

FORD **Transit Custom** Body and Equipment Mounting Manual



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1.1 About this Manual

1.1.1 Introduction

The intention of this manual is to support the conversion industry. Although individual or private users can benefit from this manual, as a manufacturer, we want to provide genuine conversion businesses with information needed for vehicle conversion/modification. If, as a Vehicle Converter, the information you require is not in this manual or you have further questions, please contact your National Sales Company representative, or local Ford dealer.

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

Any changes made to the vehicle must be made by a competent person and, on completion, the vehicle must be returned to a safe state.

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

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

All references to Gulf Standardization Organization (GSO) standards apply across Gulf Cooperation Council (GCC) member states, alongside applicable local national legislation. Where no specific GSO technical regulation exists, reference to the corresponding harmonized United Nations Economic Commission for Europe (UNECE) regulation is recommended.

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

This manual may contain references to features and options that have not been fitted to your particular vehicle. Variations occur across territories and can also be affected by external factors.

1.1.2 How to Use This Manual

This manual covers vehicle conversion procedures.

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

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

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

In some sections of the book it may refer you to additional sections for information. The links have been provided in blue text. Page numbers have also been provided. There is also an alphabetical index at the back of the manual. As with the content pages, you will be able to link to sections. To do this just click on the page number.

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

All references to GSO standards apply across Gulf Cooperation Council (GCC) member states, alongside applicable local national legislation. Where no specific GSO technical regulation exists, reference to the corresponding harmonized United Nations Economic Commission for Europe (UNECE) regulation is recommended.

As you read through this manual, you will come across: WARNINGS, CAUTIONS and NOTES. If a warning, caution or note is placed at the beginning of a series of steps, it applies to multiple steps

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

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

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

1.1.3 Important Safety Instructions

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

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

1.2 About this Publication

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

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

1.2.1 Main changes to this publication - October 2026

- All new publication.

1.3 Commercial and Legal Aspects

1.3.1 Terminology

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

Vehicle Convertor 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.

Unique component or similar wording refers to non-Ford specified or after sale fitments not covered by Ford warranty.

1.3.2 Warranty on Ford Vehicles

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

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

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

The Vehicle Convertor 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 Convertor, unless Ford has given its prior written consent to such liability.

1.3.3 Emissions Performance

Vehicle Convertors and secondary-stage manufacturers are advised to verify whether any fitted components or vehicle modifications require compliance with the latest Gulf Standardization Organization (GSO) Technical Regulations, or conformity to the applicable Model Year approvals, prior to vehicle registration.

Additionally, Vehicle Convertors must confirm whether modified vehicles are subject to re-registration, inspection, or re-certification under local national regulations in the country where the vehicle will be registered or put into service.

1.3.4 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 Convertor.**

- The Transit 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.

When the conversion needs a new approval, the following information must be quoted:

- All dimensional, weight and centre of gravity data.
- The fixing of the body to the donor vehicle.
- Operating conditions.

The responsible Technical Service may require additional information and/or testing.

1.3.5 Multi Stage Type Approval

The Vehicle Convertor must agree all modifications and impacted regulatory requirements with the relevant approval authority and technical service. Any changes to the vehicle operating conditions must be advised to the customer.

1.3.6 Legal Obligations and Liabilities

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

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

1.3.7 General Product Safety Requirement

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.**
-  **The travel and function of pedals must not be restricted.**
-  **Do not modify or remove heat protection shields.**
-  **Do not remove labels provided with the base vehicle. Ensure appropriate visibility.**
-  **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.**
-  **For component traceability, it is imperative that components removed during the conversion process are refitted to the same vehicle, in accordance with Ford Workshop Manual procedures.**
-  **CAUTION: Ensure that components removed during conversion are kept clean and dry.**

The Vehicle Convertor shall ensure that any vehicle it places on the market complies with latest GSO technical regulations list or conformity to the applicable Model Year approvals (as amended periodically) alongside applicable local national legislation relating to the safe carriage of loads on public roads. The Vehicle Convertor 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 Convertor 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 Convertor 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.

1.3.8 Product Liability

The Vehicle Convertor 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 Convertor or any of its agents. Ford shall not be liable for any such liability (except as provided by law).

The Vehicle Convertor or equipment manufacturer is liable for the:

- Operational reliability and road-worthiness of the vehicle to its original intent.
- Operational reliability and road-worthiness of any component or conversion, not listed in original Ford documentation.

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

1.3.9 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.**

Refer to: 5.9 Airbag Supplemental Restraint System (SRS) (page 109).

1.3.10 Drilling and Welding

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

Refer to: 5.1 Body (page 91).

1.3.11 Minimum Requirements for Brake system

It is not recommended to modify the braking system. If a special conversion should require modifications:

- maintain original settings.
- maintain brake certification load distribution.

Changes to the Anti-lock Braking System (ABS), Traction Control System (TCS) and Electronic Stability Control ESC (also known as ESP) system are not permitted.

1.3.12 Road Safety

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

1.4 Electromagnetic Compatibility (EMC)

1.4.1 Electromagnetic Compatibility (EMC)

WARNINGS:

-  **Do not place objects or mount equipment on or near the airbag cover, on the side of the seatbacks (of the front seats), or in front seat areas that may come into contact with a deploying airbag. Failure to follow these instructions may increase the risk of personal injury in the event of a crash.**
-  **Do not fasten antenna cables to vehicle wiring, pipes, or hoses.**
-  **Keep antenna and power cables at least 100mm from any electronic modules and airbags.**

NOTE: Ford Motor Company test and certify vehicles to meet applicable electromagnetic compatibility requirements. It is the Vehicle Convertors responsibility to make sure that any equipment an authorized dealer installs on your vehicle complies with applicable local national 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 the vehicle (such as cellular telephones and amateur radio transmitters) must keep to the parameters in the following illustrations and table. Ford Motor Company do not provide any other special provisions or conditions for installations or use.

NOTE: After the installation of RF transmitters, check for disturbances from and to all electrical equipment in the vehicle, both in the standby and transmit modes.

NOTE: Only fit one antenna in the positions shown to the roof of your vehicle.

NOTE: For EMC on Police conversions with rear view cameras please contact your National Sales Company representative, or local Ford dealer.

Permitted Antenna Locations



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Frequency Overview

Frequency Band MHz	Maximum Output Power Watts (Peak RMS)	Antenna Position
1-30	50W	1
50-54	50W	1, 2
68-87	50W	1, 2
144-174	50W	1, 2
380-512	50W	2, 3
806-940	10W	2, 3

Check all electrical equipment:

- With ignition **ON**.
- With the engine running.
- During a road test at various speeds.

Check that electromagnetic fields generated inside the vehicle cabin by the transmitter installed do not exceed applicable human exposure requirements.

1.5 Vehicle Duty Cycle Guidelines

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.

1.5.1 Vehicle Ride and Handling Attributes



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

NOTE: Raising the centre of gravity will affect ride and handling.

NOTE: The vehicle should be evaluated for safe operation prior to sale.

1.6 End of Life Vehicle (ELV) Directive

At the end of the vehicle's operational life, all decommissioning, dismantling, and disposal activities must be performed by certified, qualified personnel in accordance with applicable national and local environmental regulations across GCC member countries.

Prior to vehicle dismantling or shredding, the following actions must be taken:

- All low-voltage batteries, operating fluids (engine oil, coolant, refrigerants, hydraulic fluids, brake fluid), and pyrotechnic safety devices (airbags, seatbelt pretensioners) must be safely removed by qualified technicians.
- Removed fluids and hazardous substances must be handed over exclusively to licensed, authorized hazardous waste management and recovery facilities.
- Metallic, polymer, and glass components should be segregated where feasible to facilitate high-rate recovery, reuse, and recycling.

Vehicle Convertors and secondary-stage upfitters who install supplementary battery packs, auxiliary power units (APUs), specialized hydraulic systems, or secondary fluid circuits assume full statutory responsibility under local EPR and waste management legislation for the safe decommissioning, recovery, and compliant recycling of those added components.

Vehicle Convertors must ensure all upfitted electrical and energy storage systems are fully documented to facilitate safe downstream dismantling.

1.7 Jacking

WARNINGS:

-  **Always position the vehicle on a hard level surface. If the vehicle must be jacked up on a soft surface use load spreading blocks under the jack. Always chock the wheel diagonally opposite the jacking point. Failure to follow these instructions may result in personal injury.**
-  **Only the specified jacking points may be used for jacking up and supporting the vehicle.**
-  **Never place blocks of wood or similar underneath the vehicle jack in order to jack up the vehicle on soft ground. Failure to observe this instruction can lead to injuries.**

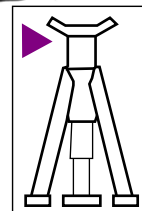
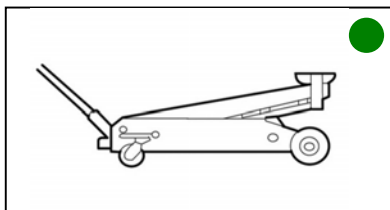
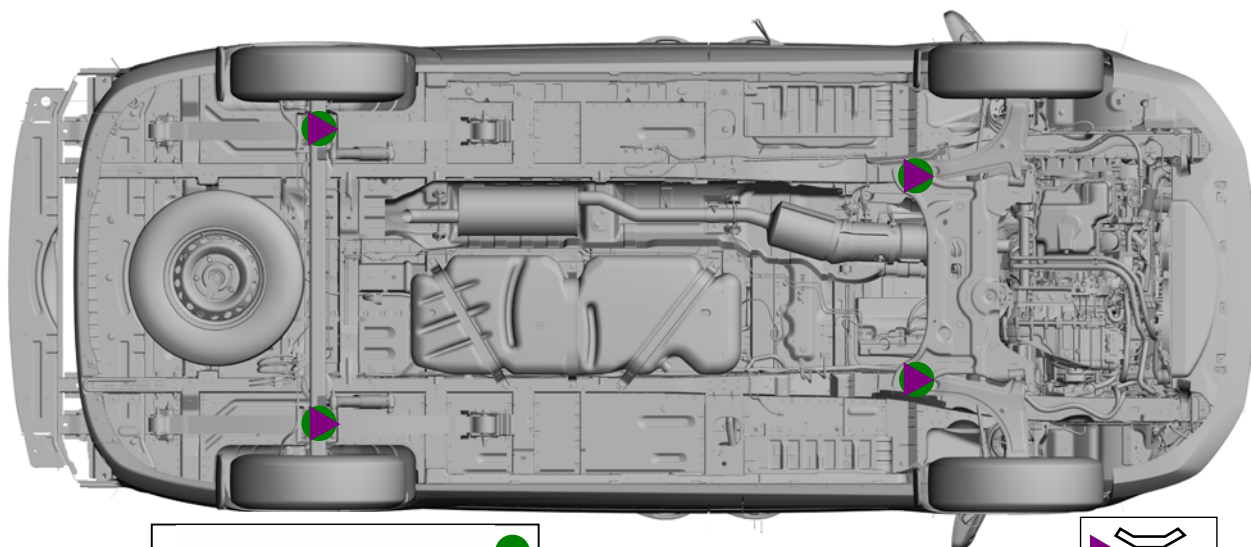
CAUTIONS:

-  **It is important that only the correct jacking and support locations are used at all times. Other positions may damage the body, steering, suspension, engine, braking system or the fuel lines.**
-  **Make sure that access to the spare wheel is maintained when converting the vehicle or relocating the spare wheel.**
-  **Ensure there is sufficient clearance when positioning the jacking equipment to prevent damage of any underfloor components.**

NOTE: When using the vehicle jack, refer to the Owner's Manual for correct operating instructions.

NOTE: Make sure that reinforcements are installed to maintain the integrity of the original body structure for/at jacking points.

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



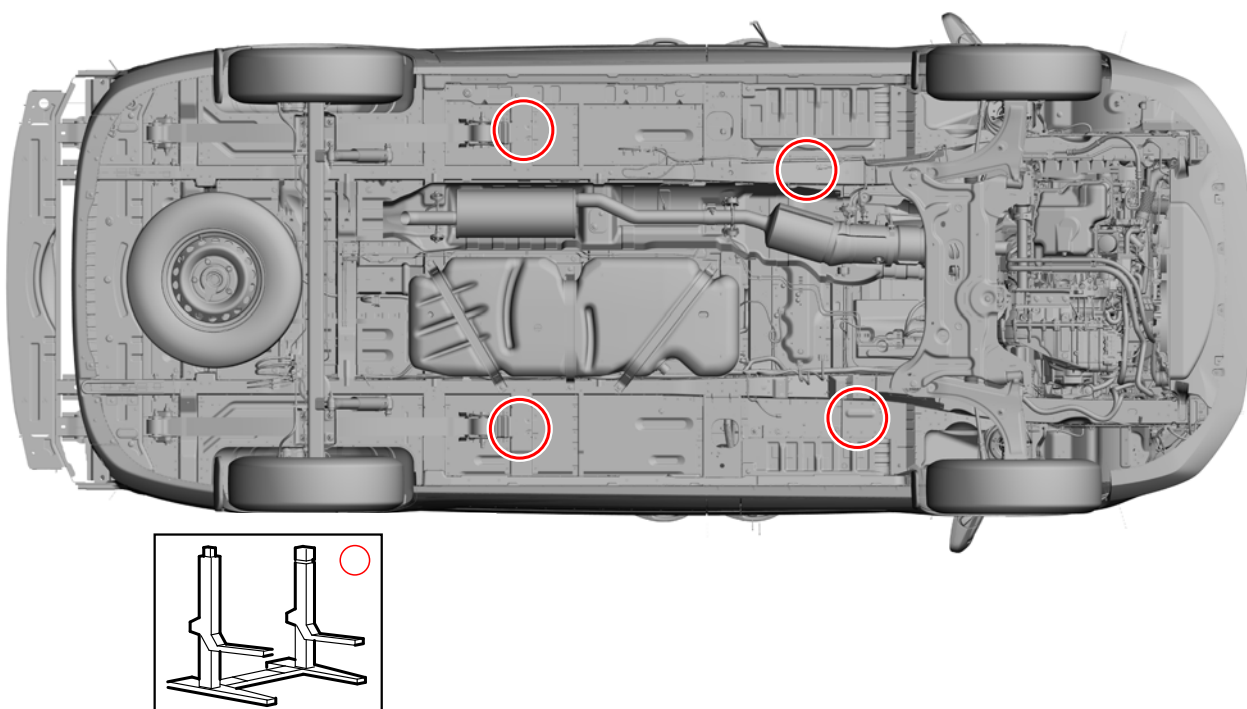
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1.8 Lifting

⚠ 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 personal injury.

CAUTIONS:

- ⚠** When lifting the vehicle with 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.
- ⚠** Ensure there is sufficient clearance when positioning the lifting equipment to prevent damage of any underfloor components.
- ⚠** When lifting the L2 variant with a two-post lift, place blocks under the rear lifting points.



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1.9 Noise, Vibration and Harshness (NVH)

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

1.10 Vehicle Transportation Aids and Vehicle Storage

 **WARNING: Transport Mode will reduce the risk of Powertrain System damage from multiple starts without sufficient engine run time to warm the vehicle up to normal operating temperatures. Exiting Transport Mode prior to upfitting/conversion increases the risk of Powertrain System damage.**

In addition:

- The windscreen wipers should be lifted off the glass and set right up.
- All air intakes should be closed.
- To avoid flat-spotting, tire pressures should be increased but **MUST NOT** exceed the maximum tire pressure marked on the tires side wall.
- The brakes and parking brake release fully.
- 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.

NOTE: Please refer to Owner's Manual for further information on preparing the vehicle for storage.

Vehicle Convertors 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 (up to 14 days):

- Wherever possible, vehicles should be stored in an enclosed, dry, well-ventilated area. This area must be 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 of the vehicle.

Long term storage (over 14 days):

- It is important to maintain the integrity of the 12V battery. The battery may be disconnected but not removed from the vehicle. A minimum charge level should be maintained through the use of a mains trickle charger or solar charger, you can also start the engine to charge the battery to 12.7V. After the vehicle is fully charged, do not keep the batteries on charge.
- The wiper blades should be removed and placed inside the vehicle. Make sure the wiper arms are suitably prevented from resting on the windscreen.
- Wheel trims (where fitted) should be removed and stored in the luggage compartment.
- Engage first gear (manual transmission) or place in park position 'P' (automatic transmission) 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 at manufacturing 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, bonnet, lift gate, tailgate, luggage compartment lid, convertible top and roof opening panel are completely closed and the vehicle is locked.

Action / Time In Storage	Receiving	Every 15 Days	Monthly	Every 3 Months	Before Shipping
Check vehicle is clean	X	-	X	-	X
Remove external contamination	X	-	X	-	X
Visually check tires	X	-	X	-	X
Check interior for condensation	X	-	-	X	X
Run engine for 5 minutes minimum with air conditioning switched on, where applicable (ICE only)	X	-	-	X	-
Check 12V battery condition (recharge if necessary)	X	X	X (if connected)	X (if disconnected)	X

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.

LV 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 monthly 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.

LV Battery Drain Prevention: As part of the Vehicle Converter process and to maximise battery life and prevent premature failure of the Ford batteries, protect and prevent battery discharge during any conversion or whilst the vehicle is in storage. This may include leaving the vehicle in Transport mode as long as possible, reducing the amount of crank cycling around the facility, door ajar events and duration. The voltage **MUST** be checked when receiving and before shipping. If the vehicle battery voltage is below 12.4 V, recharge it with a suitable battery charger or start the engine to charge the battery. This applies to all types of 12 V batteries. Measure connected to the vehicle at ignition off and no loads active including interior or exterior lights in Off status.

Refer to: [4.5 Battery and Cables \(page 62\)](#).

- At no time should vehicles sit with the key in the ignition and the engine not running.
- Vehicles with push button start should not be left in accessory or run mode.
- All electrical features should be in the off position.
- All doors and hatches need to be completely closed.
- Keep ignition off (blade keys removed from ignition cylinder).
- Do not use indicators, fuel doors or headlights to "mark" a vehicle's status, for example to signal that a repair is finished or a vehicle is ready for collection.
- Ensure automatic transmission gear shifter is in Park (P) when the vehicle is stationary.

1.11 Package and Ergonomics

1.11.1 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 Convertor has to ensure that sufficient clearance is maintained, under all drive conditions, to moving components such as axles, fans, steering, braking system etc.

The Vehicle Convertor is responsible for all installed components during the conversion. The durability has to be confirmed by appropriate test procedures.

1.11.2 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.

1.11.3 Driver Field of View

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

1.11.4 Conversion Effects on Parking Aids

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

NOTE: If a rear step is fitted that requires the deactivation of the rear parking sensors, a service routine is available in FDRS (Rear Step Configuration).

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

Refer to: [4.11 Exterior Lighting \(page 77\)](#).

1.11.5 Aids for Vehicle Entry and Exit

Steps

WARNINGS:

 **Make sure that the modified vehicle complies with all relevant regulatory 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.**

Where additional steps are installed, the required ground clearance line is to be maintained.

The Vehicle Convertor 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.

1.11.6 Front, Rear and Side Under-Run Protection

 **WARNING: Check local legislation for legal requirements.**

Front Underrun Protection must be designed in compliance with the latest GSO Technical Regulations list, conformity to applicable Model Year approvals (as amended periodically), alongside relevant local national legislation.

Rear Underrun Protection must be designed in compliance with the latest GSO Technical Regulations list, conformity to applicable Model Year approvals (as amended periodically), alongside relevant local national legislation.

Side Underrun Protection must be designed in compliance with latest GSO Technical Regulations list, conformity to applicable Model Year approvals (as amended periodically), alongside relevant local national legislation.

1.11.7 Vehicle Dimensions Key

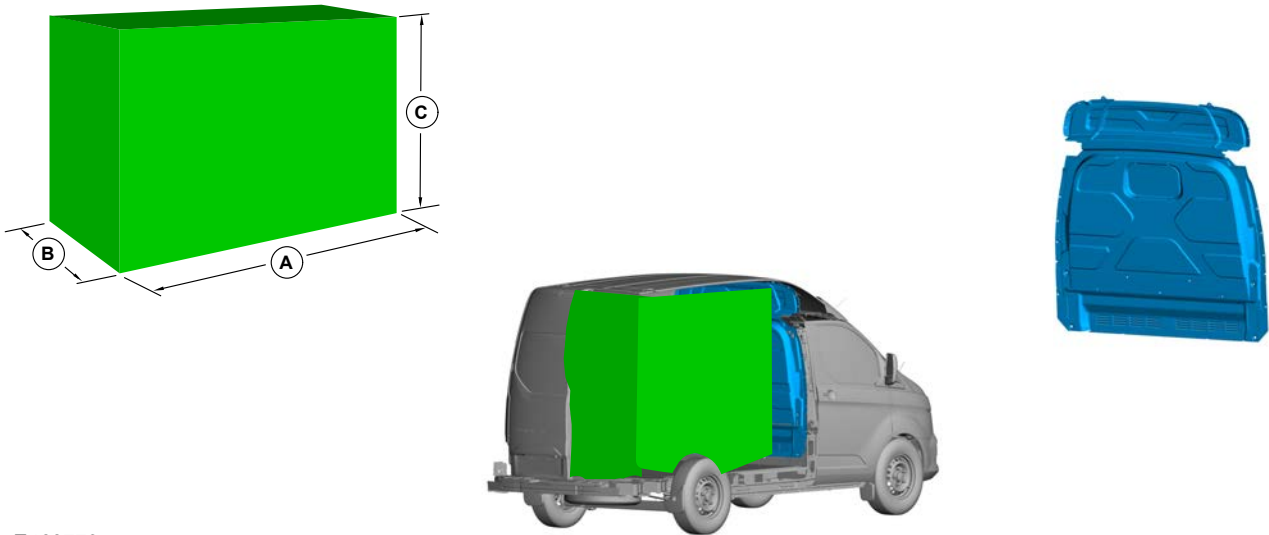
Wheelbase	Overall Length (mm)	Overall Height *(mm)	Comments
SWB / Low Roof	4974	1978-2055	16" wheels
SWB / High Roof	4974	2333-2400	16" wheels
MWB / High Roof	5341	2333-2400	16" wheels

*Overall height is measured to antenna base.

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.

1.11.8 Recommended Main Load Area Dimensions



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Vehicle	A (mm)	B (mm)	C (mm)
SWB / Low Roof	2456	1552	1395
SWB / High Roof	2456	1552	1756
MWB / High Roof	2823	1552	1756

1.12 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 Vehicle 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.

1.13 Load Distribution—Specifications

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

1.13.1 Load Distribution

CAUTIONS:

-  **Do not exceed the axle plated weights.**
-  **Do not exceed the gross vehicle weight.**
-  **In front wheel drive (FWD) vehicles, the front axle load must, in all load cases, exceed 41% of the actual vehicle weight.**

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

NOTE: The centre of mass of the payload should be located within the wheelbase of the vehicle.

NOTE: Avoid one-sided load distribution.

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

NOTE: Load distribution outside of the permitted range may result in unacceptable steering, handling and braking characteristics.

1.13.2 Center of Gravity Position

The position of the centre of gravity is changed when masses are added or removed from the vehicle. This may influence the steering characteristics, handling behaviour and the brake performance.

Lateral Position

 **WARNING: The difference right to left must not exceed 4% (absolute difference right to left/total weight in percent).**

It is important to keep the Centre of Gravity laterally within given limits.

Lateral Centre of Gravity is determined by the vertical wheel forces difference, right (front right mass added to rear right mass) to left (front left mass added to rear left mass).

Vertical Position

The Centre of Gravity Height of the vehicle is determined by the mass of the base delivered vehicle and the added and removed masses. In physics this relation is described by the Steiner’s theorem.

The Centre of Gravity Height influences axle weights while braking. Centre of Gravity height influences roll stability. Safety systems will work properly within the centre of gravity boundaries specified in the following warnings:

WARNINGS:

-  **The table below shows maximum vertical centre of gravity (CoGZ) heights by vehicle and tire type. If the CoGZ is equal to or less than the values stated and no modifications have been made to the components of the braking system, suspension and/or wheels and tires, the converted vehicle complies with GSO 42 & GSO ECE R13H & ECE R13 (as appropriate for the category of the vehicle) or applicable local national legislation.**
-  **If the CoGZ of the converted vehicle is above the values stated, Ford Motor Company makes no representation as to conformity with GSO 42 & GSO ECE R13H & ECE R13 (as appropriate for the category of the vehicle) or applicable local national legislation.**

Variant	Tire	Wheelbase	Maximum Vertical Centre of Gravity (CoGZ) Height
SWB / Low Roof	215/75 R16C	2933	870mm
SWB / High Roof	215/75 R16C	2933	870mm
MWB / High Roof	215/75 R16C	3300	870mm

1.13.3 Center of Gravity Height Test Procedure

Measurement

Vehicle should be loaded according to the test specifications of either GSO 42 & GSO ECE R13H & ECE R13 (as appropriate for the category of the vehicle) or applicable local National legislation.

In order to check the centre of gravity height, the following described method is proposed.

For this test four scales are required. The test is possible with two scales but this requires more preparation and it results in lower accuracy.

Initially the vehicle weights need to be measured in a horizontal position. Afterwards the front is lifted and weights measured again. The higher it is lifted the more accurate the results will be. The height is restricted by different possible touch conditions: between vehicle parts and roof, ground and environment.

In order to improve measurements, the following preparations need to be done:

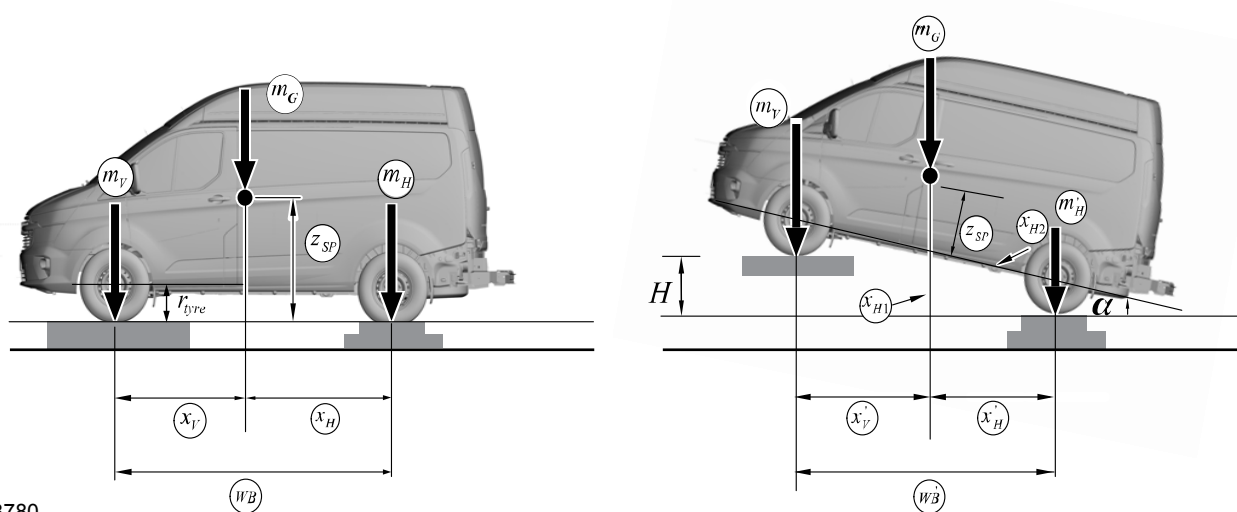
- Fix wheel travel, for example: solid shocks, or spring fixes.
- Increase tire pressure to maximum allowed value.
- It is important to remove all load - for example, moving items - from the vehicle or it should be properly fixed.
- Doors should be closed.

Before measuring the vehicle, the engine must be switched off. After lifting, it should be rolled freely in order to release tension in the tires and suspension.

Calculation

In order to estimate the resulting Centre of Gravity (CoGz) the axle load needs to be measured twice. The first measurement is in the horizontal plane and the second measurement is after the front is lifted. To get a consistent result, this test should be done 3 times independently with different heights.

To improve accuracy, repeat the test the other way around, where the rear end is lifted.



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Inclination Angle:

$$\alpha = \arcsin \left[\frac{H}{WB} \right]$$

E146623

Center of Gravity Height Z:

$$z_{SP} = \frac{m_H - m'_H}{m_G \cdot H} \cdot WB^2 \cdot \cos \alpha$$

$$z = H_{CG} = z_{SP} + r_{tyre}$$

E146624

1.13.4 Centre of Gravity Height Calculation

Given or measured parameter	
Wheelbase	WB
Front axle weight	m _v
Rear axle weight	m _H
Front height	H

Calculated and auxiliary parameter	
Center of Gravity (CoG) height	Z _{SP}
Total vehicle mass	m _G
Distance front axle to CoG (horizontal)	X _v
Distance rear axle to CoG (horizontal)	X _H
Wheelbase (projected in horizontal)	RS'
Front axle weight	m' _v
Rear axle weight	m' _H
Distance front axle to CoG (projected in horizontal direction)	X' _v
Distance rear axle to CoG (projected in horizontal direction)	X' _H
Inclination angle	arc sin
Front part of 'distance rear axle to CoG (horizontal)'	X _{H1}
Rear part of 'distance rear axle to CoG (horizontal)'	X _{H2}

1.13.5 Formulas

Masses and lengths. Total vehicle mass is the sum of front and rear axle weights:
mG= mV + mH

The longitudinal distances between the Center of Gravity and the centers of wheels equal:

$$x_V = \frac{m_H}{m_G} WB$$

$$x_H = \frac{m_V}{m_G} WB$$

E146626

In inclined system the main variable is the inclination angle which is the quotient of the lifting height and the wheelbase:

$$\sin \alpha = \frac{H}{WB}$$

E146627

Similar to the equation for the horizontal system the distance projected in to the ground plane can be determined using the sum of moments around front and rear wheel center:

$$x'_V = \frac{m'_H}{m_G} WB'$$

$$x'_H = \frac{m'_V}{m_G} WB'$$

E146628

The following equations apply:

$$WB' = WB \cos \alpha$$

$$x_{H2} = \frac{x'_H}{\cos \alpha}$$

$$x_{H1} = x_H - x_{H2}$$

E146629

Using the rule of proportion leads to the Center of Gravity height formula:

$$\frac{x_{H1}}{z_{SP}} = \frac{H}{WB'}$$

$$z_{SP} = \frac{m_V - m_V'}{m_G \cdot H} \cdot WB^2 \cdot \cos \alpha, \alpha = \arcsin \left[\frac{H}{WB} \right]$$

or

$$z_{SP} = \frac{m_H' - m_H}{m_G \cdot H} \cdot WB^2 \cdot \cos \alpha, \alpha = \arcsin \left[\frac{H}{WB} \right]$$

E146630

2.1 Suspension System

WARNINGS:

-  **Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe, lower control arm or anti-roll bars, springs or shock absorbers including mounting brackets.**
-  **Interchangeability (including between different Transit variants) of springs, shock absorbers and jounce bumpers is not permitted as the changes in vehicle dynamic performance can affect the ESP system.**
-  **CAUTION: Modifications to the suspension system can cause a deterioration of the vehicle handling characteristics and durability.**

2.2 Front Suspension

2.2.1 Springs and Spring Mounting

WARNINGS:

-  **Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, subframe, lower control arm or anti-roll bars, springs or shock absorbers including mounting brackets.**
-  **Interchangeability (including between different Transit variants) of springs, shock absorbers and jounce bumpers is not permitted as the changes in vehicle dynamic performance can affect the ESP system.**

CAUTIONS:

-  **When carrying out welding work the springs must be covered to protect them against weld spatter.**
-  **Do not touch springs with welding electrodes or welding tongs.**
-  **Make sure that components loosened or removed and reinstalled are properly reassembled and the torque set in accordance with manufacturer's requirements.**

NOTE: Do not modify the wheelbase, track width or add any type of frame extension.

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

2.3 Rear Suspension

2.3.1 Springs and Spring Mounting

WARNINGS:

-  **Interchangeability (including between different Transit variants) of springs, shock absorbers and jounce bumpers is not permitted as the changes in vehicle dynamic performance can affect the ESP system.**
-  **Springs should not be altered in rate or height in any way during vehicle conversion. This 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.**
-  **Do not modify, drill, cut or weld any suspension components, specifically the steering gear system, sub-frame, springs or shock absorbers including mounting brackets.**

CAUTIONS:

-  **When carrying out welding work the springs must be covered to protect them against weld spatter.**
-  **Do not touch springs with welding electrodes or welding tongs.**
-  **Make sure that components loosened or removed and reinstalled are properly reassembled and the torque set in accordance with manufacturer's requirements.**

NOTE: Do not modify the wheelbase, track width or add any type of frame extension.

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

NOTE: Do not add any additional axles.

2.4 Wheels and Tires

2.4.1 Wheel Clearance

The distance from the tire to the mudguard or wheel arch must be sufficient, even if snow or anti-skid chains are fitted and the suspension is fully compressed allowing for axle twist as well.

NOTE: Make sure that only approved wheels and/or permissible tire sizes are fitted.

NOTE: Ensure access to the wheel and wheel jack, and provide sufficient clearance in wheel arch to allow changing the wheels after conversion.

2.4.2 Tire Manufacturers

Replacement tires should be of the same make, size, tread pattern and load rating as the original equipment manufacturer. Under these conditions the original tire label should be satisfactory, however if the specified tires and/or inflation pressures are changed then a new label should be affixed over the original label.

2.4.3 Tire Pressure Monitoring System (TPMS)

Ford TPMS is a direct system, using physical pressure sensors. TPMS is calibrated according to the correct tire pressure for the GVM of the vehicle. If the spare wheel is ordered on a base vehicle with TPMS, the tire will not be supplied with a TPMS sensor.

If you need to replace a road wheel and tire with the temporary spare wheel, the system will continue to identify a defect. This is to remind you to repair and refit the damaged road wheel and tire to your vehicle. To restore the correct operation of the system, you must have the repaired road wheel and tire refitted to the vehicle.

NOTE: If fitting new tires, you must ensure that the TPMS sensors are fitted correctly as outlined in the service literature. For further information refer to the Owner's Manual or contact your Local Ford Dealer.



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2.4.4 Spare Wheel

When converting or relocating the spare wheel, access must be ensured.

2.4.5 Painting Road Wheels

 **CAUTION: Do not paint wheel clamp surfaces in contact with other wheels, brake drum or disc, hub and holes, or surfaces 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.

2.5 Brake System

2.5.1 General - Brake System

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

Brakes are certified according to GSO 42 & GSO ECE:13H(Part 1 to 6) & ECE R13 requirements as amended or applicable local national legislation.

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

 **CAUTION: Spoilers and wheel covers must not affect the brake cooling performance.**

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

NOTE: The donor vehicle brake fluid reservoir is translucent so that it is possible to check the level of fluid without opening the reservoir which will reduce the risk of contamination. Do not move brake fluid reservoir.

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

2.5.2 Brake Hoses General

WARNINGS:

 **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 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.**

2.5.3 Parking Brake

WARNINGS:

 **Do not modify the brakes.**

 **Do not splice into the parking brake actuation cables.**

 **Do not modify the Electronic Parking Brake (EPB).**

 **CAUTION: For vehicles that need to be in a prolonged Neutral / Handbrake off state whilst they are moved between conversion sites, follow all procedures in FSI via <https://www.fordserviceinfo.com>.**

2.5.4 Hydraulic Brake—Front and Rear Brakes

WARNINGS:

 **Do not modify the brakes.**

 **Do not modify the disc in flow and out flow of cooling air.**

2.5.5 Anti-Lock Control — Stability Assist

 **WARNING: Do not modify any part of the braking system, including Anti-Lock Brake System (ABS), Traction Control System (TCS) and Electronic Stability Control (ESC), also known as Electronic Stability Program (ESP).**

3.1 Engine

⚠ WARNING: 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 earlylife injector failure.

CAUTIONS:

- ⚠ Make sure to follow the equipment supplier's instructions for safety, warranty and sometimes legal compliance.**
- ⚠ Do not modify the oil fill level or oil type from the manufacturer's specification.**

3.1.1 Engine Types

Front Wheel Drive (FWD) 2.0L engines Stage 6.2 EU emissions with DPF.

Engine	Max Power kW/RPM	Max Torque Nm/RPM	Emissions	Vehicle Class	Info
2.0L Diesel FWD	105KW (146PS) / 3600RPM	355Nm / 1600- 2400RPM	HDT	N2	Auto Only

3.2 Engine Cooling

NOTE: The installation must be aligned with the appropriate legal requirements.

3.2.1 Air Flow Restrictions



WARNING: Do not mount components in front of the grille or in an area of air flow around the engine, which could affect the engine cooling performance.



CAUTION: Overheating within the engine compartment can seriously compromise component robustness.

NOTE: Please assume under-bonnet environment is about 130°C when selecting appropriate materials.

3.3 Accessory Drive

3.3.1 Front End Accessory Drives (FEAD)— General Information

When the correct belt is used, tensioning is and remains fully automatic for the life of the belt.

CAUTIONS:

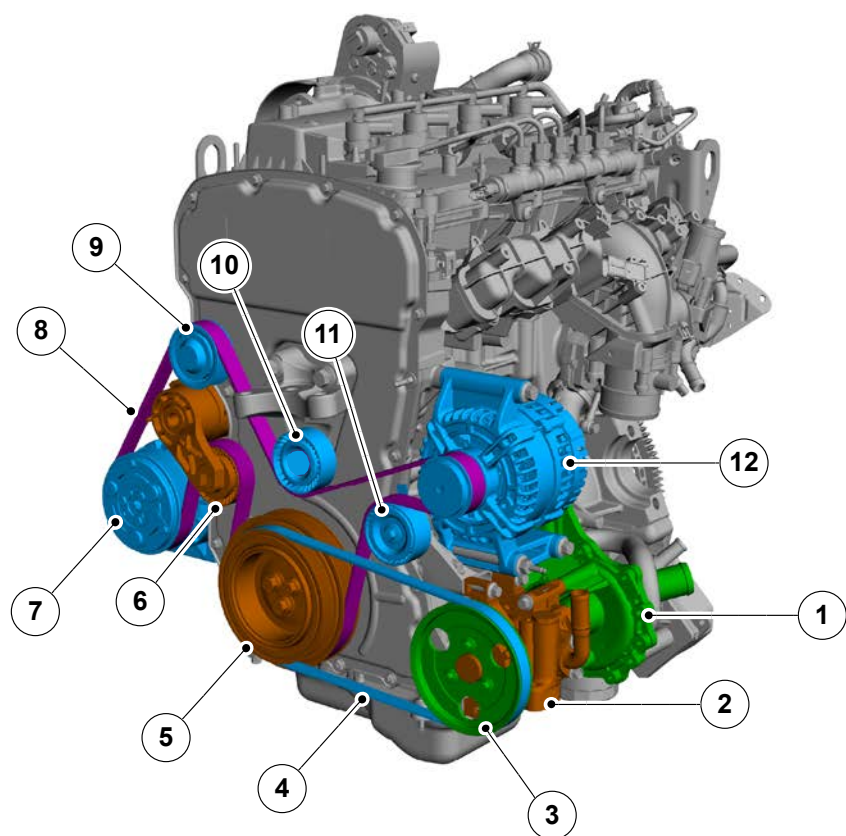
-  **Only use the manufacturers recommended (or equivalent specification) components.**
-  **Make sure that the ancillary pulley diameter is less than the crankshaft pulley diameter.**
-  **Front End Accessory Drive shields must be maintained at all times. If shields are removed, for example when attaching an ancillary unit, they must be replaced so that it is protected appropriately.**
-  **Do not fit an additional belt driven accessory within the existing belt drive when the vehicle is already equipped with an air conditioning compressor. If it is required to retain the air conditioning, then a further belt must be used to drive the additional accessory, driven from a third crankshaft pulley sheave.**

NOTE: No devices can be taken off the crankshaft damper as this is a tuned device for system resonance.

NOTE: The shields are there to protect the Front End Accessory Drive system from stone ingress and also protect people from rotating parts under Start-Stop function.

The Eigen (natural) frequency of the bracket with auxiliary unit should be above the maximum excitation frequency of the main excitation order of the individual engine at engine top speed. On 4-cylinder inline engines, this is the second engine order.

When engineering and installing a new front end accessory drive, i.e. belt driven from the crankshaft pulley, the angular alignment of the belt to any pulleys must be within $\pm 0.5^\circ$.



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Item	Description
1	Coolant Pump
2	Power Steering Pump
3	Power Steering Pump Pulley
4	Power Steering Pump Belt
5	Crankshaft Pulley
6	Accessory drive belt tensioner pulley
7	Air conditioning (A/C) compressor
8	Accessory drive belt
9	Accessory drive belt idler pulley
10	Accessory drive belt idler pulley
11	Accessory drive belt idler pulley
12	Alternator

3.4 Automatic Transmission

WARNINGS:



Do not reroute external transmission gear shift cables or restrict or otherwise interfere with the gear shift mechanisms. Doing so can restrict the selection of all gears and/or severely increase lever forces and/or reduce correct gear selection.



Do not change external electrical connectors.

9HP50 - 9 Speed Automatic FWD Transmission

Gears	Base Transmission Ratio	Overall Ratio - Final Drive 3.39
1st	4.713	20.426
2nd	2.842	12.317
3rd	1.909	8.274
4th	1.382	5.990
5th	1	4.334
6th	0.808	3.502
7th	0.699	3.029
8th	0.58	2.514
9th	0.48	2.080
Reverse	3.83	16.599

3.5 Exhaust System

⚠ WARNING: Any modifications made to either the Exhaust System or Passenger/Load Compartment must not result in a condition that could allow exhaust gas ingress into the vehicle.

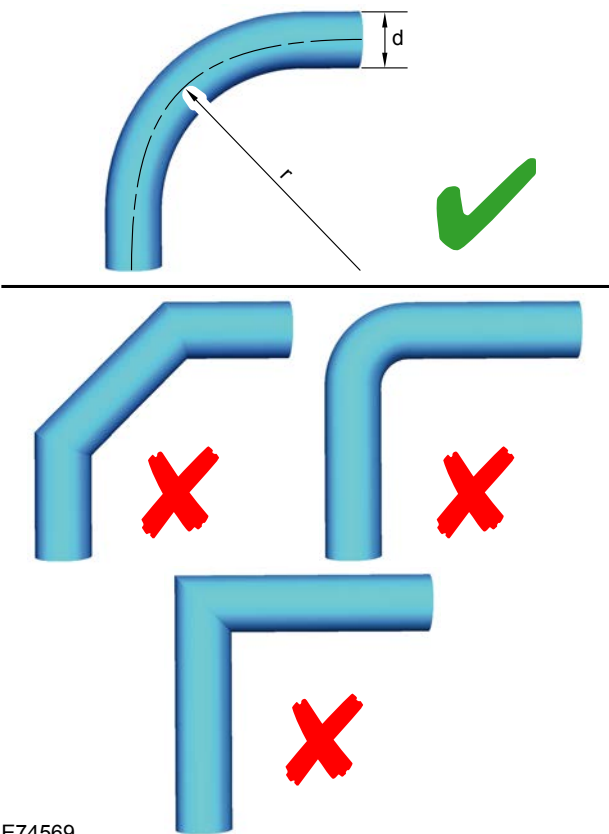
3.5.1 Extensions and Optional Exhausts

CAUTIONS:

- ⚠ Non-standard systems must be tested for engine back pressure and all legal compliance (noise and emissions).**
- ⚠ Make sure that for any pipes that require bending, the radius of the bend is minimum 2.5 x tube diameter.**
- ⚠ Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.**
- ⚠ The exhaust should not be modified upstream of the exhaust throttle. Repositioning of any of the thermal elements (DOC, DPF, SCR or aSCR) or any of the sensors will render the donor vehicle non-compliant from a legal/emissions homologation standpoint. The control of DPF and SCR regeneration has been calibrated to the delivered system layout and modification could lead to component failure.**

NOTE: Where possible all pipe connections should be designed so that the gas flows from smaller to larger diameter pipes.

Exhaust Pipe Design Principles



E74569

Item	Description
d	diameter
r	radius = 2.5d

3.5.2 Exhaust Pipes and Supports

CAUTIONS:

- ⚠ Maintain the original set-up and heat shields.**

 **Do not position any components closer than 150 mm nominal (100 mm minimum) clearance to the downpipe, the catalytic converter, the diesel particulate filter, the selective catalyst reduction and any part of the exhaust system.**

3.5.3 Exhaust Heat Shields

Exhaust Heat Shields

- Catalytic converters, in particular, operate at high temperatures.
- Ensure existing shields are maintained.
- Add further shields over exhaust system as necessary to avoid fire risk.

Standard Exhaust Heat Shields

 **CAUTION: Standard heat shields are available from your local dealer and can easily be fitted. Additional heat shields may be required over the modified exhaust system, particularly in areas of close proximity to the floor.**

3.5.4 Diesel Particulate Filter (DPF)

The DPF forms part of the emissions reduction systems fitted to your vehicle. It filters harmful diesel particulates (soot) from the exhaust gas.

Regeneration

 **WARNING: Do not park or idle your vehicle over dry leaves, dry grass or other combustible material. The DPF regeneration process creates very high exhaust gas temperatures. The exhaust will radiate a considerable amount of heat during and after DPF regeneration and after you have switched the engine off. This is a potential fire hazard.**

Unlike a normal filter which requires periodic replacement, the DPF has been designed to regenerate, or clean itself, to maintain operating efficiency. The regeneration process takes place automatically. However, some driving conditions mean that you may need to support the regeneration process.

If you drive only short distances or your journeys contain frequent stopping and starting, occasional trips with the following conditions could assist the regeneration process:

- Drive your vehicle, preferably on a main road or motorway, for up to 20 minutes avoiding prolonged idling, but always observing speed limits and road conditions.
- Do not switch off the ignition.
- Use a lower gear than normal to maintain a higher engine speed during this journey, where appropriate.

3.5.5 Manual Regeneration Initiation (A6YAB)

With the vehicle stationary, the DPF is unable to start a regeneration event.

Where the anticipated usage profile of the vehicle is expected to include longer stationary durations, it is strongly recommended that Manual Regeneration Initiation is specified and ordered for the base vehicle.

Manual Regeneration Initiation allows the driver/operator to manually perform a DPF regeneration while the vehicle is stationary, after confirming that it is safe to do so.

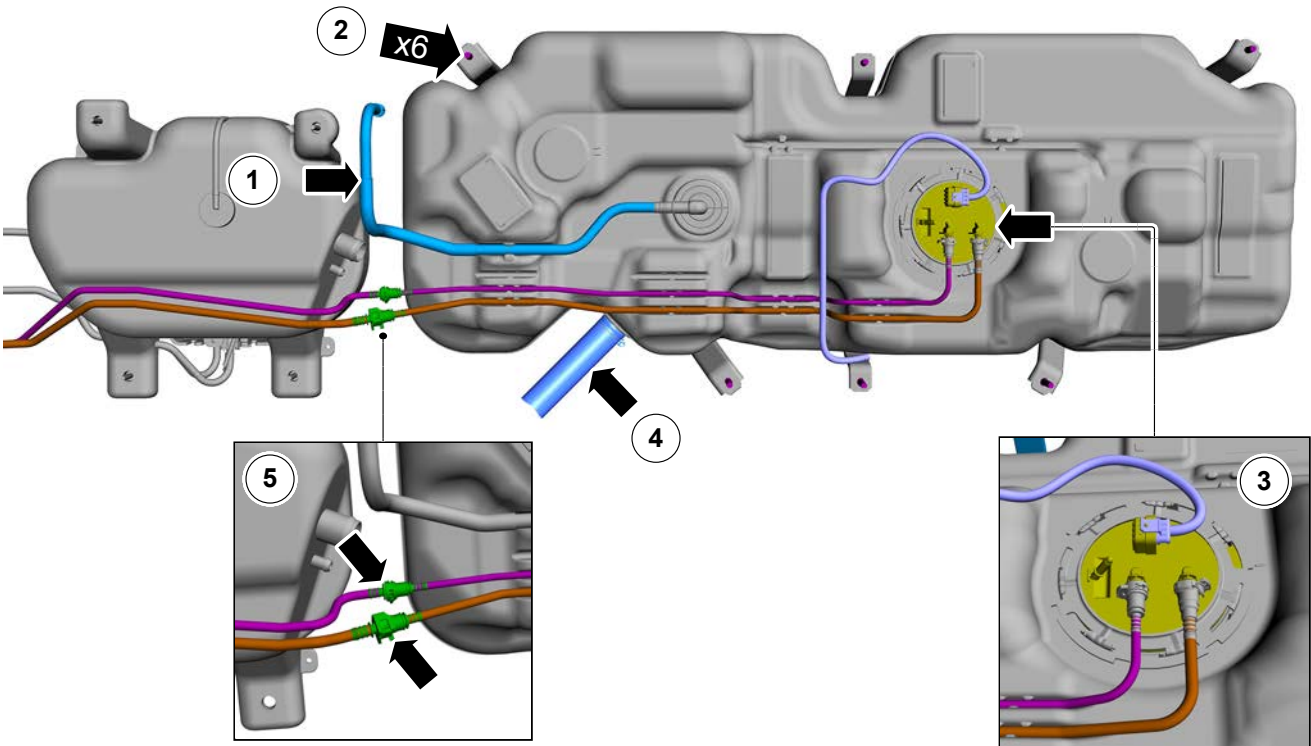
3.6 Fuel System

WARNINGS:

-  **Do not drill into Fuel Tank.**
-  **Do not cut into the original fuel supply lines.**
-  **Make sure that the modified vehicle complies with all relevant regulatory requirements.**
-  **Ensure that a suitable fuel shut-off is fitted in any unique system.**

NOTE: An Auxiliary Fuel Port can be fitted using the following process:

Fuel Tank and Line Components



E477103

Item	Description
1	Fuel Tank Vent Tube
2	Fuel Tank Retaining Straps and Fixings
3	Fuel Pump and Sender Unit Connections
4	Fuel Tank Filler Pipe
5	Fuel lines connection point

To lower fuel tank:

- Drain tank.
- Disconnect fuel lines at connection point between fuel tank and urea tank, (5) shown above.
- Disconnect Fuel Tank Vent Tube (1).
- Plug lines to prevent residual fuel from draining/spilling and dirt ingress.
- Remove filler pipe from tank (4).
- Remove bolts securing the three tank straps (2), at the same time disconnect the electrical connector (3).

With the fuel tank out. Remove the fuel pump and sender unit from the fuel tank.

To retrofit a fuel heater line:

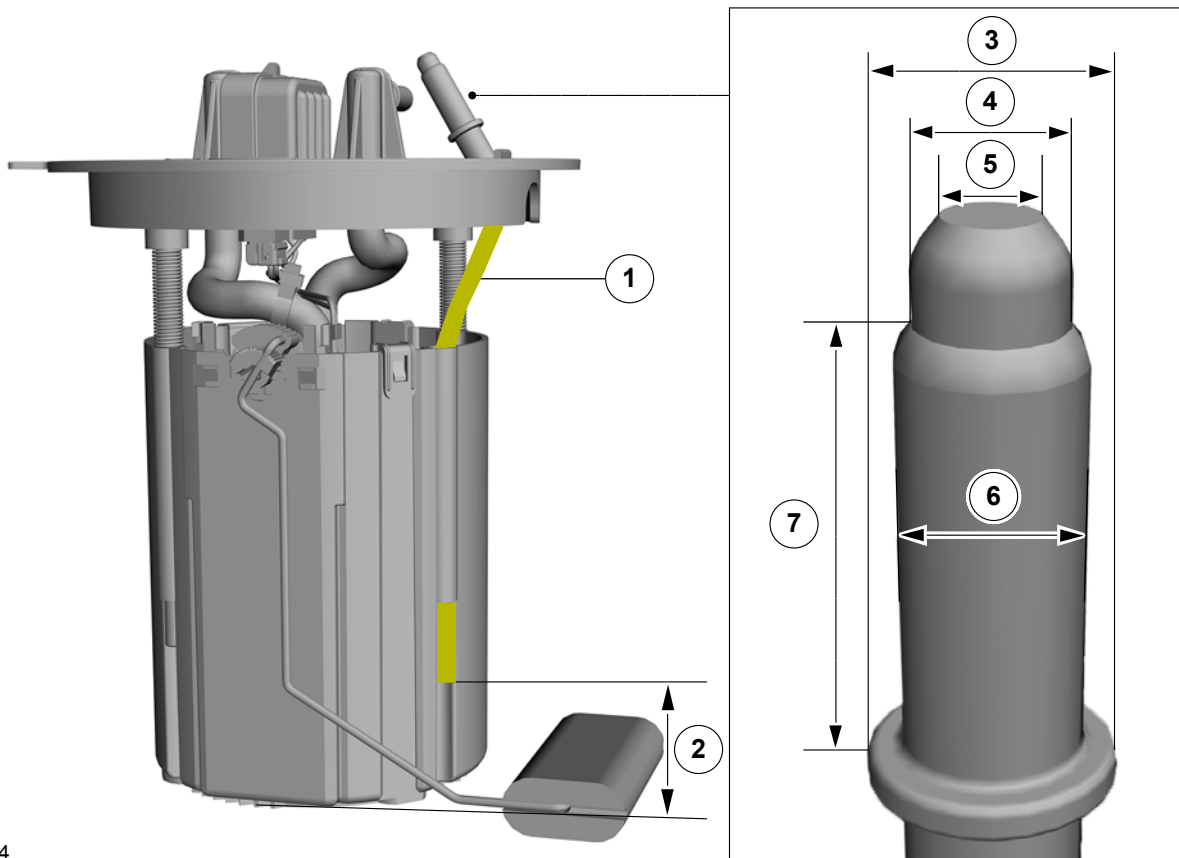
CAUTIONS:

- ❗ **Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.**
- ❗ **Make sure that when the port is cut that it is smooth with no sharp edges or burrs.**

NOTE: The Auxiliary Fuel Port Line must be secured to the body structure using the fir tree connector.

NOTE: Do not fasten anything to existing electrical components, wires or fuel lines.

- Cut the auxiliary spigot as recommended in the image below.
- Insert an auxiliary fuel line into the fuel pump and sender unit as shown in the image below.
- Install the fuel pump and sender unit back into the fuel tank.
- Install the auxiliary fuel line to the fuel pump and sender unit spigot.



E477104

Item	Description
1	Auxiliary Fuel Tube
2	50mm Clearance min
3	10.98mm
4	6.33mm
5	4.99mm
6	7.89mm
7	Cut Line 19.54mm Min to 19.77mm Max

To refit fuel tank:

- Lift fuel tank ensuring that fuel lines and electrical wires are not trapped.
- Refit straps, torque bolts to 47.5 +/- 7.2 Nm at the same time connecting the electrical connector.
- Refit filler pipe to tank spud securing hose clip torque to 3.7Nm ±0.6Nm.
- Remove plugs and reconnect fuel lines.

For additional information, refer to 5.1 Body Floor Precautionary Drilling Fuel Tank with Urea.

4.1 Electrical System Overview

WARNINGS:

-  **It is recommended to follow the guidelines in the electrical sections of the BEMM. Incorrect design, for example, overloaded ground paths or insufficient mechanical protection to a thirdparty wiring, could lead to serious system or vehicle failure.**
-  **The fitting of voltage boosters or other devices to enhance alternator output are not allowed. The fitting of such devices will not only invalidate vehicle warranties, but could damage either or both, the alternator and Engine Management System/Power Control Module, and possibly affect vehicle legal compliance. Check local national legislation.**
-  **It is strongly recommended to always follow the guidelines of the BEMM when working on the vehicle electrical system. Not following the guidelines may result in an increased risk of vehicle fire, serious injury and death.**

NOTE: Ford Motor Company has no control over the modification or installation process of the electrical content of auxiliary systems and therefore can take no responsibility for such installations.

4.2 Wiring Installation and Routing Guides

4.2.1 Wiring Harness Information

The following provides an installation guide for conversions affecting electrical components and/or electrical systems. The aim is to maintain robust integration of auxiliary systems without compromising existing systems, by control of splicing techniques, module package location, electromagnetic compatibility (EMC) etc. The Vehicle Converter must test their installation and ensure the design and function complies with all legal and homologation requirements.

4.2.2 General Wiring and Routing

Temperature requirements: Wiring systems in the vehicle interior are expected to function over the temperature ranges of -40°C to 85°C for exposure and -40°C to 75°C for function. For engine compartment and underbody, the minimum temperature is -40°C, while the maximum temperatures are 125°C for exposure and 105°C for operational.

Make sure that the insulation is compatible with any fluids it may encounter, for example: petrol, oil, antifreeze, brake fluid, transmission fluid and power steering fluid.

If a connector is to be located in a wet area, use a sealed connector. Wet areas include: the engine compartment, wheel wells, underbody and doors.

In general, the distance between retention points for wiring not contained in a rigid shield should be less than 300mm. For wiring inside the doors this should be reduced to 150mm.

Minimum clearances:

- 250mm from exhaust system
- 25mm from all sharp edges and moving parts
- 20mm from fluid lines
- 15mm from weld points
- 10mm from static components

If these clearances cannot be met, protect the wires with a convolute &/or heat shield.

For conversions with walkthroughs, it is recommended to provide appropriate protection on the floor in the walkway.

Connecting blocks with screws or spring retention are not recommended due to the low frequency vibration that can occur in certain vehicles which could lead to terminals becoming loose.

A secondary clamp design is required on all eyelets to help avoid strain and breaking of a single conductor strand.

It is recommended to use a set ratchet crimp tool for the required crimp force.

Soldering is not permitted as the only method of retention. All connections must be crimped. Soldering should only be used as a supplementary retention method to the crimp, to reduce impedance.

If routing wiring through drilled metal, all holes need to be protected by a grommet or protective edging to avoid chafing.

All wires, single or multiple, should have a secondary form of mechanical protection, for example: cotton, PVC tape, conduit or sleeving, depending on the routing environment within the vehicle.

It is recommended to use edge clips, where required, to control routing of all cables in weather zone areas of the vehicle. For non-weather zone areas of the vehicle do not use edge clips.

4.2.3 Connector Pin Out Practices

When designing a harness to connect a component, it is best practice to put the female terminals in the harness side connection and the male terminals in the component side. When determining connector pin outs, make sure that Power and Ground circuits are not in close proximity, adjacent to one another. A minimum separation of 5 mm between Power and Ground circuits is required.

 **WARNING: Do not use connectors which cut through the outer covering and into the core wire.**

 **CAUTION: Only use Ford approved connectors.**

Cutting into vehicle wiring is not recommended because:

- The base vehicle specification is unsuitable for incremental loads.
- Long-term risk of a faulty connection developing.
- Potential fire risk from overloading.

All connections into existing wiring must be permanently insulated. Exterior connections must be waterproof.

When designing electrical circuits, or making alterations, the following must be considered:

- Current rating of wiring, see table 'Current Rating of Wire Sizes' in this section.
- Any voltage drop in the circuit should not lower the terminal voltage at consumption point to below 95% of battery voltage.
- Do not cut into the original harness.
- Additional Ground returns should be included to support new equipment.
- A supplementary circuit diagram and accompanying instructions should be added to the Owner's information or a separate manual supplied with the vehicle for each unique component.

Where wires are required to be extended, break in points and only Ford approved connectors should be used.

Ford approved jumper harnesses should be used.

4.2.4 Unused Connectors

Harnesses may have a number of unused connectors, depending on which features have been ordered on the donor vehicle, e.g. heated seats. Ford do not recommend the use of these connectors for any other purpose than that intended by design.

4.2.5 Grounding

If a new grounding point is required, avoid placing it in a wet area, especially for high current grounds. Ground connections should be routed back close to the location of the +12V supply. This helps to reduce the electromagnetic field particularly generated by inrush current and improve electromagnetic compatibility.

Drill point screws are not to be used for any ground attachments:

- Do not ground to moving structures, for example: doors, deck lids, lift gates, as the ground return path through the hinges is not reliable.
- Do not exceed 2 eyelet or crimp terminals per stud connection for high current applications.
- Do not place electrical component attachments or ground nuts adjacent to vehicle fuel tanks or fuel lines.
- Each individual third-party load must have a dedicated ground connected directly to the vehicle body ground or to the battery negative spare stud.

[Refer to: 4.5 Battery and Cables \(page 62\).](#)

- Multiple grounds must not go to an interim splice to a main ground cable.

4.2.6 Prevention of Squeaks and Rattles

Wiring should be positively retained every 300mm except when inside a door when retention should be every 150mm. All connectors should be positively retained. Use tapes which do not squeak against metal or plastic.

4.2.7 Water Leakage Prevention

Make sure the harness design includes drip-loops to prevent water seepage into the vehicle interior when wiring passes from the outside to the inside of the vehicle. The drip-loop is a section of wiring deliberately formed to route below the point of entry into the vehicle. Water droplets on the harness will migrate under gravity to the lowest part of the harness.

Wiring from door to passenger compartment, should be made such that the door entry point is below the passenger compartment entry point, which creates a type of drip loop.

4.2.8 Wiring Splicing Procedures

TYCO-RAYCHEM crimp splices



E131081

Ford Motor Company strongly advises against the use of wire splicing due to the variable and unpredictable nature of the joint created. However, if it is decided that a wire splice is unavoidable, it must be made using **DuraSeal Heat-Shrinkable, Environmentally Sealed, Nylon-Insulated Crimp Splices** (manufactured by TYCO-RAYCHEM). For example, the D406 series. As a further process to improve the splice integrity, the splice should be further sealed with a suitable heat shrink tubing.

4.2.9 Wiring Specification

Current Rating of Wire Sizes

ISO Conductor Size mm ² CSA	Conductor Resistance mOhm/m					
	Maximum			Minimum		
	Plain Copper	Tinned Plated Copper	Nickel Plated Copper	Plain Copper	Tinned Plated Copper	Nickle Plated Copper
0.13	136	140	142	-	-	-
0.22	84.8	86.5	87.9	-	-	-
0.35	54.4	55.5	56.8	-	-	-
0.5	37.1	38.2	38.6	-	-	-
0.75	24.7	25.4	25.7	22.7	23.3	23.6
1	18.5	19.1	19.3	17.0	17.6	17.7
1.5	12.7	13.0	13.2	11.7	11.9	12.1
2.0	9.42	9.69	9.82	8.66	8.91	9.03
2.5	7.60	7.82	7.92	6.99	7.19	7.28
3	6.15	6.36	6.41	5.66	5.85	5.89
4	4.71	4.85	4.91	4.33	4.46	4.52
5	3.94	4.02	4.11	3.62	3.70	3.78
6	3.14	3.23	3.27	2.89	2.97	3.01
8	2.38	2.52	2.60	2.19	2.32	2.39
10	1.82	1.85	1.90	1.68	1.70	1.75
12	1.52	1.60	1.66	1.40	1.47	1.53
16	1.16	1.18	1.21	1.07	1.09	1.12
20	0.955	0.999	1.03	0.870	0.919	0.948
25	0.743	0.757	0.774	0.688	0.701	0.716
30	0.647	0.684	0.7.6	0.595	0.629	0.650
35	.0527	0.538	0.549	0.489	0.500	0.510
40	0.473	0.500	0.516	0.435	0.460	0.475
50	0.386	0.375	0.383	0.343	0.350	0.357
60	0.315	0.333	0.344	0.290	0.306	0.316
70	0.259	0.264	0.270	0.243	0.248	0.254
95	0.196	0.200	0.204	0.185	0.189	0.193
120	0.153	0.159	0.159	0.146	0.149	0.152

When designing wire installations for additional equipment use the cable size recommended by the equipment manufacturer or select a suitable size from the 'Current Rating of Wire Sizes' table.

4.2.10 Electromagnetic Compatibility (EMC) Awareness

 **WARNING: Do not route other wiring near or close to electrical cables with the Anti-lock Brake System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang extra wiring from existing looms or pipes.**

The installation and routing of Ford wiring has been fully validated and has passed the requisite EMC tests. Ford Motor Company, however, are not responsible for the vehicle's EMC immunity when non-Ford-approved systems are installed.

Wiring must be suitably fixed without any detrimental effect on other wiring.

Single or bunched looms must maintain the following clearances:

- 10 mm from static components (unless clamped to it)
- 250 mm from exhaust system
- 30 mm from rotating or moving components

Refer to: [1.4 Electromagnetic Compatibility \(EMC\) \(page 12\)](#).

4.2.11 Wiring Through Sheet Metal

 **WARNING: Harnesses passing through sheet metal must be through protective grommets that also ensure a watertight seal. A windscreen type sealer should be used. Adhesive or tape is not acceptable.**

NOTE: Holes must permit the appropriate connector to pass through.

NOTE: The maximum size of additional wire bundle diameter is 6 mm.

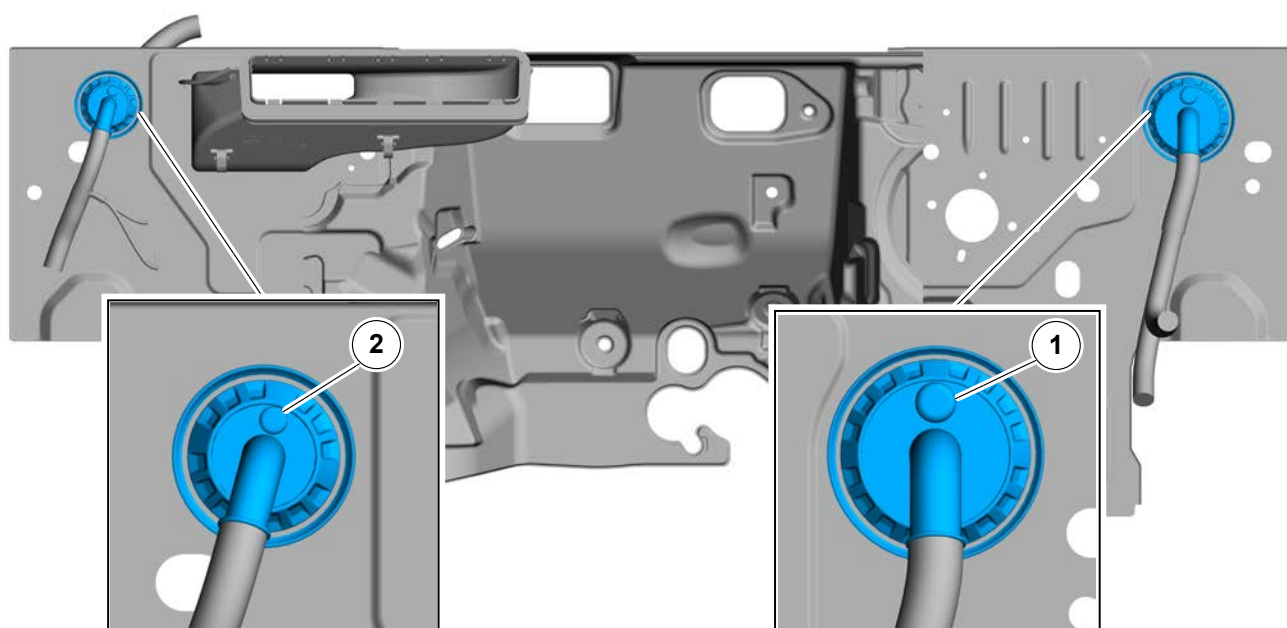
There are two locations in the dash panel which have been identified for additional holes to route wires through.

The grommets in locations 1 and 2, shown in image below are moulded directly to wire bundles in polyurethane foam material. It is not possible to feed extra wires through with the wire bundle. The grommets have an 'indent' moulded into the surface face, engine bay side, which show the positions 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 drill or spike bit
- Insert the drill or spike bit, horizontal and parallel, through the indent of the grommet, making sure not to extend further than 25 mm through the grommet surface, this will help eliminate any possible damage to items on the passenger side of the grommet.

Ford released hardware is available to support further installations to the vehicle. Only this hardware and released parts are to be used for this.

Front Wheel Drive Dash Panel (Right Hand Drive Shown)



E474879

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

4.2.12 Precautionary Drilling — Rear Cargo Area

CAUTION: Do not drill into the vehicle before checking the precautionary drill zones and electrical wire routing.

Refer also to B Pillar Precautionary Drilling for details of the restrictions in the area around the Seat Belt installation.

Refer to: [5.10 Seatbelt Systems \(page 112\)](#).

The following illustrations show the routing of cabling in the rear cargo area. This indicates Precautionary Drilling where there is wire routing that is to be avoided, (for example: when installing cladding and racking). The same care should also be taken when using self-tapping screws. Not all derivatives are shown but the routing is the same for roof line and wheelbase with regards to 'B', 'C' and 'D' pillars or roof bows and doors. The side of the vehicle where the side loading door is located will vary according to territory. Other non-electrical systems may also be present, for example: fuel tank under floor so it is important to check before drilling.

For additional information refer to the following links:

- [Refer to: 5.1 Body \(page 91\)](#).
- Precautionary Drilling sections
- [Refer to: 5.2 Racking Systems \(page 94\)](#).
- Racking Systems
- [Refer to: 5.3 Body Closures \(page 96\)](#).
- Precautionary Drilling, Body Closures.

MWB/High Roof - Rear Cargo Doors

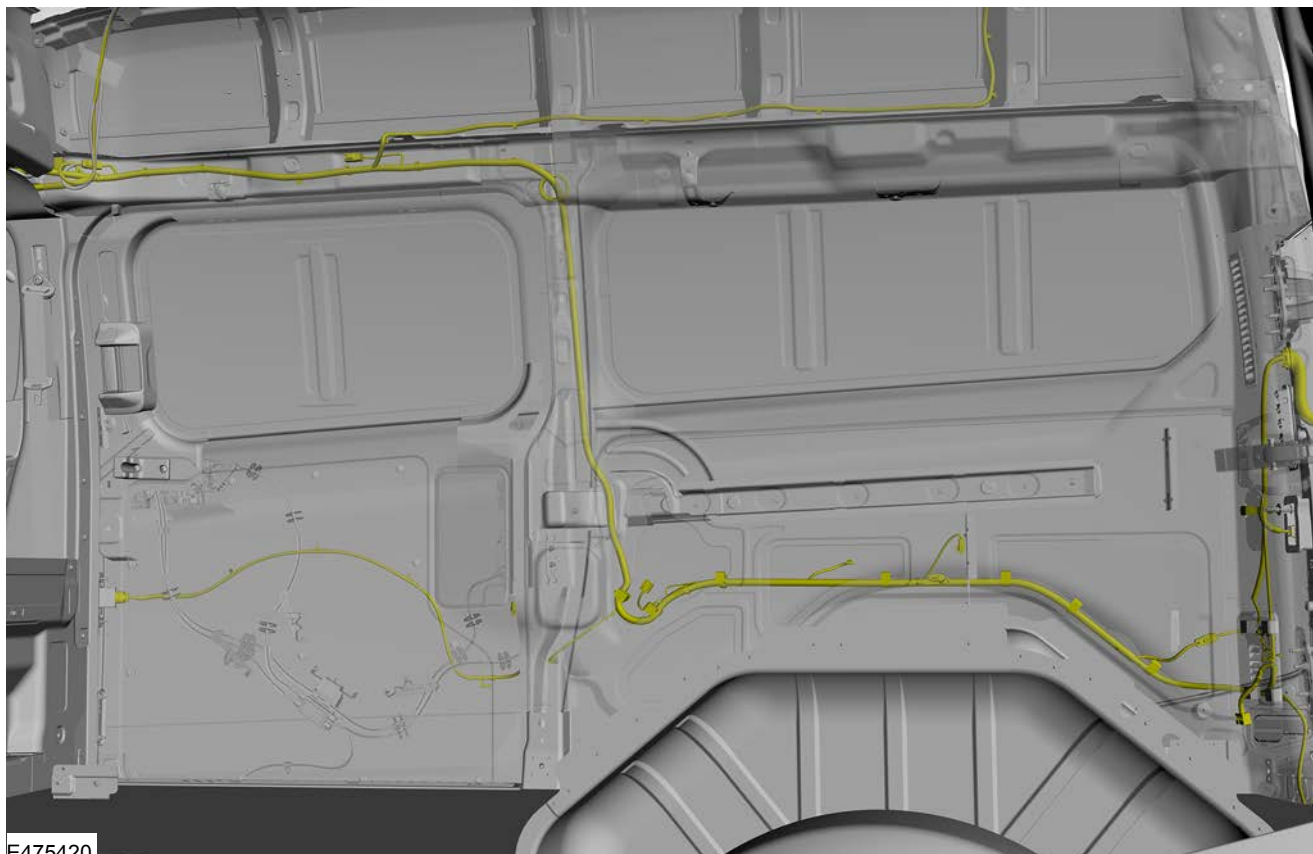


E475418

MWB / High Roof - LHS



E475419

MWB / High Roof - RHS

E475420

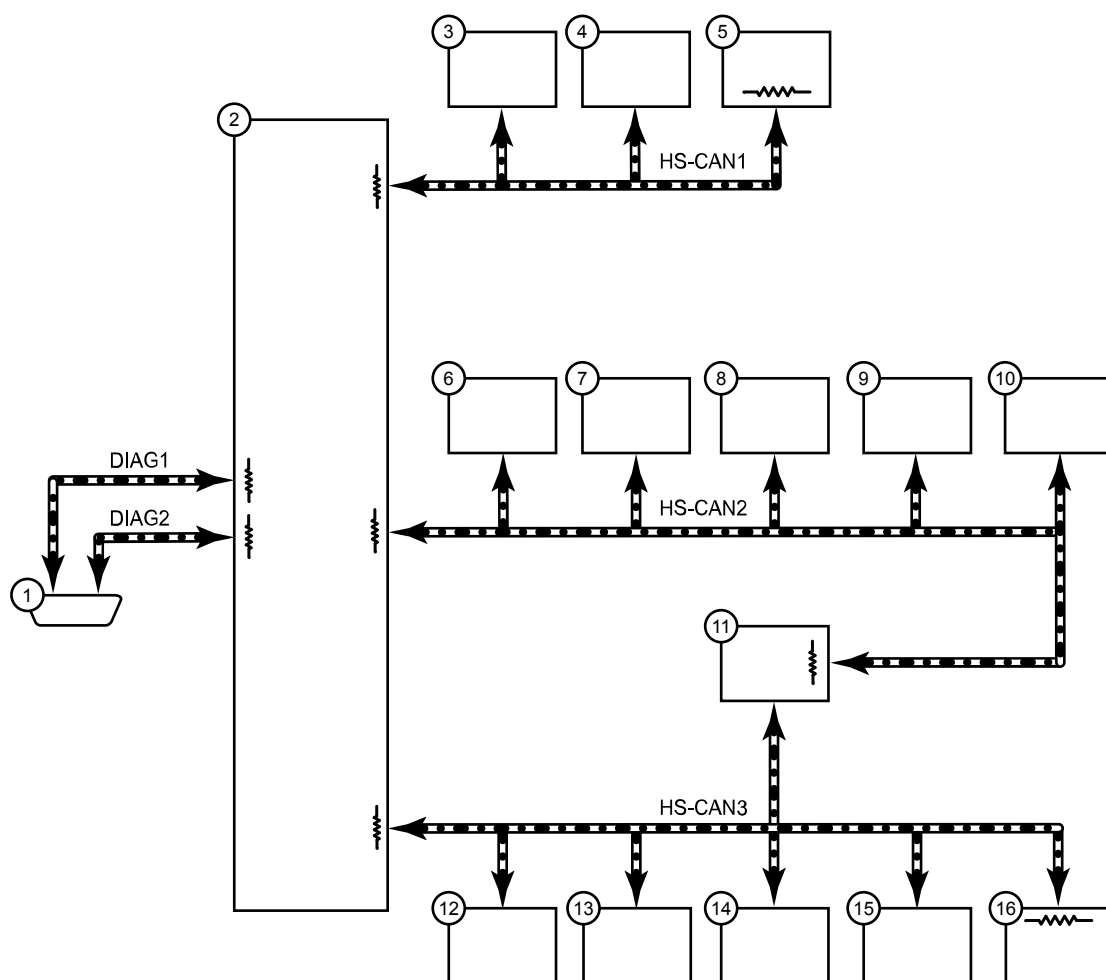
4.3 Communications Network

4.3.1 CAN-Bus System Description and Interface

 **WARNING: Do not tamper with, cut into or connect to any of the CAN-Bus interface wiring or connectors. The addition of unapproved CAN-Based modules could impact the safe operation of the vehicle.**

CAN, Controller Area Network, uses propriety message sets to communicate between the devices via High Speed (HS), Private and Public Buses. Additionally, Local Interconnect Network (LIN) is used in localised applications.

CAN-Bus System



E474202

Item	Description
1	Data Link Connector (DLC)
2	Gateway Module (GWM)
3	Gear Shift Module (GSM)
4	Transmission Control Module (TCM)
5	Powertrain Control Module (PCM)
6	Restraints Control Module (RCM)
7	Anti-lock Brake System (ABS) Module
8	Parking Assist Control Module (PAM)
9	Steering Angle Sensor Module (SASM)
10	Headlamp Control Module (HCM)
11	Body Control Module (BCM)
12	Tire Pressure Monitoring System (TPMS)

Item	Description
13	Heating, Ventilation and Air Conditioning (HVAC) Module
14	Audio Control Module (ACM)
15	Remote Function Actuator (RFA)
16	Instrument Panel Cluster (IPC)

4.3.2 Body Control Module (BCM)

WARNINGS:

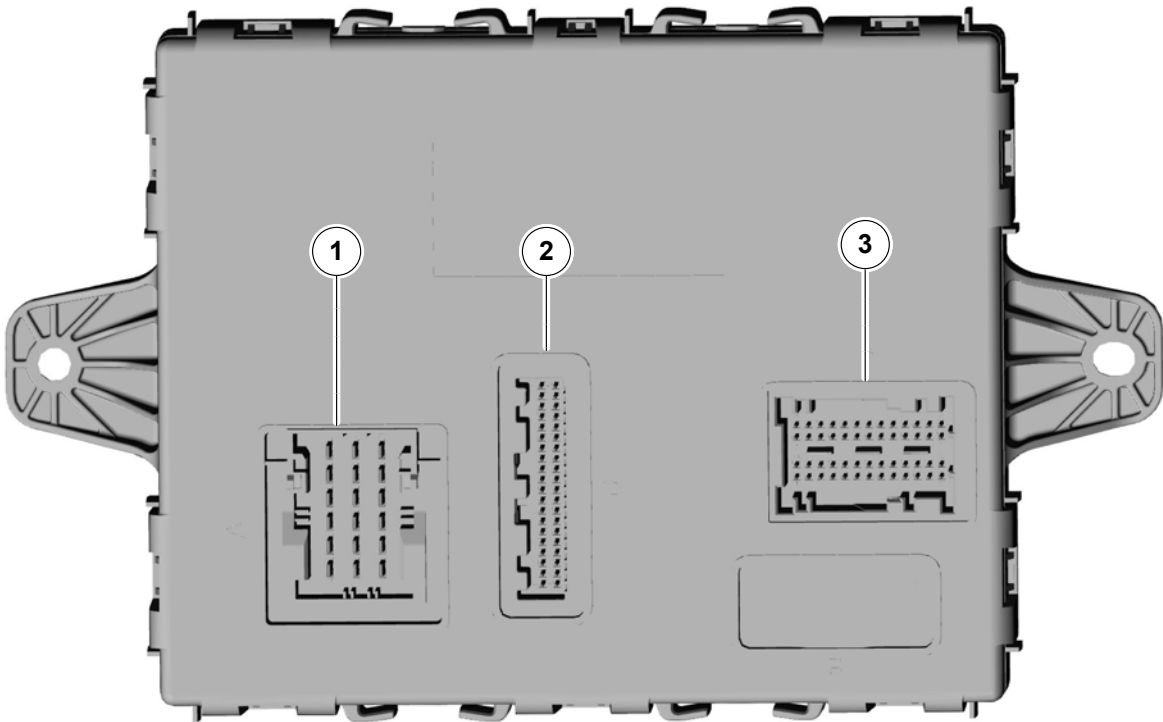
- 

Unapproved and/or incorrect connection to any of the mating wiring can cause either the associated systems to shut down (overload protection), or permanent damage to the BCM itself.
- 

Vehicle BCM configuration must NOT be modified once the vehicle has left a Ford production plant, except for any changes that may be carried out using dealership integrated diagnostic systems equipment

The BCM is the prime control module in the vehicle's electrical architecture. It is responsible for management of most of the vehicle's lighting, locking and security systems.

BCM



E464100

Item	Description
1	BCM Connector A (C2280A)
2	BCM Connector D (C2280D)
3	BCM Connector C (C2280C)

BCM Output Information

Function	Component	Load Type	Max. Load	Connector Pin
Dipped Beam	Low Side Drive External Relay	Halogen Bulb	0.3A	D (C2280D) Pin 27
Main Beam	High Side Direct Drive	?	1A	D (C2280D) Pin 32
Daytime Running Light	High Side Direct Drive	LED	3.2A	D (C2280D) Pin 7
Position Light (Number Plate)	High Side Direct Drive	LED (Front) Halogen (Rear)	5A	D (C2280D) Pin 4
Turn Indicator (Left)	High Side Direct Drive	LED (Front) Halogen (Rear)	6A	D (C2280D) Pin 20
Turn Indicator (Right)	High Side Direct Drive	LED (Front) Halogen (Rear)	6A	D (C2280D) Pin 40
Reverse Light	High Side Direct Drive	Halogen Bulb	4A	D (C2280D) Pin 8
Rear Fog Light	High Side Direct Drive	Halogen Bulb	4A	D (C2280D) Pin 2
Stop Light	High Side Direct Drive	Halogen Bulb	4A	D (C2280D) Pin 9
Center High Mounted Stop Light	High Side Direct Drive	LED	1.5A	D (C2280D) Pin 39
Background Light	High Side Direct Drive	LED	2A	D (C2280D) Pin 38
Cabin Front Courtesy Light	Low Side Direct Drive (PWM)	LED	1.5A	A (C2280A) Pin 6
Cabin Rear Courtesy Light	Low Side Direct Drive (PWM)	LED	1A	-
Alarm Siren	High Side Direct Drive	LED	0.05A	D (C2280D) Pin 30
Lock Output	H-Bridge Drive	Lock Motor	25A	A (C2280A) Pin 13
Unlock Output	H-Bridge Drive	Lock Motor	25A	A (C2280A) Pins 1,4,10

PWM = Pulse Width Modulation

4.4 Charging System

⚠ WARNING: Do not cut into the alternator wires.

NOTE: Alternator systems use Smart Regenerative Charging (SRC), please refer to this section.

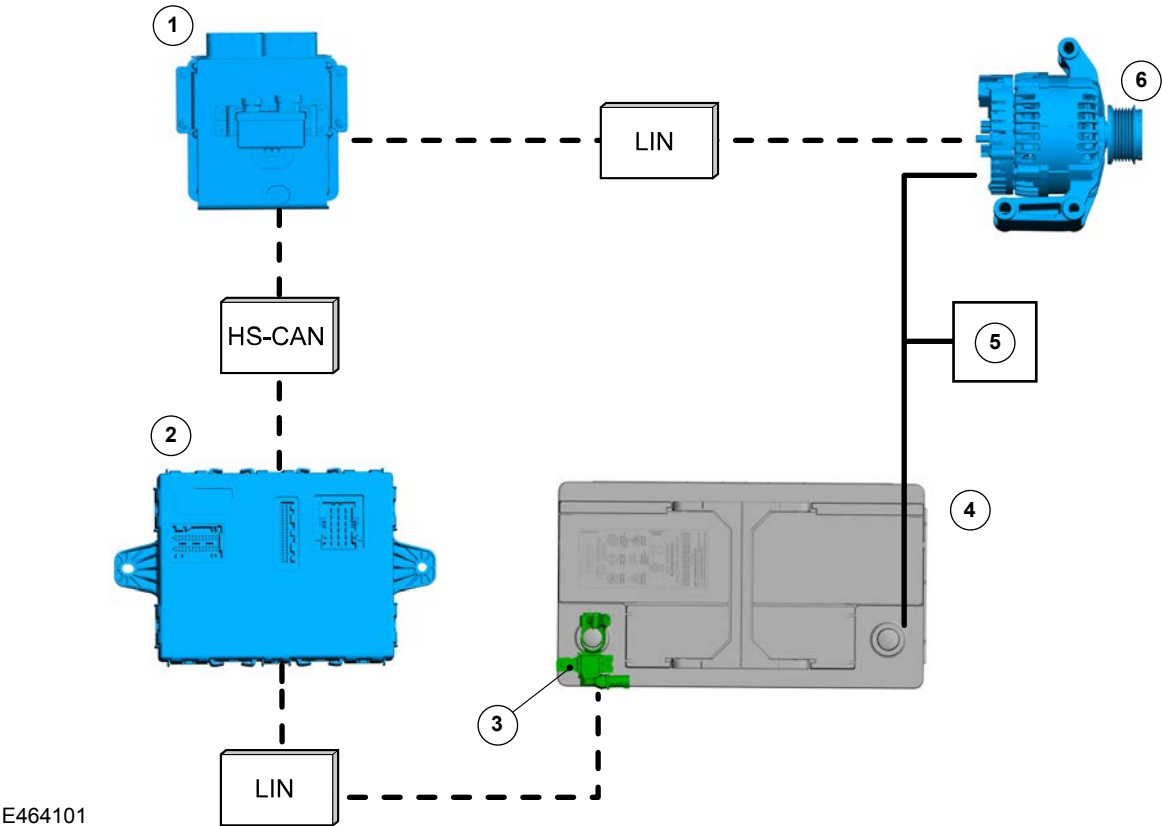
NOTE: The alternator is LIN controlled. It does not have a conventional D+ (engine start) signal line.

4.4.1 General Information

The battery capacity, technology and charge available from the alternator must be adequate to ensure engine cranking in unfavourable climatic conditions, even after fitment of additional electrical equipment.
Refer to: 4.5 Battery and Cables (page 62).

4.4.2 Charging System Layout

Battery Charging System Diagram



Item	Description
1	Engine Control Module (ECM)
2	Body Control Module (BCM)
3	Battery Monitoring System (BMS)
4	Battery
5	Electrical consumers
6	Alternator

Summary of the Available Charging Modes

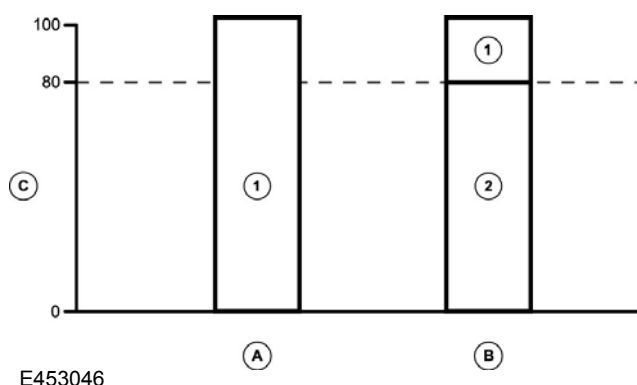
	Charge Mode	Approximate Charging Voltages (Measured at jump start post)
SRC	Smart Regenerative Charging - normal charge mode.	Minimum 13.5V - Maximum 14.8V

The voltages in the above table are approximate as the charging system is dynamic and can vary the voltage at any time.

4.4.3 Smart Regenerative Charging (SRC)

Smart Regenerative Charging varies alternator output using information from the Battery Monitoring Sensor to reduce fuel consumption. Alternator output can be increased during deceleration to charge the battery without the use of additional fuel. Alternator output can also be decreased to reduce the load on the engine and therefore fuel used. During this condition the battery supports the electrical loads. By comparison, Conventional Charging aims to charge the battery at a constant level which varies with battery temperature.

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



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

4.4.4 Circuit Diagrams

Full vehicle wiring and circuit diagrams are in the Ford Workshop Manual.

Refer to: [4.14 Fuses and Relays \(page 83\)](#).

and

Refer to: [4.15 Electrical Connectors and Connections \(page 84\)](#).

4.4.5 Alternator Characteristics

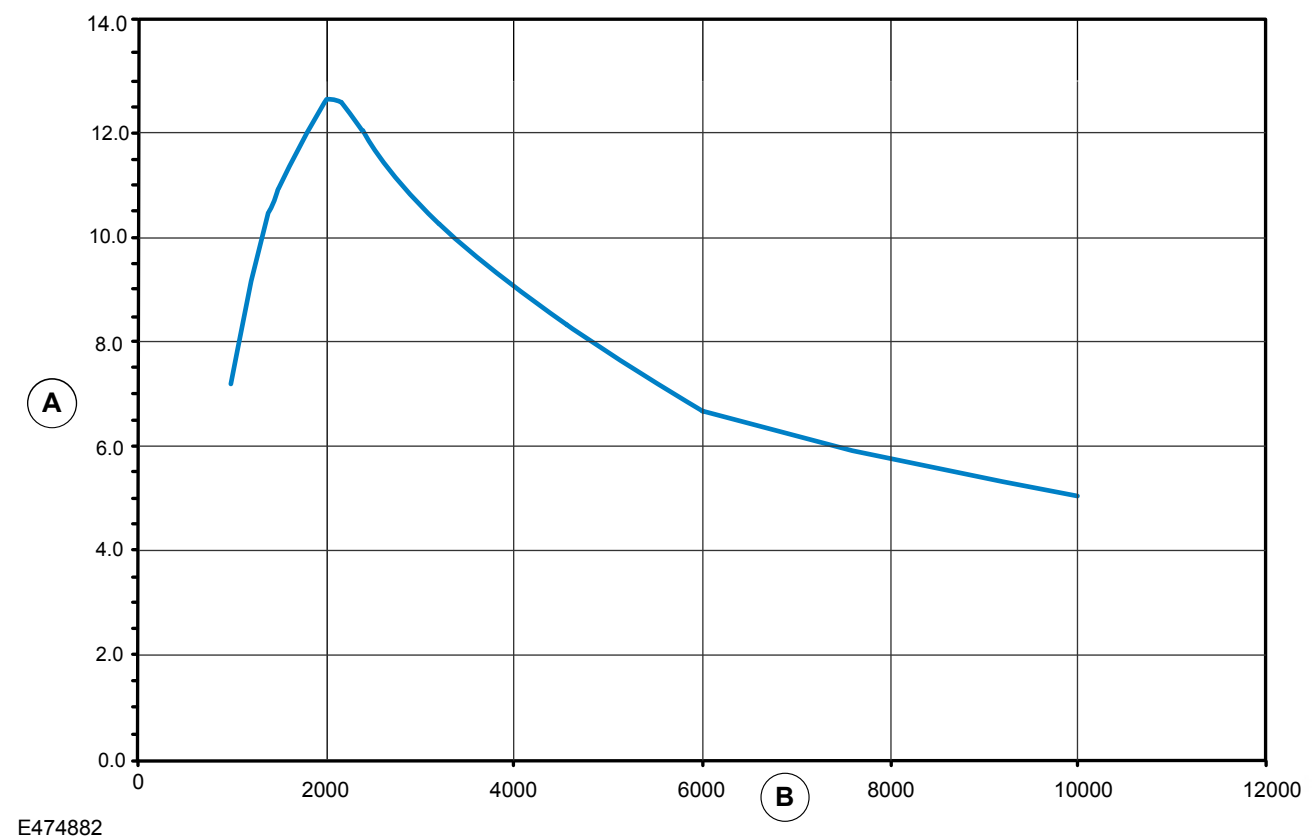
NOTE: For equivalent engine revs per minute (RPM), the alternators revolutions, axis (B) should be divided by the following factor: 2.69 for 2.0L diesel.

NOTE: These alternator curves do not show spare output capacity as this would be dependent on original vehicle features and options.

NOTE: If the engine is running for long periods, assume the hotter temperatures apply. This data can be used for calculating charge balance values for the finished third party system.

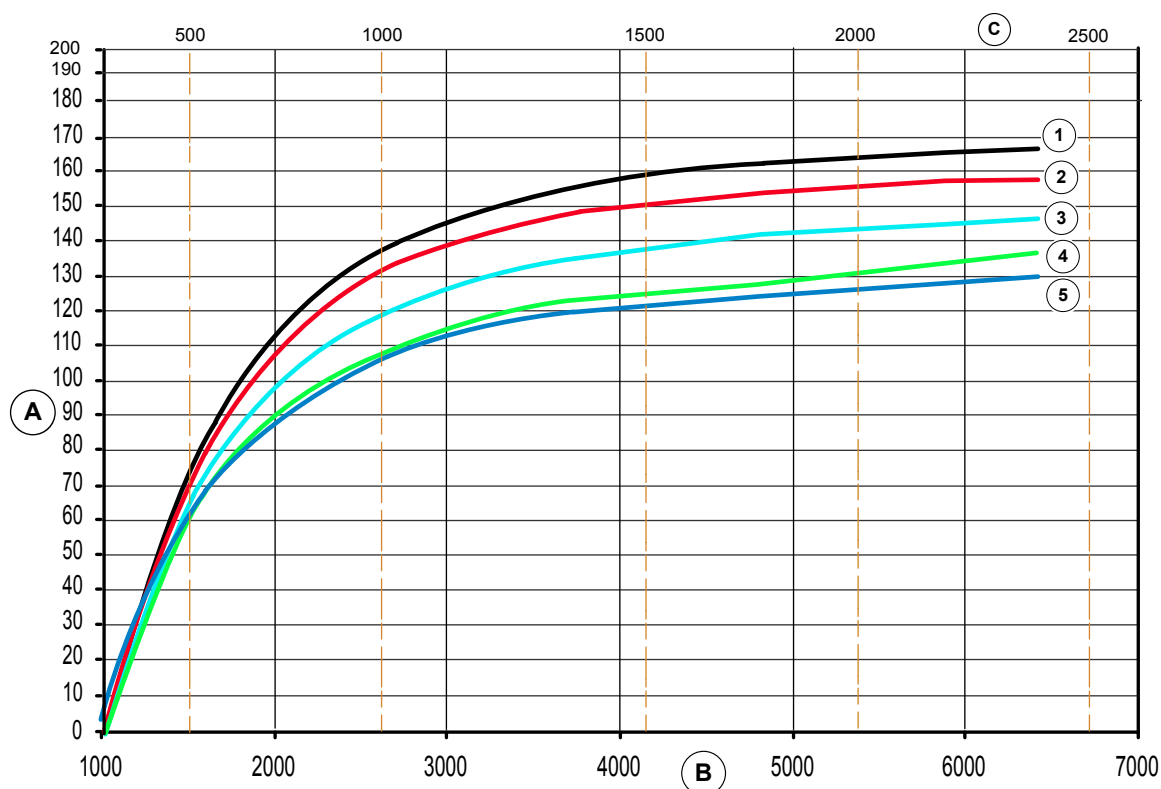
Allow for the Ford system to require approximately 20A to run the engine. Any further Ford systems active such as blowers and lights, will further reduce available Ampere for third party systems. An overloaded alternator will exhibit voltage lowering below 12.8V and could lead to damage, so must be avoided.

Torque Curve of Alternator



Item	Description
A	Torque (Nm)
B	Revolutions Per Minute (RPM)

Alternator Output Performance Curve - 180A Current Output



E474881

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

4.5 Battery and Cables

 **CAUTION:** Some batteries will require specific charging profile. Therefore, you must use a suitable battery charger (e.g. DC-DC charger) for your selected battery. Please consult your battery supplier.

NOTE: If there is an isolation relay, check settings to ensure batteries are connected to the charging circuit.

NOTE: The battery capacity, technology and charge available from the charging system must be adequate to ensure engine cranking in unfavourable climatic conditions, even after fitment of additional electrical equipment.

NOTE: Do not make any additional connections to the Power Distribution Box (PDB) terminals, as overtorqueing could cause damage to the PDB.

4.5.1 Power and Connectivity Usage Recommendations

 **CAUTION:** When evaluating the electrical system's performance, it is essential to consider engine run loads to ensure proper power management and overall efficiency.

NOTE: Use Absorbent Glass Mat (AGM) batteries for deep cycle applications, i.e. charge and discharge on a regular basis..

NOTE: When considering battery discharge, the Vehicle Converter needs to consider the current drawn when the added system is in operation, plus any continuous key off loads even when not in use. For example, an inverter fitted will consume power even with no load connected.

NOTE: Where possible, engine run operation/power active (BEV) of electrical equipment reduces battery discharge; both Vehicle Start and Auxiliary Batteries are utilised in conjunction with the charging system.

NOTE: User training and appropriate battery maintenance on a regular basis will assist in ensuring correct battery operation.

NOTE: For heavy 12V electrical demands at engine off/charging-off/DCDC-off situations, for example from 'beacons on for full working shift', then AGM technology battery/batteries are required.

An additional battery may be connected to the starter-battery positive terminal post only when used with a suitable third-party battery guard incorporating an automatic disconnect/isolation function. The battery guard must automatically isolate all upfit electrical loads from the main battery if an overload or low-voltage condition occurs, to prevent main-battery discharge and loss of vehicle starting capability.

NOTE: Do not splice, tap, backfeed, or connect any additional electrical load into the vehicle's existing wiring harness.

All added batteries and upfit equipment must use dedicated wiring, correctly rated circuit protection, suitable isolation devices, and approved connection points. Incorrect installation may cause wiring damage, loss of vehicle functions, battery discharge, overheating, fire, serious injury, or vehicle damage.

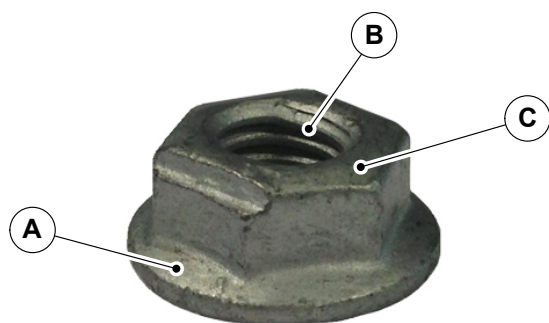
4.5.2 High Current Supply and Ground Connections

WARNINGS:

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

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

Self Locking Crimp Hexagonal Nut



E171315

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

4.5.3 Guidelines When Converting Vehicles

⚠ WARNING: Fitting of voltage boosters or other devices to enhance alternator output is not allowed. Fitting of such devices will not only invalidate vehicle warranty, but could damage either or both, the alternator and Engine Management System/Power Control Module, and possibly affect vehicle legal compliance. Check local legislation.

Operator requirements for additional and specialised electrical equipment vary. The Vehicle Converter must therefore consider the following points when designing the installation:

- Maintain legality and regulatory conformity of the base vehicle.
- Driveability and serviceability of the base vehicle.
- The effect of regulations governing the proposed conversion including national legislation in the country of sale.
- The method of integrating the circuit into the base vehicle.
- The materials and installation must meet the quality standards described in this section.

Normal Operating Voltage

The Transit electrical system is charged by an alternator. The vehicle electronics run on a 12V supply with a negative ground return. The factory fit equipment is designed for normal operations to be fully operational in the range 9-14V.

Voltage Check and Charging Procedure

⚠ WARNING: Do not connect to any ground or +12V potential points other than that specified in the Owner's Manual. There is a dedicated charge point under the bonnet. Failure to comply may lead to high current paths that may damage peripherals and electronic modules, especially in a Jump Start condition.

All voltages are to be measured with an accuracy of $\pm 5\%$ of values published, using calibrated meters. Measure connected to the vehicle at ignition off and no loads active including interior or exterior lights in Off status. Measure the voltage by using the battery plus terminal for positive connection and battery ground or battery minus terminal for negative connection. Alternatively, the voltage can be measured in the engine bay, between the Jump Start point and engine bay ground point.

1. Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm up to at least 5°C (41°F) before charging. This may require four to eight hours at room temperature depending on the initial temperature and battery size.
2. A battery which has been completely discharged may be slow to accept a charge initially, and in some cases, it may not accept a charge at the normal charger setting. When batteries are in this condition, charging can be started by use of the dead battery switch or boost charge on chargers that have this facility.
3. To determine whether a battery is accepting a charge, follow the manufacturer's instructions for the charger, for use of the discharged battery/boost charge mode.

Surface Charge Dissipation

Prior to carrying out manual voltage checks, it is necessary to establish that the battery does not have any damage and the battery voltage is stable and free from surface charge which occurs after engine run.

To ensure surface charge is not present, measure the battery voltage after the vehicle has been standing with the ignition off and no loads active for a prolonged period of 24 hours. If this is not possible an estimate can be made using the following method:

1. To dissipate whatever surface charge is present in the battery, turn on the headlamps (main beam) for 5 seconds, or turn on the parking lamps for 15 seconds if the head lamps will not turn on with the key in the off position.
2. Turn off the lights and allow the key-off loads to reach their steady value. This typically takes 35 minutes from ignition off.

Sensitivity and Voltage Tolerance

The Transit utilises multiplexed vehicle electronics. It is recommended that the appropriate Ford proprietary accessory systems are used. Inappropriate or incorrect connection of additional equipment could cause misoperation, or damage to the vehicle, and so invalidate any warranty.

Stored and Delayed Vehicles

Refer to: 1.10 Vehicle Transportation Aids and Vehicle Storage (page 19).

Transport Mode

 **WARNING: The only method to return the vehicle to Transport mode is by using a Ford diagnostic service tool with the correct level of security clearance. The Ford dealer has the correct tools and level of security to do this if required.**

If the cluster displays 'Transport Mode', the vehicle may have reduced functionality. This mode is mainly to conserve battery life/warranty during pre-delivery.

NOTE: To change from 'Transport Mode' to 'normal mode'; keep the ignition on, press the brake pedal five times, turn on and off hazard switch twice (in any combination) within a 10 second period.

NOTE: Vehicles should remain in 'Transport Mode' (where possible) during storage and prior to handover to customer.

Power Disconnection

 **WARNING: Disconnection is required for welding work and work with airbags. Disconnect all the batteries, including ground and insulate the negative battery terminal(s).**

NOTE: After disconnecting the power supply and before performing further work, a wait time of 15 minutes must be maintained to ensure safety systems are fully deactivated.

Following battery disconnection, there is no need to reprogramme the vehicle. It retains its normal power management settings and configurations. With regard to the MP5 centre screen, all of the settings are retained.

If the vehicle is in the secured state and the battery is disconnected, manually opening any door during the disconnection period will trigger the vehicle's anti-theft alarm function once the battery is reconnected.

If the vehicle was not in the secured state before battery disconnection, there will be no action after the battery is reconnected.

Ground Connections

NOTE: If there is a battery guard or an isolation relay, check settings to ensure batteries are connected to the charging circuit.

High electrical loads should also be grounded directly to the vehicle body and not the negative battery terminal. Connecting to the negative battery terminal will bypass the BMS and affect the correct assessment of the battery state of charge. Refer to BMS section in this manual.

Refer to: [4.6 Battery Protection \(page 68\)](#).

If separate charging systems are added, the ground side of the charger must also be connected to the body.

Refer to: [4.15 Electrical Connectors and Connections \(page 84\)](#).

Battery Cable Fixing Torque

The battery cables should be fixed to the terminal posts (with/without BMS) to the following torques:

- Positive battery post: 9.0Nm $\pm$ 1.4Nm
- Negative battery post: 10.5Nm $\pm$ 1.6Nm

For additional information, see BMS later in this section.

Battery Safety

WARNINGS:

-  **Take necessary safety precautions when handling batteries, for example: protective clothing, eye and hand protection.**
-  **Ensure batteries are charged in a designated charging area that is correctly ventilated.**
-  **After conversion, always check that the drain tubes have not been dislodged.**
-  **When a battery guard is fitted and is monitoring a supply from twin AGM batteries, it is recommended to keep battery open circuit voltage above 11.8V measured at the battery terminals.**

LV Battery Type and Capacity

NOTE: If a Vehicle Convertor intends to add systems or accessories that will add electrical load at key-off or engine run, then an auxiliary AGM battery should be added.

The base vehicle is equipped with either a single battery system. It is important to also read related information on Start-Stop and charging systems.

The vehicle have AGM batteries as factory fit. Before installing additional electrical equipment check that the battery capacity, technology type, harness load capability and charging system output are suitable for the extra load.

The battery capacity, technology and charge available from the charging system must be adequate to ensure engine cranking in unfavourable climatic conditions, even after fitment of additional electrical equipment.

LV Battery Covers

WARNINGS:

-  **It is important to replace battery positive terminal cover after any conversions made to the battery.**
-  **If the battery cover is missing or damaged, a replacement part must be ordered and fitted. It is recommended to check fitment as part of a quality control process.**

LV Battery Drain Prevention

Refer to: [1.10 Vehicle Transportation Aids and Vehicle Storage \(page 19\)](#).

LV Battery Rest Period

After reconnecting, the BMS requires at least 4 hours quiescent period to recalibrate to the correct battery state of charge, see also BMS information later in this section.

Usage of Electrical Loads During Conversion

If electric loads are used during conversion, for example multiple crank cycles or door ajar, check the battery voltage more often than every 7 days and recharge the battery if necessary.

Refer to: 1.10 Vehicle Transportation Aids and Vehicle Storage (page 19).

Engine Off Loads

Key-off Load should not discharge more than 25% in 40 days (Normal mode). In general, all loads should have some form of isolation. A supplemental battery may be required to power systems, for example: GPS vehicle tracking systems that pull high key off loads continuously. This is to protect from discharging batteries at ignition off and interfering with the BMS correlation of battery state of charge. This supply should also have a dedicated protection fuse of the correct value.

Refer to: 4.6 Battery Protection (page 68).

Jump Start

Do not Jump Start the vehicle directly from the battery. Use designated Jump Start points. Refer to the Owner's Manual. The wiper motor bracket must not be used as a ground as it is isolated from the body.

Auxiliary Electrical Systems

NOTE: When auxiliary electrical systems are to be added to the vehicle, it is mandatory that the additional circuit design includes the necessary fuses.

When auxiliary electrical systems are added to the vehicle, it is recommended that the additional circuits are designed to be used with the Smart Fuse Box to maintain the integrity of the electrical system.

Refer to: 4.14 Fuses and Relays (page 83).

The materials and installation must meet the quality standards described in this section. Any additional equipment or components must be designed in such a way that they have no adverse Electro Magnetic Compatibility (EMC) effect on the vehicle.

Cable Routing

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

Fitting Equipment Containing Inductive Loads

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

The following must be observed:

- All inductive loads must be driven via relays with contacts rated at least 3 times the maximum rated current of the motor.
- All inductive loads supply circuits must be individually fused with the proper fuse rating for the motor.
- All power wiring must be rated for at least 3 times the rating of the motor and installed as far away as possible from any existing vehicle wiring.
- All inductive loads fitted should be fully suppressed to latest GSO Technical Regulations list, conformity to applicable Model Year approvals (as amended periodically) alongside applicable relevant local national legislation relating to EMC to ensure electrical interference does not affect the vehicle systems.
- Add EMC emissions statement to CE approval.

Airbags

NOTE: After disconnecting the power supply and before performing further work, a wait time of up to 15 minutes must be maintained. Work on airbag systems may only be performed by persons who have a relevant certificate of competence.

Pay attention to the following points:

- Disconnect all the batteries, including ground and insulate the negative battery terminal(s).
- Disconnect the electrical connector at the airbag control module.

Welding and Cutting

Increased use of comfort and safety electronics in modern motor vehicles also requires the greatest attention to be paid during body work. Over voltages produced during welding and in alignment work during body shell rectification may cause electronic systems damage. In particular, the safety instructions for performing welding/ cutting work on vehicles with airbag systems must be adhered to.

Refer to: 5.1 Body (page 91).

Pay attention to the following points:

- Disconnect the alternator multi-plug prior to using welding or cutting equipment.
- If welding or cutting is to be performed directly near a control module, it must be removed beforehand.
- Never connect the negative cable of the welder near an airbag or a control module.
- Connect the negative cable of the welder close to the location of the weld.

4.5.4 Converter Fit Additional Third Party Batteries

NOTE: It is the Vehicle Converter's responsibility to ensure the power supply on the vehicle is adequate to supply both Ford and third party systems, especially if they can be active at the same time.

Suitable capacity in the wiring, fuses and energy sources must be calculated. The extra battery, when discharged, becomes a load that can be up to 100A, so adds to the energy requirement from the charging sources, along with the third party loads.

Refer to: [4.6 Battery Protection \(page 68\)](#).

As this vehicle is not equipped with a Smart Fuse Box, FPBG, CCP, or a Load-Shedding signal, additional batteries may be connected to the battery positive terminal post. However, this must be paired with a third-party battery guard featuring a disconnect (isolation) function. It is highly recommended to use a battery guard with intelligent voltage monitoring to automatically disconnect the upfit loads from the starter battery in the event of an overload.

If an Engine Run signal is used to control the connection and disconnection of the third-party battery guard, it must be ensured that no overload occurs under any engine operating conditions (during an overload, the battery voltage will drop below 13V).

If supplemental chargers are to be used, they must be connected directly to the third party battery. The charge can also be applied to the Ford fit batteries, all relays/switches connected, but only for an emergency charge.

When changing from an incompatible battery configuration to a compatible system, Start-Stop and SRC functionality will take some time (ignition off overnight and multiple ignition run cycles) to re-establish full functionality.

Refer to: [4.4 Charging System \(page 58\)](#).

- The return ground cable is recommended, routed in parallel to +12V supply for EMC compliance.
- When in Engine Run, systems that are not required should be turned off to help the alternator supply the main load of the third party system. This information should be passed on to the end user by the Vehicle Converter.
- The BEMM is adhered to in all relevant areas. This document allows connectivity to Ford battery clamp if the above criteria is met.

4.5.5 Battery Monitoring Sensor (BMS)

 **CAUTION: Do not permanently remove jumper cable from the BMS.**

NOTE: If the key off load only drops to the expected lower value after 30 minutes, it is probably because a feature is still active, controlled by the battery saver timer. This could be because any door is ajar or an interior lamp is switched on. Peripherals plugged into the power sockets will continue to drain power until the battery reaches a low level of charge.

The BMS continuously monitors the condition of the main battery. To do this, it is bolted directly to the negative terminal of the battery. It is recommended that this is not removed. However, if removal is required, please refer to the Ford Workshop Manual, National Sales Company representative, or local Ford dealer.

The BMS re-calibrates itself at regular intervals. This occurs during a rest period at key off. The rest period must last for at least 4 hours. If the system cannot carry out a re-calibration then it is unable to establish the correct state of charge of the battery. In this case, the Start-Stop system may be deactivated.

Note there is approximately 10mA of key off load from existing Ford fit systems. Any third party installations should ideally be activated via ignition or engine run. Regardless of battery system, long periods of discharge may necessitate long periods of recharge. (PORC REF) 'Power and Connectivity Usage Recommendation' table at the end of this section.

After Vehicle Convertors system is installed, it is recommended to measure total key off load to battery with either a current shunt or with a clamp on ammeter calibrated and sensitive to milliamperes (mA). Perform this test after 10 minutes of key off with all doors shut so that the vehicle remains in sleep mode.

4.6 Battery Protection

4.6.1 Interior Lights and 12V Sockets

12V sockets and interior lighting are both controlled by timers and SOC control. Both reset at vehicle wake for example, door opening. These will switch off earlier if battery is low.

- 12V sockets - 10 minutes from key off
- Interior lighting - 10 minutes from key off (there are some options where the interior lighting has been extended to 15 minutes)

4.7 Climate Control System

WARNINGS:

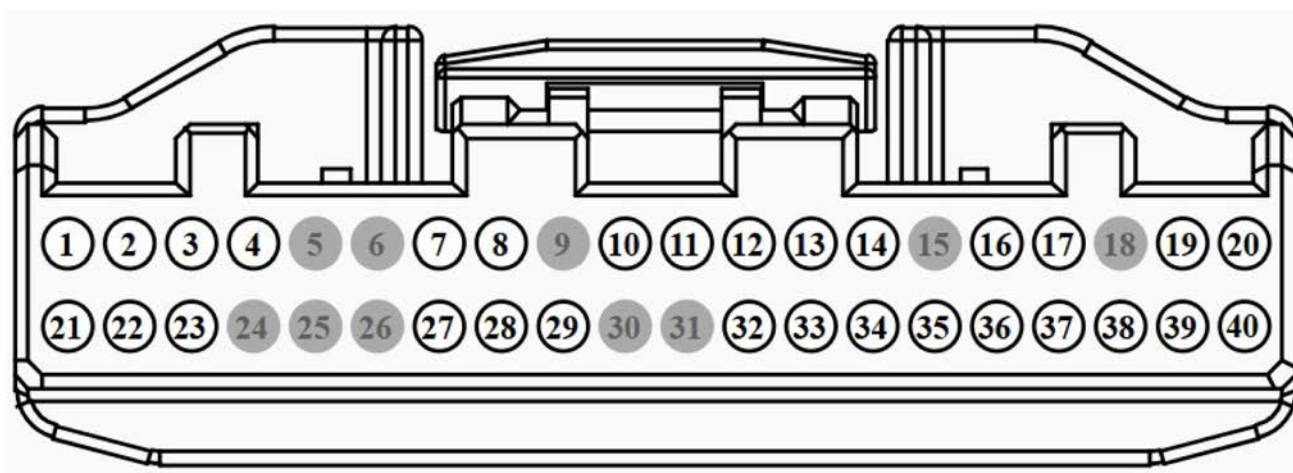
! Information provided in this section is for Vehicle Convertor reference only. Any unauthorised modifications to the climate control system including refrigerant system will result in malfunction of the system.

! Do not use propylene glycol based coolant.

NOTE: The Transit Custom Climate Control system utilises shared components from other vehicles, which may have higher feature levels and systems. Therefore, in addition to pins that are not used generally, there are others that are not available and could impede function or cause damage if connected for external use.

- Never secure hoses or tubes to the transmission fill or dip stick or to any fuel system or brake component.
- Do not route heater or refrigerant lines near or directly over any exhaust system component, including the exhaust manifolds.
- Avoid routing of hoses in the wheelhouse or stone kick-up arch. If routing is required in these areas, shield against stone pecking as appropriate.
- Do not route hoses near sharp edges. Utilise guards to protect against cutting or chafing.

4.7.1 Front Climate Control System



E474200

Climate Control Connector (C228B)

Pin	Description
1	Mode Door #1 feed 'A'
2	Mode Door #1 feed 'B'
3	Temp Door Feed 'A'
4	Temp Door Feed 'B'
7	Recirc Door Feed 'A'
8	Recirc Door Feed 'B'
10	Front Blower Relay Output
11	High Speed Sensor Output
12	Recirc Door Feedback
13	Mode Door #1 Feedback
14	Temp Door Position Feedback
16	Ground Module
17	Voltage - Reference 5V
19	Voltage - Ignition
20	Voltage - Battery
21	Front Blower Motor Control Output
22	Front Blower Negative Feedback
23	Front Blower Positive Feedback
27	MAX AC Button LED
28	Evaporator Temperature Sensor Output
29	MAX AC Button
32	On/Off Button LED
33	Defrost Button LED
34	On/Off Button
35	Defrost Button
36	Ground - Sensor
37	CAN-L
38	CAN-H
40	Ground - Battery

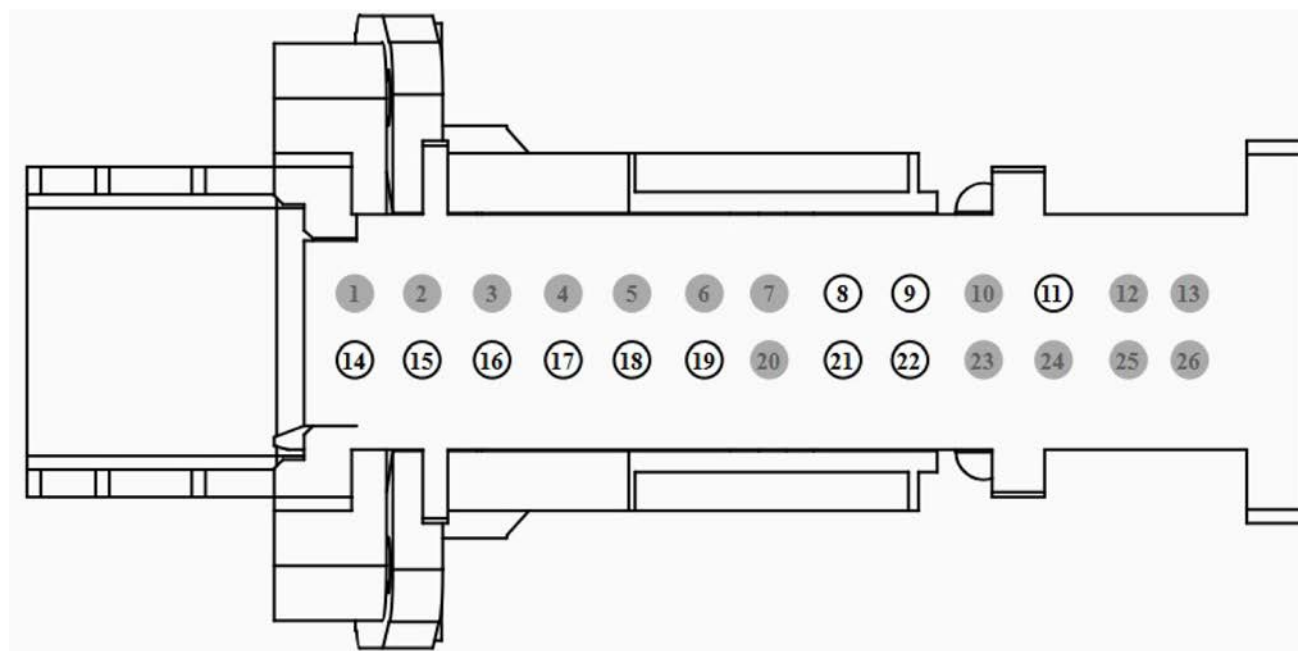
The Grey Pins in the image indicates unused and empty pins at the connector.

4.8 Instrument Panel Cluster (IPC)

⚠ WARNING: Do not tamper with, cut into or connect to any of the CAN-Bus interface wiring or connectors.

Most of the functions are managed over the CAN-Bus interface.

Instrument Cluster Connector (C220)



E474201

Pin	Description	Wire Colour
8	Fuel Level Sensor	Yellow/White
9	Fuel Level Sensor Return	Red/Violet
11	Low Oil Pressure	Brown/Blue
14	Voltage - Battery	Violet/Green
15	Voltage - Ignition	White/Violet
16	Ground	Black
17	Ground	Black
18	CAN-L	Violet
19	CAN-H	Pink

The Grey Pins in the image indicates unused and empty pins at the connector.

4.9 Horn

Any other aftermarket horn (for example an air horn) will need to be driven by a separate relay energized by the horn circuit.

4.10 Information and Entertainment System

4.10.1 Multimedia Head Unit - Summary

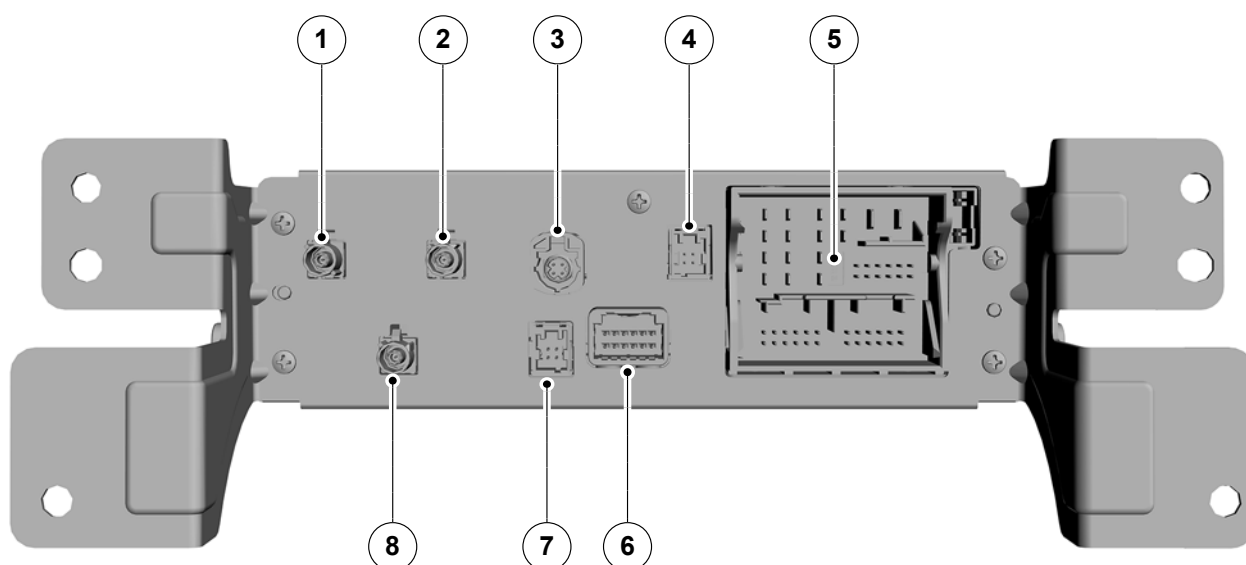
Multimedia Head Unit is a standard installation as part of the Multimedia System in your vehicle.

4.10.2 Radio with FM/DAB

NOTE: There is black co-axial cables from the roof fitted AM/FM1/DAB antenna that go to the multimedia head unit.

Multimedia Head Unit is connected to the instrument panel wiring harness via one 52 pin connector.

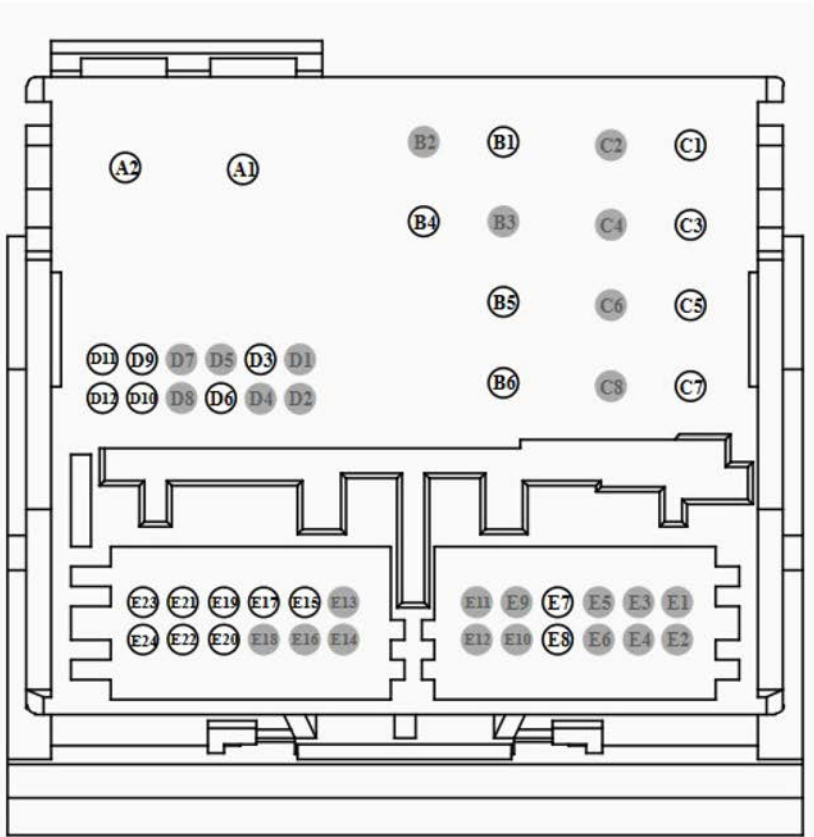
Multimedia Module Connectors



E476542

Items	Description
1	GPS Antenna Connector
2	Rear View Camera Connector
3	Center Display LVDS Connector
4	USB Data Connector
5	Audio Control Module Connector
6	Center Display Screen Connector
7	USB Charging Port Connector
8	Roof Mounted Antenna Connector

Audio Control Module (C240A)



E474578

Pin	Description	Type
A1	Ground	Input/Output
A2	Battery Power	Input
B1	Battery Power	Input
B2	Not Used	-
B3	Not Used	-
B4	Ground	Input/Output
B5	Ignition	Input/Output
B6	Ground	Input/Output
C1	Left Front Speaker-	Output
C2	Not Used	-
C3	Left Front Speaker+	Output
C4	Not Used	-
C5	Right Front Speaker-	Output
C6	Not Used	-
C7	Right Front Speaker+	Output
C8	Not Used	-
D1	Not Used	-
D2	Not Used	-
D3	Ground	Input/Output
D4	Not Used	-
D5	Not Used	-
D6	Ground	Input/Output
D7	Not Used	-
D8	Not Used	-
D9	PCAN_H	Input/Output
D10	PCAN_L	Input/Output
D11	BCAN_L	Input/Output
D12	BCAN_H	Input/Output
E1	Not Used	-
E2	Not Used	-
E3	Not Used	-
E4	Not Used	-
E5	Not Used	-
E6	Not Used	-
E7	Media Button Input-	Input
E8	Not Used	-
E9	Not Used	-
E10	Not Used	-
E11	Not Used	-
E12	Not Used	-
E13	Not Used	-
E14	Not Used	-
E15	Not Used	-

Pin	Description	Type
E16	Not Used	-
E17	Ground	Input/ Output
E18	Not Used	-
E19	Not Used	-
E20	Not Used	-
E21	Not Used	-
E22	Microphone Shield	Output
E23	Microphone Signal	Input
E24	Microphone Power Supply	Output

4.10.3 Rear View Camera

Ford Motor Company's camera systems, particularly the Rear View Camera (RVC), connect to the MP5 module using a coaxial cable. This connection is designed to be a single run, which helps minimize signal loss and supports "Power Over Coax" (PoC), meaning the camera receives power directly through the same cable that transmits the video signal.

- NOTE:** Do not paint or modify the rear camera or rear bumper as this will impede the rear park assist functionality
- NOTE:** Fitting of accessories to the rear of the vehicle will impede the functionality of rear park assist, in these instances the feature should not be used.
- NOTE:** Do not obstruct the rear camera.
- NOTE:** Do not move or modify any camera mounting positions or brackets, as this will impede on camera and rear park 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:** Change to track width is not recommended and will result in the dynamic guidelines not being representative of vehicle turning circle.

4.11 Exterior Lighting

WARNINGS:

-  **Make sure that the modified vehicle complies with all relevant regulatory requirements.**
-  **Do not tamper with the base system (controlled by Body Control Module and multiplex architecture) and any feeds taken from the associated wiring or controller.**
-  **Due to significant wiring and control/configuration differences between headlamp types, it is not possible to retrofit Bi-Xenon HID (High Intensity Discharge) headlamps to vehicles not originally built with them.**

4.11.1 Reversing Lamps

Reversing lamps are activated by a high side driver in the Body Control Module (BCM). Accessories that add additional load, such as reversing sounders, connected to the reversing lamp circuit, should be connected by a relay. Connecting such loads directly to the reversing lamp circuit could damage the BCM. .

The load on the reversing lamps should not exceed a total of 3A (42W), 250mA for a relay

4.11.2 Lamps – Front and Rear Fog Lamps

The latest GSO Technical Regulations list, conformity to applicable Model Year approvals (as amended periodically), alongside relevant local national legislation governing the electrical interconnection and switching of front and rear fog lamps must be reviewed before designing the vehicle's lighting wiring circuit. The maximum permissible load is:

- Front fog lamp - 2 x 35W (High side driver controlled)
- Rear fog lamp - 2 x 21W (High side driver controlled).

4.11.3 Lighting Loads

The BCM exterior lighting outputs have shut-down protection in the event of an overload condition. If the overload condition is not addressed, the output will be shut-down permanently to protect the driver hardware. A dealer visit and/or BCM replacement may be required if overload condition is not removed.

4.11.4 Lamps – Hazard / Direction Indication

The standard system configuration each side:

- 1 x Left Front Indicator 21W and 1 x Left Exterior Mirror Indicator 5W x Left Rear Indicator 13W (shared single output) - max load 39.5W.
- 1 x Right Front Indicator 21W x Right Exterior Mirror Indicator 5W x Right Rear Indicator 13W (single output - max load 39.5W).

4.11.5 Electrically Operated Door Mirrors

-  **WARNING: Do not tamper with the base system (controlled by Body Control Module and multiplex architecture) and any feeds taken from the associated wiring or controller.**

NOTE: These options are not suitable for aftermarket or Vehicle Convertor fit.

4.11.6 Additional External Lamps

All power feeds for additional exterior lighting must feature an isolation function from the base vehicle battery to prevent excessive drain, utilizing appropriate switches and/or relays as necessary.

Refer to: [4.14 Fuses and Relays \(page 83\)](#).

and

Refer to: [4.15 Electrical Connectors and Connections \(page 84\)](#).

Lighting Loads

BCM Outputs	Controlling Device	Max. Load	Vehicle
Number Plate and Marker Lamp Supply ¹	High Side Driver	27W	2 x 5W
Position/Parking Lamp Front - each side ³	High Side Driver	10W	5W
Position/Parking Lamp Rear - each side	High Side Driver	6W	5W
Direction Indicator Front - each side	High Side Driver	27W ²	21W + 5W ⁴
Direction Indicator Rear - each side	High Side Driver	27W ²	21W

¹ Number Plate and Marker Lamps not to exceed 27W. LED Markers are recommended where available.

² Turn Indicator Supply. Smaller loads will trigger bulb outage detection.

³ Only present on bulb position lamp variants (not present with combined LED DRL/Position lamps).

⁴ If DCUs are fitted, the 5W side repeater lamps are connected to the corresponding driver/passenger DCU.

4.12 Interior Lighting

4.12.1 Additional Internal Lamps

 **CAUTION: The maximum total internal lamp load must not exceed 5A (70W).**

Electrical supply for additional cabin interior lighting may be obtained by directly accessing the connector inside the dome lamp in the cabin.

Electrical supply for additional load space interior lighting may be obtained by directly accessing the connector inside the load space lamps.

For additional information on BCM.

[Refer to: 4.3 Communications Network \(page 54\).](#)

The battery saver system provides power for the interior lighting for a limited time.

Power supply for the interior lights.

Time delay relay provides Battery Save Power output for front cabin light. When the front dome light is set to the Courtesy position, opening any of the doors will turn on the front dome light.

The rear cargo lamp is powered by PIN4 of the front dome light, and it turns on and off completely in sync with the front dome light.

Each interior light circuit is grounded locally to the lamp. The lamps fitted to the cabin or cargo circuit depends on the vehicle type. To determine the lamps on the rear or cargo circuit:

- Set any lights with a switch to courtesy.
- Close all the doors and allow the lights to switch off.
- Open the door or lift gate at the rear of the vehicle.
- Any interior lights that switch on are in the rear cargo or rear zone.
- Some vehicle types may have no lamps on the rear circuit

If fluorescent lighting is required, it must not be connected to the existing interior cabin or cargo lighting as it is not compatible with the pulse width modulated (PWM) lighting circuit and may cause premature failure of the fluorescent lighting.

4.12.2 Additional Lighting for rear of vehicle interior

All power feeds for additional exterior lighting must feature an isolation function from the base vehicle battery to prevent excessive drain, utilizing appropriate switches and/or relays as necessary.

[Refer to: 4.15 Electrical Connectors and Connections \(page 84\).](#)

4.13 Handles, Locks, Latches and Entry Systems

4.13.1 Door Removal or Modification

 **CAUTION:** If you install an additional third-party control system into the Ford locking and unlocking system, you must use the crash event CAN signal. This signal overrides the third-party control system and triggers the crash unlock feature during a crash.

NOTE: If you install ajar switches in the modified doors, for most use cases they must be polarity NORMAL CLOSED. This means the switch is closed when the door is closed. Power Side Load Doors and Side Load Doors with Close Assist functionality are an exception to the statement above, as they have ajar polarity NORMAL OPEN, therefore an ajar switch with the same polarity must be used if they are being replaced. NORMAL OPEN means the switch is open when the door is closed. Adhering to these conditions maintains the alarm and interior lighting functions.

If you need to remove the doors for derivatives that require no doors, you must link certain circuits. This makes sure that door ajar warnings do not appear on the Instrument Cluster. The interior light also stays on if you do not do this.

To maintain the door closed state, configure the BCM as follows. Make sure that the door ajar circuits connect to ground when the door is closed, except for Power Side Load Doors and Side Load Doors with Close Assist ajar circuits.

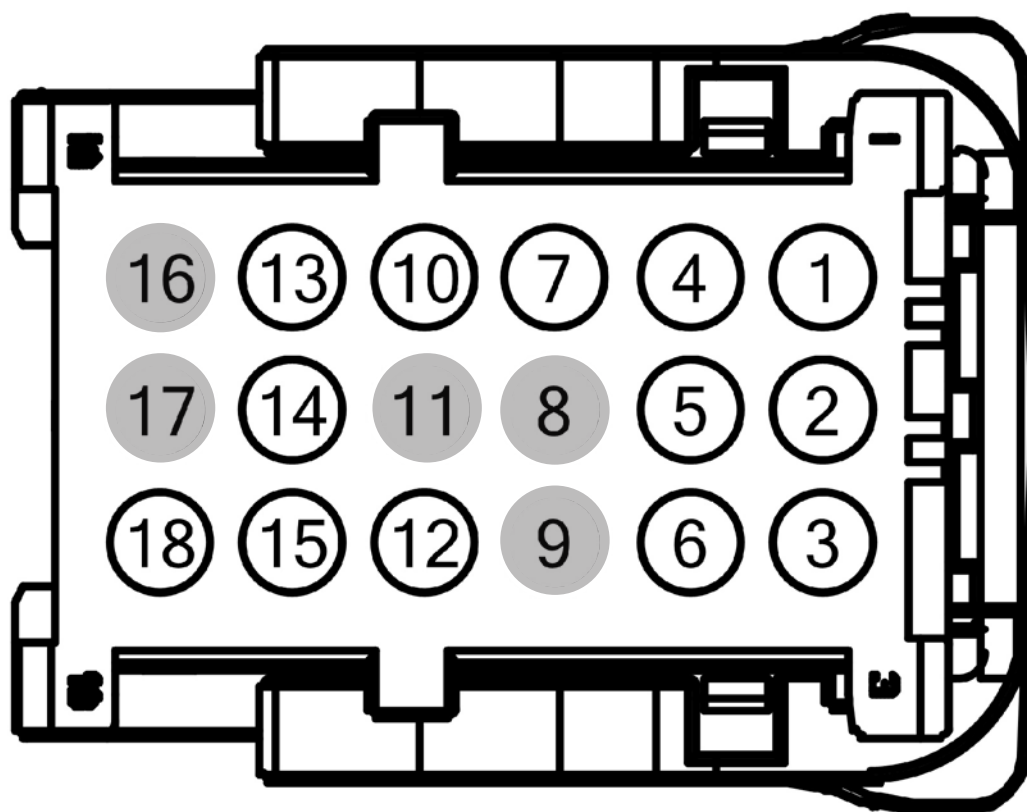
Make sure the door ajar circuits connect to ground when the door is closed, except for hood ajar circuit.

- C11 Hood Ajar Switch in OEM Hood Latch Only
- C20 Front Left Ajar - Ground
- C21 Front Right Ajar - Ground
- C07 Right Rear Hinged Door Ajar
- C22 Left Sliding Door Ajar

The circuits that follow must be ground when the latch is locked and open circuit when unlocked, or always ground. If not ground when locked, the lock can fail to complete:

- C19 Front Left Door Latch feedback
- C5 Front Right Door Latch feedback
- C16 Right Rear Sliding Door Latch feedback

Vehicles that are ordered with only the kerbside sliding door only support the kerbside sliding door ajar switch.

BCM Connector (C2280A)

E476530

Pins to control additional door locks

Pin	Description
1	Unlock Tailgate
4	Unlock Front Doors
10	Unlock Side Sliding Door
13	Unlock All Doors

4.13.2 Central Locking

Locking is controlled by the BCM. There are locking feedback circuits from the latch to the BCM on certain locking circuit pins as part of the security system – if these are tampered with, locking performance cannot be guaranteed. However, it is possible to add additional lock(s) via relays (max 300mA coil current permitted) per unlock circuit. All latch lock and unlock pulse durations are 110ms.

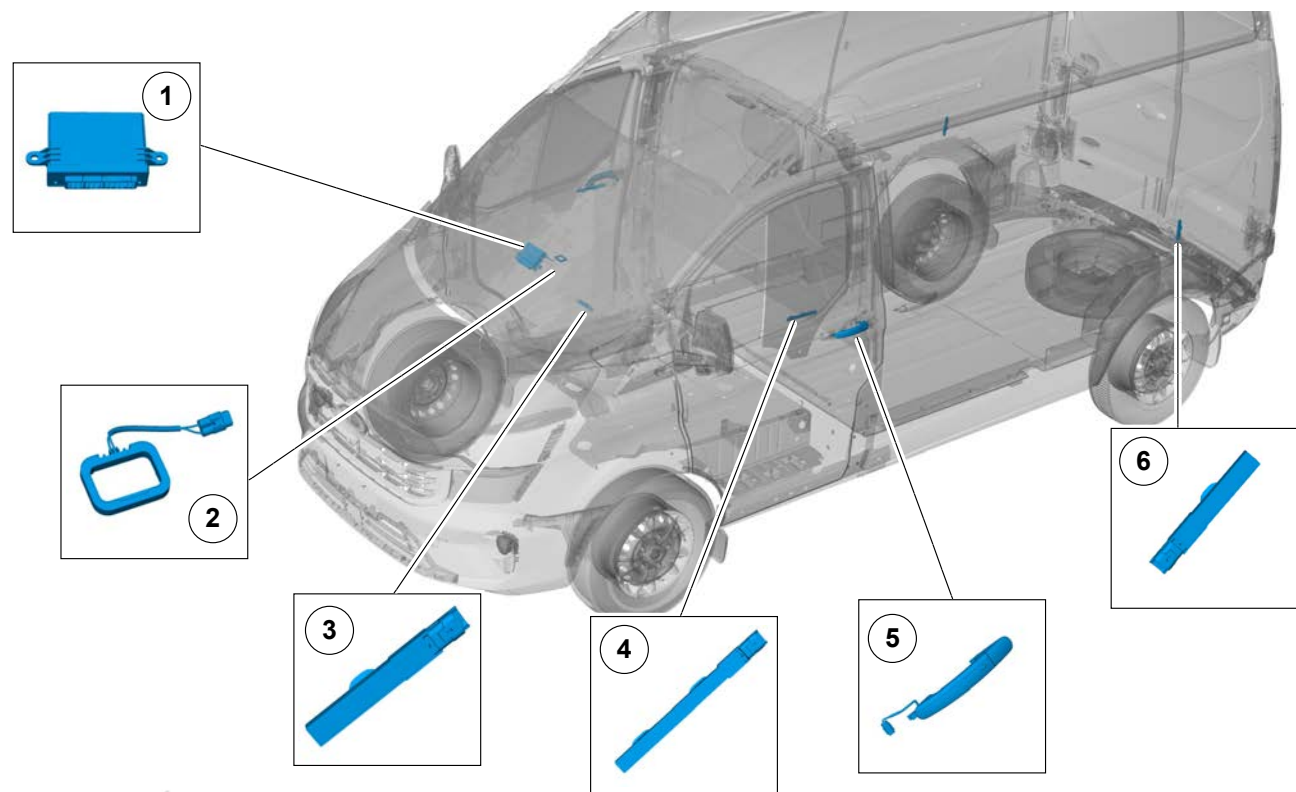
The use of Ford Transit lock mechanisms is strongly recommended as the BCM is designed to drive these latches for the correct amount of time.

4.13.3 Passive Entry Passive Start (PEPS) Antennas

! CAUTION: Relocating PEPS antenna could negatively impact its calibration and, consequently, affect the keyfob's passive start detection.

The PEPS system is composed of three interior antennas and two exterior antennas. The trio of interior antennas ensures the functionality of the Passive Start feature, located in the Instrument Panel (IP), left/right rear side panels. The exact positioning of these antennas is vital, as each generates a magnetic field within certain ranges for keyfob detection. The overarching guideline for PEPS antenna placement revolves around ensuring that the antennas are both centred and uniformly distributed relative to the vehicle's structure. Any displacement of these antennas could compromise the effective operation of the PEPS system. On the other hand, two exterior antennas on the front door interior panels of the driver's side and passenger side, facilitate the Passive Entry feature.

Any modifications to these door handles could potentially impede the functionality of the Passive Entry system.



E466047

Item	Description
1	Remote Function Actuator Module
2	PATS Immobilizer Coil Antenna
3	PATS Center Antenna
4	PATS Front Antennas
5	Front Door Exterior Handle Request Switches (if equipped)
6	PATS Rear Antennas

4.14 Fuses and Relays

4.14.1 Fuses



WARNING: No increase in existing vehicle standard fuse capacity is allowed under any circumstances. There are no spare fuses in the Engine Junction Box (EJB), Secondary Relay Box (SRB) or Body Control Module (BCM). The Vehicle Convertor must provide additional fuses as required. Please refer to Owner's Manual for further information on fuses and relays.

NOTE: Only use Ford fuses. Other fuses may interfere with the validated fusing strategy.

4.14.2 Windshield Wipers

The base wiper system should not be tampered with (controlled by Steering Column Control Module and multiplex architecture with LIN technology).

NOTE: Power to wiper motors is limited by the size of the wiring and associated relays. If any alternative wiper installation is made, it must have a specification equivalent to Ford components.

Refer to: [5.7 Glass, Frames and Mechanisms \(page 106\)](#).

4.15 Electrical Connectors and Connections

WARNINGS:

-  **The CAN-Bus should not be tampered with as this may lead to failure of safety critical components such as Anti-Lock Braking System (ABS).**
-  **Do not use connectors which cut through the outer covering and into the core wire.**
-  **CAUTION: Only use Ford approved connectors.**

4.15.1 General Information

Wiring

NOTE: Ford approved jumper harnesses should be used. It is not recommended to cut into vehicle wiring because:

- The base vehicle specification is unsuitable for incremental loads.
- Long term risk of a faulty connection developing.
- Potential fire risk from over-loading.

All connections into existing wiring must be permanently insulated. Exterior connections must be waterproof and with a drip loop.

Where wires are required to be extended, break in points should only be at existing connector points. If splicing into existing wiring is unavoidable, see wiring splicing procedures in this manual.

Refer to: [4.2 Wiring Installation and Routing Guides \(page 46\)](#).

4.15.2 Additional Vehicle Signals/Features

-  **WARNING: When interfacing with specific lighting high side driver outputs, additional supplemental signal access, relays and peripherals fitted, must be compatible with a Pulse Width Modulation (PWM) frequency of 220Hz.**

Please refer to circuit diagrams in the Ford Workshop Manual for details of Vehicle Signals and Features.

4.16 Grounding

4.16.1 Ground Points

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

CAUTIONS:

- ⚠ Do not use the populated ground points indicated. Using alternative points may affect the vehicle integrity.**
- ⚠ Make sure that all ground points are tightened to the correct torque.**

NOTE: The Ground Point (GP) numbers are only for reference to show the location of the GP.

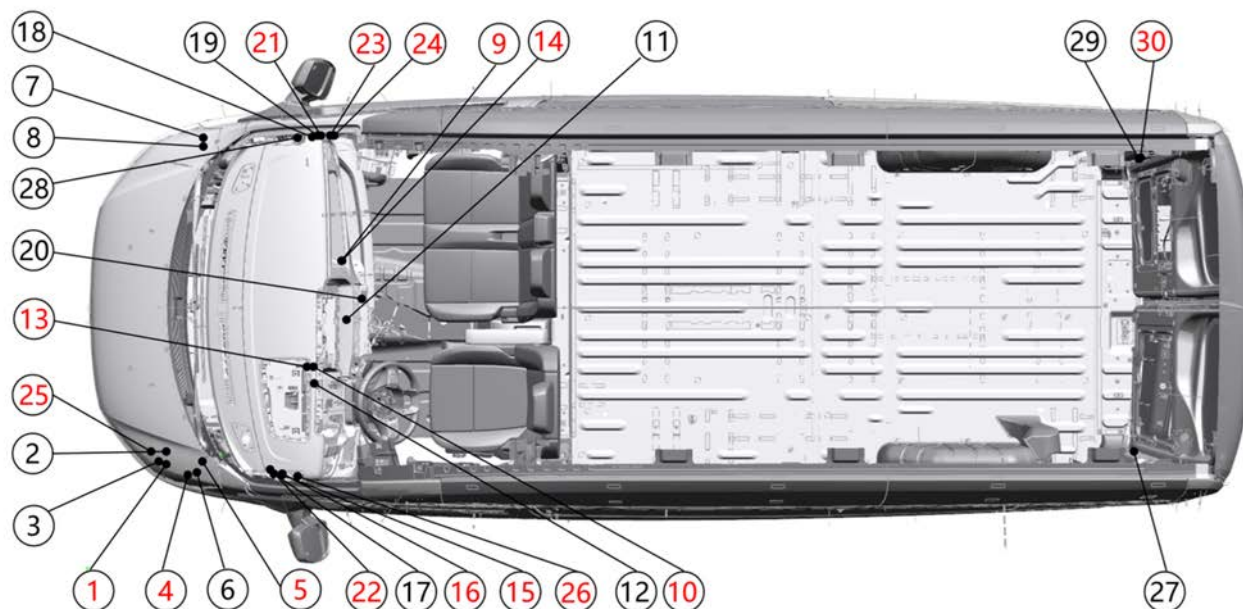
NOTE: Please refer to the following diagrams for the 12V system ground points. Additional ground points can be created by Vehicle Convertors on the body (preferable) or chassis. This may be the use of a welded on stud or nut secured to body sheet metal. Requirements for a clean surface to weld to, and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

Ground wires should be brought back to the Ford ground points provided. For very high current users, it is recommended that the ground connection is made directly to the ground point close to the battery ground point.

Refer to: 4.5 Battery and Cables (page 62).

If a new grounding point is required, avoid weather zones, especially for high current grounds. Ground connections should be routed back close to the location of the +12V supply. This helps to reduce the electromagnetic field particularly generated by inrush current and improve electromagnetic compatibility.

Van Ground Points

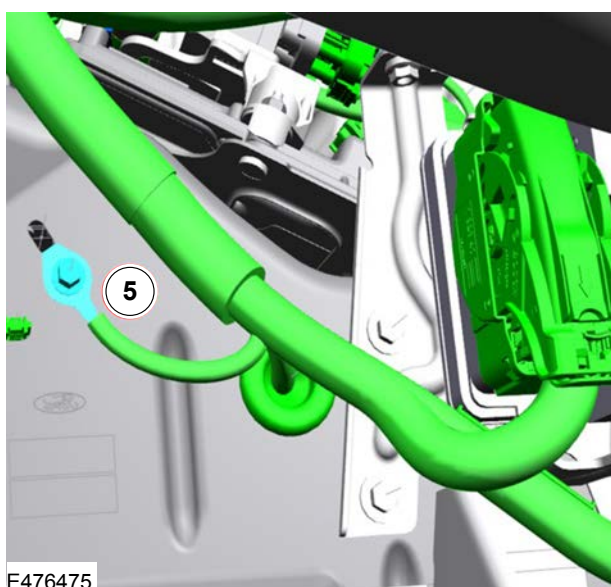
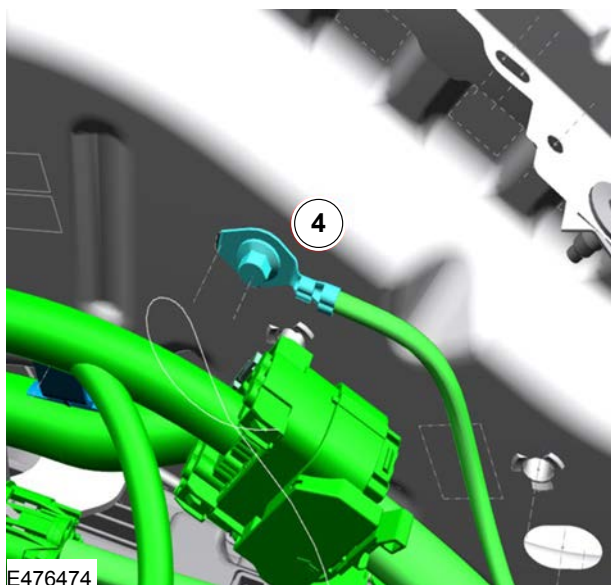
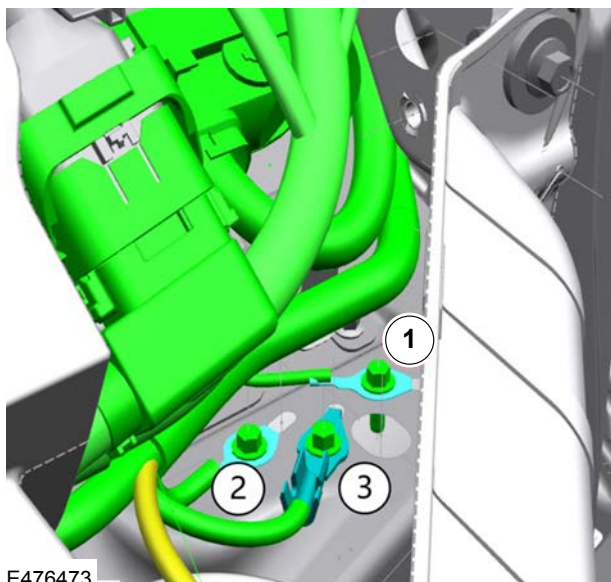


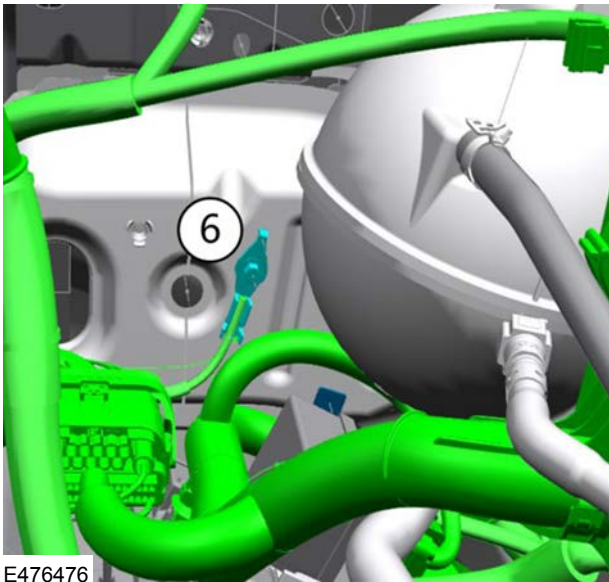
E476472

Ground points highlighted in red are safety critical and must not be used as additional ground points.

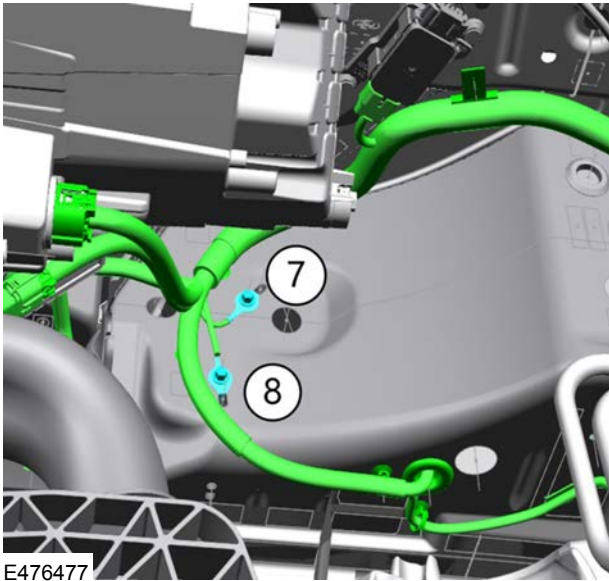
No.	Ground No.	Location	Type (use of ground point)	Harness
1 *	GD11	Engine Bay LHS	PCM	9K499
2	GD12	Engine Bay LHS	Compressor	9K499
3	GD13	Engine Bay LHS	Cooling Fan	9K499
4 *	GD14	Engine Bay LHS	TCU	12B637
5 *	GD16	Side Member Front LHS	ESP	14401
6	GD17	Side Member Front LHS	Front LHS Headlamp, Front LHS Fog Lamp, Horn	14401
7	GD18	Side Member Front RHS	Front RHS Headlamp, Front RHS Fog Lamp, Horn	14401
8	GD19	Side Member Front RHS	Front Main Wiper Motor, Front Slave Wiper Motor	14401
9 *	GD22L	Cross Car Beam Middle	IC, Combination Switch, Steering Switch, Steering Angle Sensor, OBD	14K024
10 *	GD22R	Cross Car Beam LHS	Headlight Switch, T-Box, AC Switch, HAZard Switch, EPB Switch, Shift Control Unit, USB, Start-Stop Button	14K024
11	GD23	Cross Car Beam Middle	Cigarette Lighter	14K024
12	GD24	Cross Car Beam LHS	Front A/C Blower Speed Control Module	14K024
13 *	GD26	Cross Car Beam LHS	MP5	14K024
14 *	GD27	Cross Car Beam Middle	PEPS Module, Gateway Module	14K024
15 *	GD31L	Bodyside Front LHS	BCM Power Ground	14401
16 *	GD31R	Bodyside Front LHS	BCM Signal Ground	14401
17	GD32	Bodyside Front LHS	Power Window, Mirror	14401
18	GD35	Bodyside Front RHS	RHS Door Lock Ajar Switch, Driver & Passenger Buckle Switch	14401
19	GD36	Bodyside Front RHS	Passenger Side Mirror, Passenger Power Window, Passenger Side Lock	14401
20	GD37	Front Floor Middle	Battery Grounding	14401
21 *	GD39	Bodyside Front RHS	Airbag Control Module	14401
22 *	GD40	Bodyside Front LHS	Driver Door Lock, Driver Door Outside Handle Switch	14401
23 *	GD42	Side Member Front RHS	Urea Pump, Urea Pipeline Heat	14406
24 *	GD43	Side Member Front RHS	Front/Middle/Rear Nox Sensor, DPF Sensor	14406
25 *	GD45	Side Member Front LHS	Start Motor	14303
26 *	GD50	A Pillar LHS	Rain Light Sensor	14405
27	GD52	D Pillar LHS	Rear Combo Light, HMSL, License Plate Light, Rear Door Lock Motor	14405
28	GD54	A Pillar RHS	Front Dome Light, Rear Headline Light	14A005
29	GD55	D Pillar RHS	Rear Right Combination Light, HMSL, Right Side Door Contact Switch	14A005
30 *	GD56	D Pillar RHS	Rear Park Assist	14A005

(*) Ground points are safety critical and must not be used as additional ground points.

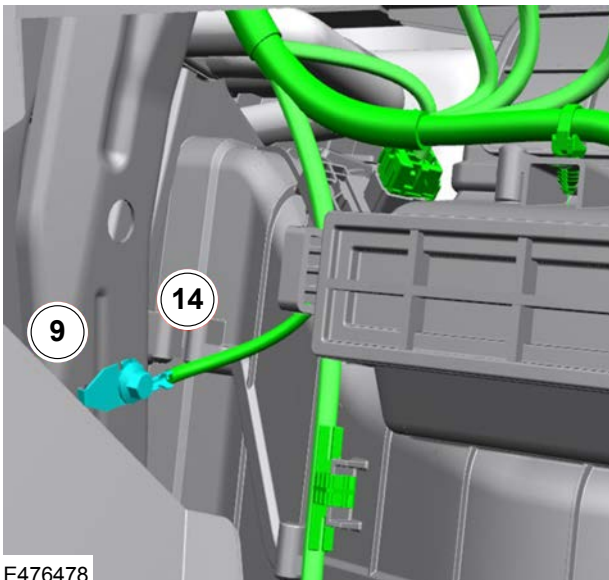




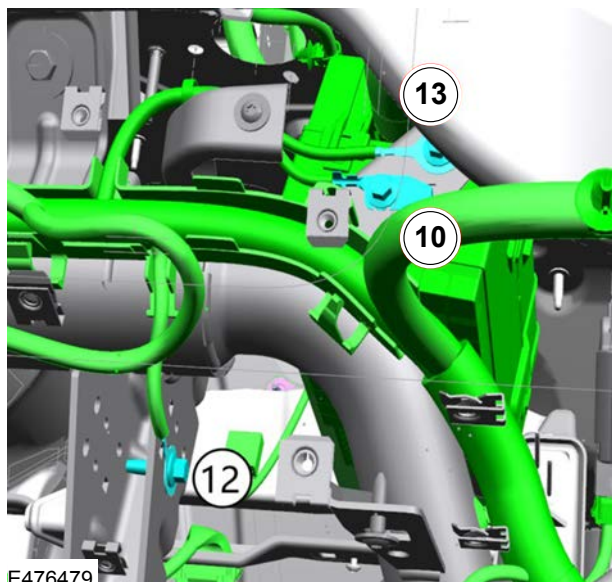
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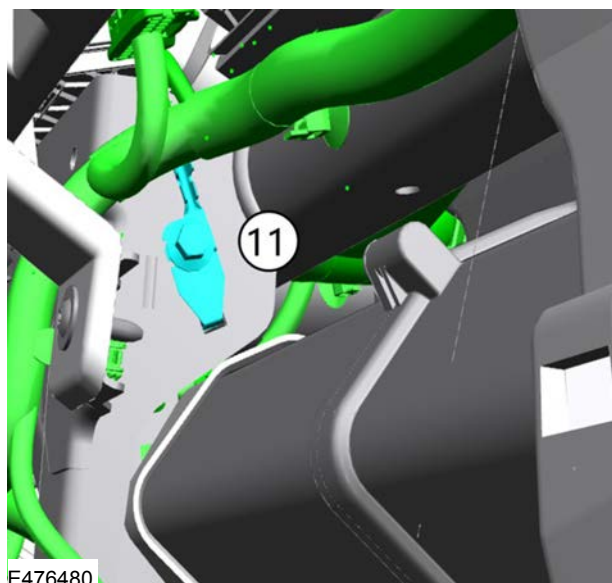
E476477



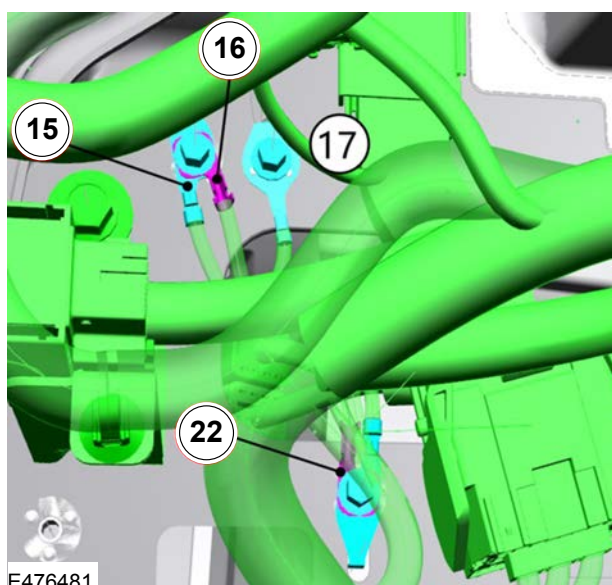
E476478



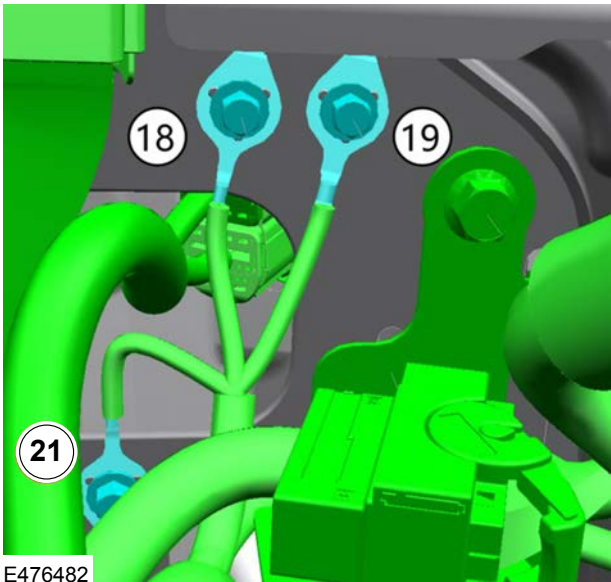
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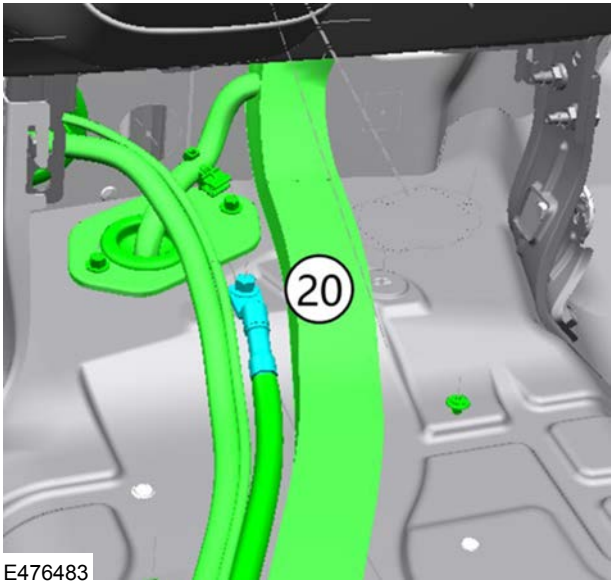
E476480



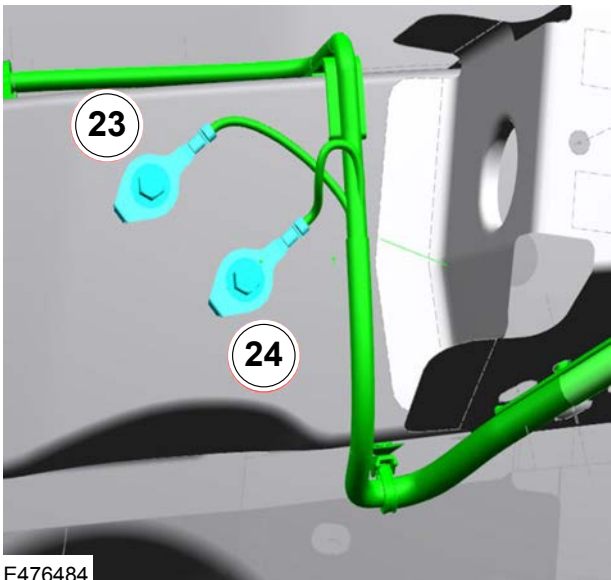
E476481



E476482



E476483



E476484

5.1 Body

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

5.1.1 Body Structures - General Information

WARNINGS:

-  **All fixing or wiring holes through the floor, sides or roof must be sealed with plugs, grommets, or tape to prevent the ingress of harmful liquids, gases, and heat to the cabin. Sealing components must be robust up to a temperature of no less than 95°C and should retain their sealing functionality at this elevated temperature for a minimum of 30 minutes.**
-  **The following components, as installed by Ford Motor Company, should not be removed, relocated, altered, or modified in any way:**
 - Battery connectors, battery brackets (carrying structure), outriggers, energy absorption members, brackets, and attachment hardware.
 - Front-end structure, including aluminum extrusion assembly "Megabrace", attachment brackets, and attachment hardware.

WARNINGS:

-  **All fixings through the floor, sides or roof must be sealed.**
-  **Before drilling see figure within Boron Steel parts, in this section of the manual.**
-  **Before drilling the floor, check the Precautionary Drill Zones.**

Refer to: [5.13 Frame and Body Mounting \(page 117\)](#).

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

When carrying out vehicle conversions 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
- Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection legislation
- Ensure proper sealing against ingress of water, salt, dust, after cutting or drilling the body. Use Ford approved sealing and finishing material, and underbody corrosion protection.

Refer to: [5.12 Corrosion Prevention \(page 116\)](#).

- Make sure that fixings in the 'B' pillar area do not encroach on the seat belts or seat belt reels
- Ensure that any swarf/debris from any work in the B Pillar does not contaminate the seat belts in any way.

For unique floor fixings, refer to:

- [Refer to: 5.5 Loadspace Bulkhead \(page 104\)](#).
- [Refer to: 5.13 Frame and Body Mounting \(page 117\)](#).

For additional Precautionary Drill Zones, refer to:

- [Refer to: 4.2 Wiring Installation and Routing Guides \(page 46\)](#).
- [Refer to: 5.3 Body Closures \(page 96\)](#).

5.1.2 Welding

-  **WARNING: Before welding see figure within Boron Steel parts, in this section of the manual.**

Before welding work is performed on a vehicle body, all safety measures for the protection of people, modules and electrical components must be observed.

Electronic Components

NOTE: After disconnecting the power supply and before performing further work, a wait time of up to 15 minutes must be maintained, depending on the vehicle. Work on airbag systems may only be performed by personnel who have a relevant certificate of competence.

Increased use of comfort and safety electronics in modern motor vehicles also requires the greatest attention to be paid during body work. Over voltages produced during welding and in alignment work during body shell rectification may cause electronic systems to be damaged. In particular, the safety instructions for performing welding work on vehicles with airbag systems must be adhered to.

Pay attention to the following points:

- Disconnect the battery negative clamp and cover the battery terminal
- Disconnect the electrical connector at the airbag control module
- If welding is to be performed directly near a control module, it must be removed beforehand
- Never connect the negative cable of the welder near an airbag or a control module
- Connect the negative cable of the welder close to the location of the weld

Before Welding

Interior surfaces of new bodywork components which will no longer be accessible after installation must be painted beforehand. The welding flanges are treated with a special welding primer. The joint areas are not always accessible from inside later. Therefore, prepare these areas so that no soot is produced by burning paint during welding.

NOTE: In order to ensure that the corrosion protection produced in production is not destroyed, the working area must be kept as small as possible.

NOTE: Do not touch cleaned bare metal any more with the bare hands. The dampness of your hands will corrode the metal.

Procedure:

- Remove the primer or paint/zinc layer in the welding area using a tress wire brush to prevent the formation of soot from the paint
- Thoroughly clean the welding area with a metal cleaning agent and rub dry
- Coat the welding flange with welding primer on all sides and allow to dry

NOTE: The welding primer must only be applied thinly to the spot welding area, to minimize spattering when welding.

The following points must be noted when welding:

- Zinc starts to melt at about 420°C
- The zinc vaporizes at a temperature of about 900°C
- The amount of heating determines the damage to the zinc coating, and therefore to the corrosion protection
- Resistance spot welding is particularly suitable for welding zinc-coated panels, because no widespread warming occurs
- With electrolytically zinc-plated panels there is no need for any special preparation because the zinc coating does not need to be removed

After Welding

During work, body panels are often heated at very high temperatures, which results in the destruction of the corrosion protection.

Working of the affected areas is therefore vital:

- Grind the welded seams flat and clean thoroughly with silicone remover. Dry with a lint-free cloth
- If the join area is accessible from the inside, the transition area to the paint must be abraded for all types of join so that good adhesion of the primer is achieved later
- If the join area is not accessible from the inside, the cleaning and sanding work is not done. For this reason, ensure that there is as little contamination as possible in the area of the repair. This allows the cavity wax applied later to penetrate the join area without hindrance

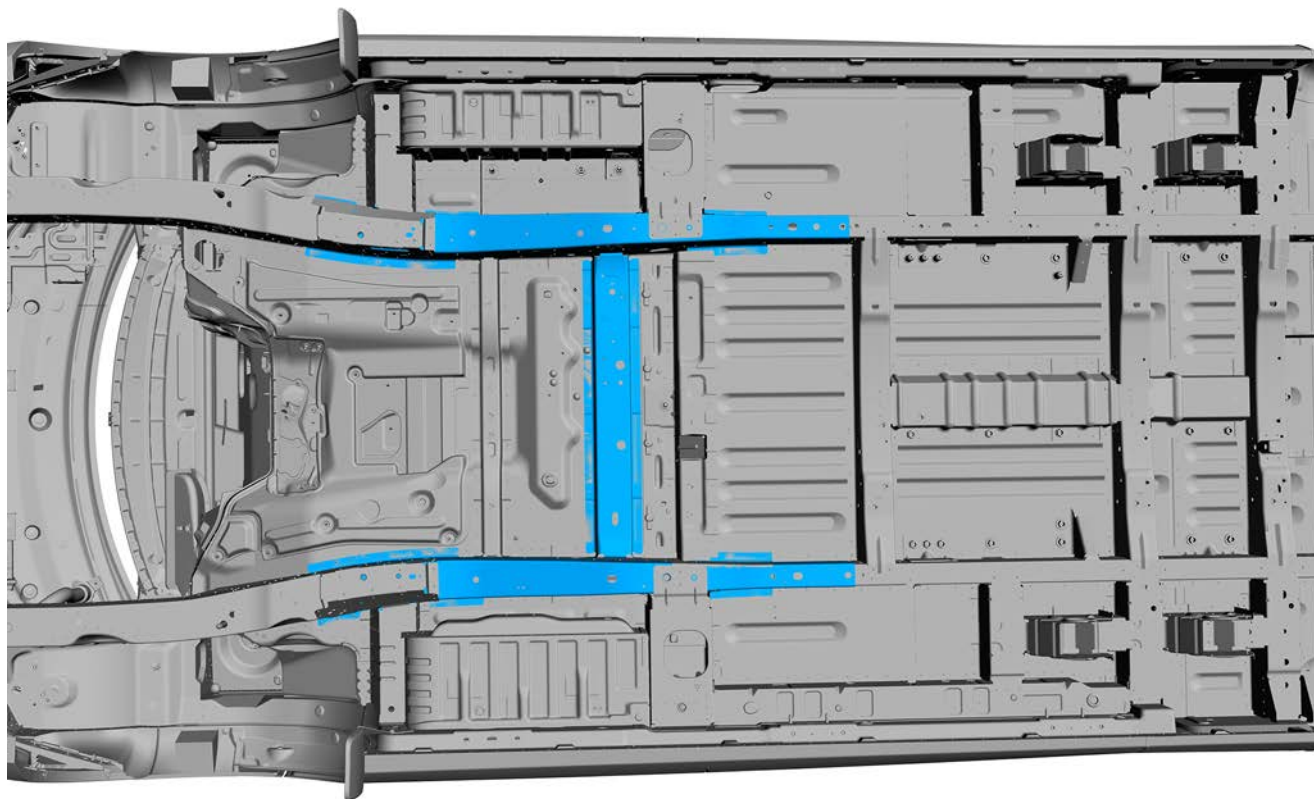
NOTE: Only apply a small amount of panel cleaner to the cleaning cloth when cleaning the area. Make sure that no cleaner reaches the connecting flange, so that the welding primer is not washed away again.

Priming after welding

Primer is applied to the welded flanges after cleaning. A check must also be made that the production corrosion protection is present in the area of the flanges. Any damage must also be re-primed.

5.1.3 Boron Steel Parts

Boron Steel Parts - Precautionary Drill or Weld Zones



E476036

5.1.4 Precautionary Floor Drilling



WARNING: All fixings through the floor, sides or roof must be sealed.



CAUTION: Care should be taken when drilling the floor of the passenger compartment and rear cargo area. The fuel tank, DEF (Urea) tank, brake lines, exhaust, electric cables and differential (All Wheel Drive only) are present below the floor.

When adding holes/fasteners to the floor of the vehicle, consideration must be given to all components below the floor.

It is strongly recommended that drill-depth stops be used. Drill stop depth shall not exceed 25 mm (1.0") maximum depth.

NOTE: Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection requirements.

NOTE: All fixings through the floor, sides or roof must be sealed.

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.

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.

5.2 Racking Systems

For attaching a racking system, it is recommended to use the marked areas shown in the figure below.

- Frames should be rigid, self-supporting and bolted through the floor, use reinforcements on the underfloor.
- It is not recommended to drill through the floor in combination with plastic load floor liners.
- For alternatively fixing through the floor to the side members.

[Refer to: 5.13 Frame and Body Mounting \(page 117\).](#)

- Ensure proper sealing against ingress of fumes, water, salt, dust, after cutting or drilling the body. Use Ford approved sealing and finishing materials, and underbody corrosion protection.
- To minimise stress in body side upper area, additional cross brace roof bows are to be used.
- If linings are planned for the inside of the load area, all racking through bolts must be designed to be accessible through the lining to the body structure with spreader plate.
- No load bearing fixing to the lining only.
- For increased crash performance the racking system should be designed with diagonal reinforcements.
- Vehicle should be equipped with Ford standard option bulkhead to give best protection to driver and front passengers.
- Preferably, there should be a rack each side to balance the vehicle load.

[Refer to: 5.12 Corrosion Prevention \(page 116\).](#)

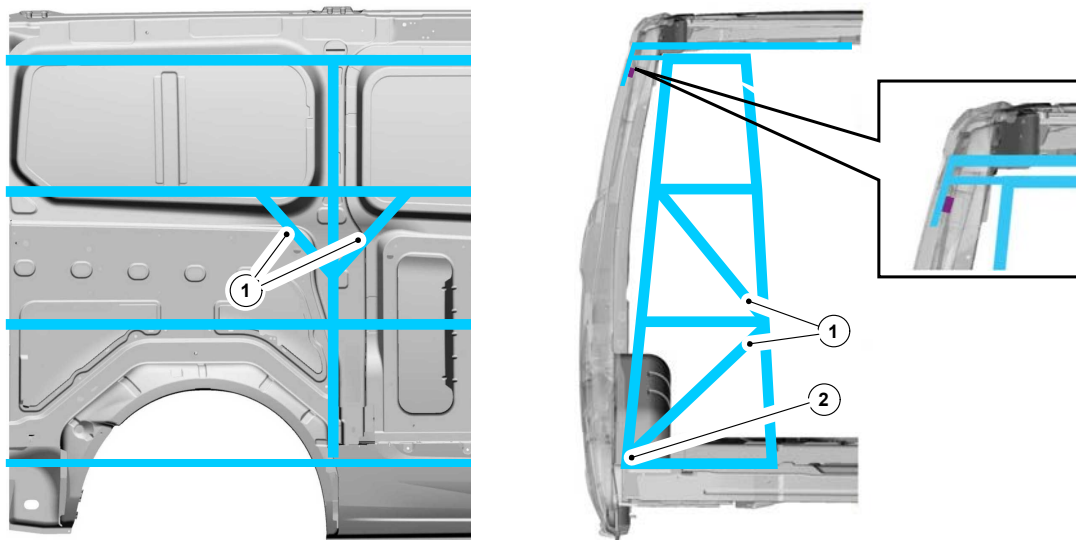
For additional information on Precautionary/No Drilling, refer to the following sections:

- [Refer to: 4.2 Wiring Installation and Routing Guides \(page 46\).](#)
- [Refer to: 5.1 Body \(page 91\).](#)
- [Refer to: 5.3 Body Closures \(page 96\).](#)

Recommended Fixing locations



E476541

Design Proposal for non Ford Production Option Racking System (LHS Shown)

E146885

Item	Description
1	Rigid Self-Supporting Racking Framework
2	Fixing to floor

5.3 Body Closures

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

5.3.1 Security, Anti-Theft and Locking System

CAUTION: To avoid locking system security complications, it is recommended to discuss with your local Ford dealer prior to conversions taking place.

NOTE: It is not recommended to alter the locking system or damage the security shielding around the lock and latch.

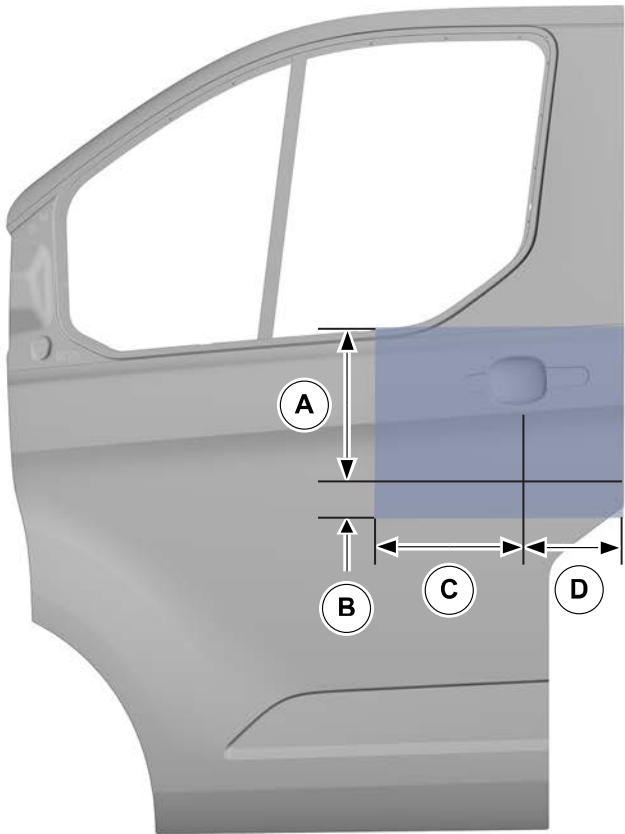
When removing and reapplying door seals take care to fit correctly, using the same seals as this is critical to door closing efforts. Any modification to the sealing flanges or surfaces will require consultation with your local Ford dealer. This may also include air extraction/venting adjustments to assist door close efforts if significant changes to closures are required.

The Central Control Unit is designed to work specifically with the Ford Transit lock and latch mechanisms and therefore drives latches to lock and unlock for specific time periods. Additional power locking functionality should be based around the use of additional Ford Transit latch mechanisms. Additional latches can be driven via relays connected in parallel with existing latches.

Refer to: 4.13 Handles, Locks, Latches and Entry Systems (page 80).

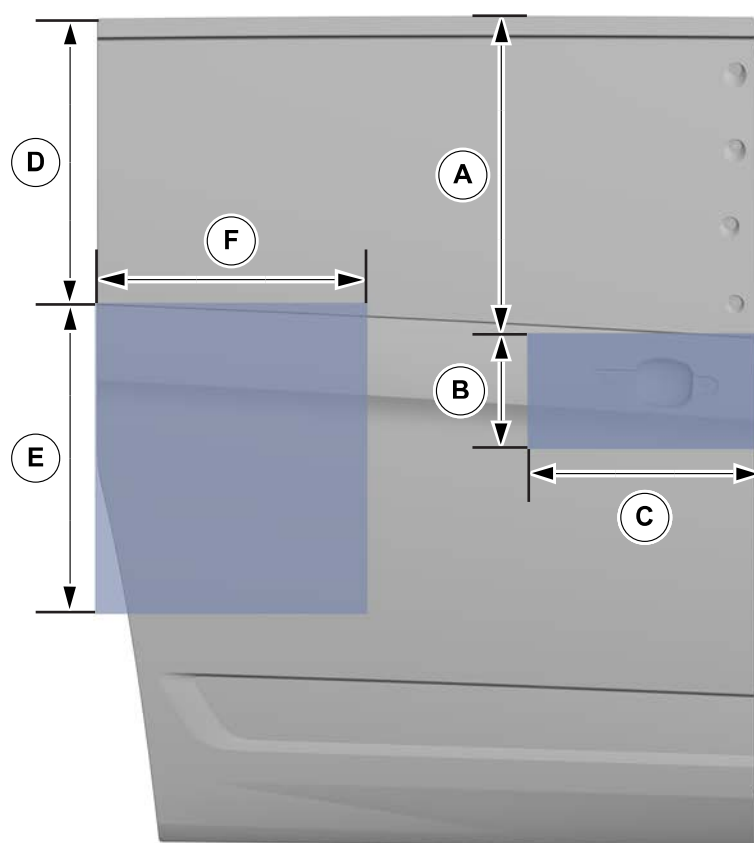
The following figures outline the areas in which it is not advisable to drill.

Front LHS Door



E475538

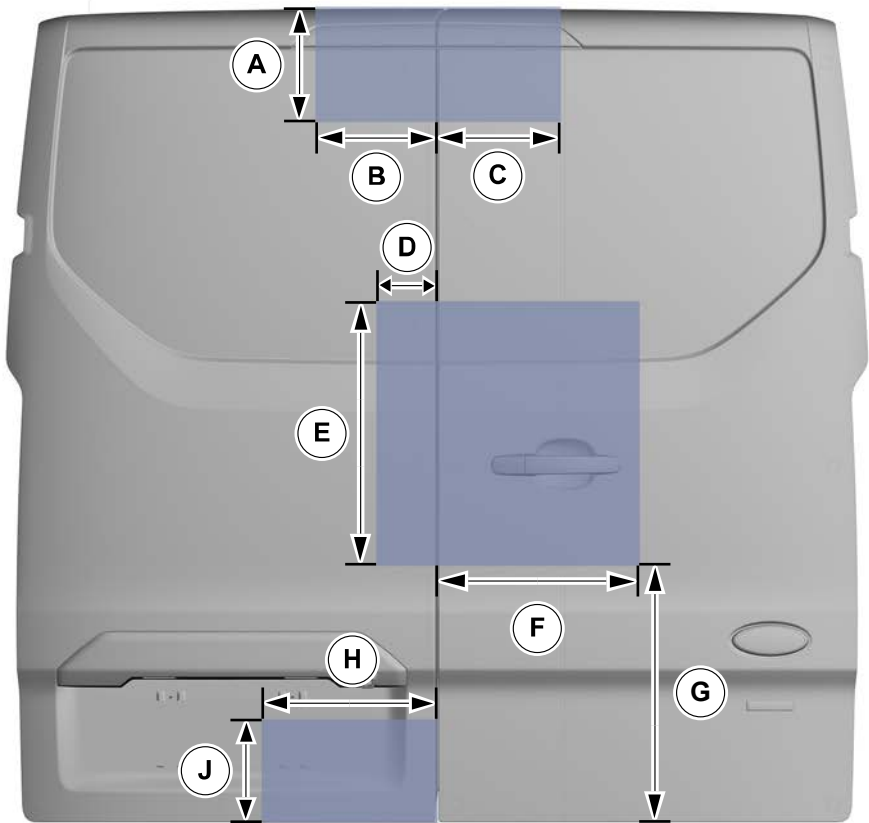
Item	Description
A	305mm
B	50mm
C	260mm
D	185mm

Sliding Door

E475539

Item	Description
A	600mm
B	215mm
C	500mm
D	530mm
E	540mm
F	410mm

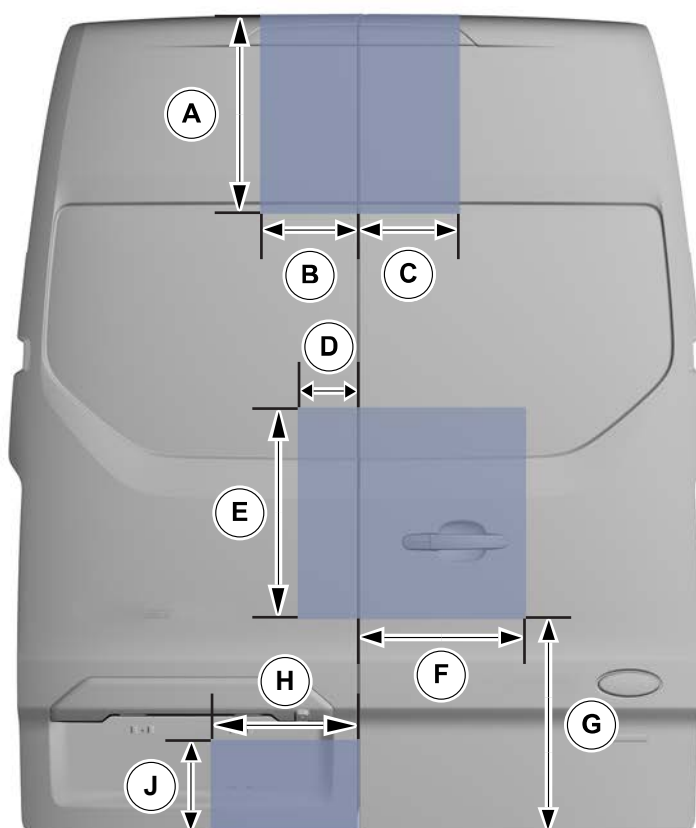
Low Roof - Rear Door



E475540

Item	Description
A	250mm
B	230mm
C	230mm
D	560mm
E	100mm
F	400mm
G	460mm
H	200mm
J	280mm

High Roof - Rear Door



E475541

Item	Description
A	550mm
B	230mm
C	230mm
D	560mm
E	100mm
F	400mm
G	460mm
H	200mm
J	280mm

5.4 Interior Trim

5.4.1 Load Compartment Interior Lining

Do not damage the lock, hinge, latch or check arm system (electrical cables, release system) when applying interior lining.

Be careful not to damage the weather shield (water shield covering inner door access hole) when removing or applying interior door trim.

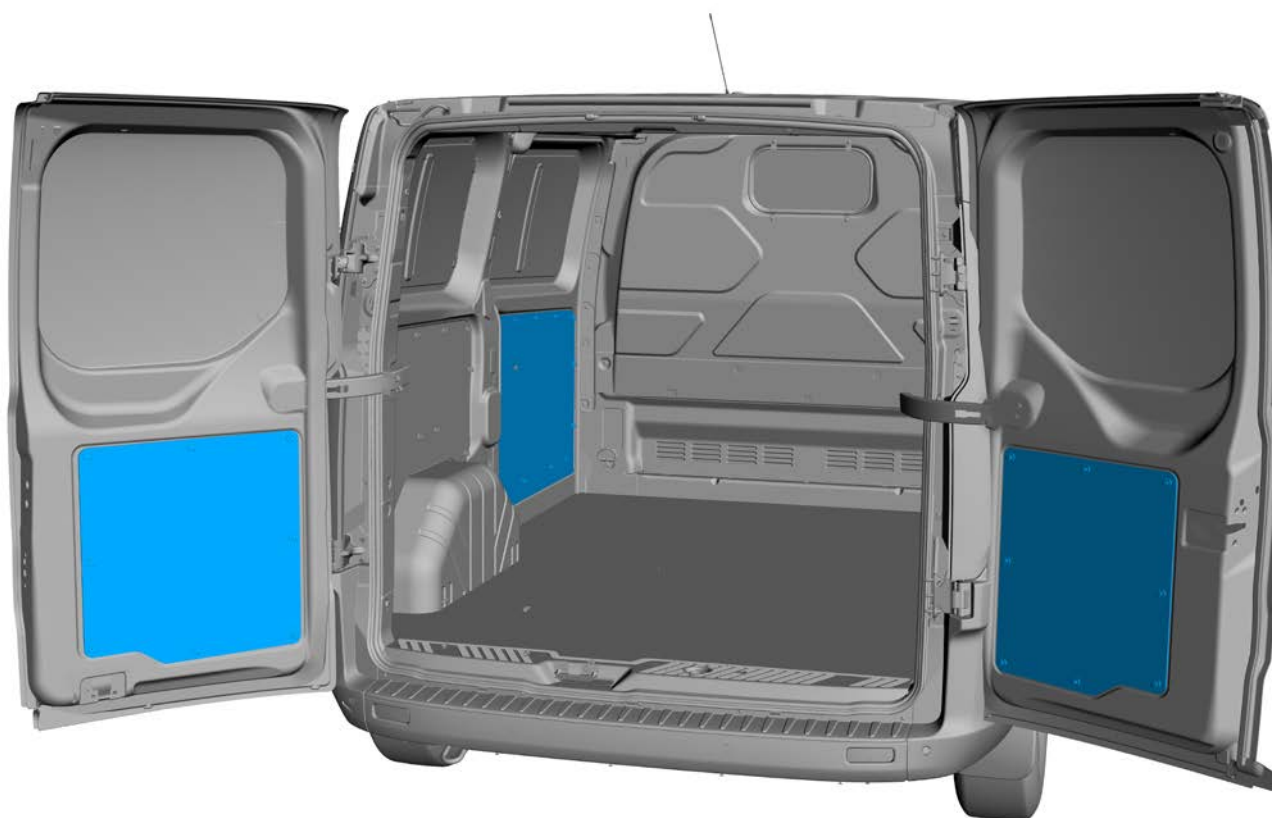
WARNINGS:

⚠ Plan fixing points for other fitments such as racking to ensure through bolting can be achieved. Fixing to the lining material may be inadequate for normal safe operation of the vehicle.

⚠ Varnish or paint wooden interior cargo area panels if exposed to high humidity conditions.

The additional weight of the linings on doors may require additional reinforcements to the door and pillar at the hinge and check mechanism.

5.4.2 Plywood Lining/Cladding



E476376

⚠ CAUTION: Do not drill into the vehicle before checking the Precautionary/No Drill Zones and electrical wire routing.

For additional information, refer to the following sections:

Refer to: [4.2 Wiring Installation and Routing Guides \(page 46\)](#).

Refer to: [5.3 Body Closures \(page 96\)](#).

Refer to: [5.1 Body \(page 91\)](#).

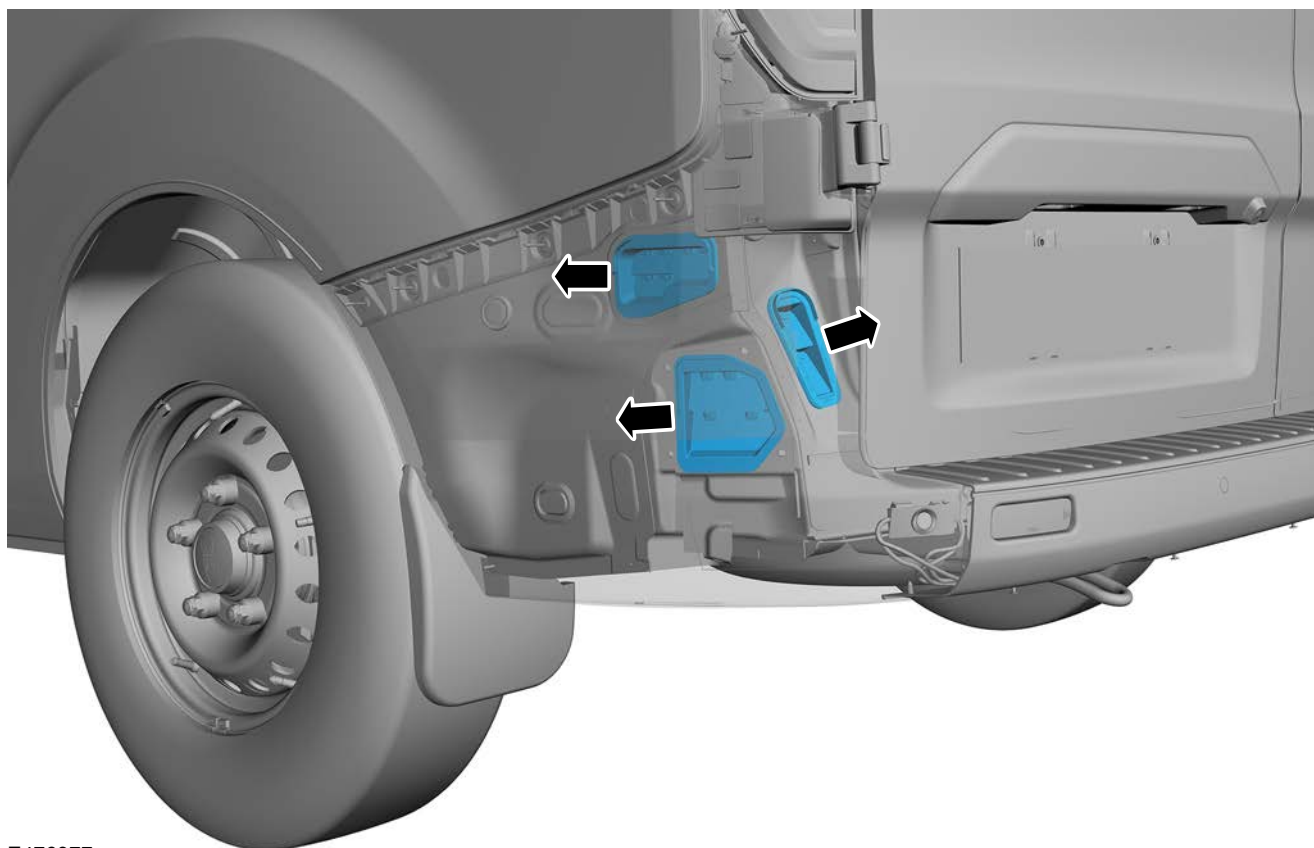
- Panels should be precision cut by machine, not by hand jigsaw, to reduce rough edges and splinters
- Panels should be pre drilled
- Do not drill through floor panels, use existing load lashing points when securing the panels
- It is recommended that when fitting a plywood floor that it is joint free
- Use aluminum floor trims

- Plywood should be water resistant (WBP, water and boil proof)
- It is recommended to use 9mm thickness for floors and 6mm thickness for side and door lining

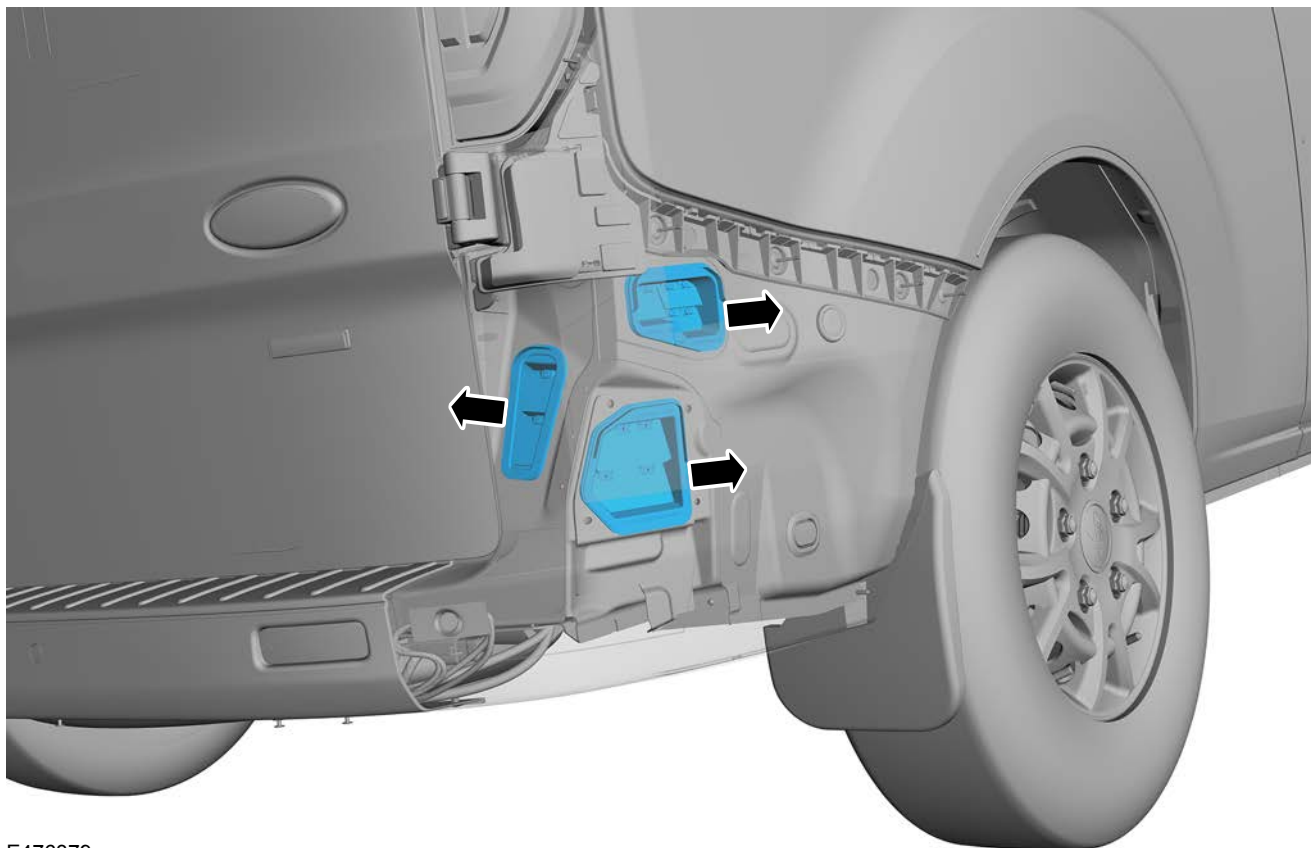
5.4.3 Body Side Vents

⚠ WARNING: Movement of air within the vehicle exits internally through holes in the D-pillar/ Body side panel then through vents located in the lower part of the body side outer as shown on the LHS and RHS (illustrated below) of all vehicles. These cannot be covered or inhibited in any way.

LH Rear Exterior Vents



E476377

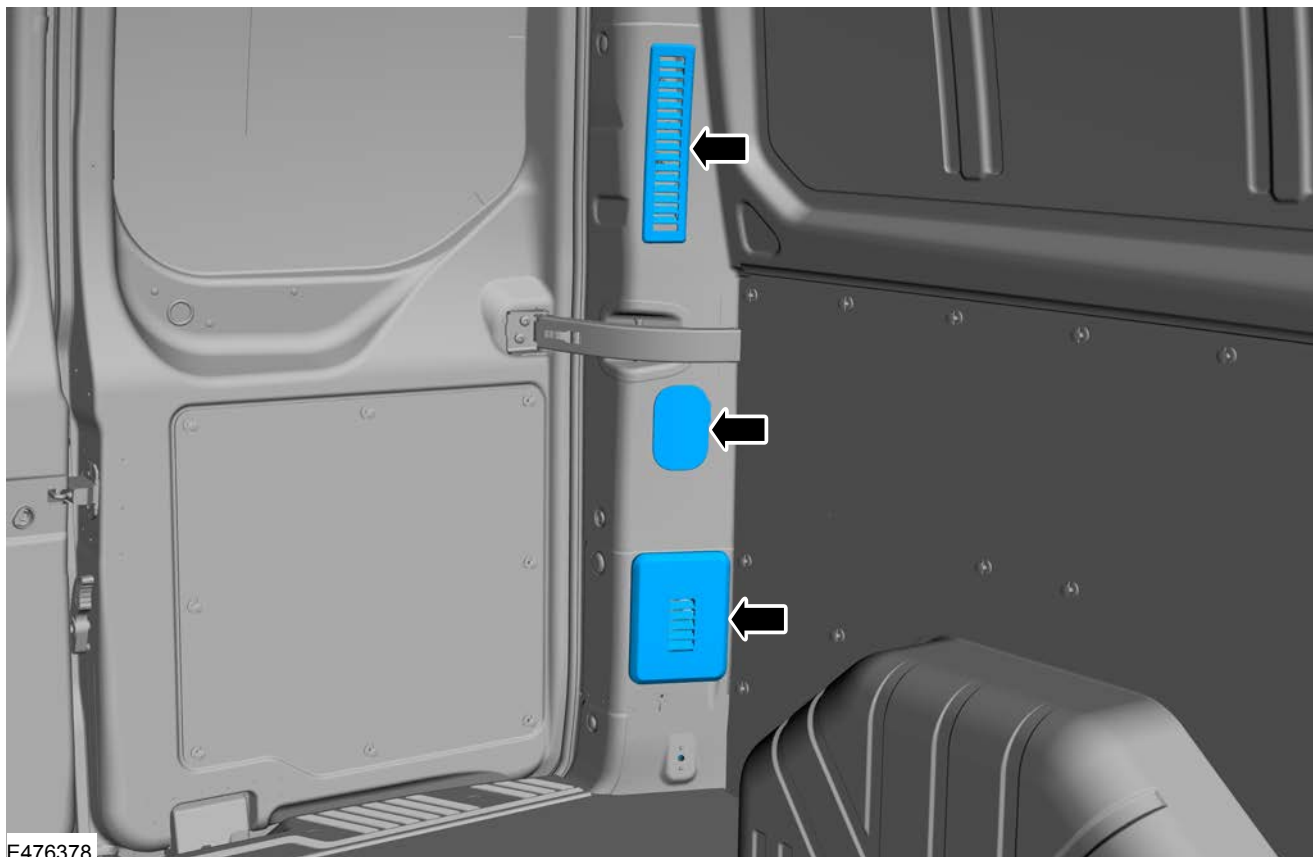
RH Rear Exterior Vents

E476379

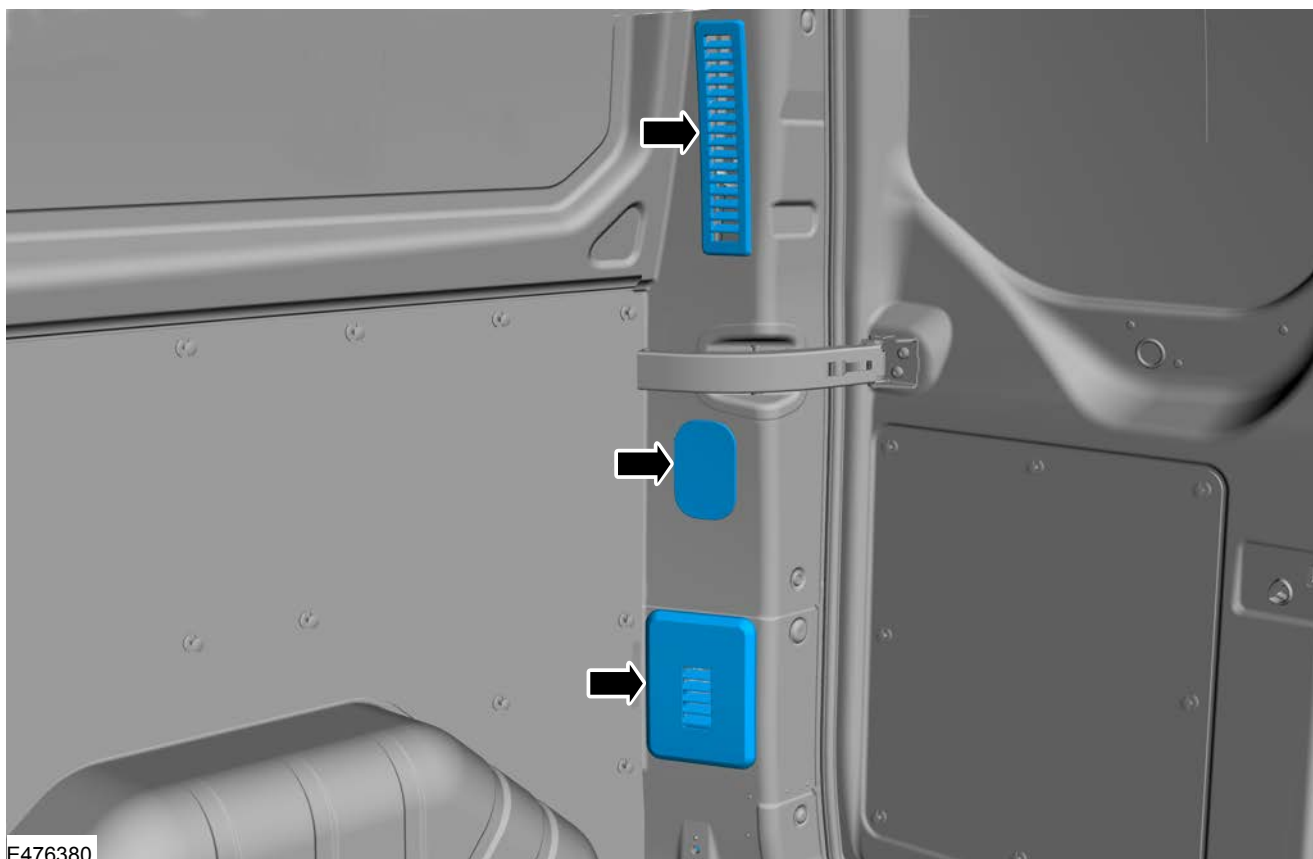
If air movement is impeded there will be problems with:

- closing of doors
- closing of tailgate/rear doors
- air extraction
- moisture evacuation
- clearing windscreen whilst driving or static
- fan system (heating or cooling) from IP and rear HVAC systems

These vents must not be covered in any variant of vehicle. If units such as cabinets for Camper or internal panels on Vans are fitting adequate air flow of 20lcm² minimum must be allowed collectively through the vents/holes shown.

LH Rear Interior Vents

E476378

RH Rear Interior Vents

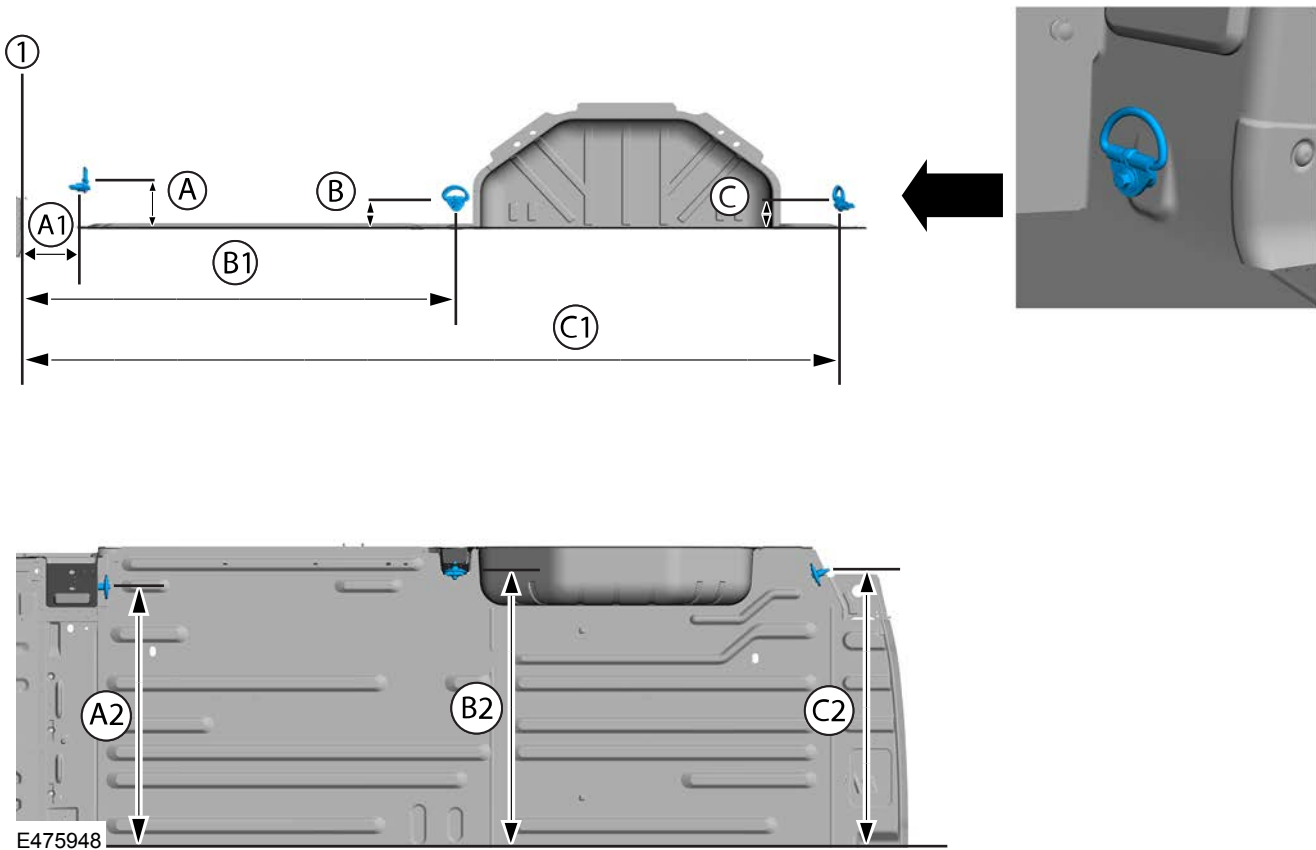
E476380

5.5 Loadspace Bulkhead

5.5.1 Load Compartment Tie Downs

All vehicles are fitted with load compartment tie downs, these are all 'D' rings as shown in the figure below. Not all vehicles will have all locations shown, it will depend on the base vehicle.

Dimensions for Load Tie Downs



Dimension (mm)	L1	L2
Dimension from B Pillar (1)		
A1	206	
B1	1318	
C1	2467	2834
Vertical from floor		
A	137	
B	75	
C	75	
From centre line of vehicle		
A2	753	
B2	799	
C2	795	

5.6 Seats



WARNING: Seats that contain airbags must not be re-covered.

NOTE: When reassembling the seat and the seat belt use specified bolts and ensure to apply the specified torque.

5.6.1 Van



CAUTION: Do not install seats in the rear cargo area of a van.

5.7 Glass, Frames and Mechanisms

5.7.1 Heated Windshield and Heated Rear Window

⚠ WARNING: The base system should not be tampered with (controlled by body control module and multiplex architecture) and no feeds taken from the associated wiring or controller.

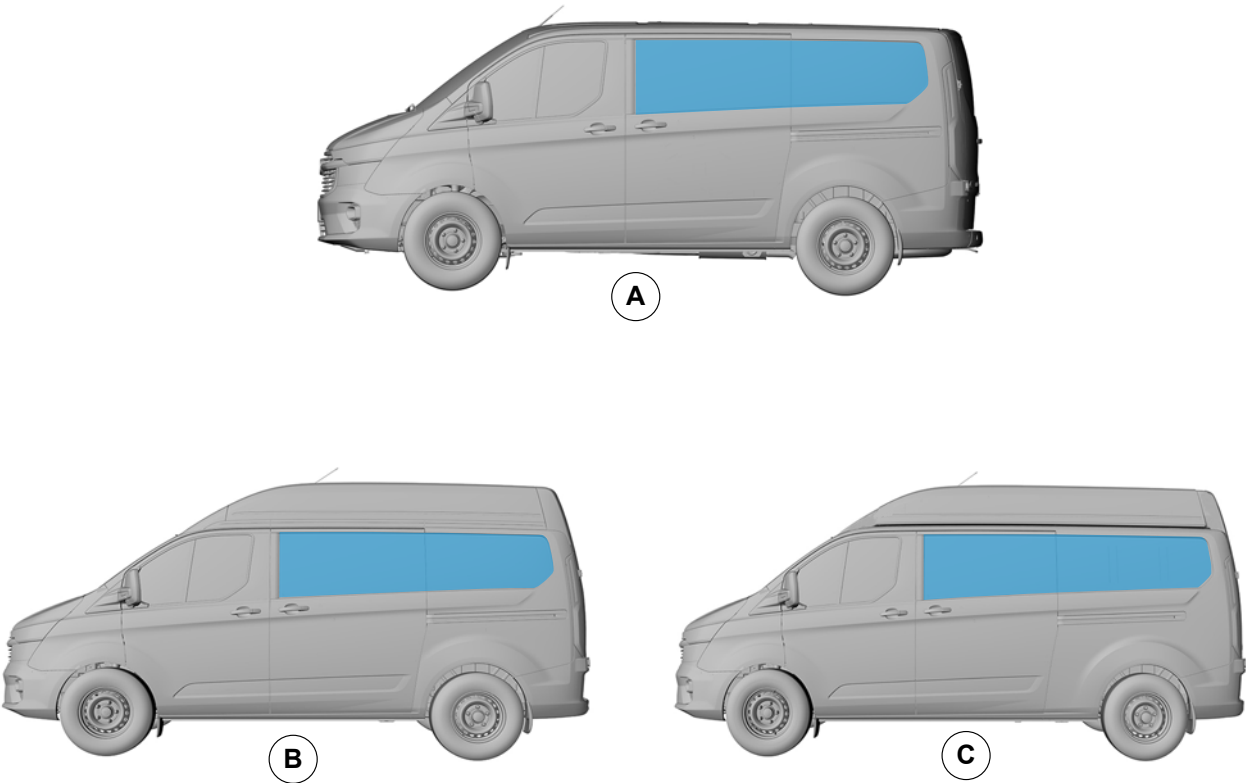
These options are not suitable for aftermarket or Vehicle Convertor fit.

5.7.2 Rear and Side Windows

When converting windows the following should be adhered to:

- Cut the outer panel of the body side and door to within 1mm of the inner panel flange
- Do not cut across panel joints or pillars.
- Use approved glass for installation according to legal requirements.
- After cutting the outer panel, join the inner panel and the outer panel robustly together.

Typical Van Body Side View for Window Engineering

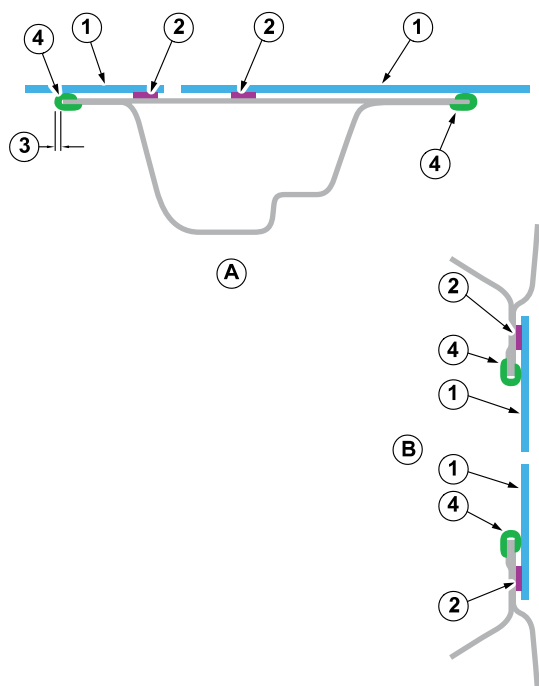


E476428

Item	Description
A	SWB / Low Roof
B	SWB / High Roof
C	MWB / High Roof

For vehicle wheelbase and Roof height,
[Refer to: 1.11 Package and Ergonomics \(page 21\).](#)

Section Through Typical Van Body Side for Window Engineering



E146620

Item	Description
A	Horizontal Section Through 'C' Pillar
B	Vertical Section Through Side Window (Non Side Load Door)
1	Glass
2	Adhesive
3	Cut outer panel flange flush with inner panel flange edge all round within 0 and 1.5mm
4	Window trim strip

Do not add parts or create sharp edges in airbag deployment zones.

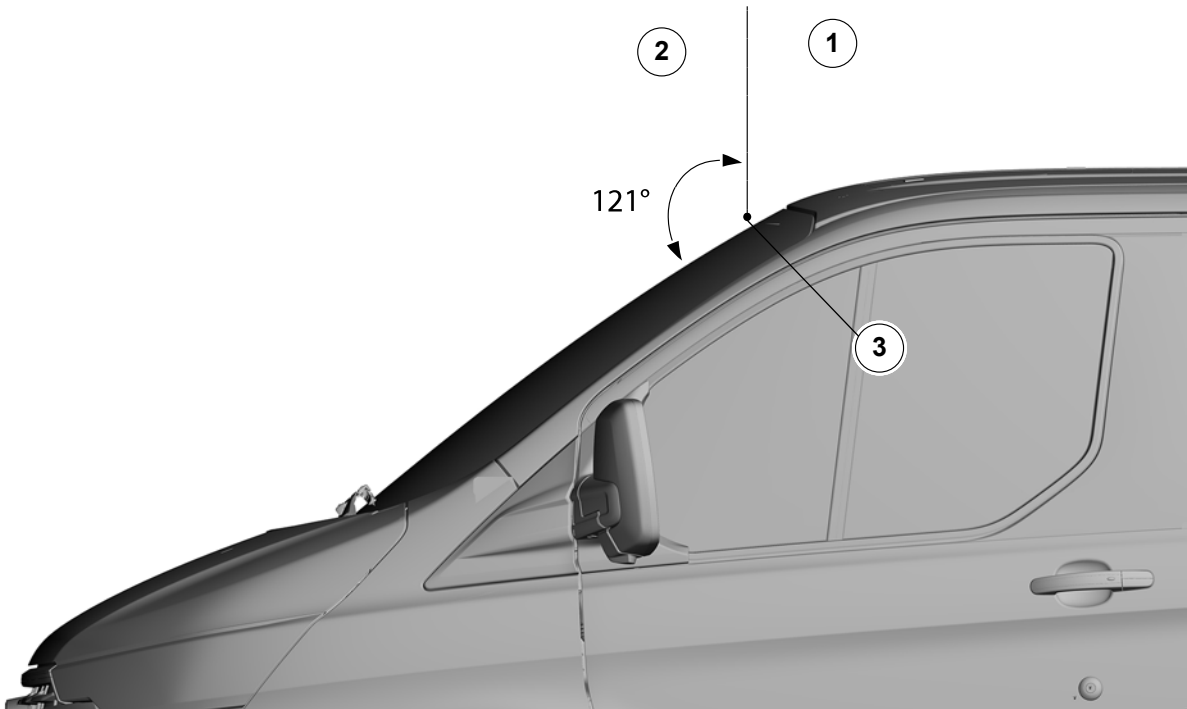
5.8 Wipers and Washers

NOTE: Where the modified vehicle has an overhang likely to cover part or all of the rain/light sensor position on the screen, see the figure below, this may affect the sensor's ability to detect light or moisture to the defined calibration and will not function correctly.

In the event that a donor vehicle has been supplied with these features, the vehicle can be modified to have manual wipers and headlamps in the following way:

For wipers, there is a menu option on the center display to switch wipers to variable intermittent rather than rain sensing. Use this setting instead.

For Auto Lamps, keep the switch in the 'OFF' position when the headlamps are not needed. If the Auto Lamp headlamp switch remains on 'AUTO' position, the customer may experience dipped beam remaining lit instead of daytime running lights with the ignition on.



E476389

Item	Description
1	Conversion or installation rearward (zone 1) where Auto Lamp and Wipe feature will function correctly
2	Conversion or installation forward (zone 2) where Auto Lamp and Wipe feature will NOT function correctly — the feature is not to be specified with the donor or configured Off by the Ford dealer
3	Auto sensor location

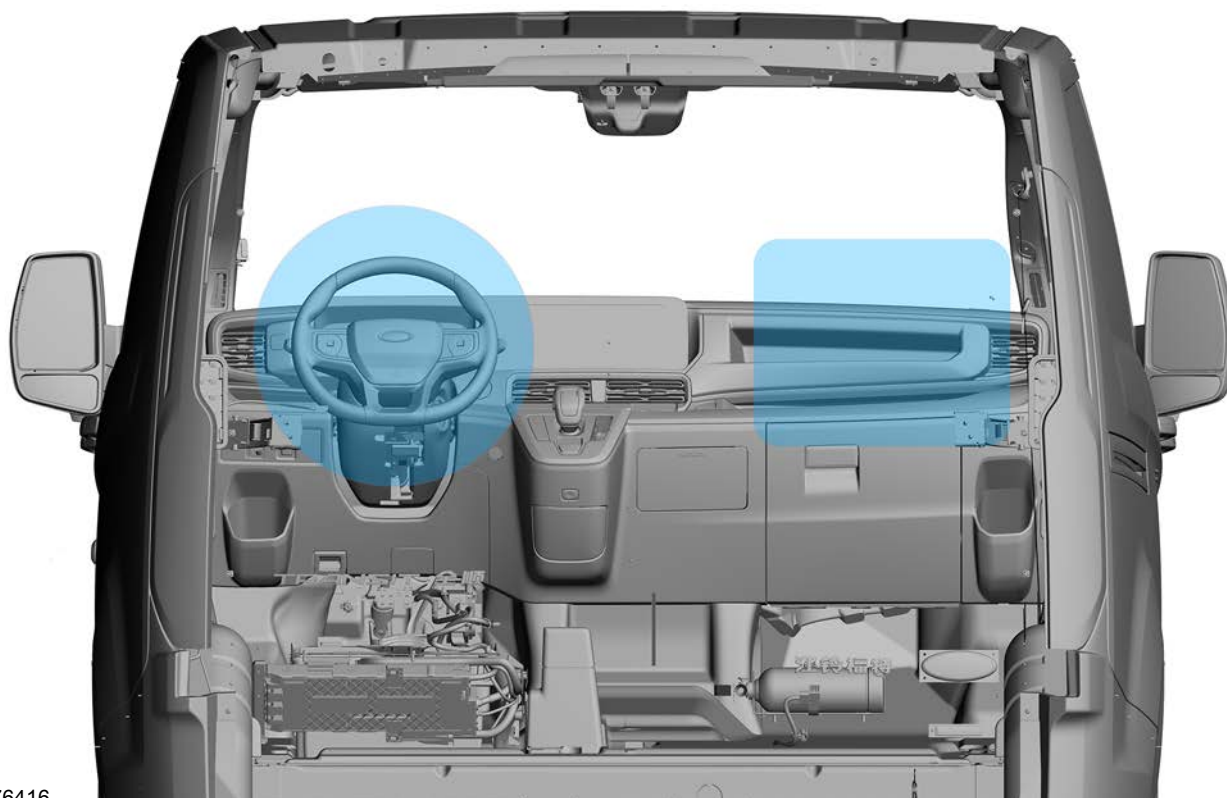
5.9 Airbag Supplemental Restraint System (SRS)

5.9.1 Airbags

Airbag Deployment Zones

WARNINGS:

-  **Do not place accessories in the deployment zone of the driver and passenger airbags as they may impair airbag deployment.**
-  **Do not place stickers or decals over the airbag covers as this may impair airbag deployment.**



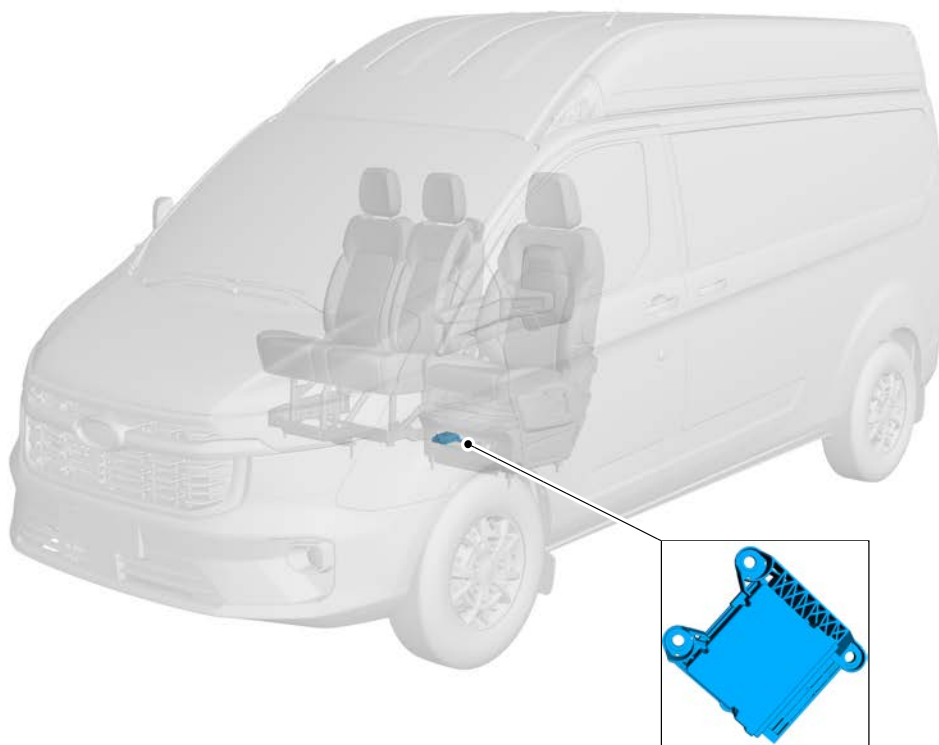
E476416

5.9.2 Restraints Control Module (RCM)

The RCM is located between the front seats, underneath the centre floor console.

-  **WARNING: Modifications or reinforcements in the area of the RCM may affect the front airbag deployment timing and result in uncontrolled front airbag deployment.**

Restraints Control Module Location



E476440

5.9.3 Sensors

The airbag sensor for the front airbags is located behind the front grille, see the figure below.

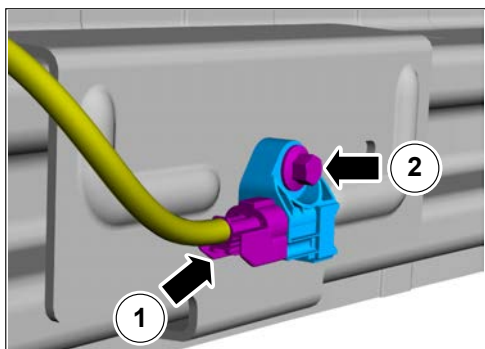
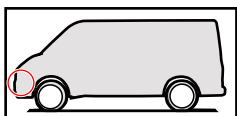
WARNINGS:

⚠ Modifications or reinforcements in the area of the sensors may affect the airbags deployment timing.

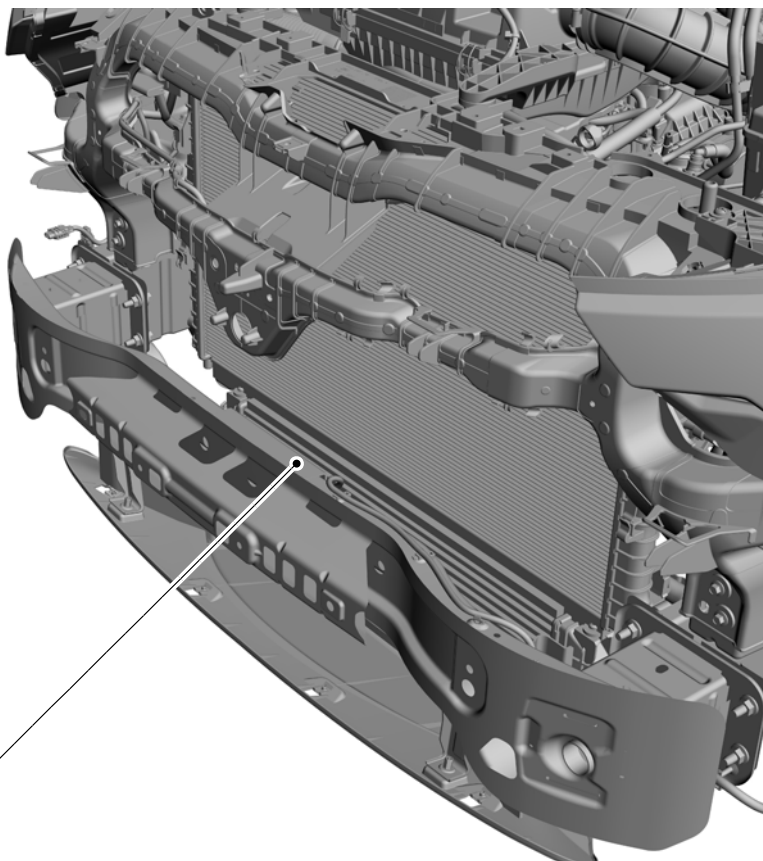
⚠ Drilling or grinding operations in these area are only permitted when battery cables are disconnected.

If the battery is disconnected:

[Refer to: 4.5 Battery and Cables \(page 62\).](#)

Front Sensor

E463565



5.10 Seatbelt Systems

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

5.10.1 Seatbelts

WARNINGS:

-  **Follow removal and installation procedures for the seatbelt system to ensure correct function of the restraints system.**
-  **Seat Belt Buckles must not be modified in situ on the seats. If Seat Belt Buckle requires modification or removal, then this must be performed by OEM Seat supplier.**
-  **In the case of 'Bulkhead Delete' (A6AAA) or bulkhead removal, the Vehicle Convertor MUST ensure that the pillar, including the seat belt and retractor, are covered. This is to ensure that the safe operation of the seatbelt is not impaired.**

The removal and reinstallation of the seatbelt, buckle 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 Ford Workshop Manual.

When removing the seatbelt system, a seat belt webbing forked retainer should be applied to the webbing 200mm below the webbing button stop. 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.

5.10.2 B Pillar Precautionary Drilling

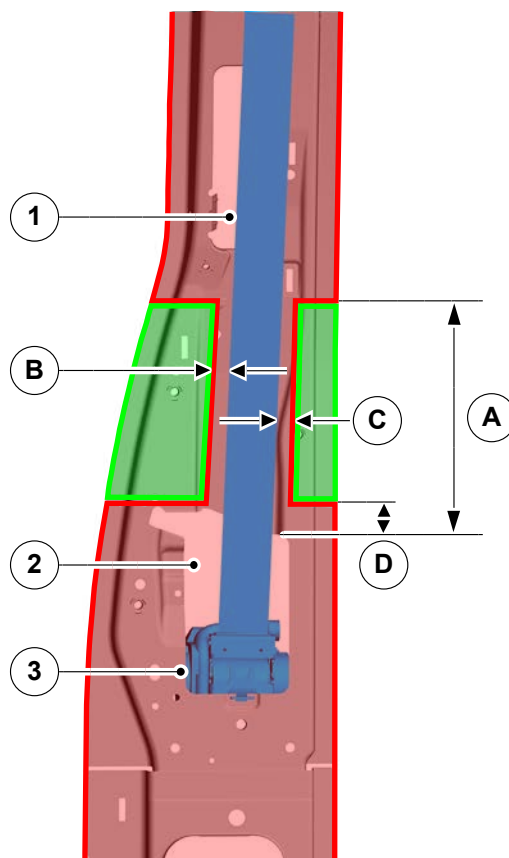
WARNINGS:

-  **Do not drill in right hand/left hand side retractor assembly area.**
-  **Drilling is only permitted in the green area indicated.**
-  **Retractor damage: If drilling holes near or above the retractor and anchor pretensioner, the mechanisms must be covered to prevent swarf/debris from falling into the assembly and causing functional issues.**

Webbing Damage:

- Any additional hardware fitted 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 0.5 mm.
- Avoid upfitting parts that may change the belt routing to the occupant.

Front Seat Belt/ B Pillar Drill Zone Definition



E476419

Item	Description
1	Webbing
2	Retractor hole
3	Retractor
A	230mm (Horizontal)
B	15mm Left of Webbing (Parallel to Belt)
C	15mm Right of Webbing (Parallel to Belt)
D	30mm above Retractor Hole (Horizontal)

5.10.3 Seat Belt Reminder

Driver Seat Belt Reminder is a legal requirement for all new vehicles. For Driver seat a sensor is provided in the seatbelt buckle to sense the seatbelt wearing status of the occupant. For rear seats the seatbelt buckle sensor only is provided. If a vehicle is modified, these functions must be retained.

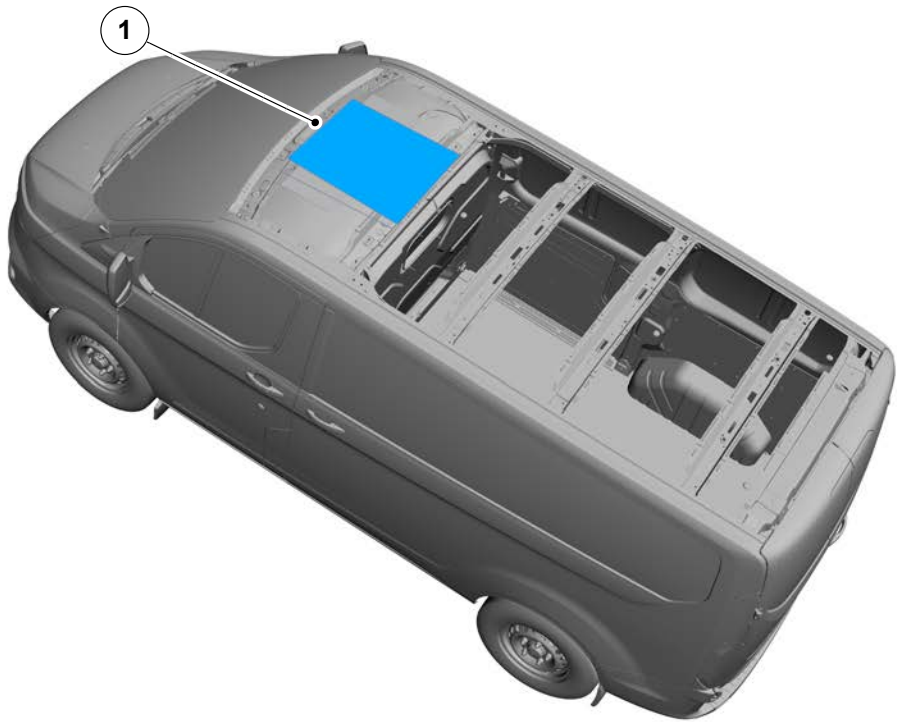
If factory-fitted wired seats are permanently removed the cluster will need to be reconfigured using Global Ford Diagnostics and Repair System (GFDRS).

If the seat trim is exchanged, the functionality of the Seat Belt Reminder will need to be successfully tested during trim development. The final seat assembly will need to be verified for function at End-Of-Line.

5.11 Roof

5.11.1 Roof Ventilation

 **WARNING:** Avoid all antenna positions when retrofitting any roof mounted units.



E476393

Item	Description
1	Roof Panel Aperture

General - Apertures must not cut through roof bows, see the figure above. Ventilators must prevent direct entry of water and dust. A shut-off system should be available to prevent fume ingress. Interior and exterior projection legal requirements must be maintained.

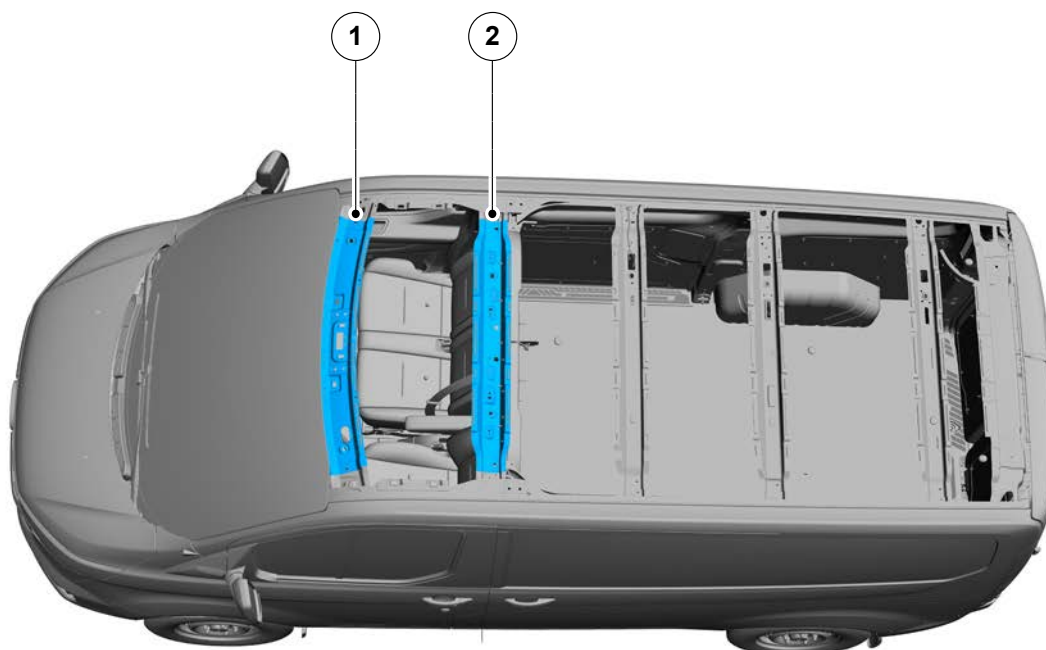
It is not recommended to cut/modify/remove the B Pillar Roof Bow. However, if this is absolutely necessary and cannot be avoided, the Roof Bow must be replaced by an appropriate structure providing the equivalent structural integrity and functionality as the original structure. Any legal requirements must be maintained.

Ventilation Units - The roof panel can support up to 1kg on an unsupported area of roof. Loads up to a maximum of 25kg must be distributed over the full length of the roof rails between the roof bows.

Air Conditioning Units - Units weighing more than 25kg must be internally supported on cross brace members distributing the load out to the roof rails.

5.11.2 Pop-Up Roof Conversion

 **WARNING:** When installing a pop-up roof conversion, do not cut/modify/remove the Heater Rail above the windscreen or the Roof Bow above the B Pillars.



E476392

Item	Description
1	Header Rail
2	B Pillar Roof Bow

It is not recommended to cut/modify/remove the B Pillar Roof Bow - see the figure above. However, if this is absolutely necessary and cannot be avoided, the Roof Bow must be replaced by an appropriate structure providing the equivalent structural integrity and functionality as the original structure. Any legal requirements must be maintained.

5.12 Corrosion Prevention

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

5.12.1 General

Avoid drilling into closed frame body members to avoid the risk of corrosion from swarf.

However, If drilling is required:

- 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

For Welding:

Refer to: 5.1 Body (page 91).

5.12.2 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 where possible.

5.12.3 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 where possible.

Some proprietary products affect the original coatings.

5.12.4 Painting Road Wheels

 **WARNING: Do not paint wheel clamp 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.**

5.12.5 Contact Corrosion

When using different materials with a different electrochemical potential, ensure that materials are isolated from each other to prevent contact corrosion caused by a potential difference.

Use appropriate isolation materials. Where possible, choose materials with low level of electrochemical potential difference.

5.13 Frame and Body Mounting

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

5.13.1 Mounting Points and Tubing

The holes on the frame are a result of the production process. They are not designed for fixing additional equipment. If additional fixings to the chassis frame are required please follow the recommendation shown in the Frame Drilling and Tube Reinforcing section below. 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: [5.12 Corrosion Prevention \(page 116\)](#).

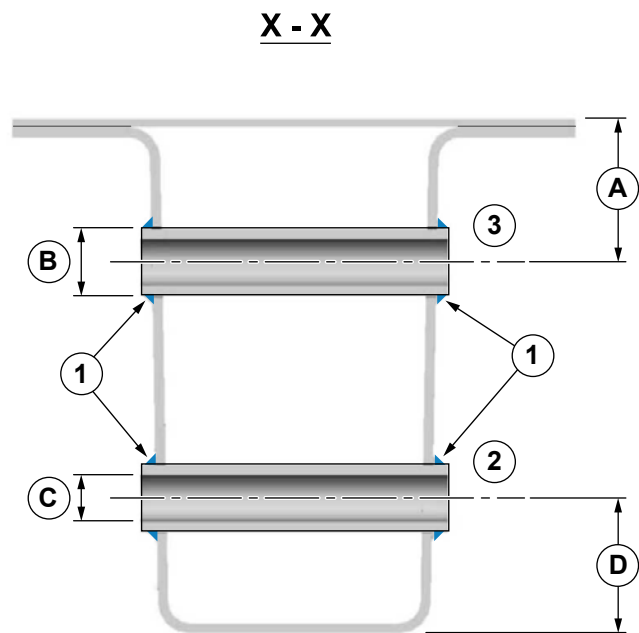
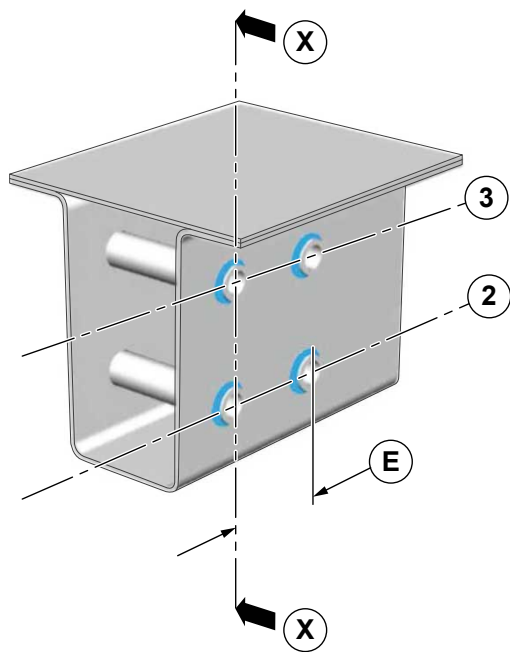
5.13.2 Frame Drilling and Tube Reinforcing

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 below.
- Drill and weld only sidewalls of the chassis frame.
- Locate and drill holes accurately by using a drill guide to ensure holes are square to frame vertical centre line (allow for side member draft angle).
- Drill undersize and ream out to size.
- Endeavor to 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: [5.12 Corrosion Prevention \(page 116\)](#).

- Holes should be in groups of two, either vertically spaced at 30 to 35 mm from chassis frame top and/or bottom surface, or horizontally at 50 mm minimum pitch, 30 to 35 mm from top and/or bottom chassis frame surface, please refer to the figure below.
- Always use M10 bolts with grade 8.8 minimum.
- Do not position tubes at the medium chassis frame height as this may create 'oil canning' of the deep section side walls.
- Diameter of 16.5 mm is the maximum allowable hole size in the chassis frame side wall, irrespective of the usage.



E176204

Item	Description	Item	Description
1	Full Penetration; Full diameter weld each side	B	Diameter 16.5mm maximum
2	Center line of holes/tubing	C	Diameter 11mm
3	Center line of holes/tubing	D	30mm to 35mm
A	30mm to 35mm	E	50mm minimum

Avoid drilling into closed frame body members to avoid the risk of corrosion from swarf.

Refer to: [5.12 Corrosion Prevention \(page 116\)](#).

Drilling and welding of frames and body structure have to be conducted following the guidelines.

Refer to: [5.1 Body \(page 91\)](#).

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