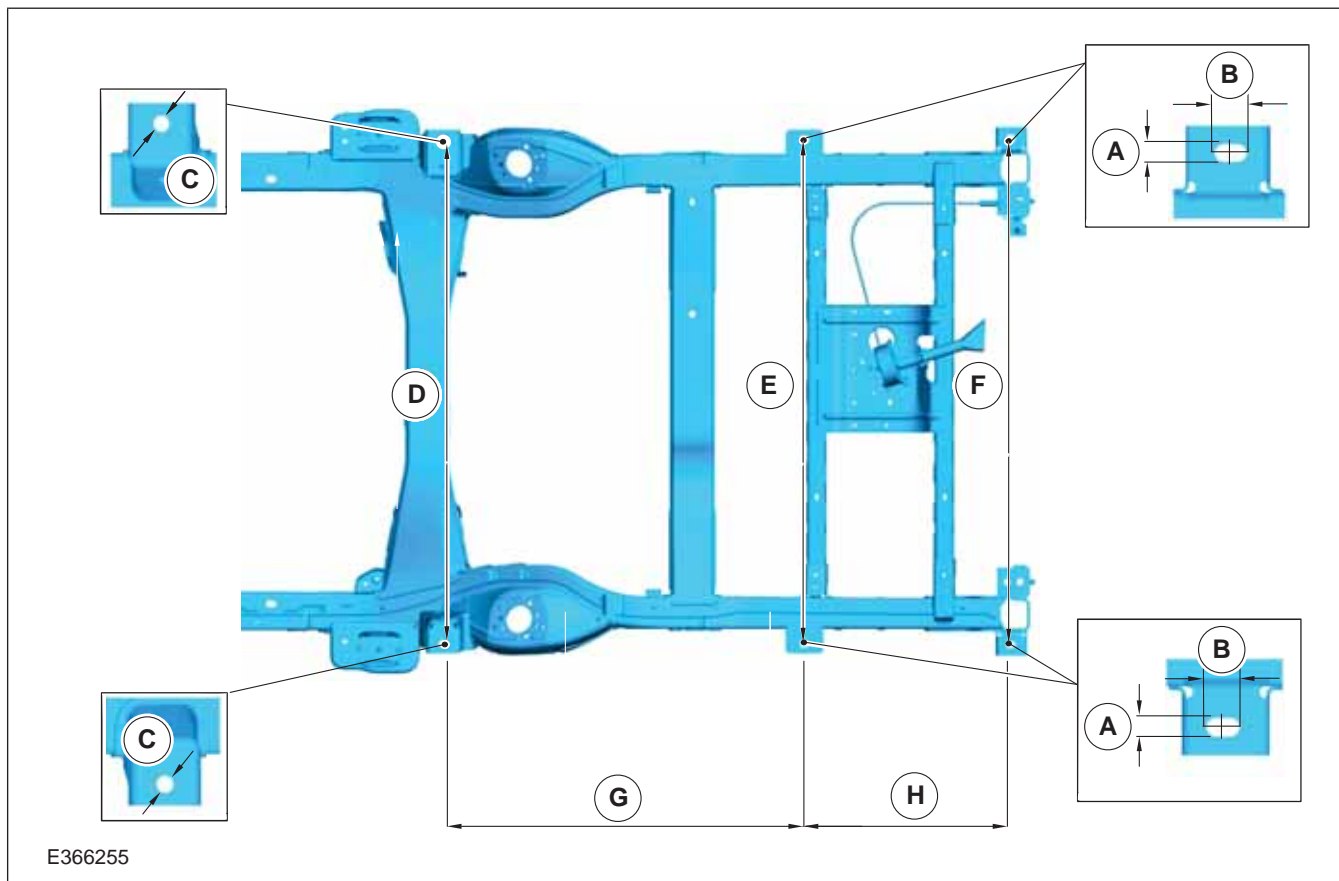
Body Attachment Holes in Chassis Frame - Double Cab



Dimensions (mm) for Body Attachment Holes in Chassis Frame - Double Cab

| Dimension | | Dimension | |
|-----------|------|-----------|-----|
| A | 20 | G | 890 |
| B | 26 | H | 506 |
| C | 20 | - | - |
| D | 1244 | - | - |
| E | 1244 | - | - |
| F | 1248 | - | - |

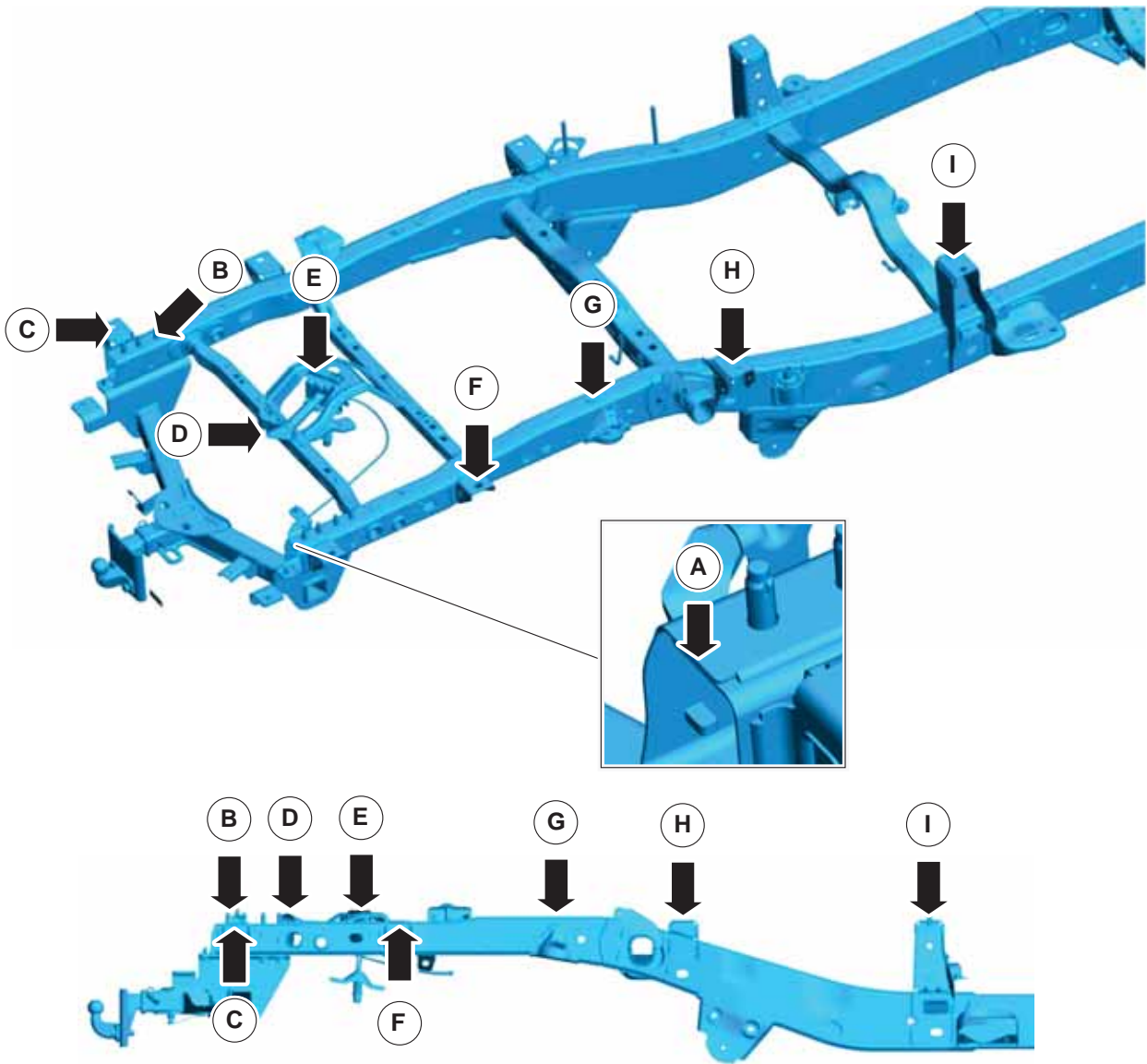
Body Attachment Holes in Chassis Frame - Raptor



Dimensions (mm) for Body Attachment Holes in Chassis Frame - Raptor

| Dimension | | Dimension | |
|-----------|------|-----------|-----|
| A | 20 | G | 887 |
| B | 26 | H | 506 |
| C | 20 | | |
| D | 1244 | | |
| E | 1244 | | |
| F | 1248 | | |

Body Mounting Pad Vertical Dimensions - Single Cab



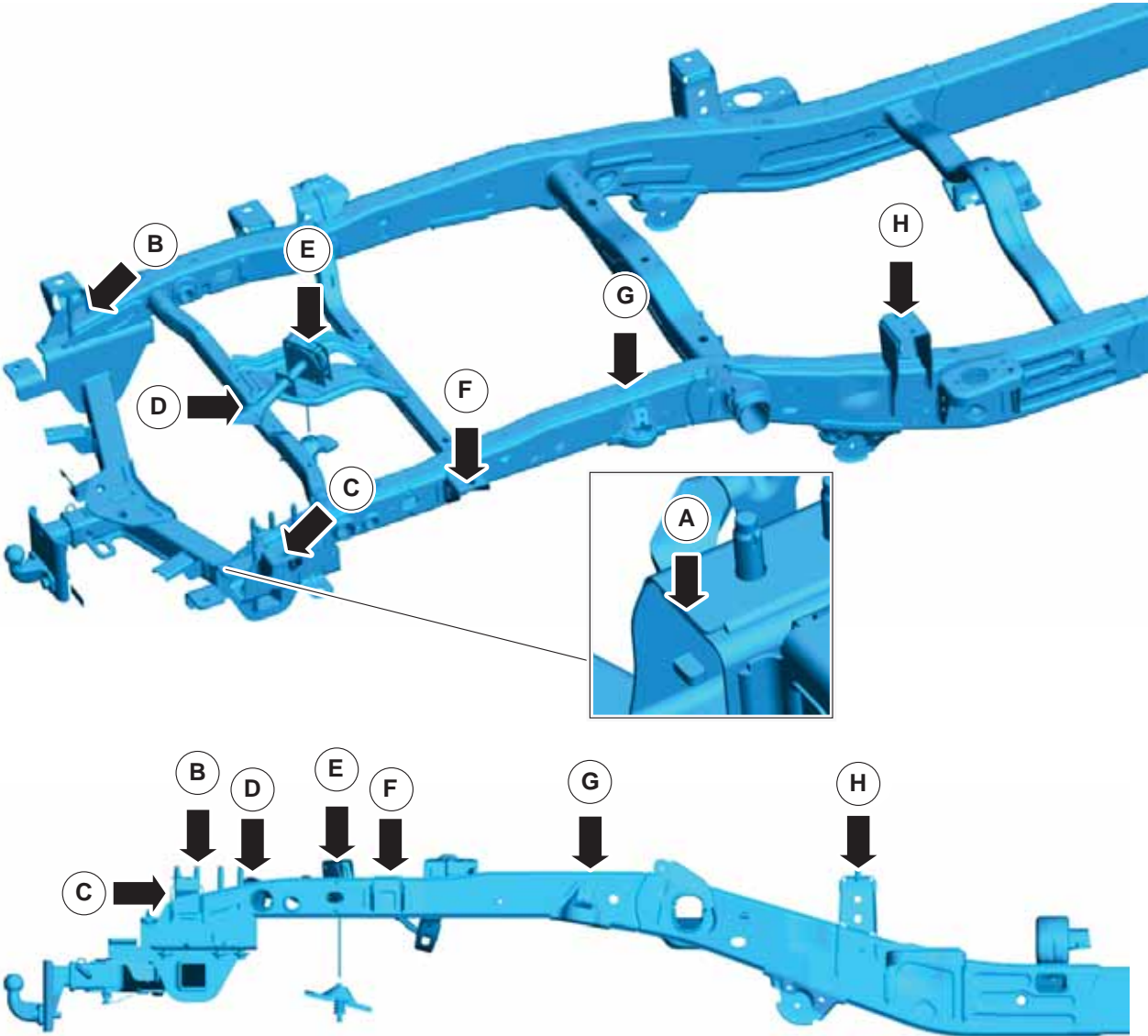
E368452

| Dimension | GVM @ RGAWR | MRO | WLTP | Height from A |
|----------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------|
| A | 540 _* / 659 _{**} | 656 _* / 776 _{**} | 637 _* / 761 _{**} | - |
| 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 |

*Low Rider

**High Rider / 4x4

Body Mounting Pad Vertical Dimensions - Super Cab



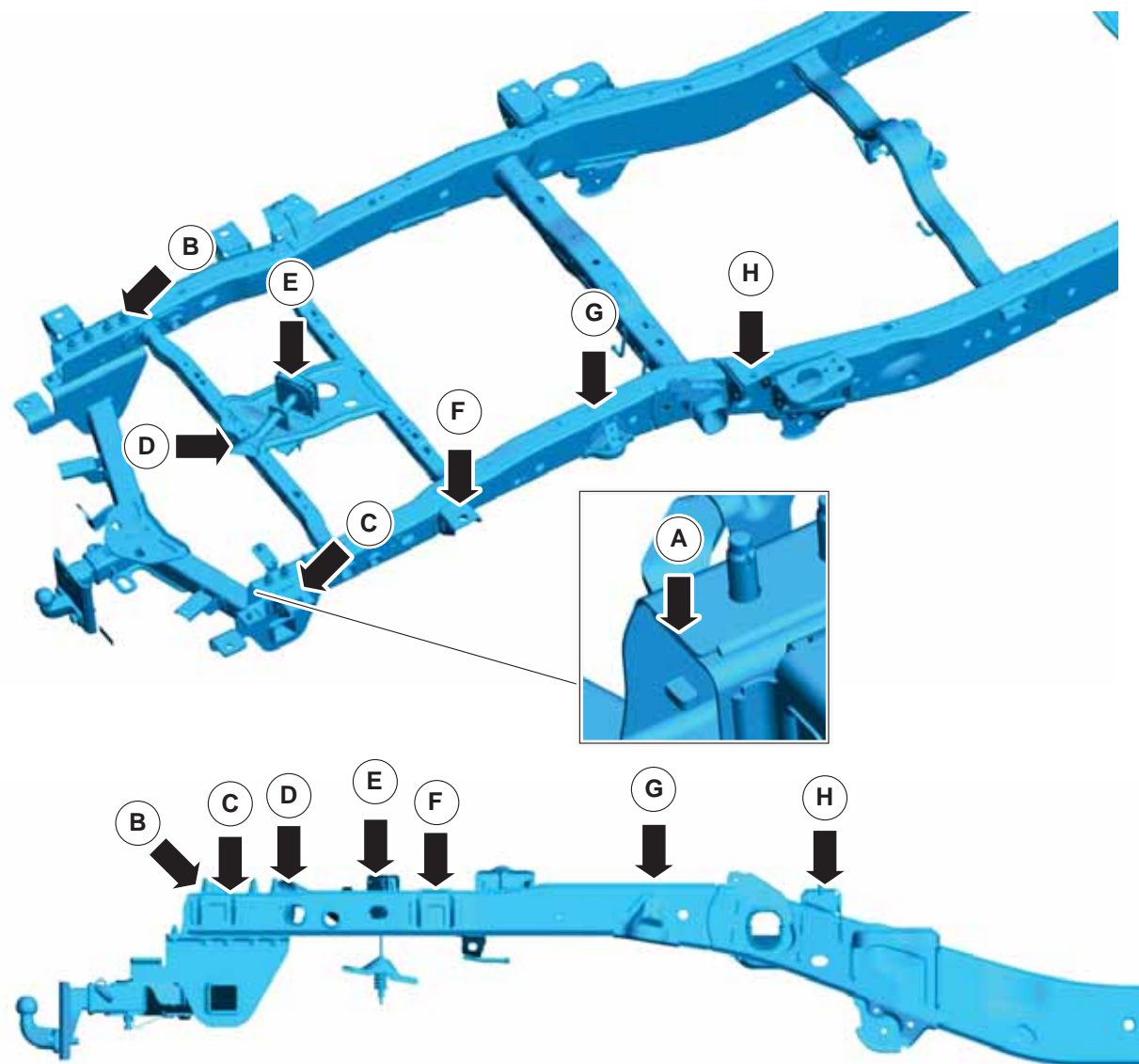
E368453

| Dimension | GVM @ RGAWR | MRO | WLTP | Height from A |
|----------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------|
| A | 540 _* / 659 _{**} | 656 _* / 776 _{**} | 637 _* / 761 _{**} | - |
| 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 |

*Low Rider

**High Rider / 4x4

Body Mounting Pad Vertical Dimensions - Double Cab



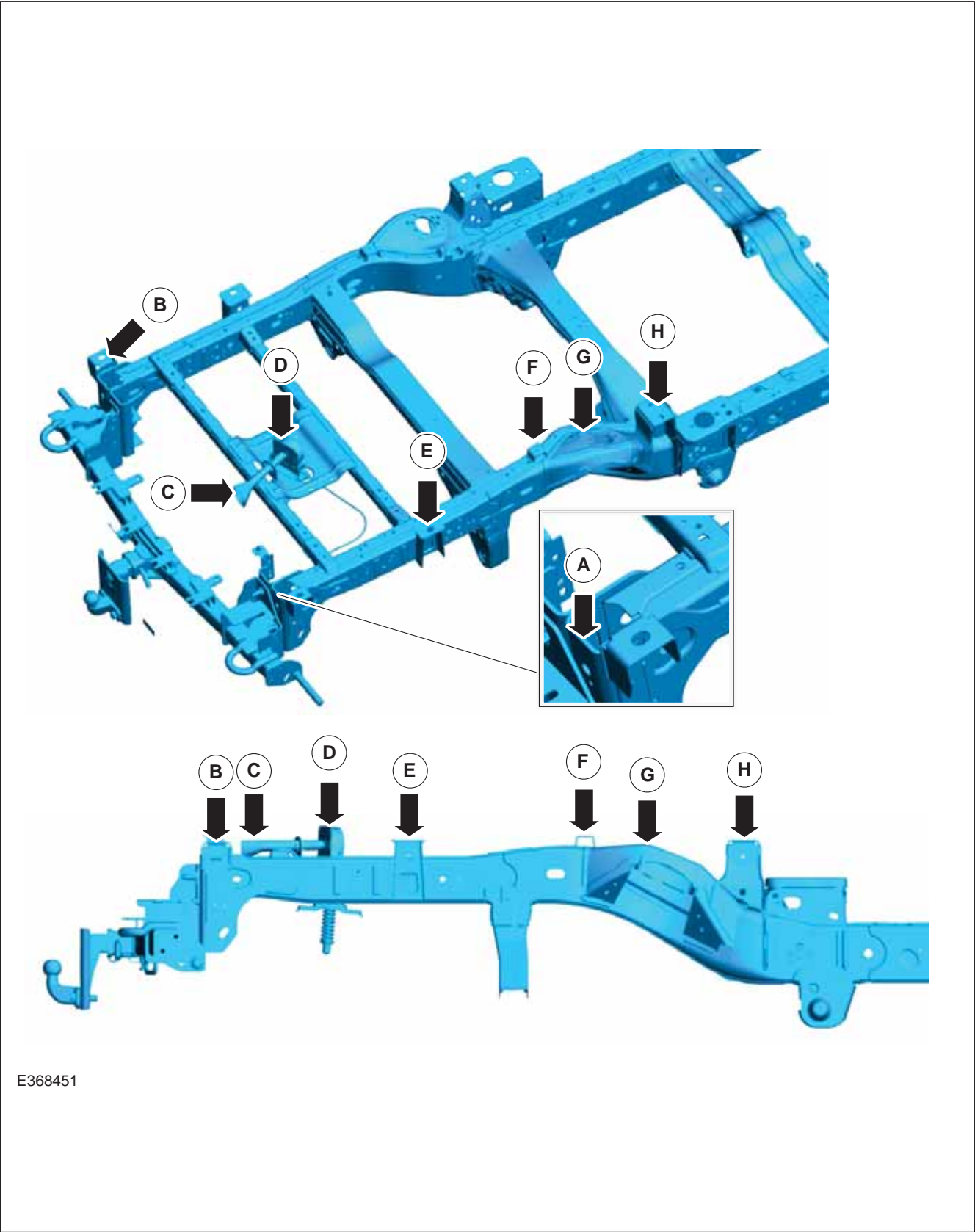
E368454

| Dimension | GVM @ RGAWR | MRO | WLTP | Height from A |
|----------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------|
| A | 540 _* / 659 _{**} | 656 _* / 776 _{**} | 637 _* / 761 _{**} | - |
| 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 |

_{*}Low Rider

**High Rider / 4x4

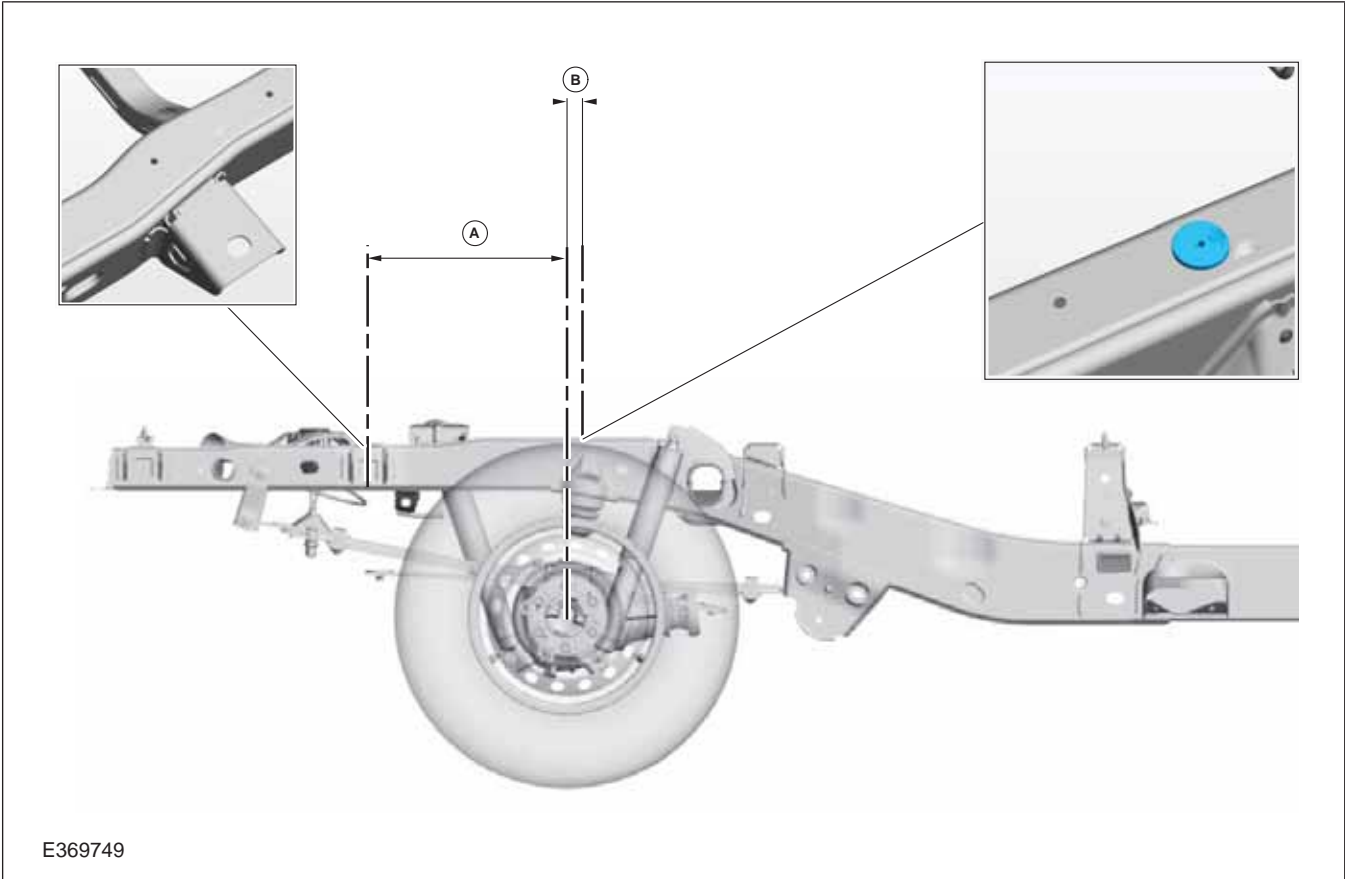
Body Mounting Pad Vertical Dimensions - Raptor



| 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 |

| Dimension | GVM @ RGAWR | MRO | WLTP | Height from A |
|-------------------------------|-------------|-----|------|---------------|
| E - Mounting Pad | - | - | - | 38 |
| F- Mounting Pad | - | - | - | 54 |
| G- Spring Hat/ Shock Mount | - | - | - | 27 |
| H- Mounting Pad | - | - | - | 38 |

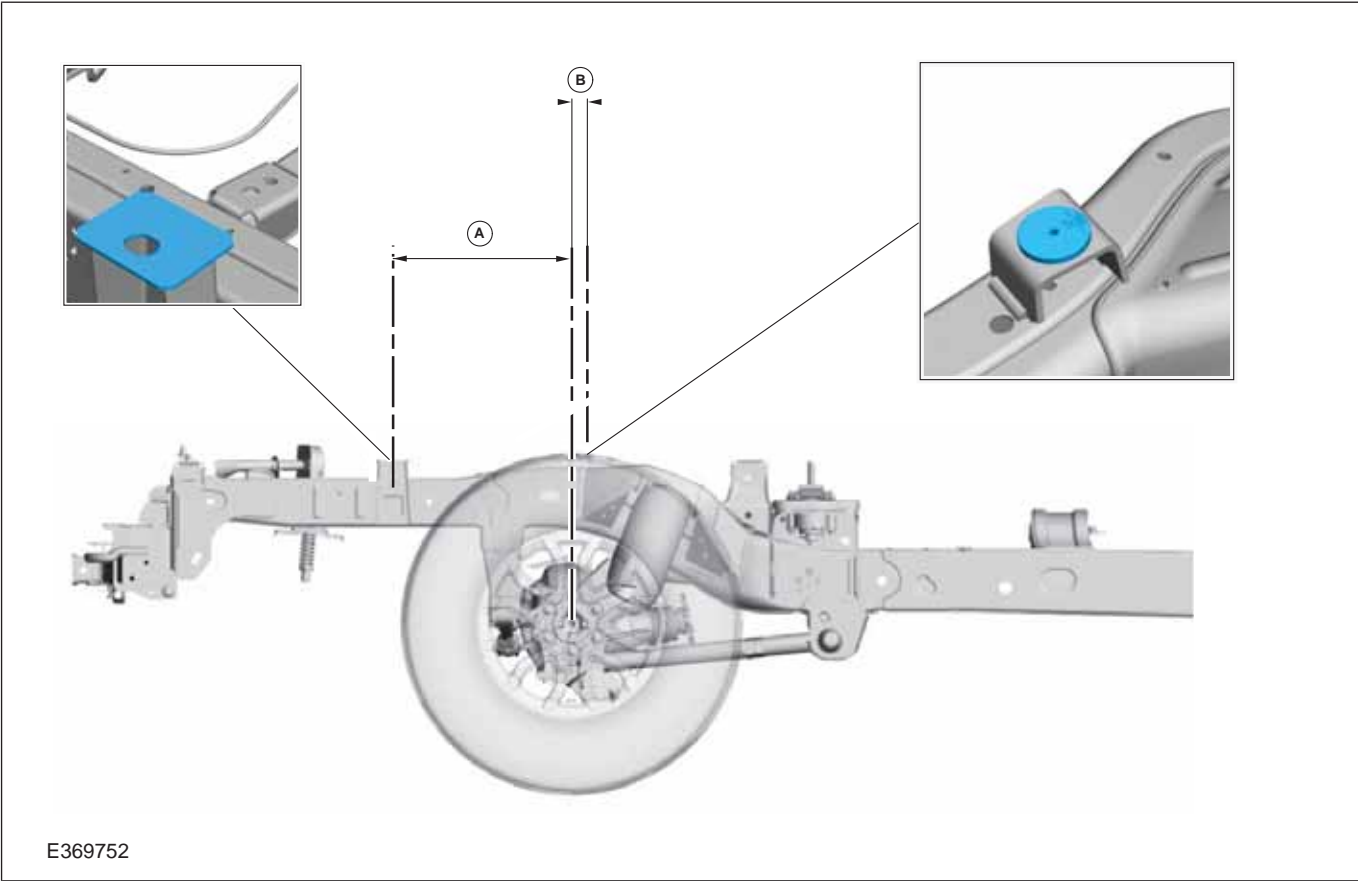
Frame Feature Centerline Distance - All Cab Styles



| Dimension | Measurement |
|-----------|-------------|
| A | 446 |
| B | 23 |

- *Low Rider
- **High Rider / 4x4

Frame Feature Centerline Distances - Raptor



| Dimension | Measurement |
|-----------|-------------|
| A | 446 |
| B | 23 |

5.1.5 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: 5.4 Corrosion Prevention (page 150).

5.1.6 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:

- 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.

- Very stiff sub-frames may damage the chassis frame by preventing its natural flexing, therefore compliant mounts should be used, with up to plus and minus 12mm compliance with the vehicle laden or un-laden (whichever is worst case). Compliant mounts should be rated with a minimum of 2mm deflection per 200kg mass at each chassis frame forward mount. Compliant mounts shall have captive fail safe bolts.
- Use two M10 grade 8.8 minimum bolts, washers and self locking nuts at each solid and compliant chassis frame location.
- 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.

5.1.7 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:

- Mount tank to full length of sub-frame.
- Mount sub-frame to all chassis frame mounting points.
- The forward location mounts must be compliant to allow relative chassis frame to sub-frame deflections.
- Sub-frame must extend to the back of the cab and not contact chassis frame at forward end under worst case deflection.
- Compliant mounts should be used, with up to plus and minus 12mm compliance with the vehicle laden or un-laden (whichever is worst case). Compliant mounts should be rated with a minimum of 2mm deflection per 200kg mass at each chassis frame forward mount. Compliant mounts shall have captive fail safe bolts.
- Use two M10 grade 8.8 minimum bolts, washers and self lock nuts per chassis frame mount bracket at each solid and compliant location.

Refer to: 1.10 (page 30).

5.1.8 Genuine Ford Accessory Bull Bar

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.

5.1.9 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).

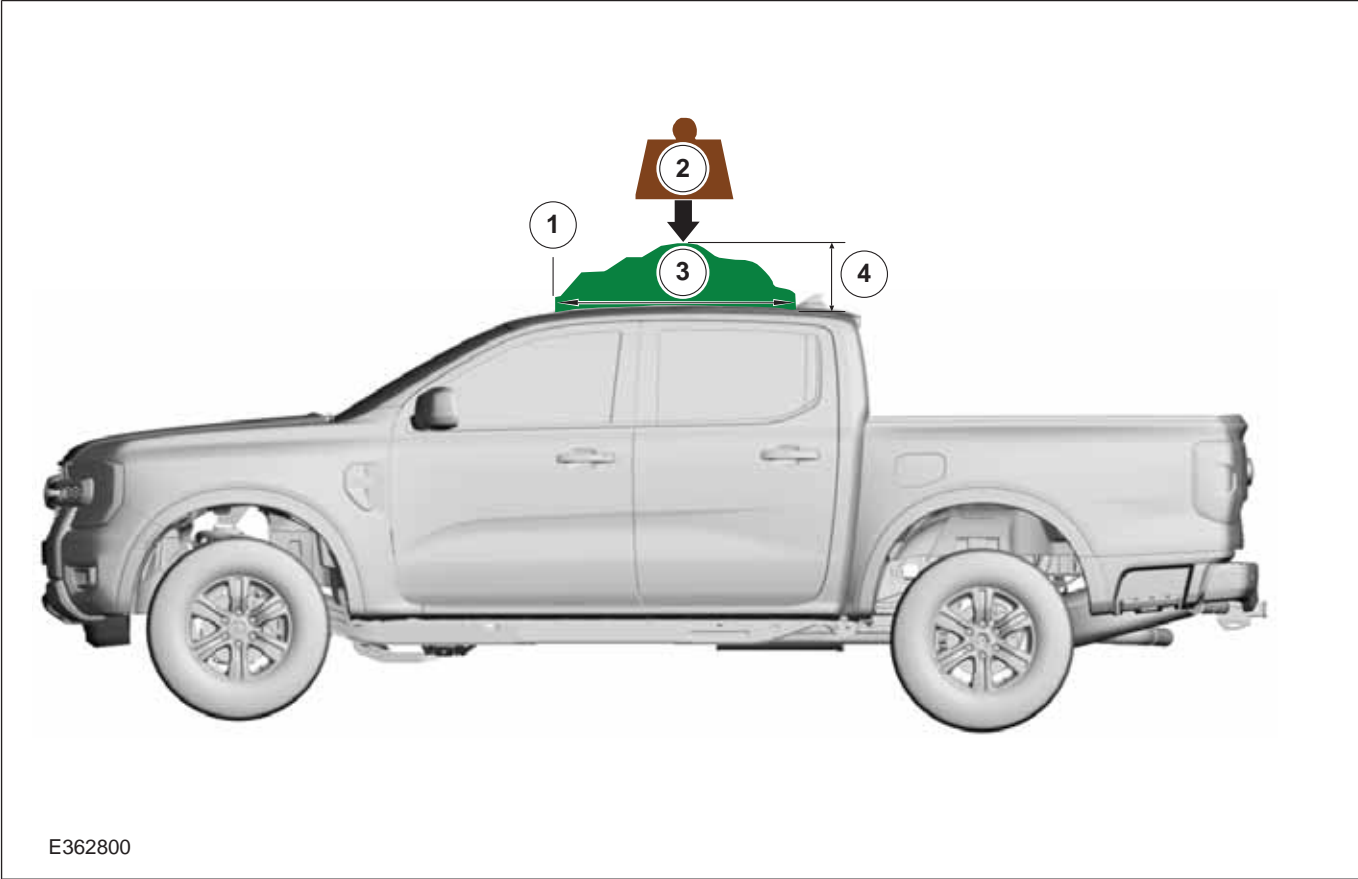
- The rack and subsequent carried load is supported according to the your local Ford dealer irrespective of rack retaining method.
- Removing or obstructing the radio antenna mast (especially with metal objects) will impact radio performance and mounting anything directly over the mast base will impact 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.

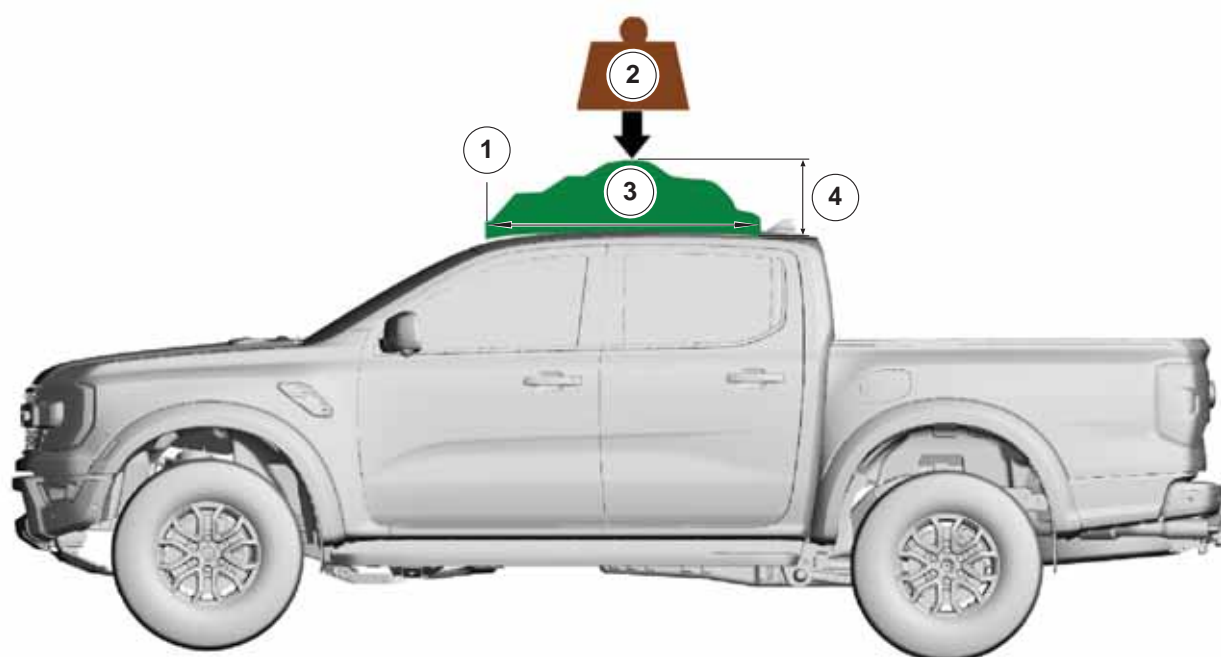
Roof Rack Vehicle Converter Special Fit - Ranger



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 - Ranger 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 |

5.1.10 Cargo Management on Vehicle Tub

WARNING: Only use the recommended attachment points, otherwise damage may occur to the load box.

CAUTIONS:

! Canopy weight and canopy load should pass through the recommended structural attachment points.

! A minimum clearance of 28mm between the vehicle cab and any fitted service body, 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.

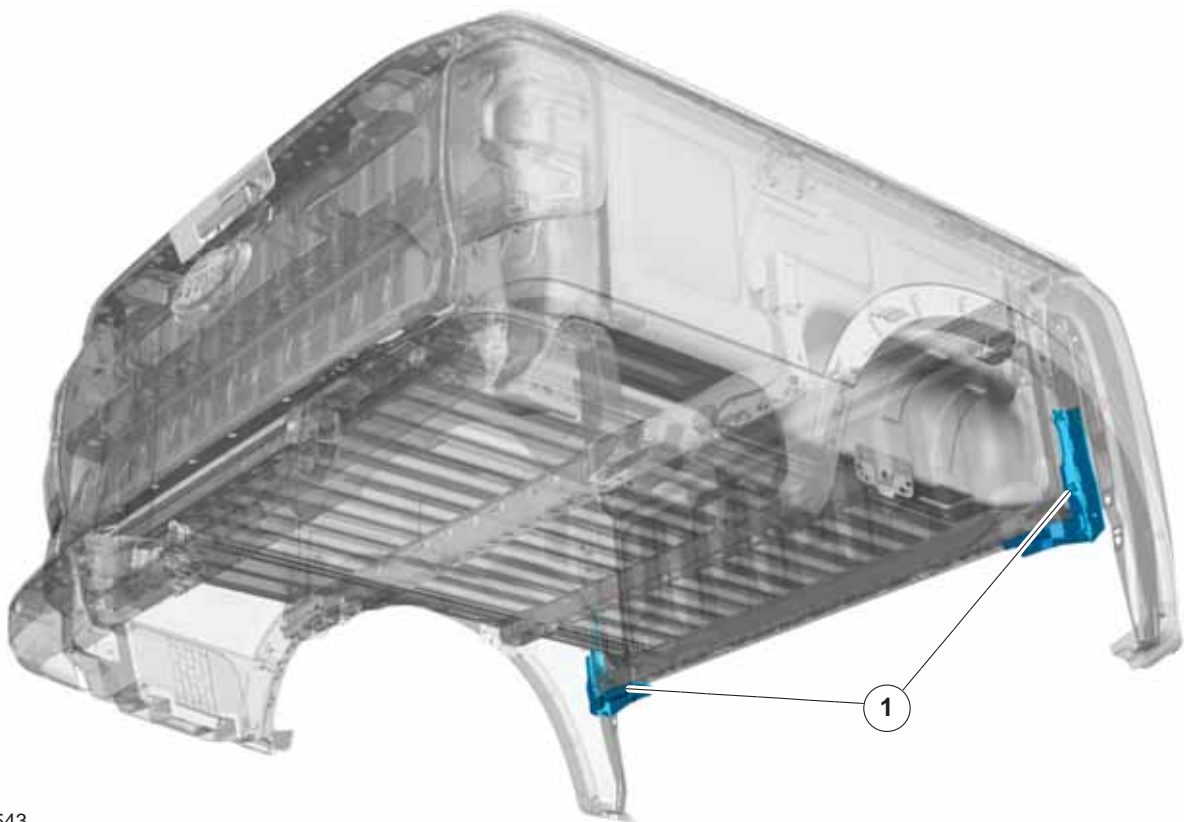
Refer to: 1.10 (page 30).

Load Box Reinforcement Brackets

! **WARNING:** Make sure that all cargo loads are properly balanced and secured.

! **CAUTION:** To support the structural integrity of the load box when a canopy is fitted, Ford recommends the installation of load box reinforcement brackets. Load box reinforcement brackets are available as a Ford Licenced Accessory.

Load Box Reinforcement Bracket Location



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 durability performance of the load box is maintained with the installation of a Ford Licenced Accessory canopy.

Ford also makes these load box reinforcement brackets available as a Ford Licensed Accessories that can be purchased from any authorised Ford Dealer:

- Ranger (Excl. Raptor) Part Number: AMN1WJ27726AA / VN1WZ2627726A
- Ranger Raptor Part Number: AMN1WJ27726BA / VN1WZ2627726B

CAUTION: These reinforcement brackets have been designed specifically for Ford Licensed Accessory Canopies and their suitability for use with any aftermarket (non Ford Licensed Accessory) canopy will need to be determined by the aftermarket canopy manufacturer or supplier.

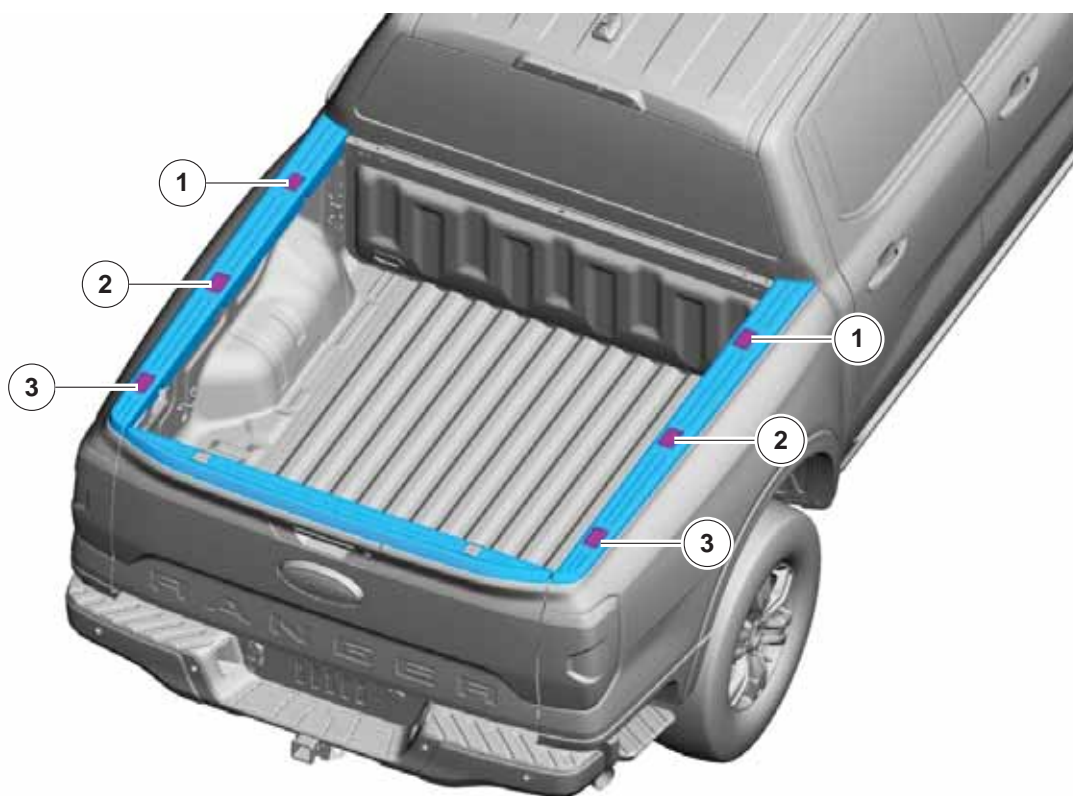
Responsibility for the appropriate use of these brackets in a vehicle which is modified by a body builder or with an alternate accessory manufacturer's products, remains with that party. It is the vehicle modifier's responsibility to ensure that the modification is carried out in such a way as to ensure 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 Canoe Rack

CAUTION: 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.

Load bearing and heavy vehicle accessories must use cross plane attachment points to ensure secure fitment.

Structural Attachment Points - Double Cab

E362801

| Item | Description |
|------|--|
| 1 | Front structural attachment points - M8 |
| 2 | Centre structural attachment points - M8 |
| 3 | Rear structural attachment points - M8 |

Structural Attachment Points - Single and Super Cab



E376121

| Item | Description |
|------|--|
| 1 | Front structural attachment points - M8 |
| 2 | Front centre structural attachment points - M8 |
| 3 | Rear centre structural attachment points - M8 |
| 4 | Rear structural attachment points - M8 |

Side Rail Mounting Points



E364788

| Item | Description |
|------|-------------------------------------|
| 1 | LH (left-hand) cargo mounting rail |
| 2 | RH (right-hand) 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.

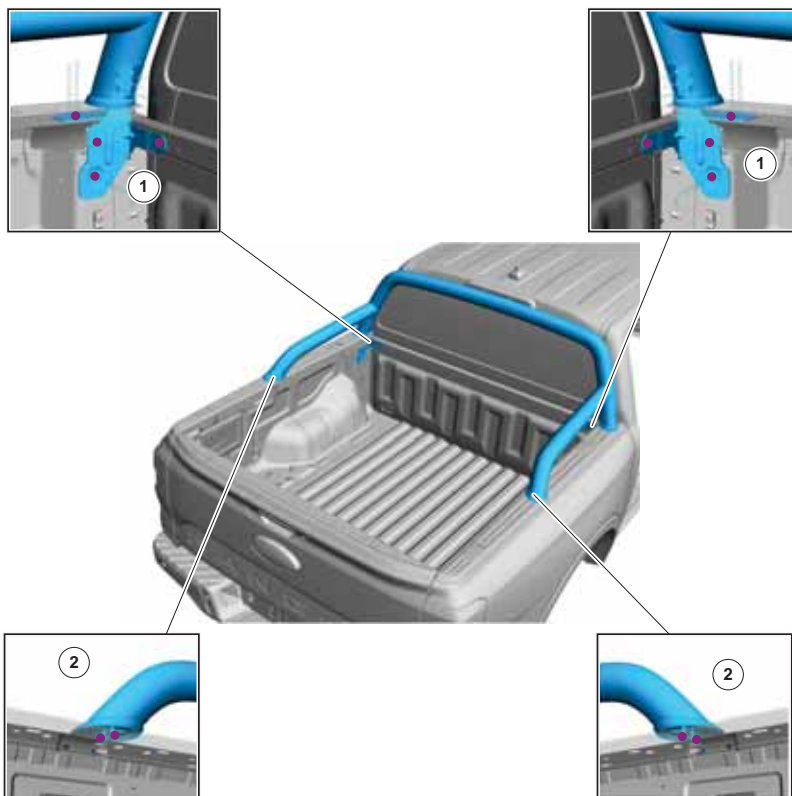
Mounting Point Load Capacities



| 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.

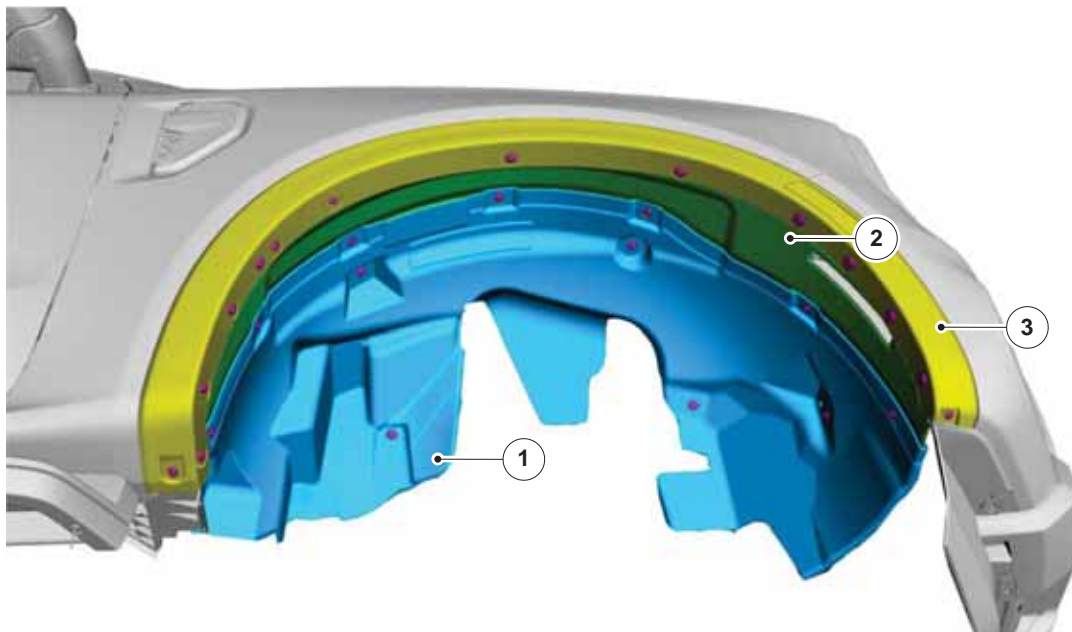


E362802

| Item | Description |
|------|---|
| 1 | Front structural attachment points - M8 |
| 2 | Rear structural attachment points - M8 |

5.1.11 Front Fender Liner

NOTE: RH shown, LH similar.



E368092

| Item | Description |
|------|----------------------------|
| 1 | Fender Liner |
| 2 | Front Fender Splash Shield |
| 3 | Wheel Opening Moulding |

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 mouldings and the front fender splash shield.

Removal of the wheel opening mouldings can be undertaken after removal of the fender liner, by accessing and releasing the wheel opening moulding 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 Airbag Supplemental Restraint System (SRS)

5.2.1 Air Bags

Front Seats

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 of the rear door on the Super Cab vehicles.

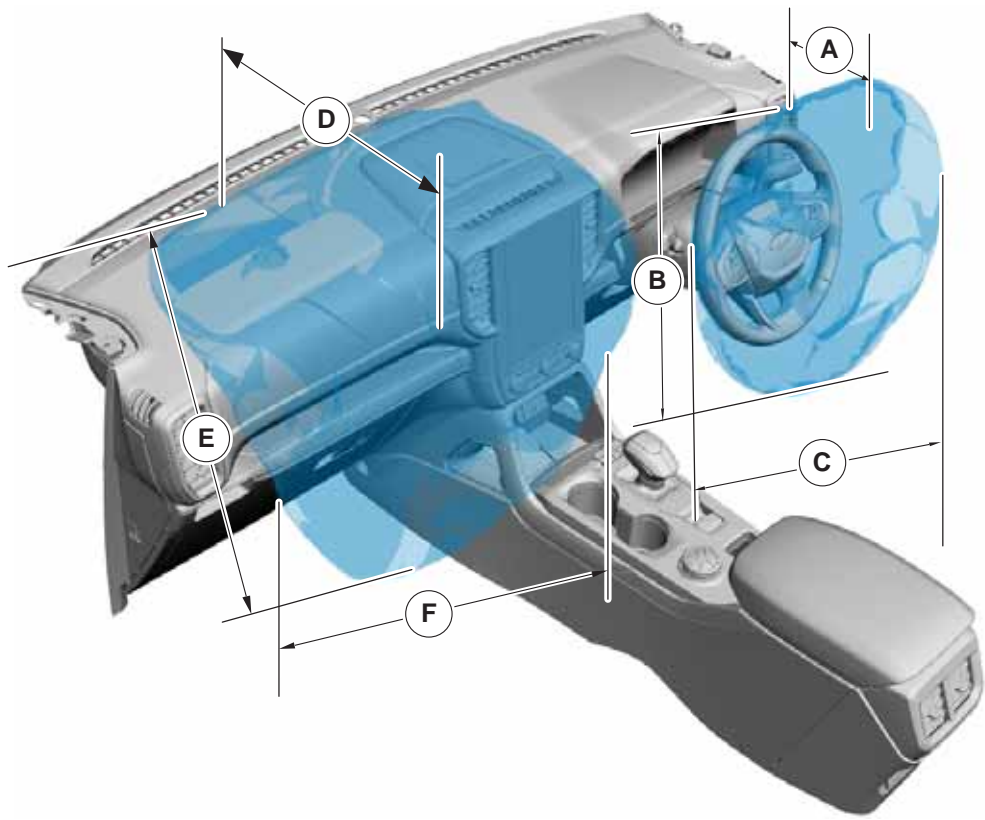


WARNING: Modifications or reinforcements in the area of the sensors may affect the side airbag fire timing and result in uncontrolled side air bag deployment.

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

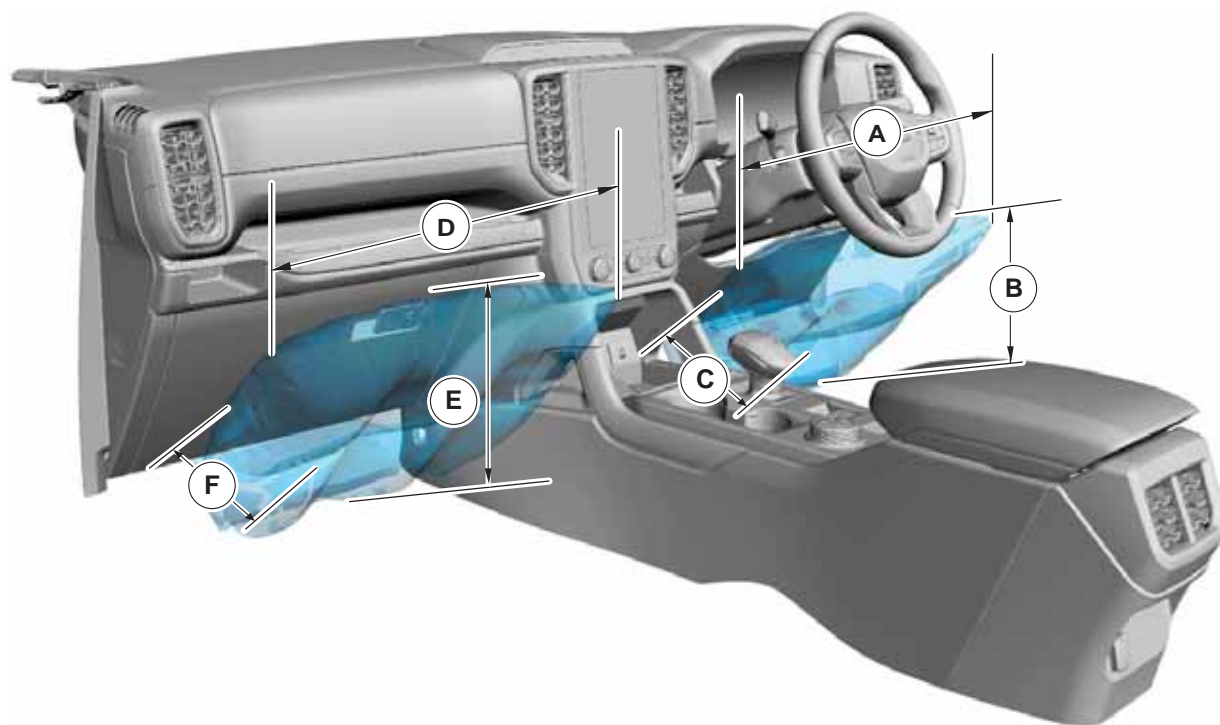


E364184

| 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)

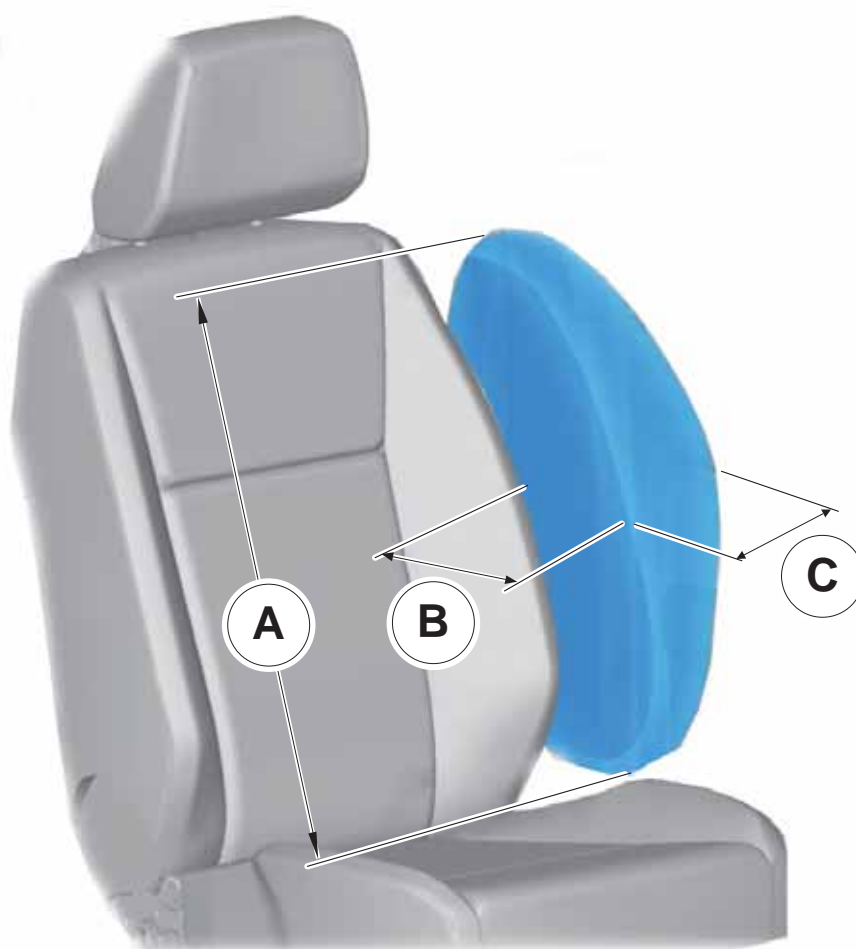


E364200

| Dimensions (mm) | | | |
|-----------------|-----|--|--|
| A | 350 | | |
| B | 750 | | |
| C | 450 | | |

NOTE: LHS shown, RHS Similar.

Side Airbag

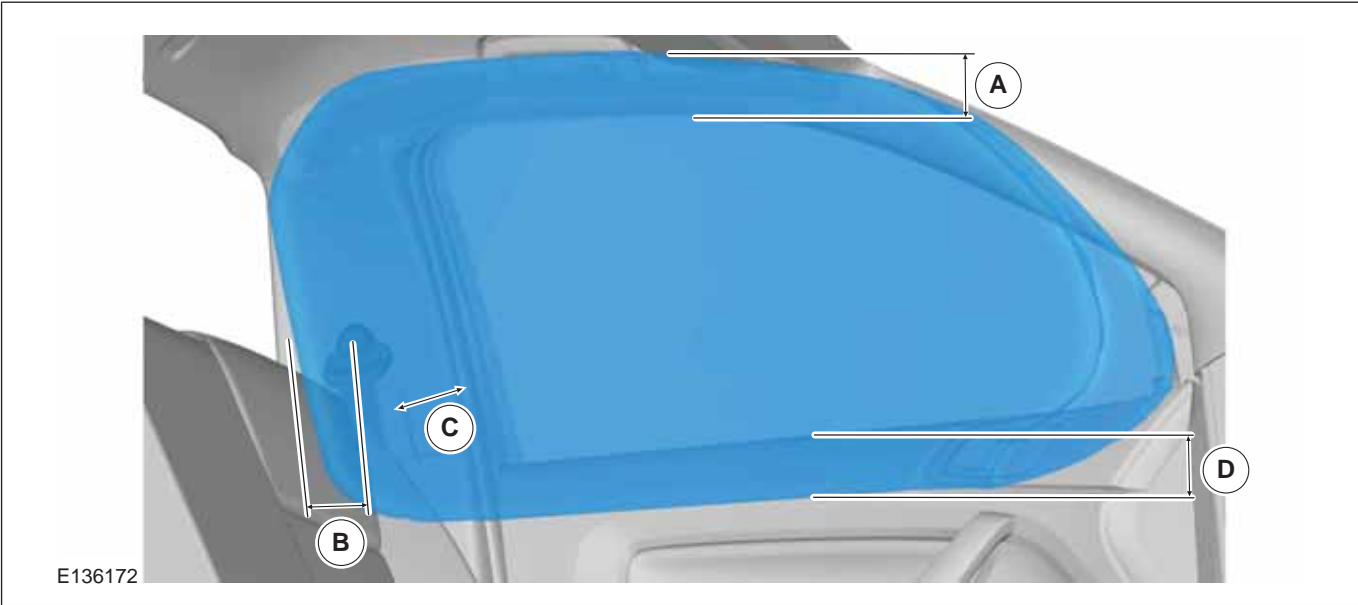


E363732

| 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.

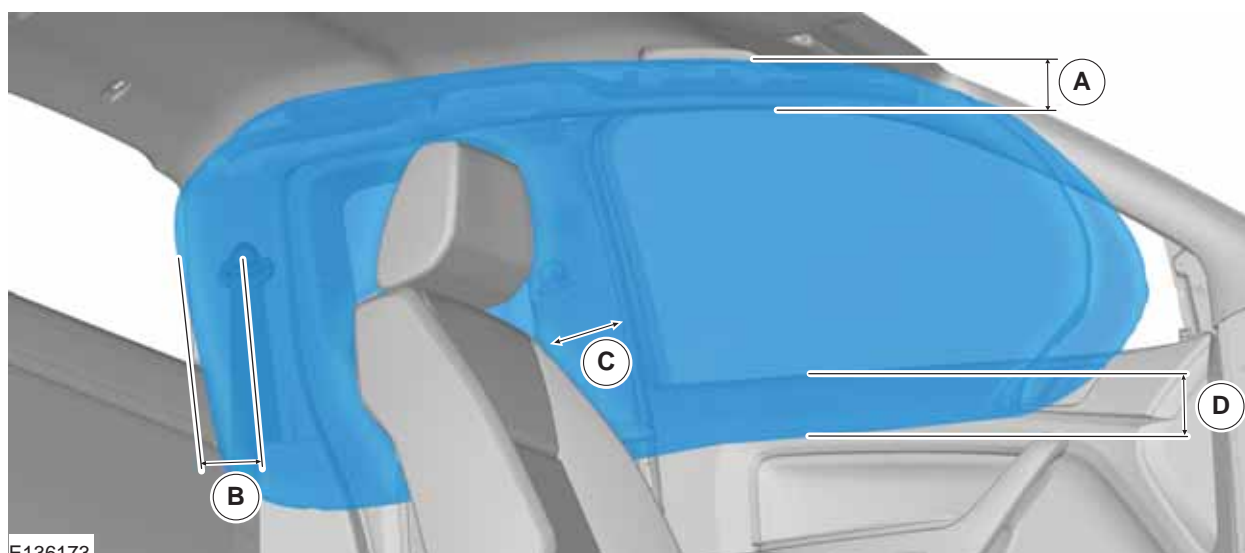
Curtain Airbag - Double cab



| Dimensions (mm) | | | |
|-----------------|-----|---|-----|
| A | 140 | C | 250 |
| B | 40 | D | 100 |

NOTE: LHS shown, RHS Similar.

Curtain Airbag - Super cab



E136173

Dimensions (mm)

| | | | |
|---|-----|---|-----|
| A | 140 | C | 250 |
| B | 40 | D | 100 |

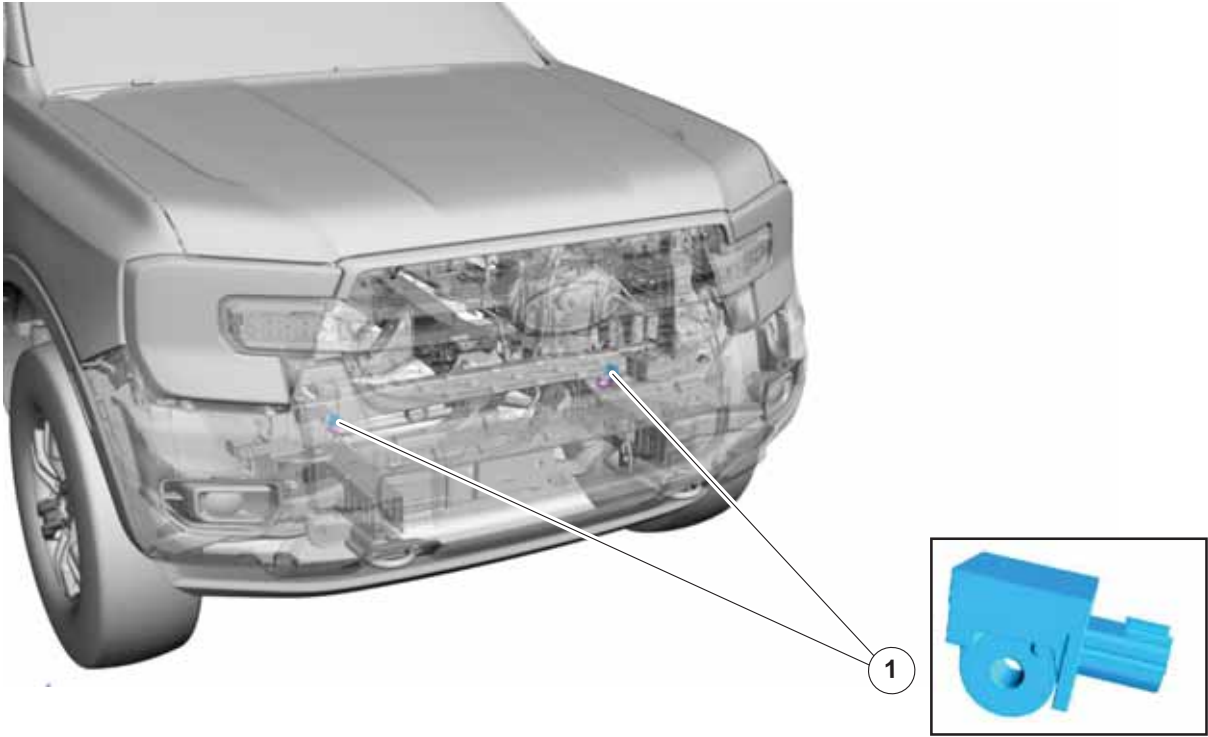
NOTE: LHS shown, RHS Similar.

5.2.2 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 |

5.3 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.

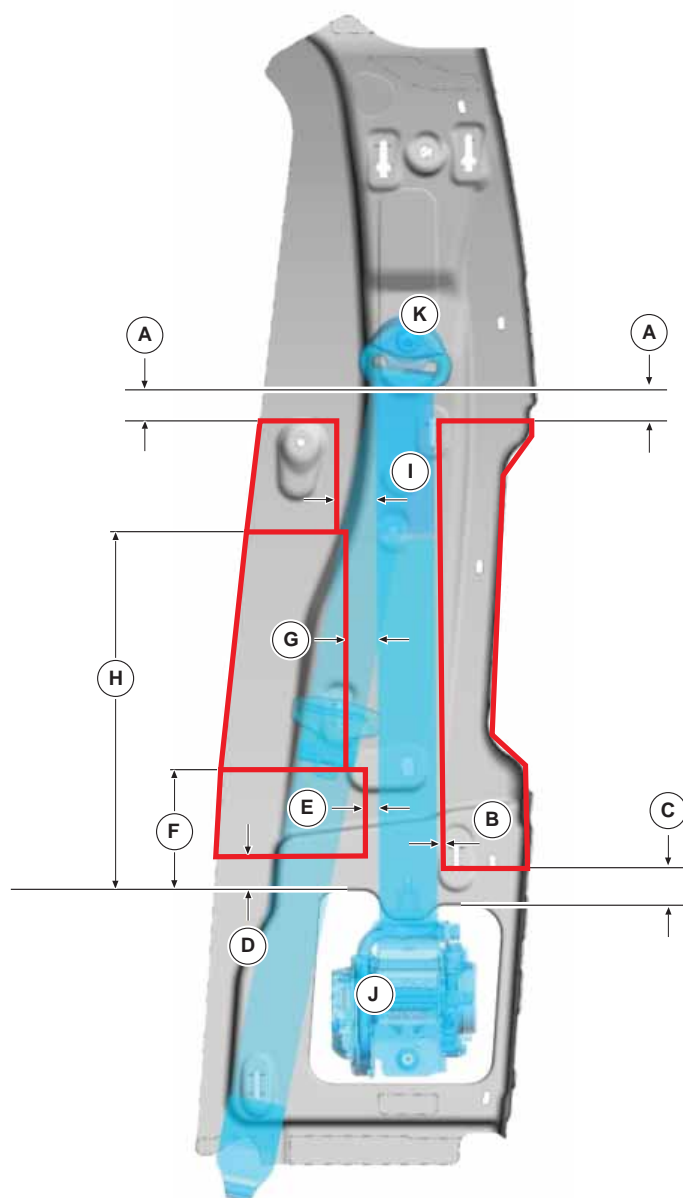
When reinstalling, fit the retractor to the body first and gently pull the webbing out of the retractor to allow fitment of the D loop. Then remove the forked retainer. If the retractor is locked, allow a small amount of webbing to reel back into the retractor to allow the webbing lock to release. Do not attempt to release the retractor by pulling on the webbing with significant force or by manually interfering with the locking mechanism.

5.3.1 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 |

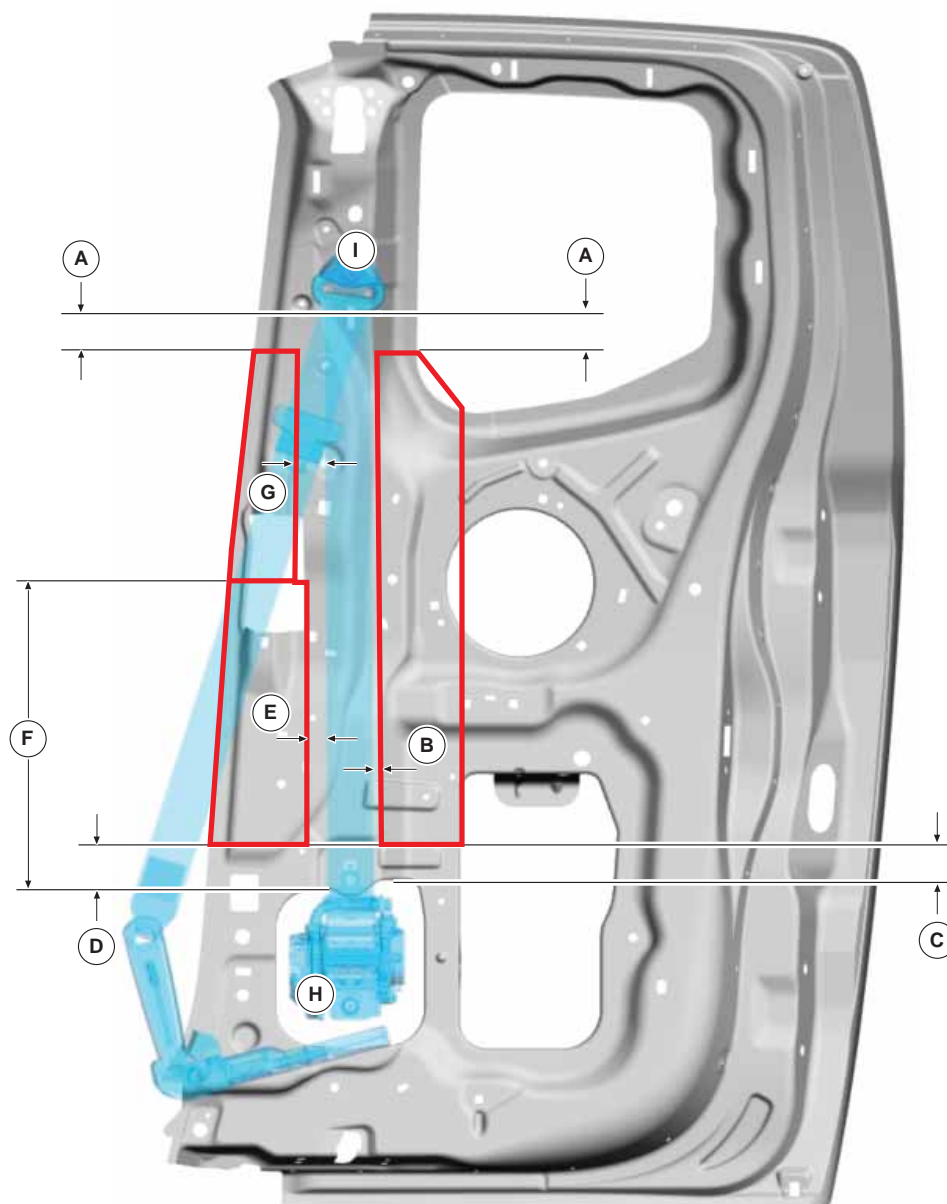
NOTE: Right hand side shown, left hand side mirrored.

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

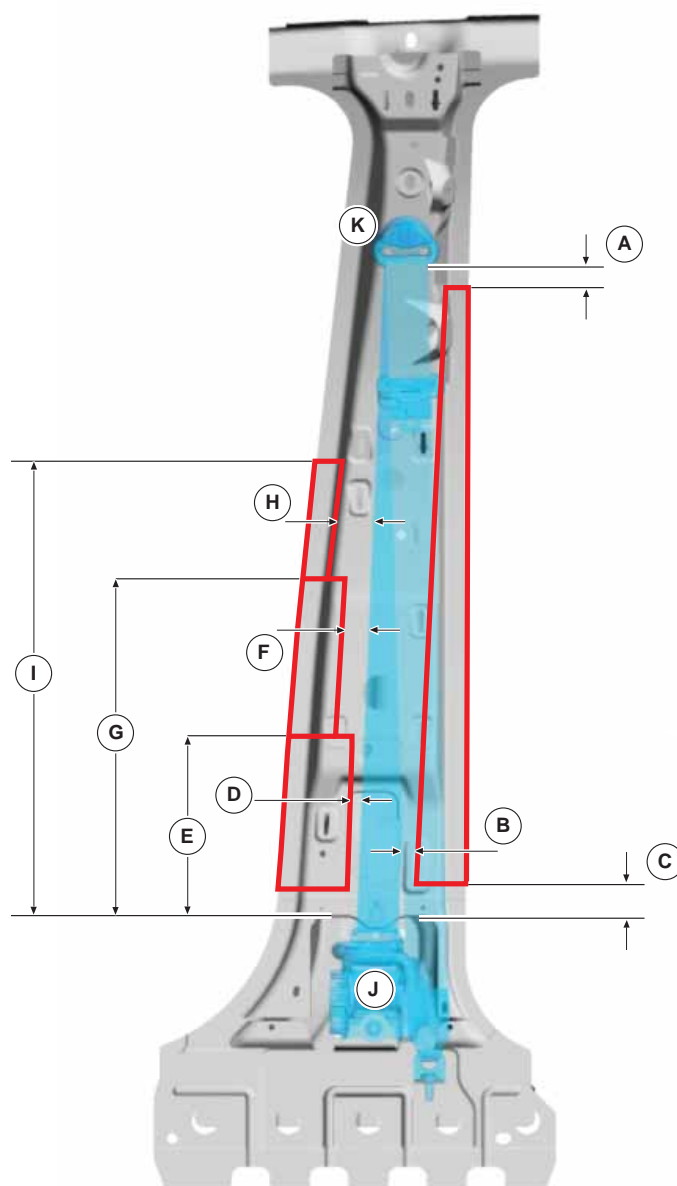
| Item | - |
|------|---|
| A | 30mm below bottom of D-ring |
| B | 15mm right of webbing |
| C | 30mm above retractor hole (right hand side) |
| D | 30mm above retractor hole (left hand side) |
| E | 25mm left of webbing |
| F | 280mm above retractor hole (left hand side) |
| G | 35mm left of webbing |

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

NOTE: Right hand side shown, left hand side mirrored.

| 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 |

5.4 Corrosion Prevention

5.4.1 General

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.

5.4.2 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.


5.4.3 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.

5.4.4 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.**

5.4.5 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.

5.5 Frame and Body Mounting

5.5.1 Mounting Points and Tubing

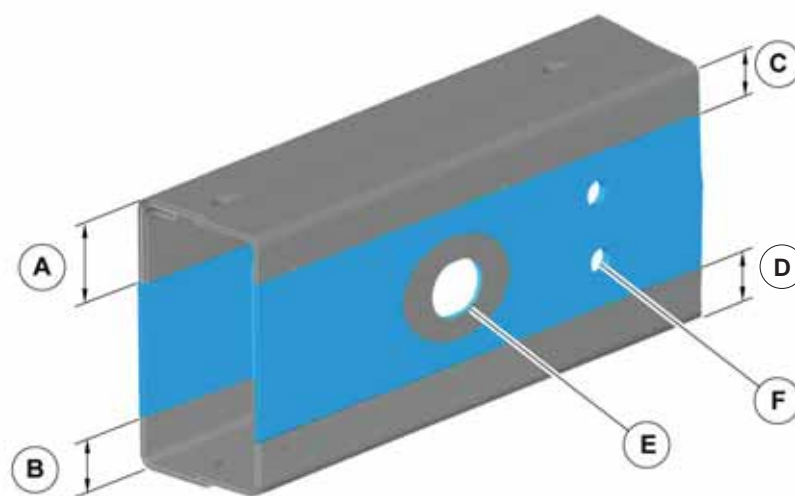
⚠ WARNING: Drilling into reinforcements and load paths may have a detrimental affect on crash performance. Vehicle Converter shall confirm any changes comply with general product safety requirements, legal requirements or type approvals

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: 5.4 Corrosion Prevention (page 150).

Frame Drilling and Welding



E134173

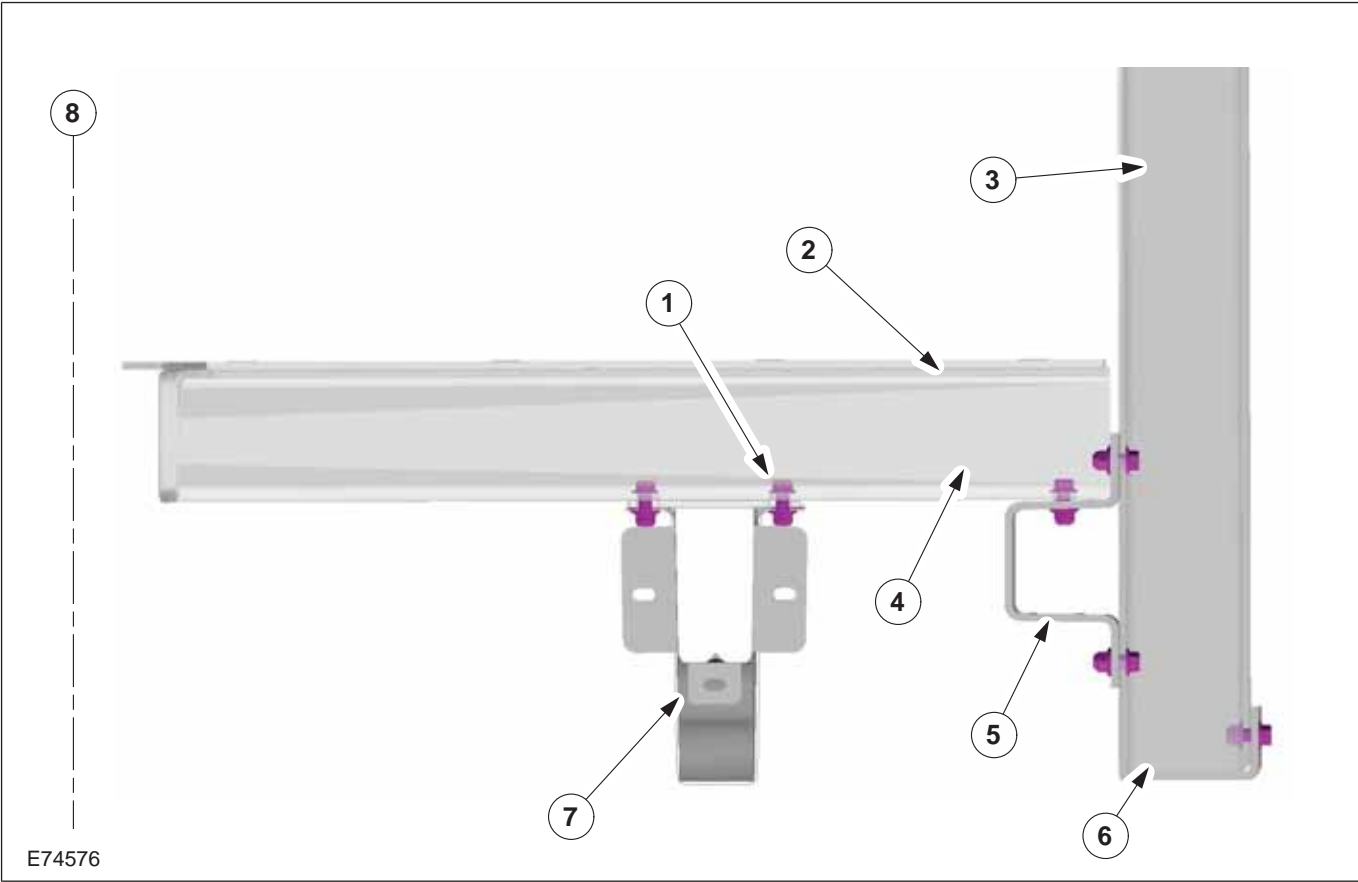
Dimensions (mm) for Body Attachment Holes in Chassis Frame Top Flange

| 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. |

- No welding permitted except as detailed below:
- To make holes in frames do not use a gas flame. Drill holes using sharp drills.
- Use cold riveting only when attaching brackets with rivets.
- 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
- 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.
- Holes must NOT be drilled near side member profile changes.
- Existing holes in top and bottom flanges must NOT be bored out.
- No more than two holes are to be drilled in a vertical line down from the frame web.
- 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



| 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 109).

5.5.2 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: 5.5 Frame and Body Mounting (page 151).

- 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.

5.5.3 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: 5.4 Corrosion Prevention (page 150).

- 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: 5.4 Corrosion Prevention (page 150).

5.5.4 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.

5.5.5 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.

5.5.6 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.

5.5.7 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

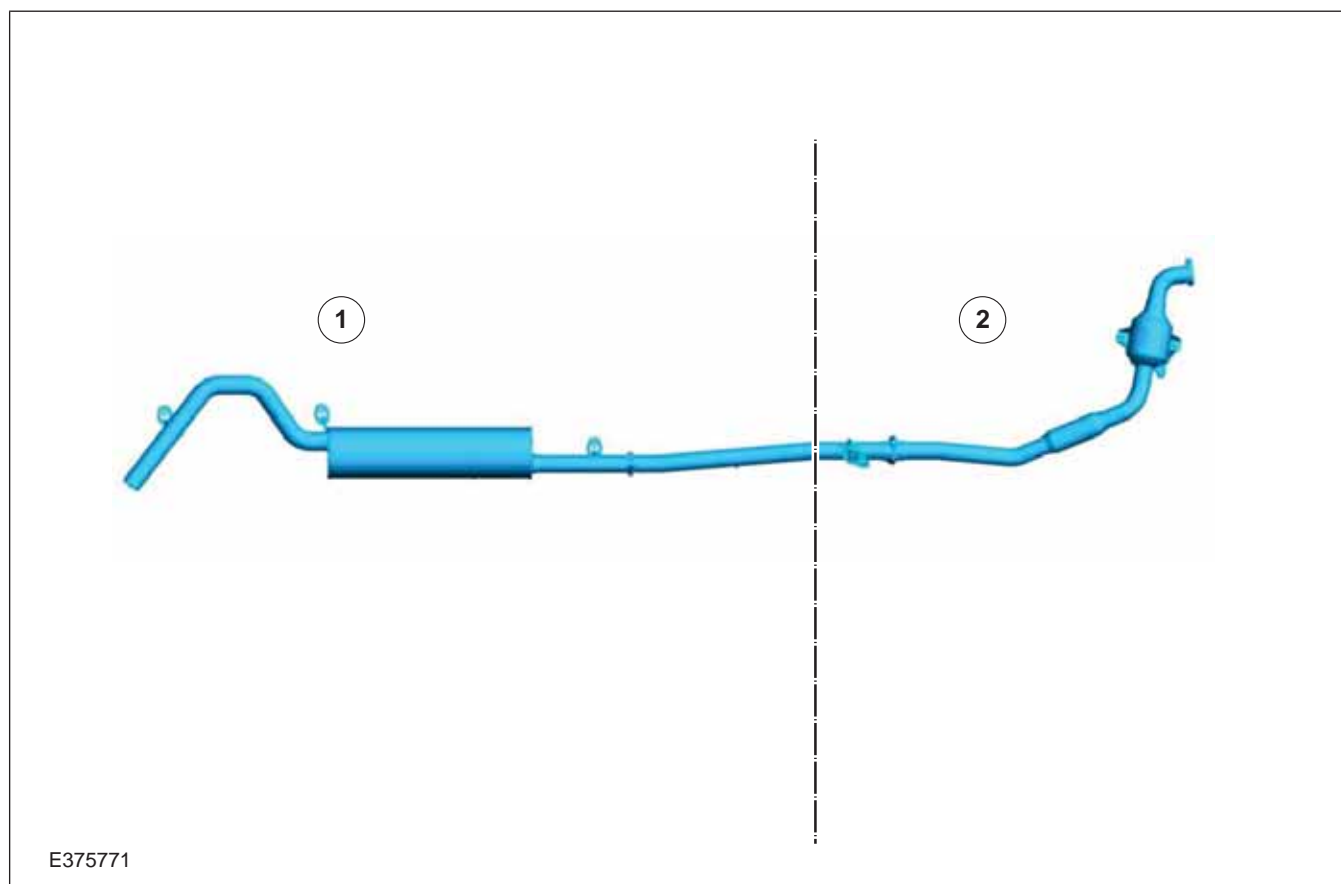
WARNINGS:

-  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.
-  **CAUTION:** 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.

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.

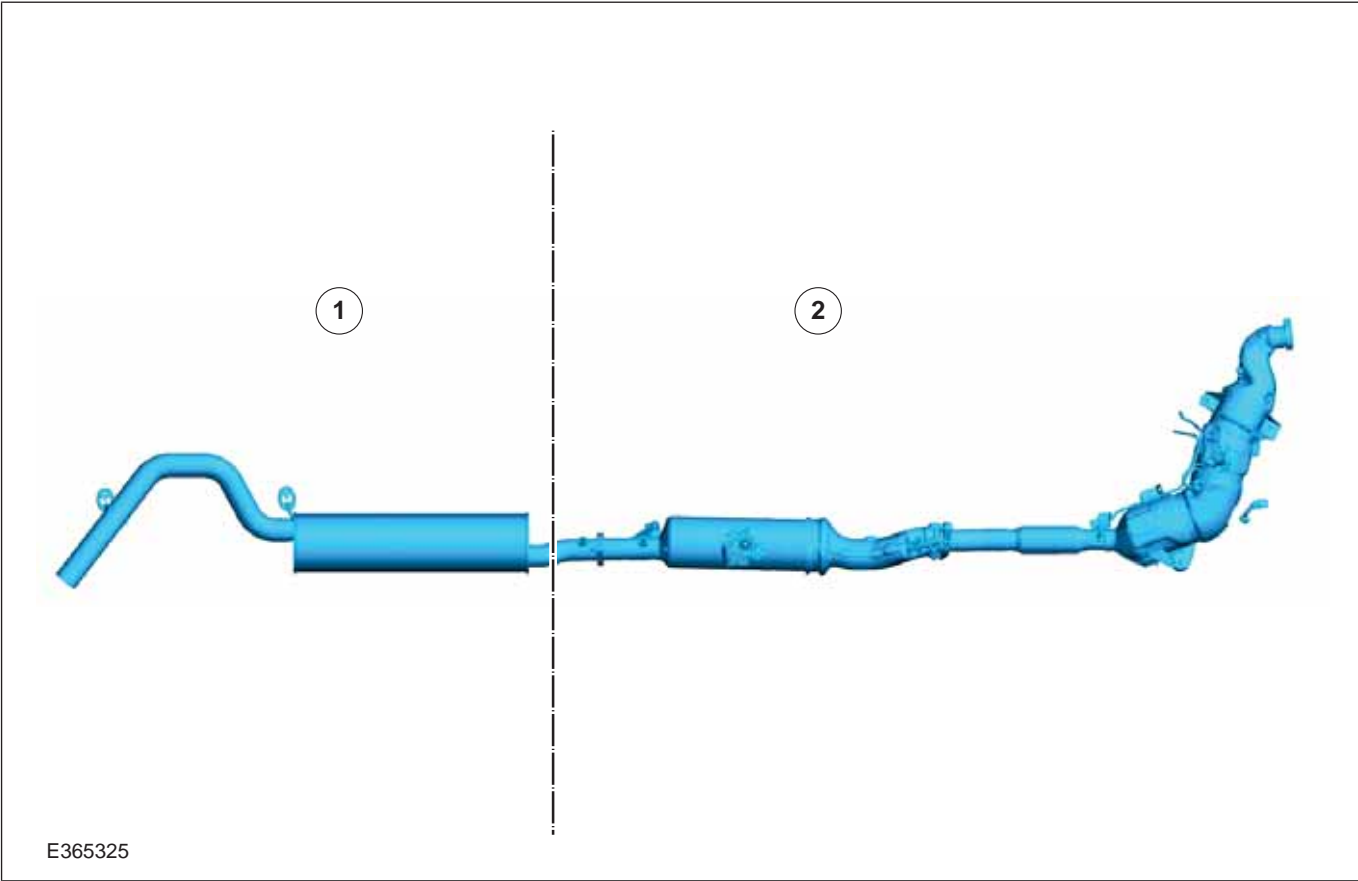
Vehicles equipped with Stage 6.2 Emissions controls require careful consideration and planning around the extension of the exhaust.

Exhaust modifications to support long wheelbase conversions are limited to the section of exhaust downstream from the indicated point in the images below:

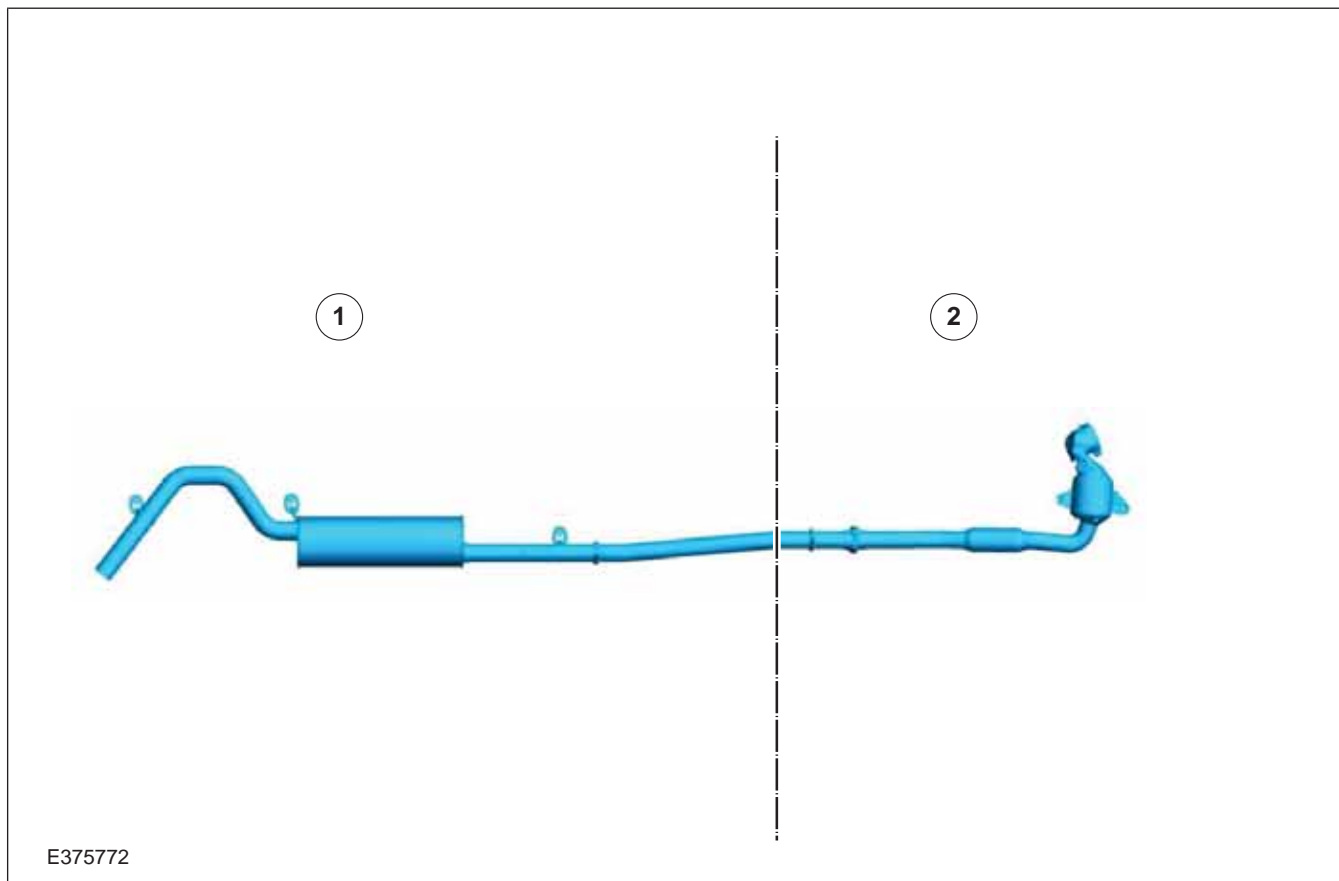
2.0L Single Turbo Diesel Engine - Stage 4 Emissions

| Item | Description |
|------|--------------------|
| 1 | Modification Zone |
| 2 | DO NOT MODIFY Zone |

2.0L Single Turbo Diesel Engine - Stage 5 Emissions

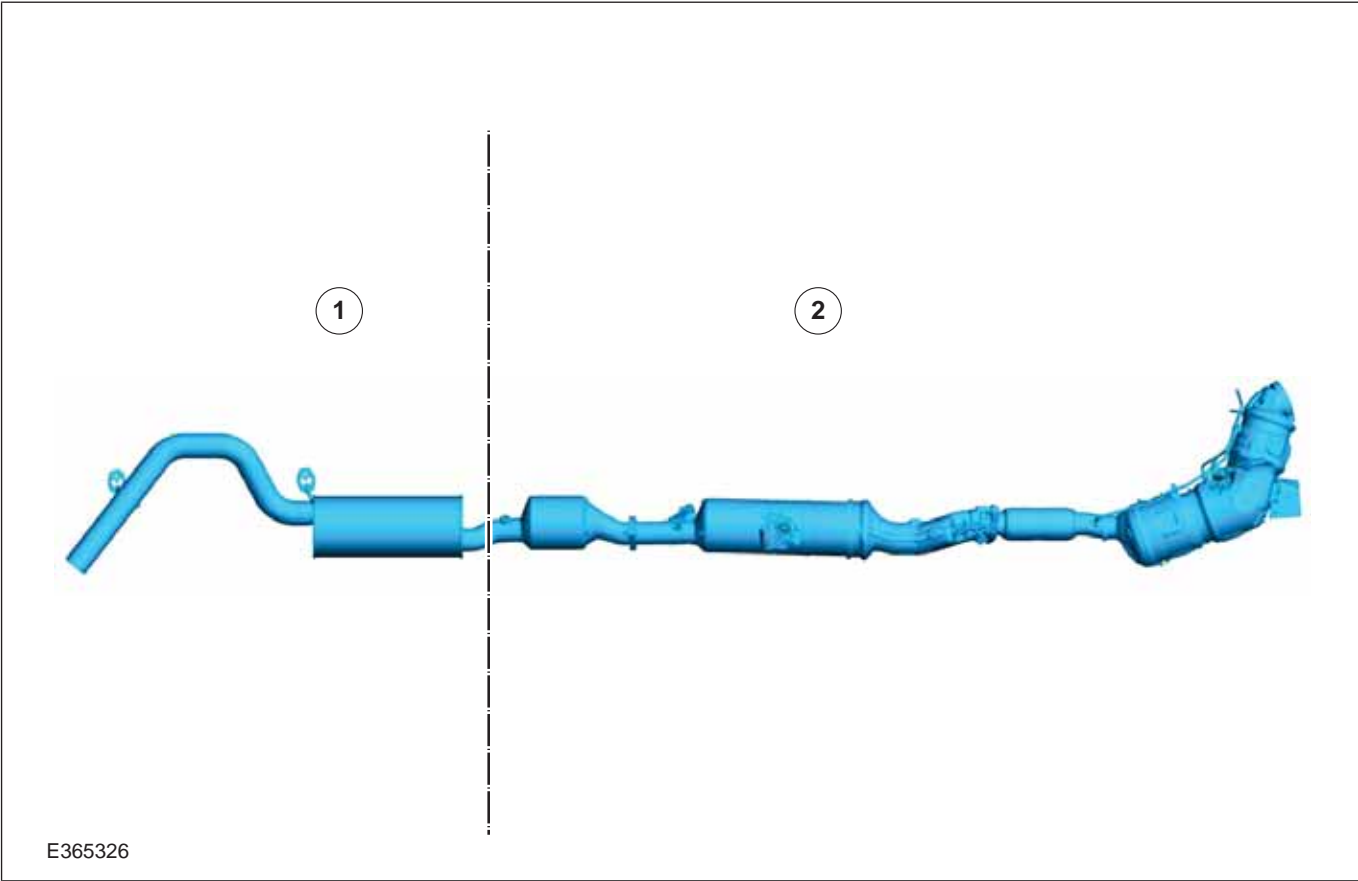


| Item | Description |
|------|--------------------|
| 1 | Modification Zone |
| 2 | DO NOT MODIFY Zone |

2.0L Bi-Turbo Diesel Engine - Stage 4 Emissions

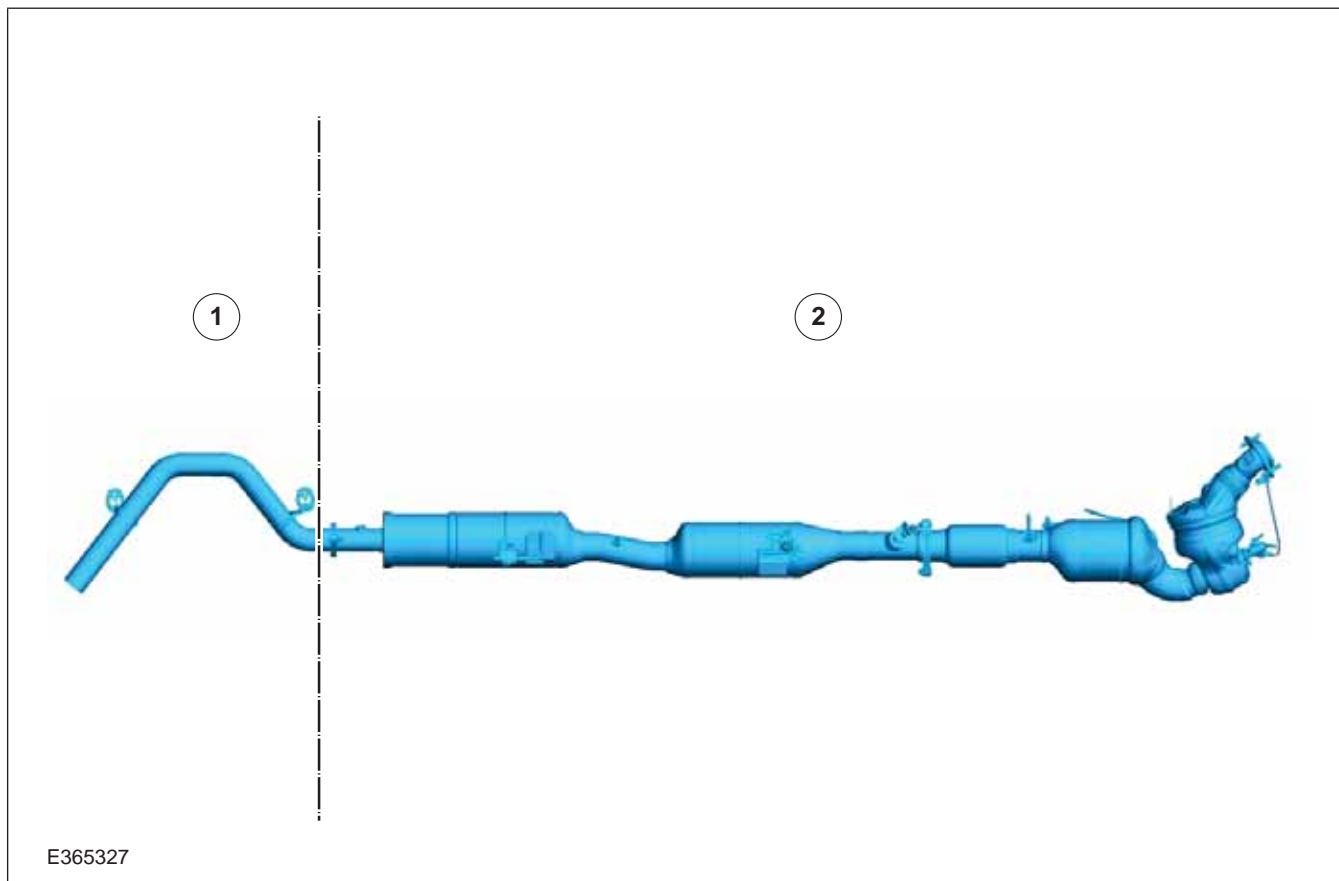
| Item | Description |
|------|--------------------|
| 1 | Modification Zone |
| 2 | DO NOT MODIFY Zone |

2.0L Bi-Turbo Diesel Engine - Stage 5 Emissions



| Item | Description |
|------|--------------------|
| 1 | Modification Zone |
| 2 | DO NOT MODIFY Zone |

3.0L Turbo Diesel Engine - Stage 5 Emissions



| 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.

| | |
|---|-----|
| A | |
| About this Publication..... | 5 |
| Adaptive Cruise Control..... | 99 |
| Additional External Lamps..... | 88 |
| Aids for Vehicle Entry and Exit..... | 19 |
| Air Bags..... | 137 |
| Airbag Supplemental Restraint System (SRS)..... | 137 |
| Alternative Type Approval..... | 6 |
| Ancillary Equipment - Sub Frame Mounting..... | 153 |
| Area for Fitting Additional Body Attachments to the Rear of the Bumper..... | 153 |
| Automatic High Beam Control..... | 97 |
| Axle Breather Vent Hose..... | 63 |
| Axle Breather Vent Hose - Raptor..... | 64 |

| | |
|--|-----|
| B | |
| Battery and Cables..... | 67 |
| Battery Information..... | 67 |
| Blind Spot Information System..... | 103 |
| Body..... | 109 |
| Body Structures - General Information..... | 109 |
| Brake Hoses..... | 53 |
| Brake (Stop) Lamps)..... | 93 |
| Brake System..... | 53 |

| | |
|--|-----|
| C | |
| Cargo Management on Vehicle Tub..... | 129 |
| Center of Gravity..... | 44 |
| Central Locking..... | 107 |
| Centre High Mount Stop Lamp (CHMSL)..... | 97 |
| Chassis Cab Body - Basic Dimensions and Weights..... | 35 |
| Chassis Cab Body - Basic Dimensions and Weights - Raptor..... | 37 |
| Chassis Cab..... | 113 |
| Commercial and Legal Aspects..... | 6 |
| Connection of Auxiliary Loads / Accessories - Vehicles with Factory Fit Auxiliary Switches, Wiring and Fuse Box..... | 73 |
| Conversion Effects on Parking Aids..... | 19 |
| Corrosion Prevention..... | 150 |
| Cruise Control..... | 99 |

| | |
|-------------------------------|-----|
| D | |
| Drilling and Welding..... | 8 |
| Driver Assist Technology..... | 100 |
| Driver Field of View..... | 19 |
| Driver Reach Zones..... | 19 |

| | |
|--|----|
| E | |
| Electrically Operated Door Mirrors..... | 97 |
| Electromagnetic Compatibility (EMC)..... | 9 |
| Electronic Engine Controls..... | 81 |
| Emissions Performance & In-service compliance..... | 6 |
| Engine Cooling Airflow Envelopes..... | 54 |
| Engine..... | 54 |
| Engine Selection for Conversions - Raptor..... | 55 |
| Exterior Lighting..... | 85 |

| | |
|--|-----|
| F | |
| Frame and Body Mounting..... | 151 |
| Frame Drilling and Tube Reinforcing..... | 153 |

| | |
|--|-----|
| Front, Rear and Side Under-Run Protection..... | 38 |
| Front End Integrity for Cooling, Crash, Aerodynamics and Lighting..... | 126 |
| Front Fender Liner..... | 135 |
| Fuel Filler Mounting..... | 56 |
| Fuel Filler Mounting - Raptor..... | 61 |
| Fuel Filler Pipe Restraining During Shipping..... | 56 |
| Fuel Filler Vent Hose - (Diesel)..... | 62 |
| Fuel System..... | 56 |
| Fuses and Relays..... | 108 |
| Fuses..... | 108 |

| | |
|---|---------|
| G | |
| Galvanic (bi-metallic) Corrosion..... | 150 |
| General..... | 53, 150 |
| General Component Package Guidelines..... | 19 |

.....5, 9

| | |
|---|---------|
| G | |
| General..... | 53, 150 |
| General Product Safety Requirement..... | 7 |
| Generator and Alternator..... | 76 |
| Genuine Ford Accessory Bull Bar..... | 127 |
| Glare Free High Beam..... | 98 |
| Gross Vehicle Mass and Axle Load Ratings..... | 38 |

| | |
|--|-----|
| H | |
| Handles, Locks, Latches and Entry Systems..... | 107 |
| Hardware—Specifications..... | 39 |
| Headlamps - Connection of Auxiliary Driving Lamp Signal..... | 89 |

| | |
|---|-----|
| I | |
| Information and Entertainment System..... | 82 |
| Integrated Bodies and Conversions..... | 109 |
| Integrated Bodies and Conversions - Raptor..... | 112 |

| | |
|--------------|----|
| J | |
| Jacking..... | 12 |

| | |
|----------------------------|----|
| K | |
| Kerb Mass and Payload..... | 38 |

| | |
|--|-----|
| L | |
| Lamps – Hazard / Direction Indication..... | 96 |
| Lane Centering Assist..... | 106 |
| Lane Keeping System..... | 106 |
| Legal and Vehicle Type Approval..... | 6 |
| Legal Obligations and Liabilities..... | 7 |
| Lifting..... | 14 |
| Load Distribution—Specifications..... | 40 |
| Load Distribution Calculations - Driver and Passenger Weight Distribution..... | 40 |
| Long Range Fuel Tanks..... | 63 |
| Long Wheelbase Conversions..... | 154 |

| | |
|--|-----|
| M | |
| Minimum Requirements for Brake system..... | 8 |
| Mounting Points and Tubing..... | 151 |

N

| | |
|---|----|
| Noise, Vibration and Harshness (NVH)..... | 16 |
|---|----|

P

| | |
|--|-----|
| Package and Ergonomics—Specifications..... | 30 |
| Package and Ergonomics..... | 19 |
| Painting Road Wheels..... | 150 |
| Parking Aid..... | 77 |
| Position (Park) Lamps)..... | 93 |
| Product Liability..... | 7 |

R

| | |
|--|-----|
| Rear Combination lamps..... | 86 |
| Rear Fog Lamp..... | 86 |
| Rear License Plate Lamp..... | 87 |
| Rear Under-Run Protection - Cab Chassis Vehicles..... | 38 |
| Rear View Camera..... | 82 |
| Recommended Body Dimensions..... | 30 |
| Recommended Body Dimensions - Raptor..... | 32 |
| Recommended Maximum Main Load Area Dimensions..... | 25 |
| Recommended Maximum Main Load Area Dimensions - Raptor..... | 26 |
| Registration Plates..... | 29 |
| Repairing Damaged Paint..... | 150 |
| Restraints System..... | 7 |
| Reversing Lamps, Rear View Camera, Reversing Alarm (Manual Transmission)..... | 94 |
| Road Safety..... | 8 |
| Roof Racks..... | 127 |

S

| | |
|--|-----|
| SeatBelts - No DRILL ZONES..... | 145 |
| Seatbelt Systems..... | 145 |
| Self-Supporting Body Structure..... | 152 |
| Sensor Location..... | 78 |
| Side View Camera..... | |
| Supplementary Restraint Sensors (Front)..... | 143 |
| Suspension System..... | 52 |

T

| | |
|--|-----|
| Tachograph..... | 81 |
| Tank and Dry Bulk Carriers..... | 127 |
| Terminology..... | 6 |
| Tipper Bodies..... | 126 |
| Towing Capacities and Specifications..... | 51 |
| Towing Requirements..... | 51 |
| Towing..... | 51 |
| Trailer Brake Connection..... | 53 |
| Trailer Towing - Lighting Connections..... | 94 |

U

| | |
|---|-----|
| Under Body Protection and Material..... | 150 |
|---|-----|

V

| | |
|---|----|
| Vehicle Cabin Clearance..... | 38 |
| Vehicle Dimensions Key..... | 22 |
| Vehicle Dimensions Key - Raptor..... | 24 |
| Vehicle Duty Cycle Guidelines..... | 11 |
| Vehicle Ride and Handling Attributes..... | 11 |
| Vehicle Speed Signal..... | 81 |

| | |
|---|--|
| Vehicle Transportation Aids and Vehicle | |
|---|--|

| | |
|--------------|----|
| Storage..... | 17 |
|--------------|----|

| | |
|----------------------|----|
| Vehicle Weights..... | 48 |
|----------------------|----|

W

| | |
|---|-----|
| Warranty on Ford Vehicles..... | 6 |
| Water Tank on Camper Vehicles..... | 154 |
| Whole Vehicle Type Approval (2007/46/EC) Regulations..... | 6 |
| Wiring Installation and Routing Guides..... | 65 |
| Wiring Splicing Procedures..... | 65 |
| Wiring Through Cabin Sheet Metal..... | 65 |
| WLTP Frontal Area Calculation..... | 26 |
| WLTP Frontal Area Calculation - Raptor..... | 28 |
| Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs..... | 21 |
| Worldwide Harmonized Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs - Raptor..... | 22 |

