

# FORD **Transit Custom/Tourneo Custom** 2023.75 Body and Equipment Mounting Manual



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## 1.1 About this Publication

This Body and Equipment Mounting Manual (BEMM) is the first publication for the 2023.75 Transit Custom/Tourneo Custom.

It is recommended to review this manual in full.

The BEMM is a live document which can be viewed at <https://azureford.sharepoint.com/sites/SVEBEMMPUBLIC>. To get access please request a free guest account by emailing [BEMM2@ford.com](mailto:BEMM2@ford.com) with your name, email and company name.

**It is the vehicle convertor's responsibility to review the online version for the most current information prior to starting any conversion.**

This BEMM is for European and related markets sourced vehicles.

For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

## 1.2 About this Manual

### 1.2.1 Introduction

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

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

It must be emphasised 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.

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. For availability of features and options, please contact... your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 1.2.2 How to Use This Manual

This manual covers vehicle conversion procedures.

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

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

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

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

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

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

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

### 1.2.3 Important Safety Instructions

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

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

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

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



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

### 1.2.4 CAD Models

For 3D CAD Models and CAD support please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

## 1.3 Commercial and Legal Aspects

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 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 fitment 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 component.

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 Worldwide Harmonised Light-Duty Vehicle Test Procedures (WLTP)

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

To determine the new values in line with WLTP, registered customers will now be able to access Ford's multi stage WLTP calculation tool via Ford Service Info. The WLTP calculator can be accessed at <https://www.fordserviceinfo.com/Home/>

[SetCountry?returnUrl=%2F](#) You will need to register or login to use it.

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

For additional information:

- [Refer to: 1.8 Vehicle Duty Cycle Guidelines](#)
- [Refer to: 1.14 Package and Ergonomics](#)
- Please go to <https://azureford.sharepoint.com/sites/SVEBEMMPUBLIC> and login. To get access please request a free guest account by emailing [BEMM2@ford.com](mailto:BEMM2@ford.com) with your name, email and company name.
- Contact [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 1.3.4 Emissions Performance & In-Service Compliance

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

For further information please contact [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com). It is advisable for you to contact your local type approval authority for any questions related to the application of WLTP to multi stage conversions under regulation 2007/46 and single vehicle approvals.

### 1.3.5 Whole Vehicle Type Approval Regulations - EU Markets Only



**WARNING:** For non-European Union territories, please refer to local legislation.

### Fitment of Parts and Accessories

**NOTE:** Ford parts fitted in the plant are covered by the Certificate of Conformity (CoC). The objective of the Regulation (EU) 2018/858 or applicable local legislation is to ensure that new vehicles, components and separate technical units put on the market provide a high level of safety and environmental protection. This will help to ensure that all vehicles are not damaged by the fitting or converting of certain parts or equipment, after they have been placed on the market or have entered service.

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



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

### Conversions from Commercial Vehicle N1 to Passenger Car M1

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

Guidance to Vehicle Convertors for M1 registered vehicles:

- The Vehicle Convertor is responsible for checking the vehicle ordered can meet all the regulations for type approval
- Exemptions for certain regulations should be checked with latest regulation and approval authority
- Where possible, order a Passenger Car M1 base vehicle such as Kombi M1 or Tourneo Custom M1
- If specifying Air Conditioning, check that the base commercial vehicle refrigerant meets the latest completed vehicle regulations. If the refrigerant needs meet the required EU Climate Guidelines for M1, then Transit Custom N1 entities are not suitable.
- [Refer to: 5.6 Body Closures](#) For information on sliding door gap reduction on M1 vehicles
- The 180 degree cargo door hinges on Transit Custom N1 entities have not been designed to meet the M1 requirements for Exterior Projections. If this is required, then the Transit Custom N1 entities are not suitable

For additional information  
[Refer to: 1.6 Conversion Homologation](#)

### 1.3.6 Compliance 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 National Sales Company representative
- Significant changes to the vehicle may affect

its regulatory compliance. Strict adherence to the original design intent for brakes, weight distribution, lighting, occupant safety and hazardous materials compliance, in particular, is mandatory

### 1.3.7 Alternative Type Approval

If significant changes are made, the Vehicle Convertor must negotiate with the relevant authority. Any changes to the vehicle operating conditions must be advised to the customer.

### 1.3.8 Legal Obligations and Liabilities

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

### 1.3.9 General Product Safety Requirement

#### WARNINGS:



**Do not exceed the gross vehicle mass, gross train mass, axle plates and trailer plate.**



**Do not change the tyre 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 Braking System and Traction Control System cables because of extraneous signal risk. It is generally not recommended to hang electrical cables from existing harnesses or pipes.**



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

The Vehicle Convertor shall ensure that any vehicle it places in the market complies with the European General Product Safety Directive 2001/95/EC (as amended periodically) or applicable local legislation. The Vehicle Convertor shall also ensure that any alteration it makes to a Ford vehicle or component does not reduce its compliance with the European General Product Safety Directive or applicable local legislation.

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

- Failure to comply with these Body Equipment and 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.

[Refer to: 1.4 Contact Information](#)

### 1.3.10 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 free movement of all moving parts (for example axles, springs, shafts, steering mechanisms, brake and transmission linkage, retarders)
- Functional safety and freedom of the tested and approved flexibility of the body and integral chassis structure

### 1.3.11 Restraints System

#### WARNINGS:



**Modifications to the restraints system are not allowed.**



**Airbags are explosive. For safe removal and storage during conversion follow the procedures in the Ford workshop manual.**



**Do not alter, modify or relocate the airbags, sensors and modules of the restraints system or any of its components.**



**Attachments or modifications to the front end or B Pillar of the vehicle may affect the airbag deployment timing and result in uncontrolled deployment.**

For additional information:

[Refer to: 5.10 Airbag Supplemental Restraint System \(SRS\)](#)

### 1.3.12 Drilling and Welding



**WARNING: Do not Drill or Weld Boron Steel parts, see figure E146882a in the Body section of this manual.**

Drilling and welding of frames and body structure have to be conducted following the guidelines in Welding and Frame Drilling and Tube Reinforcing sections.

[Refer to: 5.1.3 Boron Steel Parts](#)

[Refer to: 5.14 Frame and Body Mounting](#)

### 1.3.13 Minimum Requirements for Braking 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.

### 1.3.14 Road Safety

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

## 1.4 Contact Information

As a manufacturer, we want to provide you with the information you need for your vehicle conversion/modification. If 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. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

Ford of Britain	
<b>Contact:</b>	Keith Doxey <a href="mailto:kdoxey@ford.com">kdoxey@ford.com</a>
<b>Contact:</b>	Ron Waldock <a href="mailto:rwaldoc1@ford.com">rwaldoc1@ford.com</a>
<b>Contact:</b>	Mark Brierley <a href="mailto:mbrierl7@ford.com">mbrierl7@ford.com</a>

Ford of Germany	
<b>Contact:</b>	Leonard Lilienthal <a href="mailto:llilient@ford.com">llilient@ford.com</a>
<b>Contact:</b>	Juergen Pesch <a href="mailto:jpesch@ford.com">jpesch@ford.com</a>
<b>Contact:</b>	Christian Jungmann <a href="mailto:cjungma2@ford.com">cjungma2@ford.com</a>
<b>Contact:</b>	Marius Pawelek <a href="mailto:mpawele3@ford.com">mpawele3@ford.com</a>
<b>Contact:</b>	Sebastian Thomas <a href="mailto:sthoma24@ford.com">sthoma24@ford.com</a>

Ford of France	
<b>Contact:</b>	Franck Richard <a href="mailto:fricha19@ford.com">fricha19@ford.com</a>
<b>Contact:</b>	Nicolas Froelich <a href="mailto:nfroelic@ford.com">nfroelic@ford.com</a>

Ford of Italy	
<b>Contact:</b>	Cristiano Giusto <a href="mailto:cgiustol@ford.com">cgiustol@ford.com</a>

Ford of Ireland	
<b>Contact:</b>	Paul O'Sullivan <a href="mailto:posulli9@ford.com">posulli9@ford.com</a>

Ford of Spain/Portugal	
<b>Contact:</b>	Jose Ramirez Mallol <a href="mailto:jramil70@ford.com">jramil70@ford.com</a>
<b>Contact:</b>	Ruben Garcia Navas <a href="mailto:rgarc346@supplier.ford.com">rgarc346@supplier.ford.com</a>

Ford of Belgium	
<b>Contact:</b>	Alain Haelewyck <a href="mailto:ahaelewy@ford.com">ahaelewy@ford.com</a>

Ford of Netherlands	
<b>Contact:</b>	Daan Koppert <a href="mailto:dkoppert@ford.com">dkoppert@ford.com</a>

Ford of Austria	
<b>Contact:</b>	Gerhard Konrad <a href="mailto:gkonrad1@ford.com">gkonrad1@ford.com</a>

Ford of Denmark	
<b>Contact:</b>	Jan Olsen <a href="mailto:jolsen24@ford.com">jolsen24@ford.com</a>

Ford of Finland	
<b>Contact:</b>	Sami Jaaskelainen <a href="mailto:sjaaskel@ford.com">sjaaskel@ford.com</a>

Ford of Norway	
<b>Contact:</b>	Roar Kvernhusengen <a href="mailto:rkvernh2@ford.com">rkvernh2@ford.com</a>

Ford of Sweden	
<b>Contact:</b>	Martin Tenggren <a href="mailto:Martin.Tenggren@hedinmotorcompany.com">Martin.Tenggren@hedinmotorcompany.com</a>

Ford of Hungary	
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Ford of Greece	
<b>Contact:</b>	John Amarantos <a href="mailto:jamaran1@ford.com">jamaran1@ford.com</a>

Ford of Poland	
<b>Contact:</b>	Piotr Nowosadzki <a href="mailto:pnowosal@ford.com">pnowosal@ford.com</a>

Ford of Czech Republic	
<b>Contact:</b>	Michal Martinek <a href="mailto:mmart763@ford.com">mmart763@ford.com</a>

Ford of Switzerland	
<b>Contact:</b>	Frederic Steiner <a href="mailto:fsteine3@ford.com">fsteine3@ford.com</a>

Ford of Romania	
<b>Contact:</b>	Constantin Moldoveanu <a href="mailto:cmoldove@ford.com">cmoldove@ford.com</a>

Ford Central & Eastern Europe	
<b>Contact:</b>	Balázs Págyi <a href="mailto:bpagy@ford.com">bpagy@ford.com</a>

Ford Otosan - Turkey	
<b>Contact:</b>	Ford Otosan Call Centre
<b>Phone:</b>	+90-216-4443673
<b>E-Mail:</b>	<a href="mailto:iletisim@ford.com.tr">iletisim@ford.com.tr</a>

Ford of Australia	
<b>Contact:</b>	FoA Customer Team
<b>Phone:</b>	13 FORD or 13 36 73
<b>E-Mail:</b>	<a href="mailto:foacust1@ford.com">foacust1@ford.com</a>
<b>Fax:</b>	03 8301 2582
<b>Postal Address:</b>	Ford Customer Relationship Centre Private Mail Bag 5 Campbellfield VIC 3061

Ford of New Zealand	
<b>Contact:</b>	FoNZ Customer Team
<b>Phone:</b>	+64-9-2718500
<b>E-Mail:</b>	<a href="mailto:nzinfo@ford.com">nzinfo@ford.com</a>
<b>Fax:</b>	+64-9-2718573
<b>Postal Address:</b>	Private bag 76912 Manukau City NZ - 2241

## 1.5 Conversion Type

### 1.5.1 Order Codes

The following tables show overviews of the available options which will assist in your conversion. It is necessary to take into account the anticipated usage of the modified vehicle in order to choose the appropriate specification of the base vehicle.

Please ensure that the base vehicle is ordered with all required options by your Ford dealer. Availability of options vary by territory. For availability please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

#### Electrical

Order Code	Special Vehicle Option (SVO)	Description
JZDAK	Enhanced Electronic Interface Pack	Provides comprehensive connectivity to various electrical vehicle signals.
JZAAC	Ford Programmable Battery Guard	Provides power to 3rd party devices whilst protecting the battery state-of-charge to ensure the vehicle can always be started.
JZXAD/AF	Smart Fuse Box	Incorporates Ford Programmable Battery Guard-FPBG functionality and provides interface connection signals. Utility Smart Fuse Box (JZXAD) includes configurable inputs and outputs. The Camper version (JZXAF) is available with CI Bus & Wi-Fi connectivity along with the option to connect to Ford Enhanced Camper Touchscreen

#### Security

Order Code	Special Vehicle Option (SVO)	Description
AAKAC	Enhanced Security Packs - Slam Handle	Replacement to the SLD & RCD handles. Replaces 'pull' function with a mechanical key door opening actuation. Includes Replock/Anti-Pick lock, Loom Guards and Latch Shields.
AAKAD	Enhanced Security Packs - Hook Lock	Installation of Front Door Deadlocks (Drv & Pass), and hooklocks to SLD, RCD and Tailgate. Includes Replock/Anti-Pick lock, Loom Guards and Latch Shields.
AAKAE	Enhanced Security Packs - ArmourShell	Installation of Front Door Deadlocks (Drv & Pass), and Armourshells to SLD & RCD. Includes Replock/Anti-Pick lock, Loom Guards and Latch Shields.
AAKAF	Enhanced Security Packs - Deadlocks Only	Installation of Front Door Deadlocks, Driver & Passenger Side only.
AAKAG	Enhanced Security Packs - Hook Lock Only	Installation of SSLD, DSLD, RCD & Tailgate Hooklocks only.
AAKAH	Enhanced Security Packs - ArmourShell Only	Installation of SSLD, DSLD & RCD Armourshells only.

#### Seats

Order Code	Special Vehicle Option (SVO)	Description
BVFDM	SVO Front Seat Pack 12 (Less Front Passenger Seats)	This seat pack provides a less front passenger seat option.
AALJ5	Taxi Prep Pack (WAV, no floor covering)	Removes the 2nd and 3rd row seats and restraints and also the floor covering.
AALEX	Taxi Prep Pack 2 (WAV, floor covering)	Removes the 2nd row seats and restraints but keeps dual/single seat configuration in the 3rd row. The floor covering also remains.
AALEY	1st & 2nd Row Seat Pack	Removes the 3rd row seats and restraints but the floor covering remains.

**Racking**

<b>Order Code</b>	<b>Special Vehicle Option (SVO)</b>	<b>Description</b>
AALA6	Van Pack 1	The pack includes a driver-side racking system, non-slip phenolic floor and bulkhead as standard.
AALA7	Van Pack 2	This pack converts the vehicle into a mobile workshop. Built-in components such as gas bottle storage, cabinets and trays create a bespoke storage solution.

**RPO Options**

<b>Order Code</b>	<b>Regular Production Order (RPO)</b>	<b>Description</b>
DCNAB	Engine RPM Controller	Enables the engine to be run at an elevated idle speed. Used for electrical and mechanical power take-off to drive supplementary equipment.
A6YAB	Manual Regen Initiation	Diesel Particulate Filter (DPF) regeneration manually commanded by the operator.
HTABG	Single H8 AGM Battery	Absorbent Glass Matt (AGM) battery to power auxiliary equipment which requires a constant current drain, or a short-term high-load drain.
AAKBA	Replock	Replacement to the Lock-in-Handle and Lock-in-Latch cylinder, with a TVL anti-pick barrel and key.
JRSAB	Upfitter Integration System (UIS)	Programmable input/output controller system which communicates on the vehicle CAN network and provides integration of electrical and digital systems to control equipment and various vehicle functions via Upfitter Configuration.



## 1.5.2 Conversion Type - Reference Tables

The BEMM contains general and specific recommendations covering conversions to the new Transit range of vehicles. To assist users locate information by conversion type the following tables contain the relevant links within this Manual.

**NOTE:** The following tables are for guidance only. Full reference to the Body and Equipment Mounting Manual (BEMM) should be made prior to starting any conversion.

**NOTE:** For any conversions requiring electrical power:

[Refer to: 4.3 Communications Network](#)

[Refer to: 4.22 Fuses and Relays](#)

Chassis Cab Conversion	
Van Conversion/ Multi-Purpose Vehicle Conversions	<a href="#">Refer to: 1.14 Package and Ergonomics</a>
	<a href="#">Refer to: 1.17 Towing</a>
	<a href="#">Refer to: 3.8 Fuel System</a>
	<a href="#">Refer to: 4.5 Battery Systems</a>
	<a href="#">Refer to: 4.6 Battery Protection</a>
	<a href="#">Refer to: 5.8 Seats</a> Rear Seat Fixings Positions
	<a href="#">Refer to: 5.12 Roof</a> Roof Racks
Dry Freight	
Box Van	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.20 Auto Wipe and Auto Light for Vehicles with Large Overhang</a>
Pantechicon	<a href="#">Refer to: 1.16 Load Distribution</a>
	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
Money Carriers	<a href="#">Refer to: 4.20 Auto Wipe and Auto Light for Vehicles with Large Overhang</a>
	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.12 Roof</a>
Refuse Collection	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>

Emergency Services	
Ambulance (Front Line)/Fire Brigade/ Armed Forces / Police	<a href="#">Refer to: 3.2 Engine Cooling</a> Airflow Restrictions
	<a href="#">Refer to: 4.4 Charging System</a> Generator and Alternator
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>
	<a href="#">Refer to: 4.17 Cruise Control</a>
	<a href="#">Refer to: 4.22 Fuses and Relays</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
	<a href="#">Refer to: 4.20 Auto Wipe and Auto Light for Vehicles with Large Overhang</a>

Vocational Conversion	
Mobile Workshops	<a href="#">Refer to: 4.4 Charging System</a> Generator and Alternator
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 5.3 Racking Systems</a>
	<a href="#">Refer to: 5.12 Roof</a> Roof Racks
	<a href="#">Refer to: 4.20 Auto Wipe and Auto Light for Vehicles with Large Overhang</a>
Mobile Shops / Offices	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 5.3 Racking Systems</a>
	<a href="#">Refer to: 5.12 Roof</a> Roof Racks
	<a href="#">Refer to: 4.20 Auto Wipe and Auto Light for Vehicles with Large Overhang</a>
Glass Carrying	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.1 Body</a> Racking System.
	<a href="#">Refer to: 5.3 Racking Systems</a>
Racking Conversions	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.3 Racking Systems</a>
Recovery Vehicles	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 5.14 Frame and Body Mounting</a>
	<a href="#">Refer to: 4.20 Auto Wipe and Auto Light for Vehicles with Large Overhang</a>

Passenger Carrying	
Taxi	<a href="#">Refer to: 1.3 Commercial and Legal Aspects</a> Restraints System
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.9 Glass, Frames and Mechanisms</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
	<a href="#">Refer to: 5.12 Roof</a>
Mobility	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.9 Glass, Frames and Mechanisms</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
	<a href="#">Refer to: 5.12 Roof</a>
Coach Built	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 4.11 Tachograph</a>
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.9 Glass, Frames and Mechanisms</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
Wheelchair Accessible	<a href="#">Refer to: 5.1 Body Welding &amp; Floor Precautionary Drill Zones</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 5.3 Racking Systems</a>
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.9 Glass, Frames and Mechanisms</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
	<a href="#">Refer to: 5.12 Roof</a>
Mini Bus	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 4.14 Exterior Lighting</a>
	<a href="#">Refer to: 4.15 Interior Lighting</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.9 Glass, Frames and Mechanisms</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
	<a href="#">Refer to: 5.12 Roof</a>

Refrigerated Vehicles	
Van Conversion	<a href="#">Refer to: 1.9 End of Life Vehicle (ELV) Directive</a>
	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.7 Climate Control System</a>
	<a href="#">Refer to: 4.22 Fuses and Relays</a>
	<a href="#">Refer to: 5.12 Roof</a> Roof Racks
Compressor Installation	<a href="#">Refer to: 3.3 Accessory Drive</a>

Leisure Vehicles	
Camper Conversion	<a href="#">Refer to: 1.3 Commercial and Legal Aspects</a>
	<a href="#">Refer to: 1.5 Conversion Type</a>
	<a href="#">Refer to: 1.7 Electromagnetic Compatibility (EMC)</a>
	<a href="#">Refer to: 1.14 Package and Ergonomics</a>
	<a href="#">Refer to: 1.16 Load Distribution</a>
	<a href="#">Refer to: 3.1 Engine</a>
	<a href="#">Refer to: 3.8 Fuel System</a>
	<a href="#">Refer to: 4.1 Electrical System Overview</a>
	<a href="#">Refer to: 4.2 Wiring Installation and Routing Guides</a>
	<a href="#">Refer to: 4.3 Communications Network</a>
	<a href="#">Refer to: 4.4 Charging System</a>
	<a href="#">Refer to: 4.5 Battery Systems</a>
	<a href="#">Refer to: 4.6 Battery Protection</a>
	<a href="#">Refer to: 4.12 Information and Entertainment System</a>
	<a href="#">Refer to: 4.14 Exterior lighting</a>
	<a href="#">Refer to: 4.16 Emergency Call Systems</a>
	<a href="#">Refer to: 4.21 Handles, Locks, Latches and Entry Systems</a>
	<a href="#">Refer to: 4.23 Electrical Connectors and Connections</a>
	<a href="#">Refer to: 4.24 Grounding</a>
	<a href="#">Refer to: 5.1 Body</a>
	<a href="#">Refer to: 5.2 Hydraulic Lifting Equipment</a>
	<a href="#">Refer to: 5.3 Racking Systems</a>
	<a href="#">Refer to: 5.5 Interior Partitions</a>
	<a href="#">Refer to: 5.7 Interior Trim</a>
	<a href="#">Refer to: 5.8 Seats</a>
	<a href="#">Refer to: 5.9 Glass, Frames and Mechanisms</a>
	<a href="#">Refer to: 5.10 Airbag Supplemental Restraint System (SRS)</a>
	<a href="#">Refer to: 5.11 Seatbelt Systems</a>
	<a href="#">Refer to: 5.12 Roof</a>
	<a href="#">Refer to: 5.14 Frame and Body Mounting</a>

## 1.6 Conversion Homologation

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

The Vehicle Converter must observe any statutory rules and regulations. 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.

For additional information on vehicle type approval  
[Refer to: 1.3 Commercial and Legal Aspects](#)

## 1.7 Electromagnetic Compatibility (EMC)

**WARNINGS:**

**⚠ Do not mount any transceiver, microphones, speakers, or any other item 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.**

**⚠ Do not fasten antenna cables to original vehicle wiring, fuel pipes or brake pipes.**

**⚠ Keep antenna and power cables at least 100mm from any electronic modules and airbags.**

**NOTE:** Your vehicle has been tested and certified to electromagnetic compatibility legislation (UNECE Regulation 10 or applicable local legislation). Ensure that any additional equipment installed on your vehicle complies with applicable local legislation and other requirements.

**NOTE:** Radio Frequency (RF) transmitter equipment (for example: cellular telephones, amateur radio transmitters) may only be fitted to your vehicle if they comply with the parameters shown in the following 'Frequency Overview' table. There are no special provisions or conditions for installations or use.

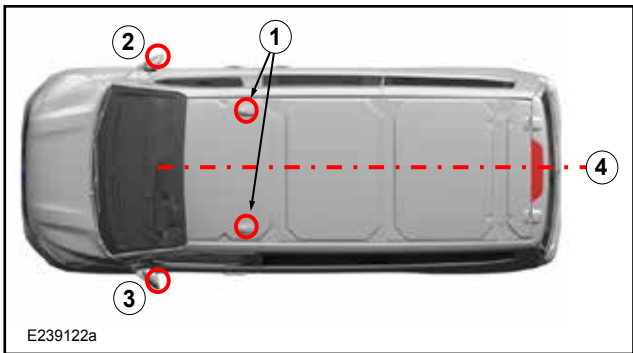
**NOTE:** Only fit one antenna in the positions shown to the roof of your vehicle.

**NOTE:** For EMC on Police conversions with rear view cameras please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

**Frequency Overview**

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

### 1.7.1 Permitted Antenna Locations



**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.

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.

Item	Description
1	GNSS/5G Antenna location
2	FM DAB Antenna location
3	FM only Antenna location
4	Additional Antennas to be on centre line Y-0



## 1.8 Vehicle Duty Cycle Guidelines

**NOTE:** For further information contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

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

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

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

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

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

### 1.8.1 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.

## 1.9 End of Life Vehicle (ELV) Directive

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

The European End-of-Life Vehicle (ELV) directive requires that environmental and recycling aspects are integrated in the development process of new components and vehicles. This includes requirements with respect to:

- The overall recyclability (85%)/recoverability (95%) of vehicles
- Limited use of hazardous substances including the elimination of prohibited substances such as lead, hexavalent chromium, cadmium and mercury
- Publication of dismantling information
- Parts Marking according to the corresponding ISO Standards: ISO 1043-1, 1043-2 and 11469 for plastics and ISO 1629 for rubber materials
- Increasing use of recycled materials
- Producers meet all, or a significant part of, the costs to take back End-of-Life Vehicles

In addition to the requirements resulting from the End-of-Life Directive other environmental targets should be taken into consideration such as:





- Minimising costs and environmental burden along the product lifecycle
- Maximising use of renewable materials e.g. natural fibres
- Minimising the presence of substances impacting vehicle interior air quality/clean compartment or allergenic reactions. This refers to aspects like smell, fogging, toxicity and allergy coming from materials in the interior
- Eliminate use of prohibited substances which are listed in the Global Automotive Declarable Substance List (GADSL) at <http://www.gadsl.org>

For continued legal compliance and environmental performance of all Ford products it is essential that any conversion of the vehicle is in compliance with the requirements listed above.

This is not a complete list of all legal requirements to be met by every converted vehicle.

## 1.10 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.**
-  **Only use the desionated jacking and support points.**
-  **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, you may damage the body, steering, suspension, engine, braking system or the fuel lines.**

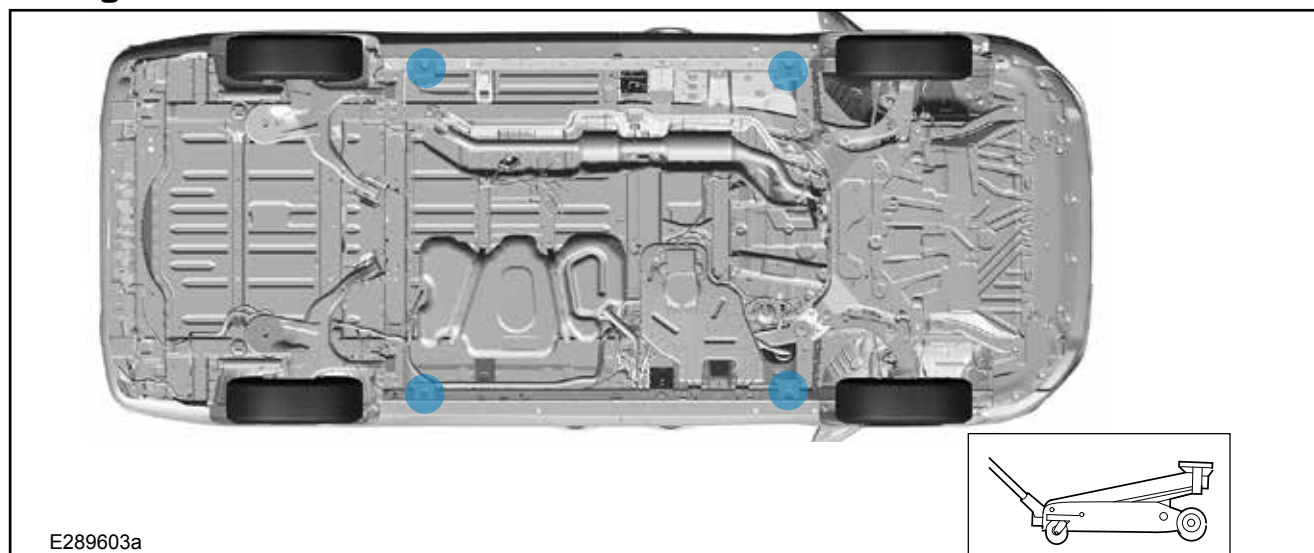
-  **Make sure that access to the spare wheel is maintained when converting the vehicle or relocating the spare wheel.**
-  **Ensure there is sufficient clearance when positioning the jacking equipment to prevent damage of any underfloor components.**

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

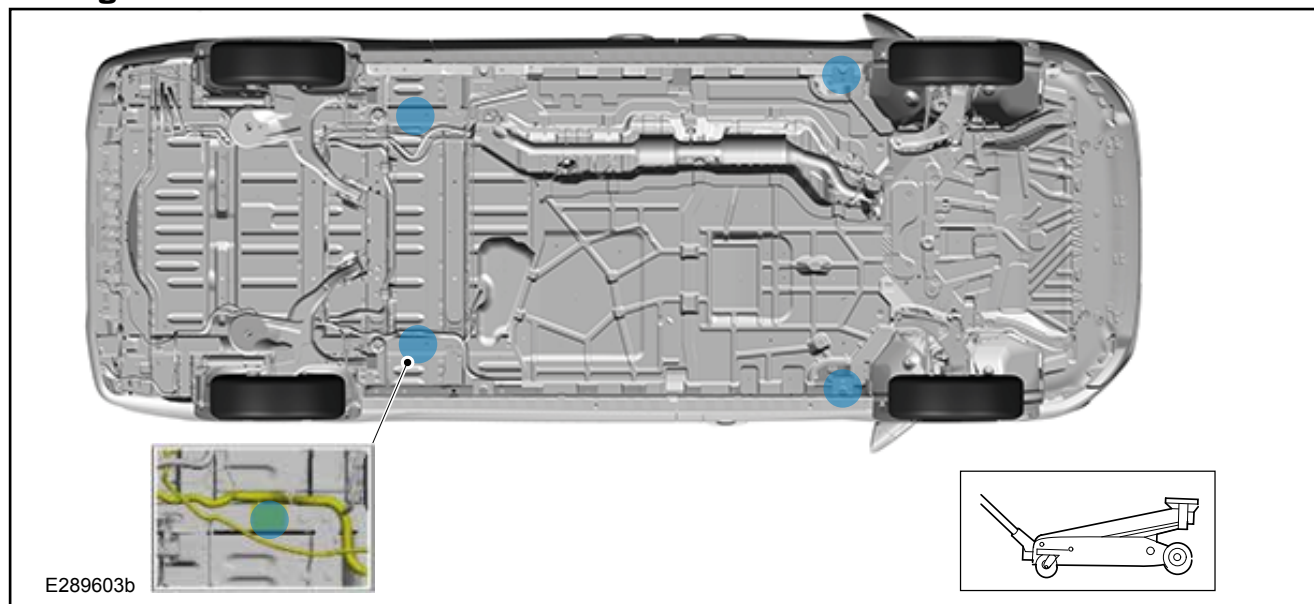
**NOTE:** Make sure that reinforcements are installed to maintain the integrity of the original body structure for/at jacking points.

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

### Jacking Points L1



### Jacking Points L2



## 1.11 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.

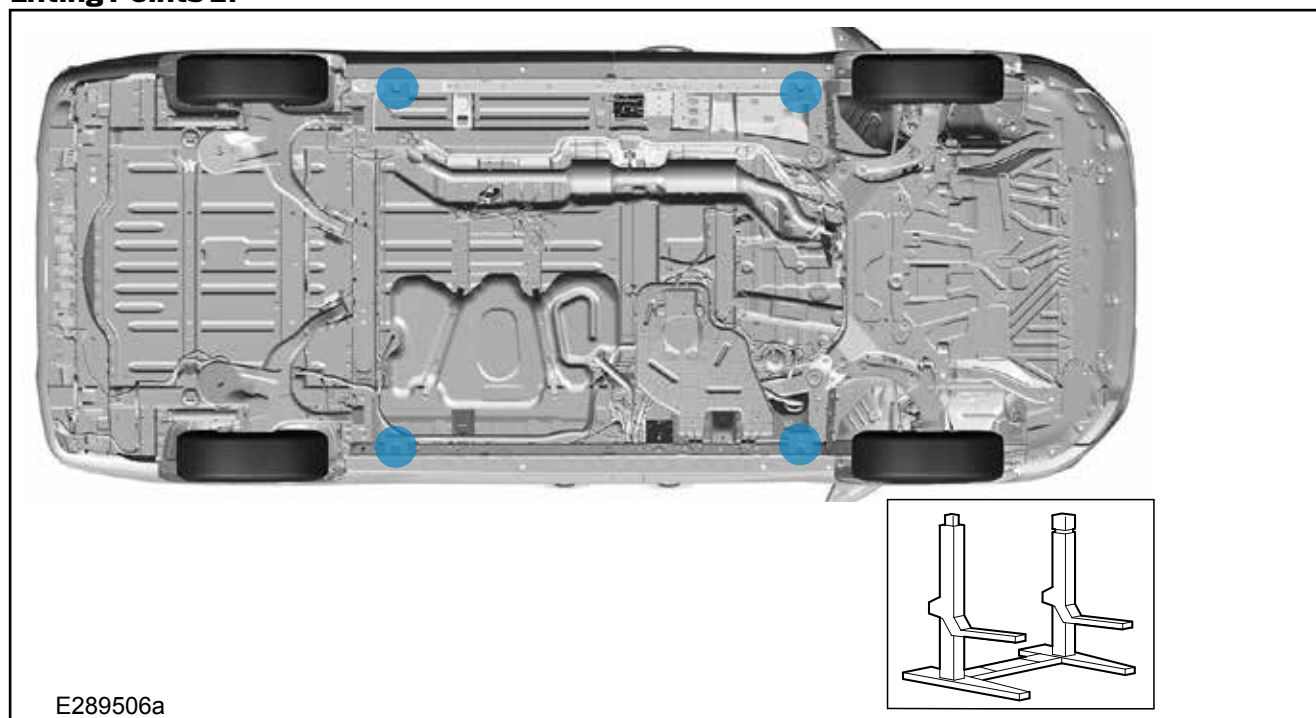
**⚠** When lifting the vehicle with a two post lift, the maximum kerb weight must not be exceeded.

**⚠** It is important that only the correct lifting and support locations are used at all times.

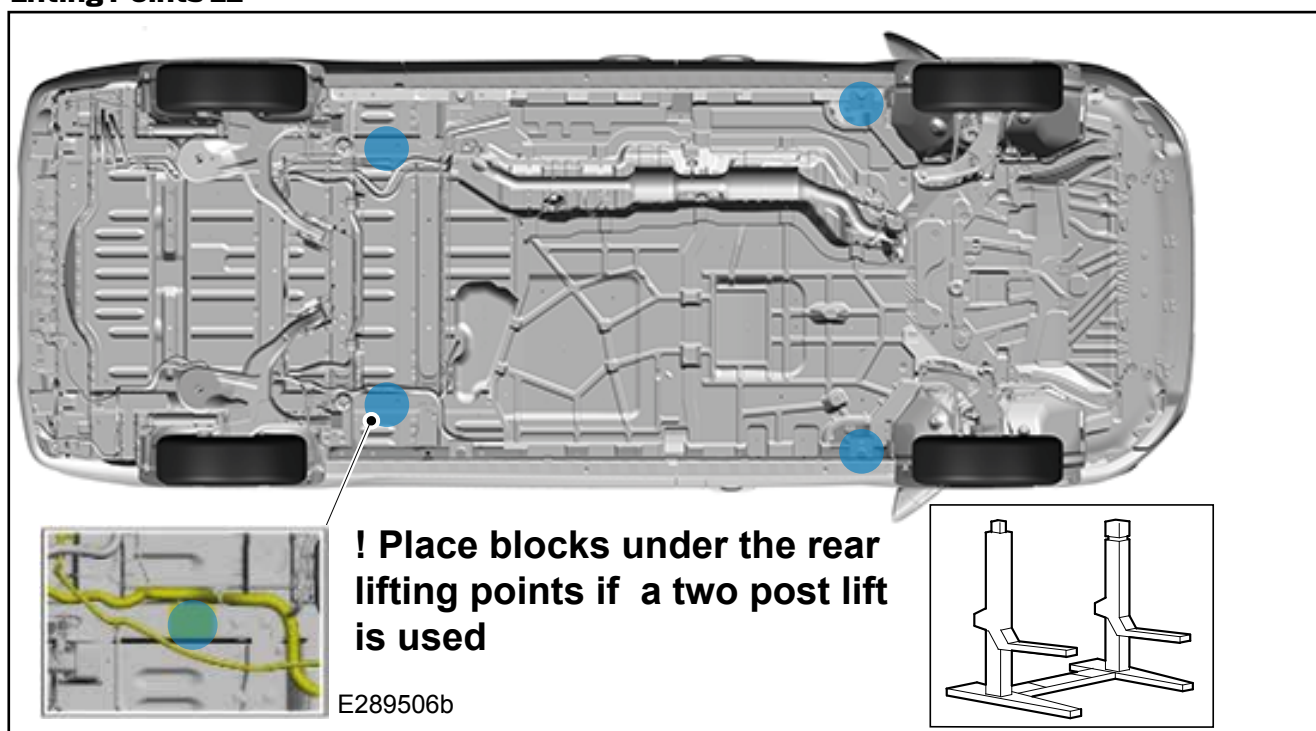
**⚠** Ensure there is sufficient clearance when positioning the lifting equipment to prevent damage of any underfloor components.

**⚠** When lifting the L2 variant with a two post lift, place blocks under the rear lifting points.

### Lifting Points L1



### Lifting Points L2



## 1.12 Noise, Vibration and Harshness (NVH)



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





Changes to the powertrain, engine, transmission, exhaust, air intake system or tyres 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.



## 1.13 Vehicle Transportation Aids and Vehicle Storage

### CAUTIONS:

-  **Make sure to disconnect the battery if the vehicle is to be stored for more than 7 days.**
-  **Make sure that the protective covers are not removed from an incomplete vehicle until the conversion is started.**
-  **Make sure that components removed during conversion are kept clean and dry.**
-  **Make sure that components removed during conversion are refitted to the same vehicle.**

In addition:

- The windscreen wipers should be lifted off the glass and set right up
- All air intakes should be closed
- Increase normal tyre pressure by 0.5 bar
- The handbrake system should not be used
- Apply suitable wheel chocks to prevent roll away

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

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

**Vehicle 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:

- 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:

- The battery should be disconnected, but not removed from the vehicle
- The wiper blades should be removed and placed inside the vehicle. Make sure the wiper arms are suitably prevented from resting on the windscreen
- 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

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

**Batteries:** To make sure the battery is maintained correctly and to assist in preventing premature failure, it is necessary to check and recharge the battery 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.

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

**MHEV Batteries:** When storing for a period greater than 6 months, the vehicle should be started periodically. The vehicle should be stored in an environment with low humidity, free from corrosive gas within a temperature range of 20 to 35°C. A temperature of 40°C or higher will accelerate the deterioration of the battery performance. The 48V battery should be stored in an environment with between 45-85% humidity.




<b>Action/Time in Storage</b>	<b>Monthly</b>	<b>Every 3 Months</b>
Check vehicle is clean	X	-
Remove external contamination	X	-
Check battery condition — Recharge if necessary	X	-
Visually check tyres	X	-
Check interior for condensation	-	X
Run engine until coolant guage reaches temperature (60 °C) with aircon switched on, where applicable	-	X

## 1.14 Package and Ergonomics

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 1.14.1 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.

### 1.14.2 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.

### 1.14.3 Driver Field of View

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

### 1.14.4 Conversion Effects on Parking Aids

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

 **System will not function if an aftermarket rear step or other rear mounted equipment is installed. Reverse Brake Assist feature will not automatically brake when a collision is imminent**


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

[Refer to: 4.14 Exterior Lighting](#)

### 1.14.5 Aids for Vehicle Entry and Exit

#### Steps

#### WARNINGS:

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

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

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

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

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.

### Grab Handles

 **WARNING: Make sure that the location of the no-drill zones are checked before drilling.**

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

Grab handles can be ordered as an option on the base vehicle. Please check for availability.

### 1.14.6 Front, Rear and Side Under-Run Protection

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

Front Under run Protection must be designed to directive ECE 93<sup>(1)</sup> or applicable local legislation.

Rear Under run Protection must be designed to directive ECE 58<sup>(1)</sup> or applicable local legislation.

Side Under run Protection must be designed to directive ECE 73<sup>(1)</sup> or applicable local legislation.

<sup>(1)</sup> As amended periodically

### 1.14.7 Worldwide Harmonised Light-Duty Vehicle Test Procedures (WLTP) Calculation Inputs

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

#### Mass of the Completed Vehicle

All modifications and changes that affect the actual mass of the vehicle must be taken into account. The definition of actual mass is described under the provisions of regulation 2017/1151 Annex XXI. The actual mass of the completed vehicle needs to be provided for the front and rear axle. This weight split will be important where the completed vehicle has mixed tyres between the front and rear.

## Frontal Surface Area

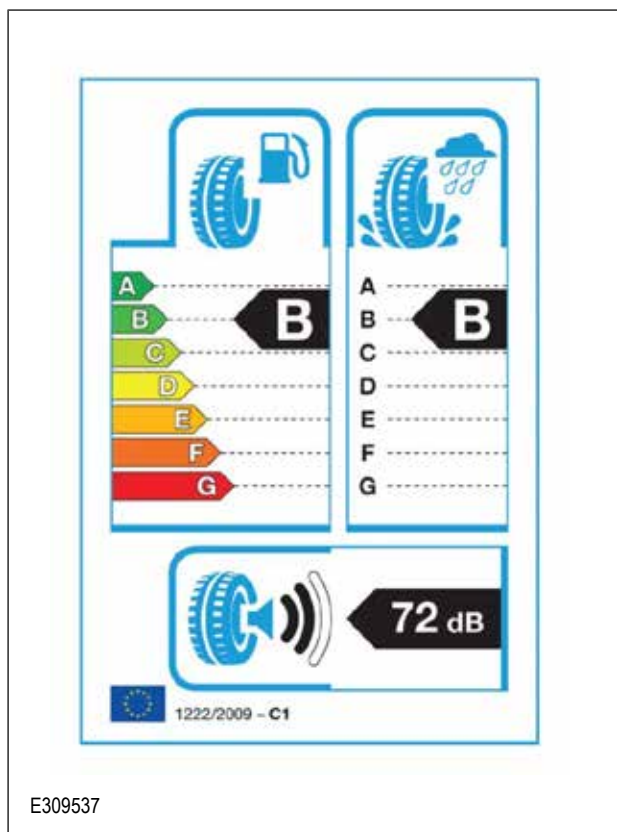
All modifications and changes that affect the frontal surface area of the completed vehicle must be taken into account. For further information please see information later in this section.

## Tyre Rolling Resistance

Any changes in tyres fitted to the completed vehicle must be taken into account. The efficiency class and tyre class is needed to determine the correct calculation. This can be found on the tyre label as per the example in image E309537.

## Exceeding Attribute Limits

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



E309537

## 1.14.8 Vehicle Dimensions Key

Dimension (mm)	L1	L2	Comments
Wheelbase Length	3100	3500	
<b>Overall Height @ Base Kerb</b>			
H1	1958 - 2019	1959 - 2010	16"-19" wheels <sup>1</sup>
<b>Overall Height @ RGAWR+GVM</b>			
H1	1902 - 1952	1902 - 1953	16"-19" wheels <sup>1</sup>

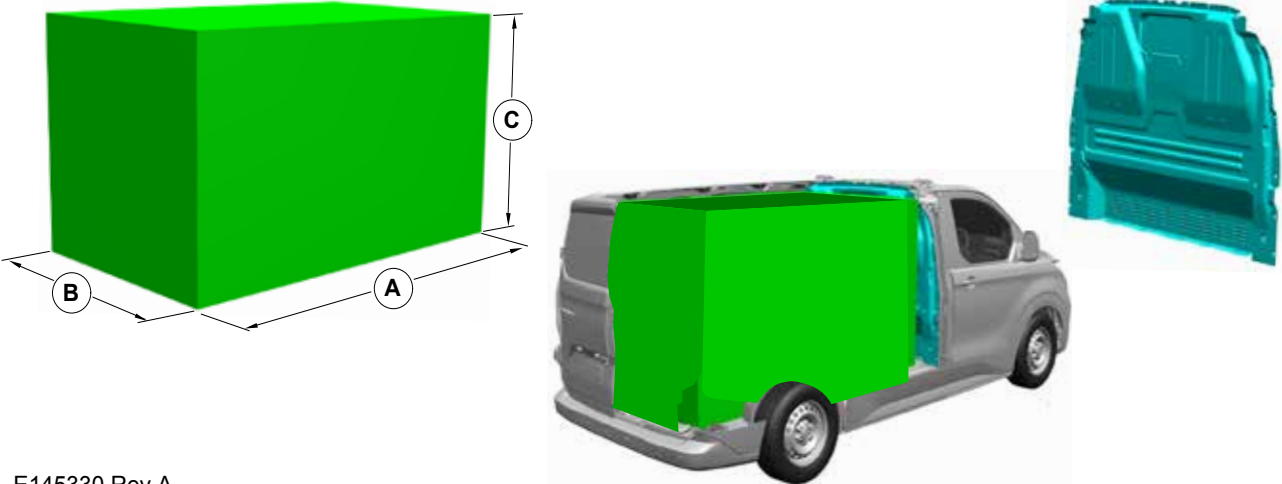
<sup>1</sup> Max. dim. includes Fixed Roof Rails (Foldable Roof Bars not included)

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.

1.14.9 Recommended Main Load Area Dimensions

Full Bulkhead - Fixed/Glazed

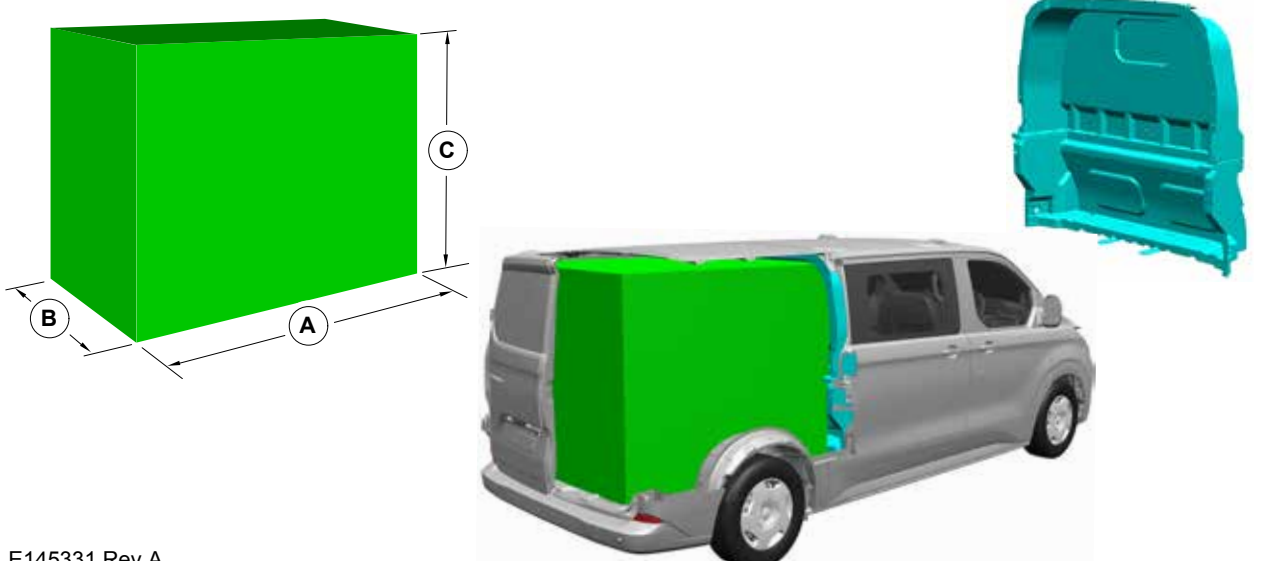


E145330 Rev A

Vehicle	A (mm)	B (mm)	C (mm)
L1 - H1	2357	1232	1282
L2 - H1	2757	1232	1282

For vehicle heights see 'Vehicle Dimension Key' table in this section of this manual

Double Cab in Van Bulkhead



E145331 Rev A

Vehicle	A (mm)	B (mm)	C (mm)
L1 - H1	1447	1232	1282
L2 - H1	1847	1232	1282

For vehicle heights see 'Vehicle Dimension Key' table in this section of this manual

## 1.14.10 Vehicles with Roof Mounted Units

### Vehicle with Roof Mounted Units Frontal Area Calculation

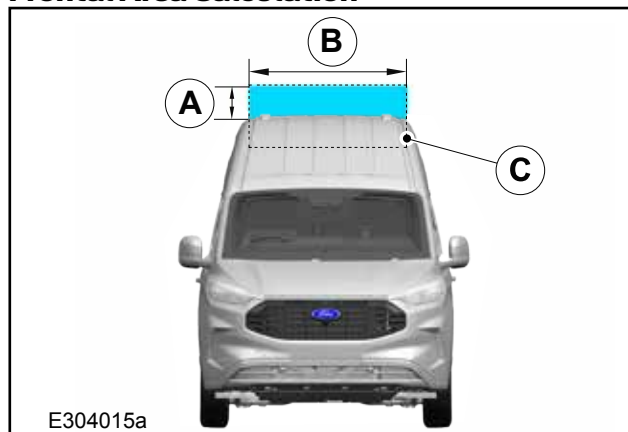
**NOTE:** The WLTP calculator can be accessed at <https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F> You will need to register or login to use it.

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

Roof mounted units may be integrated below the roof. For the height measurement (A), only measure the part of the unit that protrudes above the roof line. The Vehicle Converter only needs to calculate the frontal area of the mounted unit (AxB) in m<sup>2</sup>.

Applicable to vehicles with a Ref Mass not exceeding 2840kg (Kerb mass 2740kg). Refer to table below.

### Frontal Area Calculation



Item	Description
A	Roof Mounted Unit Height
B	Roof Mounted Unit Width
C	Integrated Roof Mounted Unit

Vehicle Line	Body Style	Engine Family	Power [PS]	Driveline	Trans	Max Frontal Area M <sup>2</sup>	Max Tyre RR (Tyre Class)
<b>Transit Custom (N1)</b>	All	2.0 EcoBlue BiT	All	All	All	4.75	6.1 (B)
<b>Tourneo Custom (M1)</b>	Low Roof	2.0 EcoBlue BiT	110/136	All	All	4.75	6.1 (B)
	Low Roof	2.0 EcoBlue BiT	150	All	Man	4.75	6.1 (B)
	Low Roof Camper	2.0 EcoBlue BiT	170	All	Auto	3.80	6.1 (B)

# 1.15 Hardware

## Material Specification, Strength and Torque

Use Ford-specified torques on Ford interfaces or, where not provided, use Standard Hardware and Tightening Torques (Nm) Bolts/Studs: ISO 898-1, Nuts: ISO 898-2

Standard Hardware and Tightening Torques (Nm) Bolts/Studs: ISO 898-1, Nuts: ISO 898-2				
	Grade 8.8		Grade 10.9	
Thread Size	Minimum	Maximum	Minimum	Maximum
M5	5.2	7.2	5.9	8.1
M6	8.9	12.1	10.2	13.8
M8	21.2	28.8	25.5	34.5
M10	40	54	53	72
M12	68	92	93	126
M14	113	153	148	201
M16	170	230	233	316




This torque chart is a recommendation and the convertor is responsible for the optimal torque for a specific joint.

## 1.16 Load Distribution

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 1.16.1 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 38% 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.

### 1.16.2 Centre 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 - Centre of Gravity Height

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 opposite shows maximum vertical centre of gravity (CG<sub>v</sub>) heights by vehicle type. If the CG<sub>v</sub> 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 tyres, the converted vehicle complies with ECE 13-H, ANNEX 9 standard or ADR 35 or applicable local legislation.**

 **If the CG<sub>v</sub> of the converted vehicle is above the values stated, Ford Motor Company makes no representation as to conformity with ECE 13-H, ANNEX 9 standard or ADR 35 or applicable local legislation.**

### 1.16.3 Centre of Gravity Height Test Procedure

#### Measurement

Vehicle shall be loaded according to test specifications specified in ECE13-H ANNEX 9 (Vehicle Mass) or ADR 35 or applicable local 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 needs 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 tyre 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 tyres and suspension.

#### Calculation

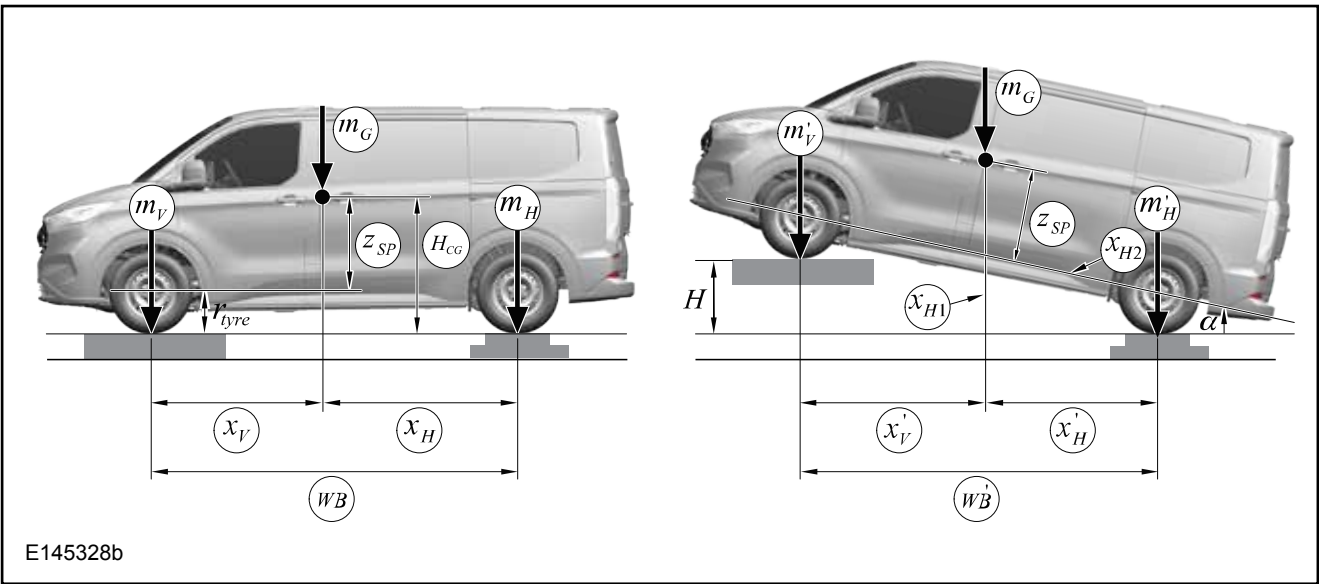
In order to estimate the resulting Centre of Gravity (CG<sub>v</sub>) the axle load needs to be measured twice. The first measurement is in the horizontal plane and the second measurement is after the front is lifted. To get a consistent result, this test should be done 3 times independently with different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

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



Maximum Vertical Centre of Gravity (CG<sub>v</sub>) Height

Vehicle	Wheelbase	Tyres	Maximum Vertical Centre of Gravity (CG <sub>v</sub> ) Height
All Transit Custom except Sports Series	All	Summer 16"/17"/19"	895mm
		All Season 16"/17"/19"	940mm
Sports Series Only	All	19"	800mm



Variables, to be measured, calculated or known			Measurement		
			1st	2nd	3rd
Wheelbase	WB	mm			
Front Axle Weight	m <sub>v</sub>	kg			
Rear Axle Weight	m <sub>h</sub>	kg			
Total Mass	m <sub>G</sub> = m <sub>v</sub> + m <sub>h</sub>	kg			
<b>Inclined Vehicle</b>					
Front Axle Weight	m' <sub>v</sub>	kg			
Rear Axle Weight	m' <sub>h</sub>	kg			
Height (Lift)	H	mm			
Inclination Angle		deg			
Centre of Gravity Height Z		mm			

Inclination Angle:

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

E146623

Centre 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

### 1.16.4 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	
Centre 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)	WB'
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)'	$X_{H2}$

### 1.16.5 Formulas

- Masses and lengths. Total vehicle mass is the sum of front and rear axle weights:
- $m_G = m_V + m_H$

**The longitudinal distances between the Centre of Gravity and the centres 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 centre:**

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

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

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 Centre 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

## 1.17 Towing

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 1.17.1 Tow Bar Requirements

When a tow bar device is required, the Vehicle Convertor should use a Ford approved tow bar. Contact your local Ford dealer for details.

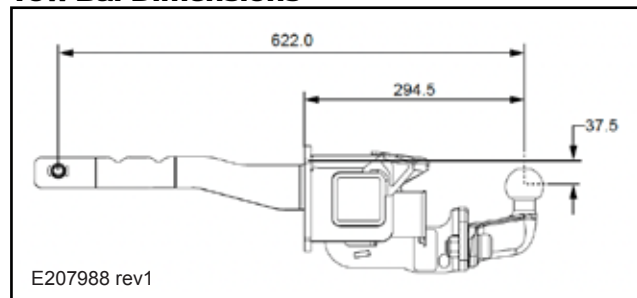
**NOTE:** Not all vehicles are suitable or approved to have tow bars fitted. See an authorised dealer for further information.

For further information on Towing a Trailer refer to the Owner's Manual.

For tow bar devices fitted by the Vehicle Convertor the following applies:

- Tow bar allowances must not exceed those of the standard vehicle
- For attachment of the tow bar see figure E145327 rev1, Tow Bar Van, Bus and Kombi.
- Any modifications to the vehicle must be noted in the owner's handbook or new descriptive literature included with the owner's documentation
- Tow bar installations must meet the requirements of the EEC Directive 94/20 EC and/or ECE R55

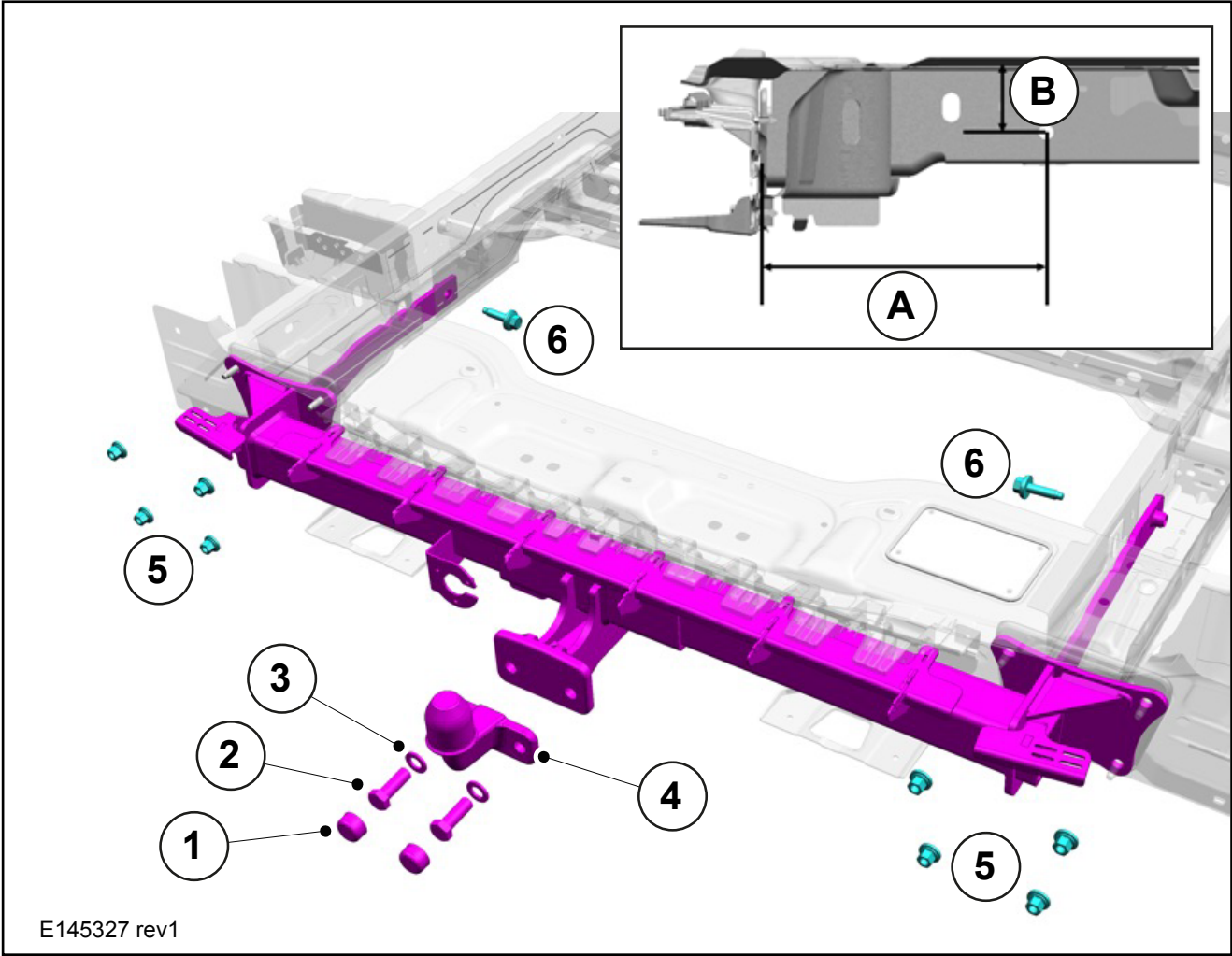
#### Tow Bar Dimensions



The centre of the towball is 1100mm from the centreline of the rear axle.

[Refer to: 4.2.13 Electrics for Tow Bar](#)

Tow Bar Van, Bus and Kombi



Item	Description
1	Bolt Cap x2
2	M16x45 Bolt - Torque 200Nm ( $\pm$ 30Nm) x2
3	M16 Washer x2
4	Tow Hook
5	M10 Nut x8
6	M12x45 Bolt x2
A	3305mm
B	76mm



## 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.**


**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)




## 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.

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)


## 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**

#### Rear Suspension

-  **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.

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

## 2.4 Wheels and Tyres

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 2.4.1 Wheel Clearance

The distance from the tyre 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 tyre sizes are fitted.

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

### 2.4.2 Tyre Manufacturers

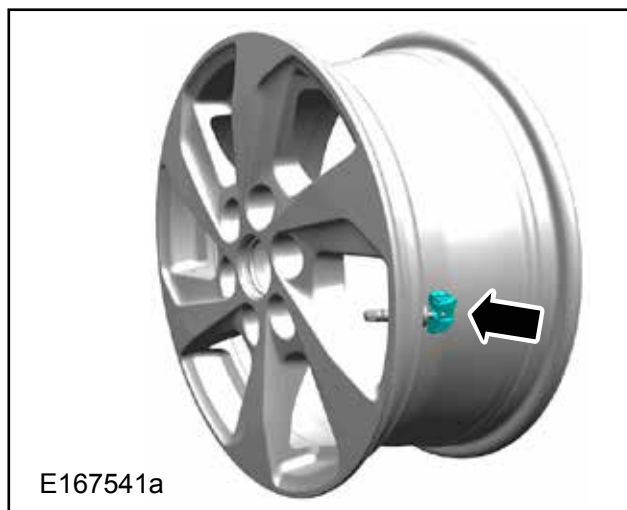
Replacement tyres should be of the same make, size, tread pattern and load rating as the original equipment manufacturer. Under these conditions the original tyre label should be satisfactory, however if the specified tyres and/or inflation pressures are changed then a new label should be affixed over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

### 2.4.3 Tyre Pressure Monitoring System (TPMS)

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

If you need to replace a road wheel and tyre 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 tyre to your vehicle. To restore the correct operation of the system, you must have the repaired road wheel and tyre assembly refitted to the vehicle.

**NOTE:** If fitting new tyres, you must ensure that the TPMS sensors are fitted correctly as outlined in the service literature.



### 2.4.4 Spare Wheel

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

### 2.4.5 Temporary Mobility Kit

If your vehicle does not have a spare tyre, it will have a temporary mobility kit which will only repair one damaged tyre. Both compressor and sealant bottle are located in the front right hand step.

For more information and usage of the tyre repair kit please refer to the Owner's Manual.

For information on vehicles with the spare wheel: [Refer to: 1.10 Jacking](#)

### 2.4.6 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 colour or repairing paint.

## 2.5 Brake System

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 2.5.1 General


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

Brakes are certified to 71/320EEC and ECE R13H requirements as amended or ADR 35 or applicable local legislation.

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

**CAUTIONS:**

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

 **For converted vehicles fitted with AEBS (Advanced Emergency Braking System), where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment and system functionality is checked by a Ford dealer. For further information, refer to the Workshop manual or Owner's manual.**

 **Do not modify the front bumper and grille. Any modification will impact ACC, AEB functionality due to radar FOV intersection.**

**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 the brake fluid reservoir.

**NOTE:** Do not obstruct the radar. [Refer to 4.17 Cruise Control](#)

**NOTE:** Do not paint the front grille of the vehicle as this may affect the functionality of the radar.

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

### 2.5.2 Kerb Mass Data

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPS VHelp@ford.com](mailto:FPS VHelp@ford.com)

### 2.5.3 Brake Hoses General

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

Front and rear brake hoses must not rub, chafe or rest on body or chassis 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.

### 2.5.4 Parking Brake

 **WARNING: Do not modify the brakes.**


### 2.5.5 Hydraulic Brake - Front and Rear Brakes

**WARNINGS:**

 **Do not modify the brakes.**



 **Do not modify the disc inflow and outflow of cooling air.**

### 2.5.6 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

- **CAUTION:** Make sure to follow the equipment supplier’s instructions for safety, warranty and sometimes legal compliance.
- **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 early life injector failure

For electrical supply to auxiliary equipment.  
[Refer to: 4.4 Charging System](#)

#### 3.1.1 Engine Selection for Conversions

The Vehicle Converter is responsible for specifying the correct emissions engine to the latest E.E.C./E.U. Regulations or applicable local legislation depending on the completed vehicle category and weight.

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

**NOTE:** Light duty emissions engines are available at Stage 6.2 EU emissions level for Transit vehicle conversions not exceeding 2840kg,

#### 3.1.2 Engine Types

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

TDCi	Max Power kW/RPM	Max Torque Nm/RPM	Emissions	Vehicle Class	Info
FWD					
81kW (110PS)	81kW (110PS) @ 3250-3500 RPM	310Nm @ 1500-2250 RPM	LDT	N1	Manual only
100kW (136PS)	100kW (136PS) @ 3250-3500 RPM	360Nm @ 1500-2500 RPM	Passcar/LDT	M1/N1	Manual/Auto
110kW (150PS)	110kW (150PS) @ 3500 RPM	360Nm @ 1500-2500 RPM	Passcar/LDT	M1/N1	Manual Only
125kW (170PS)	125kW (170PS) @ 3500 RPM	390Nm @ 1750-2500 RPM	Passcar/LDT	M1/N1	M1 Low Roof Auto Camper Only

## 3.2 Engine Cooling

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

**NOTE:** The installation must be in line with the appropriate legal requirements.

### 3.2.1 Auxiliary Heater Systems

#### WARNINGS:

**!** **Ford coolant additives are necessary for the complete function of the system. Only use Ford approved or equivalent specification components, to withstand any detrimental effects on the materials.**

**!** **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.**

#### CAUTIONS:

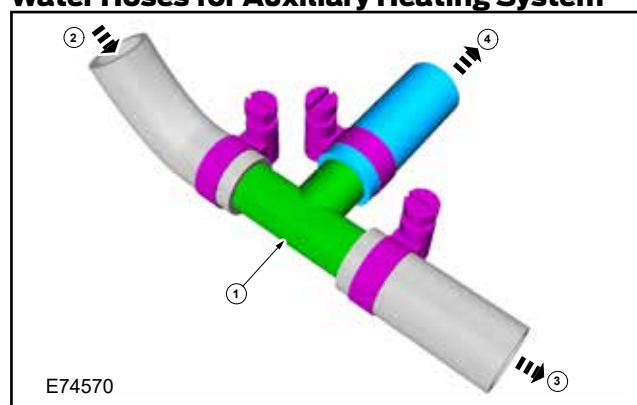
**!** **Only make connections into the heater hose between the front cab heater and water pump return inlet.**

**!** **Do not exceed the vehicle's original coolant volume (without auxiliary heater) by more than 10%.**

**!** **Maintain a coolant level between the maximum and minimum lines in cold condition after fill and de-aerating operations.**

**!** **Only use the manufacturer recommended (or equivalent specification) coolant additives/anti-freeze. Do not mix coolant types.**

#### Water Hoses for Auxiliary Heating System



Item	Description
1	Connector (aluminium or plastic)
2	Heater Hose (maintain heater fluid)
3	Original Flow
4	To Ancillary Equipment

- Coolant flow to cab heater must have priority over flow to auxiliary heater or hand wash facility
- Coolant tube routing must be below the minimum line of the degas bottle
- Use aluminium or plastic 'T' junction with swaged or beaded ends to prevent hose blow off. Reconnect original coolant tube as shown in view E74570 (in this section) with standard Ford water hose clip or suitable equivalent specification clip. Ensure interference fit between hose and 'T' joint
- Tube routing must be secured to the body structure or suitable brackets avoiding electrical components or wires, hot or moving parts and brake or fuel system components
- Hose must be heat sleeved with appropriate material if within 100mm of exhaust components (for example, manifold or exhaust gas recirculating)
- The vertical clearance between the critical cooling components (radiator, fan shroud and radiator brackets) and both the bonnet inner and outer (assembly) panels at design position shall not be less than 15mm
- There must be a minimum clearance of 10mm between the engine assembly and flexible components (for example, hoses or wiring harnesses) affixed to front end sheet metal hardware, under a maximum engine torque roll condition

### 3.2.2 Auxiliary Heater Installation

Ensure that the exhaust gas from any auxiliary heating system cannot be re-circulated into the vehicle. The exhaust gases must not pass into the engine intake system or the air intake for the passenger compartment ventilation. The heating system should be installed outside the passenger compartment. The location of the heating system should not be in close proximity to movable components. Any body reworks which damage the paint must be fully protected against corrosion.

[Refer to: 5.13 Corrosion Prevention](#)

### 3.2.3 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

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

#### 3.3.1 Front End Accessory Drives

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

**CAUTIONS:**

-  **Only use the manufacturer's recommended (or equivalent specification) components.**
-  **Make sure that the ancillary pulley diameter is less than the crankshaft pulley diameter.**
-  **The MHEV FEAD must not be modified or any accessory drive added.**
-  **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.**
-  **CAUTION: 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 crank 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.

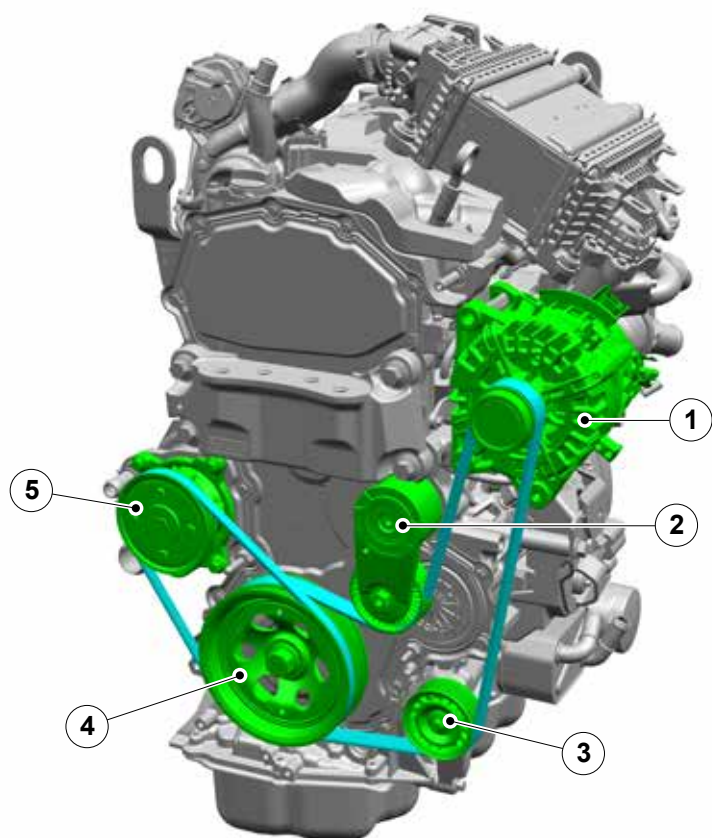
The Eigen frequency of the bracket with auxiliary unit should be above the maximum excitation frequency of the main excitation order of the individual engine at engine top speed. On 4-cylinder inline engines, this is the second engine order.

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  $\pm 0.5^\circ$ .

When the vehicle is not equipped with an air conditioning compressor, an additional accessory can be added in its place, and the longer standard option air conditioning belt can replace the standard belt if pulley size and position are the same as the standard option compressor. Then maximum power/torque that is available in that case at any engine speed is 5kW or 21Nm based on the Ford released variable air conditioning compressor.

**FWD TDCi**

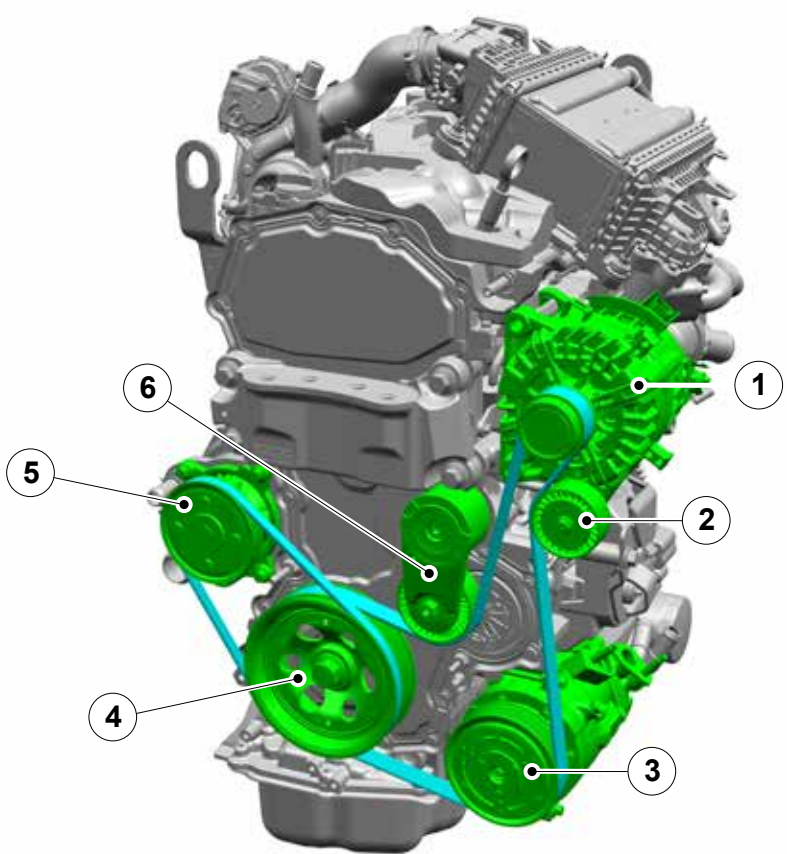
Figure	Engine
E289251a	with EPAS
E289252a	with EPAS Optional AC.

**2.0 EcoBlue.**

E289251a

Item	Description
1	Alternator
2	Tensioner
3	Idler
4	Crankshaft Pulley
5	Water Pump

2.0 EcoBlue with Optional AC.



E289252a

Item	Description
1	Alternator
2	Idler
3	AC Compressor
4	Crankshaft Pulley
5	Water Pump
6	Tensioner

## 3.4 Automatic Transmission

### WARNINGS:



**Do not reroute external transmission gear shift cables.**



**Do not change external electrical connectors.**

### 8F57 - 8 Speed Automatic FWD Transmission

Gears	Base Transmission Ratio	Overall Ratio - Final Drive 3.65
1st	4.484	16.367
2nd	3.146	11.483
3rd	2.872	10.483
4th	1.842	6.723
5th	1.414	5.161
6th	1	3.650
7th	0.742	2.708
8th	0.616	2.248
Reverse	2.882	10.519

## 3.5 Clutch

The manufacturer does not offer the option of a reinforced clutch system. The axle ratio available is dependent on the weight of the specified donor 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's order.

## 3.6 Manual Transmission

 **WARNING: Do not reroute external transmission gear shift cables.**


**NOTE:** All VMT6 FWD transmissions are tachograph compatible.

### VMT6 - 6 Speed Manual FWD Transmission

Gear	Base Transmission Ratio	Overall Ratio - Final Drive 4.93
1st	3.727	18.374
2nd	1.952	9.623
3rd	1.121	5.526
4th	0.780	3.845
5th	0.844	4.161
6th	0.683	3.367
Reverse	1.423	7.015




### 3.7 Exhaust System

**NOTE:** For further information please contact your National Sales Company representative or Local Ford Dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

 **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 in to the vehicle.

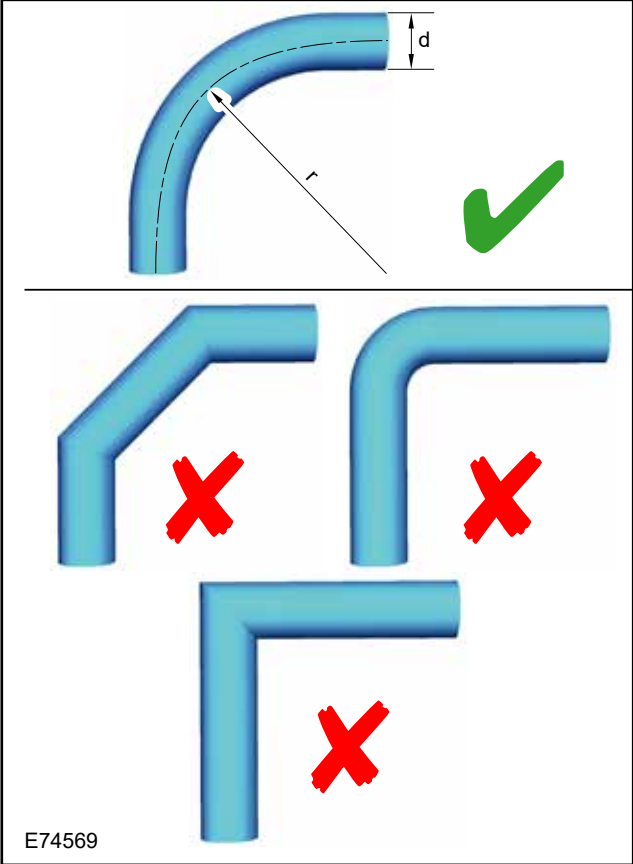
#### 3.7.1 Extensions and Optional Exhausts

**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.**

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



#### Exhaust Pipe Design Principles



Item	Description
d	diameter
r	radius => 2.5d

#### 3.7.2 Exhaust Pipes and Supports

**CAUTIONS:**

-  **Maintain the original set-up and heat shields.**
-  **Do not position any components closer than 150mm nominal (100mm minimum) clearance to the downpipe, the catalytic convertor, the diesel particulate filter, the selective catalyst reduction and any part of the exhaust system.**

#### 3.7.3 Exhaust Heat Shields

##### Exhaust Heat Shields

- Catalytic convertors, 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.

### 3.7.4 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 motor way, 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

### 3.7.5 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.

[Refer to: 4.10 Electronic Engine Controls](#)  
DPF and RPM Speed Control

## 3.8 Fuel System

### WARNINGS:



**Do not cut into the original fuel supply lines.**



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



**Ensure that a suitable fuel shut-off is fitted in any unique system**

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

**NOTE:** Two options are available to order: 1) Auxiliary Fuel Port, 2) Fuel-Fired Heater (which includes the Auxiliary Fuel Port).

**NOTE:** For vehicles without orderable options 1 or 2 (above), an Auxiliary Fuel Port can be fitted using the following process:

To lower fuel tank:

- Drain tank
- Disconnect fuel lines at connection point between fuel tank and urea tank
- Disconnect Filler Pipe Vent Tube
- Plug lines to prevent residual fuel from draining/spilling and dirt ingress
- Remove filler pipe from tank
- Remove bolts securing the two tank straps
- Lower the fuel tank to gain access to the top, see Figure E295569 rev1 for cutting Auxiliary Spigot

To refit fuel tank:

- Lift fuel tank ensuring not to trap fuel lines and electrical wires
- Refit straps, torque bolts to 80Nm ±12Nm
- Refit filler pipe to tank spud securing hose clip torque to 3.7Nm ±0.6Nm
- Remove plugs and reconnect fuel lines

### 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.**

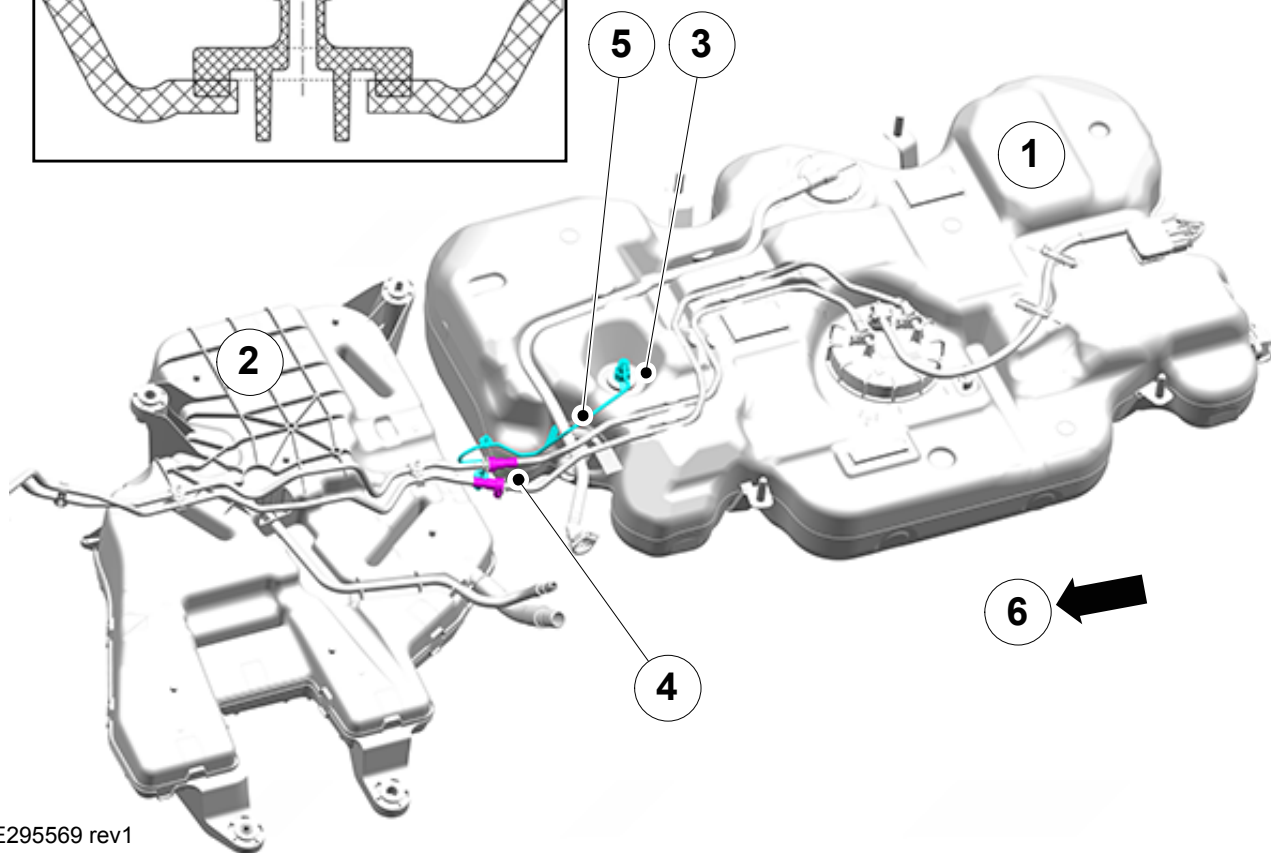
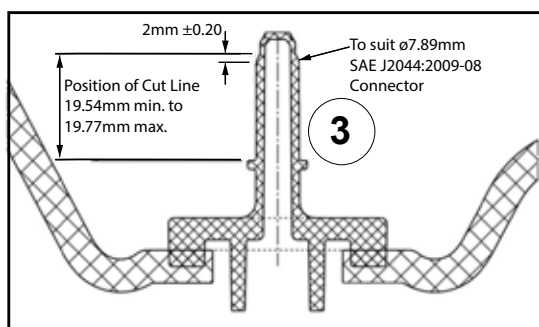
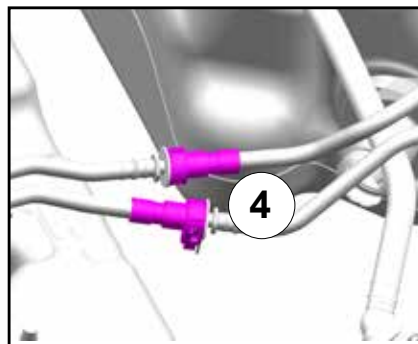
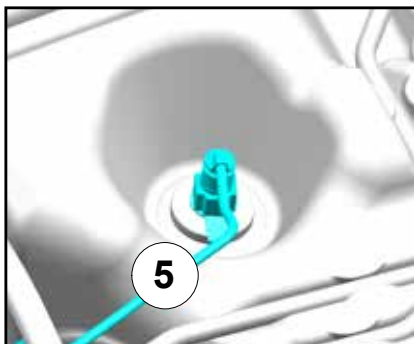
**NOTE:** The Auxiliary Fuel Port Line must be secured to the body structure using the fir tree connector

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

For additional information

[Refer to: 5.1 Body](#) Floor 'Precautionary Drill Zones' Fuel Tank with Urea.

## Retrofitting of Fuel Heater Line



E295569 rev1

Item	Description
1	Fuel Tank
2	Urea Tank
3	Auxiliary Spigot
4	Fuel lines connection point
5	Auxiliary Fuel Line
6	Drive Direction

## 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 third party wiring, could lead to serious system or vehicle failure.**



**The fitting of voltage boosters or other devices to enhance alternator/DCDC 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 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.

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.1.1 Electrical Architecture & Feature Changes

#### Battery System



**WARNING: Primary battery is now located under the bonnet. In order to ensure, low voltage system is fully powered off, all battery systems need to be disconnected.**

[Refer to 4.5 Battery Systems](#)

#### Fusing Strategy

Several signal wires and fuses may have changed location which may have an effect on the conversion design.

[Refer to: 4.3 Communications Network](#) on new BCM output signals.  
[Refer to 4.23 Electrical Connectors & Connections](#)

#### Smart Fuse Box (JZXAD/JZXAF)

Smart Fuse Box includes Ford Programmable Battery Guard-FPBG (JZAAC) functionality and provides interface connection signals. There are two configurations of Smart Fuse Box. The Utility Smart Fuse Box (JZXAD) includes configurable inputs and outputs. The Camper Smart Fuse Box version (JZXAF) is available with CI Bus & Wi-Fi connectivity

along with the option to connect to Ford Enhanced Camper Touchscreen which is available as conversion fit option. It is packaged in the front pedestal. All levels will have up to 200A of power management capability.

[Refer to 4.23.5 Smart Fuse Box](#) for further information

#### Ford Programmable Battery Guard

Ford Programmable Battery Guard functionality is now in Smart Fuse Box system (JZXAD/JZXAF).

[Refer to: 4.23.5 Smart Fuse Box](#) for further information

#### Load-Shedding and Standard Battery Guard

All vehicles are equipped with a Load-Shedding system as standard. This is designed to protect the base vehicle system voltage and it may affect the design of your conversion.

At engine-run, if the voltage falls near to 11V, loads controlled by the 'Standard Battery Guard' (SBG), CCP2, or Smart Fuse Box will be disconnected briefly, and a warning will be displayed for the driver. If this occurs regularly or persists, it may indicate a design issue with the Upfit / Conversion. To ensure Load-Shedding will protect the system, any non-controlled feeds are to be restricted by design to maximum 60A.

At engine-off, and after a time, or for depleted 12V-SOC, SBG load-shedding occurs to reserve future capability for meeting transient demands.

[Refer to: 4.6 Battery Protection](#) for load-shedding

#### Vehicle Interface Connector

The Vehicle Interface Connector has been updated from an 10-way to a 12-way connector.

#### GNSS/5G Antenna

The introduction of the Global Navigation Satellite System (GNSS)/5G antenna.

#### FM/DAB Antenna

FM/DAB antennas are now located in the side door mirrors.

#### Automatic Engine Idle Shutdown (AEIS)

AEIS, which is a safety feature, may be available on certain vehicles. Check with your dealer. If the AEIS is operating incorrectly (i.e. engine shuts down when still required) it may be inhibited by Third Party High Power Mode.

[Refer to: 4.23 Electrical Connectors and Connections](#)

## Customer Connection Point (CCP)

Vehicles are equipped with 2 x Customer Connection Points (CCP): 1 x 60A 'CCP1', 1 x 250A 'CCP2'.

[Refer to: 4.23 Electrical Connectors and Connections](#)

## Third Party High Power Mode for SRC and Start-Stop Inhibit

The SRC and Start-Stop inhibit functions have been included in the Third Party High Power Mode feature. This also provides AEIS inhibit and, at engine off, inhibit of the SBG timeout.

[Refer to: 4.5 Battery Systems](#)

## Upfitter Integration System (UIS) (JRSAB)

The Upfitter Integration System is the new programmable input/output controller system which communicates on the vehicle CAN network and provides integration of electrical and digital systems to control equipment and various vehicle functions via Upfitter Configuration.

[Refer to 4.23.9 Upfitter Integration System \(UIS\)](#)

## 4.2 Wiring Installation and Routing Guides

### 4.2.1 Wiring Harness Information

**NOTE:** For additional information and recommendations on materials and equipment for interfacing to the Ford systems, power and grounds, please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

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 exposure and operational 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.

Do not route wires near weld points or weld flashes. A minimum of 15mm clearance to any sheet metal welds under static and dynamic conditions is required. However, it is best to avoid routing near weld points or weld flashes at all times.

In general, the distance between retention points for wiring not contained in a rigid shield should be less than 300mm.

A minimum 25mm clearance is recommended from all sharp edges and a minimum 35mm clearance of all moving parts of the parking brake assembly. If these clearances cannot be met, protect the wires with a convolute.

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 5mm 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 except in conjunction with Special Vehicle Option Auxiliary Fuse Panel
- 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 – see 'Additional Loads and Charging Systems' later in this section of the BEMM
- Multiple grounds must not go to an interim splice to a main ground cable
- If additional ground studs are required it is recommended to install a busbar with multiple studs fed directly from the battery ground post. See 'Additional Loads and Charging Systems'

[Refer to: 4.24 Grounding](#) for identification of suitable grounding points

#### 4.2.6 Prevention of Squeaks and Rattles

Wiring should be positively retained/supported every 150 to 250mm, with a maximum distance not to exceed 300mm. 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



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. See Figure E131081.

## 4.2.9 Wiring Specification

### Current Rating of Wire Sizes

ISO Conductor Size mm <sup>2</sup> CSA	Conductor Resistance mOhm/m					
	Maximum			Minimum		
	Plain Copper	Tinned Plated Copper	Nickel Plated Copper	Plain Copper	Tinned Plated Copper	Nickel 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	0.706	0.595	0.629	0.650
35	0.527	0.538	0.549	0.489	0.500	0.510
40	0.473	0.500	0.516	0.435	0.460	0.475
50	0.368	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/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:

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

[Refer to: 1.7 Electromagnetic Compatibility \(EMC\)](#)

### 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 6mm.

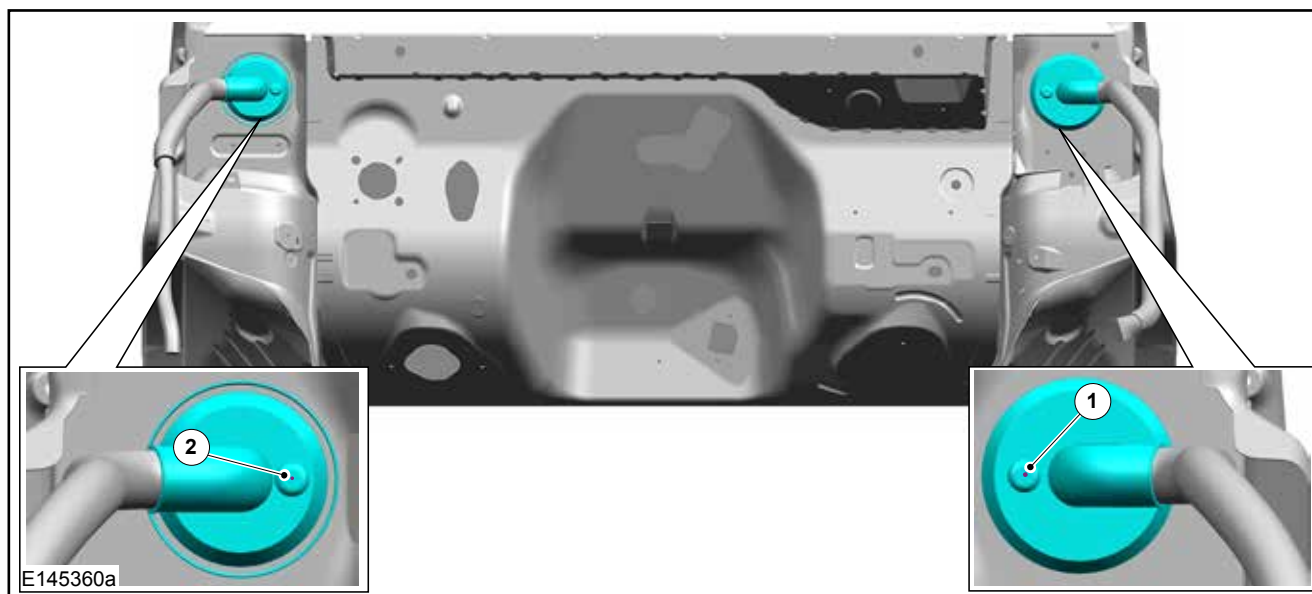
There are two locations in the dash panel which have been identified for additional holes to route wires through. See figure E145360a (view from engine bay) for locations.

The grommets in locations 1 and 2, shown in figure E145360a, 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 25mm 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)



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

## 4.2.12 Precautionary Drill Zones — Rear Cargo Area

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

**NOTE:** Refer also to [5.11.2 B Pillar No Drill Zone](#) for details of the restrictions in the area around the Seat Belt installation.

The following images show the routing of cabling in the rear cargo area. This indicates the Precautionary Drill Zones 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](#) Precautionary Drill Zones

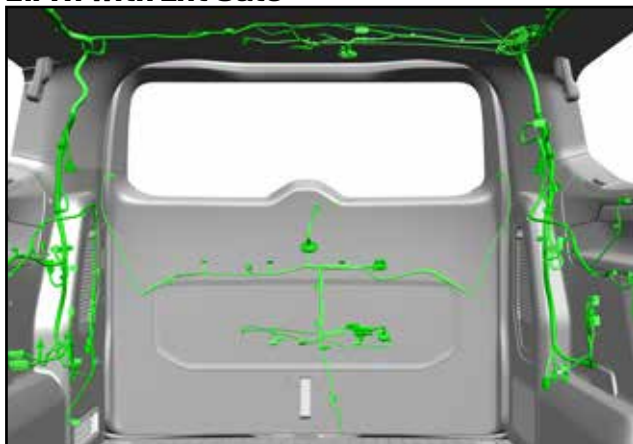
[Refer to: 5.3 Racking Systems](#)

[Refer to: 5.6 Body Closures](#) No Drill Zones, Load Compartment Tie Downs

**L1/H1 with Lift Gate (LHS)**



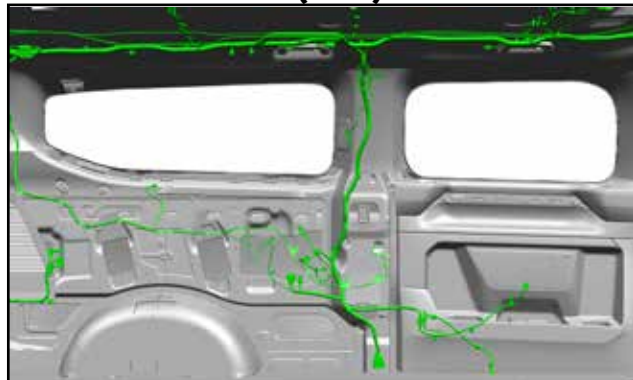
**L1/H1 with Lift Gate**



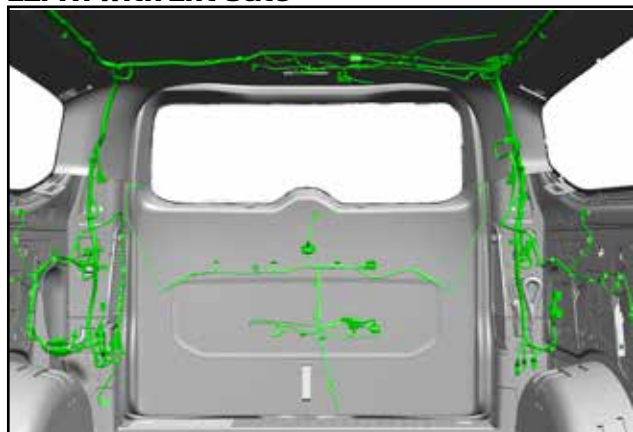
**L1/H1 with Lift Gate (RHS)**



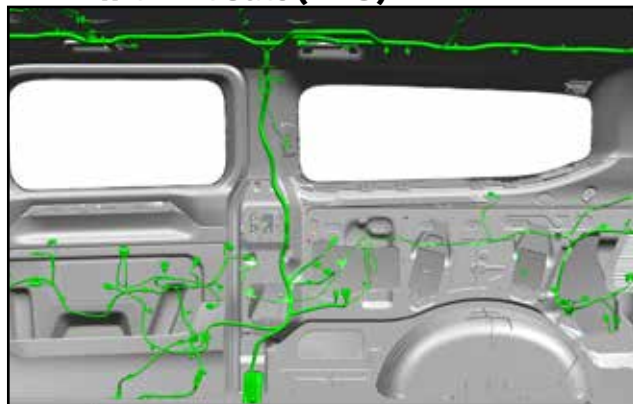
**L2/H1 with Lift Gate (LHS)**



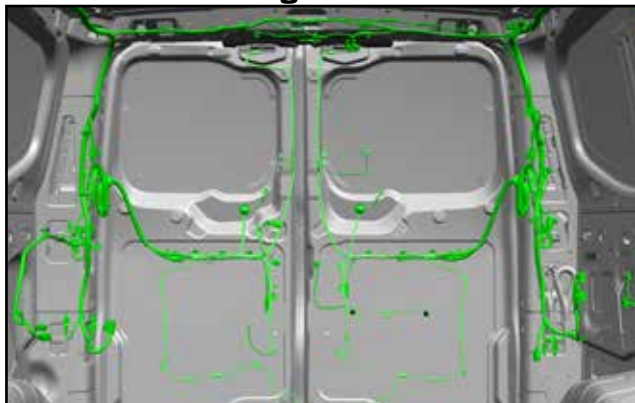
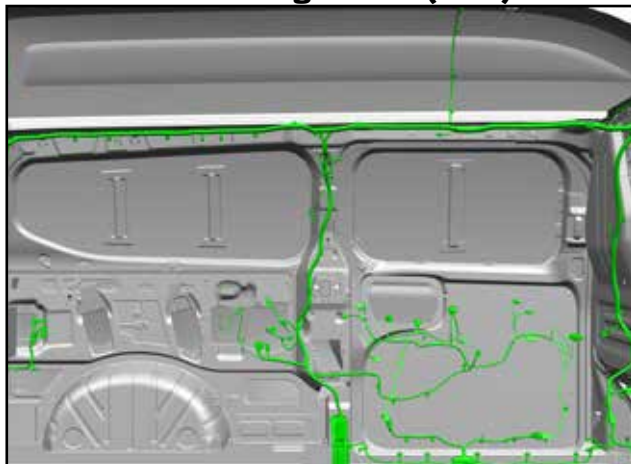
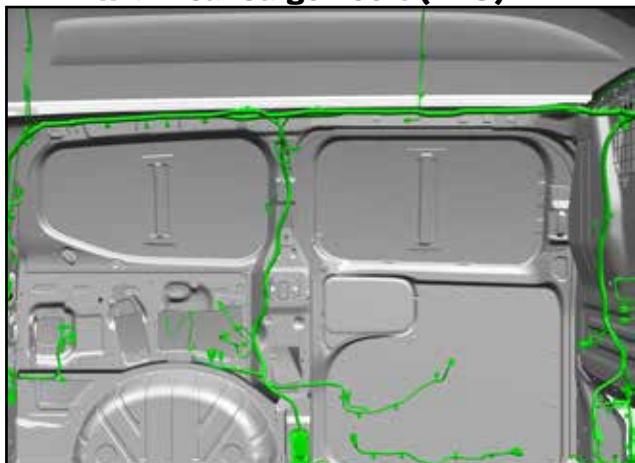
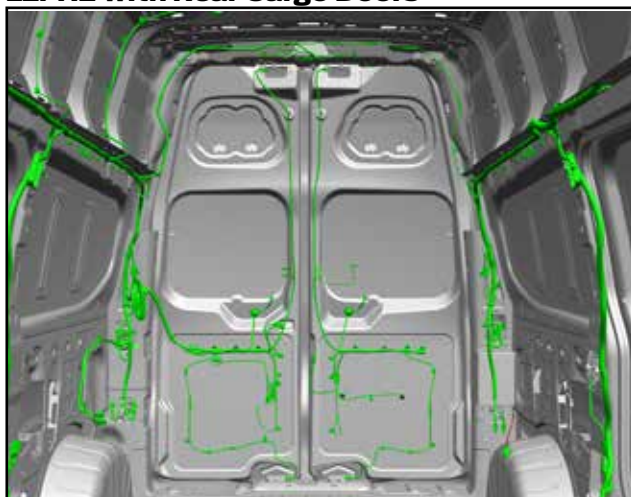
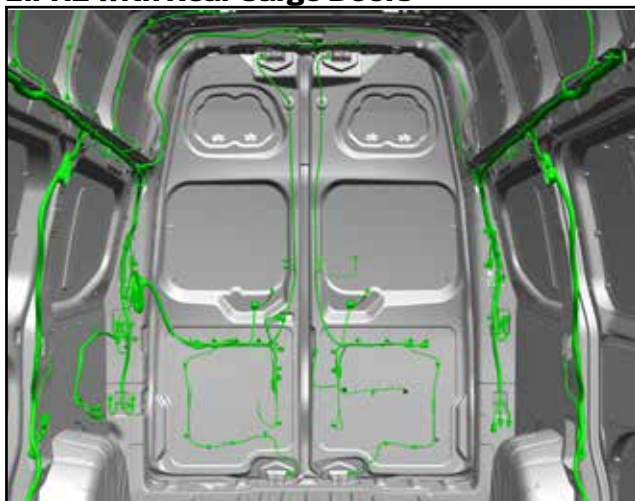
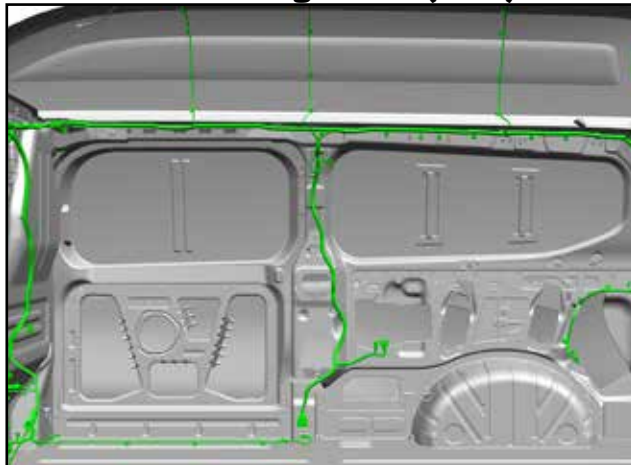
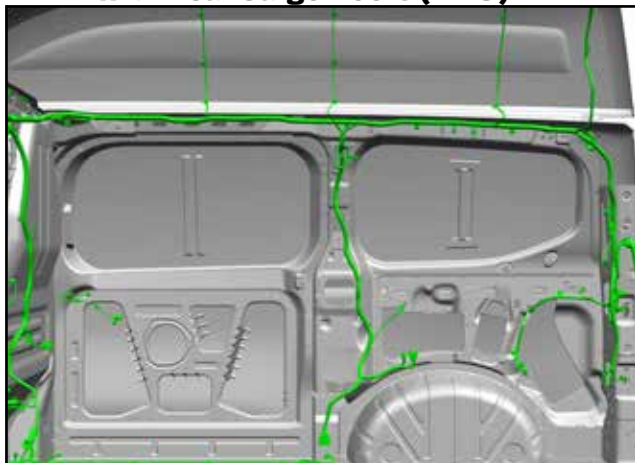
**L2/H1 with Lift Gate**



**L2/H1 with Lift Gate (RHS)**





**L1/H1 with Rear Cargo Doors****L2/H2 with Rear Cargo Doors (LHS)****L1/H2 with Rear Cargo Doors (LHS)****L2/H2 with Rear Cargo Doors****L1/H2 with Rear Cargo Doors****L2/H2 with Rear Cargo Doors (RHS)****L1/H2 with Rear Cargo Doors (RHS)**

## 4.2.13 Electrics for Tow Bar

**NOTE:** The Ford trailer tow system is integrated with the Ford park aid system. When a trailer is connected, the system communicates on CAN only, to deactivate reverse park aid feature, there is no hardwired interface. It is not possible to turn off reverse park aid with an aftermarket trailer tow system.

**NOTE:** For Van tow bars it is necessary to connect into the rear lamp unit.

**NOTE:** If tow bar connectors are not used, appropriate fixing and cover must be applied for protection from water and contaminant ingress.

**NOTE:** The trailer detect circuit is part of the Ford Trailer Tow module, it can only be implemented on vehicles with power locking and perimeter or CAT 1 alarms.

Tow bar electrical system may be ordered as a 13-pin DIN connector for Europe or 12-pin DIN connector for Australia and New Zealand, as part of the original vehicle build.

Where it is required to add trailer towing to an existing vehicle, and to ensure compliance with lighting regulations, the appropriate wiring accessory kit can be obtained from your Ford Dealer.

Fitment of non-Ford trailer tow wiring is not advisable due to Body Control Module control of lighting, and meeting lighting regulations. Contact your local Ford dealer for details of a harness that connects to the base vehicle harness.

Each output driver could handle a current of 15A but it is not recommended to always run to this maximum. A higher current is interpreted as short circuit. If a short circuit is detected the related output will be switched off. The following table (page 72) shows the recommended output maximums per circuit.

The TTM offers a battery charge output. This output is used for loading a trailer battery with a maximum parameter current of 10A. If the current exceeds 10A the output is switched off until the current drain goes below 10A. The voltage used to charge this battery is designed to maintain current charge up to 10A but not fully charge the battery or let it discharge. This voltage is approximately 13.5V. Full charge strategy should be performed separately.

The maximum total current is 30A of all circuits. If this is exceeded the battery charge output is switched off.

Summary:

- Max permanent current: 10A
- Switch on condition:
  - Power Mode > = Accessory\_1
  - Total power consumption (all lamps + battery charge) < 30A
  - Permanent battery charge output current < = 10A
  - 9V < TTM power supply voltage < 16V
- Short circuit detection: 30A

## 4.2.14 Trailer Tow Connectivity

If trailer tow system is to be added, the correct wiring and module needs to be ordered. For the correct vehicle configuration, please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

**NOTE:** It is mandatory that a trailer is detected. Therefore at least one of the following lamps have to be connected in the **on mode** or in the **standby mode** (anti-theft mode): Stop right, Stop left, Position Lamps or Direction Indicator left.

If a trailer is detected the trailer detection hardware output (JP3-pin 5) is set low (open drain).

If a short circuit is detected or an overheating of the drivers occurs, the related output remains off until an ignition cycle is performed and the engine is restarted.

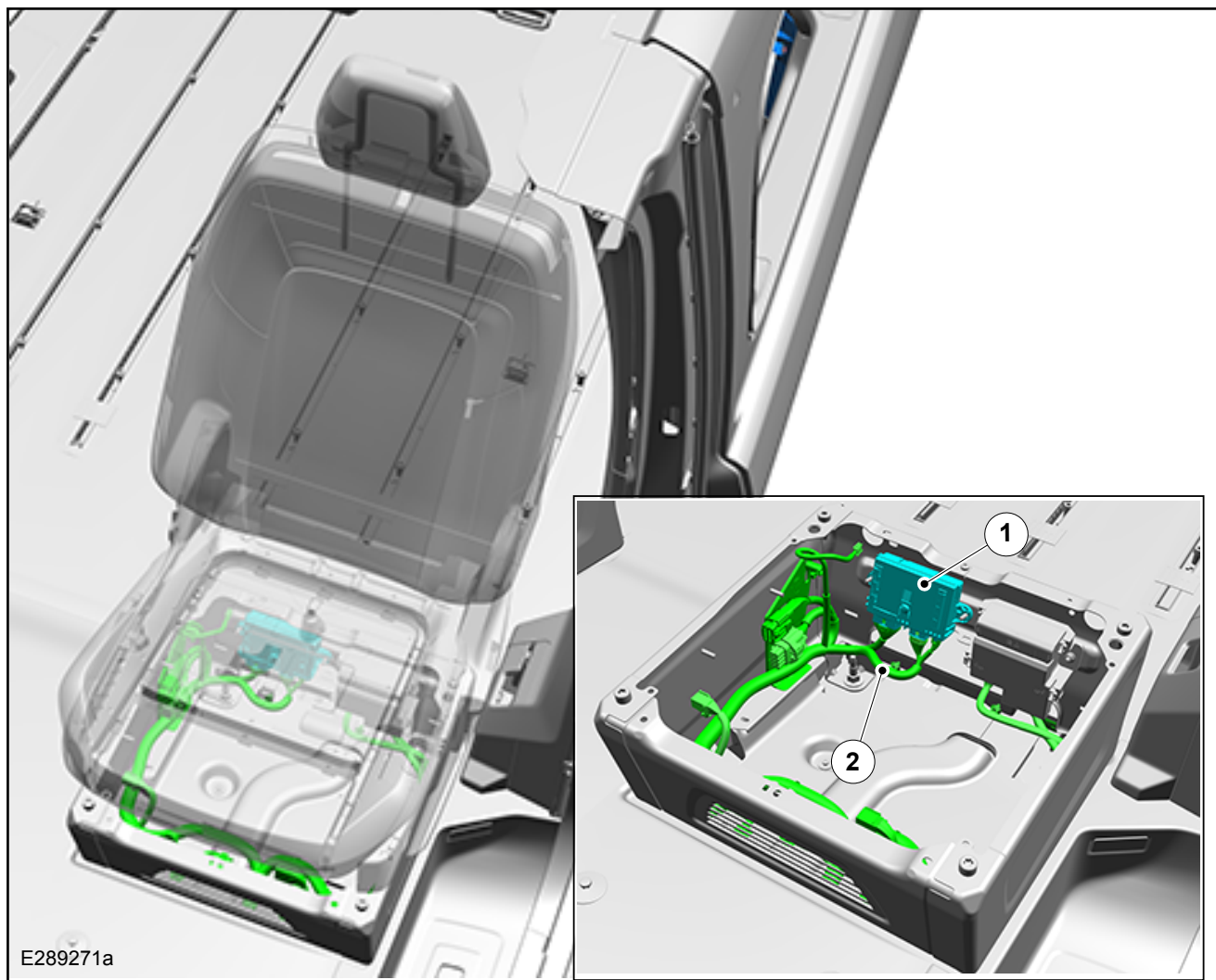
The trailer detection uses a strategy of having a 1K ohm resistor if the lights are not actually switched on to detect that the trailer has been connected. If a trailer light is already switched on the related current will be checked.

The Trailer Tow Module **does not** support the incremental load of powering side marker lamps on a trailer, if these are required they should also be driven using separate relays.

Trailer Tow features are enabled via the Ford Diagnostic Repair System (FDRS). There may be a dealer charge for this service.

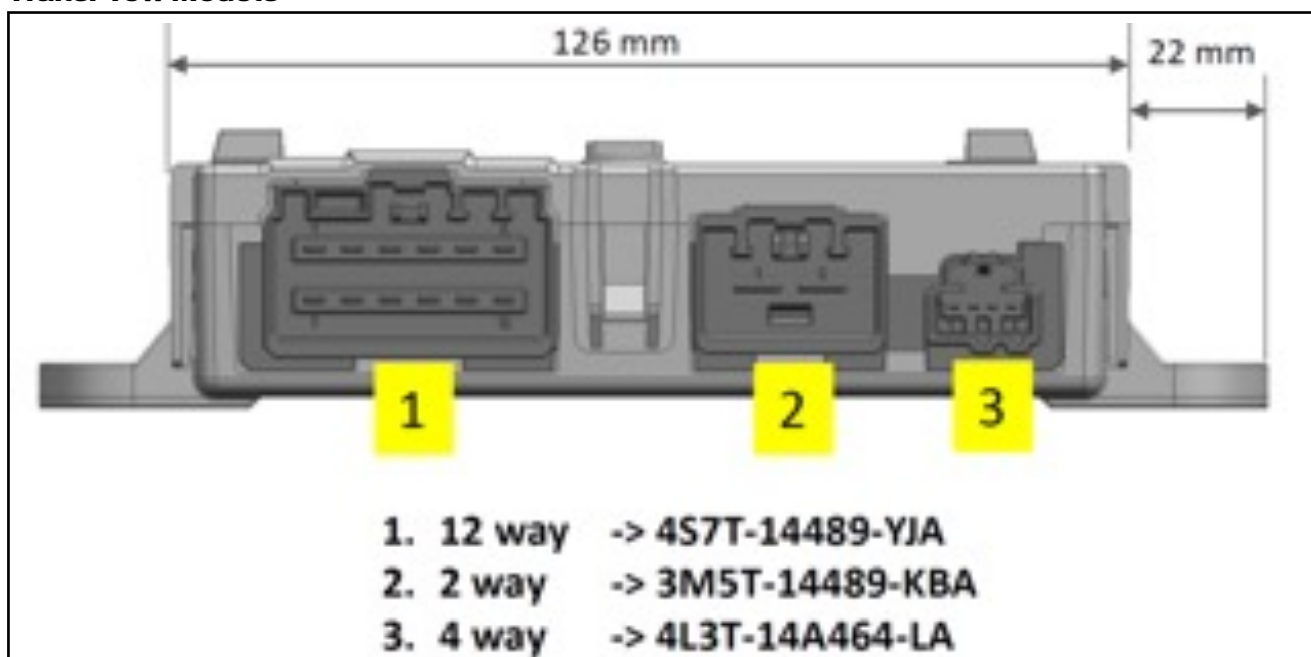
FDRS access can be purchased from Ford Service Info <https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F>

## Trailer Tow Module and Harness



Item	Description	Part Number
1	Trailer Tow Module	PZ3T-19H517
2	Main Body Harness	PZ3T-90A000

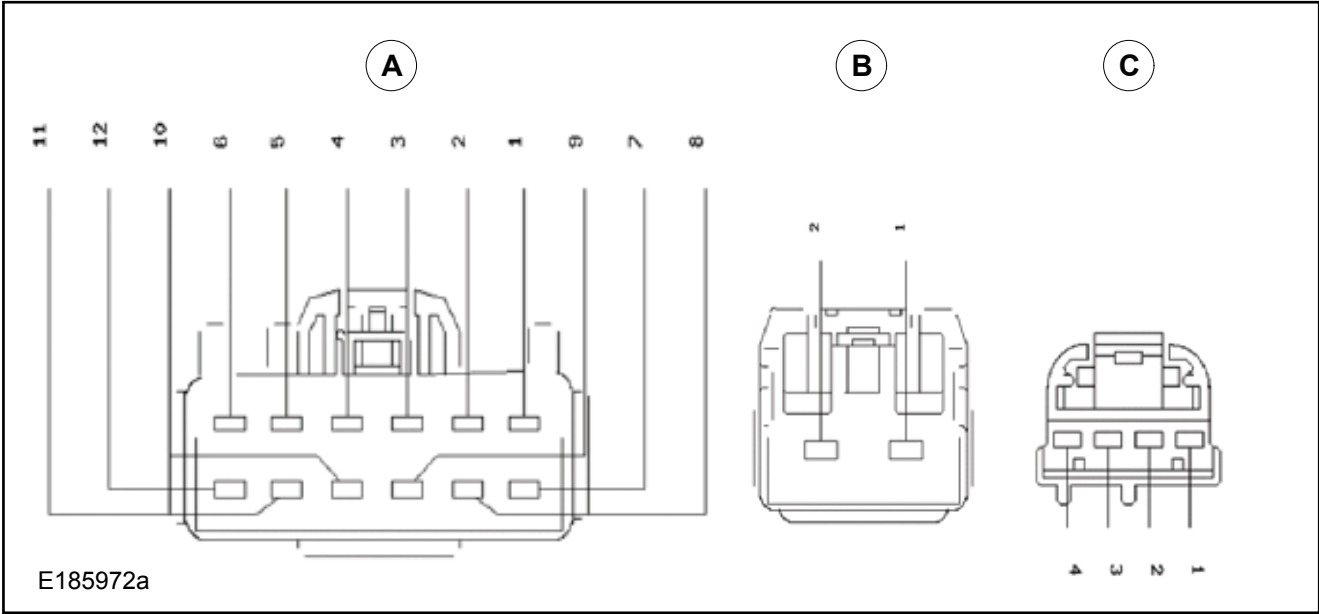
## Trailer Tow Module



Trailer Tow Module Connectors (Figure E185972a)

Component Terminal Number	Feature	Current (A)		Voltage (V)	
		Min	Max	Min	Max
Connector A					
1	Left Turn Lamp	2.1	3.4	8	19.0
2	Right Turn Lamp	2.1	3.4	8	19.0
3	Park Lamps	5.3	8.6	8	19.0
4	Not Used	-	-	-	-
5	Reversing Lamps	3.1	5.0	8	19.0
6	Battery Charging	13.0	15.0	8	16.0
7	Stop Lamps	3.1	11.0	8	19.0
8	Rear Fog Lamp	1.7	2.2	9.5	16.0
9	Trailer Connect	-	-	-	-
10	LIN BUS	-	-	-	-
11	Not used	-	-	-	-
12	Battery Charging	-	-	-	-
Connector B					
1	PWR01:PAAT	19.9	27.6	8	19
2	PWR01:PAAT	12	12	8	16
Connector C					
1	Power Ground	0.5	0.5	8	19
2	HS 3 CAN -	0.1	0.1	5	5
3	HS 3 CAN+	0.1	0.1	5	5
4	Trailer Tow Anti Theft	0.01	0.013	8	19

Trailer Tow Module Connectors





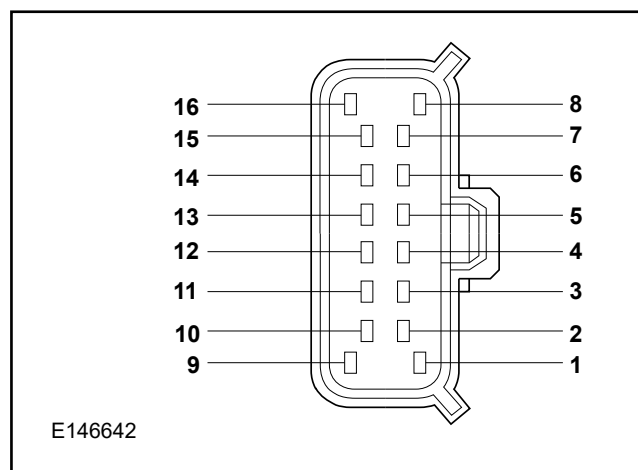
## 4.2.15 Trailer Tow Connectivity (EU)

### Trailer Tow Connectivity 13 Pin Socket

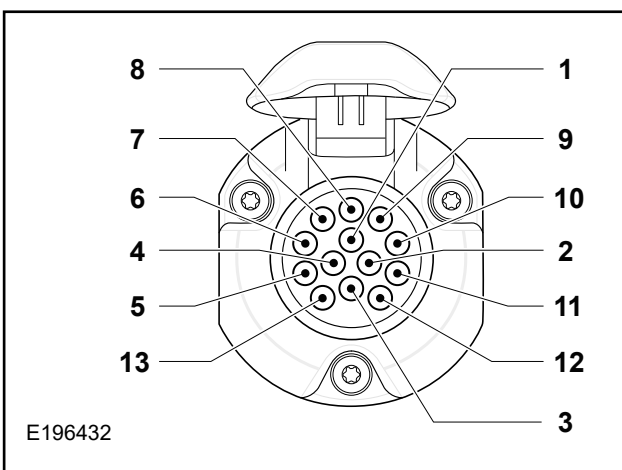
14406 Trailer Tow Connector		13 Pin Trailer Tow Connector	
Pin	Colour	Pin	Description
3	Yellow	1	Left Turn Lamp
5	Grey/Orange	2	Fog
1	Black	3	Lamp Ground
6	Green	4	Right Turn Lamp
13	Brown	5	Right Position Lamp
12	Red	6	Stop Lamps
14	Brown	7	Left Position Lamp License Lamp
11	Grey/Brown	8	Reversing Lamp
9	Violet/Red	9	KL30 Power
10	Grey/Yellow	10	KL15 Ignition
8	Black	11	Ignition Ground KL15
16	Black	13	Power Ground

Any pins not listed in the table above are not to be used.

### Trailer Tow 14406 Interface Connector



### Trailer Tow 13 Pin Socket

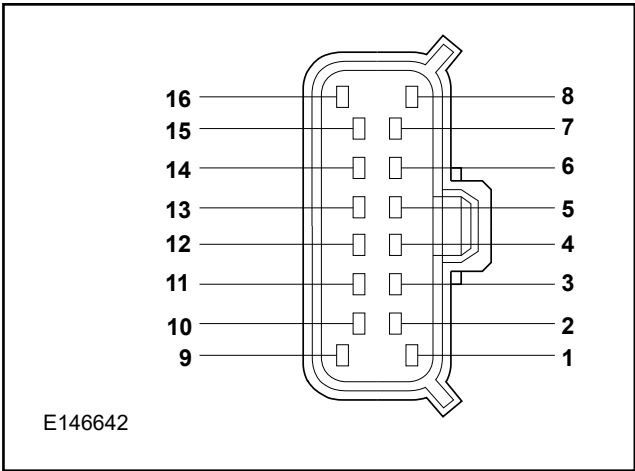


4.2.16 Trailer Tow Connectivity (AUS and NZL)

Trailer Tow Connectivity 12 Pin Socket

14406 Trailer Tow Connector		12 Pin Trailer Tow Connector - Australia and New Zealand	
Pin	Colour	Pin	Description
3	Yellow	1	Left Turn Lamp
11	Black	2	Reverse
1	White	3	Lamp Ground
6	Green	4	Right Turn Lamp
Not used	Blue	5	Electric Brakes
12	Red	6	Stop Lamps
13	Brown	7	Park Lamps
Not used	Not used	8	Not used
9	Pink	9	KL30 Power
16	White	10	Ground
Not used	Not used	11	Not used
Not used	Not used	12	Not used

Trailer Tow 14406 Interface Connector





### 4.3 Communications Network

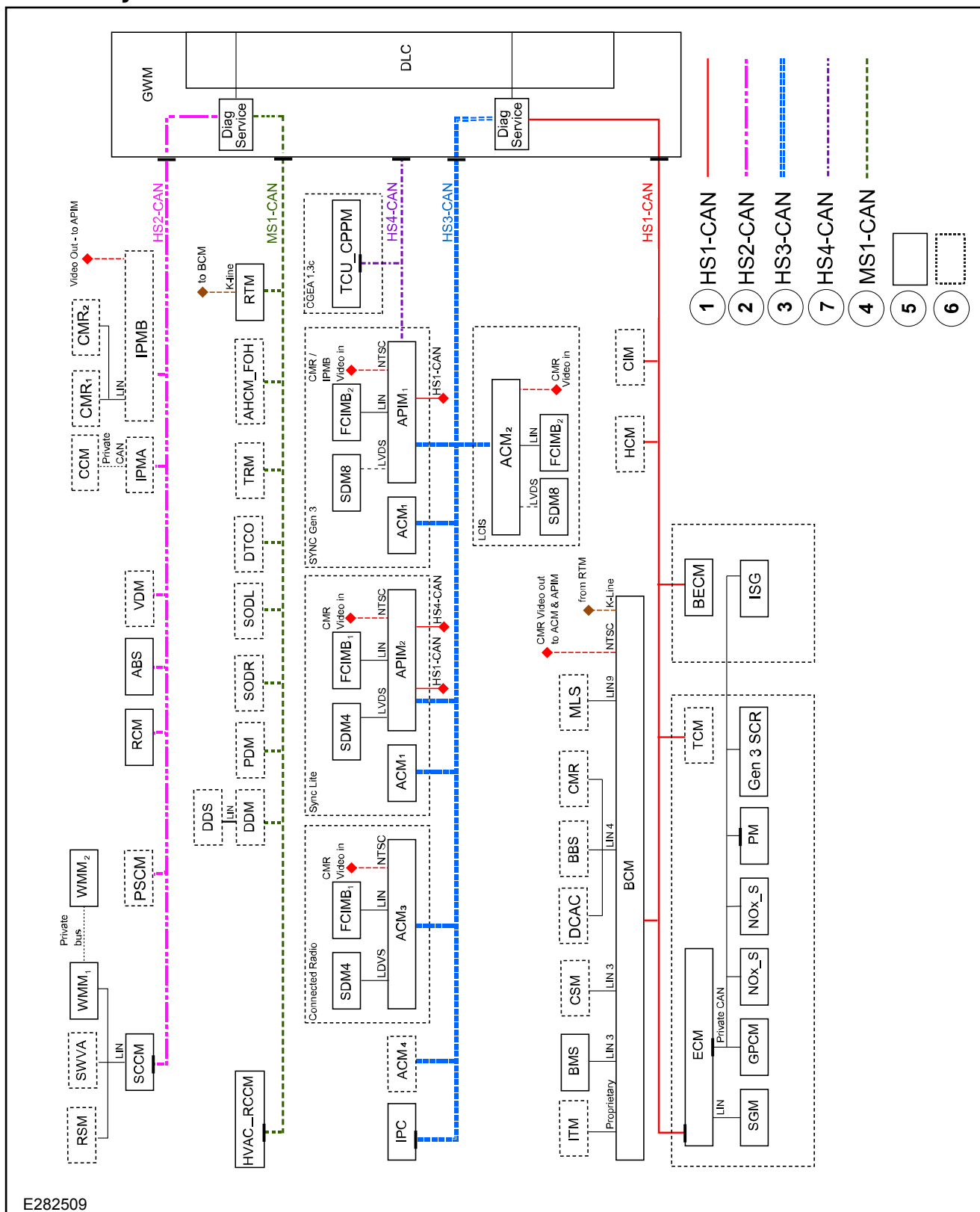
### 4.3.1 CAN-Bus System Description and Interface



**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 shown, via Medium Speed (MS), High Speed (HS), Private and Public Buses. In addition, there is localised application of Local Interconnect Network (LIN) and ISO 9141 K-line serial links.

## CAN-Bus System



**Communication Network System (Figure E282509 references)**

Item	Description
1	HS1-CAN - High Speed 1 - CAN <sup>(1)</sup>
2	HS2-CAN - High Speed 2 - CAN <sup>(1)</sup>
3	HS3-CAN - High Speed 3 - CAN <sup>(1)</sup>
4	MS1-CAN -Medium Speed 1 - CAN <sup>(2)</sup>
5	Standard ECU
6	Optional ECU
7	HS4-CAN - High Speed 4 - CAN <sup>(1)</sup>
ABS	Anti-Lock Brake System Control Module
ACM <sub>1</sub>	Audio Control Module (SYNC Radio)
ACM <sub>2</sub>	Audio Control Module (LCIS Radio)
ACM <sub>3</sub>	Audio Control Module ('Connected' Radio)
ACM <sub>4</sub>	Audio Control Module (1 DIN Radio)
AHCM_FOH	Auxiliary Heater Control Module _ Fuel Operated Heater
APIM <sub>1</sub>	Auxiliary Protocol Interface Module (Gen 3 Sync)
APIM <sub>2</sub>	Auxiliary Protocol Interface Module (Gen 3 Sync Lite)
BBS	Battery Backed-up Sounder
BCM	Body Control Module
BECM	Battery Energy Control Module (Micro- Hybrid Controller)
BMS	Battery Monitoring Sensor
CCM	Cruise Control Module (Adaptive Cruise)
CIM	Convertor Interface Module
CMR <sub>1</sub>	Camera Module (Rear)
CMR <sub>2</sub>	Camera Module (Front)
CSM	Combined Sensor Module (Interior motion detect & Tilt Sensor)
DCAC	Direct Current to Alternate Current Inverter

Item	Description
DCDC-VQM	Voltage Quality Module (Direct Current - Direct Current)
DDS	Driver Door Switch Pack
DDM	Driver Door Module
DLC	Diagnostic Link Connector
DTCO	Digital Tachograph
ECM	Engine Control Module
ECU	Electronic Control Unit
FCIMB <sub>1</sub>	Front Control Interface Module (10 Button)
FCIMB <sub>2</sub>	Front Control Interface Module (5 Button)
GWM	Gateway Module (CGEA 1.3c)
GPCM	Glow Plug Control Module
HCM	Headlamp Control Module
HVAC-RCCM	HVAC Controls (Remote Climate Control Module)
IPC	Instrument Panel Cluster
IPMA	Image processing Module A (Lane Departure System Camera)
IPMB	Image processing Module B (Front & Rear Camera)
ISG	Integrated Starter Generator
ITM	Integrated Key Transmitter (PATS)
MLS	Master Light Switch
NOx_S	NOx Sensor
PDM	Passenger Door Module
PM	Particulate Matter Sensor
PSCM	Power Steering Control Module
RCM	Restraints Control Module
RSM	Rain Sensing Module

Item	Description
RTM	Radio Transceiver Module (RKE & TPMS Receiver)
SAS	Steering Angle Sensor
SCCM	Steering Column Control Module (incl absolute SAS)
SCR	Selective Catalytic Reduction (Gen 3 UREA Sensor)
SDM4	Slim Display Monitor 4" (for non-SYNC Display)
SDM8	Slim Display Monitor 8" (for SYNC Display)
SGM	Starter Generator Control Module (Alternator Control)
SODL	Side Obstacle Detection Control Module Left
SODR	Side Obstacle Detection Control Module Right

Item	Description
SWVA	Steering Wheel Vibration Alert (IPMA Haptic Device)
TCM	Transmission Control Module
TCU_CPPM	Cell Phone Passport Module (MODEM for CGEA1.3c)
TRM	Trailer Module (Trailer Tow)
VDM	Vehicle Dynamics Module (Air Suspension)
WMM <sub>1</sub>	Wiper Motor Module (Master)
WMM <sub>2</sub>	Wiper Motor Module (Slave)

<sup>(1)</sup>500kb/s (kilobits per second)

<sup>(2)</sup>125kb/s (kilobits per second)

### 4.3.2 Body Control Module (BCM)

#### BCM - as viewed in-car position



E282647a

**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 Fuse Overview**

Fuse	Rating	Fuse Type	Function
F2	10	Micro 2	Power inverter
F3	7.5	Micro 2	Power window switch and power exterior mirrors
F4	20	Micro 2	Not Used (Spare)
F6	10	Micro 3	Anti-theft alarm horn
F7	10	Micro 3	Not Used (Spare)
F8	5	Micro 3	Not Used (Spare)
F9	5	Micro 3	Interior sensor and rear air conditioning
F12	7.5	Micro 3	Climate control
F13	7.5	Micro 3	Steering column, instrument cluster and data link connector
F14	15	Micro 3	Battery energy control module - MHEV
F15	15	Micro 3	SYNC 3 module
F17	7.5	Micro 3	Tachograph
F18	7.5	Micro 3	Passenger airbag disable indicator and switch
F19	5	Micro 3	Battery backed sounder
F20	5	Micro 3	Ignition switch
F21	5	Micro 3	PTC heater control
F22	5	Micro 3	Pedestrian alert control module
F23	30	Micro 2	Passenger door module
F24	30	Micro 2	Not Used (Spare)
F25	20	Micro 2	Not Used (Spare)
F26	30	Micro 2	Driver door module
F27	30	Micro 2	Not Used (Spare)
F28	30	Micro 2	Not Used (Spare)
F29	15	Micro 2	Not Used (Spare)
F30	5	Micro 2	Not Used (Spare)
F31	10	Micro 2	Data link connector and remote key receiver
F32	20	Micro 2	Radio and telematics module
F34	30	Micro 2	Ignition run/start relay pre fuse (park aid, heater control, LDW camera, restraints, central control panel, passenger airbag off indicator, tachograph, heater control, PTC heater, steering wheel module)
F35	5	Micro 2	Not Used (Spare)
F36	15	Micro 2	Park aid, lane departure warning camera, steering wheel module
F37	20	Micro 2	Not Used (Spare)
F38	30	Circuit Breaker	Power window supply

Any pins not listed in the table above are not to be used.

MHEV= Mild Hybrid Electric Vehicle; PTC= Positive Temperature Coefficient

**BCM Output Information**

Function	Component	Load Type	Max. Load	Overload Condition
Dipped Beam Left	High Side PWM or DC for HID Relay	Bulb/HID (via Relay)	55W	Output Shutdown <sup>(1)</sup>
Dipped Beam Right	High Side PWM or DC for HID Relay	Bulb/HID (via Relay)	55W	Output Shutdown <sup>(1)</sup>
Main Beam Left	High Side PWM or DC for HID Main Beam Shutter	Bulb/ HID Shutter	55W	Output Shutdown
Main Beam Right	High Side PWM or DC for HID Main Beam Shutter	Bulb/ HID Shutter	55W	Output Shutdown
Daytime Running Light Left	High Side PWM (configurable for Smart LED DRL/ Position Light)	Bulb/Smart LED	30W	Output Shutdown
Daytime Running Light Right	High Side PWM (configurable for Smart LED DRL/ Position Light)	Bulb/Smart LED	30W	Output Shutdown
Position Light Left Front	High Side PWM	Bulb	10W	Output Shutdown
Position Light Left Rear	High Side PWM	Bulb	6W	Output Shutdown
Position Light Right Front	High Side PWM	Bulb	10W	Output Shutdown
Position Light Right Rear	High Side PWM	Bulb	6W	Output Shutdown
Front Fog Light Left	High Side PWM	Bulb	35W	Output Shutdown
Front Fog Light Right	High Side PWM	Bulb	35W	Output Shutdown
Turn Indicators Left Front	High Side PWM	Bulb	27W	Output Shutdown
Turn Indicators Left Rear	High Side PWM	Bulb	27W	Output Shutdown
Turn Indicators Right Front	High Side PWM	Bulb	27W	Output Shutdown
Turn Indicators Right Rear	High Side PWM	Bulb	27W	Output Shutdown
Number Plate (& Marker Lights)	High Side PWM	Bulb/LED	25W	Output Shutdown
Reversing Lights	High Side DC	Bulb + Micro Relay	42W + 250mA	Output Shutdown
Rear Fog Lights	High Side PWM	Bulb	2 x 21W	Output Shutdown
Stop Light Left	High Side PWM	Bulb	2 x 21W	Output Shutdown
Stop Light Right	High Side PWM	Bulb	2 x 21W	Output Shutdown
Centre High Mounted Stop Light	High Side PWM	LED	1 x 16W or LED string	Output Shutdown
Switch Illumination	High Side PWM	LED	1.5A at 16V	Output Shutdown
Battery Saver Supply	High Side Driver	Bulb	75W	Output Shutdown
Front Cabin Lights Courtesy	High Side PWM	Bulb or LED	65W	Output Shutdown
Rear Cabin Lights Courtesy	High Side PWM	Bulb or LED	65W	Output Shutdown
Vehicle Horn	High Side Relay Driver	Micro Relay	250mA	Output Shutdown
Alarm Siren	High Side Driver	Electro Mechanical Sounder	4A nominal, 8A for 10ms in-rush	Output Shutdown
Engine Run Status	High Side Relay Driver	Micro Relay	250mA	Output Shutdown
Lock/Double Lock Outputs	Bi-directional Driver	Latch Motor (x 5 max)	6A per latch, 110ms Pulsed	Output Shutdown
Unlock Outputs	Bi-directional Driver	Latch Motor (x 5 max)	6A per latch, 110ms Pulsed	Output Shutdown

PWM = Pulse Width Modulation / DRL = Daytime Running Lights / HID = High Intensity Discharge

Repeated overloading of circuits can result in output lock-out requiring dealer reset. Repeated dealer resets can result in permanent loss of a function.

<sup>(1)</sup> BCM does NOT support HID directly Driven. HID MUST use relays.

## 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. MHEV systems use Smart Charging (SC)

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

**NOTE:** For further information please contact your National Sales Company representative or Local Ford Dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.4.1 General Information

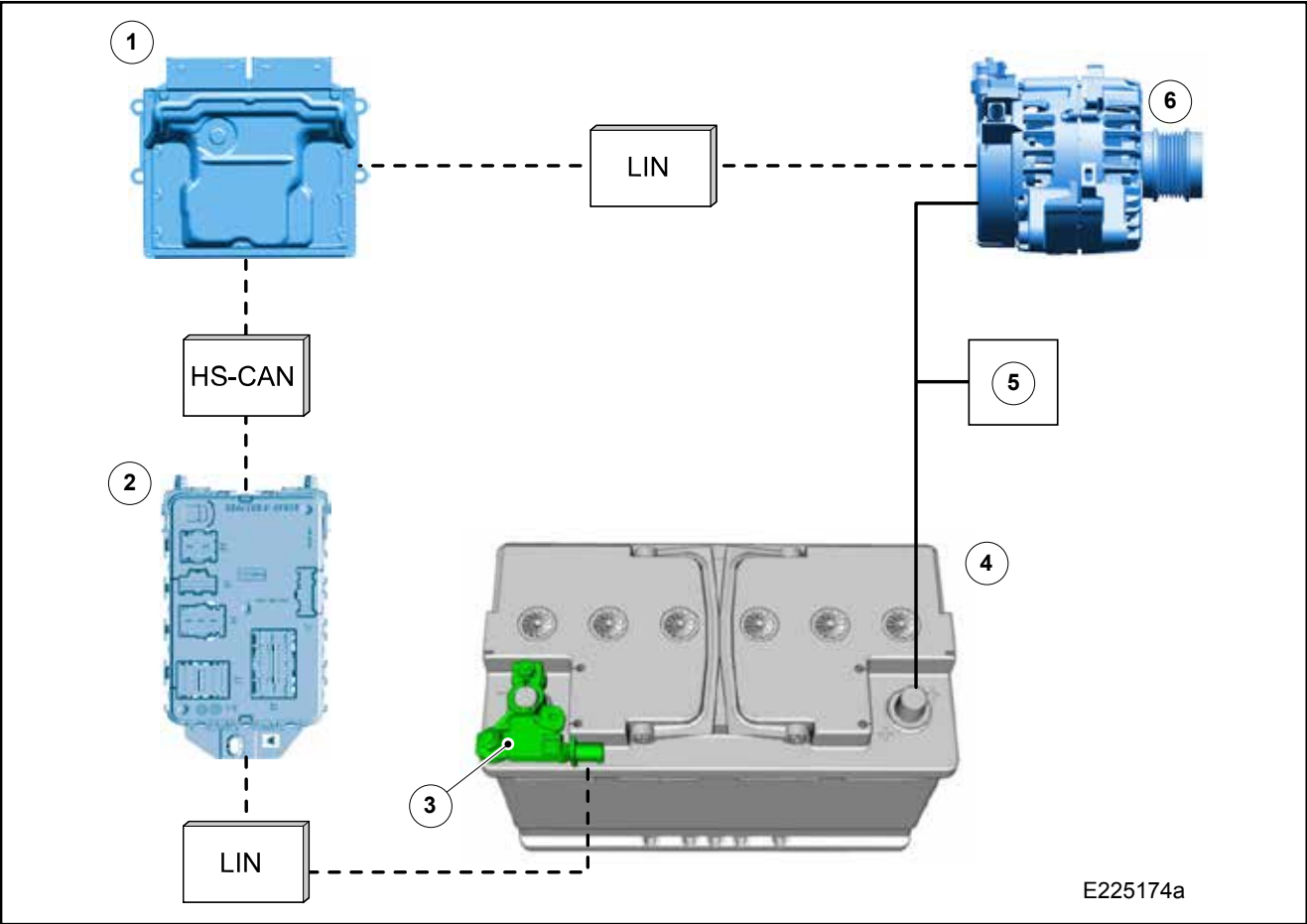
The battery capacity, technology and charge available from the alternator must be adequate to ensure engine cranking in unfavourable climatic conditions, even after fitment of additional electrical equipment.

Additional connection points are provided, specifically for customer use and are located on the outside of the driver's seat pedestal. A 60A fused connection is provided as standard on single battery vehicles. An additional 175A switched connection is provided for twin battery vehicles. Other options are possible for higher current applications,

[Refer to: 4.5 Battery Systems](#)

### 4.4.2 Alternator-Based System Layout

#### System Diagram



Item	Description
1	Power Control Module (PCM) or Engine Control Module (ECM)
2	Body Control Module (BCM)
3	Battery Monitoring Sensor (BMS)
4	Battery — Twin batteries are available as an upgrade or driven by specific features
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 12.2 - Maximum 14.9
CC	Conventional Charging - applies a strong charging voltage until the battery is full and maintains alternator voltage above 13.5V unless battery temperature >40°C. The actual voltage at the battery will vary depending on the alternator load.	Minimum 13.5 - Maximum 14.9
SS	Start-Stop - there is a 5 second delay from when the CC/SS inhibitor is activated to when it takes effect.	Not Applicable

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

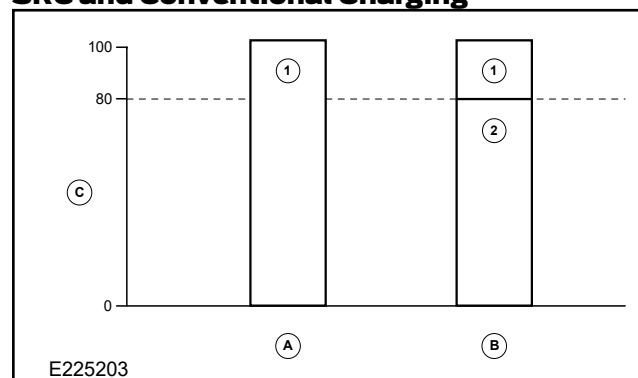
For further information on Start-Stop  
[Refer to: 4.10 Electronic Engine Controls](#)

#### 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. This function can be turned off by using Third Party High Power mode as detailed later in this section.

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

#### SRC and Conventional Charging



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

#### 4.4.4 SRC Override

SRC can be interrupted temporarily in the following ways:

- By the Start-Stop button if the vehicle is stationary.
- By Third Party High Power mode






[Refer to: 4.10 Electronic Engine Controls](#)

The Start-Stop deactivation button also deactivates SRC (LED tell-tale is illuminated). When deactivated, and when the vehicle is stationary, the engine will not shut down and the battery will be charged by the alternator with Conventional Charging.



## 4.4.5 Third Party High Power Mode

### WARNINGS:

-  **The Third Party High Power mode can inhibit engine shutdown (AEIS) which is a safety procedure designed to protect against carbon monoxide (CO) poisoning. Do not operate the feature on a vehicle in a confined space. Do not install the feature on a vehicle that may be left running in a confined space. Do not allow carbon monoxide to accumulate.**
-  **The Third Party High Power mode is a single method that has various effects. Do not allow the Third Party High Power mode to be active in incorrect conditions, as this may lead to unintended consequences. When implementing automated control of Third Party High Power mode, be sure to consider the full range of effects.**
-  **The Third Party High Power mode feature must not be grounded permanently. This will invalidate the emission and homologation of the vehicle. Permanently disabling the vehicle's fuel save features will require rehomologation as part of the approval process by the convertor.**
-  **When fitting automated systems to control Third Party High Power mode, be sure to record details within the owner's vehicle information. Advise subsequent owners of modifications relating to application of Third Party High Power mode. Subsequent owners of equipped vehicles are to be informed of applications of Third Party High Power mode.**
-  **CAUTION: Third Party High Power mode is only to be used where required for third party equipment functionality. When equipment is off and in a normal drive cycle. All fuel and emission save features must be active.**

**NOTE:** When a vehicle is decommissioned for resale, the Third Party High Power mode inhibit needs to be removed from the vehicle.

### Introduction

Third Party High Power mode has only one input that can affect the following features:

- SRC inhibit
- Start-Stop inhibit
- AEIS inhibit (feature restricted in some markets)
- At engine off, inhibit of the timer of the Standard Battery Guard (SBG)

Examples of when to not switch to third party mode include in a normal drive cycle when no extra loads are active. Solutions should only be used for heavy electrical loads, or mechanical power from the Front End Accessory Drive (FEAD), mainly when stationary.

The Third Party High Power mode is subject to configuration and may be subject to restriction.

### SRC Inhibit (Conventional Charging)

When SRC is inhibited, such as by Third Party High Power mode, then the system is using Conventional Charging.

This may be required for convertors requiring voltage in the range of 13.5V to 14.9V. Such applications include boost or supplemental battery charging, compensation for voltage drop or high ampere electrical loads whilst the engine is running.

The voltage may also drop in charging as the battery gets hotter from charge/discharge cycling. This is to protect the battery from over charge issues.

For additional information [Refer to: 4.6 Battery Protection](#) Load-shedding.

### Start-Stop Inhibit

This may be required where the charging system is required to provide voltage or high electrical power while driving, for example refrigeration or emergency service conversions.

### AEIS Inhibit

This may be required to keep the engine running when the vehicle is used for power generation, mechanical or electrical, in a stationary application. Normal AEIS functionality is where the engine will automatically shutdown after 30 minutes if no driver input is detected.

### Timer of Standard Battery Guard at Engine Off


This may be required to prevent the SBG operating too soon, when the engine is off.

[Refer to: 4.6 Battery Protection](#) Load shedding.

### Installation/Access

The Third Party High Power mode is activated by the grounding of a particular electrical circuit to a 'non permanent' switching strategy.

The Third Party High Power mode can be accessed at various vehicle connectors:

- As a kit to install the standard 12-way Vehicle Interface Connector in the driver's seat pedestal.
  - Interface Connector pin 3 available on all Non Camper variants.
-  Feature included in the Ford Programmable Battery Guard – where load active or third party sensing will trigger a ground required to turn off the fuel save features. Examples are:
  - To avoid low voltage tripping of high powered inverters
  - Charging extra batteries
  - RunLock



- Voltage drop compensation
- Voltage Stabilisation
- FEAD third party ancillaries requiring the engine to run continuously

For further information

[Refer to: 4.6 Battery Protection](#)

[Refer to: 4.23 Electrical Connectors and Connections](#)

#### 4.4.6 Test Functionality

**NOTE:** There will be a delay between setting the Third Party High Power mode and the effect occurring (up to a 5 seconds delay).

**NOTE:** If the 12V SOC is already too low, the circuit will open before the timer to protect the engine start.

#### Test Functionality: Start-Stop Inhibit - for vehicles with Start-Stop

1. Check Start-Stop functions as intended, refer to Owner's Manual for details
2. While driving the vehicle, close the Hardware Input switch, if safe to do so, and check that the Start-Stop no longer operates
3. Open the Hardware Input switch and check Start-Stop functionality is restored

#### Test Functionality: SRC Inhibit, Charging Mode Control

1. Ensure batteries have good charge. When charging, use the Jump Start point and engine bay ground point. Refer to the charging instructions in the Owner's Manual
2. Measure voltage between Jump Start point and engine bay ground point with engine running and SRC inhibit input circuit open. Refer to the Roadside Emergencies section of the Owner's Manual
3. With the engine running, set to ground the circuit for Third Party High Power mode and measure battery voltage. The voltage should be in the ranges shown in the table 'Summary of the Available Charging Modes'. The voltage may depend on many factors including total electrical load, which loads are active, battery condition and others. The rate of charge between modes varies depending on which loads are active
4. Open the switch again and check voltage level returns to the original level measured in Step 2. SRC is active

#### Test Functionality: AEIS Inhibit, Idle Shutdown Control (where fitted)

1. Check that AEIS is fitted and operational
2. Set Third Party High Power mode
3. Check that the engine continues to run whilst the inhibit is set

4. Check that normal AEIS behaviour resumes when the inhibit is not set, for example the engine shuts down after 30 minutes

#### Test Functionality: Inhibit of Timer for Engine Off Load-Shedding

1. Establish the preset timer of a SBG circuit e.g.
  - CCP2
  - Other switched ground circuits fed from the feature
2. Set Third Party High Power mode
3. Check that the circuit remains on after the timer period

[Refer to: 4.6 Battery Protection](#)

#### 4.4.7 Charge Balance Guidelines

When fitting medium to high third party electrical loads, including extra batteries, a charge balance test should be performed. This includes all relevant Ford and third party loads active at the same time where the battery voltage should not go below 13V. This will ensure that the alternator is not damaged, extra batteries are charged and correct system functionality is maintained. SRC override is recommended to ensure the alternator is in full power mode. Increased performance can be achieved by elevating the idle, utilising the Engine RPM controller option (DCNAB)

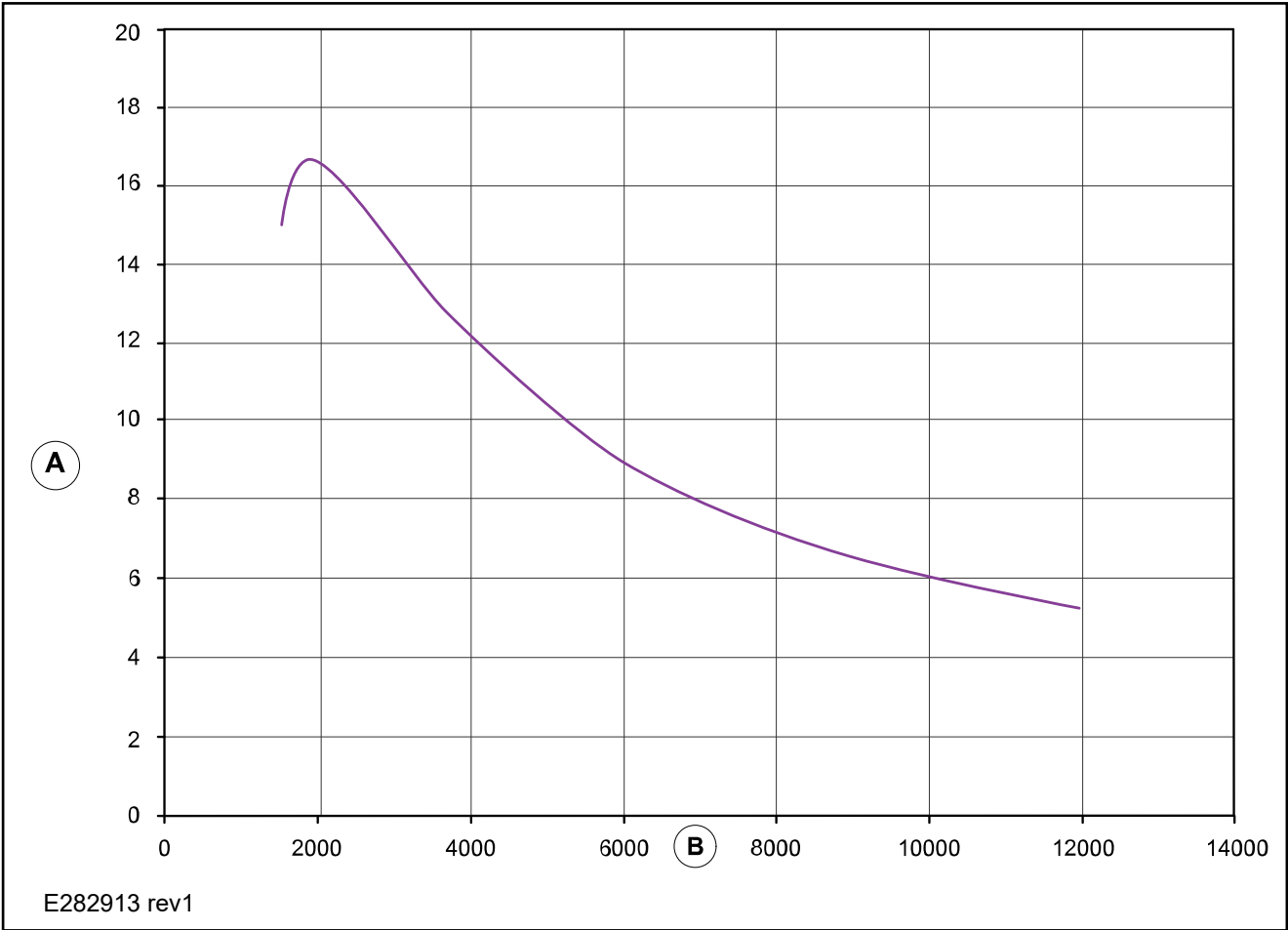
#### 4.4.8 Circuit Diagrams

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

[Refer to: 4.23 Electrical Connectors and Connections](#)

[Refer to: 4.22 Fuses and Relays](#)

Torque Curve of Alternator



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

4.4.9 Alternator Characteristics

**NOTE:** For equivalent engine revs per minute (RPM), the alternators revolutions, axis (B) should be divided by the following factor: 2.79 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.

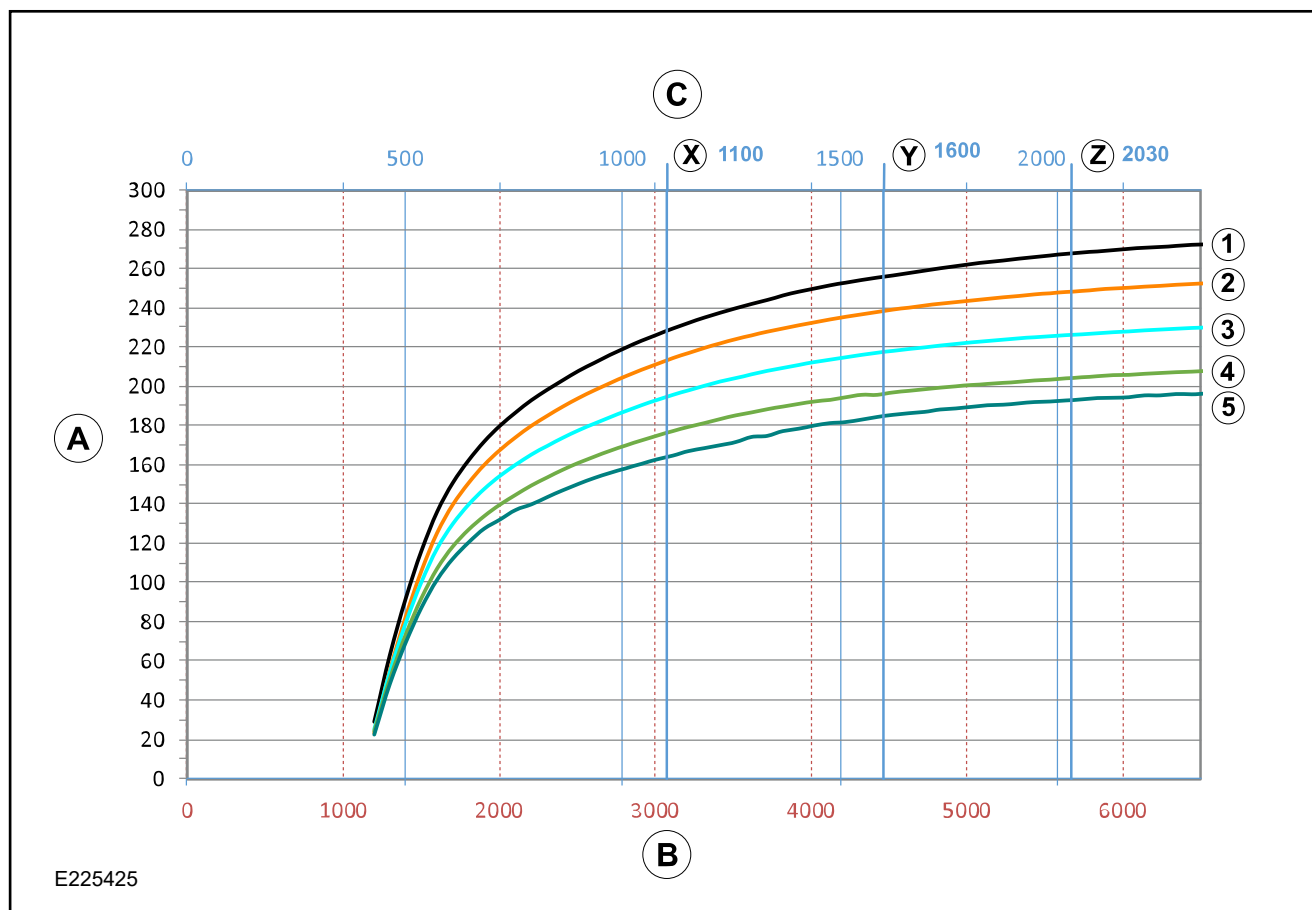
**NOTE:** If the engine is running for long periods, assume the hotter temperatures apply.

The alternator performance curves show the Engine RPM controller option (DCNAB) and the factory set engine RPM values for mode 1. This data can be used for calculating charge balance values for the finished third party system and is also the set points utilised by the Ford Programmable Battery Guard (JZAAC) which will auto range or return to base idle depending on third party power requirements.

[Refer to: 4.6 Battery Protection](#)

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. It is also recommended to utilise the SRC override feature (Third Party High Power mode) to maximise alternator output. An overloaded alternator will exhibit voltage lowering below 12.8V and could lead to damage, so must be avoided.

## Output Performance of Alternator - 240A



Item	Description
A	Output Current (Amps)
B	Alternator Speed (RPM)
C	Engine Speed (RPM)
X	RPM 1 Default
Y	RPM 2 Default
Z	RPM 3 Default
1	Temperature 0°C — Voltage 14.1V
2	Temperature 23°C — Voltage 13.9V
3	Temperature 60°C — Voltage 13.5V
4	Temperature 93°C — Voltage 13.1V
5	Temperature 116°C — Voltage 12.9V

## 4.5 Battery Systems

**⚠ WARNING: For electrical Power Take Off (PTO) that requires cycling from third party systems, High Performance AGM batteries (HTAAC or HTABG ) must be ordered on the base vehicle. For more information, refer to 'Power and Connectivity Usage Recommendations' table later in the section. If option twin H7 AGM (HTAAC) or Single H8 AGM (HTABG) is not on the base vehicle, for battery upgrade guidance please refer to Single and Twin Battery Systems further in this section."**

**⚠ 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:** Auxiliary customer electrical loads exceeding 60A must be regulated by the Standard Battery Guard (SBG) and load-shedding system. For loads greater than 175A see 'Third Party +12V electrical loads for loads exceeding 175A' section in this BEMM.

**NOTE:** Do not make any additional connections to the Power Distribution Box (PDB) terminals, as over-torquing could cause damage to the PDB. Any electrical loads should be taken from the CCP.

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.5.1 Power and Connectivity Usage Recommendations

**⚠ WARNING: If a third party battery guard is fitted, it must be connected to the load-shedding signal so that EPAS is protected in the event of an overload at engine run.**

**NOTE:** Use Absorbent Glass Mat (AGM) batteries for 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.


The section is to serve to assist with fitting the appropriately sized charging system.


Connectivity Usage	Recommended Specification (order code in brackets)
Additional fused relay outputs. For example: Service Engineer's Van.	Smart Fuse Box (JZXAD/JZXAF) Twin AGM Batteries (HTAAC)
Roof Beacons/Additional switches. For example: Highway Maintenance Vehicles, Campers.	SYNC screen switch control with Upfitter Integration System (UIS) (JRSAB) Auxiliary Battery Pre-Wiring for addition of second battery (HTYAB) (Camper only) Camper Touchscreen (Converter fit for Camper only)
Conversions using various vehicle signals are required, such as indicators, stop lamp, door ajar, handbrake on. For example: Police Vehicles and Ambulances.	Twin AGM Batteries (HTAAC) Upfitter Integration System (JRSAB) Smart Fuse Box (JZXAD/JZXAF)

Engine State	Power Usage	Recommended Specification (order code in brackets)
<b>Engine Off Loads</b>	<b>LOW CONTINUOUS PTO:</b> Up to additional 5mA at Key Off, for example: KL30 fed small current peripheral chargers.	Donor Vehicle Battery(s)
	<b>MID CONTINUOUS PTO:</b> Between 5mA and 30mA at Key Off, for example: Trackers (with sleep function, no GPS), Control Gear, KL30 fed medium current peripheral chargers.	Twin Batteries of same type (only standard on certain applications)
	<b>HIGH CONTINUOUS PTO:</b> Between 30mA and 175A at Key Off, for example: Trackers with GPS, Control Gear, KL30 fed high current peripheral chargers OR vehicles with multiple/extended activations of interior lighting, cycle locks and rear door ajar events. DO NOT EXCEED 175A.	Limited Engine Run/Charge Cycles, 2 High Performance H7 Absorbent Glass Mat (AGM) batteries (HTAAC). Frequent Engine Run/Charge Cycles, single High Performance H8 AGM battery (HTABG) Where possible connect to loads to the Smart Fuse Box (JZXAD/JZXAF) or Third Party Battery Guard. <a href="#">Refer to: 4.7 Battery Protection</a> for load-shedding.
	<b>OCCASIONAL SHORT TERM HIGH PTO:</b> Between 40A and 240A at Key Off, for example: Cranes, Tippers, Tail Lifts, 230V Inverters, Ambulances.	2 High Performance AGM batteries (HTAAC) + Smart Fuse Box (JZXAD/JZXAF) - max 200A. Additional batteries may be required, for further information see Battery Configuration, Additional Loads, Start-Stop and SRC, in this section. <a href="#">Refer to: 4.7 Battery Protection</a> for Load-Shedding.
<b>Engine Run Loads</b>	<b>LOW CONTINUOUS PTO:</b> Up to 30A, for example: Maintenance Van with water heater and additional lighting but no further systems.	Donor Vehicle Alternator
	<b>HIGH CONTINUOUS PTO:</b> up to 240A, for example: Ambulance, High Load Maintenance Vehicle, Refrigeration. DO NOT ALLOW BATTERY DISCHARGE AND DO NOT ALLOW SYSTEM TO DROP BELOW 13V. For further information see Battery Configuration, Additional Loads, Start-Stop and SRC, in this section. Any loads greater than 60A must be connected to a controlled load-shedding connection.	Use Engine RPM Controller (DCNAB) to enhance 12V charging if required. For voltage support consider using Third Party High Power Mode. Any loads greater than 60A must be connected to a controlled load-shedding connection.
	<b>PTO:</b> Applications which require elevated engine idle speeds, for example: Mobile Tyre Fitter Van, Welder's Vehicle and Mechanical PTO from engine.	Engine RPM Controller (DCNAB).
	For applications where the Vehicle Convertor Load requirement exceeds HIGH CONTINUOUS PTO, for example: total Ford and Vehicle Convertor loads exceed the highest available Ford alternator rating.	Supplemental batteries and supplemental energy source pending charge balance calculation.

4.5.2 High Current Supply and Ground Connections

WARNINGS:

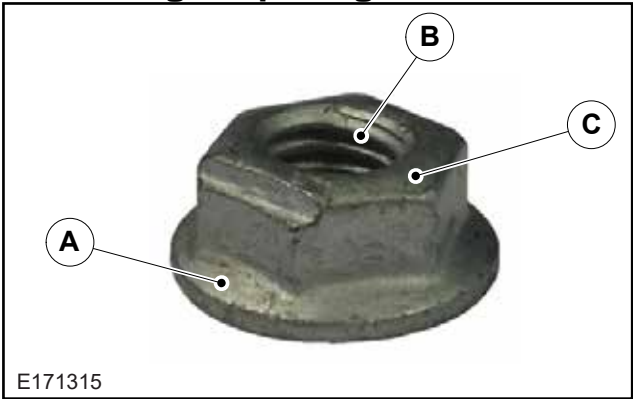
- 

**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.**

For additional information  
[Refer to: 4.23 Electrical Connectors and Connections](#)  
Customer Connection Points.


Self-Locking Crimp Hexagonal Nut



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

Responsibilities and Considerations

- 

**WARNING: The fitting of voltage boosters or other devices to enhance alternator output is not allowed. The 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 CCP1 or 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 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 10-15 minutes.

## 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

Vehicles held at the Vehicle Convertor premises and/or not in use for longer than 7 days, should have the battery's negative cable disconnected. Before shipping to the customer, the battery negative cable must be reconnected and the voltage rechecked. A complete recharge is required for battery voltage below 12.4V for standard and enhanced flooded or 12.3V for AGM or for no-crank vehicles by using an appropriate charger.

For additional information

[Refer to: 1.13 Vehicle Transportation Aids and Vehicle Storage](#)

## 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.

To change mode, the brake pedal must be depressed five times, and the hazard warning switch operated twice (in any combination) within a 10 second period.

The SBG, CCP2 and third party load-shedding system is 'always off' during Transport mode. FPBG is inhibited during engine run.

## 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. However, the central locking latches may cycle if one of these was opened manually in the intervening period. With regard to the radio, all of the settings are retained.

There is no longer a need to reprogramme the electronic security code, as it is tied into the VIN of the factory fit Transit system. The clock initialises to 12:00 and will need to be reset to the correct time in accordance with the customer handbook procedure.

## 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](#)

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

[Refer to: 4.23 Electrical Connectors and Connections](#)

## Battery Cable Fixing Torque

The battery cables should be fixed to the terminal post with a torque of 8.0Nm  $\pm$  1.2Nm for positive or negative battery post connection with/without BMS. 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 not being below 11.8V measured at the battery terminals at open circuit voltage.**

## Battery Type and Capacity

**NOTE:** If a Vehicle Convertor intends to add systems or accessories that will add load at key off or engine run, then twin batteries should be specified, in particular, AGM battery type. There are also alternator upgrades and other options that are needed for electrical load requirements. Refer to the table 'Power and Connectivity Usage Recommendations' in this section of the BEMM for your vehicle. Heavy electrical load may inhibit Start-Stop but only for the duration of the third party load. This is normal functionality.


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

The vehicle may have Enhanced Flooded or AGM batteries as factory fit. Higher capacity batteries are available as standard production options and Special Vehicle Options offer AGM technology for heavy electrical load and deep cycling applications. 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.

[Refer to: 4.5 Battery Systems](#) Power and Connectivity Usage Recommendations table.

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.

## Battery Covers

 **WARNING: It is important that the battery positive terminal cover should be replaced after any conversions 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. See figure E278335 rev2 in the BMS later in this section of the BEMM.**

## Battery Drain Prevention

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

## 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 frequently than every 7 days and recharge the battery if necessary.

For additional information

[Refer to: 1.13 Vehicle Transportation Aids and Vehicle Storage](#)

## Engine Off Loads

All loads that exceed 100mA continuous key off load require an isolation switch or disconnected relay. 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](#)

## 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.

## Customer Connection Points (CCP) and Other Electrical Load Connection Locations

Any peripherals added to the power supply must be either connected in one of the following ways via the CCPs, or from dedicated fuses such as: Smart Fuse Box or CCP 60A. For loads greater than 250A



(CCPs) or 200A (Smart Fuse Box), up to 240A can be connected from the battery cable.

[Refer to: 4.6 Battery Protection](#)

## 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. The Smart Fuse Box is recommended.

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: 4.22 Fuses and Relays](#)

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

## Third Party High Power Mode

Third Party High Power mode is a Ford function that is available to assist with third party electrical and mechanical PTO. This will allow power for longer at engine off and help sustain a higher voltage during engine run. This mode includes SRC Inhibit, Start-Stop Inhibit, AEIS inhibit, and engine off load-shedding timer over-ride.

## 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.**



**CAUTION: 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 European or applicable local Legislation relating to EMC to ensure electrical interference does not affect the vehicle systems
- Add EMC emissions statement to CE approval

## 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 to be damaged. In particular, the safety instructions for performing welding/cutting work on vehicles with airbag systems must be adhered to.

For additional information on welding

[Refer to: 5.1 Body](#)

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 Battery Options

**NOTE:** If wrong batteries or incorrect configuration, Start-Stop or SRC may not function correctly.

Any additional or different batteries must be checked for correct functionality

Refer to: [4.10 Electronic Engine Controls](#) Start-Stop and SRC

Refer to: [4.4 Charging System](#)

#### Battery Part Numbers and Options

Battery Part No.	Type	Quantity	Size
<b>Single Battery Options</b>			
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery (HTAAB) (Standard)	1	H7
8C1V-10655-A*	850CCA (95Ah @ 20 hour rate) AGM Battery (HTABG)	1	H8
<b>Single Battery Options with Auxiliary Battery Pre-Wiring Pack (HTYAB) (Campers Only) <sup>(1)</sup></b>			
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery HTAAB)	1	H7
8C1V-10655-A*	850CCA (95Ah @ 20 hour rate) AGM Battery (HTABG)	1	H8
<b>Twin Battery Options</b>			
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery (HTAAC)	2	H7
8C1V-10655-A*	850CCA (95Ah @ 20 hour rate) AGM Battery (HTAAZ)	2	H8

<sup>(1)</sup> Auxiliary Battery Pre-Wiring Pack (HTYAB) comes with BMS and Vent Tube for second battery

### 4.5.5 Battery Rules

**NOTE:** When modifying the battery pack it is recommended to also update the vehicle configuration.

**NOTE:** Charge balance calculations are required when adding additional systems, taking into account charging system capacity and battery capacity.

- Batteries in parallel must be of the same type and capacity and listed in the Ford battery table
- Third party batteries and loads are to be isolated from the standard Ford system at key off or by a Ford or third party battery guard system
- For external charging of batteries, ensure that the maximum voltage of 15.2V is not exceeded. Normal proprietary charging equipment should operate below this voltage

Where twin batteries are required on vehicles with a single battery installation, associated wiring and hardware should be fitted and aligned to Ford architecture. The extra battery must be of the same technology and performance rating as the existing battery. Alternatively, single or twin battery systems can be upgraded to the High Performance AGM batteries: twin (HTAAC) or single H8 AGM Battery System (HTABG).

If the battery type on a vehicle is changed to other compatible derivatives (see battery configuration table) it is required to reconfigure the vehicle to the new battery types from the dealer.

For special conversions requiring a third party battery, a further disconnect strategy is required. This should be controlled via the engine run signal to a normally open relay. A schematic of this architecture can be found later in this section.

[Refer to: 4.4 Charging System](#)

The load a battery could add to the vehicle when requiring a charge, may exceed 60A. If third party loads are also connected, a relay or contactor, controlled by the load-shedding signal, must be used to isolate.

#### Important Factors for Battery Choice

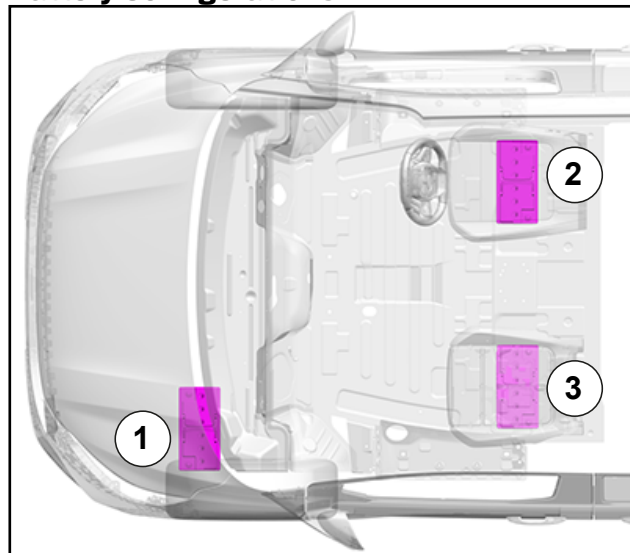
- Battery specification capability in ampere hours for continuously loading until empty. For example an 80Ah fully charged battery can supply 4A over a 20 hour period at 20°C until it is fully discharged
- The Cold Crank Ampere (CCA) rating is the maximum rating for cold start requirements
- For deep cycling and micro cycling requirements (engine off loads) the battery system is recommended. For high power (twin system) requirements at engine off use H7 (HTAAC) or for low power (single system) at engine off use H8 AGM Battery System (HTABG)

Extra batteries added to the power supply should be connected as shown at the end of this section.

### 4.5.6 Battery Configurations

The primary Battery is located in the engine compartment. The secondary battery is under the driver's seat, except on Camper where the first auxiliary battery is always in left hand seat pedestal and a second auxiliary battery may be fitted in the right hand seat pedestal.

#### Battery Configurations



Item	Description
1	Primary Battery
2	Auxiliary Battery
3	Auxiliary Battery

#### Additional Loads, Start-Stop and SRC

**NOTE:** The following battery configurations are NOT compatible with Start-Stop and SRC:

Start-Stop and SRC will operate within specification only if a correct battery configuration is installed in the vehicle. Start-Stop and SRC system functionality cannot be guaranteed with the following configurations.

- Mixed battery types - for example: 1x AGM and 1x Flooded
- Mixed sizes
- Battery types other than those listed in the Battery Part Number and Usage table
- Extra batteries than factory fit - for example: 3 or more, if not isolated from existing power supply at key off
- If twin Ford Battery Configured, only fitting single battery
- If single Ford battery configured, fitting twin Ford Battery

It will not be possible to decommission the Start-Stop and SRC features due to homologation, vehicle tax and excise requirements.

If the battery type on a vehicle with Start-Stop or SRC is changed to other compatible derivatives (see battery configuration table) it is required to

reconfigure the vehicle to the new battery types at your local Ford dealer.

The feature content of the vehicle must still remain a Start-Stop or SRC vehicle to be in line with the homologation, vehicle tax and excise requirements.

## 4.5.7 Convertor Fit Additional Third Party Batteries



**WARNING: For any third party power connections needing greater than 60A when CCP2 is not used, all connections must be controlled via either the load-shedding or load shed signal from Vehicle Interface Connector or Smart Fuse Box. There must not be any exceptions to this conversion strategy, as the signal is to protect the Ford power supply from overload and voltage drop that can affect critical systems such as the FPBG. It is not recommended to use the 60A CCPI feed to supply a third party battery.**



**Caution: Do Not mix H7 and H8 Batteries in a multiple (2 or 3) battery configuration.**

**NOTE:** It is the Vehicle Convertor'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. System voltage at engine run must not fall below 13.0V whilst the vehicle is in motion and if Third Party High Power mode is active.

The assumption is that greater than 60A would be required for camper vehicles and any other conversions requiring an additional battery. Therefore, isolation should be provided by either the 250A Customer Connection Point (CCP2), Smart Fuse Box 200A or a third party relay or contactor controlled by the load-shedding signal. In all systems, there is engine off power protection, providing enough remaining energy for a future engine start. 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](#)

If additional batteries are added, these should be connected via a disconnect mechanism, such as CCP2, SFB, or another battery guard controlled by the load-shedding signal. If the third party battery and added system requirements exceed 250A (CCP2) or 200A (Smart Fuse Box/FPBG) of current, connection to the battery positive 6mm stud is permissible only when integrated with the load-shedding signal. Refer to the 'Third Party +12V electrical loads for Loads Exceeding 250A' in this section. For example of convertor fit third party battery installation to existing Ford power supply architecture see figure E289272 in this section.

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/SC (MHEV) functionality will take some time (ignition off overnight and multiple ignition run cycles) to re-establish full functionality.

[Refer to: 4.4 Charging System](#) System Operation

- 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 Convertor
- The BEMM is adhered to in all relevant areas. This document allows connectivity to Ford battery clamp if the above criteria is met

## Third Party +12V Electrical Loads for Loads Exceeding 200A

### WARNINGS:



**DO NOT connect the same load to both CCP1 and CCP2. The system is not designed to work together as the fuses have different values.**



**It is important that the battery positive terminal cover is replaced after any conversions to the battery positive terminal. See figure E278335 rev2 in the BMS later in this section of the BEMM. If the positive terminal 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 after a conversion.**

For power up to 200A, the Smart Fuse Box can be used. For loads up to 250A, use CCP2 which comes with the second battery. For loads higher such as crank line it is recommended to use an ICE donor vehicle and interface to the crank circuit. For further information contact [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

Anytime high power beyond 60A is required but not using Smart Fuse Box or CCP2, a third party relay or contactor must be controlled by the load shed signal pin 4 in vehicle interface connector.

[Refer to: 4.6 Battery Protection](#)

The following fusing principles must apply:

- For a long duration (greater than one hour continuous), the fuse must be no higher rating than the alternator fitted to the vehicle
- For short term loads such as one minute peak loads, a 250A fused cable can be installed.

Conversion examples: Crane, Tipper, Tail-Lift

This is only allowed if testing by the Vehicle Converter confirms that there are no issues (documentation must be held to confirm the tests) and the following criteria is met:

- No movement before full tightening of the nut (no risk of rotation). The third party eyelet must be a tight fit within the battery clamp slot and have a maximum Cross Sectional Area (CSA) for current flow
- The cable CSA must be oversized

[Refer to: 4.2 Wiring Installation and Routing Guides](#) Wiring Specifications table. For example: 245A has 70mm<sup>2</sup> CSA cable

- The third party positive conductor is mounted directly to the battery clamp with the supply for the BMS last, see figure E278335
- No deformation to the Ford BMS can occur. The conductor terminal/eyelet may need to be inverted, see item 4 in figure E278335
- Only one termination (third party conductor) can be added to the 6mm stud in addition to the BMS
- The Ford 6mm self-locking nut is to be re-used and torqued to 8Nm ± 1.2Nm. Separate locking washers are prohibited

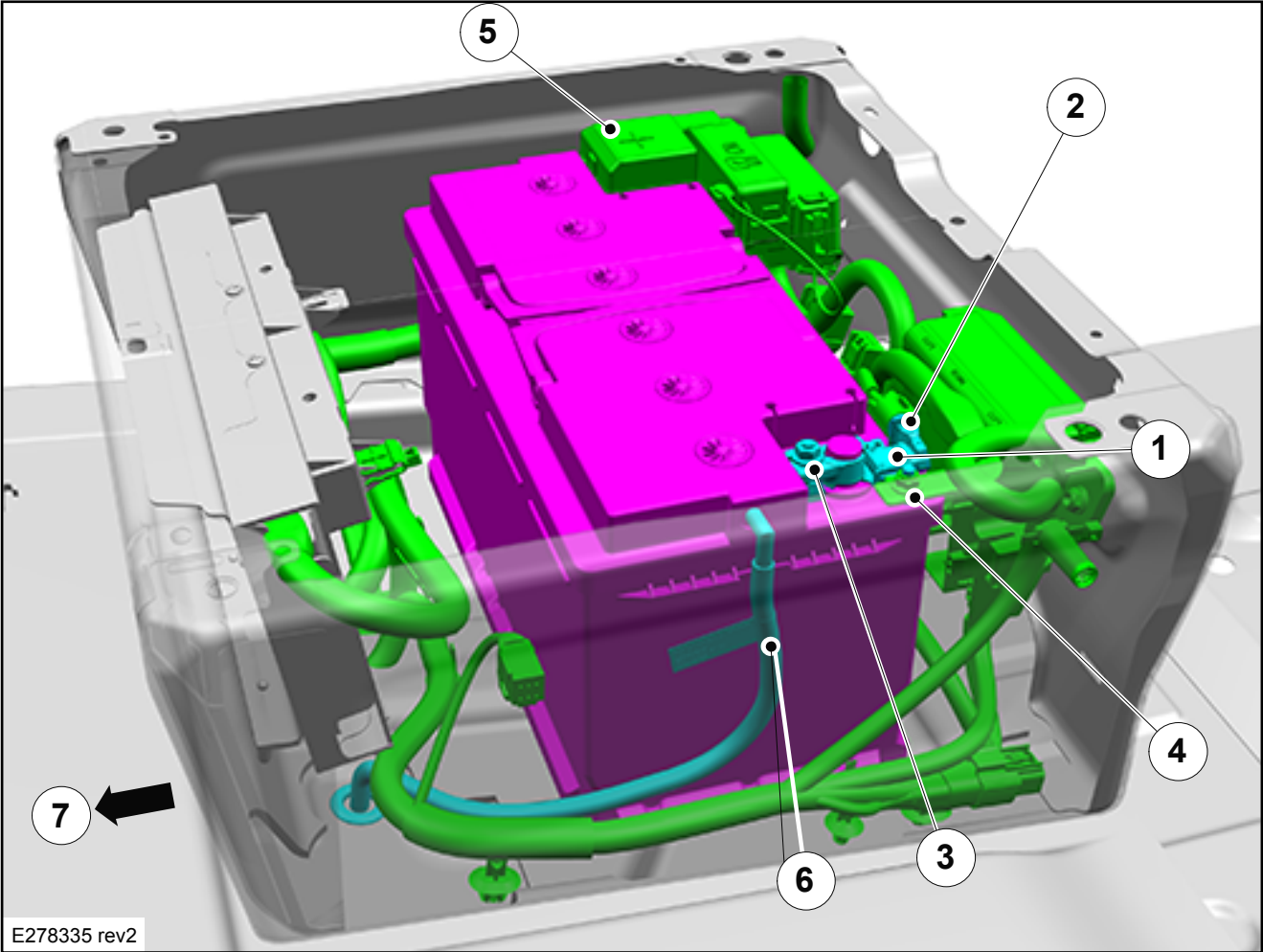
- A Mega inline fuse must be fitted as close to the 6mm stud as possible. Not to exceed 250A for short duration applications such as on Tippers, Cranes or Tail Lifts
- For long duration continuous power applications such as High Power Inverter, the Mega fuse must not exceed the rating of the alternator fitted to the vehicle. The alternator saturation voltage must be above 13.0V when testing full load. AGM battery twin system (HTAAC) must be fitted to the derivative. See 'Single and Twin Battery System' and 'Power and Connectivity Usage Recommendation' table in this section of the BEMM
- A higher ampere alternator must be fitted if long duration (greater than one hour) high loads are required. See 'Single and Twin Battery System' and 'Power and Connectivity Usage Recommendation' table in this section of the BEMM
- The Third Party High Power mode feature must be used for Engine Run applications.

[Refer to: 4.4 Charging System](#) Start-Stop Override and Configurable Charging

- Efficient isolation of third party equipment, when not required, to minimise battery discharge/deep cycling. The load-shedding signal control offers this
- Testing for end customer usage, including duty cycle, at a range of temperatures and drive cycles, worst case
- Testing of the Vehicle Converter's system must confirm no heating of Ford or third party cables or any junctions utilised, unless thermal protection is incorporated
- Testing of Vehicle Converter's +12V conductor must demonstrate no loosening possible to Ford battery cable clamp
- No detriment to Ford systems from voltage drop/inrush current by third party system (functionality or warnings)
- If engine off can still operate the third party system, then testing also required in this vehicle state
- A charge balance must also be performed to confirm system has correct battery and alternator ratings
- If idle loading can saturate the alternator (fully load and go below 13.0V) then Engine RPM speed control system must be utilised to increase alternator output at idle



Battery Pedestal



E278335 rev2

Item	Description
1	Battery Monitoring Sensor (BMS) PZ3T-10C652-BA
2	Plug-in connection — Local Interconnect Network (LIN) and Battery Positive +12V (B+) Feed
3	Connection to Negative Terminal of Main Battery Post — See 'Battery Cable Fixing Torque'
4	1x M6 nut. Do not loosen or remove
5	Battery Positive Terminal Cover
6	Battery Breather Tube
7	Front of vehicle direction

### 4.5.8 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 (or twin batteries). 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, Ford dealer or customer services.

The BMS re-calibrates itself at regular intervals. This occurs during a rest period at key off, when the battery closed-circuit current is less than 100mA. 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.

It is recommended that the total Ampere consumption, in sleep mode, does not exceed 100mA. This is because BMS will not be able to accurately correlate the battery state of charge. Note there is approximately 15mA of key off load from existing Ford fit systems, so the additional maximum is 85mA of convertor fit system. Any third party installations should ideally be activated via ignition or engine run. However, a sleep mode of 100mA is still high and will lead to deep discharge. Regardless of battery system, long periods of discharge may necessitate long periods of recharge. See 'Power and Connectivity Usage Recommendation' table at the end of this section.

After convertor 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 milliampere's (mA). Perform this test after 10 minutes of key off with all doors shut so that the vehicle remains in sleep mode.

### 4.5.9 Single and Twin Battery Systems

#### Wiring of Batteries in Parallel for High Current Applications

Review whether an upgrade to a single High Performance H8 AGM Battery System (HTABG) would be sufficient or alternatively if a higher current is required, an additional battery can be added as shown in the proposed interface schematic. In this case the load-shedding signal is used to control relay 'D' to allow the third party battery to be charged when the engine is running.

Also [refer to: 4.6 Battery Protection](#)

### Single to Twin Battery Conversion

Any additional or different batteries must be checked for correct functionality on a Start-Stop or SRC vehicle, please refer to Battery Configuration, Additional Loads, Start-Stop and Smart Regenerative Charging (SRC) and also:

[Refer to: 4.4 Charging System](#) and  
[Refer to: 4.10 Electronic Engine Controls](#)

If a requirement exists, it may be viable to order vehicles installed with a single battery, a battery disconnect relay and a kit of harnesses to be fitted by the installer. See following table for battery cables and components.

#### Battery Cables and Components

A vehicle ordered with a single battery can be converted to twin standard batteries or to High Performance AGM batteries. When converting to the standard option it is necessary to order an additional single battery to the same specification as the original fit. Alternatively when converting to the High Performance AGM batteries it is necessary to replace the original battery with two AGM batteries of the same type. The battery part numbers for each option are shown later in this section.

When changing the battery capacity or technology, the vehicle configuration must be updated after the new batteries have been installed. The vehicle needs to be connected to the Dealer Service Tool to reprogram the new batteries. Contact your National Sales Company representative or local Ford dealer with your vehicle VIN. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com). Failure to set the correct battery configuration may lead to incorrect SRC/SC and Start Stop functionality.

### 4.5.10 Additional Loads and Charging Systems

**NOTE:** Do not make any additional connections to the Power Distribution Box (PDB) terminals, as over-torquing could cause damage to the PDB. For applications that require a permanent installation to gain power for jump start requirements for example recovery vehicle conversion, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)



## Generic items when converting from Single System to single H8 AGM

Part Number	Description	Quantity
PZ3T-10A687-B*	Battery Heat Shield (not required for BEV)	1
PZ31-10723-B*	Battery Tray Assy	1
PZ31-10762-B*	Support Battery Tray (H8)	1
PZ31-16B269-A/21	Reinforcement Battery Assembly for Crash Safety	1
W722068-S/1	Screw & Washer MP6	1
W500024-S/1	Screw M08x1.25x25.0 HEX FLNG HD	2

## Replacing with High Performance AGM System

Part Number	Description	Quantity
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery (HTAAB)	2
8C1V-10655-A	850CCA (95Ah @ 20 hour rate) AGM Battery (HTABG)	2

## Battery Cables and Components

Part No.	Issue														
		HTYAB	Aux. Battery Pre-Wiring 1												
		JZXAD													
		JZXAA													
		JZXAF	Smart Fuse Box - Camper												
		HTABP	Triple H7 AGM												
		HTAAB	Single Battery												
		HTYAC	Aux. Battery Pre-Wiring 2												
		HTAAC	Twin Battery												
		HTYAA	Less Aux. Bat Pre-Wiring												
		DR--1	Left Hand Drive												
		DR--3	Right Hand Drive												
		GBVBD	MHEV Emissions												
		EN-OP	Diesel Engine (Panther)												
		EN-OE	Electric Motor (BEV)												
		EN-O4	Fox Petrol Engine (PHEV)												
		VL-G5	J74 Programme												
		BV4AB	Non-Driver Swivel Seats												
		VL-TU	V710 (ALL CODE)												
		BV4AC	Driver Swivel Seat												
		GBVAJ	Less MHEV												
PZ3T-14300-RRB	EE01-E-14451023-000		X					X			X				
PZ3T-14300-RPB	EE01-E-14451023-000		X					X		X			X	X	
PZ3T-14300-RMC	EE01-E-14451023-000		X					X		X			X	X	
PZ3T-14300-RKB	EE01-E-14451023-000			X						X	X		X	X	
PZ3T-14300-RHB	EE01-E-14451023-000			X						X	X		X	X	
PZ3T-14300-RBC	EE01-E-14451023-000			X						X	X		X	X	

## 4.6 Battery Protection

**NOTE:** If a third party battery guard is fitted, it must be connected to the load-shedding signal so that EPAS is protected in the event of an overload at engine run.

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 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 - 30 minutes from key off
- Interior lighting - 10 minutes from key off (there are some options where the interior lighting has been extended to 30 minutes)

### 4.6.2 Standard Battery Guard (SBG) and Load-Shedding

#### WARNINGS:



**When connecting a third party load, these installation instructions must be followed to avoid low system voltage during normal driving operation.**



**The load-shedding system must not be disabled or interfered with.**



**Vehicles with Single or Twin batteries should always fit battery guards if engine off power is required. The Ford Programmable Battery Guard (FPBG) is available with Smart Fuse Box.**



**If a third party battery guard is fitted, it must be connected to the load-shedding signal so that EPAS is protected in the event of an overload at engine run.**

**NOTE:** It is recommended to maintain the vehicle battery to a good level of charge to avoid load-shedding events.

Load-shedding is a system protection feature to stop excessive voltage drops at engine on. At engine off this system helps stop excessive battery drain which could lead to a failed start. To protect the system from sudden voltage drops it will on rare occasions of extreme conditions be necessary to disconnect high-current third party electrical loads. All third party electrical loads totalling over 60A must be connected under one or other method of load-shedding control.

Charge balance system testing is expected of the third party system with any Ford system loads, to ensure that the voltage does not go lower than 13.0V at engine run. When vehicle detects too low voltage then temporary load-shedding occurs. If this occurs regularly it suggests significant issue that requires attention.

At engine-off, it helps prevent excessive battery discharge with a SBG.

To avoid the risk of there being load-shedding during engine run in a **stationary** electrical Power Take Off (PTO) requirement, two systems are recommended to be utilised:

#### 1. Third Party High Power Mode override feature

This will help maintain the highest voltage by forcing the charging system into conventional charge mode.

#### 2. Engine RPM speed control feature

This can help increase current output of the charging system by increasing the engine idle. Charge balance system testing is expected of the third party system with any Ford system loads, to ensure that the voltage does not go lower than 13.0V at engine run.

### 4.6.3 Power Connections

This section explains where to connect third party electrical power connections, based on the power that will be drawn.

Ground connections are not controlled

[Refer to: 4.24 Grounding](#)

#### Connections without SBG and Load-Shedding

**NOTE:** Suitable for up to 60A total.

A total limit of 60A applies to all non-sheddable third party electrical loads added to the vehicle, across all locations including the following:

- Customer Connection Point 1 (CCP1)
- Camper connection (C Connector)

[Refer to: 4.23 Electrical Connectors and Connections](#)

All higher current third party loads are to be regulated using Ford controlled load-shedding.

Optionally, third party loads below 60A can also be connected to the load-shedding control system to make use of the protection from battery drain that this may provide.

It is required to connect loads with over 100mA continuous drain to the load-shedding system.

#### Connections using SBG and Load Shedding

This provides some protection of the battery for parked vehicles, and some protection of system voltages when the vehicle is running.

Regulation by load-shedding is required where total added electrical load is over 60A. Regulation by load-shedding is also optional for connections totalling less than 60A.

Load-shedding for third party systems is to be installed using one of the following 3 methods:

1. **Using the provided third party isolation signal directly.**
  - This is a switched ground system
  - The control wire can supply relay coil currents up to 10A total, for connected third party control relays
  - The control signal is routed to the following locations
    - 12-way standard interface connector in the driver's seat pedestal (pin 4)
  - The control signal is to be used with a third party relay when Customer Connection Point 2 (CCP2), see below, or FPBG cannot be utilised. This control is also recommended when connecting leisure batteries.

#### 2. Using Customer Connection Point 2

CCP2 is a high current load-shedding connection point to provide robust power availability whilst maintaining vehicle operation

- Loads up to 200A may use CCP2
- CCP2 is provided in any of the below options:
  - Twin battery/heavy-duty battery pack
  - Smart Fuse Box
  - Camper Donor vehicles

#### 3. Using Smart Fuse Box

Loads up to 200A can utilise the SFB.

[Refer to: 4.6 Battery Protection](#)

### 4.6.4 SBG and Load Shedding Functionality

#### WARNINGS:



**Changing configurations may invalidate the vehicle warranty.**



**Ensure the Third Party High Power mode feature does not inadvertently remain active when the battery is being charged by the vehicle.**



**Use of the Third Party High Power mode feature to override the connection timeout will allow more energy to be discharged from the vehicle battery. Excessive energies cycled through the battery may invalidate battery warranty.**



**When designing automation of the Third Party High Power mode, avoid unintended consequences. If activated when the engine is running, use of Third Party High Power mode can also prevent AEIS, where applicable. Use of Third Party High Power mode can disable this safety feature and leave the engine running. Engines that run in confined spaces cause CO accumulation which can lead to CO poisoning and death. CO can seep into adjacent confined spaces. The AEIS inhibit can be configured off at a Ford dealer.**

#### Standard Battery Guard - Vehicle -Off

Standard Battery Guard (SBG) operates when the vehicle is off. The purpose of the SBG is to protect the vehicle battery from being drained.

It disconnects the controlled third party circuits when the battery is low or after timeout has occurred. Timeout is up to 30 minutes for single-battery vehicles and up to 75mins for vehicles with twin AGM batteries. Twin AGM batteries have a lower SOC threshold and can offer for longer duration.

[Refer to: 4.6 Battery Protection](#)

Normally the SBG is configured to reconnect at vehicle unlock. The circuits are then connected before the 'key crank'.

Camper vehicles do not reconnect at 'unlock'. Instead reconnection is delayed to about 3s after 'ignition on' to allow the vehicle to be cranked first. This is intended for vehicles with Gel batteries. With this configuration, the third party load-shedding circuits are disconnected as soon as both the key is out and the driver door is opened. Other non-Camper vehicles can be configured the same, by a Ford dealer.

The Third Party High Power Mode inhibits the timer so the SBG monitors for low SOC only. The user must ensure the Third Party High Power Mode is not used during normal drive cycles except where required for third party equipment.

[Refer to: 4.4 Charging System](#)

The SBG does not offer warning if an external charger is connected to the vehicle. It will not automatically connect all batteries if an external charger is applied. Please see FPBG for these features.

If extra functionality is required, or up to 200A, consider using the FPBG.

## Load Shedding - Vehicle -On

In rare situations of very high electrical demand, it is necessary that the system can act to prevent the voltage from becoming too low. Essential loads, including some 3rd-party loads, will never be shed. Loads totalling over 60A must be connected to the Load-Shedding function.

The ability to do Vehicle-On load-shedding is required in order to be able to prevent too low voltage during driving.

## Short Term Disconnection - Contributing Factors

- Extreme environmental conditions
- High system electrical load at or already exceeding power supply capacity – including third party loads
- During short term high transient loads, such as inrush currents

If the system voltage drops very low, disconnection of the controlled third party loads may occur. This will be for a minimum of 4 seconds.

If load-shedding occurred, third party equipment may be reset and may re-initialise.

For Battery configuration

[Refer to: 4.5 Battery Systems](#)

## Driver Notification

Driver Notification Instrument Cluster Notification is provided to alert the driver that third party connections have been reset, and that this may indicate an overload condition has occurred.

A customer information message is displayed briefly on the Instrument Panel Cluster (IPC). The message is "Electrical Power Saver Active Features Turned Off".

Where the warning occurs frequently, it is recommended to review the Power Supply requirements, and additional generating equipment may be required.

No message is given when power is restored. If CCP2 or FPBG is fitted an audible click may be heard from the driver's seat area.

## Longer Term Disconnection

If the 12V SOC is very low when load-shedding occurred, the load-shedding will remain active until the 12V SOC has been raised significantly. This will take longer in cold conditions or with old batteries. This condition inhibits activation of Auto-Park-Assist.

## After a Flat Battery

An indication of continuous flat batteries is that the SBG has not been utilised.

If the battery is low, there is increased probability of load-shedding occurring.

## 4.7 Climate Control System

 **WARNING: 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

#### J1 Climate Control System Pin-Outs

##### C1 Connector

Pin	Description
Pin 1	Ground
Pin 2	Voltage - Reference Return
Pin 3	Voltage - Reference
Pin 8	Temperature (Left) Door - Feed A
Pin 9	Temperature (Left) Door - Feed B
Pin 10	Temperature (Left) Door Position Feedback
Pin 11	Front Blower Relay Output
Pin 11	Front Blower Relay Output
Pin 20	MS1 - Can Hi
Pin 21	MS1 - Can Lo
Pin 23	Mode Door #1 - Feed A
Pin 24	Mode Door #1 - Feed B
Pin 25	Mode Door #1 Position Feedback
Pin 26	Front Blower Motor PWM Control Output
Pin 27	Recirculation Door Feed A
Pin 28	Recirculation Door Feed B
Pin 29	Defrost Door (Dedicated - Driver Focus Mode Equip Only) - Feed B
Pin 30	Defrost Door (Dedicated - Driver Focus Mode Equip Only) - Feed A
Pin 31	Defrost Door (Dedicated - Driver Focus Mode Equip Only) - Position Feedback
Pin 32	Voltage - Battery

Any pins not listed in the table above are not to be used.

**C2 Connector**

Pin	Description
Pin 1	Voltage Battery Right Heated Seat Element Supply
Pin 2	Voltage Battery Left Heated Seat Element Supply
Pin 13	Temperature (Right) Door - Feed A
Pin 14	Temperature (Right) Door - Feed B
Pin 15	Right Heated Seat NTC Sense
Pin 16	Left Seat Heating Element Output
Pin 17	Right Seat Heating Element Output
Pin 18	Temperature (Right - Dual Zone Only) Door Position Feedback
Pin 23	Mode Door #2 (Driver Focus Mode Equip Only) - Feed B
Pin 24	Mode Door #2 (Driver Focus Mode Equip Only) - Feed A
Pin 25	Mode Door #2 (Driver Focus Mode Equip Only) - Position Feedback
Pin 28	Upfitter Customer Access #1
Pin 30	Left Heated Seat NTC Sense

Any pins not listed in the table above are not to be used.

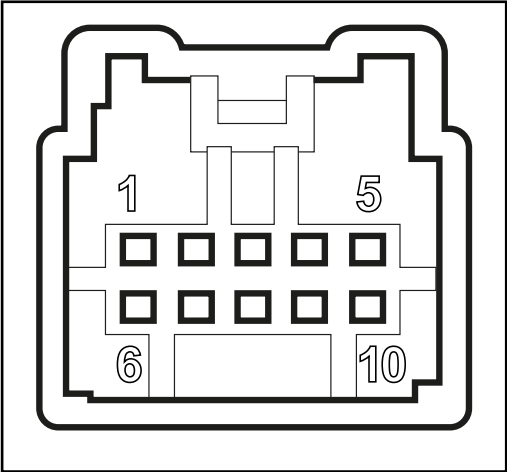
**C3 Connector**

Pin	Description
Pin 6	Rear Temperature Door - Position Feedback
Pin 8	Rear Mode (Air Distribution) Door - Position Feedback
Pin 9	Rear Blower Motor Out Return
Pin 11	Rear Temperature Door - Feed B
Pin 12	Rear Temperature Door - Feed A
Pin 15	Rear Mode (Air Distribution) Door - Feed B
Pin 16	Rear Mode (Air Distribution) Door - Feed A
Pin 18	Rear Blower Motor PWM In

Any pins not listed in the table above are not to be used.

4.7.2 Rear Climate Control System  
J2 Climate Control System Pin-Outs

C4 Connector



Pin	Description
Pin 1	MS1 - CANH
Pin 2	MS1 - CANL
Pin 5	GND
Pin 6	VBATT

Any pins not listed in the table above are not to be used.



## 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 Pin (C1)	Description	Wire Colour	
2	Fuel Level Sensor Return	Green/Blue	-
3	Ground	Black/Violet	-
4	Switch - Transmission Park Detect	Green	-
8	12V Power	Grey/Red	-
10	Fuel Level Sensor	Yellow/Violet	-
11	Switch - Low Level Washer Fluid	Grey	-
12	CAN Bus High Speed -High	Green/Blue	Twisted pair
13	CAN Bus High Speed -Low	White/Green	

Any pins not listed in the table above are not to be used.

## 4.9 Horn

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

## 4.10 Electronic Engine Controls

**CAUTION:** Do not make any additional connections to the electrical circuits associated with the engine management system.

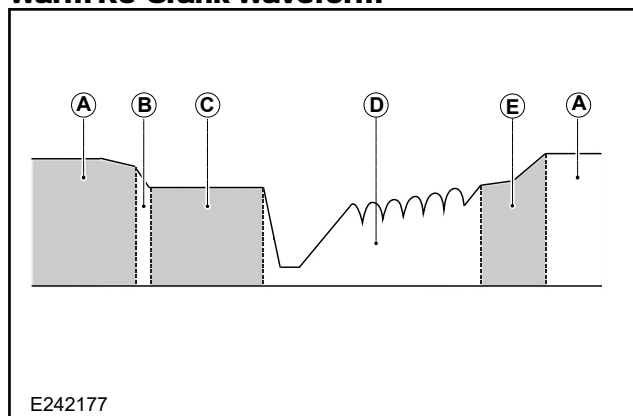
**NOTE:** It is not necessary to disconnect or remove engine management modules.

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.10.1 Cranking and Warm Cranking

During a system warm re-crank the battery voltage will drop as low as 7V for 100ms, followed by a period of voltage ripple providing an output to bring the voltage back to 12.3V. This can be up to 5 seconds. All Third Party fit modules must be robust to handle warm re-cranking waveform.

#### Warm Re-Crank Waveform



Item	Description
A	Engine On
B	Fuel Cut Off
C	Engine Off (auto-stopped)
D	Engine Crank
E	Engine On

### 4.10.2 Start-Stop

#### WARNINGS:



**If required by the system, the Start-Stop function may be deactivated which will lead to an automatic restart of the engine. In normal conditions the engine will automatically restart only if the clutch or accelerator is pressed.**



**Switch the ignition off before opening the bonnet or carrying out any maintenance.**



**Always switch the ignition off before leaving your vehicle, as the system may have shut down the engine but the ignition will still be live.**



**The system may not function if you leave additional electrical loads connected with the ignition off unless they draw less than 100mA.**

It is very important not to make any modifications to the shielding around exposed moving parts on the engine, for example the drive belt.

#### General Information

Start-Stop is designed to improve fuel economy and reduce CO<sub>2</sub> emissions by automatically stopping the vehicle's combustion engine during idle phases when it is not required for motive power and restarting it when required.

#### Start-Stop Logic

Automatic engine stops and restarts are controlled by the Start-Stop logic within the Engine Control Module (ECM). This is connected to a number of vehicle and powertrain signals, sensors and switches and decides when to shut down and when to restart the engine, based on the particular Start-Stop strategy employed.

Stop-in-Neutral is a Start-Stop strategy applicable to manual transmission vehicles which stops the engine, subject to inhibitors, when the vehicle is stationary AND neutral is selected AND the clutch has been fully released. The engine is restarted on clutch pedal press in neutral.

Stop-in-Drive is a Start-Stop strategy applicable to automatic transmission vehicles which stops the engine, subject to inhibitors, when the vehicle is stationary AND the transmission is in D AND the brake is pressed AND the accelerator is released. The engine is restarted on brake release or accelerator press. The engine also stops in P (without the brake pressed).

#### Inhibitors

Sometimes the engine may not shut down or will request auto restart due to one or more system inhibitors being active. The engine will shut down only when all inhibitors are cleared, which may be some time after the transmission/pedal conditions are met.

Typical examples of inhibitors are:

- If the ambient temperature is below the lower limit or above the higher limit for Start-Stop
- Engine coolant temperature not warmed up (value dependent on ambient temperature)
- Heated front screen is on
- Insufficient battery charge to sustain a stop event or too high a current drain or battery is cold or battery failure
- Driver's door has been opened and vehicle has not been driven over 5kph since
- Engine management reason, for example: during a DPF regeneration event
- The ABS warning lamp is on or the vehicle is on a

- steep gradient
- High electrical load where total vehicle current drain exceeds 70A
- Ford Engine RPM Speed Controller System is active
- Unrecognised battery fitted or BMS damaged or removed
- Start-Stop button is pressed (LED illuminated)
- Accelerator pedal or clutch pedal is not released
- Greater than 100mA continuous load at ignition off. The BMS will be unable to correctly assess Battery state of charge
- Vehicle in Factory or Transport mode
- Third Party High Power mode has been set

## Stall Recovery/Start Abortion Recovery

Stall Recovery is an additional feature available with Start-Stop on manual transmission vehicles, and is active even if Start-Stop itself has been deselected or is inhibited. Under stall recovery, an automatic engine restart is invoked if the clutch pedal is fully depressed immediately following a vehicle stall, thus enabling the driver to quickly recover from a stall condition without needing to cycle the ignition key/start button. Stall recovery is only available for 5 seconds following a stall.

## Start-Stop Deselection - Start-Stop button with LED illuminated

The Start-Stop function may be deselected by the driver by means of the Start-Stop button on the dash panel. An integral amber LED in the button illuminates to indicate that the function is disabled. Pressing the button again (LED not illuminated) will make auto Start-Stop active. After ignition OFF and ON, Start-Stop will be re-enabled. This also inhibits SRC when the vehicle is not moving.

[Refer to: 4.4 Charging System](#)

## Vehicle Modification Considerations

There are two main considerations: impacts to Start-Stop behaviour as a result of vehicle modifications and impacts from the Start-Stop system.

## Impacts to Start-Stop Behaviour

Inhibitor occurrence may be increased by vehicle modifications. For example, the 12V energy management system on the vehicle is designed to allow the engine to shut down only if the current drain is less than 70A. High current loads may lead to this threshold being exceeded. In addition, engine stops will be inhibited if the Battery state of charge is below 68%, which may occur if added electrical loads are active during key off periods. Once disabled, battery state of charge needs to be greater than 70% to re-enable Start-Stop. When installing extra peripherals, be aware of the continuous/quiescent current drain of such equipment, even when in Off or Standby mode. Any module should not draw more than 5mA in electrical load when off. If current draw is high at key

off, a different battery system should be considered instead of the standard fit battery system. The AGM 2 x 80Ah twin system which has been engineered to work with Start-Stop, should be considered if electrical loads will be high at engine run and engine off but total key off load including Ford systems must not exceed 100mA.

**NOTE:** Regardless of the battery configuration, key off load in excess of 100mA for 7 days or more will cause Start-Stop to inhibit.

For additional information

[Refer to: 4.5. Battery Systems](#) Battery Monitoring Sensor

Start-Stop is only designed to operate with the specified Battery type for the system. Fitting additional Batteries - or the incorrect type - will cause incorrect state of charge assessment, leading to Start-Stop becoming permanently inhibited and therefore the fuel saving features lost. This is the same for Smart Regenerative Charging (SRC).

[Refer to: 4.4 Charging System](#) SRC.

The driver's door switch is used to help identify if the driver has left the vehicle and prevent engine shutdowns. If any modifications are made to the door or switch, then this functionality may be affected. If the driver's door is not used, then ensure this switch is permanently closed (input grounded).

The system uses signals from switches/sensors on the clutch, brake and accelerator pedals along with the transmission shift mechanism. To avoid compromising the safety of the system, no electrical connection should be made to any of these signals.

## Impacts from Start-Stop System

Start-Stop is designed to shut down the engine when it would otherwise be idling. Some modifications may rely upon a running engine to operate. Ford's RPM speed controller will automatically inhibit Start-Stop from shutting down the engine when the vehicle is stationary. Aftermarket systems do not have this facility so the driver may need to use the Start-Stop button to disable Start-Stop when such devices are being used. The starter relay should never be bypassed or driven directly.

With the Ford fit RPM controller, please be aware that the throttle pedal functionality is different. For instance, if RPM is active, pressing the throttle pedal will stall the engine. If an RPM controller is required – it is recommended to use the Ford engineered system as this is developed with the Start-Stop system. An aftermarket fit system may still have the engine switch off when not expected.

The SVO feature engine run signal, which is a switched ground signal, on a Start-Stop vehicle is only active when the vehicle's engine is actually running (for example: not active during an auto-stop). Any equipment connected to the engine run signal will therefore experience more cycles than on a conventional vehicle. Such equipment must ensure that it can handle a lifetime of 300,000 cycles. A quiet or silent type relay may also be required as these

increased cycles may be audible to occupants during Start-Stop events. Alternatively, consider packaging the control system away from the occupants.

All convertor fit loads should be connected to either CCPs. Convertor fit loads must not be connected to the vehicle start battery, on a twin battery system.

## Using the Start-Stop Button

For vehicles with alternators only, the Start-Stop deactivation button also deactivates SRC when pressed (when LED tell-tale is illuminated). When SRC is deactivated, and the vehicle is stationary, the engine will not shut down and the battery will be charged by the alternator with Conventional Charging. The function has a delay of a few seconds before taking effect.

## Automatic Engine Idle Shutdown (AEIS)



**WARNING: AEIS is a safety feature to turn off engines after a set time. Carbon Monoxide (CO) can accumulate from engines left running in confined spaces. CO is poisonous and can lead to death. Using the Third Party High Power mode in this condition may inhibit AEIS, disabling this safety feature. Avoid using the Third Party High Power mode AEIS-inhibit in confined spaces.**

AEIS may be inhibited by the Third Party High Power mode which will keep the engine running at idle. The Third Party High Power mode has other behaviours during engine run and engine off. Use of Third Party High Power mode at engine run may affect emissions performance and vehicle re-homologation may be required.

[Refer to: 4.4 Charging System](#)

### 4.10.3 Engine RPM Controller (DCNAB) System Overview

**NOTE:** For Engine RPM speed control with automatic transmission, please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com) where limited functionality can be achieved under certain conditions.

This feature enables the engine in the vehicle to be run at elevated RPM speeds. The power from the engine can then be used to drive ancillary equipment. The ancillary equipment may be powered via a Front End Accessory Drive (FEAD) layout (in a similar fashion to the air conditioning compressor).

The Vehicle Convertor should consider any increased engine cooling requirements due to the conversion and running the vehicle's engine under load for extended periods while the vehicle is stationary.

[Refer to Section 3.3.1 Front End Accessory Drives](#)

## 3 Modes of Operation

There are 3 principle modes in which this feature can operate, they are:

1. **3 Speed Mode:** This provides the end user a choice of up to 3 preset RPM values of 1100, 1600 and 2030RPM to select from. The end user cannot easily override these values, so there is minimal risk of damage to ancillary equipment due to it being run at speeds it was not designed for. Very limited vehicle speed is allowable while in this mode (up to 2.5mph approx). This is the default mode when the option is ordered from the factory
2. **Variable Speed Mode:** This provides the end user with RPM speed ramp up and down buttons. The end user is free to select RPM values between 1300-3000RPM in 25RPM steps. A single press results in a 25RPM jump. If a ramp button is held depressed by the end user, then the rate of change is 250RPM/sec. Very limited vehicle speed is allowable while in this mode (up to 2.5mph approx). Variable mode can be switched to via entering the 'Learn Mode', alternatively a dealer can select it via Ford Diagnosis and Repair System (FDRS).
3. **Idle Up Speed:** *Note that this mode is not allowed with automatic transmission, since the increase in idle speed can affect creep torque.* This mode allows the engine's normal idle to be increased (in 25RPM steps) in the range 900-1200RPM. There is not a vehicle speed restriction in this mode as the intended use is to raise the engine idle to reduce the likelihood of engine stall when ancillary equipment is being run from the engine during normal drive operations. For example: refrigerator units used to keep the cargo bay cool. Idle up speed mode can only be switched to via a dealer using FDRS tool.

## System Availability

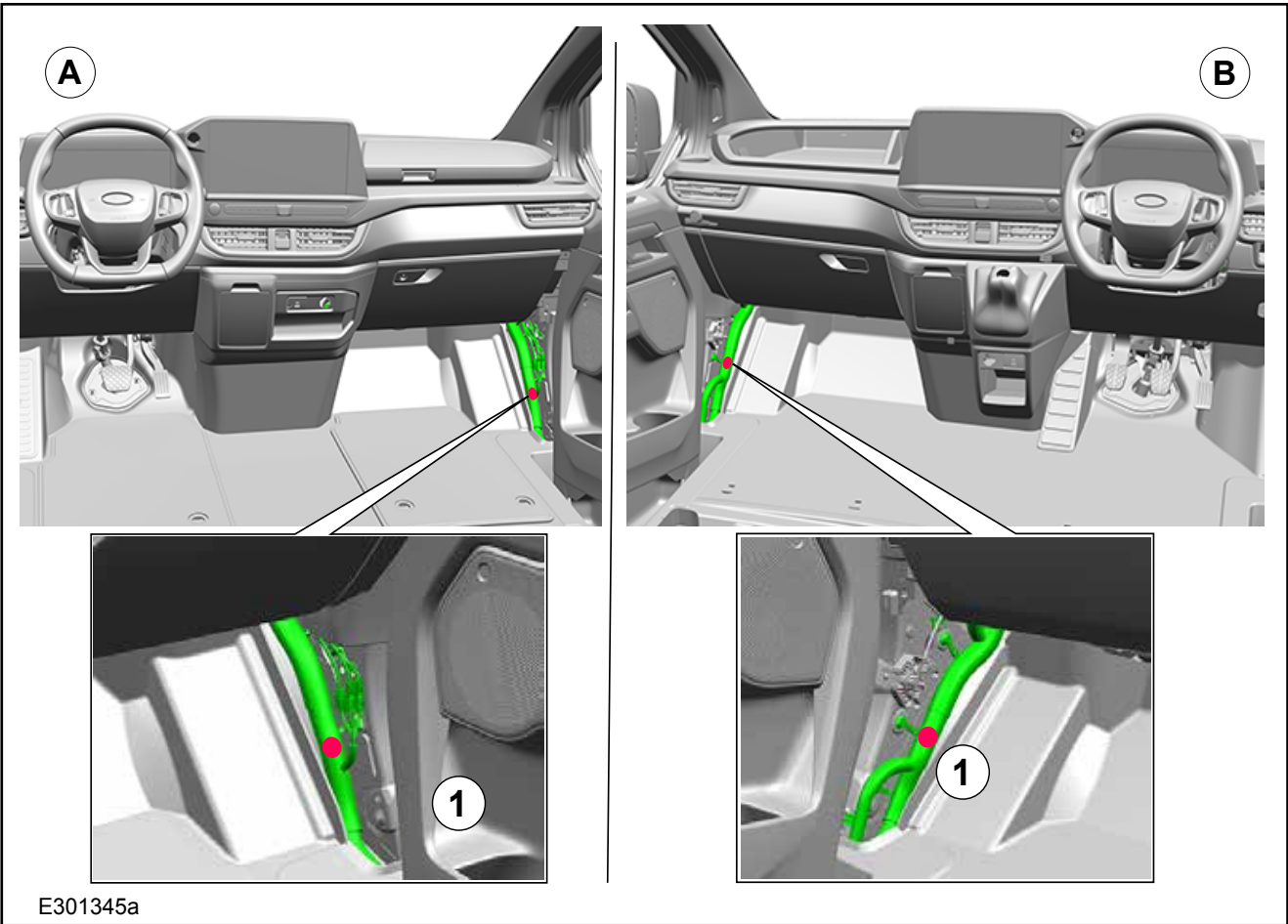
This feature is built into the latest Powertrain Control Module (PCM) software on all diesel engine variants.

By default, the feature is not enabled unless the vehicle is specifically ordered with the feature from the factory.

Vehicles which have not been ordered with this feature, may have the feature enabled at a dealer via the Ford Diagnostic Repair System (FDRS). There is a dealer charge for this service.

Vehicles fitted with Start-Stop technology may be converted to RPM speed control, however, the customer should turn Start-Stop off prior to starting RPM speed control. For more information refer to 'Impacts from Start-Stop System' in this section.

Loop Location



Item	Description
1	RPM Loop wire
A	Left Hand Drive
B	Right Hand Drive

How to Control this Feature

**NOTE:** Ford does not supply the Control Box.

A loop of wire (green/white) is provided in the main electrical harness to permit control of the RPM Speed Control software. Cutting this loop will provide two wires to connect a Control Box to the PCM. The loop wire is always on the left hand side of the vehicle.

The Control Box needs to switch resistors into the circuit across the two green/white wires which formed the loop prior to being cut. This sort of circuit is known as a resistance ladder, see figure E88295.

The PCM software monitors the green/white wire circuit and when certain resistances are detected they are interpreted as various inputs which control the feature. The switch box can be located where it is ideally required for the vehicle conversion in question, rather than having to be mounted on the Instrument Panel (IP). If the Vehicle Converter chooses to locate the switch box in a location which is subject to an adverse environment, then the Vehicle Converter should design the switch box to withstand with these conditions.

On left hand drive vehicles, the loop is taped to the harness feeding the fuse/relay box, located behind the lower instrument panel trim to the left of the steering wheel, this can be accessed through the bottle holder, see (A) in figure E301345. Refer to Workshop Manual for removal of trim.

On right hand drive vehicles (B) the loop is taped to the harness which feeds the 64 way main instrument panel connector, located behind the lower instrument panel trim, which can be accessed through the glovebox, see figure E301345. Refer to Workshop Manual for removal of of trim.

Resistance Ladder

The resistance ladder circuit acts as a potential divider. The PCM has an internal reference voltage of 5V. Current passes through an internal 320ohm resistor (not shown above) prior to passing through the resistance ladder. There is also a (second) 220nF capacitor internally within the PCM between the 320ohm resistor and ground (not shown above) and this is to reduce EMC effects.



To ensure robust operation, it is recommended for all switches that a switch debounce specification is chosen as close to 0ms as possible.

Starting from the right of the diagram, when the key switch is closed, only 2110ohms is in the circuit and the PCM software recognises this as the RPM mode being armed and ready for operation (key switch closed = off, open = on). A key switch is recommended in this position if:

- The Control Box is located externally on the vehicle, the requirement for a key avoids any passers by being able to put the vehicle into RPM Speed Control mode by simply pressing a button.
- Using a key switch where the key can be removed in either the on or off condition could be used as an aid to anti-theft. If the operator uses a key to put the vehicle into RPM Speed control mode and then removes the key, then the vehicle cannot quickly and easily be taken out of RPM speed control mode. If a foot pedal is pressed while in either the 3 speed or variable speed modes, the vehicle's engine will stall and therefore, the vehicle cannot easily be driven away and stolen. For latest software update, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

When in 3 speed mode, pressing any of the middle 3 switches (with the feature armed) results in the engine RPM jumping to the corresponding RPM value held in memory (defaults of 1100, 1600 or 2030RPM) for the 3 switch positions. A second consecutive press of the same button returns to normal idle.

When in variable speed mode the same 3 buttons act as ramp up, ramp down and return to idle selections respectively.

The software in the PCM responds to the change of state, so it is recommended that these 3 middle switches be non-latching push button micro switches. When going from idle to an elevated RPM the execution of the command will occur as the button is released. When going to idle the execution of the command occurs as the button is pressed.

The final button (the one on the left in figure E88295) acts as a vehicle engine stop. It is recommended that this be a red and oversize non-latching micro switch button. The execution of this command will occur as the button is pressed.

All wiring connecting the PCM to the resistance ladder Control Box should be shielded and twisted (33 twists/m) to reduce EMC effects.

All resistors should have a tolerance of  $\pm 5\%$  or better.

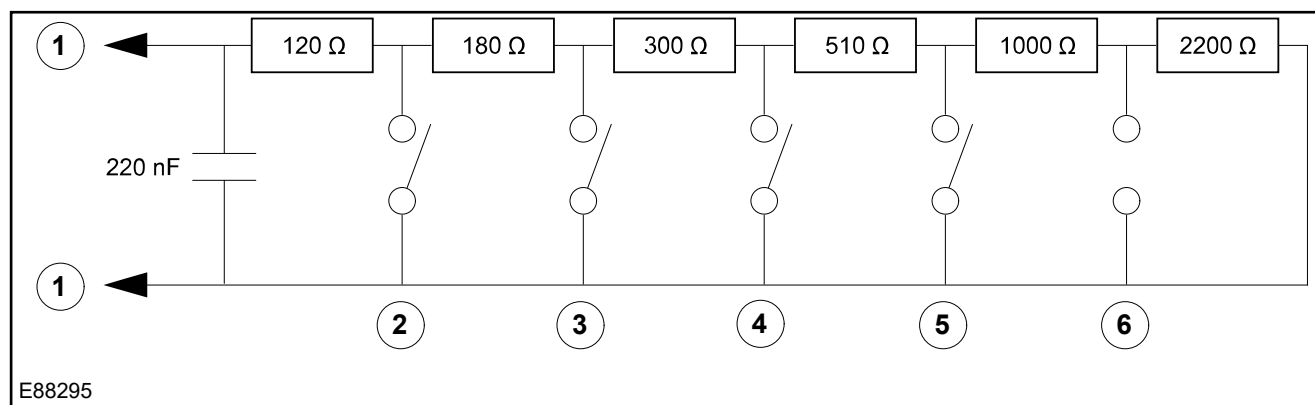
Switch contact, connectors and loom (loom between the green/white wires and the Control Box) total resistance must be no greater than 5 ohm max.

The PCM to resistor ladder control switch box loom should not come within 100mm of any other harness, especially any carrying heavy loads.

Designs which do not require all the button switches must still have the complete resistor network with the switches positioned correctly within the network.

A suitable two way quality connector should be used to connect the Control Box to the 2 green/white wires.

### Resistance Ladder Circuit



Item	Description
1	To Green/White Wire
2	Stop Engine
3	RPM 1 on/off or Variable Control 'Idle'
4	RPM 2 on/off or Variable Control 'Negative (-)'
5	RPM 3 on/off or Variable Control 'Positive (+)'
6	RPM Control Armed or Increased Idle on/off



## How to Change the Default Settings

**NOTE:** It is not possible via either method below, to change the step value of 25RPM per press or the 250RPM per second for a held down button, in the variable RPM speed.

By default, when the feature is first enabled (either via factory order or via dealer using a FDRS tools), it will be set to the 3 speed mode of operation with preset RPM values of 1100, 1600 and 2030RPM for the 3 speeds.

There are two methods by which these defaults can be modified:

1. Via a FDRS at a Ford dealer (there may be a charge for this)

Via the FDRS, the mode of operation can freely be changed between any of the 3 principle modes of operation, the feature can even be turned off (disabled). The 3 default RPM speeds can also be modified within the allowable range for the mode of operation as detailed in this section.

Trailer Tow features are enabled via the Ford Diagnostic Repair System (FDRS). There may be a dealer charge for this service.

FDRS access can be purchased from Ford Service Info <https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F>

2. Via an inbuilt vehicle 'learn mode'

Via the vehicle 'learn mode', it is possible to switch from the default 3 speed mode to variable speed mode, however it is not possible to switch back using this method.

## How to Enter Vehicle 'Learn mode'

1. Make sure that the RPM Speed controller switch box is connected but turned off
2. Start the engine (vehicle out of gear and no foot pedals being pressed, handbrake on)
3. Wait a couple of seconds for the instrument panel start up diagnostic lamps to extinguish
4. Press and release the clutch pedal
5. Press and release the brake pedal
6. Repeat steps 4 and 5 a further four times (clutch and brake pressed a total of five times sequentially each)

**NOTE:** Steps 4 to 6 have to be started within 10 seconds of the engine start.

The vehicle should now be in 'learn mode'.

On successful entry into 'learn mode' the engine RPM will momentarily rise up to 1000RPM and drop back to normal idle, which can be seen by monitoring the rev counter needle while performing step 6 above.

## How to Select Between Modes

**NOTE:** If the engine stalls at the initial brake pedal input then the vehicle was not in - or has dropped out of - learn mode and you will have to restart the learn procedure.

1. Enter learn mode (see directions above)
2. Arm the RPM speed controller (turn the key switch to On)

If the vehicle is already in 3 speed mode (the initial default):

3. Press and release the brake pedal five times

The vehicle should now be in variable speed mode. The new settings can be saved and learn mode exited (see below).

OR

4. Press and release the brake pedal once
- The vehicle should now be in 3 speed mode. The new settings can be saved and learn mode exited (see below).

Using this method, it is easy to change between these two modes of operation for the RPM speed controller.

## How to Change the 3 Pre-set Default RPM Values in the 3 Speed Mode

**NOTE:** If the engine RPM responds to the initial RPM button press, then the vehicle has not entered 'learn mode' correctly and you will have to restart the procedure. If the engine stalls at the brake or accelerator pedal inputs then the vehicle was not in - or has dropped out of - 'learn mode' and you will have to restart the procedure.

1. Enter 'learn mode' (see directions above)
2. Arm the RPM speed controller (turn the key switch to 'On')
3. Press and release the brake pedal once
4. Press and release the RPM button that requires re-programming
5. Use the accelerator pedal to rev the engine to the new desired RPM speed and hold at this speed (only speeds between 1200 to 3000 RPM can be selected in 3 speed mode)
6. Press and release the same RPM button to reset the stored RPM speed to the current engine RPM
7. Release the accelerator pedal
8. Repeat steps 4 to 7 for the remaining RPM buttons.

The three RPM speeds should now be reprogrammed to the new RPM speeds. The new settings can be saved and 'learn mode' exited (see below).

## How to Save New Settings and Exit from 'Learn Mode'

**NOTE:** The engine stalling indicates that the settings should have been saved and the vehicle has exited from 'learn mode'. Learn mode however is very specific that the exact steps are taken in the correct order and within certain time limits otherwise the learn procedure fails and it may take several attempts to get this order and timing correct and a successful modification from the default settings.

1. From within the 'learn mode' and with the RPM Speed Control switch box 'armed', fully press and release the clutch pedal at least five times in quick succession. The engine may stall out on the last depress which is normal, however if the engine does not stall out after at least 5 clutch pedal depresses, then you can key off after the sequence of rapid clutch depresses
2. Restart the engine and test the new settings, repeat above procedures if necessary,

## Troubleshooting - Reasons Why RPM Speed Control Operation May Stop or Fail to Start

The RPM Speed control software monitors vehicle information during operation in RPM speed control mode and will drop out of RPM speed control and/or stall the engine should any inhibit signals be detected. For example:

- If the engine temperature becomes too hot then RPM speed control will stop in order to protect the engine
- If the engine oil lamp illuminates then RPM speed control will stop in order to protect the engine.
- If the low fuel level lamp illuminates then RPM speed control will stop so that the vehicle can be driven to a refuelling point
- If there is a MIL warning lamp illuminated, for example ABS/Traction control, then RPM Speed Control may not be possible
- If the vehicle speed exceeds approx 2.5mph while in 3 speed or variable speed modes, then RPM speed control will stop. RPM speed control should normally be operated with the handbrake on, but some uses may require a low level of vehicle 'creep' during RPM speed control operation
- The software monitors for 'stuck on' buttons on the control switch box, this may result in RPM speed control being halted. A button that is held down for too long may be registered by the software as a 'stuck' button
- The software monitors the foot pedals, if depressed these may stall the engine if in 3 speed mode or variable speed mode (does not apply to idle up speed)
- If the control switch box circuitry significantly exceeds 2110ohms or there is a short circuit then RPM speed control will not be possible

- If a PTO conversion has been attempted on a vehicle with a non-anti lock braking System (ABS) then RPM speed control will fail due to vehicle speed being registered via a transmission speed sensor and/or the need to press the clutch in order to put the vehicle in gear while in RPM speed control mode

## 4.10.4 Diesel Particulate Filter (DPF) and RPM Speed Control



**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 the engine has stopped. This is a potential fire hazard.**

The DPF captures soot in the exhaust fumes to improve vehicle exhaust emissions. The condition of the DPF is monitored by the vehicle's electronic systems. Under normal driving conditions a regeneration feature is automatically triggered to clean the filter. If the DPF becomes full, a red engine warning lamp illuminates on the instrument cluster and the vehicle will need to be taken into the local Ford dealer to have the DPF specially purged.

Vehicles fitted with DPF, running under RPM Speed Control with the engine running under load at elevated idle, may produce soot build up over time. With the vehicle stationary, the DPF is unable to start a regeneration event. It is therefore recommended that Vehicle Convertors advise operators to break up any long periods under RPM Speed Control operation with some normal driving to permit the DPF to regenerate. Rapid cycling of the engine RPM, while in the RPM Speed Control mode, should be restricted where possible, as RPM transients increase soot generation rate. Where the anticipated use for RPM Speed Control is expected to be for longer durations, it is strongly recommended that the Operator Commanded Regeneration (OCR) option is also specified in conjunction with RPM Speed Control (check with your local Ford dealer for availability of option). OCR allows the driver/operator to manually perform a DPF regeneration while the vehicle is stationary, after confirming that it is safe to do so.

For additional information on DPF [Refer to: 3.7 Exhaust System](#)

## 4.10.5 Changing Vehicle Speed Maximum Setting

The Vehicle Speed Maximum Setting can be changed via the IDS menu under the following tabs: Toolbox, Powertrain, Service, Functions, PCM. The IDS on screen menus will guide the dealer through the options and setup.

IDS/FDRS access can be purchased from Ford Service Info <https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F>

## 4.11 Tachograph

**NOTE:** For further information on fitting a Tachograph, Speed Sensor or Dedicated Short Range Communication (DSRC) Unit please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

It is recommended that any vehicle that requires a Tachograph System is sent to an authorised Continental 'Tachograph Service Centre' (previously known as Siemens VDO) for software installation and calibration.

Ford Motor Company is not responsible for calibration of any tachograph unit.

Details of all recommended service centres can be found on Continental/ VDO web sites. These sites also contain details of current regulations and tachograph operation.

### 4.11.1 Legislation

 **WARNING: All tachographs require the same wiring connections as this is controlled by tachograph legislation.**

**NOTE:** Digital Tachograph (DTCO) & DSRC Antenna are a legal requirement under EU regulations 165/2014 from June 2019.

### Pin Assignment

For detailed information about pin assignments please contact your National Sales Company representative. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### Wiring

The tachograph wiring consists of three parts:

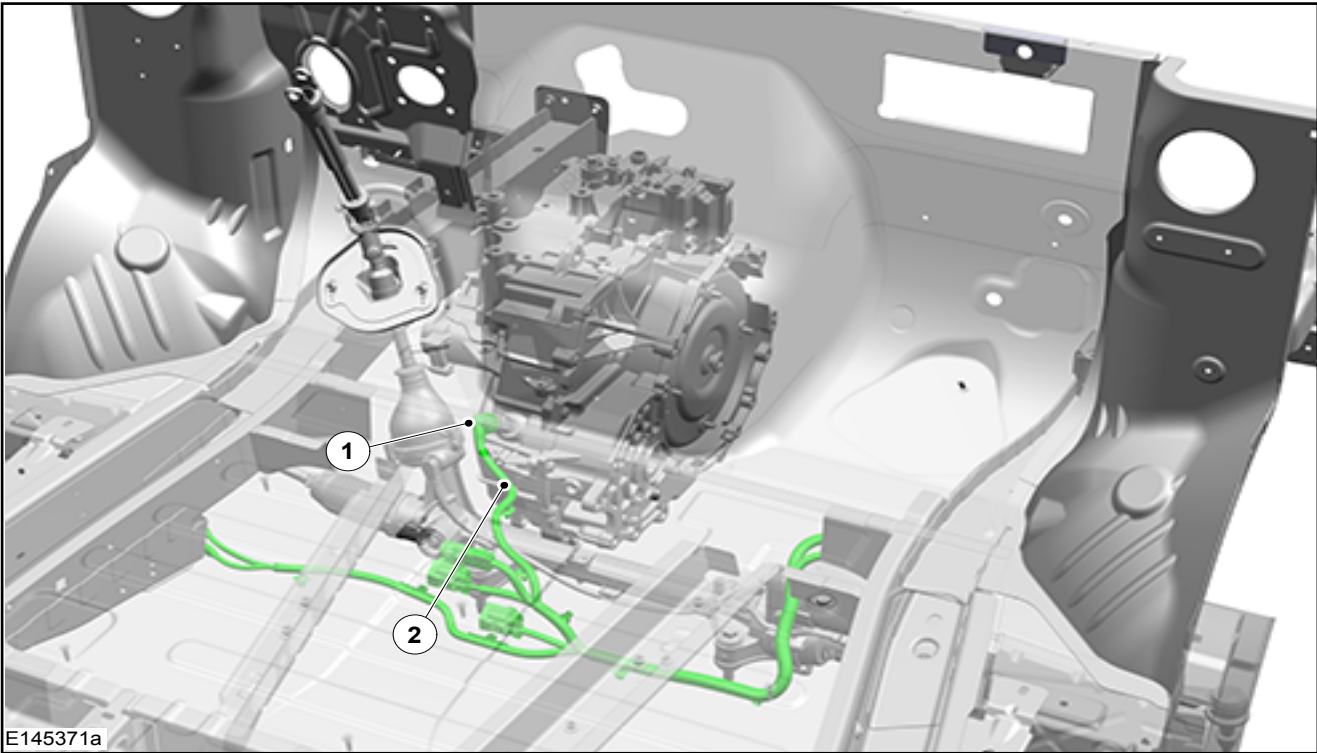
- Speed Sensor Harness, see figure E145371a for harness routing
- Tachograph Harness, see figure E291562 Rev1 for mounting and harness routing
- DSRC Harness, see figure E291562a Rev1 for mounting and harness routing

### 4.11.2 Retrofitting a Tachograph and DSRC

**NOTE:** For further retrofitting instructions please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

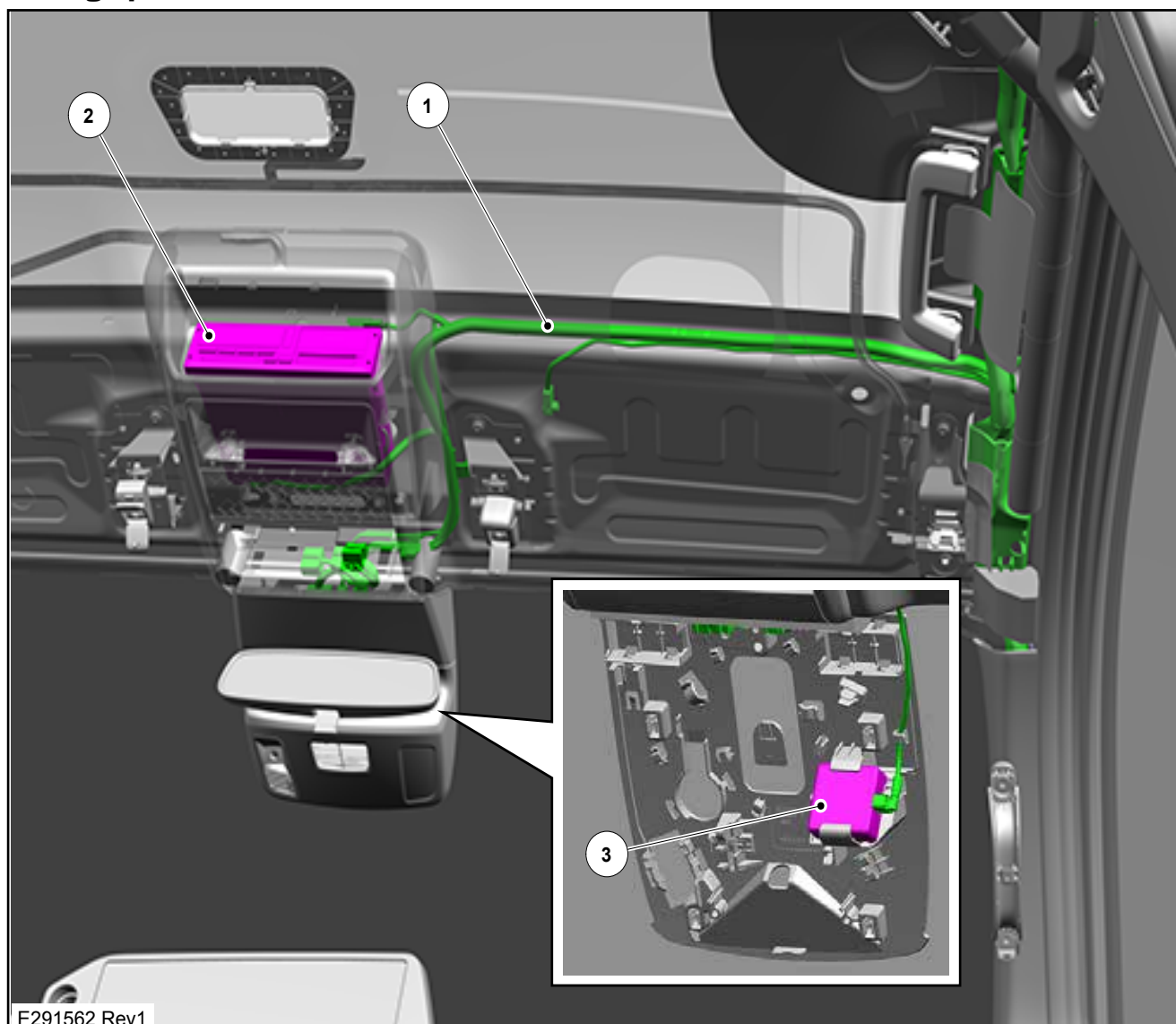
**NOTE:** If a tachograph is required, it is recommended that this is ordered on the base vehicle.

### Tachograph Speed Sensor Harness Routing



Item	Description
1	Main Harness
2	Tachograph Speed Sensor Harness
3	Clips
4	Speed Sensor into Transmission

## Tachograph Harness and DSRC



Item	Description
1	Tachograph Harness
2	Tachograph Digital Head Unit
3	DSRC

**NOTE:** The base vehicle ordered must have an overhead console and the correct level of trim (headliner) to support fitting a Tachograph and DSRC.

**NOTE:** If for any reason the DSRC Carrier needs to be replaced or fixed on the windscreen then please refer to the assembly instructions in the workshop manual.

If the system was not ordered on base vehicle then the DSRC Harness will need to be fitted accordingly. Please review the assembly instructions in the workshop manual. It is recommended that the dealership/FORD carries out fitment process for both DSRC Unit & Harness.

The Tachograph, Speed Sensor and DSRC will be fitted by Ford on the base vehicle as recommended. The system will still need to be calibrated by an authorised Continental/VDO workshop. Your local Ford dealer will organise The Tachograph calibration.

### 4.11.3 Calibration and Tachograph Retrofitting

EU Legal legislation requires that before the vehicle can be used on the road, the DTCO tachograph **must** be calibrated and certified. The activation process must be completed by an authorised Continental/VDO workshop. The Ford Dealer will organise the tachograph calibration.

**NOTE:** The Tachograph and The Cluster have independent speed signal sources, thus a difference in distance reading between The two parts may occur.

## Parts required to support aftermarket fitting of a Digital Tachograph and Speed Sensor

Part Number	Description
<b>Mounting Parts</b>	
EK2B-V519K22-A*	Bracket Roof Console
BK21-V045B34-A*	Bracket Console Mounting Tachograph
4C1T-18923-A*	Bracket Radio Receiver
<b>Fixings</b>	
W525107_S437	Rivet (4x required)
W712703_S900	Clip
W502660_S437	Screw
<b>Tachograph Units</b>	
PK3T-17A266-A*	Digital Head Unit 4.1 EU countries
KK2T-17A266-A*	Digital Head Unit 3.0a AETR countries
<b>Speed Sensor</b>	
KK2T-17K321-A*	Speed Motion Sensor
PZ3T-17K321-A*	Speed Motion Sensor (length difference)
<b>Wiring Harness</b>	
JK2T-14K141-D*	Tachograph Harness
KK2T-14K141-L*	Speed Sensor Harness

## Parts required to support aftermarket fitting of a DSRC

Part Number	Description
<b>Mounting Parts</b>	
KK2V-19H507-B*	DSRC Cover
KK2V-19H507-A*	DSRC Plate
<b>DSRC Unit</b>	
KK3T-19J269-A*	DSRC Antenna
<b>Wiring Harness</b>	
KK2V-18812-A*	DSRC Harness



## 4.12 Information and Entertainment System

### 4.12.1 Audio Head Unit (AHU) - Multimedia in Car Entertainment (ICE) Pack Summary

The Multimedia System you have, as a standard fit, will depend on the market region, body style and model of the vehicle.

**NOTE:** Depending on the vehicle upgrade you are planning, it is important to order the right level parts that include new Instrument Panel Harness, Instrument Panel Bezel and Hood.

**NOTE:** For further details on Information and Entertainment System, parts and signals, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

#### AHU/Multimedia ICE Packs

ICE Pack	Description
2	Radio with SYNC Gen4
3	Navigation (NAV) SYNC Gen4 with DAB

## 4.12.2 SYNC Radio and SYNC Radio with DAB

**NOTE:** There are black co-axial cables from the door mirror fitted double FM/DB antennas that go to the radio. There are two co-axial cables for diversity antenna.

SYNC Radio is connected to the instrument panel wiring harness via two 32 pin connectors.

### SYNC Radio Main Connector J1

Pin	Description	Type	Pin	Description	Type
1	Battery	Input	17	External CD in L -	Input
2	Right Front Speaker -	Output	18	Not Used	-
3	Right Front Speaker +	Output	19	CAN-High	Input/ Output
4	Ground	Input	20	Not Used	-
5	Left Rear Speaker -	Output	21	Not Used	-
6	Left Rear Speaker +	Output	22	Not Used	-
7	Left Front Speaker -	Output	23	Not Used	-
8	Left Front Speaker +	Output	24	Shield & Ground RVC	Ground
9	Right Rear Speaker -	Output	25	RVC -	Input
10	Right Rear Speaker +	Output	26	Microphone -	Input
11	Not Used	-	27	External CD In L -	Input
12	Not Used	-	28	External CD In L +	Input
13	Microphone Shield	Ground	29	LIN	Input/ Output
14	RVC +	Input	30	CAN - Low	Input/ Output
15	Microphone +	Input	31	Not Used	-
16	External CD In L +	Input	32	Not Used	-

### SYNC Radio Main Connector J2

Pin	Description	Type	Pin	Description	Type
1	Not Used	-	17	Not Used	-
2	Not Used	-	18	SDL-High	Input/ Output
3	Not Used	-	19	Alert In +	Input
4	Not Used	-	20	Stereo In Left +	Input
5	Middle Left Speaker -	Output	21	Stereo In Right +	Input
6	Middle Left Speaker +	Output	22	Aux1 -	Input
7	Not Used	-	23	AE/CD	Output
8	Not Used	-	24	Not Used	-
9	Middle Right Speaker -	Output	25	Not Used	-
10	Middle Right Speaker +	Output	26	Not Used	-
11	AUX1+	Output	27	Not Used	-
12	AUX1 Shield	Ground	28	Not Used	-
13	Not Used	-	29	SDL-Low	Input/ Output
14	Not Used	-	30	Alert In -	Input
15	Not Used	-	31	Stereo In Left -	Input
16	Not Used	-	32	Stereo In Right -	Input



### 4.12.3 Rear View Camera

**NOTE:** Only vehicles with SYNC radios have the capability to support Ford camera fitment of the RVC.

There are two pins on the SYNC module.

- Pin C5-1 Input Power Digital Video (+)
- Pin C5-2 Input Power Digital Video (-)

The Sync module provides power to the RVC through 'Power Over Coax', preferably of a single run to minimise signal loss. The RVC communicates with the Sync module via LVDS.

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

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

## 4.13 Cellular Phone



**WARNING: Installation of any non-Ford-approved system is not recommended and operation with associated systems cannot be guaranteed. Any resultant damage will not be covered under warranty.**

Ford offer hands-free and wireless technology (Bluetooth) phone systems (including voice recognition) as factory-fit options, these will also be available as aftermarket accessory kits from your Ford dealership.

These use the Ford MS CAN multimedia bus to operate in conjunction with the Ford audio and navigation systems.

## 4.14 Exterior Lighting

### WARNINGS:



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

### 4.14.1 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.

### 4.14.2 Lamps – Front and Rear Fog Lamps

**NOTE:** The vehicle's rear fog lights will be switched off if a trailer is connected.

National Regulations regarding inter-connection with other front and rear fog lamps must be checked before designing the wiring circuit. The maximum permissible load with the standard system is:

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

### 4.14.3 Lighting Loads

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

### 4.14.4 Lamps – Hazard/Direction Indication

The standard system configuration each side:

- 1 x Front Indicator 21W and 1 x Side Repeater 5W (shared single output) - max load 27W.
- 1 x Rear Indicator 21W (single output - max load 27W).

### 4.14.5 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 convertor fit.

### 4.14.6 Additional External Lamps

All power for additional exterior lamps must be taken through the Auxiliary Fuse Panel with a suitable switch and/or relay as required.

[Refer to: 4.22 Fuses and Relays](#)

[Refer to: 4.23 Electrical Connectors and Connections](#)

### Lighting Loads

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

<sup>(1)</sup>Number Plate and Marker Lamps not to exceed 27W. LED Markers are recommended where available.

<sup>(2)</sup>Turn Indicator Supply. Smaller loads will trigger bulb outage detection.

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

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

## 4.15 Interior Lighting

### 4.15.1 Additional Internal Lamps

 **CAUTION: The maximum total internal lamp load must not exceed 7A (105W).**

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](#)

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

#### Power Supply for the Interior Lights.

The BCM provides power to the interior lights by three outputs, two for courtesy and one for demand:

- Cabin light courtesy function - BCM pin C3-13 with maximum load of 5A
- Cargo light courtesy function - BCM pin C3-26 with maximum load of 5A
- Combined cabin and cargo light demand function - BCM pin C3-14 with maximum load of 5A

**NOTE:** Tourneo Bus front and rear (over seat lights) are LED and use a master controller in the front overhead console light. The rear over seat lights are directly controlled from this. No additional lights can be added to this overhead lighting circuit.

Each interior light circuit is grounded locally to the lamp. The lamps fitted to the cabin or cargo circuit depend 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 rear cargo door or lift gate.
- 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. If fluorescent lighting is required, it should be connected to the Smart Fuse Box.

For further information on required parts and configurations to order, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.15.2 Additional Lighting for Rear of Vehicle Interior

Where higher wattage installations are required, these should be taken through the Smart Fuse Box with a suitable switch and/or relay as required.

For additional information [Refer to: 4.23 Electrical Connectors and Connections](#)

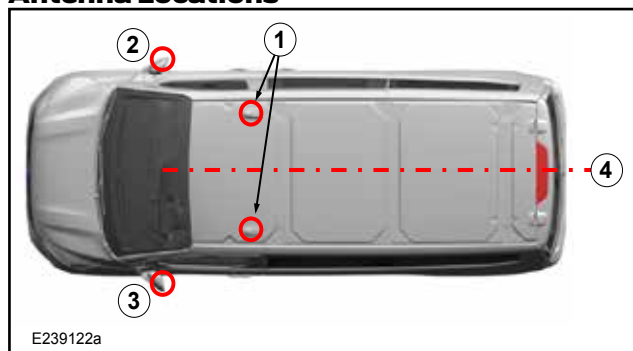
## 4.16 Emergency Call Systems

**NOTE:** Reception testing or loss of performance due to poor conversion/reinstallation are not the responsibility of Ford Motor Company.

**NOTE:** All vehicles with ICEfunction.

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### Antenna Locations



Item	Description
1	GNSS/5G Antennas location
2	FM DAB Antenna location
3	FM only Antenna location
4	Additional Antennas to be on centre line Y-0

### 4.16.1 Relocation of GNSS/5G Antenna

**NOTE:** The antenna is provided with a seal that fits to the roof surface, but it is the responsibility of the Vehicle Converter to ensure an adequate waterproof seal is achieved.

If it is unavoidable and necessary to fit an antenna, the following instructions are recommended:

- The antenna should be mounted on sheet metal (ground surface/plane) supplied. A metal roof is preferred, the antenna should still function if the ground plane is fitted to a plastic/fibreglass roof. The antenna includes two functions:
  - GNSS (GPS) required for vehicle location, which is dependent on receiving satellite signals from overhead
  - GSM (cellular) required for 'phone' communication, which is dependent on a clear line of sight from ground towers, for example: 'horizontal' transmission path. Hence a repositioned antenna needs to take these requirements into account and should be positioned on the highest possible packaging location, avoiding depressions wherever possible
- The ground surface does not require any further

grounding to the vehicle, it provides a reflective surface rather than acting as a grounding element

- Suitable fixings and sealing are required to secure the ground plane to the roof panel, for example 4x rivets
- The antenna base design/mounting requires a specific hole shape to ensure anti-rotation and orientation.
- The mounting on the antenna (shark-fin variant) will accommodate sheet metal thicknesses from 0.7mm to 1.5mm
- The GSM antenna family requires a **minimum** of a 150mm radius uninterrupted metallic ground surface area surrounding the mounting hole. No interruptions are allowed
- The antenna should be as close to horizontal as possible and must not be at an angle of greater than 12° to the horizontal
- The antenna is attached to the ground surface with a driven fastener from the underside of the plane. The fastener is a captured component on the antenna base
- Cabling needs to utilise RG58LL type cable as provided for each functional band with USCAR FAKRA-type SMB connectors, unless stated otherwise by the customer

The Vehicle Converter will need to create vehicle specific versions that meet the requirements previously mentioned in this section. A full range of reception tests will need to be conducted by the Vehicle Converter to ensure system performance.

Splitter (KK3V-18812-AE) is used when the base vehicle has a scarab (KK3T-19C175-A\*). An antenna for GNSS and new Shark Fin (GJ5T-19K351-AB) will be fitted to the conversion for GNSS.

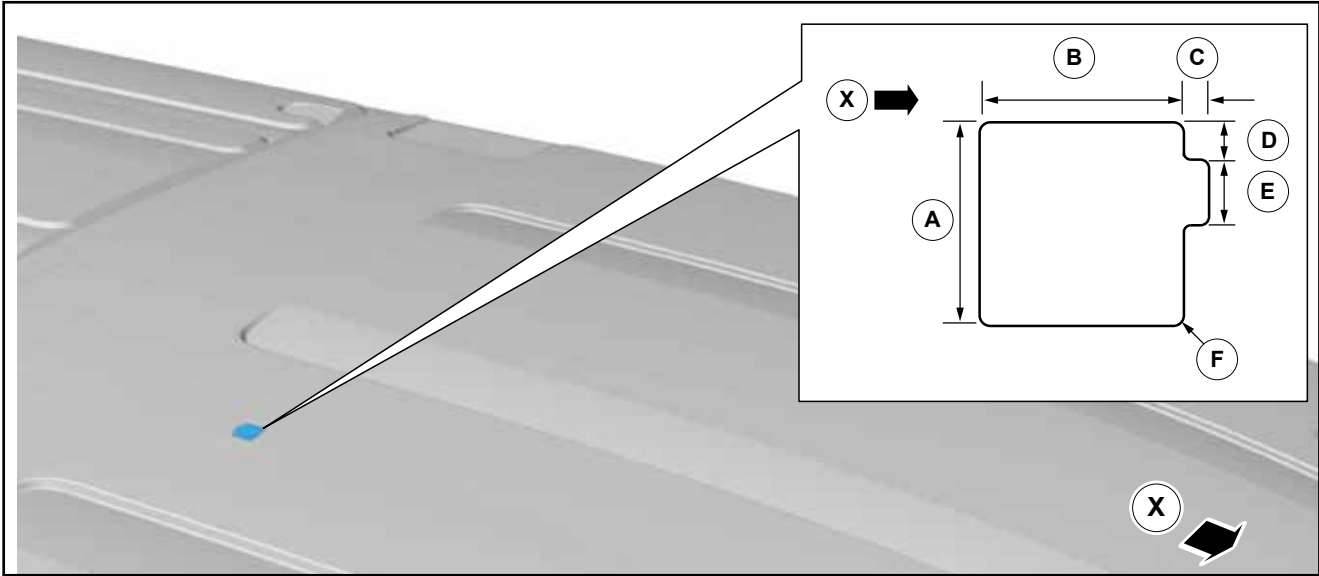
If it is unavoidable and necessary to move the antenna, the following instructions are recommended:

- Provide a minimum clearance of 50mm from all electronic (powered) devices and any wiring harness
- When mounting the antenna, place it on sheet metal at the highest possible metallic packaging location
- The antenna base design/mounting requires a specific hole shape to ensure anti-rotation and orientation (figure E234717). The roof and the position on the roof shown in figure E234717 are exemplary only
- The antenna requires a minimum of 150mm radius uninterrupted metallic ground surface area surrounding the mounting hole
- The antenna is attached to the vehicle with a driven fastener from the bottom side of the metallic ground plane. The fastener will be a captured component on the antenna base
- The antenna pigtail cabling needs to utilise RG174

type cables for each functional band with USCAR FAKRA-type SMB connectors, unless stated otherwise by the customer

- A body side cable is required to use 1.5DS-QFB cable for GNSS or RG-58LL cable for cellular
- The cable length between the Audio Head Unit and the antenna should not exceed 6m to meet required system RF performance
- A full range of reception tests will need to be conducted by the Vehicle Convertor to ensure system performance

Antenna Anti-Rotation Mounting Hole



Item	Description
A	25mm
B	25mm
C	3.2mm
D	5mm
E	8mm
F	1mm Common Radius x8
X	Front of vehicle direction



## 4.17 Cruise Control

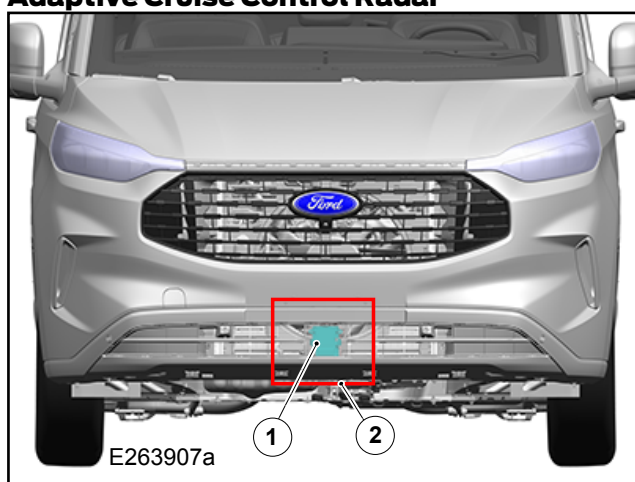
### 4.17.1 Adaptive Cruise Control

**CAUTION:** For converted vehicles fitted with adaptive cruise control, where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment and system functionality is checked by a Ford dealer. For further information refer to Workshop Manual or Owner's Manual.

**NOTE:** Do not obstruct the cruise control radar, see clearance zone 2 in Figure E263907a.

**NOTE:** Do not paint the front grille of the vehicle as this may affect the functionality of the cruise control radar.

#### Adaptive Cruise Control Radar



Item	Description
1	Adaptive Cruise Control Radar
2	Adaptive Cruise Control Radar clearance zone

## 4.18 Blind Spot Information System



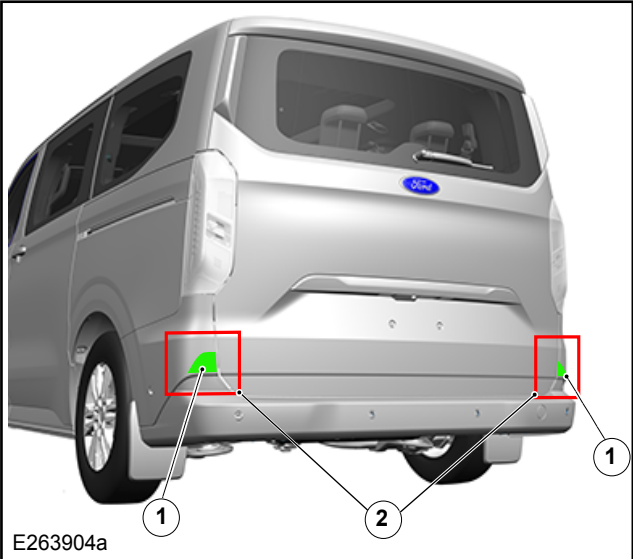
**WARNING: The Blind Spot Information System (BLIS) feature will not function if any conversion or installation is in the field of the multiple-beam radar modules which are packaged in the rear quarter panels - one each side.**

**NOTE:** Do not apply bumper stickers and/or repair compound to these areas, this can cause degraded system performance.

**NOTE:** The BLIS alert indicator(s) may turn on during heavy rain even though no vehicle(s) has entered the blind zone.

**NOTE:** If your vehicle has a tow bar with a factory equipped trailer tow module and it is towing a trailer, the sensors will automatically turn the BLIS off. If your vehicle has a tow bar but no factory equipped trailer tow module, it is recommended to turn the BLIS off manually. Operating the BLIS without the Blind Spot Trailer Tow package and a trailer attached will cause poor system performance.

### BLIS location



Item	Description
1	Multiple-beam radar module
2	Clearance zone

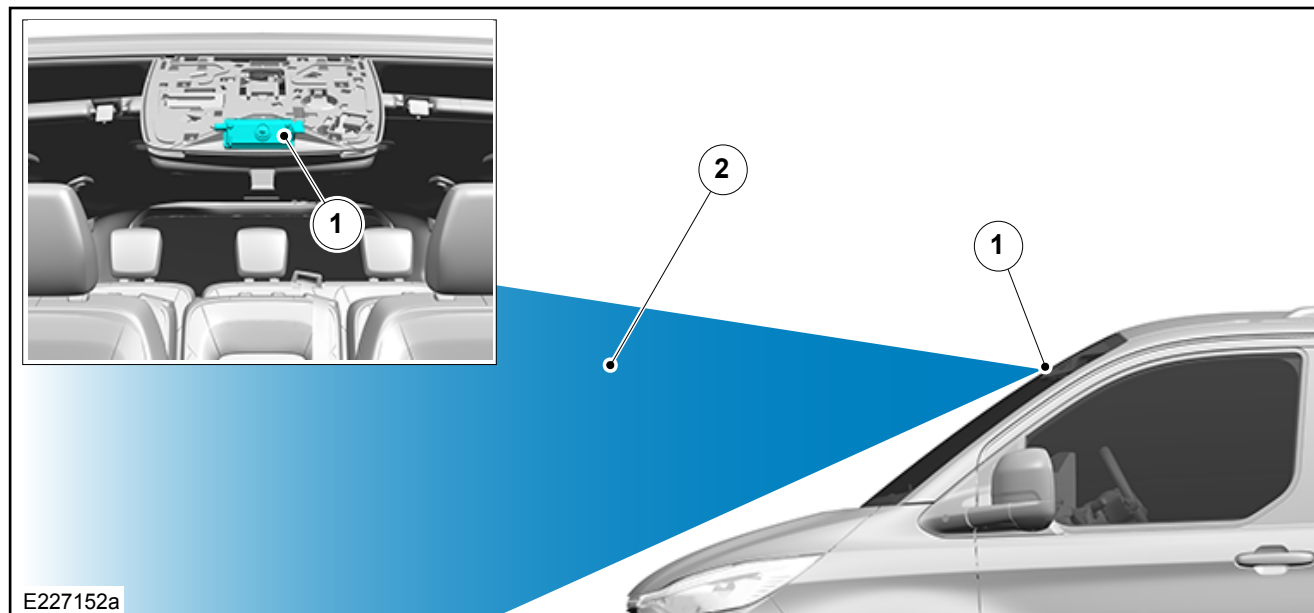
## 4.19 Lane Keeping System

**WARNING:** The lane keep alert feature will not function if any conversion or installation is in the field of view from the lane keeping system camera.

**NOTE:** For converted vehicles fitted with lane keeping system, where vehicle mass or geometry is

significantly altered, a new calibration for the camera sensor needs to be made.

For additional information for vehicles with large overhangs [Refer to: 4.20 Auto Wipe and Auto Lamp for Vehicles with Large Overhangs](#)



Item	Description
1	Lane keeping system camera located behind the interior rear view mirror trim
2	View cone from camera, horizontal direction and downwards to the bonnet edge of the vehicle

## 4.20 Auto Wipe & Auto Lamp for Vehicles with Large Overhangs

**NOTE:** Where the modified vehicle has an overhang likely to cover part or all of the rain/light sensor position on the screen, see figure E147777, this may affect the sensor's ability to detect light or moisture to the defined calibration and will not function correctly.

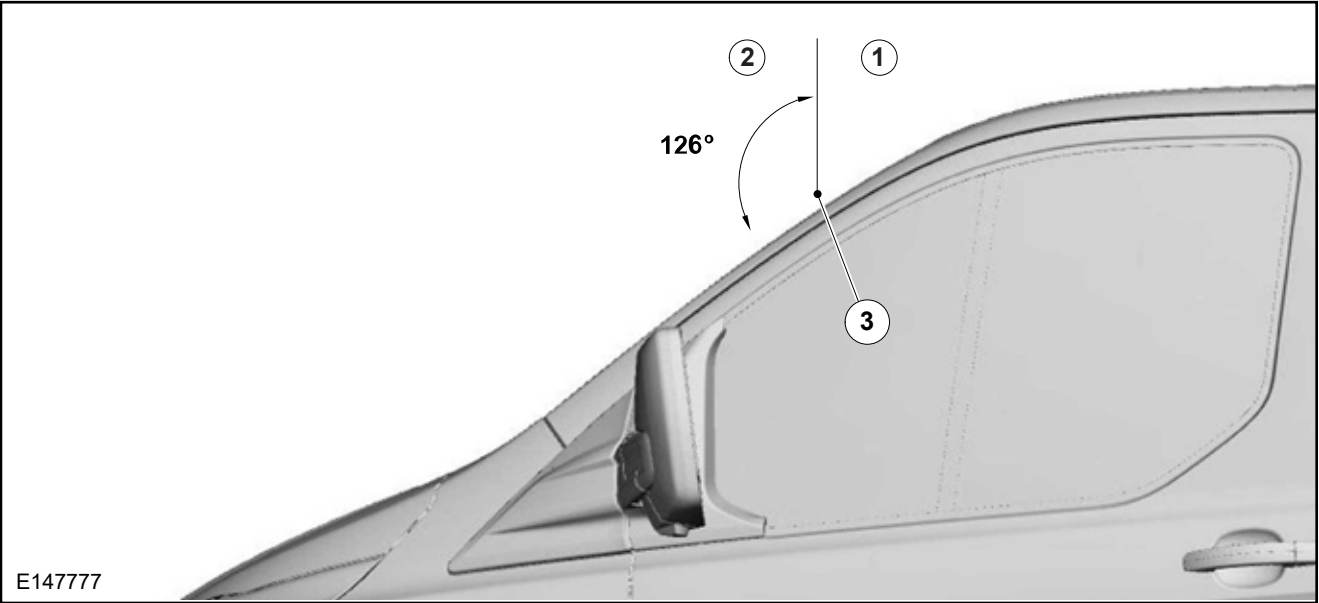
In the event that a donor vehicle has been supplied with these features, the vehicle can be modified to have manual wipers and headlamps in the following way:

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

For Auto Lamps, changing the headlamp switch to a non-auto switch will remove the auto position and the system will operate as if no sensor was present. If the Auto Lamp headlamp switch remains the customer may experience dipped beam remaining lit instead of daytime running lights with the ignition on and the switch in Auto. A Ford dealer can help advise which switch should be ordered and fitted, starting with part number PZ3T-13D061-\*\*

Be aware, when no headlamp switch Auto position is available (or Auto is not selected on the original switch), auto high beam (provided with forward facing camera) will also not be available or shown in the cluster.

### Auto Wipe and Auto Lamp for vehicles with large overhangs



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

## 4.21 Handles, Locks, Latches and Entry Systems

### 4.21.1 Door Removal or Modification

**CAUTION:** If an additional third party control system is incorporated into the Ford Locking/Unlocking System the Crash Event Can Signal must be utilised to override the third party control system to trigger a crash unlock feature within the locking system in case of a relevant event.

**NOTE:** If any modified doors have ajar switches fitted they should be polarity NORMAL\_CLOSED i.e. switch is closed when door is closed to maintain the alarm and interior lighting functions.

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

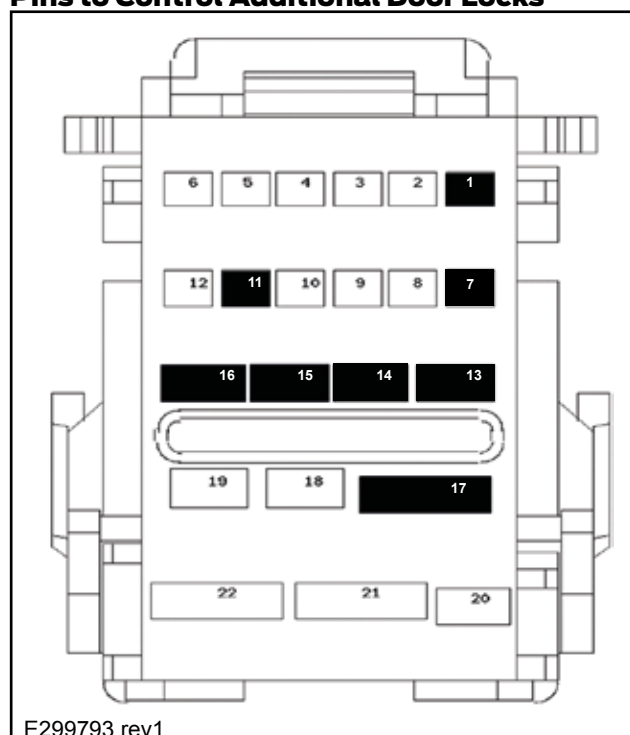
In the event of the requirement to remove the doors for derivatives requiring no doors, certain circuits will need to be linked to ensure door ajar warnings do not appear on the Instrument Cluster. The interior light will also stay on if this is not done.

It is possible to maintain a certain state by configuring the Body Control Module (BCM) J4 in the following way.

- J4-30 Front Left Ajar - Ground
- J4-22 Front Right Ajar - Ground
- J4-43 Liftgate Ajar Switch/Right Rear Hinged Cargo Door Ajar - Ground
- J6-18 Left Rear Hinged Cargo Door Ajar - Ground
- J4-45 Ajar Left Sliding Door Switch
- 4-15 Ajar Right Sliding Door Switch
- J4-44 Front Left Door Latch feedback
- J4-22 Front Right Door Latch feedback
- J4-42 Right Rear Sliding Door Latch feedback
- J4-07 Left Rear Sliding Door Latch feedback

Vehicles ordered with only the kerb side sliding door, only the kerb side sliding door ajar switch will be supported.

### Pins to Control Additional Door Locks



Item	Description
J3-13	Passenger Door Unlock
J3-07	Driver's Door Unlock
J3-14	Unlock Driver Side Sliding Door
J3-01	Unlock Passenger Side Sliding Door
J3-16	Central Lock
J3-17	Front Doors Double Lock
J3-15	Rear Side Door Double Lock
J3-11	Unlock Liftgate
C2-44	Unlock Cargo Rear Hinged Right Hand Side (pin in IPDB*)
C2-37	Unlock Cargo Rear Hinged Left Hand Side (pin in IPDB*)

\*IPDB - Power Distribution Box in Instrument Panel

4.21.2 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.

**Locking Configurations** The following list details specific locking scenarios that have been noted by customers:

- 1. Slam locking – this is a configurable parameter in the BCM.
- 2. Lock reconfiguration into no deadlocks – this can be reconfigured to be central-locking only by a Ford Dealer (via Dealership hotline, as requires vehicle As-Built to be updated).

4.21.3 Remote Keyless Entry/ Tyre Pressure Monitoring System Receiver (RKE/TPMS Receiver)

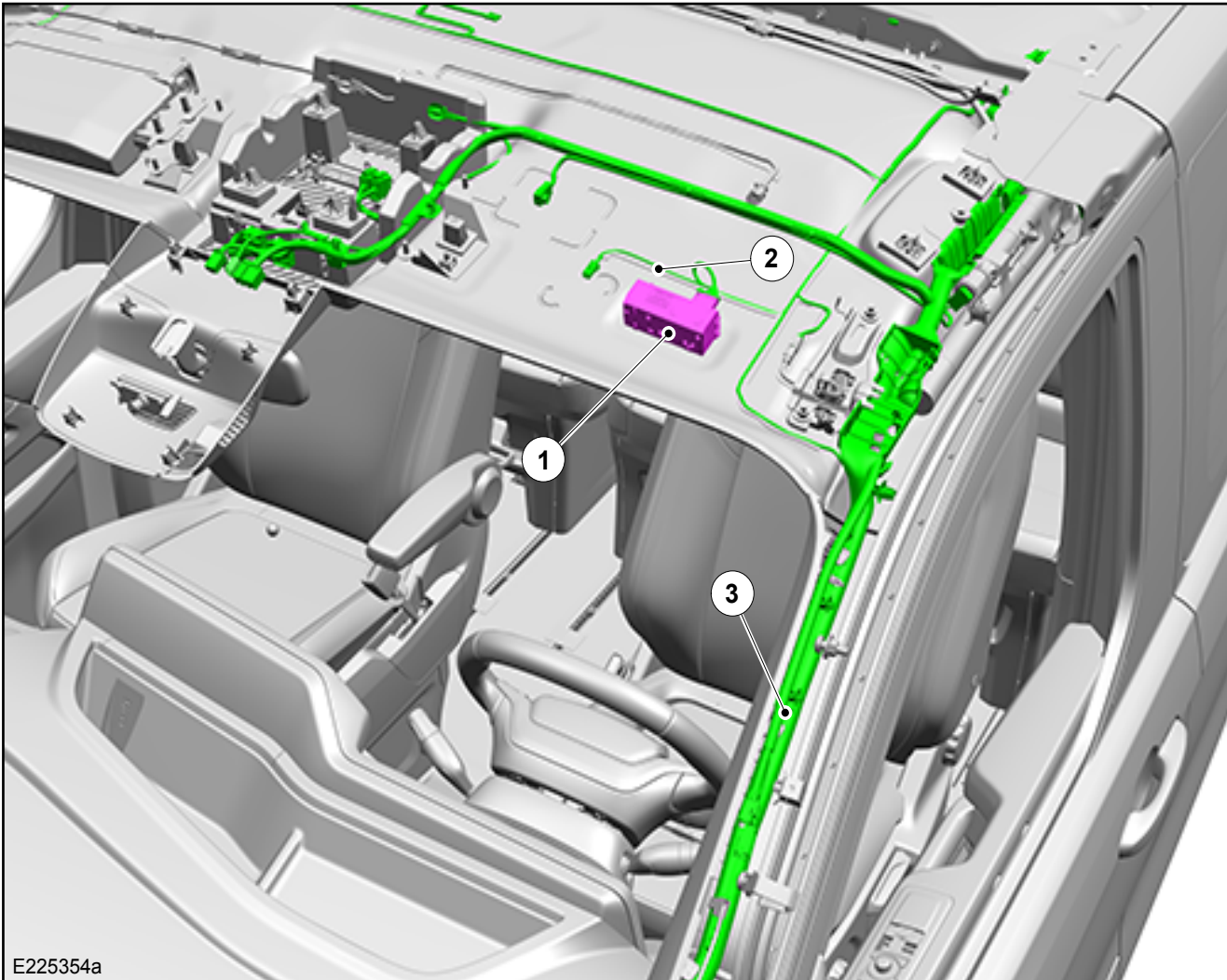
**WARNING:** For best performance, the RKE/ TPMS receiver must be a minimum distance of 25mm away from any metal objects and 100mm away from high switch loads.

**NOTE:** It is recommended that the RKE/TPMS has a dedicated ground wire and ground stud, do not splice with other modules.

The RKE/TPMS receiver is fed via a connection to the 14335 harness and then earthed at the ground point located on the 'A' Pillar.

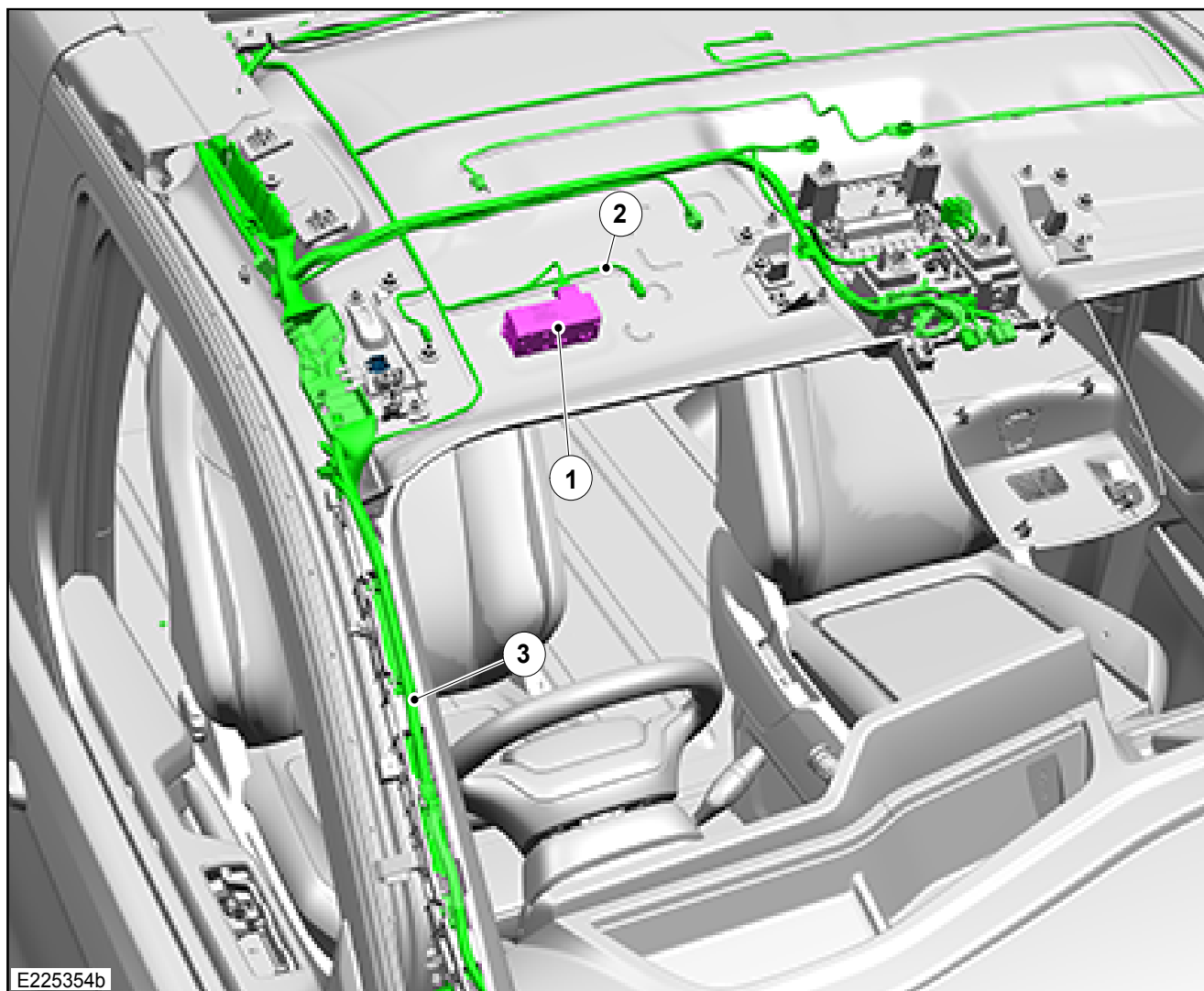
For ground point locations [Refer to: 4.24 Grounding](#) For additional information [Refer to: 2.4 Wheels and Tyres](#)

Remote Keyless Entry/Tyre Pressure Monitoring System Receiver LHD



Item	Description
1	Receiver Remote RF
2	Front Light Jumper
3	LHS Front to Back Roof Harness




**Remote Keyless Entry/Tyre Pressure Monitoring System Receiver RHD**

Item	Description
1	Receiver Remote RF
2	Front Light Jumper
3	LHS Front to Back Roof Harness

## 4.22 Fuses and Relays

### 4.22.1 Fuses

 **WARNING:** No increase in existing vehicle standard fuse capacity is allowed under any circumstances. There are no spare fuses in the Power Distribution Box (PDB), Smart Relay Box (SRB) or Body Control Module

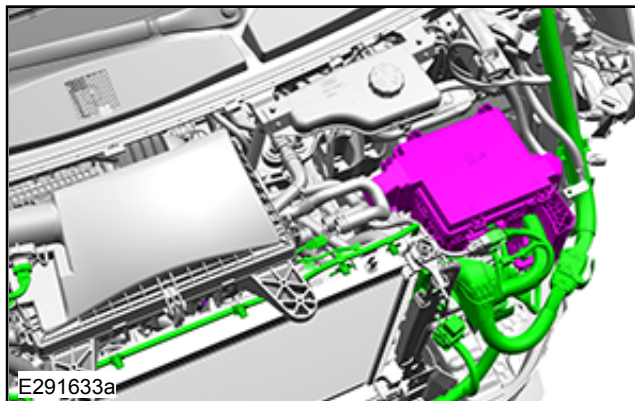
**(BCM). The Vehicle Converter must provide additional fuses as required. Please refer to the table below.**

**NOTE:** Only use Ford fuses as shown in table below. Other fuses may interfere with the validated fusing strategy.

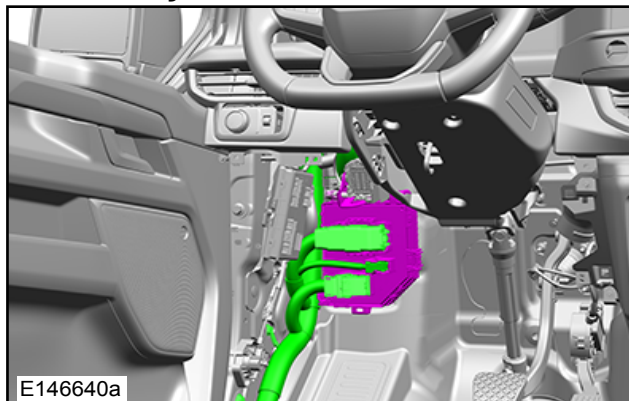
#### Ford Fuses

Part Number	Ampere Rating	Colour
<b>Mini Fuse</b>		
1L3T-14A094-A*	2A	Grey
1L3T-14A094-B*	3A	Violet
1L3T-14A094-C*	4A	Pink
1L3T-14A094-D*	5A	Tan
1L3T-14A094-E*	7.5A	Brown
1L3T-14A094-F*	10A	Red
1L3T-14A094-G*	15A	Blue
1L3T-14A094-H*	20A	Yellow
1L3T-14A094-J*	25A	Clear
1L3T-14A094-K*	30A	Green
<b>Micro2 Fuse</b>		
DG9T-14A094-F*	5A	Tan
DG9T-14A094-G*	7.5A	Brown
DG9T-14A094-H*	10A	Red
DG9T-14A094-J*	15A	Blue
DG9T-14A094-K*	20A	Yellow
DG9T-14A094-L*	25A	White
DG9T-14A094-M*	30A	Green
<b>Micro3 Fuse</b>		
DG9T-14A094-N*	5A	Tan
DG9T-14A094-S*	7.5A	Brown
DG9T-14A094-P*	10A	Red
<b>M-Case Fuse</b>		
DG9T-14A094-A*	15A	Grey
DG9T-14A094-B*	20A	Light Blue
DG9T-14A094-C*	25A	White
DG9T-14A094-D*	30A	Pink
DG9T-14A094-E*	40A	Green
<b>J-Case Fuse</b>		
F8SB-14A094-A*	20A	Blue
6E5T-14A094-A*	20A	Blue
2L5T-14A094-A*	25A	Natural
F8SB-14A094-B*	30A	Pink
6E5T-14A094-B*	30A	Pink
7T4T-14A094-D*	40A	Green
F8SB-14A094-C*	40A	Green
6EST-14A094-C*	40A	Green
7T4T-14A094-E*	50A	Red
F8SB-14A094-D*	50A	Red
6E5T-14A094-D*	50A	Red
7T47-14A094-F*	60A	Yellow
XS21-14A094-A*	60A	Yellow

### Power Distribution Box



### Smart Relay Box



## 4.22.2 Relays

**NOTE:** Only use Ford Relays shown in table.

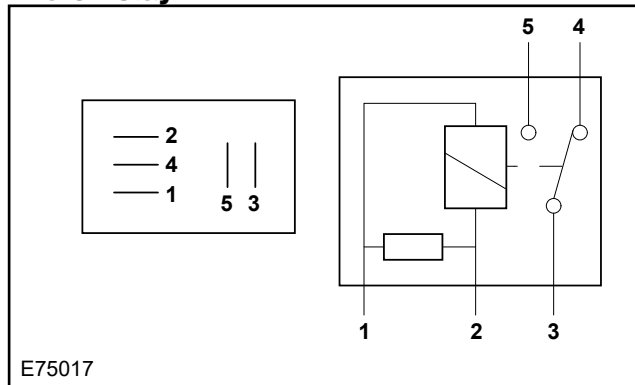
Ford standard relays have a nominal coil current of 300mA (max) at 25°C. Relays with higher loads should not be used.

For maximum switching currents please refer to Relay Figure E75017.

### Ford Relays

Part Number	Ampere Rating	Colour
5M5T-14B192-A*	20A	Black
5M5T-14B192-C*	40A	Black
5M5T-14B192-D*	40A	Black
5M5T-14B192-E*	70A	Grey
8T2T-14B192-C*	20A	Black
8T2T-14B192-A*	40A	Black
8T2T-14B192-B*	40A	Black
FU5T-14B192-A*	40A	Blue

### Micro Relay

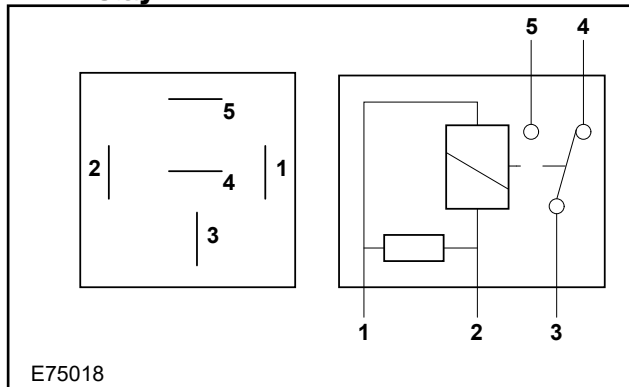


Micro Relay Parameters	
Open contacts	20A
Closed contacts	16A
Nominal coil current	300mA (max)

Medium current changeover relay - Part number: 6G9T-14B192-B\*

Medium current normally open relay - Part number: 6G9T-14B192-A\* (pin 4 not present)

### Mini Relay

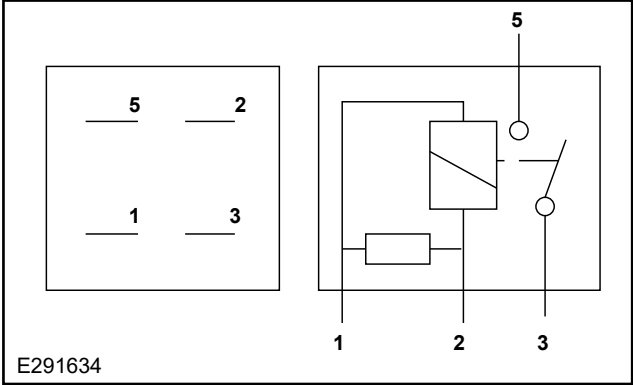


Mini Relay Parameters	
Normally open contacts	40A
Normally closed contacts	20A
Nominal coil current	300mA (max)

Medium current changeover relay — Part number: 6G9T-14B192-D\*

Medium current normally open relay — Part number: 6G9T-14B192-C\* (pin 4 not present)

Ultra Mini Relay



Mini Relay Parameters	
Normally open contacts	40A
Normally closed contacts	20A
Nominal coil current	300mA (max)

Medium current normally open relay — Part number: 8T2T-14B192-C\*

4.22.3 Windscreen 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: 5.9 Glass, Frames and Mechanisms](#)

## 4.23 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). To access the CAN ensure Upfitter Interface System (UIS) is ordered and the UIS guidelines are followed'. Delete: 'see later in this section for more details.**

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

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

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.23.1 General Information

#### Main Fuses

In order to protect the battery system from direct ground shorts or continuous high current loads, a 500A main fuse is fitted in the Pre Fuse Box under the driver's seat. Vehicle Converter fit peripherals must not use this fuse as its sole purpose is protection of the starting and charging system.

This main fuse is not repairable; use only a Ford replacement part.

#### 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 except in conjunction with Smart Fuse Box(JZXAD/JZXAF)
- 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](#)


### 4.23.2 Customer Connection Points (CCP)


#### WARNINGS:

 **CCP2 is not to be used for directly switching inductive loads off; for this purpose an extra control contactor must be installed.**

 **Before connecting to the vehicle you must remove the main vehicle ground to isolate the 12V system.**

 **Only use the Ford approved kit for adding fuses to the CCPs.**

 **DO NOT connect the same load to both CCP1 and CCP2. The system is not designed to work together as the fuses have different values.**

 **CAUTION: When connecting to the CCP, it is recommended to disconnect the battery ground so as to avoid a short circuit. The fixing torque for CCP1 (M6) is 5.2–7.2 Nm and for CCP2 (M8) is 5.9-8.1 Nm.**

**NOTE:** When fitting additional power wiring feeds, the protective cover will need to be revised to allow routing for the extra wires. The cover is pre marked with the relevant areas so that they can be easily removed.

**NOTE:** There is a maximum of two CCPs. These points are always located on the driver's seat pedestal and are protected by a cover. CCP1 which is capable of supplying a max current of 60A and CCP2 which is capable of supplying a max current of 250A.

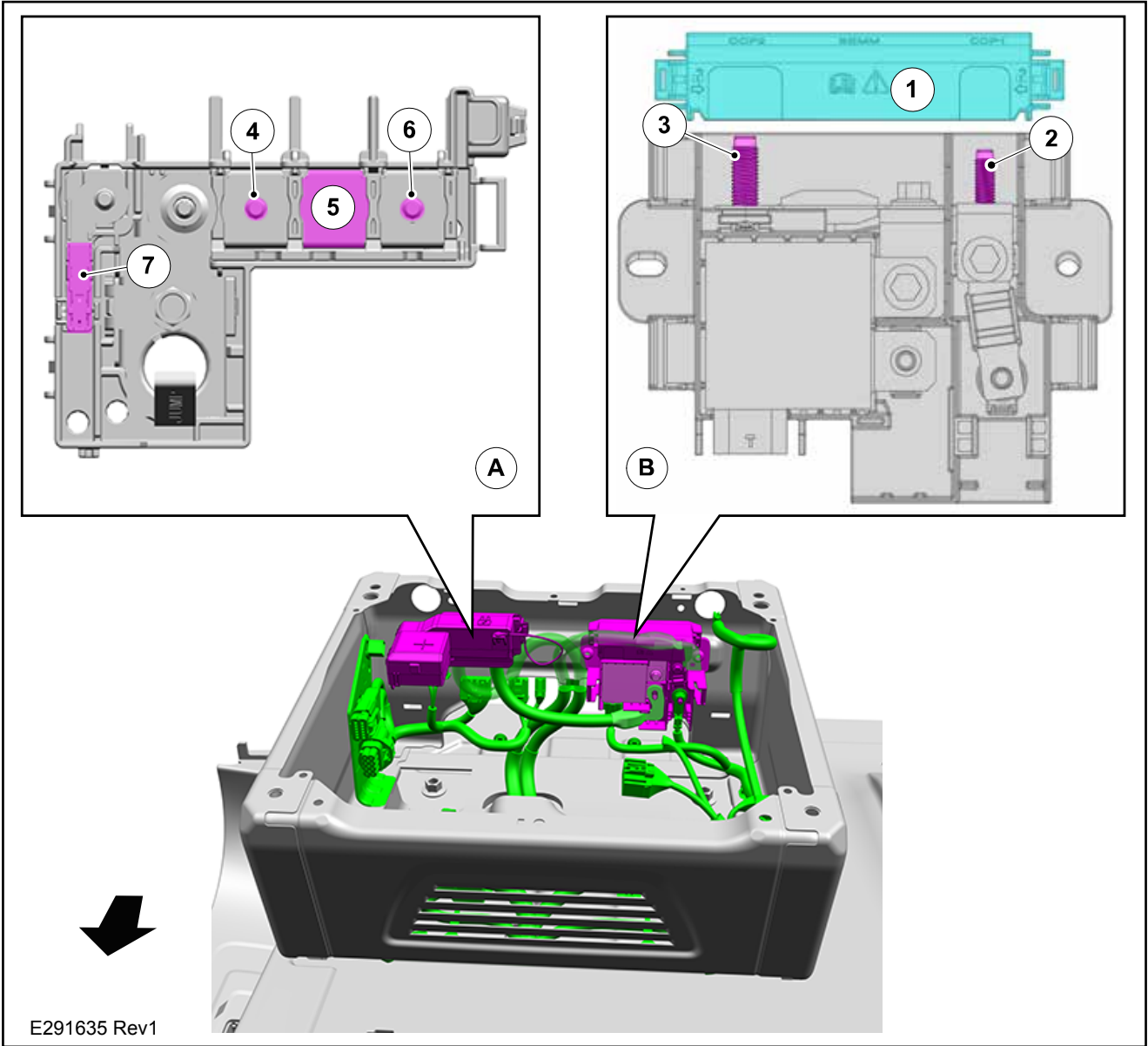
**NOTE:** Most vehicles with single battery will not have CCP2. Only those vehicles with twin batteries or certain SVO options with will have CCP2, check with your local Ford dealer for details. If CCP2 is required then order kit PZ3T-14A094-C\*.

**NOTE:** CCP2 is active only when the ignition is on. it is restricted by a timer.

**NOTE:** Before removing the CCP cover, move the driver's seat pedestal forward to provide sufficient access, avoiding the need to remove any body trim. E291635 shows the right hand drive version.

For high current supply and ground connections  
[Refer to: 4.5 Battery Systems](#)

CCP Location and Pre Fuse Panel



E291635 Rev1

Item	Description
A	Pre-Fuse Panel
B	CCP Box
1	CCP Stud Cover (Removed)
2	CCP1 60A
3	CCP2 250A
4	Pre-Fuse Panel Fuse Supplies CCP1
5	Shunt
6	Pre-Fuse Panel Fuse Supplies CCP2
7	BMS



### 4.23.3 High Current Supply and Ground Connections

For additional third party ground and +12V power cable connections to the Ford system

[Refer to: 4.5 Battery Systems](#)

Any peripherals totalling more than 60A added to the power supply must be connected via the CCPs, from dedicated fuses such as the Smart Fuse Box. When the vehicle does not offer adequate power from the CCPs, see 'Third Party PTO for loads exceeding 250A' in this section of the BEMM.




Camper vehicles: When fitting an additional battery, and an auxiliary battery circuit, if high loads are to be supplied, exceeding the CCP supplies or high in general, especially at ignition off loads, then an isolation switch disconnect relay should be fitted and controlled via the load-shedding signal.

This is to protect the vehicle start battery from a failed start and to protect system voltage when vehicle is moving. Suitable capacity in the wiring, fuses and alternator will be required. If unsure of which battery to interface with or what system requirements are needed, please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

[Refer to: 4.5 Battery Systems](#)

4.23.4 Vehicle Interface Connector

WARNINGS:

-  **Signals 3 and 5 on the Vehicle Interface Connector are for sensing purposes only and not to be loaded by high current consumers.**
-  **The max current rating for signal 6 is 10A and signal 8 is 15A. These are not to be exceeded in any situation, this includes the total of the Ford system and third party system requirements.**
-  **Unused wires in the service kit must have cable ends insulated to avoid shorting on any ground points.**

The Vehicle Interface Connector provides a direct interface to signals. See figure E292812 for location and the following table for signals.  
A service kit (KK2Z-14A411-M) can be ordered from your local Ford dealer, the kit contains the mating connector to access these signals, and 1m of wiring.

When the Auxiliary Fuse Panel is fitted to the vehicle, the Interface Connector is occupied by the attached wiring harness. In this case, these signals and some additional features are available through the C1 connector. For more details refer to Auxiliary Fuse Panel section.

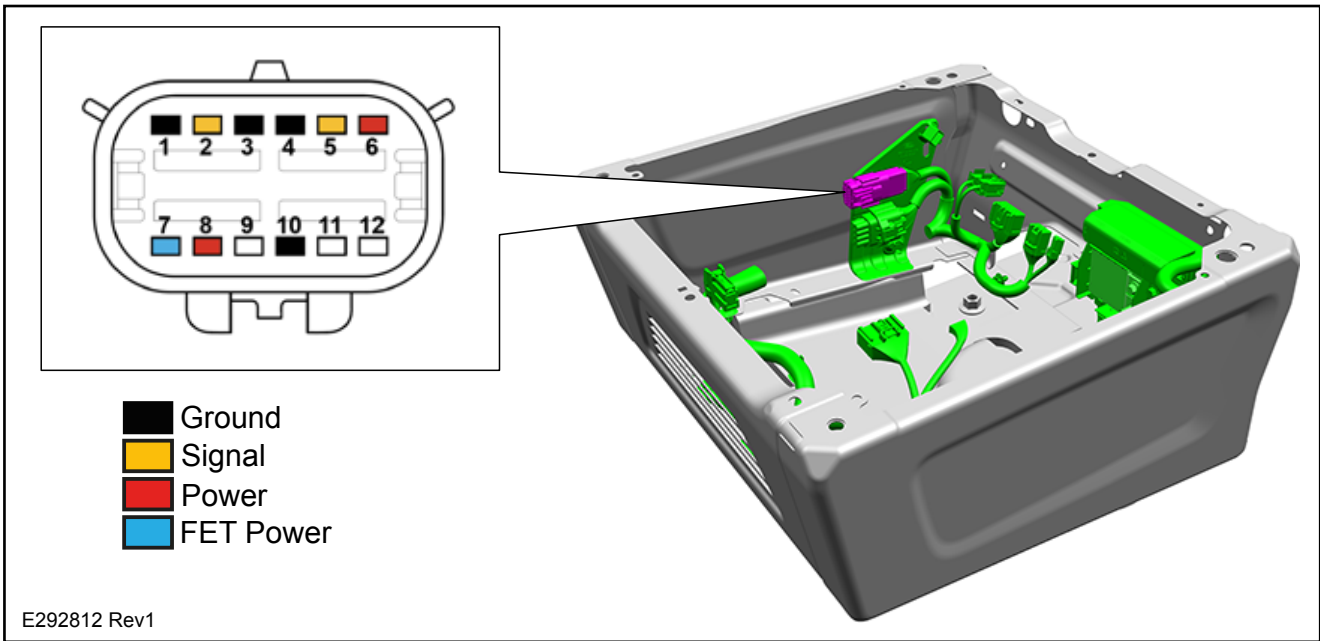
-  **WARNING: Do not interface with the CAN (Controller Area Network) for vehicle speed.**

**Pin 5:** Vehicle Speed signal is a direct current coupled square wave that varies in frequency in proportion to vehicle speed. This provides a square waveform (50% duty cycle) signal, where a frequency of 138Hz equates to 100km/h.

Ignition

**Pin 6:** Ignition signal is protected by a 10A fuse. It is +12V active at ignition positions: Accessory (1) and Run (2). It is not active at Ignition Off (0) or Crank (3). Whilst it can drive equipment directly it is recommended to use this feed to control a convertor fitted relay, especially for high current applications.

12 Way Vehicle Interface Connector



12 Way Vehicle Interface Connector Signals	
1	Ground
2	Engine Run
3	SRC Inhibit/Third Party High Power Mode
4	Load Shed/Standard Battery Guard
5	Vehicle Speed
6	Run Start KL15 (10A))
7	IP Switch Illumination
8	+12V KL30 (15A)
9	No Connection
10	Standard Battery Guard
11	No Connection
12	No Connection

## Switch Illumination

**Pin 7:** Switch illumination signal is only to be used for sensing. It is a PWM signal only for low current illumination 300mA max, that can be dimmed and not used to drive a relay.

## Engine Run



**WARNING: Do not cut into the alternator wires or use the alternator as a source to obtain a 'D+' Signal'.**

The load-shedding 10A ground signal must be used for power control. The engine run feature can only be used to control power if the load-shedding signal has overall control, for example to activate a power relay. Engine run can be used for other systems such as telematics and data loggers.

**Pin 4:** Load-shedding with Battery SOC Protection switched ground signal is a signal that must always be the primary controlling signal to be used to handle third party loads totalling over 60A.

[Refer to: 4.6 Battery Protection](#)

The engine run feature can only be used to control power if the load-shedding signal has overall control, for example through a power relay.

Engine run can be used for other systems such as telematics and data loggers. This feature will supply

power at engine run, and at engine off it will isolate when the battery reaches the timer or SOC value. At engine run, the signal will extinguish if voltage drops to below 11V. This is to protect critical systems such as EPAS. The voltage of the system should not drop below 13V for continuous periods. If this occurs, the extra equipment added, is exceeding supply and supplemental energy sources may be required, such as additional alternators.

**Pin 2:** Engine run signal will only support a sense line or relay control that is in **AND** logic with the load-shedding signal.

This engine run signal is ground switching (max current sink 250mA), it provides no positive output (open circuit) and is only active when the engine is running.

The signal will not be present when:

- Key states - Off (0), Accessory (1), Run but Engine Off (2), Crank (3)
- Key in Run position, where Start-Stop vehicle has auto stopped the engine
- Engine running but load is greater than 250mA (driving two or more relays in error)

Due to Start-Stop vehicles, the signal may switch up to 300,000 times. Provision is required for control relays switched by this signal to meet this durability cycle.

## Vehicle Speed

### Square Wave Characteristics

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

### 4.23.5 Smart Fuse Box (SFB) (JZXAD/JZXAF)



**NOTE:** The Smart Fuse Box cannot be retrofitted and so must be ordered for factory fitment.

Smart Fuse Box (SFB) utilises software controlled smart fuses allowing multiple configurations for the components to tailor the system to individual customer needs. Software controlled fuses mean that when the fuses blow the software can reset them without the need for component replacement. Inrush current and quick/slow blow profile can be tailored for various 3rd party equipment connection.

Smart Fuse Box includes Ford Programmable Battery Guard-FPBG functionality and provides interface connection signals. There are two configurations of Smart Fuse Box. The Utility Smart Fuse Box (JZXAD) includes configurable inputs and outputs. The Camper version (JZXAF) is available with CI Bus & Wi-Fi connectivity along with the option to connect to Camper Touchscreen which is available as conversion fit option. All levels will have up to 200A of power management capability.

Wi-Fi connectivity allows quick software updates and the ability to flash multiple vehicles with the same configuration for fleet customers. Bluetooth also enables the smart fuse box to be controlled by a phone or tablet app.

Smart Fuse Box has CI Bus communication for control of camper peripherals and LIN communication for battery charging and power take off management. Using additional customer added battery monitoring sensors the Smart fuse box can balance power across multiple batteries.

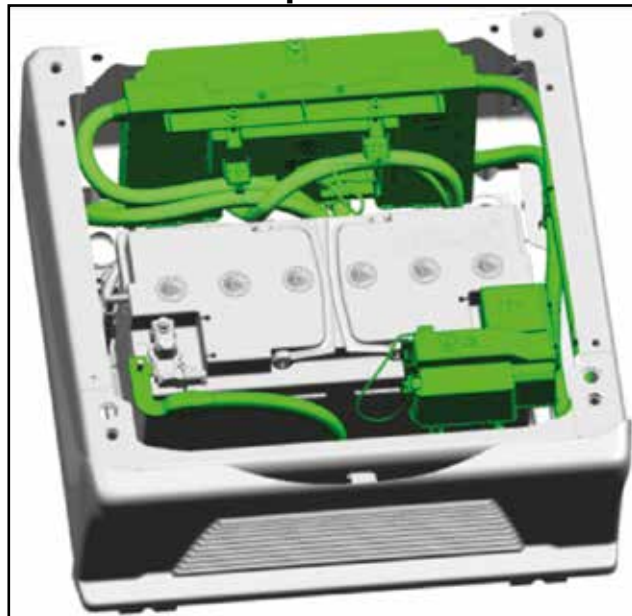
The Smart Fuse Box can be combined with a Smart hub and the Camper Touchscreen to form a fully finished system for camper convertors and high specification utility conversions

[Refer to 4.23.8 Camper Touchscreen](#)

For further information please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

The Smart Fuse Box is located in the front pedestal. Smart Fuse Box Location– Campers (JZXAF) – Swivel Seat PZ3T-14K734-BA

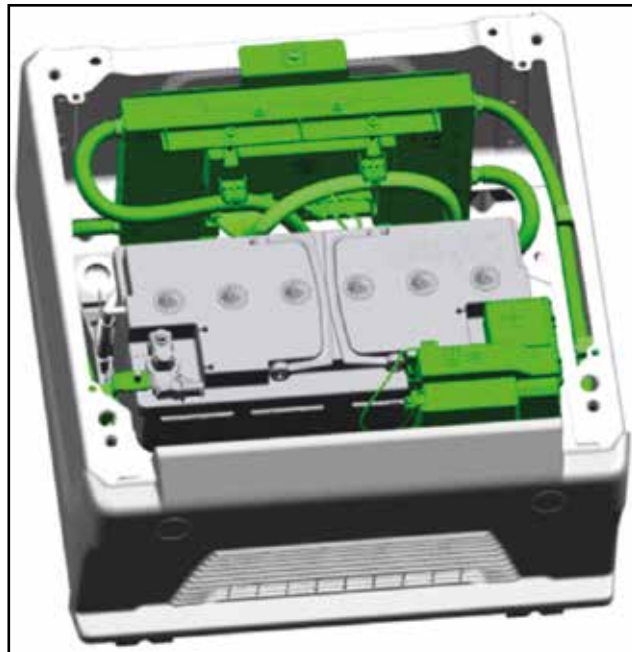
#### SFB Location - Camper



There are subtle differences between the Smart Fuse Box installations on Camper swivel seat vehicles and regular static seat vehicles.

Smart Fuse Box Location – Standard Vehicles (JZXAD) – Static Seat PZ3T-14K734-AA

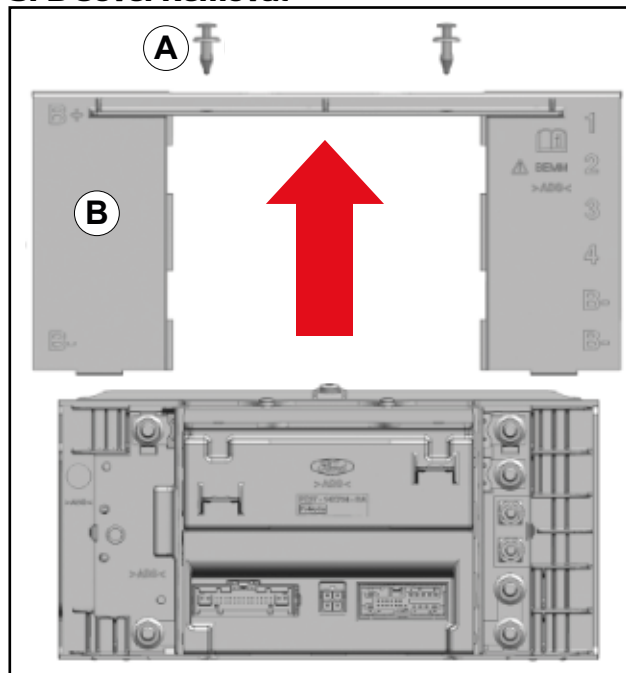
#### SFB Location - Static Seat



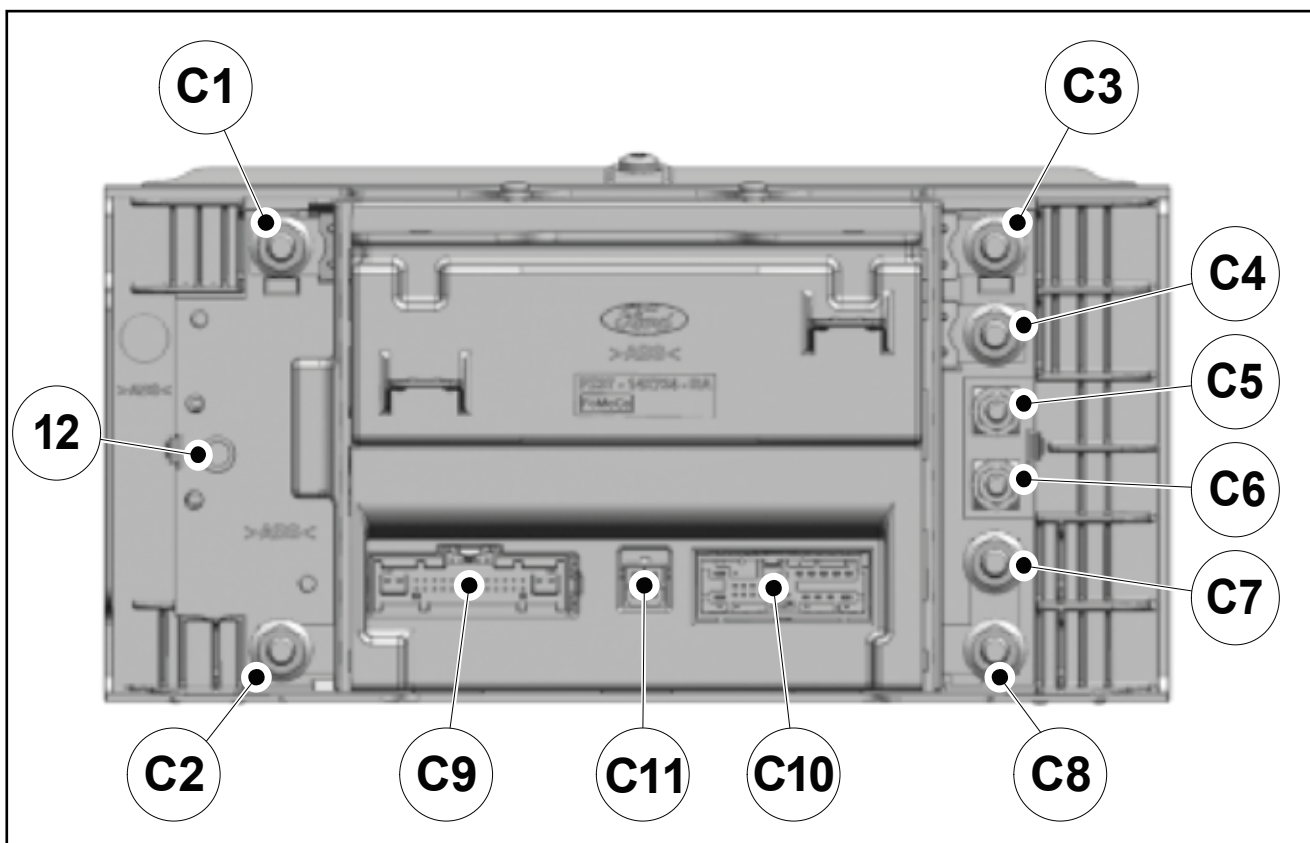
## SFB Cover Removal

Once accessed into the seat pedestal, SFB becomes accessible. To remove the cover of SFB (B), first undo the two push pins (A) holding the cover to the module. Once removed, the cover (B) can slide upwards and be completely removed. Once removed, access to all studs, eyelets and the Wi-Fi activation button is available. Removing the wiring clips from the features on the fuse box housing will make access slightly easier if required. To re-install the cover, align the cover to the runners, slide the cover back down until it is fully located. Finally put the push pins back in and push them down firmly to secure the cover in place.

## SFB Cover Removal



## Vehicle Connector Information



No.	Description	No.	Description
C1	Positive Battery Connection B+	C7	Aux1 Negative Battery Connection B-
C2	Negative Battery Connection B+	C8	Aux2 Negative Battery Connection B-
C3	Aux1 Positive Battery Connection B+	C9	30 Way Vehicle Connector
C4	Aux2 Positive Battery Connection B+	C10	24 Way Upfitter Interface Connector
C5	40A MOSFET Output	C11	4 Way Smart Hub Interface Connector
C6	40A MOSFET Output	12	Wi-Fi Button

**30 Way Connector C9**

Pin	Description
1	B+ Ford Battery +12V Power 15A
2	Ignition KL15 +12V Input 10A
3	CCP Relay Input Engage
4	CCP Relay Disengage +12v
5	CI-BUS (LIN)
6	CCP Relay Disengage - Ground (100ms)
7	No Connection
8	BMS LIN (Read Only)
9	Vehicle Speed Input
10	CCP Relay Engage +12v
11	No Connection
12	CCP Relay Engage - Ground (100ms)
13	No Connection
14	No Connection
15	CCP Relay Input Disengage
16	Engine Run Input
17	Ground - Module
18	Wire Temperature Sensor +
19	SRC Inhibit Output - Ground / Third Power High Power Mode
20	Wire Temperature Sensor -
21	No Connection
22	No Connection
23	No Connection
24	No Connection
25	RPM Speed Control -
26	RPM Speed Control +
27	EPAS Load Shed Input - Ground
28	No Connection
29	CAN High Twisted Pair
30	CAN Low Twisted Pair

**4 Way Connector C11**

Pin	Description
1	12V Switched - 20A
2	Ignition Output
3	CI-BUS (LIN)
4	Ground - Smart Camper Hub

**24 Way Connector C10**

Pin	Description
1	20A MOSFET Output
2	BMS Auxiliary Battery
3	No Connection
4	Immediate Relay Open Request - Ground
5	Immediate Relay Close Request - Ground
6	SRC Inhibit Input - Ground / Third Party High Power Mode
7	Auto RPM Speed Controller - Ground
8	10A MOSFET Output
9	10A MOSFET Output
10	10A MOSFET Output
11	Engine Run Output - Ground
12	No Connection
13	20A MOSFET Output
14	Power Isolation Warning/Status Indicator Output - Ground
15	Ignition Out
16	Input 1
17	Input 2
18	Input 3
19	Input 4
20	Input 5
21	Input 6
22	Input 7
23	Input 8
24	20A MOSFET Output

The Smart Fuse Box has 8 inputs and 8 outputs. Each input controls a corresponding output. The table below shows which input pin number will control which output pin number:

**Smart Fuse Box Inputs and Outputs**

Input	Pin		Output	Pin
Input 1	C10-16	controls	Output 1 - 10A	C10-8
Input 2	C10-17	controls	Output 2 - 10A	C10-9
Input 3	C10-18	controls	Output 3 - 10A	C10-10
Input 4	C10-19	controls	Output 4 - 20A	C10-1
Input 5	C10-20	controls	Output 5 - 20A	C10-13
Input 6	C10-21	controls	Output 6 - 20A	C10-24
Input 7	C10-22	controls	Output 7 - 40A	C5-1
Input 8	C10-23	controls	Output 8 - 40A	C6-1



### 4.23.6 SFB Software Update and Configuration

Over the air software updates can be made to the Smart Fuse Box. To do this, manually press the Wi-Fi activation button on the SFB. The password is available on a QR code next to the button (below)– this is unique for every module. It is only recommended to do this if you have been advised to do so or at a dealer.

#### SFB Wi-Fi Button



Updating the software on a SFB requires specific software for each individual SFB (this can be provided by request from Azura-Engineering). To request an updated version of software an email to Azura-Engineering with the serial number of the SFB is required (located on the top front label).

After receiving the software file:

- Save the file onto the device used to connect to the SFB.
- Use the device to connect to the SFB update page (detailed below).

- Press the 'Choose file' button and select the required software file.
- After the file name is displayed in place of 'No file chosen': Press the 'Upload' button to start the process. **Note: Wait until the buttons on the update page are no longer greyed out.** (While greyed out the software is uploading)
- After the buttons have returned to the initial colour: Press 'System Reset' to restart the SFB and run the new software.

The Smart Fuse Box (SFB) can have its configuration and software updated via Wi-Fi and hosted webpages.

After pressing, the Blue LED will flash indicating that Wi-Fi is active. The LED will stop flashing when the Wi-Fi is inactive.

There are 3 ways to interact with the SFB Wi-Fi:

- IOS: Scanning the SFB QR code (with camera app and it will ask to join SFB network.
- Android: go to Wi-Fi selection settings and select the QR add network option.
- Windows computer: Select SFB from available networks and sign in with the password printed on the SFB label.

After connecting to the SFB open a web browser on your device and input the address: 10.1.1.1

### Smart Fuse Box Camper Configuration

To set SFB into camper mode:

- Press and select the check box under 'Set Camper Mode'.
- Press the 'Camper' button.
- SFB will incur a delay (5-10 seconds) and is then set to 'Camper' mode.

#### 10.1.1.1 SFB Wi-Fi Page (This page is Used for both Wi-Fi Update and SFB Configuration)

←

→

↺

⚠ Not secure | 10.1.1.1

Smart Fuse Box Update

Please carefully read update instructions before proceeding.

Please ensure you have already download the correct update files using the QR code displayed on LCD.

Select an update file

Choose file

No file chosen

Click to upload to Smart Fuse Box

Upload

Set Camper Mode

Camper

☐

[System Reset](#)

Build date Mar 6 2023 12:17:26

### 4.23.7 Ford Programmable Battery Guard

Smart Fuse Box incorporates Ford Programmable Battery Guard (FPBG) feature.

#### WARNINGS:



**The maximum fused current on the Ford Programmable Battery Guard (FPBG) is 200A. Continuous current capability depends on the third party system and conversion.**



**The Battery Guard may isolate the Third Party system at engine run or engine off. If sensitive equipment is installed on the Third Party system, the Vehicle Converter needs to ensure protection is in place for power disconnect.**



**The system cannot be ordered with Ford 400W Power Inverter.**

**NOTE:** Vehicles should always use a battery guard if engine off power is required.

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

#### FPBG System Overview

The Battery Guard is the intelligent power management system that provides 'engine run' and 'engine off' power for Third Party electrical systems.

#### Signal Connections

The FPBG Interface Connector has the signals in the next table available to use in third party electrical system.

The connections must be done only to the wires behind the connector. The rest of the vehicle wiring must not be cut or tampered with.

1. Remove the FPBG Interface Connector
2. Undo the spiral and spot tapes around the wires behind the connector. Locate the blunt cut signal wires with heat shrink on the end
3. Cut the heat shrink, strip the insulation  
Use a U-shape crimp and heat shrink when making the connection to the third party wiring. Do not solder the crimp

#### Functionality

- **State of Charge Protection:** The FPBG isolates the Power Relay when the vehicle batteries lose charge under a certain State of Charge (SoC) percentage. This will ensure that the vehicle preserves cranking capability. In order to avoid issues on cranking, it is recommended to charge batteries via mains charger or engine run, after a SoC disconnect.
- **Wire Temperature Monitoring:** The FPBG isolates

the Power Relay when power cable temperatures rise above a certain temperature, to avoid thermal issues on the cables. It is recommended to leave the system at rest for at least 10 minutes if a Wire Temperature Disconnect happens.

- **Alternator Protection:** The FPBG isolates the Power Relay if the voltage level drops below a certain threshold at 'engine run' to protect the alternator. The system will reconnect automatically after 4 minutes if the system voltage recovers.
- **Mains Charger Support:** The FPBG will automatically detect connection of a mains charger to share the charge across all batteries in the system including the Third Party Battery. The FPBG will still detect and react if the mains charger is applied onto the Third Party Battery.
- **Third Party Battery Charge:** The FPBG monitors the Third Party Battery Voltage at 'engine off' and activates a Conventional Charge State if the Third Party Battery needs charging.
- **Load-Shedding:** The FPBG accepts the Body Control Module (BCM) as Master on the Load-Shedding Signal at 'engine run'. When the BCM requests Third Party Loads to be disconnected, the FPBG will immediately disconnect until the BCM disconnect command disappears. The FPBG is the master for disconnecting the Third Party Loads at 'engine off'.
- **Smart Fuse Box Control:** The FPBG controls the Smart fuse box at 'engine run' (except BCM signal as Master for EPAS Load-Shedding) and 'engine off'. The Main Power Relay Status will be replicated onto the Smart Fuse Box control output signal. Therefore, if the main Power Relay is connected, the Smart Fuse Box will also be connected. Otherwise, they will both be disconnected.
- **Engine Run Signal:** The FPBG provides a 1000mA low side driver Engine Run output for Third Party Systems. The signal can be used to indicate the 'engine run' status to the Third Party Equipment.
- **Third Party High Power Mode - SRC/Start-Stop/AEIS Inhibit/SBG Timeout Inhibit:** The FPBG sends a Third Party High Power Mode signal to the vehicle in order to inhibit the functions temporarily. There is a ground input available on the Interface Connector for the user to inhibit those features by connecting the input to the ground when needed by the third party device. The feature controls voltage into a narrow bandwidth of 13.5V to 15.25V where SRC varies between 12.2V to 15.2V.  
The Third Party High Power mode feature must not be used permanently. The FPBG also sends temporary inhibit signal to charge third party battery when needed.  
The feature must be used for heavy current applications at engine run to avoid voltage drop issues.
- **Immediate Relay Open:** The FPBG will open contacts immediately if the Immediate Relay Open input is connected to the Ground. It is not

recommended to use the feature as a safety switch. The feature will only work if the module and connections are properly made. For protection, it is recommended to use a separate safety switch.

- **Immediate Relay Close:** The FPBG will close relay contacts immediately providing the Immediate Relay Close input is connected to the ground, and Immediate Relay Open input is inactive.
- **Power Isolation/Status Indicator:** The FPBG gives 1000mA low side driver output to indicate the status of the system. The signals are coded to identify the status. Below is the table for the functions and warnings on the output. There is also an LED on the module to indicate the status with colour coded pulses.
- **Mode Selection with Ignition Cycle:** The FPBG detects the vehicle battery technology automatically. The battery quantity is set to single battery by default. If the vehicle has twin batteries, the user must perform 5 Ignition Cycles (Ignition 2 – Ignition 0) to set the system into Twin Battery Mode. The relay will click 2 times to indicate the correct mode setup for twin batteries. If the system is updated to a single battery, the mode can be changed to single battery by performing 5 Ignition Cycles again. The relay will click one time to indicate correct setup to Single Battery Mode.
- **Auto RPM Control:** The FPBG changes Engine RPM automatically to increase alternator efficiency for higher power outputs. This is required when high current electrical demand causes voltage drop in the system and engine idle speed is not high enough for the alternator to provide the required voltage. The feature is provided with blunt cut wires on the Smart Fuse Box 24-way Upfitter Interface Connector. The Vehicle Convertor needs to complete the system as per the below instructions:
  1. There are two RPM Control Pins – RPM Control 1 and 2 – (C9 Connector Pin 25 and 26) – that needs

### Smart Fuse Box Diagnostic - Operation

Function/Signal	Status	LED Colour Sequence*	Status Indicator Output (Signal Pattern)*
12V Ford battery (Battery Sense & Power)	OK	G	
	Low Voltage	OO	
12V Convertor (Battery Sense)	OK	G	
	Low Voltage	OOO	
	Open Circuit	RRR	OOO
Engine Run Alternator Protection	OK	G	
	Low Voltage Cut Off	RRRR	OOOO
Power Isolation Warning	Not Triggered	G	
	Triggered	OOOOO	
External Charger – Engine Off	Not Detected	G	
	>13.5V Detected	O-O	
	IGN2 Detected	R-R	O
Over Voltage Protection (>15.8V)	Not Detected	G	
	Over Voltage	RRO	O-OO
Third Party High Power Mode – Inhibit Output	Not Triggered	G	
	Triggered	OO-O	
Third Party High Power Mode – Inhibit Input	Not Triggered	G	
	Triggered	O-OOO	
Immediate Relay Contact Open	Not Triggered	G	
	Triggered	OO-OO	OO-OO
Immediate Relay Contact Close	Not Triggered	G	
	Triggered	OOO-O	O Continuous
Ignition Position 2 (IGN2) – Engine On	OK	G	
	Open Circuit	RRR-RR	OOO-OO
FPBG Internal Failure	No Failure	G	
	Soft Voltage Reset (Ignition Cycle)	RRR-R	OOO-O

\*Green (G), Red (R), Orange (O), Space (-)

to be connected to the RPM Loop Wire from the vehicle. In order to ensure correct pin connection, the voltages need to be checked between the pins after connection. The voltage needs to be 4.34V when the feature is not activated and 4.65V when feature is activated. If the voltage is 1.84V the connection needs to be reversed.

- There is one RPM Activation Pin (C10 Connector Pin 7) that needs to be switched to Ground to activate - or Open Circuit to deactivate - the feature. Switched Ground connection needs to be completed by the Vehicle Convertor.
- When the system is activated and RPM Control Pins are connected to the RPM Loop Wire, the system will automatically increase RPM one step in after 1 minute if voltage stays below 14.0V. The pre-set RPM values are 1100-1600-2030. If the

RPM is elevated and voltage stays above 14.5V for 1 minute, the system will step down RPM until idle is reached.

## FPBG - Additional Information

- The FPBG is fused at 200A. If required, the Mega Fuse can be down-rated by the Vehicle Convertor.
- Normal operation may lead to a clicking sound when opening and closing power relay contacts. The end operator may need to be advised of this condition
- The main +12V feed supply is taken from the main Ford battery cable. It is not permitted to touch this interface. If further PTO is required, it must come from the CCPs

[Refer to: 4.23 Electrical Connectors and Connections](#)

## General LED Status

Function/Signal	LED Colour Sequence
No Error	G
Ford Battery Low	OO
Convertor Battery Low	OOO
Convertor Battery Open	RRR
Engine Run Alternator Fault	RRRR
Power Isolation Fault	OOOOO
External Charger Connected Fault	O-O
External Charger Ignition On Fault	R-R
Over Voltage Warning Fault	RRO
SRC Inhibit Fault	OO-O
Convertor SRC Inhibit	O-OOO
Emergency Relay Open	OO-OO
Immediate Relay Close	OOO-O
Ignition Position 2 Status	RRR-RR
ECRM Internal Soft Reset	RRR-R
Battery Fault	GOR- -GOR
All battery Fault	OR- - OR - - OR
Battery One Error	OG
Battery Two Error	OGG
Battery Three Error	OGGG
Fuse 1 Error	RG
Fuse 2 Error	RGG
Fuse 3 Error	RGGG
Fuse 4 Error	RGGGG
Fuse 5 Error	RGGGGG
Fuse 6 Error	RGGGGGG
Fuse 7 Error	RGGGGGGG
Fuse 8 Error	RGGGGGGGG
Fuse 9 Error	RGGGGGGGGG

\*Green (G), Red (R), Orange (O), Space (-)

- If continuous heavy load usage is required, the following values and duration will be observed. The system will disconnect automatically to protect the wiring:
  - Up to 120A = Continuous
  - 121A to 140A = 20 to 26 minutes
  - 141A to 160A = 14 to 20 minutes
  - 161A to 175A = 8 to 14 minutes
  - 176A to 200A = 6 to 12 minutes
- The system will automatically disconnect load for approximately 10 minutes for cool down after allowed maximum wire temperature is reached. Different system conditions may lead to a longer waiting period and shorter usage durations, for example: wiring cross sectional area, cable length and impedance in the system. It is recommended that the Vehicle Convertor tests the finished system to calculate the usage duration and cool down period.
- The 200A Mega fuse on the FPBG has slow blow characteristics which allow short term higher currents. Example: 270A = Min 30/Max 1800 seconds. Please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com) for system specific questions.
- Mains chargers must be of the multi-stage type (including trickle charge) and be checked for performance before installation, as the system will connect all batteries to the charger
- Before performing power and signal connections, the Vehicle Convertor must unpower the system to avoid risk of contact +12V and the vehicle body
- Under heavy load applications, total system impedance should be calculated to design for voltage drop conditions. The power supply cable should be added as short as possible and to the correct cross-sectional area

[Refer to: 4.1 Electrical System Overview](#) For the Wiring Specification table

4.23.8 Camper Touchscreen

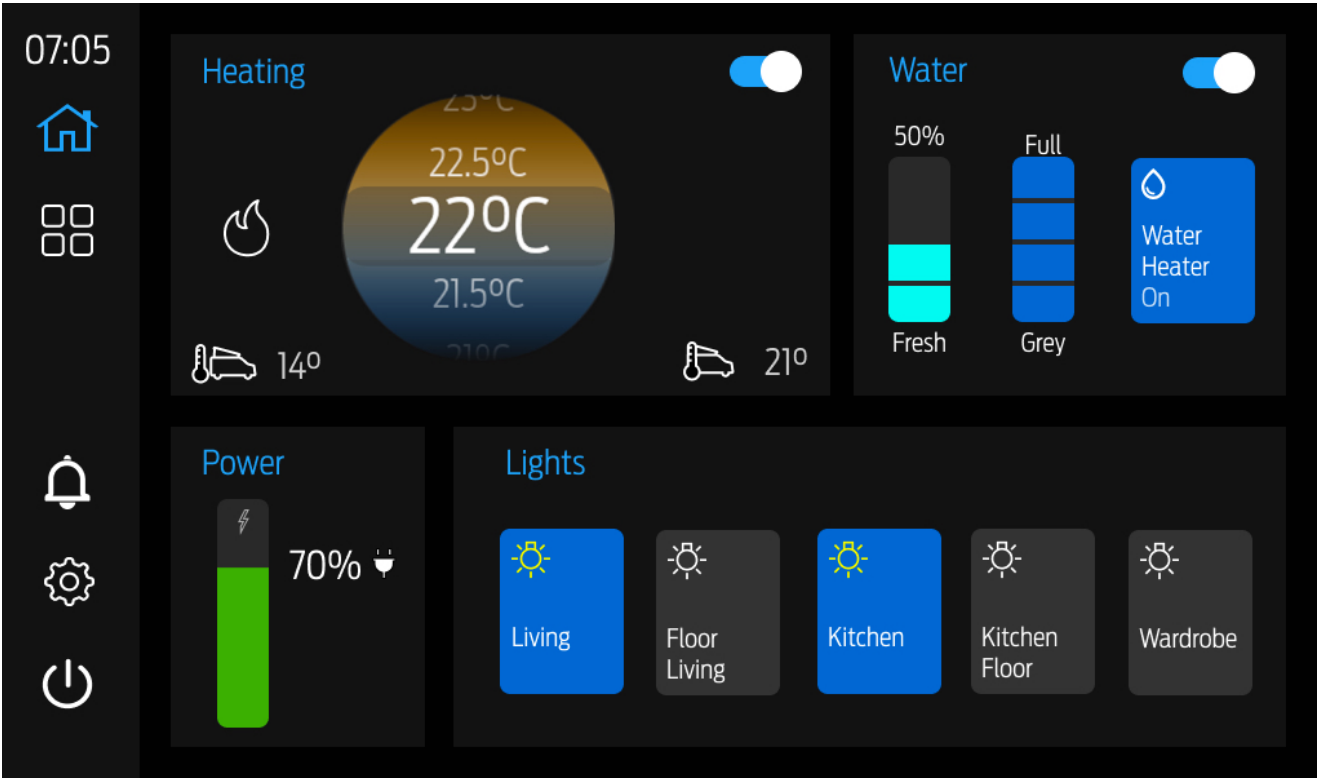
Camper touchscreen with mobile App provides a touchscreen HMI to control lighting, climate, water pump and fridge. It monitors battery health and water levels. The mobile App and touchscreen functionality provides Bluetooth & Wi-Fi connectivity for remote monitoring, and control, with an over-the-air updatable system. Camper touchscreen needs to be ordered with smart hub and smart fuse box.

For user manual, mounting instructions and compatible devices, please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

Service Part numbers:  
PZ3V-18B955-A\* Touchscreen  
PZ3V-14G371-A\* Smart Hub

For further information on smart fuse box connections  
[Refer to: 4.23.5 Smart Fuse Box](#)

Camper Touchscreen





### 4.23.9 Upfitter Integration System (UIS) (JRSAB)

#### WARNINGS:



**It is the responsibility of the Upfitter to ensure all safety checks have been carried out prior to installation of any 3rd party systems/configuration to the vehicle.**



**Upfitter Integration System (UIS) is not available with 400W Inverter**

**NOTE:** The wiring harness of the base vehicle consists of giveaway circuits and interface connector(s) to allow for the retrofitting of the UIS module.

**NOTE:** UIS can be installed to a vehicle if it was not ordered or equipped from factory (module installation referenced later in this document). Installation of UIS should be done through Ford authorised dealers.

**NOTE:** The UIS has limited functionality from factory fit. The UIS (that includes UCIM and APIM if soft

switch functionality is planned) must be flashed with Upfitter Configuration created by the UIS programming tool to enable the UIS functions.

For further details on configuration and technical support please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

The UIS module is a programmable I/O controller which communicates on the vehicle CAN network. The UIS module can control various vehicle functions via Upfitter Configuration. Users should consult the UIS programming tool manual for further information. UIS provides two methods of accessing CAN output: 1) through the UIS programming tool or 2) through an additional hardwired connection in the SAE J1939 format

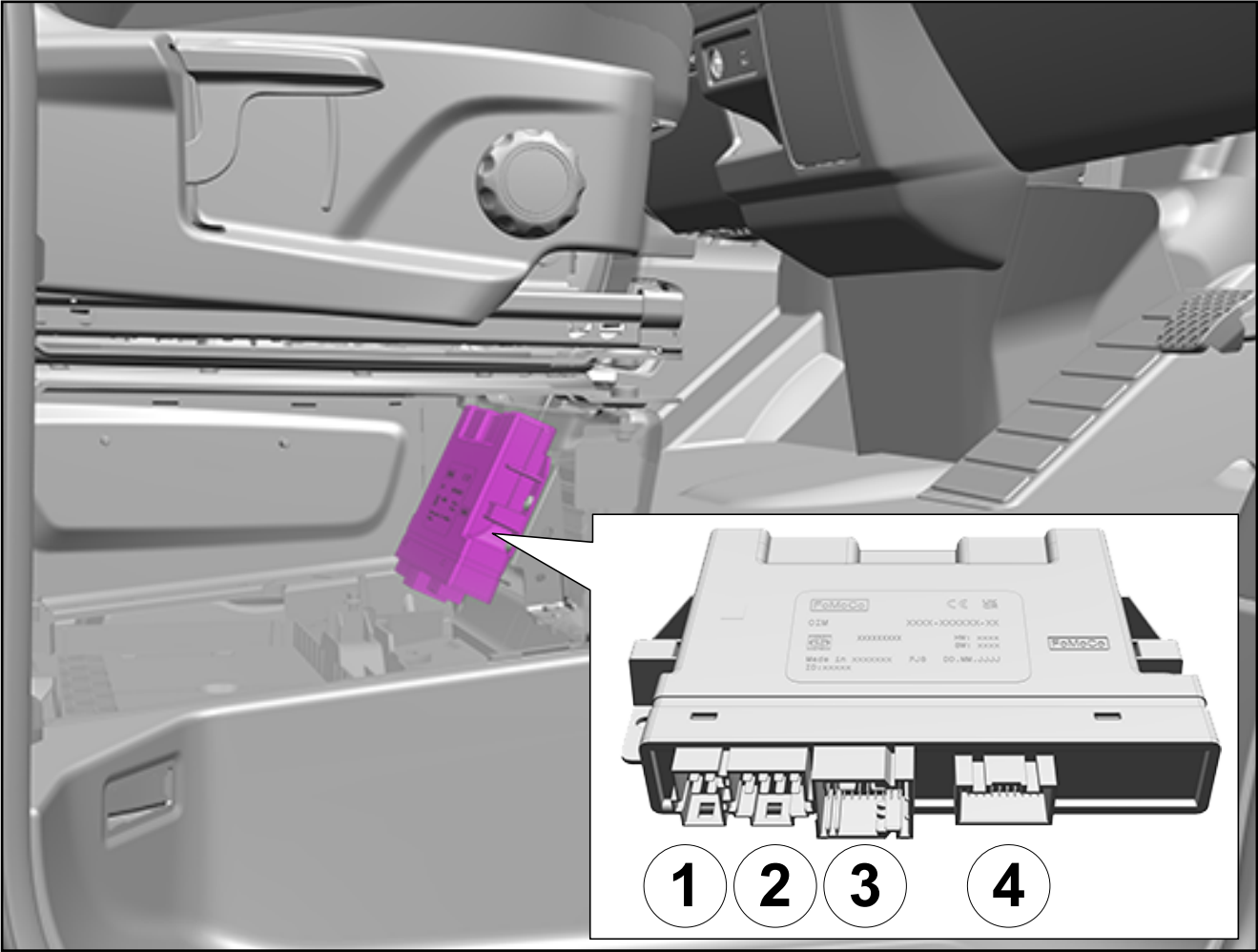
### SAE J1939 Output Signals

A set of vehicle CAN Signals are translated into SAE J1939 format and made available for use to the Upfitters when the instructions below are followed. The following are the UIS J1939 signals available.

#### J1939 CAN Putput Signals Available from the UIS

ABS Active	Day	Vehicle Inhibit Motion
Ambient Air Temperature	Hours	Auxiliary Digital Input 1 Status
Air Conditioner Compressor	Minutes	Auxiliary Digital Input 2 Status
Accelerator Pedal Position	Seconds	Auxiliary Digital Input 3 Status
HVAC Recirculation Switch	Year	Auxiliary Digital Input 4 Status
Battery Current	Headlamp Low Switch Status	Auxiliary Digital Input 5 Status
Battery Voltage	Headlamp High Switch Status	Auxiliary Digital Input 6 Status
Battery Temperature	Headlamp Light Switch Status	Auxiliary Digital Input 7 Status
Brake Switch	Front Blower Speed	Auxiliary Digital Input 8 Status
Battery State Of Charge	Ignition Status	Auxiliary Digital Input 9 Status
Cruise Control Mode	Man Rqen Soot	Auxiliary Digital Input 10 Status
Day Running Light	Max Defroster Switch Status	Auxiliary Digital Input 11 Status
Door 1 Status	Odometer Master Value	Auxiliary Digital Input 12 Status
Hood Status	Oil Pressure Warning	Auxiliary Digital Input 13 Status
Door 2 Status	Perimeter Alarm Status	Auxiliary Digital Input 14 Status
Door 3 Status	Park Brake Switch Status	Auxiliary Digital Input 15 Status
Door 4 Status	Park Brake Status	Auxiliary Digital Input 16 Status
Door 5 Status	Park Light Headlamp Status	Auxiliary Digital Output 1 Status
MIL Lamp	DPF Regen Status	Auxiliary Digital Output 2 Status
Emergency Light Siren	Second Row Passenger Buckle Status	Auxiliary Digital Output 3 Status
Engine Status	Second Row Driver Buckle Status	Auxiliary Digital Output 4 Status
Engine Speed	Second Row Driver Middle Buckle Status	Auxiliary Digital Output 5 Status
Engine Coolant Temperature	Second Row Middle Buckle Status	Auxiliary Digital Output 6 Status
Engine Oil Temperature	Second Tow Passenger Middle Buckle Status	Auxiliary Digital Output 7 Status
Powertrain Status	Steering Wheel Angle	Auxiliary Digital Output 8 Status
First Row Driver Buckle Status	Stop Lamp Brake Request	Automatic Engine Idle Shutdown Override
First Row Passenger Buckle Status	Third Row Driver Buckle Status	Wheel Based Vehicle Speed
Front Fog Light Status	Third Row Middle Buckle Status	Vehicle Identification Number
Rear Fog Light Status	Third Row Passenger Buckle Status	Acceleration Rate
Fuel Level Percentage	Tire Pressure	Long Rate
Oil Transmission Temperature	Park System	Roll Rate
Neutral Gear	Left Turn Light Status	Vertical Rate
Current Gear	Right Turn Light Status	Yaw Rate
Select Gear	Hazard Light Switch Status	Front Wiper Switch Status

UIS Module Location



Item	Description
1	C1 – 6 Way Connector - Module Power & Ground
2	C2 – 12 Way Connector - High Current Outputs
3	C3 – 40 Way Connector - Inputs & Low Current Outputs
4	C4 – 40 Way Connector - Module Communications



## SAE J1939 Output Customer CAN Signal Access

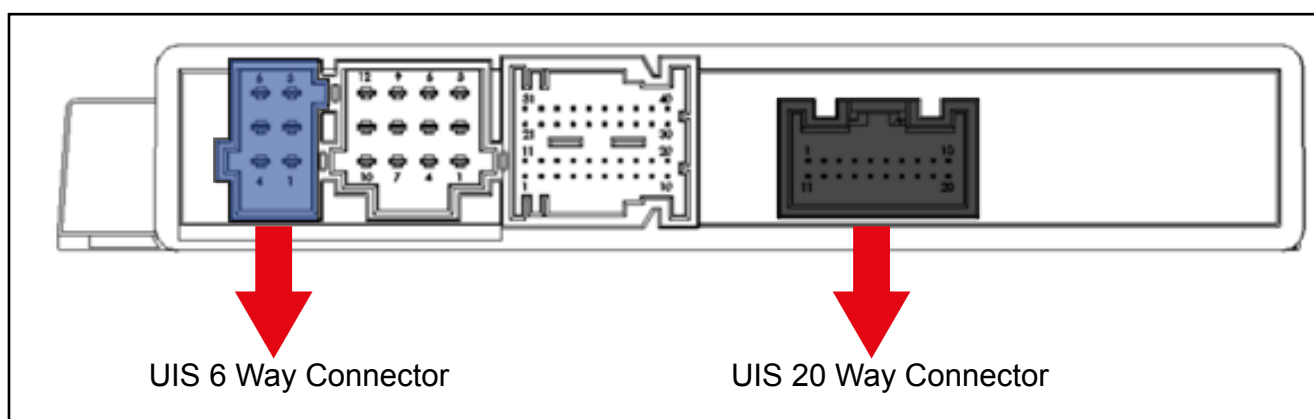
1. UIS and connectors can be accessed in the front seat pedestal.
2. Reference the UIS module and 2 connectors: Black 20-Way & Blue 6-Way (highlighted below) and disconnect both the Black 20-Way and Blue 6-Way from the module to ensure no power is being delivered to module.
3. Focusing on the Black 20-Way connector, begin to unravel/unwrap the flocked tape around the harness such that enough workable length is available to expose the wire circuits. Stow away the unravelled/unwrapped flock tape so it can be reused for reinstallation later.
4. Locate the SAE J1939 wired circuits 3 and 4. These 2 circuits will be used in order to perform the cut and splice to obtain the signals.

**NOTE:** The circuits remaining in the harness will not be used and no longer need to be connected. Recommend taping the circuits back securely and stowed away from the splice.

**NOTE:** Follow the Ford approved procedure for soldering circuits to complete the splice. These are CAN network circuits that are a twisted pair, and for the added length ensure it meets the twists per foot requirement (4 twists per 50mm)

5. Complete the splice, following the Ford Repair Guidelines, rewrap the flock tape removed (Step 4) or use an acceptable substitute ensuring that circuits are wrapped within 50mm from the back of the connector
6. Reconnect the Black 20-way, and Blue 6-way to the UIS module

### UIS Module Connectors



### Upfitter Integration System Connectors

Upfitter electrical loads should not exceed stated limits in the following tables:

#### C1 Connector (6-way) Module Power and Ground

Pin	Signal Name	Description	Voltage (V)		Current (A)	
			Min	Max	Min	Max
Power						
2	KL30_2	Power Supply 2	9	16	-	20
4	KL30_1	Power Supply 1	9	16	-	20
5	KL30_2	Power Supply 2	9	16	-	20
6	KL30_1	Power Supply 1	9	16	-	20
Ground						
1	KL31	Ground	9	16	-	24
4	KL31	Ground	9	16	-	24

## C2 Connector (12-way) High Current Outputs

Pin	Signal Name	Description	Voltage (V)		Current (A)	PWM		Power Supply
			Min	Max	Max Steady State	Frequency	Duty %	
High Side Switch								
1	MFA_7	5A HS Switch	9	16	5	-	-	2
2	MFA_5	5A HS Switch	9	16	5	-	-	1
3	MFA_6	5A HS Switch	9	16	5	-	-	1
4	MFA_8	5A HS Switch	9	16	5	-	-	2
5	MFA_4	10A HS Switch	9	16	10	-	-	2
6	MFA_1	5A HS Switch	9	16	5	-	-	1
7	MFA_3	5A HS Switch	9	16	5	-	-	2
12	MFA_2	10A HS Switch	9	16	10	-	-	1
Half Bridge								
8	MFA_20	5A HB	9	16	5	<= 3KHz	3-100	1
9	MFA_19	5A HB	9	16	5	<= 3KHz	3-100	1
10	MFA_22	5A HB	9	16	5	<= 3KHz	3-100	2
11	MFA_21	5A HB	9	16	5	<= 3KHz	3-100	2

## C3 Connector (40-way) Low Current Outputs

Pin	Signal Name	Description	Voltage (V)		Current (A)	PWM	Duty %	Power Supply
			Min	Max	Max Steady State			
Low Side Switch								
1	MFA_15	0.5A LS Switch	-	-	0.5	<=300Hz	3-100	-
2	MFA_16	0.5A LS Switch	-	-	0.5	<=300Hz	3-100	-
3	MFA_13	1A LS Switch	-	-	1	<=5KHz	5-100	-
11	MFA_17	0.5A LS Switch	-	-	0.5	<=300Hz	3-100	-
12	MFA_18	0.5A LS Switch	-	-	0.5	<=300Hz	3-100	-
13	MFA_14	1A LS Switch	-	-	1	<=5KHz	5-100	-
High Side Switch								
21	MFA_11	0.5A HS Switch	9	16	0.5	<=300Hz	3-100	2
22	MFA_12	0.5A HS Switch	9	16	0.5	<=300Hz	3-100	2
31	MFA_9	0.5A HS Switch	9	16	0.5	<=300Hz	3-100	1
32	MFA_10	0.5A HS Switch	9	16	0.5	<=300Hz	3-100	1

**C3 Connector (40-way) Inputs**

Pin	Signal Name	Description	Voltage (V)		Voltage level for digital Input detection (V)		Sink Current (mA)		Sampling Rate	Resolution
			Min	Max	Non-Active	Active	Min @9V	Max @16V		
Digital Input Active HIGH										
7	MFE_17	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
8	MFE_19	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
9	MFE_21	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
10	MFE_23	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
17	MFE_18	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
18	MFE_20	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
19	MFE_22	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
20	MFE_24	Digital High	0	16	<2.8	>6.1	6.7	12.82	5ms	N/A
Digital Input Active LOW										
23	MFE_9	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
24	MFE_11	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
25	MFE_13	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
26	MFE_15	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
33	MFE_10	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
34	MFE_12	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
35	MFE_14	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
36	MFE_16	Digital Low	0	16	>6.1	<2.8	5.3	11.81	5ms	N/A
Analog Input										
27	MFE_1	Analog Input	0	19.95	Dependant on Upfitter Configuration		5.3	11.81	5ms	12-bit
28	MFE_3	Analog Input	0	19.95			5.3	11.81	5ms	12-bit
29	MFE_5	Analog Input	0	19.95			5.3	11.81	5ms	12-bit
30	MFE_7	Analog Input	0	19.95			5.3	11.81	5ms	12-bit
37	MFE_2	Analog Input	0	19.95			5.3	11.81	5ms	12-bit
38	MFE_4	Analog Input	0	19.95			5.3	11.81	5ms	12-bit
39	MFE_6	Analog Input	0	19.95			5.3	11.81	5ms	12-bit
40	MFE_8	Analog Input	0	19.95			5.3	11.81	5ms	12-bit

**C4 Connector (20-way) Module Communications**

Pin	Signal Name	Description
1	Vehicle CAN High	Vehicle CAN coms with Upfitter module – DO NOT SPLICE
2	Vehicle CAN Low	Vehicle CAN coms with Upfitter module – DO NOT SPLICE
3	J1939 CAN High	J1939 CAN – blunt cut circuit available on vehicle
4	J1939 CAN Low	J1939 CAN – blunt cut circuit available on vehicle

ECU Sleep States (Quiescent Current)

The UIS Module has 2 sleep states depending on Upfitter Configuration. Default sleep state will only wake from vehicle CAN messages and has the lowest power consumption possible. If configured, the Upfitter Module can wake from Digital and Analog Inputs. During this sleep state the module will have higher quiescent current than in Default. Recommendations regarding Key Off Load should be followed when configuring the Upfitter Module.

Electrical Load Shedding

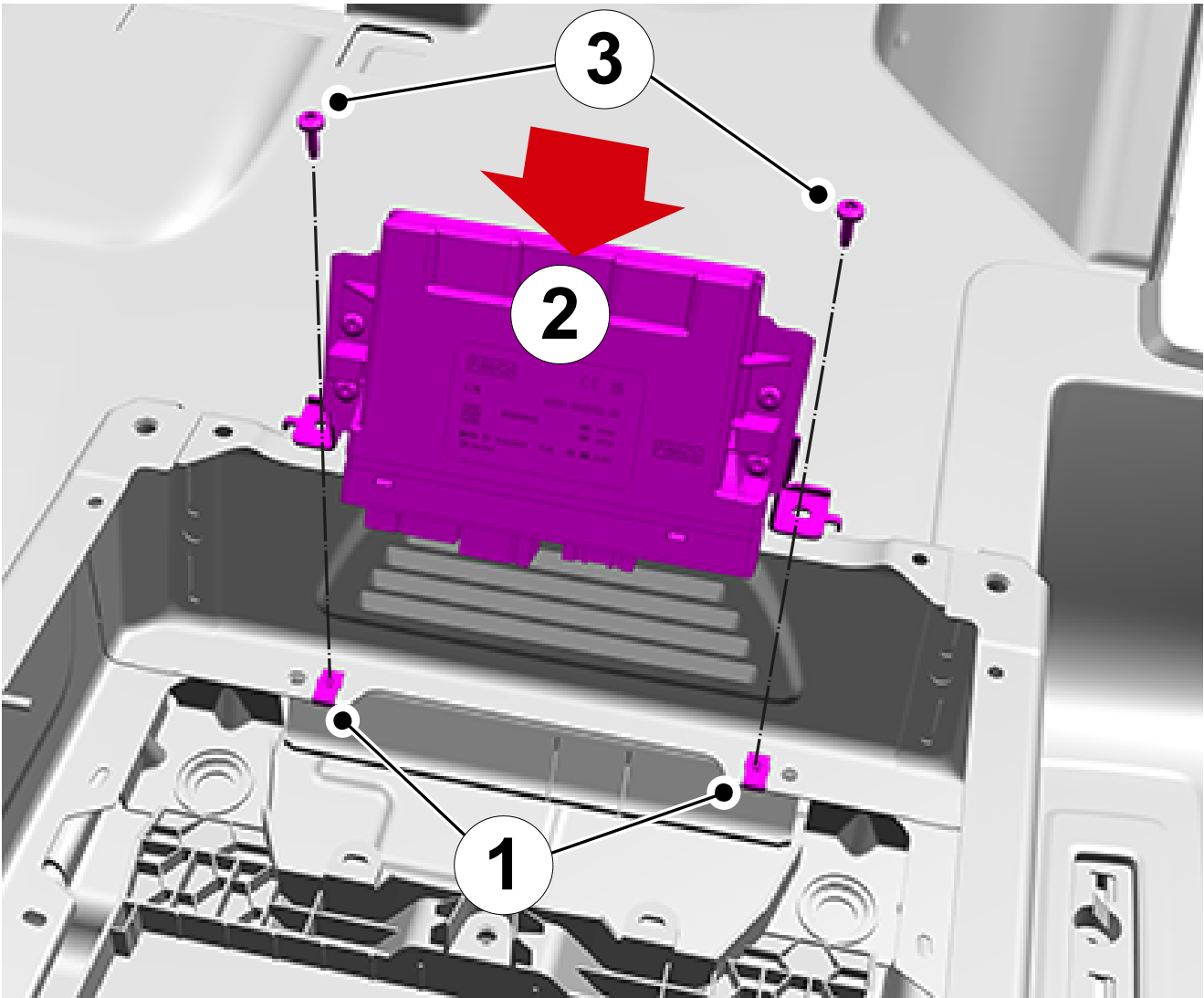
Vehicle Load Shedding strategy will command Upfitter Module outputs to be switched OFF if it deems it necessary to maintain system Voltage. A

total of 60A has been allocated to customer loads. This allocation should be considered when connecting loads to both the Upfitter Module and the non-switched Customer Connection Point 1. If >60A of electrical consumers have been fitted to the vehicle, there is higher potential for Upfitter Module outputs to be switched OFF.

Ordering and Retrofitting

If the Upfitter Integration System (JRSAB) is ordered as factory fit, the vehicle will be provided with the module fitted and the Upfitter Blunt Cut wiring stowed in the glovebox. It is possible to retrofit the module and wiring to a vehicle. The Matrix below shows list of parts to be ordered for retrofitting the Upfitter Integration System

UIS Installation For Camper and Non-Camper Variants without Load Through Box



Item	Description
1	Fit 2x Fit U-Nuts to Seat Pedestal
2	Fit Module
3	Secure Module with 2x screws – torque 5.4Nm ± 0.9Nm
4	Connect Wiring Harness to Module and Vehicle
5	Update Vehicle Configuration – see dealer

## Parts Required for Retrofitting Upfitter Integration System

Vehicle Specification	Module	Module Wiring	Upfitter Wiring	Fixings
Camper	PZ3T-14G589-A*	PZ3T-14A303-BE*	PZ3T-14A303-BB*	W505472-S450 x2 W520801-S439 x2
Non-Camper without Load Through Box	PZ3T-14G589-B*	PZ3T-14A303-BC*	PZ3T-14A303-BB*	W505472-S450 x2 W520801-S439 x2
Non-Camper with Load Through Box	PZ3T-14G372-A*	PZ3T-14A303-BD*	PZ3T-14A303-BB*	W505472-S450 x4

### Application on Sync/ Soft Switches

Ford infotainment system (centre stack display) contains Upfit Controls Application.

This application shall be only used for driver /user secondary control of Upfitter Equipment such as Auxiliary Air Conditioning Systems, sub compartment locking, sirens, beacon lights, chimes which do not directly affect the normal vehicle functions.

For configuration of soft switches and usage of Upfit Controls Application, please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

Upfitters shall not configure soft switches in Upfit Controls Application that may affect safe operation of the equipment.

### Auxiliary Switches

Upfitters must install hard wired buttons or switches where necessary to control functions of heavy equipment like snow plough, salt spreader, lifts, ramps etc that may affect normal vehicle function.

It is the Upfitter's responsibility to make sure that additional safety counter measures related to the operation of heavy equipment are in place.

For further information regarding Upfitter Integration System Features and programming of the input/output of the module, please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 4.23.10 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 200Hz.**

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

## 4.24 Grounding

### 4.24.1 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. See figure E291288b and the following table for recommended ground points that can be used.

**The wiper motor bracket must not be used as a ground as it is isolated from the body.**

**CAUTIONS:**

**Only use the ground points indicated. Using alternative points may affect the vehicle integrity.**

**Make sure that all ground points are tightened to the correct torque.**

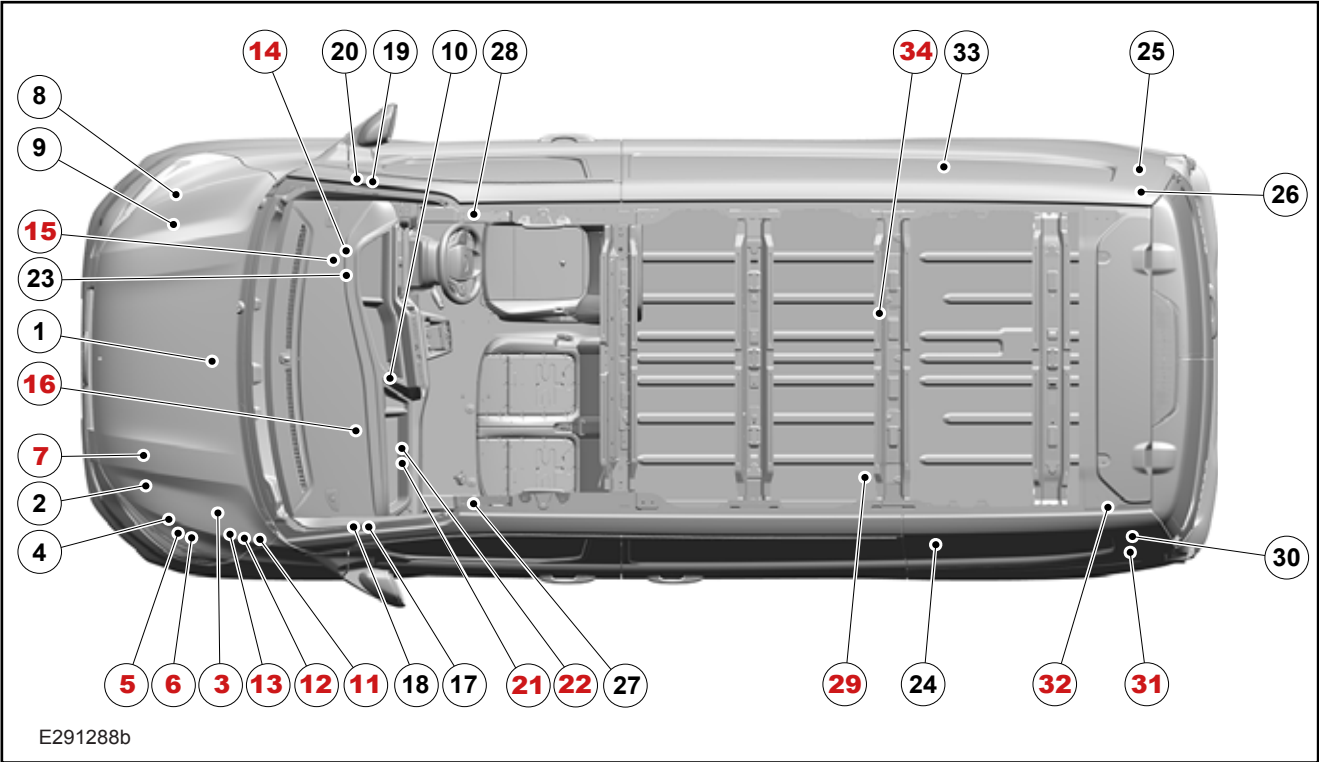
**NOTE:** The Ground Point (GP) numbers are only for reference to show the location of the GP.

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: 4.6 Battery Systems](#)

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, Bus, Kombi Recommended Ground Points



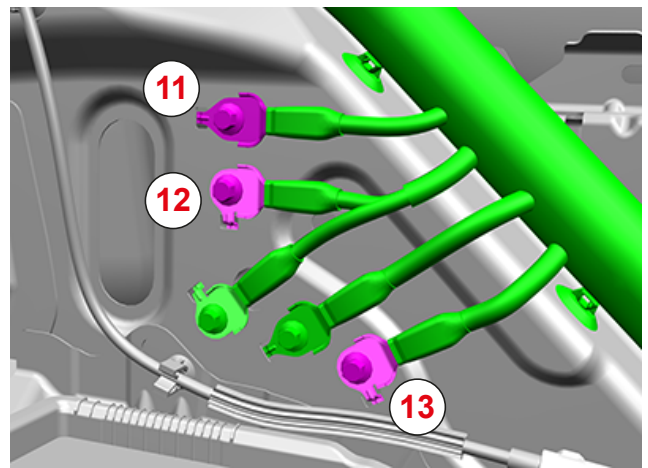
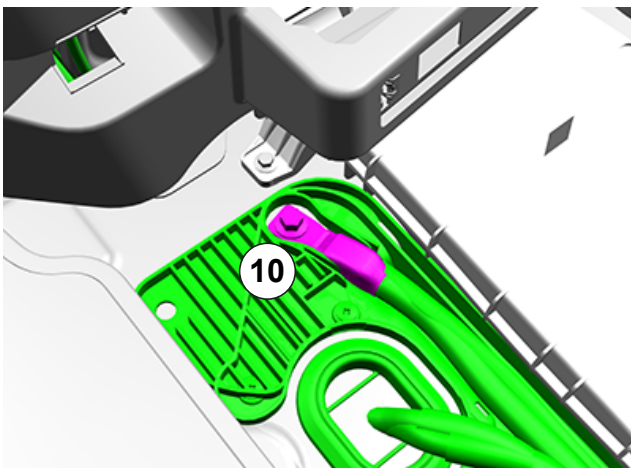
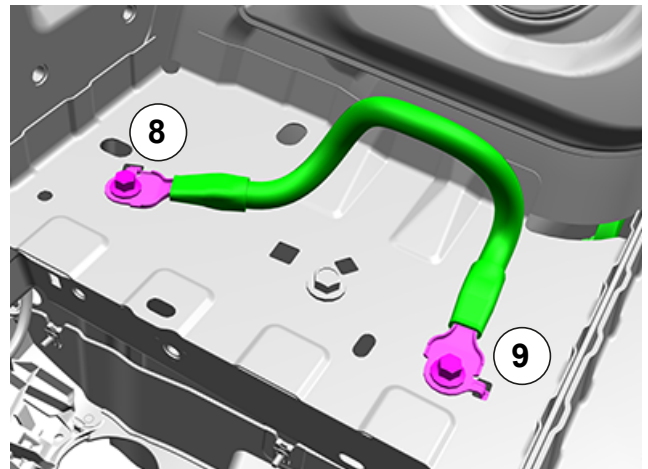
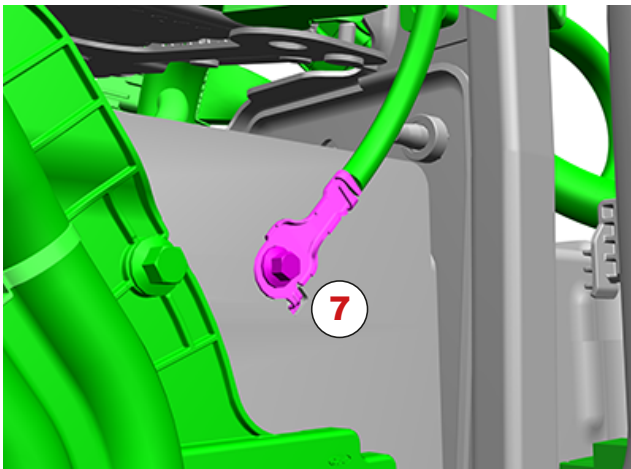
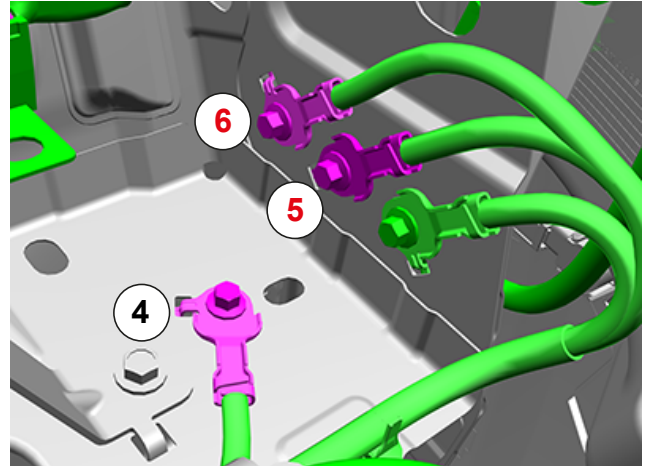
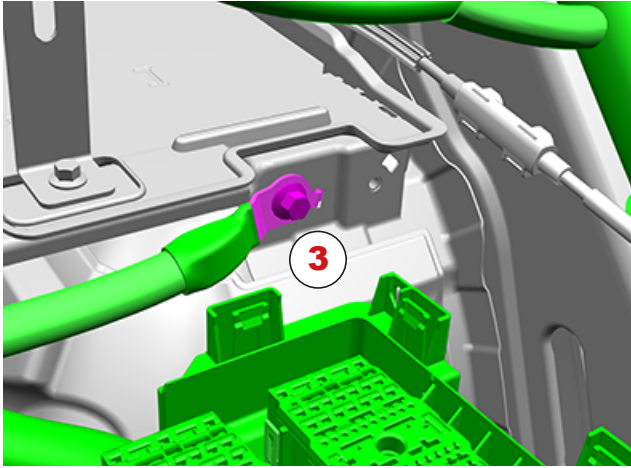
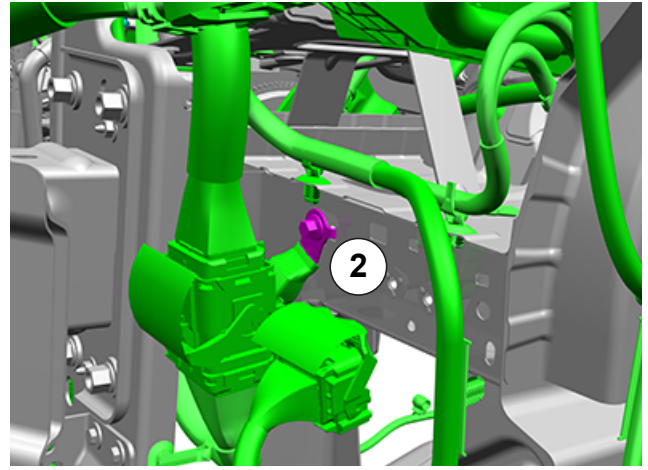
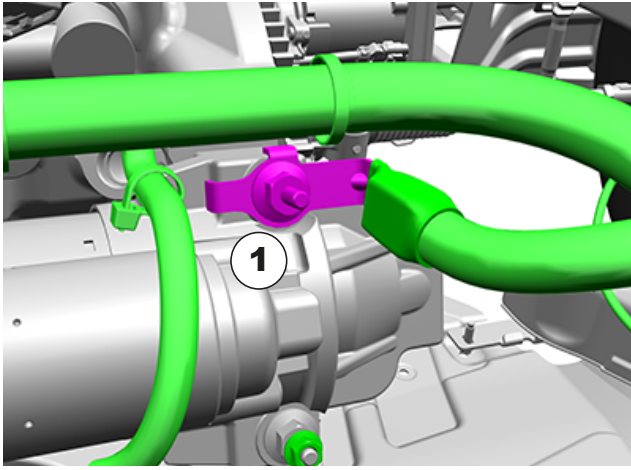
Ground points highlighted in red are safety critical and must not be used as *additional* ground points



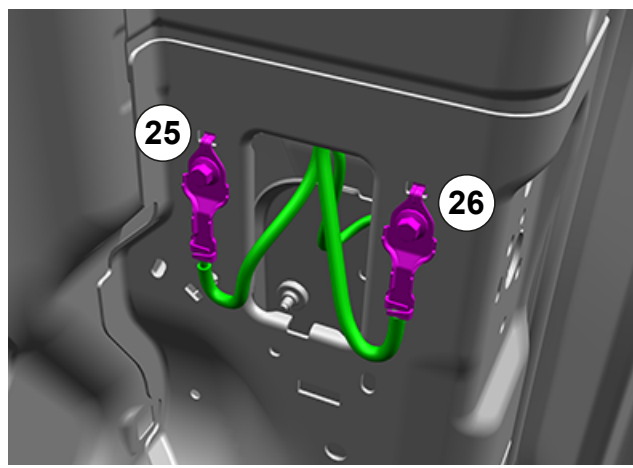
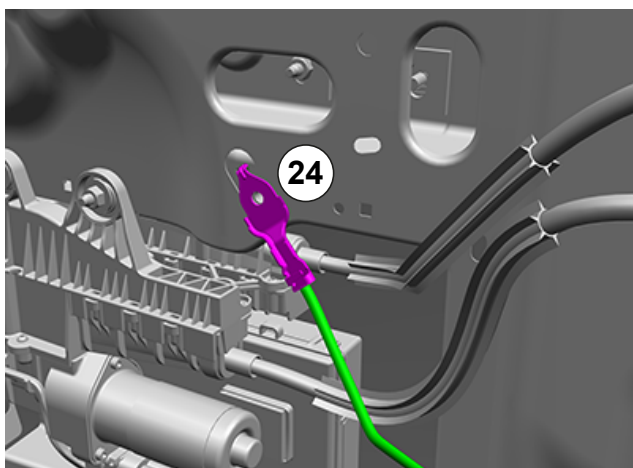
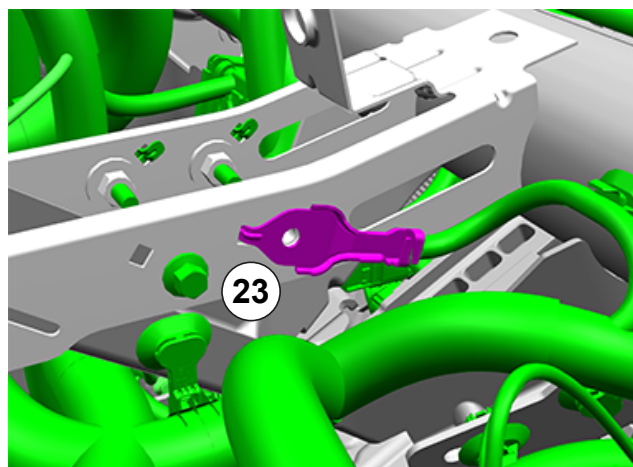
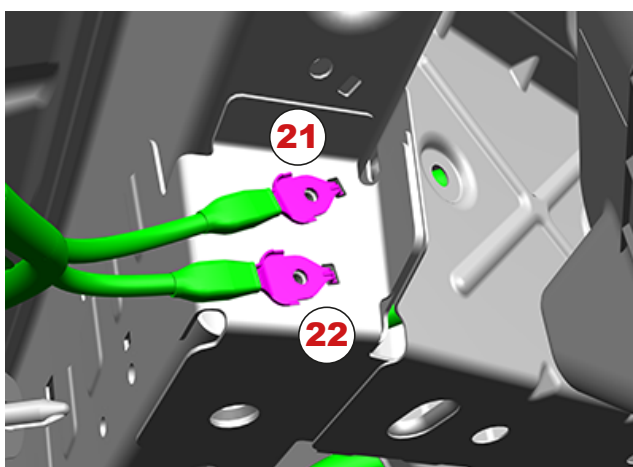
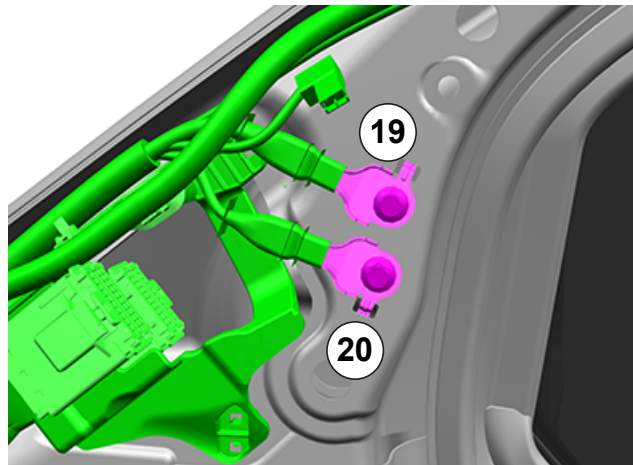
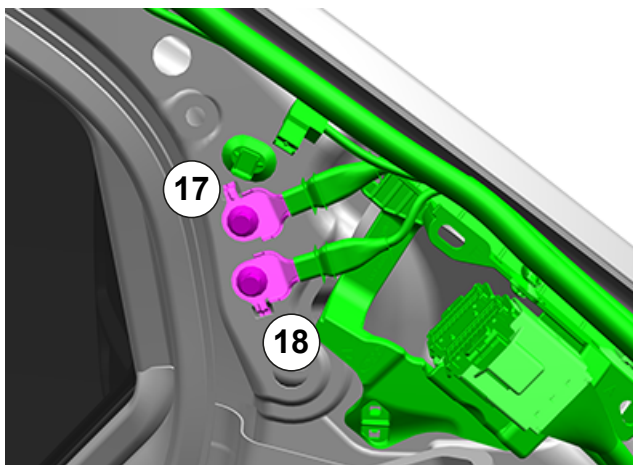
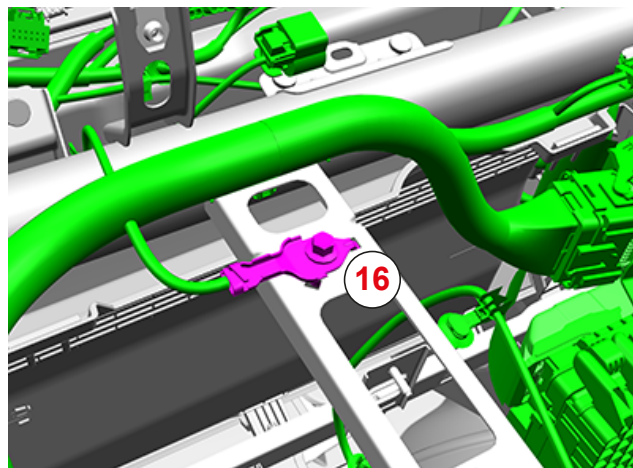
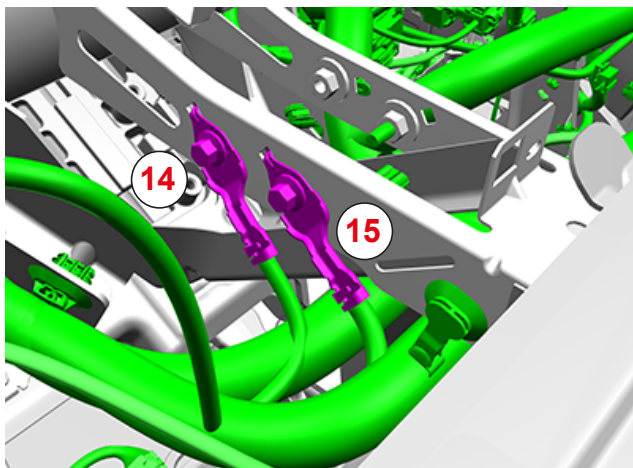
No.	Location	Type (Use of Ground Point)	Vehicle Type	Power	Harness
1*	Engine Bay Front	Main Battery to Engine	VBK, Camper	ICE	14305
2	Engine Bay LHS	Engine-Frame Ground Strap	VBK, Camper	ICE	14305
3	Engine Bay LHS	Main Battery to Engine	VBK, Camper	ICE	14301
4*	Engine Bay LHS	Cooling Fan	VBK, Camper	ICE	14290
5	Engine Bay LHS	GDM	VBK, Camper	ICE	14290
6	Engine Bay LHS	TCM, AC Clutch, Updb	VBK, Camper	ICE	14290
7	Side Member Front LHS	PCM	VBK, Camper	ICE	14290
8	Engine Bay RHS	Ground Strap	VBK, Camper	ICE	90A000
9	Engine Bay RHS	Ground Strap	VBK, Camper	ICE	90A000
10	Floor Pan Front	Batt Aux Batt	VBK, Camper	ICE	14300
11	Engine Bay LHS	RF Headlamps, Horn	VBK, Camper	ICE	90A000
12	Engine Bay LHS	EBB	VBK, Camper	ICE	90A000
13	Engine Bay LHS	EBB	VBK, Camper	ICE	90A000
14	Cross Car Beam RHS	Cluster, ICP, Diagnostic	VBK, Camper	ICE	92A000
15	Cross Car Beam RHS	AHU, Sync 4.0	VBK, Camper	ICE	92A000
16	Cross Car Beam LHS	Clmt Ctrl, EPB SW, Display	VBK, Camper	ICE	92A000
17	A Pillar LHS	UPDB, Nox, Pwr Windscreen	VBK, Camper	ICE	90A000
18	A Pillar LHS	IPDB, Pwr Window	VBK, Camper	ICE	90A000
19	A Pillar RHS	Aux PDB & Upfitter	VBK, Camper	ICE	90A000
20	A Pillar RHS	Pwr Wndw, Mirror, Roof, Upfitter, DRW	VBK, Camper	ICE	90A000
21	Side Member Front LHS	EPAS	VBK, Camper	ICE	3C221
22	Side Member Front LHS	EPAS	VBK, Camper	ICE	3C221
23*	Cross Car Beam RHS	Htr Blower, Diagnostic	VBK, Camper	ICE	92A000
24*	Bodyside Middle LHS	Power Side Load Door LHS	VBK, Camper	ICE	93A000
25	D Pillar RHS	Overhead Console	VBK, Camper	ICE	94A000
26*	D Pillar RHS	RH PSLD, Rear Blower Motor	VBK, Camper	ICE	94A000
27	Floor Pan Front	Driver Seat Assembly	VBK, Camper	ICE	90A000
28	Floor Pan Front	Passenger Seat Assembly, AC Outlet	VBK, Camper	ICE	90A000
29*	Side Member Rear LHS	Fuel Pump	VBK, Camper	ICE	14406
30	D Pillar LHS	Amplifier	VBK, Camper	ICE	93A000
31	D Pillar LHS	Intel. Torque Ctrl Coupling	VBK, Camper	ICE	14406
32	Side Member Rear LHS	LH PSLD, Rear Wiper, Rear	VBK, Camper	ICE	93A000
33	Bodyside Middle RHS	Power Side Load Door RHS	VBK, Camper	ICE	94A000
34	Cross Member 3	Nox, PM Sns, Active Exhaust	VBK, Camper	ICE	14406

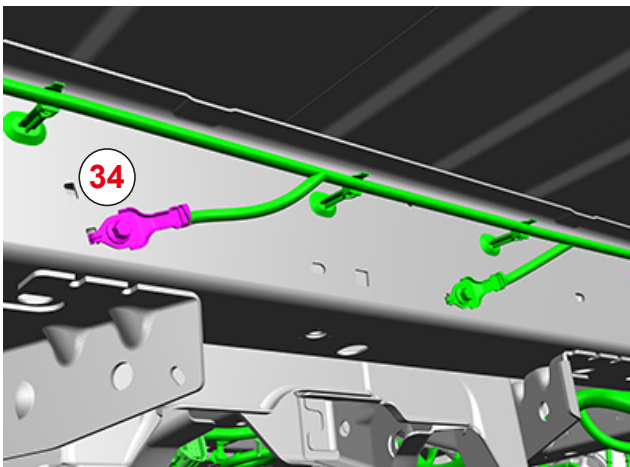
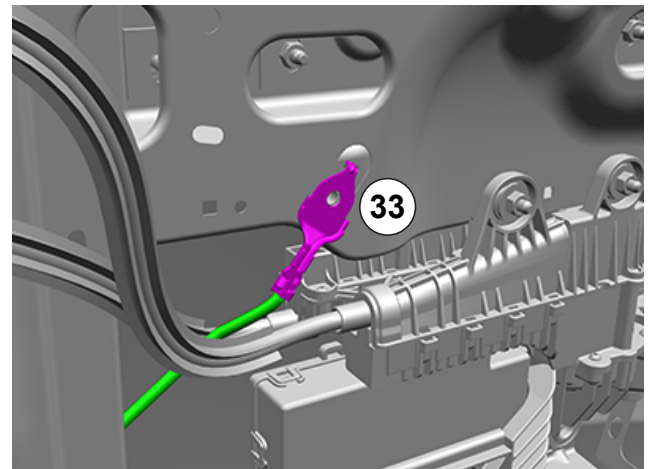
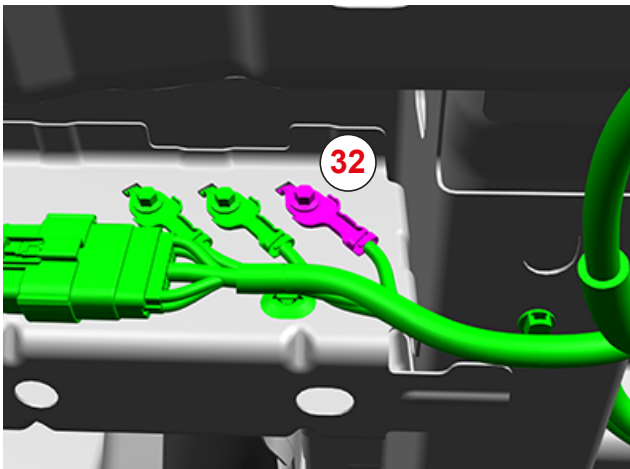
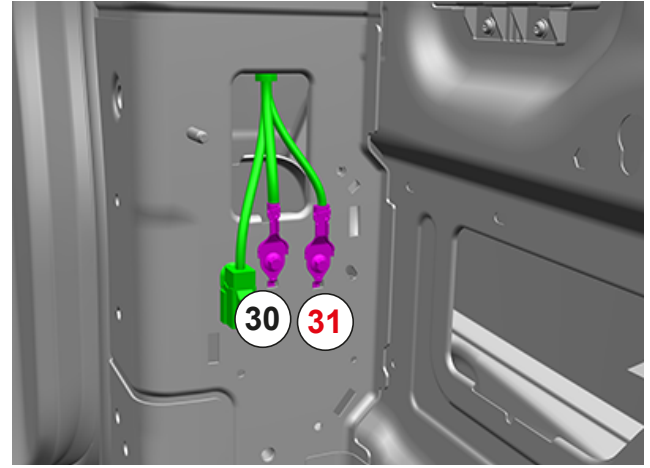
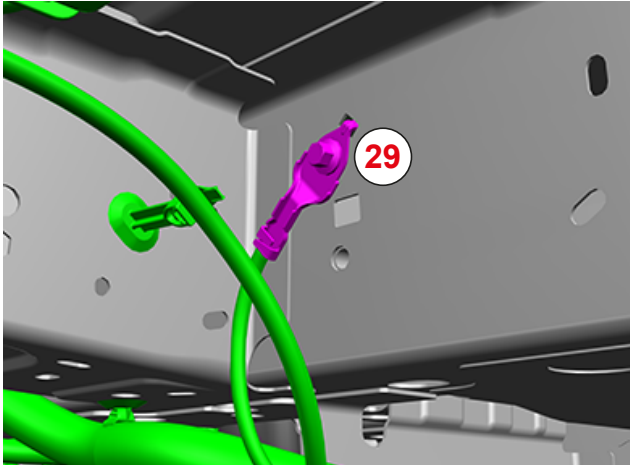
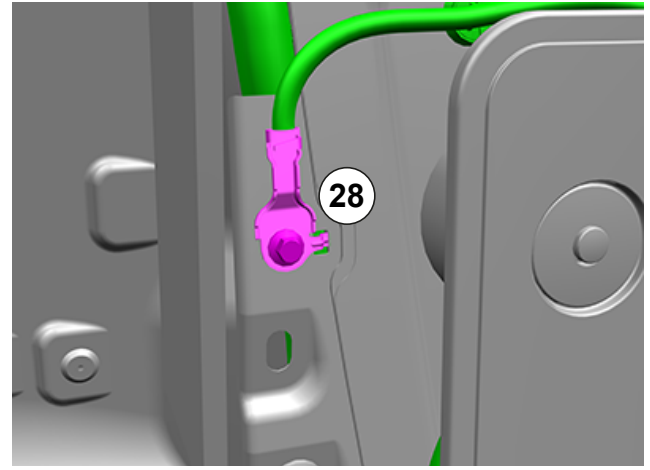
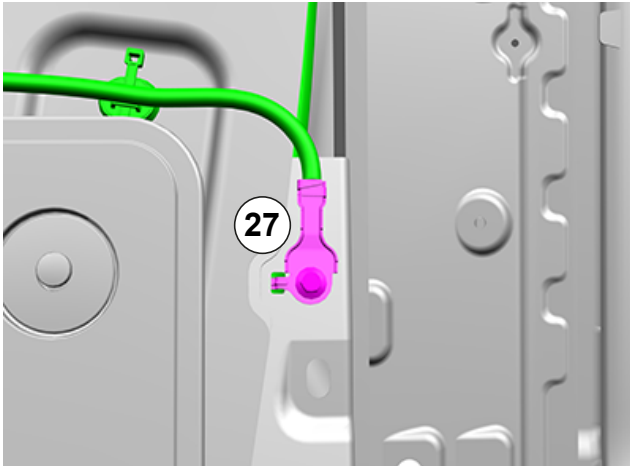
Ground points highlighted in red are safety critical and must not be used as *additional* ground points

\* If circuit based electrical/electronic items are connected they may receive ground noise/feedback











## 5.1 Body

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.1.1 Body Structures - General Information

**WARNINGS:**



**Before drilling see figure E146882a for Boron Steel parts, in this section of the manual.**



**Before drilling the floor, check the Precautionary Drill Zones, see section 5.1.4 Floor Precautionary Drill Zones: Diesel Vans.**



**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 disperses the load evenly
- Repaint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection legislation
- All fixings through the floor, sides or roof must be sealed

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.

[Refer to: 5.13 Corrosion Prevention](#)

- 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, see (Frame Drilling and Tube Reinforcing).

[Refer to: 5.14 Frame and Body Mounting](#)

For Load Compartment Tie Downs (Load Lashing Points). For additional Precautionary Drill Zones

[Refer to: 4.2 Wiring Installation and Routing Guides](#)

[Refer to: 5.6 Body Closures](#)

### 5.1.2 Welding



**WARNING: Before welding see figure E146882a for 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 with 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 minimise spattering when welding.

**The following points must be noted when welding:**

- Zinc starts to melt at about 420°C
- Zinc vaporises 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 primer is achieved later
- If the join area is not accessible from the inside and the cleaning and sanding work cannot be done, 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

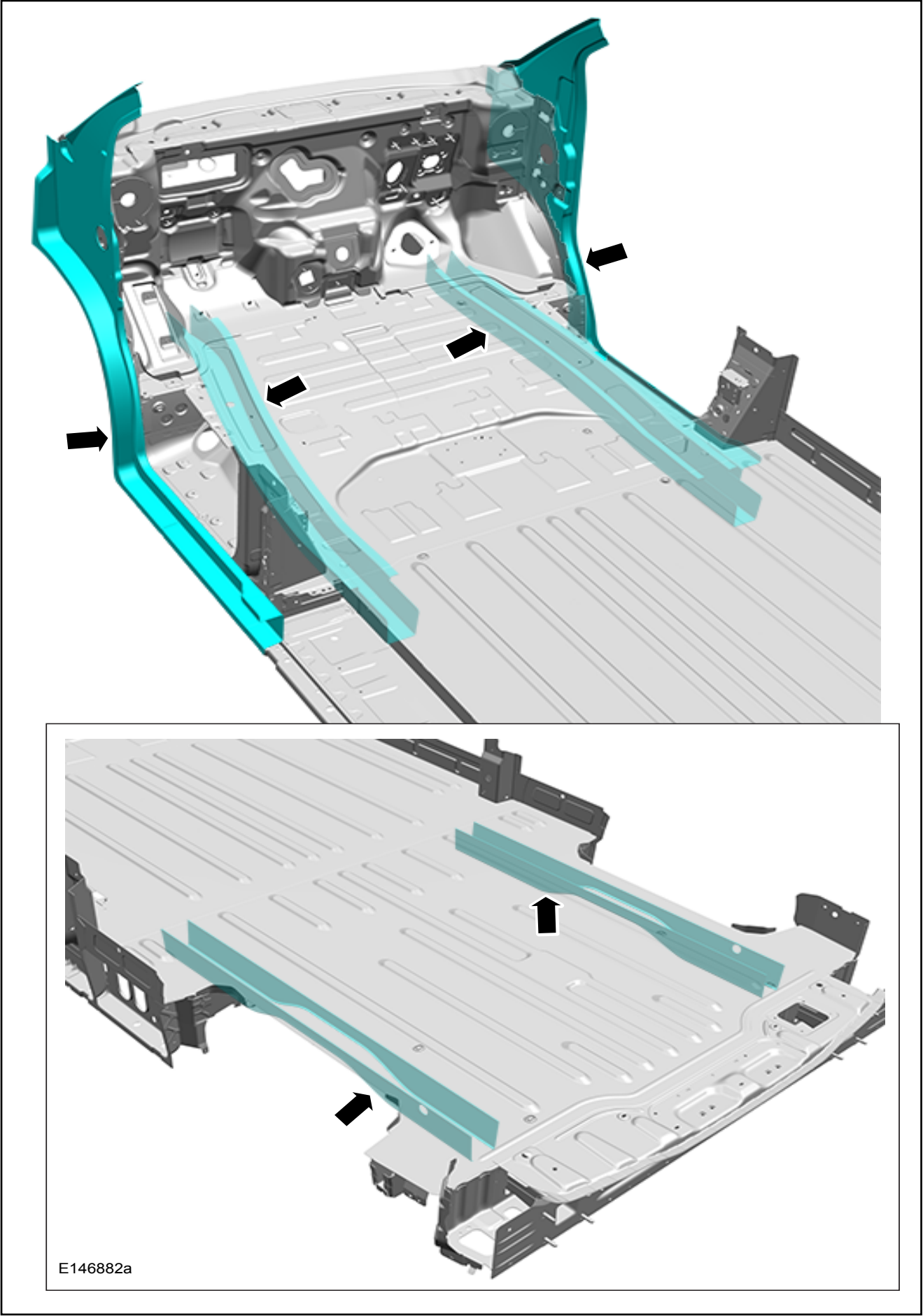
**NOTE:** Only apply a small amount of panel cleaner to the cleaning cloth when cleaning the area. Make sure that no cleaner reaches the connecting flange, so that the welding primer is not washed away.

**Priming after welding**

Primer should be 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



E146882a

### 5.1.4 Floor Precautionary Drill Zones: Diesel Vans

**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.

It is recommended that Transit Custom CAD is obtained to understand vehicle component placement/location of Fuel/DEF tanks, fuel filler, wire harness routing, coolant line routing and hydraulic brake line routing. CAD can be obtained from Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

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

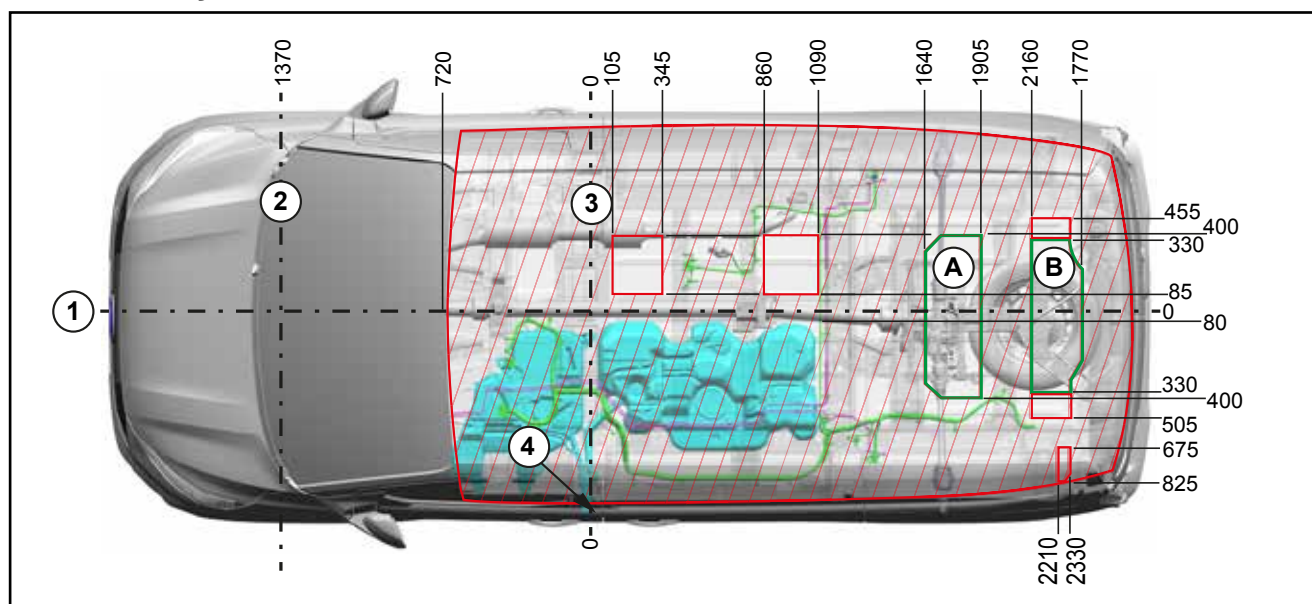
It is strongly recommended that drill-depth stops be used. Drill stop depth shall not exceed 25mm (1.0") maximum depth.

**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.

Refer to:  
[5.1.1 Body Structures - General Info](#)  
[5.13 Corrosion Prevention](#)

#### Precautionary Drill Zones - L1



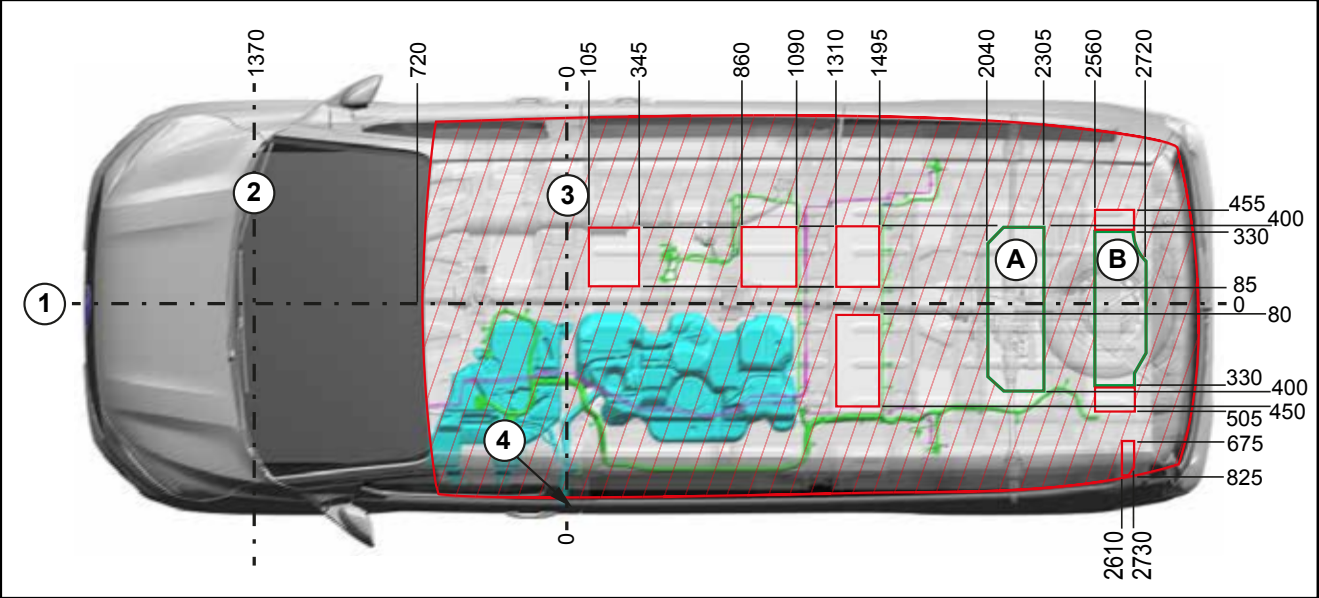
#### Floor Precautionary Drill Zones - Particular caution should be exercised in the hatched area

1	Centre Line of Vehicle	4	Fuel Filler - 'B' Pillar
2	Centre Line Front Wheel Axle	A	Area drillable only on FWD (Not AWD) and when spare wheel deleted
3	Centre Line 'B' Pillar	B	Area drillable only when spare wheel deleted

#### Colour Key

	Fuel/DEF Tanks		Brake Lines
	Electrical Harness		

Precautionary Drill Zones - L2



Floor Precautionary Drill Zones - Particular caution should be exercised in the hatched area			
1	Centre Line of Vehicle	4	Fuel Filler - 'B' Pillar
2	Centre Line Front Wheel Axle	A	Area drillable only on FWD (Not AWD)
3	Centre Line 'B' Pillar	B	Area drillable only when spare wheel deleted

Colour Key			
	Fuel/DEF Tanks		Brake Lines
	Electrical Harness		

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 Hydraulic Lifting Equipment

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### General Information

#### WARNINGS:



**Do not cut away any structural member.**



**Equipped vehicles must be designed to be stable under 'worst case' operating conditions with support legs extended, if fitted.**



**Do not lift vehicle off the ground.**

#### CAUTIONS:



**Safety devices must ensure the legs are deployed when operating the lifting equipment.**



**Safety devices must ensure the legs are stowed and locked away prior to engaging vehicle drive.**

**NOTE:** There are no tie down locations in the floor. It is the convertor's responsibility to fix with adequate reinforcements from below.

For additional information:

[Refer to: 5.14 Frame and Body Mounting.](#)

The Vehicle Convertor is responsible for:

- Fitting decals, advising on the safe use of the equipment
- Routing electrics and hydraulics separately and away from original Ford equipment
- Using suitable clips to fix on vehicle body and subframe
- Offering master switch in the cab to isolate the whole system

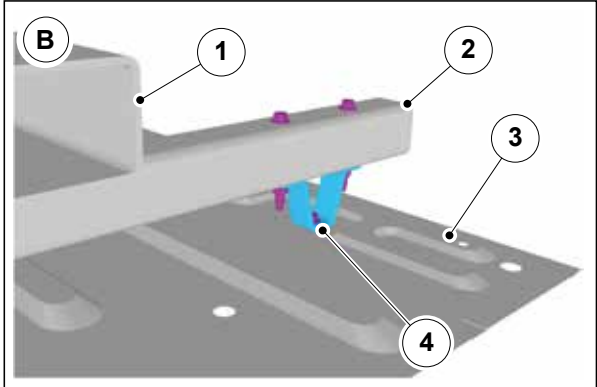
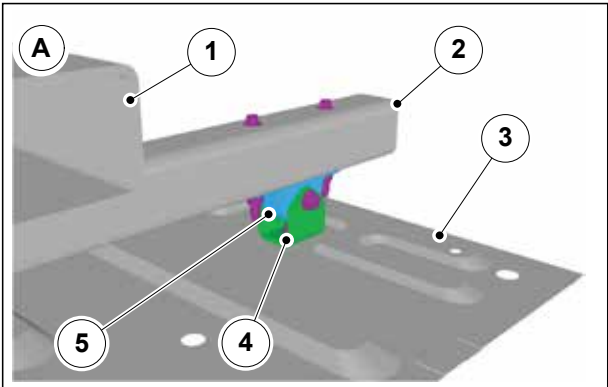
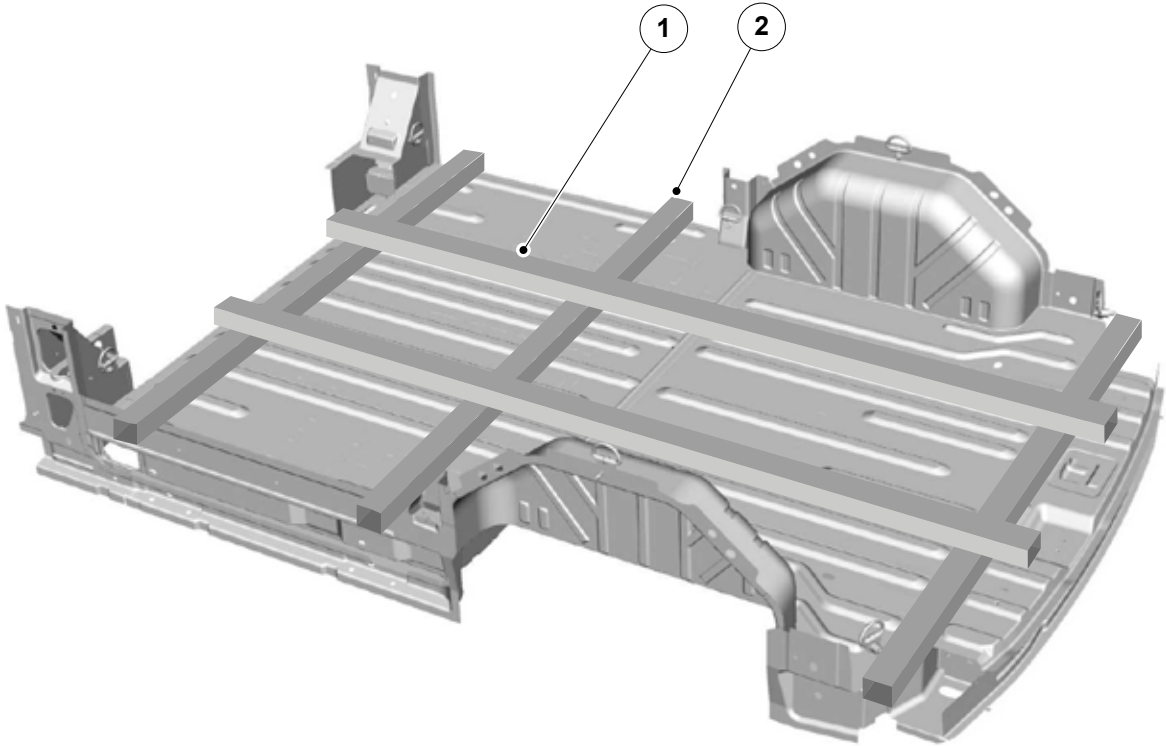
### Cranes and Platforms

It is recommended to design subframes in the way that there is no adverse strain on the vehicle structure. Use compliant and fixed mounts to attach to the vehicle body. For design principle refer to E145387.

For Van, Bus and Kombi:

- It is recommended to fix every mount with M8 bolt grade 8.8 minimum
- Any other floor contact should be padded to prevent local stress and to allow function of compliant mounts
- Very stiff sub-frames should not be rigidly mounted to the floor, please refer to Figure E145387 for an example of a compliant mount. Compliant bushes should allow up to  $\pm 12\text{mm}$  movement at a rate of 100kg per 1.0mm deflection with only the rear pair of load compartment tie down mounting brackets being fixed
- Support legs, if required, must be fitted directly to the sub-frame
- Support legs must be designed to prevent any adverse strain on the vehicle structure when operating the equipment
- It is recommended to lift the subframe from the floor as shown in figure E145387

Rigid or Torsion Stiff Subframe for Van, Bus and Kombi

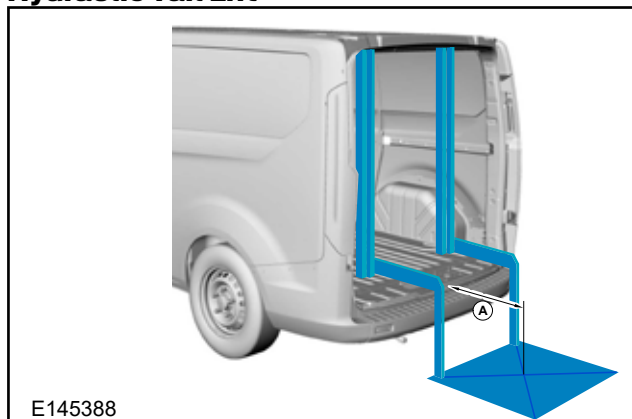


E145387

Item	Description
A	Compliant Mount
B	Fixed Mount
1	Subframe longitudinal
2	Subframe outriggers
3	Floor of vehicle
4	Fix to floor using adequate reinforcements
5	Captive compliant bush



## Hydraulic Tail Lift



Item	Description
A	1000mm

It is recommended to fix lift framework on bottom and on top side by using reinforcing plates and through bolts. It is also recommended to design and/or locate the reinforcing plates in a way that load can be routed into adjacent reinforced body structure. If mounted at rear door symmetrical to the vehicle centre line, load capacity is up to 700kg at 1000mm from floor edge to centre of load.

If mounted asymmetrical to the vehicle centre line or if mounted at side load door, load capacity is up to 500kg at 1000mm from floor edge to centre of load. For pillar lifts with adjustable reach swing jib, fixed only to one rear door pillar, load capacity is reduced to 100kg at maximum 1000mm reach.

For load conditions as described above additional stabilising equipment is not necessary. Hydraulic under-slung tail lifts are not recommended for Transit Custom Van, Bus and Kombi.

Greater off-sets and/or loads require additional stabilising equipment such as outriggers or ground jacks. It is recommended not to increase vehicle body stress over limit as given by load factors above.

It is the vehicle convertor's responsibility to fit a decal to the converted vehicle stating that the equipment must not be used without outriggers/ground jacks in operating position. It is also the vehicle convertor's responsibility to guarantee safe functioning of the equipment.

## 5.3 Racking Systems

For attaching a racking system, it is recommended to use the marked areas shown in figure E146883 rev1.

- 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 Frame and Body Mounting section of this manual, Figure E148689 Frame Drilling and Tube Reinforcing.
- 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

For additional information

[Refer to: 5.13 Corrosion Prevention](#)

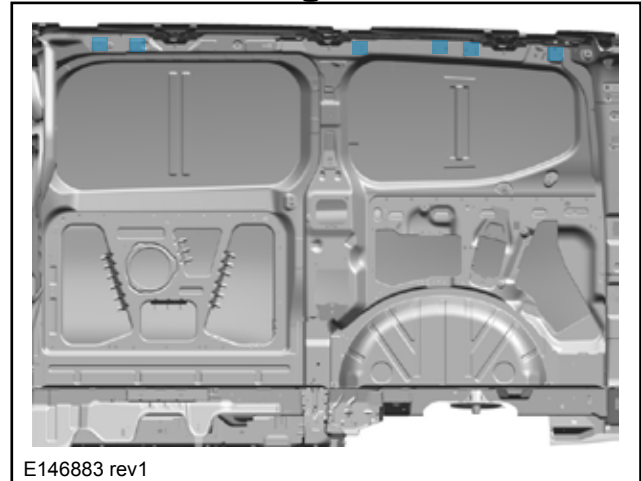
For additional information on Precautionary/No Drill Zones

[Refer to: 4.2 Wiring Installation and Routing Guides](#)

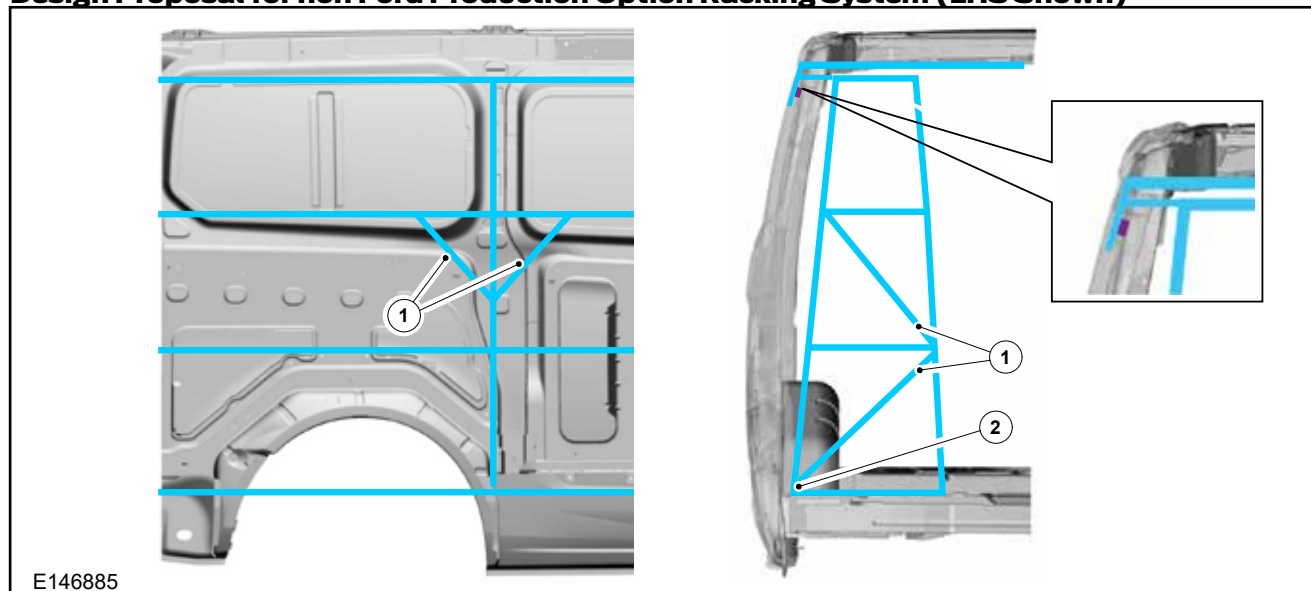
[Refer to: 5.1 Body](#)

[Refer to: 5.6 Body Closures](#)

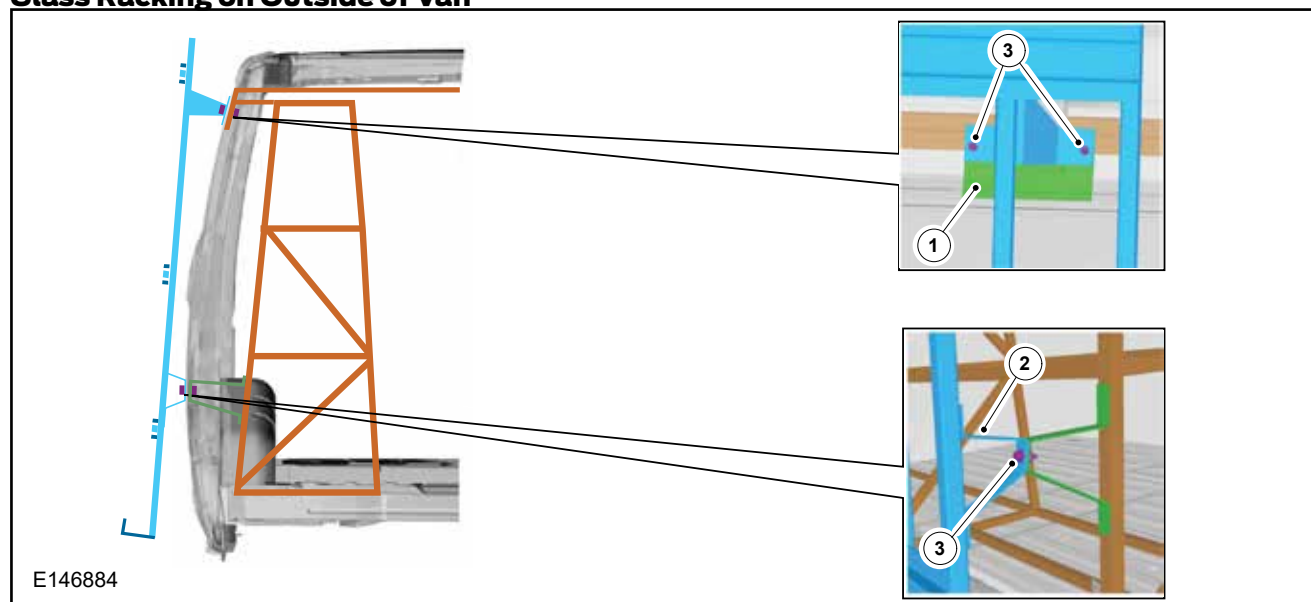
### Recommended Fixing Locations



For designing glass carrying rack on body side outer, construct internal rack and bolt through the body side to the internal rack, see figure E146885.

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

Racking - Floor Fixings to Load Compartment Tie Downs

**Glass Racking on Outside of Van**

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

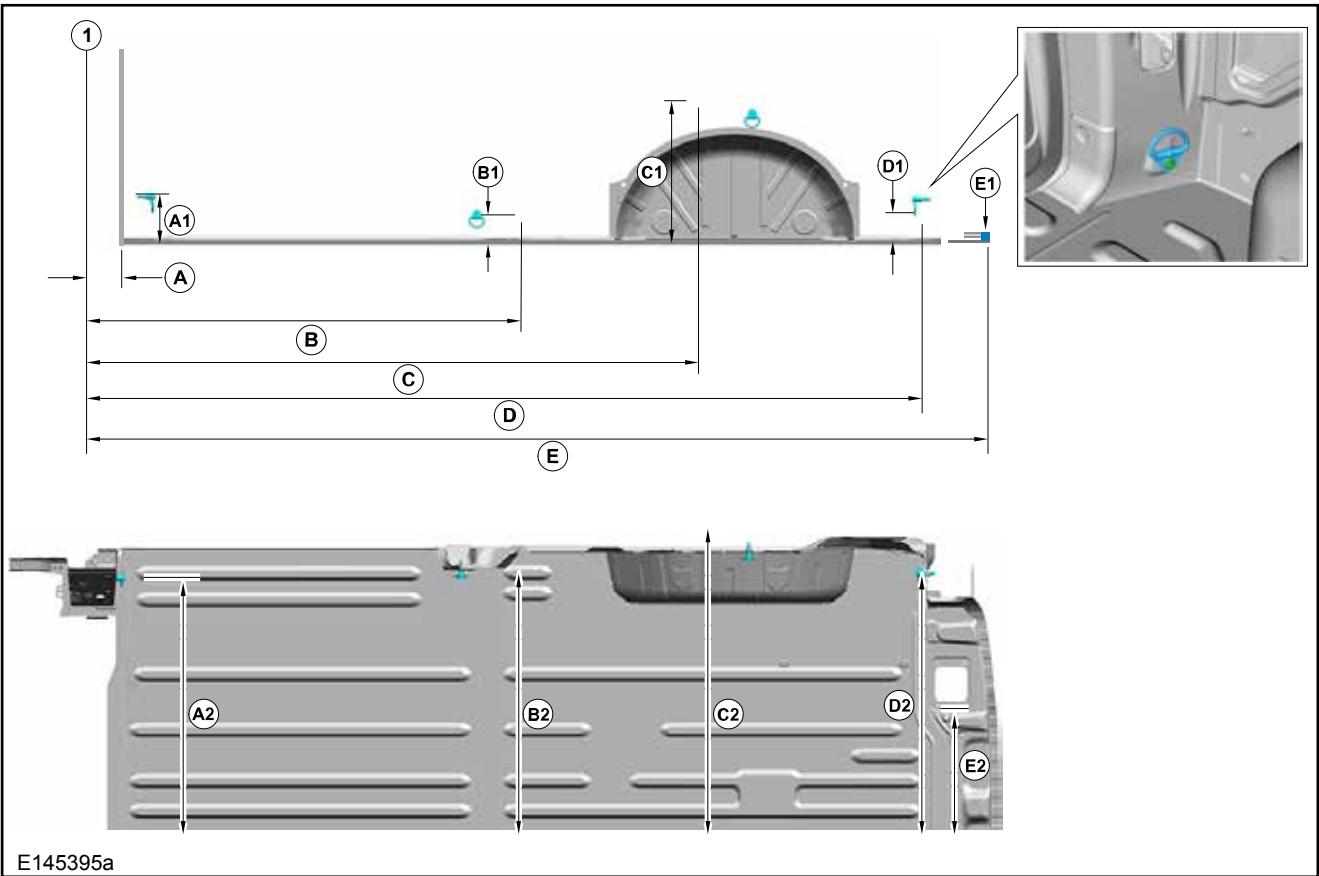
Glass Racking on Outside of Van - Through Fixed to Internal Racking (Recommended Minimum)

## 5.4 Loadspace

### 5.4.1 Load Compartment Tie Downs

For additional fixing locations [Refer to: 5.3 Racking Systems](#)

All vehicles are fitted with load compartment tie downs, these are all 'D' rings as shown in E145395. Not all vehicles will have all locations shown, it will depend on the base vehicle.



#### Dimensions for Load Tie Downs

Dimension (mm)	L1	L2
<b>Dimension from B Pillar (1)</b>		
A	78	
B	1177	
C	1716	2083
D	2374	2611
E	2515	2882
<b>Vertical from floor</b>		
A1	137	
B1	61	
C1	395	
D1	75	
E1	2	
<b>From centre line of vehicle</b>		
A2	733	
B2	817	
C2	882	
D2	791	
E2	450	

L1 = 2933mm Wheelbase, L2 = 3300mm Wheelbase

## 5.5 Interior Partitions

### 5.5.1 Partitions (Bulkhead) - Driver and Front Passenger(s) Protection on Van, Bus and Kombi

**WARNING:** In the in the case of 'Bulkhead Delete' (A6AAA) or bulkhead removal, the Upfitter **MUST** ensure that the B Pillar including the seat belt and retractor, are covered. This is to ensure that the safe operation of the seatbelt is not impaired.

**CAUTION:** Bulkheads serve an important function and are legally required in some territories.

It is the vehicle convertor's responsibility to ensure local current legislation governing bulkheads and protective window grilles is met. It is also

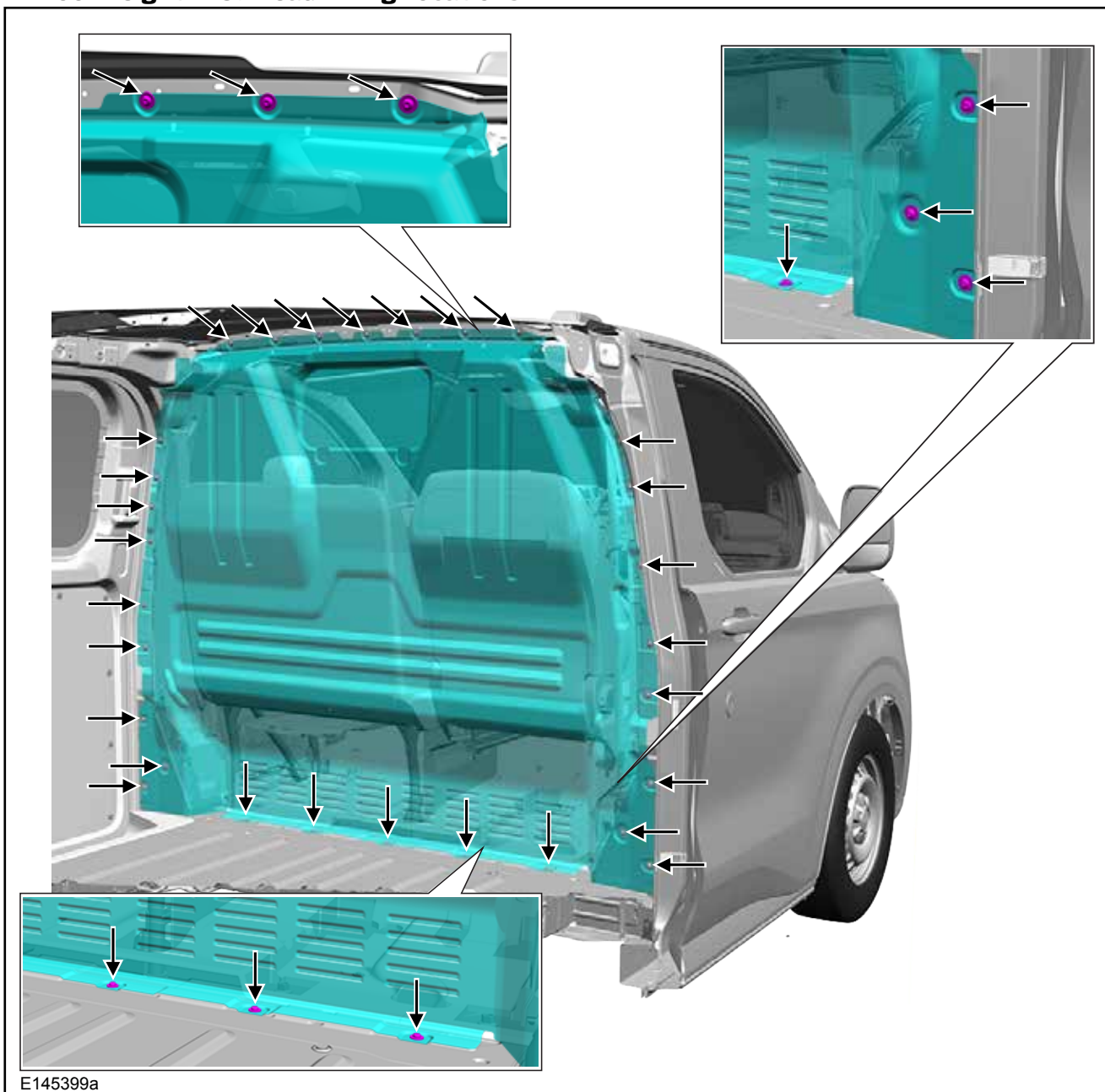
the convertor's responsibility to ensure legal load constraint requirements if using a non Ford standard bulkhead.

Standard Ford bulkheads do have a clearance between bulkhead and body structure to allow natural body flexing and an air circulation from the cab to the rear load space for ventilation control.

Air circulation and body flexing must also be given consideration when engineering an alternative bulkhead. It is not recommended to restrict driver's or passenger's seat adjustment travel.

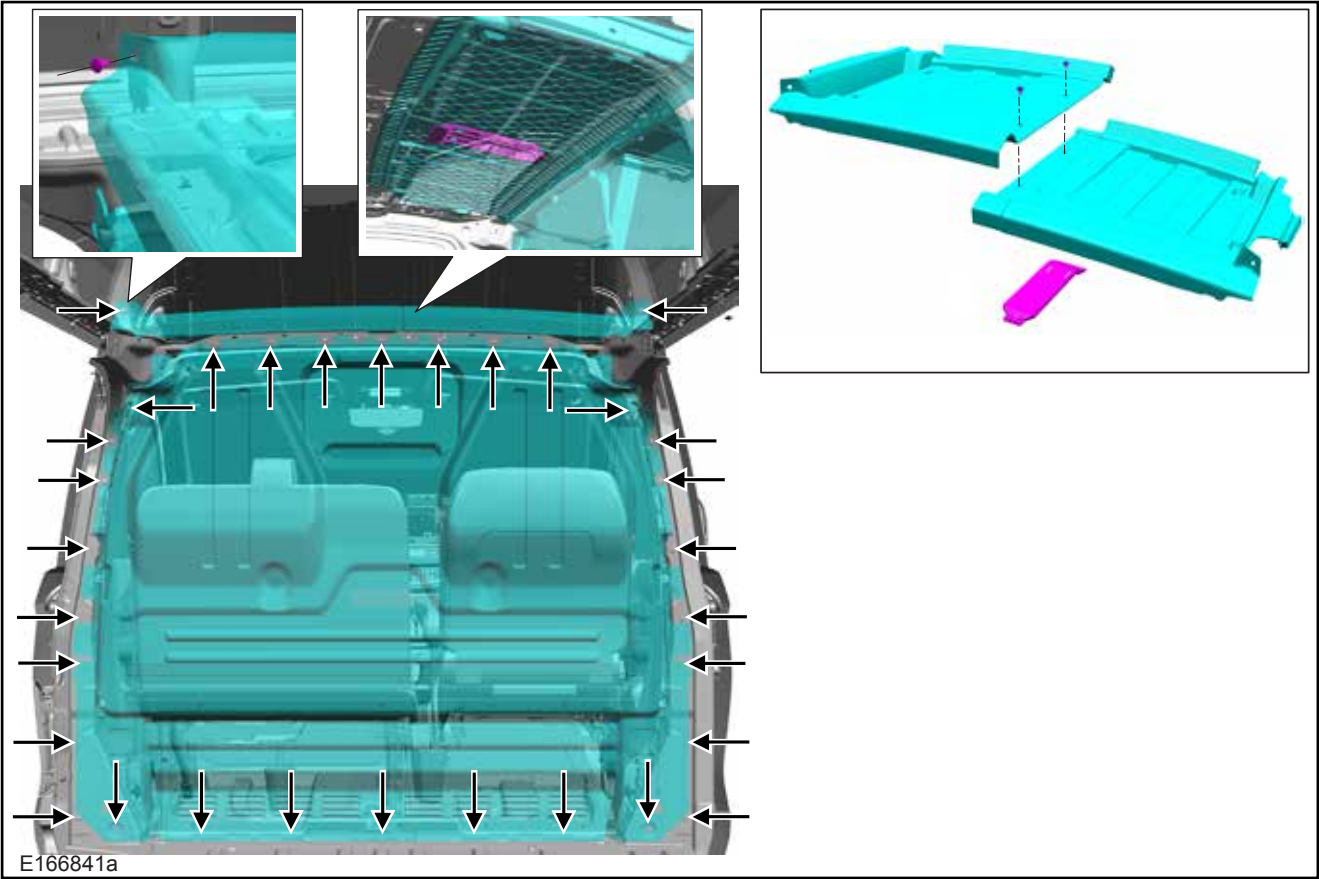
The following figures, E145399a and E166841a, show the standard bulkhead fixing locations on 'B' pillar. These are standard weld nuts for M6. The standard range of Ford bulkheads can be retro-fitted at these points.

#### H1 Roof Height - Bulkhead Fixing Locations



E145399a

H2 Roof Height - Bulkhead and Parcel Shelf Fixing locations

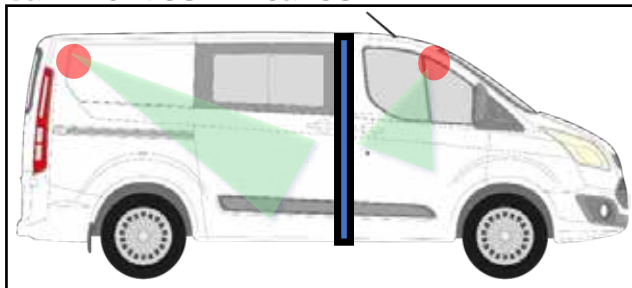




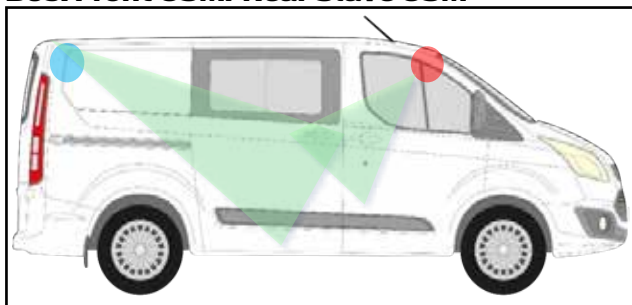
## 5.5.2 Partitions: Thatcham Alarm

The Thatcham alarm in the Van variant features two CSMs (motion sensors), one in the front and one in the rear. The Bus Variant features one CSM in the front and a slave CSM in the rear

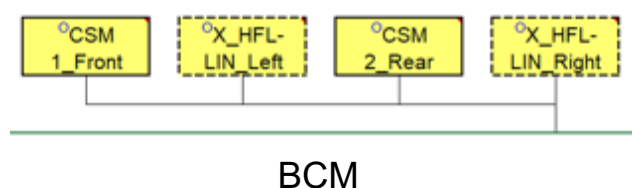
### Van: Front CSM/Rear CSM



### Bus: Front CSM/Rear Slave CSM



The front and rear CSMs are connected by a common LIN line. The front CSM will be configured by the BCM.



There are 2 main locations for the CSM to cover the front and rear with 7 different CSM modules, 4 different CSM unique brackets (+3 CSM locations in OHC and D-Pillar). There are 7 different calibrations for CSMs (front: 5, rear: 2)

### Cargo Van Less Bulkhead

Typically used for Police conversion vehicles and as prison transport vehicles. These will have Master/Slave CSM and no Bulkhead. These will require additional calibration (from Bus to DCiV) and configurations (BCM and rear CSM disabling information). Re-sold vehicles may require calibration to return them to factory settings. Calibrations are interchangeable between CSM modules.

For further information please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

	CSM Strategy	Calibration	Partition
Factory	Master/Slave	Bus	No Bulkhead
Police	Master/Slave	DCiV	Bulkhead
Camper	Master/Slave	Bus	No Bulkhead

### Camper Partition Limitations

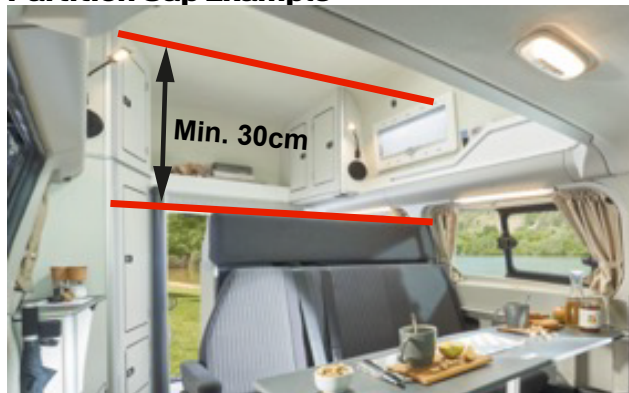
If a closed partition is fitted (such as illustrated below), this will have implications for the motion sensors. It will not be possible to detect movement in the rear of the vehicle and the opening of the rear tailgate will not be detected.

### Closed Rear Partition Example



in order to minimise these effects, a minimum gap of 30cm is recommended.

### Partition Gap Example



## 5.6 Body Closures

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.6.1 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.

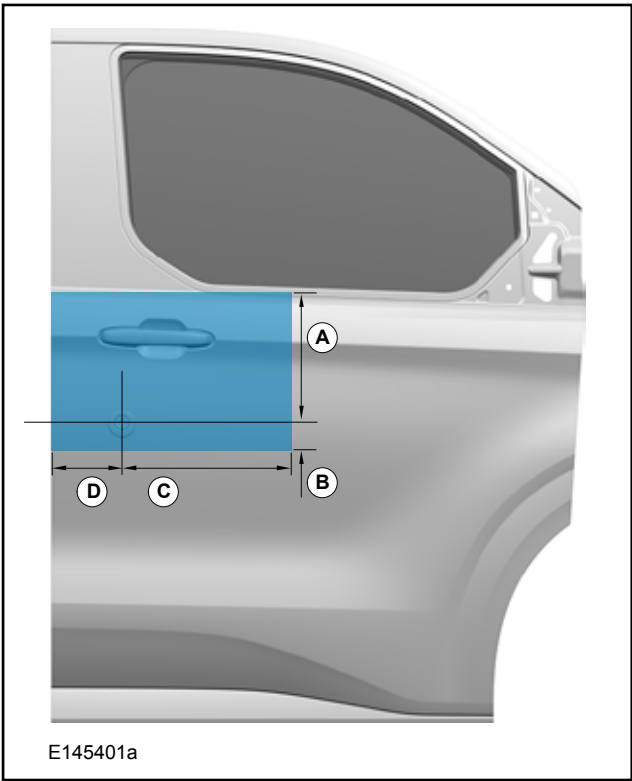
When removing and reapplying door seals, take care to fit correctly, using the same seals, as this is critical to door closing efforts. Any modification to the sealing flanges or surfaces will require consultation with your local Ford dealer. This may also include air extraction/venting adjustments to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

The Body Control Module 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: [4.21 Handles, Locks, Latched and Entry Systems](#)

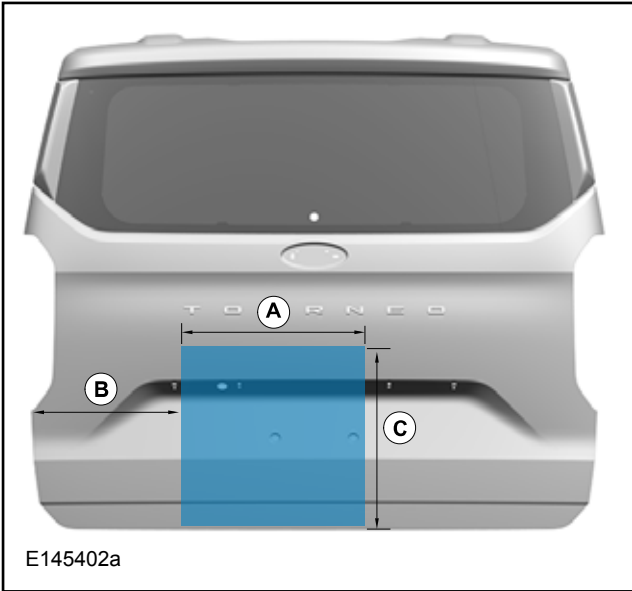
The following figures outline the areas in which it is not advisable to drill.

#### No Drill Zone - Driver and Passenger Doors



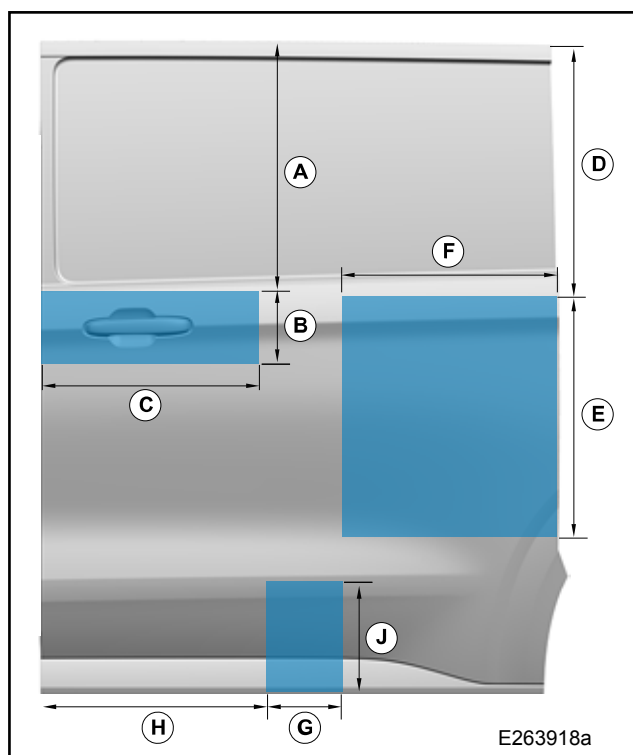
Item	Description
A	275mm
B	50mm
C	365mm
D	155mm

#### No Drill Zone - Lift-Gate



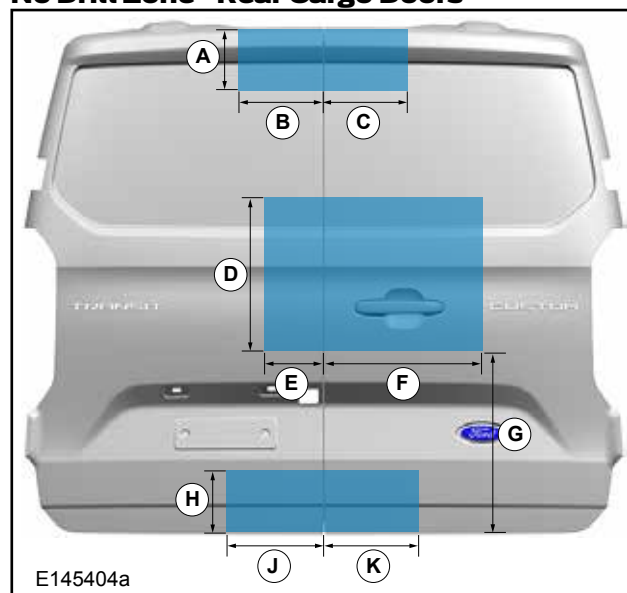
Item	Description
A	470mm
B	550mm
C	550mm

#### No Drill Zone - Side Sliding Doors



Item	Description
A	630mm
B	220mm
C	500mm
D	620mm
E	620mm
F	600mm
G	150mm
H	505mm
J	200mm

### No Drill Zone - Rear Cargo Doors



Item	Description
A	130mm
B	250mm
C	250mm
D	430mm
E	150mm
F	420mm
G	570mm
H	150mm
J	260mm
K	260mm

## 5.7 Interior Trim

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.7.1 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.

### 5.7.2 Plywood Lining/Cladding



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

Refer to: [4.2 Wiring Installation and Routing Guides](#)

Refer to: [5.6 Body Closures](#)

Refer to: [5.1 Body](#)

- 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 aluminium floor trims
- Plywood should be water resistant (WBP, water

and boil proof)

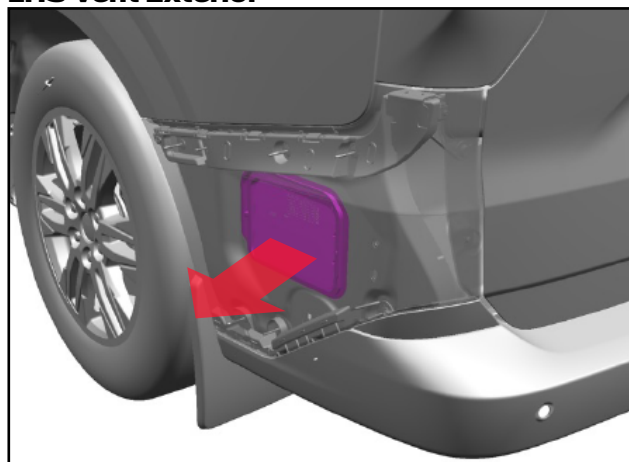
- It is recommended to use 9mm thickness for floors and 6mm thickness for side and door lining

### 5.7.3 Body Side Vents

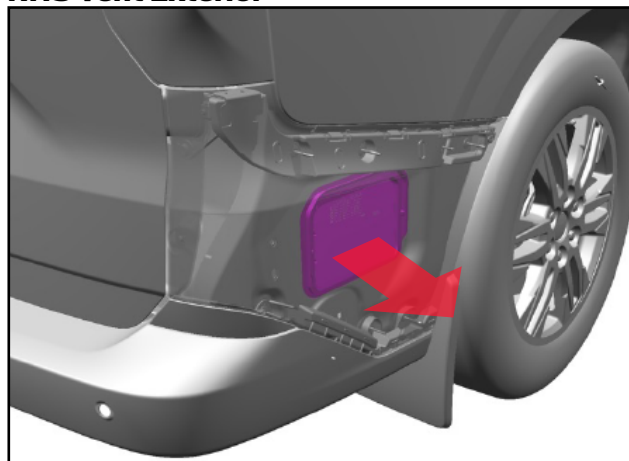


**WARNING: Movement of air within the vehicle exits internally through holes in the D-pillar/Body side panel then through vents located in the lower part of the body side outer as shown on LHS AND RHS (illustrated below) of all Vehicles. These cannot be covered or inhibited in any way.**

#### LHS Vent Exterior



#### RHS Vent Exterior

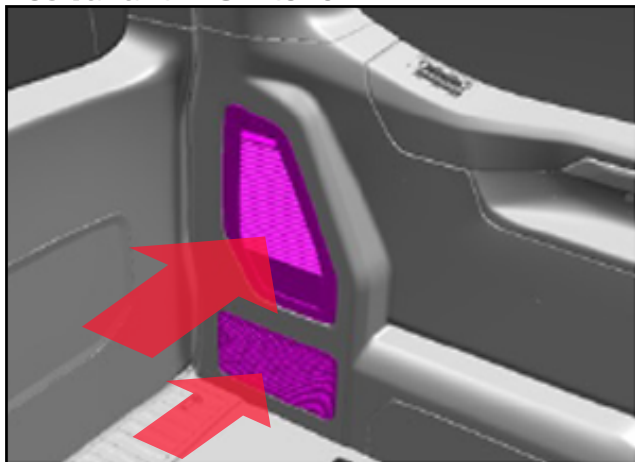


If air movement is impeded there will be problems with -

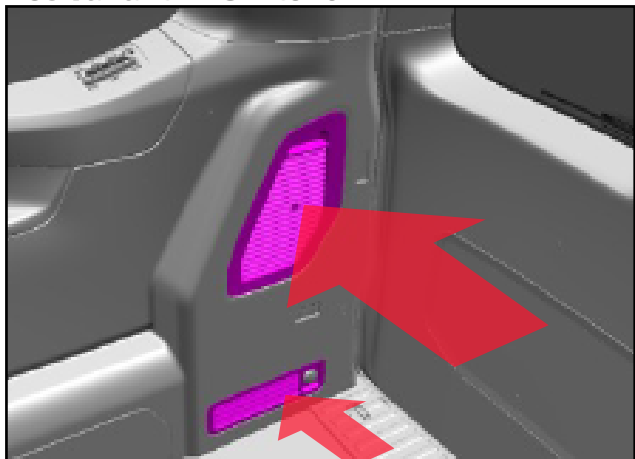
- Closing of doors.
- Closing of tailgate/rear doors.
- Air extraction.
- Moisture evacuation.
- Clearing windscreen whilst driving or static.
- Fan system (heating or cooling) from IP and rear HVAC systems.

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 201cm<sup>2</sup> MINIMUM must be allowed collectively through the vents/holes shown:

**Bus Variant LHS Interior**

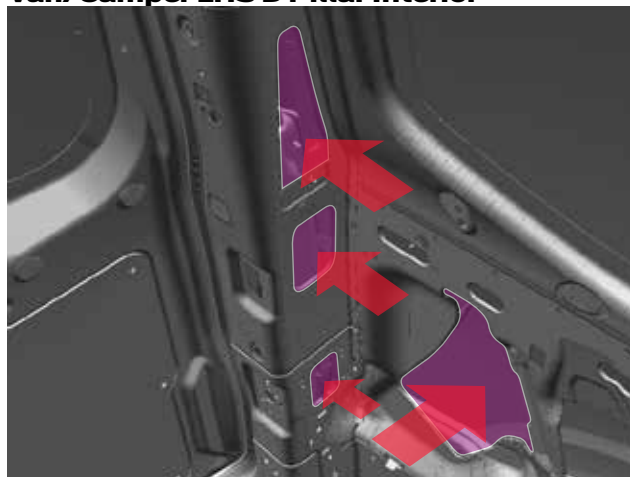


**Bus Variant RHS Interior**

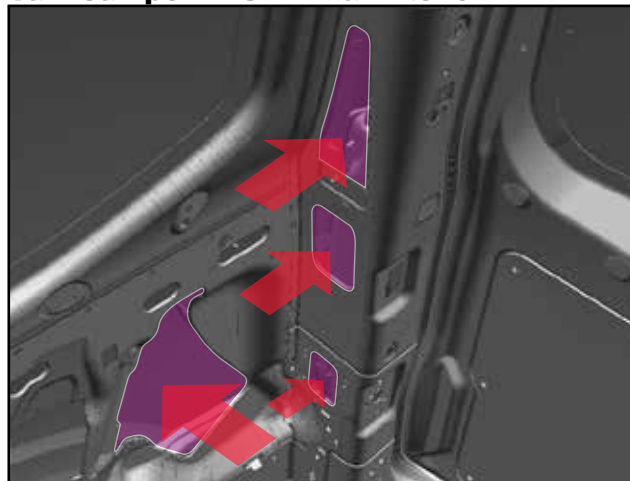


Collective air flow of 201cm<sup>2</sup> through both RHS AND LHS Body side panel and D-pillars highlighted must be allowed for.

**Van/Camper LHS D Pillar Interior**



**Van/Camper RHS D Pillar Interior**





## 5.8 Seats

**NOTE:** When reassembling the seat and the seat belt, use specified bolts and ensure to apply the specified torque. For torque specifications, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)



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

### 5.8.1 Van



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

### 5.8.2 Heated Seats



**WARNING: The electrical feed for the original heated Ford seat must not be used for other purposes, e.g. other electrical consumers.**

It is not advisable to retrofit heated seats due to potential airbag operation or malfunction (incorrect configuration).

### 5.8.3 Rear Seat Fixing Positions

Figures E265264a and E265265 show the second/second and third row seat fixing positions in the floor. These positions are independent of the wheelbase. The fixings are always present but access to the fixing is dependent on floorpan. Access holes in the floorpan may be required to gain access to the fixing.

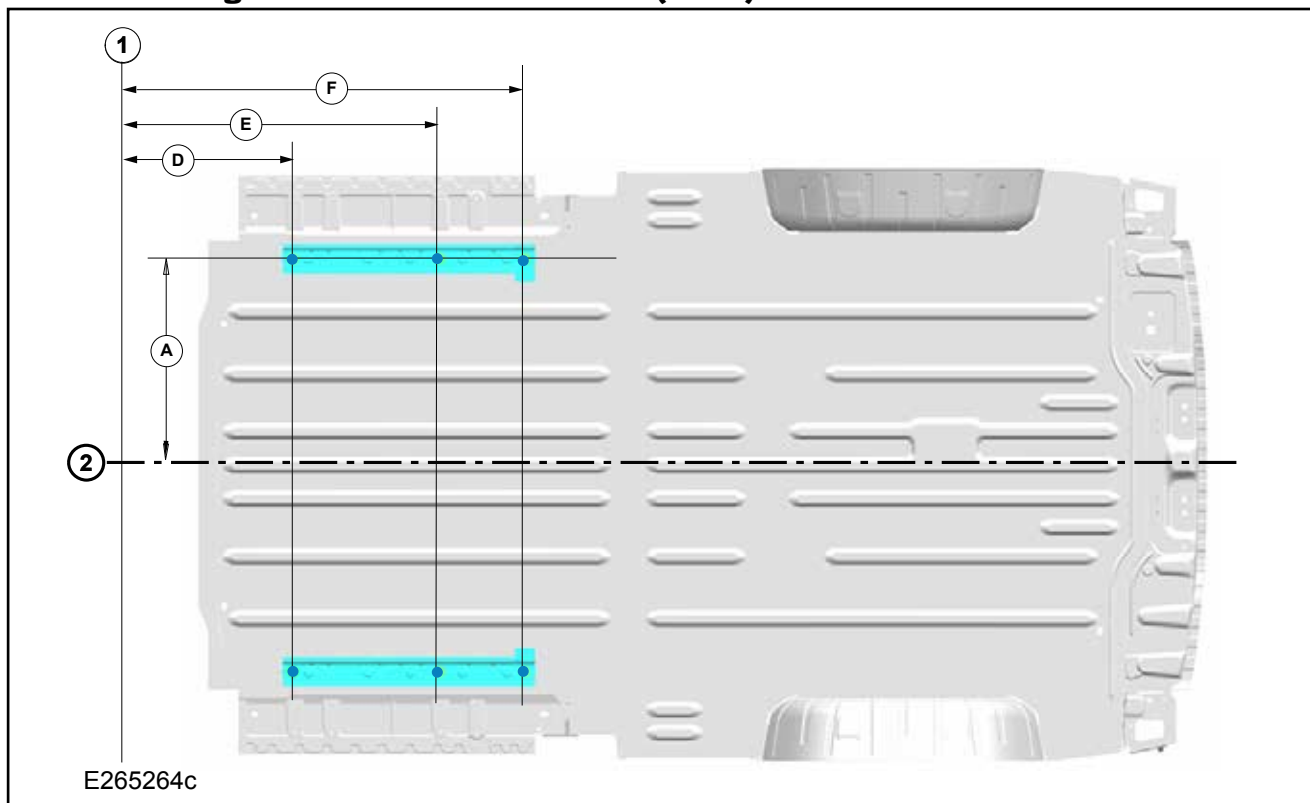
### 5.8.4 Fabricless Front Swivel Seats

Camper Donors – seat re-covering for fabricless front Swivel Camper Seats

**NOTE:** The camper fabric covering must be the same construction and stitching pattern as the standard Ford seats (do NOT stitch the fabric over the top of the SBM sensor – this must be a continuous section of fabric across the whole SBM sensor, extending to the edges for the seat cushion).

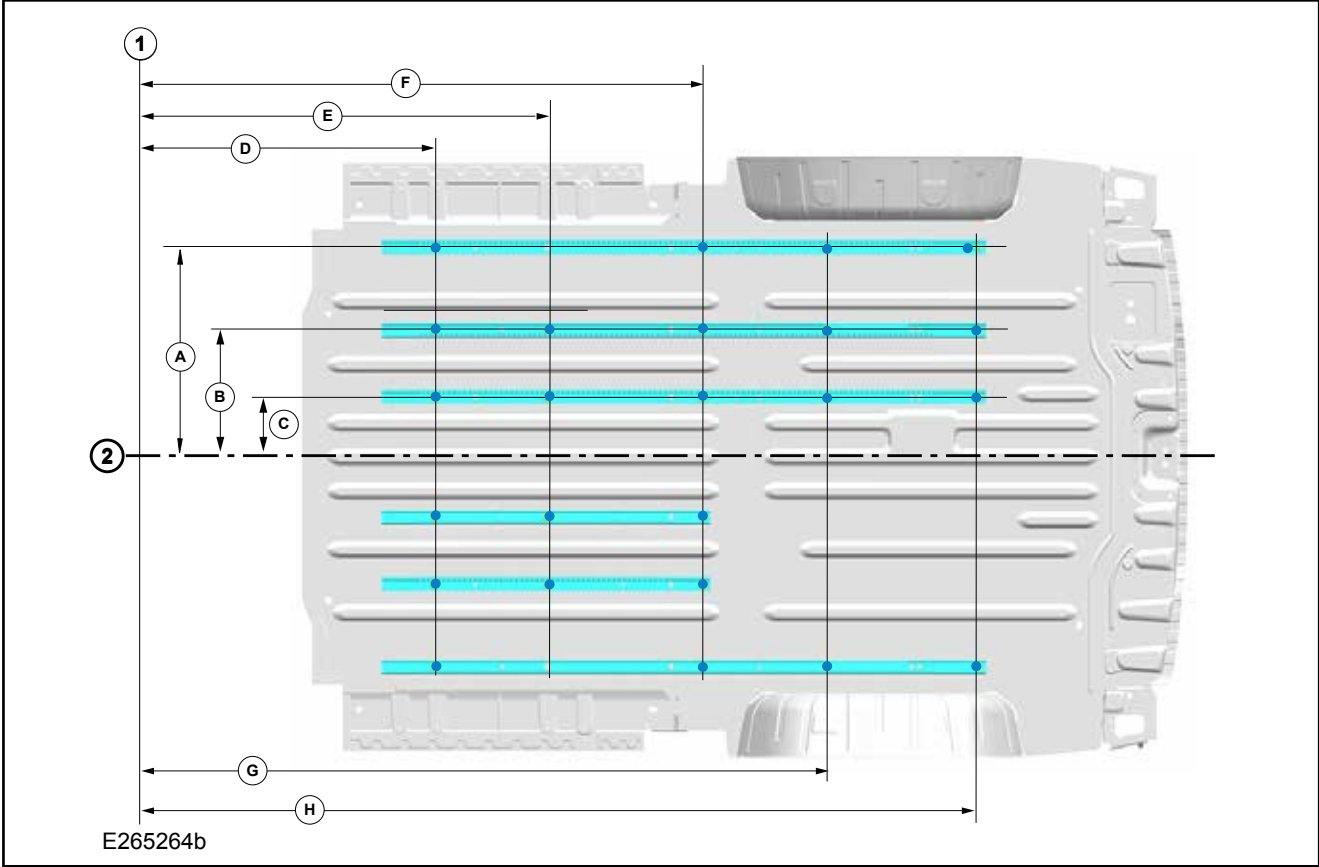


## Rear Seat Fixing Positions Double Cab In Van (DCIV)



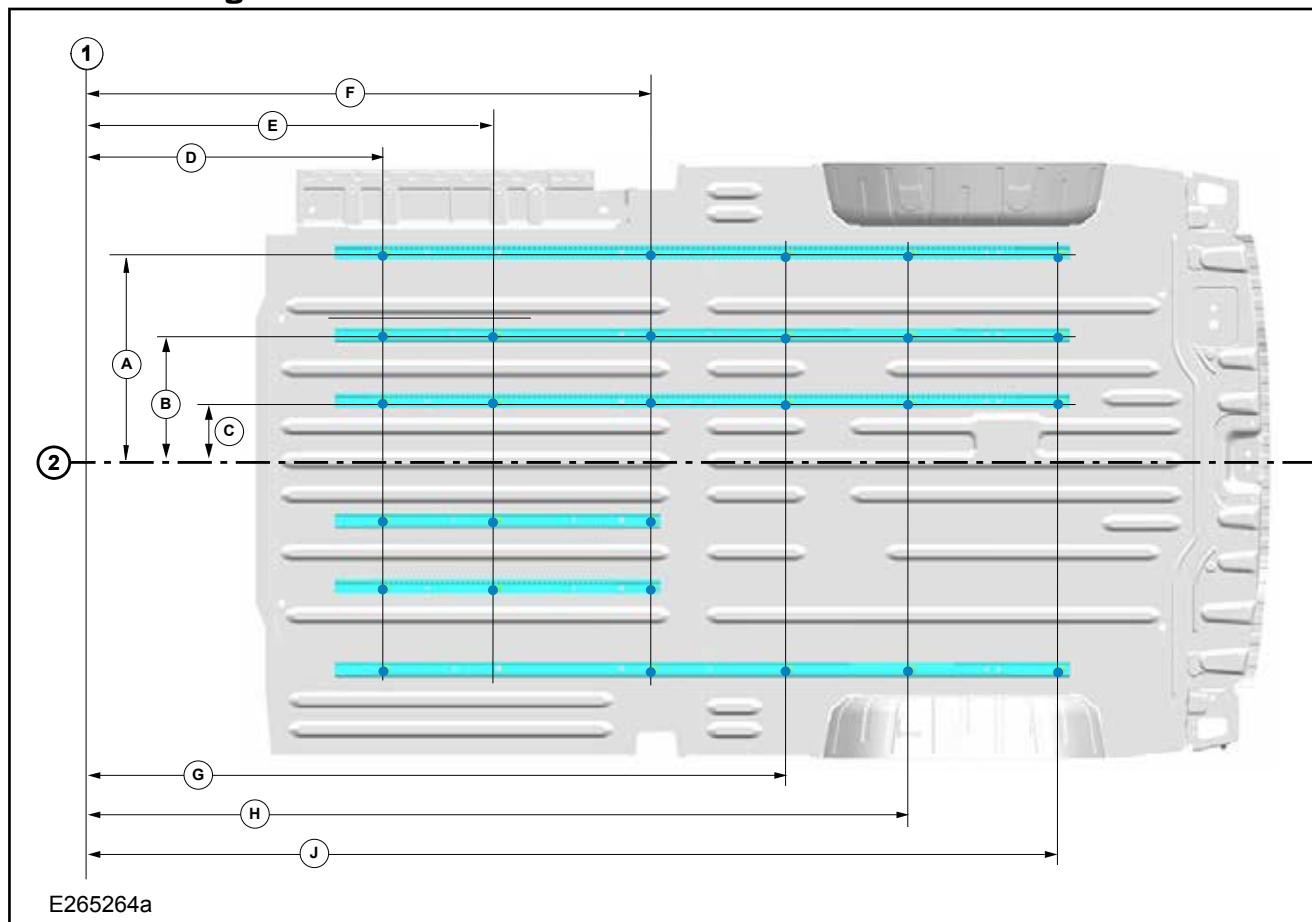
Item		Item	
1	Front Axle Line		
2	Centre line of vehicle		
A	614	E	2133
D	1699	F	2384

Rear Seat Fixing Locations L1



Item		Item	
1	Front Axle Line		
2	Centre line of vehicle		
A	614	E	2134
B	374	F	2587
C	175	G	2949
D	1804	H	3387

## Rear Seat Fixing Positions L2



Item		Item	
1	Front Axle Line		
2	Centre line of vehicle		
A	614	F	2587
B	374	G	2987
C	175	H	3349
D	1804	J	3787
E	2134		

## 5.9 Glass, Frames and Mechanisms

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.9.1 Heated Windscreen 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 Converter fit.

### 5.9.2 Rear and Side Windows

For windows, it is recommended to specify the base vehicle as a Kombi or Bus body - however, when converting a van, 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.

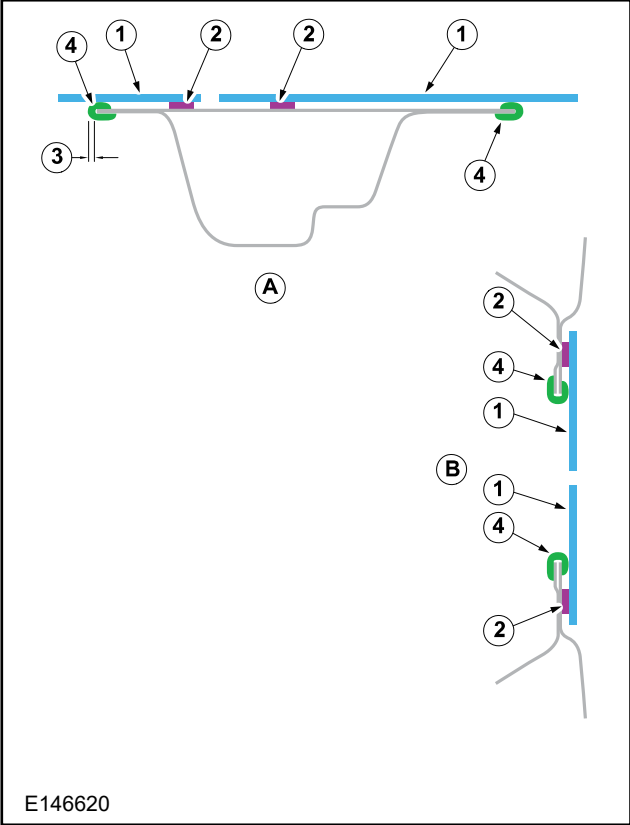
**WARNING:** For rear seat installation  
[Refer to: 5.8 Seats](#)

#### Typical Van Body Side view for Window Engineering



For vehicle wheelbase and overall vehicle height key dimensions  
[Refer to: 1.14 Package and Ergonomics](#)

#### Section through Typical Van Body Side for Window Engineering



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

## 5.10 Airbag Supplemental Restraint System (SRS)

### 5.10.1 Airbags

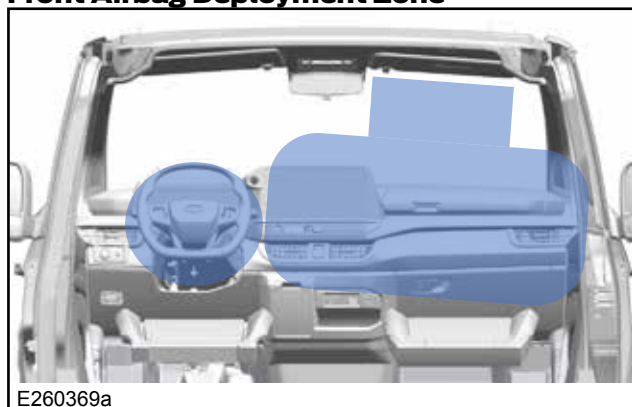
#### Front Airbag Deployment Zones

##### WARNINGS:

 **Do not add parts, sharp protrusions (eg bolts), place accessories or create sharp edges in the deployment zones 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.**

#### Front Airbag Deployment Zone



#### Side and Curtain Airbag Deployment Zones

##### WARNINGS:

 **Do not add parts, sharp protrusions (eg bolts), place accessories or create sharp edges in the deployment zones of the side and curtain airbags as they may impair airbag deployment.**

 **Do not place stickers or decals over the airbag covers as this may impair airbag deployment.**

**NOTE:** It is recommended to specify a base vehicle without airbags if planning conversions in this area.

**NOTE:** All M1 Buses are specified with side and curtain airbags as standard fitment.

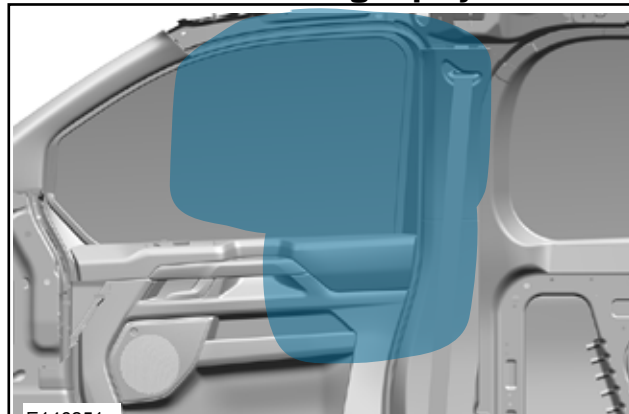
**Side Airbags (Seat Mounted):** The side airbags on this vehicle have not been validated for use with swivelling front seats. Do not specify a base vehicle with side airbags if planning to retrofit a swivelling device on the front seats and/or an armrest on the outer side of the front seats; this may affect the function and/or deployment of the side airbags. Ensure any seat covers installed are designed to be used with side airbag equipped seats.

**Curtain Airbags:** Extensive conversions to the roof and headlining may impair deployment of the curtain airbags. If roof or headlining is to be modified or replaced, do not specify curtain airbags on the base vehicle.

If access to the roof is required, to install roof mounted exterior accessories for example, ensure the unmodified headlining is refitted using the existing mounting points.

**NOTE:** On deployment, the Front Side Curtain Airbags will encroach approximately 260mm horizontally into the cabin. The placement of any objects within this zone should be avoided.

#### Front Side Curtain Airbag Deployment Zone



#### Kombi Side Curtain Airbag Deployment Zone

The rear Curtain Airbag is defined by centre of the 2nd row grabhandle till the 3rd row seat belt hanger bracket and door trim toproll.

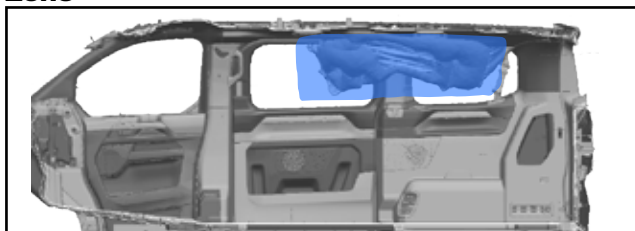
Do not mount equipment to the B, C and D Pillar above the beltline. Do not mount equipment above the beltline within 10mm of the C Pillar, from the B Pillar leading edge to the rear edge of the D pillar.

Do not mount equipment on the headliner within 10mm of the side edges. Do not mount equipment on the headliner along the siderails.

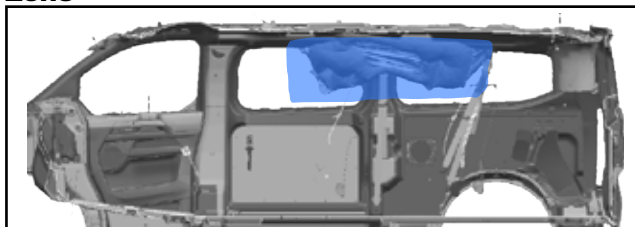
All airbag and equipment mounting zone dimensions are approximate due to different airbag deployment characteristics and represent free-form deployments without loading of occupants.

**NOTE:** On deployment, the Kombi Side Curtain Airbags will encroach approximately 100mm horizontally into the cabin. The placement of any objects within this zone should be avoided.

### L1 Kombi Side Curtain Airbag Deployment Zone



### L2 Kombi Side Curtain Airbag Deployment Zone



### Bus Side Curtain Airbag Deployment Zone

The rear Curtain Airbag extends from the B Pillar to the D Pillar and from the roof rail to the beltline.

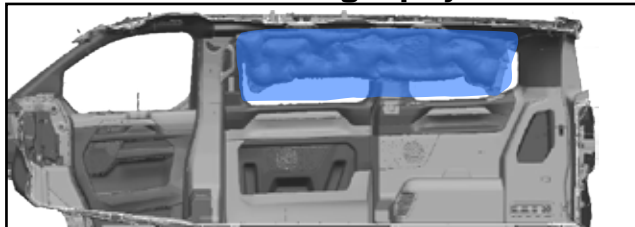
Do not mount equipment to the B, C and D Pillar above the beltline. Do not mount equipment above the beltline within 10mm of the C Pillar, from the B Pillar leading edge to the rear edge of the D pillar.

Do not mount equipment on the headliner within 10mm of the side edges. Do not mount equipment on the headliner along the siderails.

All airbag and equipment mounting zone dimensions are approximate due to different airbag deployment characteristics and represent free-form deployments without loading of occupants.

**NOTE:** On deployment, the Bus Side Curtain Airbags will encroach approximately 120mm horizontally into the cabin. The placement of any objects within this zone should be avoided.

### L1 Bus Side Curtain Airbag Deployment Zone



### L2 Bus Side Curtain Airbag Deployment Zone



## Restraints Control Module (RCM)

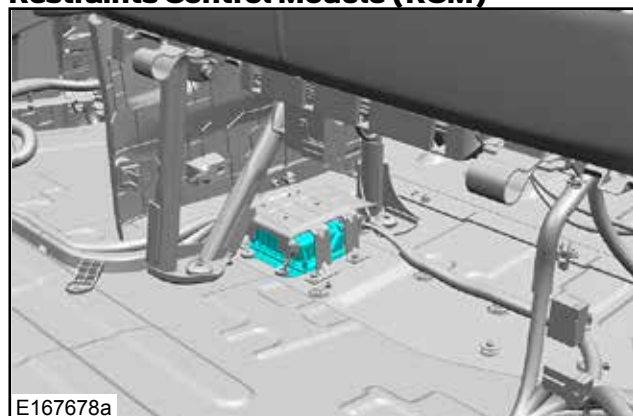
The RCM is located under the front seat on the centre line of the vehicle, see figure E167678a. This is Driver's, Passenger's or Dual Seat depending on specification.

### WARNINGS:

**⚠** Modifications or reinforcements in the area of the RCM may affect the side airbag deployment timing and result in uncontrolled side airbag deployment.

**⚠** The RCM device is protected by a cover, to prevent damage. The protective cover should be maintained in its fitted position to ensure protection for the RCM.

### Restraints Control Module (RCM)



## Front, Rear and Side Sensors

The airbag sensor for the front airbags is located behind the front grille, see figure E263912a.

Sensors are located in the B, C and D pillars on the of the vehicle, see figures E263912b, E263912c, E263912d.

The sensors for the side airbags are located in the front doors, see figure E145412a.

### WARNINGS:

**⚠** Modifications or reinforcements in the area of the sensors may affect the side airbag deployment timing and result in uncontrolled side airbag deployment.

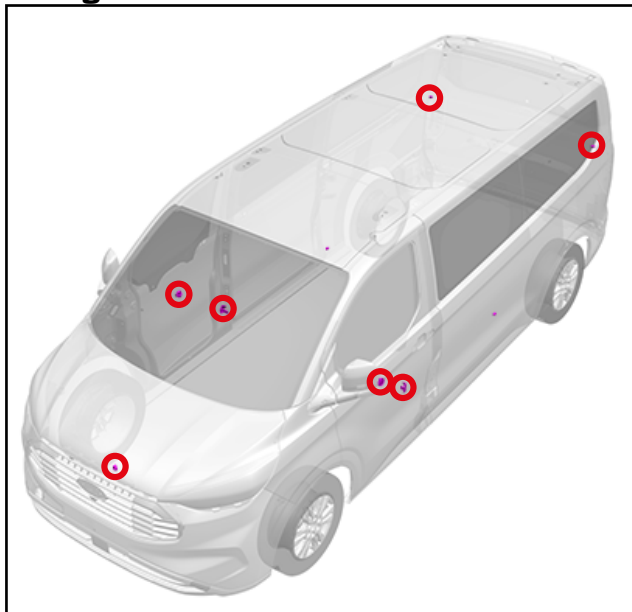
**⚠** Drilling or grinding operations in these areas are only permitted when battery cables are disconnected.

**⚠** If the vehicle is specified with side and curtain airbags, ensure any accessories fitted to the doors are clear of the airbag deployment zones and that any holes created in the door trim, inner or outer sheet metal are sealed to retain the integrity of the door cavity. Failure to seal holes in the door trim or sheet metal may affect the sensitivity of the restraints system.

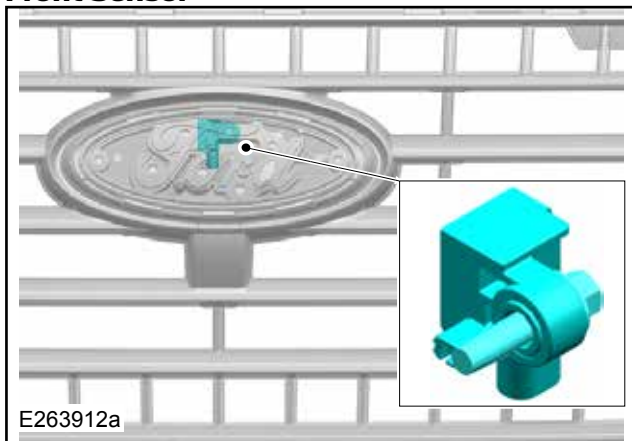
If the battery is disconnected: [Refer to: 4.5 Battery Systems](#) Battery and Monitoring Sensor section for reconnecting battery.



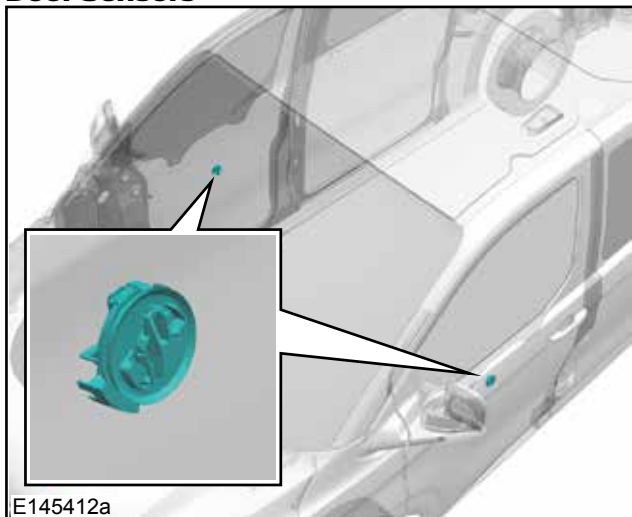
## Airbag Sensor Locations



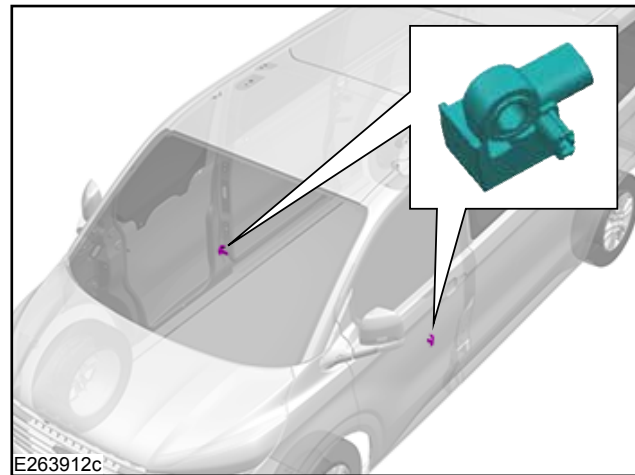
## Front Sensor



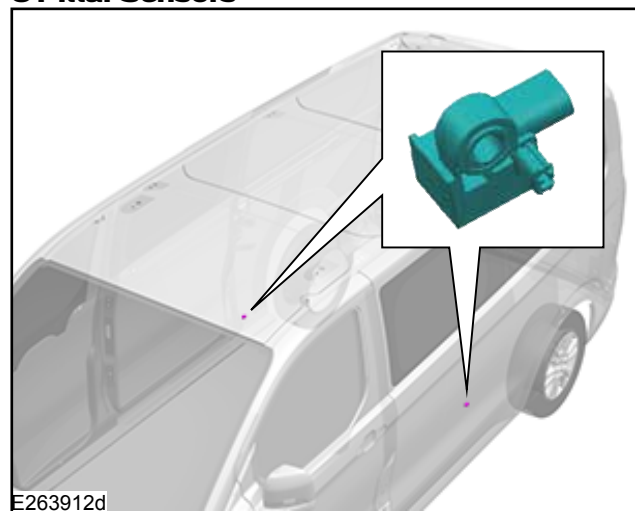
## Door Sensors



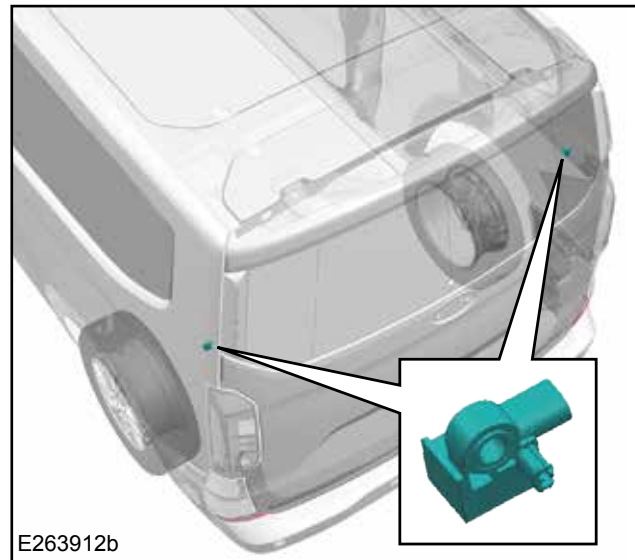
## B Pillar Sensors



## C Pillar Sensors



## D Pillar Sensors



## 5.11 Seatbelt Systems


**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help, then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.11.1 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 in the case of ‘Bulkhead Delete’ (A6AAA) or bulkhead removal. the Upfitter MUST ensure that the B 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 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.


### 5.11.2 B Pillar No Drill Zone

**WARNINGS:**

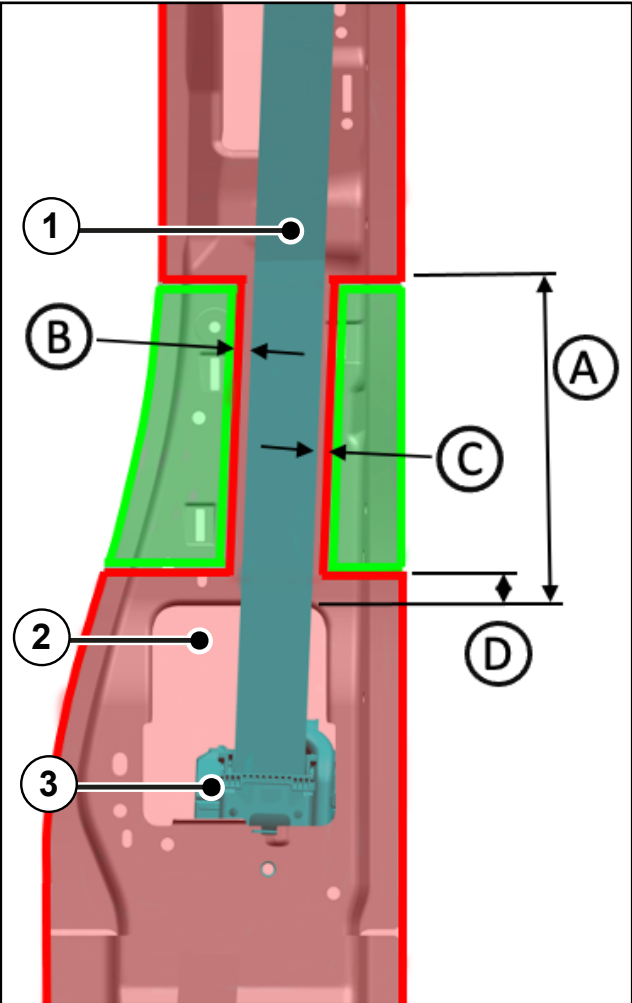
 **Do not drill in right hand/left hand side retractor assembly area.**

 **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:**  
**1) Any additional hardware fitted must not cut, pinch or interfere with the seatbelt webbing along its entire path (from retractor to D-ring area).**  
**2) Avoid sharp brackets near webbing; all edges must have a minimum radius of 0.5mm.**  
**3) Avoid upfitting parts that may change the belt routing to the occupant.**

**Front Seat Belt/B Pillar Drill Zone Definition**



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)

### 5.11.3 Seat Belt Reminder

Seat Belt Reminder is a legal requirement for all new vehicles. For front seats (including single and dual passenger seats) a sensor is provided in the seatbelt buckle to sense the seatbelt wearing status of the occupant, in addition to occupant detection mats in the seats. For rear seats the seatbelt buckle sensor only is provided. If a vehicle is modified, these functions must be retained.

If factory-fitted seats are removed and refitted as part of a conversion, the Seat Belt Reminder function will need to be reconfigured using the following procedure:

#### Permanent Deactivation/Reactivation Procedure

The deactivation/reactivation procedure will deactivate/reactivate the audible signal for front seats individually or all the rear seats together.

1. With the vehicle stationary, Key On the ignition
2. Perform 4 buckling and unbuckling actions. The sequence should start and end with 'unbuckled'.
3. The Seat Belt Reminder tell-tale lamp flashing will confirm successful deactivation/reactivation.

**NOTE:** Any seat belt buckle can be used for the procedure.

**NOTE:** Additional (non factory-fitted) seats cannot be added to the belt-minder function using this procedure.

**NOTE:** The convertor shall not provide the procedure for Seat Belt Reminder de-activation to the owner/operator via handbook or other easily accessible sources.

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. Please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com) for further information

### 5.11.4 Wireless Beltminder

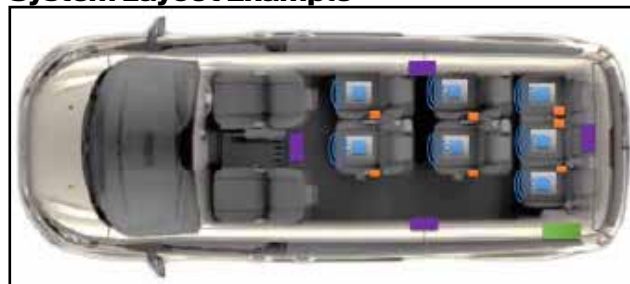
#### Bus, Kombi and Camper (Flexibus) Only

The Wireless Beltminder consists of a number of wireless transmitters in the seat and 4 antennas which are body mounted; see following figure. The transmitters in the seats need to triangulate their position by sensing the field strength of the antennas. The antenna power is calibrated for each body style.

The system will not measure the correct seat position for every seat if:

- Antennas are re-positioned
- Mounted on different material
- Shielded from the seats by any conductive (metal) material
- Magnets are packaged closer than 70mm to the antennas

#### System Layout Example



Item	Description
	Wireless Buckle Controller
	Seat Buckle Switch
	Occupant Presence Detection Switch
	Wireless Buckle Sensor, seat mounted
	Antenna <sup>1</sup>

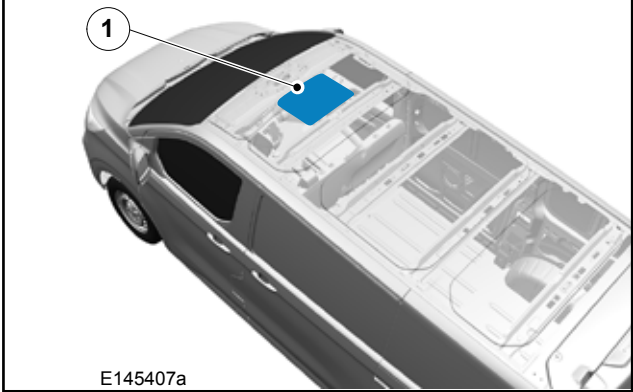
<sup>1</sup> 1x mounted on Headliner, 2x Side Trim, 1x Rear Door

## 5.12 Roof

### 5.12.1 Roof Ventilation

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

#### Sun Roof Retrofit Option



Item	Description
1	Local form in Roof Panel (Low Roof Only)

**General** - It is not recommended for apertures to cut through roof bows, see figure E145407a. 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 - see figure E145407b. 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.

### 5.12.2 Roof Racks

**WARNING:**  **When installing a roof rack or any other accessory the fixing points need to be sealed for preventing water ingress into the interior of the vehicle.**

**NOTE:** Refer to the Owner's Manual for maximum roof load, including roof rack.

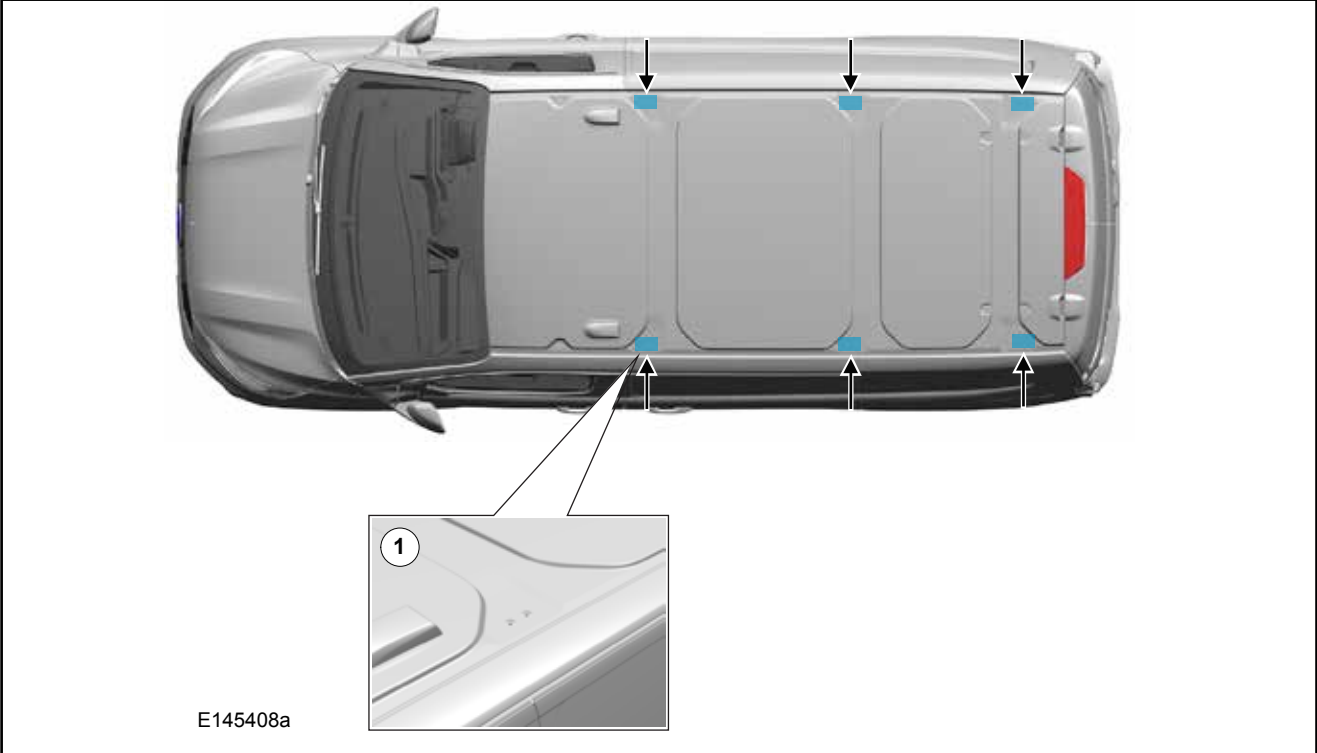
**NOTE:** Read and follow the manufacturer's instructions when fitting a roof rack.

**NOTE:** Maximum roof rack length for H1 roof height vehicles should consider liftgate in fully opened position.

Roof racks may be fitted to all H1 Van, Bus and Kombi variants as illustrated in figure E145408a, providing the following is satisfied:

- The carried load does not exceed the

#### H1 Roof Height



Item	Description
1	Roof Rack Supports, 3 attachments each side. Positions depend on wheelbase.

recommended weight stated in the Owner's Manual

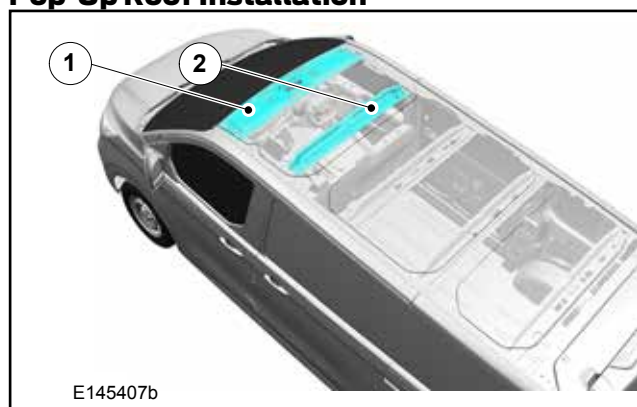
- The load is evenly distributed (Vehicle Convertor to ensure Owner's information book identifies this limitation)
- The load of a single attachment under worst case loading, must not exceed 75kg
- The roof rack should be fixed to the roof using one or two M8 bolt/s per attachment as shown in figure E145408a
- It is recommended that the rack leading edge should not be located forward of the rear edge of the driver's door, or 'B' pillar

### 5.12.3 Pop-Up Roof Conversion



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

#### Pop-Up Roof Installation



Item	Description
1	Header Rail
2	B Pillar Roof Bow

It is not recommended to cut/modify/remove the B Pillar Roof Bow - see figure E145407b. 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.



## 5.13 Corrosion Prevention

**NOTE:** For further information please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.13.1 General

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

If drilling is required, however:

- Re-paint metal edges and protect against corrosion after cutting or drilling operations
- Endeavour 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](#)

### 5.13.2 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.

### 5.13.3 Under Body Protection and Material



**WARNING: Do not over-coat or contaminate surfaces of components such as brakes or catalytic convertors.**

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance where possible.

Some proprietary products affect the original coatings.

### 5.13.4 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 colour or repairing paint.**

### 5.13.5 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.



## 5.14 Frame and Body Mounting

**NOTE:** For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at [FPSVHelp@ford.com](mailto:FPSVHelp@ford.com)

### 5.14.1 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 given in figure E176204. 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: 5.13 Corrosion Prevention](#)

### 5.14.2 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:

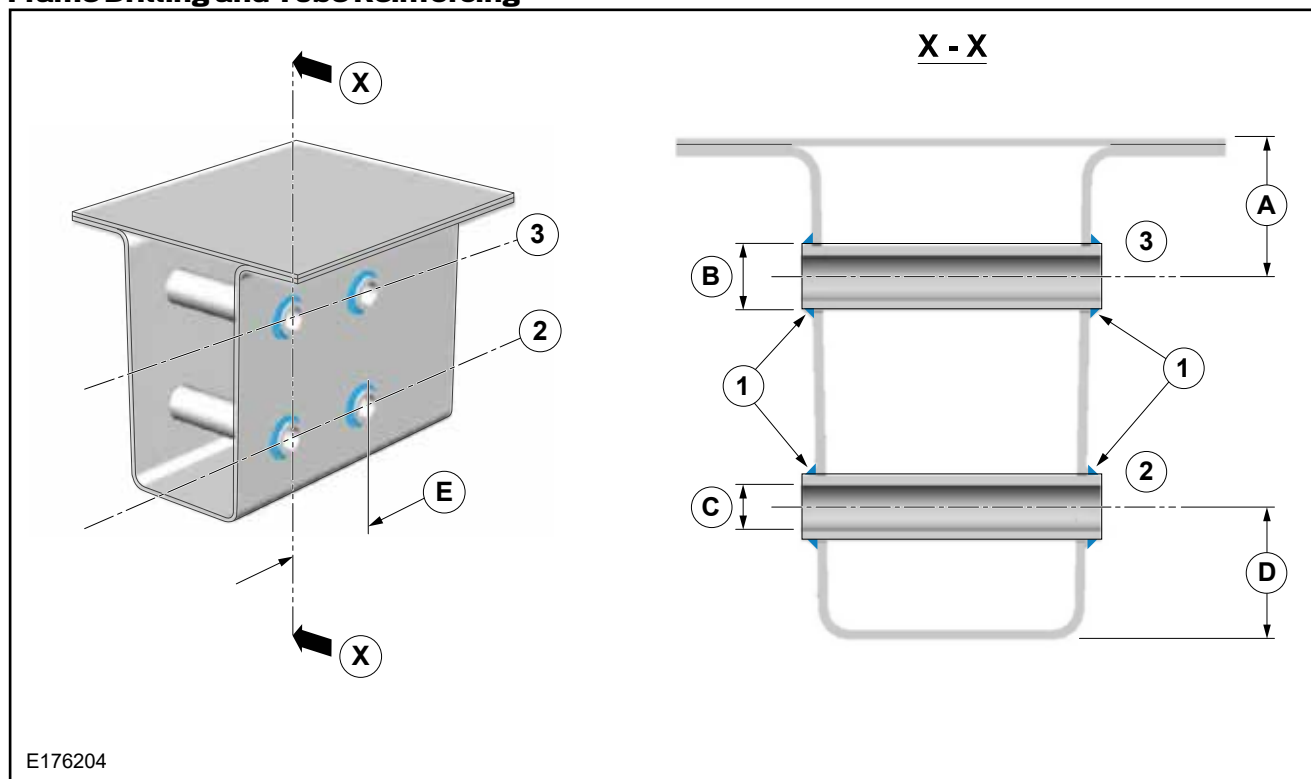
- Adhere to all details shown in figure E176204
- Drill and weld only sidewalls of the chassis frame

- Locate and drill holes accurately, 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
- Endeavour 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: 5.13 Corrosion Prevention](#)

- Holes should be in groups of two, either vertically spaced at 30 to 35mm from chassis frame top and/or bottom surface, or horizontally at 50mm minimum pitch, 30 to 35mm from top and/or bottom chassis frame surface, please refer to figure E176204
- Always use M10 bolts with grade 8.8 minimum
- Do not position tubes at the medium chassis frame height, this may create 'oil canning' of the deep section side walls
- A diameter of 16.5mm is the maximum allowable hole size in the chassis frame side wall, irrespective of the usage

### Frame Drilling and Tube Reinforcing



Item	Description	Item	Description
1	Full Penetration; Full diameter weld each side	B	Diameter 16.5mm maximum
2	Centre line of holes/tubing	C	Diameter 11mm
3	Centre 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: 5.13 Corrosion Prevention](#)

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

[Refer to: 5.1.2 Welding](#)

### **5.14.3 Area for Fitting Additional Body Attachments to the Rear of the Bumper**

**NOTE:** With the vehicle on level ground and with all measurements taken rearward of the bumper bar edge. The area designated for the fitting of attachment is defined as 220mm horizontally by 95mm vertical downward to the road surface, with a max width of 1390mm about vehicle centre line.

It is not the manufacturer's recommendation to fit additional body attachments (tow bars, steps, bicycle racks and carriers) outside of the designated area.

### **5.14.4 Water Tank on Camper Vehicles**

**NOTE:** It is recommended that a decal or label is fitted adjacent to the filler aperture identifying the correct fluid to be used, for example: 'Water only' for water tanks.



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