FORD **Transit & E-Transit** 2022.5
Body and Equipment Mounting Manual



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Abc = BEV Only Abc = ICE Only

Table of Contents

1 General Information

1.1 About this Publication....8
1.1.1 EV Training....8
1.1.2 Colour Coded Content....8
1.2 About this Manual....9
1.2.1 Introduction....9
1.2.2 How to Use This Manual....9
1.2.3 Important Safety Instructions....9
1.2.4 CAD Models....10
1.3 Commercial and Legal Aspects....11
1.3.1 Terminology....11
1.3.2 Warranty on Ford Vehicles....11
1.3.3 WLTP Vehicle Test Procedures....11
1.3.4 Emissions Performance & Compliance....11
1.3.5 Whole Vehicle Type Approval....11
1.3.6 Compliance and Vehicle Type Approval....12
1.3.7 Alternative Type Approval....12
1.3.8 Legal Obligations and Liabilities....12
1.3.9 General Product Safety Requirement....12
1.3.10 Product Liability....13
1.3.11 Restraints System....13
1.3.12 Drilling and Welding....13
1.3.13 Minimum Requirements for Braking System....13
1.3.14 Road Safety....13
1.3.15 Acoustic Vehicle Alerting System....13
1.3.16 High Voltage Vehicle Systems....13
1.4 Contact Information....15
1.5 Conversion Type....17
1.5.1 Order Codes....17
1.5.2 Conversion Type - Reference Tables....21
1.6 Conversion Homologation....25
1.7 Electromagnetic Compatibility (EMC) 26
1.7.1 Permitted Antenna Locations....26
1.8 Vehicle Duty Cycle Guidelines....27
1.8.1 Vehicle Ride and Handling Attributes....27
1.9 End of Life Vehicle (ELV) Directive....28
1.10 Jacking....29
1.11 Lifting....31
1.11.1 ICE (Diesel) Vehicles....31
1.11.2 E-Transit BEV Vehicles....33
1.12 Noise, Vibration and Harshness....36
1.13 Vehicle Transportation Aids/Storage. 37
1.14 Package and Ergonomics....39
1.14.1 General Component Package Guidelines....39
1.14.2 Driver Reach Zones....39
1.14.3 Driver Field of View....39
1.14.4 Conversion Effects on Parking Aids....39
1.14.5 Aids for Vehicle Entry and Exit....39
1.14.6 Front, Rear and Side Under-Run Protection..39
1.14.7 WLTP Calculation Inputs....40
1.14.8 Vehicle Dimensions Key....43
1.14.9 Recommended Main Load Area Dimensions 44
1.14.10 Vehicles with Roof Mounted Units....50
1.14.11 Chassis Cab Body for Diesel and E-Transit....50
1.14.12 Skeletal Chassis for Non Camper Body....53
1.14.13 Skeletal Chassis for Camper Body....55
1.15 Hardware....57
1.16 Load Distribution....58
1.16.1 Load Distribution....58
1.16.2 Centre of Gravity Position....58
1.16.3 Centre of Gravity Height Test Procedure....59
1.16.4 Centre of Gravity Height Calculation....61
1.16.5 Formulas....61
1.17 Towing....63
1.17.1 Tow Bar Requirements....63
1.17.2 Tow Bar Types (EU spec vehicles)....63
1.17.3 Tow Bar Types (AUS and NZL spec vehicles) 69

2 Chassis

2.1 Suspension System....74
2.2 Front Suspension....75
2.2.1 Springs and Spring Mounting....75
2.3 Rear Suspension....76
2.3.1 Springs and Spring Mounting....76
2.4 Wheels and Tyres....77
2.4.1 Wheel Clearance....77
2.4.2 Tyre Manufacturers....77
2.4.3 Tyre Pressure Monitoring System (TPMS)....77
2.4.4 Spare Wheel....77
2.4.5 Tyre Repair Kit....77
2.4.6 Jacking Kit....77
2.4.7 Painting Road Wheels....77
2.5 Driveshaft....78
2.5.1 Power Take Off (PTO)....78
2.6 Brake System....79
2.6.1 General....79
2.6.2 Kerb Mass Data....79
2.6.3 Brake Hoses General....79
2.6.4 Parking Brake....79
2.6.5 Hydraulic Brake - Front and Rear Brakes....79
2.6.6 Anti-Lock Control — Stability Assist....79

3 Powertrain

3.1 Engine....80
3.1.1 Engine Selection for Conversions....80
3.1.2 Engine Types....81
3.2 Engine Cooling....82
3.2.1 Auxiliary Heater Systems....82
3.2.2 Auxiliary Heater Installation....82
3.2.3 Air Flow Restrictions....82
3.3 Accessory Drive....83
3.3.1 Front End Accessory Drives (FEAD)....83
3.4 Automatic Transmission....89
3.5 Clutch....90
3.6 Manual Transmission....91

3.7 Exhaust System 92
3.7.1 Extensions and Optional Exhausts 92
3.7.2 Exhaust Pipes and Supports 92
3.7.3 Exhaust Heat Shields 92
3.7.4 Diesel Particulate Filter (DPF) 92
3.7.5 Operator Commanded Regeneration (A660) 93
3.7.6 Vehicle Exhaust Systems - Full Bulkheads 93
3.8 Fuel System 94
3.9 HV System & Electrified Drivetrain..... 97
3.9.1 High Voltage Health & Safety Precautions 97
3.9.2 High Voltage System Overview 99
3.9.3 HV System De-Energising 100
3.9.4 Cooling.....100
3.9.5 Electric Drive Assembly.....100
3.9.6 High Voltage Battery 101
3.9.7 EV Charging.....102

4 Electrical

4.1 Electrical System Overview 104
4.1.1 Electrical Architecture Changes 104
4.2 Wiring Installation & Routing Guides 106
4.2.1 Wiring Harness Information 106
4.2.2 General Wiring and Routing 106
4.2.3 Connector Pin Out Practices 106
4.2.4 Unused Connectors 107
4.2.5 Grounding 107
4.2.6 Prevention of Squeaks and Rattles 107
4.2.7 Water Leakage Prevention 107
4.2.8 Wiring Splicing Procedures 107
4.2.9 Electromagnetic Compatibility (EMC) 107
4.2.10 Wiring Specification.....108
4.2.11 Wiring through Sheet Metal.....109
4.2.12 Precautionary Drill Zones - HV Cables..... 110
4.2.13 Precautionary Drill Zones - HV Modules 112
4.2.14 Precautionary Drill Zones - Cable.....113
4.2.15 Precautionary Drill Zones - Chassis 115
4.2.16 Precautionary Drill Zones - Cargo Area 116
4.2.17 Trailer Tow Electrics (A055) 117
4.2.18 Electrics for Tow Bar 117
4.2.19 Trailer Tow Connectivity.....120
4.3 Communications Network 123
4.3.1 CAN-Bus System Description and Interface ..123
4.3.2 Body Control Module (BCM) 127
4.4 LV Charging System (12 V) 131
4.4.1 General Information 131
4.4.2 LV Charging System Layout.....131
4.4.3 Smart Regenerative Charging (SRC) 133
4.4.4 SRC Override 133
4.4.5 Third Party High Power Mode 133
4.4.6 Test Functionality 134
4.4.7 Charge Balance Guidelines 135
4.4.8 Circuit Diagrams 135
4.4.9 Alternator Characteristics 136
4.5 Mild Hybrid Charging System 137
4.5.1 General Information 137
4.5.2 MHEV 48V System Operation/Description ... 137
4.5.3 48V Battery Pack 138
4.5.4 System Operation - Smart Charging (SC) 138
4.5.5 Smart Charging Override 138
4.5.6 Third Party High Power Mode 138
4.5.7 Vehicle Electrical Capacity 140
4.5.8 Charge Balance Guidelines 140
4.5.9 Circuit Diagrams 140
4.6 Battery Systems..... 141
4.6.1 Power and Connectivity Usage 141
4.6.2 High Current Supply & Ground Connections 143
4.6.3 Guidelines When Converting Vehicles 143
4.6.4 Battery Options 147
4.6.5 Battery Rules 148
4.6.6 Battery Configurations 148
4.6.7 Converter Fit Additional 3rd Party Batteries . 150
4.6.8 Battery Monitoring Sensor (BMS) 153
4.6.9 Single and Twin Battery Systems 153
4.6.10 Additional Loads and Charging Systems 153
4.7 Battery Protection 156
4.7.1 Interior Lights and 12V Sockets 156
4.7.2 SBG and Load-Shedding 156
4.7.3 Power Connections 156
4.7.4 SBG and Load Shedding - Functionality 159
4.7.5 Ford Programmable Battery Guard GEN2 162
4.7.6 Retrofitting a FPBG 166
4.8 Climate Control System 170
4.8.1 Front Climate Control System.....170
4.8.2 Rear Climate Control System 171
4.9 Instrument Panel Cluster (IPC) 172
4.10 Horn.....173
4.11 Electronic Engine Controls 174
4.11.1 Cranking and Warm Cranking 174
4.11.2 Start-Stop 174
4.11.3 Engine RPM Speed Controller (A003) 176
4.11.4 DPF and RPM Speed Control 180
4.11.5 Changing Vehicle Speed Maximum Setting 180
4.12 Tachograph 181
4.12.1 Legislation 182
4.12.2 Tachograph and DSRC Harness Mounting....182
4.12.3 Retrofitting a Digital Tachograph 182
4.12.4 Calibration and Tachograph Retrofitting 184
4.13 Info/Entertainment System..... 186
4.13.1 AHU - Multimedia ICE Pack Summary 186
4.13.2 AHUs 188
4.13.3 Sub-Entry Radio 188
4.13.4 Connected HMI Radio/with DAB 189
4.13.5 Connected Touch Radio/with DAB 190
4.13.6 SYNC Radio and SYNC Radio with DAB 191
4.13.7 Rear View Camera 192
.....192
4.13.8 Speakers 193
4.14 Cellular Phone 194
4.15 Exterior Lighting 195
4.15.1 Reversing Lamps 195
4.15.2 Lamps – Front and Rear Fog Lamps 195
4.15.3 Lighting Loads 195
4.15.4 Lamps – Hazard / Direction Indication 196
4.15.5 Lamps for Wide Vehicles 196
4.15.6 Electrically Operated Door Mirrors 196

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4.15.7 Power for Additional External Lamps 196
4.15.8 Additional External Lamps 197
4.15.9 Side Marker Lamps 202
4.16 Interior Lighting 203
4.16.1 Additional Internal Lamps 203
4.16.2 Additional Lighting - Rear of Interior 203
4.17 Emergency Call Systems 204
4.17.1 Relocation of GNSS/4G Antenna 204
4.18 Cruise Control 207
4.18.1 Adaptive Cruise Control 207
4.19 Blind Spot Information System 208
4.20 Front Windscreen Camera 209
4.21 Acoustic Vehicle Alerting System ... 210
4.22 Handles, Locks, Latches and Entry... 211
4.22.1 Door Removal or Modification 211
4.22.2 Central Locking 211
4.22.3 Third Button on Key Fob 212
4.22.4 Remote Keyless Entry/TPMS Receiver 212
4.23 Fuses and Relays 214
4.23.1 Fuses 214
4.23.3 Windscreen Wipers 215
4.23.2 Relays 215
4.24 Special Conversions 216
4.24.1 Special Vehicle Options (SVO) 216
4.24.2 Additional Vehicle Signals/Features 216
4.24.3 Auto Wipe/Lamp with large overhangs 217
4.25 Electrical Connectors/Connections 218
4.25.1 General Information 218
4.25.2 Customer Connection Points (CCP) 218
4.25.3 High Current Supply/Ground Connections 220
4.25.4 Camper Central Connectors 221
4.25.5 Vehicle Interface Connector 223
4.25.6 Auxiliary Fuse Panel (A526) 225
4.25.7 Beacon Preparation Pack (A606) 231
4.25.8 Utility Vehicle Switch Pack (A626) 232
4.25.9 Auxiliary Switches 233
4.25.10 High Spe Vehicle Interface Connector 235
4.25.11 Programmable CAN Interface Module 242
4.25.12 Adding Connectors 245
4.26 Pro Power Onboard Chassis Cab.....246
4.27 Grounding 247
4.27.1 Ground Points 247

5 Body& Paint

5.1 Body 256
5.1.1 Body Structures - General Information 256
5.1.2 Welding 257
5.1.3 Boron Steel Parts 258
5.1.4 Floor Precautionary Drill Zones: DieselVans ..259
5.1.5 No Drill/No Weld Zones - BEV.....263
5.1.6 Integrated Bodies and Conversions 265
5.1.7 Chassis Cab 267
5.1.8 Skeletal Chassis for Camper & Non Camper .277
5.1.9 Front End Integrity 280
5.1.10 Tipper Bodies 281
5.1.11 Dropside Bodies.....281
5.1.12 Tank and Dry Bulk Carriers 281
5.2 Hydraulic Lifting Equipment.....282
5.2.1 General Information 282
5.3 Racking Systems 286
5.3.1 Racking Systems 286
5.4 Loadspace 288
5.4.1 Load Compartment Tie Downs 288
5.5 Front End Body Panels 289
5.5.1 Partitions (Bulkhead) on Van, Bus 289
5.5.2 Polymer Bulkhead 291
5.6 Body Closures 292
5.6.1 Sliding Door Gap Reduction on M1 Vehicles .292
5.6.2 Security, Anti-Theft and Locking System 292
5.7 Interior Trim 295
5.7.1 Load Compartment Interior Lining 295
5.7.2 Plywood Lining/Cladding 295
5.8 Rear View Mirrors 296
5.8.1 Door Mirrors 296
5.9 Seats 297
5.9.1 Van 297
5.9.2 Windowed Van 297
5.9.3 Heated Seats 298
5.9.4 Rear Seat Fixing Positions 298
5.9.5 Fabricless Front Swivel Seats..... 298
5.10 Glass, Frames and Mechanisms.....299
5.10.1 Heated Windscreen/Rear Window 299
5.10.2 Rear and Side Windows 299
5.11 Airbag SRS 300
5.11.1 Airbags 300
5.12 Seatbelt Systems 302
5.12.1 Seatbelts 302
5.12.2 B Pillar No Drill Zone 302
5.12.3 Seat Belt Reminder 303
5.13 Roof 304
5.13.1 Roof Ventilation 304
5.13.2 Roof Cut Out - Camper Based Vehicles 304
5.13.3 Roof Racks and Load Carriers 305
5.14 Corrosion Prevention 307
5.14.1 General 307
5.14.2 Repairing Damaged Paint 307
5.14.3 Under Body Protection and Material 307
5.14.4 Painting Road Wheels 307
5.14.5 Contact Corrosion 307
5.15 Frame and Body Mounting..... 308
5.15.1 Mounting Points and Tubing 308
5.15.2 Self-Supporting Body Structure 310
5.15.3 Extended Chassis Frame 311
5.15.4 Non Standard Chassis Frame Extension 311
5.15.5 Frame Drilling and Tube Reinforcing 313
5.15.6 Ancillary Equipment - Subframe Mounting 313
5.15.7 Water Tank on Camper Vehicles 313

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1.1 About this Publication

This Body and Equipment Mounting Manual (BEMM) is the third publication for the 2022.5 Transit/E Transit.

The main changes in this version are:

Feb 2022
4.2.17 Trailer Tow Electrics (A055): Updated to reflect change in BEV towing status
4.2.18 Electrics for Tow Bar: Updated to reflect change in BEV towing status

Apr 2022
Reference to Regulation (EU) 2018/858 added
1.13 Vehicle Transportation Aids and Vehicle Storage: Modification of instructions for prevention of Injector Nozzle corrosion in storage
1.14.11-13 WLTP: updates
4.2.16 Precautionary Drill Zones - Rear Cargo Area: Note added to refer to B Pillar Drill Zone
4.27.1 Ground Points: clarification of information for E-Transit BEV
5.1.11 Dropside Bodies: Warning added for E-Transit BEV dropside conversions with charge port mounted behind rear wheel
5.12.2 B Pillar No Drill Zones: Subsection added to advise of No Drill Zone around Seat Belt installation

June 2022
1.16.2 Centre of Gravity Position: AWD variants added
1.14.8 Vehicle Dimensions Key: Stripped chassis dimensions added to table

July 2022
4.13.7 Rear View Camera: Rear Light connector change
4.17.1 Relocation of GNSS/4G Antenna: Section updated for new Bull Shark Fin Antenna and deletion of fitting kit in favour of custom cabling
5.1.7 Chassis Cab: Wheelhouse dimensions added for BEV CCAB. Colour coding added

Oct 2022
1.2.1 Introduction: Clarification of different parts and options fitted in different territories
1.13 Vehicle Transportation Aids and Vehicle Storage: Battery Drain Prevention information added
1.16.2 Centre of Gravity Position: Variation of max CoG for certain Camper variants
4.25.2 Customer Connection Points (CCP): Note added to clarify when CCP2 is operational
5.1.7 Chassis Cab (BEV): Updated part numbers for adding Tuned Mass Damper

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 with your name, email and company name.

It is the vehicle converter'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 Conversionworks@ford.com

1.1.1 EV Training

Ford Customer Service Division (FCSD) develops the training and deploys it to the Ford Dealer Network. We will forward and/or provide our upfitter partners the information to obtain training through links in Ford Service Info https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F

1.1.2 Colour Coded Content

A colour coding system is in place to identify different content:

Abc = ICE Only

Blue text, blue boxes behind text and illustrations bordered in blue indicate content specific to Transit Internal Combustion Engine (ICE) vehicles only.

Abc = BEV Only

Green text, green boxes behind text and illustrations bordered in green indicate content specific to E-Transit Battery Electric Vehicle (BEV) only.

Abc = Common to ICE/BEV

Black text and illustrations bordered in black are common to ICE (Diesel) engined versions and E-Transit Battery Electric Vehicle (BEV).

1.2 About this Manual

1.2.1 Introduction

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

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

It must be 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 Conversionworks@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.

WARNING: Any personnel working with or undertaking any modifications to the E-Transit BatteryElectric Vehicle (BEV) must receive training for High Voltage (HV) vehicle systems prior to starting any work.

Working on a High Voltage Electrical Vehicles is only allowed after completion of the appropriate training(s):

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

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

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

WARNING: Orange coloured cables are HV system (approximately 450V DC) parts and must not be modified nor rerouted.

CAUTION: There are limitations when adding additional electrical devices. Any power take-off consumption needs to be controlled within the guidelines. Extra equipment and usage may have an impact to weight and vehicle driving range.

1.2.4 CAD Models

For 3D CAD Models and CAD support please contact Conversion Works conversionworks@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 Conversionworks@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 Converter refers to any party altering the vehicle by converting the body and adding or modifying any equipment not originally specified and/or supplied by Ford.

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

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

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

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

1.3.3 Worldwide Harmonised Light-Duty Vehicle Test Procedures (WLTP)

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

WLTP takes into account individual optional equipment for weight, aerodynamics and rolling resistance, which have an impact on the fuel consumption, exhaust emissions and electric vehicle range.

For incomplete and complete conversions, WLTP will now take into account the completed option equipment. Vehicle Converters now have a new responsibility to recalculate the CO2, fuel consumption and electric vehicle range 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 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 with your name, email and company name.
- Contact Conversionworks@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 Converter must stay within.

For further information please contact Conversionworks@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.

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

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

Conversions from Commercial Vehicle N1, N2 to Passenger Car M1

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

Guidance to Vehicle Converters for M1 registered vehicles:

- The Vehicle Converter is responsible for checking the vehicle ordered can meet all the regulations for type approval
- Exemptions for certain regulations should be checked with latest regulation and approval authority
- Where possible, order a Passenger Car M1 base vehicle such as Kombi M1
- If specifying Air Conditioning, check that the base commercial vehicle refrigerant meets the latest completed vehicle regulations
- If Tyre Pressure Monitoring System (TPMS) is required, specify this when ordering
- If seat belt warning it required, specify passenger airbag which includes the belt minder function for the driver and passenger
- Refer to: 5.6 Body Closures For information on sliding door gap reduction on M1 vehicles
- Special Purpose Vehicles such as ambulances, motor caravans, hearses and wheelchair accessible vehicles may be allowed to use the base vehicle homologation for some regulations

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 Converter.

- 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 Converter 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 Converter 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 Converter 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 Converter 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 directive.

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

The Vehicle Converter or equipment manufacturer is liable for the:

- Operational reliability and road-worthiness of the vehicle to its original intent
- Operational reliability and road-worthiness of any component or conversion, not listed in original Ford documentation
- Operational reliability and road-worthiness of the vehicle as a whole (for example the body changes and/or additional equipment must not have a negative effect on the driving, braking or steering characteristics of the vehicle)
- Subsequent damage resulting from the conversion or attachment and installation of unique components, including unique electrical or electronic systems
- Functional safety and freedom of movement of all moving parts (for example axles, springs, 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: 5.11 Airbag Supplemental Restraint System (SRS)

1.3.12 Drilling and Welding

WARNING: Do not Drill or Weld Boron Steel parts, see figure E167660 in the welding 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: 5.15 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.

1.3.15 Acoustic Vehicle Alerting System

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

Refer to: 4.21 Acoustic Vehicle Alerting System

1.3.16 High Voltage Vehicle Systems

WARNING: Any personnel working with or undertaking any modifications to the E-Transit BatteryElectric Vehicle (BEV) must receive training for High Voltage (HV) vehicle systems prior to starting any work.

Working on a High Voltage Electrical Vehicles is only allowed after completion of the appropriate training(s):

Abc = BEV Only Abc = ICE Only

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

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

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

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

CAUTION: There are limitations when adding additional electrical devices. Any power take-off consumption needs to be controlled within the guidelines. Extra equipment and usage may have an impact to weight and vehicle driving range.

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 Conversionworks@ford.com

Ford of Britain	
Contact:	Keith Doxey kdoxey@ford.com
Contact:	Ron Waldock rwaldoc1@ford.com

Ford of Germany	
Contact:	Torsten Wagner twagner5@ford.com
Contact:	Leonard Lilienthal llilient@ford.com
Contact:	Daniela Achenbach dachenb1@ford.com

Ford of France	
Contact:	Franck Richard fricha19@ford.com
Contact:	Nicolas Froelich nfroelic@ford.com

Ford of Italy	
Contact:	Andrea Marconcini amarconc@ford.com
Contact:	Cristiano Giusto cgiusto1@ford.com

Ford of Ireland	
Contact:	Paul O'Sullivan posulli9@ford.com

Ford of Spain/Portugal	
Contact:	Jose Ramirez Mallol jrami170@ford.com
Contact:	Ruben Garcia Navas rgarc346@supplier.ford.com

Ford of Belgium	
Contact:	Alain Haelewyck ahaelewy@ford.com

Ford of Netherlands	
Contact:	Daan Koppert dkoppert@ford.com

Ford of Austria	
Contact:	Gerhard Konrad gkonrad1@ford.com

Ford of Denmark	
Contact:	Jan Olsen jolsen24@ford.com

Ford of Finland	
Contact:	Petteri Pajanen ppajanen@ford.com

Ford of Norway	
Contact:	Roar Kvernhusengen rkvernh2@ford.com

Ford of Sweden	
Contact:	Pierre Kjellen pierre.kjellen@hedinmotorcompany.com

Ford of Hungary	
Contact:	Gabor Dorogi gdorogi@ford.com

Ford of Greece	
Contact:	John Amarantos jamaran1@ford.com

Ford of Poland	
Contact:	Piotr Nowosadzki pnowosa1@ford.com

Ford of Czech Republic	
Contact:	Petr Simunek psimunek@ford.com

Ford of Switzerland	
Contact:	Frederic Steiner fsteine3@ford.com

Ford of Romania	
Contact:	Constantin Moldoveanu cmoldove@ford.com

Ford of Russia	
Contact:	Evgeniy Gnusov egnusov@ford.com

Ford Central & Eastern Europe	
Contact:	Balázs Págyi bpagyi@ford.com

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Rest of the World (RoW)	
Contact:	Duvall Hunter dhunte11@ford.com

Ford Otosan - Turkey	
Contact:	Ford Otosan Call Centre
Phone:	+90-216-4443673
E-Mail:	iletisim@ford.com.tr

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

Ford of New Zealand	
Contact:	FoNZ Customer Team
Phone:	+64-9-2718500
E-Mail:	nzinfo@ford.com
Fax:	+64-9-2718573
Postal Address:	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 Conversionworks@ford.com

RPO Regular Production Order

Feature Code	Regular Production Order (RPO)	Description
BVFBS	Swivel Seat Pack 49	Front swivel seats for Camper market
JRSAB	Programmable Can Interface Module	RPO – N/A (same on all FNV2 product)
AAKBA	Replock	TVL Replock – Drivers' door
J3EAJ	Pro Power on Board	Connection points in cab, plus cargo area for van
JCMAD	LED Load compartment Light	Upgrade to a LED cabin light - incorporated within the LED load space lighting option
HTAAZ	2 High Performance AGM Batteries	High Performance deep cycle batteries for electrical Power Take Off (PTO) that requires deep discharge and cycling from third party systems at engine-off condition.
GB2AB	Auxiliary Fuel Port	Provides a fuel line and connector for easier attachment to auxiliary equipment such as aftermarket heaters.
HLDAB	Transit Skeletal Chassis Reverse Gear Buzzer	Buzzer part and its harness comes as a disassembled unit within a plastic bag for skeletal chassis.
A59AA	Chassis Cab Cutaway	Removes the back panel of the Transit Chassis Cab and replaces it with a temporary plastic back panel.

SVO Electrical

Feature Code	Special Vehicle Option (SVO)	Description
HNLAD	Configurable Front Parking Aid	Front only parking sensors (to allow fitment of aftermarket rear steps).
J3KAN	Rear View Camera Plus Prep Pack	Chassis Cabs Only - Rear facing camera with no aids
HDKAD	Tachograph - Digital	New Smart tachograph system including Dedicated Short Range Communication (DSRC) sensor.
JZGAB	Auxiliary Fuse Panel	Provides access to fused power connections and various signals and control circuits.
JZAAC	Ford Programmable Battery Guard (FPBG)	Patented multi-mode FPBG system capable of protecting Ford and third party batteries.
JZXAC	High Power Supply Pack	Meets heavy electrical power take-up requirements (including options: OW5, HFP, A003, A540).
JDCAH	Side Marker Preparation Pack	Provides wiring and side marker LED lamps for Chassis Cab
JZFAC	Beacon Wiring Preparation Pack	Provides wiring for front and rear beacons and switch located in 1-DIN mini overhead console (inc. option: A526/not available with tachograph)

Abc = BEV Only Abc = ICE Only

JZDAE	High Specification Vehicle Interface Connector	Provides a range of hard-wired signals and control circuits (includes option: A526).
JZFAF	Utility Vehicle Switch Pack	Provides wiring and 3 switches for beacon and 2 power outputs located in 1-DIN mini overhead console (includes options: A526, A606 / not available with tachograph).
J3EAJ	Pro Power on Board for Conversion	Rear Power Socket for chassis cab for upfit – Intro Date TBC (van to be added)
HTABG	Single H8 AGM Battery	95AH H8 AGM Deep Cycle Battery which is located in the driver's seat pedestal
JZFAG	Touchscreen	7" touchscreen display that can control third party equipment and configure timers for auto switch on and off equipment
JCHAD	Courtesy Light Disable (Stealth Mode)	Stealth Mode disables DTRL, IP & Cluster illumination, cabin and load area lighting and hazard light flash on lock/unlock on Police and Military vehicles
JDKAE	Electronic High Visibility Panels	Illuminates the red part of the panel, making it easier for other road users to see the vehicle even when not directly behind it.
HLKAC	Overload Protection System	Enables the driver to see the gross vehicle mass (GVM) and individual axle weight in real time
A6YAB	Operator Command DPF Regeneration	The system is designed to clean diesel exhausts automatically when the engine reaches full operating temperature for a sustained period of time
C1DAD	Trailer Tow Electrics	Includes Towing Electrics (connector and wiring) without the physical Tow-Bar.
DCNAB	Engine RPM Controller	Enables the engine to be run at an elevated idle speed.

SVO Body

Feature Code	Special Vehicle Option (SVO)	Description
BVFDL	Seat Pack SVO 11	This seat pack provides a less front passenger seat option on a trend (level 4) Van .
BVFDC	Seat Pack SVO 3 - Orange Seat Belt Single Passenger Seat	Single passenger seat configuration with added orange seat belts for passenger and driver
BVFDE	Seat Pack SVO 3 - Orange Seat Belt Driver Only	Driver only seat configuration with added orange seat belt
BVFDM	Seat Pack SVO 12	This seat pack provides a less front passenger seat option on a trend (level 4) Van with black seat belt.
BVFDS	Seat Pack SVO 17	Easier cross-cab movement and improved access to the rear conversion
BVFDT	Seat Pack SVO 18	Easier cross-cab movement and improved access to the rear conversion
BVFDR	Seat Pack SVO 16	Easier cross-cab movement and improved access to the rear conversion
BVFDF	Seat Pack SVO 6	This seat pack provides swivel seats less fabric

AAKAC	Slam Handle TVL Security Pack	Lock Group 1: Includes Factory Fit RepLock (driver door), latch shields (RCD & SLD) & slam handles (RCD & SLD) – auto lock, key unlock (MFC: AAKAC)
AAKAD	Hook Lock TVL Security Pack	Lock Group 2: Includes factory fit RepLock (driver door), front door loom guard, dead locks on driver & passenger front doors, plus hook lock on side/rear. (MFC: AAKAD)
AAKAE	Armourshell TVL Security Pack	Lock Group 3: Includes factory fit RepLock (driver door), front door loom guard, dead locks on driver and front passenger door, plus armourshell lock on side and rear doors (MFC: AAKAE)
CSGAB	Tyre Carrier Drop Door Closed	Provides spare wheel access from the outer side of the vehicle without need to open the rear doors.
BL1AC	Roof Air Shield Fairing Package	Available on Luton Van PK2, Box Van Body, Box Van Body 2
A6KAP	Cargo Door 250 Hinge	Increases cargo door opening to 250º angle
A1GAJ	Skeletal Cutaway	Low-floor Transit Skeletal chassis cab with the additional Closed Roof and B-Pillar cappings.
BEBAC	Transit Skeletal Chassis Rear Lights Pack	Rear Lights Pack provided inside the vehicle to fit them after
A6KAH	Rear Tail Lift Prep Pack	Wiring in preparation for a Rear Tail Lift on Transit Chassis Cab

SVO Additional

Feature Code	Special Vehicle Option (SVO)	Description
AALE6	Service Van pack	Floor covering, Side Lining and Tie Down for a wide variety of delivery uses
AALNN	Luton Van Pack 2	Luton Van pack
AGAAF	Express Delivery Pack Plus	Protects the floor and side walls ready for use
AALEB	Ambulance Pack C	Donor vehicle suitable for conversion to an ambulance body
AALJJ	Glass Van Pack 4	Conversions into specialist people carriers
AALPM	People Mover Prep Pack	Donor vehicle for recreational and community transport.
AALAV	Parcel Delivery Van pack	Base vehicle for Service Line conversion. For further information please contact your National Sales Company representatives, or local Ford dealer. Italy only.
AGAAX	Taxi Pack Version 1	2nd row seats deletion on titanium bus for taxi conversion purposes. Britain and Ireland only.
AALFV	Refrigeration Unit Prep pack	Refrigerated donor vehicle containing refrigeration main harness and single AGM battery for Van, Chassis Cabs and Skeletal Chassis.
AALH4	Ambulance Donor Pack	Donor vehicle for an Ambulance conversion
AALQA	Mobile Service Van	Donor vehicle for mobile workshop service van
AALQQ	Double Chassis Cab Tarpaulin Conversion	Tarpaulin kit on a Transit Double Chassis Cab float. The Tarpaulin encloses the entire cargo area
AALDI	Double Cab Equipment Storage	Internal storage area for equipment, removing both the rear seats and glazing from the rear doors
AGAAP	1-Way Tipper	A Tipper which tips only to the rear of the vehicle. Frame constructed in high strength steel with aluminium boards

Abc = BEV Only Abc = ICE Only

AGAA1	1 Way Tipper + Tool Pod	A Tipper which tips only to the rear of the vehicle. Frame constructed in high strength steel with aluminium boards. Plus this option has an aluminium full width & full height storage box located between cab & the Tipper which has side access roller doors.
AGAA2	1 Way Aluminium Tipper + Tool Pod	A Tipper which tips only to the rear of the vehicle. Frame constructed in high strength steel with aluminium boards but with the Tipper subframe & bed constructed in aluminium for weight saving / increase payload capability. Addition of a Tool pod located between the cab & Tipper bed
AGAA3	3 Way Tipper + Tool Pod	A Tipper which can tip to the rear or to either side of the vehicle. Frame constructed in mild steel with aluminium boards. Plus this option has an aluminium full width & full height box located between cab & the Tipper which has side access roller doors
AGAAI	3-Way Tipper	A Tipper which can tip to the rear or to either side of the vehicle. Frame constructed in mild steel with aluminium boards
AGAAJ	Low Floor Luton Van	Low floor Luton van. The skeletal version permits a much lower load bay floor than the box or luton vans based upon chassis cabs.
AGAAY	1 Way Aluminium Tipper	A Tipper which tips only to the rear of the vehicle. Frame constructed in high strength steel with aluminium boards but with the Tipper subframe & bed constructed in Aluminium for weight saving / increase payload capability.
AALQD	Refrigeration Prep Pack B	Refrigerated donor vehicle with A/C
AALQE	Refrigeration Prep Pack C	Refrigerated donor vehicle without A/C
AALQF	Freezer Unit Prep Pack D	Freezer donor vehicle with A/C
AALQG	Freezer Unit Prep Pack E	Freezer donor vehicle without A/C
AALA1	Light Weight Chassis Pack	

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: 4.23 Fuses and Relays

Chassis Cab Conversion	
Van Conversion/ Multi-Purpose Vehicle Conversions	Refer to: 1.14 Package and Ergonomics
	Refer to: 1.17 Towing
	Refer to: 3.8 Fuel System
	Refer to: 4.6 Battery Systems
	Refer to: 4.7 Battery Protection
	Refer to: 4.24 Special Conversions
	Refer to: 4.25 Electrical Connectors and Connections
	Refer to: 4.26 Grounding
	Refer to: 5.15 Frame and Body Mounting Rear Seat Fixings Positions
	Refer to: 5.13 Roof Roof Racks

Skeletal Chassis	
Camper	Refer to: 1.17 Towing Tow Bar Skeletal Chassis for camper
	Refer to: 3.7 Exhaust System Exhaust Heat Shields
	Refer to: 3.8 Fuel System Auxiliary Fuel Line
	Refer to: 4.25 Electrical Connectors and Connections Driver Swivel Seat
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang
	Refer to: 5.1 Body Integrated Bodies and Conversions (Skeletal Chassis for camper)
	Refer to: 5.8 Rear View Mirrors Door Mirrors
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)
	Refer to: 5.13 Roof Roof Cut Out - Camper Based Vehicles Only
	Refer to: 5.15 Frame and Body Mounting Self-supporting Body Structure & Water Tank on Skeletal Chassis for camper
Non-Camper Conversion	Refer to: 1.17 Towing Tow Bar Transit Skeletal Chassis for non-camper
	Refer to: 3.7 Exhaust System Exhaust Heat Shields
	Refer to: 3.8 Fuel System Auxiliary Fuel Line
	Refer to: 4.25 Electrical Connectors and Connections Driver Swivel Seat
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang
	Refer to: 5.1 Body Integrated Bodies and Conversions (Skeletal Chassis for non-camper)
	Refer to: 5.8 Rear View Mirrors Door Mirrors.
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)

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Refrigerated Vehicles	
Van Conversion	Refer to: 1.9 End of Life Vehicle (ELV) Directive
	Refer to: 4.4 LV Charging System (12 V) Generator and Alternator
	Refer to: 4.8 Climate Control System
	Refer to: 4.23 Fuses and Relays
	Refer to: 5.13 Roof Roof Racks
Compressor Installation	Refer to: 3.3 Accessory Drive

Dry Freight	
Box Van	Refer to: 4.4 LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang
Pantechnicon	Refer to: 4.4 LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang
Money Carriers	Refer to: 4.4 LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.13 Roof
	Refer to: 4.15 Exterior Lighting
Refuse Collection	Refer to: 4.4 LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 4.16 Interior Lighting

Emergency Services	
Ambulance (Front Line)/Fire Brigade/ Armed Forces / Police	Refer to: 3.2 Engine Cooling Airflow Restrictions
	Refer to: 4.4 LV Charging System (12 V) Generator and Alternator
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.16 Interior Lighting
	Refer to: 4.23 Fuses and Relays
	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 5.9 Seats
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang

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Passenger Carrying	
Taxi	Refer to: 1.3 Commercial and Legal Aspects Restraints System
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.16 Interior Lighting
	Refer to: 5.9 Seats
	Refer to: 5.10 Glass, Frames and Mechanisms
	Refer to: 5.13 Roof
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)
Mobility	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.16 Interior Lighting
	Refer to: 5.9 Seats
	Refer to: 5.10 Glass, Frames and Mechanisms
	Refer to: 5.13 Roof
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)
Coach Built	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 4.12 Tachograph
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.16 Interior Lighting
	Refer to: 5.9 Seats
	Refer to: 5.10 Glass, Frames and Mechanisms
	Refer to: 5.13 Roof
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)
Wheelchair Accessible	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 4.15 Exterior Lighting
	Refer to: 5.9 Seats
	Refer to: 5.10 Glass, Frames and Mechanisms
	Refer to: 5.13 Roof
	Refer to: 4.16 Interior Lighting
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)
Mini Bus	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 4.15 Exterior Lighting
	Refer to: 4.16 Interior Lighting
	Refer to: 5.9 Seats
	Refer to: 5.10 Glass, Frames and Mechanisms
	Refer to: 5.13 Roof
	Refer to: 5.11 Airbag Supplemental Restraint System (SRS)

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Vocational Conversion	
Mobile Workshops	Refer to: LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 5.3 Racking Systems
	Refer to: 5.13 Roof Roof Racks
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang
Mobile Shops / Offices	Refer to: LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.2 Hydraulic Lifting Equipment
	Refer to: 5.3 Racking Systems
	Refer to: 5.13 Roof Roof Racks
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang
Glass Carrying	Refer to: LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.1 Body Racking System
Racking Conversions	Refer to: LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.3 Racking Systems
Recovery Vehicles	Refer to: LV Charging System (12 V) Generator and Alternator
	Refer to: 4.12 Tachograph
	Refer to: 5.15 Frame and Body Mounting
	Refer to: 4.24 Special Conversions Auto Wipe and Auto Light for Vehicles with Large Overhang

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 Conversionworks@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

Abc = BEV Only Abc = ICE Only

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 and 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.

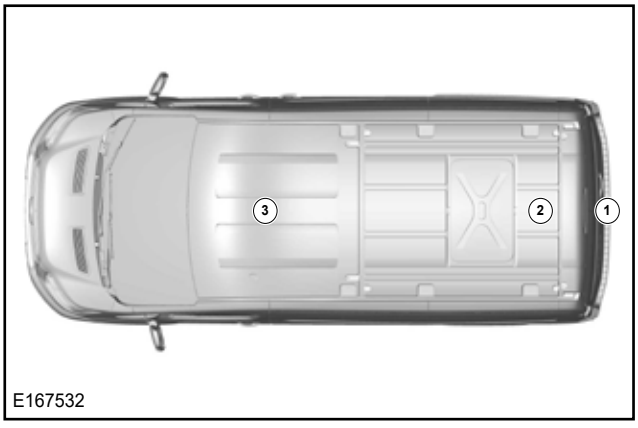
NOTE: Only fit one antenna in the positions shown to the roof of your vehicle.

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 Conversionworks@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



E167532

Item	Description
1	Rear Antenna location 1
2	Rear Antenna location 2
3	Front Antenna location 3

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.

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 Conversionworks@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 Conversionworks@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 material 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.

You must use the specific jacking points.

When jacking the E-Transit BEV, the Jack must NOT be placed under the High Voltage Battery, the Battery Cradle, the Side Impact Protection Bars or the Electric Drive Assembly. The vehicle must only be jacked using the correct jacking locations identified in the Owners Manual.

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: : For Rear Wheel Drive ICE vehicles (gasoline/diesel), please ensure that the jack is ONLY placed beneath the rear axle tube and NOT under the rear damper bracket.

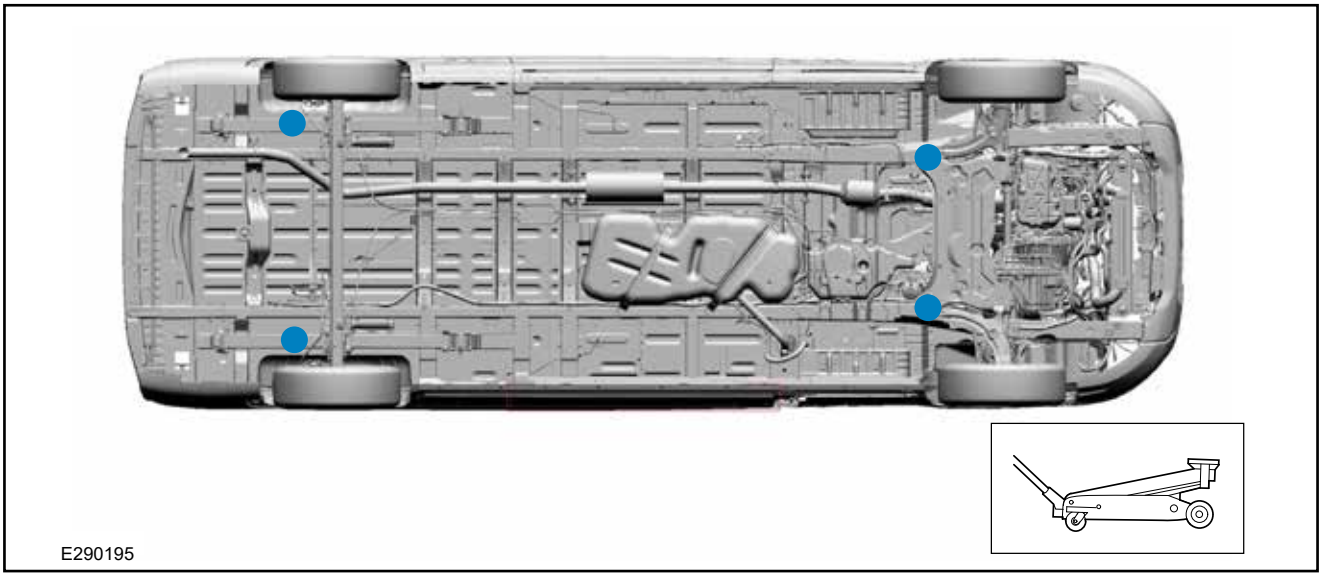
NOTE: Make sure that reinforcements are installed to maintain the integrity of the original body structure for/at jacking points.

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

NOTE: Make sure that for rear wheel drive vehicles the jack is only placed underneath the rear axle tube and not under the rear damper bracket.

NOTE: If the vehicle has rear air conditioning make sure the vehicle jack does not come in contact with the air conditioning lines.

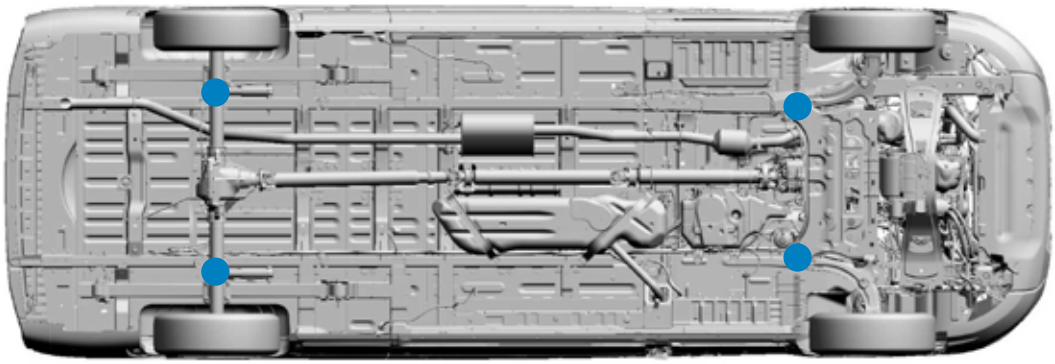
Front Wheel Drive - Van, Bus, Kombi

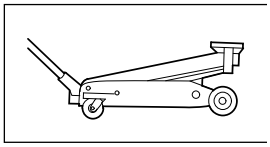


E290195

Abc = BEV Only Abc = ICE Only

Rear Wheel Drive - Van, Bus, Kombi





E290194

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.

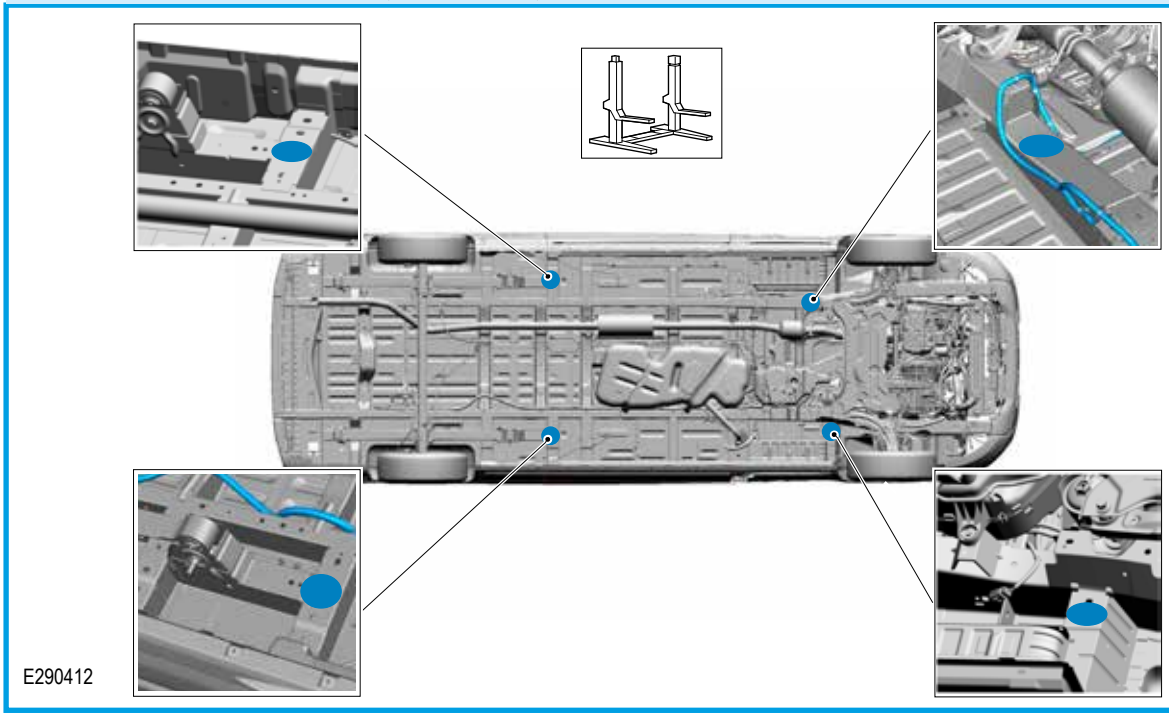
When lifting the vehicle with a two post lift, the maximum kerb weight must not be exceeded.

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.

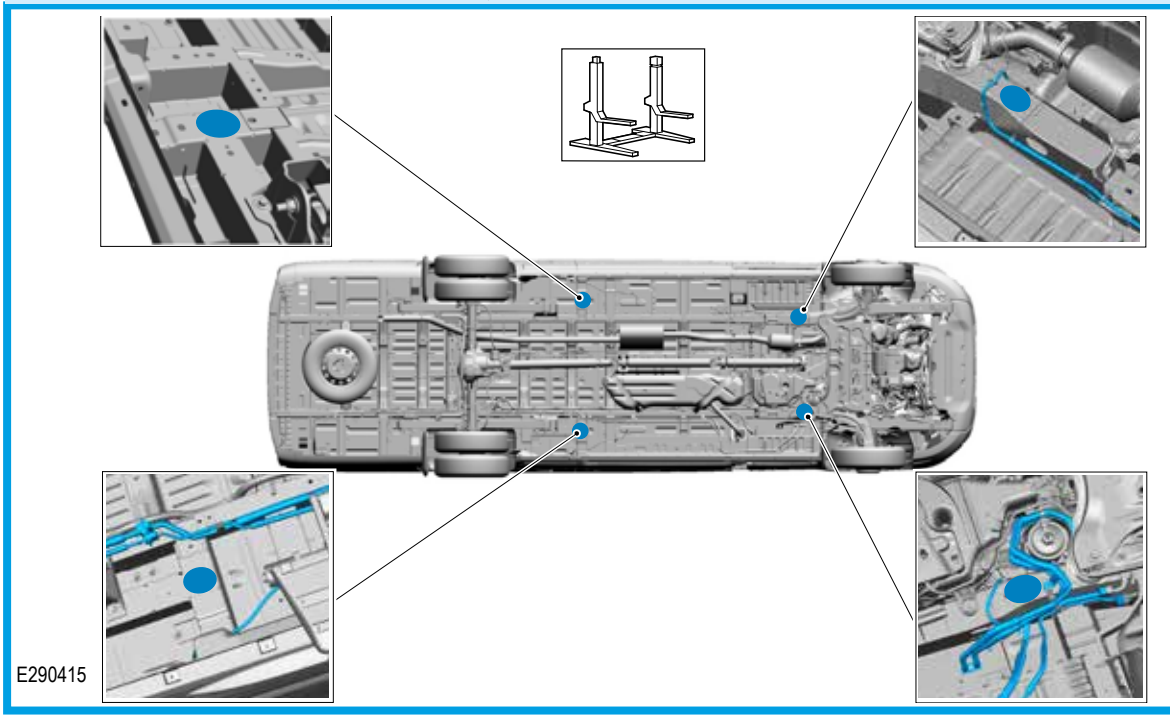
1.11.1 ICE (Diesel) Vehicles

Front Wheel Drive - Kombi (L3 shown)



E290412

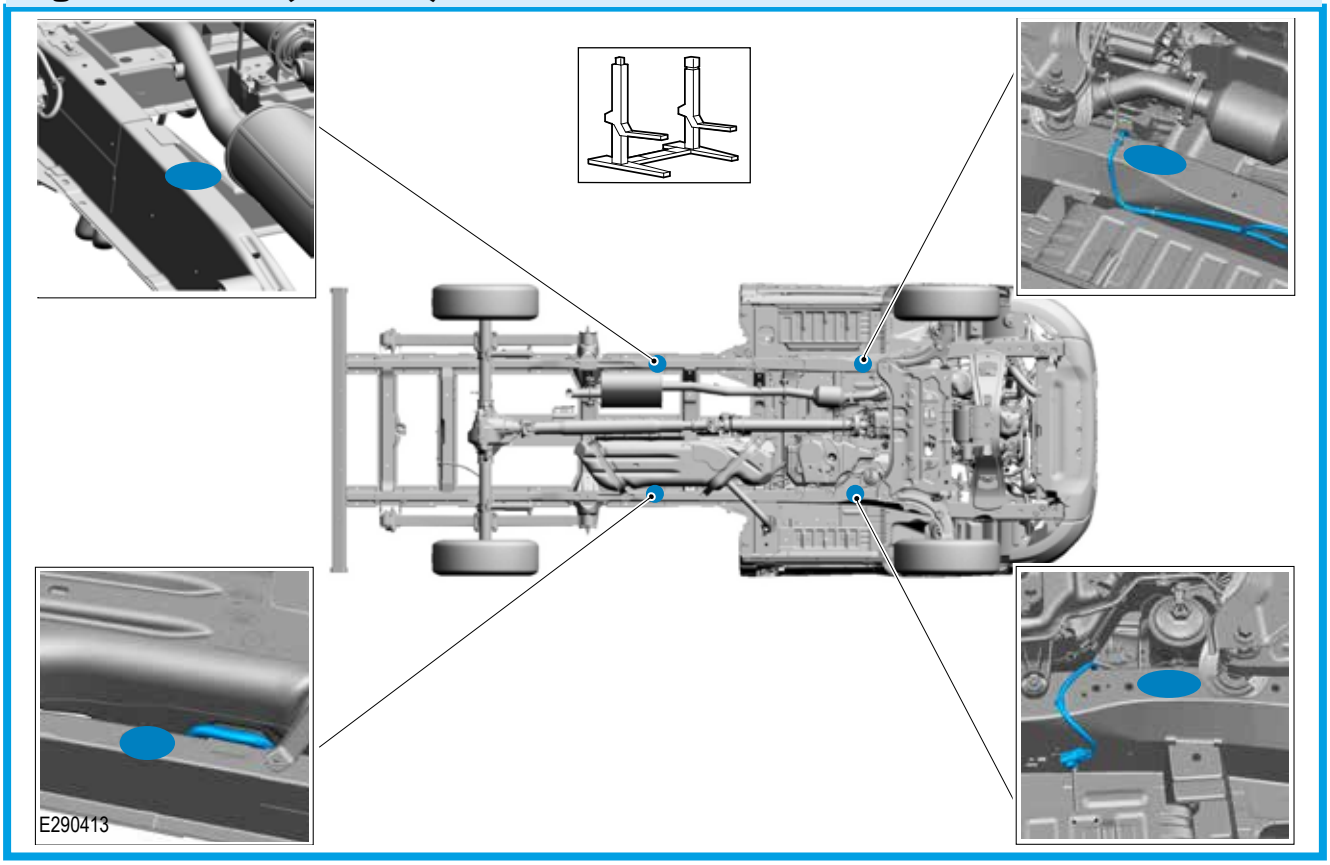
Rear Wheel Drive - Bus (L4 shown)



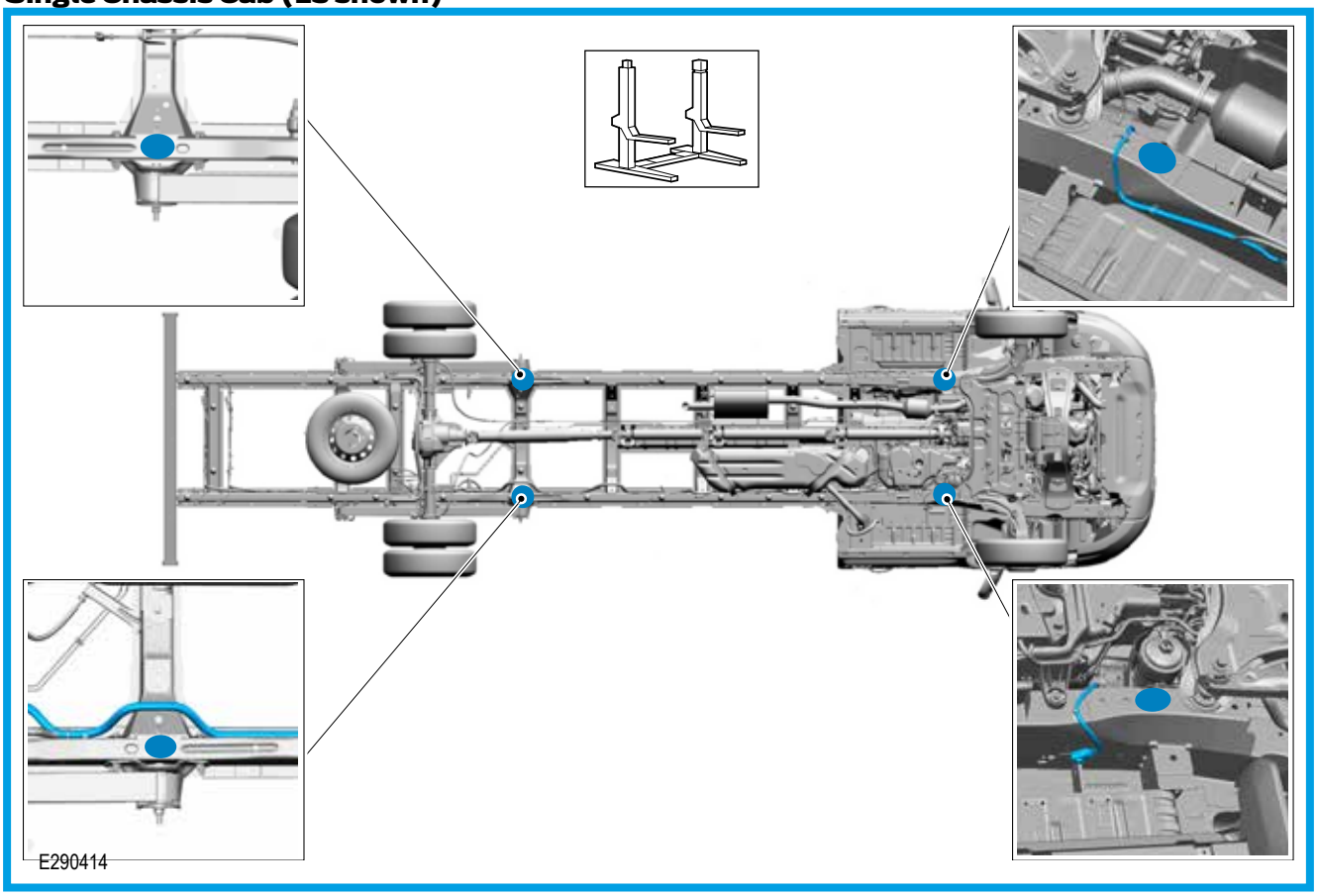
E290415

Abc = BEV Only Abc = ICE Only

Single Chassis Cab (L1 shown)



Single Chassis Cab (L5 shown)



1.11.2 E-Transit BEV Vehicles

WARNING: The E-Transit BEV must NOT be lifted using the Battery, Battery Cradle, Side Impact Protection. Megabrace or Electric Drive Assembly as a lifting point

Front Hoist Locations

- Common for all variants
- Use of the "front step" body location either side
- Dependent on pad used, a block may need to be employed to avoid wheel arch liner damage

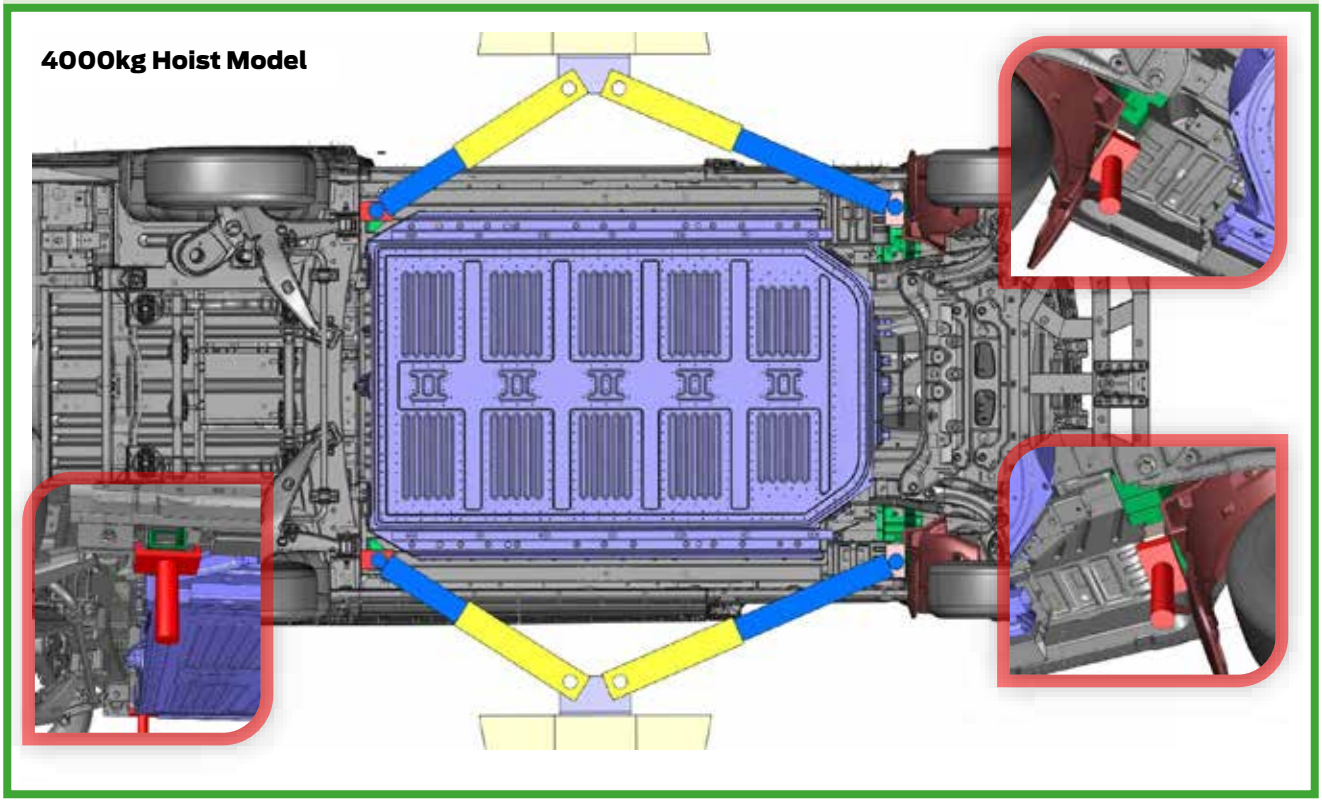
Rear Hoist Locations

- Specific to variant
- L2 Van/Bus/Kombi - dedicated cradle lift pad
- L3/L4 Van/Bus/Kombi rail location
- L3/L4 Single Chassis Cab dedicated cradle lift pad
- All other Single Chassis Cab variants use rail location

Lift Pad and Dedicated Lift Cradle Pad

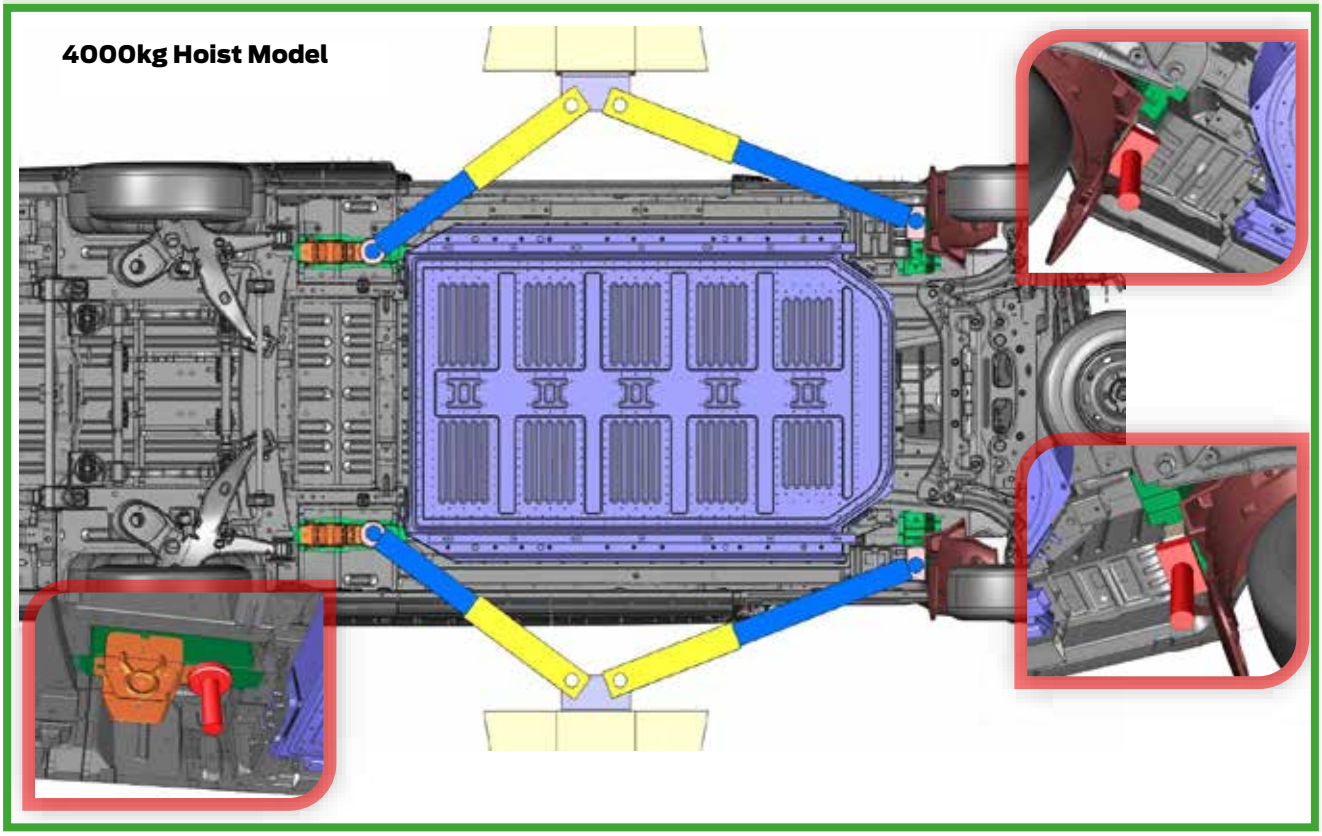


L2 Van, Bus, Kombi

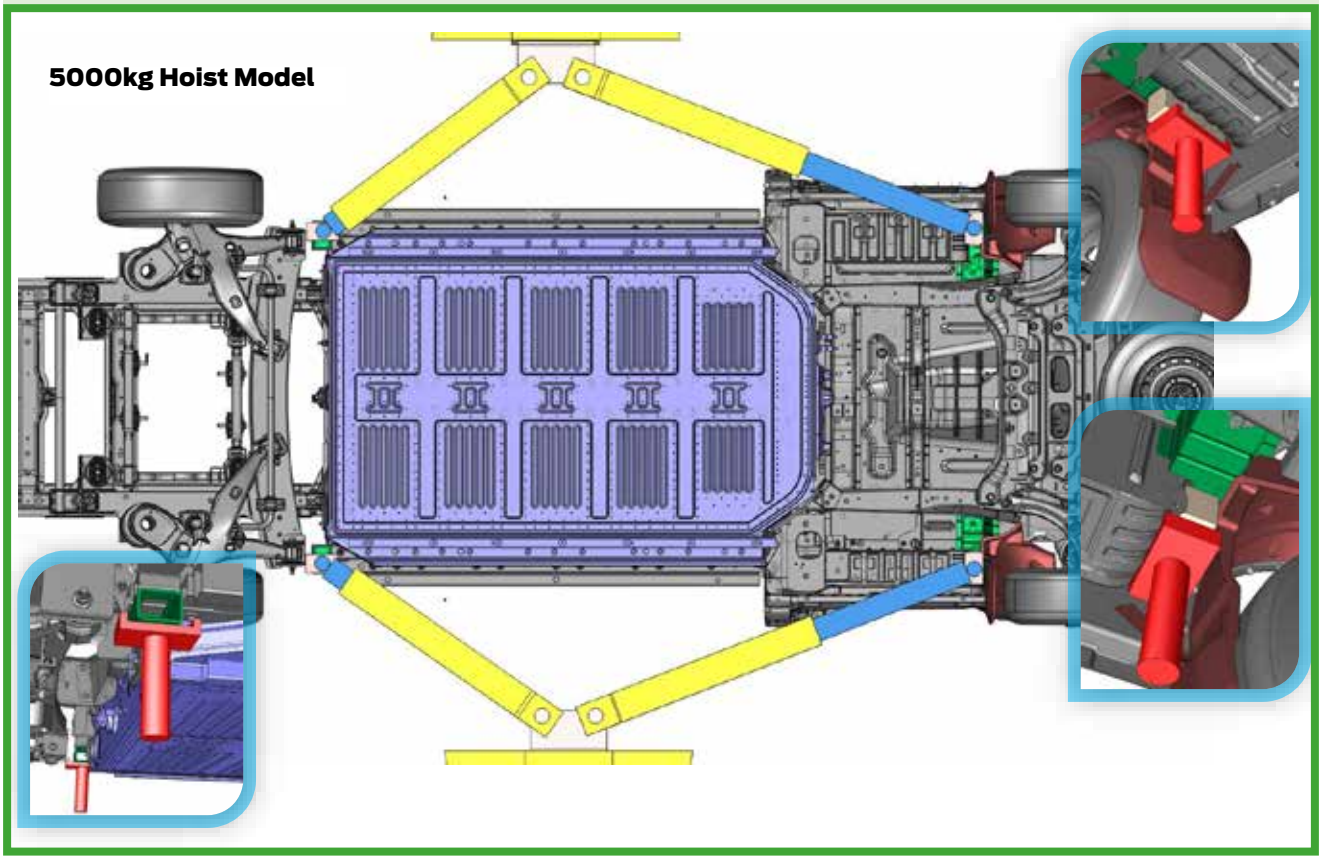


Abc = BEV Only Abc = ICE Only

L3/L4 Van, Bus, Kombi

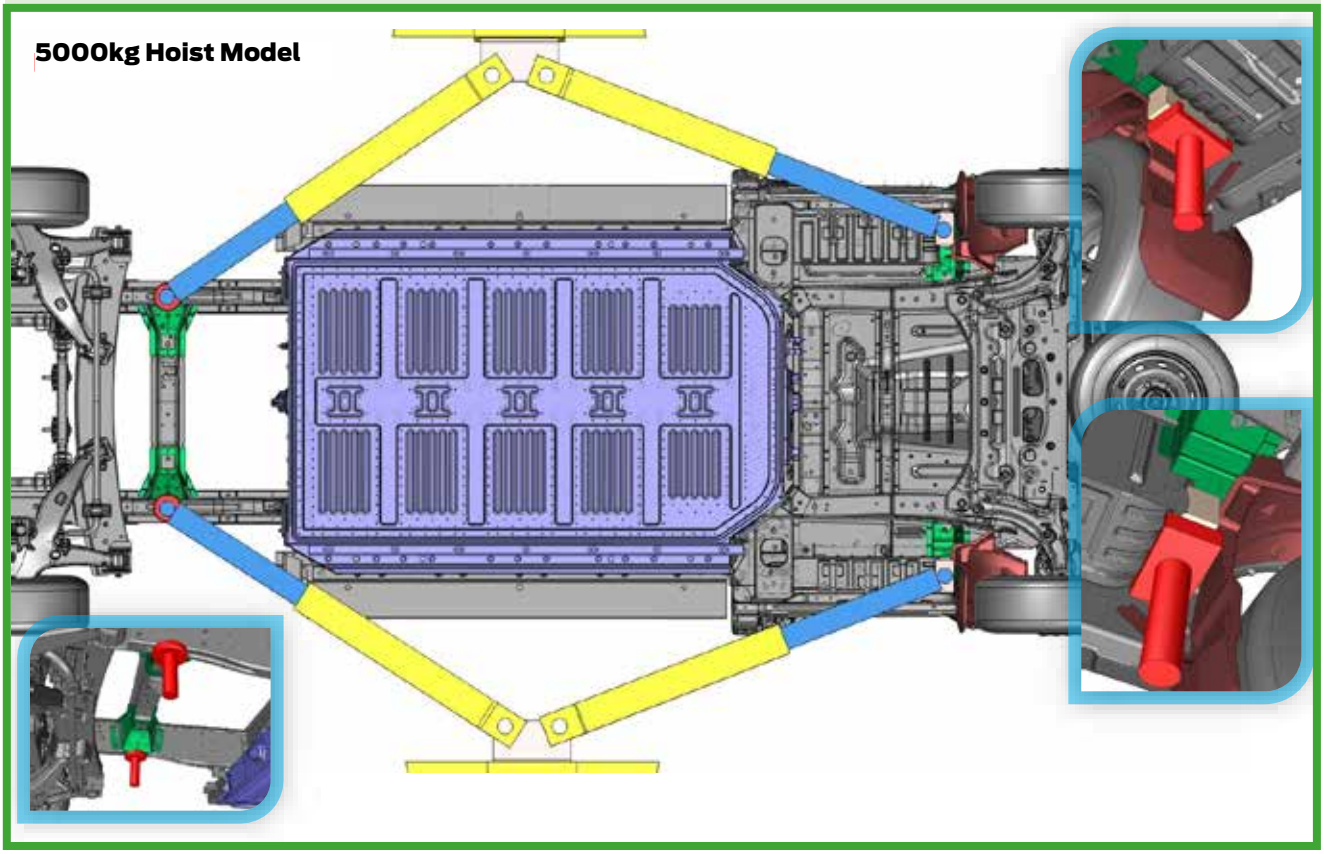


L3/L4 Single Chassis Cab



Abc = BEV Only Abc = ICE Only

L5 Single Chassis Cab



Abc = BEV Only Abc = ICE Only

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:

Disconnect the battery if the vehicle is to be stored for more than 7 days (ICE only).

For a storage period in excess of 30 days, disconnect the 12V Battery to maintain state of charge of the High Voltage battery (BEV only)

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.

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

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

The following may be considered a sensible approach to storage:

Short term storage:

- Wherever possible, vehicles should be stored in an enclosed, dry, well-ventilated area. 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 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 Converter process and to maximise battery life and prevent premature failure of the Ford batteries, protect and prevent battery discharge during any conversion or whilst the vehicle is in storage. This may include leaving the vehicle in Transport mode as long as possible, reducing the amount of crank cycling around the facility, door ajar events and duration. The voltage MUST be checked when receiving and before shipping. 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.

Refer to: 4.5 Mild Hybrid Charging System

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

Charging stations may be particularly important at vehicle receiving locations in case vehicles arrive with insufficient charge to maneuver through the manufacturing process.

Charging stations are recommended at vehicle storage locations

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

- BEV vehicles upfit as ship-thrus should enter the Ford transportation system with the same state of charge they had leaving the Ford assembly plant.
- In other cases, upfitters should consider their customer's expectations and transportation arrangements when determining any state of charge requirements.

Refer to: 4.6 Battery Systems

Action/Time in Storage	Monthly	Every 3 Months
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 º C) with aircon switched on, where applicable	-	X

Protection from Injector Nozzle Corrosion During the Upfitting/Conversion Process

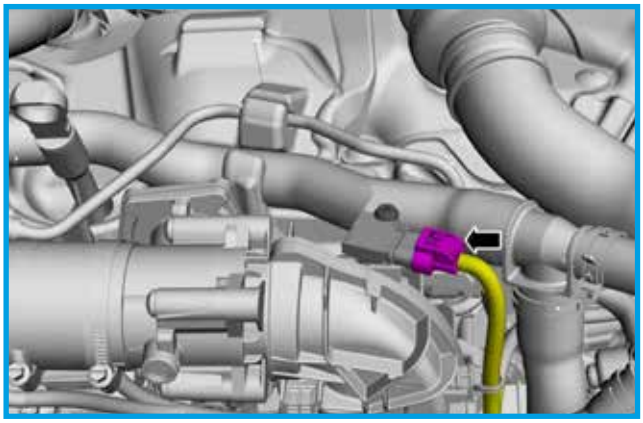
Ford Engineering has identified a concern with the fuel injectors on the 2.0L EcoBlue engine (Euro 6 and 6.2 emissions standards) fitted to Transit and Transit Custom, whereby the injector nozzle can become corroded. Ford is working on a permanent solution, which will be communicated in due course (new VCIN1 injector implementation to complete by Q4 2022).

The corrosion is caused by condensation which forms on the nozzle when the engine is new and run repeatedly for very short periods whilst cold (less than 60 degrees centigrade). As a consequence, fuel injectors may fail during vehicle storage , whilst undergoing a conversion (Motorhomes are particularly susceptible), or early in service time.

If the vehicle cannot be left in transportation mode then the below procedure to disconnect the Manifold Absolute Pressure (MAP) sensor's electrical connector, until the vehicle is prepared for delivery to the customer, should be followed to achieve the same result.

Procedure for Disconnecting the Manifold Absolute Pressure (MAP) Sensor

1. Open the bonnet.
2. Partially loosen the air cleaner (if required), locate and disconnect the MAP sensor (Transit 2014.75 FWD shown, all other variants similar)
   - As a consequence, the engine's power and torque output will be limited (by up to 30%).



3. Start and stop the engine 4 times to ensure that the Malfunction Indicator Lamp (MIL) is illuminated and the corresponding information message is displayed in the instrument cluster.
   - The vehicle can be operated safely with the MAP sensor disconnected during any conversion that the vehicle may be undergoing.
4. Before the vehicle is handed over to the customer, the MAP sensor must be reconnected and the engine must be started 4 times to turn off the Malfunction Indicator Lamp (MIL), remove the information message and restore the engine's normal power and torque outputs.

NOTE: When the MAP sensor is disconnected, the vehicle must only be used at the storage facility and NOT on public roads.

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 Conversionworks@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 Converter 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 Converter 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: 4.15 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.

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

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, Wheel Guards and Rear Registration Plate

WARNING: Check local legislation for legal requirements.

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

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

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

(1) As amended periodically

Australian Government Approval for Chassis Cab Variants:

Rearmost Wheel Guards per ADR 42

Provision for Rear Registration Plate per ADR 61

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.

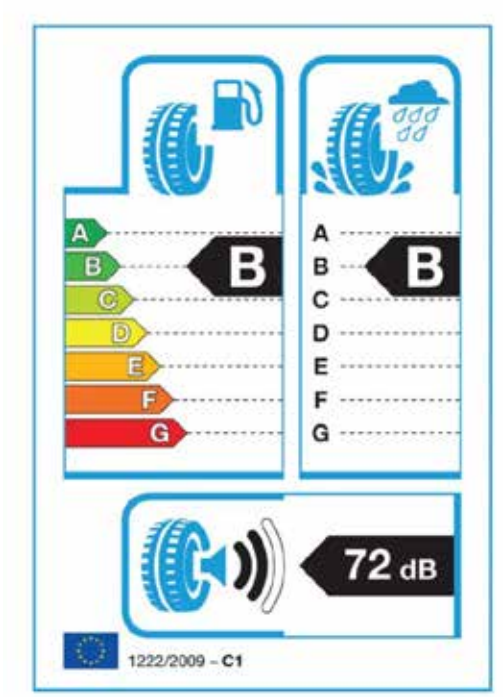
Tyre Rolling Resistance

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 below.

Exceeding Attribute Limits

As a requirement of the Vehicle Converter to use the base vehicle approval, the Vehicle Converter must stay within the defined limits of the BEMM and the Emissions Type Approval applicable to the vehicle.

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

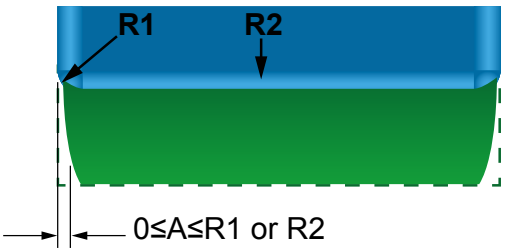


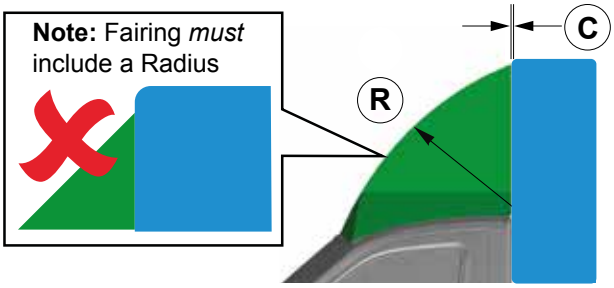
E309537

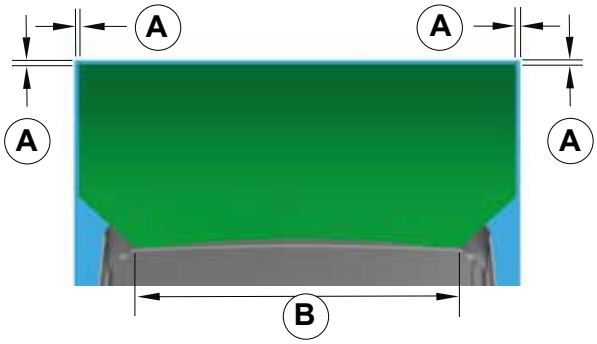
WLTP Constraints

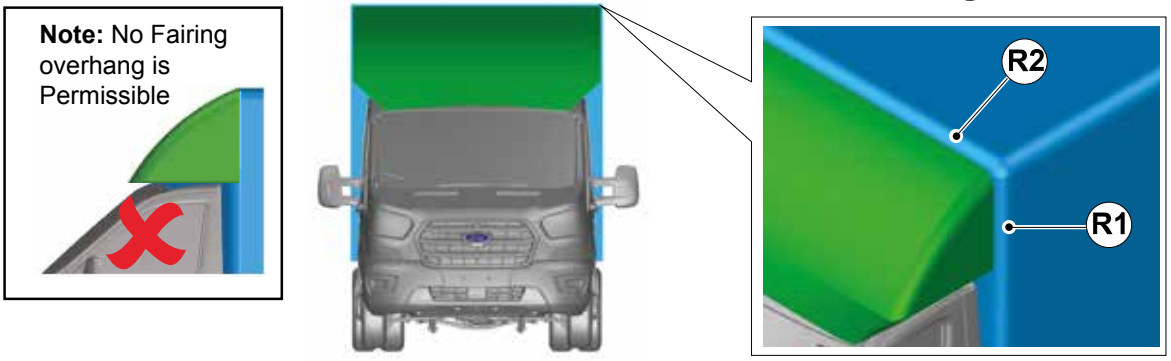
Please Note: If the *front/top* edge of the box body (**R2**) has a radius between **60-200mm**, the *fairing* top edge should be placed at the lowest point of that radius - see Ref 1 image (bottom)

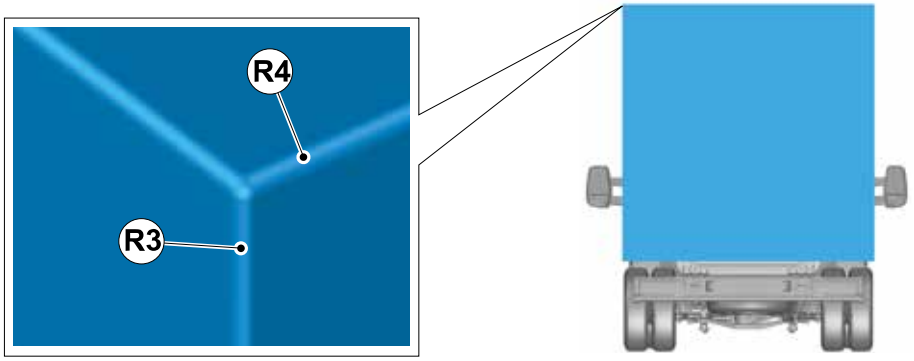
Gap between fairing and body (C) should limited to a maximum of 20mm



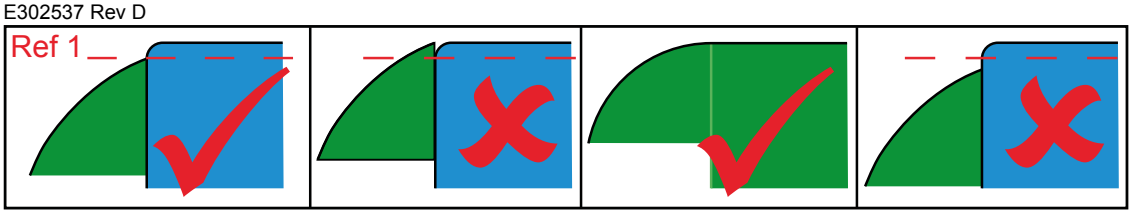








E302537 Rev D



Fairing aligned to lower point of radius (R2)

Fairing with sharp edge above radius (R2)

Fairing tangential to top of box. No raised edge. Applicable to integrated fairing/box only

Fairing below lowest point of radius (R2)

Item	Description	Item	Description
A	Distance between Fairing/Edge of Box Body: 0≤A≤R1 or R2	R1	Front Box Body Edge - Radius LHS/RHS
B	Fairing Width (Min: 850mm/Max: Width of Box body)	R2	Front Box Body Edge - Radius Top
C	Gap between Fairing and Body: Max 20mm	R3	Rear Box Body Edge - Radius LHS/RHS
R	Radius of Fairing Range 1000mm - 3000mm	R4	Rear Box Body Edge - Radius Top

Abc = BEV Only Abc = ICE Only

Frontal Area Calculation

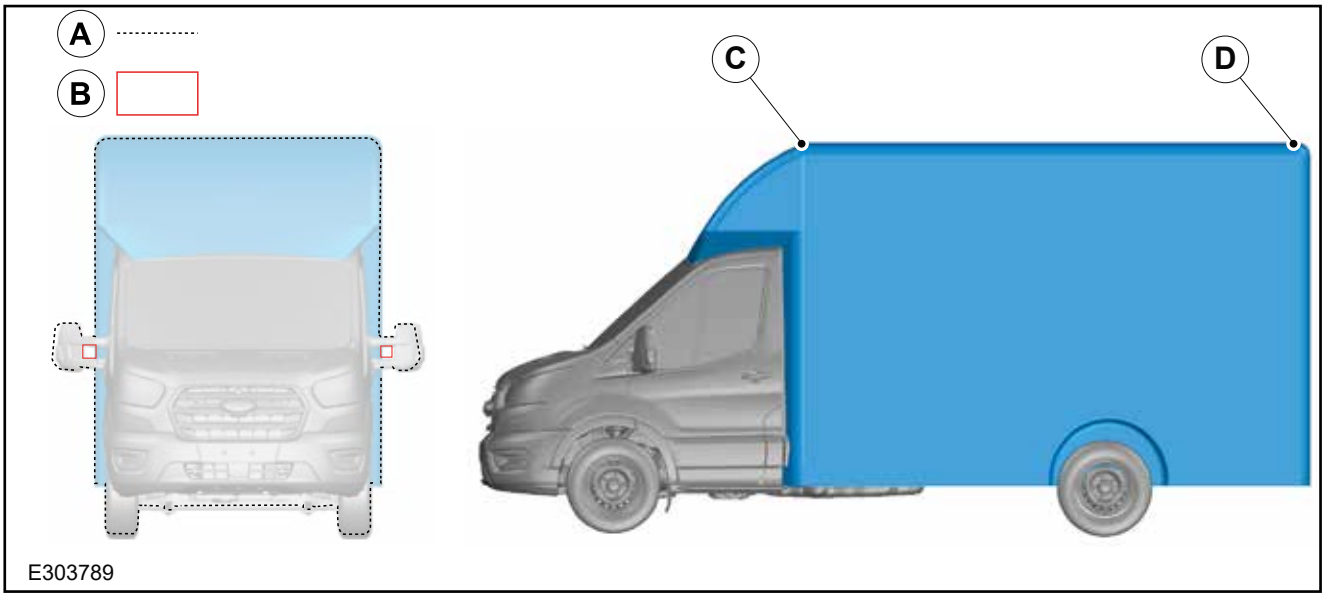
NOTE: The WLTP calculator can be accessed at https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F You will need to register or login to use it.

Regognised options of calculating Frontal area are by CAD, pixel counting or a certified laboratory wind tunnel test.

*The front surface area must be taken from the highest point of the conversion. This point can either be at the front (C), the rear (D) or anywhere in between on the Box Body.

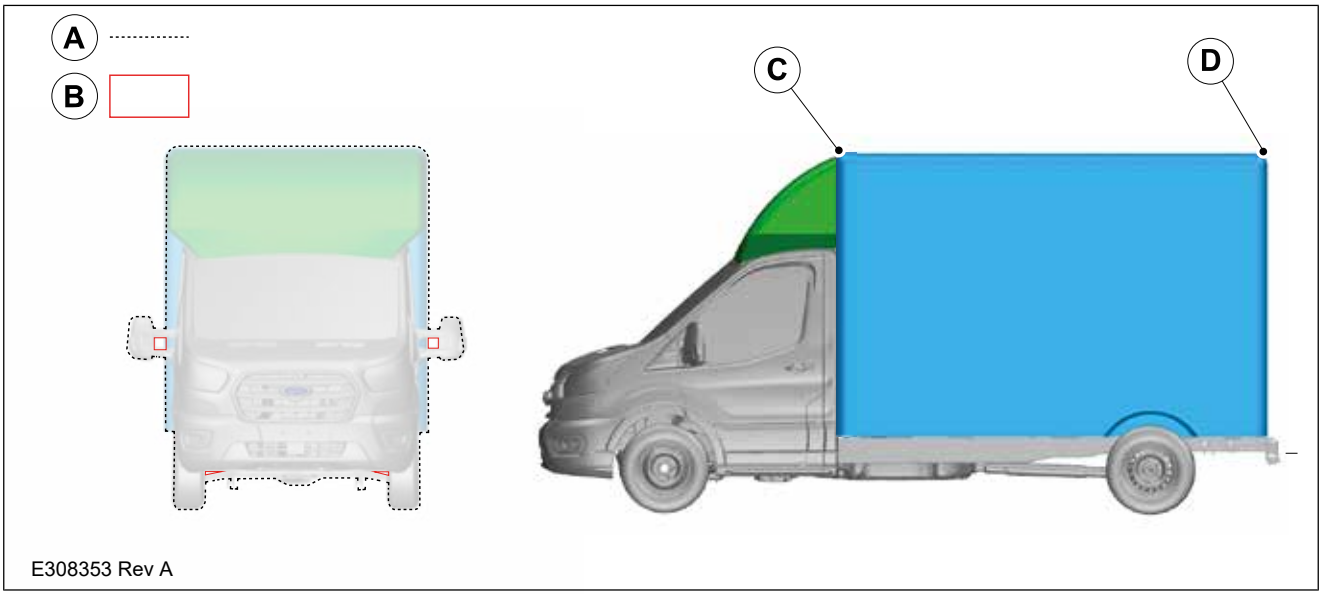
To find the front surface area use calculation (m^2):
A - B

Total Frontal Area Calculation FWD



E303789

Total Frontal Area Calculation RWD



E308353 Rev A

Item	Description
A	Total frontal area to be calculated*
B	Example areas to exclude in calculation

1.14.8 Vehicle Dimensions Key

Van, Bus, Kombi			
Wheelbase	**Overall Length (mm)**	**Overall Height (mm)**	
		H2	H3
L2 - 3300	5531	2469 - 2568	2708 - 2807
L3 - 3750	5981	2469 - 2601	2708 - 2840
L4 - 3750	6704	-	2784 - 2806

Skeletal for Camper and Non Camper	
Wheelbase	**Overall Height (mm)**
L2 - 3300	2191
L3 - 3750	2184
L4 - 3954	2187 - 2202
L5 - 4522	2140 - 2174

Chassis Cab			
Wheelbase	**Overall Length (mm)**		**Overall Height (mm)**
	Without Float	**With Float**	
Single Chassis Cab - H1			
L1 - 3137	5205	5357	2204 - 2217
L2 - 3504	5572	5767	2191 - 2218
L3 - 3954	6022	6204	2186 - 2208
L4 - 3954	6579	6797	2188 - 2211
L5 - 4522	7577	7797	2180 - 2196
Double Chassis Cab - H1			
L2 - 3504	5572	5767	2215 - 2261
L3 - 3954	6022	6204	2210 - 2246
L4 - 3954	6404	6587	2200 - 2240
L5 - 4522	7394	7612	2198 - 2211

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.

Depending on the body style, Transit is available in 3 Roof Heights and 5 Wheelbases.

Roof Heights:

- Low (H1)
- Medium (H2)
- High (H3)

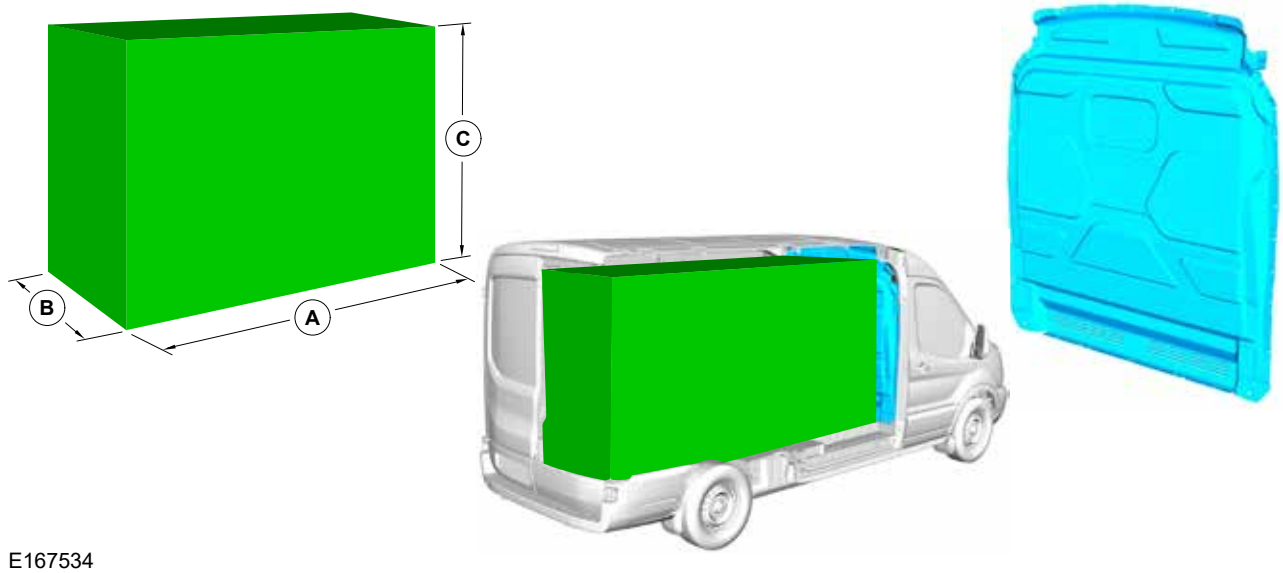
Wheelbases:

- Short Wheelbase (L1)
- Medium Wheelbase (L2)
- Long Wheelbase (L3)
- Long Wheelbase Extended Frame (L4)
- Extra Long Wheelbase Extended Frame (L5)

Abc = BEV Only Abc = ICE Only

1.14.9 Recommended Main Load Area Dimensions

H2 - Medium Roof Height - Full Bulkhead - Fixed/Glazed

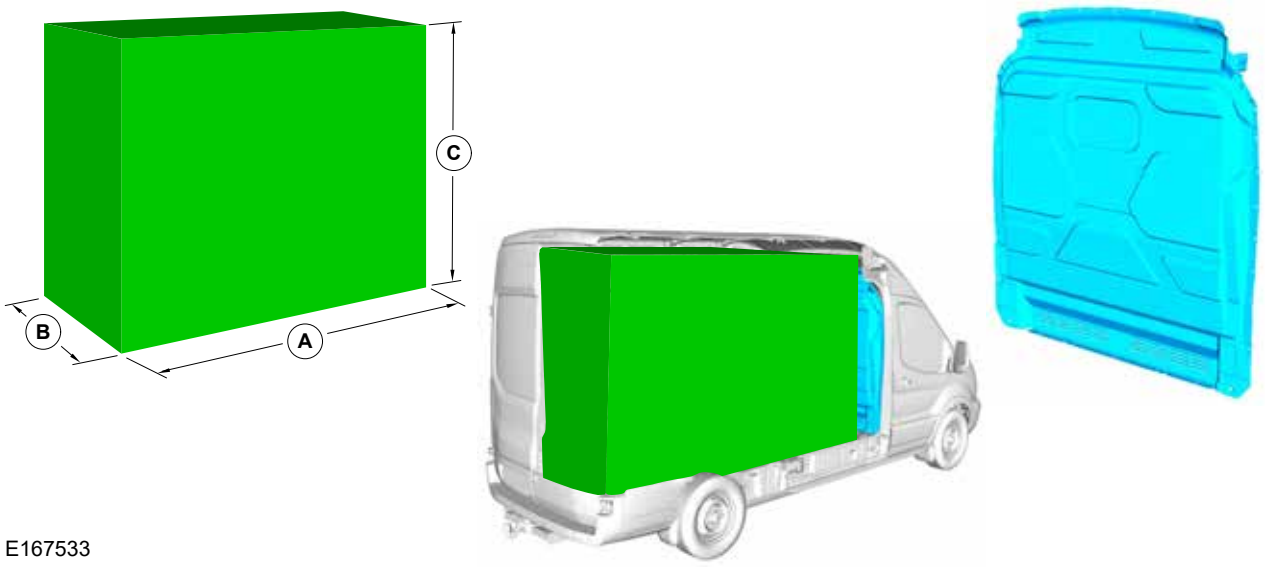


Vehicle	A (mm)	B (mm)	C (mm)
L2 - H2 FWD SRW	2872	1392	1700
L2 - H2 RWD SRW	2872	1392	1600
L3 - H2 FWD SRW	3322	1392	1700
L3 - H2 RWD SRW	3322	1392	1600

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

Abc = BEV Only Abc = ICE Only

H3 - High Roof Height - Full Bulkhead - Fixed/Glazed

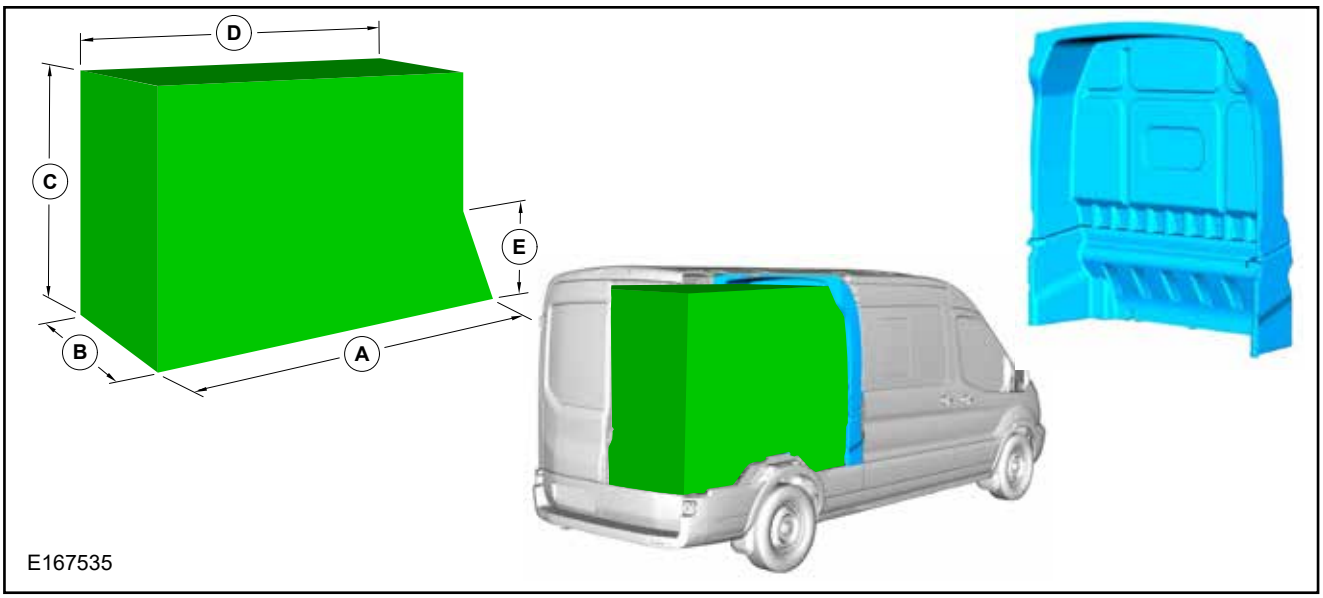


Vehicle	A (mm)	B (mm)	C (mm)
L2 - H3 FWD SRW	2877	1386	1925
L2 - H3 RWD SRW	2877	1386	1825
L3 - H3 FWD SRW	3327	1386	1925
L3 - H3 RWD SRW	3327	1386	1825
L4 - H3 RWD SRW	4050	1386	1825
L4 - H3 RWD DRW	4064	1154	1868

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

Abc = BEV Only Abc = ICE Only

H2 - Medium Roof Height - Double Cab in Van Full Bulkhead - Fixed/Glazed

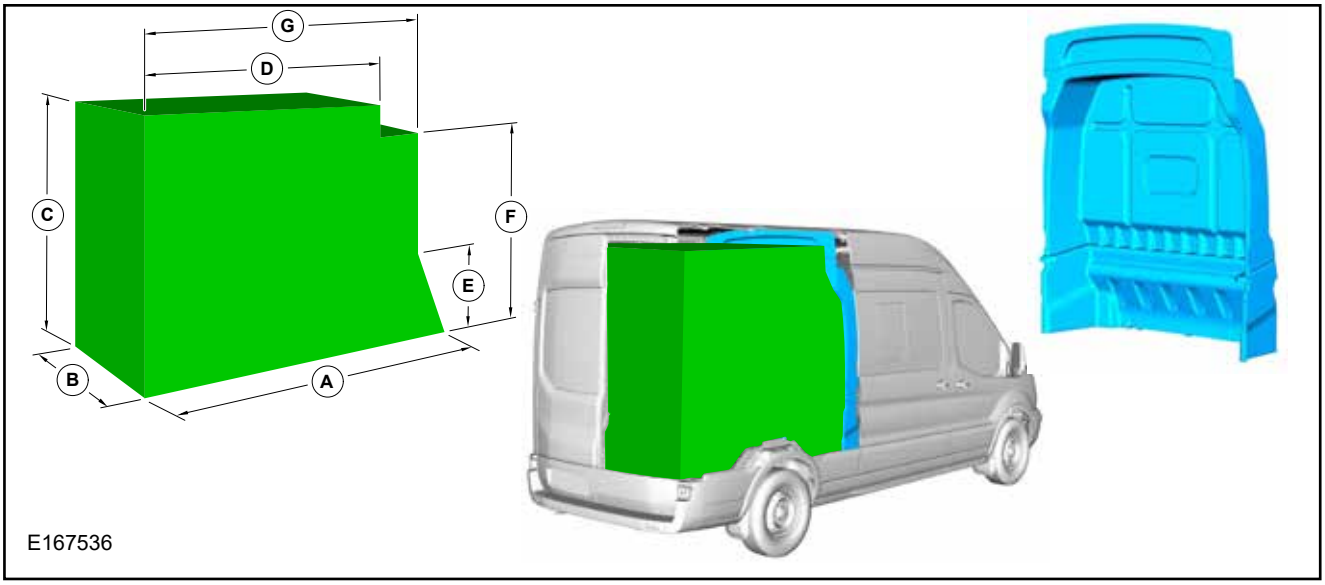


Vehicle	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
L2 - H2 FWD	2038	1392	1818	1789	520
L2 - H2 RWD	2038	1392	1718	1789	520
L3 - H2 FWD	2488	1392	1818	2239	520
L3 - H2 RWD	2488	1392	1718	2239	520

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

Abc = BEV Only Abc = ICE Only

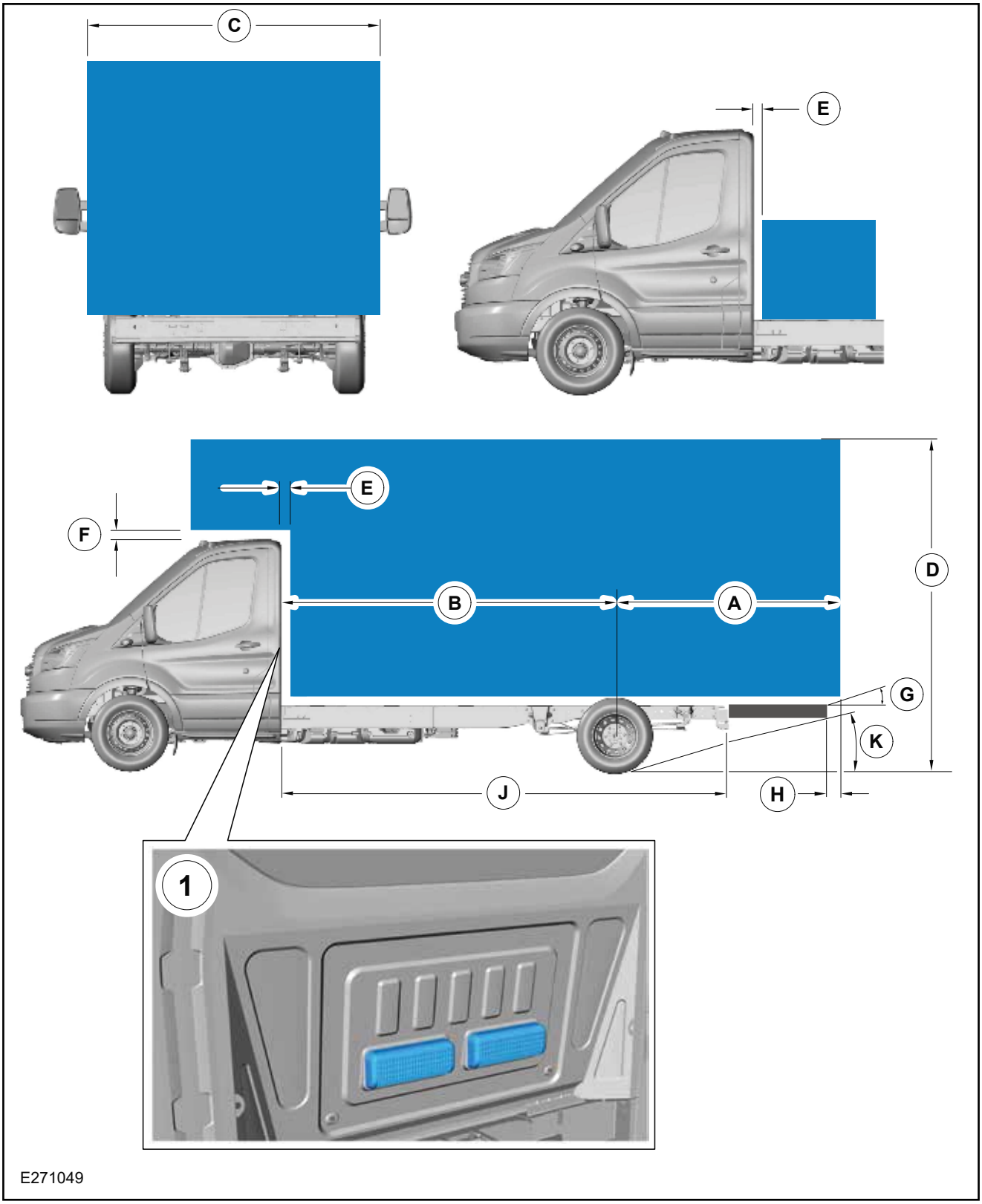
H3 - High Roof Height - Double Cab in Van Full Bulkhead - Fixed/Glazed



Vehicle	Dimensions (mm)						
	A	B	C	D	E	F	G
L2 - H3 FWD	2038	1392	2055	1439	520	1798	1788
L2 - H3 RWD	2038	1392	1955	1439	520	1698	1788
L3 - H3 FWD	2488	1392	2055	1889	520	1798	2238
L3 - H3 RWD	2488	1392	1955	1889	520	1698	2238
L4 - H3 RWD SRW	3211	1392	1955	2612	520	1698	2961
L4 - H3 RWD DRW	3211	1154	1955	2612	520	1698	2961

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

Abc = BEV Only Abc = ICE Only



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Abc = BEV Only Abc = ICE Only

Description			L1	L2	L3	L4	L5
A	Maximum recommended rear overhang		Maximum 50% of the wheelbase considering CoG of (second unit) body and payload is not rearwards of rear axle centre line and considering the requirements of masses and dimensions regulation				
B	Back of cab to rear axle	Single Cab	1730mm	2097mm	2547mm	2547mm	3115mm
		Double Cab	-	1282	1732	1732	2300
C	Maximum external body width	Short Mirror Arms	2200mm				
		Long Mirror Arms	Maximum widths of up to 2400mm [1]				
D	Maximum recommended external overall height RWD and FWD		3300mm without exceeding the maximum Centre of Gravity (CoG) height. See Load Distribution section in this manual for CoG Position				
E	30mm minimum clearance between the back of the cab and the second unit body						
F	30mm						
G	Ensure local lighting legislation is maintained						
H	Under run bar and towing attachment legislation to be maintained						
J	Frame length behind back of cab (not including rear light cross member)	Single Cab	2775mm	3142mm	3592mm	4149mm	5147mm
		Double Cab	-	2327mm	2777mm	3159mm	4149mm
		Stripped Chassis	-	2939mm	3389mm	3593mm	4154mm
K	Departure angle		It is recommended to ensure that a minimum departure angle of 14° at RGAWR of the converted vehicle and for any additional part of the conversion is maintained.				

[1] The maximum width of a vehicle conversion may be restricted below 2400mm in order to comply with installation of Lighting Regulation ECE R48 which specifies widths restrictions for mandatory light components. Fitting optional Front Fog Lamps restricts the vehicle width to 2375mm. For non-European Union territories, please refer to local legislation. For Australia and New Zealand, please refer to ADR43 vehicle regulations.

Abc = BEV Only Abc = ICE Only

1.14.10 Vehicles with Roof Mounted Units for Diesel and E-Transit

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 log in to use it.

NOTE: LDT/HDT and E-Transit variants are covered.

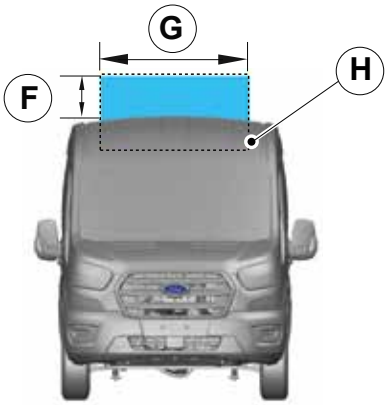
NOTE: All standard/optional equipment have already been taken into account, i.e. base vehicle frontal area including mirrors.

Roof mounted units may be integrated below the roof. For the height measurement (F), 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 (FxG) in m². This additional frontal area needs to be added to the WLTP calculator.

Roof unit must be aerodynamic

.Frontal Area Calculation



Item	Description
F	Roof Mounted Unit Height
G	Roof Mounted Unit Width
H	Integrated Roof Mounted Unit

Vehicle Type	Vehicle Class	Max Additional Frontal Area. (FxG) m²	Tyre Class
Transit Van Bus Kombi Med Roof	M1/N1	2.2	No Restriction
Transit Van Bus Kombi Hi Roof	M1/N1	1.8	No Restriction

Max Frontal Area will depend on the roof height of the vehicle. Higher roof line will reduce frontal area allowance.

1.14.11 Chassis Cab Body for Diesel and E-Transit

General Information

WARNINGS:

Do not modify the wheelbase or add any type of frame extension.

Do not allow Centre of Gravity of the body payload to fall behind the rear axle centre line.

NOTE: The maximum front surface area for incomplete Chassis Cab is shown in frontal area table (only applicable to Light Duty WLTP).

NOTE: Extreme rear overhang may encourage unacceptable loading conditions, which could unload the front axle producing unacceptable handling and braking characteristics.

All dimensions are subject to manufacturing tolerances and refer to minimum specification models and do not include additional equipment. The illustrations are for guidance only.

Chassis Cab Body WLTP Constraints

CAUTION: For WLTP compliance, Vehicle Converters must use the highest efficiency class tyre available that meets local legislation. Any tyre with a category F or G risks not being in the WLTP energy range.

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: The maximum front surface area for incomplete Chassis Cab is shown in WLTP Constraints Table (Applicable to Light Duty and Heavy Duty WLTP) .

To meet WLTP requirements depending upon the frontal area, aerodynamic measures are required for the box body as specified by the following tables.

For WLTP Heavy Duty Incomplete Chassis Cabs (SRW/DRW) that fall within a reference mass of 2380-2610kg, Fairing and radii detail are required see constraints table.

For list of engines and powers please see (3.1 Engine)

Abc = BEV Only Abc = ICE Only

WLTP Constraints Table Diesel Engines - Chassis Cab
Light Duty 130PS non-mMev & all WLTP Heavy Duty (excludes 5T non-speed limit)

Max Af (m²)	Fairing	Minimum Radius (mm)			
		R1	R2	R3	R4
SRW					
5.9	No	25	25	25	25
6.4	No	60	60	25	25
6.6	Yes	25	25	25	25
6.8	Yes	60	60	25	25
7.0	Yes	100	100	25	25
7.1	Yes	100	100	100	100
7.3	Yes	200	200	25	25
7.4	Yes	200	200	25	100
7.6	Yes	100	300	25	25
7.8	Yes	100	400	25	25
8.0	Yes	100	500	25	25
DRW					
5.8	No	25	25	25	25
6.2	No	60	60	25	25
6.5	Yes	25	25	25	25
6.7	Yes	60	60	25	25
6.8	Yes	100	100	25	25
6.9	Yes	100	100	100	100
7.1	Yes	200	200	25	25
7.2	Yes	200	200	25	100
7.4	Yes	200	300	25	25
7.6	Yes	100	400	25	25
7.8	Yes	100	500	25	25

Max Af (m2) applies until next minimum radius/fairing requirement is met, eg If frontal area 6.5 m² use max Af of 6.6 m².
For SRW it must comply the defined design requirement (Fairing, R1&R2, R3&R4≥25mm).

Abc = BEV Only Abc = ICE Only

WLTP Constraints Table Diesel Engines - Chassis Cab
Light Duty Engine 130PS mHEV and 170PS* mHEV/non mHEV

Max Af [m²]	Fairing	Minimum Radius (mm)			
		R1	R2	R3	R4
SRW					
5.3	No	25	25	25	25
5.7	No	60	60	25	25
6.0	Yes	25	25	25	25
6.2	Yes	60	60	25	25
DRW					
5.1	No	25	25	25	25
5.6	No	60	60	25	25
5.8	Yes	25	25	25	25
6.0	Yes	60	60	25	25
6.2	Yes	100	100	25	25

Max Af (m2) applies until next minimum radius/fairing requirement is met, eg if Frontal area 5.8 use max Af of 6.0m². For SRW it must comply the defined requirement (Fairing, R1, R2, R3, R4 ≥25mm).

*For power level changes refer to: Section 3.1.2 Engine Types

WLTP Constraints Table Diesel Engines - Chassis Cab
Heavy Duty Engine for 5T Series non-speed limit

Max Af (m²)	Fairing	Minimum Radius (mm)			
		R1	R2	R3	R4
DRW					
5.4	No	25	25	25	25
5.9	No	60	60	25	25
6.2	Yes	25	25	25	25
6.5	Yes	100	100	25	25
6.6	Yes	100	100	100	100
6.8	Yes	100	100	100	200

WLTP Constraints Table E-Transit - Chassis Cab SRW

Max Af [m²]	Fairing	Minimum Radius (mm)			
		R1	R2	R3	R4
SRW					
5.9	No	25	25	25	25
6.4	No	60	60	25	25
6.6	Yes	25	25	25	25

1.14.12 Skeletal Chassis for Non Camper Body, Diesel Engines

General Information

NOTE: The Maximum front surface area for incomplete Skeletal Chassis cab is shown in the frontal area table for both Light Duty and Heavy Duty WLTP. See WLTP constraints table.

For WLTP Heavy Duty Incomplete Chassis cab (SRW) that fall within a reference mass of 2380-2610Kg, Fairing and radii detail are required. See WLTP constraints table.

For list of engines and powers please refer to: Section 3.1.2 Engine Types

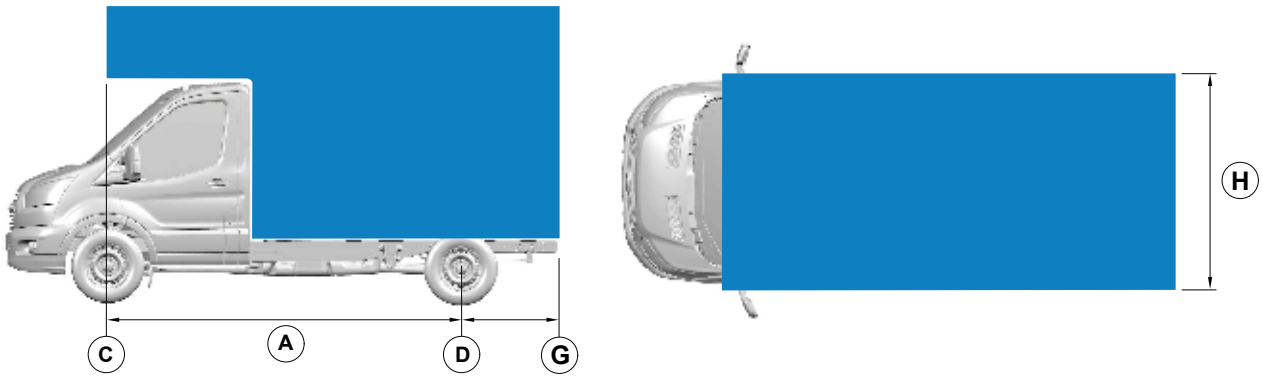
It is recommended to ensure that a minimum departure angle of 14º at RGAWR (Rear Gross Axle Weight Rating) of the converted vehicle and for any additional part of the conversion is maintained.
Rear track widths 1759mm and 1980mm are available pending markets.

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

For Australia and New Zealand, please refer to ADR43 Vehicle regulations.

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 conversionworks@ford.com.

Basic Dimensions and Weights



E176200

Description		L2	L3	L4	L5
A	Wheelbase (mm)	3300	3750	3954	4522
B	Gross Vehicle Mass GVM (kg)	3500	3500/4100	3500/4100	3500/4100
C	Max. Axle load front (kg)	1750/1850	1750/1850	1750/1850	1750/1850
D	Max. Axle load rear (kg)	2150	2250/2500	2250/2500	2250/2500
E	Max. Trailer load (kg)	1400/2000	1400/2000	1400/2000	1400/2000
F	Max. Towing nose mass (kg)	112	112	112	112
G	Max. Rear Overhang/ Extension	60% of the wheelbase or the donor vehicle for Skeletal Chassis for camper			
		50% of the wheelbase or the donor vehicle for Skeletal Chassis for non camper			
H	Max Body Width (mm)	2400(1)			

(1) The maximum width of a vehicle conversion may be restricted below 2400mm in order to comply with installation of Lighting Regulation ECE R48 which specifies widths restrictions for mandatory light components. Fitting optional Front Fog Lamps restricts the vehicle width to 2375mm.

The maximum overall height is limited to 3300mm.

Abc = BEV Only Abc = ICE Only

Skeletal Chassis for Non Camper Body WLTP Constraints

CAUTION: For emission compliance, Vehicle Converters must use the highest efficiency class tyre available that meets local legislation. Any tyre with a category F or G risks not being in the WLTP energy range.

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.

To meet WLTP requirements depending upon the frontal area, aerodynamic measures are required for the second unit body as specified by the following tables.

WLTP Constraints Table - Skeletal Chassis for Non Camper Body Light Duty Engine 130PS non mHEV and WLTP Heavy Duty Engines

Max Af (m²)	Fairing	Minimum Radius (mm)			
		R1	R2	R3	R4
SRW					
5.9	No	25	25	25	25
6.4	No	60	60	25	25
6.6	Yes	25	25	25	25
6.8	Yes	60	60	25	25
7.0	Yes	100	100	25	25
7.1	Yes	100	100	100	100
7.3	Yes	200	200	25	25
7.4	Yes	200	200	25	100
7.6	Yes	100	300	25	25
7.8	Yes	100	400	25	25
8.0	Yes	100	500	25	25

Max Af (m2) applies until next minimum radius/ fairing requirement is met, eg if Frontal area 6.5 use max Af of 6.6m².
For SRW it must comply the defined requirement (Fairing, R1, R2, R3, R4 ≥25mm).

WLTP Constraints Table - Skeletal Chassis for Non Camper Body Light Duty Engine 130PS mHEV and 170PS* mHEV/non mHEV

Max Af [m²]	Fairing	Minimum Radius (mm)			
		R1	R2	R3	R4
SRW					
5.3	No	25	25	25	25
5.7	No	60	60	25	25
6.0	Yes	25	25	25	25

Max Af (m2) applies until next minimum radius/fairing requirement is met, eg if Frontal area 5.8 use max Af of 6.0m².
For SRW it must comply the defined requirement (Fairing, R1, R2, R3, R4 ≥25mm).

*For power level changes refer to: Section 3.1.2 Engine Types

1.14.13 Skeletal Chassis for Camper Body, Diesel Engines

General Information

NOTE: The Maximum front surface area for incomplete Skeletal Chassis cab is shown in the frontal area table for both Light Duty and Heavy Duty WLTP. See WLTP constraints table.

For WLTP Heavy Duty Incomplete Chassis Cab (SRW) that fall within a reference mass of 2380-2610Kg, a maximum frontal area of 8m2 is applicable to comply with WLTP CO2 Requirements. Fairing and radii detail are not required. No WLTP constraints table required.

For list of engines and powers please see (3.1 Engine)

It is recommended to ensure that a minimum departure angle of 14º at RGAWR (Rear Gross Axle Weight Rating) of the converted vehicle and for any additional part of the conversion is maintained.
Rear track widths 1759mm and 1980mm are available pending markets.

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

For Australia and New Zealand, please refer to ADR43 Vehicle regulations.

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 conversionworks@ford.com.

WLTP Constraints table - Skeletal Chassis for Camper Body Light Duty Engine 130PS non mHEV and WLTP Heavy Duty

	Integrated (A)		Over Cab (B)	
Max Af [m²]	Min Radius (mm)	Min Angle	R1	R2
6.6	-	-	60	170
6.9	1000-3000	20°	-	-

WLTP Constraints table - Skeletal Chassis for Camper Body Light Duty Engine 170PS* non mHEV Engines

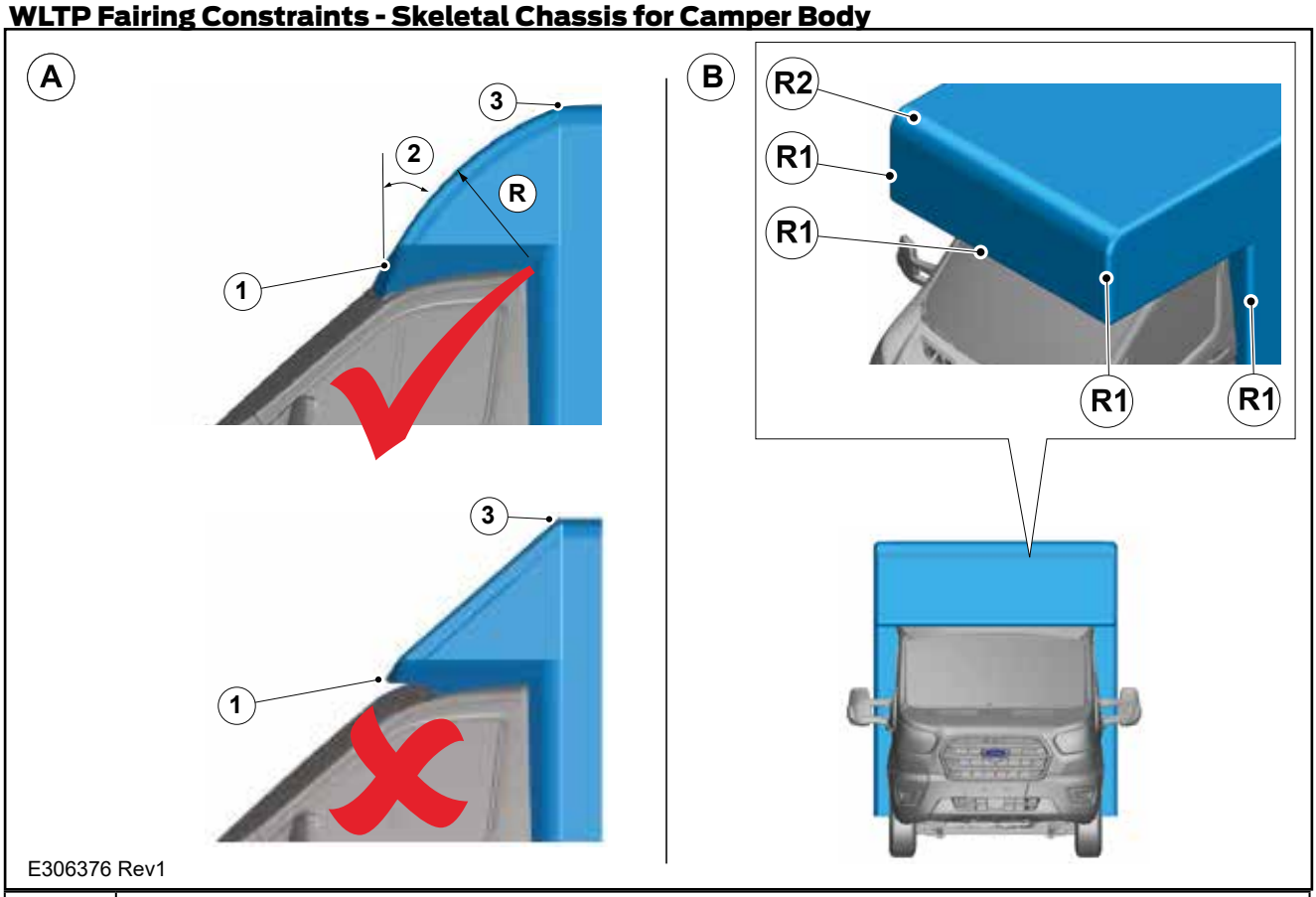
	Integrated (A)		Over Cab (B)	
Max Af [m²]	Min Radius (mm)	Min Angle	R1	R2
6.0	-	-	60	170
6.2	1000-3000	20°	-	-

Max Af (m2) applies until next minimum radius/fairing requirement is met, eg for Integrated (A), if Frontal area 6.7 use max Af of 6.9m² it must comply the defined requirement, fairing and min angle required.

*For power level changes refer to: Section 3.1.2 Engine Types

Abc = BEV Only Abc = ICE Only

WLTP Fairing Constraints - Skeletal Chassis for Camper Body



E306376 Rev1

Item	Description
A	**No overhang**
1	No overhang to meet WLTP requirements
2	Angle: min 20°
3	Tangential transition ie must blend smoothly, with no sharp 'corners'
R	Radius of Fairing Range 1000mm - 3000mm
B	**Option with cab overhang**
R1	Radius - Front LHS/RHS edge of body and Overhang LHS/RHS/Bottom edge
R2	Top Overhang Edge - Radius

1.15 Hardware

Material Specification, Strength and Torque

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 converter 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 Conversionworks@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.

In rear wheel drive (RWD) single rear wheel (SRW) vehicles, the front axle load must, in all load cases, exceed 36% of the actual vehicle weight.

In RWD dual rear wheel (DRW) vehicles, the front axle load must, in all load cases, exceed 30% of the actual vehicle weight.

On Skeletal Chassis for camper conversions the front axle load must exceed 40% of the actual vehicle weight in all load cases.

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.

Only for conversions based on Skeletal Chassis for camper. The minimum kerb weight of the converted vehicle is 2700kg for 350 and 3000kg for 410.

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 per cent).

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 following table shows maximum vertical centre of gravity (CG_v) heights by vehicle type. If the CG_v 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 R140 Standard or ADR 35 or applicable local legislation.

If the CG_v of the converted vehicle is above the values stated, Ford Motor Company makes no representation as to conformity with ECE R140 standard or ADR 35 or applicable local legislation.

Abc = BEV Only Abc = ICE Only

Vehicle ICE = Diesel Engine BEV= Battery Electric Vehicle	Drive	Wheelbase	Maximum Vertical Centre of Gravity (CG_V) Height
eTransit BEV All Variants up to 3.5t	RWD	All	950mm
eTransit BEV All Variants over 3.5t	RWD	All	870mm
Van/Kombi ICE	FWD	All(1)	850mm
Van/Kombi ICE	RWD/AWD	L2	850mm
Van/Kombi ICE	RWD/AWD	L3 and L4	1000mm
M2 Bus ICE	RWD	All(2)	1000mm
Single Chassis Cab ICE	FWD	All(3)	850mm
Single Chassis Cab ICE	RWD/AWD	All	1000mm
Double Chassis Cab ICE	FWD	All	850mm
Double Chassis Cab ICE	RWD/AWD	All	1000mm
Skeletal Chassis for Camper ICE	FWD	All	960mm
Skeletal Chassis for non Camper ICE	FWD	All	850mm

(1) When converted a Van, Kombi N1, Kombi M1, Kombi Van N1, Kombi Van M1 and Double Cab in Van vehicles with a gross vehicle mass of less than 3300kg are excluded from conformity with ECE R140 Standard.
(2) Except M2 Bus RWD SRW 440 LWB EL (L4) which has a Maximum Vertical Centre of Gravity Height of 950mm
(3) Except 3.5t L5 Extended Length chassis, HD engined variant which has a Maximum Vertical Centre of Gravity Height of 1000mm

The camper converter as the final stage manufacturer is fully responsible for the converted vehicle and may apply the following part of (EU) 2018/858 shown below.

In line with Regulation (EU) 2018/858, the converter of Motor-Caravans, Ambulances, Hearses or Armoured Vehicles can opt to apply Note A1 from Annex II, Part III, Appendix 1 and 2.

The maximum Centre of Gravity heights for fully converted Camper Vehicles based on the following Camper base vehicle derivatives: Front wheel drive Transit van L3H3 and L2H3, from build dates November 2022 onwards, can be obtained by contacting ConversionWorks@ford.com

1.16.3 Centre of Gravity Height Test Procedure

Measurement

Vehicle shall be loaded according to test specifications specified in ECE R140 Standard 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, 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_V) 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.

Abc = BEV Only Abc = ICE Only

Inclination Angle:

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

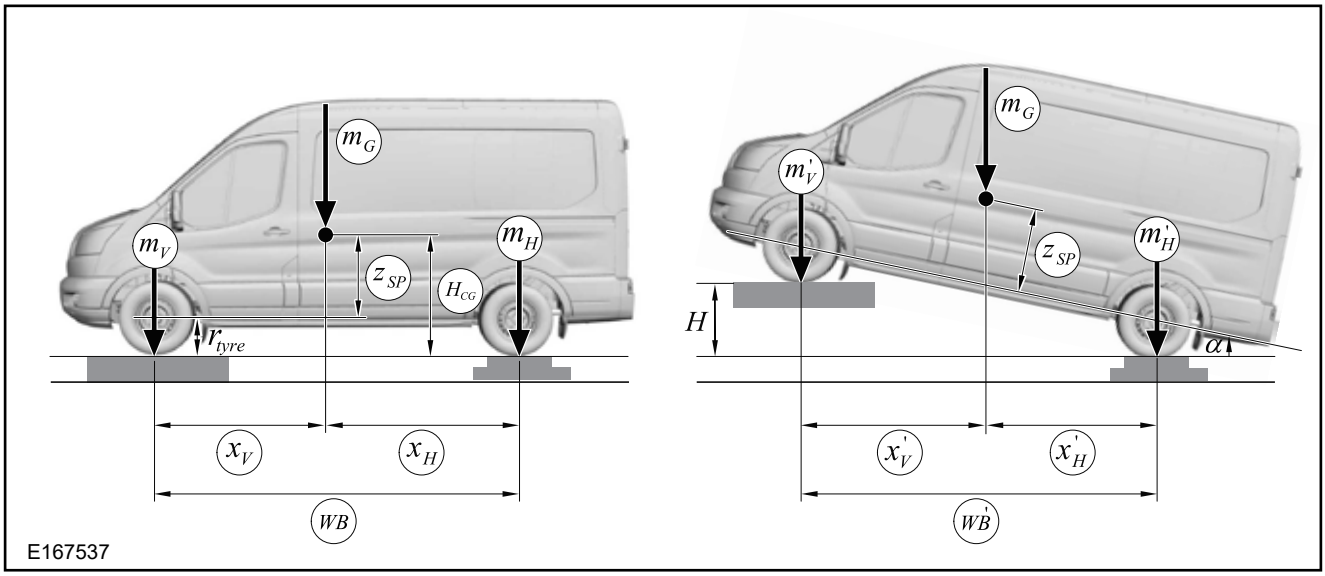
E146623

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



E167537

Variables, to be measured, calculated or known			Measurement		
			1st	2nd	3rd
Wheelbase	WB	mm			
Front Axle Weight	m_V	kg			
Rear Axle Weight	m_H	kg			
Total Mass	$m_G = m_V + m_H$	kg			
Inclined Vehicle					
Front Axle Weight	m'_V	kg			
Rear Axle Weight	m'_H	kg			
Height (Lift)	H	mm			
Inclination Angle		deg			
Centre of Gravity Height Z		mm			

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:

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

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

or

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

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 Conversionworks@ford.com

1.17.1 Tow Bar Requirements

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

CAUTION: Rear cargo doors may not be compatible with all tow bars and tow couplers, check before fitting.

NOTE: For base vehicles ordered without a tow bar or underrun, bar reinforcements and hardware need to be ordered and fitted. 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.

NOTE: It is not recommended to retrofit a tow bar to vehicles equipped with rear air suspension.

For further information on Towing a Trailer and Trailer Sway Control (TSC) refer to the Owner's Manual.

An electric Prep Pack (A055) can be ordered with the base vehicle and is fitted in the plant. A055 does not contain any tow bar, reinforcements or tow bar hardware.

For additional information in this manual:

Refer to: 1.10 Jacking

Refer to: 4.2 Wiring Installation and Routing Guides Electrics for Tow bar.

1.17.2 Tow Bar Types (for EU specification vehicles)

NOTE: When attaching a tow bar to the side rails, the top two holes on either side are to be used with new bolts and nuts, plus the re-use of two bolts on the bottom holes each side which attach the Rear Crash Beam, as shown in figure E175744.

NOTE: When attaching the tow ball to the tow bar use the top two fixing holes.

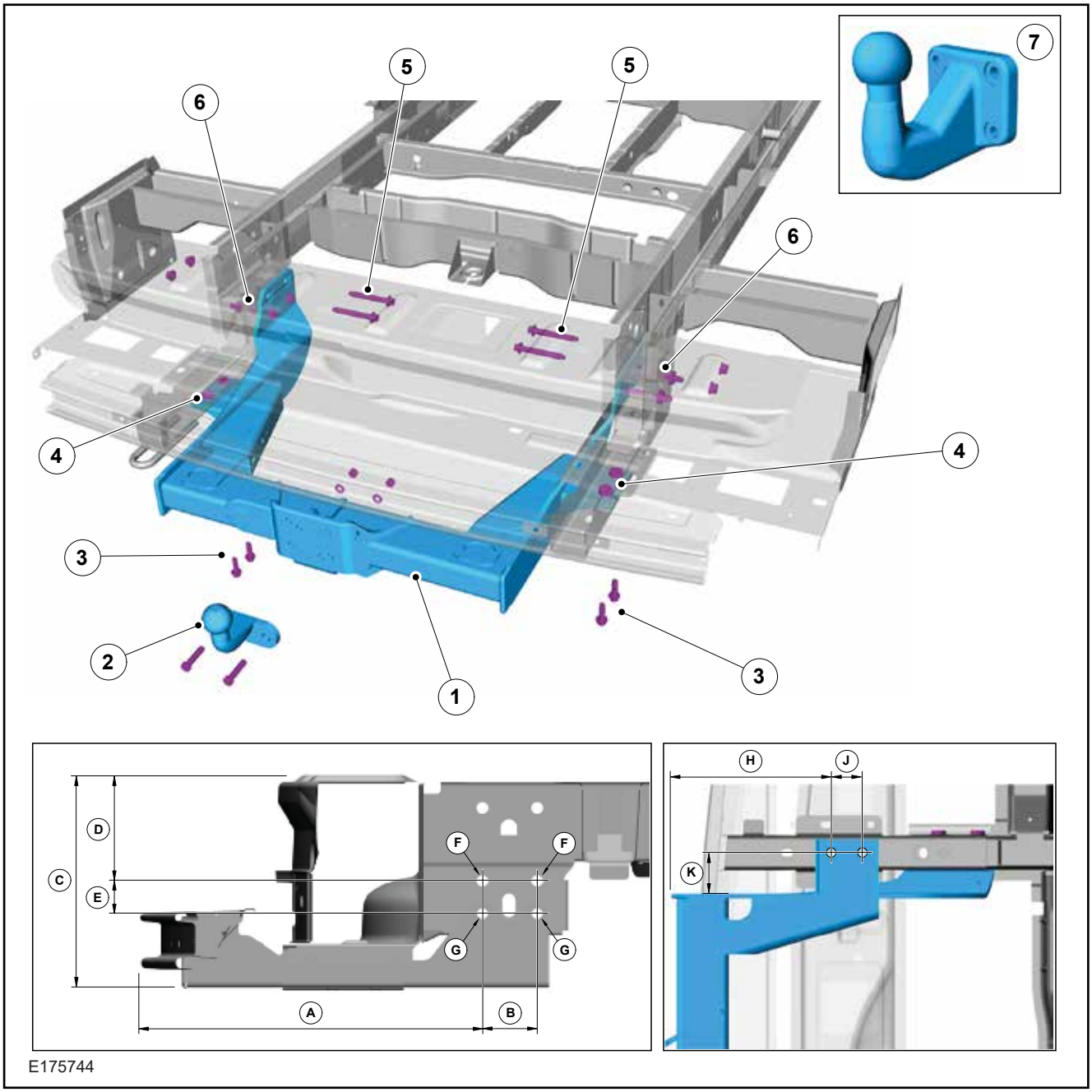
For tow bar devices fitted by the Vehicle Converter the following applies:

- Tow bar allowances must not exceed those of the standard vehicle
- For attachment of the tow bar, under run bar and step see the following figures E175744, E167538, E167539 and E167540
- Any modifications to the vehicle must be noted in the owner's handbook or new descriptive literature included with the owner's documentation
- The maximum allowable tow ball static load is 112kg on a Van , Bus, Kombi and Chassis Cab with GVM up to 3.5 tonne **ICE only**
- The maximum allowable tow ball static load is 140kg on Van and Chassis Cab with GVM of 4.7 tonne and 3.5 tonne HD (derated)**ICE only**
- The maximum allowable tow ball static load is 60kg on a Van , Bus, Kombi and Chassis Cab with GVM up to 3.5 tonne. For towing, there is a maximum trailer mass of 750kg. **BEV only**
- Tow bar installations must meet the requirements of the EEC Directive 94/20 EC and /or ECE R55
- Whenever frame drilling is necessary use tube reinforcement

NOTE: When fitting a tow bar to Van, Bus and Kombi variants use all 12 fixing points as shown in E175744.

Abc = BEV Only Abc = ICE Only

Tow Bar Van, Bus and Kombi



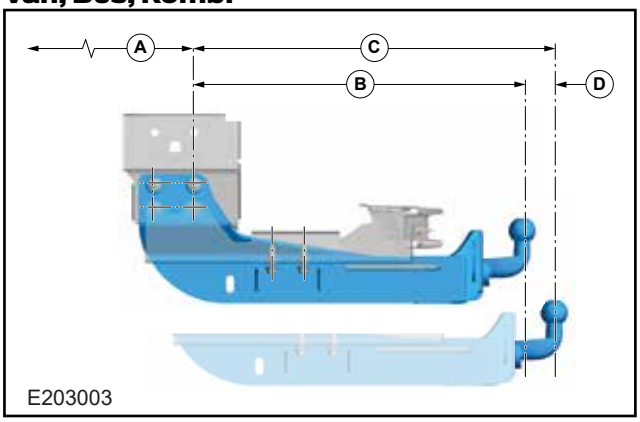
E175744

Item	Description						
1	Tow bar frame assembly						
2	Tow ball(1) 2.8 Tonne vehicle						
3	2x thread rolling bolts(2) each side, M12 x 40 - Torque 62.5Nm ±6.2						
4	2x unthreaded weld nuts inside the longitudinal member of the rear bumper						
5	2 new nuts and bolts (each side) in holes 'F' M12 x 90 - Torque 110Nm ±16.5						
6	Reuse 2x bolts (each side) in holes 'G' M12 x 100 Torque 103Nm ±15						
7	Tow ball 4.7 Tonne / 3.5 Tonne HD (derated) vehicle - use all 4 fixings hole						
A	514mm	D	135.8mm	G	12mm diameter	K	78.5mm
B	75mm	E	45mm	H	367.4mm	-	-
C	361.4mm	F	15mm diameter	J	60mm	-	-

(1) The low position two fixing holes should be used for attaching the tow ball to vehicles with 16 inch wheels and the mid position two fixing holes should be used for attaching the tow ball to vehicles with 15 inch wheels

(2) Use thread rolling bolt (Ford Part Number: W505286 – S442, M12x40 HF010) or equivalent.

Trailer Sway Control (TSC) Tow Ball Zone - Van, Bus, Kombi

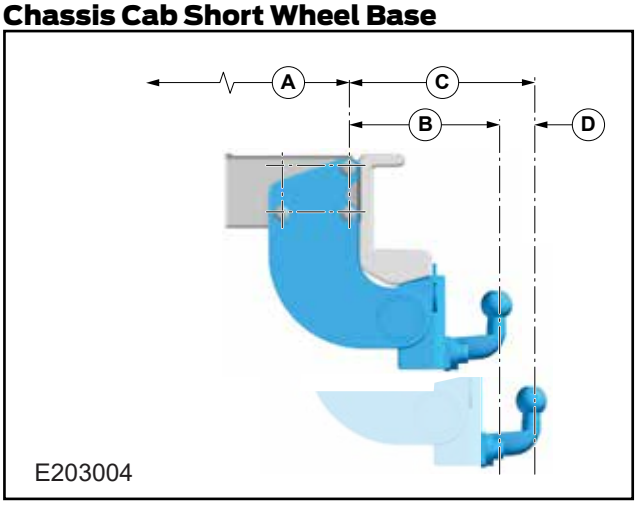


Item	Description
A(1)	MWB/LWB = 715mm, LWB-EL = 1439mm
B	629mm
C	666mm
D	37mm

(1) From centre of rear axle.

WARNING: To ensure functionality of Trailer Sway Control (TSC), please make sure that the tow ball is within zone 'D' as shown in figure E203003.

Trailer Sway Control (TSC) Tow Ball Zone - Chassis Cab Short Wheel Base



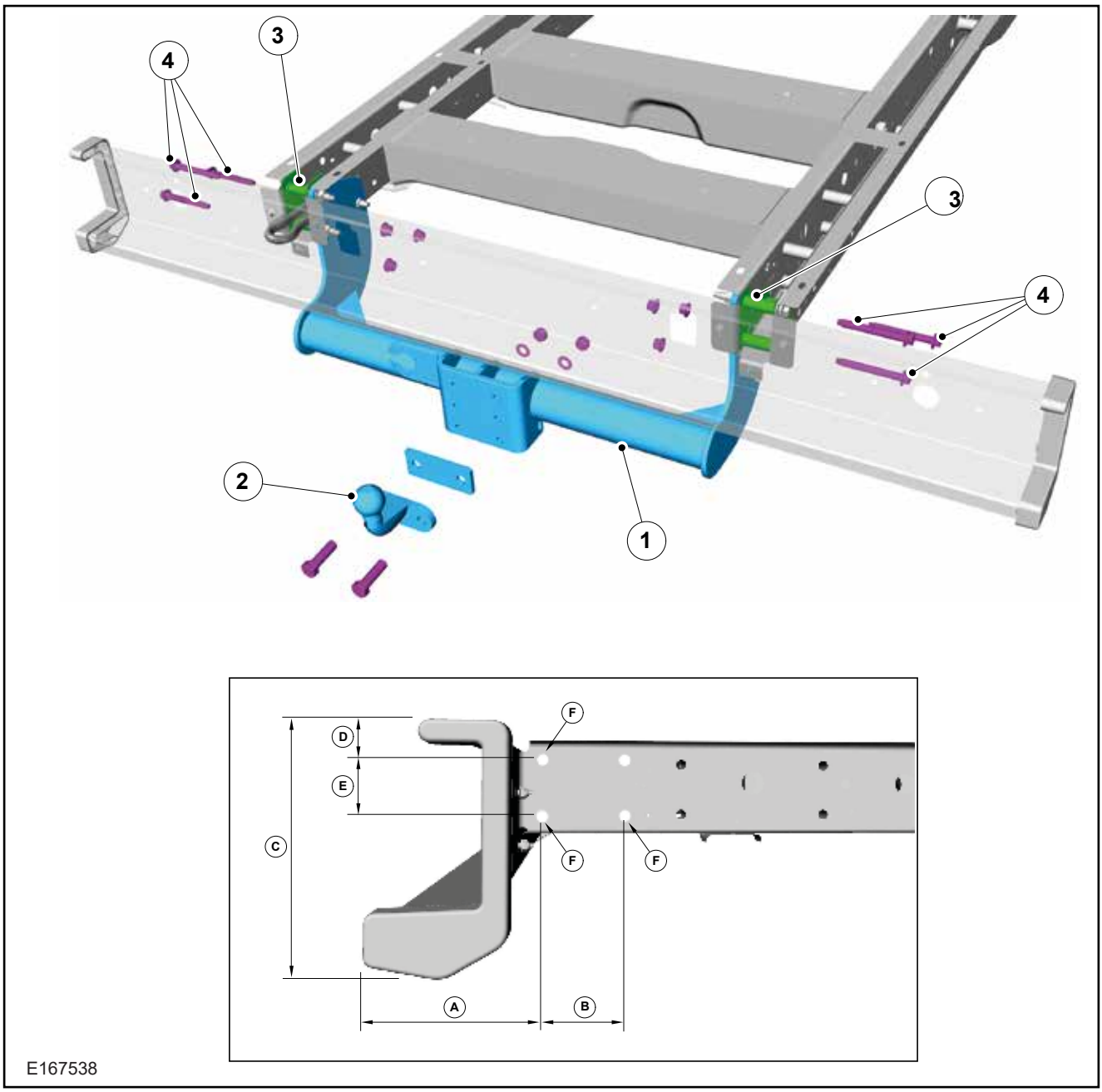
Item	Description
A(1)	941mm
B	222mm
C	257mm
D	35mm

(1) From centre of rear axle.

WARNING: To ensure functionality of Trailer Sway Control (TSC), please make sure that the tow ball is within zone 'D' as shown in figure E203004.

Abc = BEV Only Abc = ICE Only

Tow Bar Chassis Cab 2.8 Tonne

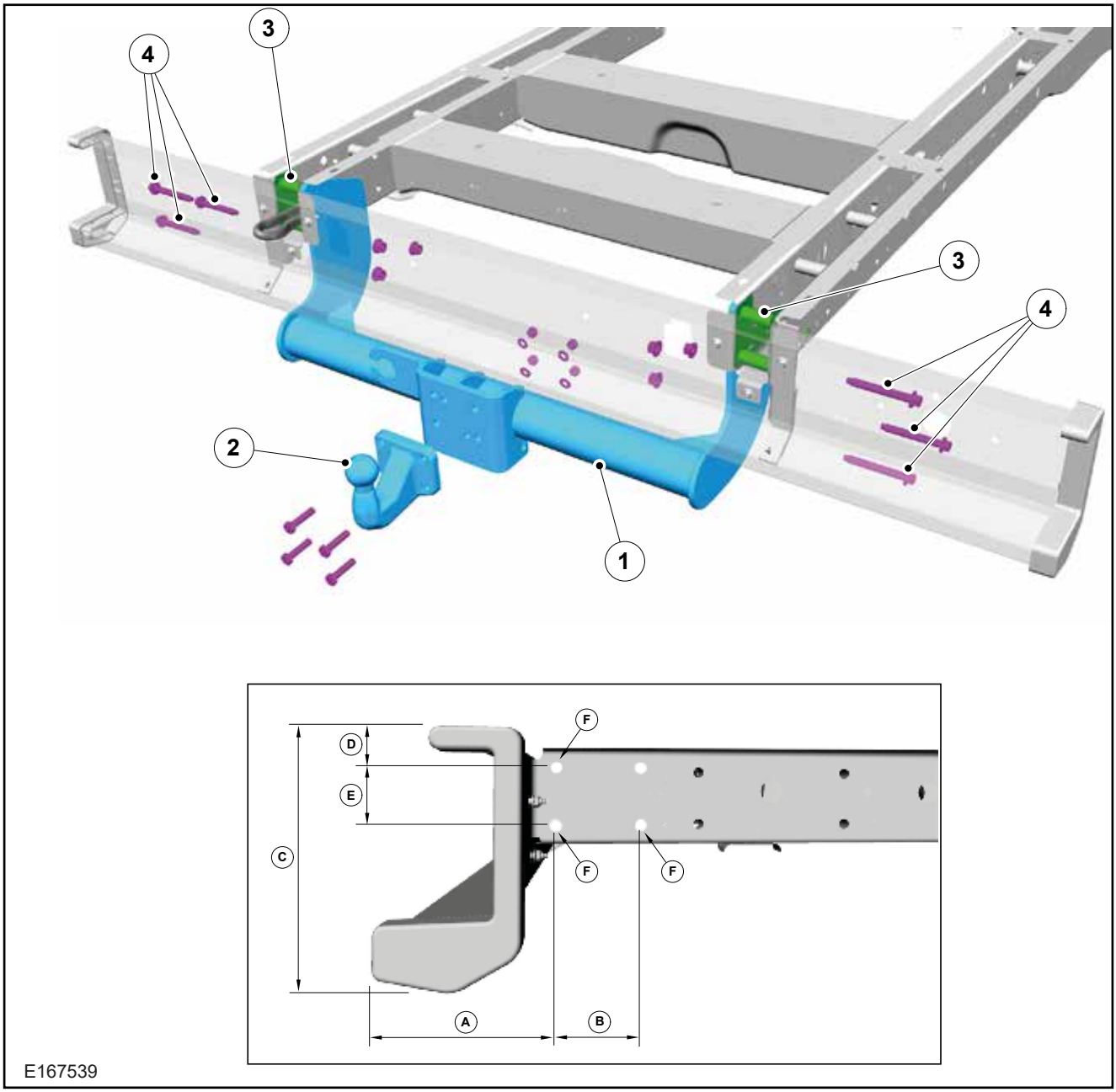


Item	Description		
1	Tow bar frame assembly		
2	Tow ball with 2x fixing bolts(1)		
3	Reinforcement clamp plate		
4	Side member with 3x fixing nuts and bolts each side, M12 x 1.75 x 100 - Torque 103NM ±15		
A	115mm	D	22mm
B	106mm	E	74mm
C	267mm	F	15mm Diameter

(1) The low two fixing positions should be used for attaching the tow ball to vehicles with 16 inch wheels and the mid two fixing positions should be used for attaching the tow ball to vehicles with 15 inch wheels

Abc = BEV Only Abc = ICE Only

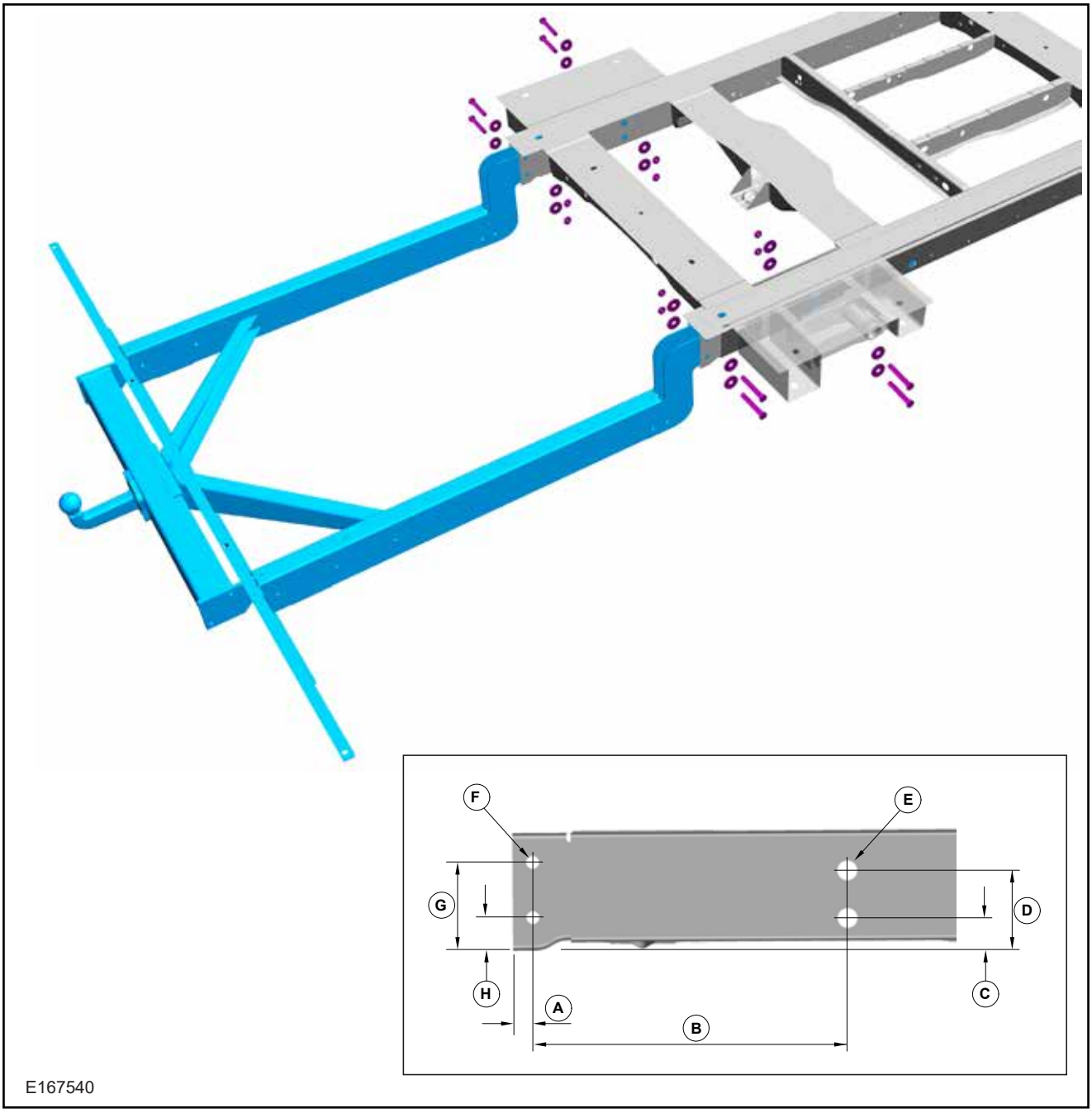
Tow Bar Chassis Cab 4.7 Tonne and 3.5 Tonne HD (de-rated)



Item	Description		
1	Tow bar frame assembly		
2	Tow ball with 4x fixing bolts		
3	Reinforcement clamp plate		
4	Side member with 3x fixing nuts and bolts each side, M12 x 1.75 x 100 - Torque 103NM ±15		
A	115mm	D	22mm
B	106mm	E	74mm
C	267mm	F	15mm Diameter

Abc = BEV Only Abc = ICE Only

Tow Bar Skeletal Chassis for camper Conversion Only



Item	Description
A	20mm
B	314mm
C	30mm
D	77.5mm
E	20mm Diameter
F	13mm Diameter
G	86mm
H	32mm

1.17.3 Tow Bar Types (for AUS and NZL specification vehicles)

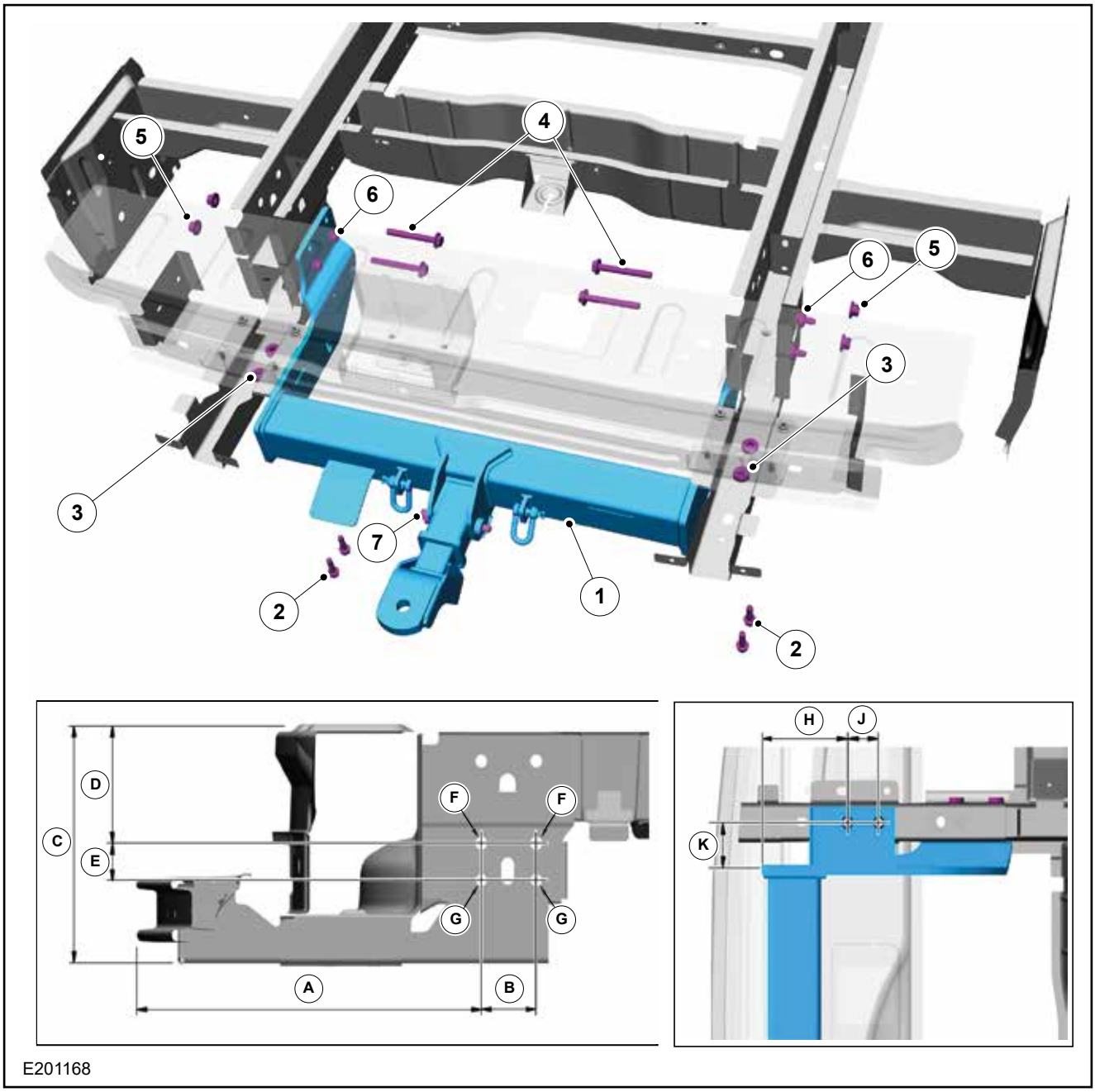
For tow bar devices fitted by the Vehicle Converter the following applies:

- Tow bar allowances must not exceed those of the standard vehicle.
- For attachment of the tow bar, under run bar and steps see the following figures E201168 and E201169
- Any modifications to the vehicle must be noted in the owner's handbook or new descriptive literature included with the owner's documentation
- The maximum allowable tow ball static load is 170kg on 350L LWB Van (FWD AT) - 1700kg maximum towing
- The maximum allowable tow ball static load is 275kg on 350L LWB Van (RWD AT) - 2750kg maximum towing
- The maximum allowable tow ball static load is 275kg on 350E E-LWB Van (SRW MT) - 2750kg maximum towing
- The maximum allowable tow ball static load is 350kg on 470E E-LWB Van (DRW MT) - 3500kg maximum towing
- The maximum allowable tow ball static load is 350kg on 470E Single C/C (DRW MT) - 3500kg maximum towing
- The maximum allowable tow ball static load is 350kg on 470E Double C/C (DRW MT) - 3500kg maximum towing
- A minimum tow ball static load of 10% of towed weight is required for Australia and New Zealand
- Tow bar installations must meet the requirements of the Australian Design Regulations ADR 62
- Whenever frame drilling is necessary use tube reinforcement

NOTE: When fitting a tow bar to Van and Bus variants use all 12 fixing points as shown in E201168.

Abc = BEV Only Abc = ICE Only

Tow Bar Skeletal Chassis for camper Conversion Only

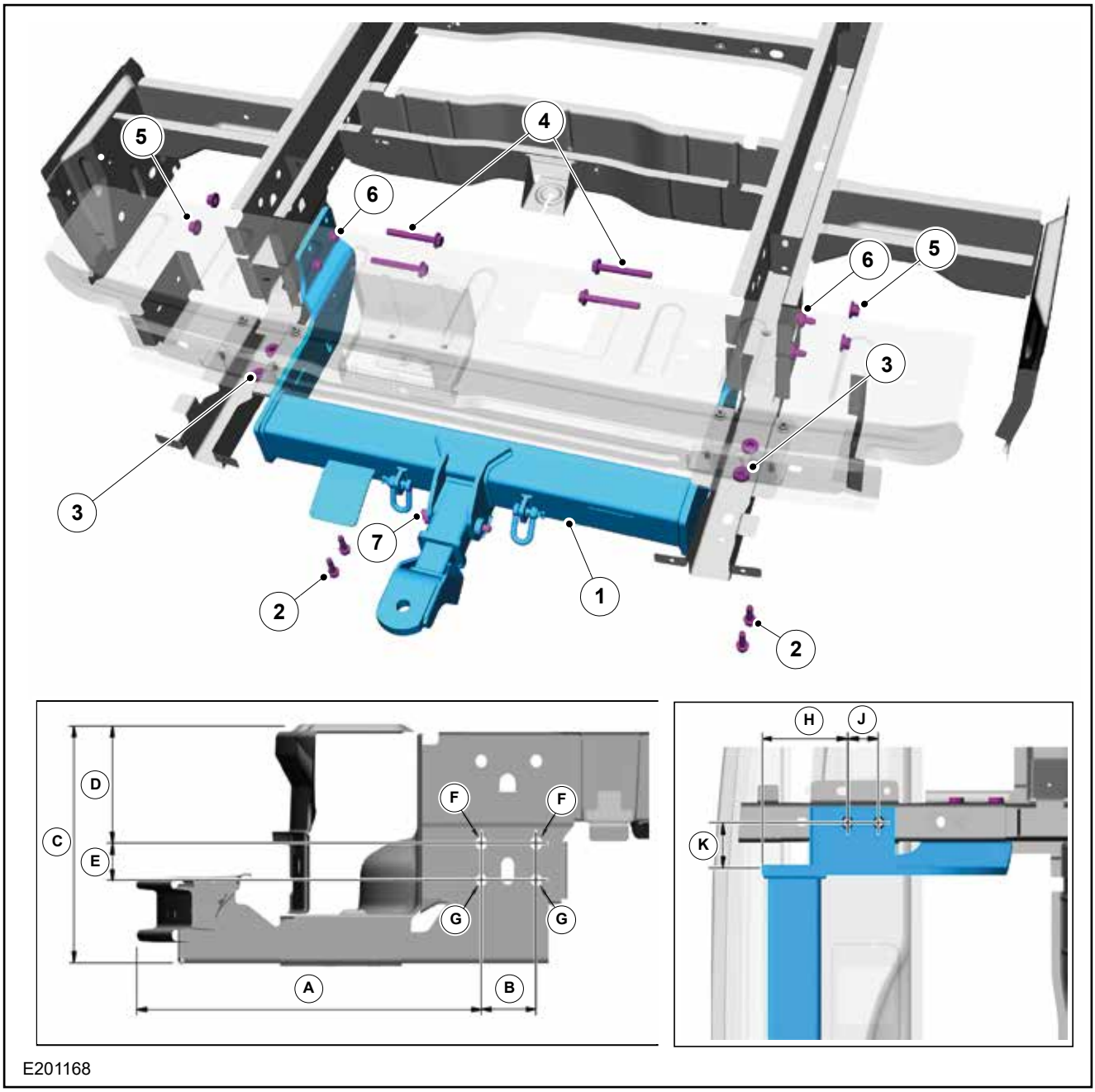


E201168

Item	Description								
1	Tow bar frame assembly								
2	2x thread rolling bolts[1] each side - Torque 110±5Nm								
3	2x unthreaded weld nuts inside the longitudinal member of the rear bumper								
4	2x fixing bolts each side in holes 'F' M12 x 1.75 x 100 - Torque 115±5Nm								
5	2x fixing nuts each side								
6	Reuse 2x fixing bolts (each side) in holes 'G' M12 x 100 - Torque 103±15Nm								
7	1x Anti-rattle pin - Torque 150±5Nm								
A	514mm	C	361.4mm	E	45mm	G	12mm	J	60mm
B	75mm	D	135.84mm	F	15mm	H	120mm	K	58mm

[1] Use thread rolling bolts (Ford Part Number: W505286 – S442, M12x40 HF010) or equivalent.

LWB-EL Van (DRW) 4.5 Tonne



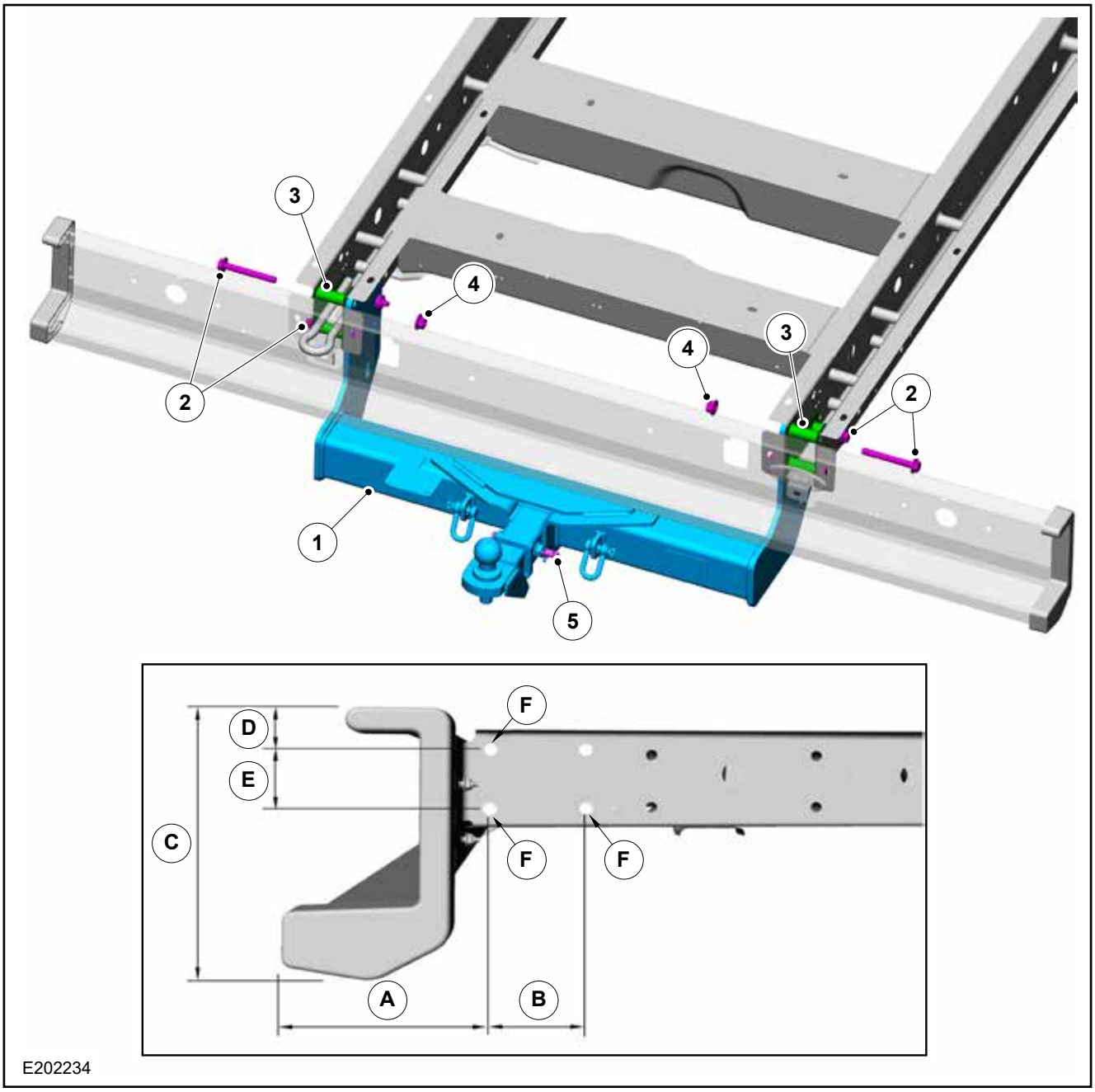
E201168

Item	Description								
1	Tow bar frame assembly								
2	2x thread rolling bolts[1] each side - Torque 110±5Nm								
3	2x unthreaded weld nuts inside the longitudinal member of the rear bumper								
4	2x fixing bolts each side in holes 'F' M12 x 1.75 x 100 - Torque 115±5Nm								
5	2x fixing nuts each side								
6	Reuse 2x fixing bolts (each side) in holes 'G' M12 x 100 - Torque 103±15Nm								
7	1x Anti-rattle pin - Torque 150±5Nm								
A	514mm	C	361.4mm	E	45mm	G	12mm	J	60mm
B	75mm	D	135.84mm	F	15mm	H	120mm	K	58mm

[1] Use thread rolling bolts (Ford Part Number: W505286 – S442, M12x40 HF010) or equivalent.

Abc = BEV Only Abc = ICE Only

Single Cab Chassis and Double Cab Chassis 4.5 Tonne



E202234

Item	Description		
1	Tow bar frame assembly		
2	3x fixing bolts each side M12 x 1.75 x 100 - Torque 115±5Nm		
3	Reinforcement clamp plate (each side)		
4	Fixing nut (each side)		
5	1x Anti-rattle pin - Torque 150±5Nm		
A	115mm	D	22mm
B	106mm	E	74mm
C	267mm	F	15mm Diameter

Abc = BEV Only Abc = ICE Only

Abc = BEV Only Abc = ICE Only

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 Conversionworks@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 or 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 Conversionworks@ford.com

Abc = BEV Only Abc = ICE Only

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.

The rear leaf springs are pre-stressed in manufacture and should not be altered for rate or height in any way during vehicle conversion. Adding or removing leaves (or any other spring type) 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.

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

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

CAUTIONS:

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

Do not touch springs with welding electrodes or welding tongs.

Make sure that components loosened or removed and reinstalled are properly reassembled and the torque set in accordance with manufacturer's requirements.

NOTE: Do not modify the wheelbase or 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 Conversionworks@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 Conversionworks@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. Please consult Conversion Works Conversionworks@ford.com for clearance requirements and data.

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.

NOTE: Maintain access to the spare wheel winch on Chassis Cab via the hole in the side rail, under all loading conditions.

For standard wheelhouse dimensions:
Refer to: 5.1 Body Integral Bodies and Conversions

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 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. For further information refer to the Owner's Manual or contact your Local Ford Dealer.

The TPMS receiver is located in the overhead shelf and points directly towards the rear doors.

For additional information Refer to: 4.22 Handles, Locks, Latches and Entry Systems


E167541

2.4.4 Spare Wheel

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

2.4.5 Tyre Repair Kit

If your vehicle does not have a spare tyre, it will have a temporary mobility kit which will only repair one damaged tyre. The temporary mobility kit is made up of a compressor and separate sealant. The compressor will be located in the glove stowage compartment. If the passenger seat is removed and the resultant space is converted, please ensure access to the glovebox is maintained or the compressor is relocated to an alternate easily accessible location. The sealant will be located in the right hand side step well. For more information and usage of the tyre repair kit please refer to the Owner's Manual.

2.4.6 Jacking Kit

On right hand drive camper variants the customer is required to find a new location for the jack kit which will be supplied in a foam pod which houses all necessary components.

2.4.7 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 Driveshaft

2.5.1 Power Take Off (PTO)

Gearbox add-on - Auxiliary Propeller Drive Shaft

CAUTIONS:

Make sure that an inhibitor is fitted to any modified vehicle that uses the propshaft to power auxiliary equipment.

The only modification to the engine control system (throttle, powertrain control module and fuel pump) recommended by the manufacturer is the addition of an engine (RPM) controller.

Do not weld or join onto any part of the axle assembly.

The transmission oil temperature must not exceed 130°C during operation of the PTO.

Where power is to be taken from the propshaft for accessory drive, the engine controller can be used in the same way as for the Front End Accessory Drive (FEAD).

Refer to: 3.3 Accessory Drive

Exceeding the recommended PTO ratings may result in the engine overheating.

If the driveshaft is modified, it must be balanced to a limit of 80gmm at 5000rpm and the installation must not have universal joint angles exceeding 4°. The gearbox output included angle must be no more than 1°.

2.6 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 Conversionworks@ford.com

2.6.1 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.

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: 4.18 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.

2.6.2 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 Conversionworks@ford.com

2.6.3 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.

2.6.4 Parking Brake

WARNINGS:

Do not modify the brakes.

Do not splice into the parking brake cable.

Do not modify the Electronic Parking Brake (EPB) on E-Transit.

CAUTION: Make sure that a new parking brake cable is fitted if modification impacts the existing parking brake cable.

2.6.5 Hydraulic Brake - Front and Rear Brakes

WARNINGS:

Do not modify the brakes.

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

2.6.6 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).

Abc = BEV Only Abc = ICE Only

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

Procedure for protection from Injector Nozzle Corrosion During the Upfitting/Conversion Process
Refer to 1.13 Vehicle Transportation Aids and Vehicle Storage

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 final weight of a vehicle including the conversion, determines whether a vehicle needs a light duty or heavy duty emissions engine.

The weight is based on the Reference Mass defined as the mass in running order, less a 75kg allowance for the driver, add a 100kg uniform mass.
For guidance purposes only, if the Reference Mass used for completed vehicle type approval is:

- Not exceeding 2840kg, a light duty engine may be specified for N1 and N2 vehicles.
- Greater than 2840kg, a heavy duty engine needs to be specified. Note: heavy duty engines are required for M2 Bus Conversions.

NOTE: Light duty emissions engines are available at EU6 emissions level for Transit vehicle conversions not exceeding 2840kg, including Vans and Chassis Cabs. Conversions exceeding 2840kg need to be specified with heavy duty engines.

For incomplete heavy duty vehicles between 2380kg and 2610kg reference mass. WLTP values will be required from 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.

Refer to: 1.14.10 Chassis Cab Body Heavy Duty Incomplete Chassis Cab
Refer to: 1.14.12 Skeletal Chassis for Camper and Non Camper Heavy Duty Incomplete Skeletal Chassis

Abc = BEV Only Abc = ICE Only

3.1.2 Engine Types

2.0L diesel engines Stage VI/EU6 emissions with DPF:

TDCi	Max Power kW/RPM	Max Torque Nm/RPM	Emissions	Vehicle Class	Timing Info
FWD					
77kW (105PS)	77kW (105PS) @ 3250-3500 RPM	310Nm @ 1500-2250 RPM	Passcar/LDT	M1/N1	-
96kW (130PS)	96kW (130PS) @ 3250-3500 RPM	360Nm @ 1500-2500 RPM	Passcar/LDT/ HDT	M1/N1/N2	-
110kW 150PS)	110kW (150PS) @ 3500 RPM	360Nm @ 1500-2750 RPM	Passcar	M1	-
118kW (160PS)	118kW (160PS) @ 3500 RPM	390Nm @ 1750- 2500 RPM	HDT	N1/N2	Deleted from July 2022
114kW (155PS)	114kW (155PS) @ 3500 RPM	390Nm @ 1750- 2500 RPM	HDT	N1/N2	Added from July 2022
125kW (170PS)	125kW (170PS) at 3500 RPM	390Nm @ 1750-2750 RPM	LDT	N1/N2	-
RWD					
77kW (105PS)	77kW (105PS) @ 3250-3500 RPM	310Nm @ 1500-2250 RPM	LDT	N1	-
96kW (130PS)	96kW (130PS) @ 3250-3500 RPM	360Nm @ 1500-2500 RPM	LDT/HDT	N1/N2/M2	-
121kW (165PS)	121kW (165PS) @ 3500 RPM	390Nm @ 1750-2750 RPM	HDT	N1/N2/M2	Added from July 2022
125kW (170PS)	125kW (170PS) @ 3500 RPM	390Nm @ 1750-2750 RPM	LDT/HDT	N1/N2/M2	Deleted from July 2022
125kW (170PS)	125kW (170PS) @ 3500 RPM	390Nm @ 1750-2750 RPM	L7/P7 (Brazil only)	N1/N2/M2	Added from July 2022
121kW (165PS)	21kW (165PS) @ 3500 RPM	390Nm @ 1750-2750 RPM	P8 (Brazil only)	N1/N2/M2	Added from Nov 2022

Unless stated, all engines in table are in production

Abc = BEV Only Abc = ICE 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 conversionworks@ford.com

NOTE: For the E-Transit BEV Cooling System, refer to: 3.9.4 Cooling

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 component, 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:

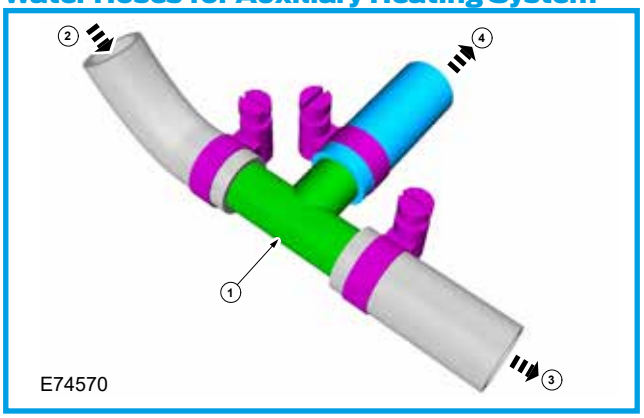
Only make connections into the heater hose between the front cab heater and water pump return inlet.

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: 5.14 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 Conversionworks@ford.com

3.3.1 Front End Accessory Drives (FEAD) — General Information

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

CAUTIONS:

Only use the 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.

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.

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.

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 ±0.5º.

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

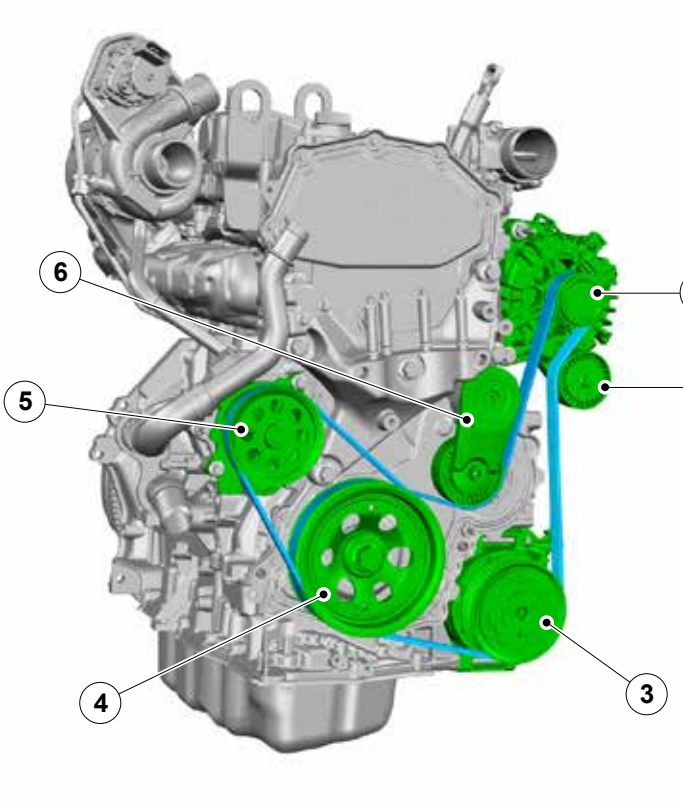
Figure	Engine
E289251	GEN1 with EPAS / Upgrade with EPAS. Start-Stop Shields as standard. Optional AC.
E289252	GEN1 with EPAS and MHEV / Upgrade with EPAS and MHEV. Start-Stop Shields as standard. Optional AC.

RWD TDCi

Figure	Engine
E224687	GEN1 with HPAS. No AC or Start-Stop Shield.
E293302	GEN1 with EPAS / Upgrade with EPAS. Optional AC. No Start-Stop Shield.
E293303	Upgrade with EPAS and MHEV. AC with no Start-Stop Shield **OR** Non AC with Start-Stop Shield.

Abc = BEV Only Abc = ICE Only

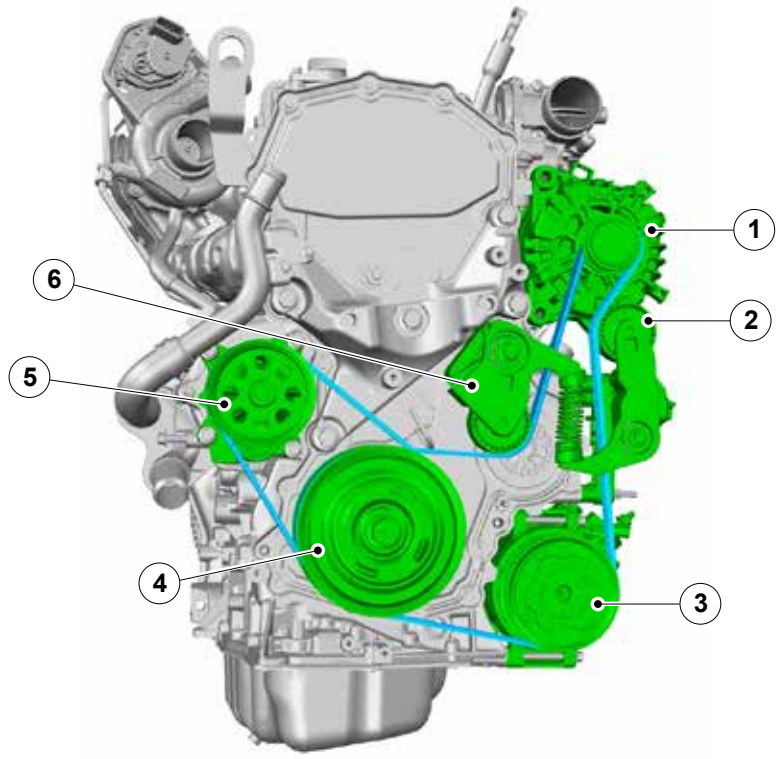
2.0 EcoBlue with EPAS/Upgrade with EPAS. Start-Stop Shields as standard. Optional AC



E289251

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

2.0 EcoBlue with EPAS and MHEV/Upgrade with EPAS and MHEV. Start-Stop Shields as standard. Optional AC

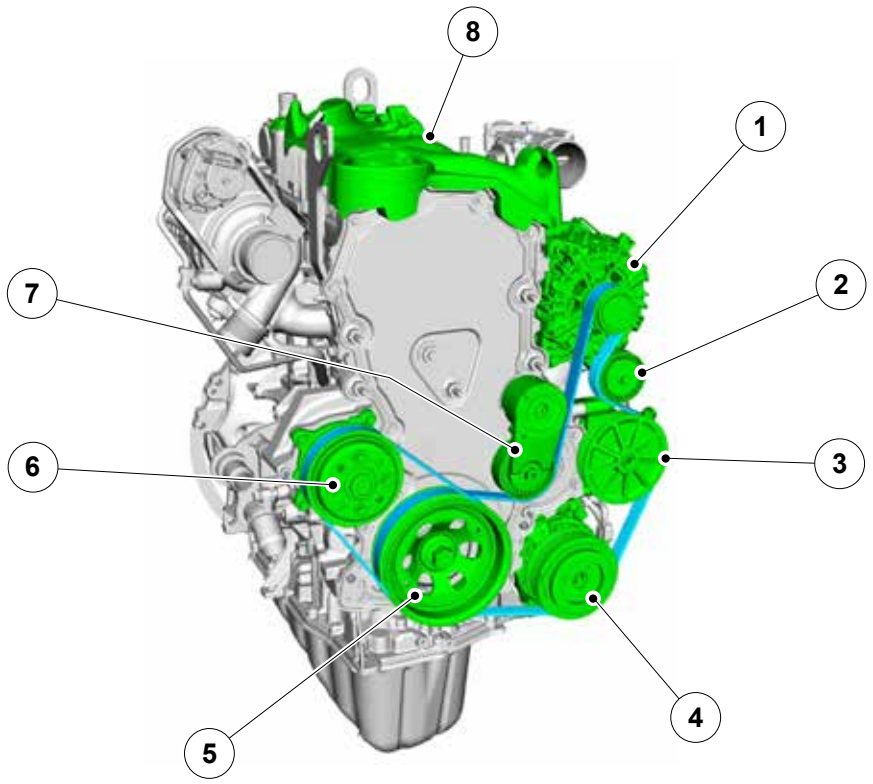


E289252

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

Abc = BEV Only Abc = ICE Only

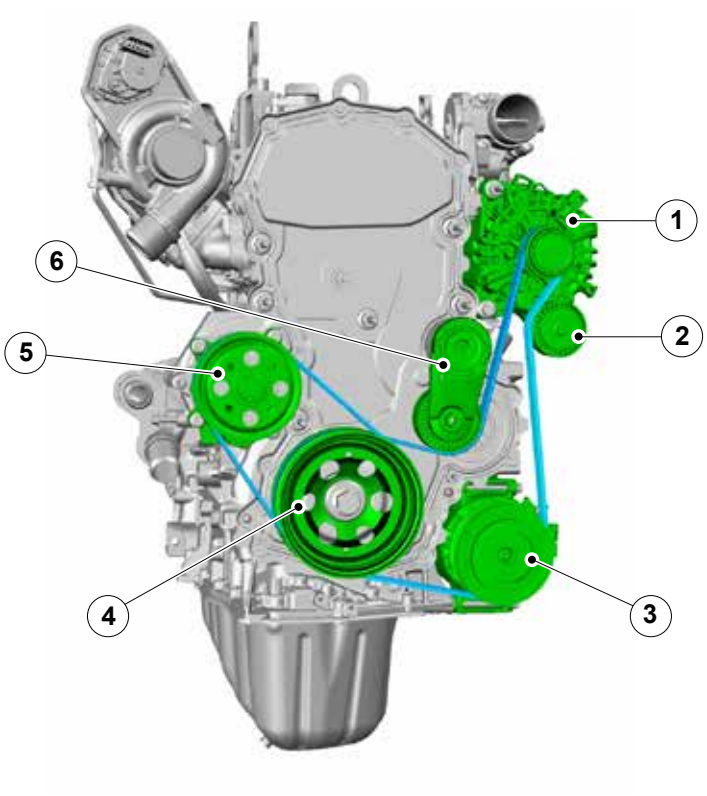
2.0 EcoBlue with HPAS. No AC or Start-Stop Shield.



E224687

Item	Description
1	Alternator
2	Idler
3	HPAS Pump
4	AC Compressor
5	Crankshaft Pulley
6	Water Pump
7	Tensioner
8	Engine Top Cover

2.0 EcoBlue with EPAS/Upgrade with EPAS. Optional AC. No Start-Stop Shield

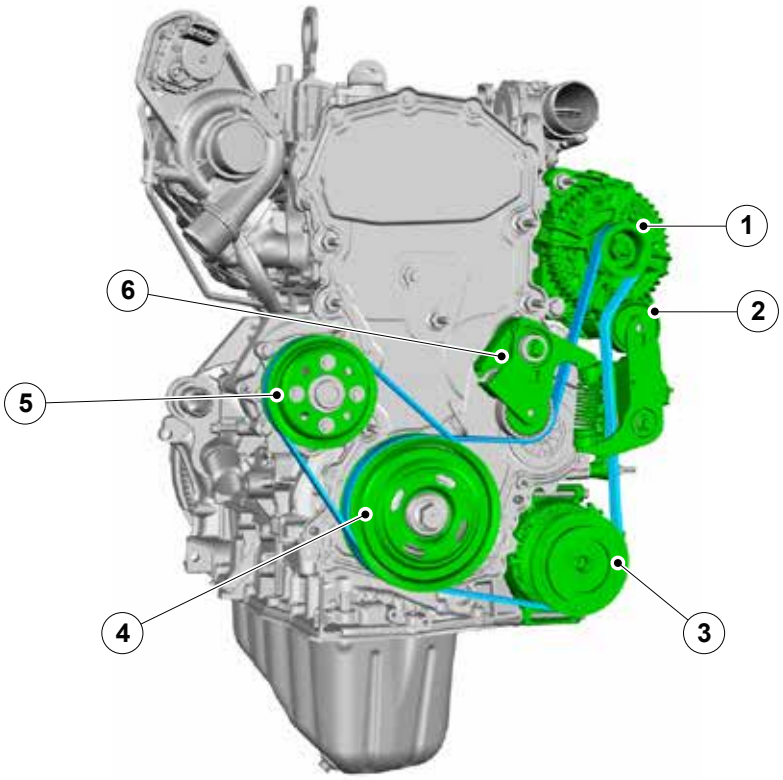


E293302

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

Abc = BEV Only Abc = ICE Only

2.0 EcoBlue Upgrade with EPAS and MHEV. AC with no Start-Stop Shield OR Non AC with Start-Stop Shield



E293303

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.

Tachographs cannot be fitted into 6F55 transmissions.

Do not change external electrical connectors.

6F55 - 6 Speed Automatic FWD Transmission

Gears	Base Transmission Ratio	Overall Ratio - Final Drive 3.39
1st	4.484	15.201
2nd	2.872	9.736
3rd	1.842	6.244
4th	1.414	4.793
5th	1	3.390
6th	0.742	2.515
Reverse	2.882	9.770

Abc = BEV Only Abc = ICE Only

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 transmissions are tachograph compatible.

VMT6 - 6 Speed Manual FWD Transmission

Gear	Base Transmission Ratio	Overall Transmission Ratio		
		4.19 Final Drive	4.43 Final Drive	4.93 Final Drive
1st	3.727	15.609	16.507	18.370
2nd	1.952	8.175	8.645	9.620
3rd	1.121	4.695	4.965	5.530
4th	0.780	3.267	3.455	3.850
5th	0.844	2.570	2.754	2.910
6th	0.683	2.080	2.229	2.360
Reverse	1.423	16.150	17.306	18.30

MT82 - 6 Speed Manual RWD and AWD Transmission

Gear	RWD Gear Set E			
	Base Transmission Ratio	Overall Transmission Ratio		
		3.31 Final Drive	3.73 Final Drive	4.10 Final Drive
1st	5.701	18.870	21.265	23.374
2nd	2.974	9.844	11.093	12.193
3rd	1.803	5.968	6.725	7.392
4th	1.282	4.243	4.782	5.256
5th	1.000	3.310	3.730	4.100
6th	0.776	2.569	2.894	3.182
Reverse	5.170	17.113	19.284	21.197

Abc = BEV Only Abc = ICE Only

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 Conversionworks@ford.com

3.7.1 Extensions and Optional Exhausts

CAUTIONS:

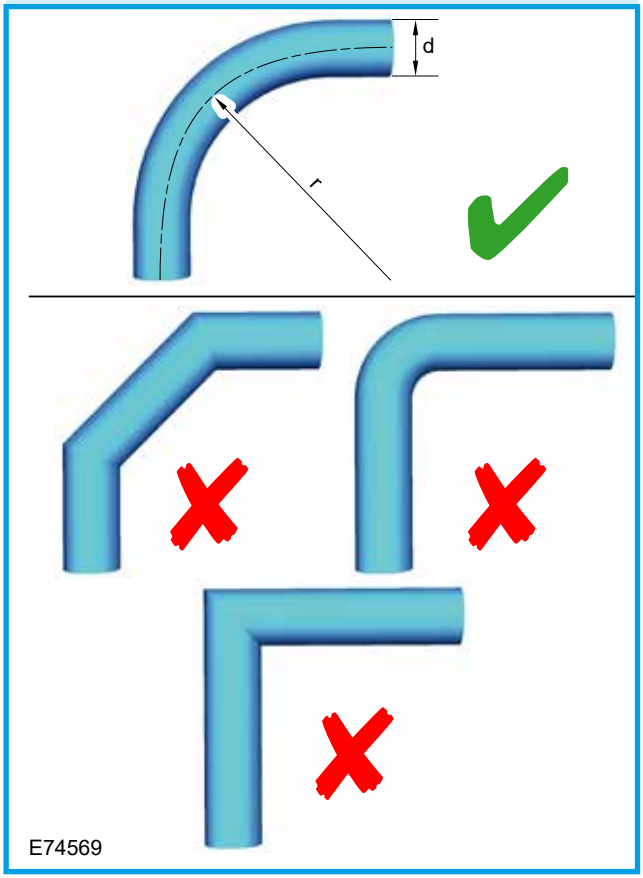
Non-standard systems must be tested for engine back pressure and all legal compliance (noise and emissions).

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

Standard Exhaust Heat Shields

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

MWB Skeletal Chassis for camper and non camper with Left Hand Side Mid Exit Exhaust

WARNING: The heat shield CK41-5290-A* is to be applied to all MWB Skeletal Chassis for camper with left hand side mid exit exhaust. This includes conversions with left hand side mid exit exhaust.

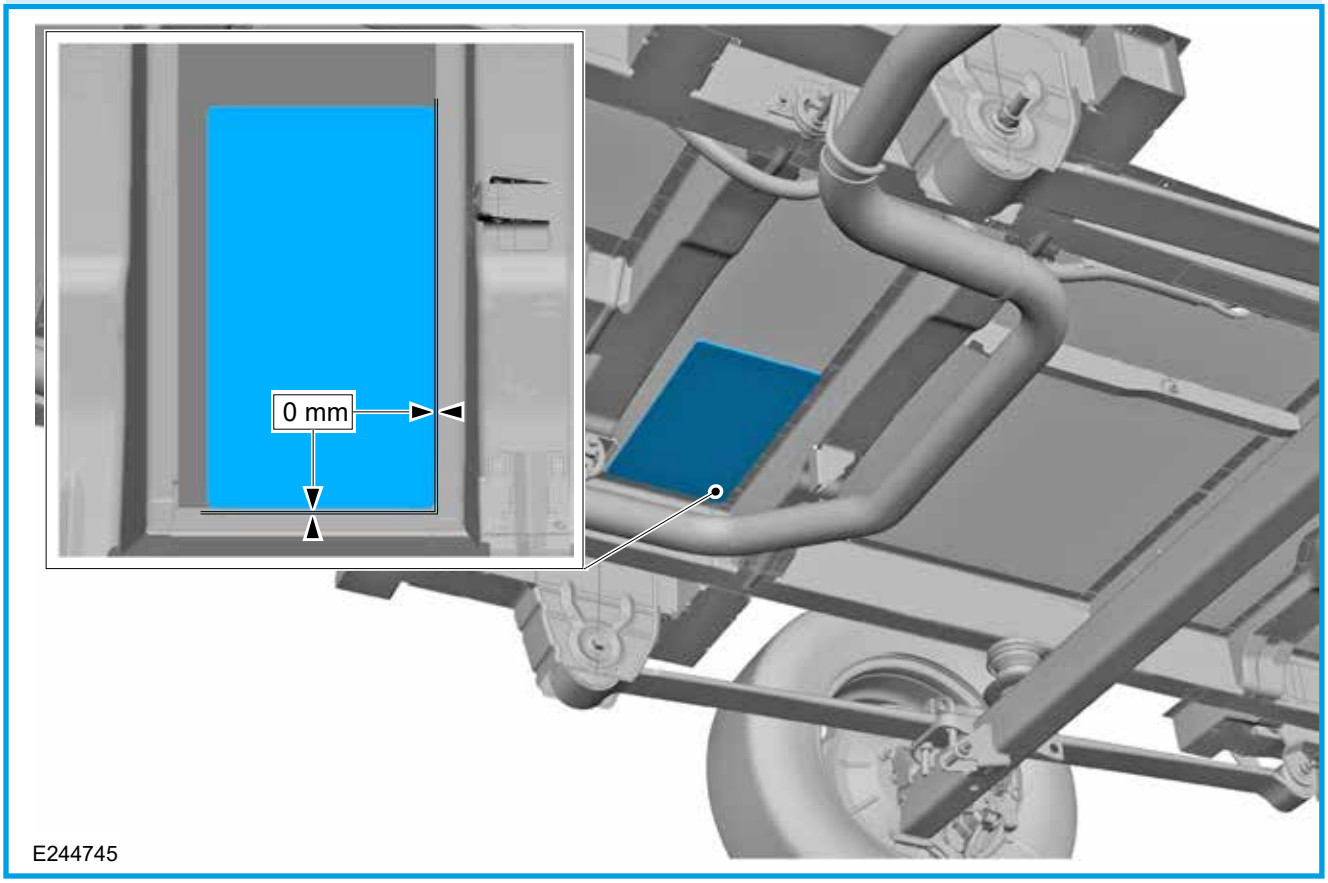
CAUTION: The part is a self-adhesive heat shield. No additional material or process is needed for fixing the part. Use the part in the location as indicated in figure E244745. For correct placement the body cross members should be taken as reference. Apply part to clean and even surface for maximum bonding and durability. The part should not be bent, twisted or subjected to any other geometrical change that would cause deformation of the pad or inconsistent adhesion.

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.

For further information
Refer to: 4.11 Electronic Engine Controls DPF & RPM Speed Control.

Self-Adhesive Heat Shield Fixing Location



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 Operator Commanded Regeneration (A660)

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 the Operator Commanded Regeneration (OCR) is specified and ordered for the base vehicle.

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.

Refer to: 4.11 Electronic Engine Controls

3.7.6 Vehicle Exhaust Systems — Vans with Full Bulkheads

Vehicle exhaust systems for vans with bulkheads are available in two lengths; a short length exhaust finishing approximately in the centre of the vehicle, which is standard fit, and a long exhaust finishing at the rear of the vehicle. If you are undertaking any modification to the load compartment of the vehicle ensure that the most suitable length of exhaust is used to avoid exhaust gas ingress into the vehicle.

Abc = BEV Only Abc = ICE Only

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.

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

Procedure for protection from Injector Nozzle Corrosion During the Upfitting/Conversion Process
Refer to 1.13 Vehicle Transportation Aids and Vehicle Storage

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 Conversionworks@ford.com

NOTE: The fuel heater line comes with a fuel fired heater as a factory-fit option, it is also available as a service item.

For vehicles without the fuel heater Line that require a fuel supply for applications (for example: auxiliary heater or fuel fired hand wash facility) it is advisable to use the auxiliary fuel supply port on the top of the fuel sender unit located on the top of the fuel tank as shown in figure E295894.

NOTE: To fit the fuel heater line, the fuel tank will need to be lowered, see the following process:

To lower fuel tank:

- Drain tank
- Disconnect fuel lines between fuel tank and urea tank
- Plug lines to prevent residual fuel from draining/spilling
- Remove filler pipe from tank
- Remove bolts securing the two tank straps
- Lower the fuel tank to gain access to the top, see Figure E295894 for fitting fuel heater Line

To refit fuel tank:

- Lift fuel tank ensuring not to trap fuel lines and electrical wires
- Refit straps, torque bolts to 47.5Nm ±7.2Nm
- 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 tube and/or line must be routed independently and secured to the body structure or to suitable brackets.

NOTE: Ensure that a suitable fuel shut-off is fitted in any unique system.

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.

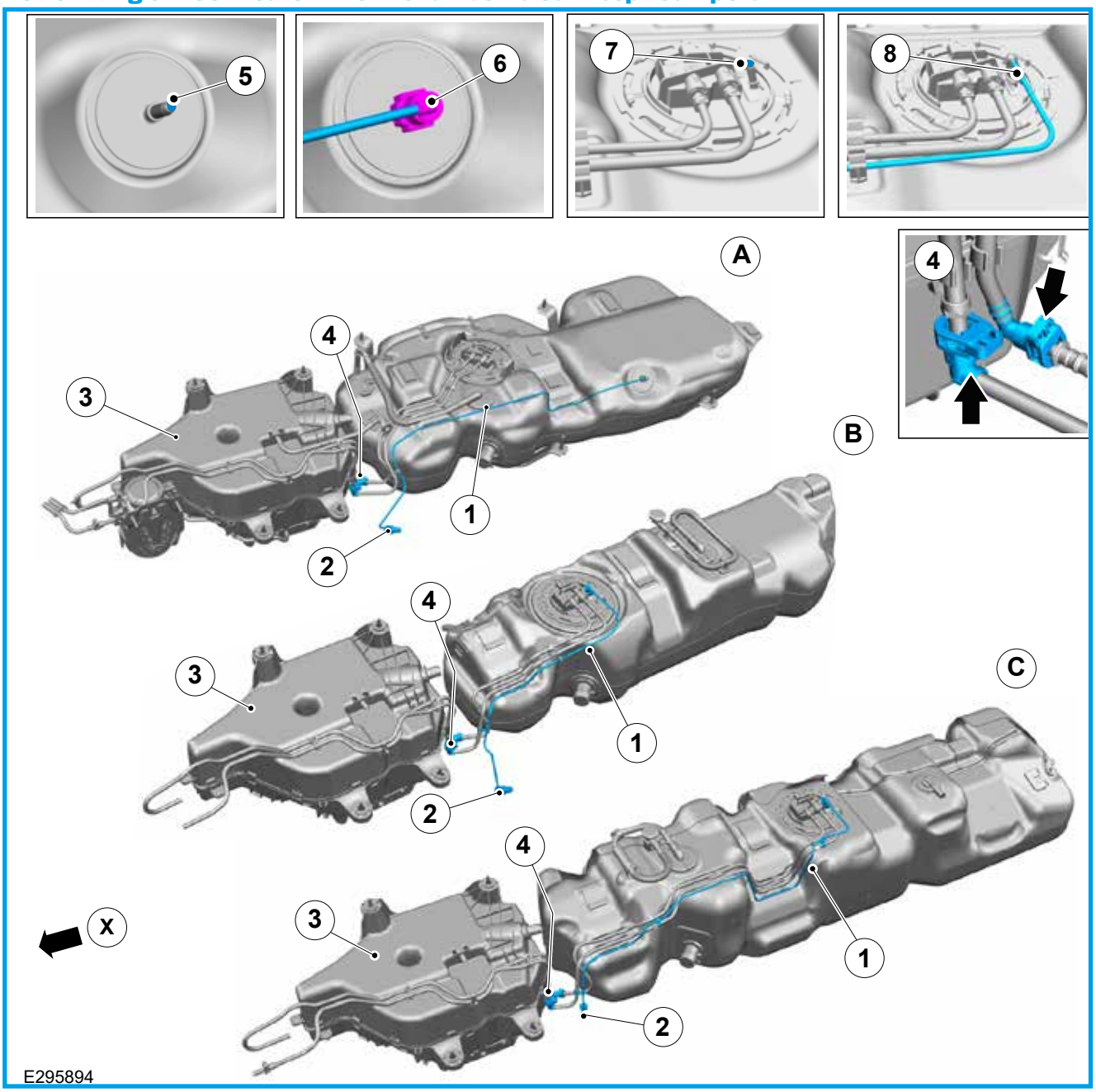
Retrofitting of Fuel Heater Line - For all Vehicles Except Campers

Follow the steps below to retrofit the fuel heater line (figure E295894):

1. Disconnect fuel lines between fuel tank and Urea tank (Item 4)
2. Cut off top of port of tank flange (tank A) leaving 19.64 ±0.12mm and carefully insert heater tube, part number BK21-9T308A* (Item 5)
3. Fix quick fit connector of fuel line to heater tube (Item 6)
4. Cut off top of port of module flange (tank B & C) leaving 19.64 ±0.12mm and carefully insert heater tube, part number for 70L Chassis Cab FWD, RWD/AWD: KK31-9T308-A* or 95L : BK31-9T308-A* (Item 7)
5. Fix quick fit connector of fuel line to heater tube (Item 8)

Abc = BEV Only Abc = ICE Only

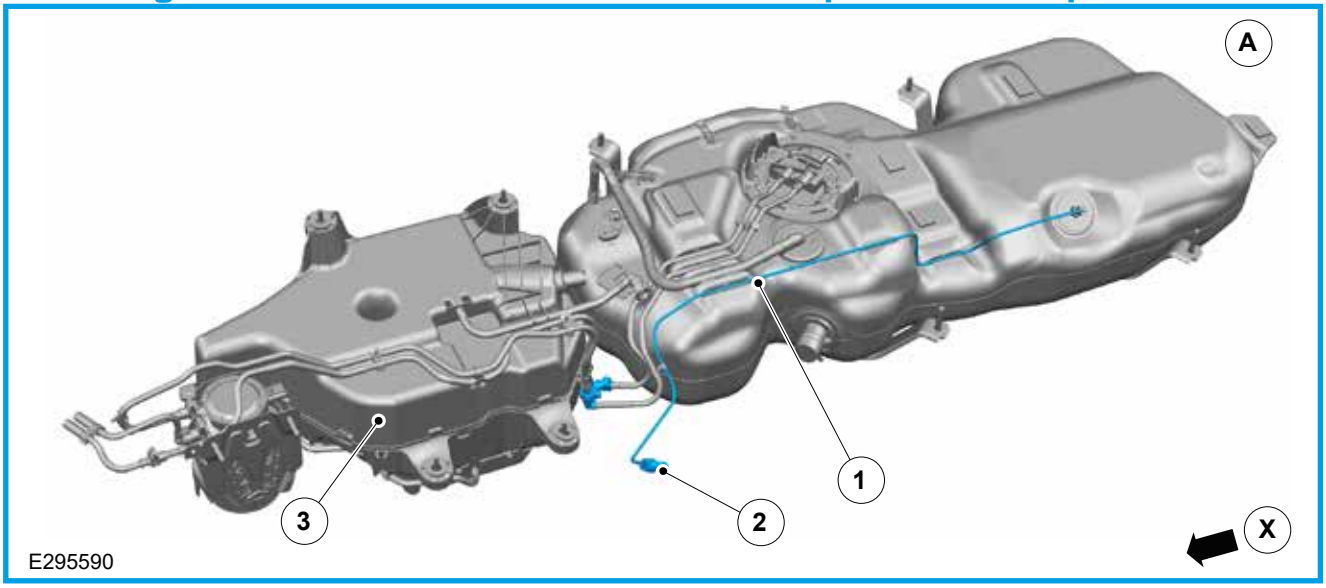
Retrofitting of Fuel Heater Line - For all Vehicles Except Campers



Item	Description
A	70L Standard Fuel Tank for all FWD vehicles except Chassis Cab
B	70L Standard Fuel Tank for Chassis cab FWD, all RWD and AWD vehicles.
C	95L Fuel Tank, optional for Chassis cab FWD, all RWD and AWD vehicles.
1	Heater Fuel Line, part number 70L FWD except Chassis Cab: KK21-9N126-A*, 70L Chassis Cab FWD, RWD/AWD: KK31-9N126-A*, 95L : GK31-9N126-C*
2	Heater Fuel Line has a female end adapter TI LOCC QC 7.89mm fitted as standard. It is recommended to use a male 8mm (5/16") quick connector that meets SAE J2044 standard (August 2009 or later), where the seal diameter = 7.89mm
3	Urea Tank/AdBlue® Tank
x	Drive Direction

Abc = BEV Only Abc = ICE Only

Retrofitting of Fuel Heater Line - Skeletal Chassis for Camper and Non Camper



Item	Description
A	70L Standard Fuel Tank for Skeletal Chassis for camper and non camper
1	Heater Fuel Line, part number FWD KK31-9N126-B*, RWD KK31-9N126-C*
2	Heater Fuel Line has a male end adapter TI LOCC QC 7.89mm diameter fitted as standard, with a female blind quick connector. After the female blind quick connector is removed, it is recommended to use a female 8mm (5/16") quick connector that meets SAE J2044 standard (August 2009 or later), where the seal diameter = 7.89mm.
3	Urea Tank/AdBlue® Tank
X	Drive Direction

3.9 High Voltage System & Electrified Drivetrain

WARNINGS: Before beginning any vehicle modifications refer to the following overview of High Voltage System Health & Safety Precautions

3.9.1 High Voltage Health & Safety Precautions

WARNINGS:

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

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

To prevent the risk of High Voltage shock, always follow precisely all warnings and service instructions, including instructions to de-energisze the system. The High Voltage system utilises approximately 450V DC, provided through High Voltage cables to its components and modules. The High Voltage cables and wiring are identified by orange harness tape or orange wire covering. All High Voltage components are marked with 'High Voltage' warning labels with a 'High Voltage' symbol. Failure to follow these instructions may result in serious personal injury or death

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

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

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

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

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

"High Voltage" is defined in Federal Motor Vehicle Safety Standard 305 as:

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

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

Only qualified Ford service personnel should attempt to diagnose or repair any high voltage components or systems. Any personnel involved in engineering, subsequent stage manufacturing, modifying, or servicing vehicles with high voltage systems (content other than the HV systems) should be trained in basic understanding and safety principles regarding HV systems.

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

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

- Welding anywhere on the chassis or installed body.
- Cutting or drilling operations near HV components.
- Operations generating significant heat near HV components, especially near the HV battery.
- Paint curing operations above 60°C (140°F) or longer than 45 minutes.

Abc = BEV Only Abc = ICE Only

High Voltage Labels

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

HV Label Example 1



HV Label Example 2



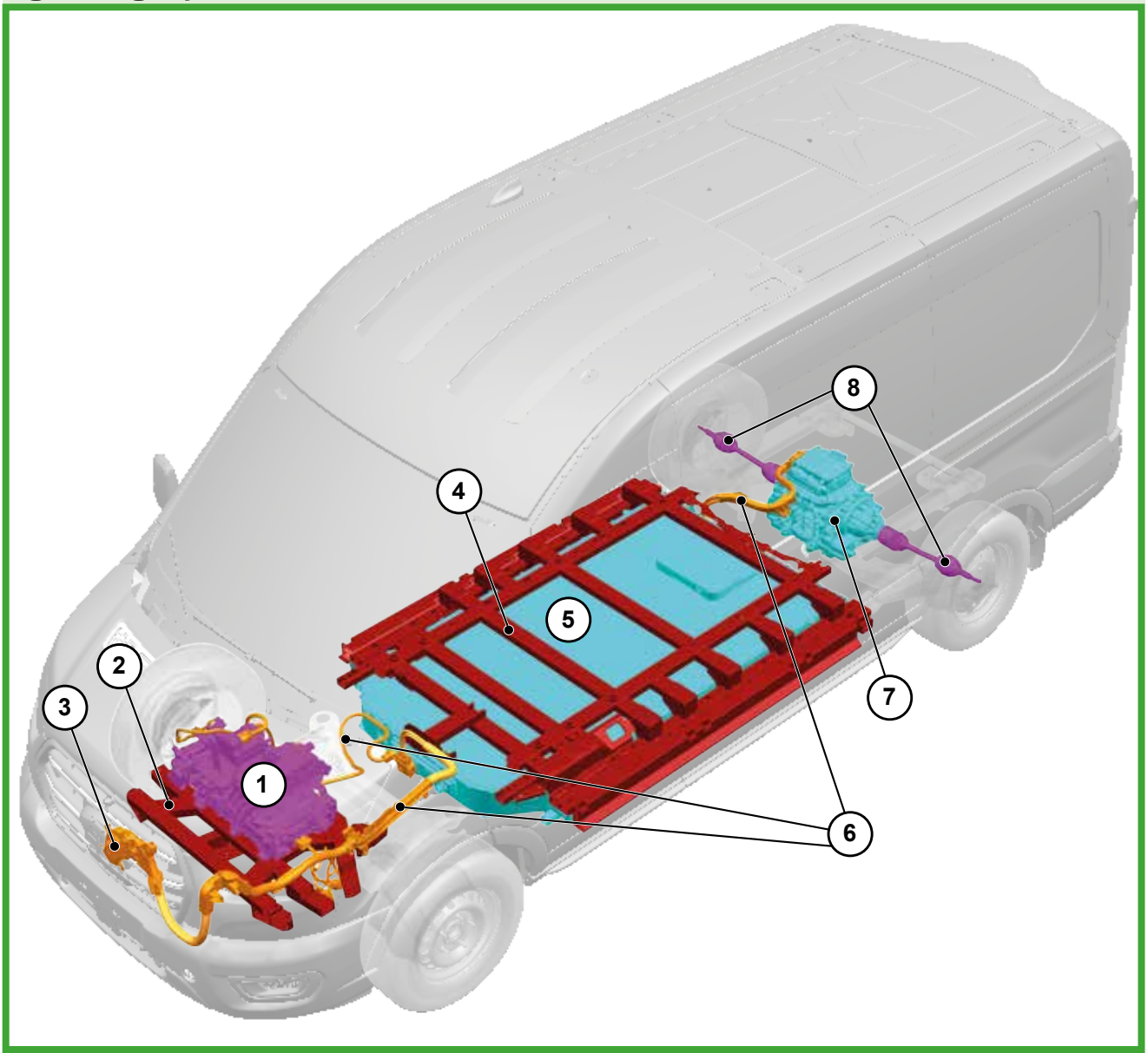
HV Label Example 3



3.9.2 High Voltage System Overview

The High Voltage System on E-Transit consists of a centrally mounted, underfloor High Voltage Battery Pack, a front-mounted 'stack' of HV control systems under the 'bonnet', that are mounted to the 'Megabrace' and an Electric Drive Assembly providing drive to the rear wheels. These are connected by orange High Voltage cables and a system for cooling the components of the High Voltage system

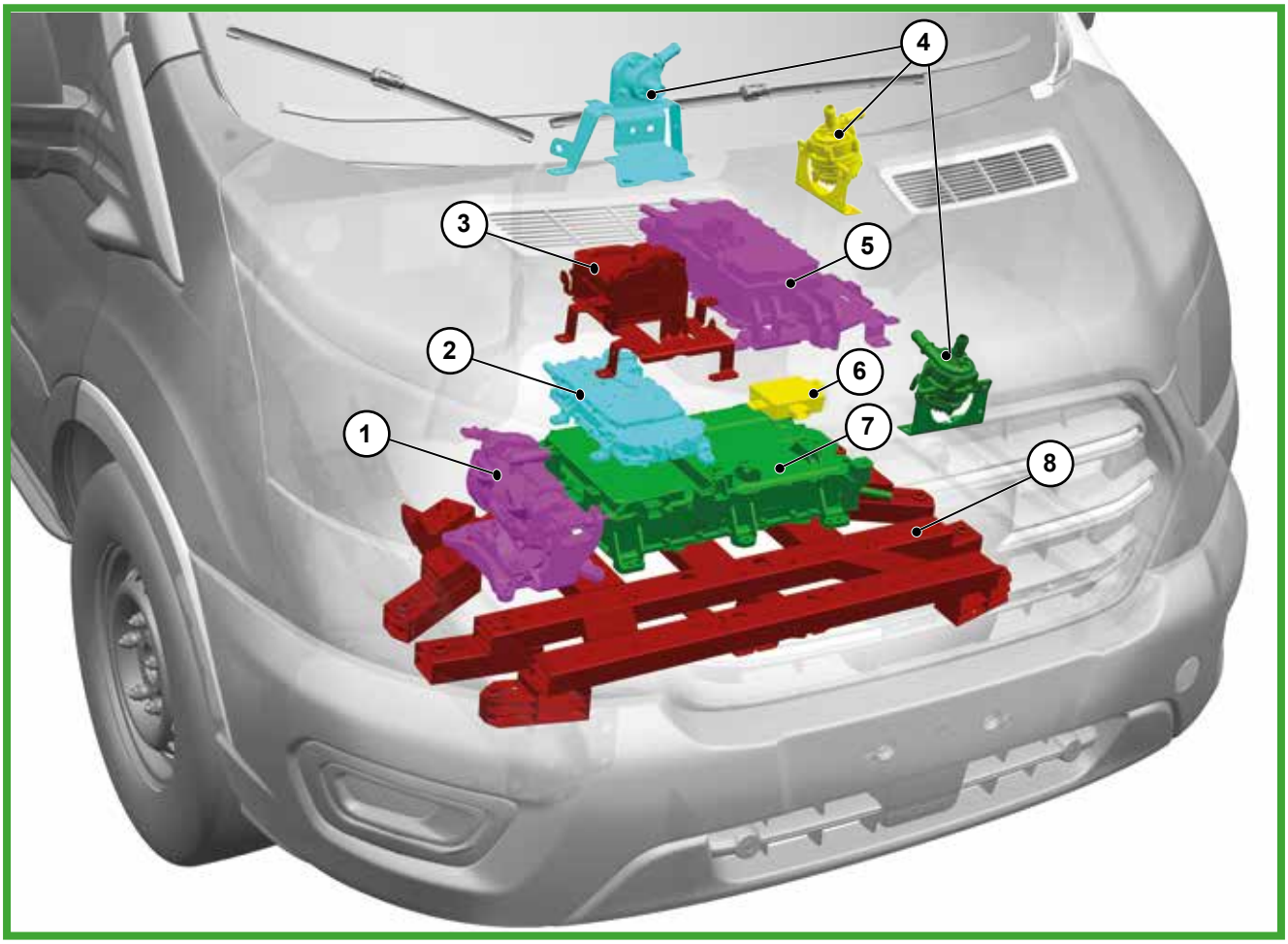
High Voltage System Overview



Item	Description
1	High Voltage Module Stack
2	Megabrace
3	High Voltage Charge Port Inlet
4	High Voltage Battery Cradle
5	High Voltage Battery Pack
6	Orange High Voltage Cables
7	Electric Drive Assembly
8	Halfshafts

Abc = BEV Only Abc = ICE Only

Exploded View of HV Stack Components



Item	Description
1	Electric Air Conditioning Compressor
2	DC-DC Converter
3	Electric Heater
4	Cooling Pumps and Valves
5	On Board Generator Inverter Module (optional)
6	Off-Board Charger Control Module
7	Charge Unit
8	Megabrace

3.9.3 HV System De-Energising

Please refer to the Ford E-Transit workshop manual for de-energising procedure.

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

NOTE: When the HV system has been de-energised, the 12V Low Voltage system will remain live

3.9.4 Cooling

CAUTION: For E-transit BEV, do not modify the High Voltage Battery cooling system.

3.9.5 Electric Drive Assembly

CAUTIONS:

For E-Transit BEV, do not modify the Electric Drive Assembly

For E-Transit BEV, do not modify the Halfshafts in the Electric Drive Assembly

3.9.6 High Voltage Battery

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

- Do not cut the High Voltage Battery case. Do not penetrate the batteries or case in any way.
- The High Voltage Battery Pack is located under the vehicle.
- The total voltage of the HV Battery Pack may be up to approximately 450V DC.
- The Battery Case is water resistant.
- The battery cells contain liquid electrolyte absorbed in a porous special polymeric film. The electrolyte will not leak from the battery under most conditions. However, if the battery is crushed, it is possible for a small amount of electrolyte to leak.
- If possible, isolate and avoid contact with any electric vehicle components. If contact with the High Voltage system cannot be avoided, Personal Protective Equipment (PPE) such as a splash shield or safety goggles, gloves (butyl), an apron or overcoat and rubber boots are required when handling damaged batteries. Exposure to electrolyte could cause skin and/or eye irritation/ burns. If exposed, rinse with large amounts of water for 10-15 minutes.

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

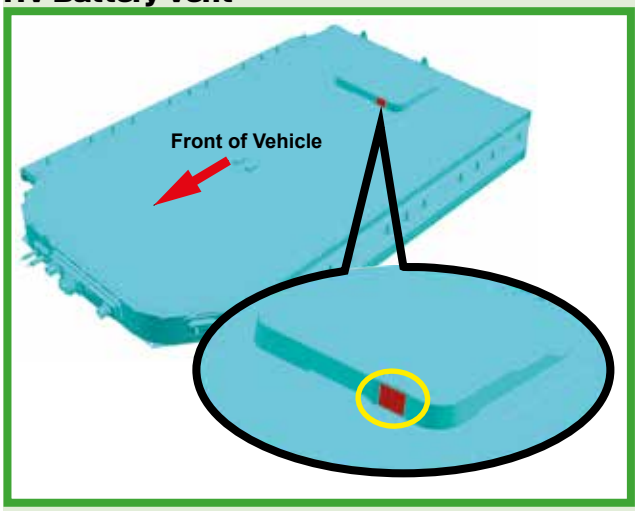
The power terminals of the high voltage battery are only activated when necessary for vehicle operation, including:

- When the vehicle is in key “on” or “accessory” state (“Ready” indicator lit in instrument cluster).
- When the 12v battery has a low state of charge - the HV battery will activate to charge the 12v battery through the DC-to-DC Converter, even in the vehicle key “off” state
- When the vehicle is plugged into a charging station (BEV only) - the charge port, charge unit, HV battery and wiring between these components may be active, with high voltage present even in the vehicle key “off” state.

HV Battery Venting

1. The E-Transit BEV HV Battery is equipped with an exhaust vent. No additional components nor obstructions (beyond any installed by Ford) shall be located in the same environment as the battery (e.g., underbody) and within 150 mm of these features. Additionally, no components which may contain combustible liquids or gases at any time shall be added within 300 mm of these features.
2. There shall be no modifications or installed components which confine the air space near the outside of the HV Battery or obstruct the free flow of air about the battery (beyond any installed by Ford).
3. Any cut outs or openings created between the occupant space and the vehicle underbody shall be sealed such that air is not free to pass from under the vehicle into the occupant space.
4. If any primary ingress/egress paths for occupant spaces are located above or rearward of the rear axle(s), a metallic shielding shall be added to obstruct any air flow from the battery towards those ingress/egress paths, and redirect that air flow towards a side/rear area that is not a primary ingress/egress path.

HV Battery Vent



HV Battery Grounding

WARNINGS:

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

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

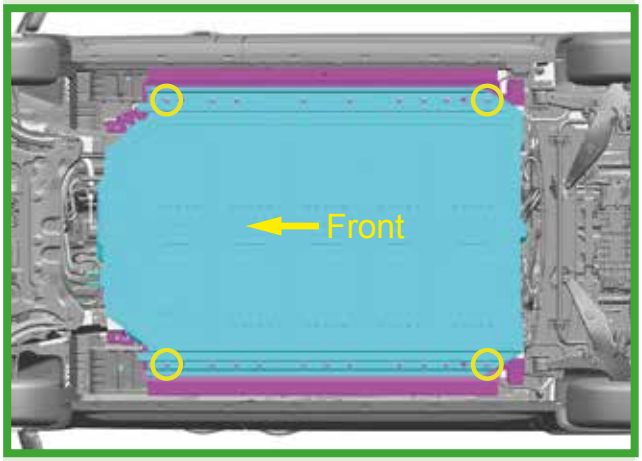
NOTE: As part of the safety features built in to the HV system, measurements between the HV circuitry and vehicle ground are measured using these ground paths. Therefore, HV battery ground paths must not be altered in any way.

NOTE: Battery ground path for Van and Chassis Cab/Cutaway are not the same, the complete battery ground path includes the cradle as well as attachment to the body rail.

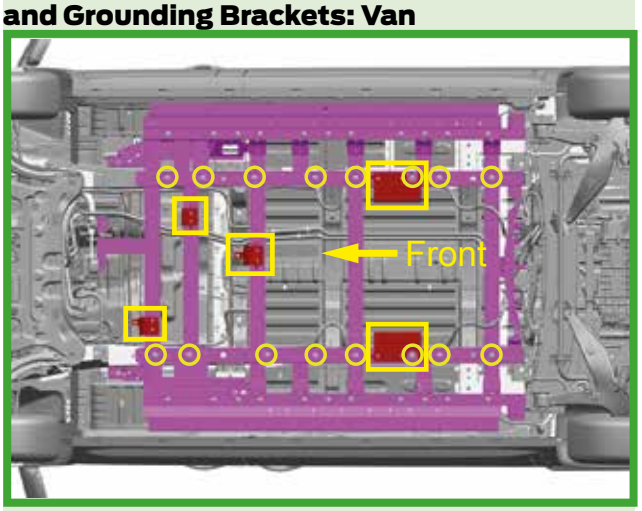
Refer to:
3.7.9 HV Module Grounding

Abc = BEV Only Abc = ICE Only

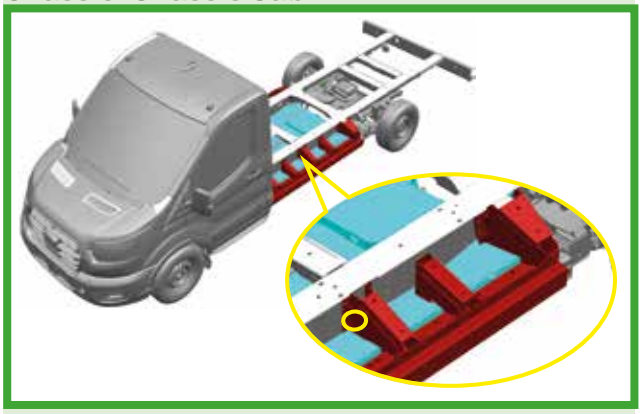
HV Battery to Cradle Grounding Fasteners: Van and Chassis Cab



HV Cradle to Chassis Grounding Fasteners and Grounding Brackets: Van



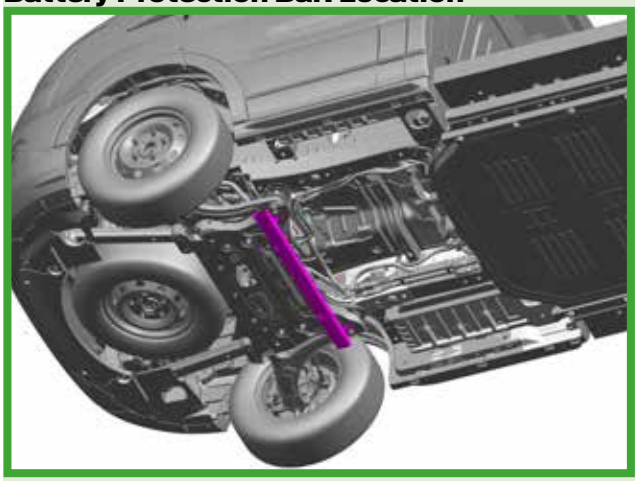
HV Battery Grounding Location - Cradle to Chassis: Chassis Cab



Battery Protection Bar

CAUTION: The E-Transit Chassis Cab Variant has a front-mounted Battery Protection Bar to protect the battery from hitting the road surface where ground clearance is an issue. The Battery Protection Bar must NOT be removed

Battery Protection Bar: Location



3.9.7 EV Charging

Please refer to the E-Transit Owners Manual

ePower Pack System

Please refer to the E-Transit Owners Manual

Mobile Charger Unit

Please refer to the E-Transit Owners Manual

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

NOTE: The standard charge cord storage location is lost if the passenger seat delete option is chosen and the upfitter must provide their own storage feature for the cord

Abc = BEV Only Abc = ICE Only

Abc = BEV Only Abc = ICE Only

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 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.

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 Conversionworks@ford.com

4.1.1 Electrical Architecture Changes

Fusing Strategy

The Power Distribution Box (PDB) replaces the previous Electrical Junction Box (EJB).

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.

Ford Programmable Battery Guard GEN2 (A540)

Vehicles will be equipped with a new generation of Ford Programmable Battery Guard (FPBG), if ordered with this option or retrofitted.

The new generation 2 differs from the previous generation 1:

- There is increased power output to 200A
- There is an easier selection of modes, with only ignition cycles
- Extra sensing capability looking at battery temperature, ageing and current flow
- Thermal protection is added to the Electrical Distribution System (EDS) to support high current usages
- The new electrical architecture is supported with the load-shedding input signal compliance
- Features integrated FPBG control to Aux Fuse Panel (engine off) where fitted
- Features built in Mode 1 Engine RPM control when buying option A003

The FPBG GEN2 differs from the previous version in its setup and provides a range of additional features based on the new electrical architecture.

Refer to: 4.7 Battery Protection For further information on the FPBG.

Electric Power Assisted Steering (EPAS)

The Electric Power Assisted Steering (EPAS) replaces the Hydraulic Power Assisted Steering (HPAS). AWD, however, still takes HPAS.

Load-Shedding and Standard Battery Guard

Vehicles using EPAS are equipped with a load-shedding system. This is designed to protect the base vehicle system voltage. The load-shedding system will be standard for all vehicles and may affect the design of your conversion.

At engine run, if the supply voltage is near to 11V, the supplies to the CCP2, FPBG, Auxiliary Fuse Panel and signal to certain connectors will be disconnected. At engine off, disconnection occurs after a certain time or SOC value to protect the battery so the vehicle can restart (crank).

Refer to: 4.7 Battery Protection for load-shedding

Vehicle Interface Connector

The Vehicle Interface Connector has been updated from an 8-way to a 10-way connector.

SVO Auxiliary Fuse Panel (A526, A606 and A626)

The Auxiliary Fuse Panel is now located behind the glove box. It now offers more circuits, more power, battery guard and Third Party High Power Mode.

High Specification Interface Connector [A608]

Increased features and functions (RunLock, load-shedding, battery guard, locking third party latches and lower cost mating kit).

GNSS/4G Antenna

The introduction of the Global Navigation Satellite System (GNSS)/4G antenna.

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: 4.25 Electrical Connectors and Connections

Customer Connection Point (CCP)

Vehicles are equipped with a different power supply strategy. The previous 3 x Customer Connection Point (CCP) with 3x 60A fuses is replaced with a 1x 60A 'CCP1' power at all times stud and a 1x 175A 'CCP2' controlled stud.

Refer to: 4.25 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: 4.6 Battery Systems

Mild Hybrid Electric Vehicle (MHEV) 48V Systems

MHEV vehicles are provided with a 48V charging system. This replaces the alternator. The 12V supply is from a DC/DC converter in the 48V battery pack.

Electrical conversions are restricted on MHEV variants.

Refer to: 4.5 Mild Hybrid Charging System

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 Conversionworks@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 5 mm between Power and Ground circuits is required.

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

CAUTION: Only use Ford approved connectors.

Cutting into vehicle wiring is not recommended because:

- The base vehicle specification is unsuitable for incremental loads 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

Refer to: 4.6 Battery Systems

- 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'

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



E131081

Ford Motor Company strongly advises against the use of wire splicing due to the variable and unpredictable nature of the joint created. However, if it is decided that a wire splice is unavoidable, it must be made using **DuraSeal Heat-Shrinkable, Environmentally Sealed, Nylon-Insulated Crimp Splices** (manufactured by TYCO-RAYCHEM). For example the D406 series. As a further process to improve the splice integrity, the splice should be further sealed with a suitable heat shrink tubing. See Figure E131081.

4.2.9 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)

Abc = BEV Only Abc = ICE Only

- 250mm from exhaust system
- 30mm from rotating or moving components

Refer to: Electromagnetic Compatibility (EMC)

4.2.10 Wiring Specification

Current Rating of Wire Sizes

ISO Conductor Size mm² 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.

4.2.11 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.

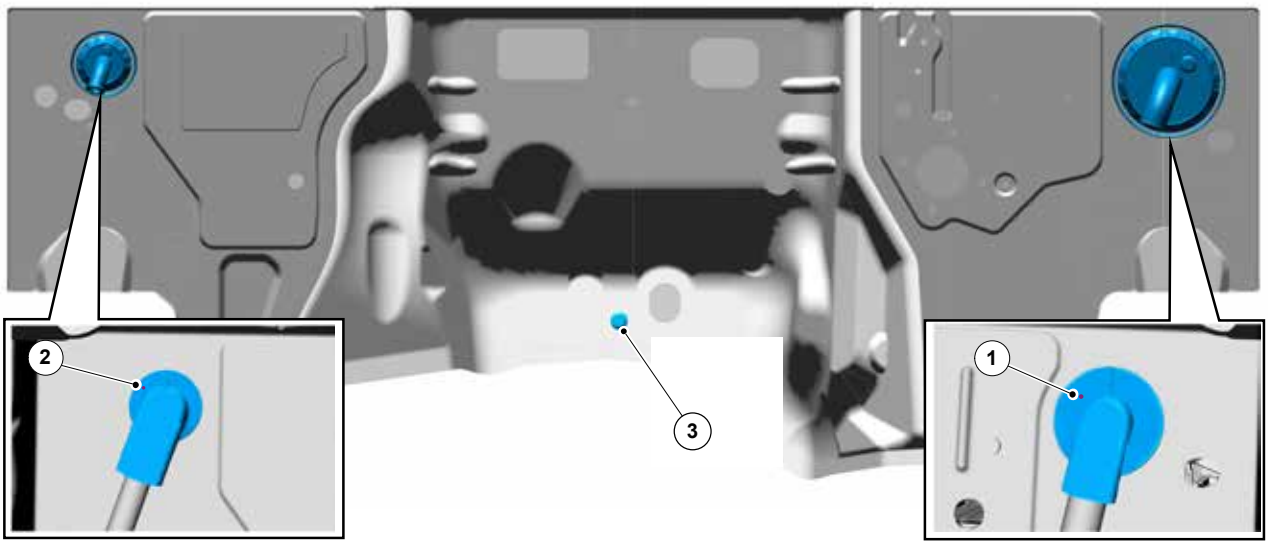
There are three locations in the dash panel which have been identified for additional holes to route wires through. See figure E145360 (view from engine bay) for locations. The number of suitable locations will depend on the vehicle specification.

The grommets in locations 1 and 2, shown in figure E145360, 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.

Wiring through Sheet Metal: Front Wheel Drive Dash Panel (Left Hand Drive Shown)



E145360 Rev1

Item	Description
1	Dash Grommet Left Hand Side
2	Dash Grommet Right Hand Side
3	This location is available on Rear Wheel Drive vehicles and Front Wheel Drive without Tachograph

Abc = BEV Only Abc = ICE Only

4.2.12 Precautionary Drill Zones - High Voltage (HV) Cables

WARNINGS:

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

Fasteners that upfitters install must point away from the battery so as to not to cause damage to the battery. Do not add a fastener into the vehicle that would point toward the HV Battery

No components or structure installed by an upfitter shall result in contact, penetration (especially added fasteners pointed towards the high voltage battery or other electrical components), separation, or other damage to the high voltage electrical system or any portion thereof when the vehicle is tested in any manner.

Do not modify the High Voltage Charge Port Inlet Connector/Mounting Bracket

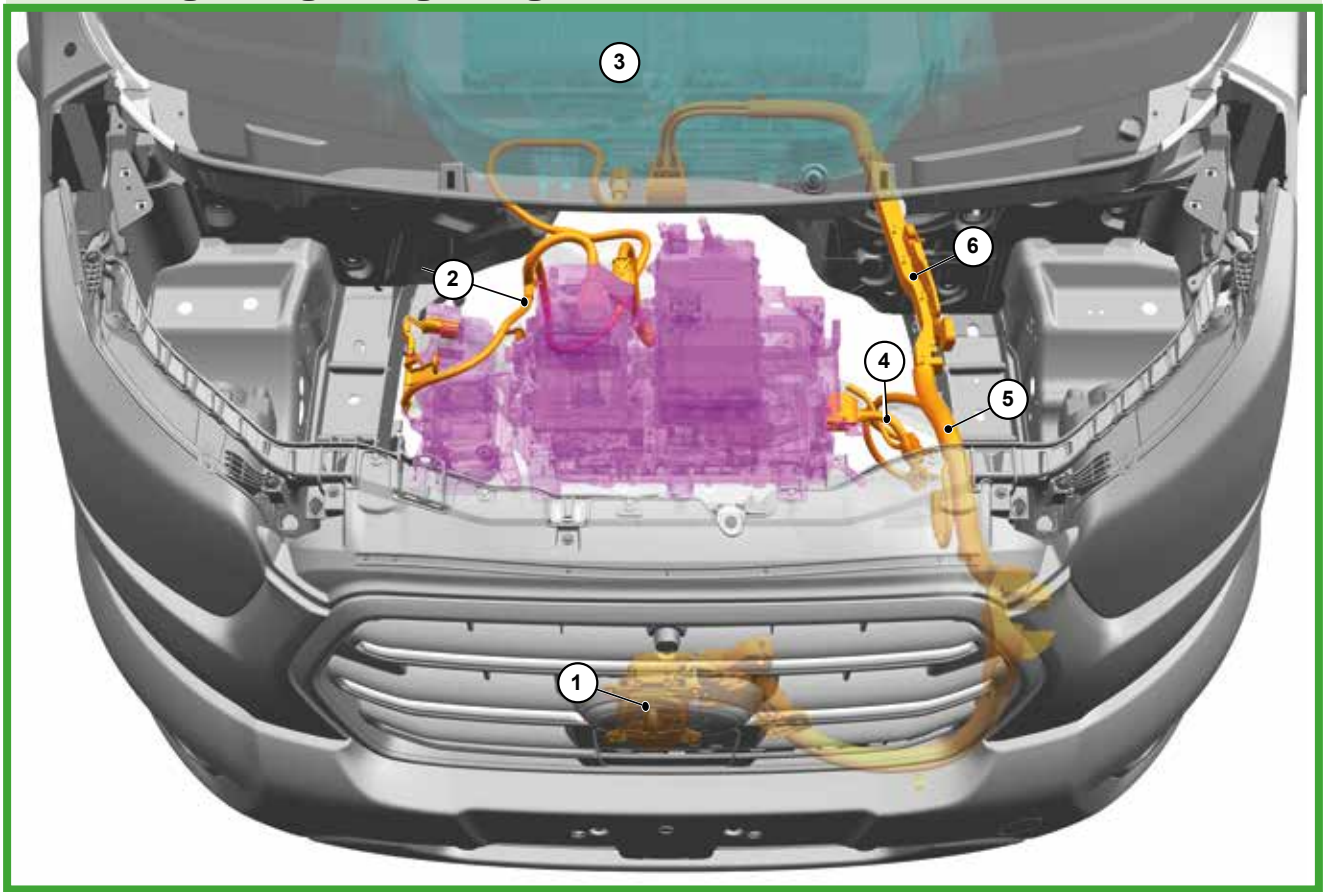
Do not modify these High Voltage/Low Voltage grounding locations/joints/ fasteners of the Charge Port Harness Package Grounds

Do not modify the length of any of the orange high voltage cables

Do not remove fasteners and protective shield from the Charge Port Inlet Harness

CAUTION: Take precaution when undertaking drilling or any other operation in or near any HV cable to prevent damage.

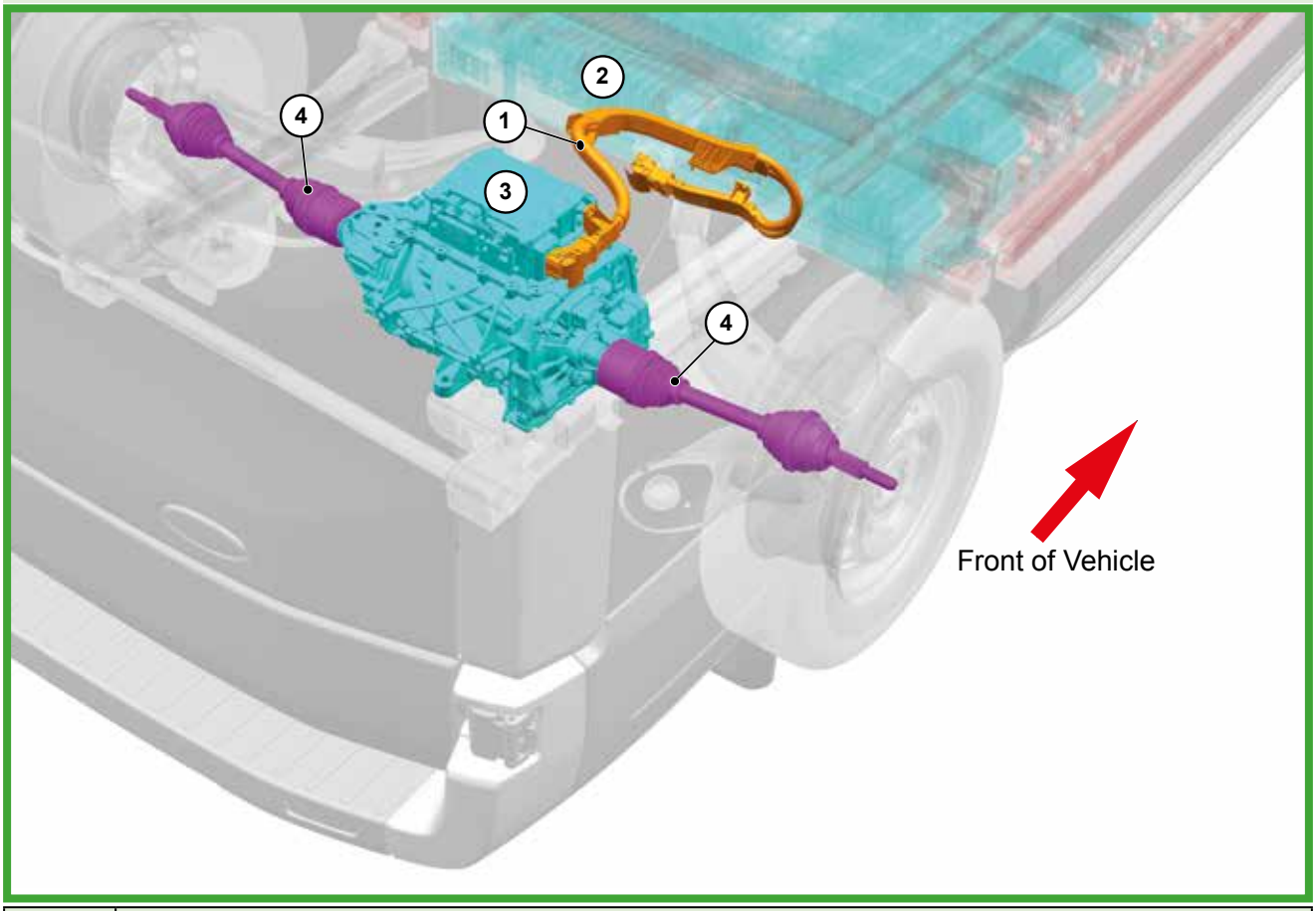
Front End High Voltage Wiring Package



Item	Description
1	High Voltage Charge Port Inlet
2	Accessory Harness
3	High Voltage Battery Pack
4	Battery Charger Inline Jumper
5	Charge Port Harness
6	Charge Port Harness Protective Shield

Abc = BEV Only Abc = ICE Only

Rear End HV Cable Package: 14B322



Item	Description
1	Electric Drive Assembly to High Voltage Battery Cable
2	High Voltage Battery Pack
3	Electric Drive Assembly
4	Halfshaft

Abc = BEV Only Abc = ICE Only

4.2.13 Precautionary Drill Zones - HV Modules LV Cables and Connectors

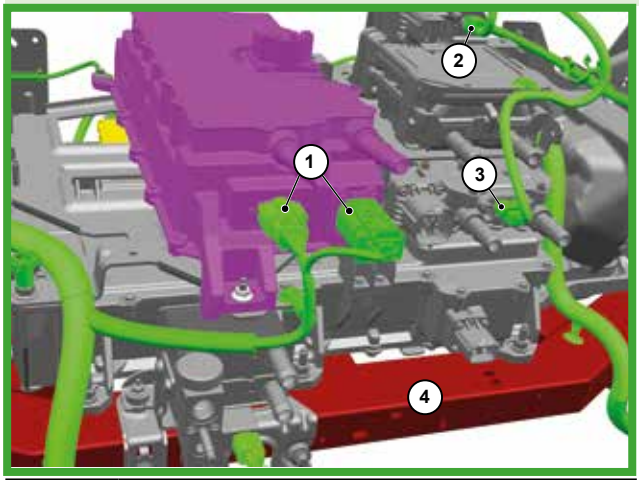
CAUTION: Beware when drilling or undertaking any operation near the LV cable that connects to the High Voltage modules, as this could negatively impact vehicle performance. The LV cable also includes a ground for HV components.

WARNINGS:

Take precautions when drilling or undertaking any other operation in the areas indicated ,in order to prevent damage to any components

Do not modify any existing Low Voltage Cable cable/connections

LV Connectors: Rear of HV Stack



Item	Description
1	LV Connector to OBGI
2	LV Connector to Electric Heater
3	LV Connector to DC-DC Converter
4	Megabrace

LV Connectors: Front of HV Stack



Item	Description
1	LV Connector to Charger
2	LV Connector to OBCC
3	Megabrace

4.2.14 Precautionary Drill Zones - Cable Grounding

WARNINGS:

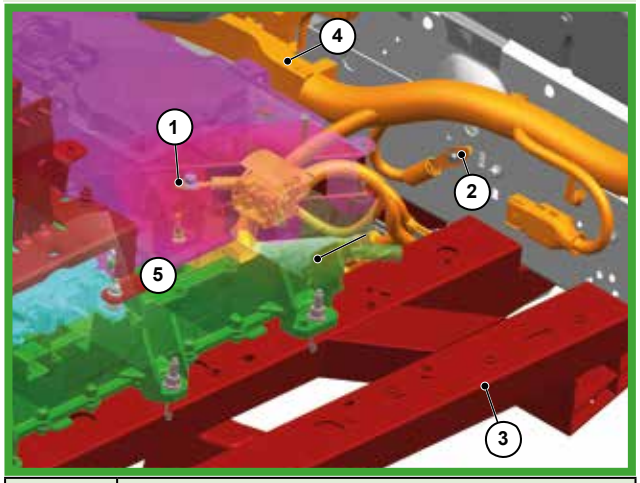
Take precautions when undertaking drilling, or any other operation, in or around the high voltage stack or electric drive assembly in order to prevent damage to any components. HV grounding points in the vehicle are not to be touched.

Do not modify any High Voltage grounding locations, connectors or joints.

On the E-Transit BEV, the High Voltage (HV) circuitry is not grounded to the body/chassis in the same way as the Low Voltage (12V) system. As part of the safety features built in to the HV system, measurements between the HV circuitry and vehicle ground are measured using these ground paths. Therefore, HV module ground paths must not be altered in any way.

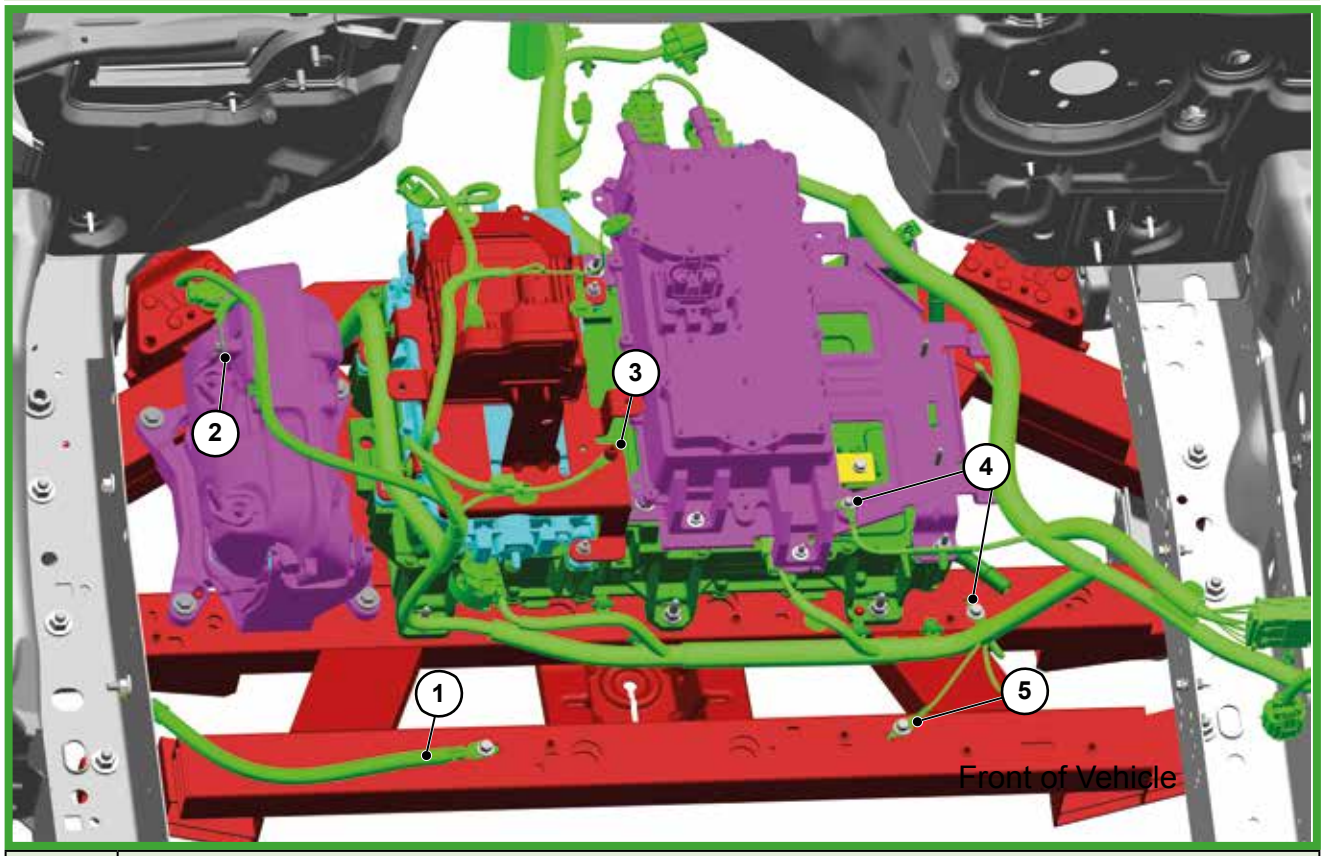
WARNING: Do not modify these High Voltage/Low Voltage grounding locations/joints/fasteners of the Charge Port Harness Package Grounds

Cable Grounding: Charge Port Harness



Item	Description
1	Harness Ground to Megabrace
2	Harness Ground to Chassis
3	Megabrace
4	Harness Protective Shield
5	High Voltage Stack

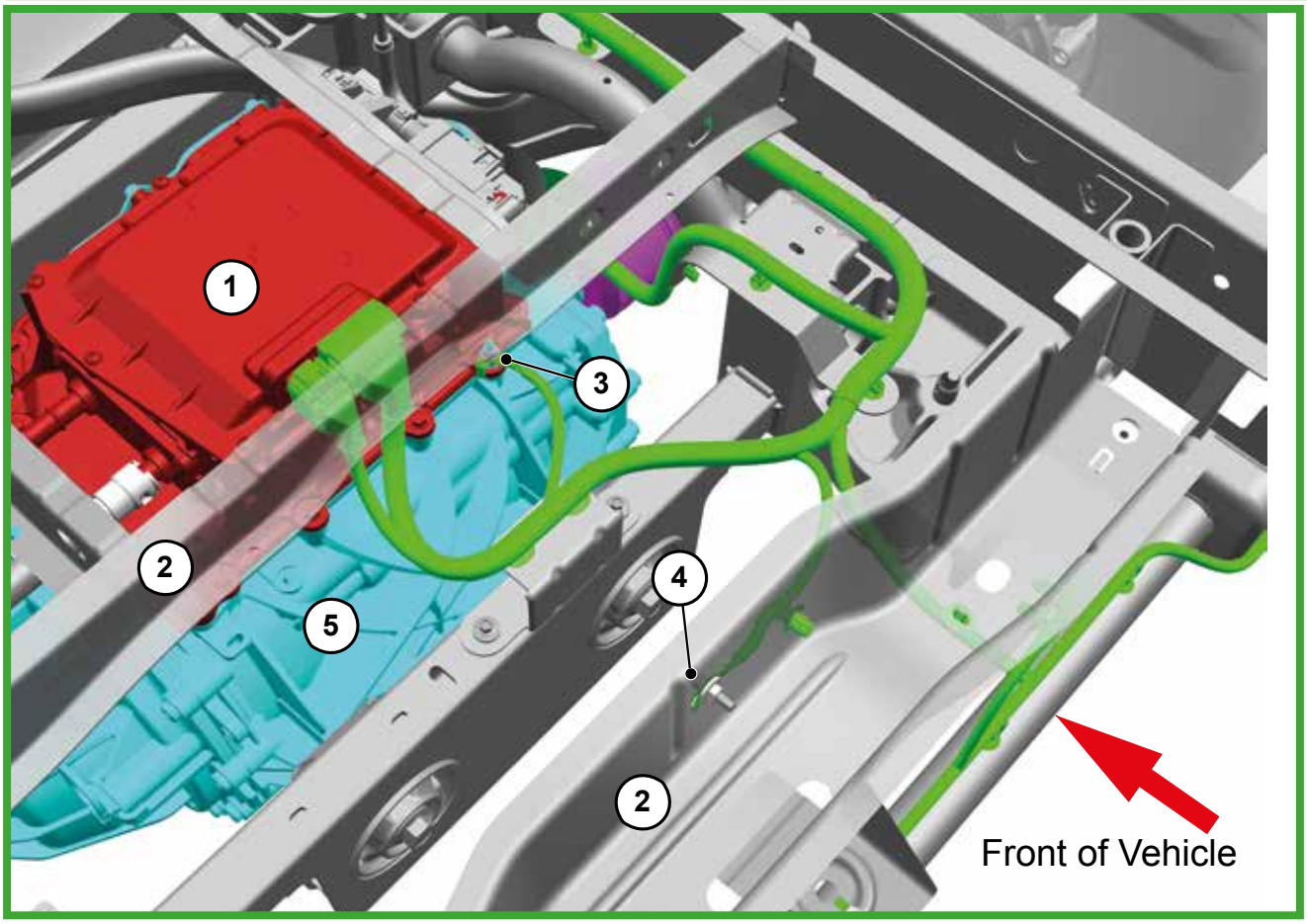
Cable Grounding: High Voltage Modules



Item	Description
1	Megabrace Ground Strap to Chassis
2	Electric A/C Compressor Grounding
3	HV Electric Heater Grounding
4	OBGI Ground Strap to Chassis
5	EDS Grounding to Megabrace for Electric A/C Compressor and HV Electric Heater

Abc = BEV Only Abc = ICE Only

Cable Grounding: Electric Drive Assembly

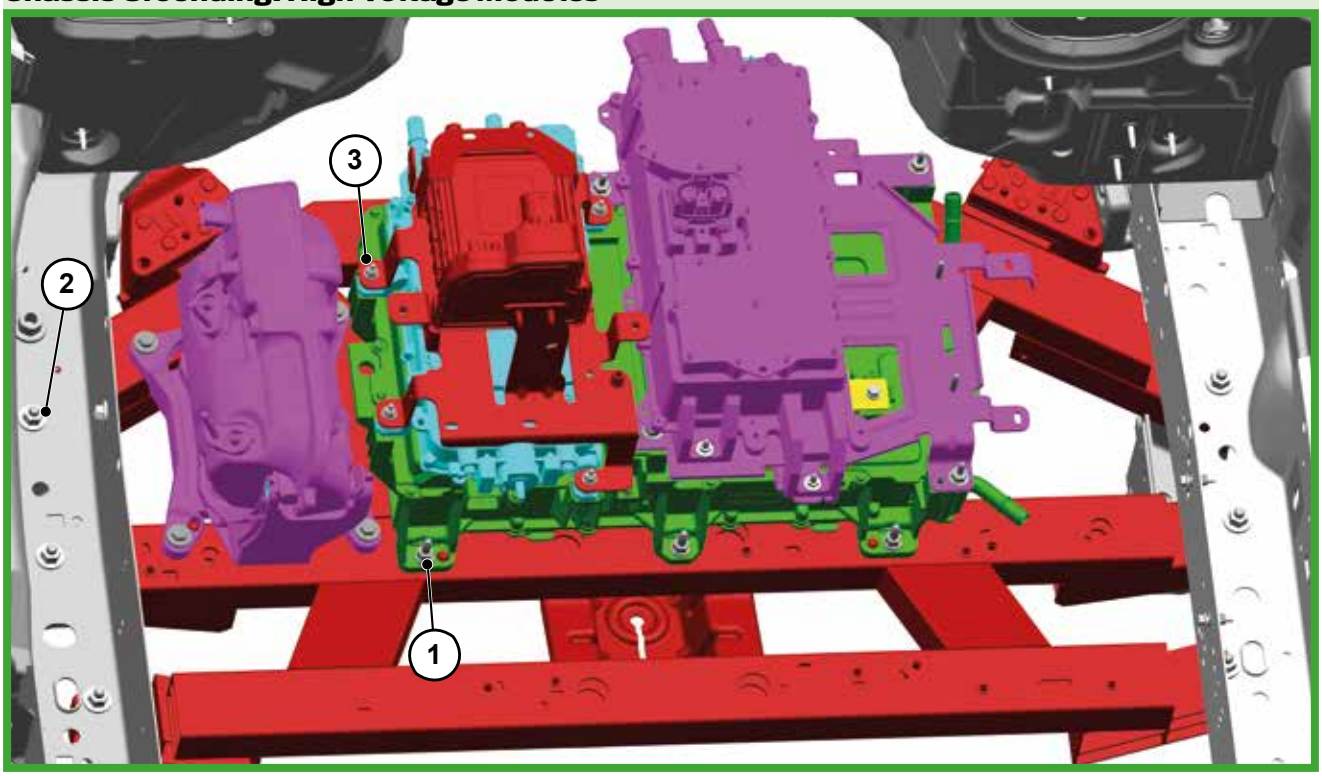


Item	Description
1	Inverter System Controller (ISC)
2	Chassis Crossmember
3	Inverter System Controller (ISC) to Electric Drive Unit
4	Inverter System Controller (ISC) to Chassis Crossmember
5	Electric Drive Unit

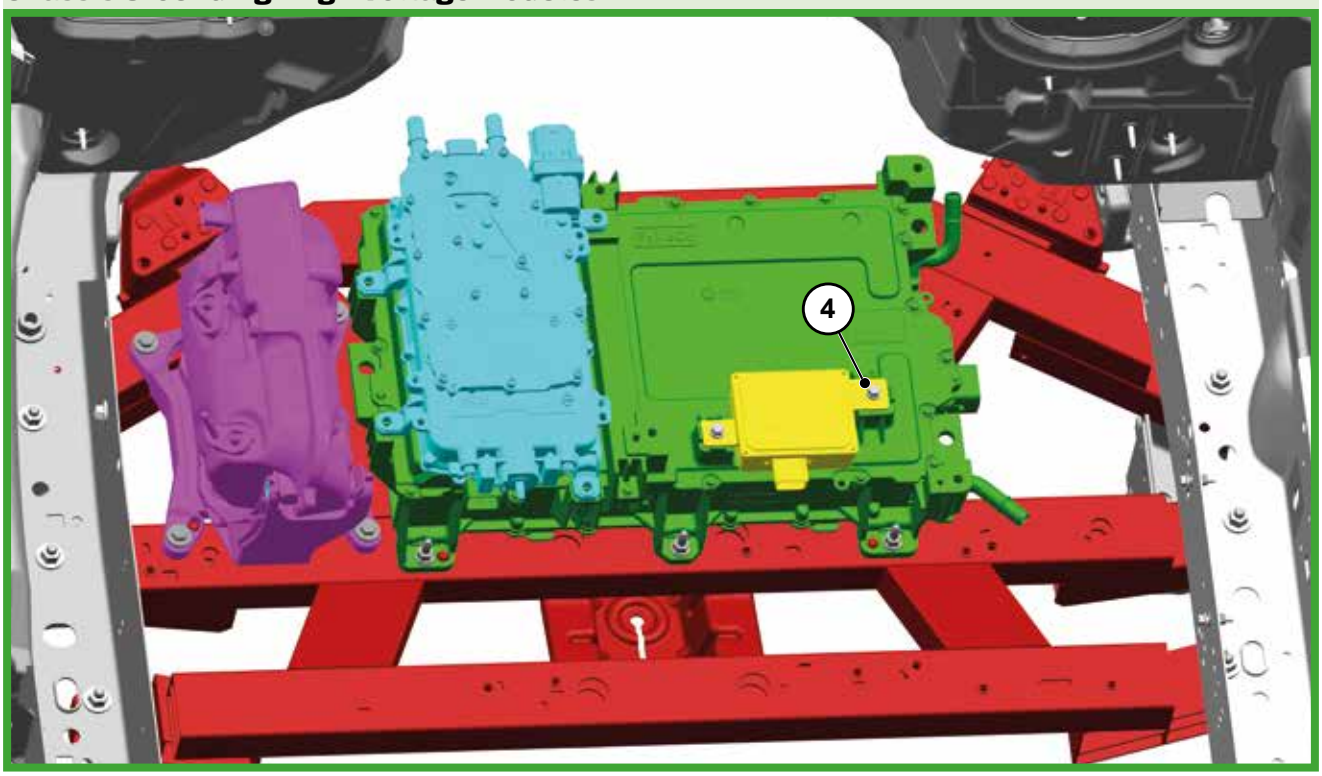
4.2.15 Precautionary Drill Zones - Chassis Grounding

WARNING: Do not modify locations/joints of the Electric Drive Assembly Ground Path from the Inverter System Controller to the Electric Drive Unit or Chassis Crossmember

Chassis Grounding: High Voltage Modules



Chassis Grounding: High Voltage Modules



Item	Description
1	High Voltage Charger to Megabrace - 6 Locations
2	Megabrace to Chassis - 6 Locations
3	DC-DC Convertor to HV Charger - 4 Locations
4	Off-Board Charger Control Module (OBCC) to HV Charger

Abc = BEV Only Abc = ICE Only

4.2.16 Precautionary Drill Zones — Rear Cargo Area

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

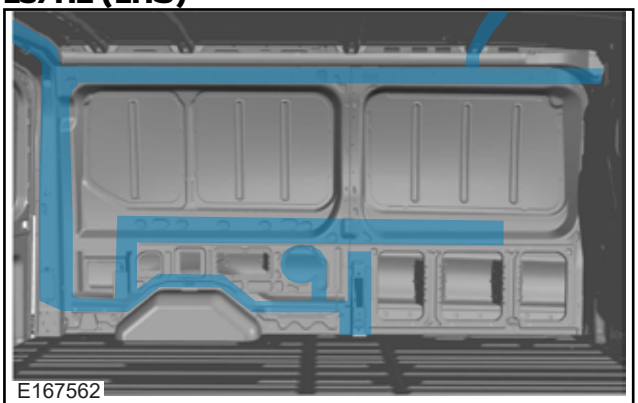
NOTE: Refer also to 5.12.2 B Pillar No Drill Zone for details of the restrictions in the area around the Seat Belt installation.

For vehicle wheelbase and roof height Refer to: 1.14 Package and Ergonomics
The areas marked in blue on figures E167561 - E167565 show the Precautionary Drill Zones for the rear cargo area where there is wire routing and 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. 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.

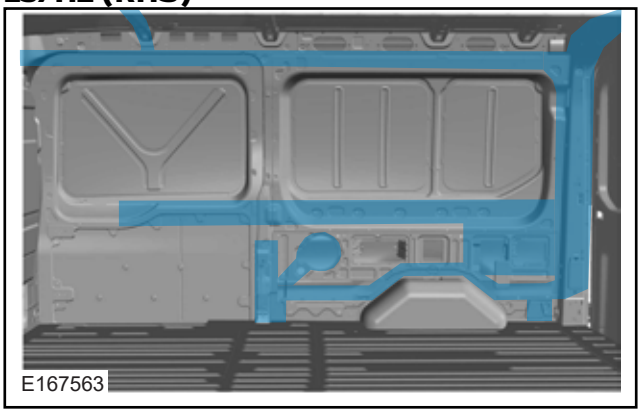
L2/H2 — Rear Cargo Doors


E167561

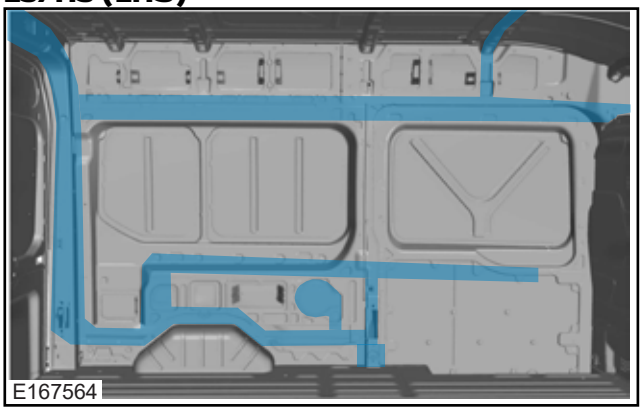
L3/H2 (LHS)


E167562

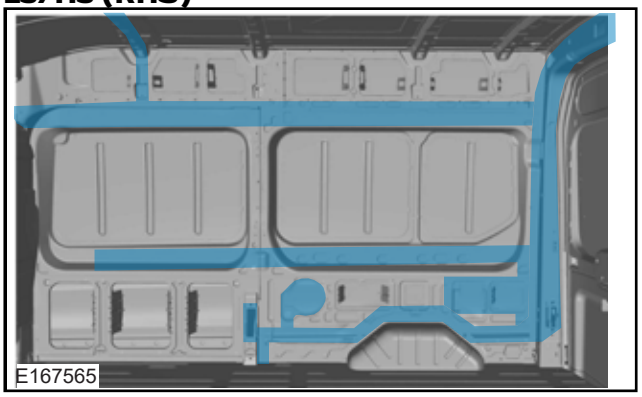
L3/H2 (RHS)


E167563

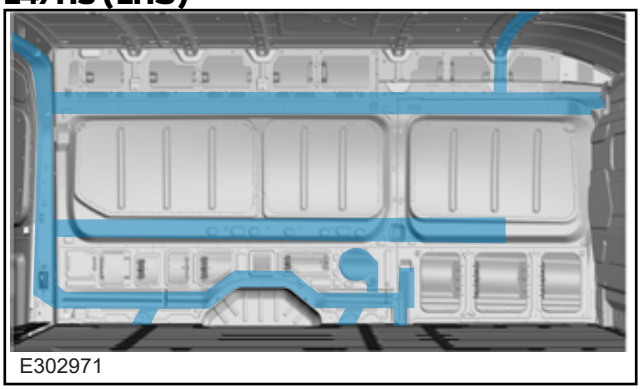
L3/H3 (LHS)


E167564

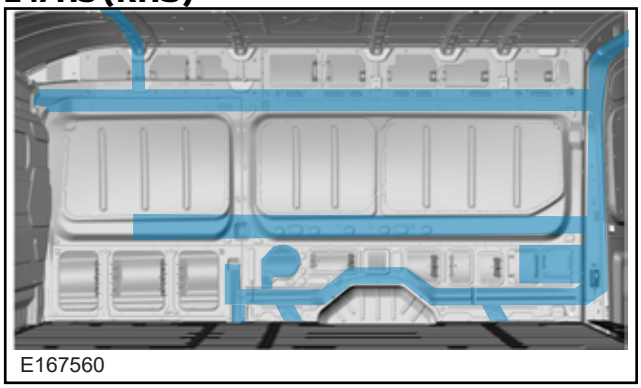
L3/H3 (RHS)


E167565

L4/H3 (LHS)


E302971

L4/H3 (RHS)



E167560

Refer to: 5.1 Body Precautionary Drill Zones
Refer to: 5.4 Loadspace Load Compartment Tie Downs
Refer to: 5.3 Racking Systems
Refer to: 5.6 Body Closures No Drill Zones – Closures

4.2.17 Trailer Tow Electrics (A055)

NOTE: Fix over length of the wiring on a secure area of the vehicle.

NOTE: The 12V socket bracket can stay in its original position when the socket is mounted in a different location.

Figure E236337 shows the routing for the Trailer Tow Electric Wiring Kit (A055) without a tow bar and the recommended wiring routing and wiring clip positions if a tow bar will be retrofitted.

4.2.18 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, 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 legal 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 92) 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.

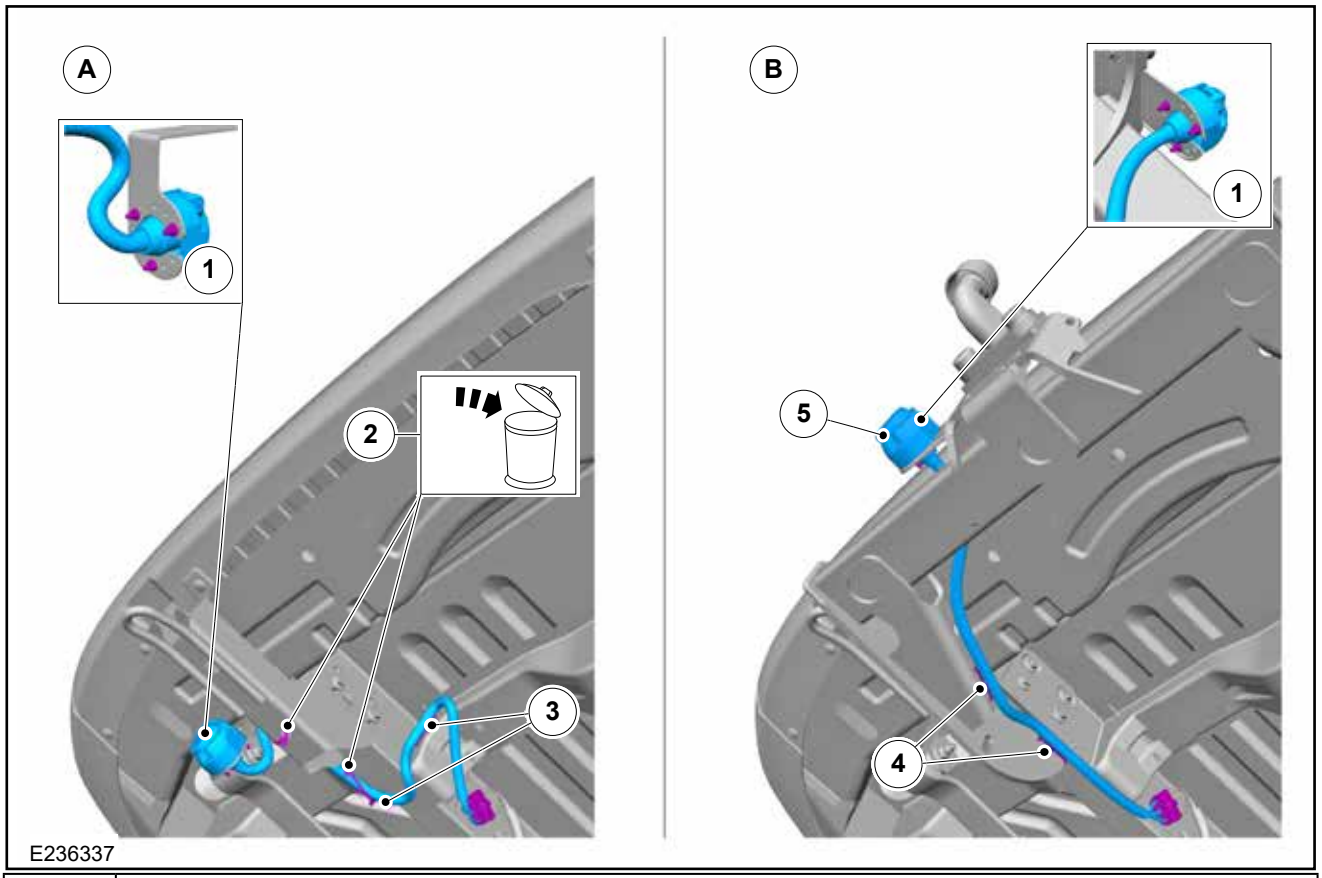
The maximum total current is 30A of all circuits. If this is exceeded the battery charge output is switched off.

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

Abc = BEV Only Abc = ICE Only

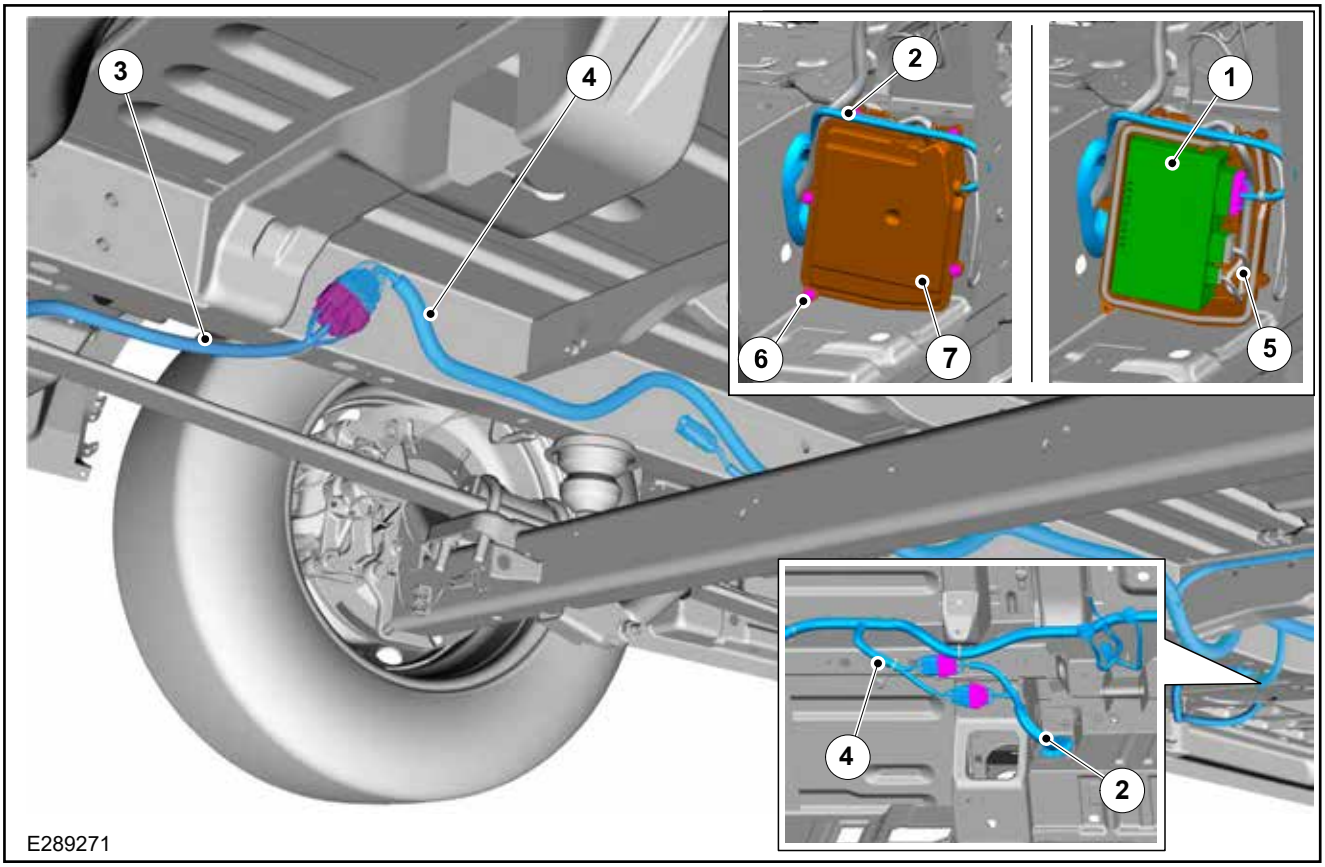
Electrics for Tow Bar



Item	Description
A	Trailer Tow Electric Wiring Kit without a Tow Bar
B	Rerouted Trailer Tow Electric Wiring Kit with a Tow Bar Retrofitted
1	3x Screw for 12V Socket
2	Cable Ties 2x
3	Wiring clips 2x
4	Recommended Wiring Clip Position 2x
5	Recommended 12V Socket Position

Abc = BEV Only Abc = ICE Only

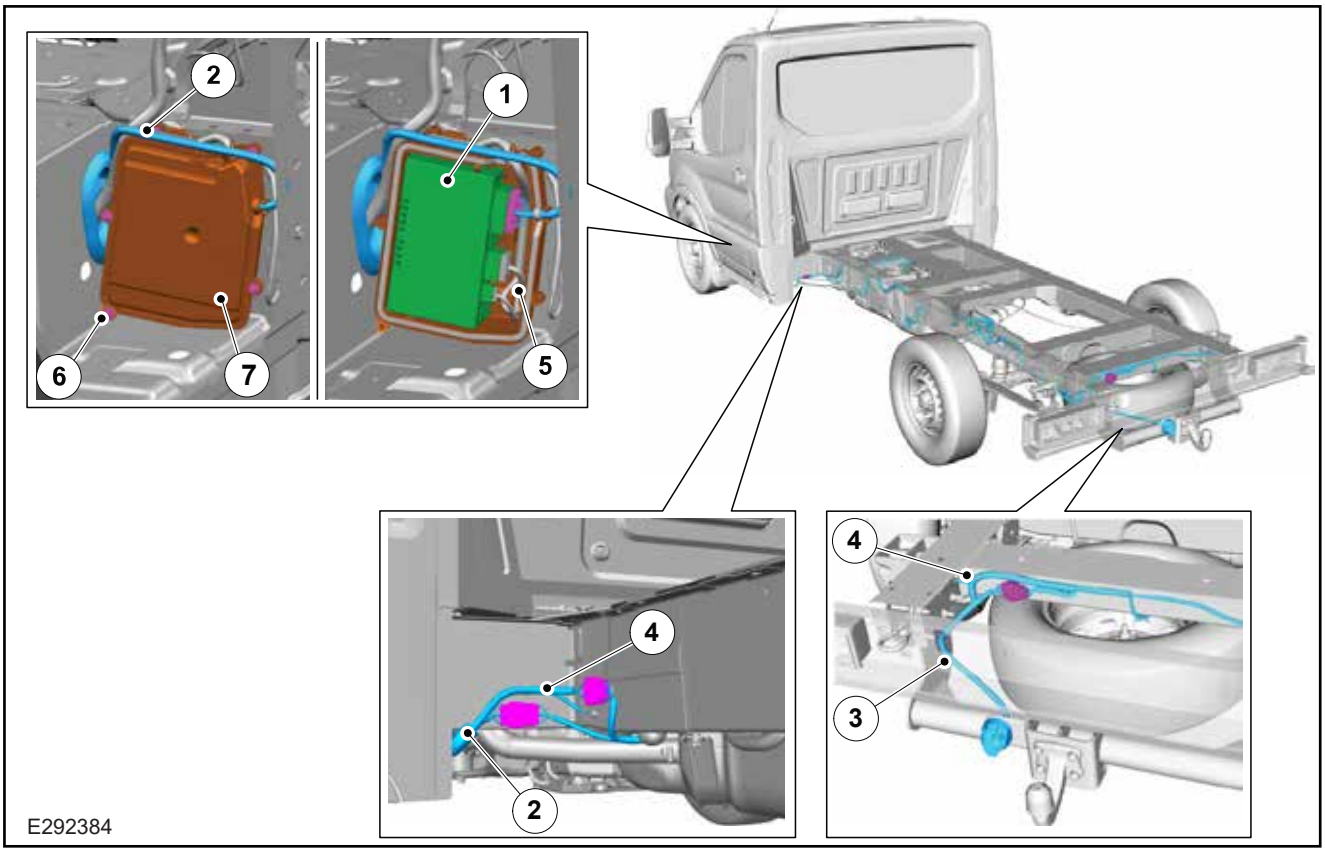
Trailer Tow Module and Harnesses - Van, Bus and Kombi Vehicles



Item	Description	Part Number
1	Trailer Tow Module	DG9T-19H517-AJ
2	Trailer Tow Jumper (with Trailer Tow Module connector 'A' see figure E185972)	KK2T-14D469-A*
3	Trailer Tow Socket Jumper - Europe	BK2T-13B576-D*
	Trailer Tow Socket Jumper - Australia and New Zealand	AMBK3J-15A416-A*
4	Underbody Harness	KK2T-14406-**
5	Main Harness (with Trailer Tow Module connectors 'B' and 'C' see figure E185972)	KK2T-14401-**
6	Screws (x5)	W720357
7	Trailer Tow Module Box	LK4T-14D054-A*

Abc = BEV Only Abc = ICE Only

Trailer Tow Module and Harnesses - Chassis Cab Vehicles



Item	Description	Part Number
1	Trailer Tow Module	DG9T-19H517-AJ
2	Trailer Tow Jumper (with Trailer Tow Module connector 'A' see figure E185972)	KK2T-14D469-A*
3	Trailer Tow Socket Jumper	BK3T-13B576-G*
4	Fuel Tank Harness	GK3T-14406-E*
5	Main Harness (with Trailer Tow Module connectors 'B' and 'C' see figure E185972)	GK3T-14401-**
6	Screws (x5)	W720357
7	Trailer Tow Module Box	LK4T-14D054-A*

4.2.19 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 Conversionworks@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

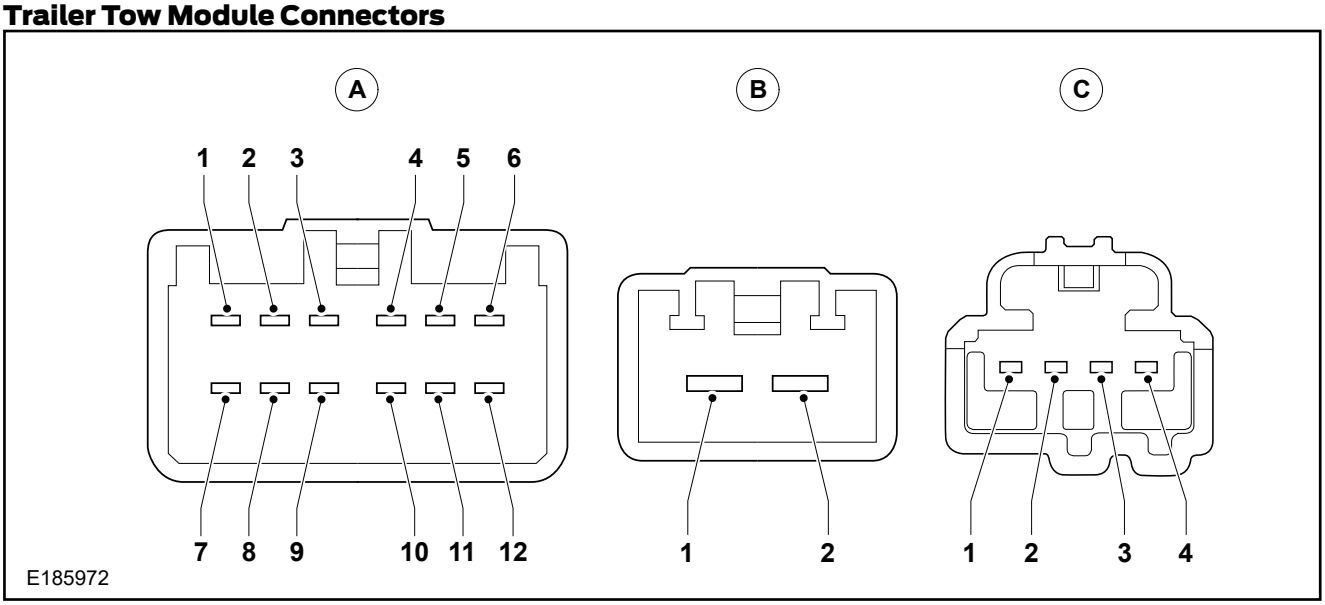
Abc = BEV Only Abc = ICE Only

Trailer Tow Module Connectors (Figure E185972)

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	Position Lamp	5.3	8.6	8	19.0
4	Not used	-	-	-	-
5	Reversing Lamp	3.1	5.0	8	19.0
6	Battery Charge	13.0	15.0	8	16.0
7	Stop Lamp	3.1	11.0	8	19.0
8	Rear Fog Lamp	1.7	2.2	9.5	16.0
9	Not used	-	-	-	-
10	Not used	-	-	-	-
11	Not used	-	-	-	-
12	Not used	-	-	-	-
Connector B					
1	KL30	19.9	27.6	8	19
2	Battery Charge Feed KL30	12	12	8	16
Connector C					
1	Ground	0.5	0.5	8	19
2	MS CAN L	0.1	0.1	5	5
3	MS CAN H	0.1	0.1	5	5
4	Trailer Parameter Alarm	0.01	0.013	8	19

The electrical system on the vehicle is suitable for towing trailer with LED lights.

Trailer Tow Module Connectors



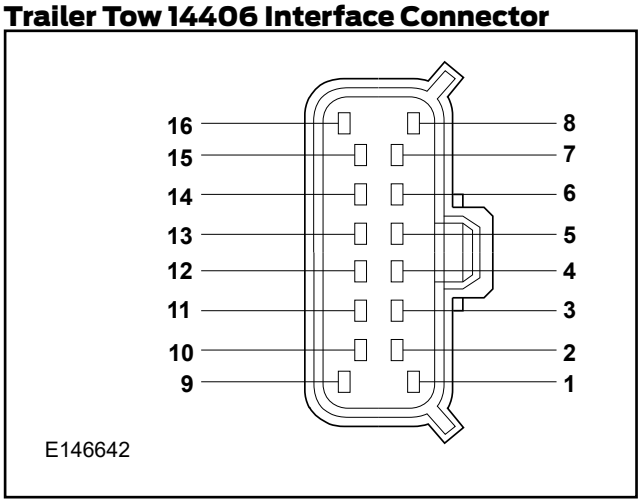
Abc = BEV Only Abc = ICE Only

Trailer Tow Connectivity 13 Pin Socket

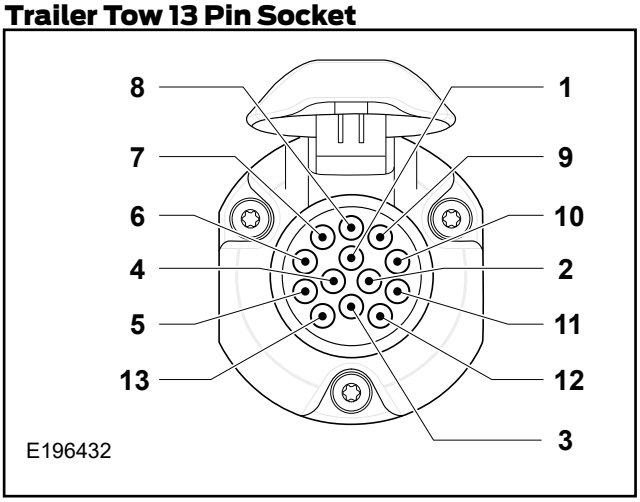
14406 Trailer Tow Connector		13 Pin Trailer Tow Connector	
Pin	**Colour**	**Pin**	**Description**
3	Yellow	1	Left Turn Lamp
5	Grey/Orange	2	Fog
1	Black/Violet	3	Lamp Ground
6	Green	4	Right Turn Lamp
13	Brown	5	Right Position Lamp
12	Red	6	Stop Lamps
14	Brown	7	Left Position Lamp License Lamp
11	Grey/Brown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



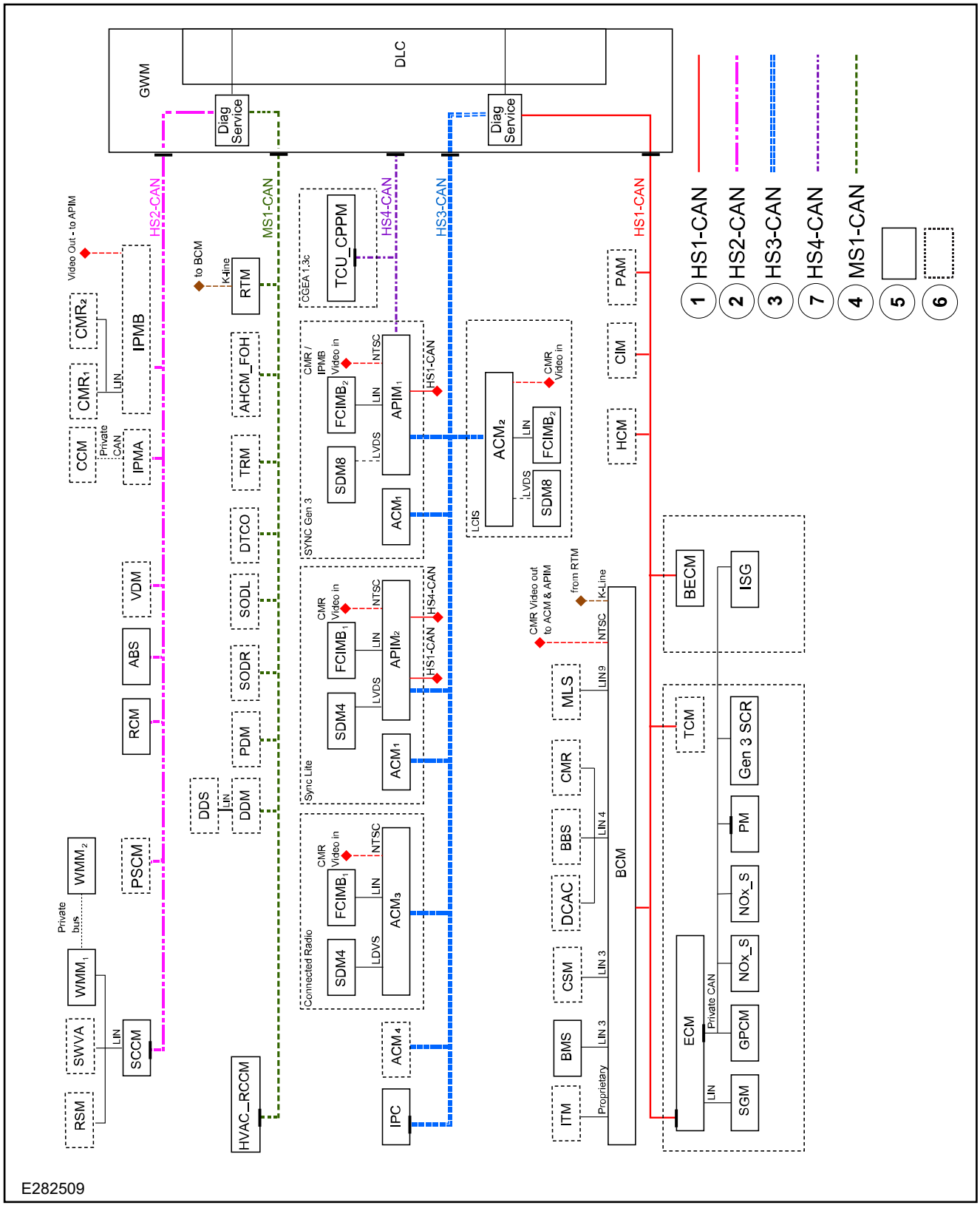
4.3 Communications Network

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.

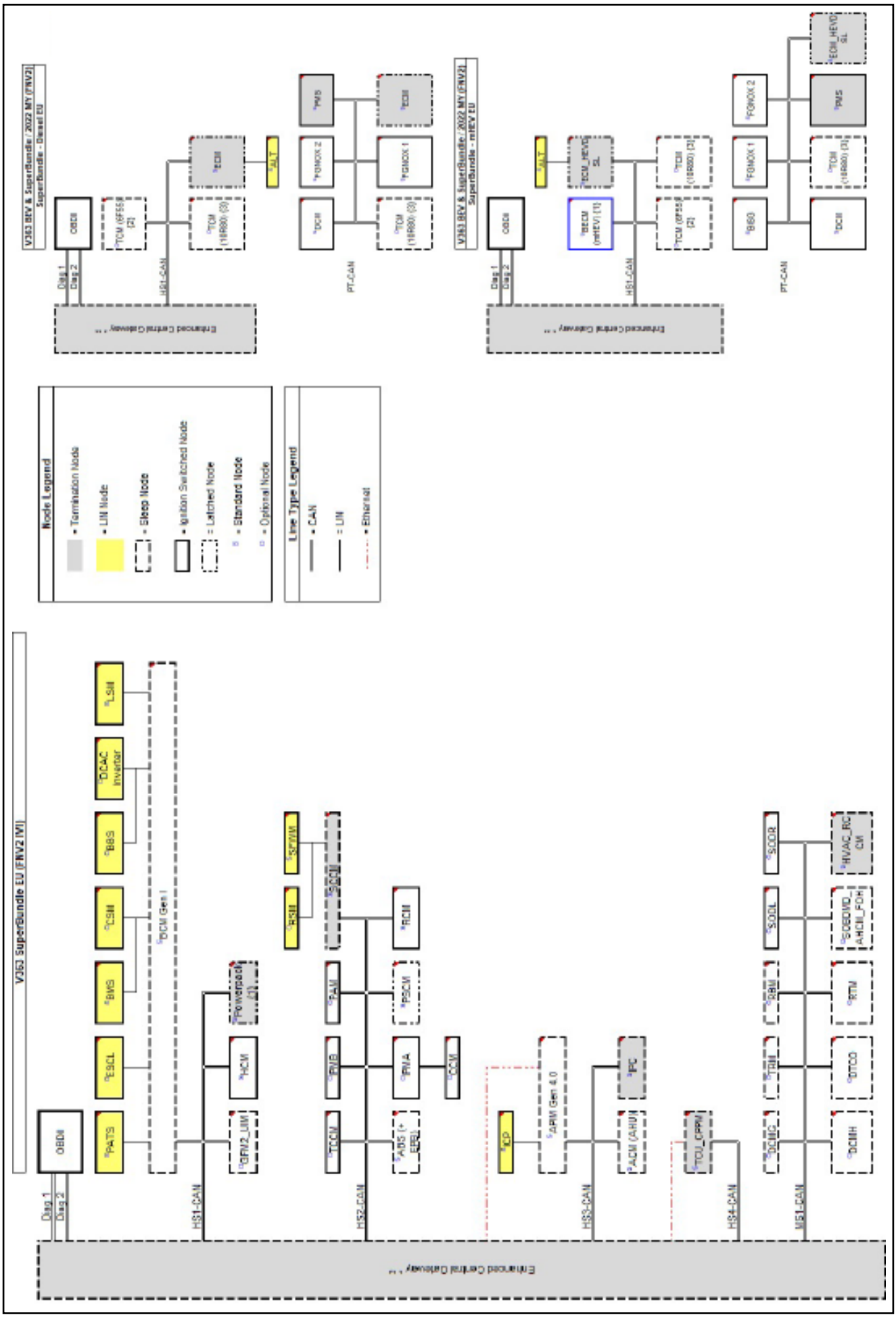
CAN, Controller Area Network, uses propriety message sets to communicate between the devices shown, via Medium Speed (MS), High Speed (HS), Private and Public Buses. In addition, there is localised application of Local Interconnect Network (LIN) and ISO 9141 K-line serial links.

CAN-Bus System, Non-SYNC 4 (smaller touch screen)



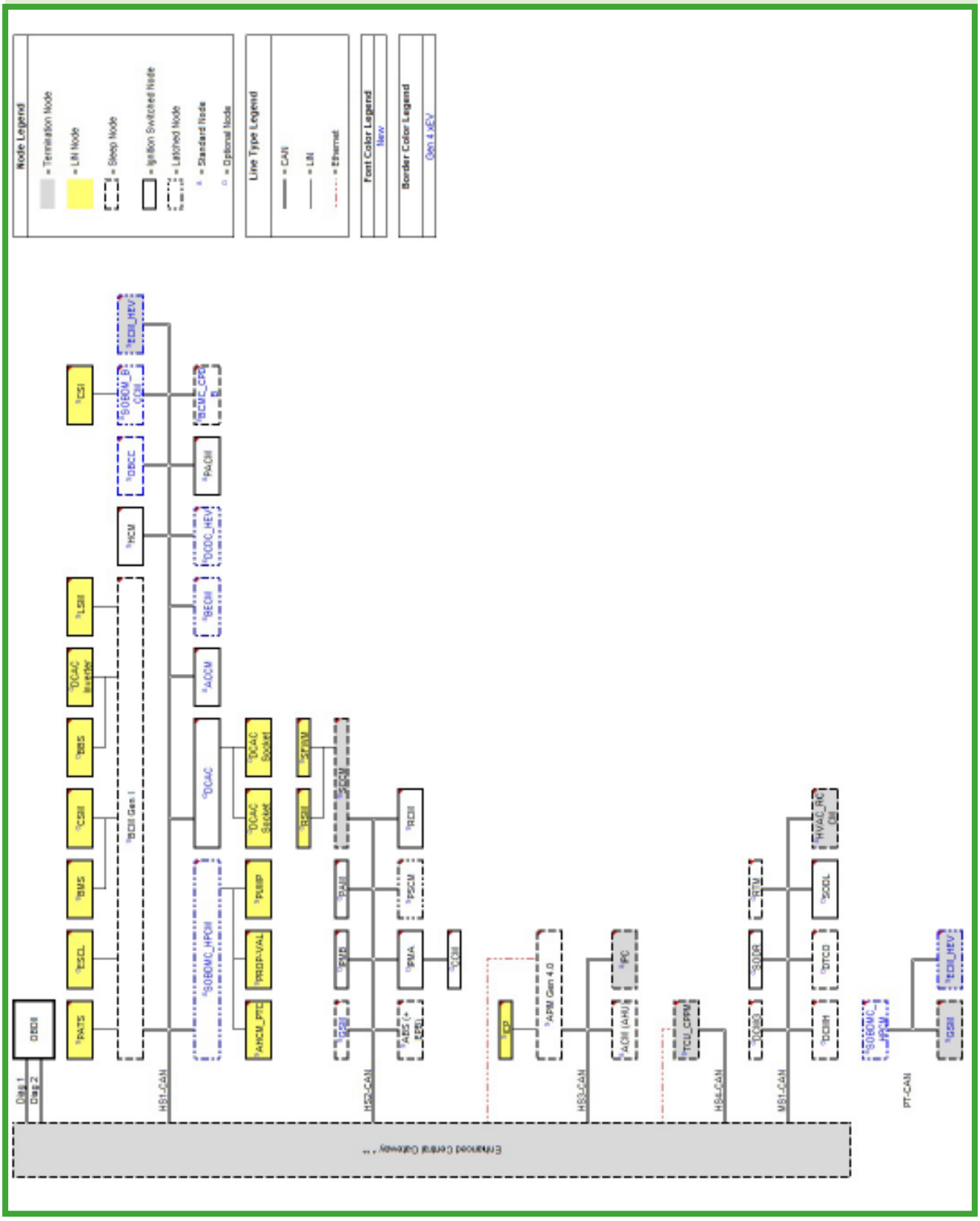
Abc = BEV Only Abc = ICE Only

CAN-Bus System, SYNC 4 (12" touch screen)



Abc = BEV Only Abc = ICE Only

CAN-Bus System, eTransit BEV



Abc = BEV Only Abc = ICE Only

Communication Network System (Figure E282509 references)

Item	Description
1	HS1-CAN - High Speed 1 - CAN(1)
2	HS2-CAN - High Speed 2 - CAN(1)
3	HS3-CAN - High Speed 3 - CAN(1)
4	MS1-CAN -Medium Speed 1 - CAN(2)
5	Standard ECU
6	Optional ECU
7	HS4-CAN - High Speed 4 - CAN(1)
ABS	Anti-Lock Brake System Control Module
ACM_1	Audio Control Module (SYNC Radio)
ACM_2	Audio Control Module (LCIS Radio)
ACM_3	Audio Control Module ('Connected' Radio)
ACM_4	Audio Control Module (1 DIN Radio)
AHCM_ FOH	Auxiliary Heater Control Module _ Fuel Operated Heater
$APIM_1$	Auxiliary Protocol Interface Module (Gen 3 Sync)
$APIM_2$	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	Converter Interface Module
CMR_1	Camera Module (Rear)
CMR_2	Camera Module (Front)
CSM	Combined Sensor Module (Interior Motion Detect & Tilt Sensor)
DCAC	Direct Current to Alternating 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
$FCIMB_1$	Front Control Interface Module (10 Button)
$FCIMB_2$	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
PAM	Parking Aid Module
PDM	Passenger Door Module
PM	Particulate Matter Sensor
PSCM	Power Steering Control Module
RCM	Restraints Control Module

Item	Description
RSM	Rain Sensing Module
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

Item	Description
SODR	Side Obstacle Detection Control Module Right
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_1	Wiper Motor Module (Master)
WMM_2	Wiper Motor Module (Slave)

(1)500kb/s (kilobits per second)
(2)125kb/s (kilobits per second)

4.3.2 Body Control Module (BCM)

WARNINGS:

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

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

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

BCM Location - Left Hand Drive

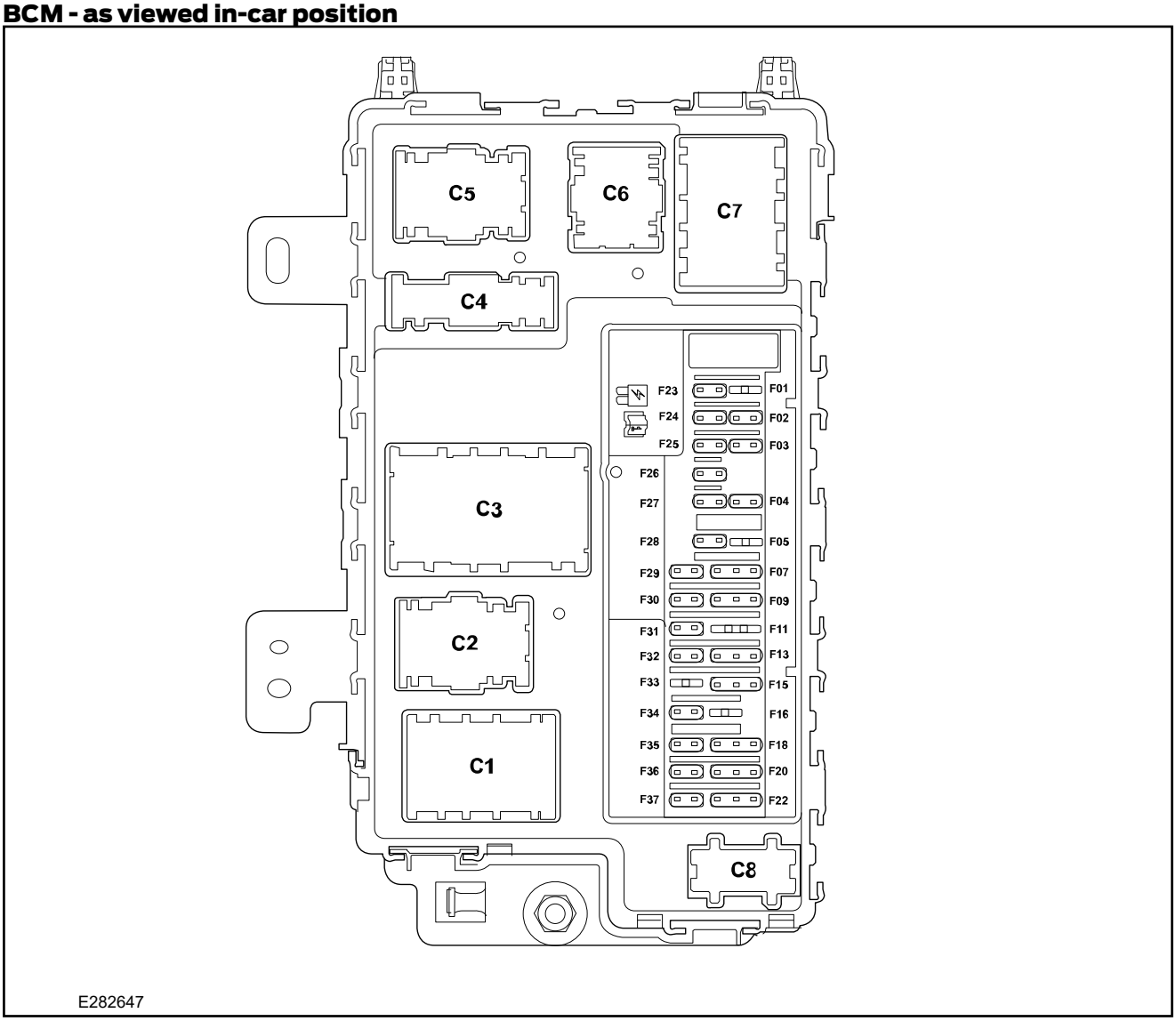


Abc = BEV Only Abc = ICE Only

BCM Location - Right Hand Drive



BCM - as viewed in-car position



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

Abc = BEV Only Abc = ICE Only

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 (1)
Dipped Beam Right	High Side PWM or DC for HID Relay	Bulb/HID (via Relay)	55W	Output Shutdown (1)
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 (configur- able 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 Mechan- ical 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.

(1) BCM does NOT support HID directly Driven. HID MUST use relays.

4.4 LV Charging System (12 V)

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 Conversionworks@ford.com

4.4.1 General Information

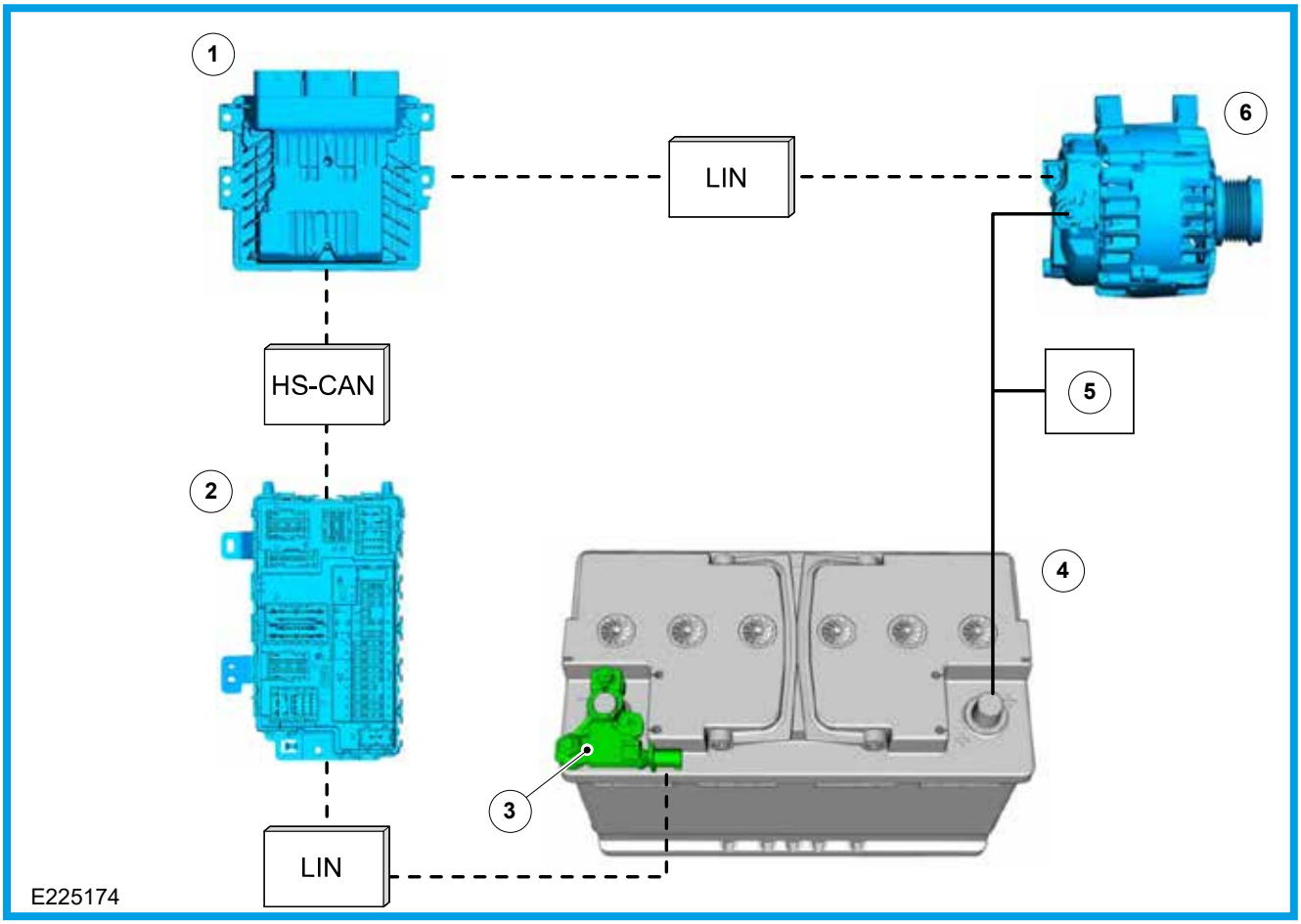
The battery capacity, technology and charge available from the alternator must be adequate to ensure engine cranking in unfavourable climatic conditions, even after fitment of additional electrical equipment.

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: 4.6 Battery Systems

4.4.2 LV Charging System Layout

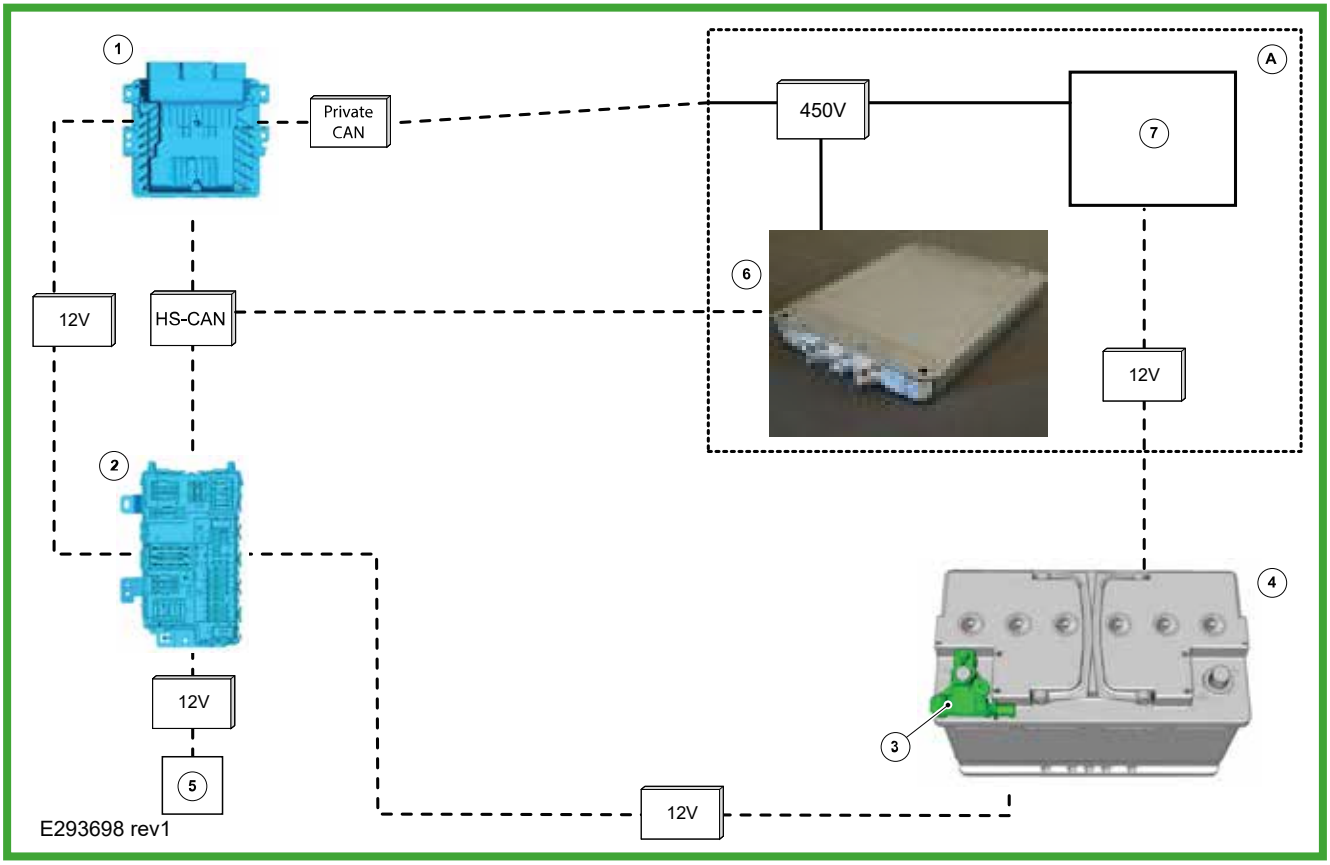
Alternator-Based System Diagram



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

Abc = BEV Only Abc = ICE Only

BEV System Diagram



Item	Description	Item	Description
1	Power Control Module (PCM) or Engine Control Module (ECM)	5	Electrical Consumers
2	Body Control Module (BCM)	6	High Voltage Battery Module
3	Battery Monitoring Sensor (BMS)	7	DC-DC Converter
4	Battery	A	BECM

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 >40ºC. 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.

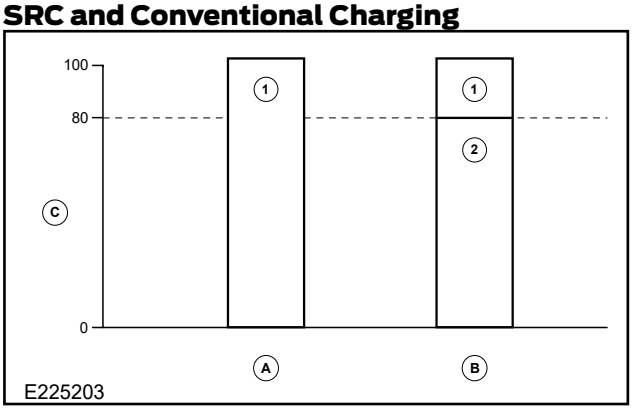
For further information on Start-Stop
Refer to: 4.11 Electronic Engine Controls

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: 4.11 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 converter.

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.

Abc = BEV Only Abc = ICE Only

This may be required for converters 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.

For additional information Refer to: 4.7 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: 4.7 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 10-way Vehicle Interface Connector in the driver's seat pedestal.
  - Interface Connector pin 3 available on all Non Camper variants.
- Pre-installed as part of a Camper Donor vehicle (C9)
  - 15-way camper connector pin 14
- Pre-installed as part of the High Specification Vehicle Interface Connector (A608).
- A mating 43 way connector with one metre of wiring (connector including circuits 1-22, with 22 loose wires with terminals), is available as kit (KK2Z-14A411-Y). An additional kit (less connector including circuits 23-43, with 20 loose wires with terminals) is available as kit (KK2Z-14A411-Z) from your local Ford dealer. For information on High Specification Vehicle Interface Connector , please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at conversionworks@ford.com
- High Specification Interface Connector (A608) pin 23
- Feature included in the Ford Programmable Battery Guard (A540) – 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: 4.7 Battery Protection
Refer to: 4.25 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: 4.7 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 and third party loads active at the same time where the battery voltage should not go below 13V. This will ensure that the DC/DC is not overloaded, extra batteries are charged and correct system functionality is maintained. Third Party High Power Mode [TPHPM] is recommended to be utilised to ensure the highest power mode..

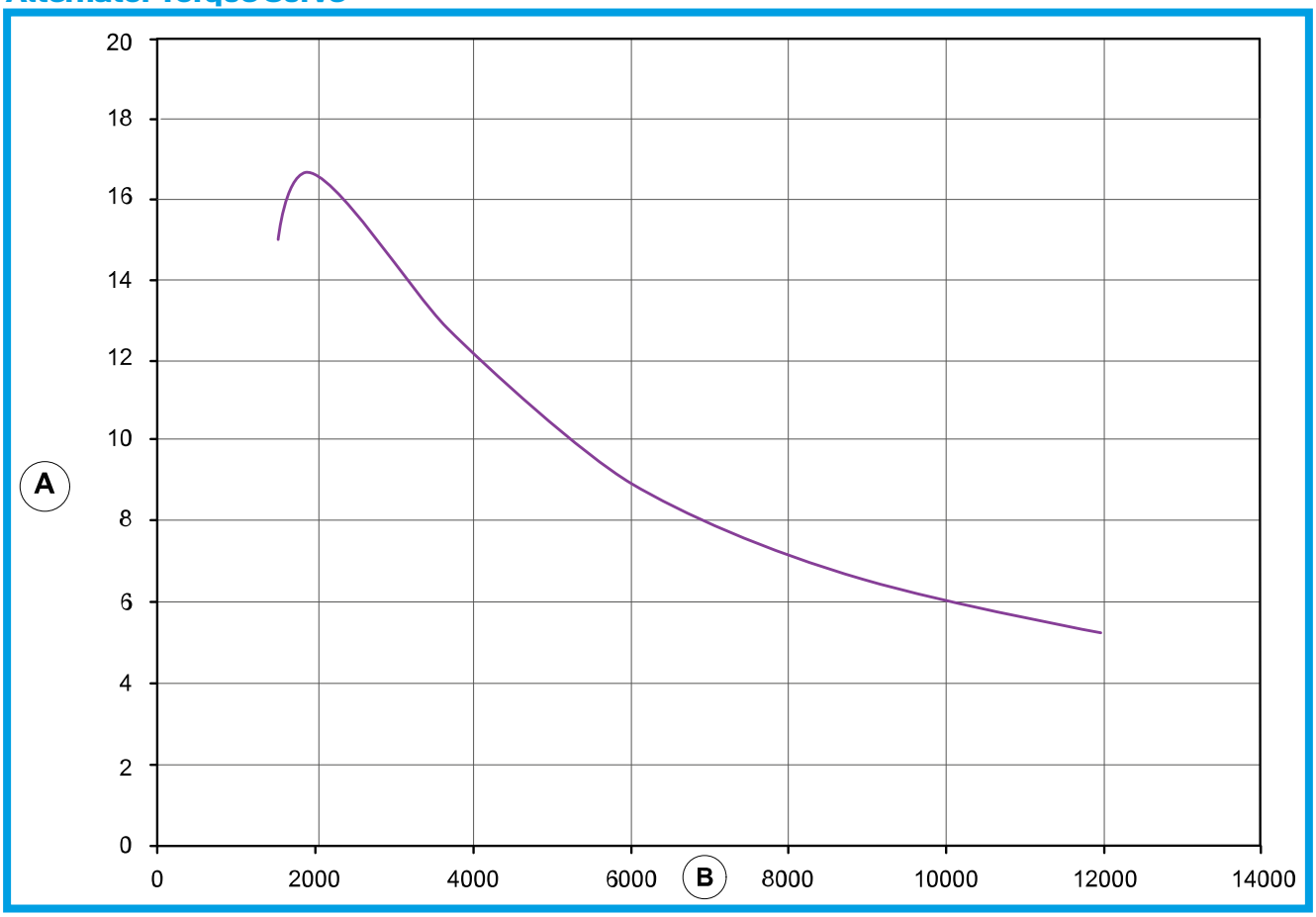
4.4.8 Circuit Diagrams

For circuit diagrams for Auxiliary Fuse Panel connections and standard Ford relays.

Refer to: 4.25 Electrical Connectors and Connections
Refer to: 4.23 Fuses and Relays

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

Alternator Torque Curve



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

Abc = BEV Only Abc = ICE Only

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.

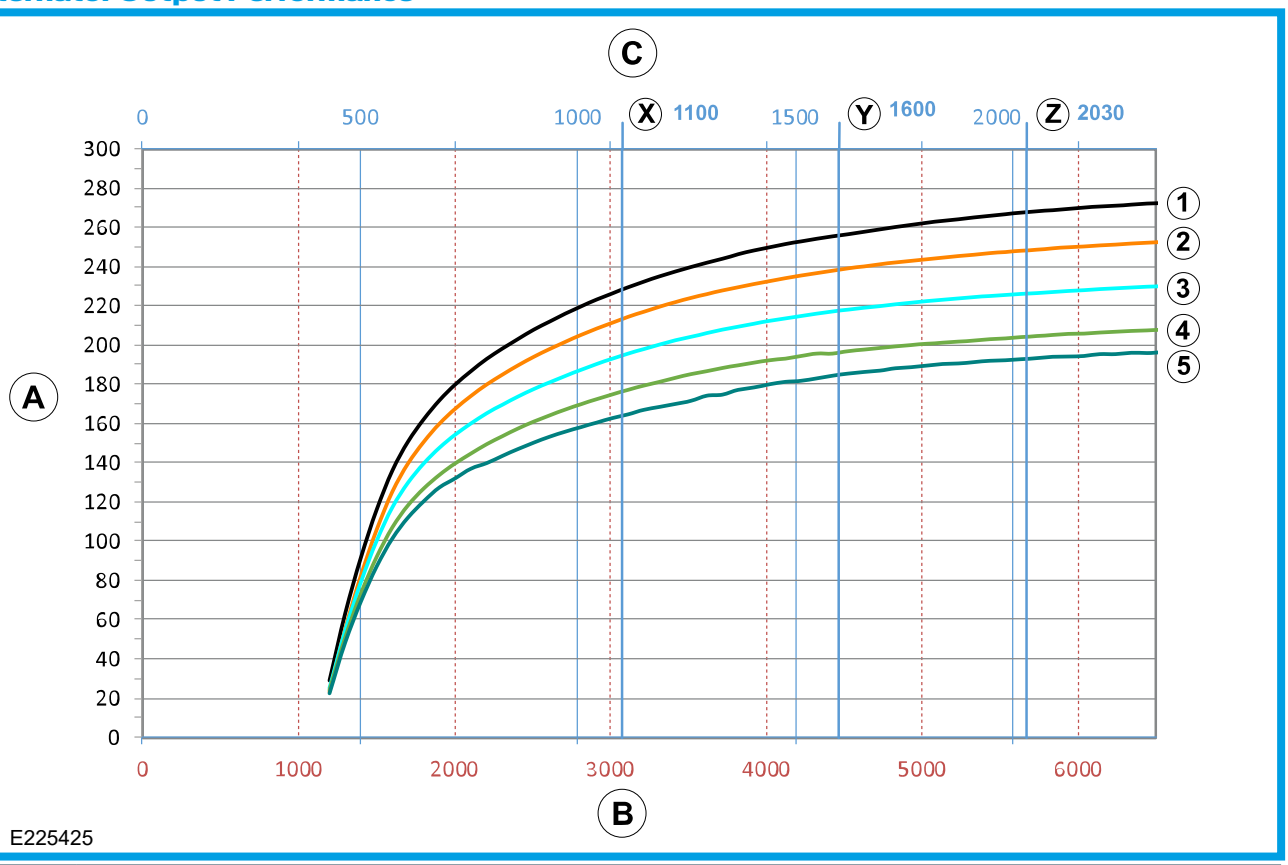
NOTE: If the engine is running for long periods, assume the hotter temperatures apply.

The alternator performance curves show the Engine RPM speed control option (A003) 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 (A540) which will auto range or return to base idle depending on third party power requirements.

Refer to: 4.7 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.

Alternator Output Performance



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 Mild Hybrid Charging System

WARNINGS:

The MHEV system cannot be used for vehicle conversions.

Do not remove, open, repair or modify the 48V battery pack. The MHEV system is a 48V system separate from the main 12V electrical system. The 48V battery is located in the passenger seat pedestal.

CAUTION: MHEV vehicles have a Belt Integrated Starter Generator (BISG) instead of an alternator. Do not remove, open, repair or modify the BISG.

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 Conversionworks@ford.com

4.5.1 General Information

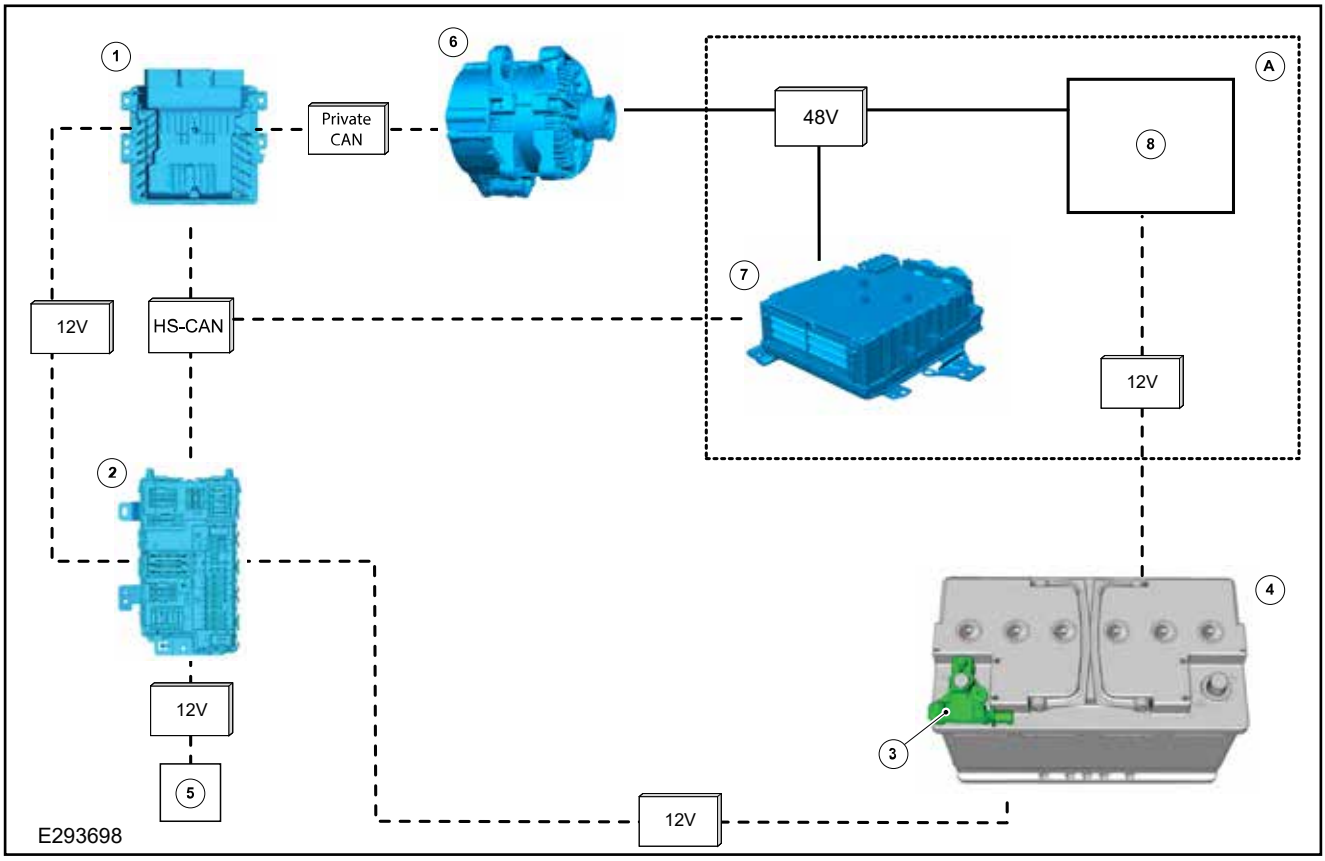
The Belt Integrated Starter Generator (BISG) serves as the generator. The BISG can also act as a motor to restart the engine during Start-Stop operation, and to give torque assistance. The BISG is connected to the Battery Energy Control Module (BECM) by a special 48V circuit.

Do not connect anything to the BISG wiring. The low voltage power supply for the vehicle's electrical system comes from the low voltage (12V) output of the DC/DC converter which is part of the BECM.

The voltage of the wiring between the BISG and the BECM is 48V. The 12V system is supplied from a 3kW DC/DC converter within the BECM, not directly from the generator.

4.5.2 MHEV 48V System Operation and Component Description

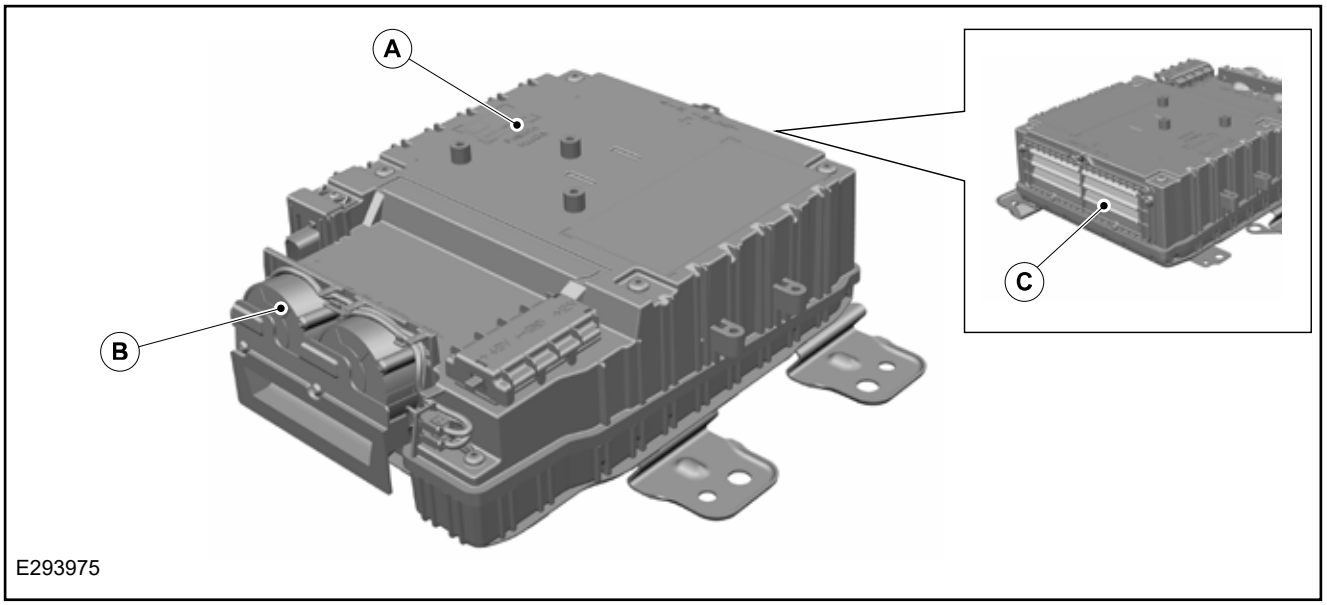
System Diagram



Item	Description	Item	Description
1	Power Control Module (PCM) or Engine Control Module (ECM)	6	48V Generator
2	Body Control Module (BCM)	7	48V Battery
3	Battery Monitoring Sensor (BMS)	8	DC/DC Converter
4	Battery	A	BECM (located in the passenger seat pedestal)
5	Electrical Consumers		

Abc = BEV Only Abc = ICE Only

MHEV 48V Battery - Driver Seat Pedestal



Item	Description
A	Cover
B	Dual Fan Air Outlet
C	Air inlet Louvre

4.5.3 48V Battery Pack

WARNINGS:

The 48V Battery must not be removed, opened, repaired or modified in any way during the conversion process.

Do not perform any vehicle modifications that fully or partially block the air inlet or outlet of battery.

Do not electronically or mechanically connect any third party accessories to the 48V battery.

NOTE: Any service or replacement of the 48V battery must be performed by an authorised Ford dealer.

Only persons with appropriate training should be allowed to handle 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.

4.5.4 System Operation - Smart Charging (SC)

12V battery charging is controlled by the DC/DC converter within the 48V battery, instead of the alternator.

The output voltage and power of the 48V battery are dependent upon the vehicle electrical loads, 12V battery State of Charge (SOC), 12V battery temperature, 48V battery SOC and BISG output. The 48V Battery output voltage is effectively independent of engine speed and Start-Stop status during normal operation.

The output voltage at of the DC/DC converter varies between 12.50V and 15.25V.

If the 12V battery is below about 83% SOC, the DC/DC output voltage will be in the region of 13.5V to 15.25V. Once the 12V battery reaches above 83% SOC, the DC/DC output voltage will drop to about 12.50V to 13.5V.

4.5.5 Smart Charging Override

MHEV smart charging is not influenced by the Start-Stop inhibit button, unlike alternator based charging.

4.5.6 Third Party High Power Mode

WARNINGS:

The Third Party High Power mode can inhibit engine shutdown (AEIS) which is safety procedure designed to protect against carbon monoxide (CO) poisoning. CO can accumulate to dangerous levels from engines running in confined spaces and can cause harm or death. 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 at 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 Vehicle Converter.

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.

Introduction

Third Party High Power mode has only one input that can affect all the following features. It can be configured by dealer to have a selective effect. Ford may restrict feature availability, in certain markets.

- SC inhibit – sets Conventional Charging
- Start-Stop inhibit
- Automatic Engine Idle Shutdown (AEIS) inhibit
- At engine off, inhibit of the timeout of the standard battery guard (SBG)

Examples of when to not switch to Third Party High Power mode include in a normal drive cycle when no extra loads are active. Solutions should only be 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.

SC Inhibit - Conventional Charging

This may be required for Vehicle Converters 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.

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, in case the engine is off.

Refer to: 4.7 Battery Protection

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 10-way Vehicle Interface Connector in the driver's seat pedestal.
  - Interface Connector pin 3 – available on all Non Camper variants.
- Pre-installed as part of a Camper Donor vehicle (C9)
  - 15-way camper connector pin 14
- Pre-installed as part of the High Specification Vehicle Interface Connector (A608).
  - A mating 43 way connector with one metre of wiring (connector including circuits 1-22, with 22 loose wires with terminals), is available as kit (KK2Z-14A411-Y). An additional kit (less connector including circuits 23-43, with 20 loose wires with terminals) is available as kit (KK2Z-14A411-Z) from your local Ford dealer. For information on High Specification Vehicle Interface Connector , please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at conversionworks@ford.com
  - High Specification Interface Connector (A608) pin 23.
- Feature included in the Ford Programmable Battery Guard (A540) – 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

Refer to: 4.7 Battery Protection
Refer to: 4.25 Electrical Connectors and Connections

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

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

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: SC Inhibit, Charging Mode Control

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

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 SC 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. Remove the ground and check voltage level returns to the original level measured in Step 2. SC is active

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

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

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 beyond 30 minutes
4. Check that normal AEIS behavior 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

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.

1. Establish the preset timer of a the 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: 4.7 Battery Protection

4.5.7 Vehicle Electrical Capacity

The MHEV vehicle does not have a conventional alternator. The 12V system is supplied by a DC/DC converter, integrated into the BECM under the front passenger seat, which replaces the function of the alternator.

4.5.8 Charge Balance Guidelines

The maximum DC/DC converter output is 3kW/223A. This is a 'constant power' device so the 12V supply current may vary with voltage. The output current may be further limited under certain conditions.

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 system is not overloaded, extra batteries are charged and correct system functionality is maintained. SC override is recommended to ensure the DC/DC is in full power mode. Increased performance can be achieved by elevating the idle, utilising the engine RPM control option (A003).

4.5.9 Circuit Diagrams

For circuit diagrams for Auxiliary Fuse Panel connections and standard Ford relays.

Refer to: 4.25 Electrical Connectors and Connections
Refer to: 4.23 Fuses and Relays

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

4.6 Battery Systems

WARNING: For electrical Power Take Off (PTO) that requires deep discharge and cycling from third party systems, High Performance Deep Cycle AGM batteries (OW5 or A739) must be ordered on the base vehicle. For more information, refer to 'Power and Connectivity Usage Recommendations' table later in the section. If option OW5 or A739 is not on the base vehicle they can be fitted by your local Ford Dealer. See table in Single and Twin Batteries Section.

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 PTO for loads exceeding 175A' section in this BEMM.

NOTE: Do not make any additional connections to the Power Distribution Box (PDB) terminals, as over-torqueing 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 Conversionworks@ford.com

4.6.1 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 deep cycle applications, i.e. charge and discharge on a regular basis.

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

NOTE: Where possible, engine run operation 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.	Auxiliary Fuse Panel (A526) option includes CCP2.
Roof Beacons/Additional switches. For example: Highway Maintenance Vehicles.	Beacon Preparation Pack (A606)/Utility Vehicle Switch Pack (A626)[1] Note: includes Auxiliary Fuse Panel (A526)
Conversions using various vehicle signals are required, such as indicators, stop lamp, door ajar, handbrake on. For example: Police Vehicles and Ambulances.	High Specification Vehicle Interface Connector (A608)[1] Note: includes Auxiliary Fuse Panel (A526).

[1]Utility Vehicle Switch Pack (A626) and High Specification Interface Connector (A608) cannot be ordered together

Abc = BEV Only Abc = ICE Only

Engine State	Power Usage	Recommended Specification (order code in brackets)
Engine Off Loads	**LOW CONTINUOUS PTO:** Up to additional 5mA at Key Off, for example: KL30 fed small current peripheral chargers.	Donor Vehicle Battery(s)
	MID CONTINUOUS PTO: 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)
	HIGH CONTINUOUS PTO: 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.	2 High Performance Deep Cycle AGM batteries (OW5). Where possible connect to loads to the standard battery guard, FPBG or Third Party Battery Guard. Refer to: 4.7 Battery Protection for load-shedding.
	OCCASIONAL SHORT TERM HIGH PTO: Between 40A and 240A at Key Off, for example: Cranes, Tippers, Tail Lifts, 230V Inverters, Ambulances.	2 High Performance Deep Cycle AGM batteries (OW5) + Ford Programmable Battery Guard - max 175A (A540). Additional batteries may be required, for further information see Battery Configuration, Additional Loads, Start-Stop and SRC, in this section. Refer to: 4.7 Battery Protection for Load-Shedding.
Engine Run Loads	**LOW CONTINUOUS PTO:** Up to 30A, for example: Maintenance Van with water heater and additional lighting but no further systems.	Donor Vehicle Alternator
	HIGH CONTINUOUS PTO: Between 30A and 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 RPM Speed Control (A003) 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.
	PTO: Applications which require elevated engine idle speeds, for example: Mobile Tyre Fitter Van, Welder's Vehicle and Mechanical PTO from engine.	RPM Speed Control (A003). This does not assist MHEV 12V charging.
	For applications where the Vehicle Converter Load requirement exceeds HIGH CONTINUOUS PTO, for example: total Ford and Vehicle Converter loads exceed the highest available Ford alternator rating.	High Power Pack option (A550) and supplemental batteries and supplemental energy source pending charge balance calculation.

4.6.2 High Current Supply and Ground Connections

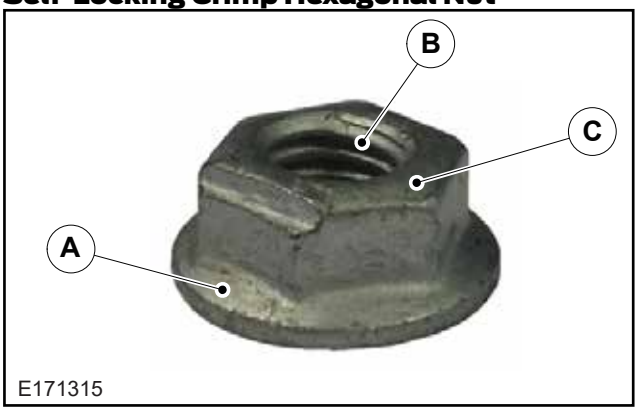
WARNINGS:

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: 4.25 Electrical Connectors and Connections
Customer Connection Points.

Self-Locking Crimp Hexagonal Nut



E171315

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

4.6.3 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 either by an alternator or by an MHEV system. 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.

The MHEV system uses 48V charging with a common ground, with a 48V battery and a 48V/12V DC/DC converter. The 48V Battery Pack is not suitable for any conversion work.

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 ±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 5ºC (41ºF) 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 Converter 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: with the ignition on, 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: 4.7 Battery Protection

If separate charging systems are added, the ground side of the charger must also be connected to the body. An auxiliary ground stud eyelet can be ordered: part numbers KU5T-14436-B** for single battery and standard with A739 option or jumper cable KK2V-14301-K* for twin battery systems.

Refer to: 4.25 Electrical Connectors and Connections

This will be standard when pre-ordered with Special Vehicle Options, A526, A606, A626, A608, and A652 also Regular Production Order OW5.

For additional information on order codes
Refer to: 1.5 Conversion Type

Battery Cable Fixing Torque

The battery cables should be fixed to the terminal post with a torque of 8.0Nm ± 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.

Vehicles with Start-Stop* require an AGM battery. You must replace the battery with one of exactly the same specification and technology. *Optional in some markets

Make sure that the battery box is correctly sealed including any additional cables routing in and out of the box. After conversion, always check that the drain tubes have not been dislodged.

When a battery guard is fitted, the supply from a non-deep cycle twin standard flooded battery should not be below 12.0V measured at the battery terminals at open circuit voltage. If a battery guard is monitoring a supply from a deep cycle twin AGM battery, 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 Converter 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 PTO requirements. Refer to the table 'Power and Connectivity Usage Recommendations' in this section of the BEMM for your vehicle. Heavy PTO 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 Standard Flooded, 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 PTO 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: 4.6 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 Box

WARNING: It is important that the battery box lid, on vehicles fitted with H7 batteries or the battery cover and battery positive terminal cover, on vehicles fitted with an H8 battery, must be replaced after any conversions to the battery positive terminal. If the battery lid/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 in the BMS later in this section of the BEMM.

Battery Drain Prevention

As part of the Vehicle Converter process and to maximise battery life and prevent premature failure of the Ford batteries, protect and prevent battery discharge during any conversion or whilst the vehicle is in storage. This may include leaving the vehicle in Transport mode as long as possible, reducing the amount of crank cycling around the facility, door ajar events and duration. The voltage MUST be checked when receiving and before shipping. 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: 4.7 Battery Protection

Abc = BEV Only Abc = ICE Only

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 PTO 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: the Auxiliary Fuse Panel (A526), the High Specification Interface Connector (A608), the Ford Programmable Battery Guard (A540) or CCP 60A. For loads greater than 175A (CCPs) or 200A (FPBG), up to 240A can be connected from the battery cable.

Refer to: 4.7 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 Auxiliary Fuse Panel 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 SVO Auxiliary Fuse Panel to maintain the integrity of the electrical system

Refer to: 4.23 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

4.6.4 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 on a Start-Stop or SRC vehicles.
Refer to: 4.11 Electronic Engine ControlsStart-Stop and SRC
Refer to: 4.4 LV Charging System (12 V)

Battery Part Numbers and Usage

Battery Part Number	Type	Quantity	Size
Single Battery (FWD ICE without Start-Stop) (1)			
GK2T-10655-D*	750CCA (80Ah @20 hour rate) Standard Flooded Battery	1	H7
Single Battery (FWD ICE without Start-Stop) (2)			
GK2T-10655-E*	710CCA (75Ah @ 20 hour rate) Enhanced Flooded Battery	1	H7
Single Battery (FWD ICE with Start-Stop) (BEV Base)			
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery	1	H7
Single Battery (RWD ICE with/without Start-Stop) (BEV Base)			
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery	1	H7
Twin Battery (ICE without Start-Stop) (1) **(BEV option)**			
GK2T-10655-D*	750CCA (80Ah @ 20 hour rate) Standard Flooded Battery	2	H7
Twin Battery (ICE without Start-Stop) (2) **(BEV option)**			
GK2T-10655-E*	710CCA (75Ah @ 20 hour rate) Enhanced Flooded Battery	2	H7
Twin Battery (ICE with Start-Stop) (BEV option)			
GK2T-10655-F*	800CCA (80Ah @ 20 hour rate) AGM Battery	2	H7
High Performance Deep Cycle AGM Batteries (A739) (ICE/BEV option)			
8C1V-10655-A*	850CCA (95Ah @ 20 hour rate) AGM Battery	1	H8
High Performance Deep Cycle AGM Batteries (OW5) (ICE/BEV option)			
8C1V-10655-A*	850CCA (95Ah @ 20 hour rate) AGM Battery	2	H8

(1) 2 year warranty territories, (2) 3 year warranty territories

Abc = BEV Only Abc = ICE Only

4.6.5 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 Deep Cycle AGM batteries: twin (OW5) or single (A739) system. 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 LV Charging System (12 V)

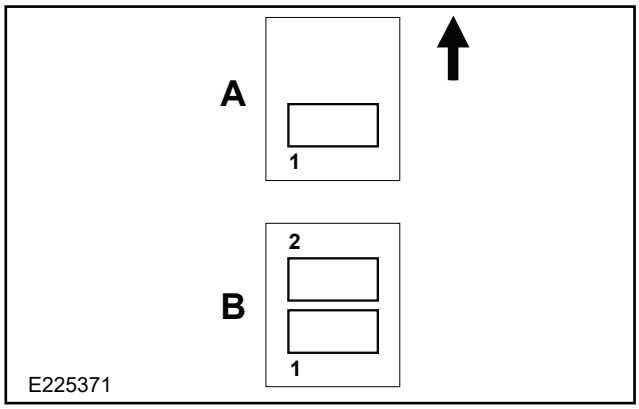
The load a battery could add to the vehicle when requiring a charge, may exceed 60A. If third party loads are also connected, a relay or contactor, controlled by the load-shedding signal, must be used to isolate.

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 deep cycle battery system is recommended. For high power (twin system) requirements at engine off use H7 (OW5) or for low power (single system) at engine off use H8 (A739)

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

4.6.6 Battery Configurations



Item	Description
1	Main Battery
2	Auxiliary Battery
A	Single Battery System
B	Twin Battery System
Arrow	Front of vehicle direction

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

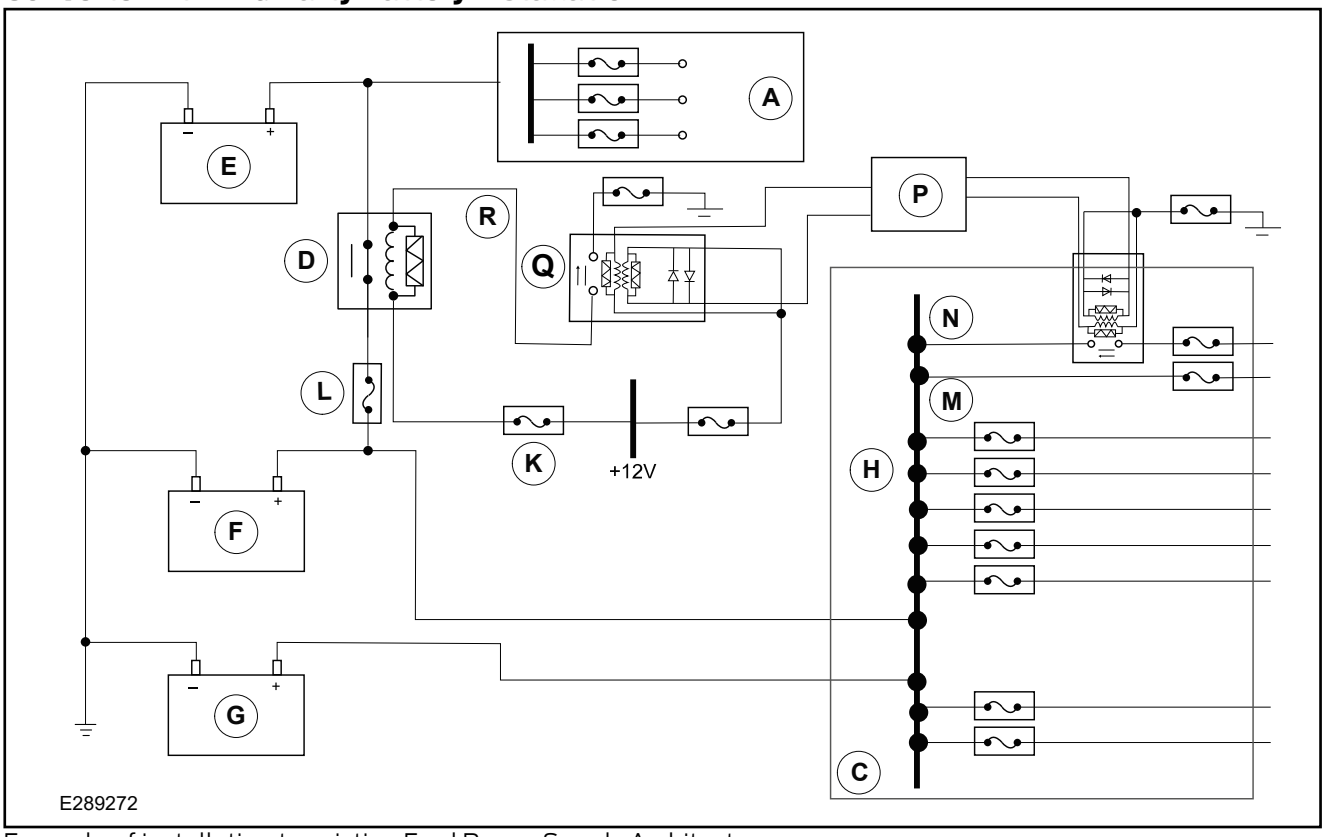
If such a battery configuration is required, it is recommended not to equip the vehicle with Start-Stop in the factory so the vehicle should be originally ordered without. It will not be possible to decommission the Start-Stop and SRC features due to homologation, vehicle tax and excise requirements.

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.

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Converter Fit Third Party Battery Installation



Example of installation to existing Ford Power Supply Architecture

Item	Description
A	Converter Fit — Loads
C	Pre Fuse Box — Driver's Seat Pedestal
D	Converter Fit — Normally open latched third party Battery Control Relay
E	Converter Fit — third party Battery
F	Ford Fit — Auxiliary Battery(1)
G	Ford Fit — Vehicle Start Battery
H	Ford Fit — Loads (from Auxiliary Battery)
K	Converter Fit — +12V Fused KL30 Supply
L	Converter Fit Power Supply Fuse (For loads between 175-240A)
M	CCP1 - 60A standard
N	CCP2 - 175A relay and Mega fuse (with any SVO Fuse Box option (including A526)/Twin Batteries)
P	BCM
Q	Ford fit SBG and load-shedding control relay
R	Ford fit signal/grid, 10A switched ground, controlled by SBG and load-shedding control relay

(1) Must be ordered as an extra option

Converter fit power supply fuse may not be required if CCPs are the correct value.

See also similar solution which offers a relay and power off from the Ford Battery system as well as third party battery protection with the FPBG later in this section.

Abc = BEV Only Abc = ICE Only

4.6.7 Converter 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 FPBG signal. 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 EPAS. It is not recommended to use the 60A CCP1, Camper, Blue light feed to supply a third party battery.

NOTE: It is the Vehicle Converter's responsibility to ensure the power supply on the vehicle is adequate to supply both Ford and third party systems, especially if they can be active at the same time. 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 175A Customer Connection Point (CCP2), the Ford Programmable Battery Guard 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: 4.7 Battery Protection

If additional batteries are added, these should be connected via a disconnect mechanism, such as CCP2, FPBG, or another battery guard controlled by the load-shedding signal. If the third party battery and added system requirements exceed 175A (CCP2) or 200A (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 PTO for Loads Exceeding 175A' in this section. For example of converter 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 LV Charging System (12 V) System Operation

Third Party +12V PTO for Loads Exceeding 175A

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 box lid/cover are replaced after any conversions to the battery positive terminal. See figure E278335 in the BMS later in this section of the BEMM. If the battery lid/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.

Third party +12V PTO connectivity should be made to the CCP or FPBG, where possible. In the event a current requirement greater than 175A but less than 250A peak loading (maximum fuse value third party installed), connecting to the rear battery +12V clamp 6mm stud is permitted in conjunction with a disconnect relay controlled by the load-shedding signal. A twin battery system is recommended for this application.

Refer to: 4.7 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 70mm² 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

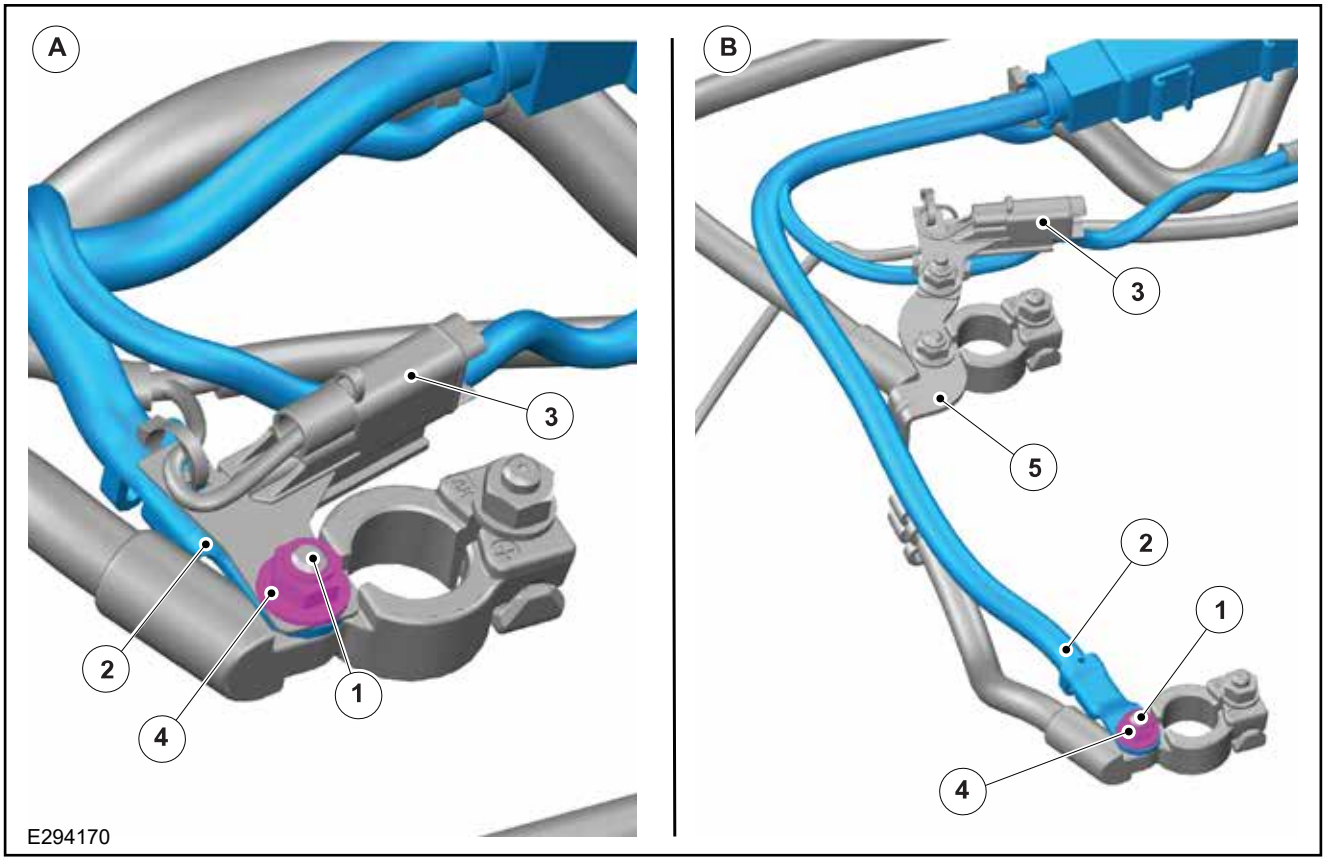
- For long duration continuous power applications such as High Power Inverter, the Mega fuse must not exceed the rating of the alternator fitted to the vehicle. The alternator saturation voltage must be above 13.0V when testing full load. AGM battery twin system (OW5) must be fitted to the derivative.See '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 LV Charging System (12 V) 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
- The return ground cable is recommended, routed in parallel to +12V supply for EMC compliance
- When in Engine Run, systems that are not required should be turned off to help the alternator supply the main load of the third party system. This information should be passed on to the end user by the Vehicle Converter
- The BEMM is adhered to in all relevant areas. This document allows connectivity to Ford battery clamp if the above criteria is met

Abc = BEV Only Abc = ICE Only

Third Party +12V PTO Assembly



Item	Description
A	Single Battery Assembly
B	Twin Battery Assembly
1	+12V Battery Clamp 6mm Stud
2	Third Party Eyelet and Cable - Must be a tight fit to the battery clamp
3	BMS Fuse
4	Self-Locking Crimp Hexagonal Nut - Re-use and torque to 8.0Nm ± 1.2Nm
5	Twin Battery positive link cable with 6mm stud - KK2V-14300-M*

4.6.8 Battery Monitoring Sensor (BMS)

WARNING: It is important that the battery box lid/covers are replaced after any conversions to the battery positive terminal. See figure E278335. If the battery box lid/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.

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 converter 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 converter 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.

4.6.9 Single and Twin Battery Systems

Wiring of Batteries in Parallel for High Current Applications

Review whether an upgrade to a single High Performance H8 deep cycle AGM Battery (A739) 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', see figure E289272 'Converter Fit Third Party Battery Installation' diagram to allow the third party battery to be charged when the engine is running.

Also refer to: 4.7 Battery Protection figure E286668, Battery Guard System Overview'.

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 LV Charging System (12 V) and
Refer to: 4.11 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 Deep Cycle 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 Deep Cycle 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 Conversionworks@ford.com. Failure to set the correct battery configuration may lead to incorrect SRC/SC and Start Stop functionality.

4.6.10 Additional Loads and Charging Systems

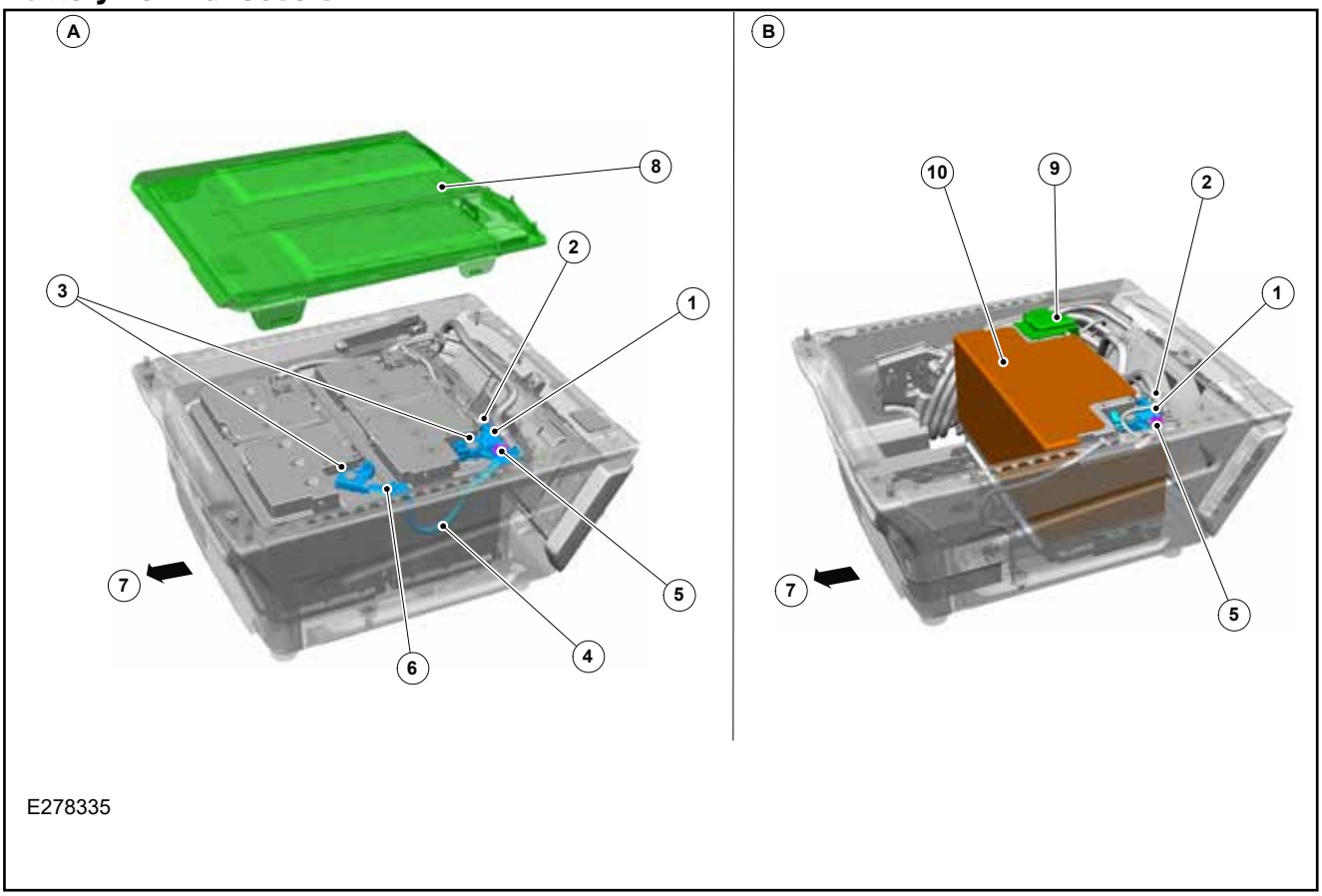
NOTE: Do not make any additional connections to the Power Distribution Box (PDB) terminals, as over-torqueing could cause damage to the PDB.

NOTE: Only use approved connection methods and connection points for additional electrical loads.

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 Conversionworks@ford.com

Abc = BEV Only Abc = ICE Only

Battery Box Lid/Covers



E278335

Item	Description
A	Vehicles with H7 Batteries
B	Vehicles with a single H8 Battery
1	Battery Monitoring Sensor (BMS) GK2T-10C652-A*
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	Jumper Cable (KK2T-14300-LA) only with twin batteries
5	1x M8 nuts. Do not loosen or remove
6	1x M6 nut. Do not loosen or remove
7	Front of vehicle direction
8	Battery Box Lid
9	Battery Positive Terminal Cover
10	Battery Cover

Abc = BEV Only Abc = ICE Only

Generic items when converting from Single System to single H8 AGM

Part Number	Description	Quantity
KU5T-14436-BU*	Auxiliary ground stud	1
BK3V-10A721-C*	Battery clamp	1
JK2V-10A818-AA	Breather tube	1
JK3V-10N669-AA	Battery tray	1
KK2V-14277-A*	Battery positive insulation covers	1
KK2V-14277-B*	Battery negative insulation covers	1
BK21-63226-A* / 63227-A*	Driver's pedestal	1
JK2V-10A687-A	Battery cover	1

Generic items when converting from Single to Twin Batteries

Part Number	Description	Quantity
GK2T-14301-A*	BMS jumper cable - less auxiliary ground stud	1
KK2V-14301-K*	BMS jumper cable - with auxiliary ground stud	1
KK2T-14300-L*	Battery link positive cable	1(1)
KK2V-14300-M*	Positive link cable with auxiliary positive stud	1

(1) only one battery pending on drive.

Abc = BEV Only Abc = ICE Only

4.7 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 Conversionworks@ford.com

4.7.1 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)

4.7.2 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) A540 is recommended.

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. If 11.0V is measured, this is the cut off point for load-shedding but here there would be serious problems with the system design of supply and demand.

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. If 11.0V is measured, this is the cut off point for load-shedding but here there would be serious problems with the system design of supply and demand.

4.7.3 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: 4.26 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)
- The Auxiliary Fuse Panel (A526)
- High Specification Interface Connector (A608)

Refer to: 4.25 Electrical Connectors and Connections

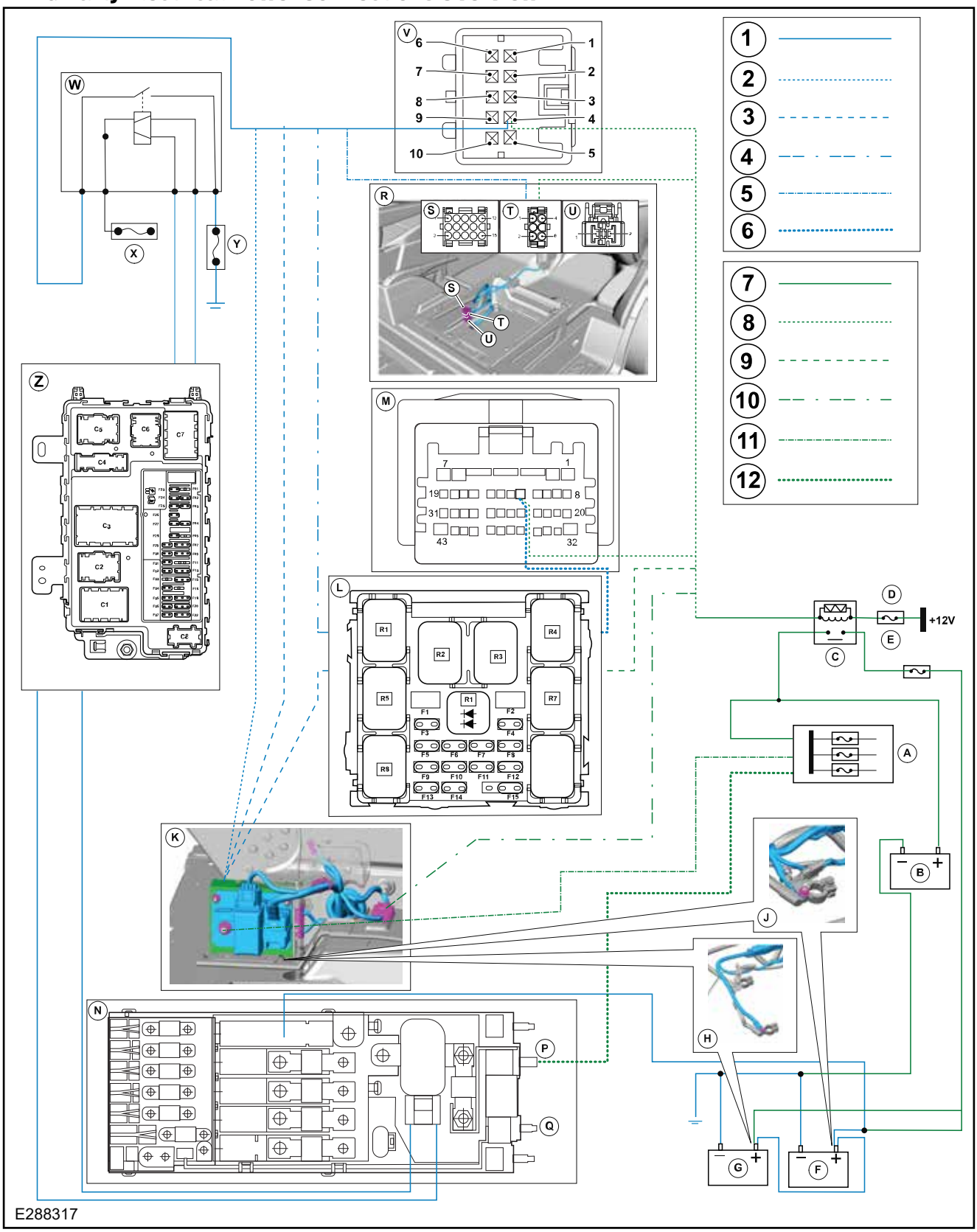
All higher current third party loads are to be regulated using Ford controlled load-shedding.

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.

Abc = BEV Only Abc = ICE Only

Third Party Electrical Power Connections Overview



Abc = BEV Only Abc = ICE Only

Third Party Electrical Power Connections Overview - Key

Item	Description	Item	Description
1	Ford Wiring (FW)	G	Front pedestal battery (twin)
2	FW - FPBG less Auxiliary Fuse Panel	H	Twin battery connection
3	FW - FPBG and Auxiliary Fuse Panel	J	Single battery connection
4	FW - Auxiliary Fuse Panel less FPBG	K	FPBG (A540 or A550)
5	FW - with Camper Connector (no Vehicle Interface Connector)	L	Auxiliary Fuse Panel (A526)
6	FW - With High Specification Interface Connector	M	High Specification Interface Connector (A608) - Pin 12
7	Third Party Wiring (TPW)	N	High current fuse box^
8	Option connection (Vehicle Interface Connector, High Specification Interface Connector, Camper connector, Auxiliary Fuse Panel or FPBG) to connect to Third Party control relay	P	CCP2 (175A)
9	TPW - Auxiliary Fuse Panel less FPBG	Q	CCP1 (60A)
10	TPW - FPBG less Auxiliary Fuse Panel **OR** FPBG and Auxiliary Fuse Panel	R	Camper C2 (Y) connector - Pin 1
11	TPW - FPBG (200A)	S	C2-1 - 15 way connector
12	TPW - CCP2 (175A) less FPBG	T	C2-2 - 6 way connector
A	Third Party loads	U	C2-3 - KL30 connector 60A fed from high current fuse box and ground
B	Third Party battery (if fitted)	V	Vehicle Interface Connector - Pin 4
C	Third Party battery control relay (normally open)	W	Slave load-shedding relay (10-20A) - FU5T-14B192-A*
D	Third Party +12 fused KL30 supply	X	2A fused +12V
E	Third Party power supply fuse	Y	10A fused ground
F	Rear pedestal battery (single or twin)	Z	Body Control Module (BCM)

^CCP2 (175A) standard for FPGB and some single SVO Options.

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
  - 10-way standard interface connector in the driver's seat pedestal (pin 4)
  - High Specification Interface Connector [A608] [pin 12]
  - The Auxiliary Fuse Panel, cloned, 10-way standard interface connector (A526) (pin4)
  - FPBG (A540) (pin 12)
- Camper 6-way (pin 1)
- 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 175A may use CCP2
- CCP2 is provided in any of the below options:
  - Twin battery/heavy-duty battery pack
  - Any High Specification Interface Connector packs [A608]
  - Aux Fuse Panel [A526]
  - Refrigeration [FV]
  - Camper Donor vehicles

3. Using FPBG
Loads up to 200A can utilise the FPGB.

Refer to: 4.7 Battery Protection

4.7.4 SBG and Load Shedding - Functionality

WARNINGS:

Changing configurations may invalidate the vehicle warranty.

Using Third Party High Power mode 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: 4.7 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 LV Charging System (12 V)

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 (A540).

Abc = BEV Only Abc = ICE Only

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: 4.6 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.

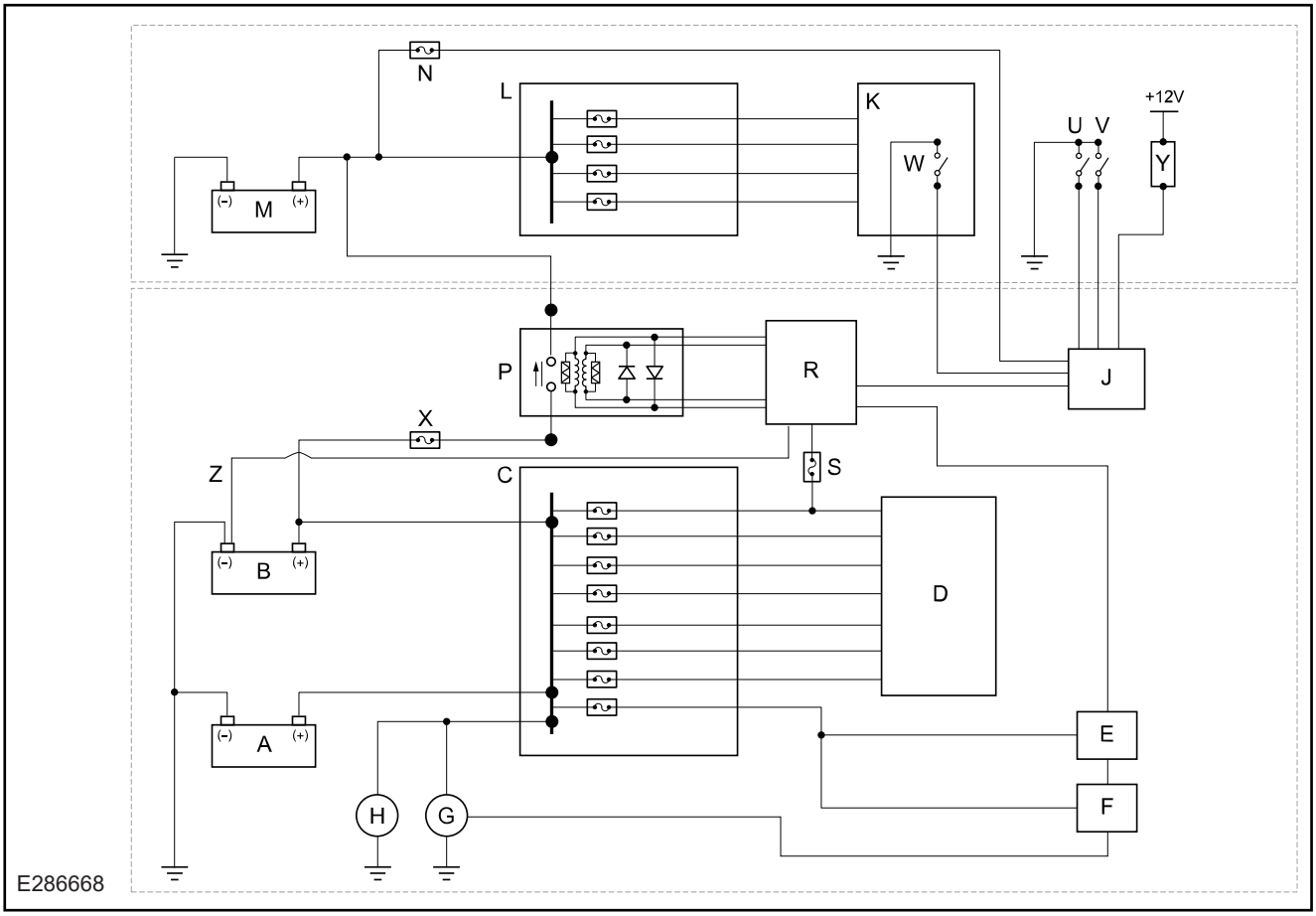
After a Flat Battery

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.

Abc = BEV Only Abc = ICE Only

System Overview



Item	Description	Item	Description
A	Vehicle Battery 1	M	Third Party Battery
B	Vehicle Battery 2	N	Third Party Battery Sense Fuse
C	Vehicle Power Distribution	P	FPBG Relay
D	Vehicle Loads	R	FPBG Module
E	Body Control Module (BCM)	S	FPBG Fuse
F	Powertrain Control Module (PCM)	U	Immediate Close Relay
G	Alternator	V	Immediate Open Relay
H	Starter Motor	W	Third Party High Power Mode
J	Interface Connector	X	Mega Fuse
K	Third Party Loads	Y	Power Isolation Warning/Status Indicator
L	Third Party Power Distribution	Z	FPBG/BMS LIN Connection

Abc = BEV Only Abc = ICE Only

4.7.5 Ford Programmable Battery Guard GEN2 (A540)

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 150W Power Inverter.

Ford Programmable Battery Guard Cannot be ordered on E-Transit Battery Electric Vehicle

NOTE: Vehicles should always use a battery guard if engine off power is required. A540 is recommended.

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 Conversionworks@ford.com

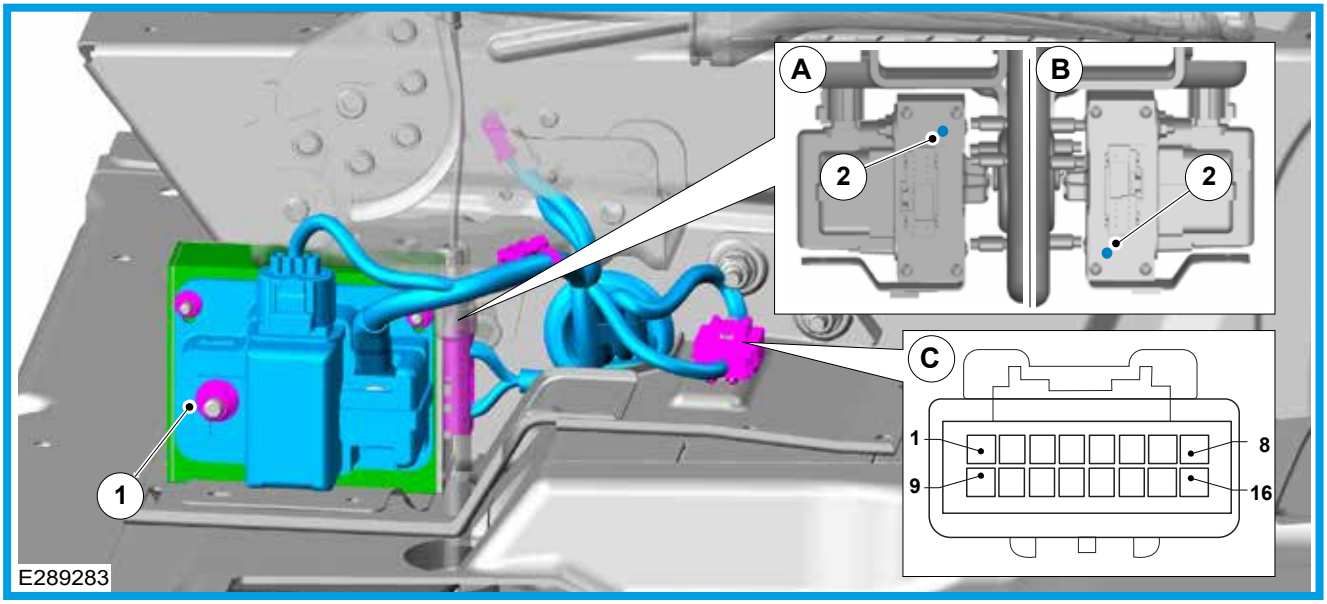
FPBG System Overview

The Battery Guard is the intelligent power management system that provides 'engine run' and 'engine off' power for Third Party electrical systems, see figure E286668 System Overview.

Third Party System Connections

Third party systems must be connected to the FPBG as per below instructions. The FPBG connections are located under the handbrake lever. They are accessible when the handbrake shroud top and bottom are removed.

FPBG Third Party System Connections



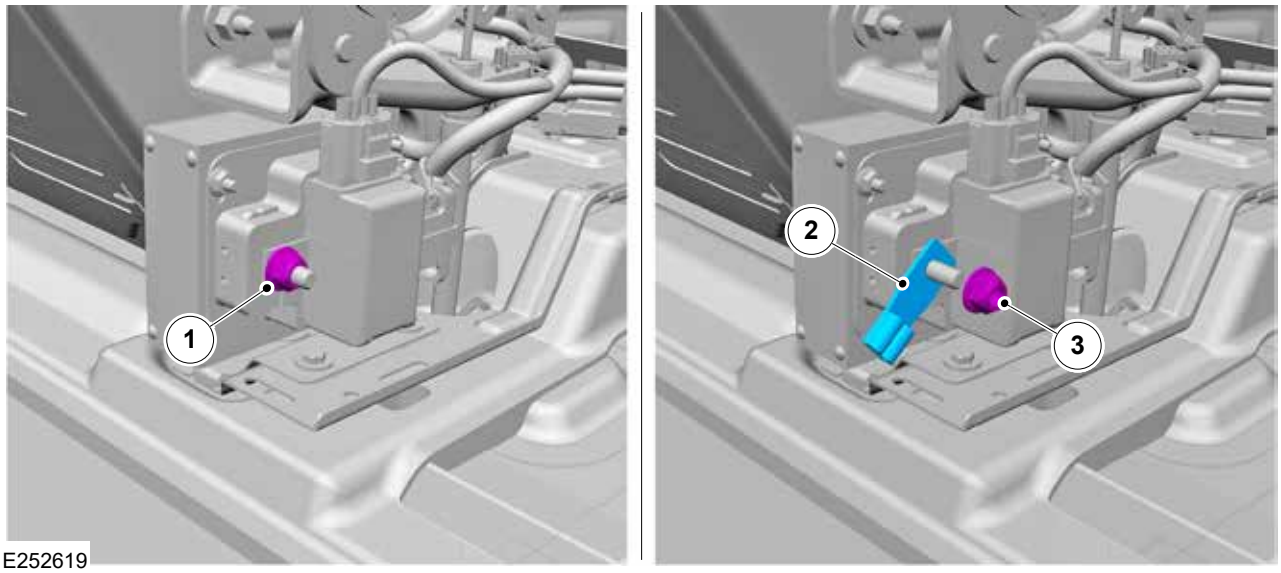
Item	Description	Item	Description
A	FPBG LHD - LED location	1	Power Relay Terminal (B)- Third Party Power Connection (+12V)
B	FPBG RHD - LED location		
C	FPBG Interface Connector	2	LED

Power Connections

The FPBG Power Relay secondary terminal has a M8 stud and nut for Third Party Power connection.

1. Remove the M8 nut
2. The Third Party power cable eyelet needs to be seated onto the stud
3. The M8 Nut needs to be tightened to 12Nm ±1.8Nm

FPBG Power Connections



FPBG Interface Connector Pin layout - See E289285

Pin	Description	Wire Colour
1	Open Relay Request Input - SW GND	Black
2	Close Relay Request Input - SW GND	Yellow
3	Vehicle Switch Illumination	Brown
4	B+ Converter Battery Sense Line	Brown/Yellow
5	RPM Control 1	Green/White
6	RPM Control 2	Green/White
7	Empty	-
8	Empty	-
9	Third Party Full Power Mode - SW GND	Green
10	Empty	-
11	Power Isolation Warning / Status Indicator	Yellow
12	Relay Status	Black/White
13	Vehicle Speed	Violet/Orange
14	Engine Run	Grey
15	Auto RPM Control Activation Input - SW GND	Black
16	Ignition KL15 +12V	Blue/Red

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

Abc = BEV Only Abc = ICE Only

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
4. 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'.
- **SVO Fuse Box Control:** The FPBG controls the SVO 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 SVO Fuse Box control output signal. Therefore, if the main Power Relay is connected, the SVO 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 FPBG Customer Interface

Connector. The Vehicle Converter needs to complete the system as per the below instructions:

1. There are two RPM Control Pins - RPM Control 1 and 2 (Pins 5 and 6) - that needs 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.
2. There is one RPM Activation Pin (Pin 15) 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 Converter.
3. 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 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 Converter (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)	OK	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 (Close Switch)	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), Orange (O), Red (R) and Space (-)

Abc = BEV Only Abc = ICE Only

4.7.6 Retrofitting a FPBG

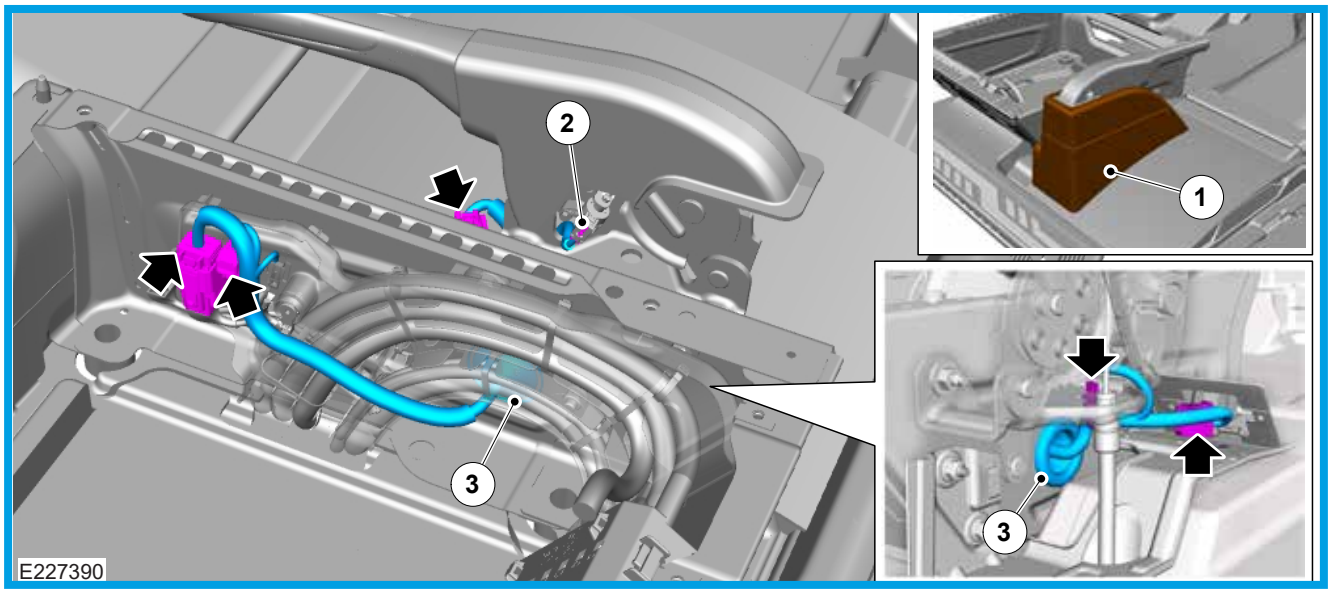
WARNINGS:

The system cannot be ordered with either a Ford 150W or 400W Power Inverter.

Ford Programmable Battery Guard Cannot be retrofitted to E-Transit Battery Electric Vehicle

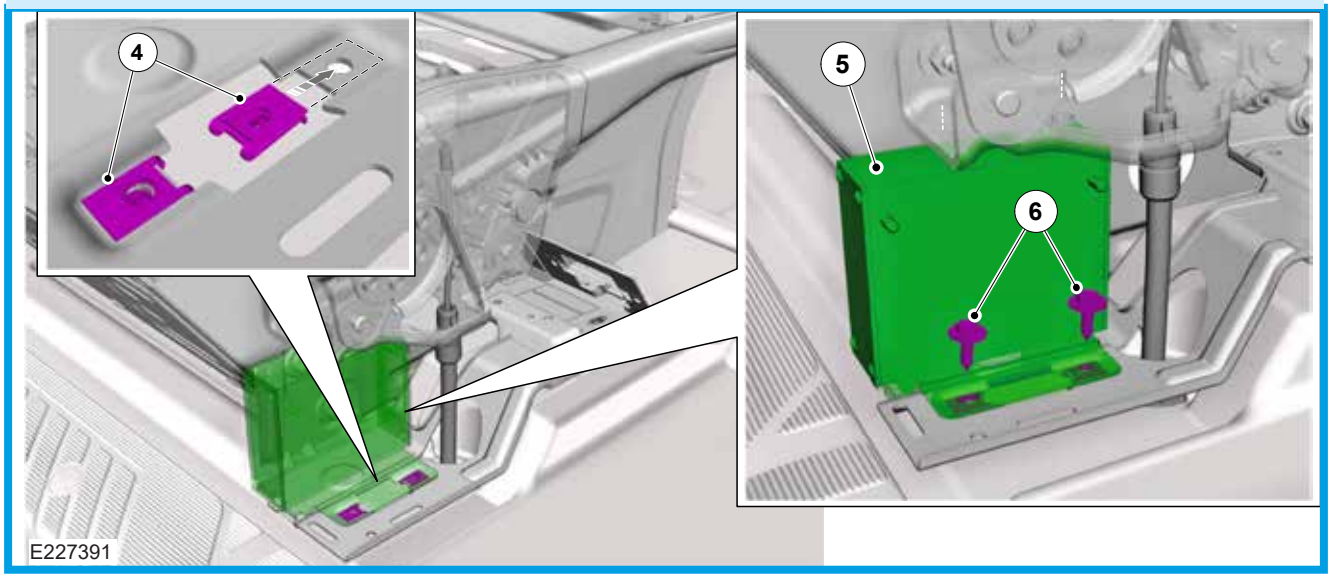
Vehicle Preparation

- The FPBG is compatible with the 10-way connector
- The handbrake shroud top and bottom needs to be removed
- The handbrake jumper wiring needs to be removed. Please refer to figure E227390



Item	Description
1	Remove Handbrake Console
2	Disconnect the handbrake lever connector
3	Remove grommet, disconnect connectors, fir tree clips and tie wraps. Dispose of Harness.

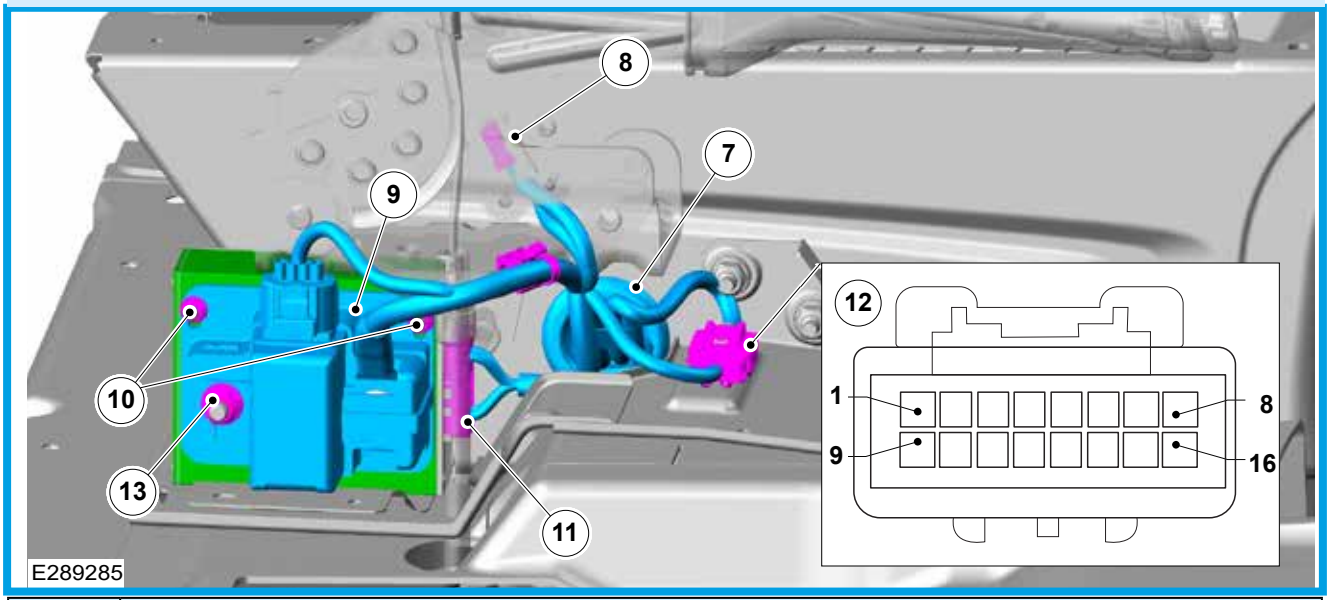
Module Fitment



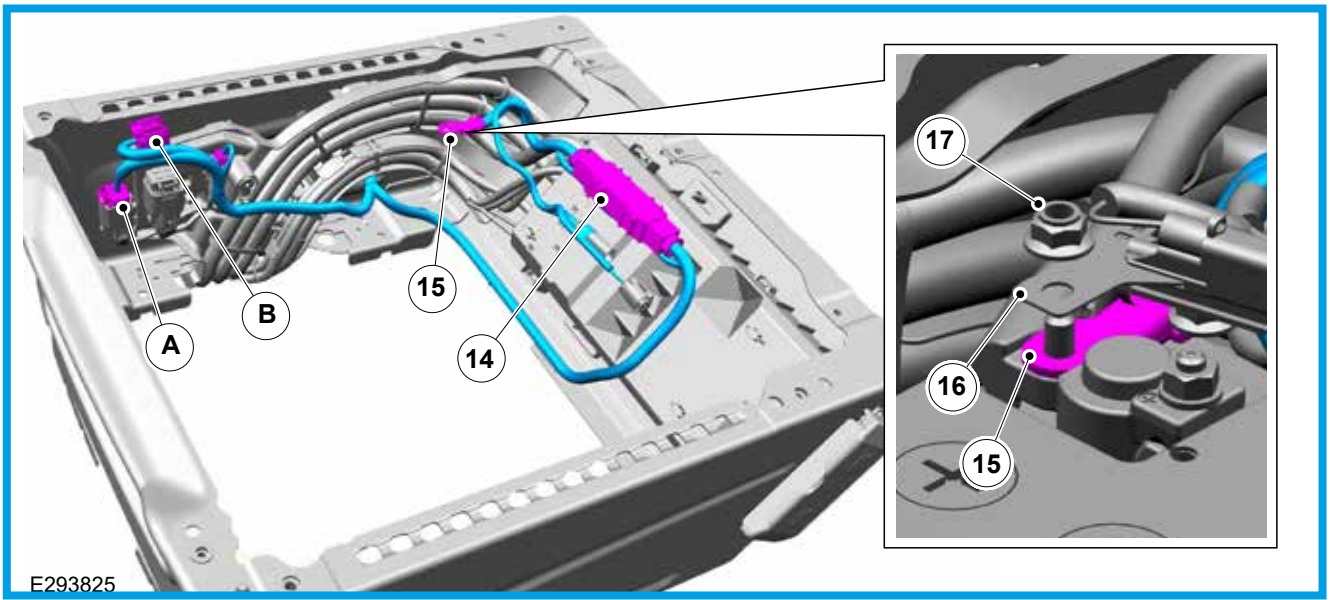
Item	Description
4	Fit 2 x U nuts
5	Fit Module
6	Secure Module with 2 x screws - torque 3.2Nm ± 0.5Nm

Abc = BEV Only Abc = ICE Only

Harness Fitment
Harness needs to be fitted onto the module and routed inside the pedestal.



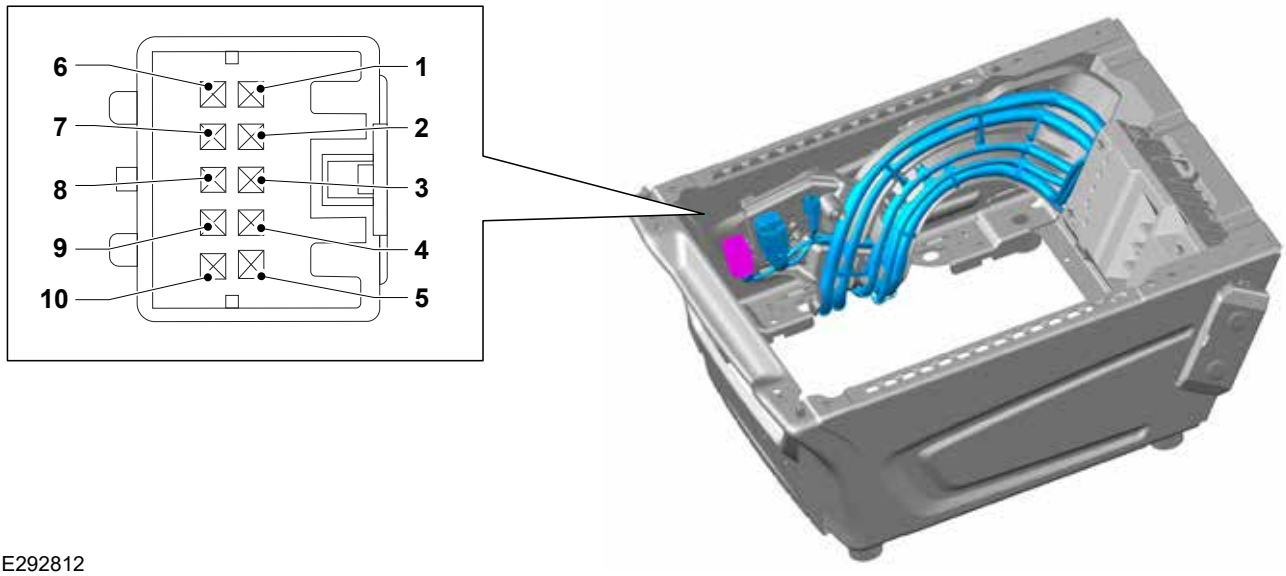
Item	Description
7	Route Harness GK2V-15K857-** through the driver's seat pedestal, making sure the grommet is seated/sealed properly making sure the harness does not obstruct or interfere with the handbrake cable and assemble edge clip to handbrake bracket.
8	Fit Handbrake Connector
9	Fit Relay Holder
10	Secure Relay Holder with 2 x M5 Nuts - Torque 3.2Nm ± 0.5Nm
11	Fit Module Connector
12	FPBG Interface Connector - Mating Connector face view
13	FPBG Power Connection - Relay Terminal Nut - Torque 12Nm ± 1.8. See also figure E252619



Item	Description
A	Connection without SVE Fuse box
B	Connection with SVE Fuse box
14	200A Mega Fuse - Route and connect harness as shown in E289285
15	Battery Positive Eyelet
16	Battery Monitoring Sensor
17	M6 Nut - Torque 8.0Nm ± 1.2Nm

Abc = BEV Only Abc = ICE Only

Vehicle Interface Connector



System Check

The system status can be checked via the LED on the module near the connector, if Green is pulsed, the system is OK. If any other status codes are received, refer to the POWER ISOLATION/STATUS INDICATOR table in this section for the code you observe.

FPBG - Additional Information

- The FPBG GEN2 is fused at 200A. If required, the Mega Fuse can be down-rated by the Vehicle Converter.
- 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: 4.25 Electrical Connectors and Connections

- 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 Converter 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. Contact conversionworks@ford.com for system specific questions.
- The FPBG System can also be ordered as part of the Converter High Power Pack (A550)
- 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 Converter 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

Abc = BEV Only Abc = ICE Only

Parts Requited for FPBG Retrofit

Decription	FINIS	Quantity
FPBG Module	2577223	1
Select wiring harness based on your vehicle specification		
LHD Single Battery Wiring	2524027	1
LHD Twin Battery Wiring	2524028	1
RHD Single Battery Wiring	2524029	1
RHD Twin Battery Wiring	2524030	1
Hardware		
M5 Nut	5221281	2
U-Nut	1459634	2
M5 Screw	4796040	2

Abc = BEV Only Abc = ICE Only

4.8 Climate Control System

WARNING: Do not use propylene glycol based coolant.

NOTE: The Transit 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

4.8.1 Front Climate Control System

J1 Climate Control System Pin-Outs

Pin	Description
1	Ground
2	Voltage Reference Return
3	Voltage Reference
4	Third Party High Power Mode (For Vehicle Converter Use)
5	A/C Request (For Vehicle Converter Use)
7	Rear Defrost Output
8	Left Temp Door Feed 'A'
9	Left Temp Door Feed 'B'
10	Left Temp Door Feedback
11	Front Blower Relay Output
14	Eco/Selectable Drive Mode Input
17	MS1-CAN Bus High
18	MS1-CAN Bus Low
19	Evaporator Temp Sensor Input
20	Mode Door #1 Feed 'A'
21	Mode Door #1 Feed 'B'
22	Mode Door #1 Feedback
23	Front Blower Controller PWM Command Output
24	Recirc Door Feed 'A'
25	Recirc Door Feed 'B'
26	Battery Power Supply (+12V)

Any pins not listed in the table above are not to be used.
PTC= Positive Temperature Coefficient, NTC= Negative Temperature Coefficient

Abc = BEV Only Abc = ICE Only

J2 Climate Control System Pin-Outs

Pin	Description
1	Voltage Battery Left Heated Seat Element Supply
2	Voltage Battery Right Heated Seat Element Supply
6	PTC PWM Output
12	Heated Windscreen Right Relay Driver
15	Right Heated Seat NTC Sense
16	Left Heated Seat Element Output
17	Right Heated Seat Element Output
23	Start-Stop Disable Button Input
24	Start-Stop Indication Output
28	Heated Windscreen Left Relay Driver
30	Left Heated Seat NTC Sense

Any pins not listed in the table above are not to be used.
PTC= Positive Temperature Coefficient, NTC= Negative Temperature Coefficient

4.8.2 Rear Climate Control System

J2 Climate Control System Pin-Outs

Pin	Description
1	PWM Signal Blower
2	Temp Door 3
3	Temp Door 1
4	Mode Door 3(1)
5	Mode Door 1(1)
8	Ground
9	Mode Door Power Supply (KL30)(1)
10	Ignition Signal (KL15)
11	Battery Power Supply (+12V)
14	PWM Signal Blower(2)
15	Temp Door 4
16	Temp Door 2
17	Mode Door 4(1)
18	Mode Door 2(1)
23	Temp Door Power Supply (KL30)
24	Backlighting Illumination (KL58)

Any pins not listed in the table above are not to be used.
(1) FWD Only
(2) RWD Only
PTC= Positive Temperature Coefficient, NTC= Negative Temperature Coefficient

Abc = BEV Only Abc = ICE Only

4.9 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.

4.10 Horn

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

Abc = BEV Only Abc = ICE Only

4.11 Electronic Engine Controls

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

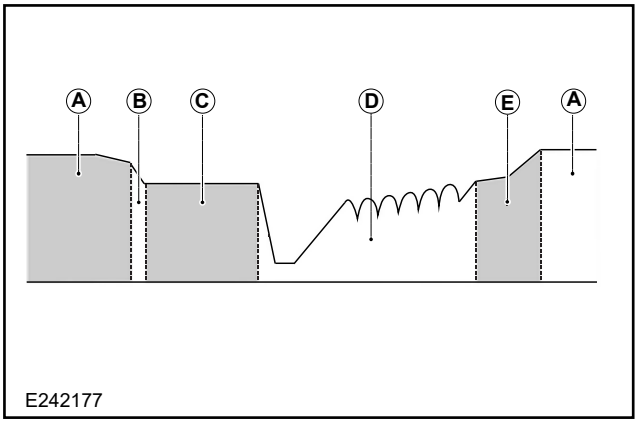
NOTE: It is not necessary to disconnect or remove engine management modules.

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 Conversionworks@ford.com

4.11.1 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



E242177

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

4.11.2 Start-Stop

WARNINGS:

If required by the system, the Start-Stop function may be deactivated which will lead into 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 CO2 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 LV Charging System (12 V)

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 60A. 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. 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 90mA.

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: 4.6 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 LV Charging System (12 V) 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 converter fit loads should be connected to either CCPs. Converter 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 LV Charging System (12 V)

4.11.3 Engine RPM (Revs per Minute) Speed Controller (A003)

System Overview

NOTE: For RPM speed control with automatic transmission, please contact the Conversion Works at Conversionworks@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 maximum power that is available for Front End Accessory Drive applications at any engine speed is 6kW (in lieu of the 26Nm air conditioning compressor).

The Vehicle Converter 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.

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:** 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.

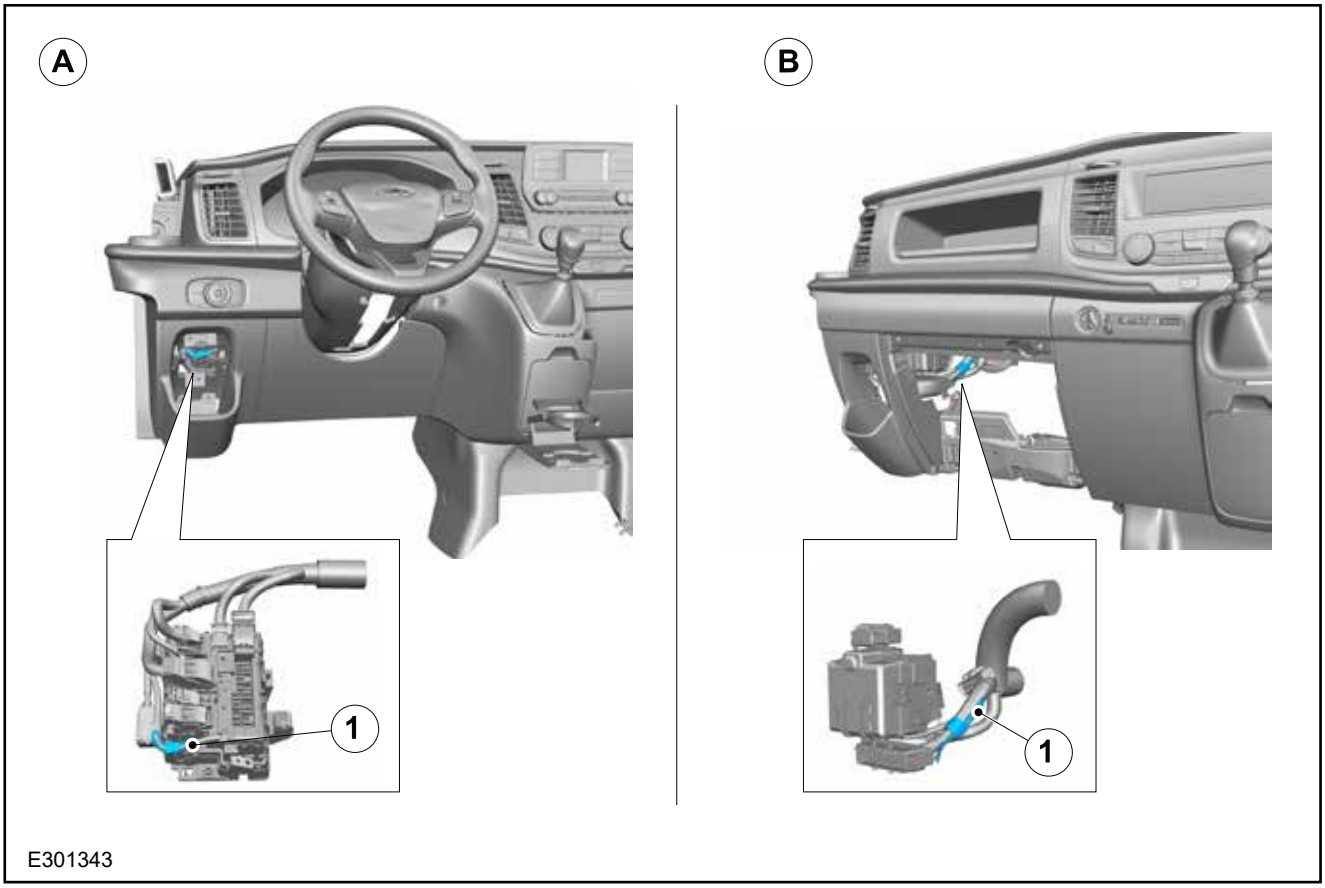
Vehicles fitted with Start-Stop technology may be converted to RPM speed control, however, the customer should turn Start-Stop off prior to starting RPM speed control. For more information refer to 'Impacts from Start-Stop System' in this section.

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.

Loop Location



E301343

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

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 E301343. 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 E301343. 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 regognises 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 Conversionworks@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 ± 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.

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.

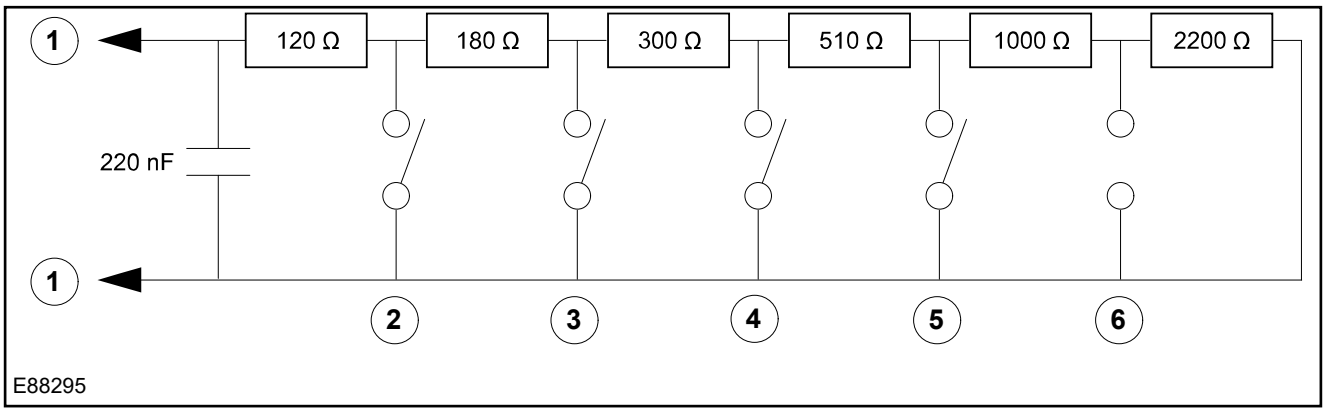
By default, when the feature is first enabled (either via factory order or via dealer using a FDRS tools), it will be set to the 3 speed mode of operation with preset RPM values of 1100, 1600 and 2030RPM for the 3 speeds.

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

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

(disabled). The 3 default RPM speeds can also be modified within the allowable range for the mode of operation as detailed in this section.

FDRS access can be purchased from Ford Service Info https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F148

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 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

4.11.4 Diesel Particulate Filter (DPF) and RPM Speed Control

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 Converters 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.

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.

For additional information on DPF Refer to: 3.7 Exhaust System

4.11.5 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.

4.12 Tachograph

CAUTION: Tachograph is not available with FWD Automatic Transmission (6F55)

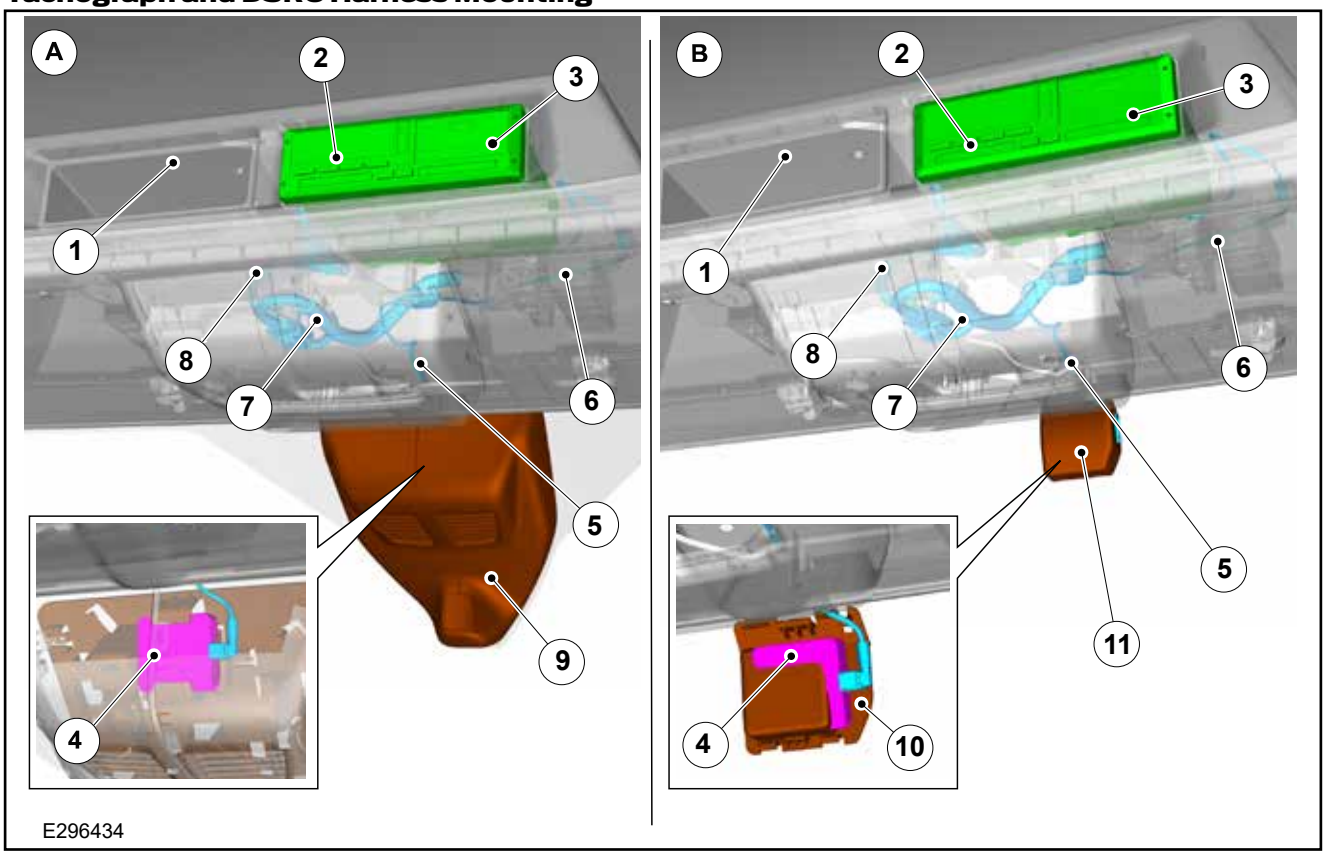
NOTE: For further information please contact your National Sales Company representative or local Ford dealer. If they are unable to help you then please contact Conversion Works at Conversionworks@ford.com .

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

It is recommended that any vehicle that requires a tachograph is sent to an authorized Continental Tachograph Service Centre (previously known as Siemens VDO) for system installation and calibration.

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.

Tachograph and DSRC Harness Mounting



Item	Description
A	If Image Processing Module A (IPMA) Bracket Present
B	If IPMA Bracket Not Present
1	Position of Tachograph if RHD
2	Position of Tachograph if LHD
3	Tachograph Digital Head Unit 4.0
4	DSRC Antenna
5	DSRC Harness 1
6	DSRC Harness 2
7	Tachograph Overhead Shelf main Harness
8	Tachograph Harness
9	IPMA Bracket
10	DSRC Carrier Base
11	DSRC Carrier Cover

Abc = BEV Only Abc = ICE Only

4.12.1 Legislation

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

NOTE: Digital Tachograph (DTCO) and Designated Short Range Communication (DSRC) is the legal requirement for Europe.

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

4.12.2 Tachograph and DSRC Harness Mounting

Pin Assignment

For detailed information about pin assignments please contact your local Ford dealer. If they are unable to help you then please contact Conversion Works at Conversionworks@ford.com .

Wiring

The tachograph wiring consists of:

- Tachograph Harness, see figures E296434 for mounting and harness routing
- DSRC Harness, see figure E296434 for harness routing
- Speed Sensor Harness, for harness routing see figure E296435 or E225083 later in this section.

4.12.3 Retrofitting a Digital Tachograph, DSRC and Speed Sensor

CAUTION: It is recommended that the dealer carries out fitment process for both DSRC Unit and Harness

NOTE: It is not always possible to retrofit a tachograph. If a tachograph is required, it is strongly recommended that this is ordered on the base vehicle.

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

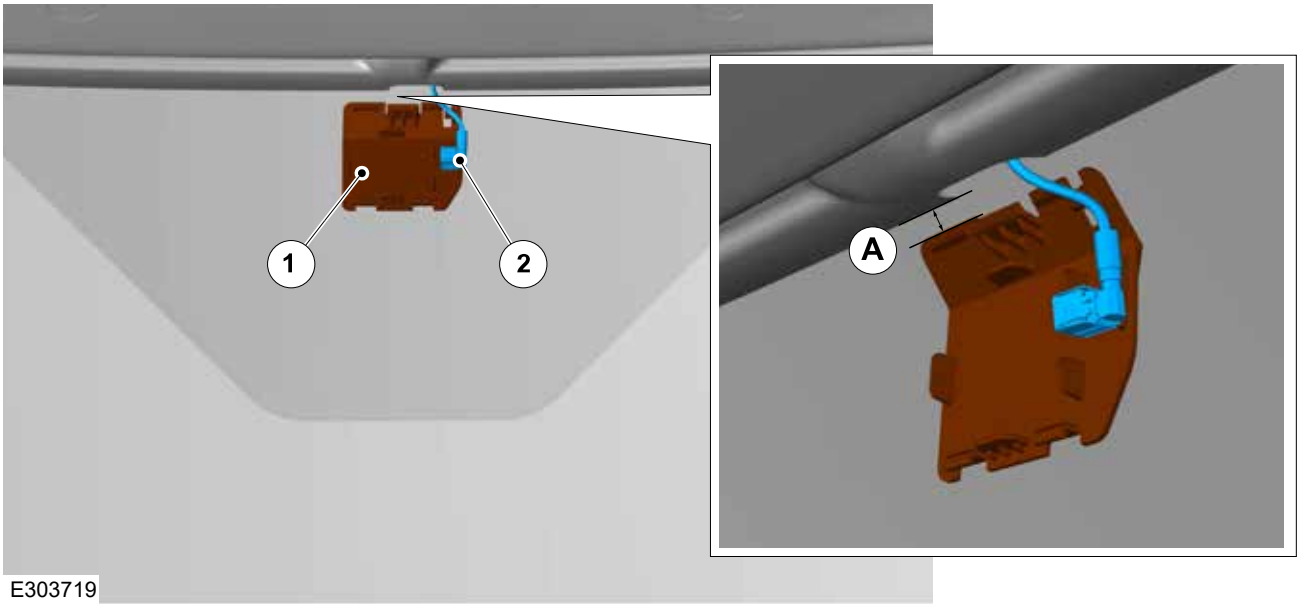
NOTE: For further retrofitting instructions please contact your local Ford dealer. If they are unable to help you then please contact Conversion Works at Conversionworks@ford.com

NOTE: If for any reason the DSRC Carrier will need 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 the base vehicle then the DSRC harness will need to be fitted accordingly.

Retrofitting the Tachograph Unit and DSRC

NOTE: The tachograph head unit will be fitted by the Continental/VDO Calibration Centre.

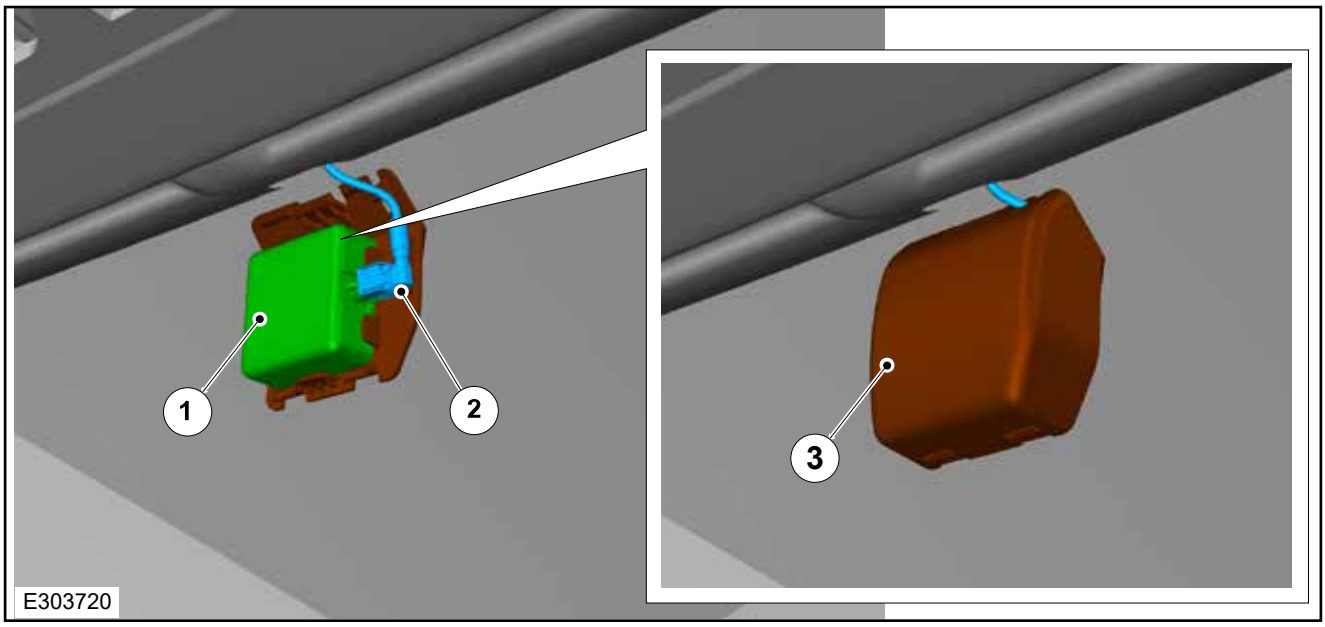
The DSRC Carrier Base should be fitted as follows:



E303719

Item	Description
1	DSRC Carrier Base
2	DSRC Harness
A	9mm

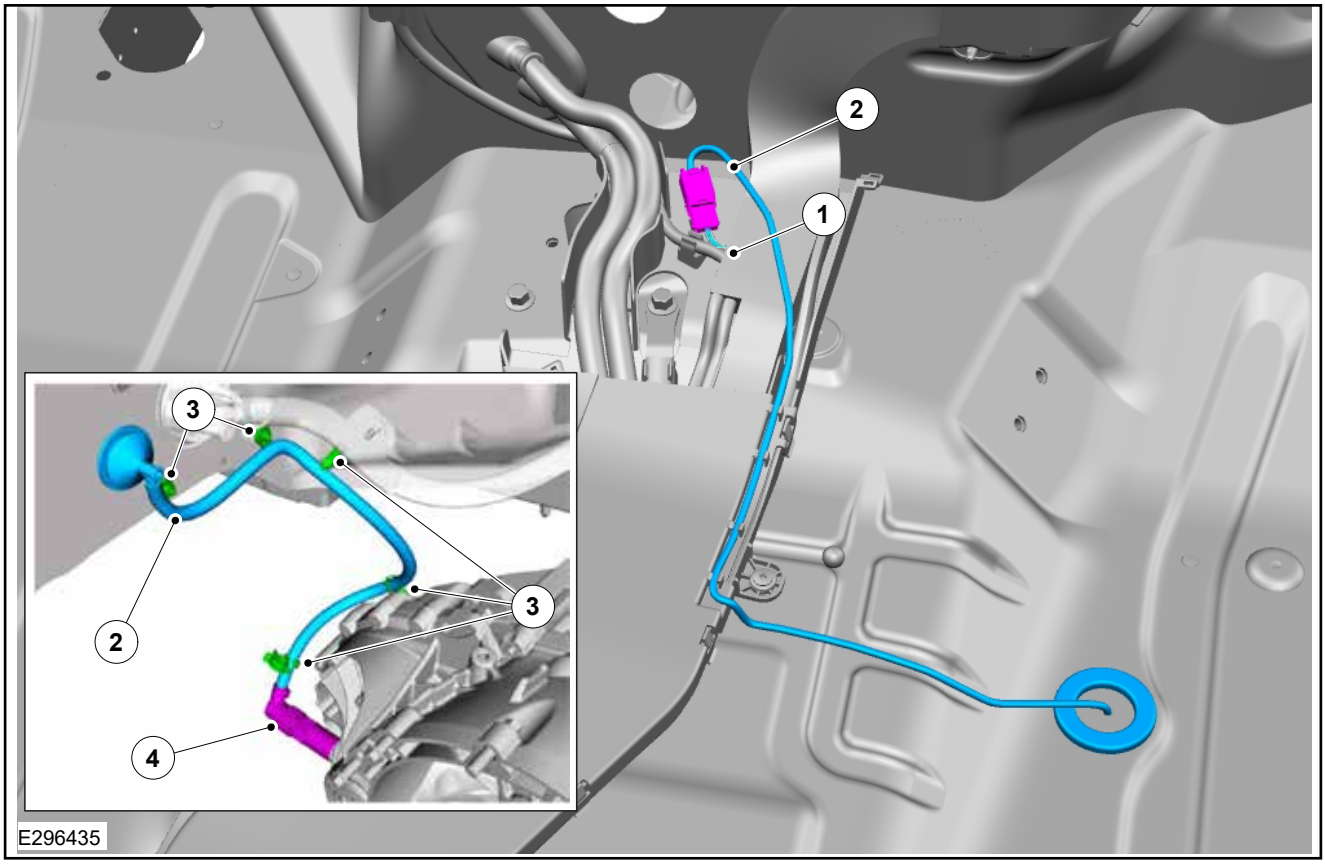
1. Ensure windscreen is dust free and clean
2. Remove adhesive tape from carrier base, align in the correct orientation to the headliner as shown in figure E303719 and stick to the windscreen
3. Remove the adhesive on the DSRC antenna and mount the antenna to the DSRC base carrier (figure E303720)



Item	Description
1	DSRC Antenna
2	DSRC Harness
3	DSRC Carrier Cover

4. Connect the DSRC harness to the antenna
5. Clip on the DSRC carrier cover onto the base, ensuring the entry clips align and clip into place (figure E303720)

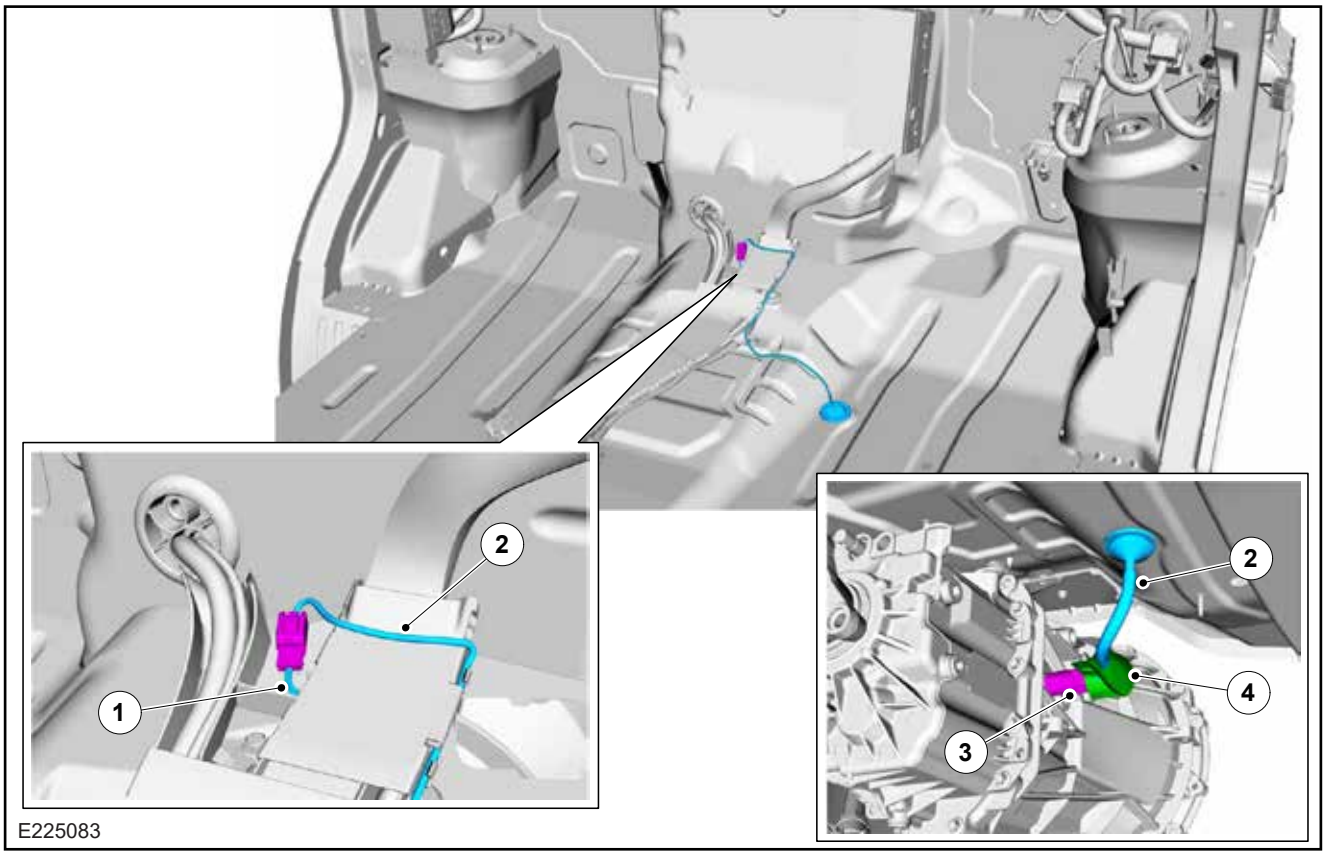
Tachograph Speed Sensor Harness Routing - FWD Manual Transmission



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

Abc = BEV Only Abc = ICE Only

Tachograph Speed Sensor Harness Routing - RWD Manual Transmission



E225083

Item	Description
1	Main Harness
2	Tachograph Speed Sensor Harness through floor
3	Sensor into Transmission
4	Heat Shield

Retrofitting the Speed Sensor — See figure E296435 and E225083

1. Locate the sensor housing
2. Remove the protective cap
3. Fit the speed sensor
4. Fit the supporting wiring harness

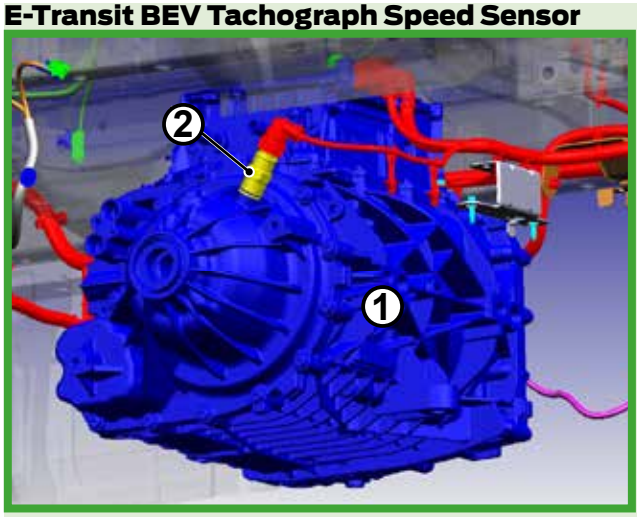
4.12.4 Calibration and Tachograph Retrofitting

NOTE: The tachograph and the cluster have independent speed signal sources and therefore a difference in distance reading between the two parts may occur.

The Continental/VDO Calibration Centre will order the tachograph and fit the unit to the vehicle.

EU Legal legislation requires that before the vehicle can be used on the road, the DTCO tachograph must be calibrated. The digital tachograph activation must be completed by an authorized Continental/ VDO workshop. The Ford dealer will organise the tachograph calibration.

E-Transit BEV Tachograph Speed Sensor



Item	Description
1	Primary Drive Unit
2	Tachograph Speed Sensor

Abc = BEV Only Abc = ICE Only

Tachograph and Speed Sensor Aftermarket Parts

Parts Required to Support Aftermarket Retrofitting of a Digital Tachograph and Speed Sensor

Part Number	Description
Mounting Parts	
4C1T-18923-A*	Metal Frame
Tachograph Units	
KK3T-17A266-A*	Digital Head Unit 4.0
Speed Sensor	
KK2T-17K321-A*	Manual Transmission FWD
KK3T-17K321-A*	Manual Transmission RWD
Wiring Harness	
KK3T-14K141-K*	Tachograph Harness
KK2T-14K141-L*	Speed Sensor Harness - Manual Transmission FWD
GK3T-14K141-H*	Speed Sensor Harness - Manual Transmission RWD
NK3T-14A107-TA	Speed Sensor Harness - E-Transit BEV

DSRC Aftermarket Parts

Parts Required to Support Aftermarket Retrofitting of a DSRC if IPMA Bracket IS Present on Vehicle

Part Number	Description
DSRC Units	
KK3T-19J269-A*	DSRC Antenna
Wiring Harness	
KK3T-18812-AA*	DSRC Harness 1
KK3T-18812-AB*	DSRC Harness 2

Parts Required to Support Aftermarket Retrofitting of a DSRC if IPMA Bracket IS NOT Present on Vehicle

Part Number	Description
Mounting Parts	
KK2V-19H507-A*W	DSRC Carrier Base
KK2V-19H507-B*W	DSRC Carrier Cover
DSRC Units	
KK2V-19J269-A*	DSRC Antenna
Wiring Harness	
KK3T-18812-AA*	DSRC Harness 1
KK3T-18812-AB*	DSRC Harness 2

Abc = BEV Only Abc = ICE Only

4.13 Information and Entertainment System

4.13.1 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 Conversionworks@ford.com

AHU/Multimedia ICE Packs

AHU/ICE Pack	Description
35	Single DIN Radio (Stripped Chassis Only)
36	Single DIN Radio (Stripped Chassis Only) with DAB
30	Pre Equipment Pack (less speakers) - no audio
12	Single DIN Radio
13	Single DIN Radio with DAB
16	Connected HMI Radio
17	Connected HMI Radio with DAB
20	Connected Touch Radio
21	Connected Touch Radio with DAB
24	Navigation (NAV) SYNC Gen 3 with DAB
25	Navigation (NAV) SYNC Gen 3 with DAB with IACC (Intelligent Adaptive Cruise Control)

Item	Description	Item	Description
(1)	Body style dependent	DAB	Digital Audio Broadcasting
(2)	Microphone changes with Overhead Console	Div	Diversity
-	Not available	ICP	Instrument Control Panel
X	Included	RVC	Rear View Camera
O	Optional	TMC	Traffic Message Channel
ACC	Accessory	TPEG	Transport Protocol Experts Group
Ch	Channel	GNSS	Global Navigation Satellite System

	Description	35	36	30	12	13	16	17	20	21	24	25
Audio Head Unit (AHU)	Less AHU	-	-	X	-	-	-	-	-	-	-	-
	1-DIN	X	-	-	X	-	-	-	-	-	-	-
	1-DIN with DAB	-	X	-	-	X	-	-	-	-	-	-
	FM/AM Connected HMI Radio 4ch	-	-	-	-	-	X	-	-	-	-	-
	FM/AM Connected HMI Radio 4ch with DAB	-	-	-	-	-	-	X	-	-	-	-
	FM/AM Connected Touch Radio 4ch	-	-	-	-	-	-	-	X	-	-	-
	FM/AM Connected Touch Radio 4ch with DAB	-	-	-	-	-	-	-	-	X	-	-
	FM/AM SYNC Radio 6ch DAB - TMC TPEG	-	-	-	-	-	-	-	-	-	X	X
	Bluetooth	X	X	-	X	X	X	X	X	X	X	X
Speakers	Less Radio Speaker	X	X	-	-	-	-	-	-	-	-	-
	4 Speaker front low series speakers[1]	-	-	X	X	X	X	X	X	X	X	X
	6 Speaker[1]	-	-	-	X	X	X	X	X	X	X	X
Antenna	AM/FM - Non DAB	X	-	X	X	-	X	-	X	-	-	-
	AM/FM - with DAB (active antenna)	-	X	-	-	X	-	X	-	X	X	X
	GNSS/Cellular Antenna (Available with Embedded Modem)	X	X	X	X	X	X	X	X	X	X	X
Slim Display Module (SDM)	Less SDM	X	X	X	X	X	-	-	-	-	-	-
	Display Module 4”	-	-	-	-	-	X	X	-	-	-	-
	Display Module 8”	-	-	-	-	-	-	-	X	X	X	X
	Less ICP	X	X	X	X	X	-	-	-	-	-	-
	Mini ICP - 10 Buttons	-	-	-	-	-	X	X	-	-	-	-
	Mini ICP - 5 Buttons	-	-	-	-	-	-	-	X	X	X	X
Steering Wheel Control	Less Radio Controls	-	-	X	-	-	-	-	-	-	-	-
	Radio Controls	X	X	-	X	X	X	X	X	X	-	-
	Radio Controls (with voice)	-	-	-	-	-	-	-	-	-	X	X
	Trip Computer	X	X	X	X	X	X	X	X	X	X	X
Cluster	Cluster S0 (Mono 2.3” display LCD) **ICE Only**	X	X	X	X	X	X	X	X	X	X	-
	Cluster S1 (Mono 4.2” display TFT) **ICE Only**	O	O	O	O	O	O	O	O	O	O	-
	Cluster S2 (colour 4.2” display TFT)	O	O	O	O	O	O	O	O	O	O	X
Connectivity	Less Accessory USB unit	-	-	-	-	-	-	-	-	-	-	-
	ACC 1 USB Port-1 Remote Port	X	X	-	X	X	-	-	-	-	-	-
	ACC 2x USB + BT with connected Radio	-	-	-	-	-	X	X	-	-	-	-
	Mini Media Hub (x2 USB) with Adaptor Bezel +BT	-	-	-	-	-	-	-	X	X	X	X
	Microphone - Overhead Console Mic[2]	X	X	-	X	X	X	X	X	X	X	X
	Microphone - Headliner Mic[2]	X	X	-	X	X	X	X	X	X	X	X
Sync	Sync Gen 3	-	-	-	-	-	-	-	-	-	X	X
Navigation	Non Navigation	X	X	X	X	X	X	X	X	X	-	-
	Navigation	-	-	-	-	-	-	-	-	-	X	X
Embedded Modem	Cellphone Interface	-	-	-	-	-	X	X	X	X	X	X

Abc = BEV Only

Abc = ICE Only

Abc = BEV Only Abc = ICE Only

4.13.2 AHUs

- Single DIN Radio with/without DAB
- Connected HMI Radio with/without DAB
- Connected Touch Radio with/without DAB
- SYNC Radio With/Without DAB

4.13.3 Sub-Entry Radio

NOTE: There is a black co-axial cable for the roof-mounted AM/FM/DAB antenna that goes to the rear of the AHU. There is also a black USB cable which goes to the rear of the AHU.

AHU is connected to the instrument panel wiring harness via a single 32 pin connector.

Sub-Entry Radio Main Connector

Pin	Description	Type	Pin	Description	Type
1	Battery	Input	17	Not Used	-
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	Not Used	-
9	Right Rear Speaker -	Output	25	Not Used	-
10	Right Rear Speaker +	Output	26	Microphone -	Input
11	Not Used	-	27	Not Used	-
12	Not Used	-	28	Not Used	-
13	Not Used	-	29	Not Used	-
14	Not Used	-	30	CAN - Low	Input/ Output
15	Microphone +	Input	31	Not Used	-
16	Not Used	-	32	Not Used	-

4.13.4 Connected HMI Radio and Connected HMI Radio with DAB

NOTE: There is a black co-axial cable for the roof-mounted single AM/FM/DAB antenna that goes to the radio. There are two co-axial cables for diversity antenna. (Diversity antenna only available on kombi M1, N1 and buses).

NOTE: There are two black USB cables, which go to the radio. One of the USB cables has grey connector and the other one has black connector.

NOTE: There is a blue co-axial cable for global navigation satellite system (GNSS) antenna that connects to the back of the AHU.

NOTE: CHR will only work with SDM4 display and the mini-ICP version for this combination.

NOTE: There is a black LVDS Cable which is connected to the radio via a Blue connector. SDM4 display is powered via this LVDS cable and serial communication between radio & display takes place through this cable.

Connected HMI Radio (CHR) is connected to the instrument panel wiring harness via a single 32 pin connector. Although there are two connectors on the radio side, only one connector is utilised for CHR.

Connected HMI Radio Main Connector

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	-

Abc = BEV Only Abc = ICE Only

4.13.5 Connected Touch Radio and Connected Touch Radio with DAB

NOTE: There is a black co-axial cable for the roof-mounted single AM/FM/DAB antenna that goes to the radio. There are two co-axial cables for diversity antenna.

NOTE: There is a black USB cable, which go to the multimedia hub.

NOTE: There is a blue co-axial cable for global navigation satellite system (GNSS) antenna that connects to the back of the audio head unit.

NOTE: CTR will only work with SDM8 display and 5 button mini-ICP.

NOTE: There is a black LVDS Cable which is connected to the radio via a Blue connector. SDM8 display is powered via this LVDS cable and serial communication between radio & display takes place through this cable.

Connected Touch Radio (CTR) is connected to the instrument panel wiring harness via a single 32 pin connector. Although there are two connectors on the radio side, only one connector is utilised for CTR.

Connected Touch Radio Main Connector

Pin	Description	Type	Pin	Description	Type
1	Battery	Input	17	MCM Power	Output
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	SWC -	Input
12	Not Used	-	28	MCM Ground	Ground
13	Microphone Shield	Ground	29	LIN	Input/ Output
14	RVC +	Input	30	CAN - Low	Input/ Output
15	Microphone +	Input	31	Not Used	-
16	SWC +	Input	32	Not Used	-

4.13.6 SYNC Radio and SYNC Radio with DAB

NOTE: There is a black co-axial cable for the roof-mounted single AM/FM/DAB antenna that goes to the radio. There are two co-axial cables for diversity antenna. (Diversity antenna only available on kombi M1, N1 and buses).

NOTE: SYNC Radio is present only when SYNC3 module is available.

NOTE: There is a blue co-axial cable for global navigation satellite system (GNSS) antenna that connects to the back of the AHU.

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

Abc = BEV Only Abc = ICE Only

4.13.7 Rear View Camera

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

There are three pins on the SYNC module.

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

The cable between the RVC and SYNC module needs to be screened twisted pair, preferably of a single run to minimise signal loss.

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. For vehicles with non-SYNC audio systems, it is not possible to install an aftermarket RVC.

Rear Light Connector Change

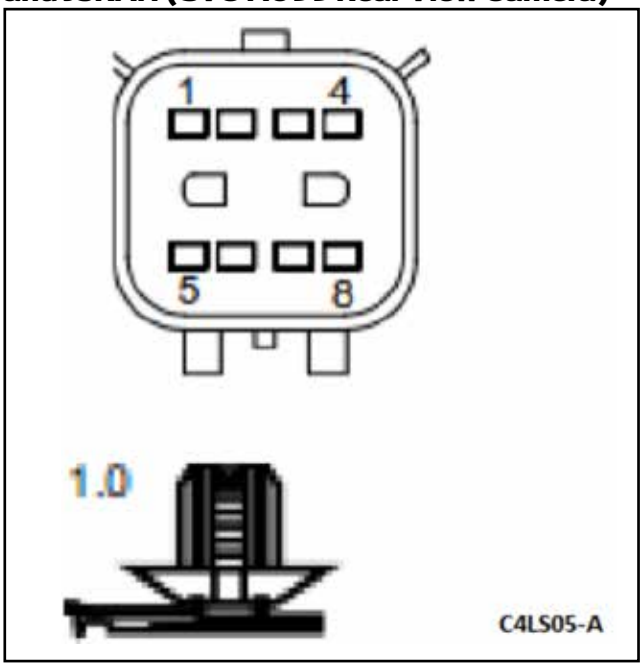
On the Transit stripped chassis vehicle (Skeletal) a change has been made to the rear connector to include the SVO A099 Rear View Camera option J3KAN.

Pre MY2022.5 (January 2022): Base Connector (3-Way Male)

Introduced with MY2022.5 (February 2022) and J3KAN (SVO A099 Rear View Camera): CONNECTOR (8-WAY MALE)

AU5T-14A624-HB (006) -> Molex connector 33482-4878 (Pin 1 sealed)
6S6T-14A592-AA clip

Introduced with MY2022.5 (February 2022) and J3KAN (SVO A099 Rear View Camera)



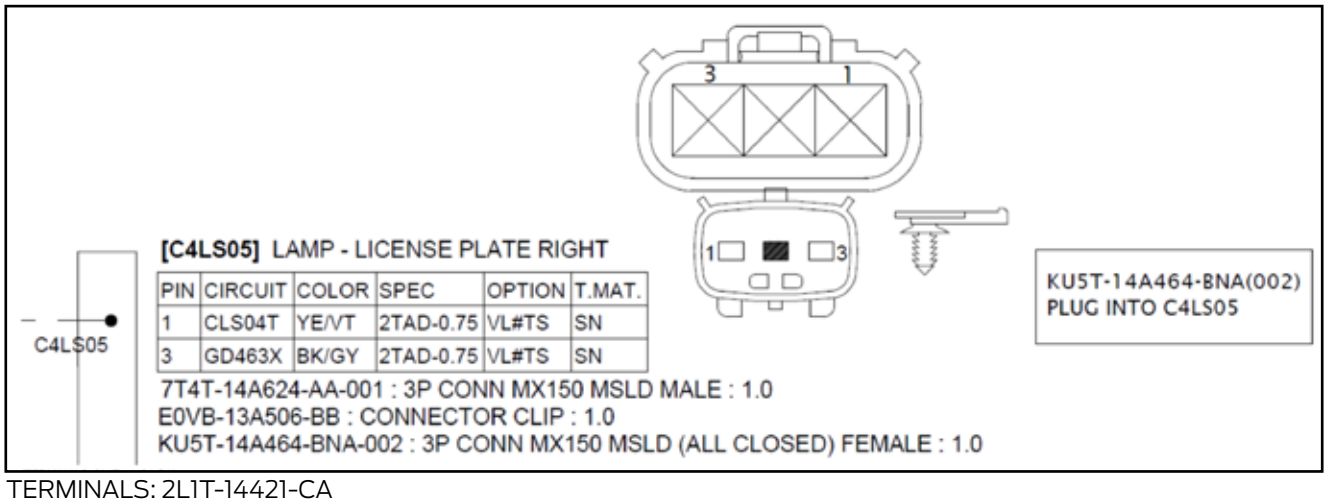
PIN	CIRCUIT	COLOUR	WIRE SPEC	OPTION
1	-	-	-	-
2	VDN04X	VT/WH	3TAD-0.75	J3KAN
3	GD463X	BK/GY	2TAD-0.75	VL#TS
4	CB125X	WH/OG	3TAD-0.75	J3KAN
5	DMP19	SI	SCR-0.75	J3KAN
6	VMP19	WH/GN	2TBD-0.75	J3KAN
7	RMP19	BN/VT	2TBD-0.75	J3KAN
8	CLS04T	YE/VT	2TAD-0.75	VL#TS

TERMINALS: 2L1T-14421-CA

Remark: ĐMP19/DMP19/RMP19 to be a shielded multicore wire

MATING CONNECTOR (8-WAY FEMALE)
KU5T-14A464-TA (006) with keying option B -> Molex connector 33472-5035 (Pin 1 sealed)

Pre MY2022.5 (January 2022 Base Connector (3-Way Male)



TERMINALS: 2L1T-14421-CA

4.13.8 Speakers

To add additional Rear Speakers

Rear speaker wiring is only present in the instrument panel harness 14K024 when 6 or 10 speakers are present. The harnesses 14401 will only support rear speakers when 6 or 10 speakers are requested. This is also the case for the 14405/14A005 they are also linked to 6 or 10 speakers.

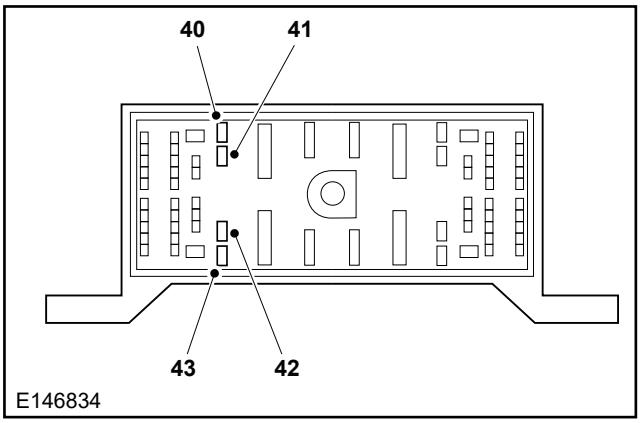
When the rear speakers are not present at the body harness 14401/IP harness 14K024 in-line connector on low series variants the rear speakers, if the harness is supporting 6 or 10 speakers, may be spliced into the Audio Jumper Harness at the rear of the AHU.

When installing rear speakers to a camper conversion the Audio Control Module will need re-configuring using FDRS.

Rear Speakers Spliced into the Audio Jumper Harness

Pin	Speaker	Wire Colour
24	Right Rear (+)	Brown/White
12	Right Rear (-)	Brown/Blue
21	Left Rear (+)	White/Green
9	Left Rear (-)	Brown/Yellow

Rear Speakers In-line Connector (14401/14K024)



Item	Description
Pin 40	Rear Speaker Left +
Pin 41	Rear Speaker Left -
Pin 42	Rear Speaker Right -
Pin 43	Rear Speaker Right +

4.14 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.

4.15 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) or LED DRL (Daylight Running Lights) headlamps to vehicles not originally built with them. If Bi-Xenon HID or LED DRL headlamps are required, then these must be specified at time of ordering for factory fitment.

4.15.1 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.

4.15.2 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 55W (High side driver controlled).
- Rear fog lamp - 2 x 21W (High side driver controlled).

For trailer tow, rear fog lighting, relating to that system.
Refer to: 4.24 Special Conversions

4.15.3 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.

BCM Outputs	Controlling Device	Max. Load	Vehicle
Number Plate and Marker Lamp Supply(1)	High Side PWM	27W	2 x 5W(2)
Position/Parking Lamp Front - each side	High Side PWM	10W	5W
Position/Parking Lamp Rear - each side	High Side PWM	6W	5W
Direction Indicator Front - each side	High Side PWM	27W	21W(3) or 24W(4)
Direction Indicator Rear - each side	High Side PWM	27W	21W(3)
Direction Indicator Side Repeater - each side	High Side PWM	32W	5w or 16W(5)

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

(2)+14W if Side, Roof or End Marker Lamps are already fitted.

(3)Turn Indicator Supply, smaller load will cause double flashing (bulb outage detection).

(4)21W Turn bulb fitted to Halogen headlamps and 24W Turn bulb fitted to Xenon HID headlamps

(5)CAT5 = 5W, CAT6 = 16W

4.15.4 Lamps – Hazard / Direction Indication

NOTE: If LED indicators are used on the rear of a Camper and Ford Skeletal Chassis conversion, the wattage needs to simulate the 21W expected by the bulb outage detection circuit. If LED indicators are supplemental to existing system, then the load resistor may not be required. When adding extra lamps, the converter must check they comply with the legal requirements and that functionality is maintained.

NOTE: For various vehicles CAT 6 repeater lamps must be fitted. See legislation for full details. Check with your local Ford Dealer or National Sales Company representative.

The standard system configuration each side:

- 1 x Front Indicator 21W - max load 27W.
- 1 x Rear Indicator 21W - max load 27W.
- 1 x Side Repeater (Mirror Mounted) either CAT5 (5W) or CAT6 (16W). The whole mirror assembly needs to be changed if moving from CAT5 to CAT6.

4.15.5 Lamps for Wide Vehicles

Lamps - End Outline and Side Marker Lamps

The maximum permissible load with the standard system is:

- 6 x 0.5W - Side Marker.
- 2 x 0.5W - End Outline Marker.
- 2 x 4W - Roof Marker.

Parking Lights

In order to maintain compliance with Lighting Regulations ECE R48 (Parking Lamps), based on the finished vehicle dimensions all Transit Vehicles have single side parking lights disabled. Two side parking lights (including number plate and marker lights) are always available when the headlamp switch is set to POS.

When fitting additional marker it is recommended to use LED's.

4.15.6 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 converter fit.

4.15.7 Power for Additional External Lamps

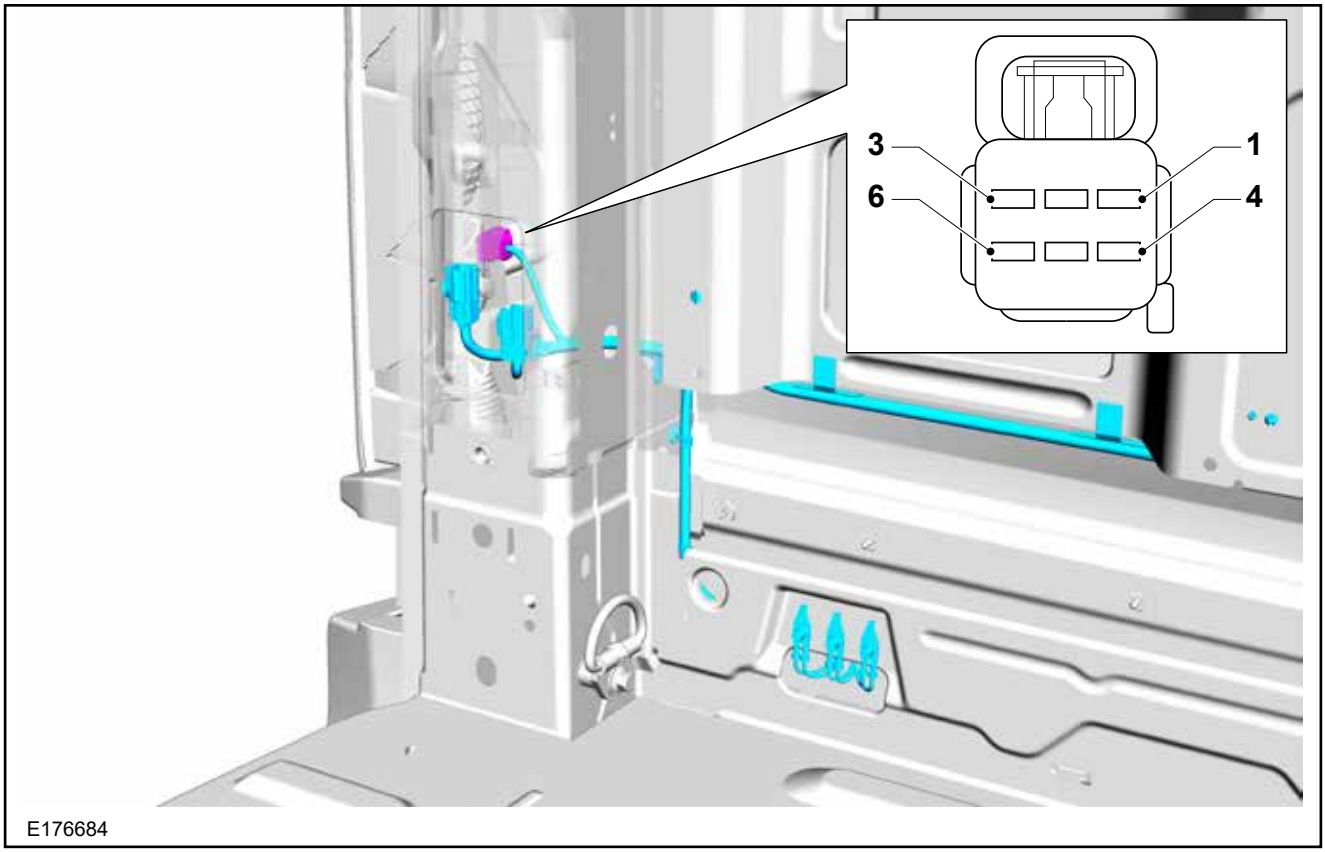
All power for additional exterior lamps must be taken through the Auxiliary Fuse Panel with a suitable switch and/or relay as required.

Refer to: 4.23 Fuses and Relays
Refer to: 4.25 Electrical Connectors and Connections

When fitting additional Markers it is recommended to use LED lamps.

4.15.8 Additional External Lamps

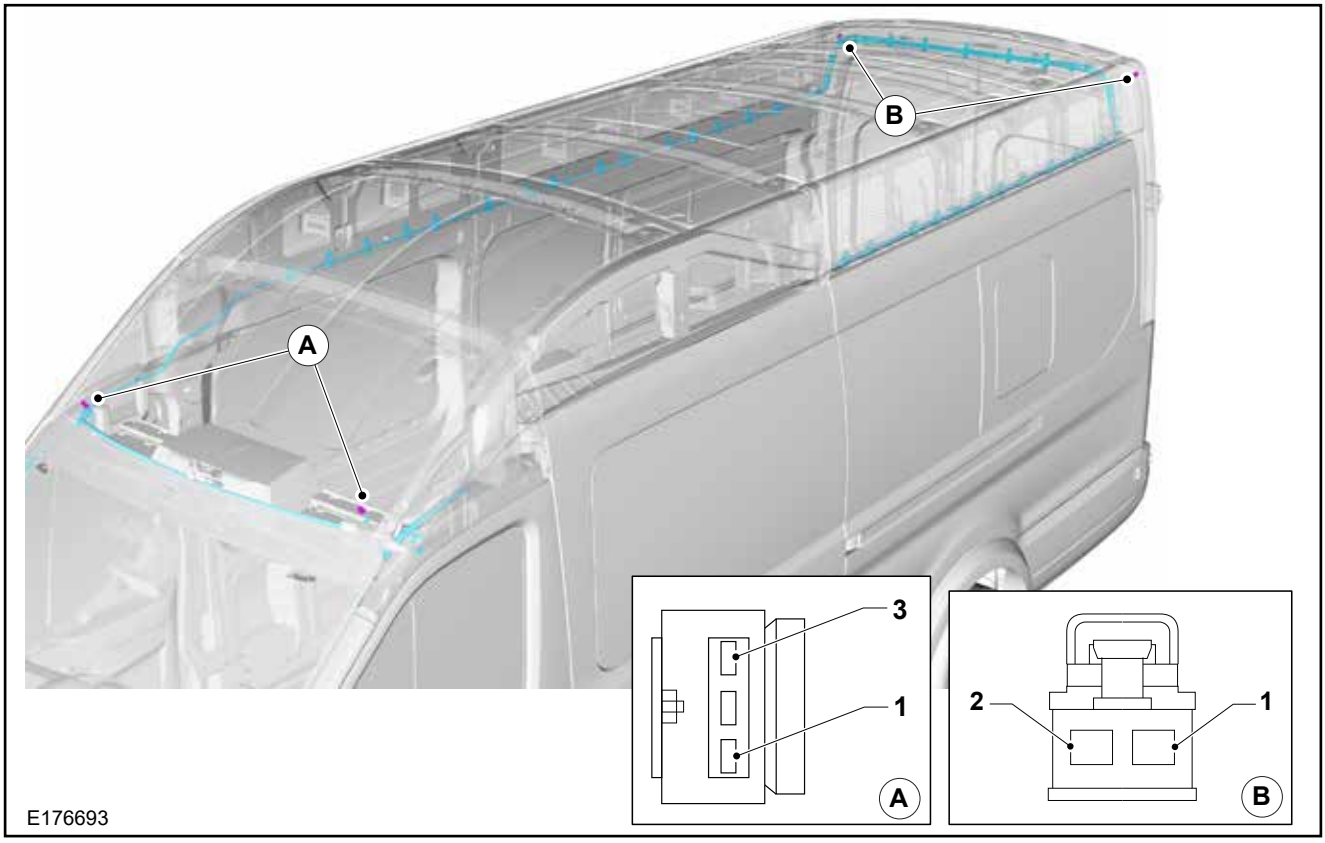
Rear Lamp Connector - Van, Bus and Kombi (Left Hand Side Shown)



Rear Lamp Connectors - Van, Bus and Kombi			
Lamp Assembly Tail Right		**Lamp Assembly Tail Left**	
GK3T-13A409-**	Harness	GK3T-13A409-**	Harness
4S7T-14489-V*	Connector	4S7T-14489-V*	Connector
4S7T-14A459-V*	Mating Connector	4S7T-14A459-V*	Mating Connector
Pin 1	Turn Lamp Right Rear	Pin 1	Stop Right
Pin 2	Stop Left	Pin 2	Park Rear Left
Pin 3	Park Rear Right	Pin 3	Turn Lamp Left Rear
Pin 4	Ground - Pillar D Right 2nd Point	Pin 4	Fog Lamp Rear Left
Pin 5	Reverse Left or Common	Pin 5	Reverse Left or Common
Pin 6	Fog Lamp Rear Right or Common	Pin 6	Ground - Pillar D Left

Abc = BEV Only Abc = ICE Only

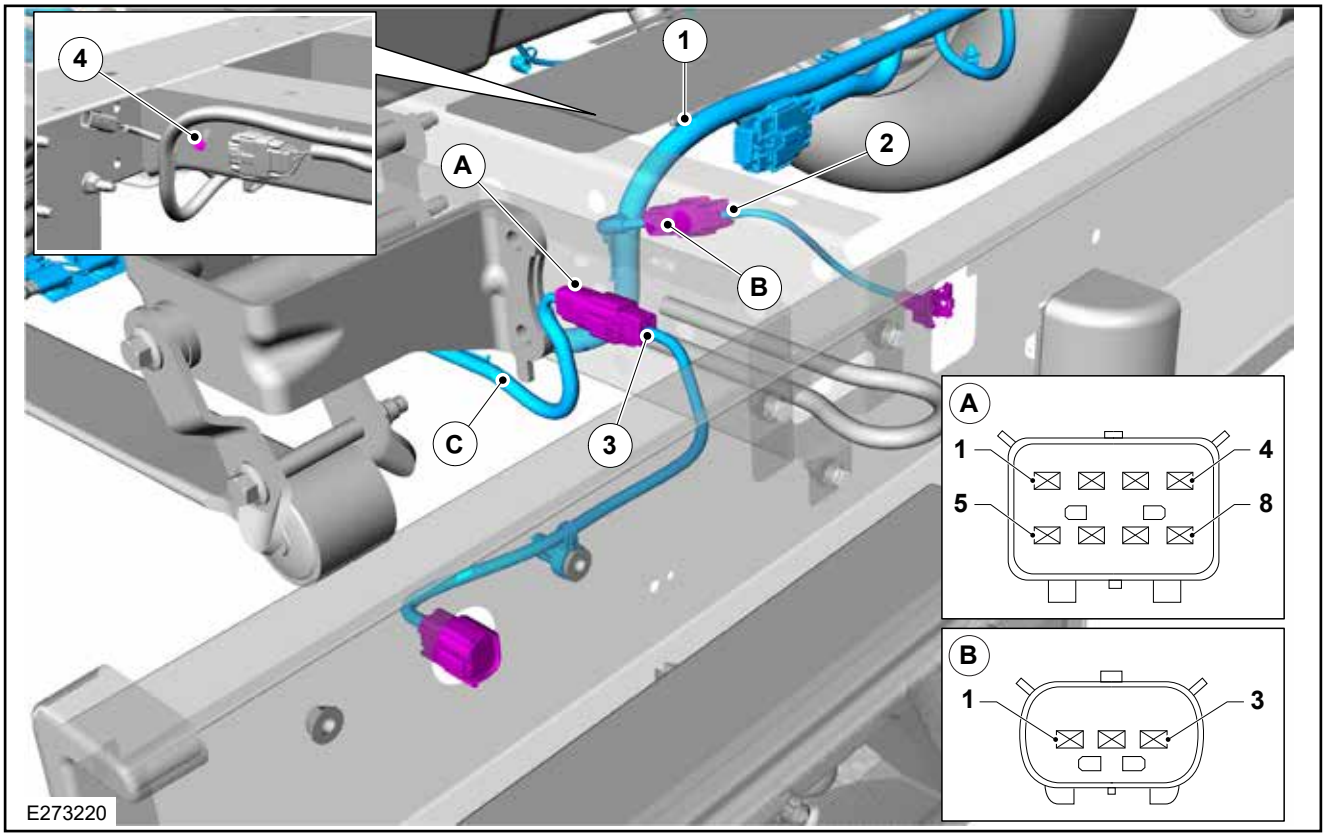
Roof Marker Lamps - Van, Bus and Kombi



Roof Marker Lamps			
'A' Front Roof Markers		**'B' Rear Roof Markers**	
GK3T-13A409-**	Harness	GK3T-13A409-**	Harness
F3LB-14489-M*	Connector	3M5T-14489-B*	Connector
Pin 1	Number Plate Lamps/Marker Lamps	Pin 1	Number Plate Lamps/ Marker Lamps
Pin 2	-	Pin 2	Ground - Pillar D Right/Left
Pin 3	Ground - Pillar D Right/Left	-	-

Abc = BEV Only Abc = ICE Only

Rear Lamps - Chassis Cabs (Left Hand Side Shown)

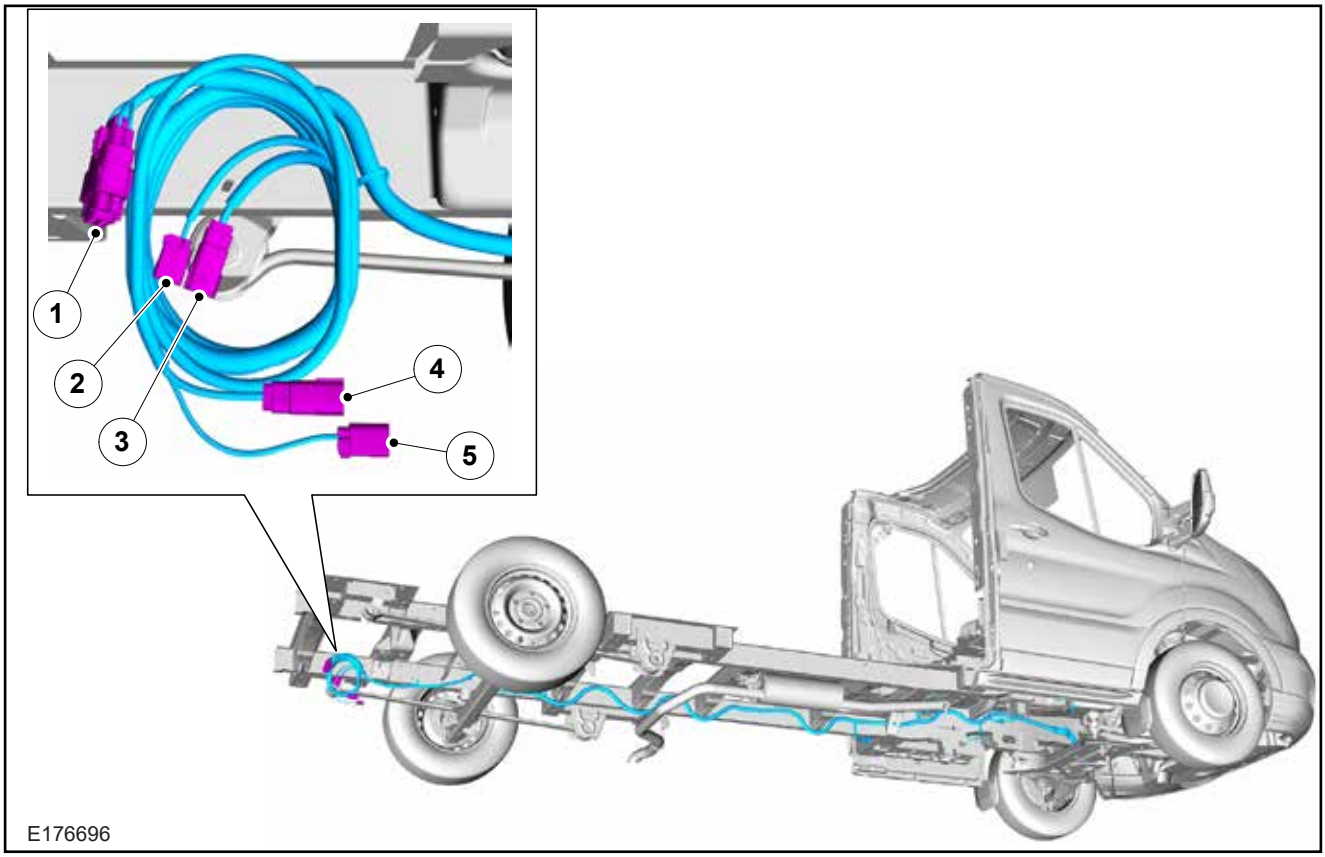


Rear Lamps - Chassis Cabs (Left and Right Hand Side)			
1	Harness - 14406		
2	Mating Connector on Harness BK31-13550 - A*		
3	Mating Connector on harness BK31-12663-A*		
4	Ground Point		
'A' Rear Lamp Connector AU5T-14A624 -H* on Harness 14406			
Pin 1	-	Pin 5	Ground - Frame Middle
Pin 2	Turn Lamp Rear	Pin 6	-
Pin 3	Stop Lamp	Pin 7	Fog Lamp Rear
Pin 4	Park Lamp Rear	Pin 8	Reversing Lamp
'B' Number Plate Lamp Connector 7T4T-14A624-A* on Harness 14406			
Pin 1	Number Plate Lamp	Pin 3	Ground - Frame Middle
Pin 2	-		
'C' Centre High Mounted Stop Lamp (CHMSL) on Harness 14406			
Blunt Wire	CHMSL Wire (Yellow/Grey)[1]		

[1]The CHMSL wire is located under the convoluted sleeve approximately 20mm from the connector.

Abc = BEV Only Abc = ICE Only

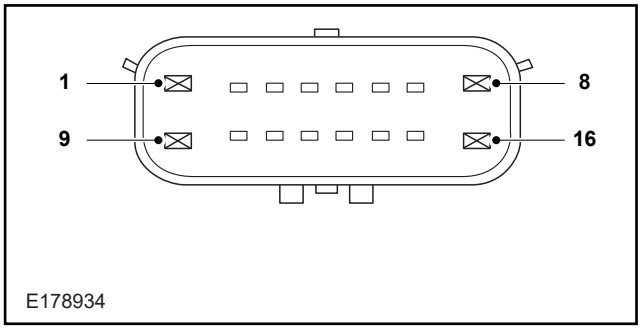
Skeletal Chassis for Camper and Non Camper



Skeletal Chassis for Camper and Non Camper	
GK3T-14406-**	Harness
1	16 pin Connector, See figure E178934
2,5	Number Plate Lamps(1)
3,4	Rear Lamps(1)

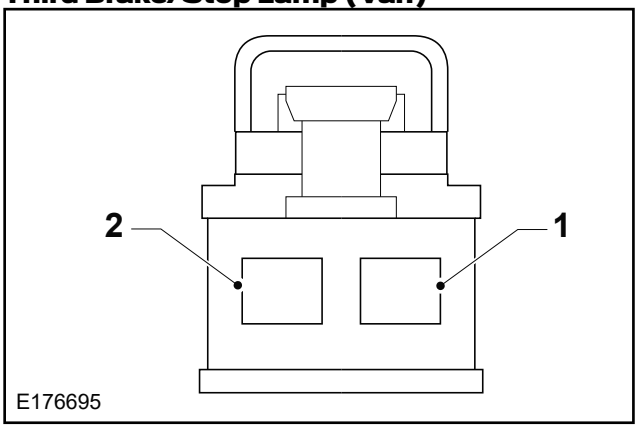
(1)See Rear Lamps - Chassis Cab table for further details

Skeletal Chassis for Camper and Non Camper - 16 Pin Connector



Skeletal Chassis for Camper and Non Camper - 16 Pin Connector			
4R3T-14A624-A* Connector		4R3T-14A464-B* Mating Connector	
Pin 1	Ground - Headlamp Panel/GOR Right 2nd Point	Pin 9	Fuse - 43 or Circuit Breaker
Pin 2	-	Pin 10	Control Module - Trailer Tow Power Ignition On
Pin 3	Control Module - Trailer Tow Turn Signal Left	Pin 11	Control Module - Trailer Tow Backup Lamps
Pin 4	-	Pin 12	Control Module - Trailer Tow Stop Lamps
Pin 5	Control Module - Trailer Tow Rear Fog lamp	Pin 13	Control Module - Trailer Tow Park Lamps
Pin 6	Control Module - Trailer Tow Turn Signal Right	Pin 14	Control Module - Trailer Tow Park Lamps
Pin 7	-	Pin 15	-
Pin 8	Ground - Headlamp Panel/GOR Right 2nd Point	Pin 16	Ground - Headlamp Panel/GOR Right 2nd Point

Third Brake/Stop Lamp (Van)



Third Brake/Stop Lamp Connector	
Pin 1	Third Brake/Stop Lamp on 13A409 Harness - Yellow/Grey
Pin 2	Ground - Black/Grey

A signal for a Third Brake/Stop Lamp is also available on the Rear Lamp connector.

In order to avoid electrical issues due to leakage, and to ensure connector compatibility, a mating connector with seals/plugs and pre-crimped wire and terminal should be used.

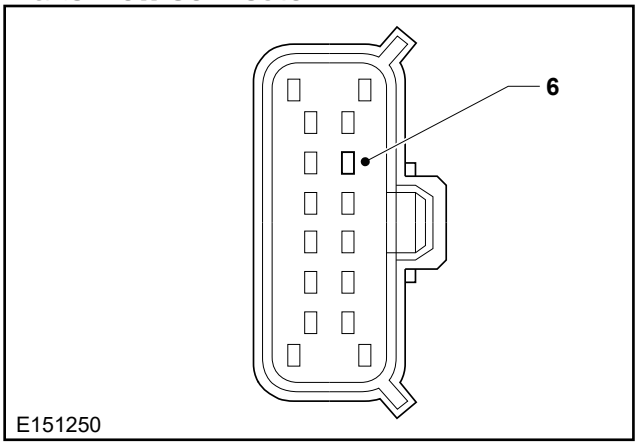
For connectivity, see figure E176695. The Third Brake lamp feed can be accessed from the Third Brake Lamp Connector on 13A409 harness. This connector is centrally located at the rear of the vehicle, above the rear door. For Camper Chassis Cab connectivity

NOTE: Third stop light is not available with the following options (cable is present, but no power):

- Enhanced electronic interface pack A608
- Refrigeration unit prep pack
- Motorhome Prep Pack

Refer to: 4.25 Electrical Connectors and Connections Camper Central Connectors' section of this manual. For Chassis Cab connectivity contact your Local Ford Dealer or email conversionworks@ford.com

Trailer Tow Connector



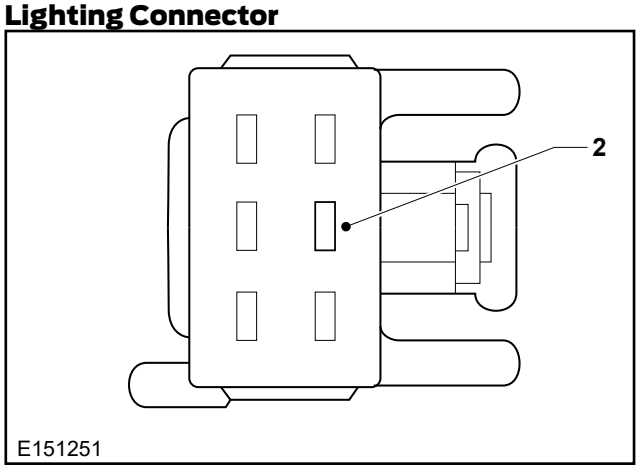
Item	Description
Pin 6	Stop Lamp Feed

The use of the trailer tow connector is not recommended. In situations where it is necessary, please see the following figure E151250. This connector can be found at the 14406 interface with the 13B576 harness. Pin 6 is the stop lamp feed. The trailer tow module GK2T-19H378-A* will need to be fitted to get the system active. For full trailer tow kit a Trailer Tow Socket Jumper is also required, BK2T-13B576-E, F or G* pending on the vehicle. For additional information on electrics for tow bars:

Refer to: 4.1 Electrical System Overview

Additional Position Lamps at the Rear of the Vehicle

Lighting Connector



The feed for position lamps can be taken from the lighting connector, at the rear left hand side of the vehicle on 13A409 harness, pin 2 (violet/green), see figure E151251 or direct from the number plate feed connector, see figure E176686. The maximum load is 6W per side.

NOTE: Lighting connector shown in E151251 will require a local ground.

The position and parking functions operate independently.

Where applicable, when the position lamps are extinguished, the side marker and end-outline markers turn off simultaneously, in line with International Regulations No 48, which states the following:

The electrical connections must be such that the front and rear position lamps, the end-outline marker lamps (if they exist), the side-marker lamps (if they exist) and the rear registration plate lamp can only be switched on and off simultaneously. This condition does not apply when using front and rear position lamps, as well as side-marker lamps when combined or reciprocally incorporated with said lamps, as parking lamps and when side-marker lamps are permitted to flash.

Front Fog Lamps

NOTE: In case front fog lamps are required, it is strongly recommended to order the base vehicle with fog lamps fitted already in the plant.

Abc = BEV Only Abc = ICE Only

Retrofit of front fog lamps may require major rework, dependent upon the level of features on the vehicle. Please contact Conversionworks@ford.com for any front fog lamp retrofit questions.

Connecting to Lighting Information

Additional turn indicators must be powered through relays (max 300mA), driven by existing turn lamps.

The maximum load for turn lamps on each side:

- Front - 27W
- Side (Mirror) - 16W
- Rear - 27W

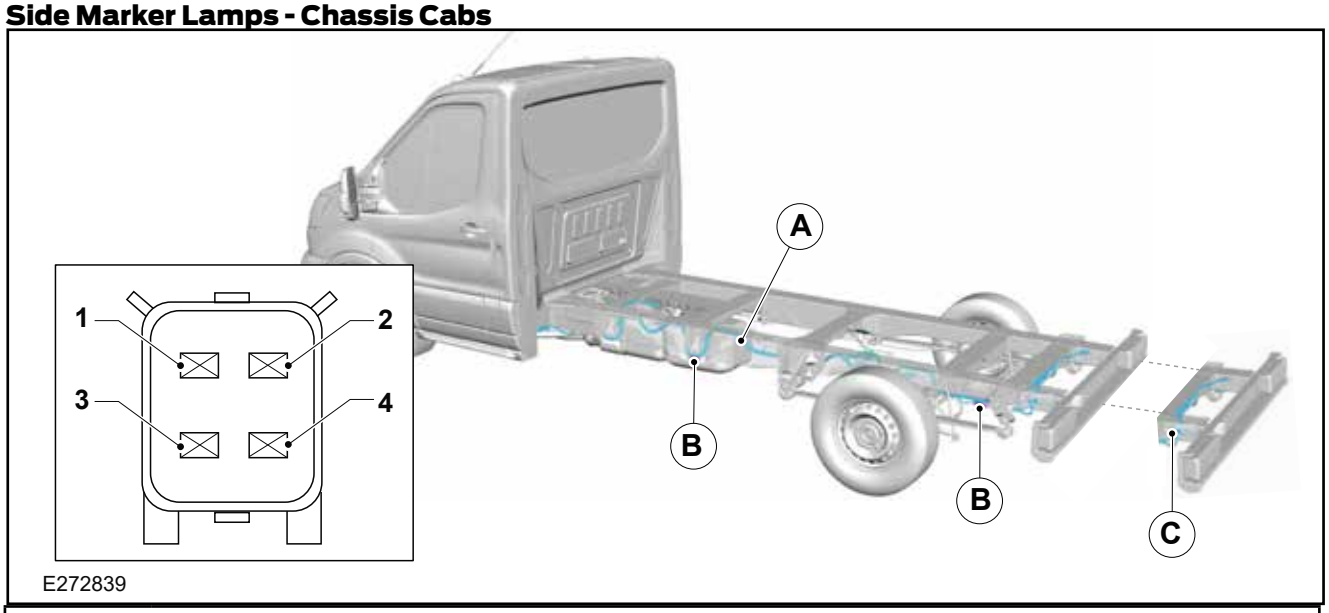
4.15.9 Side Marker Lamps

If side marker lamps are required on a chassis cab they can be connected to the dedicated side marker lamp interfaces.

The side marker interface connectors are always located at the main harness along the frame at the LHS.

There are two mating kits available for connection of side marker lamps:

Side Marker Lamps - Chassis Cabs



E272839

Side Marker Lamps - Chassis Cabs	
A	Main Harness
B	Side Marker Interface Connector for L1 - L5
C	Side Marker Interface Connector for L4 - L5
Pin 1	Side Marker Lamp
Pin 2	Not Used
Pin 3	Not Used
Pin 4	Ground

Side Marker Preparation Pack (A560)

The side marker Preparation pack consists of full sets of LED side marker lamps including integral plastic brackets, wiring and mating interface connector. Every set provides two LED lamps (for LHS and RHS) with adequate wiring length to support different conversion types and widths.

The amount of sets depends on the wheelbase of the vehicle. There will be two sets for L2-L4 Chassis Cabs and three sets for L5 Chassis Cabs.

If the preparation pack A560 will be ordered, the sets will be delivered with the vehicle in plastic bags as loose items. They will be stored in the overhead shelf of the cabin.

Additional single sets (2 LED lamps) can be ordered at Ford dealers.

Side Marker Service Kit

The side marker service kit is to be used to connect third party side marker lamps.

The kit contains mating interface connector and open end wires.

The aftermarket kit is available from Ford dealers.

Order Code	Part Number	Description
A560	GK3V-15B484-A*	Side Marker Preparation Pack (including interface connection, wiring and side marker LED lamps)
-	GK3T-12663-E*	Side Marker Service Kit (including interface connector and open end wires without side marker lamps)

4.16 Interior Lighting

4.16.1 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

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 door or lift gate at the rear of the vehicle.
- Any interior lights that switch on are in the rear cargo or rear zone.
- Some vehicle types may have no lamps on the rear circuit

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

If enhanced bright lights are required for the cargo area of a van, it is recommended to fit the Ford Enhanced Load Space Lighting. Option A080 and LED lamp part numbers BK2V-13776-A*, 4x on medium (L2) and long (L3) wheelbase vehicles and 5x on extra long (L4) wheelbase vehicles. These are controlled from the side load or rear door being ajar or manual demand from the dome lamp in the front cabin. For further information on required parts and configurations to order contact your Local Ford Dealer.

4.16.2 Additional Lighting for Rear of Vehicle Interior

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

For additional information Refer to: 4.25 Electrical Connectors and Connections

Abc = BEV Only Abc = ICE Only

4.17 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 ICE Pack 16 and above will have the Emergency Assist function.

NOTE: For Ford Skeletal Chassis Vehicles the antenna kit will be stored in the glove box.

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 Conversionworks@ford.com

4.17.1 Relocation of GNSS/4G Antenna

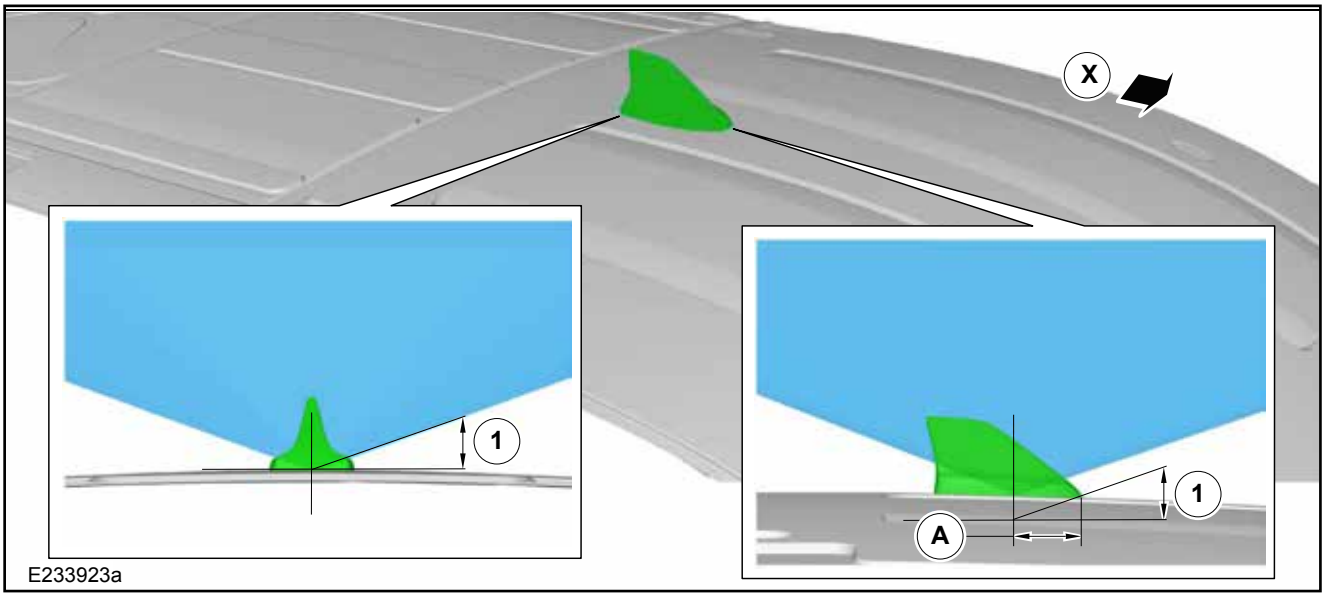
If the conversion requires the Antenna to be relocated, the recommendation is that the existing antenna should be disconnected and left in place for waterproofing. A new Antenna should be used for the alternative location, due to design intent for a single crimp fitment.

The Antenna recommended for relocation is part number **NCPT – 19K351 – C*,** as this is designed to fix to a flat roof design.

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). 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
- 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 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



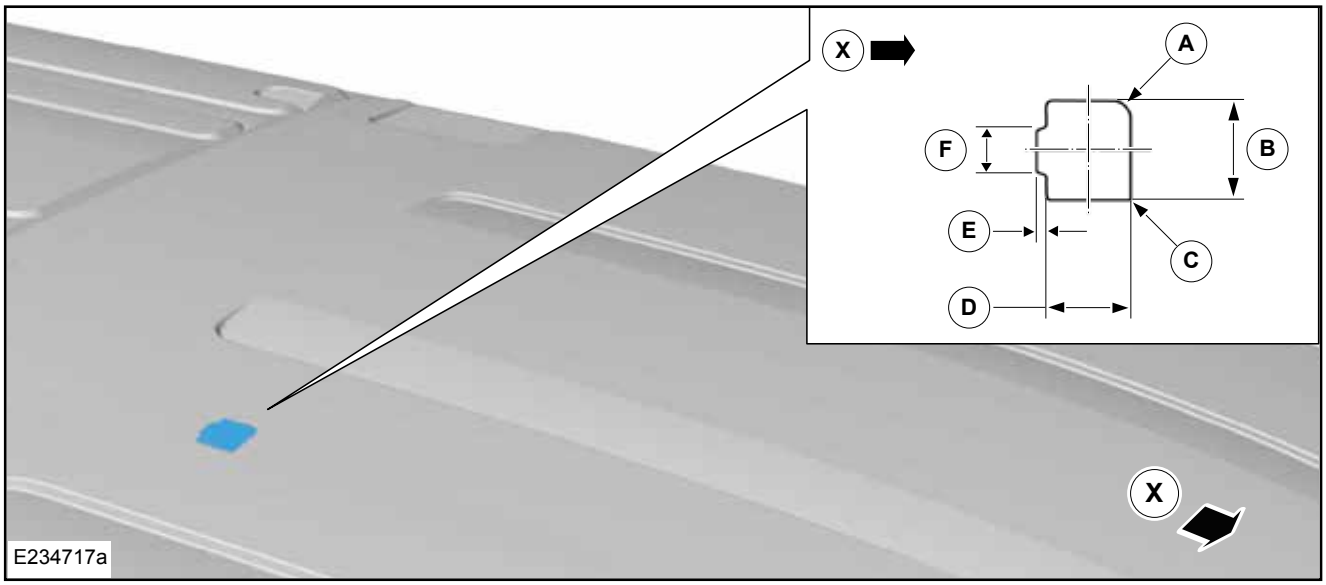
E233923a

Item	Description
1	20°
A	68.8 ± 1mm
X	Front of vehicle direction

- The antenna base design/mounting requires a specific hole shape to ensure anti-rotation and orientation (figure E234717a). The roof and the position on the roof shown in figure E234717a and E233923a are exemplary only
- The mounting on the antenna (bull shark fin variant) will accommodate sheet metal thicknesses from 0.7mm to 1.5mm
- The antenna family requires a **minimum** of a 150mm radius uninterrupted metallic ground surface area surrounding the mounting hole. No interruptions are allowed
- The antenna must have a **minimum** clearance of 250mm from any other antenna located on the vehicle roof and from any metallic structures above the ground plane (if present)
- The antenna should be as close to horizontal as possible and must not be at an angle of greater than 12º 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

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.

Bull Shark Fin Antenna Anti-Rotation Mounting Hole



Item	Description
A	4mm Radius
B	30mm (+0.3)
C	7x 1mm Radius
D	28mm (+0.3)
E	2mm (+0.3)
F	9mm (+0.3)
X	Front of vehicle direction

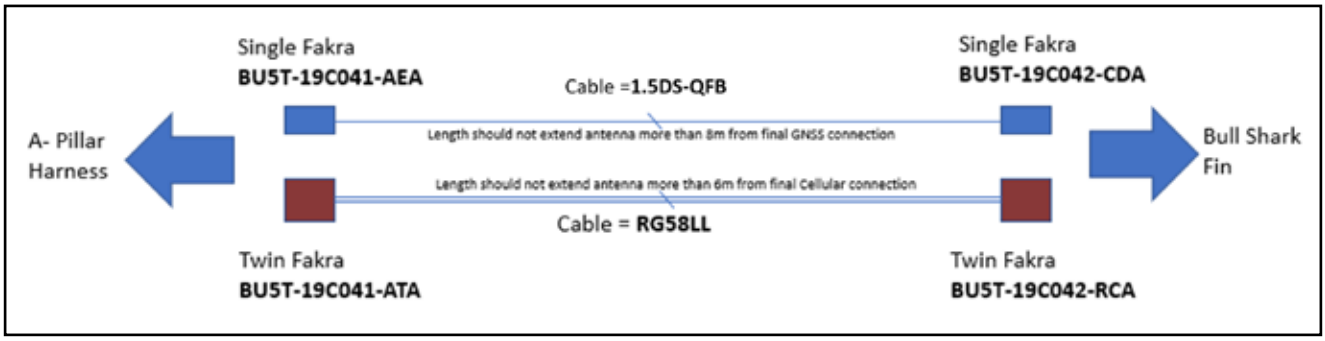
Abc = BEV Only Abc = ICE Only

Cable Extension (to be prepared by converter)

The cable run from the Connected component (Audio Head Unit/SYNC module/Telematics Control Unit) should be no longer than 8m for GNSS connections and 6m for cellular connections.

Extensions should utilise materials and direction from the table and diagram below:

Prefix	Base	Suffix	Rosenberger No	Male/Female	Function	Single/Dual	Colour	Keycode
BUST	19C042	RCA	59Z067-C00-D	Female	GSM	Dual	Bordeaux	D
BUST	19C042	CDA	59Z073-C00-C	Female	GNSS	Single	Blue	C
BUST	19C041	ATA	59Z065-000-D	Male	GSM	Dual	Bordeaux	D
BUST	19C041	AEA	59Z074-000-C	Male	GNSS	Single	Blue	C



4.18 Cruise Control

4.18.1 Adaptive Cruise Control

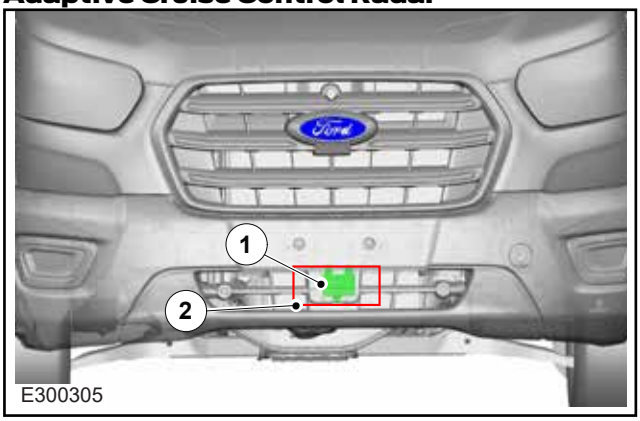
CAUTION: For converted vehicles fitted with adaptive cruise control, where vehicle mass or geometry is significantly altered, it is recommended that the radar vertical alignment and system functionality is checked by a Ford dealer. For further information refer to Workshop Manual or Owner's Manual.

NOTE: Do not obstruct the cruise control radar, see clearance zone 2 in Figure E300305.

NOTE: For converted vehicles fitted with an Adaptive Cruise Control Radar, where vehicle mass or geometry is significantly altered, vertical adjustment - via the screw provided - and calibration for the radar sensor needs to be carried out.

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



E300305

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

Abc = BEV Only Abc = ICE Only

4.19 Blind Spot Information System

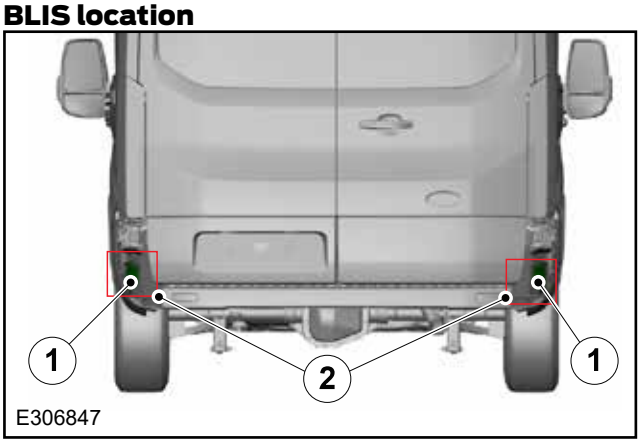
WARNING: The Blind Spot Information System (BLIS) feature will not function if any conversion or installation is in the field of the multiple-beam radar modules which are packaged in the rear quarter panels - one each side.

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



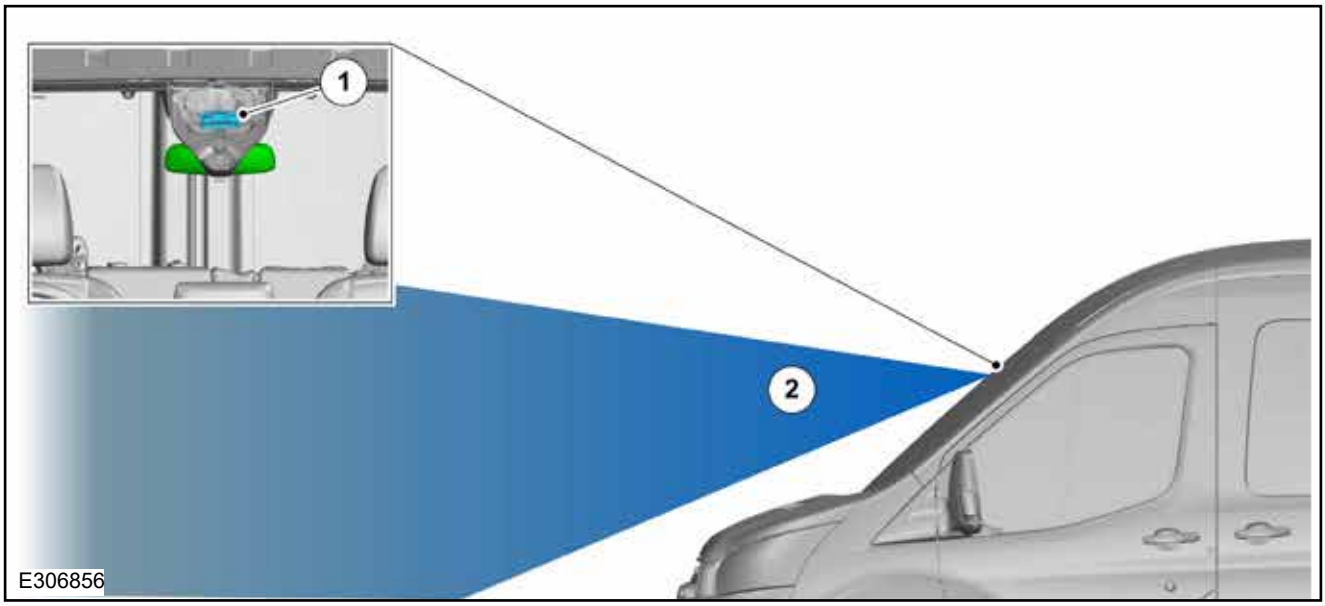
Item	Description
1	Multiple-beam radar module
2	Clearance zone

4.20 Front Windscreen Camera

NOTE: The Front Windscreen Camera features (if available: Pre-Collision Assist, Lane Keeping System, Auto High Beam, Traffic Sign Recognition, Intelligent Speed Assist, Wrong Way Alert, Adaptive Cruise Control, Intelligent Adaptive Cruise Control) will not function if any conversion or installation is in the field of view from the Front Windscreen Camera.

NOTE: For converted vehicles fitted with Front Windscreen Camera, 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: 4.24 Special Conversions



Item	Description
1	Front Windscreen 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

Abc = BEV Only Abc = ICE Only

4.21 Acoustic Vehicle Alerting System (AVAS)

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

All E-Transit BEV vehicles are equipped with AVAS (acoustic Vehicle Alerting System).

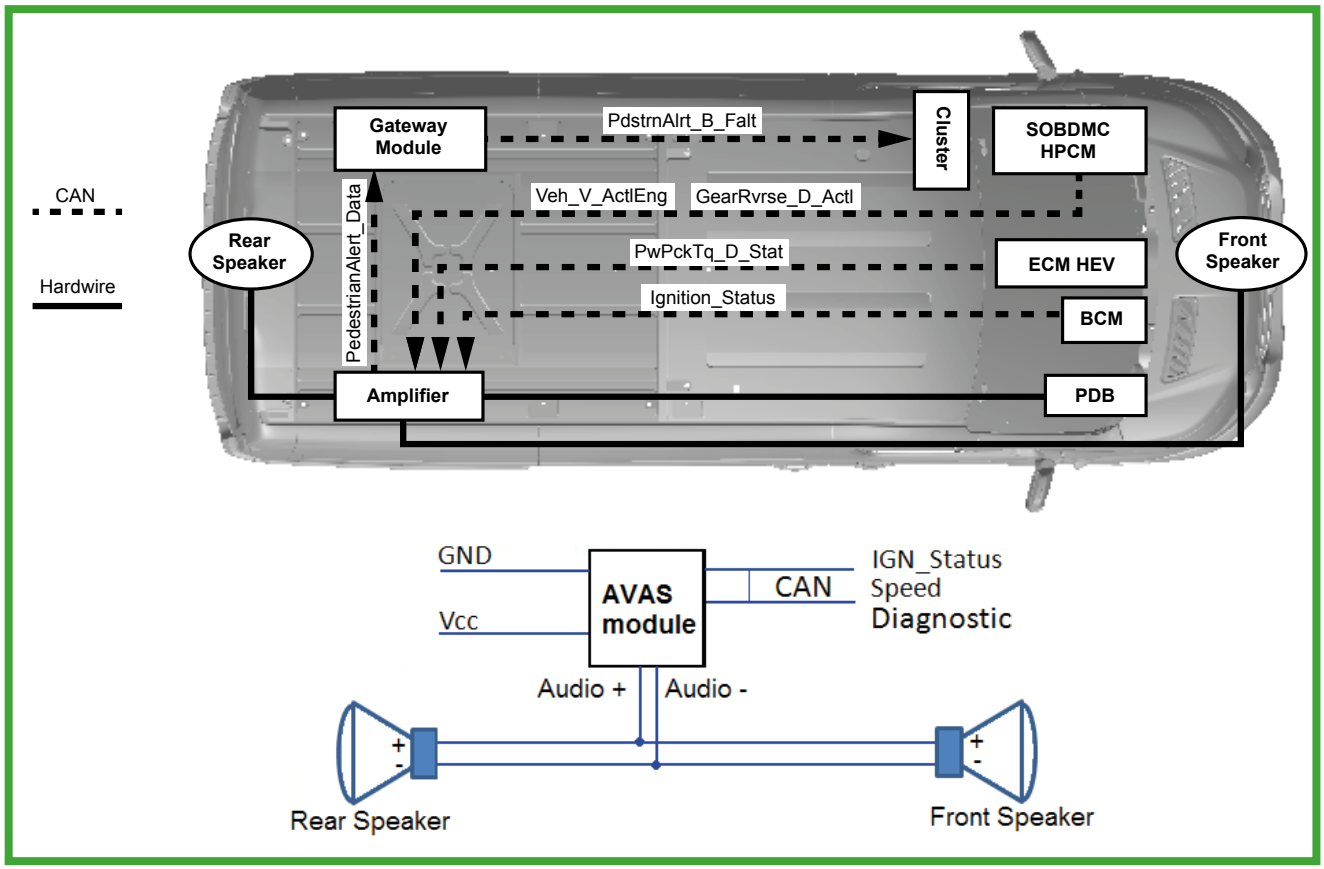
Changes to the AVAS system may influence the minimum required sound level.

Changes to the AVAS system may be: speaker position, sound radiation from the speaker to the outside of the vehicle, sound generation and amplification.

It is not permitted to remove, change position or obscure the AVAS speaker.

Converted vehicles, on the basis of a Chassis Cab or Cutaway, must not exceed the geometrical limits of a Van vehicle.





4.22 Handles, Locks, Latches and Entry Systems

4.22.1 Door Removal or Modification

CAUTION: If an additional third party control system is incorporated into the Ford Locking/Unlocking System the Crash Event Mid Speed 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.

WARNING: Door outer handles should not be replaced, removed or modified due to Passive Entry/Passive Start (PEPS) function (Keyless Entry with Pushbutton Start).

NOTE: If any modified doors have ajar switches fitted and operating in accordance with the above, the original alarm and interior lighting functions can be maintained.

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 Conversionworks@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) C5 in the following way.

- C5-33 Front Left Ajar - Ground
- C5-21 Front Right Ajar - Ground
- C5-34 Rear Cargo Ajar - Ground (if donor has rear door) or not connected if no rear door present on donor (i.e. chassis cab or skeletal chassis cab)
- C5-46 Ajar Left Side Cargo Switch - not connected
- C5-19 Ajar Left Side Cargo Switch - not connected

4.22.2 Central Locking

NOTE: Each unlock circuit supports 1 production type Latch. If more than 1 latch needs to be fitted, additional relays will need to be used (max 300mA coil current permitted) per unlock circuit.
NOTE: All latch lock and unlock pulse durations are 110ms.

Locking is controlled by the BCM. There is current sensing 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.

See also the sections: 4.22.3 Third Button on Key Fob, and 4.25 Electrical Connectors and Connections, for more locking interface options.

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

1. Raid locking or drive away locking for taxi and parcel van usage – this is a configurable parameter in the Instrument Cluster (Ford Dealerships can set this). Once enabled, the parameter can be set and unset via the cluster menu.
2. Slam locking – this is a configurable parameter in the BCM (dealerships can only switch off this feature, but not switch on).
3. 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).

BCM	14A631 in-line Drive Side	14A631 in-line Passenger Side	Function
C3-35	A16	A16	Central Lock
C3-27	A17	-	Driver's Door Unlock
C3-32	B17	B17	Double Lock All (non PSD) or Double Lock Front Row & Cargo (with PSD)
C3-05	-	A17	Passenger Door Unlock

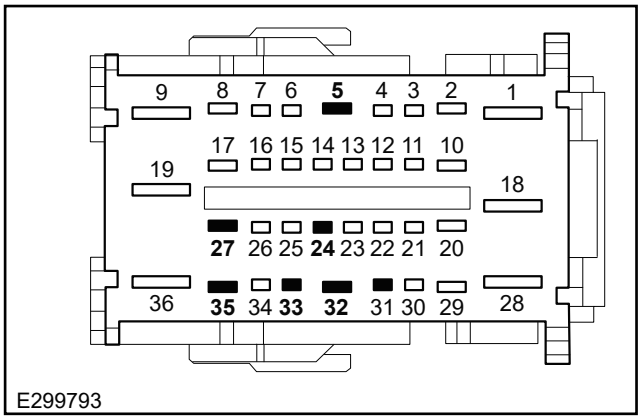
PSD= Power Sliding Door

BCM	19L540	Function
C3-24	1	Unlock RH Sliding Door (non PSD) or Child Lock (with PSD)
C3-33	1	Unlock LH Sliding Door (non PSD) or Unlock PSD LH/RH

BCM	13A409	Function
C3-31	6	Unlock Cargo

Abc = BEV Only Abc = ICE Only

Pins to Control Additional Door Locks



Item	Description
C3-05	Passenger Door Unlock
C3-27	Driver's Door Unlock
C3-24	Unlock RH Sliding Door (non PSD) or Child Lock (with PSD)
C3-35	Central Lock
C3-33	Unlock LH Sliding Door (non PSD) or Unlock PSD LH/RH
C3-32	Double Lock All (non PSD) or Double Lock Front Row & Cargo (with PSD)
C3-31	Unlock Cargo

4.22.3 Third Button on Key Fob - Single Chassis Cab and Skeletal Chassis for Camper and Non Camper

NOTE: There are no micro switches, no current sensing, or any alarm system functionality associated with this pin, or any lock set driven by it.
C3-31 on the BCM is controlled by the third button on the key fob. This provides a 12V 110ms pulse when pressed. The signal can be used via an external relay for a variety of converter applications, subject to load required.

Pin R11-3 is part of the circuit protected by a 15A fuse (F19).

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

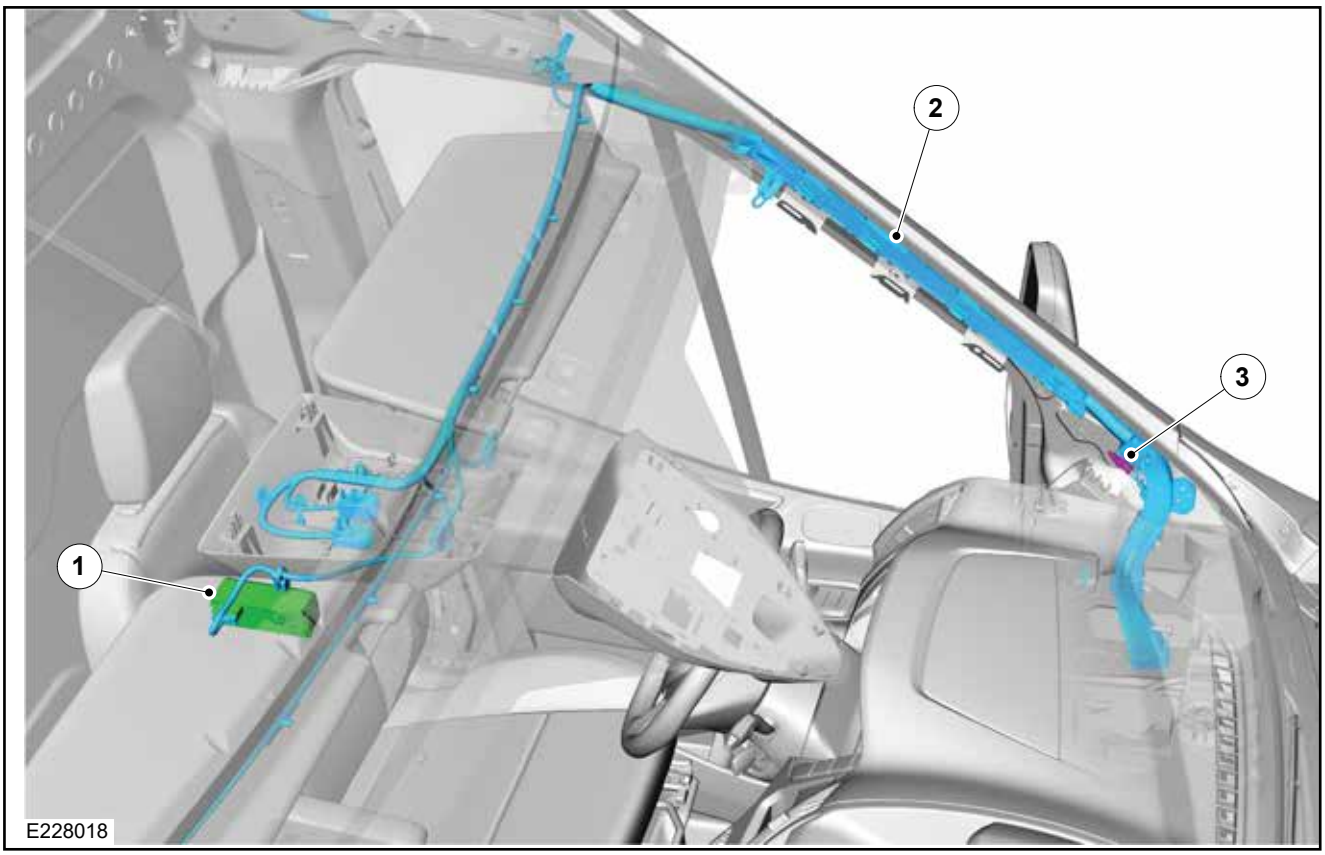
WARNING: For best performance, the RKE/ TPMS receiver must be a minimum distance of 25mm away from any metal objects and 100mm away from high switch loads.

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 14A005 harness and then earthed at the ground point located on the 'A' Pillar. For ground point locations

Refer to: 4.26 Grounding For additional information
Refer to: 2.4 Wheels and Tyres

Remote Keyless Entry/Tyre Pressure Monitoring System Receiver



Item	Description
1	RKE/TPMS Receiver
2	Harness 14A005
3	Ground Point Location

Abc = BEV Only Abc = ICE Only

4.23 Fuses and Relays

4.23.1 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
Mini Fuse		
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
Micro2 Fuse		
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
Micro3 Fuse		
DG9T-14A094-N*	5A	Tan
DG9T-14A094-S*	7.5A	Brown
DG9T-14A094-P*	10A	Red
M-Case Fuse		
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
J-Case Fuse		
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

4.23.2 Relays

NOTE: Only use Ford Relays shown in table.

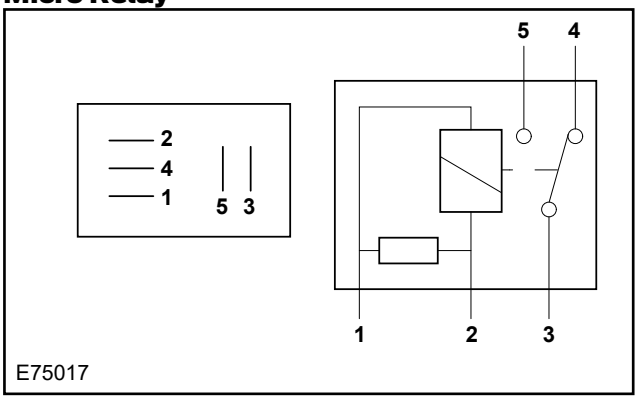
Ford standard relays have a nominal coil current of 300mA (max) at 25°C. Relays with higher loads should not be used.

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



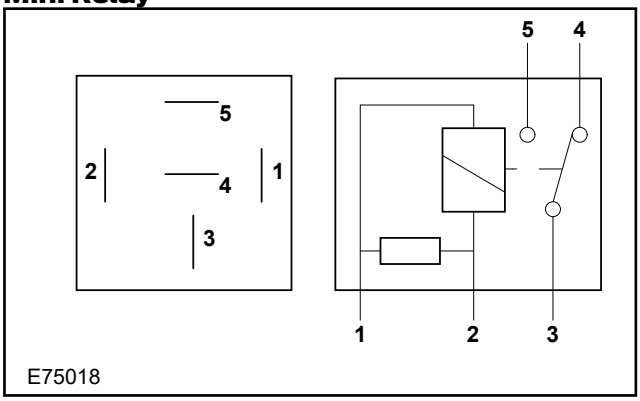
E75017

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



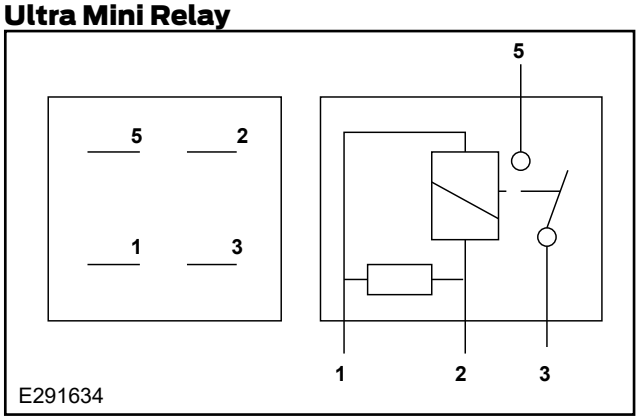
E75018

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



E291634

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*

4.23.3 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: 5.10 Glass, Frames and Mechanisms

Abc = BEV Only Abc = ICE Only

4.24 Special Conversions

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 Conversionworks@ford.com

4.24.1 Special Vehicle Options (SVO) Harnesses and Aftermarket Kits

WARNING: Only Ford release wiring should be used to support added vehicle functionality. If the implementation of wiring other than this is required, Ford guidelines must be followed.

In addition to the Auxiliary Fuse Panel, a number of other kits are available to meet customer needs, see the 'Special Vehicle Option Harnesses and Aftermarket Kits' table.

Special Vehicle Option Harnesses and Aftermarket Kits

Part Number	Description
KK2Z-14A411-K	C1 connector jumper harness (for Auxiliary Fuse Panel)
KK2Z-14A411-L	C2 switch connector jumper harness (for Auxiliary Fuse Panel)
KK2Z-14A411-M	Mating kit for vehicle interface connector
KK2Z-14A411-Y	Kit populated with 22 flyleads for populating A608 High Specification Vehicle Interface Connector
KK2Z-14A411-Z	Mating kit for A608 High Specification Vehicle Interface Connector
KK2Z-14A411-N	Utility pack connector jumper harness
BK2Z-14A411-AX	Beacon connector jumper harness
BK3Z-10A933-D	Beacon preparation pack jumper harness
KK2Z-13A576-A	Trailer tow jumper harness (connector A) Refer to: 4.2 Wiring Installation and Routing Guides Figure E185972 Trailer Tow Module Connectors
BK3Z-13A576-H	Trailer tow socket jumper FWD
BK3Z-13A576-G	Trailer tow socket jumper RWD - Van, Kombi and Bus
BK3Z-13A576-J	Trailer tow socket jumper - Chassis Cabs only
DG9Z-19H332-M	Trailer Tow Module (TTM)
KK3Z-15B484-A	Side marker preparation pack
GK3Z-14A318-C	Side marker service kit - Rear lighting +TT jumper CC/Camper (FCSD)

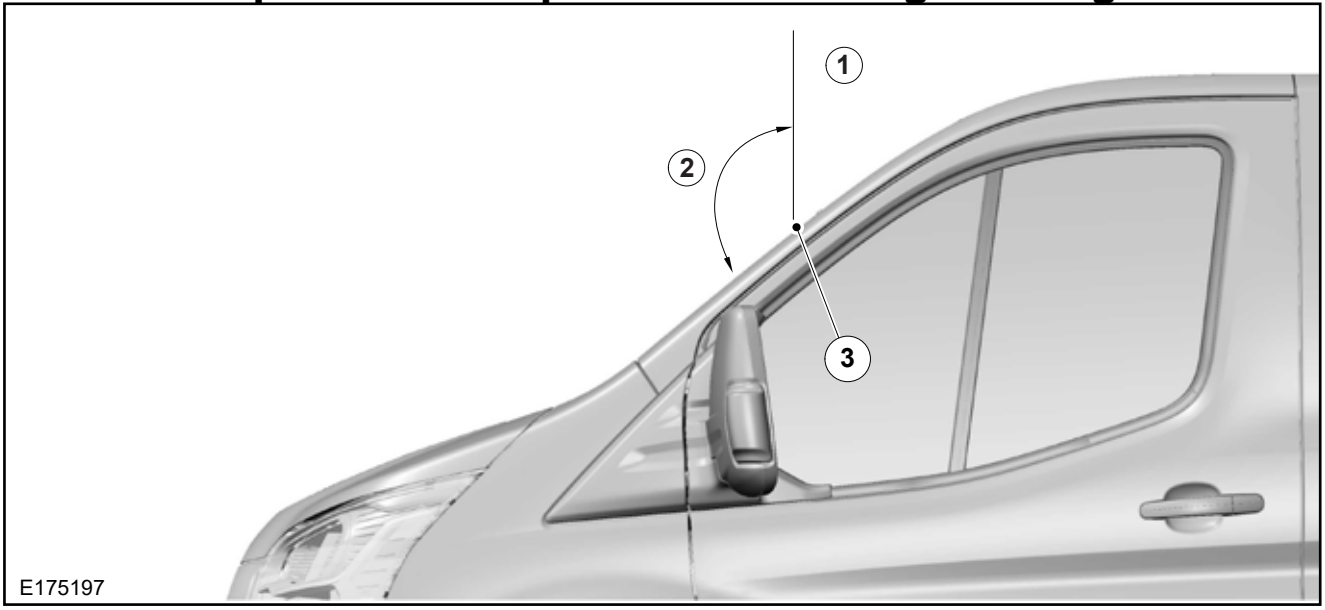
4.24.2 Additional Vehicle Signals/ Features

WARNING: When interfacing with specific lighting high side driver outputs, additional supplemental signal access, relays and peripherals fitted, must be compatible with a Pulse Width Modulation (PWM) frequency of 200Hz.

For list of lighting circuits that are PWM supplied: Refer to: 4.3 Communications Network BCM Output Information table.

For additional information on lighting loads Refer to: 4.15 Exterior Lighting

4.24.3 Auto Wipe and Auto Lamp for vehicles with large overhangs



Item	Description
1	Conversion or installation rearward where Auto Lamp and Wipe feature will function correctly
2	Conversion or installation forward (132°) 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

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 E175197, 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 JX7T-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.

Abc = BEV Only Abc = ICE Only

4.25 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 the High Specification Vehicle Interface Connector (A608) is ordered and the procedure followed, 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 Conversionworks@ford.com

4.25.1 General Information

Main Fuses

In order to protect the battery system from direct ground shorts or continuous high current loads, a 470A 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 Auxiliary Fuse Panel or the High Specification Vehicle Interface Connector (A608)
- 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

4.25.2 Customer Connection Points (CCP)

WARNINGS:

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 (M5) is 3.5–4.5Nm and for CCP2 (M8) is 12Nm.

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.

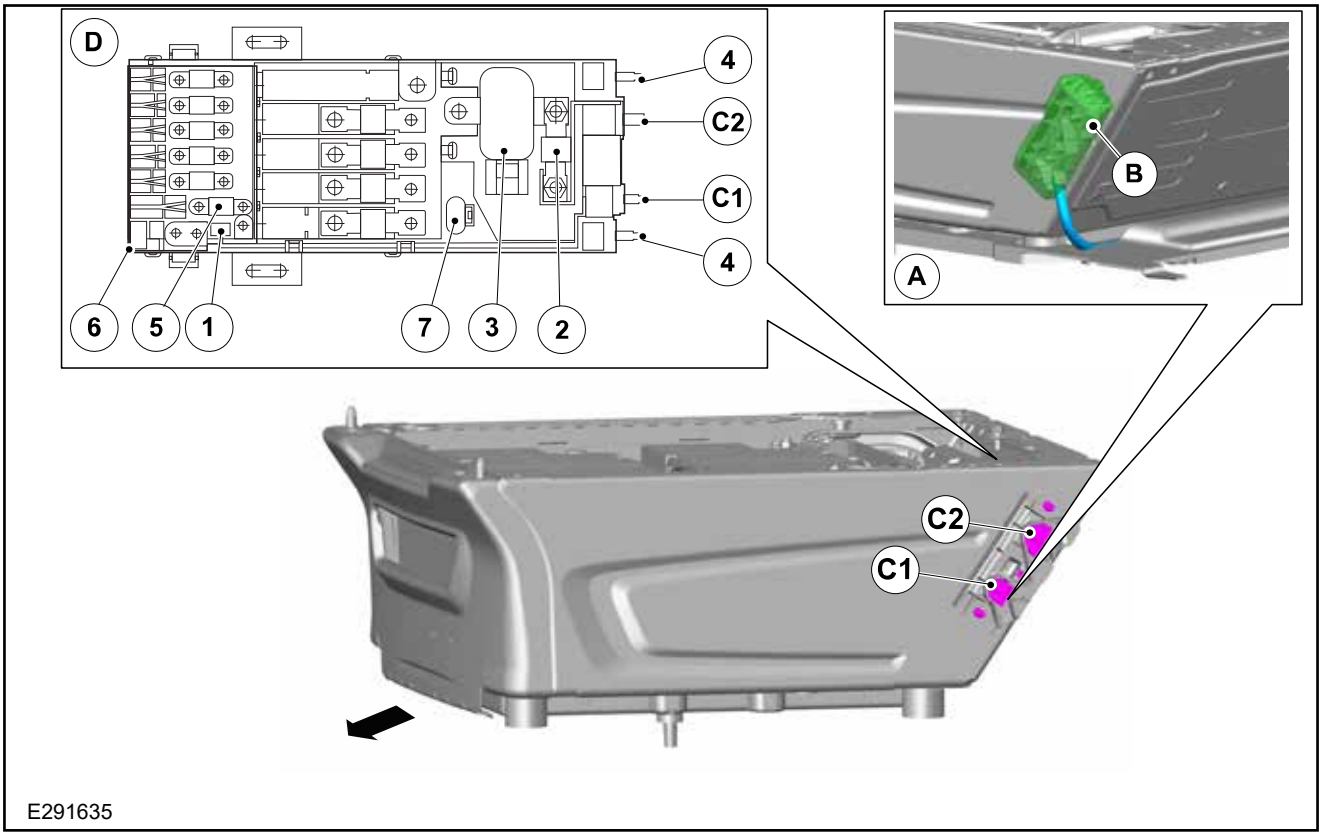
NOTE: There is a maximum of two CCPs. These points are always located on the driver's seat pedestal and are protected by a cover. CCP1 which is capable of supplying a max current of 60A and CCP2 which is capable of supplying a max current of 175A.

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 KU5T-14D089-B*.

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.

CCP Location and Pre Fuse Panel



E291635

Item	Description
A	Suggested wiring location
B	CCP Cover
D	Pre Fuse Panel
C1	CCP1 (60A)
C2	CCP2 (175A)
1	60A fuse - supplies CCP1, High Specification Interface Connector (A608), Camper
2	175A fuse - supplies CCP2
3	CCP2 Load-shedding, and Standard Battery Guard (SBG) Relay
4	CCP cassette fixing studs (NOT to be used as grounding points)
5	150A SVO Auxiliary Fuse Panel feed
6	If any of the fuses in this area have failed, this section of the Pre-Fuse Panel will need replacing. Please contact Conversionworks@ford.com for service kit number.
7	Park position for relay connector control when single battery donor

E291635 shows the left hand drive situation where CCP2 is in the upper position. On a right hand drive vehicle the high current fuse box is rotated 180 degrees so CCP2 will be in the lower position.

For high current supply and ground connections
Refer to: 4.6 Battery Systems

Abc = BEV Only Abc = ICE Only

4.25.3 High Current Supply and Ground Connections

For additional third party ground and +12V power cable connections to the Ford system
Refer to: 4.6 Battery Systems

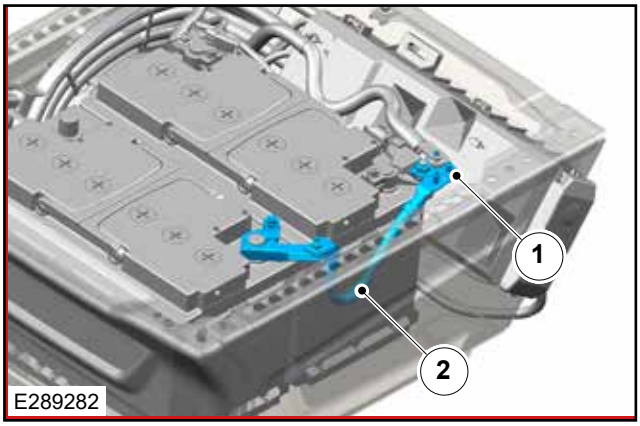
Any peripherals totalling more than 60A added to the power supply must be connected via the CCPs, from dedicated fuses such as: the Auxiliary Fuse Panel (A526), the High Specification Interface Connector (A608) or the FPBG (A540). When the vehicle does not offer adequate power from the CCPs, see 'Third Party PTO for loads exceeding 175A' 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 Conversionworks@ford.com.

Refer to: 4.6 Battery Systems

Auxiliary Ground Stud Eyelet - Twin Battery System shown



Item	Description
1	6mm Auxiliary Ground Stud for Converter Equipment - Torque 8Nm ± 0.8Nm
2	Battery Ground Jumper Cable part number KK2V-14301-K* for Twin Battery System

4.25.4 Camper Central Connectors

WARNING: If multiple systems are to use this supply, the total system load must not exceed the 60A short term loading.

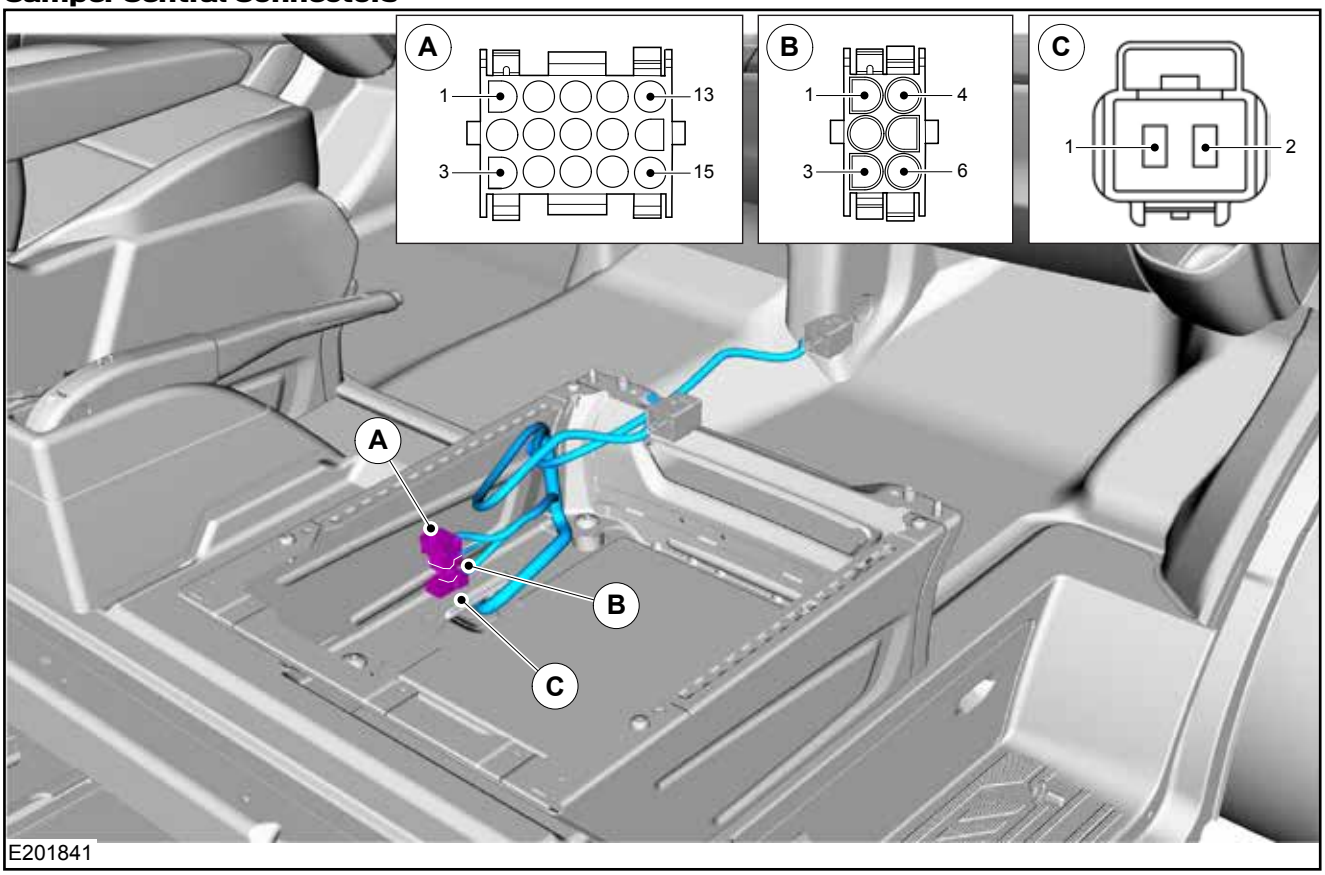
NOTE: To maintain vehicle security, it is recommended to utilise the Door Ajar pin on the 15-pin camper connector so that the camper conversion is included in the security system. This will eliminate the auto-relock, turn on interior lights and provide the door non-closure warning.

Camper conversions are fitted with a dedicated main wiring harness. There is no CCP. Instead 3 connectors are located within the passenger seat pedestal to support camper installations. The connector to power up the 2-way connector underneath the passenger pedestal is securely taped back to the main wire branch running behind the front seats and would need to be connected by the Vehicle Converter during the installation. See CCP in this section for further information. The Vehicle Converter is responsible for good protection of the exposed wire to the CCP, protecting the wire against chafing.

For a Camper Van on a Kombi derivative, rear speaker wiring and Camper speaker connectivity is provided at 2.5mm CSA. It is recommended to only connect one 4ohm speaker to each channel either from the Camper interface connector or the body wiring. If twin speakers per channel are required then each value must be 8ohm.

For additional information
Refer to: 4.2 Wiring Installation and Routing Guides
Wiring Specification table for characteristics on continuous loads versus temperature.

Camper Central Connectors



E201841

Item	Description
A	C2-1 - 15 way connector (face view)
B	C2-2 - 6 way connector (face view)
C	C2-3 - KL30 connector (face view) 60A fed from Pre Fuse Box + Ground

Abc = BEV Only Abc = ICE Only

Part Numbers for Vehicle Connectors and Mating Connectors

Vehicle Connectors			Mating Connectors	
Connector	**Tyco Connector**	**Tyco Terminal**	**Tyco Connector**	**Tyco Terminal**
15-way (C2-1)	0-926647-1	926882-1 (socket)	1-480710-0	926883-1 (pin)
6-way (C2-2)	0-480705-0	926882-1 (socket)	1-480704-0	926883-1 (pin)
Connector	**MTA Connector**	**MTA Terminal**	**MTA Connector**	**MTA Terminal**
2-way (C2-3)	44.403	11.077	44.404	17.077

Pin	Function	Wire CSA	Colour	Comments
Connector C2-1 (Figure E201841 - Item A)				
1	Stop lamp (CHMSL)	0.5	Yellow/Grey	2.5A including existing lamps
2	Engine Run	0.5	Brown/Yellow	300mA, Ground switching
3	Vehicle Speed Output	0.5	Violet/Orange	138Hz@100KPH, 50% duty cycle
4	Interior Lock Switch Input(1)	0.5	Grey/Yellow	Lock switch momentary signal to ground
5	Interior Unlock Switch Input(1)	0.5	Violet/Grey	Unlock switch momentary signal to ground
6	Rear Door Ajar	0.5	Grey	Local switch to ground. Base vehicle with rear door (circuit closed=door closed). Base vehicle less rear door (circuit open=door closed).
7	Interior Light feed(2)	0.5	Green/Grey	300mA max
8	Auto Trans in Park	0.5	Grey/Brown	-
9	Lock Motor Output(1)	1.0	Violet/Green	15A Total (3A per latch) - Total load for locking all vehicle latches
10	Unlock Motor Output(1)	1.0	White/ Orange	15A Total (3A per latch) - Total load for unlocking all vehicle latches
11	Courtesy Light Dimming High Side Rear	0.75	White/Blue	PWM +12V 5A max including all existing rear interior lights
12	Auto Trans in Neutral	0.75	Green/White	-
13	Ignition (KL15)	0.75	Grey/Yellow	10A/F21 (SRB)
14	Third Party High Power mode	0.5	Violet/Grey	Grounded = Third Party High Power mode is Active
15	Reverse Signal	0.75	Green/Brown	+12V 300mA max

AEIS = Automated Engine Idle Shutdown

(1) The lock and unlock signals are intended to operate with Ford lock sets, or components with equivalent function and operational characteristics: – Central Locking and unlocking are a 110ms high side pulse. There is no double locking available via this connector.

(2) Interior light feed is a high side output used for demand lighting. It is battery saver timed to switch off after 30 minutes. Do not use this high demand load which will re-energise every time the door is opened.

Note: There are no additional ground wires in either C2-1 or C2-2 auxiliary devices and systems; local grounds should be used.

Pin	Function	Wire CSA	Colour	Comments
Connector C2-2 (Figure E201841 - Item B)				
1	Load-shedding control	0.75	Black/White	Switched ground
2	Rear Speaker Left +	1.5	White/Green	Twisted pair
3	Rear Speaker Left -	1.5	Brown/Yellow	-
4	Rear Speaker Right +	1.5	Brown/White	twisted pair
5	Rear Speaker Right -	1.5	Brown/Blue	-
6	IP Illumination(1)	0.5	Brown	PWM +12V 300mA (nominal)
Connector C2-3 (Figure E201841 - Item C)				
1 (A)	B+ (KL30)	6.0	Green	60A Fed from Pre Fuse Box
2 (B)	B-	6.0	Black/White	Ground

IP= Instrument Panel, PWM= Pulse Width Modulation

(1) PWM output optimised for LED switch back lighting & dimmable when vehicle has IP dimmer fitted. Do not fit relays to this output.

Note: There are no additional ground wires in either C2-1 or C2-2 auxiliary devices and systems; local grounds should be used.

4.25.5 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.

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)

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 converter fitted relay, especially for high current applications.

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'.

Abc = BEV Only Abc = ICE Only

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: 4.7 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.

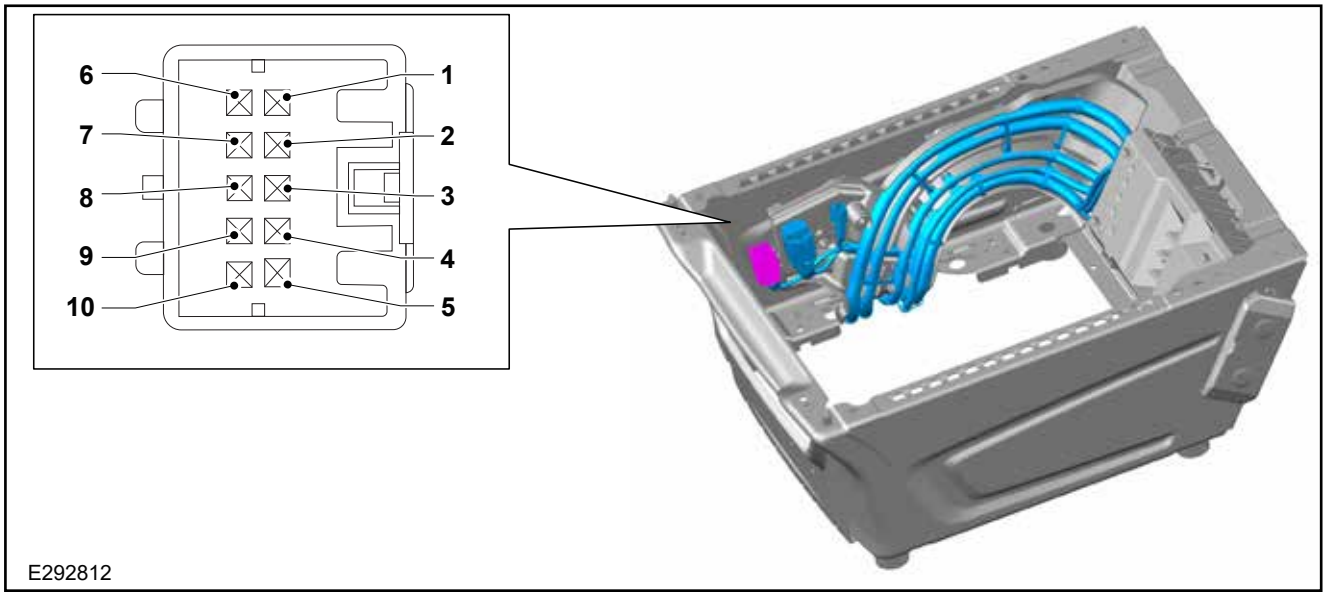
This engine run signal is ground switching (max current sink 250mA), it provides no positive output (open circuit) and is only active when the engine is running.

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.

10 Way Vehicle Interface Connector



E292812

10 Way Vehicle Interface Connector Signals	
1	Ground
2	Engine Run
3	Third Party High Power mode
4	Load-shedding and SBG
5	Vehicle Speed
6	Ignition (10A to System Relay Box 1 F52)
7	IP Switch Illumination
8	Ford Programmable Battery Guard (15A to System Relay Box 1 F48) - +12V KL30
9	A608 only load-shedding and SBG (Pin not used if less A608)
10	Not Used

4.25.6 Auxiliary Fuse Panel (A526)

NOTE: The Auxiliary Fuse Panel cannot be retrofitted and so must be ordered for factory fitment.

NOTE: Where a load-shedding relay in the fuse panel is controlled by a separate 12V input, it is recommended that a diode is added to avoid any sneak current path and uncontrolled battery drain or incorrect functionality.

The Auxiliary Fuse Panel is recommended for Vehicle Converters where access to fused power connections are required (for example, additional lighting), see figures E296346 and E296347. A dedicated wiring harness (KK2V-14517-A*/B*) is used to implement the Auxiliary Fuse Panel to the vehicle. The Auxiliary Fuse Panel is located behind the glove box and slightly outboard behind the removable cup holder. The main power is supplied by a 150A fuse in the high current fuse panel, located in the driver's seat pedestal.

Critical signals are obtained from the standard interface connector. If the signals are still needed for other third party add-on systems, the fuse panel comes with a cloned standard interface connector, packaged slightly higher in the driver's seat pedestal.

The Auxiliary Fuse Panel uses the Vehicle Interface Connector, shown in figure E292812, and provides an advanced customer access point (C1) connector as well as a (C2) interface connector to further switch installations and a power and ground supply.

There are 4 relays that can be controlled via third party input switches (when ordering the stand alone fuse panel A526). Two of the outputs can switch 40A per circuit.

Features

- The fuse panel comes from production, 'powered at ignition position 2' only and not 'powered at all times'. This is to avoid any discharged batteries during the shipping and conversion process. Once switched and peripherals are added, the fuse panel can be configured to 'powered at all times' by the jumper fuse relocation from position A to B, as shown in figure E294965. It is recommended to change to the permanent power mode after the third party equipment has been added and near the end of the total conversion.
- In the Auxiliary Fuse Panel, all switched relays are now controlled via the 'load shed' signal, which also functions as a 'battery guard' feature at 'engine off'. There are no 'engine run' controlled signals. If 'engine run' control is added, it must be '**AND** logic', not '**OR** logic' with the 'load shed' system. Even when 'engine run' control is required, the total vehicle third party system load must not exceed 60A. This total includes use of CCP1.
- At 'engine off', under SBG control, the BCM provides the following timers and SOC values before disconnect. The timer resets each 'ignition on' and in 'engine run'.
  - For a single battery and non-AGM, 30 minutes activation limit and 60% SOC limit.
  - For a twin AGM battery (in vehicle configuration) the timeout is 75 minutes and SOC limit is 40%.
- If the Third Party High Power mode feature is activated, the timeout on the SBG is suppressed so the system will isolate only on the battery SOC limit. The FPBG (A540) operation is unaffected. If a more finely tuned and prolonged energy availability is required, it is recommended to also order the Ford Programmable Battery Guard (A540) which allows a 3 hour timer and down to 20% SOC performance.

Refer to: 4.7 Battery Protection

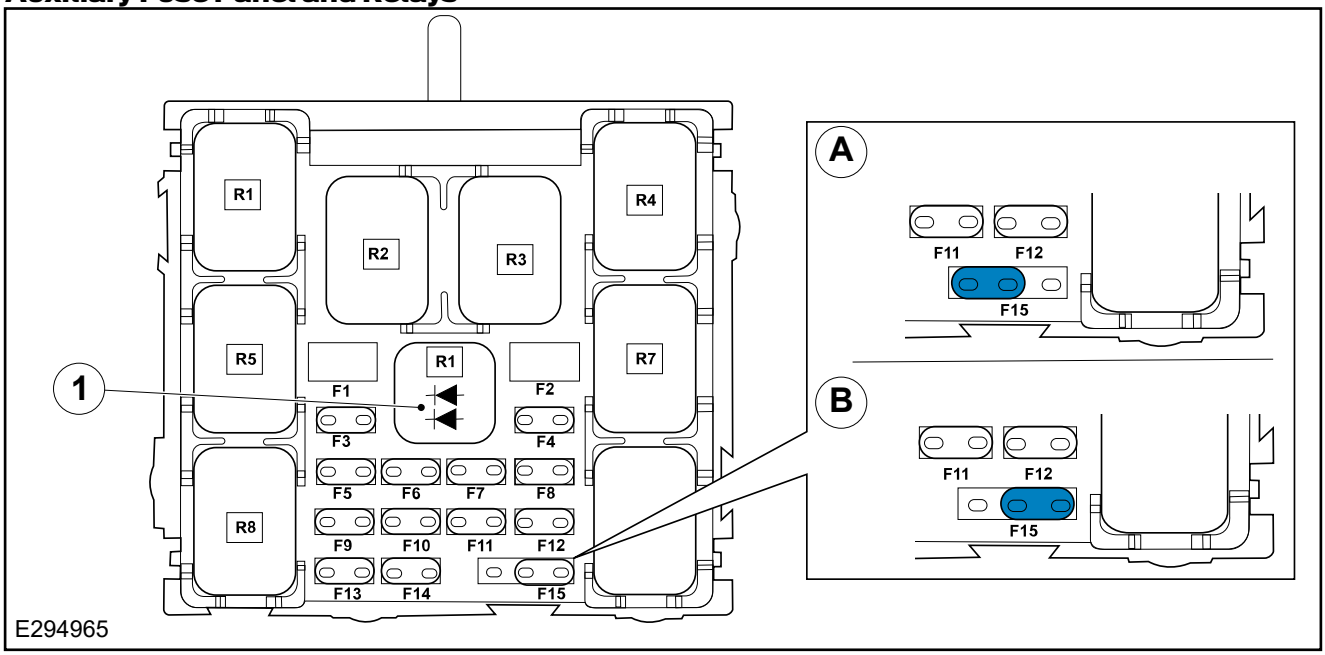
- The Auxiliary Fuse Panel outputs, controlled by 'load shedding', and excluding the relay driven direction indicators, may switch off at engine 'drive run' mode in the event of a low voltage (11V). This is designed to protect EPAS which is now standard on the Ford Transit. If the system is continuously reaching this low voltage, there may be an issue with the energy sources or the third party system demand is greater than the supply. System voltage should not drop below 13V for continuous periods. Check that each system's energy supply is compatible with the add on third party equipment and Ford system demands.
- There is a dedicated 40A output connection, separate to the C1 and C2 traditional connectors. This is mounted onto the fuse box housing.
- The 43-way interface connector (when ordering A608) is also mounted to the fuse box housing.
- The 10-way standard interface connector, shown in figure E292812, is cloned nearby and is located in the driver's seat area. Extra signals for third party equipment can be obtained from here with the same dealer service kit part number KK2Z-14A411-M. If the FPBG is also fitted, this cloned connector will be utilised. To get the same signals for other equipment, the FPBG will offer these signals.

Refer to: 4.7 Battery Protection

- The Auxiliary Fuse Box is fed from a 150A fuse F06, in the driver's seat pedestal, high current fuse panel, with the control grounds from the battery ground stud. If this fuse is an open circuit, then a complete fuse assembly is required.
- The SBG signal in the standard interface connector (cloned pin 3) must be used to control a third party relay (non-latched normally open type) if the CCP2 cannot be utilised and more than 60A is required.
- The mating connector supplier part number for the switch output wiring is 4S7T-14A4599-YL*.

Abc = BEV Only Abc = ICE Only

Auxiliary Fuse Panel and Relays



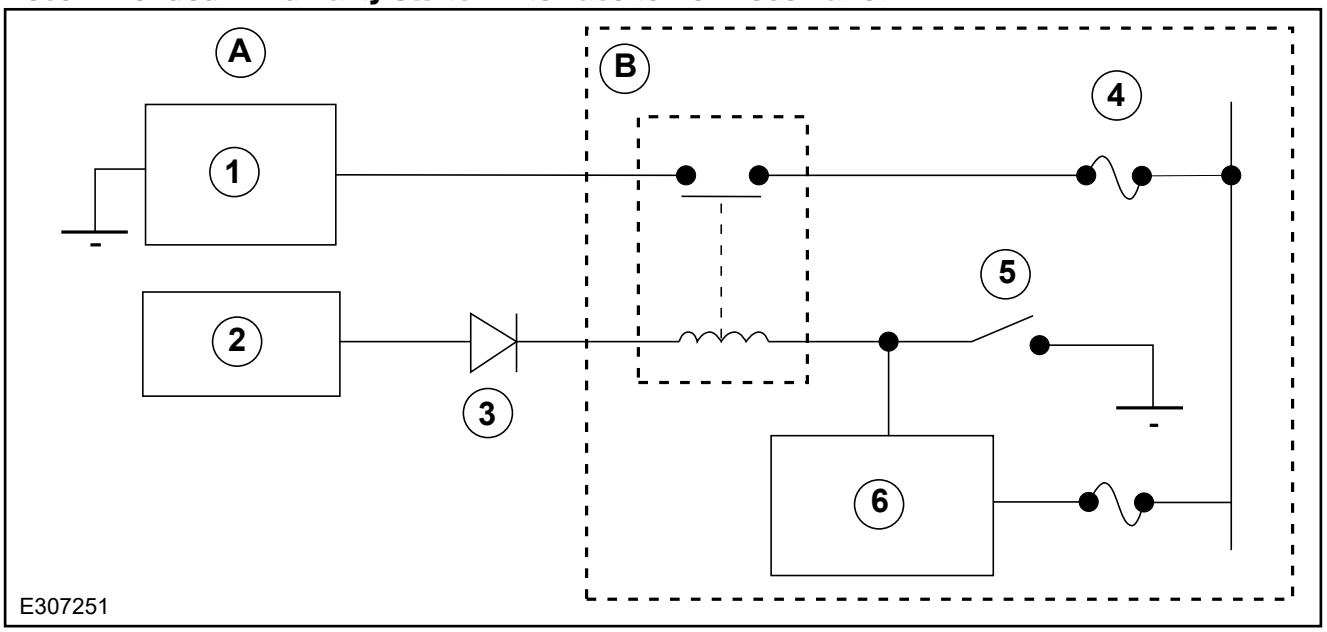
Item	Description
A	Ignition Only position of F15
B	Permanent Power Only position of F15
1	Diodes (1A rated) - Make sure the diodes are orientated correctly or they will not work

Item	Description	Item	Description
F1	40A Fuse	F14	5A Fuse
F2	40A Fuse	F15	3A Fuse
F3	20A Fuse	R1	20A Relay (Beacon(1))
F4	20A Fuse	R2	40A Relay (Aux1 power)
F5	10A Fuse	R3	40A Relay (Aux2 power)
F6	3A Fuse	R4	20A Relay (Ignition)
F8	10A Fuse	R5	20A Relay (LHS Indicator)
F9	15A Fuse	R6	Ultra micro relay. Ground to set Third Party High Power mode when Beacon Switch is ON
F10	5A Fuse	R7	20A relay (Interior light)
F11	5A Fuse	R8	20A Relay (RHS Indicator)

(1)When specified on Ford options
Any pin/fuse not listed in the table above are not to be used.

Abc = BEV Only Abc = ICE Only

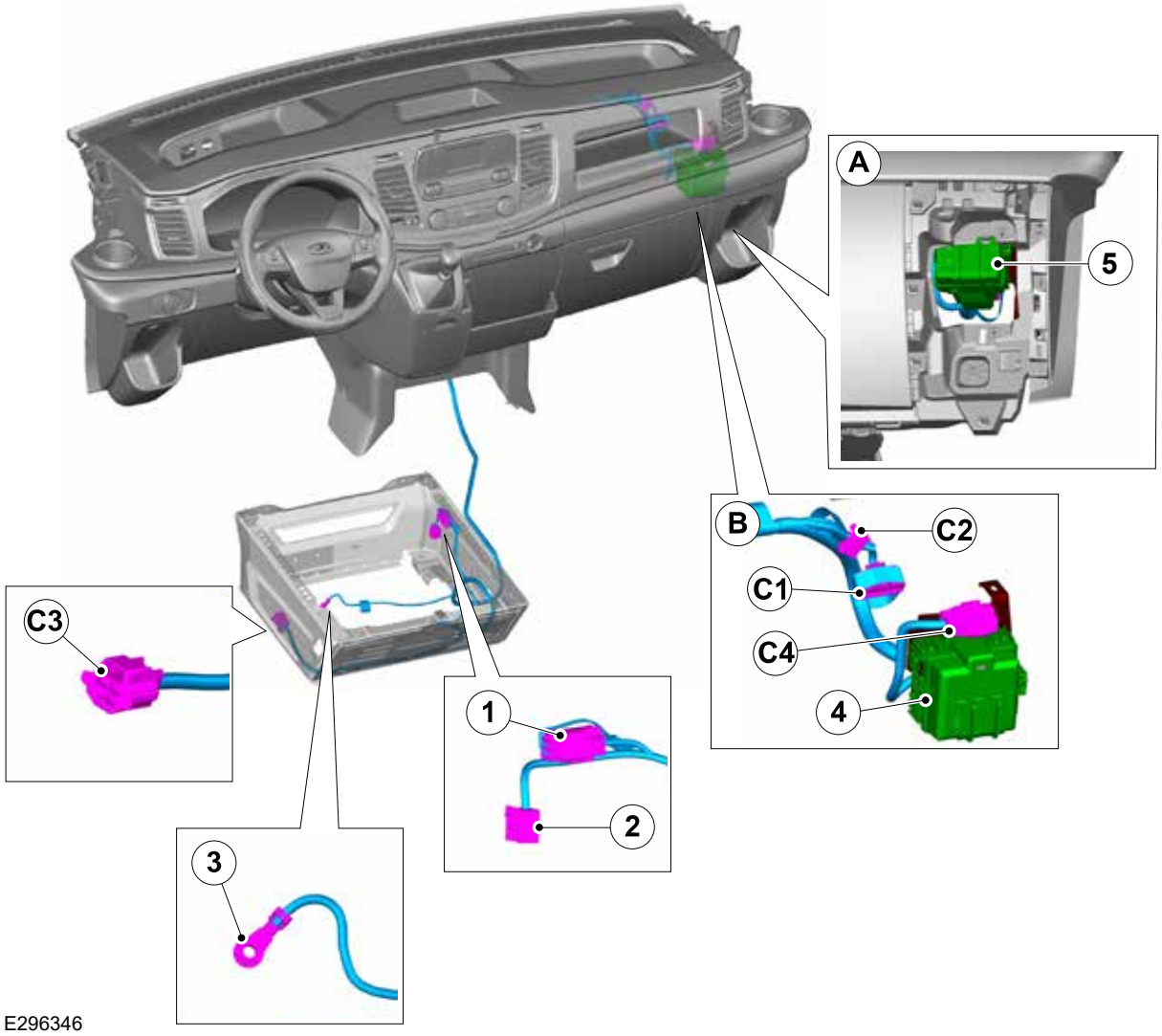
Recommended Third Party Switch Interface to Aux Fuse Panel



Item	Description
A	Third Party Fit System
B	Fuse Box Sub-System
1	Third Party Device to Power
2	Third Party +12V Input
3	Recommended To Add a Diode to the 12V Input Feed to Avoid a Back Feed Sneak Path
4	Fused Supply to Contacts
5	Load Shedding Ground
6	Other Auxiliary Fuse Panel Relays

Abc = BEV Only Abc = ICE Only

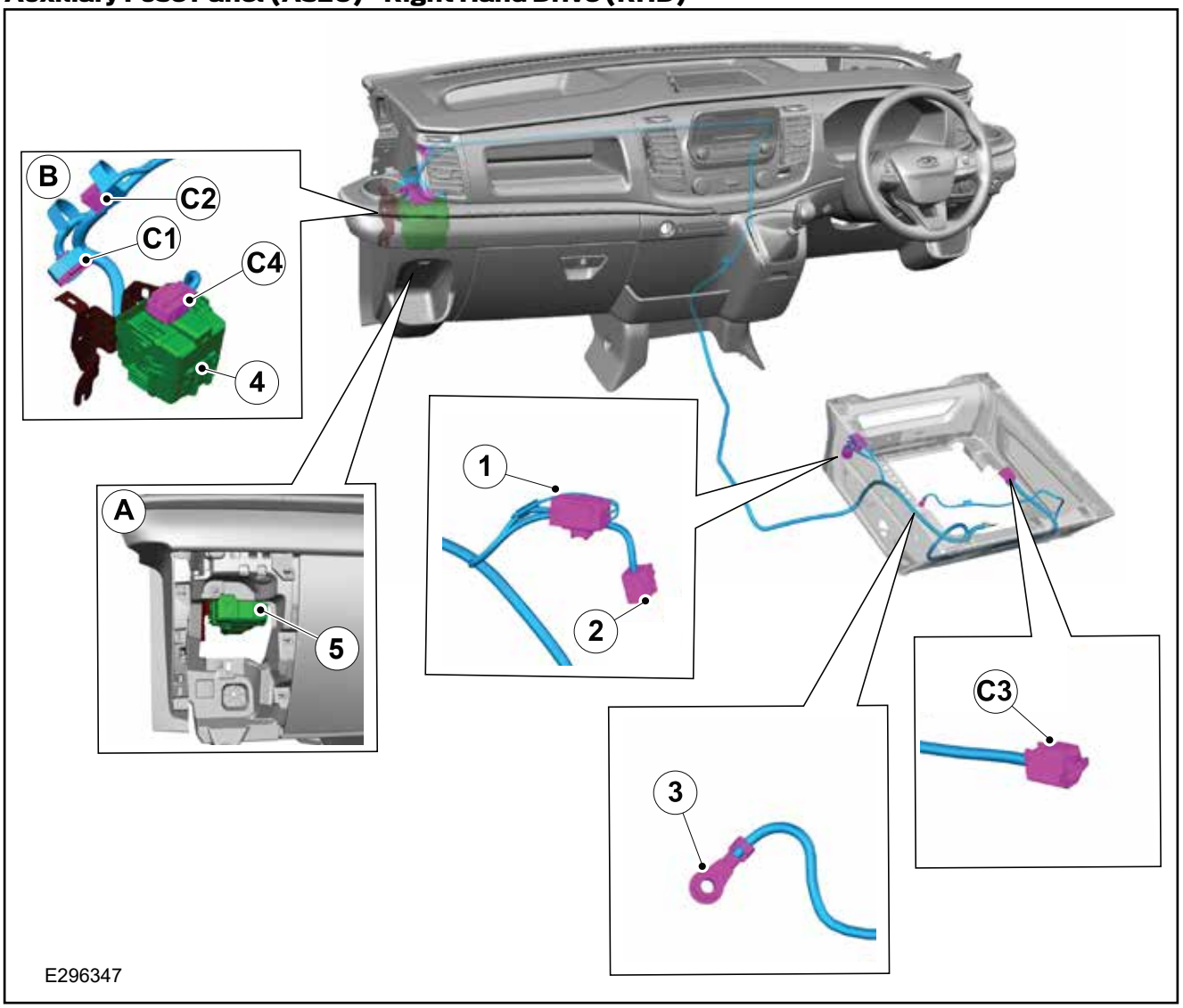
Auxiliary Fuse Panel (A526) - Left Hand Drive (LHD)



Item	Description	Item	Description
A	For better visibility of F15 location remove the cup holder	C4	Connector 4
		1	Vehicle Interface Connector 1^
B	Access through the glove box for connectors and Auxiliary fuse panel	2	Vehicle Interface Connector 2
		3	Ground
C1	Connector 1	4	Auxiliary Fuse Panel
C2	Switch Connector	5	Auxiliary Fuse Panel access lid
C3	2 Way Radio Connector		

^ Only suitable to be used with FPBG (A540). No other connections to be made via this connector. If certain signals are required go to the Auxiliary Fuse Panel (A526), FPBG (A540) or High Specification Interface Connector (608) directly.

Auxiliary Fuse Panel (A526) - Right Hand Drive (RHD)

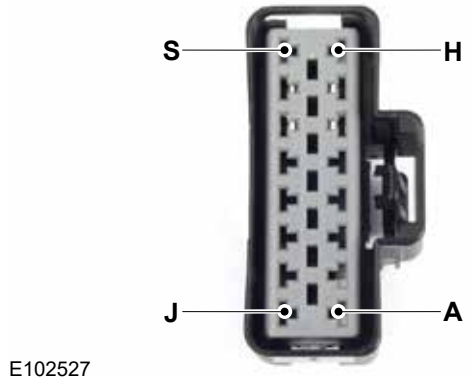


Item	Description	Item	Description
A	For better visibility of F15 location remove the cup holder	C4	Connector 4
		1	Vehicle Interface Connector 1^
B	Access through the glove box for connectors and Auxiliary fuse panel	2	Vehicle Interface Connector 2
		3	Ground
C1	Connector 1	4	Auxiliary Fuse Panel
C2	Switch Connector	5	Auxiliary Fuse Panel access lid
C3	2 Way Radio Connector		

^ Only suitable to be used with FPBG (A540). No other connections to be made via this connector. If certain signals are required go to the Auxiliary Fuse Panel (A526), FPBG (A540) or High Specification Interface Connector (608) directly.

Abc = BEV Only Abc = ICE Only

C1 Connector

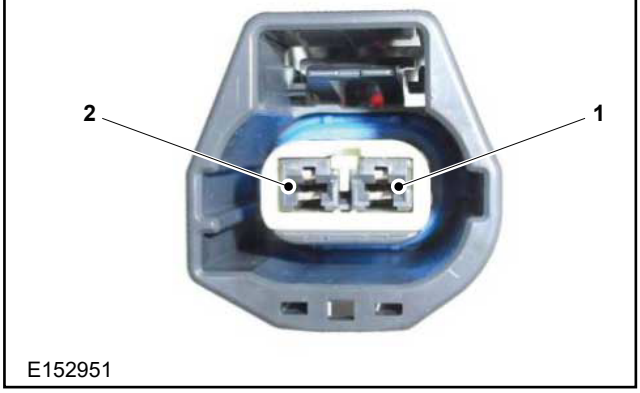


E102527

Item	Description
A	Relay 2 Output (5A)
B	Relay 7 Coil Out
C	Relay 7 Coil IN
D	Relay 7 Output (10A)
E	Ground
F	Relay 6 Coil IN
G	Relay 5 Coil IN A
H	Relay 3 Output 1 (15A - F5 Fuse Shared)
J	Relay 2 Output 2 (15A)
K	KL30 20A
L	Relay 4 Output (15A)
M	KL15 Ignition Switch
N	Relay 2 Coil IN A
P	Relay 6 Output (15A - F7 Fuse Shared)
R	Relay 5 Output (15A - F7 Fuse Shared)
S	Vehicle Speed Signal

The C1 connector is a major interface to the vehicle, providing various signals and control circuits. It is wired to the Auxiliary Fuse Panel, see figures E296346 and E296347. The mating connector for the C1 is DELPHI 15326956. A service kit (KK2Z-14A411-K) can be ordered from your local Ford dealer, this kit contains the mating connector, and 3m of wiring.

2 Way Radio Connector

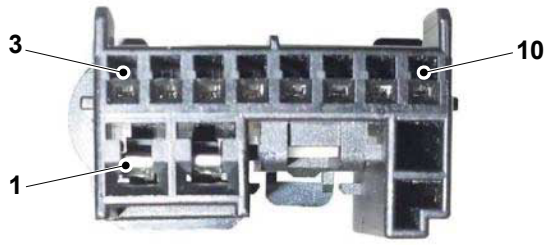


E152951

Item	Description
1	KL30 20A
2	Ground

Mating Kit - KK2Z-14A411-L

C2 Switch Connector

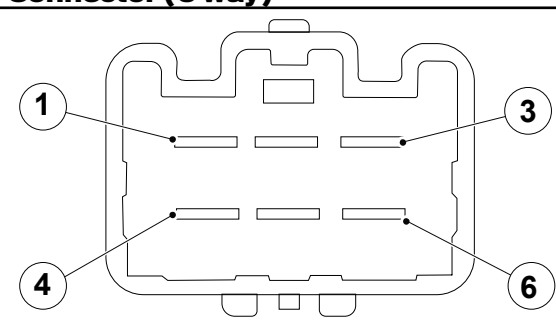


E152952

Item	Description
1	Relay 1 Output (20A)
2	Ground
3	Switch Illumination Supply
4	Relay 3 Coil IN
5	Relay 4 Coil IN
6	Relay 1 Coil IN
7	Relay 3 Output 2 (F5 Fuse Shared)
8	Relay 2 Coil IN B
9	KL30 (3A)
10	Relay 5 Coil IN B

C2 Mating Kit — KTKK2V-14A411-B*

C3 Connector (6 way)



E308466

Item	Description
1	Relay 2 Output (40A)
2	Not to be used
3	Ground
4	Relay 3 Output (40A)
5	Not to be used
6	Ground

C3 mating kit - KK2Z-14A411-AA

4.25.7 Beacon Preparation Pack (A606)

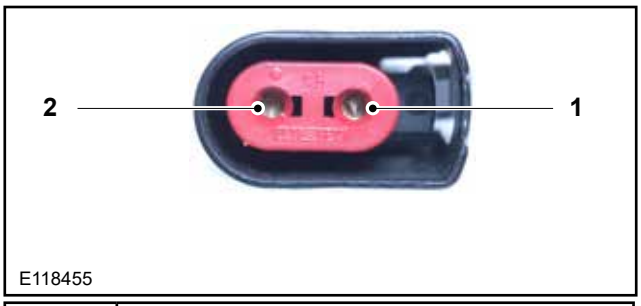
NOTE: The Beacon switch symbol is illuminated at 'ignition on' or by permanent power, depending on fuse F15 position in the Auxiliary Fuse Panel.

Figure E308463 shows the routing for front and rear beacon wiring installations and location of connectors for the beacons which should be viewed in conjunction with the fitment of the beacon switch, KK2V-13D768-A*, see figure E175195 for switches and see figures E296346 and E296347 for Auxiliary Fuse Panel, shown in this section.

The Beacon Switch pack (A606) switches 20A of 12V power and is switch protected by F15 (20A output by F3). The beacon power at 'engine off' is now protected by the SBG so that in the event of excessive battery drain, isolation occurs, the operator can still start the engine, reactivate the beacons and drive away from a potential hazardous location. Beacons could also be deactivated in an overload condition at 'engine run', for example, the voltage falls to 11V whilst driving and the alternator or DC/DC is active. This is to protect EPAS. If this regularly occurs there may be an issue with the vehicle where the energy demand is exceeding supply, saturating energy supplies leading to a voltage drop.

Refer to: 4.7 Battery Protection

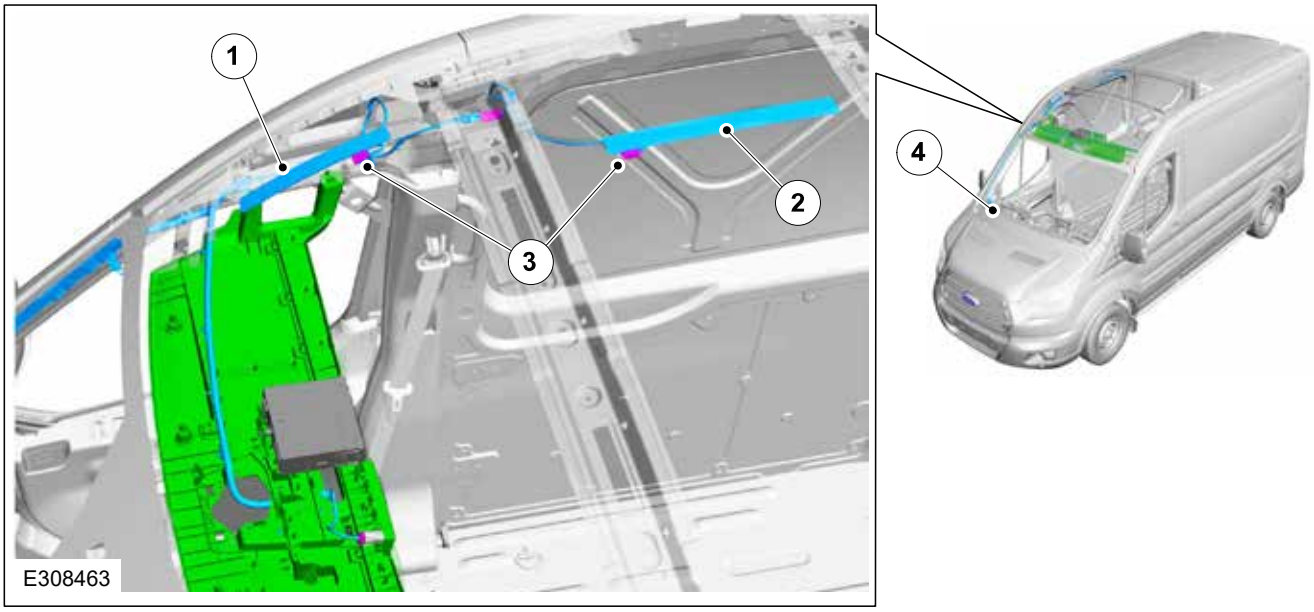
The fuse box relay control is factory set to 'ignition supply' only. If the conversion requires direct from the battery supply (KL30 but on SBG) the logic fuse (F15) needs to be moved to a permanent power mode.



Item	Description
1	Ground
2	Beacon Supply

If 'ignition logic', the beacon symbol will only illuminate when the vehicle key is in the ignition position. If in permanent power mode, the symbol will always be illuminated, even with the key out. The illumination will be turned off by the vehicle the SBG or FPBG (A540). The illumination will also be turned off in a 'load shedding' event whilst driving. To reactivate the system, either an ignition cycle may be required or the vehicle will need to be restarted. Another solution could be to plug in an external power charging source for the 12V system, as the battery guard system may have been initiated due to the vehicle's batteries having a low SOC.

Beacon Preparation Pack



Item	Description
1	Front beacon harness on LHD KK3V-14659-J* (shown)/ RHD KK3V-14659-R*
2	Rear beacon harness on BK3V-10A933-B*
3	Front and rear connectors
4	C2 mating connector - See E296346 (LHD) or E296347 (RHD) for location

Abc = BEV Only Abc = ICE Only

4.25.8 Utility Vehicle Switch Pack (A626)

The Utility Vehicle Switch pack has the Beacon Preparation Pack included.

Harness KK3V-14659-** is always on the passenger side of the vehicle. The beacon wiring connects to the C2 connector of the fuse box harness 14517. The utility pack shares the C2 connector with the beacon wiring, and its power outputs connect to the C3 connector of the fuse box harness KK2V-14517-**, see figures E296346 and E296347 for C1 connector location and also figure E175195 for switches.

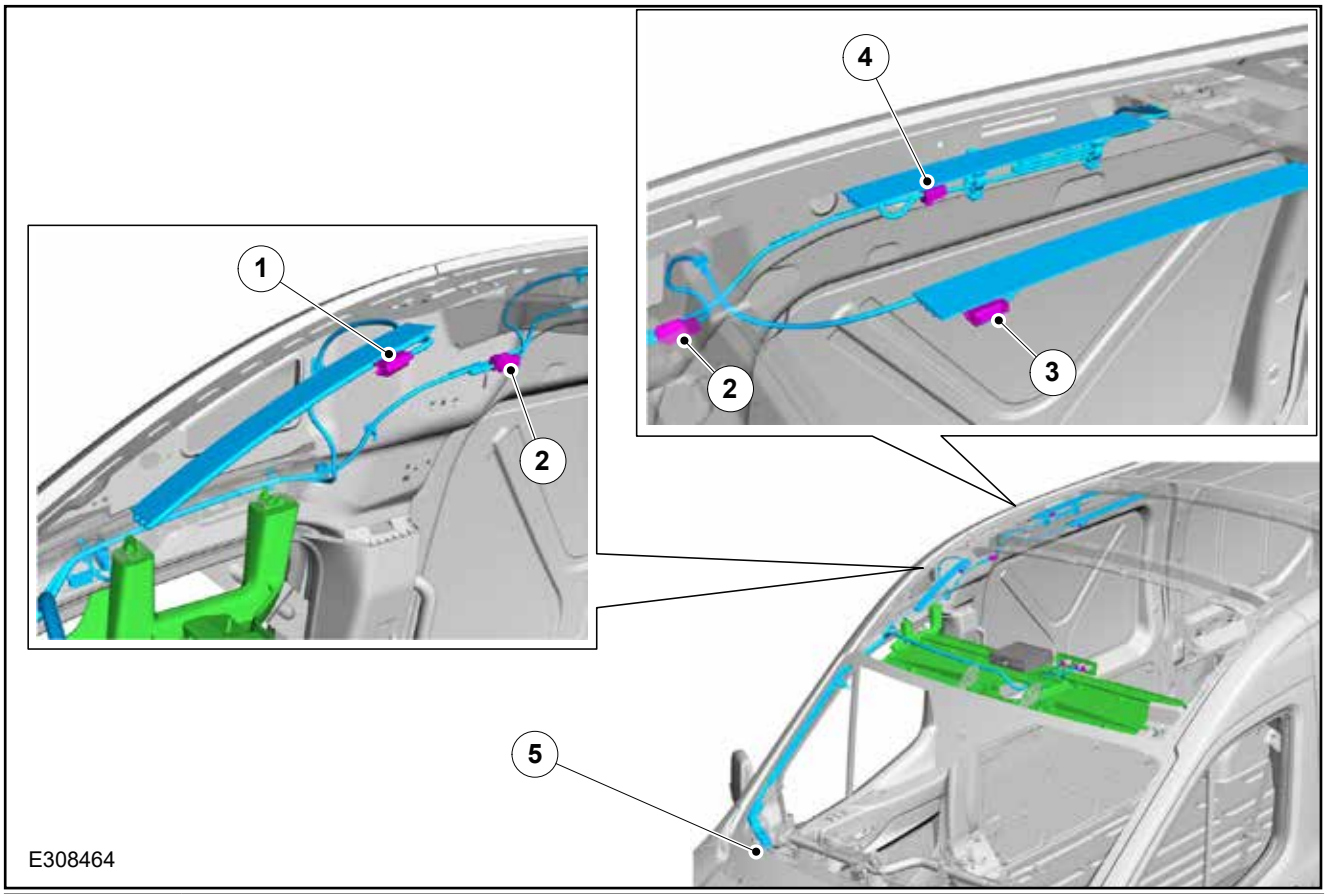
The Utility Switch Pack (A626) contains a Beacon switch and Aux1 and Aux2 switches. This option is now compatible with the High Specification Interface Connector (A608). The Beacon Switch functionality is as described in the Beacon Preparation Pack (A606). Aux 1 and Aux 2 supply is the same as the Beacon with factory fit ignition logic that can be changed to permanent battery power by the Vehicle Converter, by changing the logic control fuse as identified in the Auxiliary Fuse Panel section. The Aux 1 and Aux 2 switched outputs are 40A each. Outputs Beacon and AUX2 are located in the cargo area. Output AUX1 is located on the lower A-Pillar, behind the IP. There is no longer 'engine run only logic' on the Aux 2 switched output. This has been replaced by the 'battery guard' feature to prevent a failed start.

If similar logic is required, it is recommended to utilise the ignition status and control third party power relay.

NOTE: The Beacon, Aux 1 and Aux 2 switch symbols are now illuminated at 'ignition on' or by permanent power depending the position of fuse F15 in the Auxiliary Fuse Panel.

If ignition logic, the switch symbol will only illuminate when the vehicle key is in the ignition position. If in permanent power mode, the symbol will always be illuminated, even with keys out. The illumination will be turned off by the vehicle SBG or FPBG (A540). The illumination will also be turned off in a 'load shedding' event whilst driving. To reactivate the system, either an ignition cycle may be required or the vehicle will need to be restarted. Another solution could be to plug in an external power charging source for the 12V system, as the 'battery guard' system may have been initiated due to the vehicle's batteries having a low SOC.

Utility Vehicle Switch Pack - Right Hand Drive shown



Item	Description
1	Front beacon connector
2	Inline connector for rear beacon connector
3	Rear beacon connector
4	Aux 2 connector
5	C1 and C2 mating connector - See E296346 (LHD) or E296347 (RHD) for location

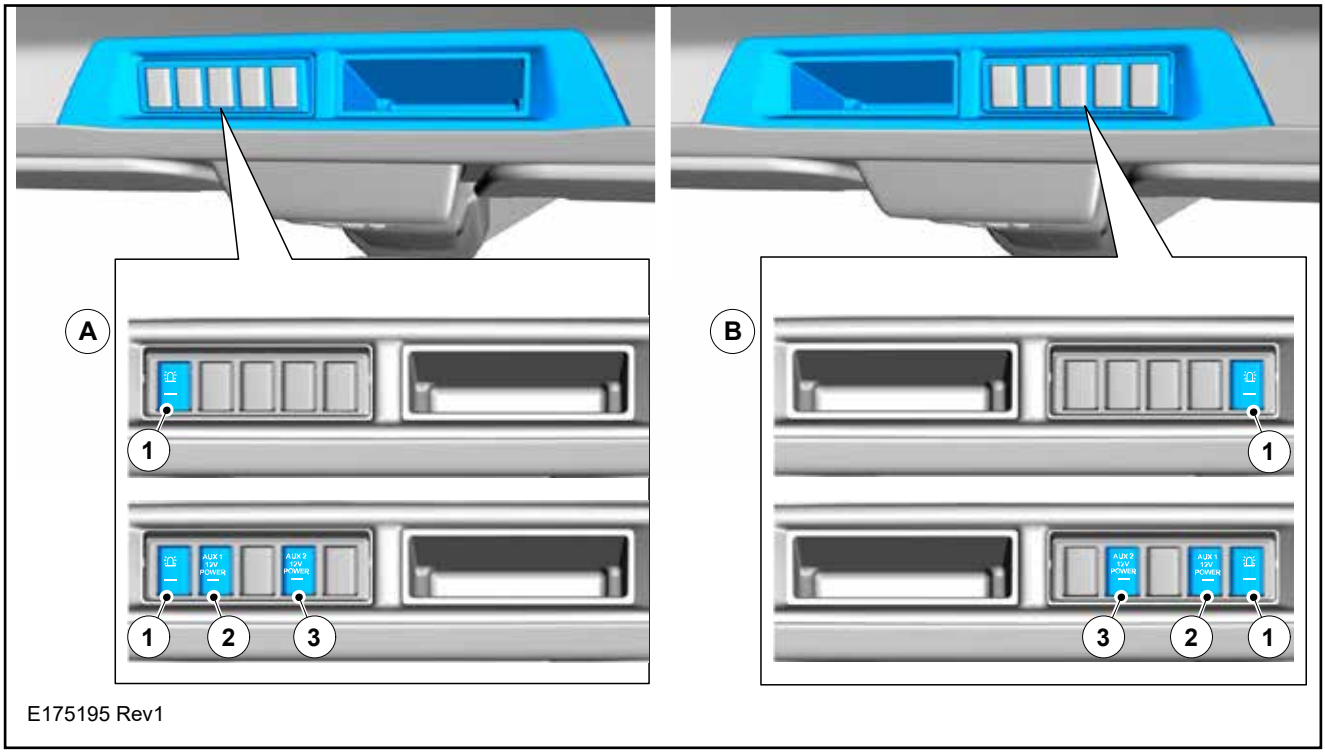
4.25.9 Auxiliary Switches

NOTE: Aux 1 and Aux2 switches will be powered at all times. They will be controlled by 'load shedding' and SBG or FPBG. Any device from previous installations, relying on the engine run control only, will now be powered at 'engine off'. Therefore, extra cycling should be considered; for example, with a water heater.

There are a combination of switch packs available to order for specific conversions. The 'Beacon Preparation Pack' or 'Utility Vehicle Switch Pack' are high current latched switches that control relays in the Auxiliary Fuse Panel. When the switches are pressed (light on) the switches provide a +12V/20A or 40A output.

If heavy loads are required, controlled via these switches (especially at engine off), it is recommended to install the High Performance Deep Cycle AGM Battery option (OW5). The switches are illuminated red when the lights are: side, dipped, full beam or auto lights on. They switch +12V and can switch up to 8A directly.

Switch Locations



E175195 Rev1

Item	Description
A	LHD Switch options
B	RHD Switch options
1	Beacon
2	Aux 1 — Part of Utility Vehicle Switch pack (A626)
3	Aux 2 — Part of Utility Vehicle Switch pack (A626)

Abc = BEV Only Abc = ICE Only

Switches and Harness Part Numbers

Harness	Beacon -BK2V-13D768-A*	Aux 1 (12V)	Aux 2 (12V)	Interior Light
KK3V-14659-J*	LHD Van,Bus,Kombi	-	-	-
KK3V-14659-LS*	LHD Chassis Cab Only	-	-	-
KK3V-14659-R*	RHD Van,Bus,Kombi	-	-	-
KK3V-14659-SS*	RHD Chassis Cab Only	-	-	-
GK3V-14659-D*	LHD Utility Pack - Except Chassis Cabs	BK2V-13D734-A*	BK2V-13D734-B*	-
GK3V-14659-E*	RHD Utility Pack - Except Chassis Cabs	BK2V-13D734-A*	BK2V-13D734-B*	-
KK3V-14659-J* see note	LHD BK2V-13D768-A*	-	-	BK3V-13D756-B*
KK3V-14659-R* see note	RHD BK2V-13D768-A*	-	-	BK3V-13D756-B*

Note: If Beacons are required on an M2 Bus then BK3V-V045L70-B* must be ordered instead of BK2V-V045L70-A* or BK2V-V045L70-D* and fitted in place of the Interior Light Switch Assembly supplied with the vehicle. GK3V-14659-B*or GK3V-14659-C* will still be needed to supply the Beacon Switch. The Interior Lighting Switch Loom is provided on all M2 Buses. For switch location see figure E175195 item 4.

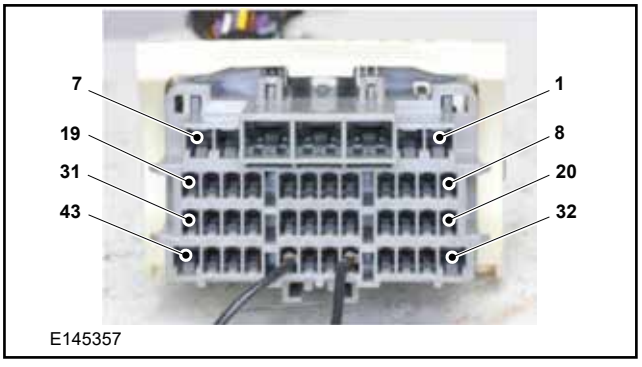
4.25.10 High Specification Vehicle Interface Connector (A608)

NOTE: For access to individual CAN-Bus relay signals, please contact Conversion Works at Conversionworks@ford.com

The standard system includes the Auxiliary Fuse Panel and a 6-way supplemental fuse panel, located in the Instrument Panel, behind the glove box. It is powered by 1 x 60A fuse in the High Current Fuse Panel and connected at the factory. The CCP2 175A is unused for the Blue Light system and can be utilised for high powered devices separately.

The High Specification Interface connector (43-way) is an order only option (A608) and cannot be updated after the vehicle is built. The connector is located behind the glove box and mounted to the Auxiliary Fuse Panel casing, see figure E296348. The system provides multiple signals, power and ground with extra features over previous versions. This can be utilised for high specification utility, Police and emergency services. New features include a SBG and 'load shedding' control signal which must be utilised if the CCP2 relay is not available or sufficient. AC active is now present, where third party systems can remotely control the Ford AC system. There is a RunLock +12V Input pin designed to receive 12V feed into the ignition circuit to maintain engine run, with keys out (please note that safe and secure third party added interlocks would be required to finish off the system). This is at the discretion of the installer with no liability by Ford.

A standard mating connector with the link wire is provided production fit. A service kit is available (BK2Z-14A411-BC) which includes 22 crimped pins wired at 1 metre but not populated. Ensure correct population by referencing the High Specification Vehicle Interface Connector for the features required and by ensuring that the large power and ground cavities get the large size wires from the kit. If more than 22 circuits required then service kit BK2Z-14A411-BP (no connector and 19 loose wires with terminals, 1m) should be purchased. When all routing and splicing is complete, it is advised to mechanically protect and control all wiring near sharp edges.



E145357

NOTE: Mating change on the 43-way connector of the SVO A608. The supplied connector on the Vehicle harness is now male instead of female. Male connector on the 14401 (was female) Female connector in the service kit 14A411 (was male)

Refer to: 4.2 Wiring Installation and Routing Guides

WARNING: This link wire provides a 'no start function'. If the connection becomes 'Open Circuit' by removing the mating connector or link wire the vehicle will not Crank/Start.

Supplementary Fuse Box

WARNINGS:

The fuse ratings and nominal ratings within the table should be followed strictly. Any deviation will interfere with the validated fusing strategy and wiring architecture. Some inputs are provided via electronic modules and any overloading could cause serious vehicle malfunction and may conflict with legal requirements.

No increase in existing vehicle standard fuse capacity is allowed under any circumstances.

On high specification vehicles, the C1 connector is not available as a customer interface and only the 43-way Interface Connector should be used. The connector to add wiring for switches and beacons is still available.

125kb/s MS CAN Access Interface

WARNING: It is not allowed to transmit DATA on any of the CAN lines. The system provided to splice into the 125kb/s MS CAN-Bus is for modules that will read only. If messages are transmitted from a third party fit module, vehicle functionality can be compromised and lead to serious failure. It is vital that any CAN stubs added must comply to the twisted rate, length, correct parity, with routing away from any high EMP (Electromagnetic Pulse) devices.

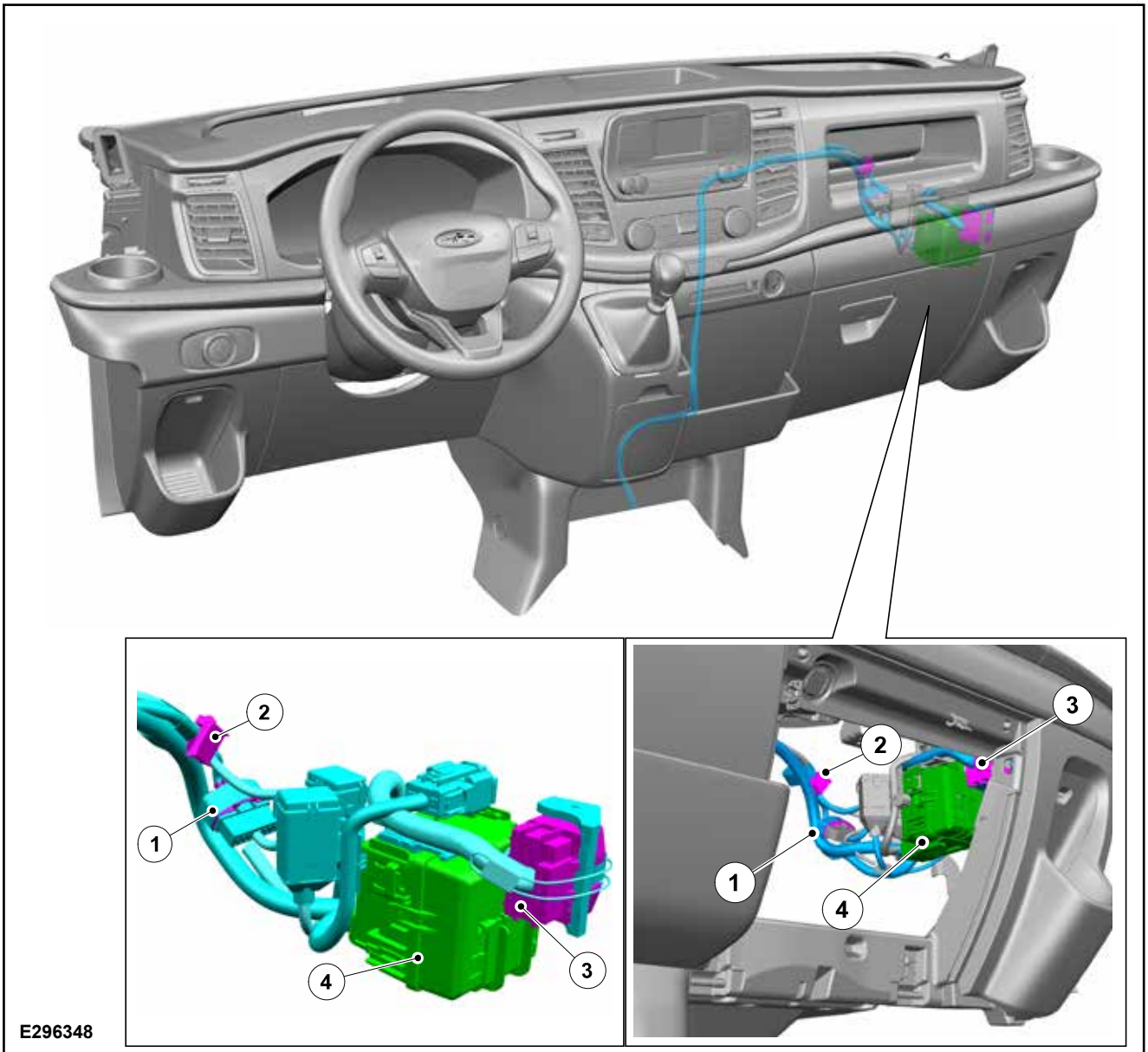
The High Specification Interface Connector option A608 has a 125Kb/s MS CAN interface EDS connection point that can have third party CAN wires spliced into. This is designed to provide Ford CAN-Bus interfacing for third party fit module telematics and logic controller systems. For further information on splicing

Refer to: 4.2 Wiring Installation and Routing Guides

Modules to be installed are only allowed to be '**read only**' of the Ford system CAN-Bus data and must be CE marked. After installation, functional testing of Ford systems connected to the same CAN-Bus is expected. These include: Trailer Tow, Rear Camera, Tachograph, Body Control Systems, Fuel Fired Heater and Cluster Systems. The system should also receive a health check DTC read to ensure no failures are present after the installation and ignition cycle has been performed. The converter is also responsible for legal compliance to EU EMC requirements of the finished system and ensure no adverse impact has been generated to the existing Ford systems. Please refer to Section 1 of the BEMM for responsibility and EMC compliance.

Abc = BEV Only Abc = ICE Only

High Specification Vehicle Interface Connector

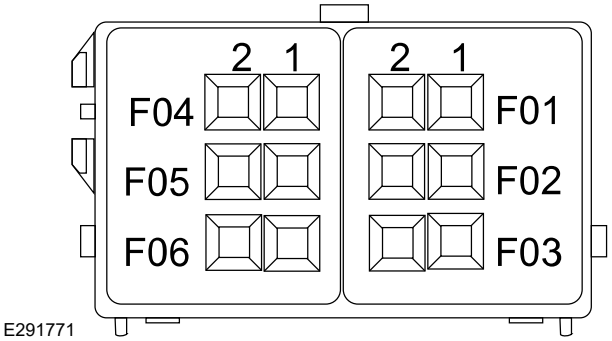


Item	Description
1	C1 Connector
2	C2 Connector
3	High Specification Vehicle Interface Connector
4	Auxiliary Fuse Panel

Abc = BEV Only Abc = ICE Only

KL Terminology	
KL15	Ignition - Position 2
KL30	B+ (Always +12V)
KL31	Chassis or Body Ground
KL50	Crank/Start Position 3
KL58	Side Marker and Number Plate Lighting
KL75	Accessory - Position 1

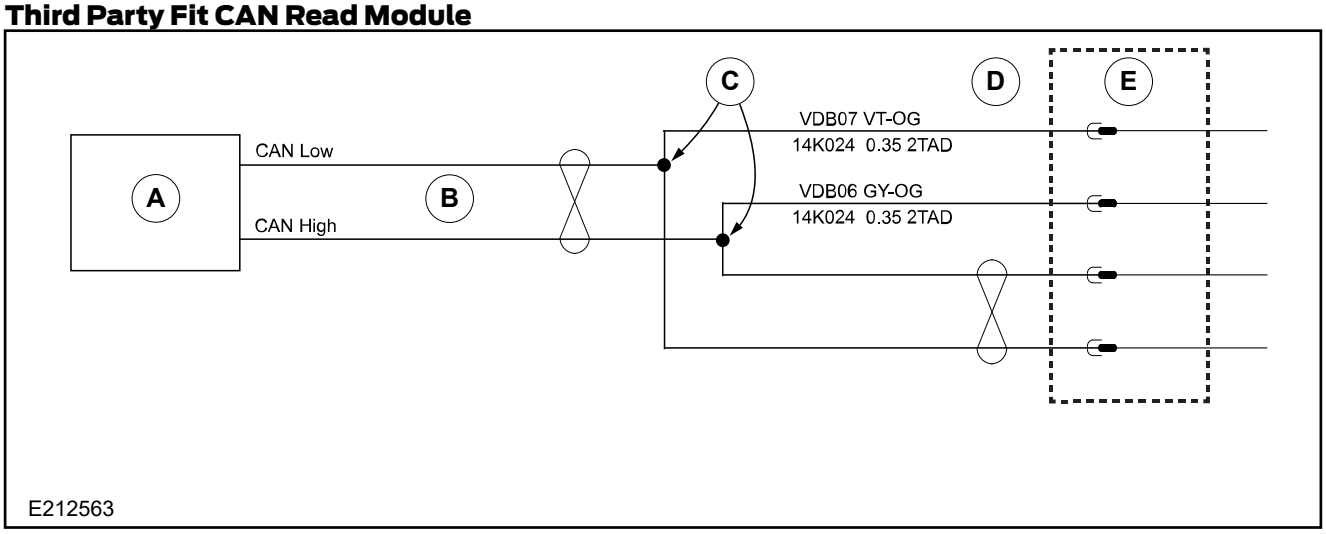
Supplementary Fuse Box - for High Specification Interface Connector



Fuse Ratings

Fuse	Type	Rating (A)	Colour	Function	Part Number
F1	Mini	10	Red	Battery KL30	1L3T-14A094-FA
F2	Mini	5	Tan	Battery KL30	1L3T-14A094-DA
F3	Mini	15	Blue	Battery KL30	1L3T-14A094-GA
F4	Mini	20	Yellow	Fused Ground	1L3T-14A094-HA
F5	Mini	20	Yellow	Fused Ground	1L3T-14A094-HA
F6	Mini	20	Yellow	Fused Ground	1L3T-14A094-HA

Third Party Fit CAN Read Module



Item	Description
A	Converter Fit Read Module
B	Converter Fit Stub Wiring
C	Spliced Interface Connection
D	Ford CAN Loop Wire - CAN Low (Violet/Orange wire), CAN High (Grey/Orange wire)
E	C22-AB

Abc = BEV Only Abc = ICE Only

The CAN Interface loop wire is located near the 43 way Interface Connector, behind the glove box and outboard to the wheel arch. The halfway loop point can be spliced into with third party twisted pairs of at least 3 twists per 50mm and a minimum of 0.3m to a maximum of 2m stub length to module. CAN Low is the Violet/Orange wire. CAN High is the Grey/Orange wire.

Third Party Fit CAN Read Module

CAN-Bus network stubs must comply with the following standards, they must:

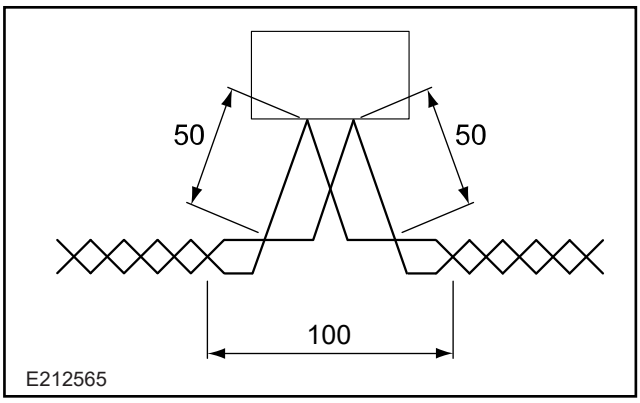
- Originate at the CAN-Bus backbone
- Have a final length of between 0.3m and 2m, see dimension 'X' in figure E212566
- Have at least 3 twists per 50mm of wire.
- Follow the splice guidelines, shown later in this section

Stub length added must exceed 0.3m but be less than 2m, at least 3 twists per 50mm of wire and not be less than 50mm of untwisted wire to the added module or splice.

Physical Interface of splice in EDS Requirements

The twisted pair that forms the CAN-Bus shall be twisted throughout the total run of the vehicle except for a maximum of 50mm from connectors or harness splices. At splices, an additional 50mm of untwisted wire is allowed between the CAN high and CAN low contact points.

Maximum CAN-Bus Length Series Chain Method - all values are maximum limits (dimensions shown in mm)



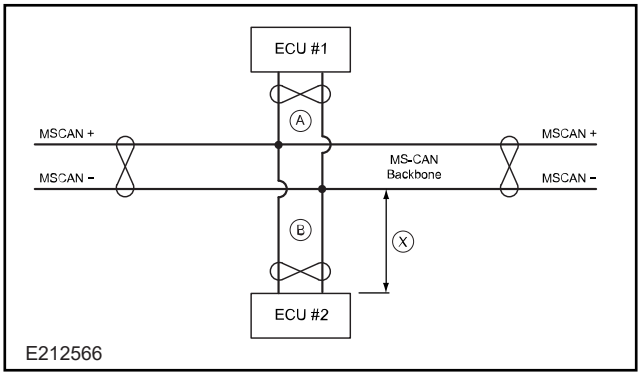
It is allowed to connect modules to the backbone using a series chain method instead of a stub. If the series chain method is selected, the untwisted wire on each side of the double crimp in the connector cannot exceed 50mm. See figure E212565.

The two terminating ECUs (Electronic Control Unit) shall be placed the furthest distance apart on the CAN-Bus. The maximum wiring length for each type of network is defined in the following table.

NOTE: Exceeding the permitted CAN network lengths will result in data transfer issues and could cause serious vehicle error.

Cable Stub Length: Must be a final length of between 0.3m and 2m, see dimension 'X' in figure E212566. It is acceptable for any stub, except the terminating ECU stubs, to be open circuit and unterminated, i.e. harness variants are not required to support option fit ECUs.

Cable Stub Circuit



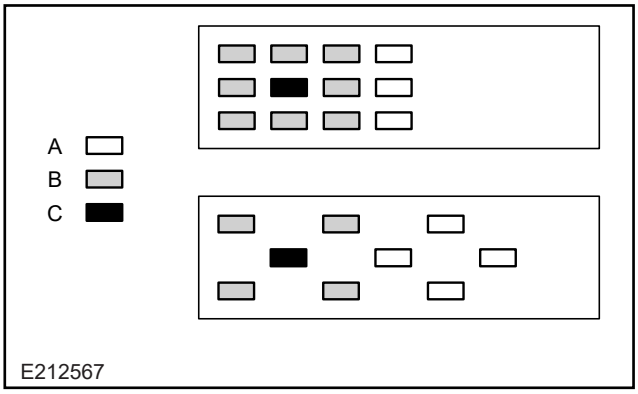
Item	Description
A	Stub 1
B	Stub 2
X	Stub - Final length between 0.3m and 2m

Stub Splices: The general rule is that there shall be at least 50mm of twisted wire between any series of the following connections: splice-splice, connector-splice, connector-connector. Splices include wire to wire splices and splice blocks.

Two stubs may be connected to the same stub connection point, at the CAN backbone only, on a 125kbps MS CAN-Bus. In this case the stubs must differ in length by at least 10%. Example: If one stub is 1m long, the second can be less than 0.9m or between 1.1m and 2m.

Stub Topologies: Stubs connected to stubs are not allowed. If multiple nodes need to be connected to a single stub, then the nodes must be series chained. This can be accomplished by double crimping, if only two pins (CAN High and CAN Low) are available or making the CAN-Bus connection through the module if 4 pins are available (2 x CAN High and 2 x CAN Low).

CAN High and CAN Low Adjacent Pin Connections



Item	Description
A	Stub 1
B	Stub 2
X	Stub - Final length between 0.3m and 2m

The maximum number of ECUs on network transmission speed 125 kbps, including the off-board tester, is 32.

The two wires forming each pair of CAN High and CAN Low connections shall be routed via physically adjacent pins as shown in the figure E212567.

Each Bus pair may be routed via separate connectors.

Details of the pin allocation for each node shall be defined in the relevant module specification .

The voltage supply used by the network interface must not be directly connected to any external part. That means that the regulated power used by the CAN-circuitry on the Printed Circuit Board (PCB) shall be used only inside the cover of the ECU.

NOTE: This does not apply to the Vbat connection required for full-sleep functionality in transceivers powered by Voltage battery.

The CAN network shall be fully functional, as a minimum, over the operating range 9V to 16V, as measured at the module's battery pin. Outside this operating range, it is recommended that modules continue to communicate. However, it is not acceptable for modules to send corrupt messages/error frames/illegal symbols, or disrupt the transmissions of other modules.

NOTE: Module feature requirements may require a larger operating range.

Modules shall not drive the CAN-Bus dominant during module reset.

Common mode EMC chokes shall not be used in terminating nodes. Additionally, chokes may only be used in non-terminating ECUs with the agreement of the relevant FMC design authority, for each vehicle programme to which the ECU shall be fitted.

Suppliers may use Electrostatic Component Discharge components as long as they pass tests:

- Conducted Immunity (CI)
  - 280 Electrostatic Discharge
  - 270-C Immunity to Voltage Overstress (24V), applied to CAN High and CAN Low

Additionally, the capacitance of the component, measured at 2.5V reverse bias, shall be <30pF

The Zener stacks may be removed for modules on CAN links that do not connect to the diagnostic connector, as long as it is shown that the unpowered ESD (Electrostatic Discharge) test can be passed without these parts (Powered ESD testing on the CAN pins is not required for modules that do not connect to the diagnostic connector). The circuit board pads for these parts must be present for all designs.

All grounding of the CAN transceiver and capacitors shall be made to ECU signal ground.

All transceiver voltage reference pins shall be left open circuit.

Capacitors shall be monolithic ceramic capacitors or equivalent.

A ground plane is required under the transceiver chip on the component layer of the PCB (printed circuit board).

Transceiver shall be located as close to edge connector as possible. Other IC's are not permitted between edge connector and the transceiver.

CAN High/CAN Low circuits between edge connector and transceiver shall be as short as possible and routed side-by-side. Guard tracks are required for all CAN High/CAN Low, TXD and RXD circuits on the same PCB layer. Guard tracks should not be placed between CAN High and CAN Low.

All guard tracks shall be at least 0.5mm wide and grounded at least every 10mm.

The decoupling capacitor shall be placed as close as possible to the transceiver.

Transceivers that are battery powered are required to have a Flexisafe capacitor.

Abc = BEV Only Abc = ICE Only

High Specification Vehicle Interface Connector

Cavity	Wire	Signal	Comments	Fuse	Fuse Rating	Nominal Rating
1	1.00	KL58 - shed		8Aux	10A	8A
2	Not Used	-	-	-	-	-
3	2.50	KL31-unshed	Ground	6 BL	20A	16A
4	Not Used	-	-	-	-	-
5	2.50	KL31-unshed	Ground	5BL	20A	16A
6	2.50	KL31-unshed	Ground	4BL	20A	16A
7	0.75	KL30-unshed	Battery Supply	1BL	10A	8A
8	0.50	KL30-unshed	Battery Supply	2BL	5A	4A
9	1.00	KL30-unshed	Battery Supply	3BL	15A	12A
10	Not Used	-	-	-	-	-
11	Not Used	-	-	-	-	-
12	0.75	Load-shedding and SBG	Load-shedding and SBG switched ground signal	-	-	-
13	1.50	Lock Motor Output	reverse polarity with pin 14 for lock/unlock	-	-	-
14	1.50	Lock Motor Output	reverse polarity with pin 13 for lock/unlock	-	-	-
15	0.75	KL15 -shed	Ignition from R4	10Aux	5A	4A
16	1.00	KL15 -shed	Ignition from R4	11Aux	10A	8A
17	0.75	KL15 -shed	Ignition from R4	14Aux	5A	4A
18	0.75	RunLock	Spliced into ignition barrel position 2, apply 12V to keep ignition alive.	-	-	-
19	0.5	Rear Door Ajar Switch	Door Open = Ground (<50ohms)	-	-	-
20	0.5	IP and Switch Illumination	Pulse Width Modulation Signal from BCM	-	-	300mA
21	0.5	AC Active	Ground = AC Active (<50ohms)	-	-	-
22	0.75	Stop Lamp Signal	Pulse Width Modulation Signal from PCM	-	-	2.5A(4)
23	0.50	Third Party High Power mode	Ground = Third Party High Power mode	-	-	-
24	0.50	LHS Sliding Door Ajar	Door Open = Ground (<50ohms)	-	-	-
25	0.50	Passenger Door Ajar	Door Closed = Ground (<50ohms)			-
26	0.50	Parking Lamps	Pulse Width Modulation Signal from BCM	-	-	300mA
27	0.50	RHS Sliding Door Ajar	Door Open = Ground (<50ohms)	-	-	-
28	1.00	Turn Indicator LHS	Fuse and Relay located in Aux Fuse Panel in seat pedestal	5Aux	10A	8A
29	1.00	Turn Indicator RHS				
30	0.50	Horn Signal	Relay Output from Smart Relay Box 1	-	-	300mA
31	0.75	Vehicle Speed	To be used as input to Electronic Control Units only. 138Hz@100KPH, 50% duty cycle	-	-	-
32	0.75	Reverse Signal	PWM Signal from BCM	-	-	300mA
33	0.75	High Beam	Output from BCM	-	-	300mA
34	0.75	Low Beam	Output from BCM	-	-	300mA
35	Not Used	-	-	-	-	-
36	0.75	KL50	-	-	-	300mA
37	0.50	Handbrake Signal	Handbrake Activated = Ground (<50ohms)	-	-	-
38	0.50	Engine Run	Engine Running Ground (3)	-	-	-
39	0.75	No Start Function	-	-	-	300mA
40	0.75	Key In(2)	12V	-	-	30mA
41	0.50	Driver Door Ajar	Door Closed = Ground (<50ohms)	-	-	-
42	0.50	Lock Switch Input	Lock switch momentary signal to ground	-	-	-
43	0.50	Unlock Switch Input	Unlock switch momentary signal to ground	-	-	-

(1) Bridged via circuit on mating connector to enable crank/start. If mating connector is removed, vehicle will not start.

(2) Ignition switch 3M5T-11572-A* is required for Key In Signal. To replace the ignition switch refer to the Workshop Manual, 'Removal and Installation for Steering Wheel and Column Electrical Components' - 'Ignition Switch'.

(3) Attached system impedance must be between 6K-10Kohms if a true 12V to ground value is needed. To use as an input signal a 10Kohms pull up resistor is needed.

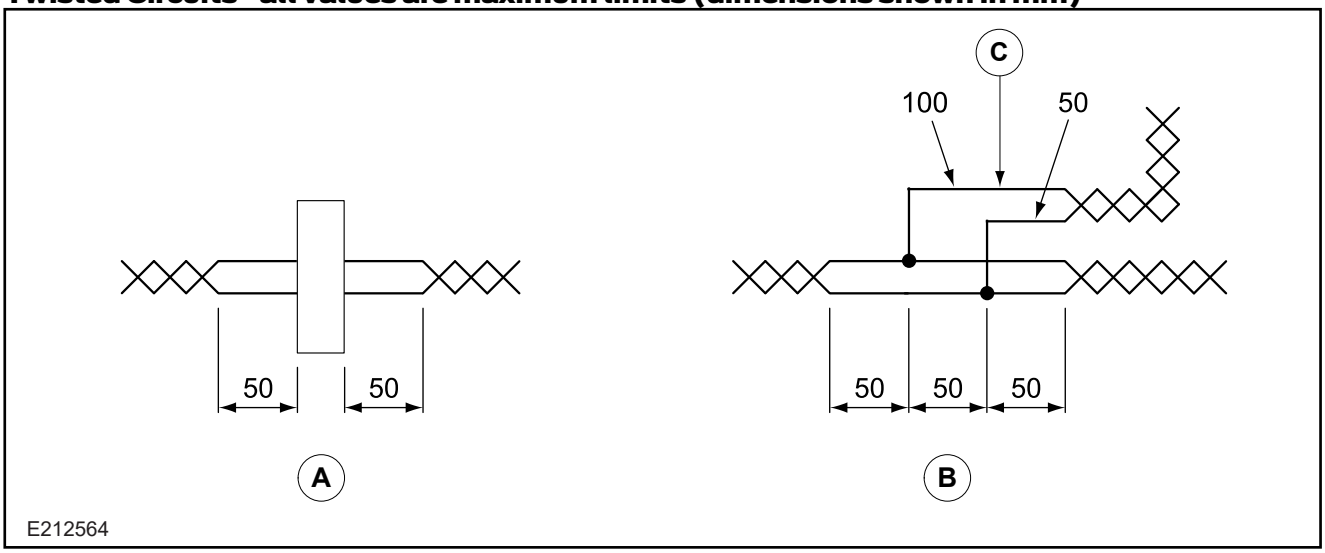
(4)Including existing lamps

Abc = BEV Only Abc = ICE Only

Physical Interface of splice in EDS Requirements

Parameter	Minimum	Nominal	Maximum	Units
Impedance	108	120	132	Ohm
Resistance	-	-	175	mOhm/m
Signal Speed	-	-	5.5	nS/m
Twisting	3	-	-	Twisted/50mm
Phase Shift	-	-	3.4	nS
Differential Mode Offset	-	-	0.5	V

Twisted Circuits - all values are maximum limits (dimensions shown in mm)



Item	Description
A	Connector
B	Splice
C	Typically taped to backbone

Maximum CAN Network Lengths

Network Speed	Between terminating ECUs	SAE J1962 Connector to Furthest Terminating ECU[1]
125kbps	50m	45m
500kbps	33.5m	28.5m

[1] This allows for an off-board tester cable of up to 5m.

Abc = BEV Only Abc = ICE Only

4.25.11 Programmable CAN Interface Module (PCIM)

WARNING: It is the responsibility of the installer to ensure all safety checks have been carried out prior to installing any systems that interface to the PCIM connections.

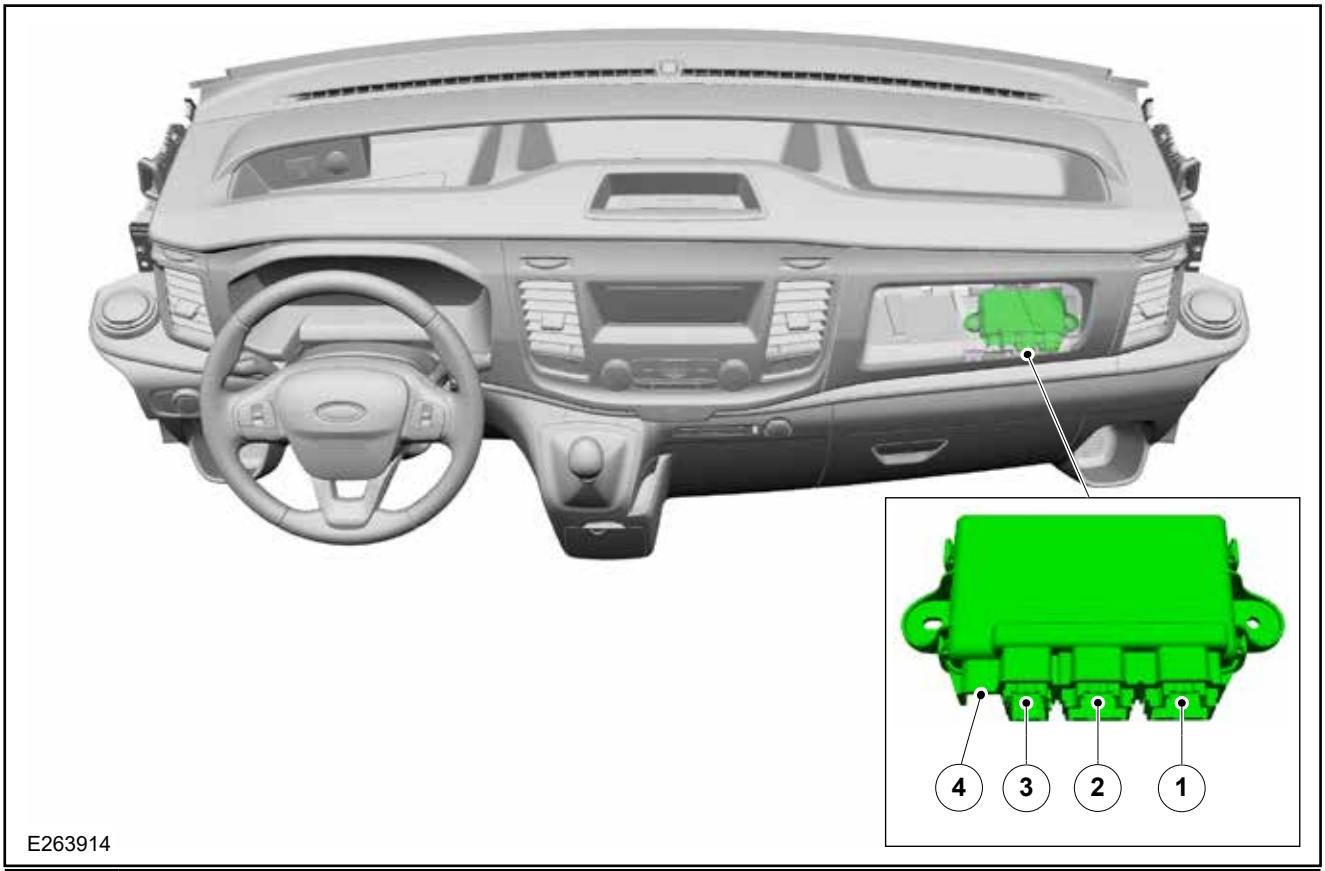
NOTE: The harness of the base vehicle needs to consist of the interface connector to the PCIM at factory fit. Only if the base vehicle is configured to support the PCIM, can the module be retrofitted.

NOTE: The PCIM does not have functionality from factory fit. To activate the control logic, inputs and outputs pins, the converter will need to access the supplemental documentation and Graphical User Interface (GUI) via Ford Service Info https://www.fordserviceinfo.com/Home/SetCountry?returnUrl=%2F

NOTE: The vehicle CAN data available from the PCIM is refreshed at 1000 ms intervals

The PCIM is an electronic control module that has the ability to operate equipment (such as lift buckets, cranes, motors, salt spreaders, snowploughs, etc), with external automotive grade relays via customer programmable logic based on switch inputs and CAN signals. The operation of such equipment is limited to the load parameters of the PCIM. The user should not excess those load limits.

PCIM location



E263914

Item	Description
1	C1
2	C2
3	C3
4	USB

C1 Connector

Description	PU/ PD	Voltage (V)			Current (A)			State		
		Min	Nom	Max	Min	Nom	Max	Active	Inactive	Nom
Digital										
Input	PU	9	13.5	16	0.005	-	0.05	GND (ON)	OPEN (OFF)	OPEN (OFF)
Input	PD	9	13.5	16	0.007	-	0.012	VBATT (ON)	OPEN/ GND (OFF)	OPEN/ GND (OFF)
Analogue										
Input Hall Effect Sensor	-	9	13.5	16	0.003	-	0.025	-	-	-

PU=Pull Up, PD = Pull Down, Min = Minimal, Nom = Nominal, Max = Maximum

C1 Connector Pins

Pin	Type	Voltage (V)		Current (mA)	
		Min	Max	Min	Max
Digital					
1	Input	9	16	8	-
2	Input	9	16	8	-
3	Input	9	16	8	-
4	Input	9	16	8	-
5	Input	9	16	8	-
6	Input	9	16	8	-
7	Input	9	16	8	-
8	Input	9	16	8	-
9	Input	9	16	8	-
10	Input	9	16	8	-
Digital I/O					
11	CAN High 250kbps	9 (Steady State)	24	0	8
12	CAN Low 250kbps	9 (Steady State)	24	0	8
Analogue					
13	Hall Effect Sensor Feed	-	-	-	-
14	Not used	-	-	-	-
15	Switch -Hall Effect Sensor	-	-	-	-
16	Hall Effect Sensor Return	-	-	-	-

Min = Minimal, Nom = Nominal, Max = Maximum

Abc = BEV Only Abc = ICE Only

Connector 2 (Digital)

Pin	Description	Driver	Voltage (V)			Current(A)	
		High/ Low	Min	Nom	Max	Min	Max
1	External Relay Control 1	Low	9	13.5	16	0.170	0.320
2	External Relay Control 2	Low	9	13.5	16	0.170	0.320
3	Not used	-	-	-	-	-	-
4	External Relay Control 3	Low	9	13.5	16	0.170	0.320
5	External Relay Control 4	Low	9	13.5	16	0.170	0.320
6	External Relay Control 5	Low	9	13.5	16	0.170	0.320
7	External Relay Control 6	Low	9	13.5	16	0.170	0.320
8	External Relay Control 7	Low	9	13.5	16	0.170	0.320
9	External Relay Control 8	High	9	13.5	16	0.170	0.500
10	External Relay Control 9	High	9	13.5	16	0.170	0.500
11	External Relay Control 10	High	9	13.5	16	0.170	0.500
12	External Relay Control 11	High	9	13.5	16	0.170	0.500
13	External Relay Control 12	High	9	13.5	16	0.170	0.500
14	External Relay Control 13	High	9	13.5	16	0.170	0.500
15	External Relay Control 14	High	9	13.5	16	0.170	0.500
16	External Relay Control 15	High	9	13.5	16	0.170	0.500

Min = Minimal, Nom = Nominal, Max = Maximum

C3 Connector

Pin	Type	Voltage (V)		Current (mA)	
		Min	Max	Min	Max
1	Power	9	16	-	-
4	Ground	9	16	-	-
6	Vehicle CAN High	9	16	0 (Steady State)	8
7	Vehicle CAN Low	9	16	0 (Steady State)	8

The C3 connector is the power and CAN feed from the base vehicle. Do not splice into those wires or modify the connector.
Min = Minimal, Max = Maximum

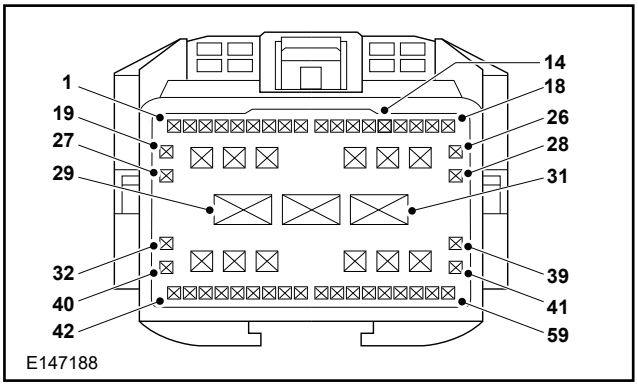
Hall Effect Sensor

The Hall Effect Sensor can be used as the Seatbelt Circuit. The PCIM will diagnose the status by applying a regulated voltage in the range of 4.5V to 16V relative to the PCIM ground and measuring the resulting current. Refer to vehicle or aftermarket seatbelt design transmission for specific sensor details.

- The PCIM will block reverse current in the event of a reverse battery condition
- The Hall Effect Sensor (e.g. Seatbelt Buckle Sensor) will function as a current sink from its feed circuit to its return circuit
- The Hall Effect Sensor return will return to the PCIM and be shared with other sensor returns as determined by the restraints grounding strategy
- The sensor status shall be determined by the amount of current drawn by the sensor
- If a sensor is resistive, rather than constant current, the range shall be normalised to the specified thresholds, based upon the assumption of an applied 5.0V
- A capacitance <=100nF ± 20% (initial tolerance) may be placed between the feed and return pin of each sensor. The capacitance may be 0nF

4.25.12 Adding Connectors

Marker Lamps



Item	Description
Pin 14	Side Marker Supply - Yellow/Violet

WARNING: Maximum load on pin 14 is 2.5A, including existing number plate bulbs. Do not exceed 2.5A on this circuit. Recommend only LED side markers be added.

Additional Rear Speakers

NOTE: The connectors on the Instrument Panel harness (14K024) and the main harness (14401) are reversed between Left Hand Drive (LHD) and Right Hand Drive (RHD) vehicles, hence different sets of terminals/wires are required to cover all the markets.

For information on rear speakers:
Refer to: 4.13 Information and Entertainment System

Unused Connectors

The harnesses may have a number of unused connectors. These are dedicated to other features and options, e.g. heated seats, but are **not** always present depending on level of harness fitted. Ford **do not** recommend the use of these connectors for any other purpose than that intended by design.

Power Outlet/Cigar Lighter

NOTE: The timer is reset when a door is opened, the vehicle is unlocked or ignition is switched on.

Both features adopt a 20A fusing strategy. Continued loading on these outlets will lead to battery drain, and risk the vehicle not starting.

At engine Off, all power outlets will switch off after 30 minutes.

If longer duration electrical power is required after ignition off, a second battery option should be installed and the CCPs, where fitted, utilised.

Abc = BEV Only Abc = ICE Only

4.26 Pro Power Onboard Chassis Cab

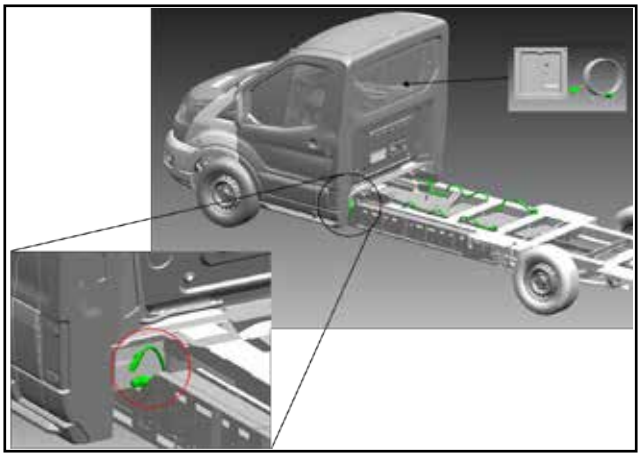
The cab outlet (single) is installed in the Passenger seat pedestal.

The rear outlet (duplex) is provided in dunnage and will need to be installed in the Second Unit Body.

- The Pro Power Onboard feature will not be functional until the rear outlet is installed (will reset on next key cycle).
- The rear outlet is water resistant but should be installed such that it is protected from direct spray or flow of water. The wiring connectors are sealed and do not need to be protected from the elements.
- The rear outlet should be installed on a vertical surface.
- The rear outlet has a ~550mm wiring pigtail. The included grommet and retaining clip may be carefully removed if desired.

A 6m (18 ft) extension wiring harness is also provided in dunnage to allow flexibility in placement of the rear outlet. The rear outlet pigtail can also connect directly to the chassis wiring if preferred.

Chassis wiring connectors are located near the LH frame rail at back of cab. These connectors have sealed caps which should remain in place until the rear outlet is plugged in (directly or via extension harness) to prevent contamination and potential shock hazard.

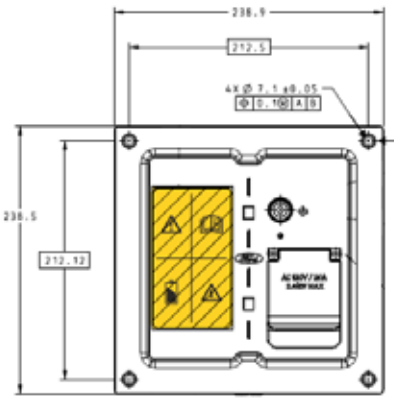


If the rear outlet cannot be installed in the SUB, the Pro Power Onboard feature should be disabled, which requires use of the Ford Diagnostic and Repair System (FDRS) tool to reconfigure the Inverter Module.

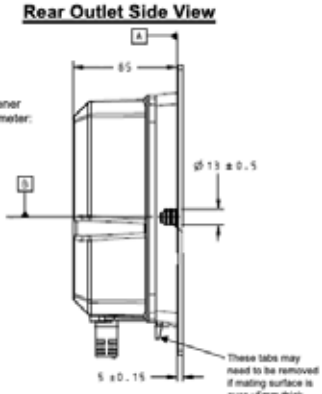


Wiring Length from Strain Relief (+/- 10mm):
to Grommet - 290mm
to Clip – 430mm
to Signal connector – 550mm
To Power connector – 580mm

Rear Outlet Front View



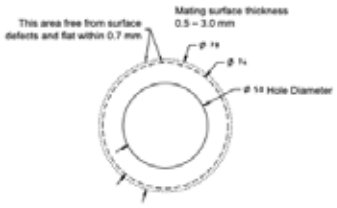
Rear Outlet Side View



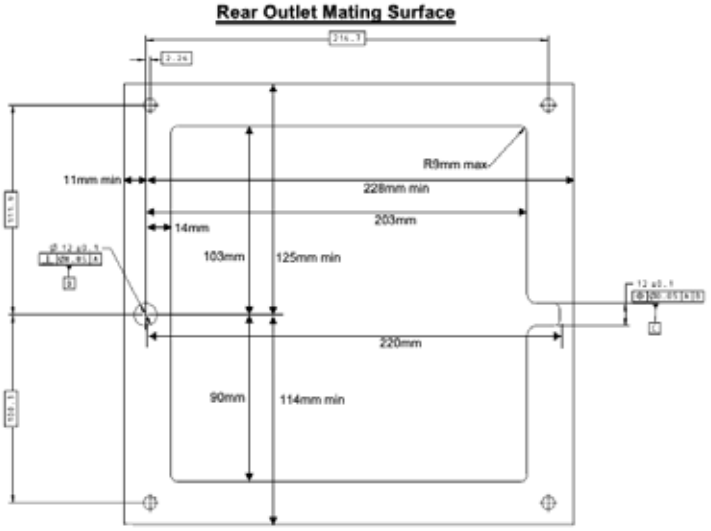
Wiring Clip Mating Surface

SHEET METAL THICKNESS RANGE: 0.60mm - 6.75mm
APPLICABLE OVAL HOLE SIZES:
A. 6.2 X 12.2mm
B. 6.5 X 12.5mm
C. 6.5 X 13.0mm
D. 7.0 X 12.0mm

Wiring Grommet Mating Surface



Rear Outlet Mating Surface



4.27 Grounding

4.27.1 Ground Points

WARNINGS:

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 figures E296416, E228189 and the following table for recommended ground points that can be used.

All the High Voltage components on the E-Transit BEV are either grounded through the metallic case or through a ground cable/ wire or a EMC ground strap. Do not tamper with or modify any of these HV component fastener joints or grounding points

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.

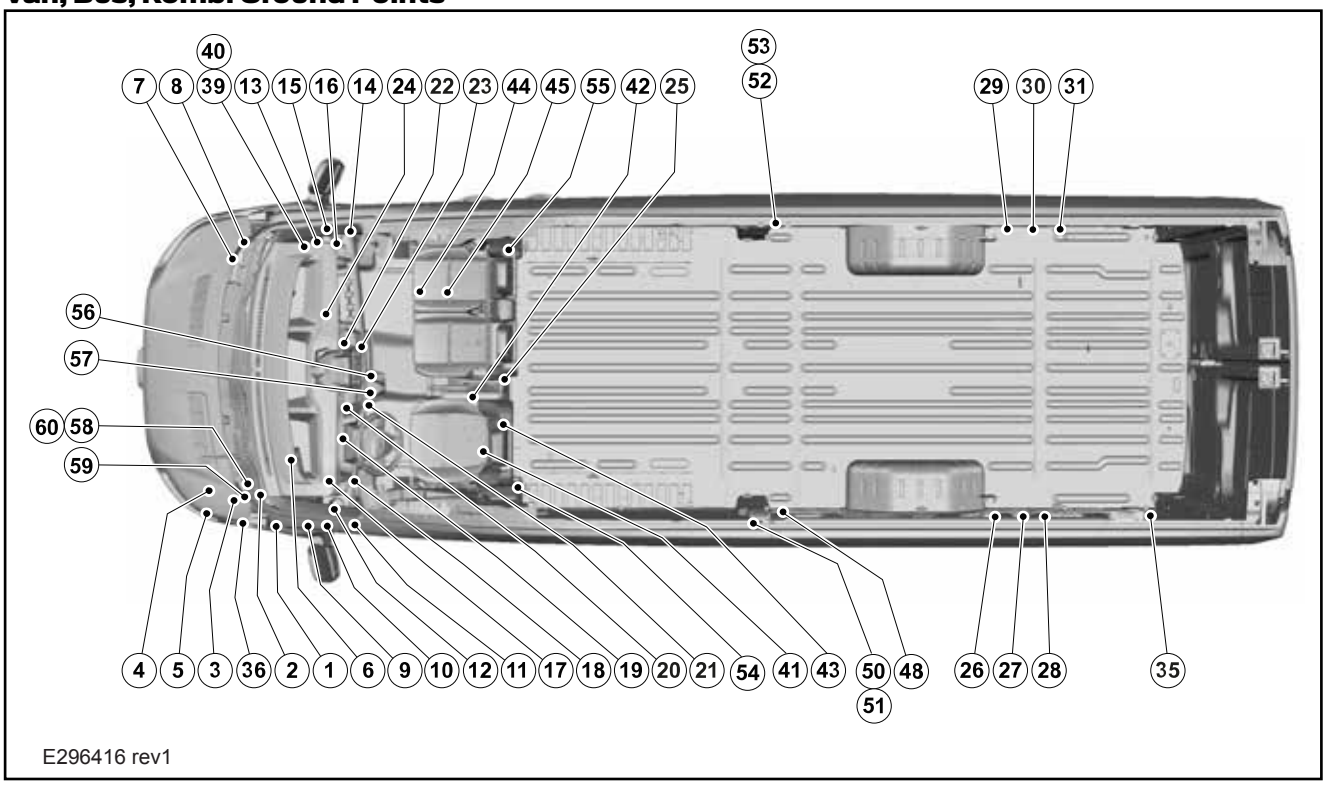
NOTE: The Ground Point (GP) numbers are only for reference to show the location of the GP.

Ground wires should be brought back to the Ford ground points provided, please refer to the following figures. 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. An auxiliary ground stud eyelet can be ordered

Refer to: 4.7 Battery Protection Additional Loads and Charging Systems section for additional information.

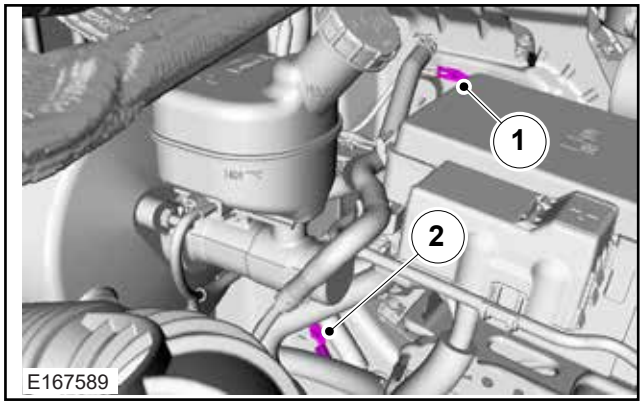
If a new grounding point is required, avoid weather zones, especially for high current grounds. Ground connections should be routed back close to the location of the +12V supply. This helps to reduce the electromagnetic field particularly generated by inrush current and improve electromagnetic compatibility.

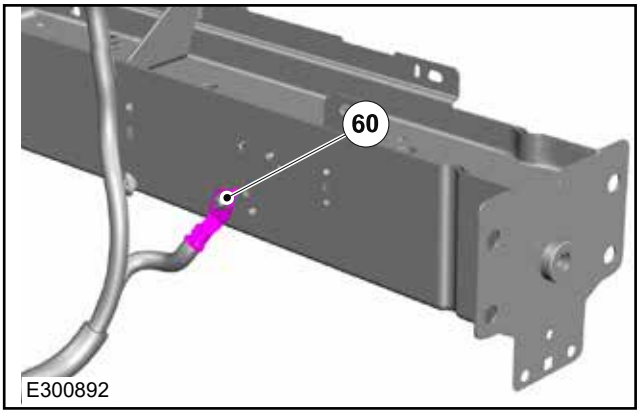
Van, Bus, Kombi Ground Points

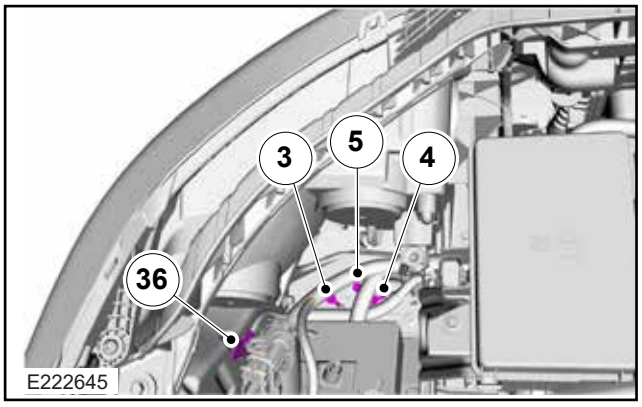


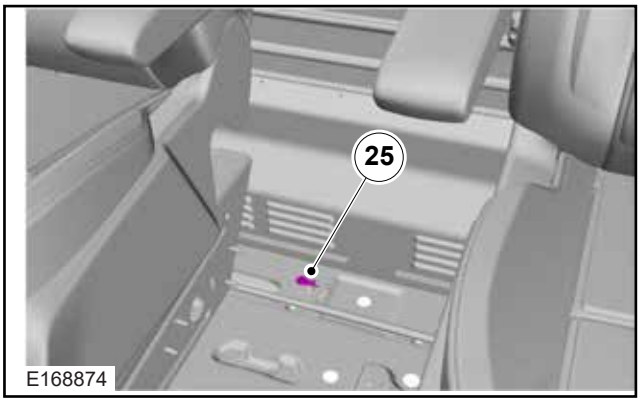
E296416 rev1

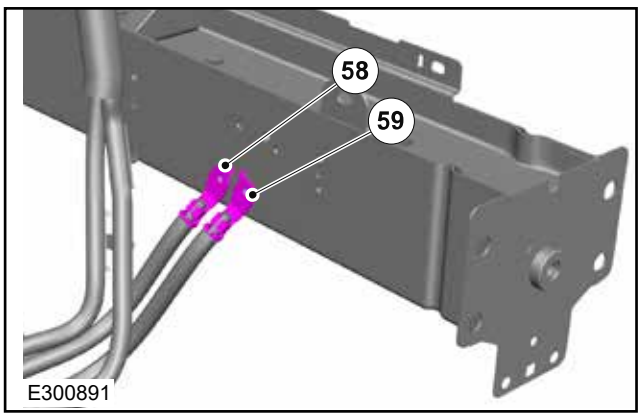
Abc = BEV Only Abc = ICE Only

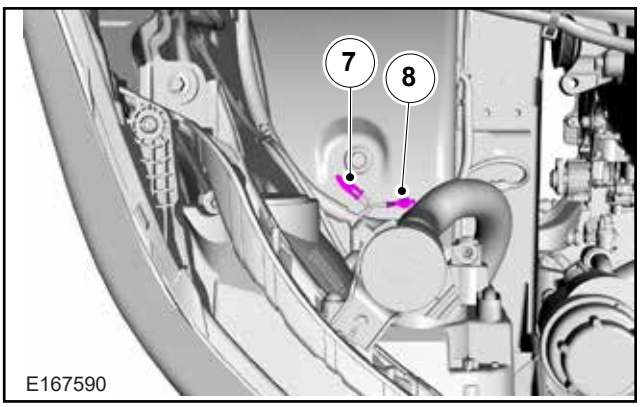


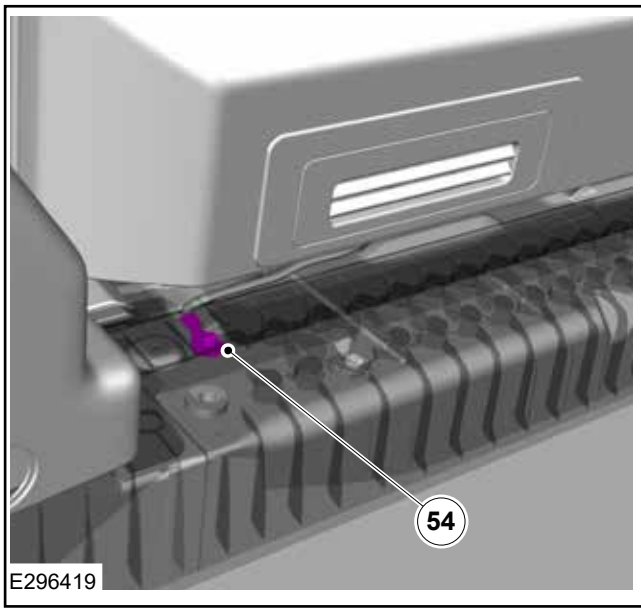


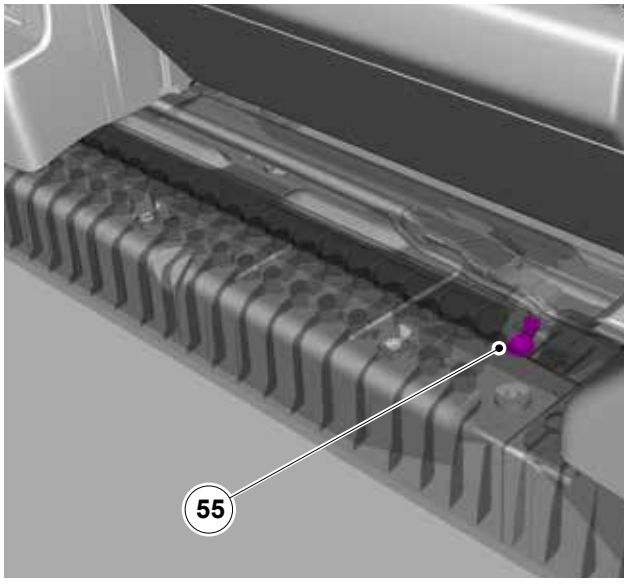




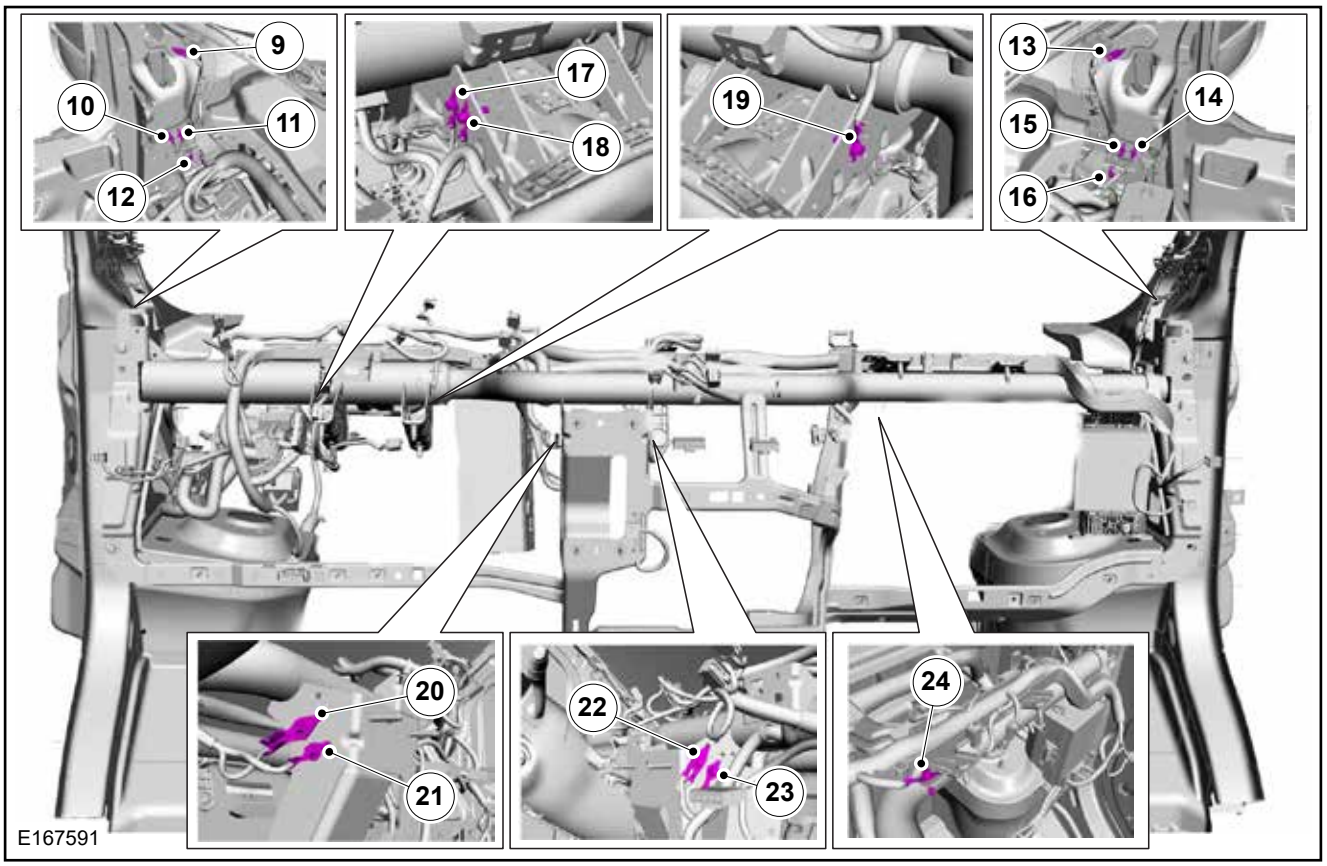


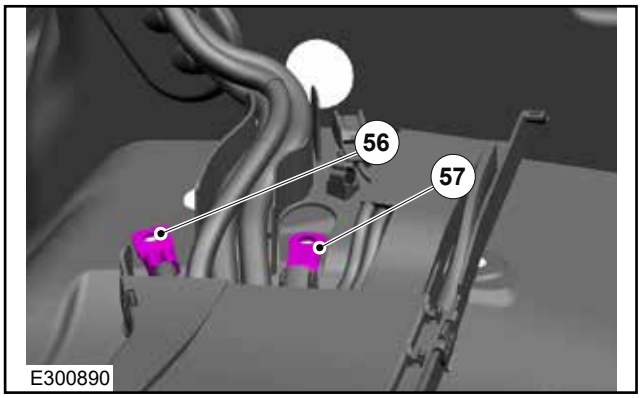


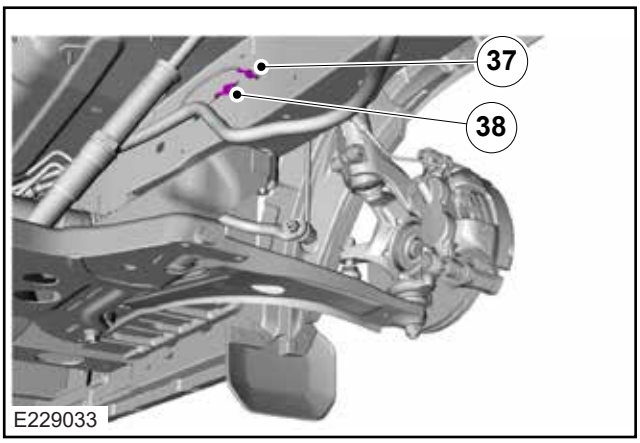


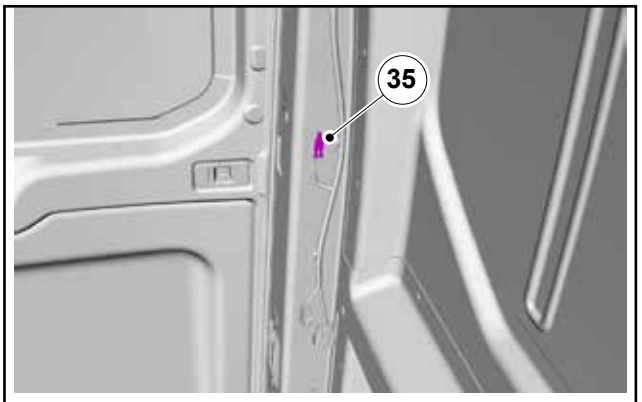


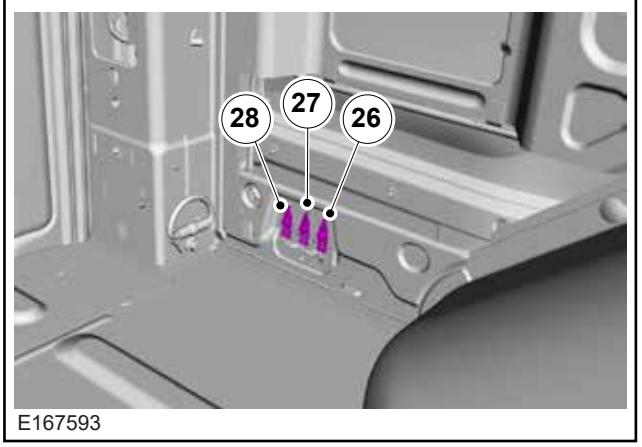
Abc = BEV Only Abc = ICE Only



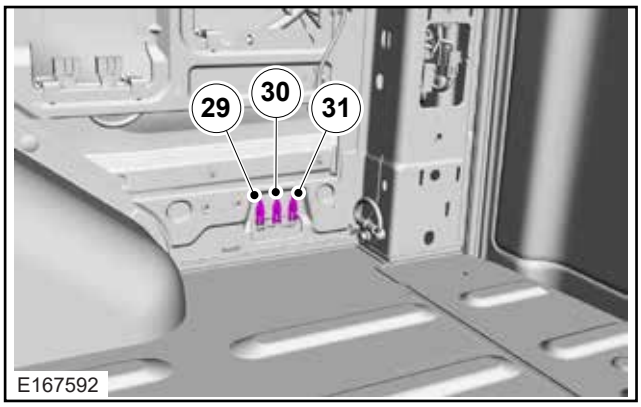


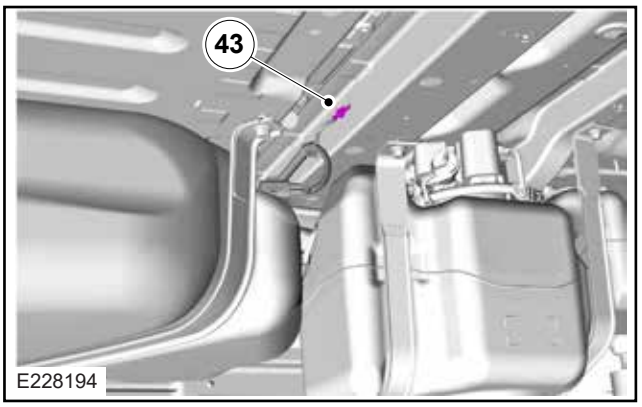


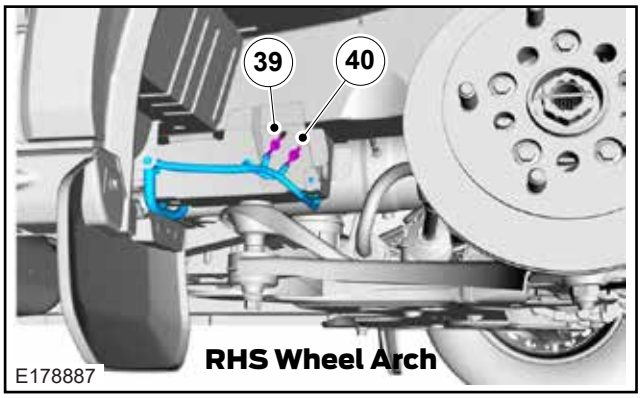


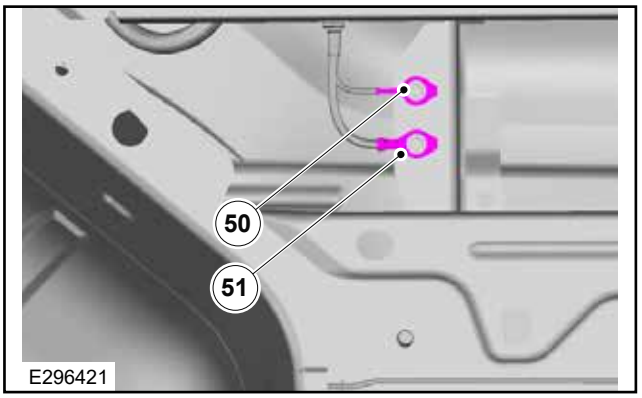


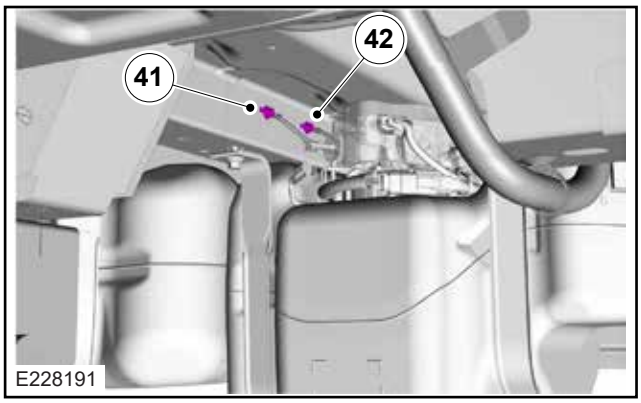
Abc = BEV Only Abc = ICE Only

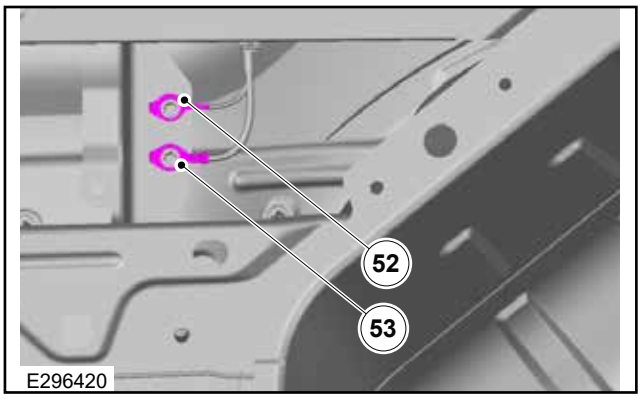


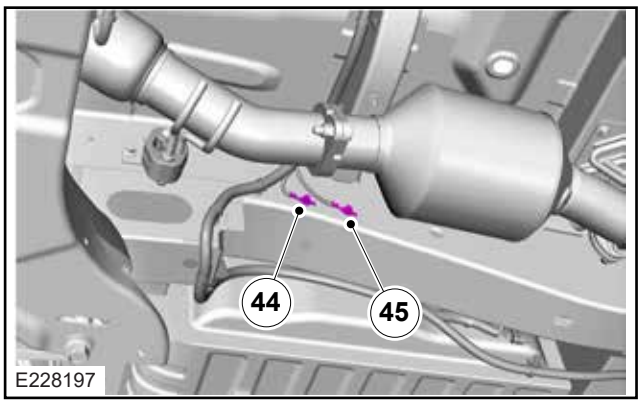












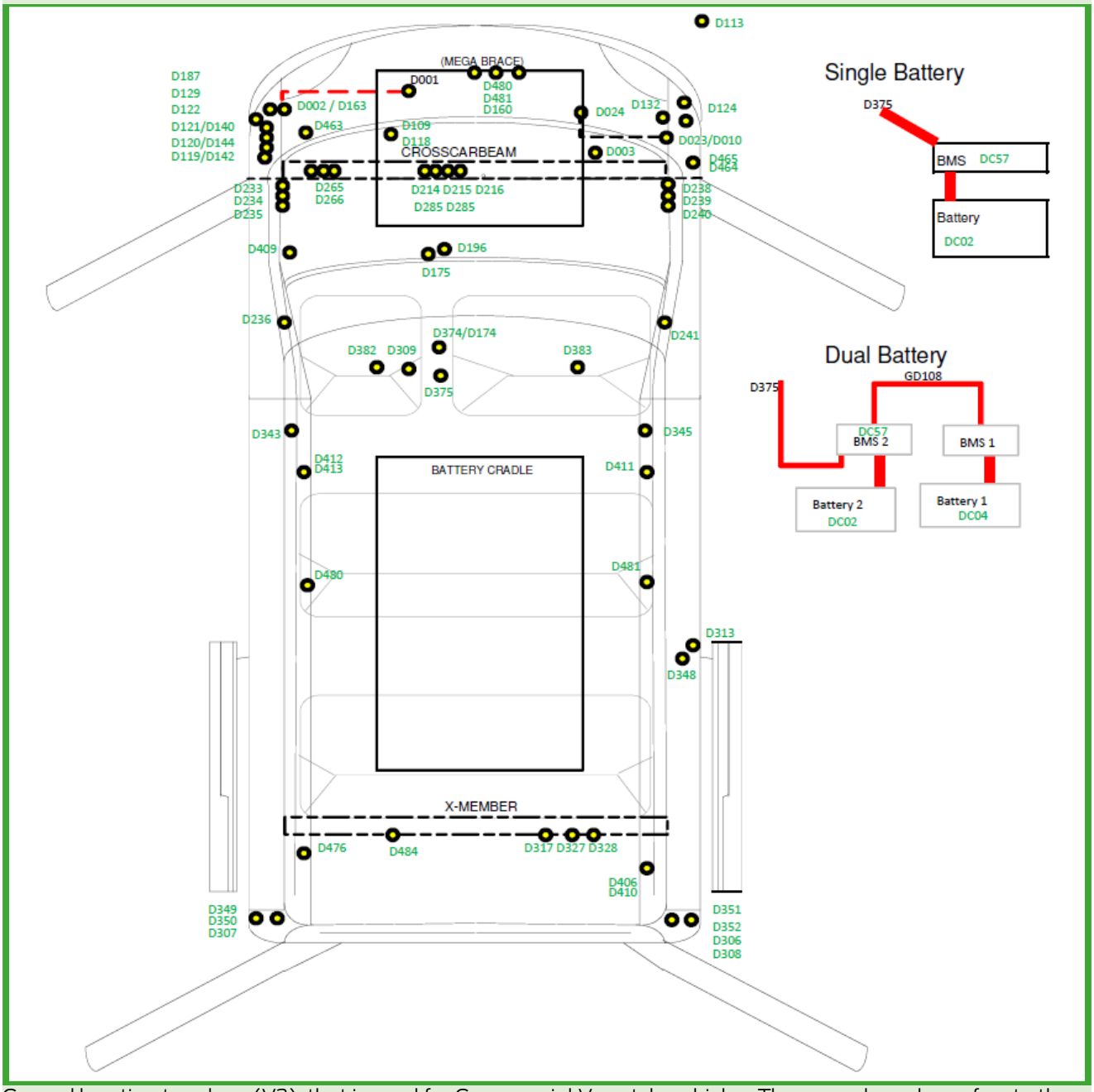
Abc = BEV Only Abc = ICE Only

WARNING: Electrical ground paths for High Voltage components (includes Low Voltage ground points for the High Voltage system) must not be utilised as additional ground points for 12 volt system applications.

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

Refer to:
5.1.2 Welding
5.14 Corrosion Prevention

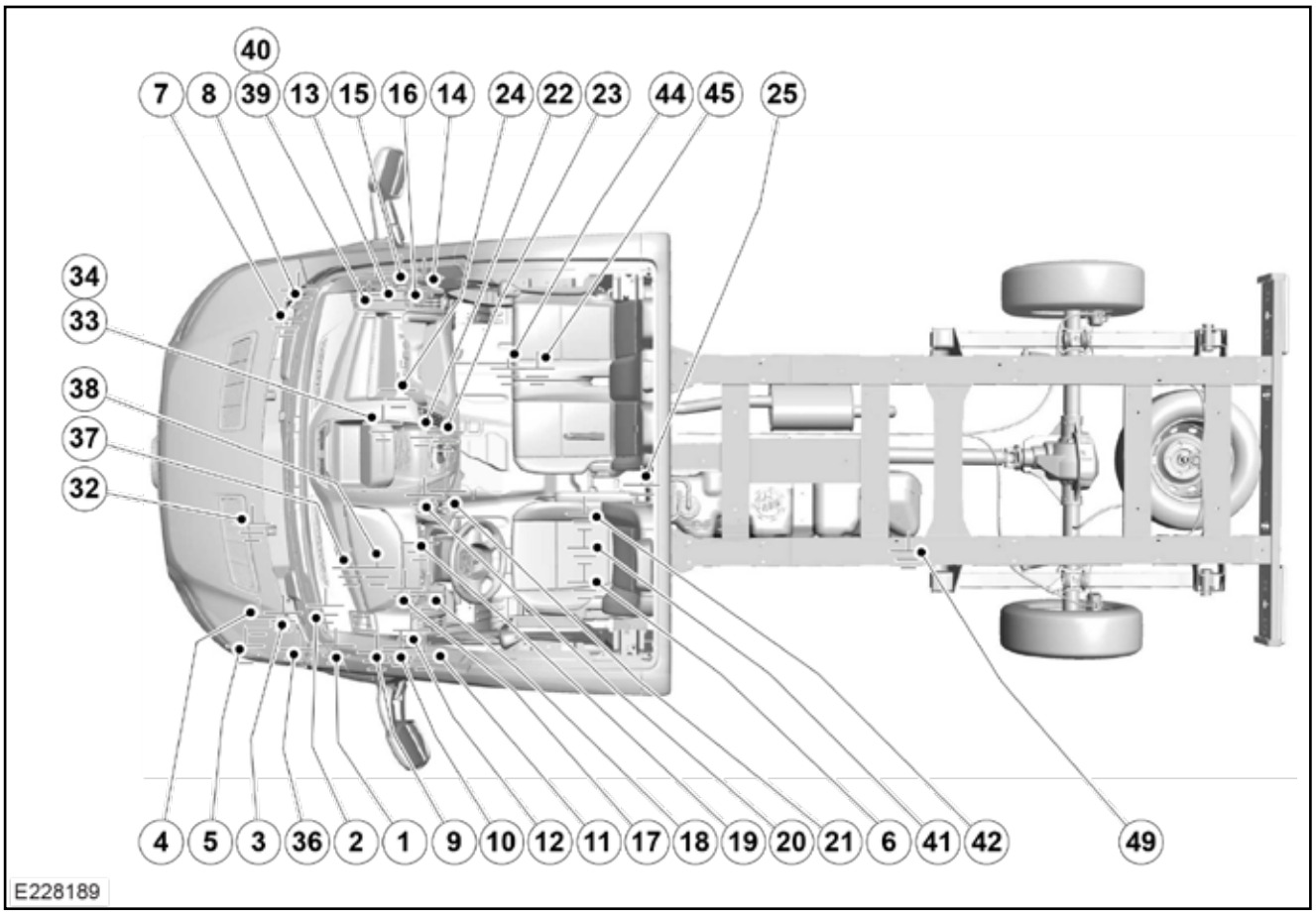
E/E System Ground Attachment Points - V3 E-Transit BEV Commercial Van

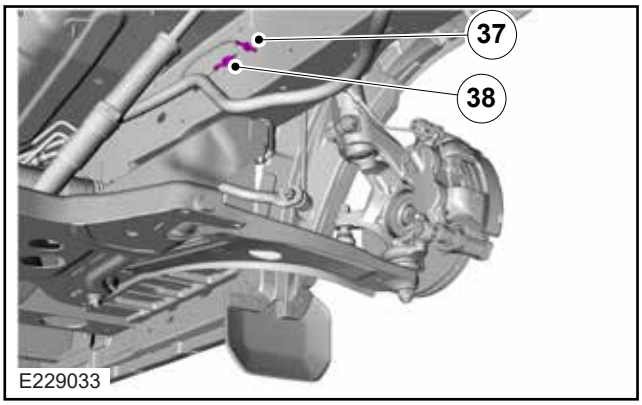


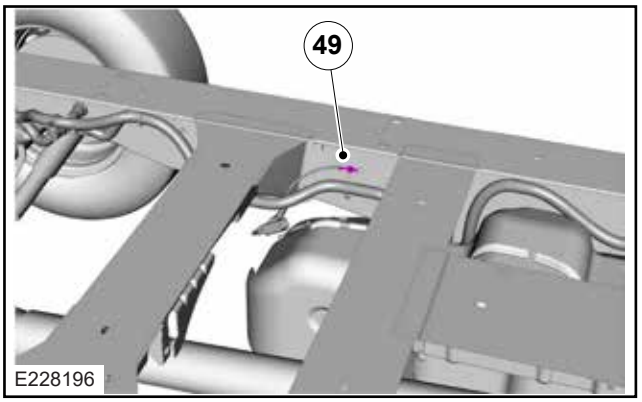
Ground location topology (V3) that is used for Commercial Van style vehicles. The ground number refers to the location of the ground point in the vehicle (see ES-KU5T-1274-AA).

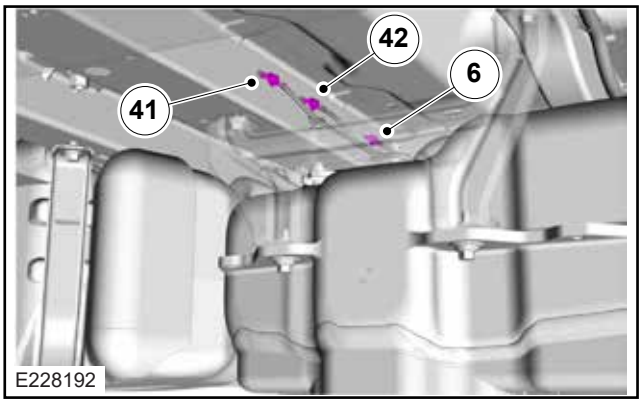
Abc = BEV Only Abc = ICE Only

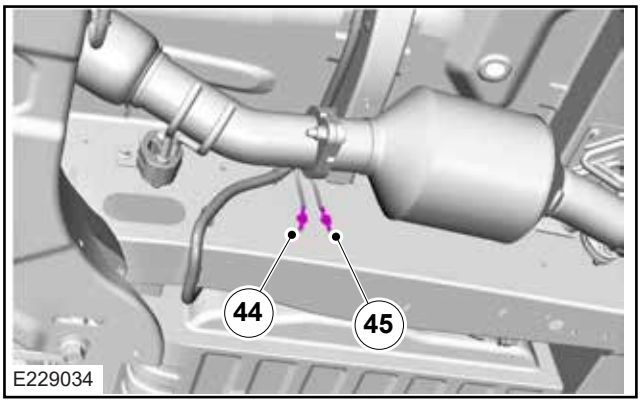
Chassis Cab Ground Points



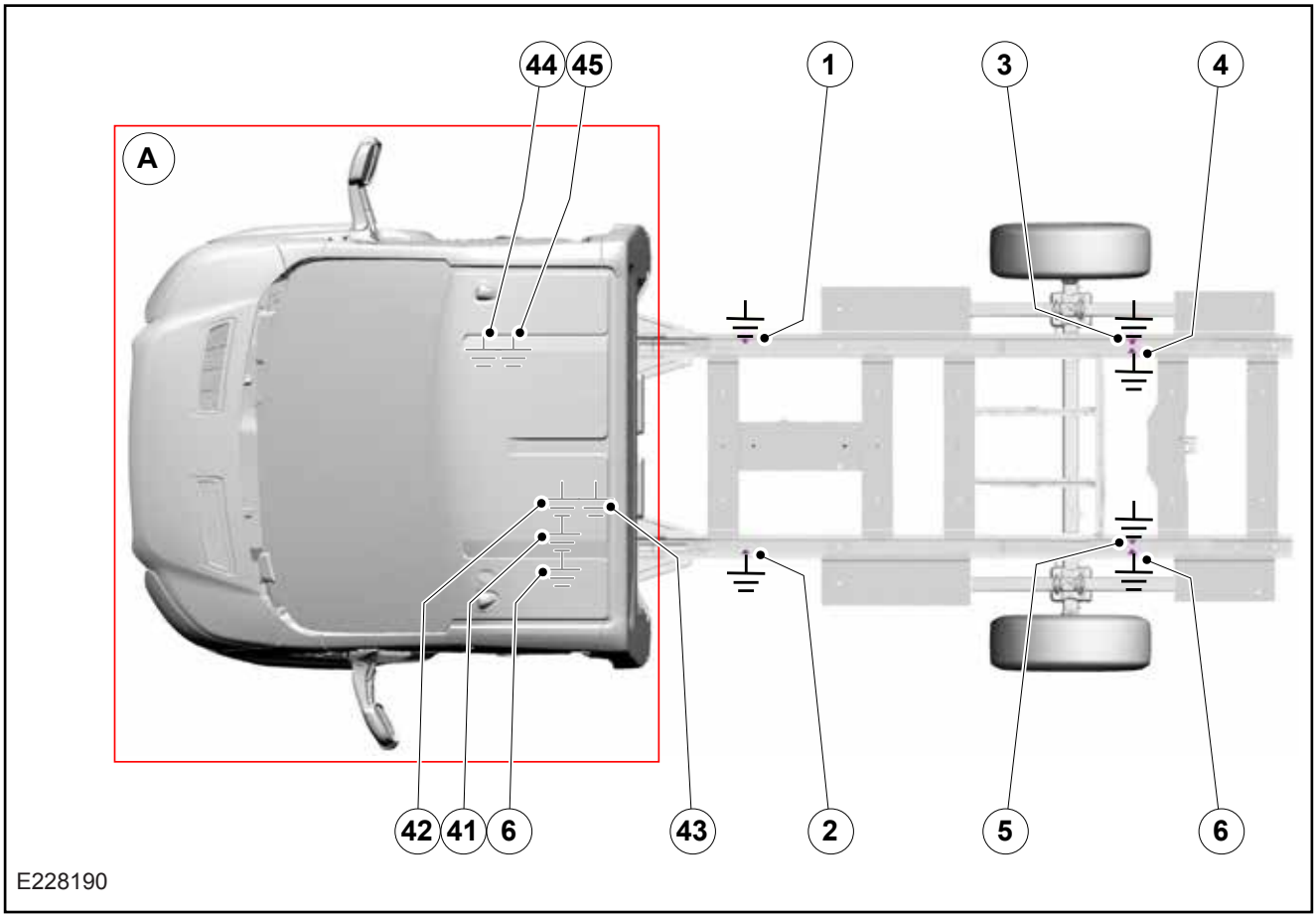






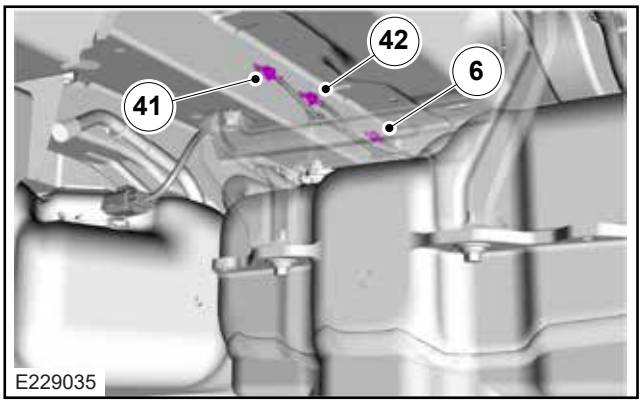


Skeletal Chassis for Camper and Non Camper

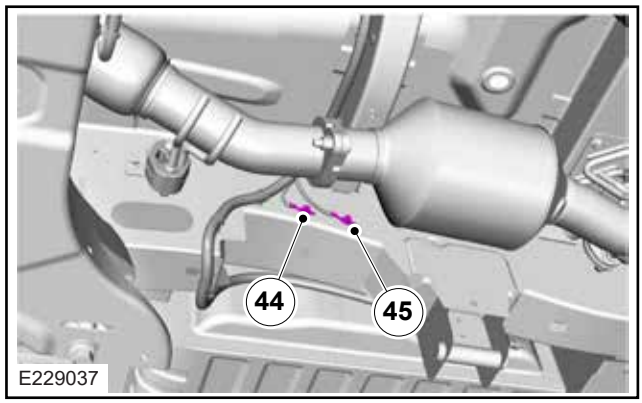


E228190

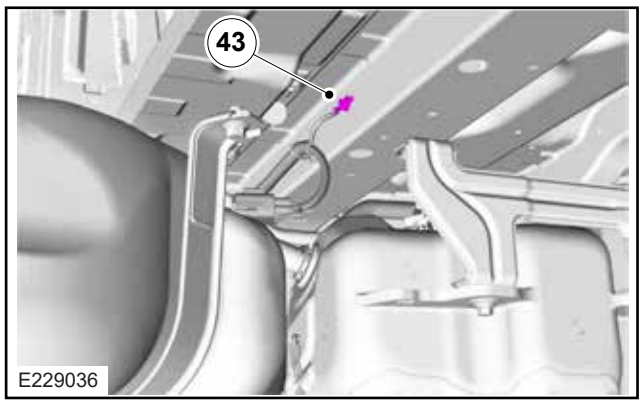
Item	Description
A	All ground points are the same as Van, Bus, Kombi, except GP6.
1 - 6	Additional ground points (Locations 1 and 2 use the outer rail positions only). M8 threadless weld nuts requiring M8 thread rolling screws.



E229035

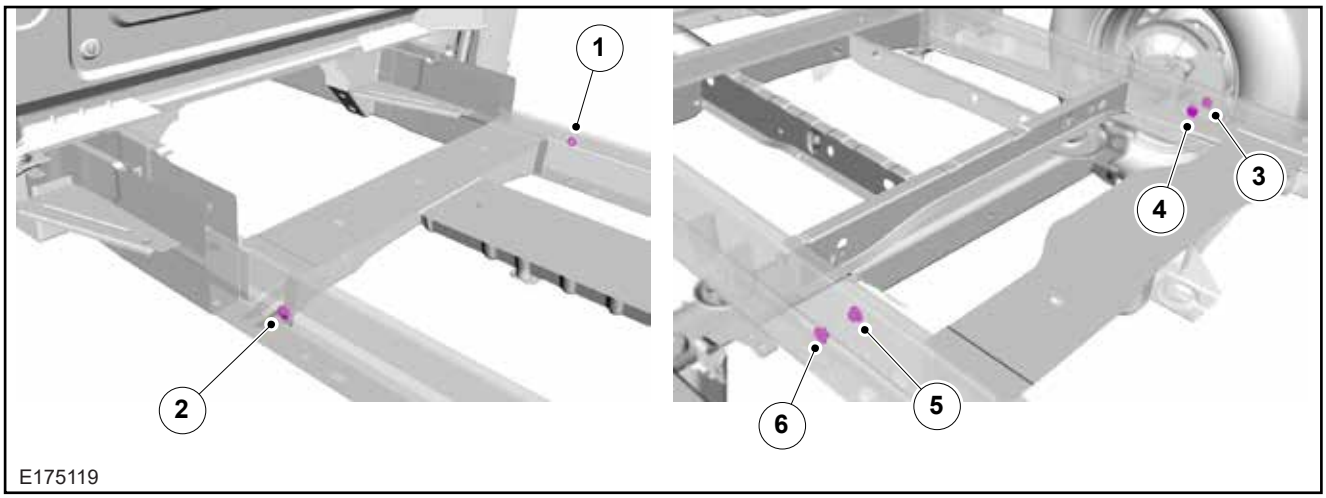


E229037



E229036

Abc = BEV Only Abc = ICE Only



E175119

Ground Point	Location	Type	Harness
Ground Points - Chassis Cabs and Van, Bus, Kombi			
1	Engine Bay LHS	Misc Power Electric	14401
2	Engine Bay LHS	Misc Power Electric	14401
3	Engine Bay LHS Front	Exhaust Emissions Control	9K499
4	Engine Bay LHS Front	Exhaust Emissions Control	9K499
5	Engine Bay LHS Front	Exhaust Emissions Control	9K499
7	Engine Bay RHS Front	Misc. Power Electric	14401
8	Engine Bay RHS Front	Misc. Power Electric	14401
9	A Pillar LHS Upper	Rear Air Condition Control	13A409
10	A Pillar LHS Lower	Misc. Power Electric	14401
11	A Pillar LHS Lower	Misc. Power Electric	14401
12	A Pillar LHS Lower	Misc. Power Electric	14401
13(1)	A Pillar RHS Upper	Misc. Power Electric	14659
14	A Pillar RHS Lower	Misc. Power Electric	14401
15	A Pillar RHS Lower	Misc. Power Electric	14401
16	A Pillar RHS Lower	Misc. Power Electric	14401
17	Cross Car Beam LHS	Misc. Power Electric	14K024
18	Cross Car Beam LHS	Misc. Power Electric	14K024
19	Cross Car Beam LHS	Misc. Power Electric	14K024
20(1)	Cross Car Beam LHS	Misc. Power Electric	14K024
21(1)	Cross Car Beam LHS	Misc. Power Electric	14K024
22	Cross Car Beam LHS	Misc. Power Electric	14K024/14C007
23(1)	Cross Car Beam LHS	Misc. Power Electric	14K024
24(1)	Cross Car Beam RHS	Misc. Power Electric	14K024
25(1)	Floor Pan	Power Inverter	14401
26	Bodyside Rear LHS	Misc. Power Electric	13A409
31	Engine Bay LHS	Engine Control Sensor and Fuel Charge	12B637
36	Engine Bay LHS Front	Engine Control Sensor and Fuel Charge	12B637
39	RHS Wheel Arch	Exhaust Emissions Control	14D469
40	RHS Wheel Arch	Exhaust Emissions Control	14D469
41	Frame Middle Left	Trailer Tow	14406
42	Frame Middle Left	Fuel Fired Heater & Filter Heater	14406
44	Frame Middle Right	NOx Sensor	14406
45	Frame Middle Right	NOx Sensor	14406
56	Floor Pan	48V Body Main MHEV	14401

Abc = BEV Only Abc = ICE Only

Ground Point	Location	Type	Harness
57	Floor Pan	12V Body Main	14401
58	Engine Bay LHS Front	Misc. Power Electric	14300
59	Engine Bay LHS Front	Misc. Power Electric	14300
60	Engine Bay LHS Front	Misc. Power Electric	14303
Ground Points - Van, Bus, Kombi Only			
27	Bodyside Rear LHS	Misc. Power Electric	13A409
28	Bodyside Rear LHS	Misc. Power Electric	13A409
29	Bodyside Rear RHS	Misc. Power Electric	13A409
30	Bodyside Rear RHS	Misc. Power Electric	13A409
31	Bodyside Rear RHS	Misc. Power Electric	13A409
35[1]	D Pillar LHS Middle	Misc. Power Electric	14659
48	Frame Middle Right	PEM (Fuel Pump Control Module) RWD	14406
50	Bodyside Middle LHS	Misc. Power Electric	14401
51	Bodyside Middle LHS	Misc. Power Electric	14401
52	Bodyside Middle RHS	Misc. Power Electric	14401
53	Bodyside Middle RHS	Misc. Power Electric	14401
54	LHS under seat Pedestal	Misc. Power Electric	14401
55	RHS under seat Pedestal	MHEV	14401
Ground Points - Chassis Cabs Only			
37	Engine Bay LHS	Fuel Tank Sender	14406
38	Engine Bay LHS	Fuel Tank Sender	14406
49	Frame Middle Left	PEM (Fuel Pump Control Module)	14406
Ground Points - Van, Bus, Kombi and Skeletal Chassis for Camper and Non Camper			
43	Frame Middle Left	PEM (Fuel Pump Control Module)	14406
Ground Points - Chassis Cab and Skeletal Chassis for Camper and Non Camper			
6	Frame Middle Left	Lighting	14406

[1] Recommended Ground Points that can be used.

Ford Part Number W505255-S450M, M6 screw type fixing - torque 12Nm ± 1.8

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 Conversionworks@ford.com

5.1.1 Body Structures - General Information

WARNINGS:

Before drilling see figure E167660 for Boron Steel parts, in this section of the manual.

Before drilling the floor, check the Precautionary Drill Zones, see Figure E224824 in this section.

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

The following components, as installed by Ford Motor Company, should not be removed, relocated, altered, or modified in any way:

- **High voltage battery, battery connectors, battery cradle (carrying structure), outriggers, energy absorption members, brackets, and attachment hardware.**
- **Front-end structure, including aluminum extrusion assembly ("Megabrace"), attachment brackets, and attachment hardware.**

WARNING: The Ford side protection must not be removed as part of any conversion.

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 water, salt, dust, after cutting or drilling the body. Use Ford approved sealing and finishing materials, and underbody corrosion protection.

Refer to: 5.14 Corrosion Prevention

- Make sure that fixings in the B pillar area do not encroach on the seat belts or seat belt reels

For unique floor fixings, see (Frame Drilling and Tube Reinforcing) Refer to: 5.15 Frame and Body Mounting

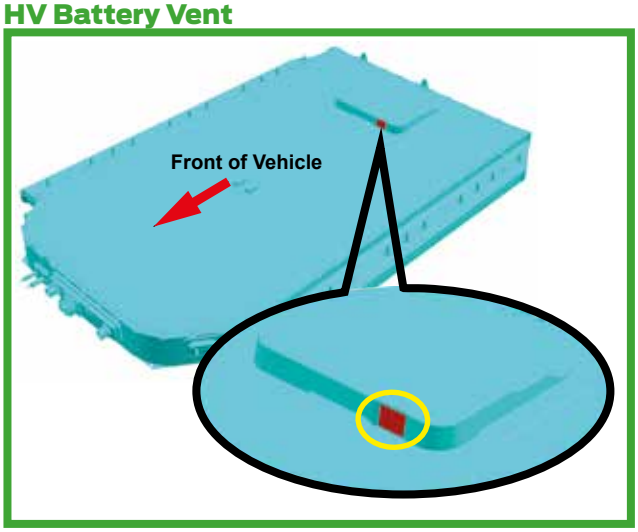
For Load Compartment Tie Downs (Load Lashing Points). For additional Precautionary Drill Zones

Refer to: 4.2 Wiring Installation and Routing Guides
Refer to: 5.6 Body Closures

Specific to the E-Transit BEV:

1. The E-Transit BEV HV Battery is equipped with an exhaust vent. No additional components nor obstructions (beyond any installed by Ford) shall be located in the same environment as the battery (e.g., underbody) and within 150 mm of these features. Additionally, no components which may contain combustible liquids or gases at any time shall be added by the converter within 300 mm of these features.
2. There shall be no modifications or installed components which confine the air space near the outside of the HV Battery or obstruct the free flow of air about the battery (beyond any installed by Ford).
3. Any cut outs or openings created between the occupant space and the vehicle underbody shall be sealed such that air is not free to pass from under the vehicle into the occupant space.
4. If any primary ingress/egress paths for occupant spaces are located above or rearward of the rear axle(s), a metallic shielding shall be added to obstruct any airflow from the battery towards those ingress/egress paths, and redirect that air flow towards a side/rear area that is not a primary ingress/egress path.

HV Battery Vent



5.1.2 Welding

WARNING: Before welding see figure E167660 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 the 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.

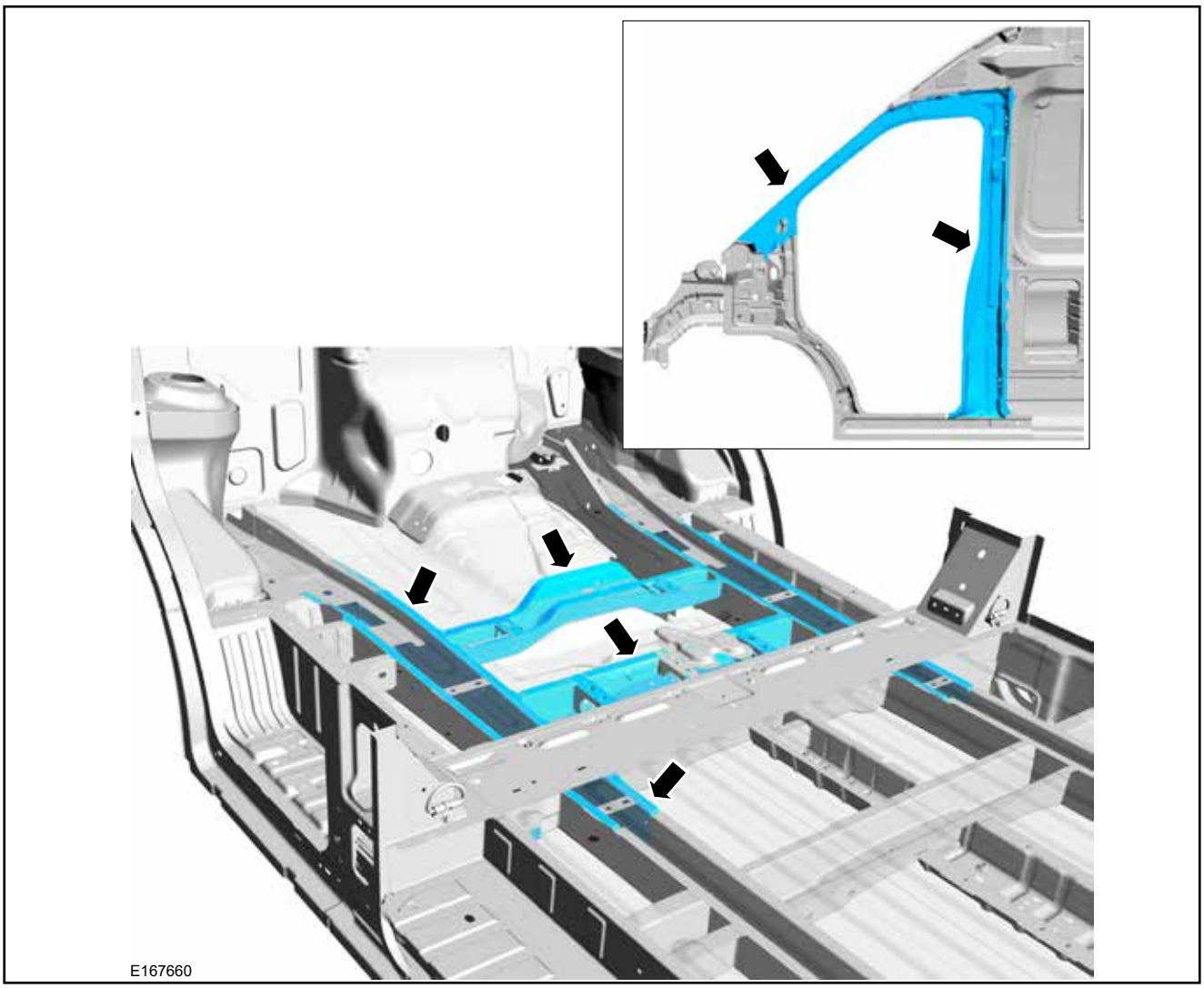
Priming after welding

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.

Abc = BEV Only Abc = ICE Only

5.1.3 Boron Steel Parts

Boron Steel Parts - Precautionary Drill or Weld Zones



5.1.4 Floor Precautionary Drill Zones: DieselVans

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 and electic cables are present below the floor.

It is recommended that Transit Van 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 conversionworks@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.

Fuel tanks come in Standard and Extended range. Both are shown for exemplary purposes.

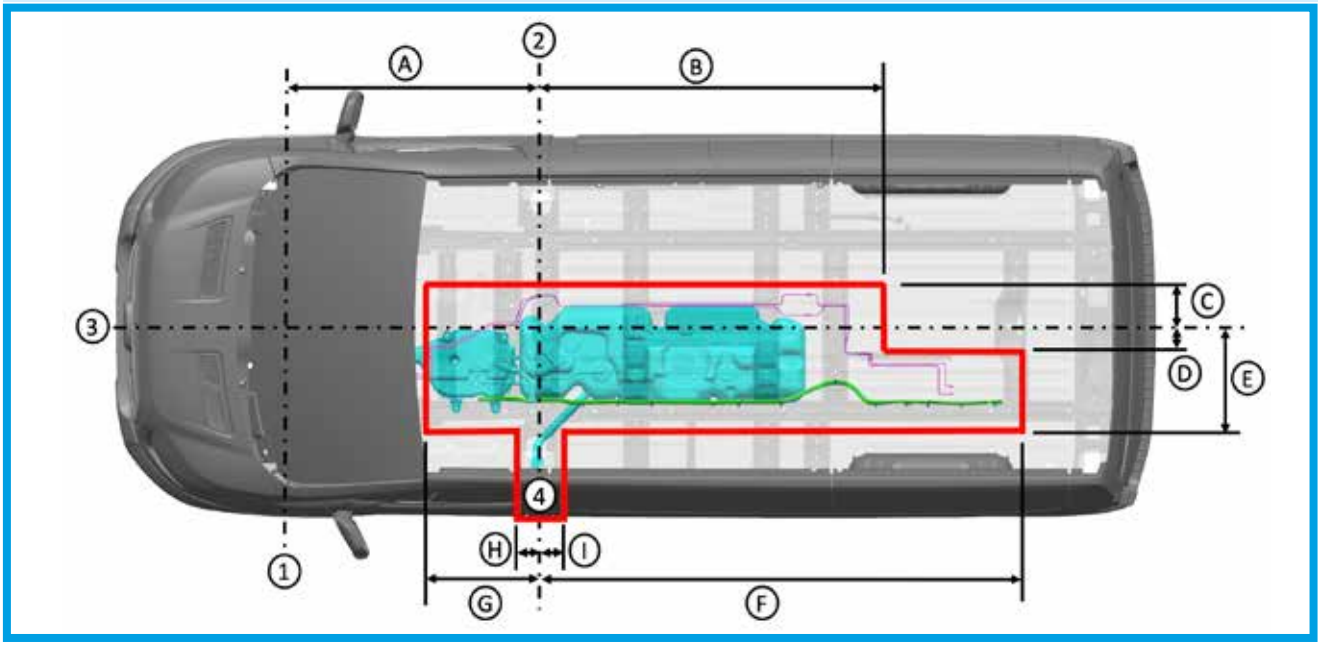
NOTE: Re-paint metal edges after cutting or drilling. All metal edges must comply with exterior and interior protection requirements.

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

Refer to:
5.1.1 Body Structures - General Info
5.14 Corrosion Prevention

Colour Key			
	Fuel/DEF Tanks		Brake Lines
	Electrical Harness		

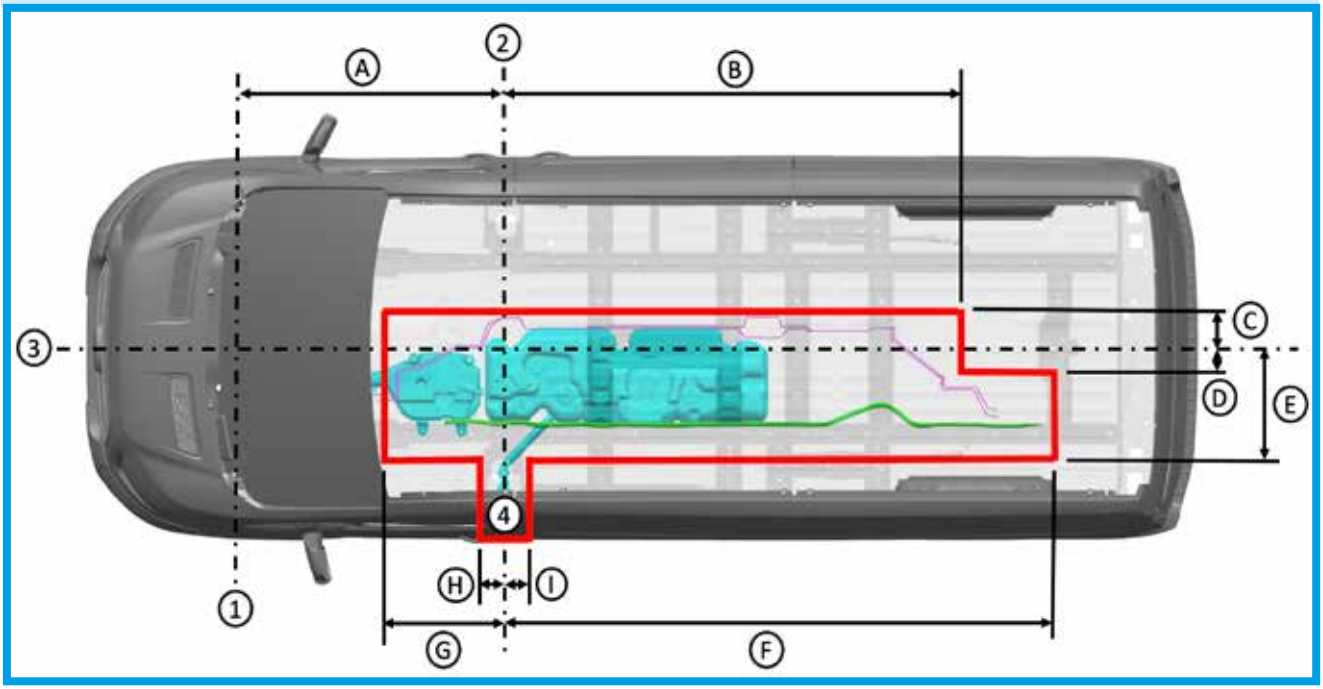
Front Wheel Drive Vans - L2



Floor Precautionary Drill Zone Dimensions (mm)	
1	Centre Line Front Wheel Axle
2	Centre of 'B' Pillar
3	Centre Line of Vehicle
4	Fuel Filler - Driver's Side 'B' Pillar
A	1235mm
B	1820mm
C	215mm
D	150mm
E	505mm
F	2515mm
G	625mm
H	75mm
I	75mm

Abc = BEV Only Abc = ICE Only

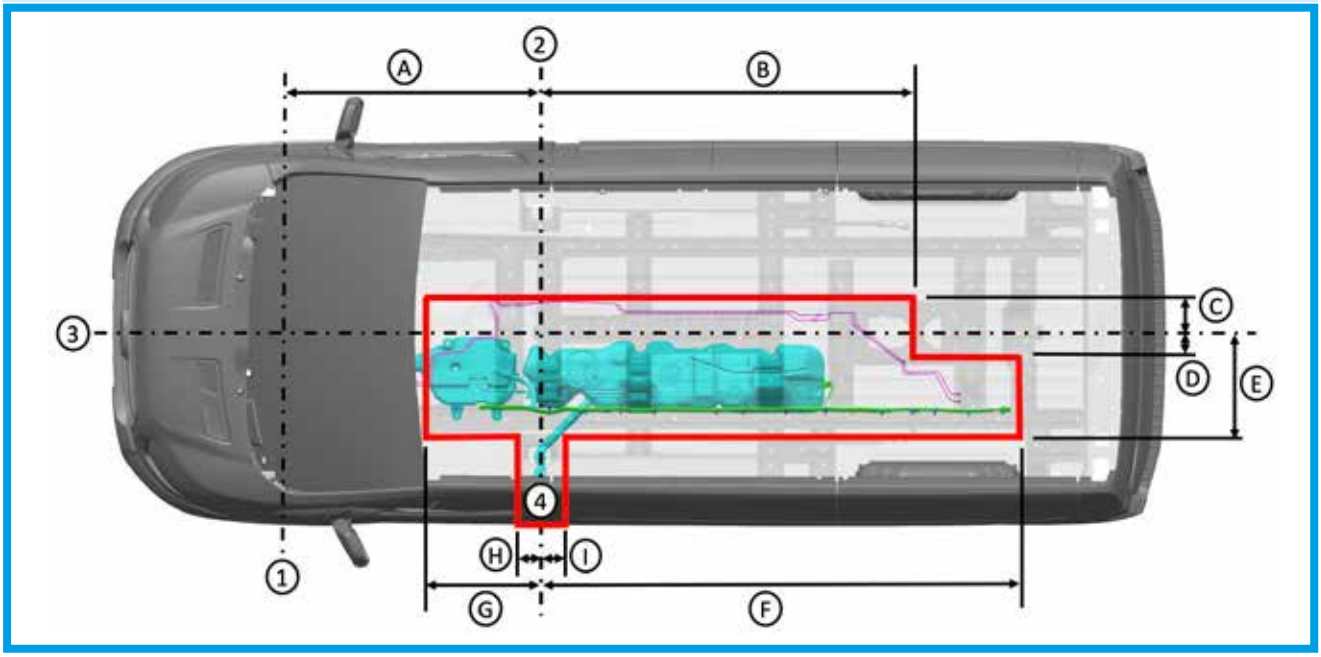
Front Wheel Drive Vans - L3/L4



Floor Precautionary Drill Zone Dimensions (mm)	
1	Centre Line Front Wheel Axle
2	Centre of 'B' Pillar
3	Centre Line of Vehicle
4	Fuel Filler - Driver's Side 'B' Pillar
A	1235mm
B	2410mm
C	215mm
D	95mm
E	555mm
F	3045mm
G	625mm
H	75mm
I	75mm

Abc = BEV Only Abc = ICE Only

Rear Wheel Drive Vans - L2

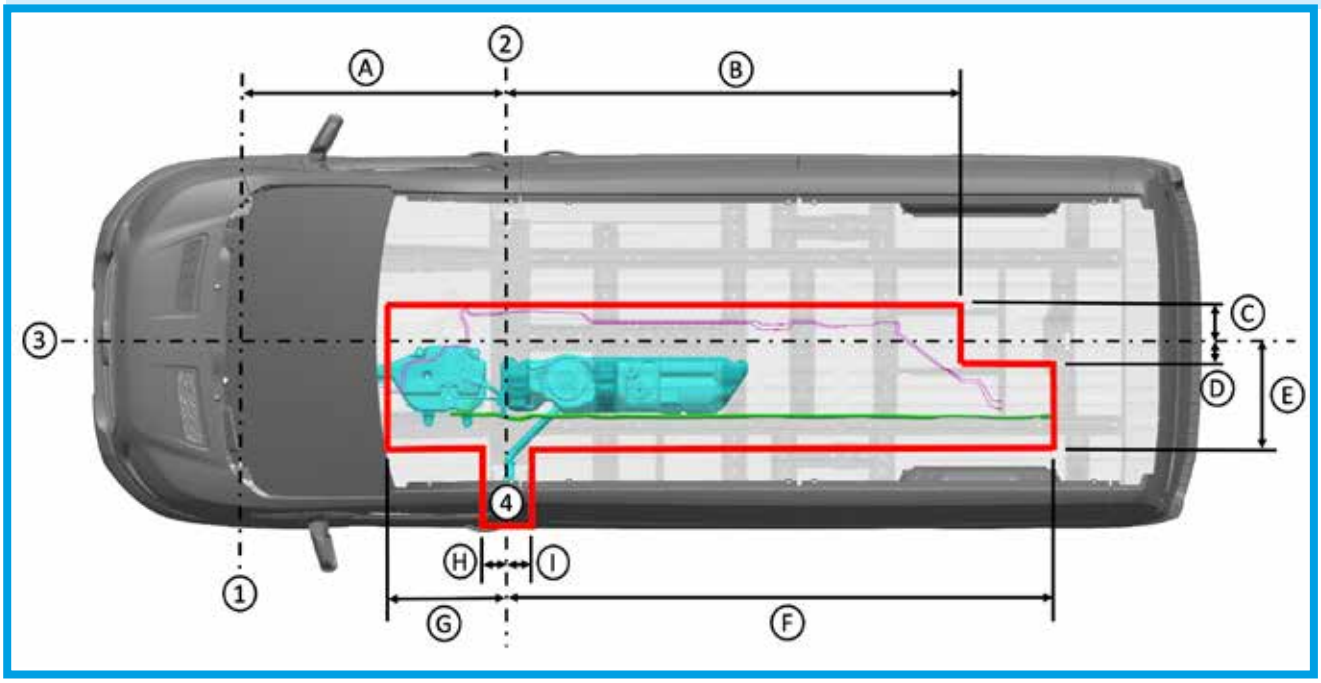


Floor Precautionary Drill Zone Dimensions (mm)	
1	Centre Line Front Wheel Axle
2	Centre of 'B' Pillar
3	Centre Line of Vehicle
4	Fuel Filler - Driver's Side 'B' Pillar
A	1235mm
B	1705mm
C	220mm
D	150mm
E	555mm
F	2595mm
G	625mm
H	75mm
I	75mm

Extended Range Fuel Tank shown

Abc = BEV Only Abc = ICE Only

Rear Wheel Drive Vans - L3/L4



Floor Precautionary Drill Zone Dimensions (mm)	
1	Centre Line Front Wheel Axle
2	Centre of 'B' Pillar
3	Centre Line of Vehicle
4	Fuel Filler - Driver's Side 'B' Pillar
A	1235mm
B	2400mm
C	220mm
D	95mm
E	555mm
F	3050mm
G	325mm
H	75mm
I	75mm

Standard Range Fuel Tank shown

Abc = BEV Only Abc = ICE Only

5.1.5 No Drill/No Weld Zones - BEV

WARNINGS:

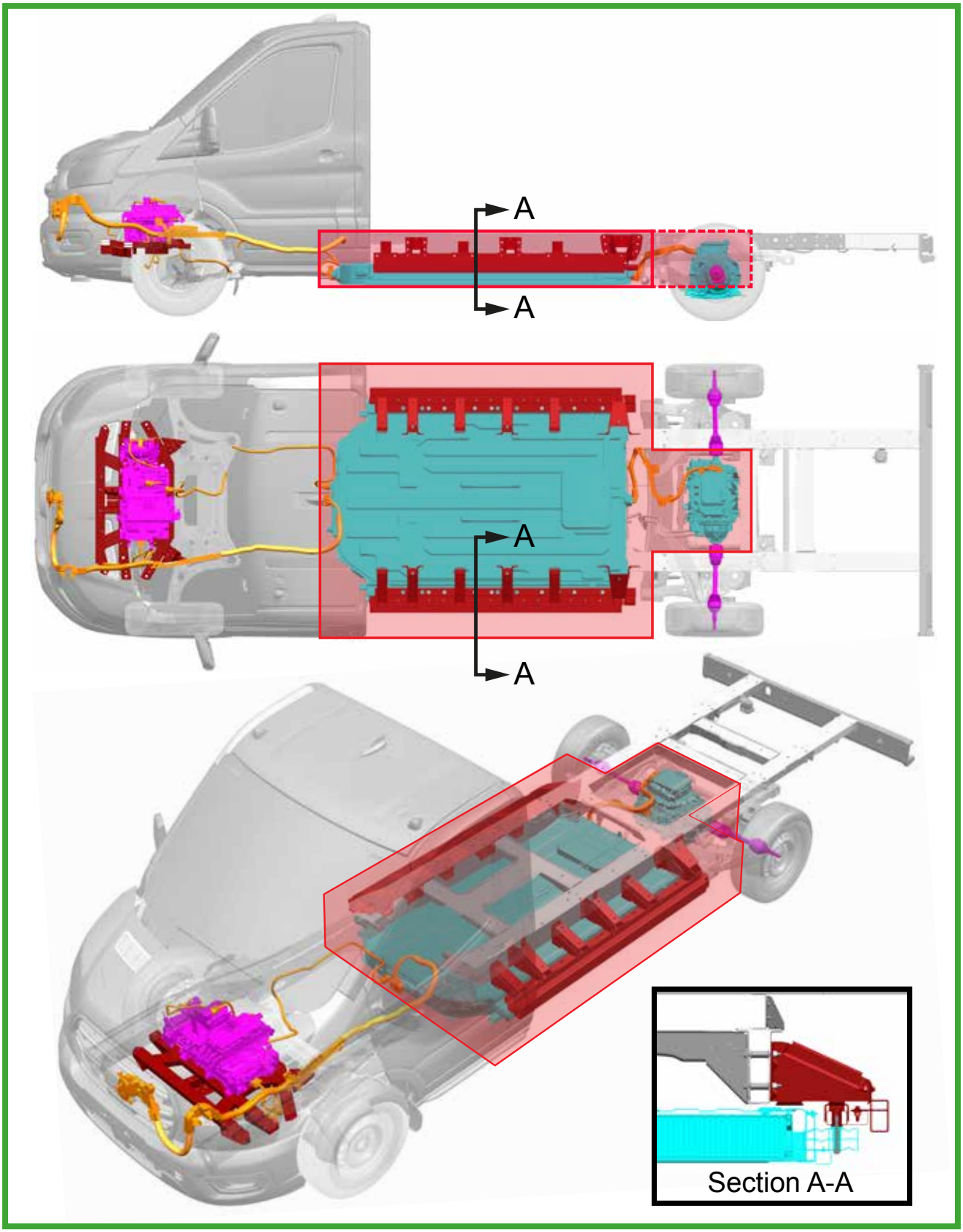
Do not undertake drilling, welding, or any other operation, in the red marked zone in order to prevent damage to the components placed underneath the floor, in particular battery and high voltage system components.

Do not drill the Side Impact Bars or Side Energy Absorption Members

Do not weld to the High Voltage Battery, casing or cradle

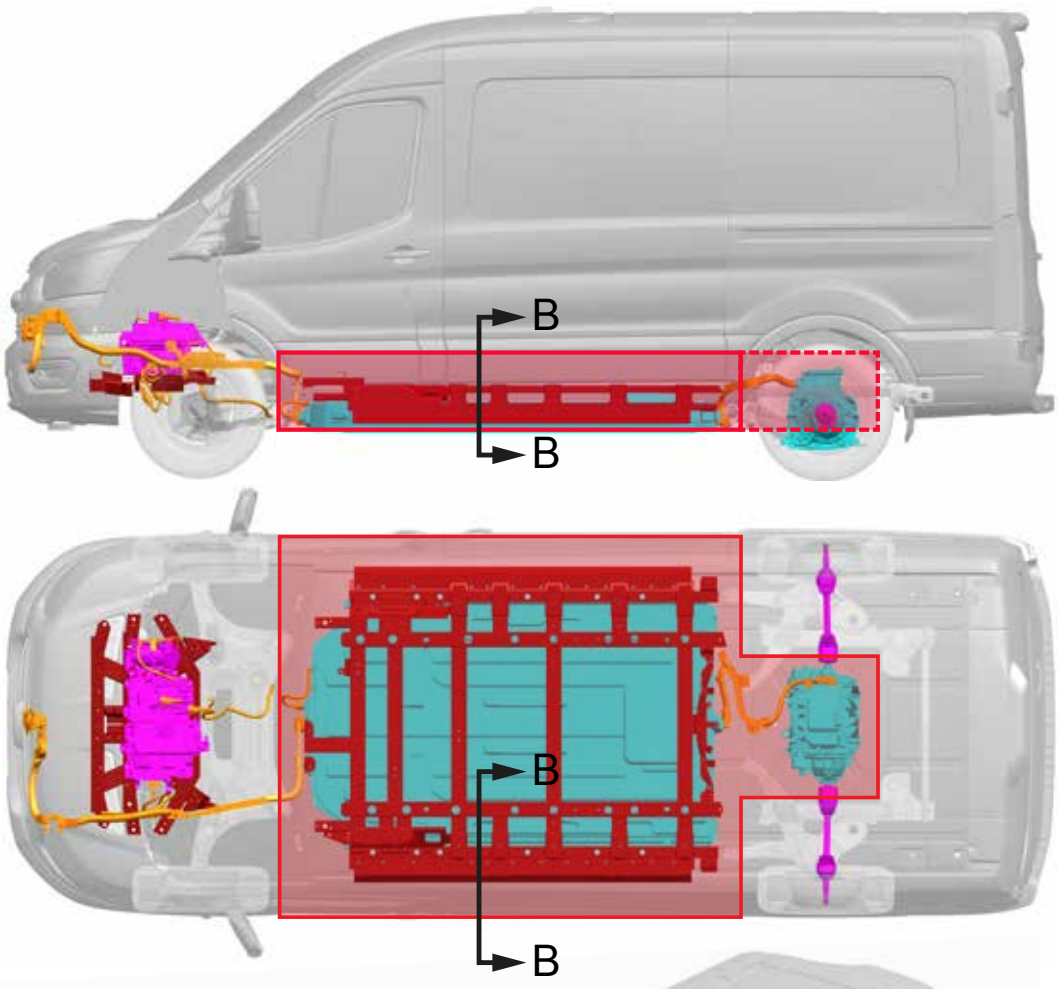
Do not ground welding equipment to the Battery, Battery Casing, or Battery Cradle

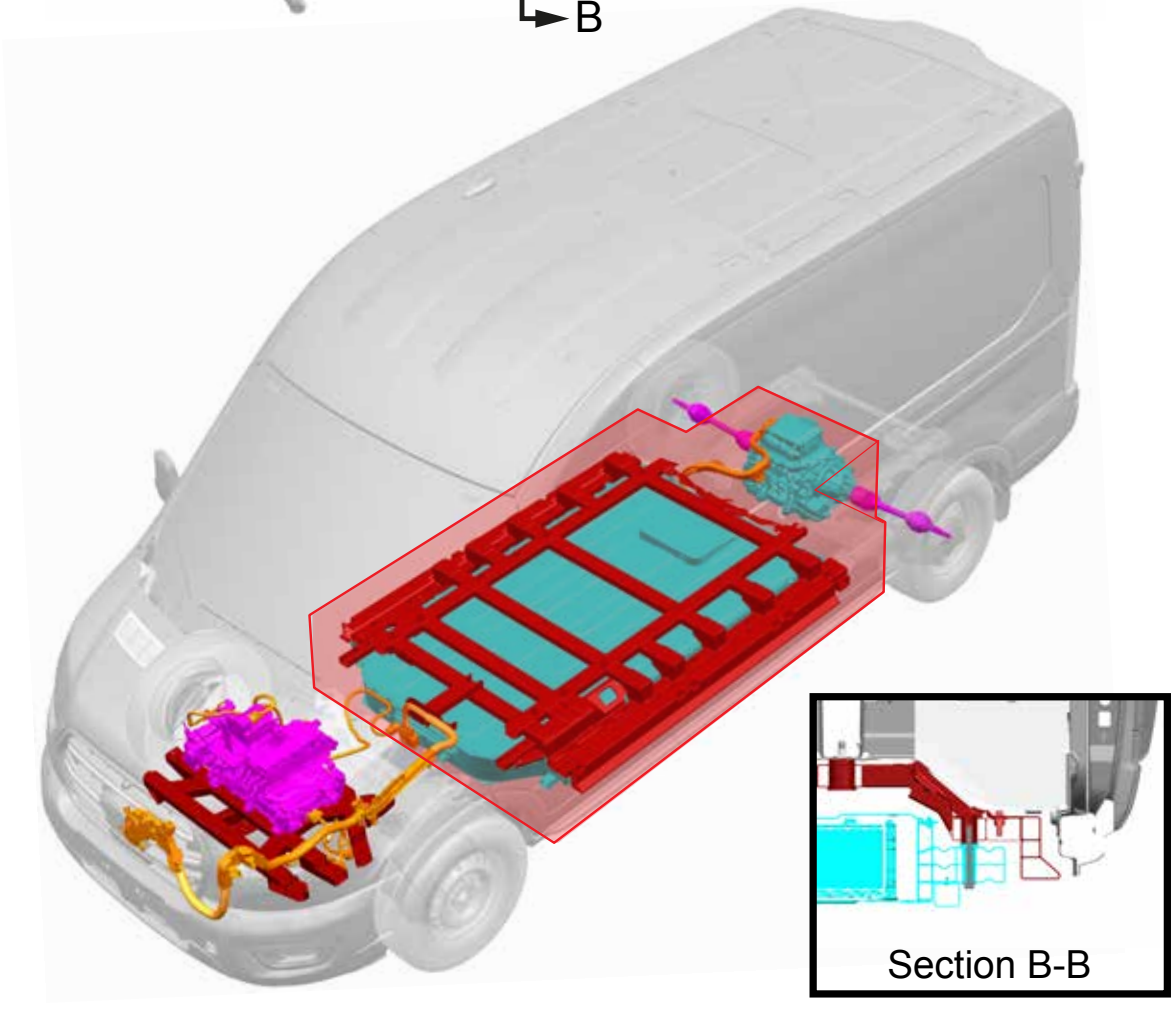
Floor No Drill/No Weld Zones - Chassis Cab



Abc = BEV Only Abc = ICE Only

Floor No Drill/No Weld Zones: Van, Bus, Kombi



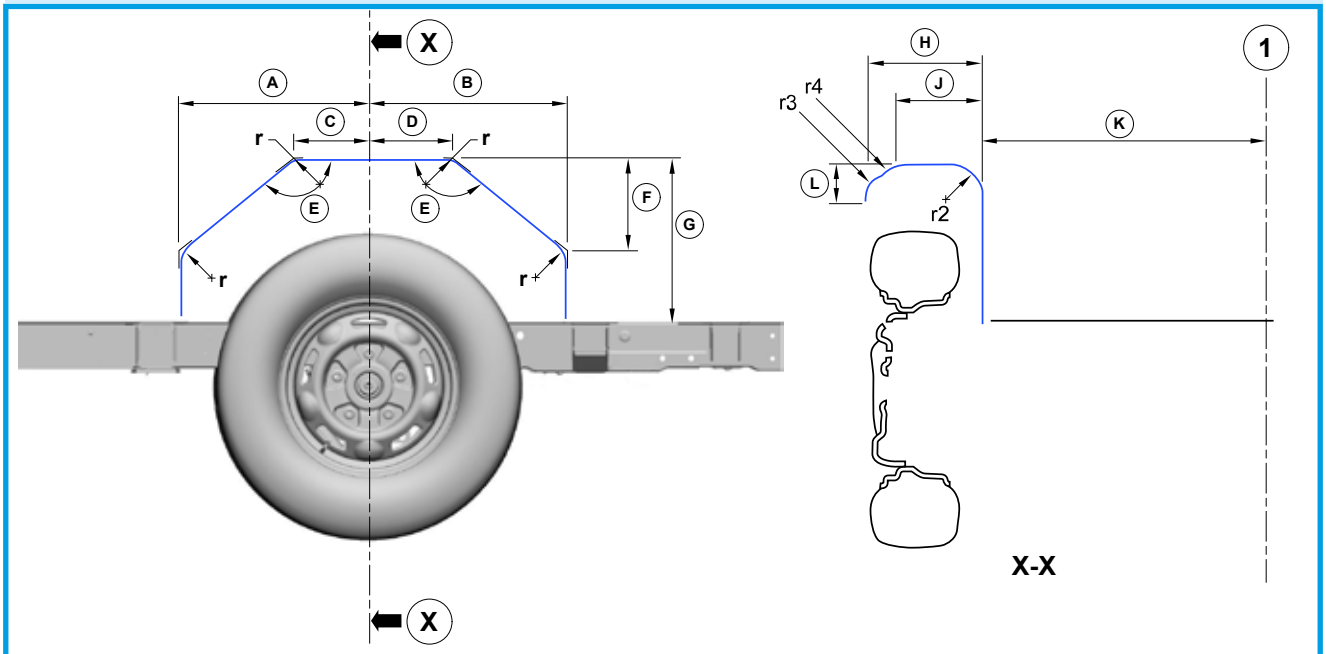


5.1.6 Integrated Bodies and Conversions

For integral structures such as ambulances or motorhomes, with increased rear overhang built onto the chassis, the following applies:

- Reduced departure angles, e.g. rear entry step, should be discussed with the end user/customer. Consider removable components to avoid damage on ferries or lowloaders
- Unique spare wheel stowage may be required if obscured by rear step, check for accessibility
- The recommended dimensions for wheelhouses on conversions are outlined in Figures E74529, E74530 and E167664. However, in case a specific conversion requires wheelhouse dimensions smaller than described, please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact Conversion Works at Conversionworks@ford.com for an individual solution

Skeletal Chassis for Camper and Non Camper

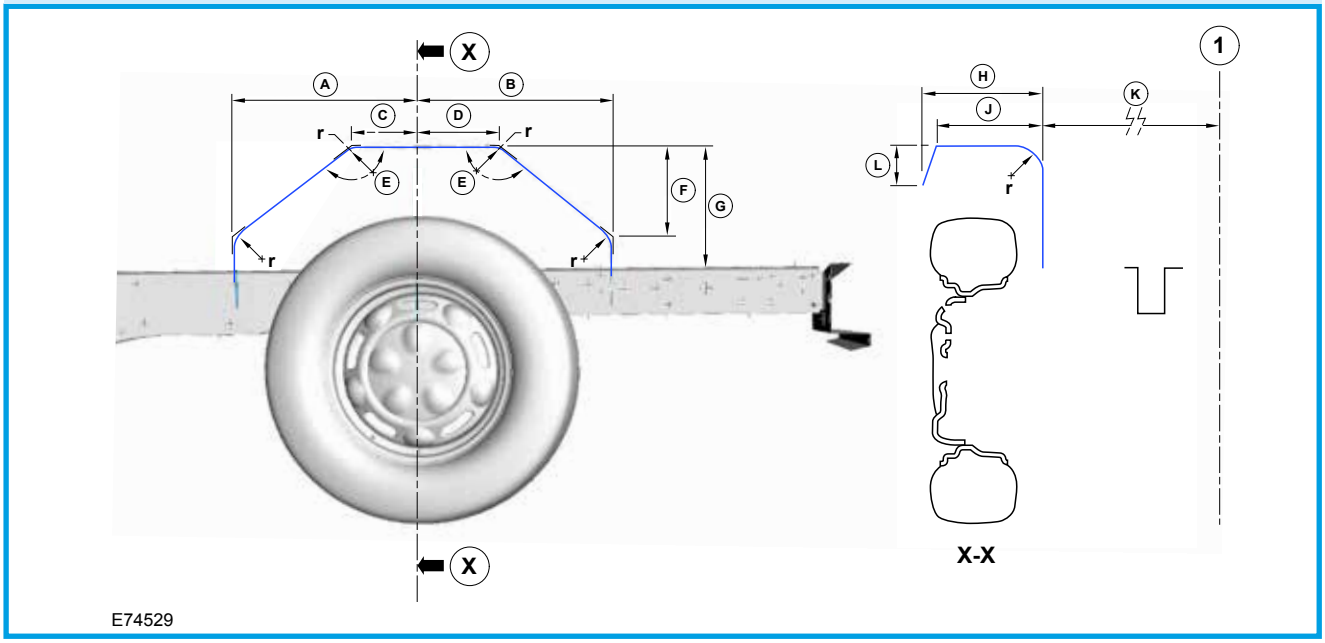


E167664

Wheelhouse Dimensions		
Rear Track Width	Skeletal Chassis for Camper and Non Camper	Skeletal Chassis for Camper
	1759 mm Standard	1980 mm Wide
A	420mm	420mm
B	449mm	449mm
C	176mm	176mm
D	205mm	205mm
E	141°	141°
F	197mm	197mm
G	362mm	364mm
H	302mm	302mm
J	236mm	236mm
K	696mm	803mm
L	72mm	72mm
r1	75mm radius	75mm radius
r2	75mm radius	75mm radius
r3	50mm radius	50mm radius
r4	42mm radius	42mm radius
1 - Centre line of Vehicle		X - Section through Centre of Wheelhouse

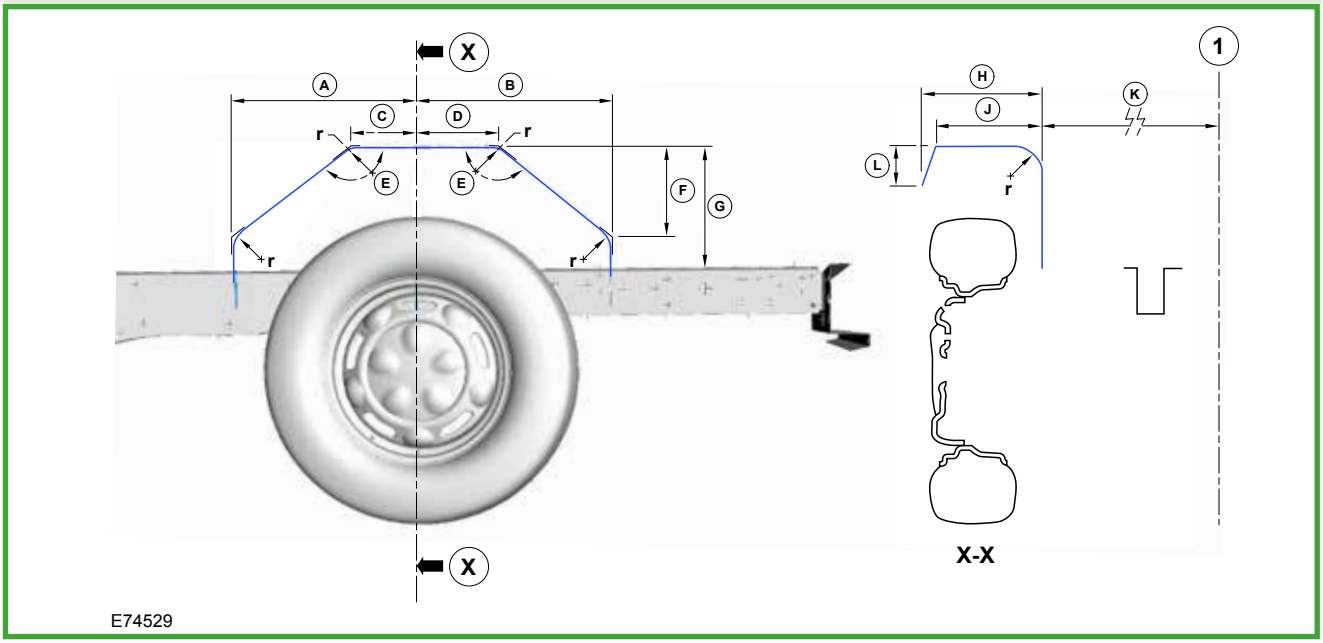
Abc = BEV Only Abc = ICE Only

ICE Chassis Cab - Single Rear Wheel Axle for FWD and RWD Vehicles



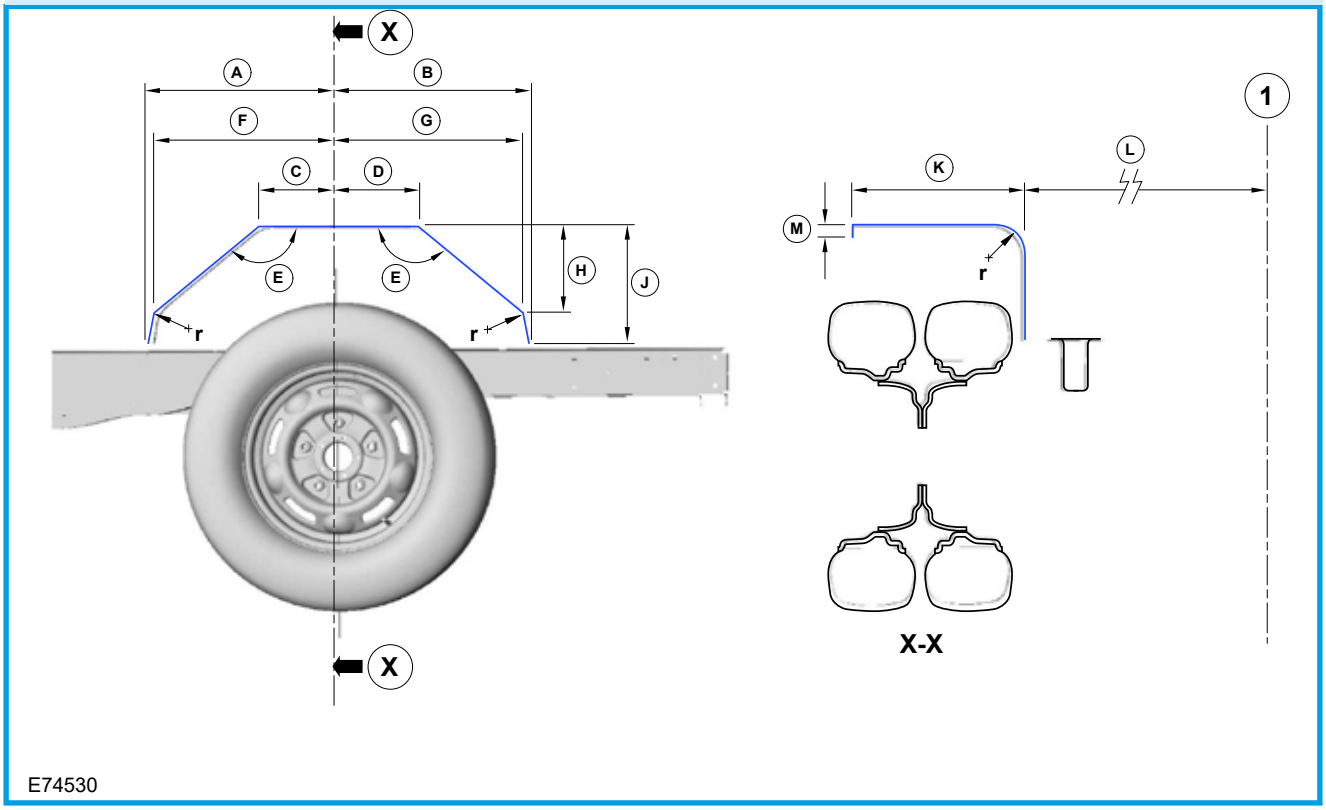
Wheelhouse Dimensions for Chassis Cab with Single Rear Wheel Axle for FWD and RWD Vehicles			
A	418mm	G	265mm
B	448mm	H	268mm
C	165mm	J	242mm
D	194mm	K	696mm
E	141°	L	80mm
F	197mm	r	75mm
1 - Centre Line of Vehicle		X - Section through Centre of Wheelhouse	

BEV Chassis Cab - Single Rear Wheel RWD Vehicles with IRS (steel coil springs only)



Wheelhouse Dimensions for BEV Chassis Cab Single Rear Wheel Vehicles with RWD and IRS			
A	418mm	G	185mm
B	448mm	H	268mm
C	165mm	J	242mm
D	194mm	K	696mm
E	141°	L	80mm
F	197mm	r	75mm
1 - Centre Line of Vehicle		X - Section through Centre of Wheelhouse	

ICE Chassis Cab - Dual Rear Wheel Drive Axle



E74530

Wheelhouse Dimensions for Chassis Cab with Dual Rear Wheel Drive Axle			
A	418mm	H	197mm
B	448mm	J	265mm
C	164mm	K	403mm
D	194mm	L	577mm
E	141°	M	27mm
F	406mm	r	75mm
G	436mm		
1 - Centre line of Vehicle		X - Section through Centre of Wheelhouse	

5.1.7 Chassis Cab

WARNING: Excessive heat can build up from the exhaust system, in particular from the catalytic converter. Ensure adequate heat shields are maintained.

CAUTIONS:

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

For E-Transit Battery Electric Vehicle Chassis Cab, conversions behind the B-pillar may exhibit low mass inertia, resulting in longitudinal vibrations of the cabin (nodding). These can be addressed by applying a Tuned Mass Damper, please consult your dealer for availability.

NOTE: Battery Electric Chassis Cab vehicles with a Platform or Stake style Second Unit Body (SUB) may exhibit Low Frequency Ride Comfort Characteristics that do not meet customer expectations. When upfitting a vehicle with either of these SUBs, Ford Motor Company recommends the following parts:

- L3/L4 (Production) TMD (NK31-110867-AD) and the attachment brackets (NK31-110867-AC)
- L5 (Service Only) TMD Kit (KTNK41-110867-AA)

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

- Make sure that all of the reinforced holes provided in the chassis frame top surface are used for full length bodies or subframes, see Figures E167667, E167668, E167669 and E167670
- 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
- Re-paint 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

Refer to: 5.14 Corrosion Prevention

Abc = BEV Only Abc = ICE Only

- Ensure that any additional equipment in the vicinity of the fuel tank will not damage the tank in a crash condition

NOTE: The reinforcement plate in cab back panel to chassis member area must be maintained. Do not drill or cut into this area, see figure E167672.

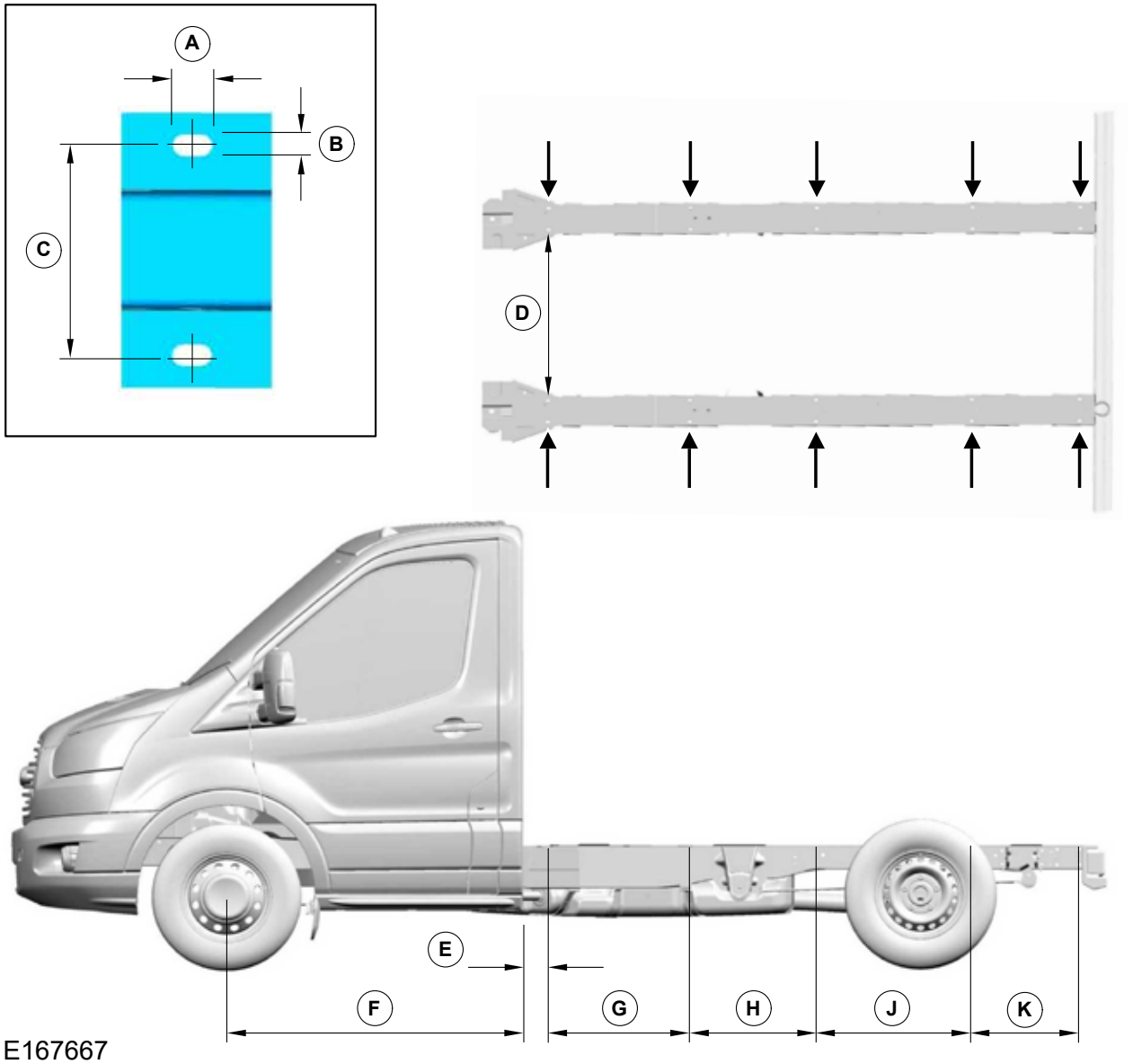
For additional information: Refer to: 5.15 Frame and Body Mounting

For any conversion structure attached to - or mounted onto - the base vehicle cab structure, the following applies:

- Ensure that neither the conversion structure nor the existing vehicle structure get pre-loaded by the assembly process
- Adhesive jointing is recommended but should be supplemented with mechanical fasteners to prevent initial peel and long term failure
- Spread bolt loads to minimise local stress

When mounting a Second Unit Body all of the attachment holes shown in figures E167667, E167668, E167669, E167670 or E167674 should be used unless specified they can be omitted.

Body Attachment Holes - Chassis Frame Top Flange L1 Wheelbase

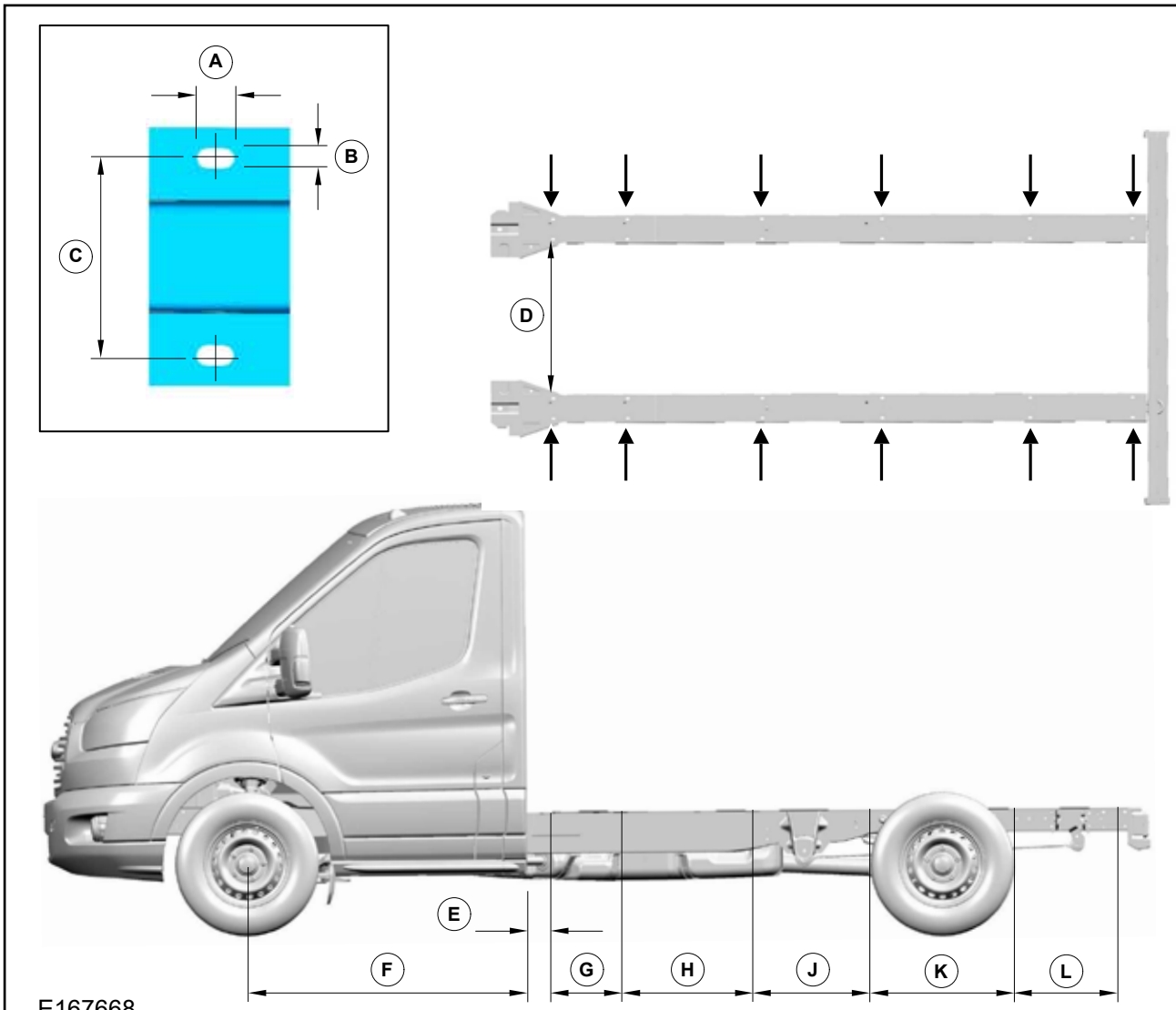


E167667

Body Attachment Holes -Chassis Frame Top Flange L1 Wheelbase			
A	19mm	F	1407mm
B	11mm	G	665mm
C	100mm	H	592mm
D	800mm	J	730mm
E	108mm	K	506mm

Abc = BEV Only Abc = ICE Only

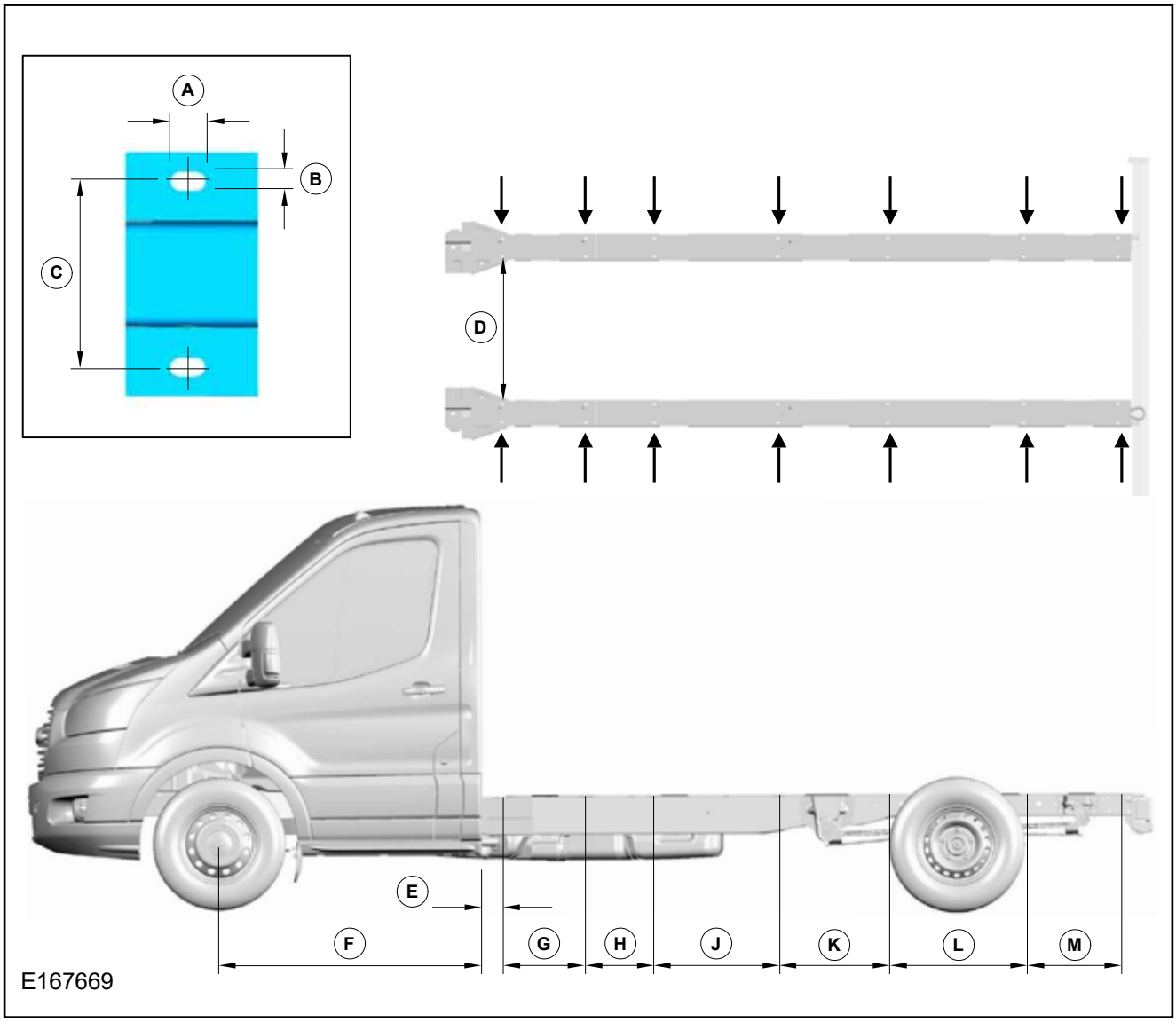
Body Attachment Holes - Chassis Frame Top Flange L2 Wheelbase



Body Attachment Holes -Chassis Frame Top Flange L2 Wheelbase			
A	19mm	G	367mm
B	11mm	H	665mm
C	100mm	J	592mm
D	800mm	K	730mm
E	108mm	L	506mm
F	1407mm	-	-

Abc = BEV Only Abc = ICE Only

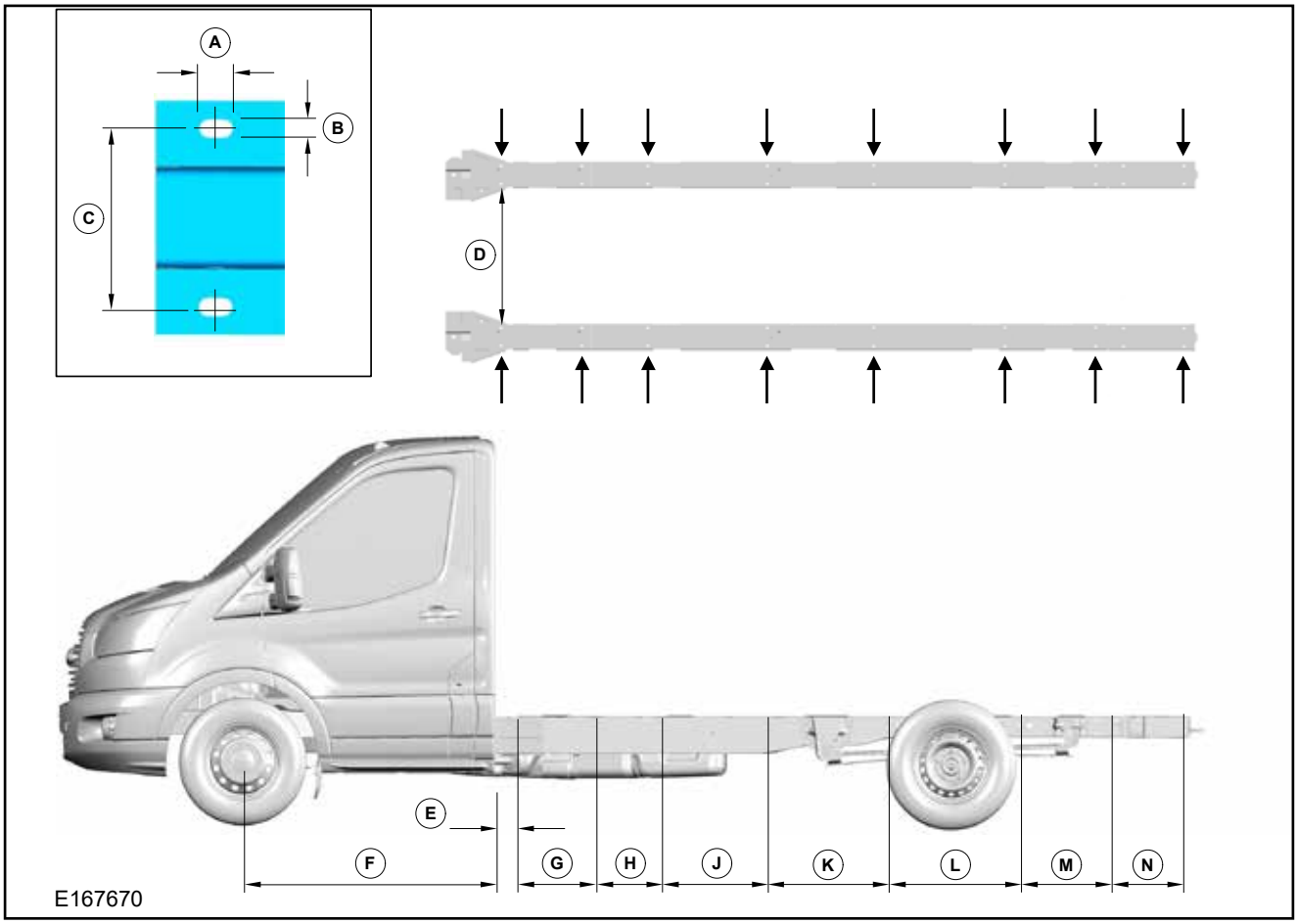
Body Attachment Holes - Chassis Frame Top Flange L3 Wheelbase



Body Attachment Holes - Chassis Frame Top Flange L3 Wheelbase			
A	19mm	G	450mm
B	11mm	H	367mm
C	100mm	J	665mm
D	800mm	K	592mm
E	108mm	L	730mm
F	1407mm	M	506mm

Abc = BEV Only Abc = ICE Only

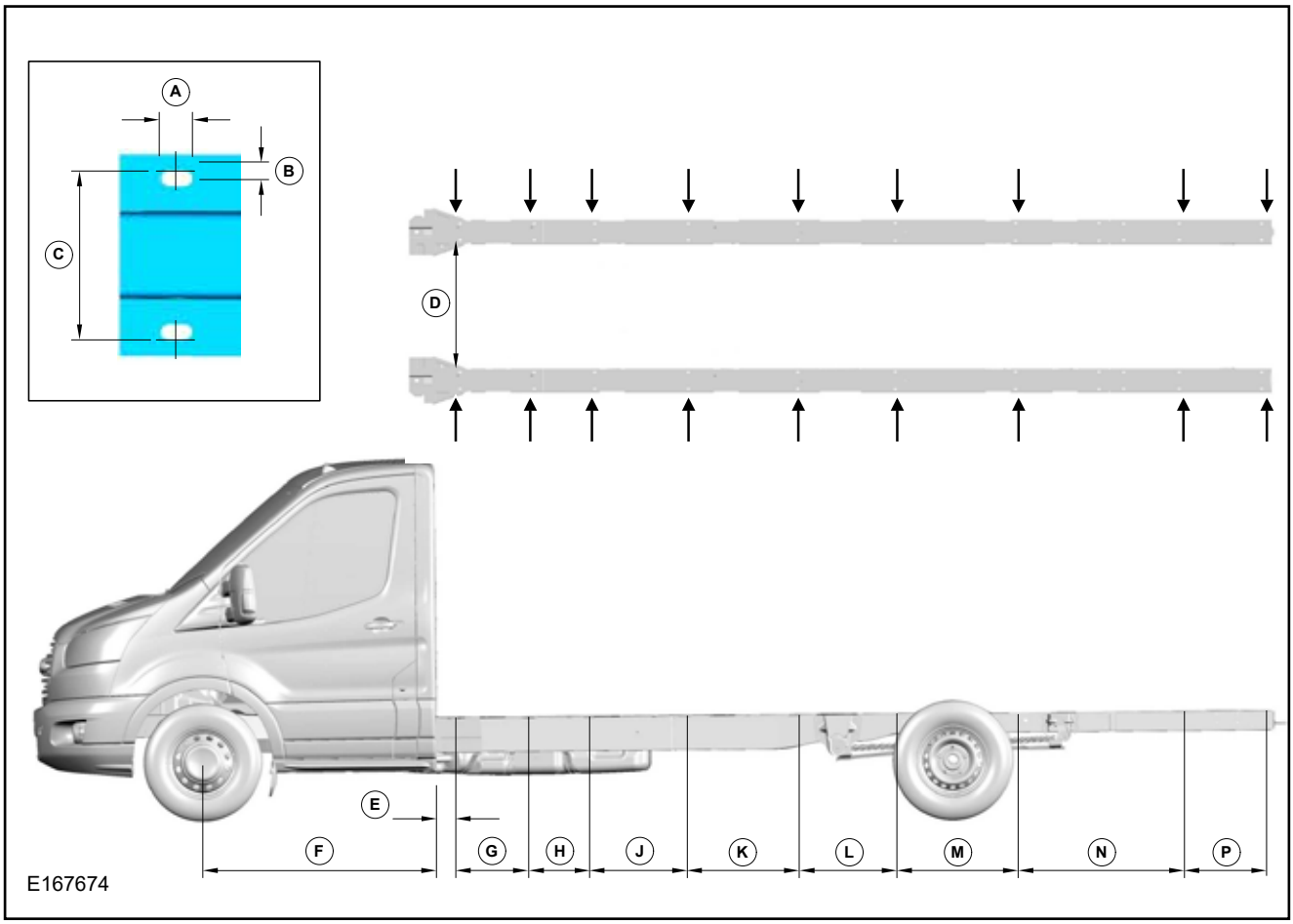
Body Attachment Holes - Chassis Frame Top Flange L4 Wheelbase



Body Attachment Holes Chassis Frame Top Flange L4 Wheelbase			
A	19mm	H	367mm
B	11mm	J	665mm
C	100mm	K	592mm
D	800mm	L	730mm
E	108mm	M	506mm
F	1407mm	N	561mm
G	450mm	-	-

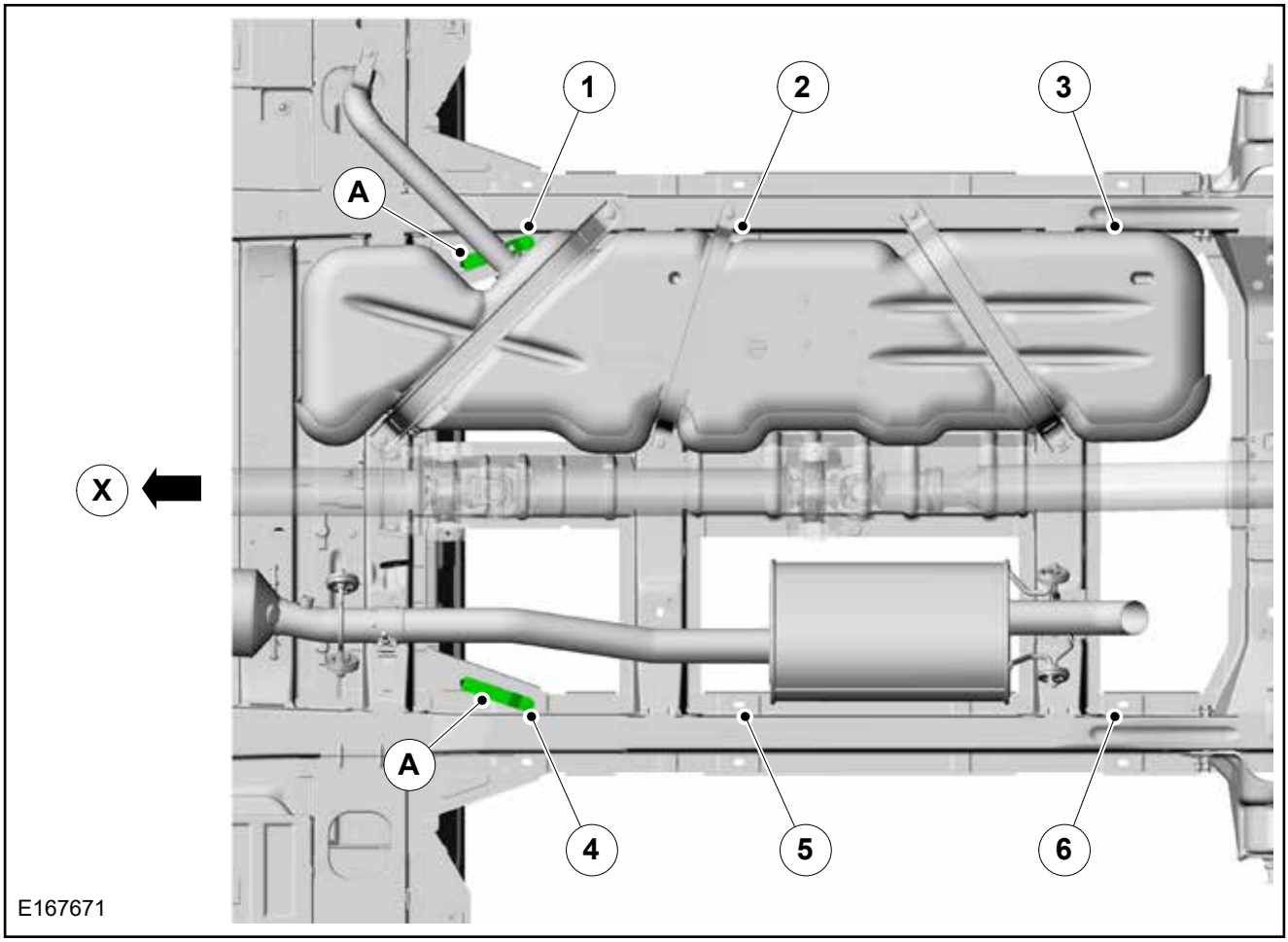
Abc = BEV Only Abc = ICE Only

Body Attachment Holes - Chassis Frame Top Flange L5 Wheelbase



Body Attachment Holes Chassis Frame Top Flange L5 Wheelbase			
A	19mm	H	367mm
B	11mm	J	568mm
C	100mm	K	665mm
D	800mm	L	592mm
E	108mm	M	730mm
F	1407mm	N	993mm
G	450mm	P	500mm

Recommended Second Unit Body Fixing Strategy - Single Chassis Cabs



Item	Description
A	Anti Rotation Bolt - EK31-101D80-A*
1	Restricted access to inner attachment hole due to fuel tank. Must use Anti Rotation Bolt 'A'
2 and 3	Inner attachment holes can be omitted.
4	Restricted access to inner attachment hole due to heat shield. Recommended to use Anti Rotation Bolt 'A'
5 and 6	Inner attachment holes can be omitted.

NOTE: Some of the attachment holes are difficult to reach or obscured by the fuel tank and can be omitted, EXCEPT attachment hole 1 which must be used, a special anti-rotation bolt is available - EK31-101D80-A*. It is recommended to use this special bolt in both the inner first positions 1 and 4, see figure E176671 'Recommended Second Unit Body Fixing Strategy'.

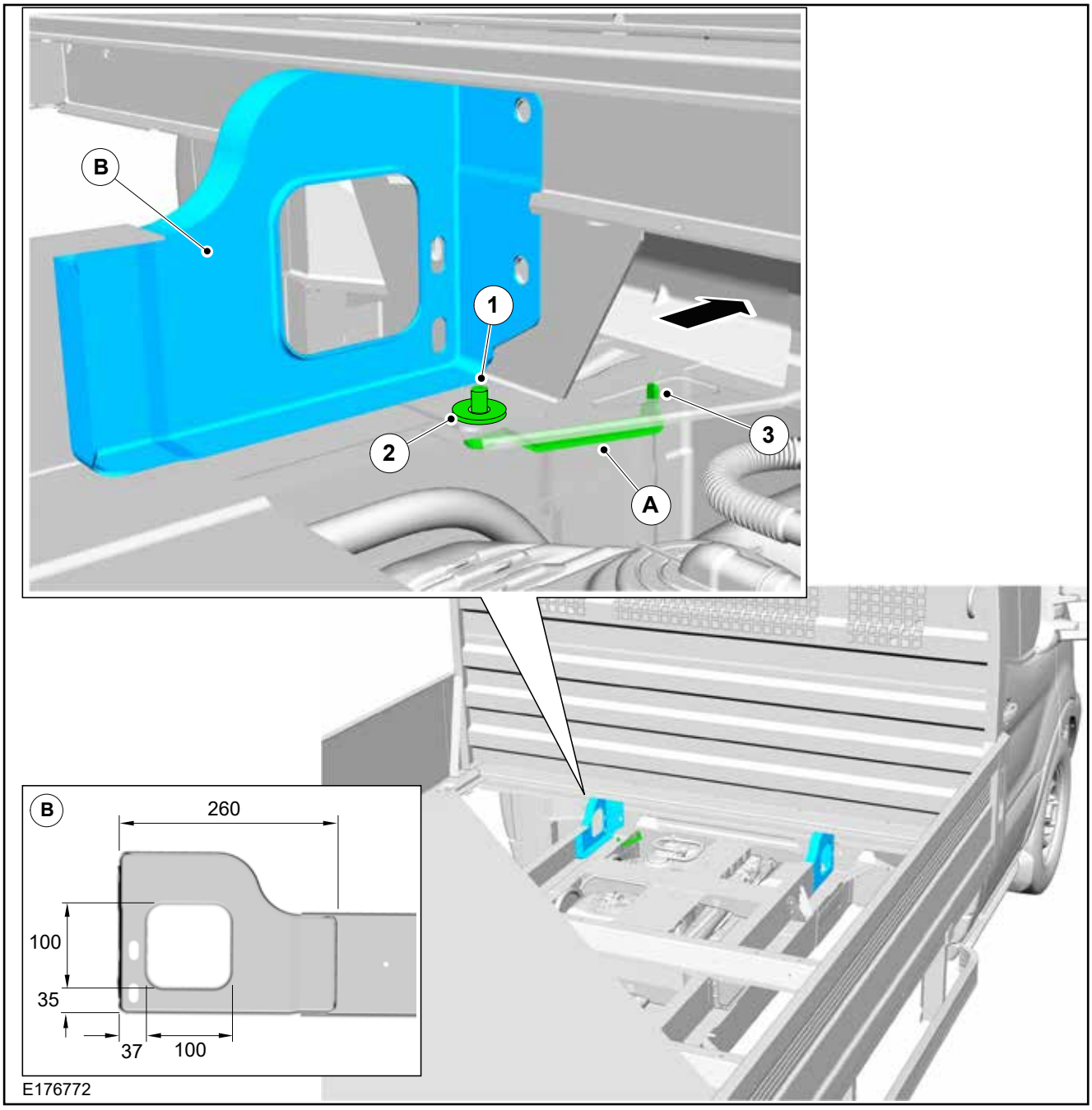
NOTE: So that the bolt can be tightened from outside the vehicle, a cut out in the lower rail of the second unit body may be necessary for tool access.
Fitting the Anti-rotation Bolt

- Insert anti-rotation bolt from underneath into hole 1 and insert the anti-rotation pin into hole 3, see figure E1766712, repeat for other side
- Temporarily secure the bolt using the locking/grip washer on the upper side of the chassis rail, see item 2 in figure E176672
- Mount the float, box body ensuring the bolt aligns with the hole in the second unit body
- Complete the joint by tightening the bolt, torque 55Nm

When fitting a second unit body to a Medium Wheelbase (MWB) Double Chassis Cab not all the attachment points are accessible, position 1, shown in figure E167673 is obscured by the fuel tank and can be omitted. All other fixing points should be used.

Abc = BEV Only Abc = ICE Only

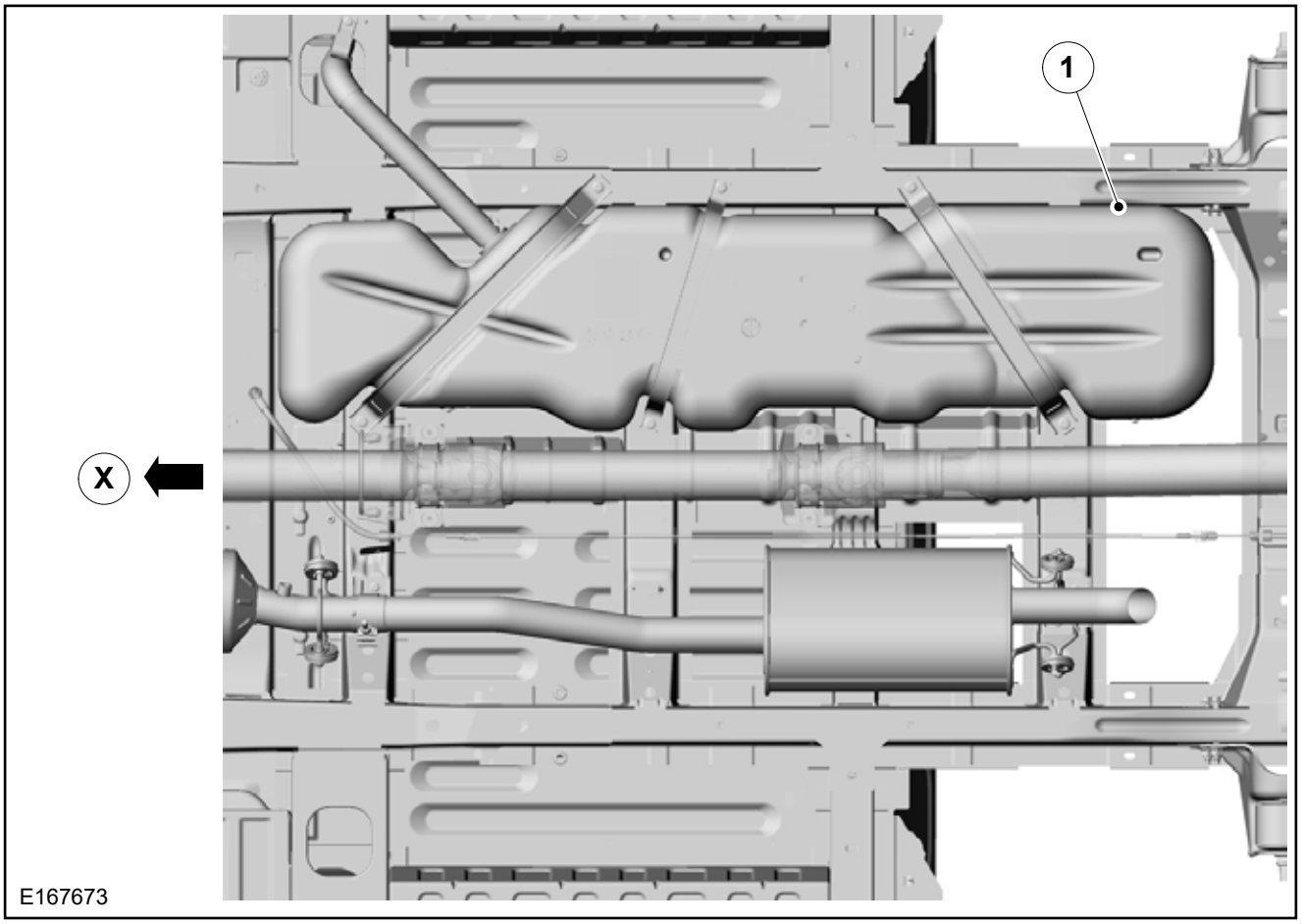
Recommended Fixing Strategy - Second Unit Body to Chassis Frame



Item	Description
A	Anti-rotation bolt -EK31-101D80-A*
B	Cut out in lower rail of second unit body to allow tool access to tighten bolt
1	Anti-rotation bolt
2	Locking/Grip Washer
3	Anti-rotation pin

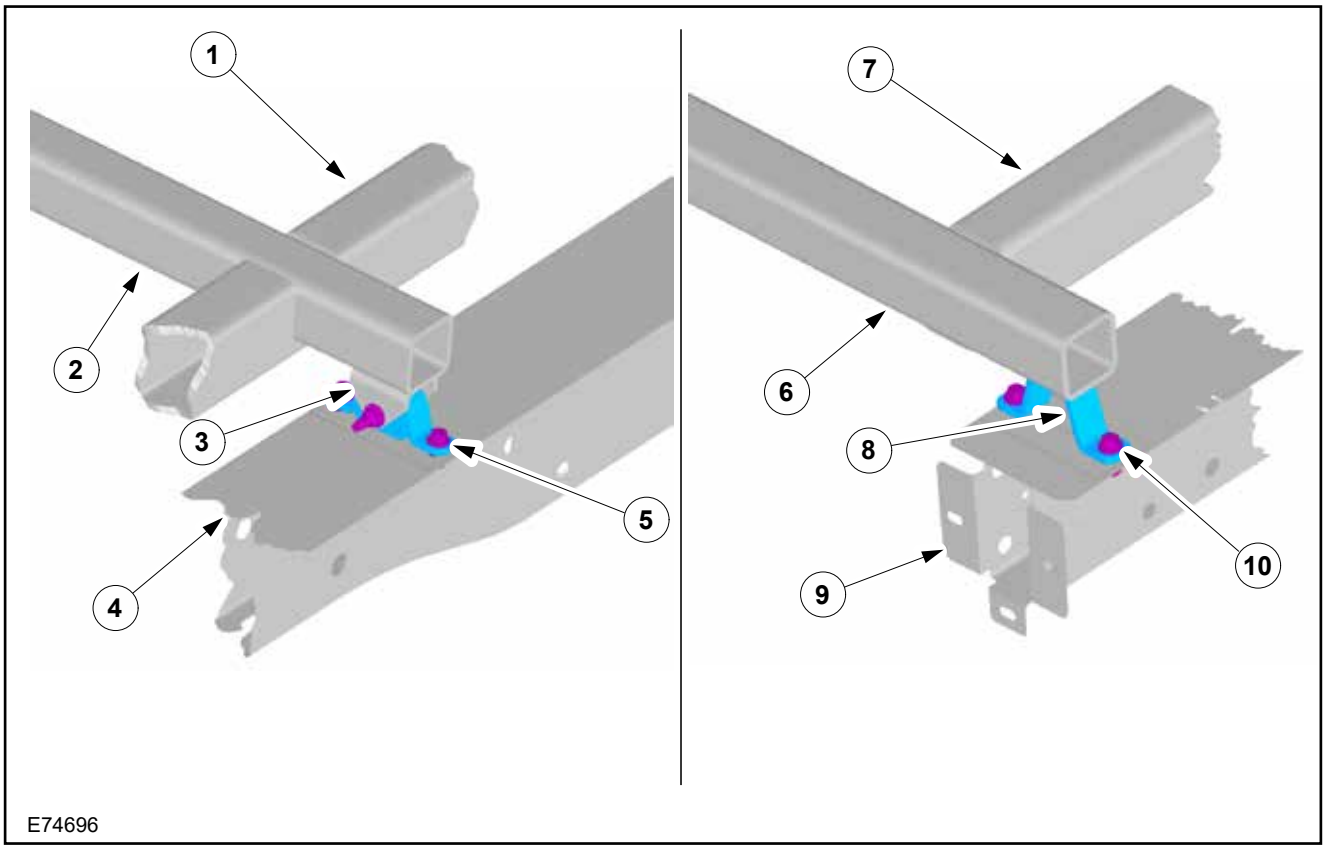
Abc = BEV Only Abc = ICE Only

Recommended Second Unit Body Fixing Strategy - Double Chassis Cabs MWB only



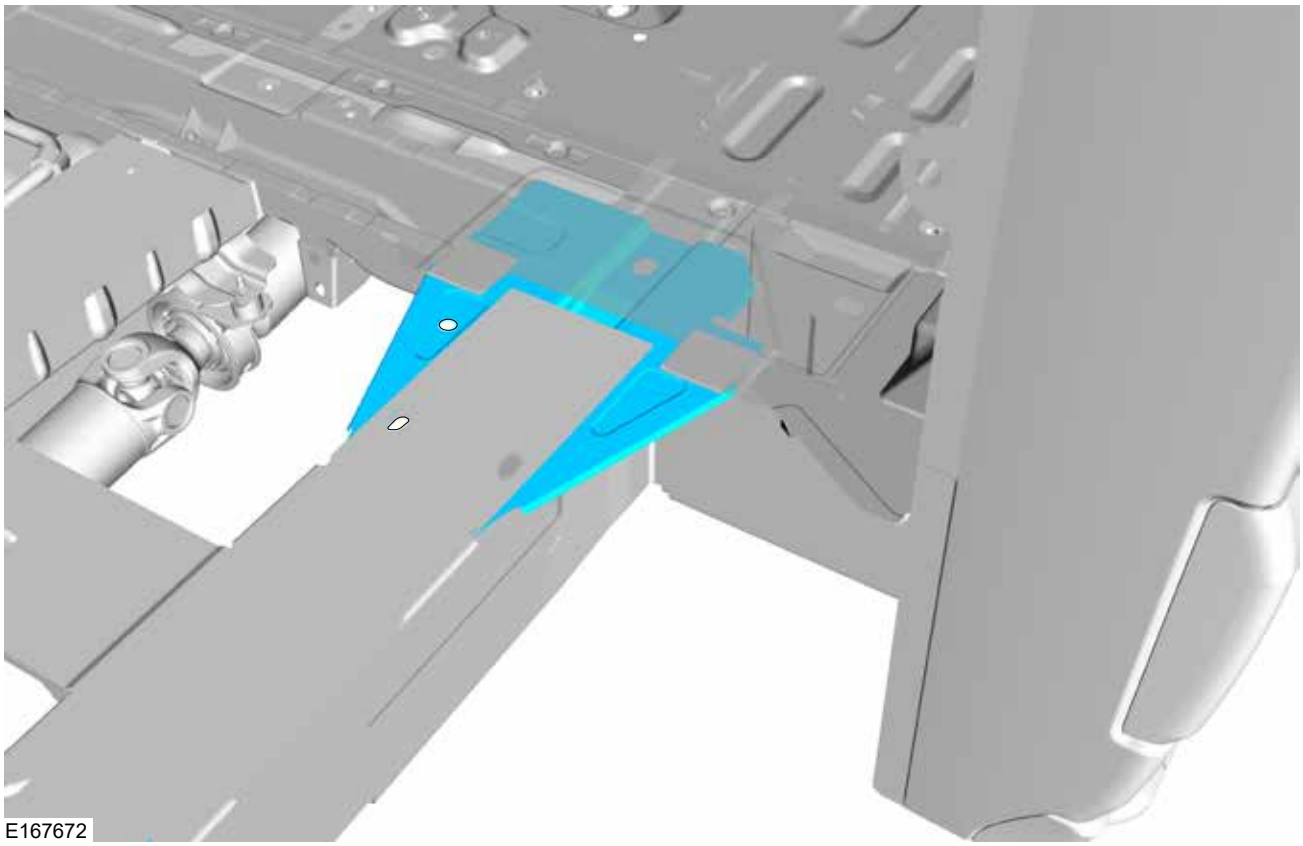
Abc = BEV Only Abc = ICE Only

Subframe Attachment to Chassis Frame



Item	Description
1	Subframe Longitudinal
2	Subframe Outriggers
3	Compliant Mount
4	Chassis Frame
5	M10 Bolts and Self Locking Nuts
6	Subframe Outriggers
7	Subframe Longitudinal
8	Solid or Fixed Mount
9	Chassis Frame
10	M10 Bolts and Self Locking Nuts

Reinforcement Plate on Single Chassis Cab Vehicles



5.1.8 Skeletal Chassis for Camper and Non Camper

NOTE: Please contact your National Sales Company representative, or local Ford dealer. If they are unable to help you then please contact the Conversion Works at Conversionworks@ford.com

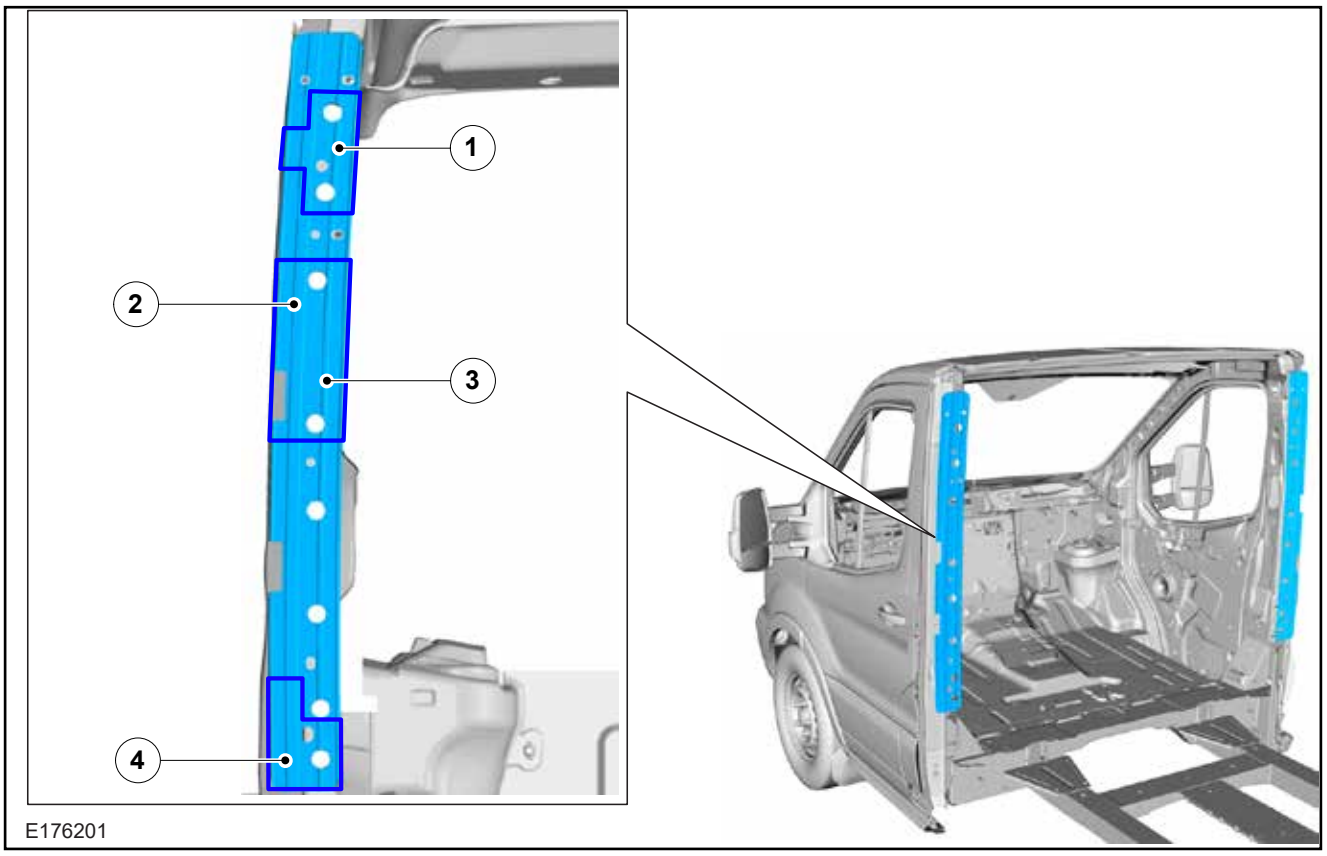
Please refer to general advice and warnings for Chassis Cab. For Skeletal Chassis for camper and non camper the following additional guidelines apply:

- Refer to: 1.5 Conversion Type (page 14). for reference table
- The Skeletal Chassis for Camper and Non Camper are incomplete vehicles and do not offer a self-supporting body structure. A box body or equivalent structure must be added and appropriate attachments to the frame and cabin must be provided to ensure structural integrity of the converted vehicle
- Design a sufficient connection to the 'B' pillar bracket (sidewall to cab connection), by using at least 4x M8 screws per side, see figure E176201 for the areas that can be used for bolting the body to the 'B' pillar bracket
- Do not drill into B pillar flange behind bracket. Leave sufficient space between drilled hole and outer border of bracket
- Add appropriate reinforcements to the frame, frame rails and outriggers of the base vehicle to provide sufficient structural integrity of the converted vehicle

Provide sufficient clearance between the drill hole and edge of the B pillar bracket

Abc = BEV Only Abc = ICE Only

Body to 'B' Pillar Bracket - Recommended Attachment Area



E176201

- If implementing a fully sealed body air extraction is required, the recommendation is the use of one Ford service part 6G91-A280B62-A* on each side of the vehicle. If this is not possible the alternative extractor should provide 150cmx2 of cross sectional area on each side of the vehicle. An ideal position for the extractors would be in the back panel of the cab. If this is not feasible, then the extractors should be situated rearwards of 'B' pillar such that there is a free airflow path equating to the extractor effective CSA maintained both upstream and downstream of each extractor to maintain windscreen defogging performance and door closing efforts. Extraction should not be installed near exhaust components, or areas exposed to potential fuel spillage.
- It is recommended to fix the converters floor by using additional U-type fixings around the main rails and cross members or by using screws running vertically through floor and rails, cross members and outriggers. To eliminate deformation of the rails during screwing process, we recommend to use tubing

Refer to: 5.15 Frame and Body Mounting

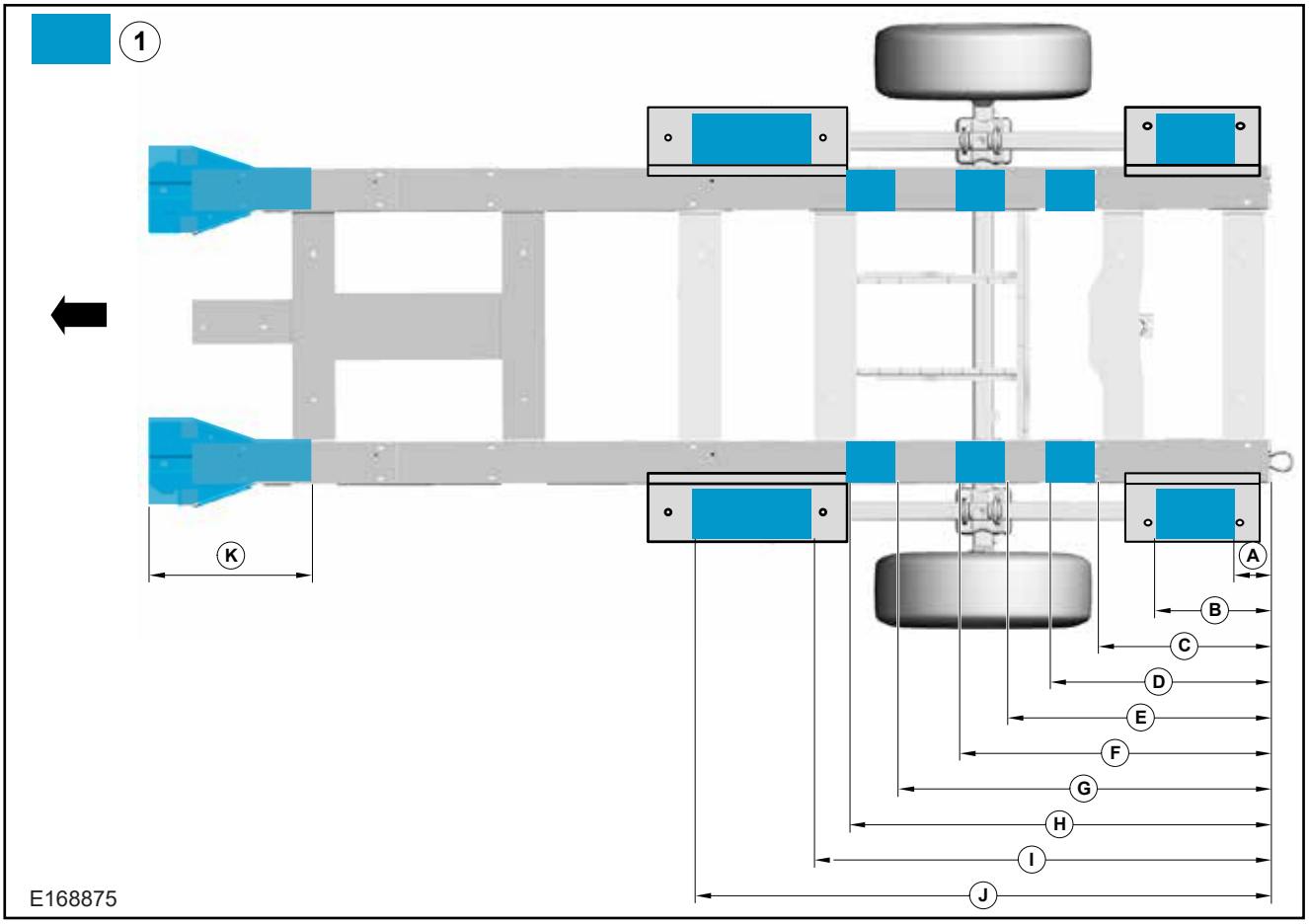
- The Skeletal Chassis for camper and non camper offers most design flexibility for adding a sidestep
- Due to the wide side overhang it is recommended to support the Vehicle Converters floor

Refer to: 5.15 Frame and Body Mounting

- Do not cut or drill into areas as shown in figure E168875
- Drill only through the centre line of rails and ensure no spot weld is drilled out
- The vehicle structure must not get preloaded by the conversion structure or the assembly process.

Abc = BEV Only Abc = ICE Only

Skeletal Chassis for camper and non camper Rails - No Drill Zones (1)



Item	Wheelbase (mm)			
	L2 - 3300	L3 - 3750	L4 - 3954	L5 - 4522
A	166	166	166	166
B	396	396	396	396
C	596	596	596	596
D	754	754	754	754
E	926	926	926	926
F	1066	1066	1066	1066
G	1356	1356	1356	1356
H	1442	1442	1442	1442
I	1580	1580	1580	1580
J	2020	2020	2020	2020
K	430	430	430	430

- For attachment to the base vehicle

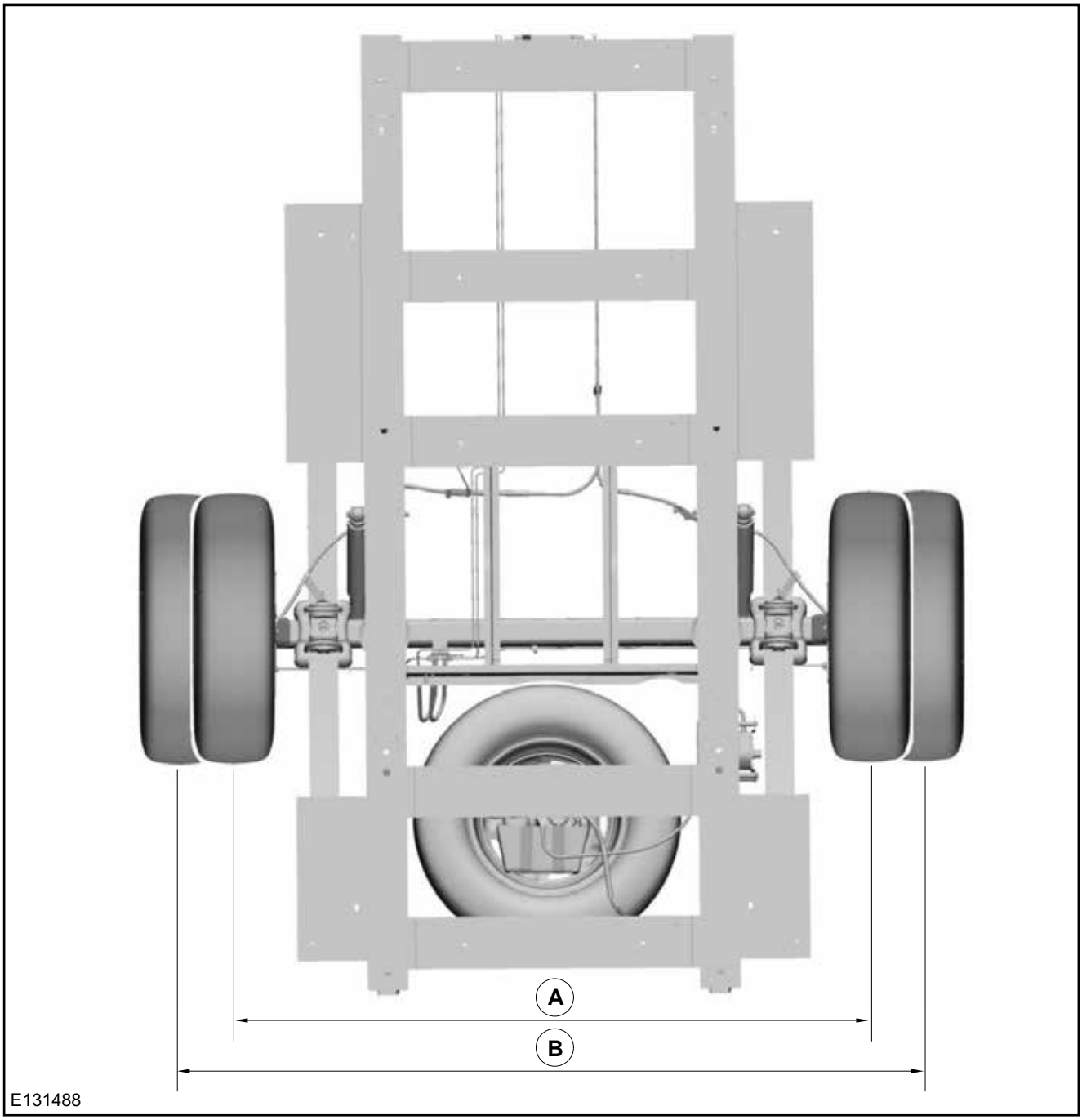
Refer to: 1.17 Towing

- For basic dimensions and weights see figure E176200 and table
- For standard track and wide track width rear axle see figure E131488
- See also Exhaust Heat Shields

Refer to: 3.7 Exhaust System

Abc = BEV Only Abc = ICE Only

Skeletal Chassis for Camper and Non Camper Track Widths



Item	Description
A	Standard Track Width - 1759mm
B	Wide Track Width - 1980mm

5.1.9 Front End Integrity for Cooling, Crash, Aerodynamics and Lighting

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.

For WLTP information:
Refer to: 1.14 Package and Ergonomics.
Refer to: 1.8 Vehicle Duty Cycle Guidelines.

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.

The side airbag system is not permitted if:

- A swivelling device is fitted on the front seats
- Any additional material or structure is attached to the B pillar inner and/or outer area

5.1.10 Tipper Bodies

For tipper conversions single and double Chassis Cab versions can be used. All variants allow single and three way tipping.

It is recommended to have the tipping system operative only when the engine is running. It is also recommended to have the master control switch in the security of the cab. According routing of wires and hydraulic lines please refer to section hydraulic lift.

Ensure that axle plated weights including the front axle minimum are not exceeded.

For tipper sub-frames please refer to the following guidelines:

- Design for full length continuous frame with mountings for motor, pump unit, reservoir, pivot points and ram
- Use all mounting points on the chassis frame to mount sub-frame, see Chassis Cab - Body Attachment figures E167671 and E176772 for fixing strategy
- The rear two sets of chassis frame mounting brackets should have a full torque with 100% grip. The attachment to the remaining forward chassis frame brackets must be precisely located and retained, but allow some relative flexing between the sub-frame and chassis frame. That is clamp control devices such as conical washer stacks or machine springs with self-locking fastenings
- Very stiff sub-frames may damage the chassis frame by preventing its natural flexing, therefore appropriate and captive fail safe compliant mounts should be used. See figures E74696 sub-frame attachment to chassis frame and figure E175999 rigid or torsion stiff sub-frame for chassis cab
- Use two M10 grade 8.8 minimum bolts, washers and self-locking nuts at each solid and compliant chassis frame location
- Sub-frame must extend to the back of the cab and attach to all mounting locations, with the forward end designed to minimise local frame stress, see figures E167671 and E176772 for fixing strategy and figure E74575 sub-frame for low floor or other equipment. However, it is preferable to mount the sub-frame onto the mounting brackets with a clearance to the chassis frame top surface
- Side tipping loads/forces must be resolved by the sub-frame. It is not recommended to strain the chassis frame

To fit a Tipper body on an Extended Frame Chassis, use the following process:

1. Fit the Tipper Subframe to the Chassis
2. Untighten the Rear Chassis Extension Frame from the Chassis
3. Tighten all Tipper Subframe bolts on the Chassis and Chassis Extension
4. Tighten the Extension Frame to the chassis

This will realign the Chassis Extension with the Tipper Frame and the Chassis, and will avoid Chassis preload.

5.1.11 Dropside Bodies

WARNING: On E-Transit BEV, where a dropside body is fitted to a vehicle with the charge port located behind the rear wheel: to avoid clash, parts breakage or serious injury, DO NOT open the side float and tipper side panels while the vehicle is being charged. Disconnect the Charge Port first, close the Charge Port door, then open the side panels. This warning MUST be communicated to the end user in the converter's user documentation and by the application of warning decals.

5.1.12 Tank and Dry Bulk Carriers

Due to the high rigidity of tanks it is necessary to isolate the tank and its sub-frame from the chassis frame allowing the chassis frame to naturally flex. Please refer to the following guidelines:

- Mount tank to full length of sub-frame
- Use all mounting points on the chassis frame to mount sub-frame, see Chassis Cab - Body Attachment figures E167671 and E176772 for fixing strategy
- Brackets should have solid full bolts torque with 100% grip
- The remaining forward location mounts must be compliant to allow relative chassis frame to sub-frame deflections
- Sub-frame must extend to the back of the cab and not contact chassis frame at forward end under worst case deflection
- Use appropriate and captive fail safe compliant mounts, please refer to figures E74696 Sub-frame attachment to Chassis frame and figure E175999 Rigid or Torsion Stiff sub-frame for Chassis Cab
- Use two M10 grade 8.8 minimum bolts, washers and self lock nuts per chassis frame mount bracket at each solid and compliant location

Abc = BEV Only Abc = ICE Only

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 Conversionworks@ford.com

5.2.1 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: It is the converter's responsibility to fix with adequate reinforcements from below.

For additional information:
Refer to: 5.15 Frame and Body Mounting

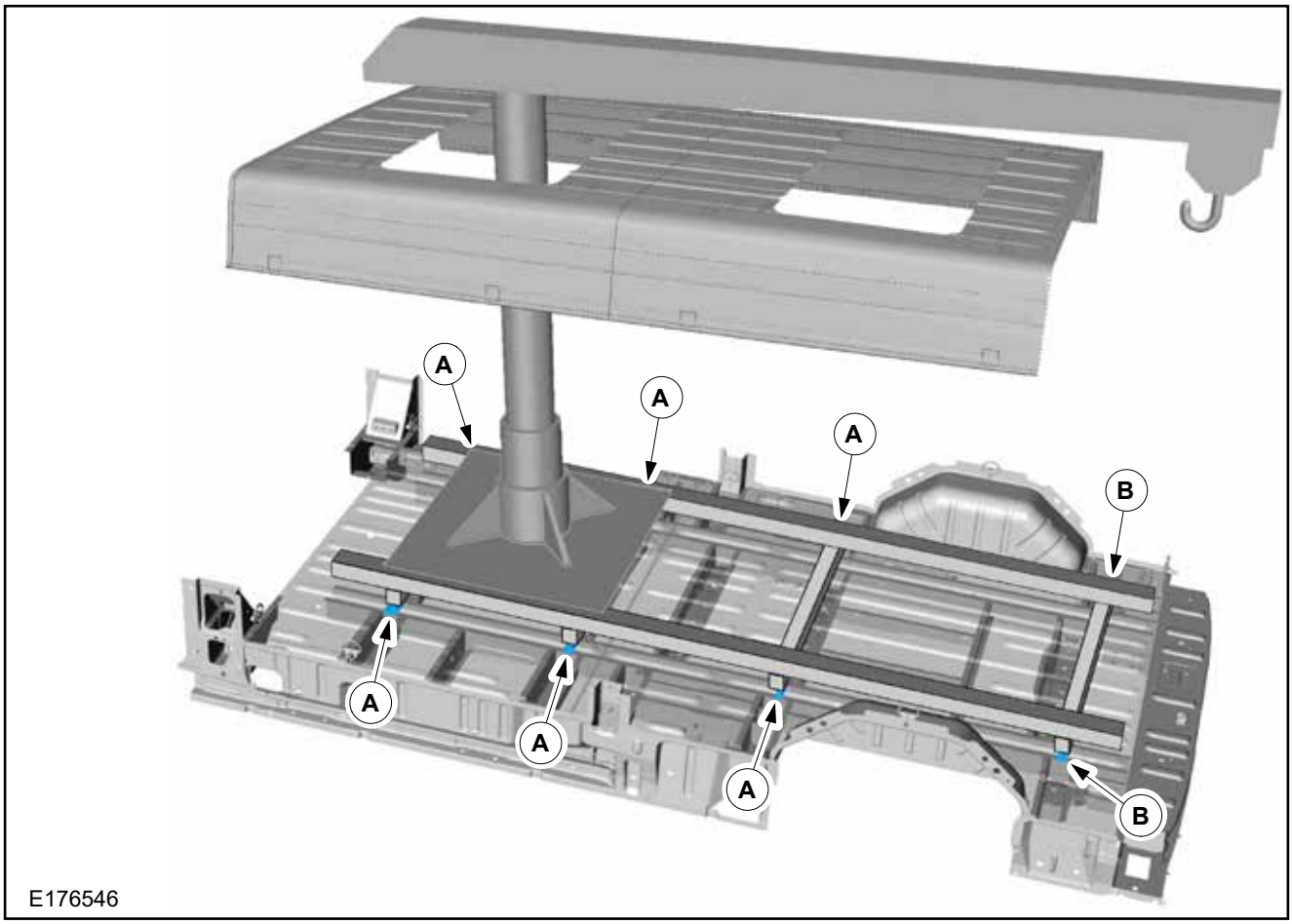
The Vehicle Converter is responsible for:

- 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 mount Cranes and Aerial Platforms on a full length subframe for Van vehicles as shown in figure E176546 and for all reinforced holes on longitudinal rails for Chassis Cabs as shown in figure E175999.

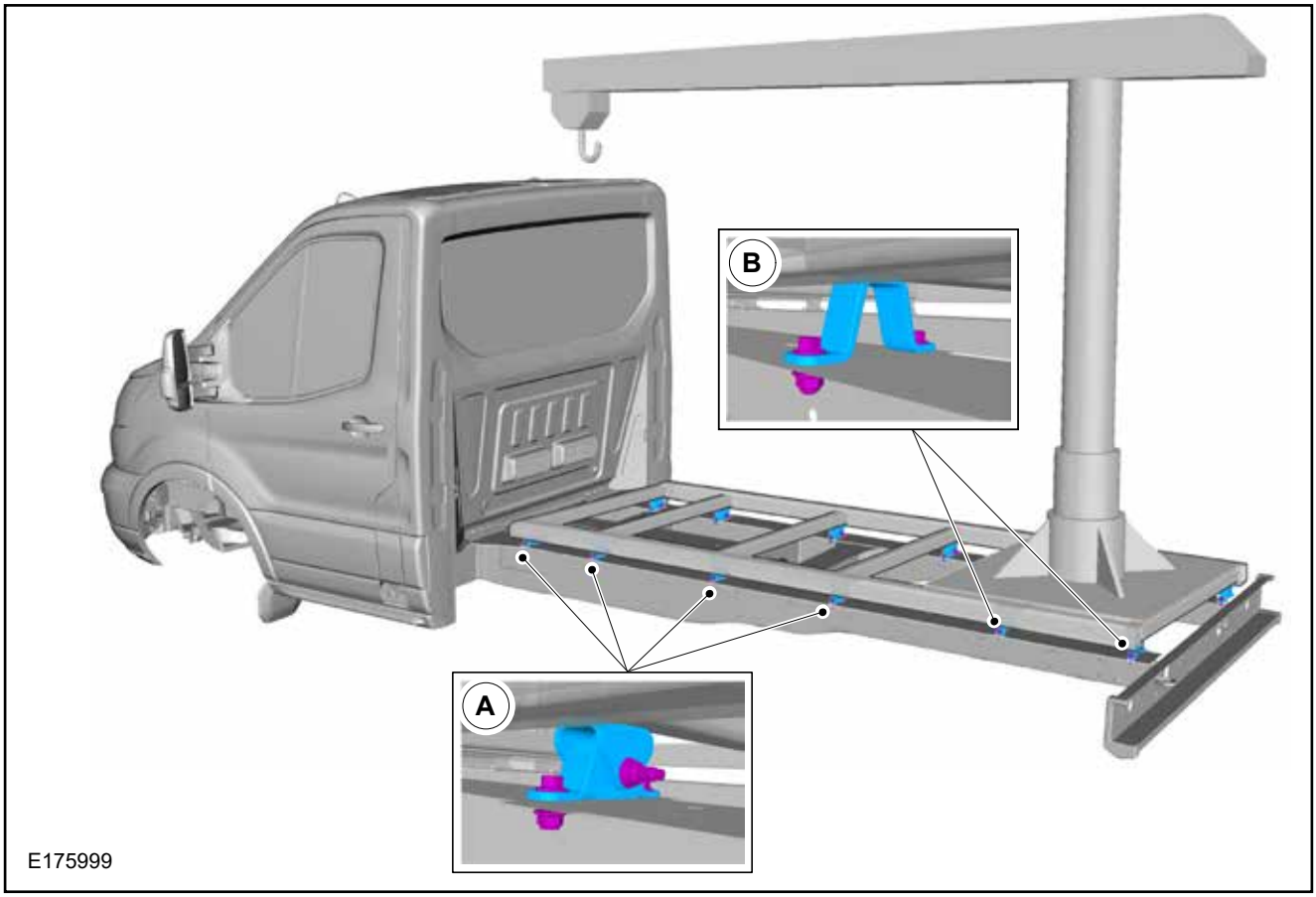
Design Principle - Rigid or Torsion Stiff Subframe for Van



E176546

Item	Description
A	Compliant Mount - see 'A' in figure E176724
B	Fixed Mount - see 'B' in figure E176724

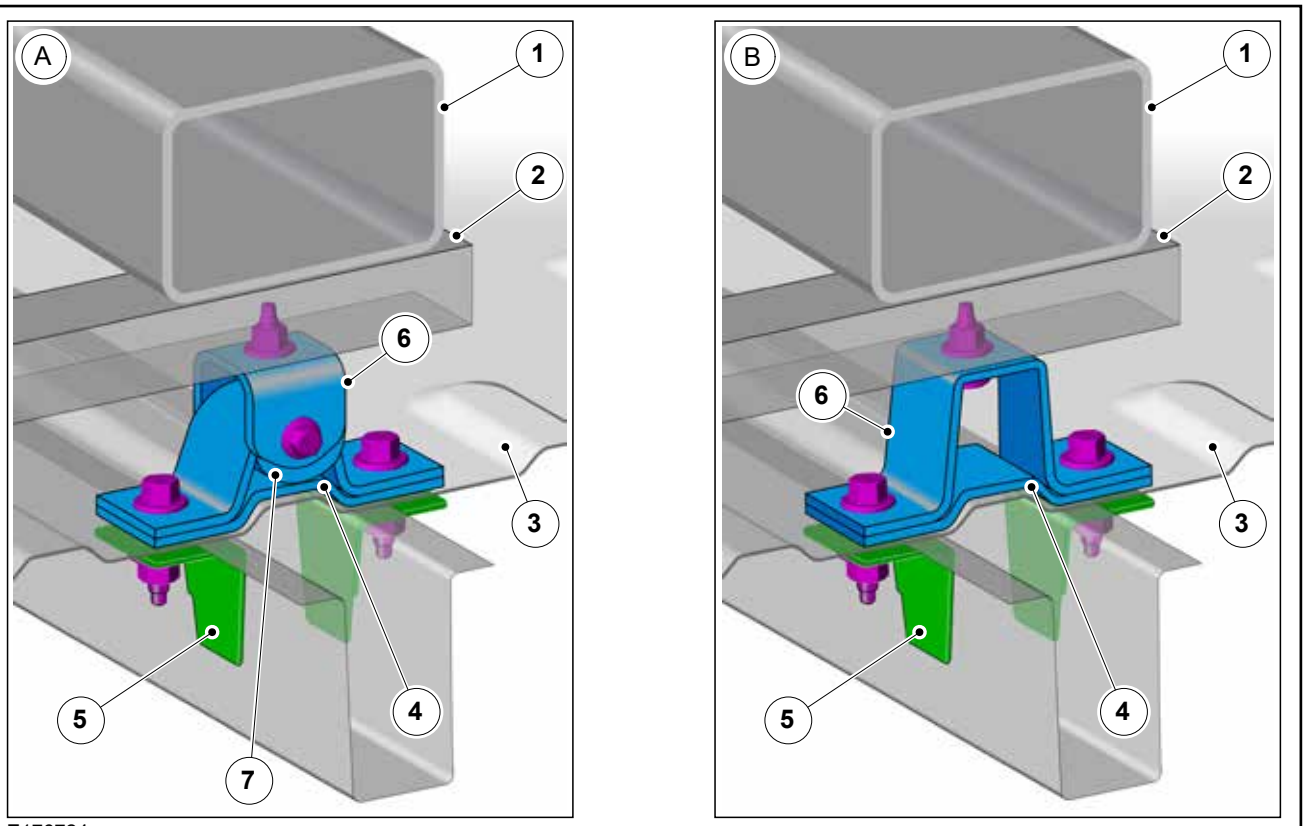
Design Principle - Rigid or Torsion Stiff Subframe for Chassis Cab



Item	Description
A	Compliant Mount
B	Fixed Mount

Abc = BEV Only Abc = ICE Only

Subframe Mounted on Floor



E176724

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	Reinforcement Bracket - Use 2x per attachment location, one each side of the rail
6	Reinforcement Bracket to Sub-frame
7	Captive Compliant Bush

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 E176546.

For Van, Bus and Kombi:

- It is recommended to fix every mount with M8 bolt grade 8.8 minimum
- It is not recommended to engineer through the floor fixings to clamp around side members.

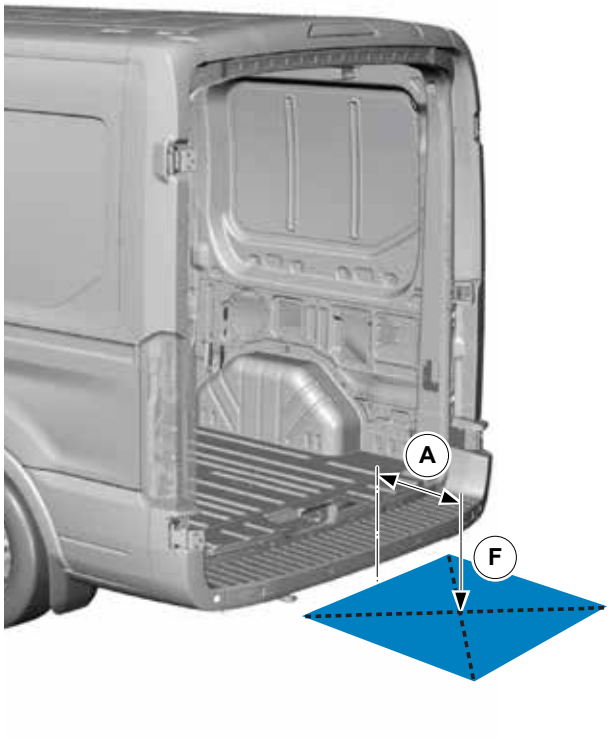
Refer to: 5.15 Frame and Body Mounting

- Please see figure E176546 which show the principle of adequate fixings
- Very stiff sub-frames should not be rigidly mounted to the floor, please refer to figure E176724 for examples of a compliant mount. Compliant bushes should allow up to ±12mm movement at a rate of 100kg per 1.0mm deflection with only the rear pair of mounts 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 equipment

For Chassis Cabs:

- Subframe ends must be relieved at forward end to minimise local contact stress concentrations, see figure E176724. Refer to: 5.15 Frame and Body Mounting (page 260). (it is recommended to mount the longitudinal brackets with a clearance to the chassis frame top surface.)
- Stiff sub-frames, for example closed section longitudinal rigidly connected with similar section cross members, may damage the chassis frame by preventing its natural flexing. Therefore, appropriate compliant mounts should be used. Please refer to figure E176546
- Each set of brackets must use 2x 10 bolt grade 8.8 minimum
- For safety device on outriggers/legs please refer to Van, Bus and Kombi

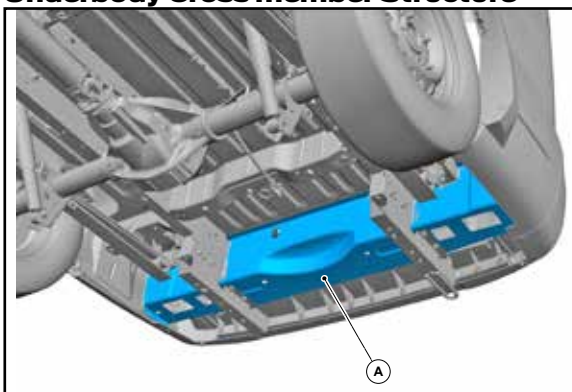
Hydraulic Tail Lift



E175998

Item	Description
A	600mm from rear of vehicle, Van, Bus, Kombi and Chassis Cab
F	Tail Lift Payload - 600kg Van, Bus, Kombi / 750 kg Chassis Cab

Underbody Cross member Structure



E176725

For Hydraulic under-slung tail lifts on Transit Van, Bus and Kombi vehicles it is recommended to design and/or locate the reinforcing plates in a way that load can be routed into adjacent reinforced underbody cross member structure see (A) in figure E176725.

For Chassis Cab with tail lift design it is recommended to use unique body sub-frame for fixing to Chassis Cab structure. For connection between subframe and Chassis Cab body structure, see figure E176724.

For tail lift electrical connections use the Customer Connection Points,

Refer to: 4.24 Electrical Connectors and Connections

Greater off-sets and/or loads require additional stabilising equipment such as outriggers or ground jacks.

It is the vehicle converter'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 converter's responsibility to guarantee safe functioning of the equipment.

For hydraulic tail lifts as used for general loading or more specialised for wheelchair lifts refer to E176546.

5.3 Racking Systems

5.3.1 Racking Systems

For attaching a racking system, it is recommended to use the marked areas shown in figure E176000.

NOTE: Upper fixing locations are not structural and take a 30kg maximum load only.

- 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 E176203 Frame Drilling and Tube Reinforcing.

Refer to: 5.15 Frame and Body Mounting

- Load compartment tie downs can also be used for additional fixing locations.

Refer to: 5.4 Loadspace

- Ensure proper sealing against ingress of 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

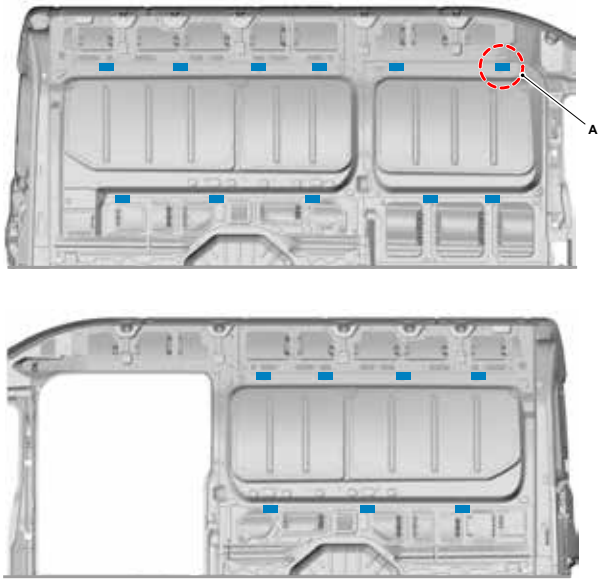
For designing glass carrying rack on body side outer, construct internal structure and bolt through the body side to the internal structure, using the recommended fixing locations, see figures E176000 and E176512, or load compartment tie downs.

Refer to: 5.4 Loadspace

For additional information
Refer to: 5.14 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

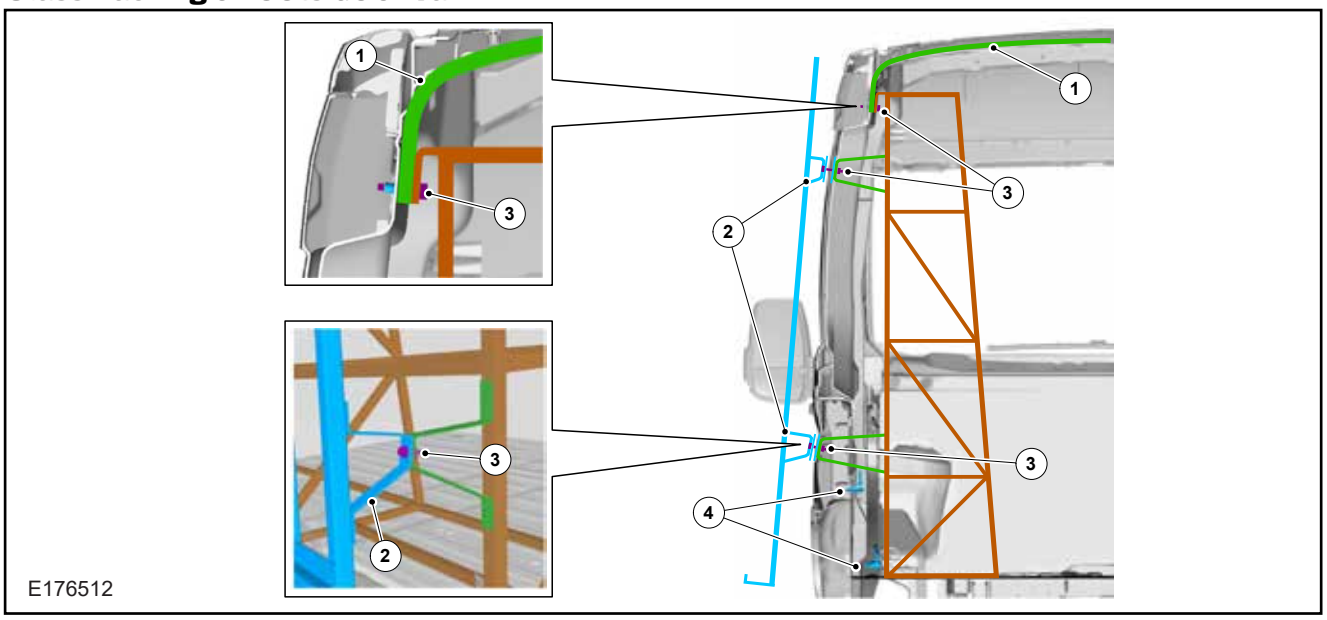
Recommended Fixing Locations



E176000

Item	Description
A	Low roof vehicles do not have this fixing location.

Glass Racking on Outside of Van



Glass Racking on Outside of Van - Through Fixed to Internal Strong Structure (Recommended Minimum)

Glass Racking on Outside of Van

For designing glass carrying rack on bodyside outer, the following unique requirements are recommended:

- Construct the internal structure and bolt through the body side to the external structure, see figure E176512
- Internal structures should be rigid, self-supporting and bolted through the floor. Use reinforcements on the underfloor
- Avoid the no-drill zones when selecting fixing locations.

Refer to: 4.2 Wiring Installation and Routing Guides

- It is recommended to balance the vehicle load.

Refer to: 1.16 Load Distribution

- Distribute the force equal to the fixed structure

5.4 Loadspace

5.4.1 Load Compartment Tie Downs

All vehicles are fitted with load compartment tie downs, these are all 'D' rings as shown in E146219. Not all vehicles will have all locations shown, it will depend on the base vehicle. For additional information refer to the Owner's Manual and for additional fixing locations

Refer to: 5.3 Racking Systems



E146219

5.5 Front End Body Panels

5.5.1 Partitions (Bulkhead) - Driver and Front Passenger(s) Protection on Van, Bus

WARNING: Do not obstruct any of bulkhead vents.

CAUTION: Bulkheads serve an important function and are legally required in some territories.

It is the vehicle converter's responsibility to ensure local current legislation, governing bulkheads and protective window grilles, is met. It is also the converter's responsibility to ensure legal load constraint requirements if using a non Ford standard bulkhead.

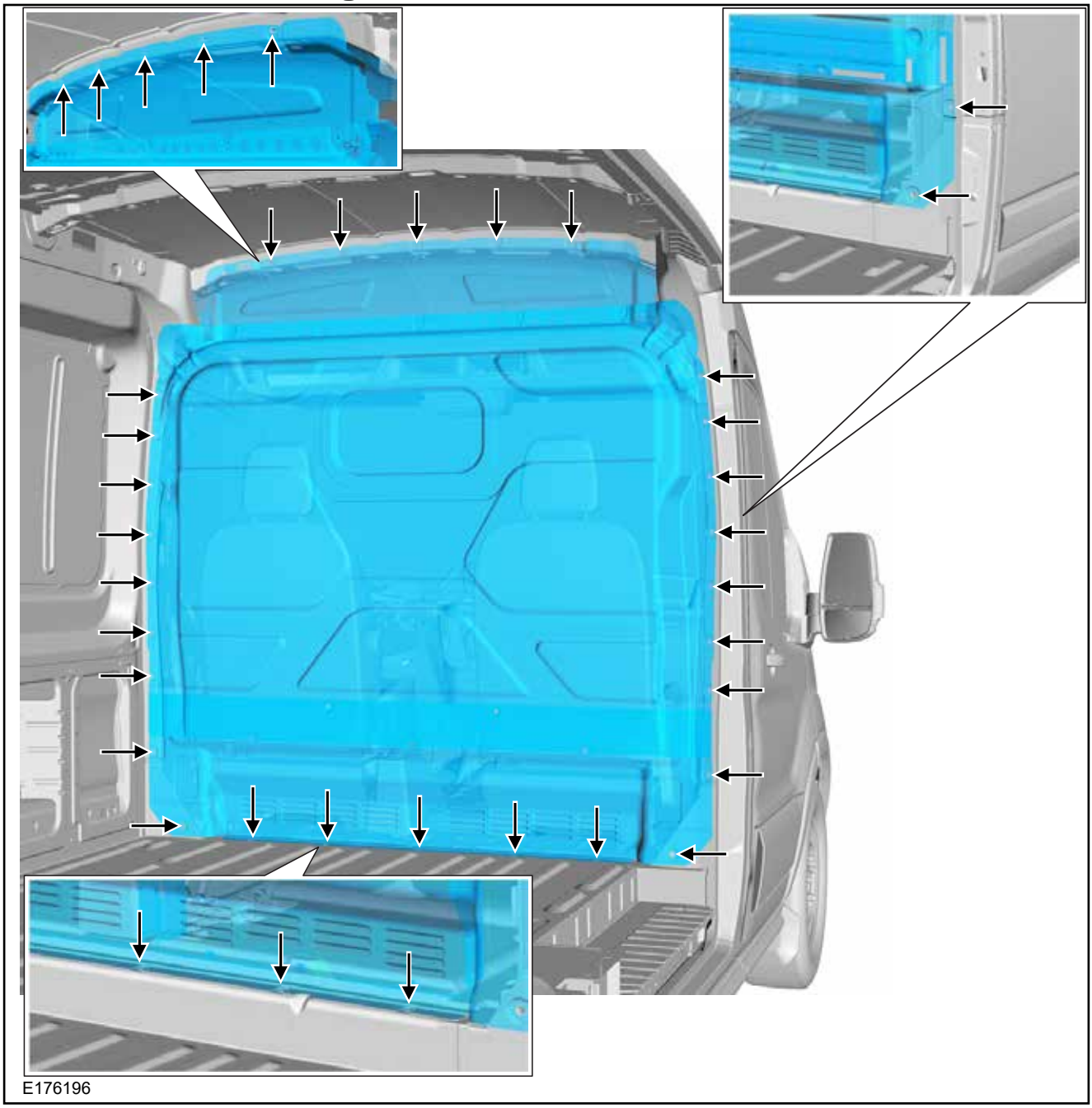
Standard Ford bulkheads do have a clearance between bulkhead and body structure to allow natural body flexing and an air circulation from the cab to the rear load space for ventilation control.

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 figure shows the standard bulkhead fixing locations on 'B' pillar. These are standard weld nuts. The standard range of Ford bulkheads can be retro-fitted at these points.

In some territories it is a legal requirement for bulkhead fixings to be tamper proof. For further information check with your local Ford dealer.

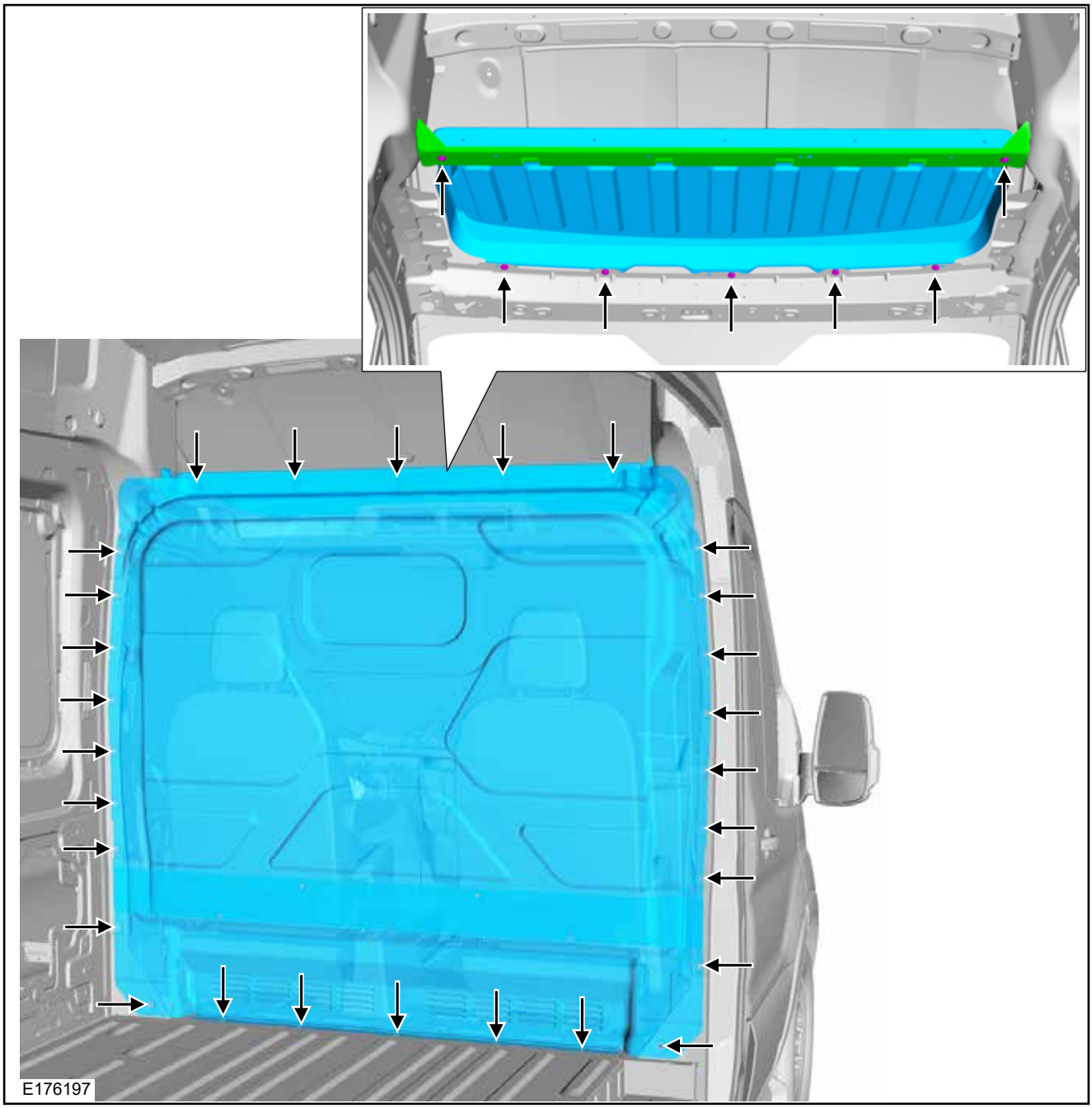
Medium Roof Bulkhead Fixing Holes



E176196

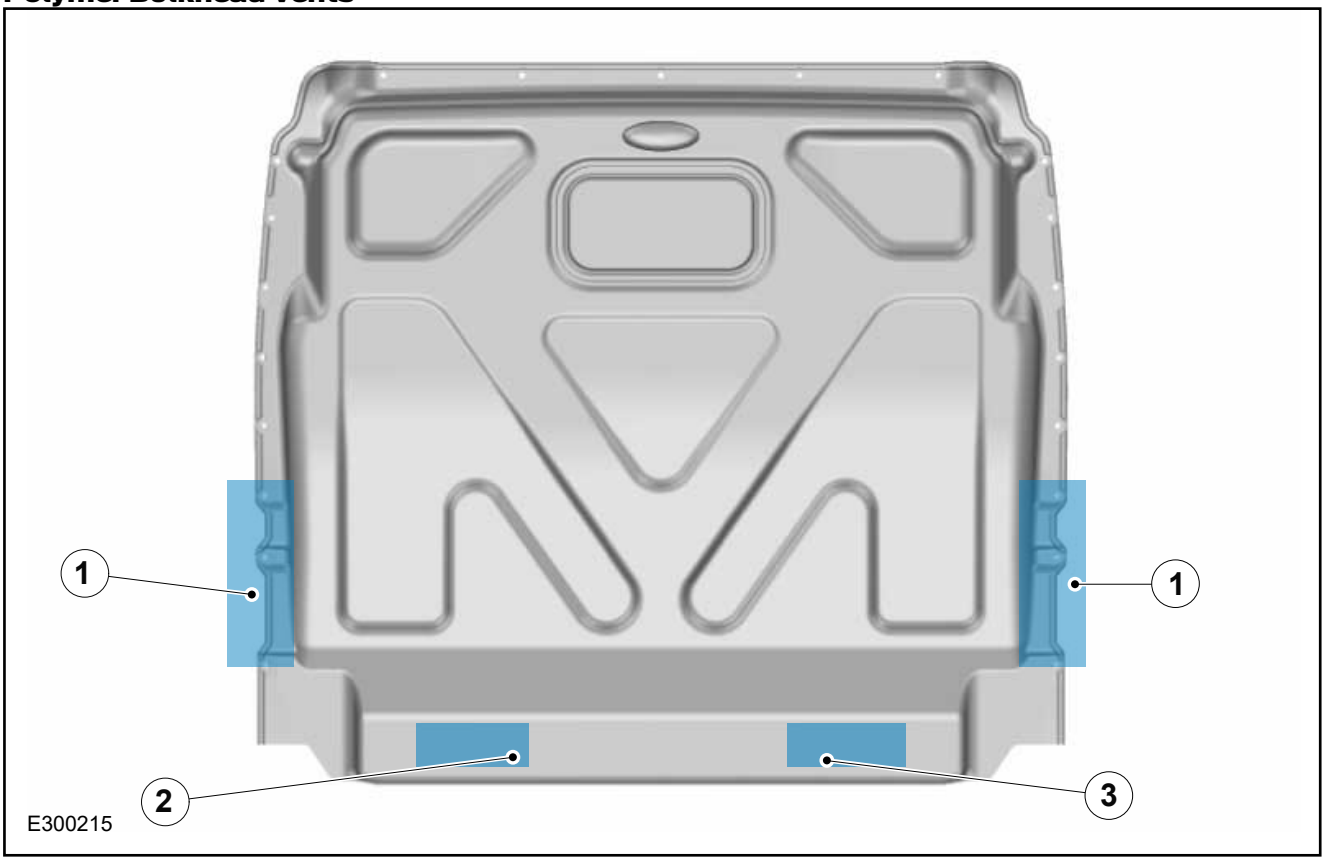
Abc = BEV Only Abc = ICE Only

High Roof Bulkhead Fixing Holes



5.5.2 Polymer Bulkhead

Polymer Bulkhead Vents



Item	Glazing	Side Vents	Under Passenger Seat Vent
1	Unglazed/Glazed	All Vehicles	-
2	Unglazed/Glazed	All Vehicles	LHD MHEV only
3	Unglazed/Glazed	All Vehicles	RHD MHEV only

Fixing to Polymer Bulkhead

WARNING: Do not obstruct any of bulkhead vents.

CAUTION: It is not recommended cutting into the polymer bulkhead as this could affect the strength and performance.

NOTE: Prior to attaching any significant load to the polymer bulkhead please check with conversionworks@ford.com

NOTE: When fitting anything to the polymer bulkhead the load should be evenly distributed to balance the vehicle load and supported with appropriate fixing points.

If fitting auxiliary brackets to a polymer bulkhead it is recommended to use M5/M6 rivets with appropriate drilled hole size for M5/M6 rivets.

The head of the fixing used should be larger than the drilled hole to disperse the load and to prevent pull through. It is recommended to use a 30mm diameter washer or collar.

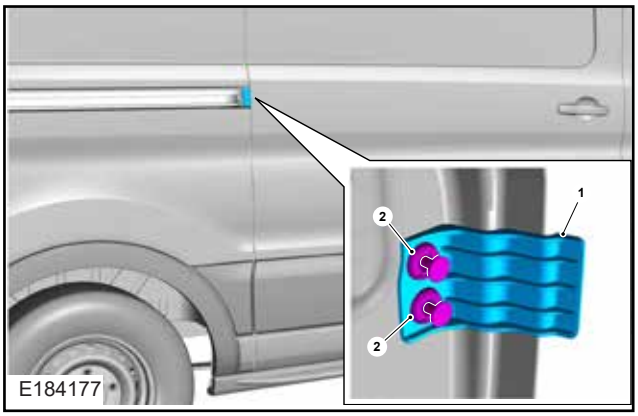
Any rivet or bolt that is visible in the cab area should be finished or capped.

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 Conversionworks@ford.com

5.6.1 Sliding Door Gap Reduction on M1 Vehicles

CAUTION: When converting an N1/N2 or M2 vehicle into an M1 vehicle, left and right hand spacer brackets or an equivalent designed part must be retrofitted to the sliding side load doors.



Item	Description
1	Spacer Bracket: Right Hand Side - BK31-A214A46-A* Left Hand Side - BK31-A214A47-A*
2	2 X Clip and Fastener W711712

5.6.2 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.

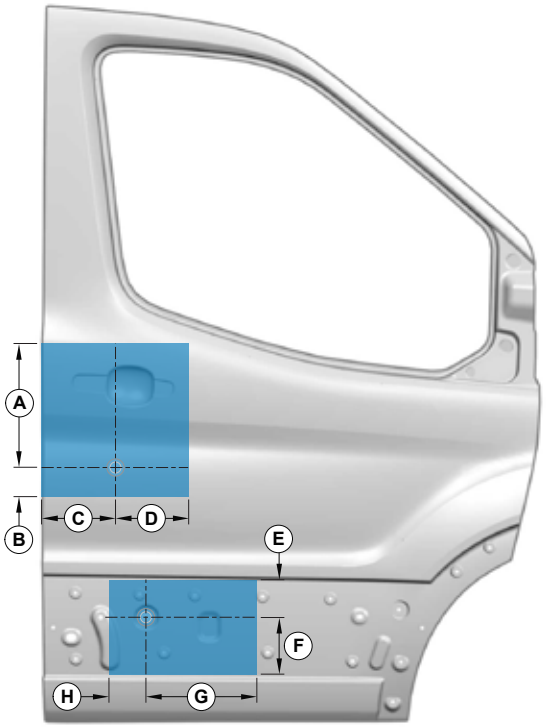
NOTE: It is not recommended to alter the locking system or damage the security shielding around the lock and latch.

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.

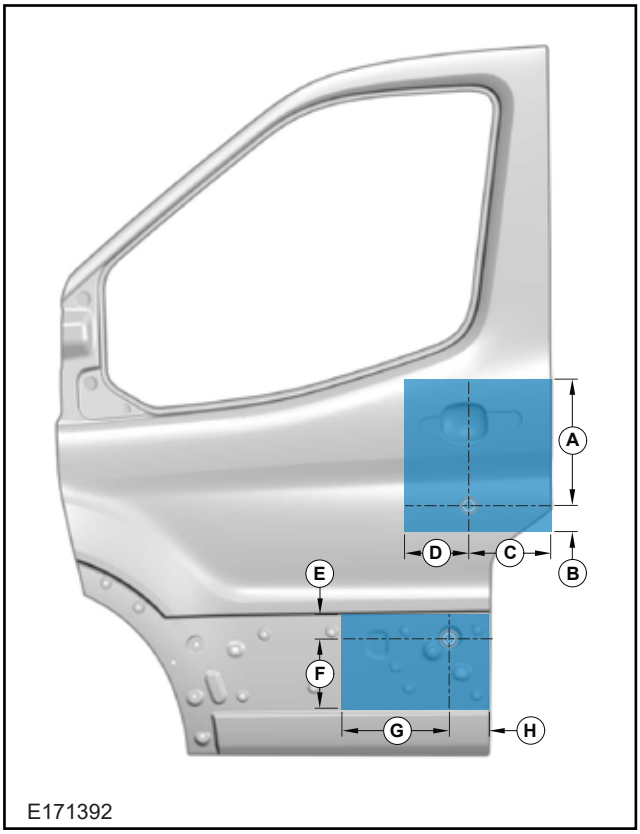
The following figures outline the areas in which it is not advisable to drill.

No Drill Zone - Right Hand Side Door



Item	Description
A	300mm
B	55mm on RHD vehicles / 35mm on LHD vehicles
C	190mm
D	150mm
E	100mm
F	140mm
G	200mm
H	70mm

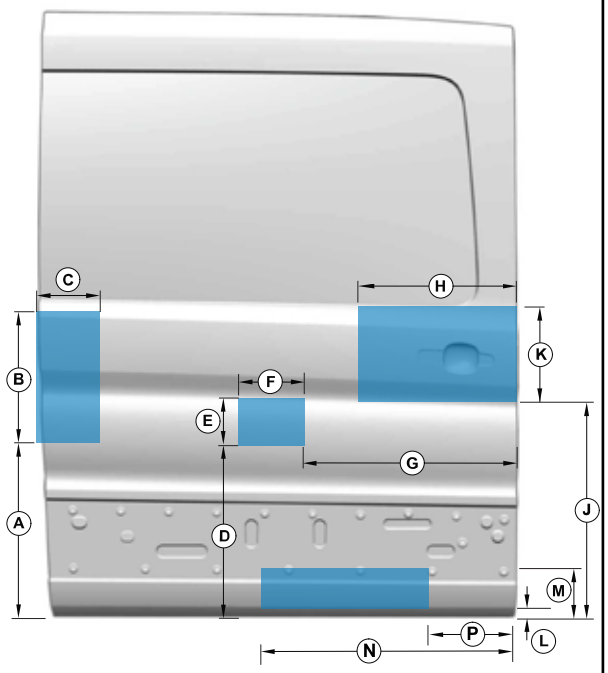
No Drill Zone - Left Hand Side Door



E171392

Item	Description
A	300mm
B	35mm on RHD vehicles / 55mm on LHD vehicles
C	190mm
D	150mm
E	60mm
F	140mm
G	200mm
H	90mm

No Drill Zone - Side Sliding Doors (right side door shown, left hand door symmetrically opposite)

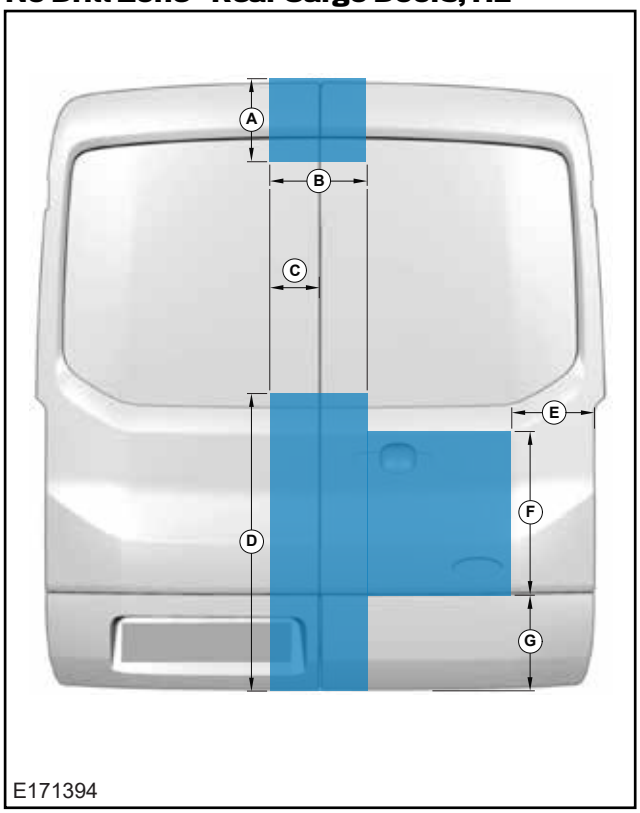


E294970

Item	Description
A	550mm
B	450mm
C	150mm
D	550mm
E	150mm
F	200mm
G	650mm
H	450mm
J	770mm
K	350mm
L	50mm
M	200mm
N	770mm
P	270mm

Abc = BEV Only Abc = ICE Only

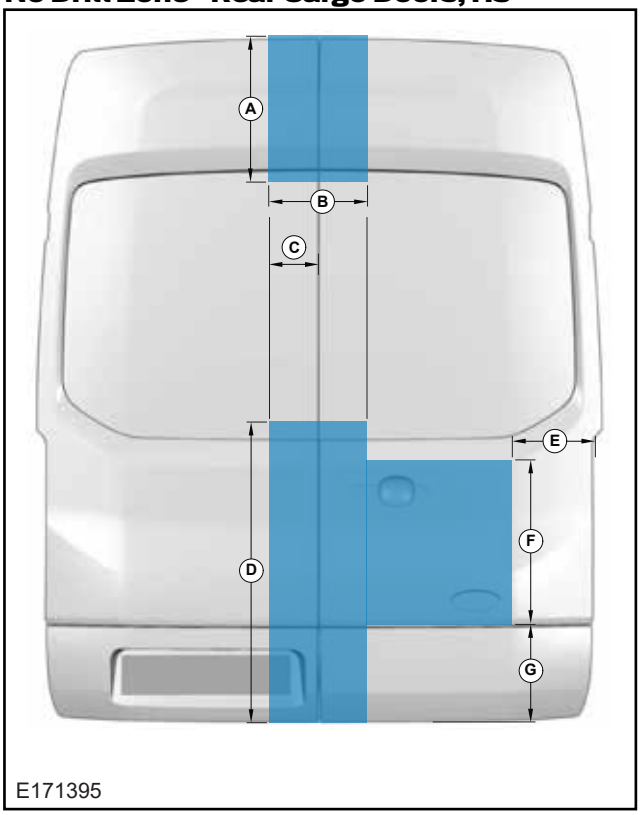
No Drill Zone - Rear Cargo Doors, H2



E171394

Item	Description
A	320mm
B	340mm
C	170mm
D	920mm
E	200mm
F	520mm
G	300mm

No Drill Zone - Rear Cargo Doors, H3



E171395

Item	Description
A	550mm
B	340mm
C	170mm
D	920mm
E	200mm
F	520mm
G	300mm

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 Conversionworks@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, 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

5.8 Rear View Mirrors

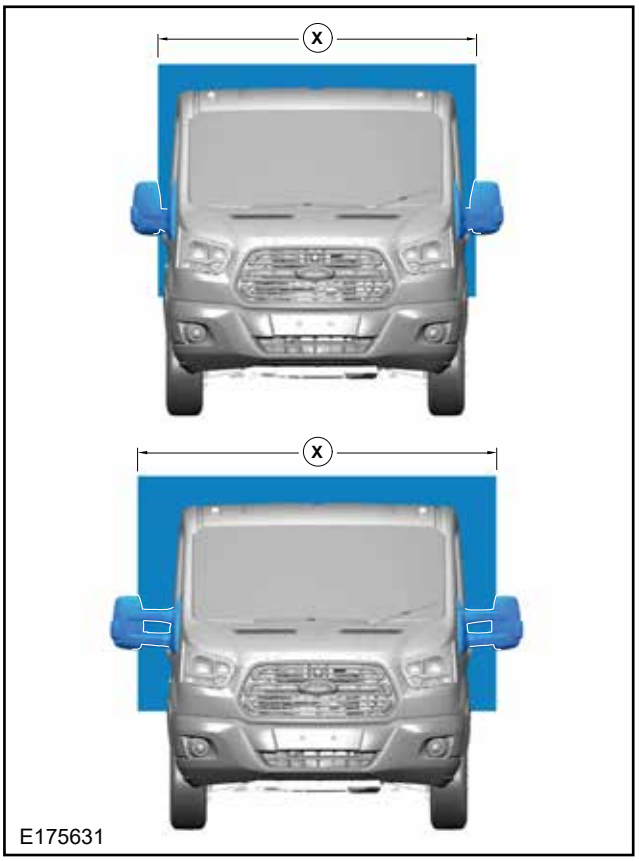
5.8.1 Door Mirrors

NOTE: The maximum width of a vehicle conversion may be restricted below 2400mm in order to comply with installation of Lighting Regulation ECE R48 which specifies widths restrictions for mandatory light components. Fitting optional Front Fog Lamps restricts the vehicle width to 2375mm.

- For non-European Union territories, please refer to local legislation
- For Australia and New Zealand, please refer to ADR43 Vehicle regulations

Short Arm Mirrors are specified on all versions and allow vehicle or trailer maximum widths of up to 2.2m.

Long Arm Mirrors are available as an option on Chassis Cab and Motorhome Chassis variants and covers vehicles or trailer maximum widths of up to 2.4m.



5.9 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 Conversionworks@ford.com

NOTE: On eTransit BEV,If the passenger seat is not fitted (passenger seat delete option) or removed, the standard charger unit cord storage location is lost and the convertor must provide an alternative storage feature for the cord

5.9.1 Van

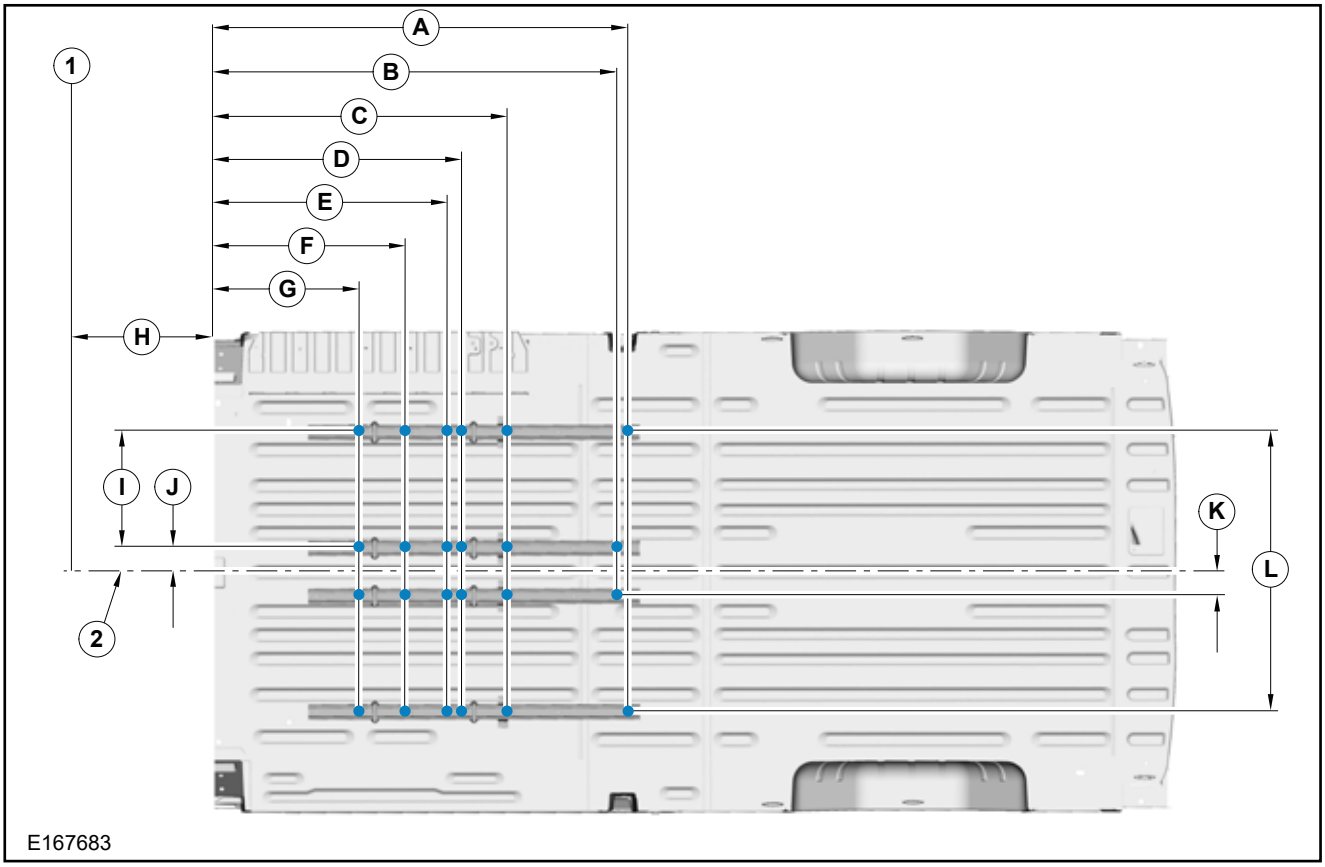
CAUTION: Do not install seats in the rear cargo area of a van.

5.9.2 Windowed Van

The body and floor of a windowed van are not equipped with the appropriate reinforcements required for Original Equipment Manufacturers (OEM) rear seats and seat belt systems. Do not install original rear seats or rear seat belts.

For installation of non OEM rear seats, the rear seats

Rear Seat Fixing Positions



E167683

Item	Rear Seat Fixing Location (mm)
1	Front Axle
2	Centre line of vehicle
A	1630
B	1504
C	1060
D	895
E	845
F	670
G	520
H	1225
I	425
J	88
K	88
L	1027

and seat belt systems need to comply with the relevant legal requirements and ECE directives or ADR 3,4,5 or applicable local legislation.

Refer to: 3.7 Exhaust System Vehicle Exhaust Systems - Vans with Bulkheads.

5.9.3 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).

5.9.4 Rear Seat Fixing Positions

Figure E167683 shows the 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.

5.9.5 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.

5.10 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 Conversionworks@ford.com

5.10.1 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.

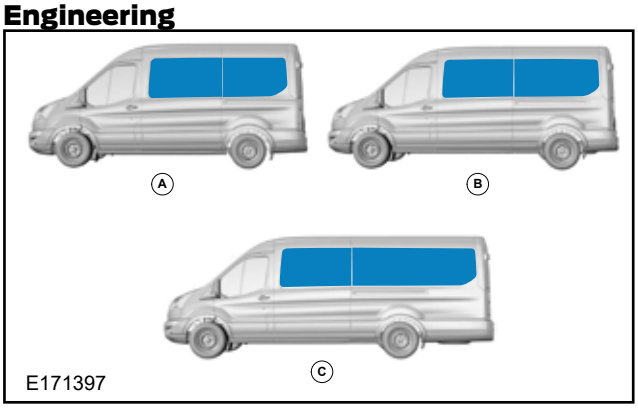
5.10.2 Rear and Side Windows

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.

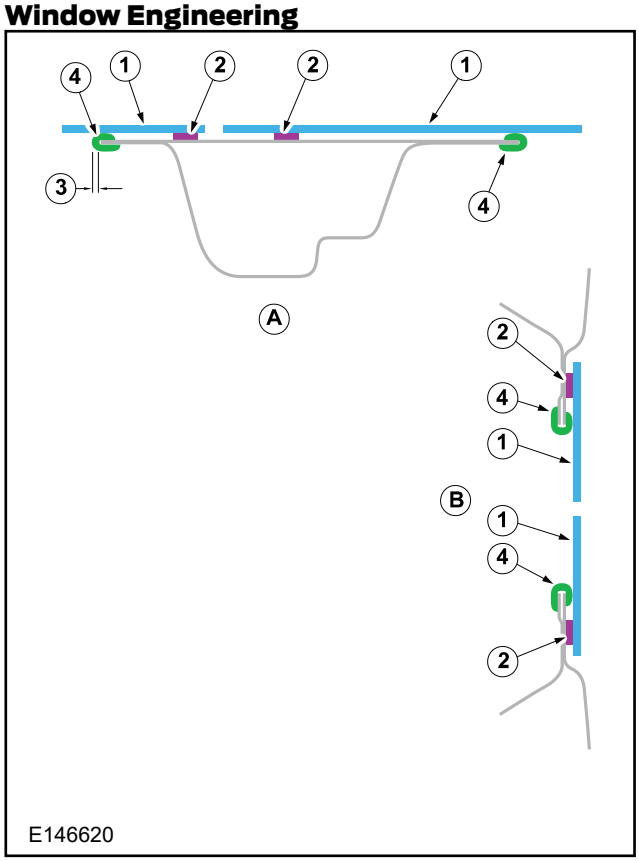
WARNING: For rear seat installation
Refer to: 5.9 Seats

Typical Van Body Side view for Window Engineering



For vehicle wheelbase and Roof height
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

Abc = BEV Only Abc = ICE Only

5.11 Airbag Supplemental Restraint System (SRS)

5.11.1 Airbags

Front Airbag Deployment Zones

WARNINGS:

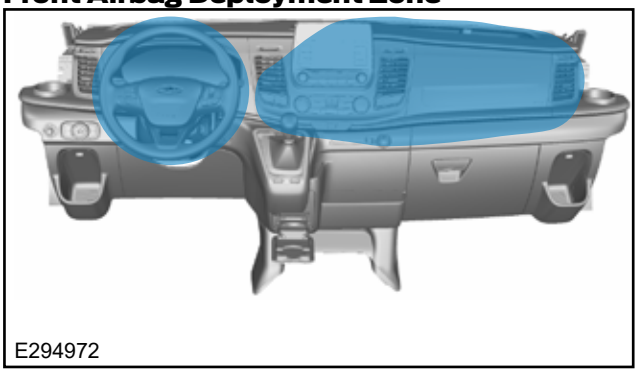
Do not place accessories in the deployment zone of the driver and passenger airbags as they may impair airbag deployment.

Do not place stickers or decals over the airbag covers as this may impair airbag deployment.

NOTE: Vehicles specified with a front passenger airbag are fitted with a deactivation switch located on the side of the Instrument Panel, on the passenger side. DO NOT remove or cover the deactivation switch as this could restrict access or function may be impaired.

NOTE: All M1 Vehicles are specified with passenger airbag as standard fitment. Passenger airbag includes the driver belt minder function.

Front Airbag Deployment Zone



E294972

Side and Curtain Airbag Deployment Zones

WARNINGS:

Do not place accessories in the deployment zone 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.

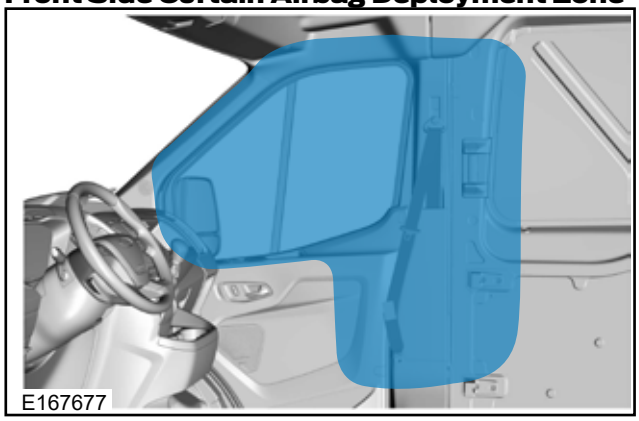
NOTE: All M1 Buses are specified with side and curtain airbags as standard fitment.

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.

Front Side Curtain Airbag Deployment Zone



E167677

Restraints Control Module (RCM)

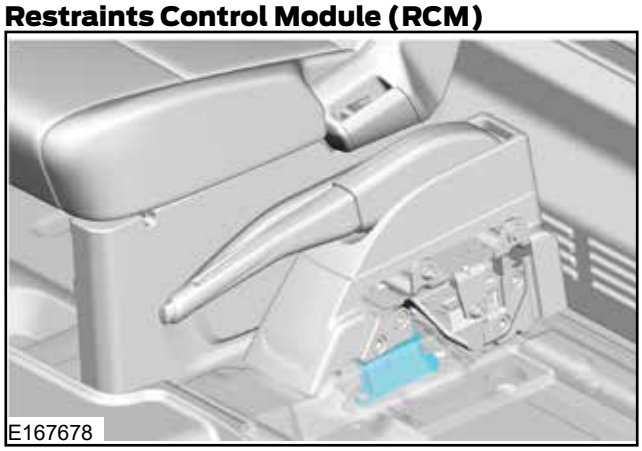
The RCM is located between the front seats, underneath the parking brake console, see figure E167678.

WARNINGS:

Conversions 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 the parking brake and console, to prevent damage from occupants when stepping past the seat to access the rear of the vehicle. The parking brake and console should be maintained in their fitted position to ensure protection for the RCM.

Restraints Control Module (RCM)



E167678

Front, Side and Door Sensors

The airbag sensor for the front airbags is located behind the front grille, see figure E167679.

The sensors for the side airbags are located at the bottom of the B-pillars, see figure E145412, and in the front door behind the speaker, see figure E167680.

WARNINGS:

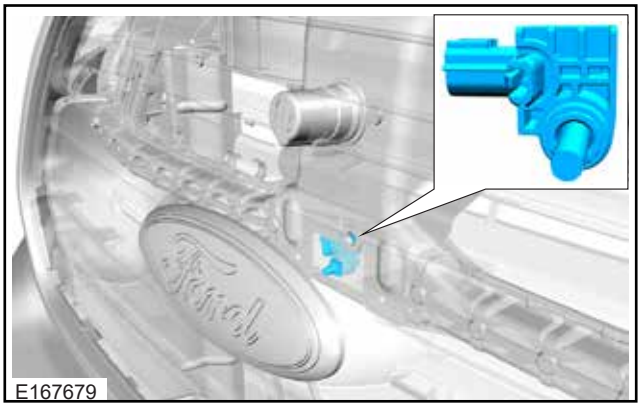
Conversions or reinforcements in the area of the sensors may affect the side airbag deployment timing and result in uncontrolled side airbag deployment.

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: 4.6 Battery Systems Battery and Monitoring Sensor section for reconnecting battery.

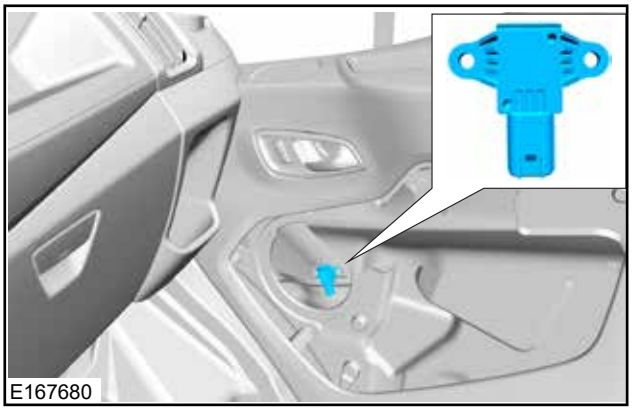
Front Sensor


E167679

Side Sensor


E145412

Door Sensor


E167680

Abc = BEV Only Abc = ICE Only

5.12 Seatbelt Systems

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 Conversionworks@ford.com

5.12.1 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.

The removal and re-installation 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 re-installing, 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.

5.12.2 B Pillar No Drill Zone

WARNINGS:

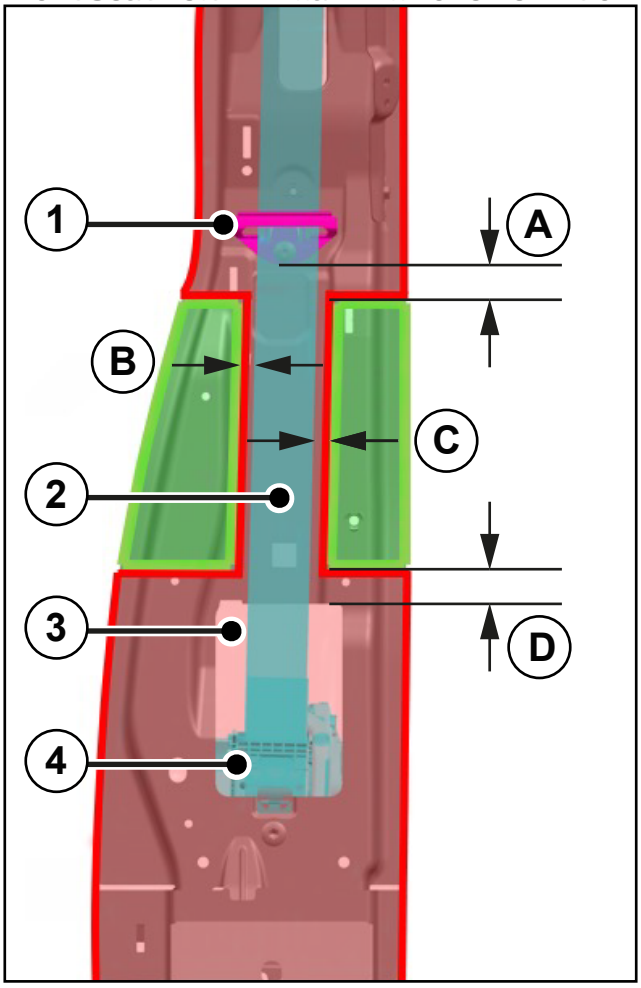
Do not drill in right hand/left hand side retractor assembly area.

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 Guide
2	Seatbelt Webbing
3	Retractor Hole
4	Retractor
A	30mm Below Webbing Guide
B	15mm Left of Webbing
C	15mm Right of Webbing
D	30mm above Retractor Hole

5.12.3 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.

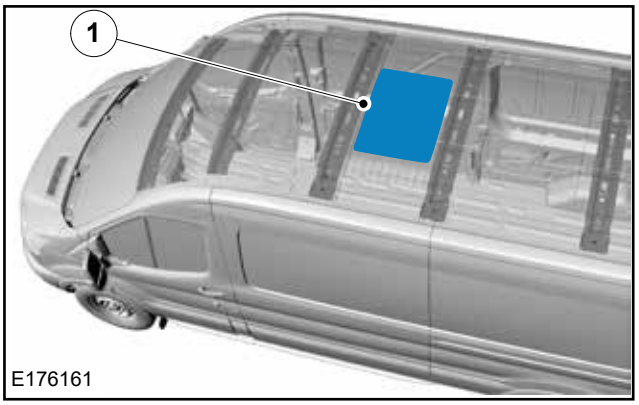
NOTE: Additional (non factory-fitted) seats cannot be added to the belt-minder function using this procedure.

NOTE: The converter 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 (or added in the case of Fabricless seats being ordered), 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 conversionworks@ford.com for further information

5.13 Roof

5.13.1 Roof Ventilation



E176161

Item	Description
1	Roof Panel Aperture

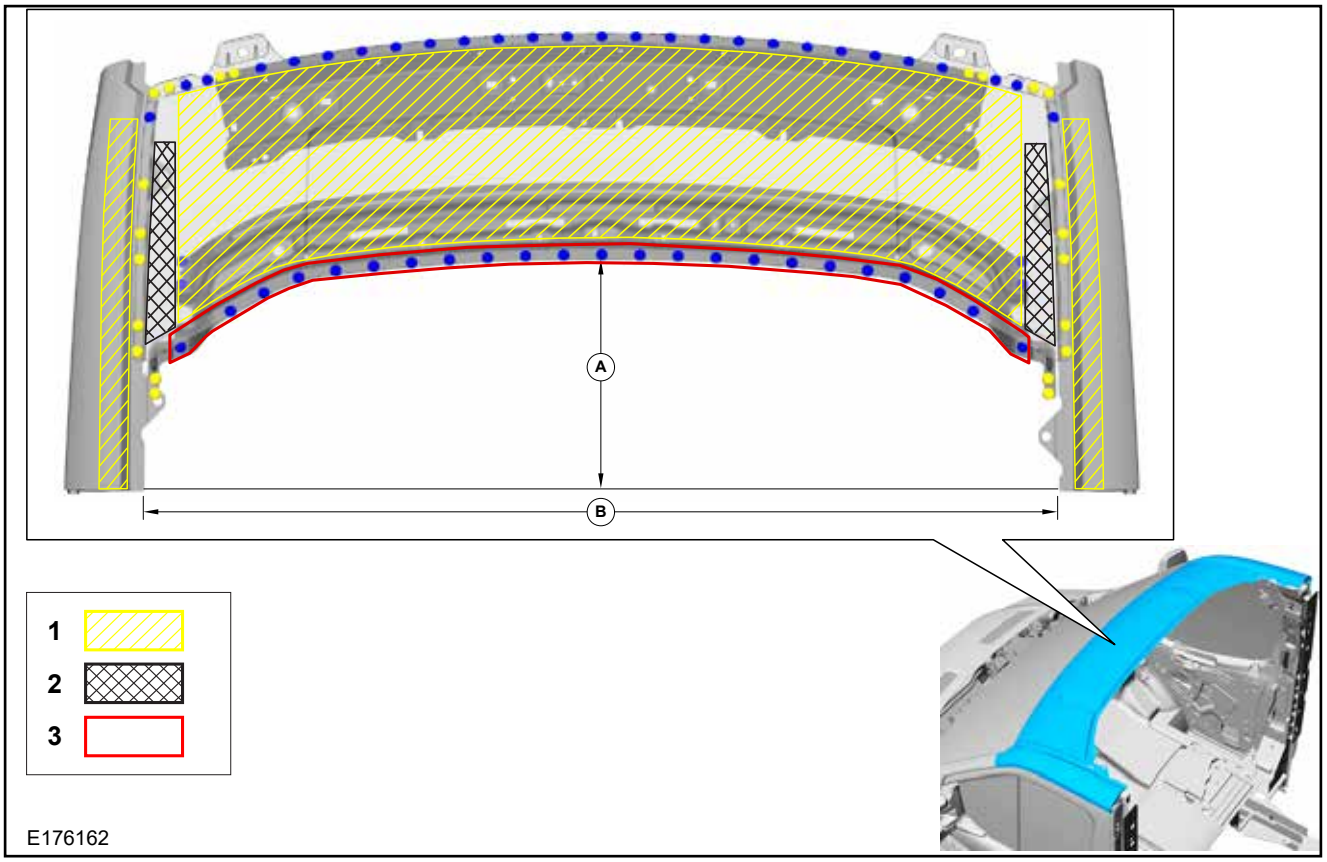
General - Apertures must not cut through roof bows, see figure E176161. Ventilators must prevent direct entry of water and dust. A shut-off system should be available to prevent fume ingress. Interior and exterior projection legal requirements must be maintained.

In case a roof bow is cut or removed, it 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.

5.13.2 Roof Cut Out - Camper Based Vehicles Only

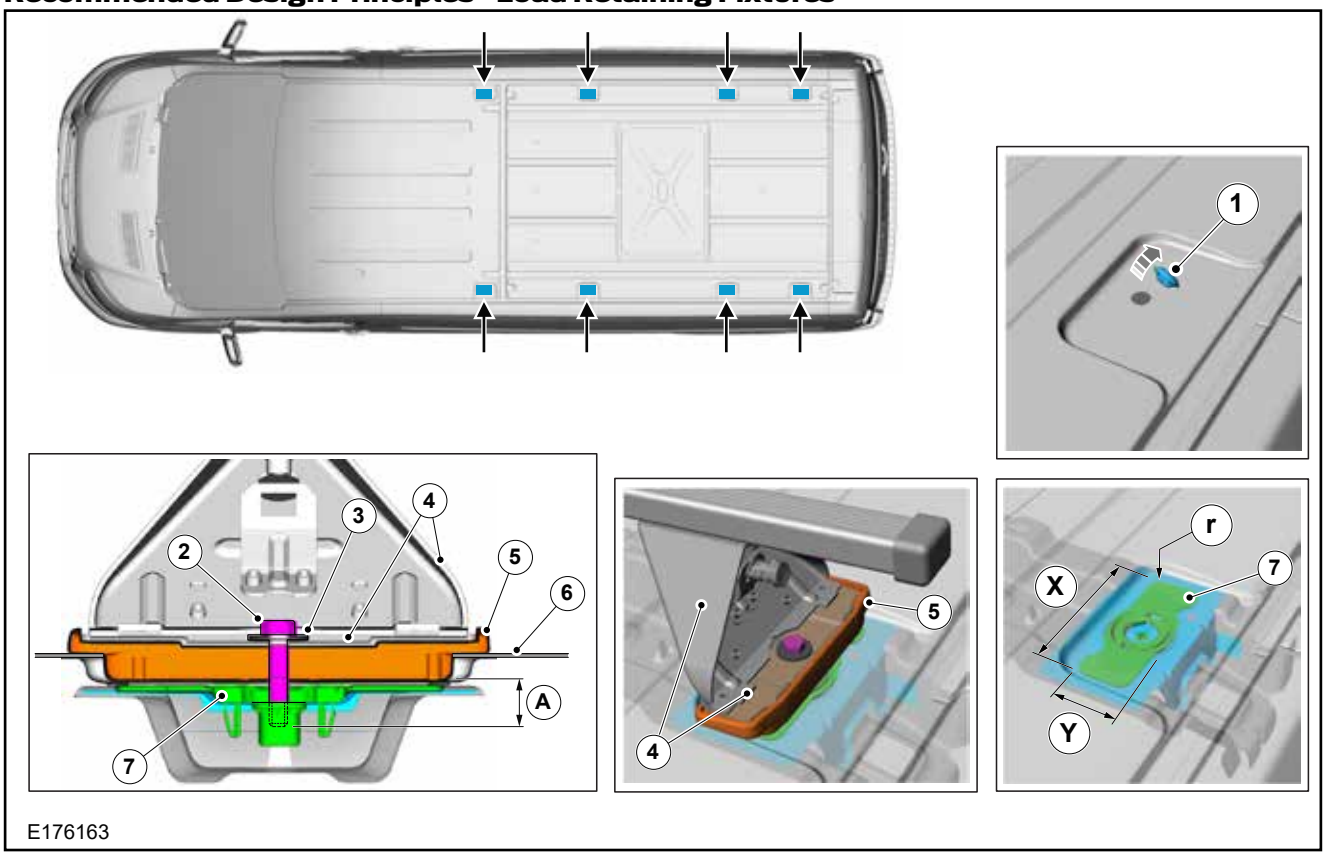


E176162

Item	Description
1	Rivet and self tapping screw area
2	Bolting area
3	Bolting area providing bolts are between blue spot welds
A, B	Maximum roof cut out standard (Transit Motorhome Chassis with roof and back panel removed Shown, for Camper Single Chassis Cab, the same fixing strategy applies).

5.13.3 Roof Racks and Load Carriers

Recommended Design Principles - Load Retaining Fixtures



E176163

Item	Description
1	Plug to avoid water ingress and corrosion
2	M8 Bolt
3	Seal
4	Roof Rack System
5	Seal/Spacer (see E247462)
6	Roof Panel
7	Reinforcement
A	Maximum intrusion 16mm
X	130mm
Y	47mm
r	10mm

WARNING: Refer to the Owner's Manual for information on Load Carrying and maximum roof loads.

NOTE: Read and follow the manufacturer's instructions when fitting a roof rack.

NOTE: The number of load retaining fixtures vary depending on the vehicle.

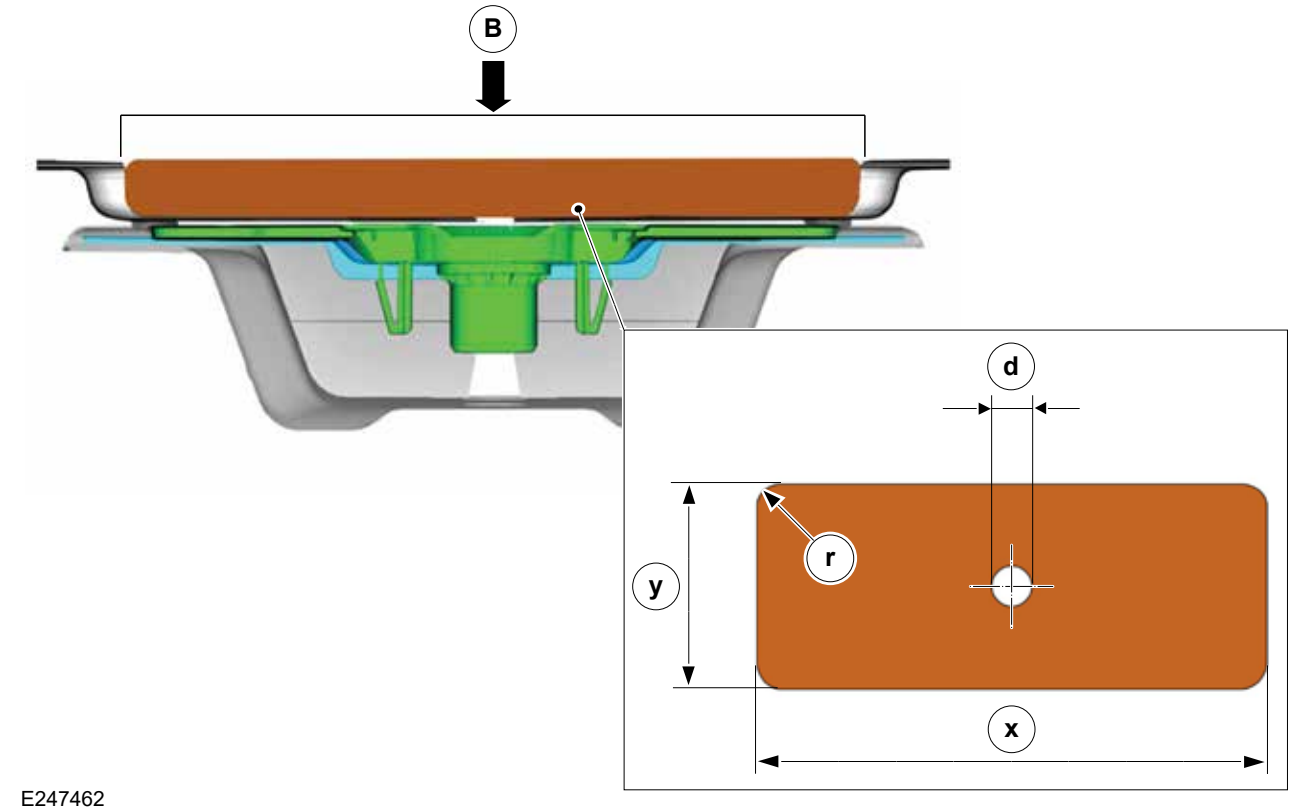
Roof racks may be fitted to all Van, Bus and Kombi variants providing the following is satisfied:

- Load not to exceed 79.3kg at individual attachment points for local durability
- Load not to exceed 190kg total for roof structure durability
- Refer to: 1.16 Load Distribution For guidance on centre of gravity information
- Ideally, the bearing surface of the roof rack attached should be the same as the reinforcement inside the roof, see figure E176163, item 7 and dimensions X,Y and r
- Ensure sealing of surfaces, for example: with EPDM rubber material or equivalent and ensure sealing along the bolt for preventing water ingress into the interior of the vehicle, see figure E176163 items 3 and 5
- The thread size is M8. The maximum intrusion of the M8 bolt into the roof is 16mm, see 'A' in figure E176163.
- Read and follow the manufacturer's instructions when fitting a roof rack

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- When removing the roof rack ensure holes are properly sealed with sealing plugs or equivalent water tight elements

Recommended Spacer Dimensions



Item	Description
B	Load Bearing Surface – Lateral roof rack beams should be centred fore/aft over the roof mounting points/depressions
X	127mm
Y	50.8mm
r	6.35mm radius x 4
d	10.00 ±0.15 mm diameter hole (centre of spacer)

NOTE: De-burr all edges.

NOTE: Avoid load application to Class A roof panel surface.

Trimline Tolerance ± 0.5mm

Material Thickness Low Roof = 9.523mm.
Material Thickness Medium and High Roof = 14.28mm.

5.14 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 Conversionworks@ford.com.

5.14.1 General

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

Do not apply any coating/corrosion prevention treatment to the HV battery pack area and connectors.

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

If drilling is required, however:

- 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

5.14.2 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.

5.14.3 Under Body Protection and Material

WARNING: Do not over-coat or contaminate surfaces of components such as brakes or catalytic converters.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance where possible.

Some proprietary products affect the original coatings.

5.14.4 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.

5.14.5 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.

5.15 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 Conversionworks@ford.com

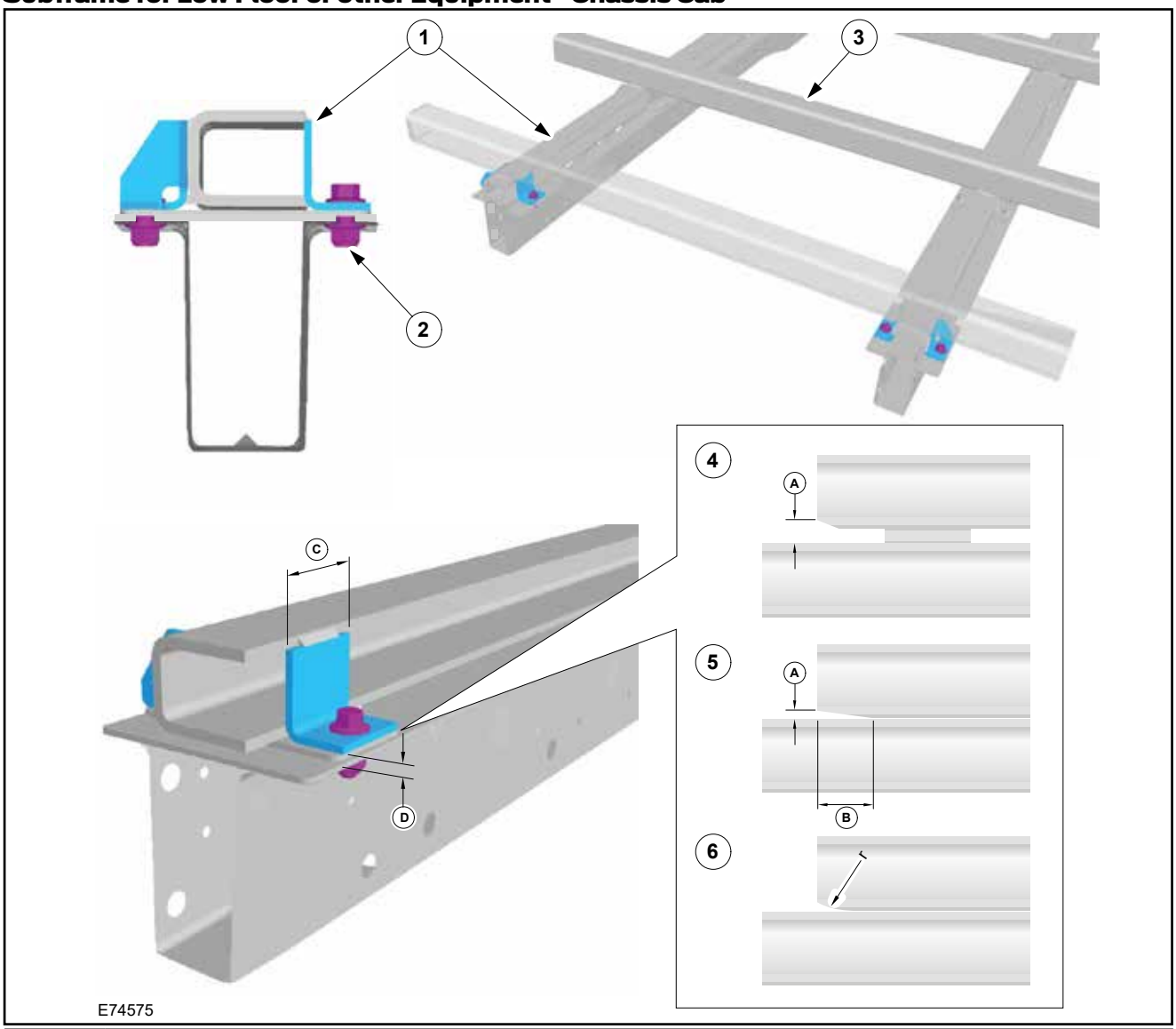
5.15.1 Mounting Points and Tubing

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: 5.14 Corrosion Prevention

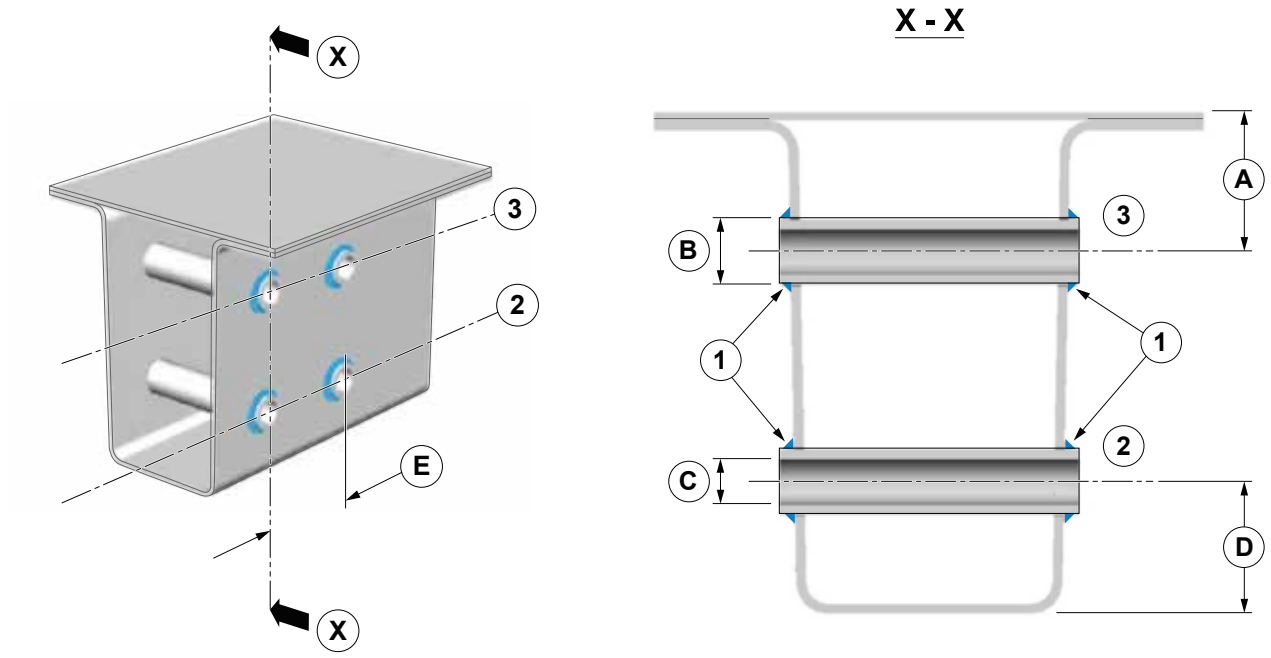
Subframe for Low Floor or other Equipment - Chassis Cab



E74575

Item	Description
1	Continuous longitudinal float or body support member
2	Always use both sides of all chassis mounts
3	Crossmembers
4, 5, 6	Relief front end and longitudinal if there is a risk of stress concentration in chassis frame from longitudinal contact
A	5mm (minimum)
B	50mm (minimum)
C	50mm width for all brackets
D	Avoid longitudinal contact if possible which may create stress concentration
r	20mm (minimum)

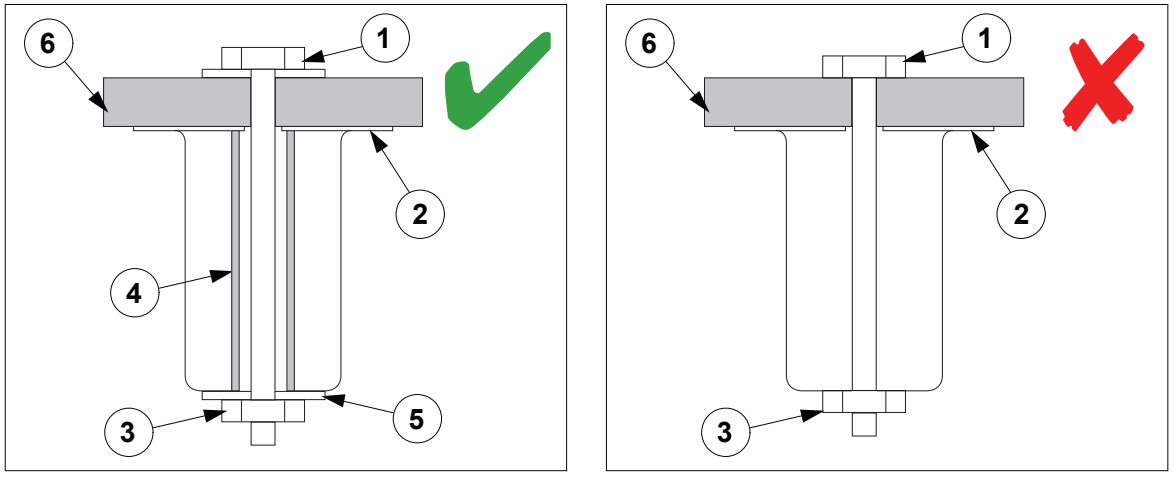
Frame Drilling and Tube Reinforcing



E176204

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

Recommended Frame Drilling and Tube Reinforcing



E196988

Item	Description	Item	Description
1	Screw	4	It is recommended to always use a tube
2	Longitudinal rail	5	It is recommended to always use washers. Size minimum equal to lower rail width.
3	Screw Nut	6	Floor - minimum thickness 37mm

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5.15.2 Self-Supporting Body Structure

Bodies and structures can be judged as self-supporting providing they maintain the following rules:

- Cross members are used at each chassis mounting point, please refer to: 5.1 Body - Chassis Frame Body Attachment: figures E67667, E167668, 167669 and E167670, also E74576 and E176203 in this section
- Each crossmember has a suitably engineered connection to the body sidewall (3) or to the continuous floor frame (5), shown in figure E74576
- The body sidewall or the continuous floor frame supports any overhang beyond the chassis frame, whether on standard frame or extended frame

Alternatively, the self-supporting body structure can also be designed as shown in figure E74577. This concept is based on a self-supporting structure where the floor is mounted directly onto the top surface of the chassis frame.

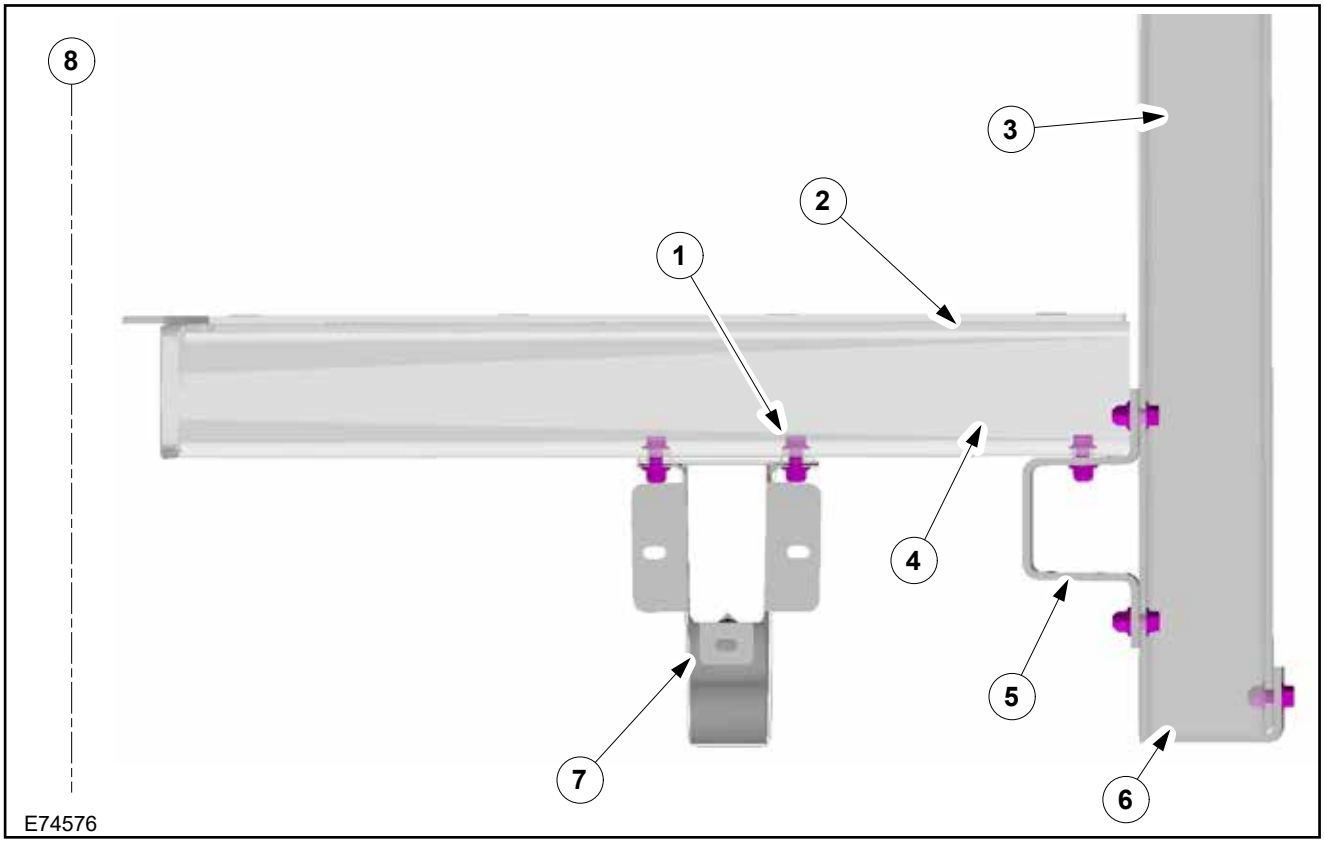
Figure E74577 shows a generic vehicle cross section where the crossmembers and opposing outriggers are flush with the surface of the chassis frame side members.

It is important to the overall function of the vehicle structure that the outriggers are each connected to a continuous longitudinal floor side frame or a structural body side structure assembly.

Low floor re-work for guidance only:

- Engineer unique crossmembers and outriggers spaced at approximately 600mm maximum pitch
- Outrigger moment to be re-acted with crossmember between chassis frame, with common through bolts where possible; see figure E74577 Low floor standard chassis frame
- Drill frame and add spacer tubes, see frame drilling & tube reinforcing; see figure E176204
- Outrigger outboard ends should be attached to load bearing body side/floor edge frame or body side structure (including over wheel support)
- Structural wheel box should maintain longitudinal

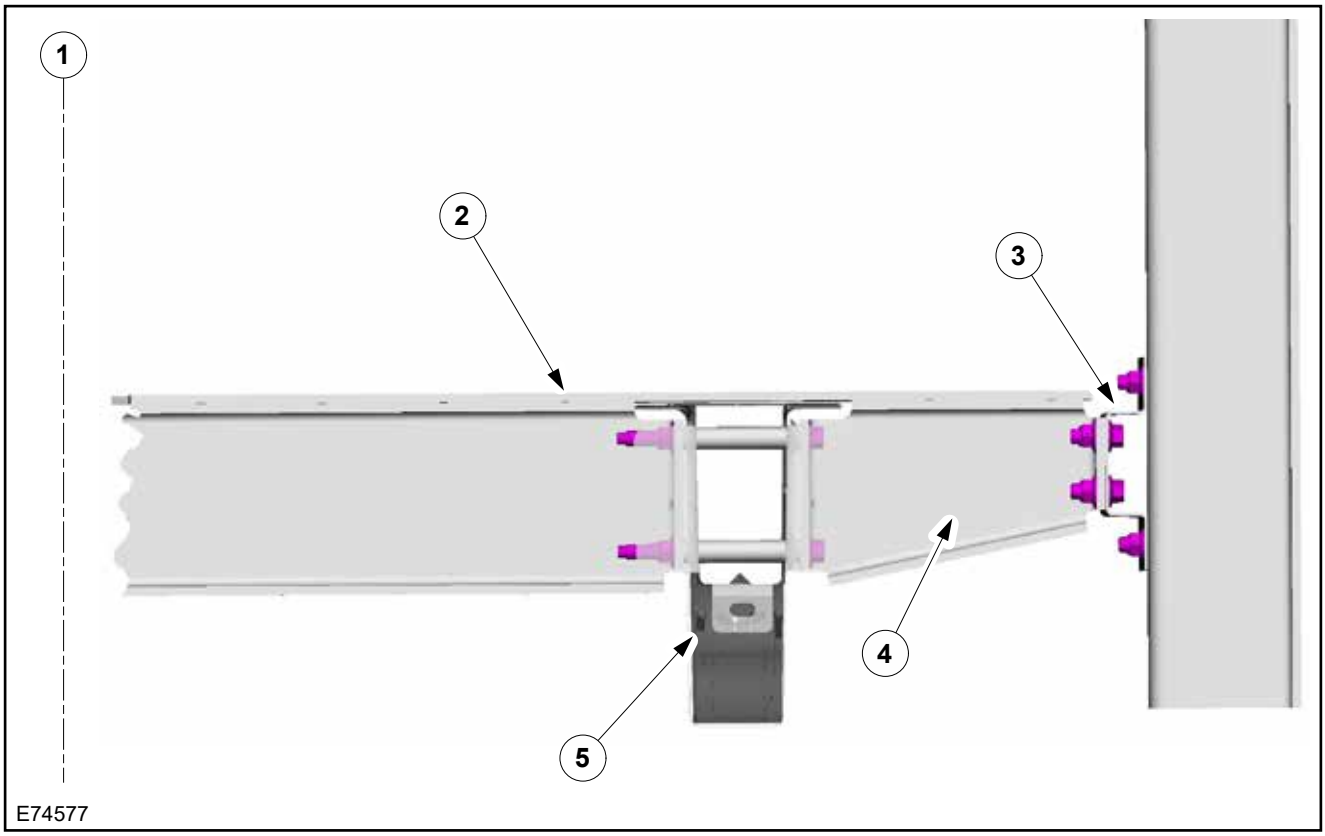
Typical Design Principle of a Self-Supporting Body Structure



E74576

Item	Description
1	Use all standard locations with 2x M10 fixings
2	Floor Panel
3	Body side frames
4	Floor crossmembers
5	Continuous floor U-profile frame
6	Longitudinal L-profile
7	Chassis frame rail of base vehicle
8	Vehicle centre line of base vehicle

Low Floor Standard Chassis Frame



Item	Description
1	Vertical centre line of vehicle
2	Floor panel
3	Continuous floor edge longitudinal
4	Outrigger
5	Low floor

continuity with a rigid attachment to the floor edge frame or to the body side structure

- Floor boards should be substantially attached to crossmembers and outriggers, but not to the chassis frame top surface
- Low floor exhaust heat shields;

Refer to: 3.7 Exhaust System

5.15.3 Extended Chassis Frame

General:

- Rear overhang extensions are available as Regular Production Option
- Bodies or equipment exceeding the standard extension length must be supported, please refer to figure E74575 low body longitudinal members or figure E74576 self supporting body structures
- It is the Vehicle Converter's responsibility to mark up the Owner's Manual advising the available payload. Axle plated weights and maximum allowable axle mass, as shown in this manual, must not be exceeded
- The vehicle should be planned for uniformly distributed loads

5.15.4 Non Standard Rear Chassis Frame Extension

Extensions longer than the standard Regular Production Option must comply with the following guidelines:

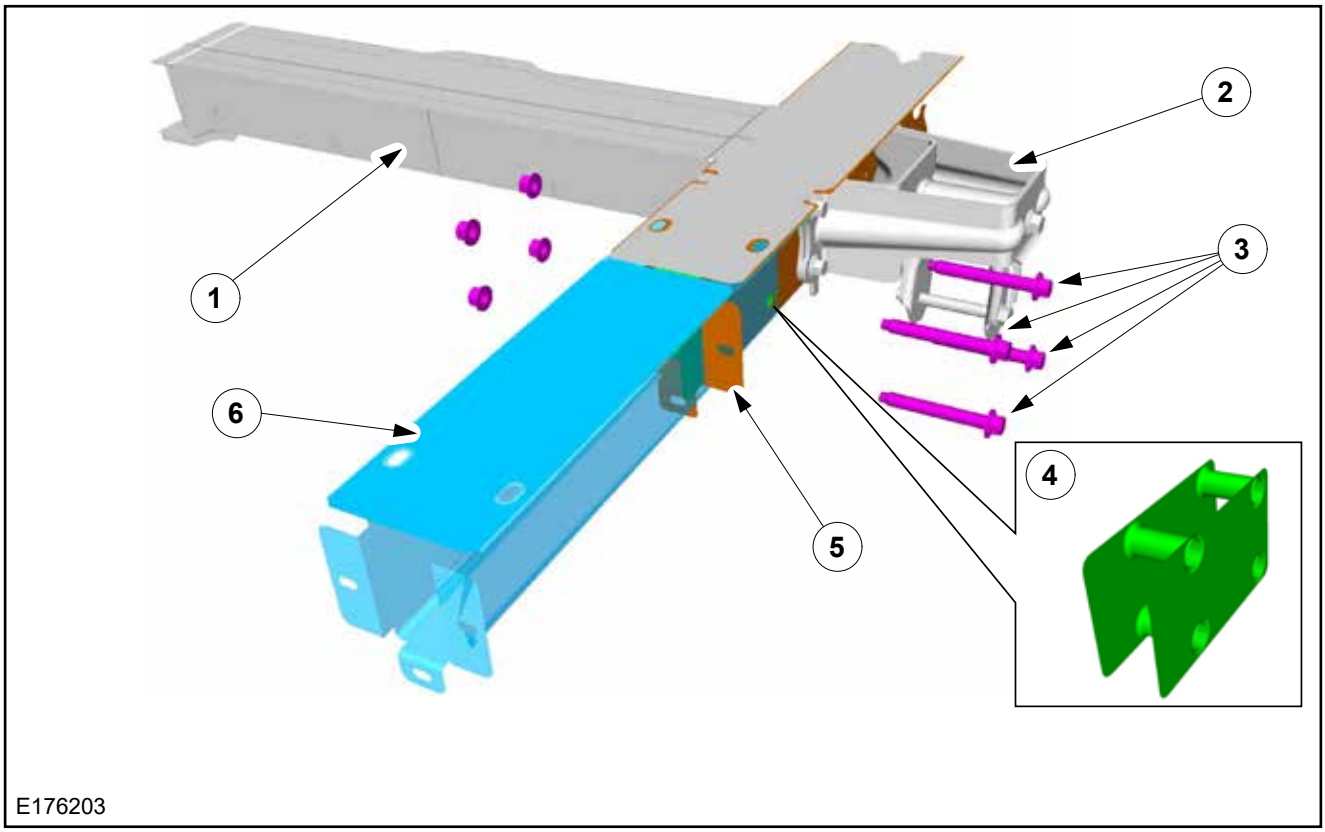
- The original rear crossmember and or under-run bar or equivalent must be repositioned at the end of any altered extension to meet legislation, please refer to Figure E176203 Non Regular Production Option rear chassis frame extensions. Also see.

Refer to: 1.17 Towing figure E167538

- The standard fit under-run bar is bolted on as shown in figure E176203 and figure E167538 as mentioned in previous paragraph
- The altered extension assembly must include a crossmember adjacent to the end of the original chassis frame to replace the relocated under-run bar, see Figure E74577
- Flat-beds and low bodies built onto Non Regular Production Option extensions must have continuous longitudinal members engineered by the Body Builder or equipment supplier, please refer to figure. E74577, to resolve the worst case moments at rear bump stop

Abc = BEV Only Abc = ICE Only

Non Standard Rear Chassis Frame Extension



E176203

Item	Description
1	Cross member
2	Rear spring hanger
3	4x M10 bolts
4	Spacer tube assembly
5	Flanges removed
6	New flanges for under-run bar

- Extensions should be secured to the chassis frame sandwiched under the rear spring shackle bracket utilising the 4 bolts and 4 holes in the rear of the chassis frame, totalling 8 per vehicle, see figure E176203
- The 4 rear most existing holes in the chassis frame must be sleeved with tubes to prevent chassis frame collapse, refer to figure E176203. The spacer tubes should, ideally, be part of a welded bracket and tube assembly to hold the tubes accurately in place, avoiding the need to weld the tubes in place, see figure E176203
- Care must be taken when tightening the spring shackle bracket bolts and nuts to the correct torque. For Tightening torques

Refer to: 1.15 Hardware

- Extensions sleeved over the outside of the chassis frame will necessitate the removal of the under-run bar attachment flanges turned out at the chassis frame ends. The cut edges must be protected against corrosion.

Refer to: 5.14 Corrosion Prevention

- Drilling of the top flanges turned out is only permissible rearward of the spring hanger brackets, for continuity of the altered extension closing plate, if required. The diameter of the holes should be 6.0mm maximum
- It is recommended that the altered extension has a similar closed section, material thickness and properties to the existing chassis frame
- An equivalent open section for the extension assembly is at the Vehicle Converter's discretion
- Lightening holes in new extension and cross members are discretional
- Do not weld original chassis frame except as specified when adding reinforcing tubes, please refer to figure E745171
- Do not drill the top or bottom surface of the chassis frame, including the flanges turned out, except as recommended above for continuity of closure
- Any alternative finish such as hot dip galvanizing is at the discretion of the Body Builder providing it does not have a detrimental effect on the original Ford product.

Refer to: 5.14 Corrosion Prevention

5.15.5 Frame Drilling and Tube Reinforcing

CAUTION: Before drilling, check Precautionary Drill Zone figures earlier in this Section (5.1.4, 5.1.5, 5.1.6)

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 E148689
- 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: 5.14 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 E148689
- 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 sidewalls
- Where possible, the outrigger moments should be resolved by matching inner crossmembers between the chassis side members inline with the outriggers, please refer to figure E74577
- A diameter of 16.5mm is the maximum allowable hole size in the chassis frame sidewall, irrespective of the usage

Avoid drilling into closed frame body members to avoid the risk of corrosion from swarf.
Refer to: 5.14 Corrosion Prevention
Drilling and welding of frames and body structure have to be conducted following the guidelines.
Refer to: 5.1 Body Welding.

5.15.6 Ancillary Equipment - Subframe Mounting

Typical subframes and longitudinal members for flatbed and low or dropside bodies, or equipment exceeding the standard or Regular Production Order frame length, should adhere to the following guidelines:

- Flat beds and low bodies mounted on integral longitudinal members, channel or box section metal – not wood - must use both sides of all frame mounting brackets, see figure E74575
- Longitudinal members must be relieved at the front end if they are to contact the chassis frame top surface, to minimise stress concentrations; see figure E74575. However, it is preferable to mount the longitudinal onto the mounting brackets, with a clearance to the chassis frame top surface
- Each set of brackets must use 2 x M10 bolts grade 8.8 minimum
- The rear 2 sets of chassis frame mounting holes/locations should have a full bolt torque with 100% grip. The attachment to the remaining forward chassis frame holes/locations must be precisely located and retained, but allow some relative flexing between the subframe and chassis frame. For example, clamp control devices such as conical washer stacks or machine springs with self-locking fasteners
- Minimum floor heights will require wheel arch boxes to clear the rear tyres, see Vehicle Data sheets for relevant tyre jounce

Pedestal mounted low or dropside bodies – (not illustrated)

For bodies or equipment not exceeding the standard or Regular Production Order chassis frame length.

For flat beds and low bodies raised above the maximum 'jounced' tyre position to obtain an uninterrupted flat floor surface see vehicle data sheets.

- Fore and aft longitudinal bracing must be added between the rearmost 2 cross members only
- All chassis frame mounting holes/locations must always be used
- All chassis frame mounting bracket fastenings must have a full bolt torque with 100% friction grip

5.15.7 Water Tank on Camper Vehicles

NOTE: It is recommended that a decal or label is fitted adjacent to the filler aperture identifying the correct fluid to be used, for example: 'Water only' for water tanks.

Abc = BEV Only Abc = ICE Only

48V Battery Pack 138

A

About this Manual 9
About this Publication 8
Accessory Drive 83
Acoustic Vehicle Alerting System (AVAS) 210
Acoustic Vehicle Alerting System 13
Adaptive Cruise Control 207
Adding Connectors 245
Additional External Lamps 197
Additional Internal Lamps 203
Additional Lighting for Rear of Vehicle Interior 203
Additional Loads and Charging Systems 153
Additional Vehicle Signals/Features 216
AHUs 188
Aids for Vehicle Entry and Exit 39
Airbags 300
Airbag Supplemental Restraint System (SRS) 300
Air Flow Restrictions 82
Alternative Type Approval 12
Alternator Characteristics 136
Ancillary Equipment - Subframe Mounting 313
Anti-Lock Control — Stability Assist 79
Audio Head Unit - Multimedia ICE Pack Summary 186
Automatic Transmission 89
Auto Wipe and Auto Lamp with large overhangs 217
Auxiliary Fuse Panel (A526) 225
Auxiliary Heater Systems 82
Auxiliary Switches 233

B

Battery Configurations 148
Battery Monitoring Sensor (BMS) 153
Battery Options 147
Battery Protection 156
Battery Rules 148
Battery Systems 141
Beacon Preparation Pack (A606) 231
Blind Spot Information System 208
Body 256
Body Closures 292
Body Control Module (BCM) 127
Body Structures - General Information 256
Boron Steel Parts 258
B Pillar No Drill Zone 302
Brake Hoses General 79
Brake System 79

C

CAD Models 10
Calibration and Tachograph Retrofitting 184
Camper Central Connectors 221
CAN-Bus System Description and Interface 123
Cellular Phone 194
Central Locking 211
Centre of Gravity Height Calculation 61
Centre of Gravity Height Test Procedure 59
Centre of Gravity Position 58
Changing Vehicle Speed Maximum Setting 180
Charge Balance Guidelines 135
Charge Balance Guidelines 140
Chassis Cab 267
Chassis Cab Body for Diesel and E-Transit 50
Circuit Diagrams 135
Circuit Diagrams 140
Climate Control System 170
Clutch 90
Colour Coded Content 8
Commercial and Legal Aspects 11
Communications Network 123
Compliance and Vehicle Type Approval 12
Connected HMI Radio/with DAB 189
Connected Touch Radio/with DAB 190
Connector Pin Out Practices 106
Contact Corrosion 307
Contact Information 15
Conversion Effects on Parking Aids 39
Conversion Homologation 25
Conversion Type - Reference Tables 21
Conversion Type 17
Converter Fit Additional Third Party Batteries 150
Cooling 100
Corrosion Prevention 307
Cranking and Warm Cranking 174
Cruise Control 207
Customer Connection Points (CCP) 218

D

Diesel Particulate Filter (DPF) 92
Door Mirrors 296
Door Removal or Modification 211
DPF and RPM Speed Control 180
Drilling and Welding 13
Driver Field of View 39
Driver Reach Zones 39
Driveshaft 78
Dropside Bodies 281

E

E-Transit BEV Vehicles 33
Electrical Architecture Changes 104
Electrical Connectors and Connections 218
Electrically Operated Door Mirrors 196
Electrical System Overview 104
Electric Drive Assembly 100
Electrics for Tow Bar 117
Electromagnetic Compatibility (EMC) 26
Electromagnetic Compatibility (EMC) Awareness 107
Electronic Engine Controls 174
Emergency Call Systems 204
Emissions Performance & In-Service Compliance 11
End of Life Vehicle (ELV) Directive 28
Engine 80
Engine Cooling 82
Engine RPM Speed Controller (A003) 176
Engine Selection for Conversions 80
Engine Types 81
EV Charging 102
EV Training 8
Exhaust Heat Shields 92
Exhaust Pipes and Supports 92
Exhaust System 92
Extended Chassis Frame 311
Extensions and Optional Exhausts 92
Exterior Lighting 195

F

Fabricless Front Swivel Seats 298
Floor Precautionary Drill Zones: DieselVans 259
Ford Programmable Battery Guard GEN2 (A540) 162
Formulas 61
Frame and Body Mounting 308
Frame Drilling and Tube Reinforcing 313
Front, Rear and Side Under-Run Protection 39
Front Climate Control System 170
Front End Accessory Drives (FEAD) 83
Front End Body Panels 289
Front End Integrity 280
Front Suspension 75

Front Windscreen Camera 209
Fuel System 94
Fuses 214
Fuses and Relays 214

G
General Component Package Guidelines 39
General Product Safety Requirement 12
General Wiring and Routing 106
Glass, Frames and Mechanisms 299
Grounding 107
Grounding 247
Ground Points 247
Guidelines When Converting Vehicles 143

H
Handles, Locks, Latches and Entry Systems 211
Hardware 57
Heated Seats 298
Heated Windscreen and Heated Rear Window 299
High Current Supply and Ground Connections 143
High Current Supply and Ground Connections 220
High Spec Vehicle Interface Connector (A608) 235
High Voltage Battery 101
High Voltage Health & Safety Precautions 97
High Voltage System & Electrified Drivetrain 97
High Voltage System Overview 99
High Voltage Vehicle Systems 13
Horn 173
How to Use This Manual 9
HV System De-Energising 100
Hydraulic Brake - Front and Rear Brakes 79
Hydraulic Lifting Equipment 282

I
ICE (Diesel) Vehicles 31
Important Safety Instructions 9
Information and Entertainment System 186
Instrument Panel Cluster (IPC) 172
Integrated Bodies and Conversions 265
Interior Lighting 203
Interior Lights and 12V Sockets 156
Interior Trim 295
Introduction 9

J
Jacking 29
Jacking Kit 77

K
Kerb Mass Data 79

L
Lamps for Wide Vehicles 196
Lamps – Front and Rear Fog Lamps 195
Lamps – Hazard / Direction Indication 196
Legal Obligations and Liabilities 12
Legislation 182
Lifting 31
Lighting Loads 195
Load Compartment Interior Lining 295
Load Compartment Tie Downs 288
Load Distribution 58
Load Distribution 58
Loadspace 288
LV Charging System (12 V) 131
LV Charging System Layout 131

M
Manual Transmission 91
MHEV 48V System Operation and Description 137
Mild Hybrid Charging System 137
Minimum Requirements for Braking System 13
Mounting Points and Tubing 308

N
No Drill/No Weld Zones - BEV 263
Noise, Vibration and Harshness (NVH) 36
Non Standard Rear Chassis Frame Extension 311

O
Operator Commanded Regeneration (A660) 93
Order Codes 17

P
Package and Ergonomics 39
Painting Road Wheels 307
Painting Road Wheels 77
Parking Brake 79
Partitions (Bulkhead) - on Van, Bus 289
Permitted Antenna Locations 26
Plywood Lining/Cladding 295
Polymer Bulkhead 291
Power and Connectivity Usage Recommendations 141
Power Connections 156
Power for Additional External Lamps 196
Power Take Off (PTO) 78
Precautionary Drill Zones - Cable Grounding 113
Precautionary Drill Zones - Chassis Grounding 115
Precautionary Drill Zones -HV Cables 110
Precautionary Drill Zones - HV Modules LV Cables 112
Precautionary Drill Zones — Rear Cargo Area 116
Prevention of Squeaks and Rattles 107
Product Liability 13
Programmable CAN Interface Module (PCIM) 242
Pro Power Onboard Chassis Cab 246

R
Racking Systems 286
Rear and Side Windows 299
Rear Climate Control System 171
Rear Seat Fixing Positions 298
Rear Suspension 76
Rear View Camera 192
Rear View Mirrors 296
Recommended Main Load Area Dimensions 44
Relays 215
Relocation of GNSS/4G Antenna 204
Remote Keyless EntryTPMS Receiver 212
Repairing Damaged Paint 307
Restraints System 13
Retrofitting a Digital Tachograph 182
Retrofitting a FPBG 166
Reversing Lamps 195
Road Safety 13
Roof 304
Roof Cut Out - Camper Based Vehicles Only 304
Roof Racks and Load Carriers 305
Roof Ventilation 304

S
SBG and Load Shedding - Functionality 159
Seat Belt Reminder 303
Seatbelts 302
Seatbelt Systems 302
Seats 297
Security, Anti-Theft and Locking System 292
Self-Supporting Body Structure 310
Side Marker Lamps 202
Single and Twin Battery Systems 153

Abc = BEV Only Abc = ICE Only

Skeletal Chassis for Camper and Non Camper 277
Skeletal Chassis for Camper Body, Diesel Engines 55
Skeletal Chassis for Non Camper Body 53
Sliding Door Gap Reduction on M1 Vehicles 292
Smart Charging Override 138
Smart Regenerative Charging (SRC) 133
Spare Wheel 77
Speakers 193
Special Conversions 216
Special Vehicle Options (SVO) Harnesses & Kits 216
Springs and Spring Mounting 75
Springs and Spring Mounting 76
SRC Override 133
Standard Battery Guard and Load-Shedding 156
Start-Stop 174
Sub-Entry Radio 188
Suspension System 74
SYNC Radio and SYNC Radio with DAB 191
System Operation - Smart Charging (SC) 138

T

Tachograph 181
Tachograph and DSRC Harness Mounting 182
Tank and Dry Bulk Carriers 281
Terminology 11
Test Functionality 134
Third Button on Key Fob 212
Third Party High Power Mode 133
Third Party High Power Mode 138
Tipper Bodies 281
Tow Bar Requirements 63
Tow Bar Types (AUS and NZL spec vehicles) 69
Tow Bar Types (for EU specification vehicles) 63
Towing 63
Trailer Tow Connectivity 120
Trailer Tow Electrics (A055) 117
Tyre Manufacturers 77
Tyre Pressure Monitoring System (TPMS) 77
Tyre Repair Kit 77

U

Under Body Protection and Material 307
Unused Connectors 107
Utility Vehicle Switch Pack (A626) 232

V

Van 297
Vehicle Dimensions Key 43
Vehicle Duty Cycle Guidelines 27
Vehicle Electrical Capacity 140
Vehicle Exhaust Systems — Vans with Bulkheads 93
Vehicle Interface Connector 223
Vehicle Ride and Handling Attributes 27
Vehicles with Roof Mounted Units 50
Vehicle Transportation Aids and Vehicle Storage 37

W

Warranty on Ford Vehicles 11
Water Leakage Prevention 107
Water Tank on Camper Vehicles 313
Welding 257
Wheel Clearance 77
Wheels and Tyres 77
Whole Vehicle Type Approval Regulations 11
Windowed Van 297
Windscreen Wipers 215
Wiring Harness Information 106
Wiring Installation and Routing Guides 106
Wiring Specification 108
Wiring Splicing Procedures 107
Wiring through Sheet Metal 109
WLTP Calculation Inputs 40
WLTP Test Procedures 11

Abc = BEV Only Abc = ICE Only