FORD **Transit Connect North America** 2019
Body and Equipment Mounting Manual

Date of Publication: 09/2018

1 General Information

2 Chassis

3 Powertrain

4 Electrical

5 Body and Paint

1.1 About this Publication

This Body and Equipment Mounting Manual (BEMM) is the latest publication for the 2019 Transit Connect. This BEMM comprises Stage 6/EU6 emissions powertrains, powertrain systems and further revised vehicle systems. It is recommended to review this manual in full. The BEMM is a live document which can be viewed on www.fleet.ford.com/truckbbas. It is the vehicle modifiers responsibility to review the online version for the most current information prior to starting any modification.

This BEMM has been updated since the last publication dated 06/2018 for consistency, alignment and layout. Also the following sections have been updated:

Refer to: 4.16 Handles, Locks, Latches and Entry Systems (page 76).
Caution for Third Party control system added.

Refer to: 5.8 Glass, Frames and Mechanisms (page 94).
Updated retrofit guidelines

If you require further help or information please go to the Body Builders Advisory Service, https://www.fleet.ford.com/truckbbas, or please contact bbasqa@ford.com

1.2 About this Manual

1.2.1 Introduction

This manual has been written in a format that is designed to meet the needs of Vehicle Modifiers. 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 modifying vehicles.

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

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

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

If you require further help or information please go to the Body Builders Advisory Service, https://www.fleet.ford.com/truckbbas, or please contact bbasqa@ford.com

1.2.2 How to Use This Manual

This manual covers vehicle modification 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 for printed manuals.

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

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

1.2.3 Important Safety Instructions

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

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

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

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

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

1.2.4 Supplemental Information

For further information please go to the Body Builders Advisory Service, https://fordbbas.com/, or email bbasqa@ford.com

1.3 Commercial and Legal Aspects

1.3.1 Legal Obligations and Liabilities

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

1.3.2 General Product Safety Requirement

The Vehicle Modifier shall ensure that any vehicle it places on the market complies with all F/CMVSS standards.

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

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

WARNINGS:

Do not exceed the Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), Gross Axle Weight Rating (GAWR), Front Gross Axle Weight Rating (FGAWR), Rear Gross Axle Weight Rating (RGAWR) or trailer ratings.

Do not change the tire size or load rating.

Do not modify the steering system.

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

Do not modify or remove heat protection shields.

Do not remove labels provided with the base vehicle. Ensure appropriate visibility.

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

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

NOTE: For further information please contact the Body Builders Advisory Service at https://fordbbas.com/

Refer to: 1.4 Contact Information (page 8).

1.3.3 Restraints System

WARNINGS:

Modifications to the restraints system are not allowed.

Airbags are explosive. For safe removal and storage during modification please follow the procedures in the Ford Workshop Manual.

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

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

For additional information:

Refer to: 5.9 Airbag Supplemental Restraint System (SRS) (page 95).

1.3.4 Drilling and Welding

WARNING: Do not drill or weld Boron steel parts, see figure E172290 in the welding section of this manual.

Refer to: 5.1 Body (page 81).

1.3.5 Minimum Requirements for Brake System

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

- Maintain original settings
- Maintain brake certification load distribution

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

1.3.6 Road Safety

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

1.4 Contact Information

As a manufacturer, we want to provide you with the information you need for your vehicle modification. If the information you require is not in this manual or you have further questions, please contact Ford Body Builders Advisory Service at https://fordbbas.com/, telephone 877-840-4338 or email bbasqa@ford.com

1.5 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 3.9" (100mm) from any electronic modules and airbags.

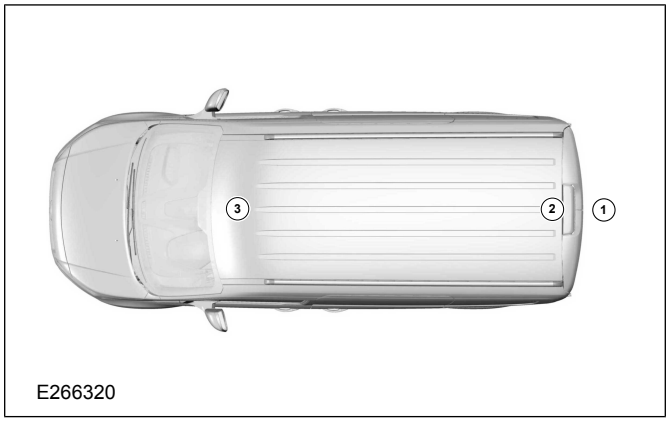
NOTE: Radio Frequency (RF) transmitter equipment (for example: cellular telephones, amateur radio transmitters) may only be fitted to your vehicle if they comply with the parameters shown in the following 'Frequency Overview' table. There are no special provisions or conditions for installations or use.

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

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

1.5.1 Permitted Antenna Locations



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Item	Description
1	Antenna Location 1
2	Antenna Location 2
3	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.

1.6 Vehicle Duty Cycle Guidelines

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@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 Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), Gross Axle Weight Rating (GAWR), Front Gross Axle Weight Rating (FGAWR), Rear Gross Axle Weight Rating (RGAWR) and payload of the base vehicle to match the customer requirements.

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

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

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

1.6.1 Modification Impact on Fuel Economy and Performance

Any modification may affect the fuel consumption and performance depending on the aerodynamics and the weight added by the modification. It is advisable to control the weight, but without deteriorating other vehicle attributes and functions (especially those related to safety and durability).

1.6.2 Vehicle Ride and Handling Attributes

CAUTION: Do not exceed the Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR), Gross Axle Weight Rating (GAWR), Front Gross Axle Weight Rating (FGAWR), Rear Gross Axle Weight Rating (RGAWR) or trailer rating limits.

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

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

1.7 Noise, Vibration and Harshness (NVH)

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

CAUTION: The travel and function of pedals must not be restricted.

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

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

1.8 Vehicle Transportation Aids and Vehicle Storage

CAUTIONS:

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

In addition:

- The windshield wipers should be lifted off the glass and set right up
- All air intakes should be closed
- Increase normal tire pressure by 7.25Psi
- The hand brake system should not be used
- Apply suitable wheel chock 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 Modifiers 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 to be disconnected, but not removed from the vehicle
- The wiper blades should be removed and placed inside the vehicle. Make sure the wiper arms are suitably prevented from resting on the windshield
- Wheel trims (where fitted) 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
- Make sure that all windows, doors, hood, 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 regularly while a vehicle is not in use. Where a battery is left below its optimum charge level for any length of time, it may result in premature failure of the battery.

Action / Time in Storage	Monthly	Every 3 Months
Check vehicle is clean	X	-
Remove external contamination	X	-
Check battery condition — Recharge if necessary	X	-
Visually check tires	X	-
Check interior for condensation	-	X
Run engine for 5 minutes minimum with air conditioning switched on, where applicable	-	X

Refer to: 4.4 Battery and Cables (page 53).

1.9 Package and Ergonomics

1.9.1 General Component Package Guidelines

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

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

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

1.9.2 Driver Reach Zones

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

1.9.3 Driver Field of View

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

1.9.4 Modification Impact on Parking Aids

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

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

Refer to: 4.11 Exterior Lighting (page 71).

1.9.5 Aids for Vehicle Entry and Exit

Steps

WARNINGS:

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

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

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

Where additional steps or running boards are installed the required ground clearance line is to be maintained.

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

1.9.6 Vehicle Dimensions

Transit Connect is available in 2Wheelbases:

- Regular Wheelbase
- Long Wheelbase

If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

1.9.7 Front, Rear and Side Under-run Protection

WARNING: Check local legislation for legal requirements.

1.10 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	41	54	53	72
M12	68	92	93	126
M14	113	153	148	201
M16	170.0	230	233	316

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

1.11 Load Distribution

1.11.1 Load Distribution

WARNINGS:

Overloading of the vehicle could result in unacceptable ground clearance.

The center of mass of the payload should be located within the wheelbase of the vehicle.

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

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

Avoid one-sided load distribution.

CAUTIONS:

Do not exceed the axle plated weights.

Do not exceed the gross vehicle weight.

If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

1.11.2 Center of Gravity Position

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

Do not raise the center of gravity beyond specified limits or the vehicle may become unstable and dangerous.

Lateral Position

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

Lateral Center 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).

For any lateral position information please refer to the IVM.

Vertical Position - Center of Gravity Height

The Center 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 Steiner's theorem.

The Center of Gravity Height influences axle weights while braking. Center of Gravity height influences roll stability.

1.11.3 Center of Gravity Height Test Procedure

Measurement

Vehicle Center of Gravity calculation is required to determine compliance with F/CMVSS 105 Brakes and F/CMVSS 126 Electronic Stability Control. Maximum allowable Vertical Center of Gravity values for these standards can be found in the Incomplete Vehicle Manual: https://fordbbas.com/

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

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

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

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

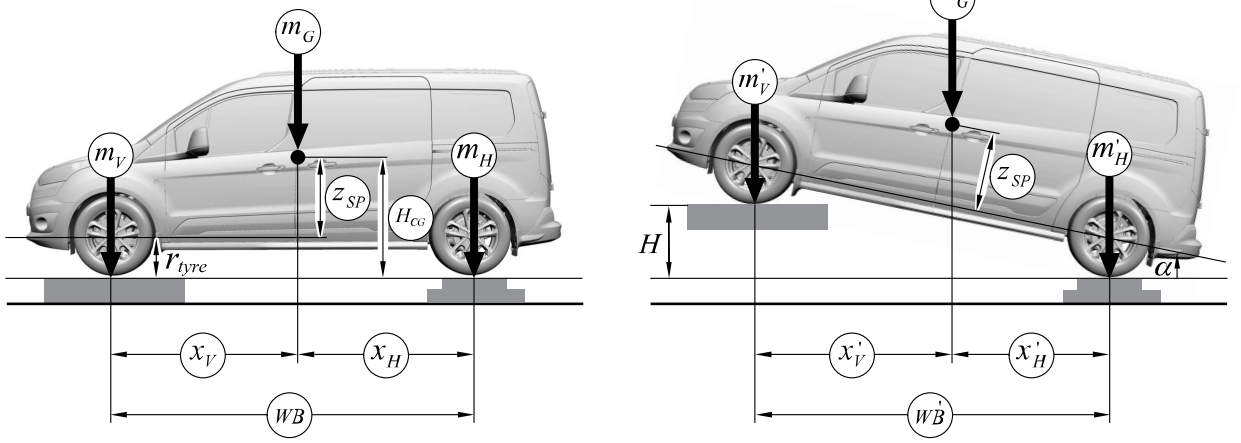
- Fix wheel travel, for example: solid shocks, or spring fixes
- Increase tire pressure to maximum allowed value
- It is important to remove all load, for example moving items, from the car or it should be properly fixed
- Doors should be closed

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

Calculation

In order to estimate the resulting Center 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 should be repeated, with the rear end lifted.



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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			
Center of Gravity Height $_Z$- H_{CG}		mm			

Inclination Angle:

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

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Ancillary and Center of Gravity Height z:

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

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

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1.11.4 Center of Gravity Height Calculation (based on wheel center height)

Given or measured parameter	
Wheelbase	WB
Front axle weight	m_V
Rear axle weight	m_H
Front height	H

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

1.11.5 Formulas

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

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

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

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

E146626

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

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

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

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

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

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The following equations apply:

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

$$x_{H2} = \frac{x_H'}{\cos\alpha}$$

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

E146629

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

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

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

or

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

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1.12 Towing

1.12.1 Tow Hitch

NOTE: There is no wiring provisions for Trailer Tow operations provided on the base vehicle.

If planning to tow with a vehicle, the Trailer Tow Package (53T) should be ordered.

If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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

2.1 Suspension System

WARNINGS:

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

Interchangeability (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: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@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 or anti-roll bars, springs or shock absorbers including mounting brackets.

Interchangeability (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 splatter.

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 manufactures requirements.

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

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

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

2.3 Rear Suspension

2.3.1 Springs and Spring Mounting

WARNING: 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 splatter.

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 manufactures requirements.

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

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

NOTE: Do not add any additional axles.

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

2.4 Wheels and Tires

2.4.1 Wheel Clearance

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

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

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

2.4.2 Tire Pressure Monitoring System (TPMS)

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

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

NOTE: If fitting new tires, ensure that the TPMS sensors are fitted correctly. 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: 4.16 Handles, Locks, Latches and Entry Systems (page 76).


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2.4.3 Spare Wheel

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

2.4.4 Temporary Mobility Kit

Your vehicle may not have a spare tire. Therefore you will have a temporary mobility kit which will only repair one damaged tire. The kit is located in the left-hand side of the rear luggage compartment.

2.4.5 Painting Road Wheels

CAUTION: Do not paint wheel clamp surfaces in contact with brake drum or disc, hub and holes, or surfaces under wheel nuts. Any further treatment in these areas may affect the wheel clamp performance and the vehicle safety.

Mask the wheel when changing the color or repairing paint.

2.5 Brake System

2.5.1 General

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

Brakes are certified to F/CMVSS 105 on completed vehicles. Guidance for complying with F/CMVSS 105 on incomplete vehicles is provided in the Incomplete Vehicle Manual.

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

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

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

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

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

2.5.2 Brake Hoses General

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

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

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

2.5.3 Parking Brake

WARNINGS:

Do not modify the brakes.

Do not splice into the parking brake cable.

2.5.4 Hydraulic Brake—Front and Rear Brakes

WARNINGS:

Do not modify the brakes.

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

2.5.5 Anti-Lock Control — Stability Assist

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

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

CAUTION: Make sure to follow the equipment suppliers instructions for safety, warranty and sometimes legal compliance.

3.1.1 Engine Selection for Modifications

The Vehicle Modifier is responsible for specifying the correct emissions engine to the latest Regulations depending on the completed vehicle category (N1/M1) and weight.

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

3.1.2 Engine Types

2.0L GDi 110kW (150PS) Gasoline Engine - Automatic Powershift Transmission (This engine is optionally available as E-85 capable)

Item	Description
Max Power kW/rpm	110kW (150PS) at 6200 rpm
Max Torque ft-lbs/rpm	144ft-lbs at 4500 rpm

2.5L Duratec 125kW (170PS) Gasoline Engine - Automatic Powershift Transmission

Item	Description
Max Power kW/rpm	125kW (170PS) at 6000 rpm
Max Torque ft-lbs/rpm	171ft-lbs at 4500 rpm

1.5L EcoBlue 88.2kW (120PS) Diesel Engine - Automatic Powershift Transmission

Item	Description
Max Power kW/rpm	88.2kW (120PS) at 3600 rpm
Max Torque ft-lbs/rpm	199ft-lbs at 1750-2500 rpm

3.2 Engine Cooling

3.2.1 Auxiliary Heater Systems

WARNINGS:

If additional engine coolant is required, refer to Adding Engine Coolant in the Maintenance and Specifications section of the Ford Workshop Manual.

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 by more than 10%.

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

- The coolant tube routing must be below the minimum line of the degas bottle
- The 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
- The hose must be heat sleeved with appropriate material if within 3.9" (100mm) of the 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 hood inner and outer (assembly) panels at design position shall not be less than 0.6" (15mm)
- There must be a minimum clearance of 0.4" (10mm) between the engine assembly and flexible components (for example, hoses or wiring harnesses) affixed to the front end sheet metal hardware, under a maximum engine torque roll condition

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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: 5.12 Corrosion Prevention (page 99).

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

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 the under hood environment is about 266ºF (130ºC) when selecting appropriate materials.

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@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 manufacturers recommended (or equivalent specification) components.**
- **Make sure that the ancillary pulley diameter is less than the crankshaft pulley diameter.**
- **FEAD shields must be maintained at all times. If shields are removed 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 FEAD system from STONE ingress and also protect people from rotating parts under Start-Stop function.

NOTE: Do not pull the engine appearance cover forward or sideways to remove. Failure to press straight upward on the underside of the cover at the attachment points may result in damage to the cover or engine components.

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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.

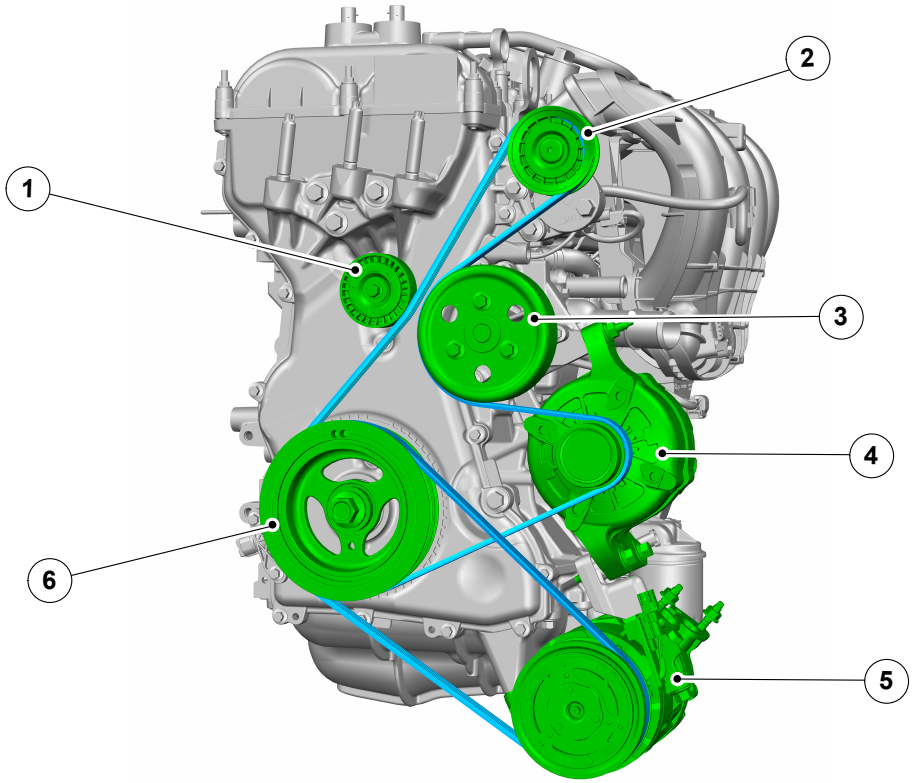
- **CAUTION: Do not fit an additional FEAD to a vehicle already equipped with an air conditioning compressor.**

When engineering and installing a new front end accessory drive, i.e. belt drive of the crankshaft pulley, the longitudinal alignment must be within ± 0.01" (0.25mm) and angular within ± 0.33º. For more information please refer to the workshop manual.

For most FEAD applications the longer, standard option, air-conditioning belt can replace the standard belt and pulley layout.

The maximum power that is available for FEAD applications at any engine speed is 6kW (in lieu of the 26Nm air conditioning compressor). If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

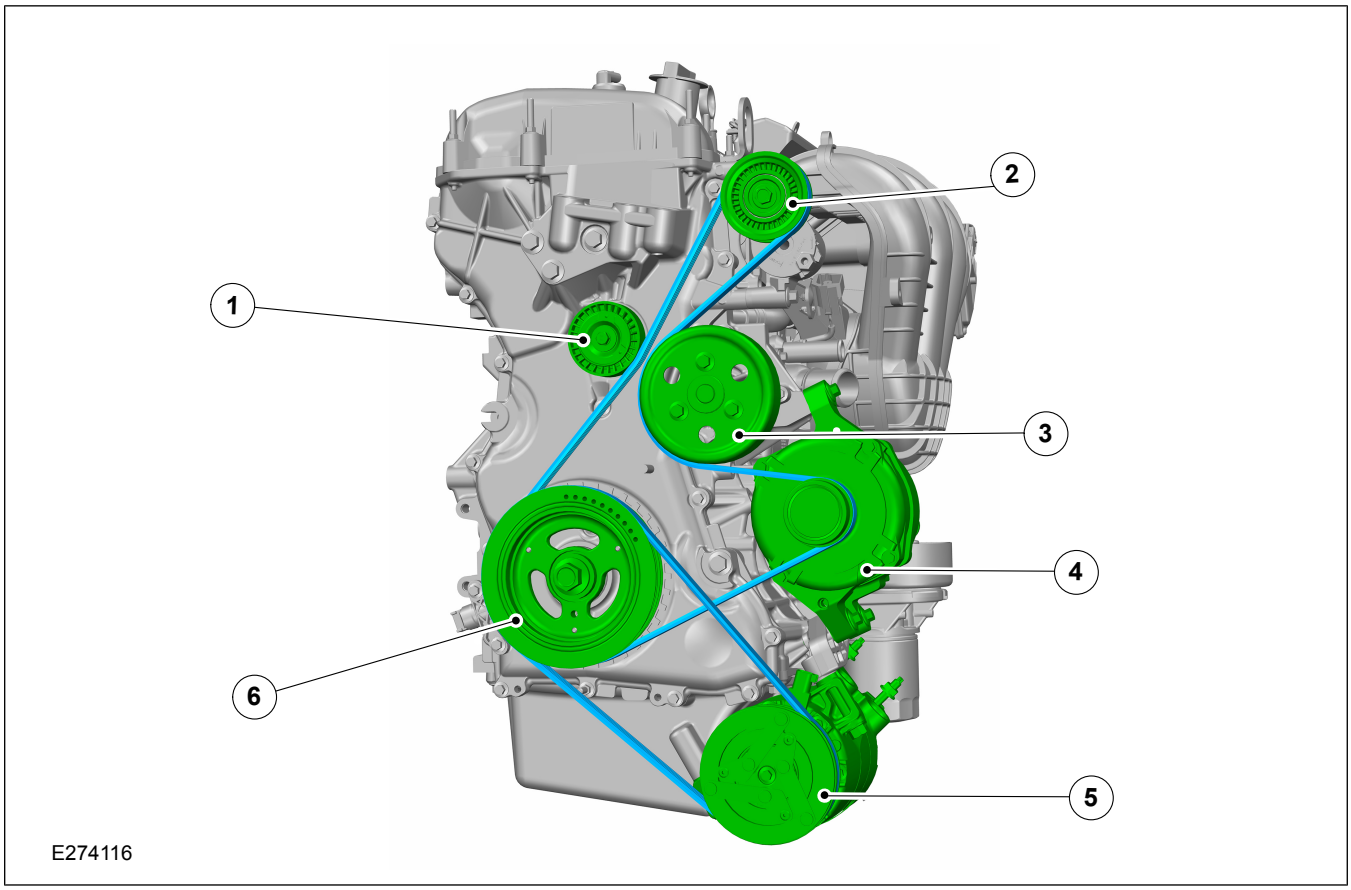
FWD 2.0L GDi Gasoline Engine



FEAD Layout FWD 2.0L GDi Gasoline Engine

Item	Description
1	Idler Pulley
2	Tensioner
3	Water pump Pulley
4	Alternator Pulley
5	Air conditioner Pulley
6	Crank damper Pulley

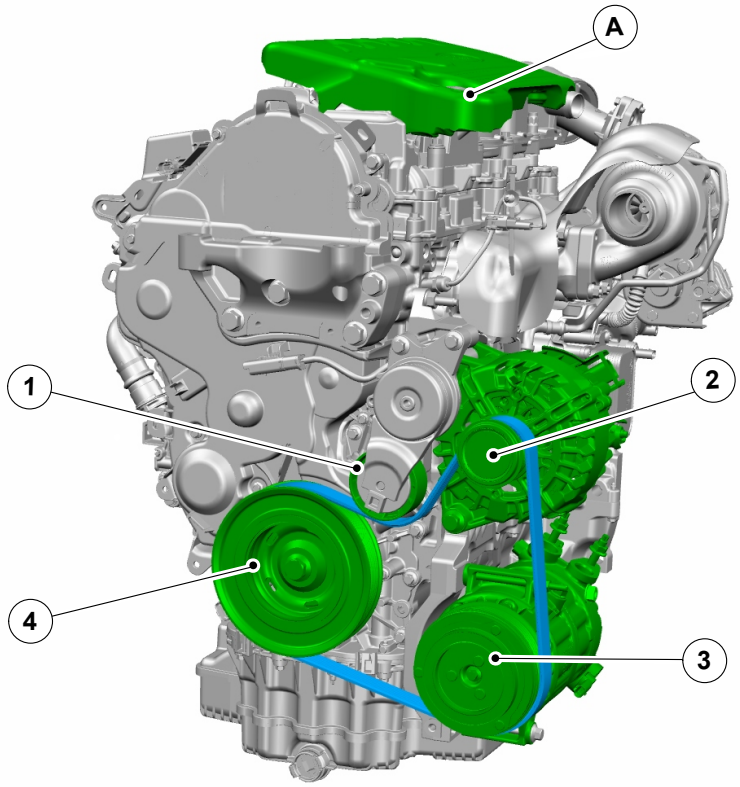
FWD 2.5L Duratec 125kW (170PS) Gasoline Engine - with Air Conditioning



FEAD Layout FWD 2.5L Duratec 125kW (170PS) Gasoline Engine - with Air Conditioning

Item	Description
1	Idler Pulley
2	Tensioner
3	Water pump Pulley
4	Alternator Pulley
5	Air conditioner Pulley
6	Crank damper Pulley

FWD 1.5L EcoBlue Diesel Engine - with Air Conditioning



FEAD Layout FWD 1.5L Diesel Engine - with Air Conditioning

Item	Description
1	Tensioner
2	Alternator Pulley
3	Air Conditioner Compressor Pulley
4	Crankshaft Pulley
A	Engine Top Cover

3.4 Automatic Transmission

Front Wheel Drive (FWD) vehicles

WARNINGS:

Do not reroute external transmission gear shift cables.

Mechanical tachographs cannot be fitted into 8F35 transmissions.

Do not change external electrical connectors.

8F35 - 8 Speed Automatic FWD Transmission, 1.5L EcoBlue Engine / 2.0L GDi Engine

Gears	Base Transmission Ratio	Overall Ratios
		Final Drive 3.805
1st	4.689	17.842
2nd	3.306	12.579
3rd	3.012	11.461
4th	1.923	7.317
5th	1.446	5.502
6th	1	3.805
7th	0.747	2.842
8th	0.617	2.348
Reverse	-2.96	-11.263

6F35 - 6 Speed Automatic FWD Transmission, 2.5L Duratec Engine

Gears	Base Transmission Ratio	Overall Ratios
		Final Drive 3.210
1st	4.584	14.715
2nd	2.964	9.514
3rd	1.912	6.138
4th	1.446	4.642
5th	1.000	3.210
6th	0.746	2.395
Reverse	2.943	-9.447

3.5 Exhaust System

3.5.1 Extensions and Optional Exhausts

WARNINGS:

Do not modify the Selective Catalytic Reduction system (SCR), nor the location and orientation of its sensors. Any after-treatment devices (Gasoline and Diesel Particulate Filter/Catalyst/SCR) must not be relocated or permanently removed.

When modifying the exhaust routing, length or location of the exhaust tailpipe, ensure that no exhaust gas ingresses into the cabin or the cargo area. Use suitable measuring equipment to verify no exhaust gas ingresses.

CAUTIONS:

Non-standard systems must be tested for engine back pressure and all legal compliance (noise and emissions). Any modifications to exhaust systems with GPF/DPF after treatment devices must maintain the same backpressure as the unmodified exhaust system.

Make sure that for any pipes that require bending, the radius of the bend is minimum 2.5 x tube diameter.

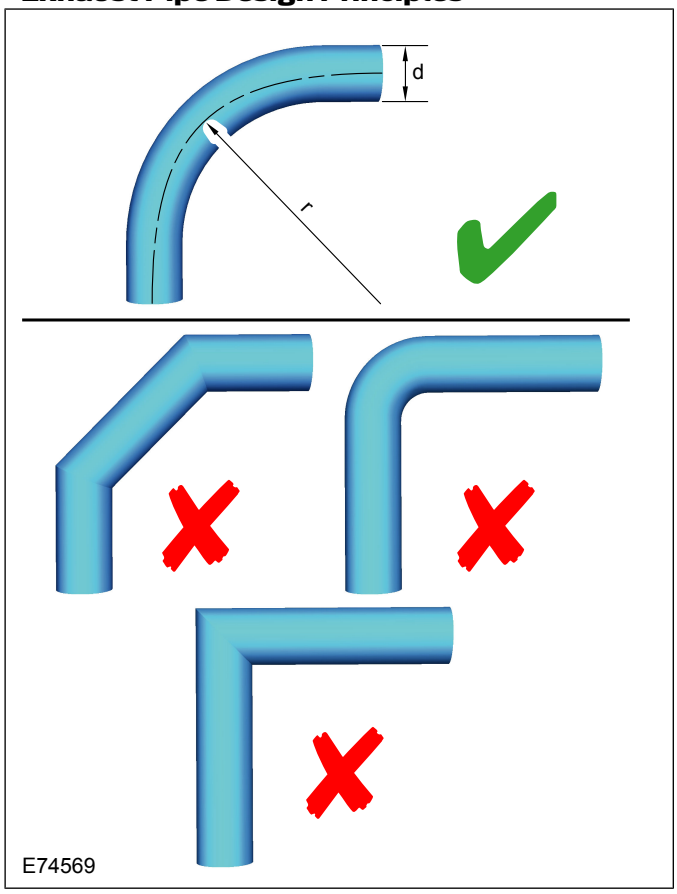
Make sure that sufficient clearance is maintained for all driving conditions to all hot and moving components.

Take preventative measures to insure welding spatter does not damage the after-treatment substrate integrity when welding or cutting pipes.

In case of revising the exhaust routing, provide sufficient number of exhaust hangers and adequate locations to support the exhaust system. Any modifications to the exhaust hanging system must allow for thermal growth. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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

3.5.2 Exhaust Pipes and Supports

CAUTIONS:

Do not position/route exhaust components/tailpipes underneath fuel fill locations

Maintain the original set-up and heat shields.

Do not position any components closer than 5.9" nominal (150mm), 3.9"minimum (100mm) clearance to the downpipe, the catalytic converter, the gasoline and diesel particulate filter and any part of the exhaust system.

3.5.3 Exhaust Heat Shields

Exhaust Heat Shields

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

Standard Exhaust Heat Shields

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

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

3.5.4 Diesel Particulate Filter (DPF)

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

Regeneration

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

Unlike a normal filter which requires periodic replacement, the DPF has been designed to regenerate, or clean itself to maintain operating efficiency. The regeneration process takes place automatically.

If your journeys meet one of the following conditions:

- You drive only short distances
- You frequently switch the ignition on and off
- Your journeys contain a high level of acceleration and deceleration

However, some driving conditions mean that you may need to carry out occasional trips with the following conditions to assist the regeneration process:

- Drive your vehicle in more favorable conditions, which you will find at higher vehicle speeds in normal driving, on a main road or freeway for a minimum of 20 minutes. This drive may include short stops that will not affect the regeneration process
- Avoid prolonged idling and always observe speed limits and road conditions
- Do not switch off the ignition
- Select a suitable gear to ideally maintain engine speed between 1500 and 3000 RPM

3.6 Fuel System

WARNINGS:

Do not cut into the original fuel supply lines.

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

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

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

For Precautionary Drill Zones:

Refer to: 5.1 Body (page 81).

4.1 Wiring Installation and Routing Guides

4.1.1 Wiring Harness Information

NOTE: For additional information and recommendations on materials and equipment for interfacing to the Ford systems, power and grounds, please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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.

The following provides an installation guide for modifications 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 Modifier must test their installation and ensure the design and function complies with all legal and homologation requirements.

4.1.2 General Wiring and Routing

Temperature requirements: Wiring systems in the vehicle interior are expected to function over the temperature ranges of -40°F to 185°F (– 40°C to 85 °C) for exposure and -40°F to 167°F (– 40°C to 75°C) for function. For engine compartment and underbody, the minimum temperature is - 40°F (-40°C), while the maximum exposure and operational temperatures are 257°F (125°C) for exposure and 221°F (105°C) for operational.

Make sure that the insulation is compatible with any fluids it may encounter, for example: gasoline, 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 0.6" (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 11.8" (300mm).

A minimum 1" (25mm) clearance is recommended from all sharp edges and a minimum 1.4" (35mm) clearance of all moving parts of the parking brake assembly. If these clearances cannot be met, protect the wires with a convolute.

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

4.1.3 Connector Pin Out Practices

When designing a harness-to-component connection, it is best practice to put the female terminals in the harness side and the male terminals in the component side. When determining connector pin outs, make sure that Power ad Ground terminals are not in close proximity. A minimum separation of 0.2" (5mm) between Power and Ground circuits is required.

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

CAUTION: Only use Ford approved connectors

Cutting into vehicle wiring is not recommended because of:

- Long term risk of a fault developing in the connection
- The potential risk of fire from over-loading

All connections into existing wiring must be permanently insulated. Exterior connections must be water-proof.

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 Grounds 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

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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.

4.1.4 Unused Connectors

The Ford installed harnesses may have a number of unused connectors. These are present so that during production of the vehicle one harness design can accommodate several trim levels. For example, the harness may have connectors for heated seats, but the vehicle trim level does not call for heated seats.

Ford recommends you **do not** use these connectors for any other purpose than that which they are designed for.

4.1.5 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 eyelets or crimp terminals per Ground stud. For high current applications

  Refer to: 4.4 Battery and Cables (page 53).
- Do not place electrical component attachments or ground nuts adjacent to vehicle fuel tanks or fuel lines

4.1.6 Prevention of Squeaks and Rattles

Wiring should be positively retained/ supported every 5.91 to 9.84" (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.

4.1.7 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.

4.1.8 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 robustness improvement to the splice joint, the splice should be sealed with a suitable heat shrink tubing. See graphic E131081.

4.1.9 Wiring Specification

Current Rating of Wire Sizes

		Maximum Continuous current (A)	
Cross Sectional Area (mm²)	**mOhms/m@68°F**	**86°F**	**122°F**
0.35	54.4	7	4.9
0.5	37.1	11	7.7
0.75	24.7	14	9.8
1	18.5	19	13.5
1.5	12.7	24	17.0
2.5	7.6	32	22.7
4	4.71	42	29.8
6	3.14	54	38.3
10	1.82	73	51.8
16	1.16	98	69.6
25	0.743	129	91.6
35	0.527	158	112
50	0.368	198	140
70	0.259	245	174
95	0.196	292	207
120	0.153	344	244

NOTE: The maximum continuous current (A) values for 86°F to 122°F (30°C and 50°C) is a value below the maximum fuse rating allowed for the cable. This is because the fuse/cable system values at these temperatures are the continuous usage whereas the maximum fuse also needs to protect for high current short term loadings such as electric motors.

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.

4.1.10 Electromagnetic Compatibility (EMC) Awareness

The installation and routing of Ford wiring have been fully-validated and have 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.

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 it off existing looms or tubes.

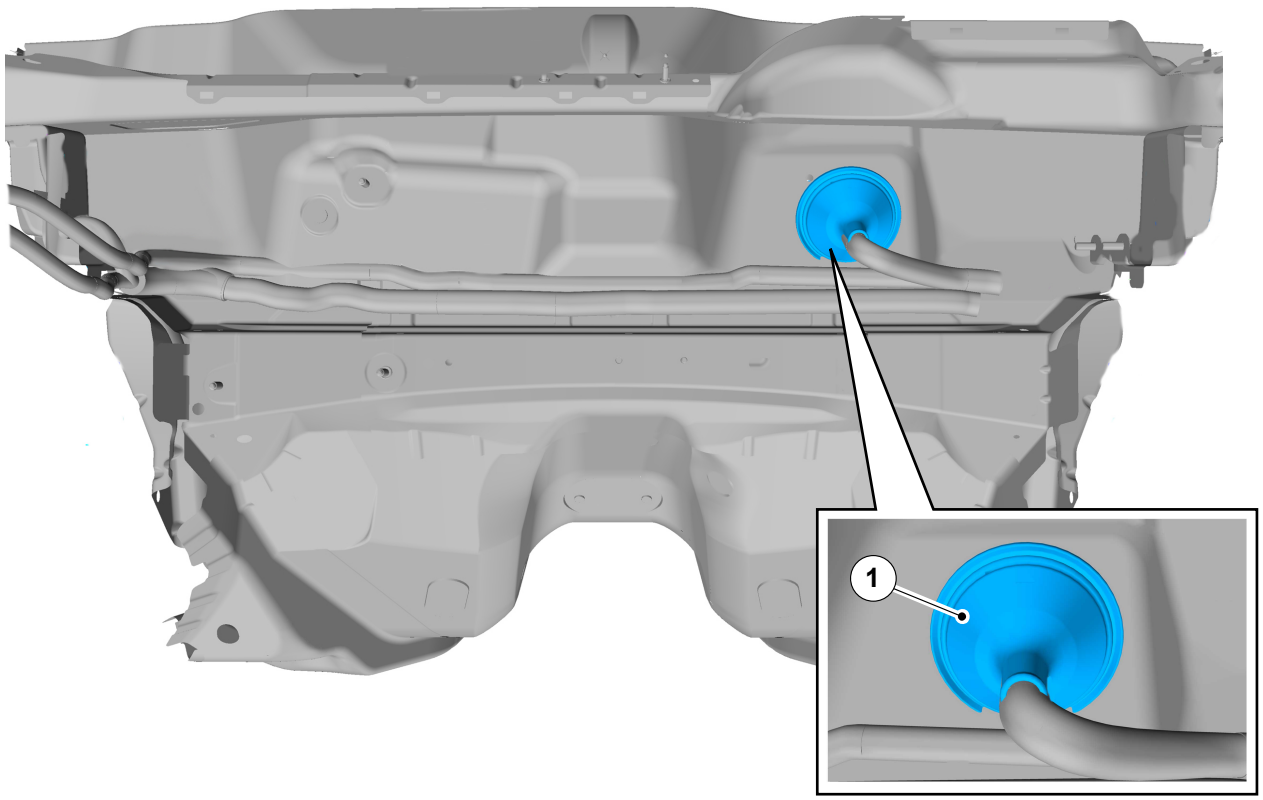
Wiring must be suitably fixed without any detrimental effect on other wiring.

Single or bunched looms must maintain the following clearances:

- 0.4" (10mm) from static components (unless clamped to it)
- 9.8" (250mm) from exhaust system
- 1.2" (30mm) from rotating or moving components

4.1.11 Wiring through Sheet Metal

Dash Panel (Right Hand Drive Shown)



E172549

Item	Description
1	Dash Grommet - Left Hand Drive symmetrical opposite

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 0.24" (6mm).

There is one location in the dash panel which have been identified for additional holes to route wires through. See figure E172549 (view from engine bay) for location.

The grommet in location 1, shown in figure E172549, is molded directly to wire bundles in polyurethane foam material. It is not possible to feed extra wires through with the wire bundle. The grommet has an 'indent' molded into the surface face, engine bay side, which show the position 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 0.98" (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.

4.1.12 Precautionary Drill Zones — Rear Cargo Area

The areas marked in blue on figures E266829, E266831 and E266834-E266839 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 wheel base with regards to 'B', 'C' and 'D' pillars or roof bows and doors. Other non-electrical systems may also be present, for example: the fuel tank under the floor, so it is important to check before drilling. For additional information refer to the following links:

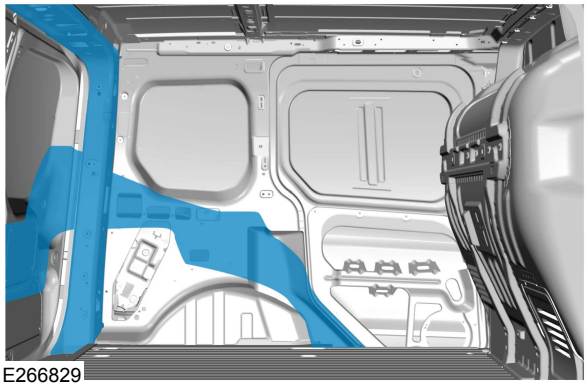
CAUTION: Do not drill into the vehicle before checking precautionary drill zones and electrical wire routing.

Refer to: 5.1 Body (page 81).
Precautionary Drill Zones - Under the Floor Tank
Refer to: 5.3 Loadspace (page 86).
Load Compartment Tie Downs
Refer to: 5.2 Racking Systems (page 84).
Refer to: 5.5 Body Closures (page 88).
Precautionary Drill Zones - Closures

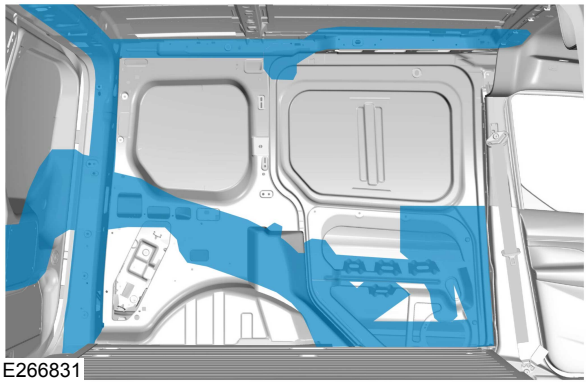
For Wheel Base and Roof Height dimensions:

Refer to: 1.2 About this Manual (page 6).

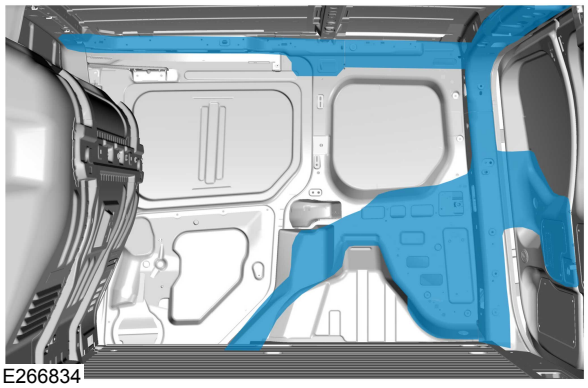
Van Rear Cargo Area (LHS)


E266829

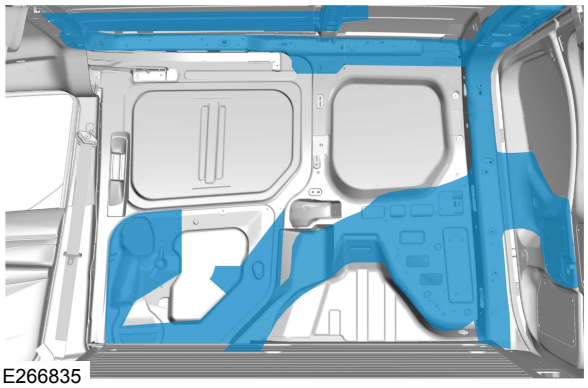
Wagon Rear Cargo Area (LHS)


E266831

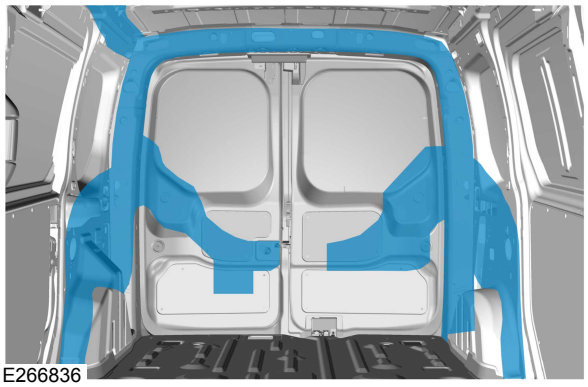
Van Rear Cargo Area (RHS)


E266834

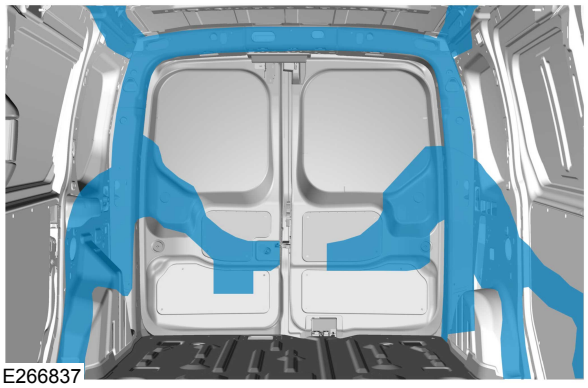
Wagon Rear Cargo Area (RHS)


E266835

Van Rear Cargo Area (Rear Cargo Doors)


E266836

Wagon Rear Cargo Area (Rear Cargo Doors)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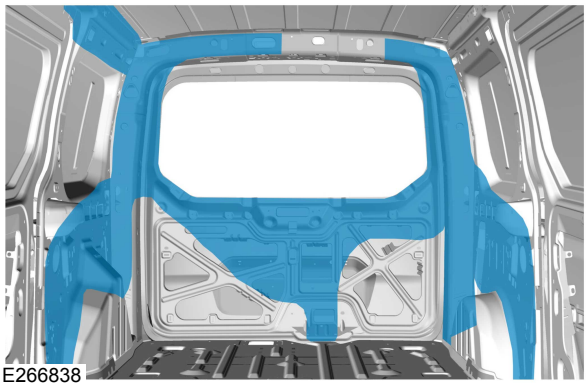
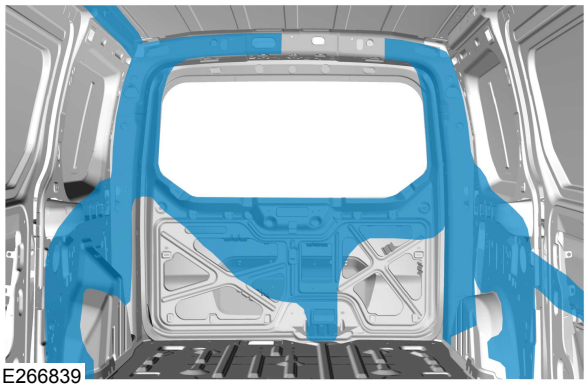
Van Rear Cargo Area (Lift Gate)



Wagon Rear Cargo Area (Lift Gate)



4.1.13 Electrics for Trailer Tow

CAUTION: Only use Ford approved connectors and harness service parts.

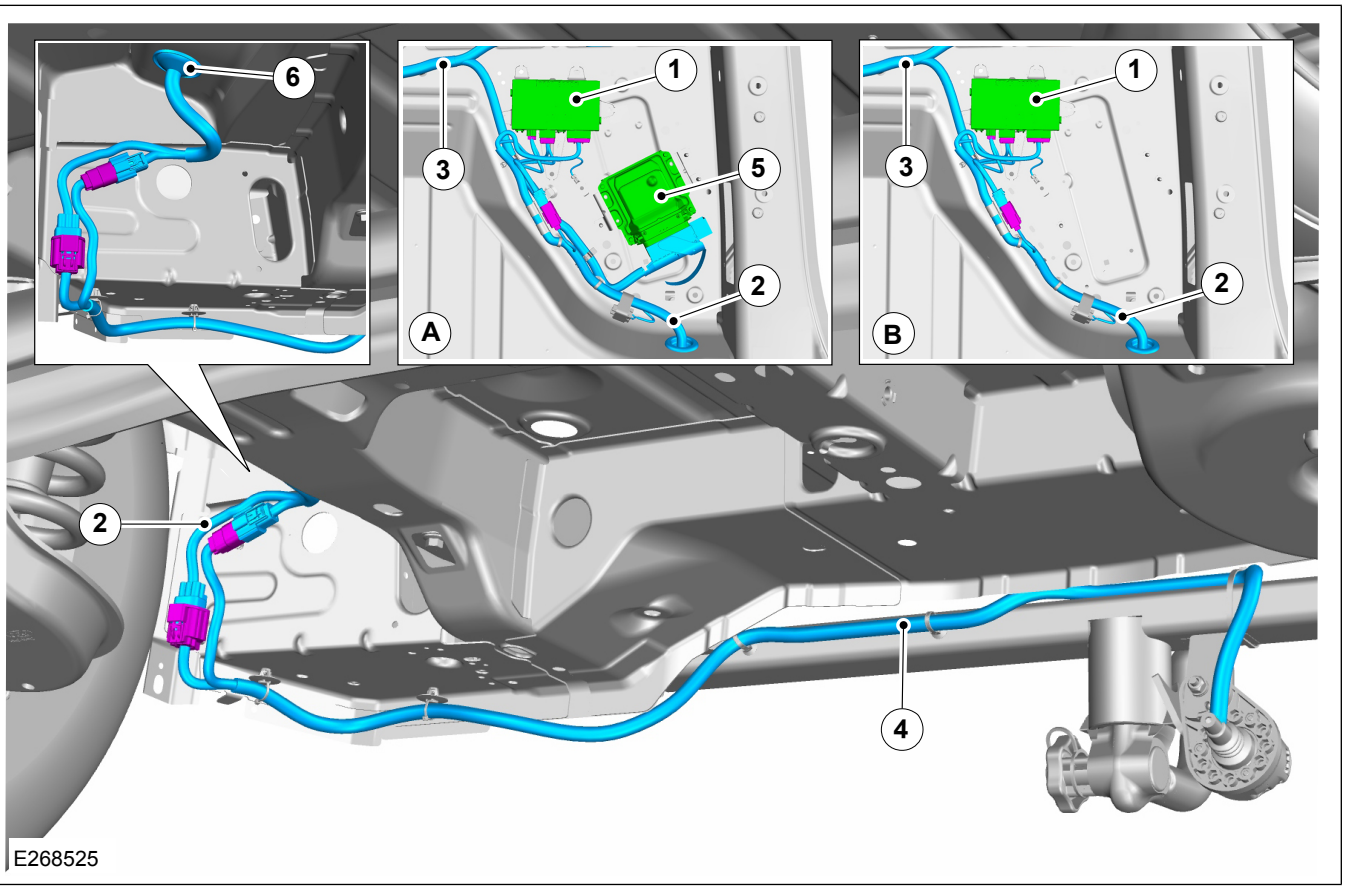
It is not recommended to cut into vehicle wiring because:

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

All connections into existing wiring must be permanently insulated. Exterior connections must be water-proof 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.

Trailer Tow Module and Harnesses



Item	Description
1	Trailer Tow Module
2	Trailer Tow Jumper
3	Main Harness
4	Trailer Tow Socket Jumper
5	Dosing Control unit (diesel vehicles only)
6	Grommet

The Trailer Tow 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 local Ford dealer.

Fitment of non-Ford trailer tow wiring is not advisable due to the Body Control Module control of lighting, and meeting legal lighting regulations. For details of a harness that connects to the base vehicle harness, please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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

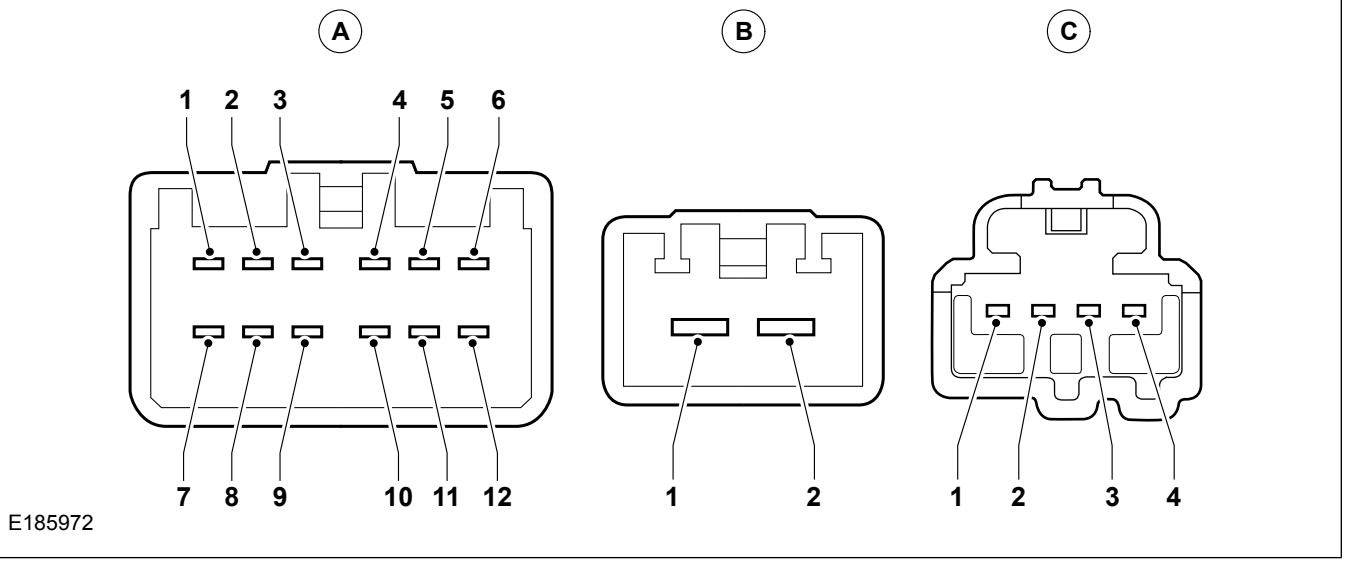
Each output driver could handle a maximum current as stated in next table, but it is not recommended to always run to this maximum. A higher current is interpreted as short circuit. If a short circuit is detected the related output will be switched off. The following table shows the recommended output maximums per circuit.

Trailer Tow Module Connectors (Figure E185972 and E268525)

Component Terminal Number	Feature	Current (A)		Voltage (V)	
		Min	Max	Min	Max
Connector A					
1	Left Turn Lamp	2.1	3.4	8	19
2	Right Turn Lamp	2.1	3.4	8	19
3	Position Lamp	5.3	8.6	8	19
4	Not used	-	-	-	-
5	Reverse Lamp	3.1	5.0	8	19
6	Battery Charge	15	15	8	19
7	Stop Lamp	3.1	5.0	8	19
8	Rear Fog Lamp	1.7	2.2	8	19
9	Not used	-	-	-	-
10	Not used	-	-	-	-
11	Not used	-	-	-	-
12	Not used	-	-	-	-
Connector B					
1	B+	17.4	27.6	8	19
2	Battery Charge Feed	15	15	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	Not Used	-	-	-	-

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

Trailer Tow Module Connectors



The Trailer Tow Lighting Module (TTLM) offers a battery charge output. This output is used for loading a trailer battery with a maximum parameter current of 15A. If the current exceeds 15A the output is switched off until the current drain goes below 15A. The voltage used to charge this battery is designed to maintain current charge up to 15A 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: 15A
- Switch on condition:
  - Power Mode > = Accessory_1
  - - Total power consumption (all lamps + battery charge) < 30A
  - - Permanent battery charge output current <= 15A
  - 9V < Trailer Tow Module (TTM) power supply voltage < 16V
- Short circuit detection: 30A

If trailer tow system is to be added, the correct wiring and module needs to be ordered. The vehicle needs to have Central Car Configuration (CCC) programmed to the correct parameters:

CCC Parameter 20

- 0x1 without trailer tow
- 0x5 with trailer tow

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**: 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.

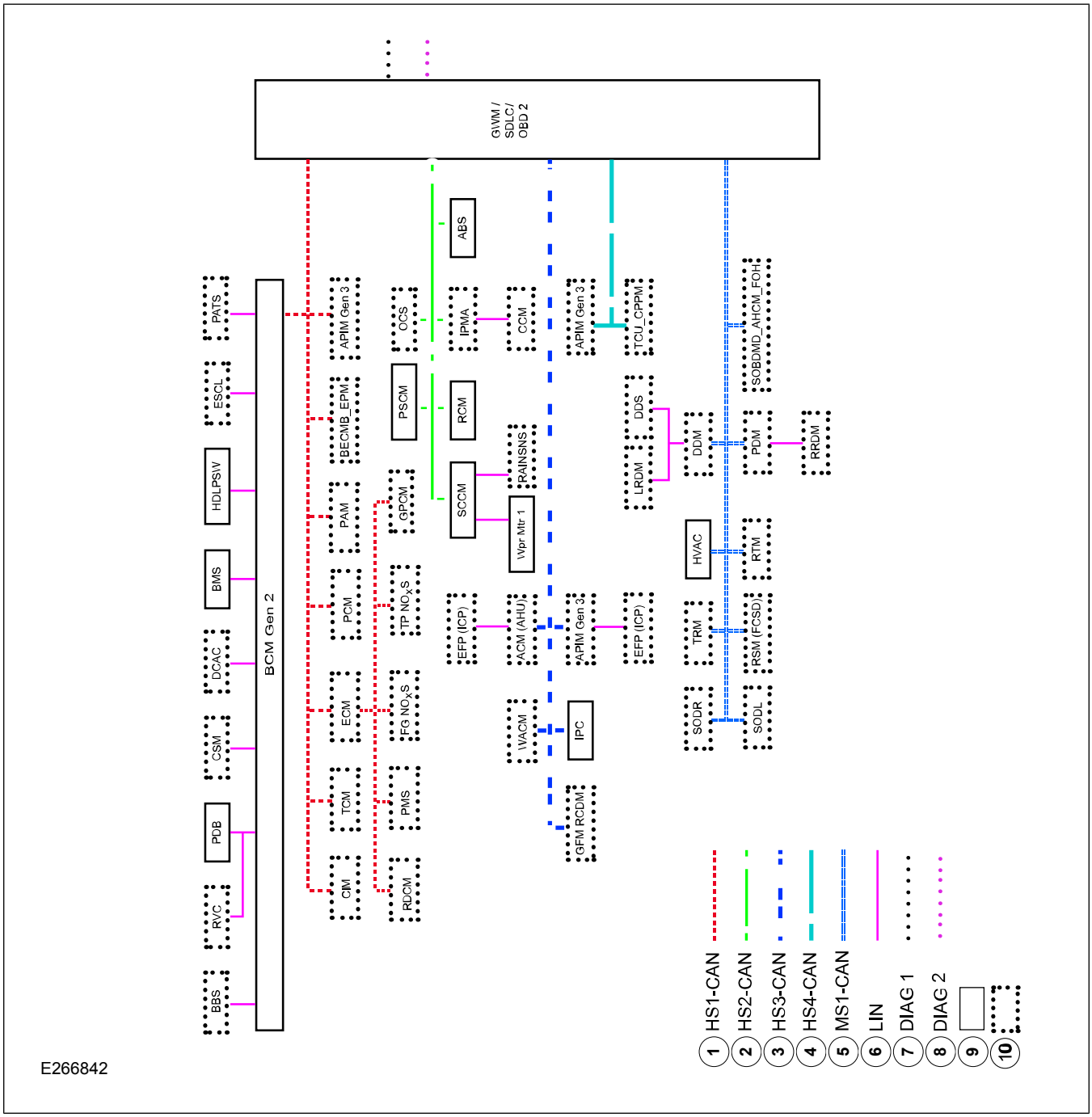
4.2 Communications Network

4.2.1 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 proprietary message sets to communicate between the devices shown, via Medium Speed (MS), High Speed (HS). In addition there is localized application of Local Interconnect Network (LIN)

CAN-Bus System



Communication Network System (Figure E266842 references)

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	High Speed 1 - CAN	HDLPSW	Headlamp Switch
2	High Speed 2 - CAN	HVAC	Heating, Ventilating and Air Conditioning
3	High Speed 3 - CAN	IPC	Instrument Panel Cluster
4	High Speed 4 - CAN (Present if TCU is present)	IPMA	Image processing Module A (Front View Camera System)(6)
5	Medium Speed CAN	LRDM	Left Rear Door Module
6	Local Interconnect Network (Regardless of actual power mode, all LIN nodes are represented as ISN as Netcom does not track them.)	OCS	Occupant Classification System Module
7	Diagnostic Channel 1	PAM	Parking Aid Module(4)
8	Diagnostic Channel 2	PATS	Passive Anti-Theft System (8)
9	Standard	PCM	Powertrain control module(2)(3)
10	Optional	PDB	Power Distribution Box
ABS	Anti-Lock Brake System Control Module	PDM	Passenger Front Door Module
ACM	Audio Control Module	PMS	Particle Monitor System(1)
APIM	Auxiliary Protocol Interface Module (Sync Gen3)	PSCM	Power Steering Control Module
BBS	Battery Backed-up Sounder	RAINSNS	Rain Sensor Module
BCM	Body Control Module(5)	RCM	Restraints Control Module
BECMB_EPM	Battery Energy Control Module "B" (Extended Power Module)	RDCM	Reductant Dosing Control Module(1)
BMS	Battery Management System	RRDM	Right Rear Door Module
CIM	Converter Interface Module	RSM (FCSD)	Remote Start Module
CCM	Cruise Control Module(6)	RTM	Radio Transceiver Module
CSM	Combined Sensor Module	RVC	Rear View Camera
DCAC	Power Inverter (Direct current - Alternating Current)	SCCM	Steering Column Control Module
DDM	Drivers Front Door Module	SOBDMD_AHCM_FOH	Secondary On Board Diagnostic Control Module - Auxiliary Heater Module - Fuel Operated Heater
DDS	Drivers Door Switch Pack	SODL	Side Obstacle Detection Left
ECM	Engine Control Module(1)(3)	SODR	Side Obstacle Detection Right
EFP (ICP)	Electronic Finisher Panel(7)	TCM	Transmission Control Module(1)
ESCL	Electric Steering Column Lock	TCU_CPPM	Telematics Control Unit (Cell Phone Passport Module)
FG NO_x_S	Feed Gas Nitrogen Oxide Sensor(1)	TP NO_x_S	Tail Pipe Nitrogen Oxide Sensor(1)
GFM_RCDM	Generic Function Module - Remote Compact Disc Module	TRM	Trailer Module (Trailer Tow)
GPCM	Glow Plug Control Module(1)	WACM	Wireless Accessory Charging Module
GWM	Gateway Module	Wpr Mtr 1	Wiper Motor 1

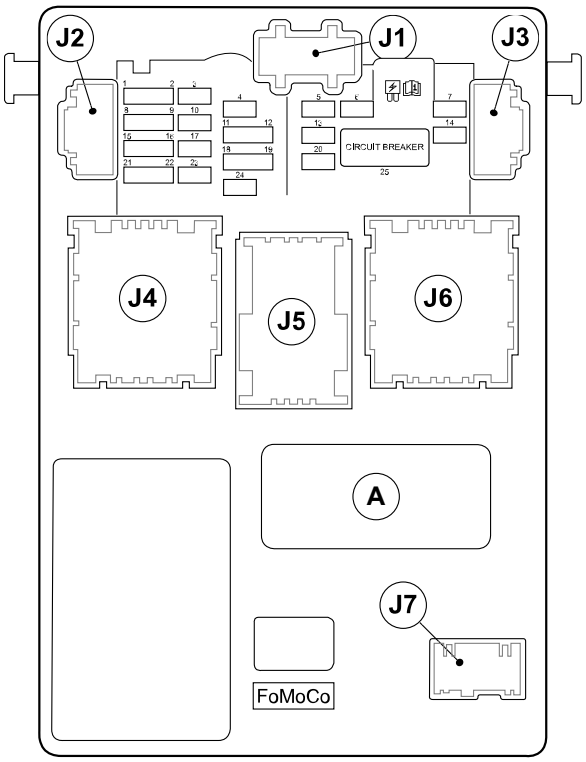
HS1 - CAN and HS2-CAN will not be available at the OBD 2 connector. DIAG 1/2 will only allow Diagnostic messages to flow through.

The SDLC is a termination node for all network legs.

[1] = Diesel specific (standard for diesel). [2] = Gas specific. [3] = Network management type must be verified by the program as this varies depending on PCM family. [4] = Gen 2 BCM only. [5] = BCM slave LIN node organization will be dictated by BCM Hardware Specification, not architecture specification. [6] = Private CAN configuration only used on vehicles with PCA and/or ACC. [7] = ICP will be LIN slave to Audio Head Unit when APIM is not present. [8] = Present for keyed vehicles. Not present for PEPS vehicles.

4.2.2 Body Control Module (BCM)

BCM - as viewed in-car position



E267579

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 Functionality

Functionality	
Alarms	Heated Rear Screen
Battery Management	High Beam
Brake Fluid Level	Interior Motion Sensor
Brake Lamps	Keyholder/Ignition
Brake Transmission Shift Interlock (Automatic Transmission)	Lift Gate Opening
Central Lock Indication LED	License Plate Lamps
Central Lock Supply	LIN Communication (PATS, RAINSNS, CSM,RVC, BMS, Steering column Lock, HDLPSW, Power Inverter, BBS & PDB)
Central Unlock supply	Low Beam
Climate Control	Main Beam
Clutch Position	Operational Mode Management (Factory, Transport, Normal)
Courtesy Lamps / Interior Lights	Park Brake Warning
Crash Signal	Park Lamps
Daytime Running Lamps	Power Sunblind
Delayed Accessory Mode	Power Door Dead Locks (Double Lock)
Dipped Beam	Rear Fog Lamps
Direction Indicators and Hazard Lights	Rear Wiper
Driver Unlock Supply	Reversing Lamps
Engine Run Signal	Side Marker Lamps
Extended Power Mode	Start-Stop Button Indication LED
Front and Rear Screen Washer	Tire Pressure Monitoring
Front Fog Lamps	Taxi Odometer/Vehicle Speed Output
Front Wiper	Thatcham Category 1 Alarm - with volume sensing and perimeter alarm and BBS
Global Open/Close Window	Vehicle Horn
Heated Front Screen	Warnings and Chimes

BCM Output Information

Function	Component	Load Type	Max. Load	Overload Condition
IP/Switch Illumination	Digital Output High	NONE	0.2	Output Shutdown
IP/Switch Illumination	Digital Output High	LED	1	Output Shutdown
IP/Switch Illumination #2 (white)	Digital Output High	NONE	2	Output Shutdown
Door Lock Status (Indicator rear Driver)	Digital Output High	LED	0.06	Output Shutdown
Door Lock - All Lock	Relay High Output	Coil	16.2	Blown Fuse
Door Lock - All unlock	Relay High Output	Coil	16.8	Blown Fuse
Door Lock - Liftgate/Decklid release	Digital Output High	Coil	8.76	Output Shutdown
Door Lock - Driver Unlock	Relay High Output	Coil	10.8	Blown Fuse
Door Lock - Double Lock All Lock	Relay High Output	Coil	7.5	Blown Fuse
Door Lock - Rear Driver Side Child Lock	Relay High Output	Coil	4	Blown Fuse
Fog Lamps Front	Digital Output High	Bulb/LED	5.4	Output Shutdown
Fog Lamp Rear (Right or Common)	Digital Output High	Bulb	5.7	Output Shutdown
Wake Up PCM	Digital Output High	ECU	0.15	Output Shutdown
Wake Up PCM	Digital Output High	PCM	0.15	Output Shutdown
Beam High	Digital Output High	Bulb/Coil	6.2	Output Shutdown
Beam Low Right	Digital Output High	Bulb	6.2	Output Shutdown
Beam Low Left	Digital Output High	PCM	6.2	Output Shutdown
Turn Lamp Front	Digital Output High	Bulb	3.3	Output Shutdown
Turn Lamp Rear	Digital Output High	Bulb	2.9	Output Shutdown
Key Inhibit	Digital Output Low	Resistor	0.3	Output Shutdown
Brake Shift Interlock	Digital Output High	Coil	1	Output Shutdown
Wireless Charge Enable/Disable	Digital Output High	ECU	0.05	Output Shutdown
Stop/Turn (Inboard)	Digital Output Low	NONE	0.4085	Output Shutdown
Stop/Turn (Outboard)	Digital Output High	Bulb	3.1	Output Shutdown
Daytime running light	Digital Output High	Bulb/LED	3.1	Output Shutdown
Battery Saver	Digital Output High	Coil	0.84	Output Shutdown
Battery Saver	Digital Output High	Bulb	3.36	Output Shutdown
Battery Monitoring System Sensor (+)	Analog Output	NONE	0.02	Output Shutdown
Power Outlet Enable or Reset	Digital Output Low	Coil	0.344	Output Shutdown
Power Outlet Disable or Reset	Digital Output Low	NONE	0.344	Output Shutdown
Stop High Mount	Digital Output High	LED	0.5	Output Shutdown
Stop High Mount	Digital Output High	NONE	2.7	Output Shutdown
Park Front Right or Front/Rear Right	Digital Output High	Bulb	1	Output Shutdown

Function	Component	Load Type	Max. Load	Overload Condition
Park Front Left or Front/Rear Left	Digital Output High	Bulb	1	Output Shutdown
Park Rear	Digital Output High	Bulb	1	Output Shutdown
Park Lamps 1	Digital Output High	Bulb	1	Output Shutdown
Fuel Pump on	Digital Output High	PCM	0.045	Output Shutdown
Fuel Pump On/Off (+)	Digital Output Low	Coil	0.516	Output Shutdown
Electrical Steering column lock	Digital Output High	Coil	0.516	Output Shutdown
Load Management (Load Shed)	Digital Output Low	NONE	0.4085	Output Shutdown
Relay Horn	Digital Output Low	Coil	0.344	Output Shutdown
Run Accessory	Digital Output Low	Coil	0.4085	Output Shutdown
Trailer Tow Park Lamps	Digital Output Low	NONE	0.4085	Output Shutdown
Run Start	Digital Output Low	Coil	0.516	Output Shutdown
Ambient lighting	Digital Output High	NONE	1.85	Output Shutdown
Puddle Lamps (Kerb Illumination)	Digital Output High	NONE	2.9	Output Shutdown
Switch Keyless Keypad Illumination	Digital Output High	NONE	0.03	Output Shutdown
Interior/Courtesy Lamp dimming	Digital Output High	Bulb	2.9	Output Shutdown
Relay 3rd Row Seat (Enable)	Digital Output High	NONE	0.688	Output Shutdown
Brake Shift Interlock	Digital Output High	NONE	1	Output Shutdown
Power Window Global Set (+)	Digital Output Low	NONE	0.12	Output Shutdown
Vehicle Speed Output	Digital Output Low	Taxi Speed	0.1	Output Shutdown
Anti-theft/Security Horn	Relay High Output	Coil	5	Blown Fuse
Reverse Left or Common	Digital Output High	Bulb	6.2	Output Shutdown
Keyless Vehicle - Start/Stop run LED	Digital Output High	LED	0.045	Output Shutdown
Keyless Vehicle - Sounder	Digital Output High	NONE	0.07	Output Shutdown
Keyless Vehicle - Antenna Interior 1 Front (+)	Analog Output	Antenna (+)	0.33	Output Shutdown
Keyless Vehicle - Antenna Interior 1 Front (-)	Analog Output	Antenna (-)	0.33	Output Shutdown
Keyless Vehicle - Antenna Interior 2 Center (+)	Analog Output	Antenna (+)	0.33	Output Shutdown
Keyless Vehicle - Antenna Interior 2 Center (-)	Analog Output	Antenna (-)	0.33	Output Shutdown
Keyless Vehicle - Antenna Trunk Interior (+)	Analog Output	Antenna (+)	0.33	Output Shutdown
Keyless Vehicle - Antenna Trunk Interior (-)	Analog Output	Antenna (-)	0.33	Output Shutdown
Keyless Vehicle - Antenna Trunk Exterior (+)	Analog Output	NONE	0.33	Output Shutdown
Keyless Vehicle - Antenna Trunk Exterior (-)	Analog Output	NONE	0.33	Output Shutdown
Keyless Vehicle - Antenna Handle Driver (+)	Analog Output	Antenna (+)	0.33	Output Shutdown
Keyless Vehicle - Antenna Handle Driver (-)	Analog Output	Antenna (-)	0.33	Output Shutdown
Keyless Vehicle - Antenna Handle Passenger (+)	Analog Output	Antenna (+)	0.33	Output Shutdown
Keyless Vehicle - Antenna Handle Passenger (-)	Analog Output	Antenna (-)	0.33	Output Shutdown

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

Speed Signal Output

Signal Requirement	Speed Signal Output
Interface	Discrete Output
Functional Class	B
Input Voltage Range	Minimal= 9V, Nominal= 13.5V, Maximum = 16V
Input Current Range	Minimal= 0.9mA (10KOhm load @ 9V), Maximum = 16mA (10x10KOhm load @ 16V)
Inactive state	Voltage Battery (Active Low Driver with BCM Internal Pull-Up to PCB R/S Relay output)
Active State	GND
Shared Signal	Yes (external spliced to multiple loads)

The speed signal can be accessed in the BCM connector J6 Pin J6-60

BCM Fuse Overview

Fuse	Rate (A)	Function
1	5	Restraint Control Module
2	5	PTC (aux heater), Lane Departure Warning Switch Indicator, Manual Rear Temperature Control Module, Humidity Sensor, Headlamp Control Module (HCM) - non CAN, 4x4 Switch (E-locker Indicator), Forward Collision Warning Switch Indicator, Hill Descent Switch Indicator, Rear Heated Seat Module, Ignition Sense
3	10	Reverse Park Aid Module, Rear Heated Seat Module, Ignition Sense, SPARE Suspension Module (CCD), Extended Power Mode (EPM in body), HCM (EPM in Instrument panel), Reverse Park Aid Module (less EPM)
4	10	Ignition switch, Key Inhibit Solenoid, Push Button Start Switch
5	20	Central Lock
6	10	Ignition switch, Key Inhibit Solenoid, Push Button Start Switch, Compass
7	30	Radio Frequency Smart Window Motor, Radio Frequency Door Zone Module
8	5	Occupant Classification Sensor (OCS), Trailer Brake Controller, OCS (Less EPM), Reverse Park Aid Module (with EPM)
9	5	TCS (O/D cancel/Tow Haul/Grade Assist), Haptic device, Electrochromatic Mirror/Auto High Beams/ LDW (Image Processing Module) Module, CADS-3, 4x4 Module, Passenger Airbag Deactivation Indicator
10	10	EPM
11	5	Tracking/Blocking Module, TCU modem, Siren Control Module, Cell Phone Passport Module
12	5	CSM, Rear EATC (Electronic Automatic Temperature Control) Climate Control
13	15	Driver Unlock
14	30	Left Front Smart Window Motor, Left Front DZM
15	10	EPM (in Instrument panel), Headlamp Control Module (EPM in body)
16	10	Steering Angle Sensor Module (Adaptive Front Steering), Police 4 Function Module
17	15	Auxiliary Protocol Interface Module (MGM or SYNC), Multi-function Display, Integrated Control Panel, GPS, RF Transceiver Module, Clock, Center Gauge Module
18	7.5	Memory Seat Sw (Lumbar Motor), Driver Seat Module Logic, Seat Switches (LIN)
19	7.5	Tracking/Blocking Module, Headlamp Switch (LIN), TCU modem, Siren Control Module, Cell Phone Passport Module
20	10	Security Horn Relay
21	7.5	Electronic Control Panel (FCIM), Gear Shift Module, Electronic Control Panel
22	7.5	SCCM (Logic), Smart data link connector (gateway module), Logic Cluster
23	20	Audio Control Module, Active Noise Control, Remote CD Mechanism
24	20	Family Entertainment System, Police B+ Access Circuit Center Console
25	30	Left Front Power Window, Right Front Power Window, SPARE, Left Rear Power Window, Right Rear Power Window, Power Slide Rear Window

PTC= Positive Temperature Coefficient, CCD= Continuously Controlled Damping, TCS= Transmission Control Switch, CADS= Collision Avoidance Driver Support, TCU= Telematics Control Unit, GPS= Global Positioning System, FCIM= Front Control Interface Module

4.3 Charging System

4.3.1 General Information and Specific Warnings

The Transit Connect electrical system is a 12V supply with a negative ground return. The alternator and battery equipment used as standard are designed for normal operations with the type of engine fitted. Before installing additional electrical equipment check that the battery capacity, technology type, harness load capability, and alternator output are suitable for the extra load.

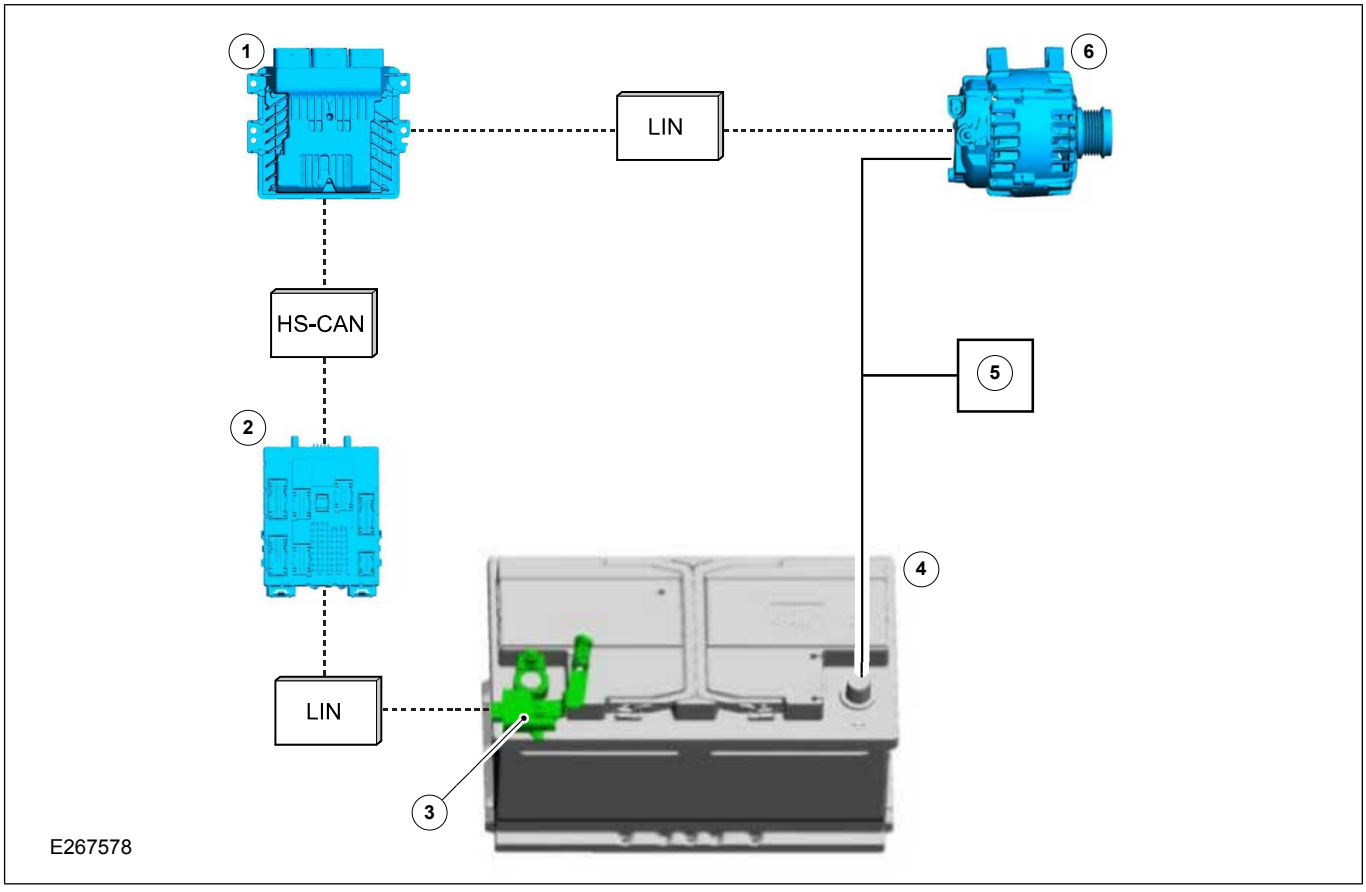
The battery capacity, technology and charge available from the alternator must be adequate to ensure engine cranking in unfavorable climatic conditions.

The Transit Connect utilizes 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 will invalidate any warranty.

Do not jump-start the vehicle directly from the battery. Use designated jump-start points. Refer to the Owner's Manual.

4.3.2 System Operation and Component Description

System Diagram



Item	Description
1	Power Control Module (PCM) or Engine Control Module (ECM)
2	Body Control Module (BCM)
3	Battery Monitoring Sensor (BMS) — Where fitted
4	Battery
5	Electrical consumers
6	Alternator

4.3.3 Electrical Modifications

WARNING: 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.

Operator requirements for additional and specialized electrical equipment varies. The Vehicle Modifier must, therefore, consider the following points when designing the installation:

- Legality and regulatory conformity of the base vehicle
- Drive-ability and serviceability of the base vehicle
- The effect of regulations governing the proposed modification including National Legislation in the country of sale
- The method of integrating the circuit into the base vehicle
- No additional circuits are to be run alongside the electrical circuits (shown in blue in figure E172551) associated with the Engine Management System (shown in green in figure E172551), due to the possible inductive or electrostatic coupling of electrical interference
- It is important to also read relative information on Start-Stop and SRC

  Refer to: 4.4 Battery and Cables (page 53).
- 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 Electromagnetic Compatibility (EMC) effect on the vehicle
- 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)
- The alternator and Engine Management System (EMS)- Also referred to as Powertrain Control Module (PCM) are interdependent
- The alternator is LIN controlled. It does not have a conventional D+ (engine start)signal line.

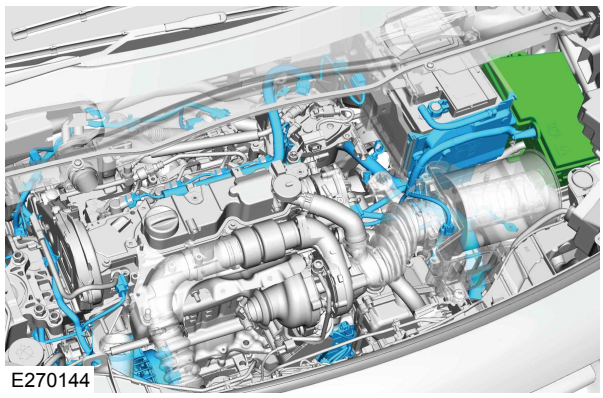
  Refer to: 4.8 Electronic Engine Controls (page 65).

Any second battery fitted should be isolated by a relay. If a Vehicle Modifier intends to add a second battery, please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

Refer to: 4.8 Electronic Engine Controls (page 65).

Additional added electrical loads should be connected to the body ground and not directly to the battery negative terminal. All additional electrical loads should be correctly fused.

Electrical Circuits Associated with Management System


E270144

4.3.4 Fitting Equipment Containing Electric Motors

WARNING: When electric motors are to be fitted, account must be taken of the potentially high in-rush currents that a motor can draw.

CAUTION: The following must be observed:

- All motors must be driven via relays with contacts rated at least 3 times the maximum rated current of the motor
- All motor 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 motors fitted should be fully suppressed to Government Regulations relating to Electromagnetic Compatibility to ensure electrical interference does not affect the vehicle systems
- Add EMC emissions statement to CE approval

4.3.5 Vehicle Electrical Capacity — Alternator

WARNING: Do not cut into the alternator wires. The alternator is LIN controlled. It does not have a conventional D+ (engine start) signal line.

4.3.6 Charge Balance Guidelines

Gasoline powered vehicles are fitted between 150A and 210A alternator depending on the vehicle configuration. Diesel powered vehicles can be fitted with alternators between 220A and 240A depending on the vehicle configuration. There is a label on the rear of the alternator showing the part number and size of the installed part.

Engine	150A Alternator	220A Alternator	240A Alternator
1.5L EcoBlue	-	O	O
2.0L GDi	O	-	-
2.5L Duratec	O	-	-

- = Not Available, O= Available Option

It is recommended to conduct a charge balance calculation in case the modification comprises a high number of electrical consumers or high electrical consumption is expected.

4.3.7 Circuit Diagrams

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

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

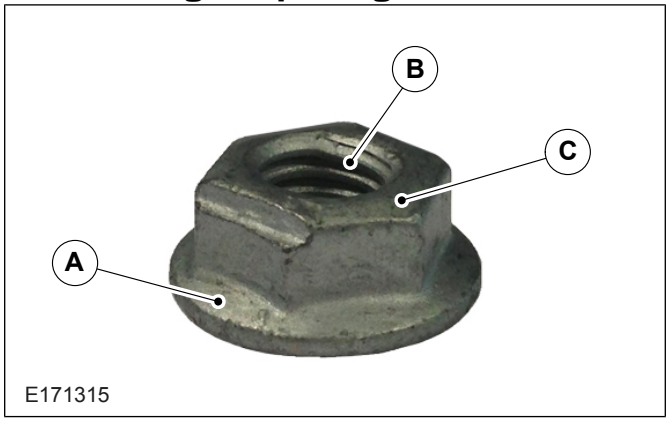
4.4.1 High Current Supply and Ground Connections

WARNINGS:

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

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

Self-Locking Crimp Hexagonal Nut



E171315

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

4.4.2 Battery Information

WARNINGS:

If serviceable batteries are fitted, it is essential that regular checks are made to determine that the electrolyte (acid) levels are correctly maintained. There is a level indicator in each cell.

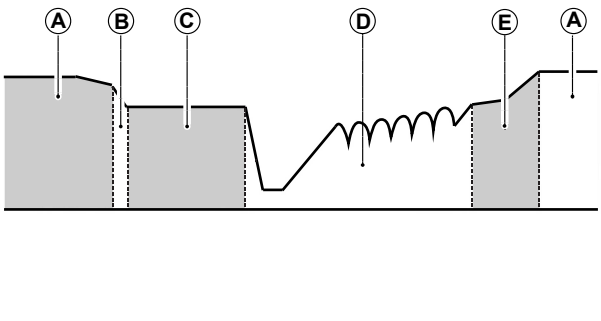
Take necessary safety precautions when handling batteries, for example: protective clothing, eye and hand protection.

Ensure batteries are charged in a designated charging area that is correctly ventilated.

NOTE: 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, see E242177.

NOTE: Make sure that the added key off loads do not exceed 5mA. If loads are likely to exceed 5mA, the Modifier should consider adding a split charge system. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

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 (alternator ramping up)

To add electrical loads at engine run is not recommended. This may exceed the alternator output capability particularly when using vehicle high power features such as air conditioner or heated screens.

Where a Battery Guard or equipment with low voltage disconnect is fitted, the following applies:

- For standard single or twin flooded batteries, the open circuit voltage should not be set below 12V
- For AGM technology, single or twin configuration, the open circuit voltage should not be set below 11.8V
- If the system is under load, a voltage drop will occur. For example, at 20A continuous load, the approximate voltage drop is 0.3V. Therefore the Battery Guard on or below this load could be set to 11.7V for standard flooded or 11.5V for AGM technology

- If continuous battery cycling is required (power at engine off), then AGM is recommended. See also 'Power and Connectivity usage recommendations' tables earlier in this section
- When setting the Battery Guard set point for a particular battery configuration, it is recommended to test that the vehicle will still start, factoring in low temperatures and an aged battery
- Equipment and the Battery Guard should also function and not disconnect above 15.3V as this is the normal voltage upper limit of the power supply. The guard is recommended to disconnect at around 16V as this is seen as the normal upper limit operating voltage. DCDC or voltage regulators may be required to protect sensitive third party equipment
- Third party equipment should not be damaged at 24V for up to 1 minute to protect for accidental connection of a second battery in series for jump start
- Low and high voltage transients will be experienced from cranking and load dump. Equipment is recommended to be robust against these voltages such as functionality preserved and no damage to the system

If added equipment or the vehicle usage profile requires deep discharge or cycling of the battery, High Performance Deep Cycle AGM is recommended. The option of the AGM battery should be ordered as a part of the base vehicle or can be fitted by our local Ford dealer (see section Replacing with High Performance AGM System). Note: Dealer support is required to update the central car configuration.

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

Battery Voltage Requirements and Testing

To maximize battery life, at the time of arrival at the Vehicle Modifier, all batteries must have a minimum Open Circuit Voltage (OCV) of not less than 12.5V. When the Closed Circuit Voltage (CCV) is applied, the voltage must not be less than 12.4V. This applies to any of the Ford battery technologies.

As part of the Modifier process, to maximize battery life and prevent premature failure of the Ford batteries, the Modifier should protect and prevent battery discharge during any modification 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. 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.

All voltages are to be measured with an accuracy of: ± 5% of values published using calibrated meters.

Customer Connection Point (CCP) or the battery plus terminal for positive connection and battery ground or battery minus terminal for negative connection.

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 headlamps 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.

Delayed Vehicles

Vehicles held at the Vehicle Modifier premises and 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 re-connected and the voltage re-checked. 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.

Refer to: 1.8 Vehicle Transportation Aids and Vehicle Storage (page 12).

Usage of Electrical Loads During Modification

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

Refer to: 1.8 Vehicle Transportation Aids and Vehicle Storage (page 12).

Battery Charging Procedure

WARNING: Do not connect to any Ground or +12 volt potential points other than that specified in the Owner's Manual. There is a dedicated charge point under the hood. Failure to comply may lead to high current paths that may damage peripherals and Electronic Control Unit's (ECU) especially in a jump start condition.

1. Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm up to at least 41ºF (5ºC) before charging. This may require 4 to 8 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 manufacturers instructions for the charger, for use of the dead battery/boost charge mode.

Battery Cable Fixing Torque

For vehicles without Battery Monitorying Sensor (BMS) the battery cables should be fixed to the terminal positive and negative posts with a torque of 9.0 Nm ± 1.4 Nm.

For vehicles with BMS the battery cables should be fixed to the terminal positive and negative posts with a torque of 5.4 Nm ± 0.9 Nm.

For additional information see BMS later in this section.

Battery Options

Any different batteries must be checked for correct functionality on a Start-Stop or Smart Regenerative Charging (SRC) vehicle.

Refer to: 4.8 Electronic Engine Controls (page 65).
Start-Stop and SRC
Refer to: 4.3 Charging System (page 50).

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

Battery Part Numbers and Usage

Battery Part Number	Type	Size	Engine
With Start-Stop - High Performance Deep Cycle AGM Battery			
DV6T-10655-B*	800 CCA (80Ah @ 20 hour rate) Absorbent Glass Mat Battery	H7	1.5L EcoBlue
			2.0L GDi
Without Start-Stop			
H1BT-10655-C*	590 CCA (60Ah @ 20 hour rate) SLI Battery	H6	2.5L Duratec

On top of the battery you will find the part number and size of the installed battery.

Battery Rules:

- Third party batteries and loads are isolated from the standard Ford system at key off
- For external charging of batteries ensure that the maximum voltage is not exceeded. Normal proprietary charging equipment should operate below this voltage

Maximum Battery Voltage	
Standard	**AGM**
15.2V	14.8V

NOTE: Charge balance calculations are required when adding additional systems, taking into account alternator size and battery capacity.

Import 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 68ºF (20ºC) 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 AGM battery system is recommended

Additional Loads and Charging Systems

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

High loads should be fitted via an isolation switch or disconnect relay. 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. High 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 in this section of the manual.

4.4.3 Battery Monitoring Sensor (BMS)

The BMS continuously monitors the condition of the battery. To do this, it is bolted directly to the negative terminal of the battery. It is recommended that this is not removed. However, if removal is required, please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

Any third party installations should ideally be activated via ignition or engine RUN. Regardless of battery system, it will still be required to frequently charge when at long periods of engine off.

After modifier system is installed, it is recommended to measure the total key off load to battery with a clamp on ammeter calibrated and sensitive to mili ampere's (mA). Perform this test after 45 minutes of key off with all doors shut so that the vehicle remains in sleep mode. The key off load should not exceed 20mA.

Battery Cables and Components

A vehicle ordered with a standard battery can be fitted with a High Performance Deep Cycle AGM battery.

Dealer support is required to update the central car configuration.

Replacing with High Performance AGM System

Part Number	Description	Quantity
DV6T-10655-B*	High Performance Deep Cycle 80Ah AGM Battery	1
DV61-10718-A*	Bracket Hold Down Clamp	1

4.5 Climate Control System

WARNING: Do not use propylene glycol based coolant.

- 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. Utilize guards to protect against cutting or chafing

4.5.1 Front Climate Control System

C2 Climate Control System Pin-Outs - Heater Only

Pin	Description
1	Voltage Battery Left Heated Seat Element Supply
2	Voltage Battery Right Heated Seat Element Supply
3	Voltage Battery
4	Temperature Power
5	Mode Power
6	Recirculation Door Feed 'A'
7	Recirculation Door Feed 'B'
8	Temperature Feed 'C'
9	Temperature Feed 'A'
10	Mode Feed 'B'
11	Mode Feed 'D'
12	MS1 - CAN L
13	MS1 - CAN H
14	ECO/SDM Input
15	Right Heated Seat Sense
16	Left Heated Seat Element
17	Right Heated Seat Element
18	Front Blower Relay
19	Not Used
20	Smart Regen Charging
21	Stop/Start Disable
22	Stop/Start Indication
23	Module Ground
24	Voltage Reference Return
25	Front Out
26	Temperature Feed 'D'
27	Temperature Feed 'B'
28	Mode Feed 'A'
29	Mode Feed 'C'
30	Left Heated Seat Sense

C5 Climate Control System Pin-Outs - Heater Only

Pin	Description
1	High
2	Medium -High
3	Medium - Low
4	Low
5	Ground

C1 Climate Control System Pin-Outs - Manual AC

Pin	Description
1	Temperature Power
2	Mode Power
3	Recirculation Door Feed 'B'
4	Recirculation Door Feed 'A'
5	Not Used
6	Not Used
7	Voltage Reference Return
8	Not Used
9	Temperature Feed 'C'
10	Temperature Feed 'A'
11	Mode Feed 'B'
12	Mode Feed 'D'
13	MS - CAN H
14	Voltage Battery
15	Recirculation Power
16	Recirculation Feed 'D'
17	Recirculation Feed 'C'
18	Module Ground
19	Not Used
20	Not Used
21	Not Used
22	Temperature Feed 'D'
23	Temperature Feed 'B'
24	Mode Feed 'A'
25	Mode Feed 'C'
26	MS - CAN L

C2 Climate Control System Pin-Outs - Manual AC

Pin	Description
1	Voltage Battery Left Heated Seat Element Supply
2	Voltage Battery Right Heated Seat Element Supply
3	Not Used
4	Not Used
5	Not Used
6	Not Used
7	Not Used
8	Not Used
9	Not Used
10	ECO/SDM Input
11	Stop/Start Disable
12	Stop/Start Indication
13	Not Used
14	Front Out
15	Right Heated Sense
16	Left Heated Seat Element
17	Right Heated Seat Element
18	Front Blower Relay
19	Not Used
20	Smart Regen Charging
21	Not Used
22	Not Used
23	Not Used
24	Not Used
25	Not Used
26	Sensor Input
27	Not Used
28	Not Used
29	Not Used
30	Left Heated Seat Sense

C5 Climate Control System Pin-Outs - Manual AC

Pin	Description
1	High
2	Medium -High
3	Medium - Low
4	Low
5	Ground

C1 Climate Control System Pin-Outs - Dual Zone

Pin	Description
1	Defrost/Recirc/Mode/Temp Power
2	Right Temperature Door Feed 'A'
3	Right Temperature Door Feed 'B'
4	Right Temperature Door Feed 'C'
5	Right Temperature Door Feed 'D'
6	Left Temperature Door Feed 'A'
7	Left Temperature Door Feed 'B'
8	Left Temperature Door Feed 'C'
9	Left Temperature Door Feed 'D'
10	Mode Door Feed 'A'
11	Mode Door Feed 'B'
12	Mode Door Feed 'C'
13	Mode Door Feed 'D'
14	Recirculation Feed 'A'
15	Recirculation Feed 'B'
16	Recirculation Feed 'C'
17	Recirculation Feed 'D'
18	Defrost Feed 'A'
19	Defrost Feed 'B'
20	Defrost Feed 'C'
21	Defrost Feed 'D'
22	Taxi Switch
23	Taxi Switch Ground
24	Discharge Sensor Floor Right
25	Discharge Sensor Floor Left
26	Voltage Reference Return

C2 Climate Control System Pin-Outs - Manual AC

Pin	Description
1	Voltage Battery Left Heated Seat Element Supply
2	Voltage Battery Right Heated Seat Element Supply
3	Voltage Battery
4	Smart Regen Charging
5	Blower PWM
6	Discharge Sensor Panel Right
7	Discharge Sensor Panel Left
8	MS -CAN H
9	MS - CAN L
10	ECO/SDM Input
11	Stop/Start Disable
12	Stop/Start Indication
13	Rear Auxiliary On/Off - Low Side Output
14	Front Out
15	Right Heated Seat Sense
16	Left Heated Seat Element
17	Right Heated Seat Element
18	Front Blower Relay
19	Humidity Sensor Input
20	Rear Auxiliary On/Off Input from Rear Auxiliary
21	Rear Out
22	Rear Request from Rear Auxiliary
23	Taxi Switch LED
24	Sunload Left
25	Sunload Right
26	Sensor Input
27	In-Car Sensor Aspirator Motor - Low Side
28	Module Ground
29	Front In-Car Temp Sensor Input
30	Left Heated Seat Negative Temperature Coefficient Sense

4.5.2 Rear Climate Control System

J1 Climate Control System Pin-Outs

Pin	Description
1	Rear PWM Output
2	Rear Temperature Door Feed 'C'
3	Rear Temperature Door Feed 'A'
4	Rear Mode Door Feed 'C'
5	Rear Mode Door Feed 'A'
6	Sensor
7	Expansion Value
8	Ground
9	Rear Mode Actuator Power
10	Ignition
11	Voltage Battery
12	Not Used
13	Not Used
14	Rear Auxiliary On/Off Indicator
15	Rear Temperature Door Feed 'D'
16	Rear Temperature Door Feed 'B'
17	Rear Mode Door Feed 'D'
18	Rear Mode Door Feed 'B'
19	Rear Auxiliary On/Off Input
20	Rear Request Line
21	Sensor Ground
22	Diagnostic
23	Rear Temperature Actuator Power
24	Illumination
25	Not Used
26	Not Used

4.6 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.

Connector Pin (C1)	Description	Wire Color	
1	Fuel Sensor Level 2	No Connection	
2	Fuel Sensor Level 1 (return)	Green- Blue	
3	Ground	Black-White / Back-Gray	
4	Transmission Park Detect	Green	
5	Not Used	No Connection	
6	Interactive Vehicle Dynamics / Traction Control Switch (Disable)	Yellow-Gray	
7	Hill Descent Control	No Connection	
8	Voltage Battery fuse	Brown-Red	
9	Fuel Sensor level 2 (FLI)	No Connection	
10	Fuel Sensor level 1(FLI)	Yellow-Violet	
11	Low level Washer Fluid switch	No Connection	
12	CAN Bus high speed 3 (lower) high	Green-Blue	Twisted pair
13	CAN Bus high speed 3 (lower) low	White-Green	
14	4 Wheel Drive high Indicator lamp	No Connection	
15	4 Wheel Drive low Indicator lamp	No Connection	
16	Not Used	No Connection	

FLI= Fuel Level Input

4.7 Horn

A dual horn may be fitted to the vehicle in place of the single horn.

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

4.8 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.

4.8.1 Start-Stop

WARNINGS:

The engine may restart automatically if required by the system.

Switch the ignition off before opening the hood 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 loads connected with the ignition off.

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

General Information

Start-Stop is designed to improve fuel economy and reduce CO_2 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 ECM (Engine Control Module)/PCM (Powertrain Control Module), known as the Start-Stop scheduler. 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. The Auto-Stop turns off the engine when the vehicle is stationary, in Drive, with the brake pedal pressed. The Auto-Start starts the engine as the brake pedal is released.

Inhibitors

Sometimes the engine may not shut down or may restart, due to one or more system inhibitors being active. The engine will shut down only once all inhibitors are cleared.

Typical examples of inhibitors are:

- If the ambient temperature is below the lower limit and 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
- Driver's door has been opened and vehicle has not been driven over 5 kph since
- Engine management reason, for example: during a Diesel Particulate Filter (DPF) regeneration event
- The ABS warning lamp is on or the vehicle is on
- High electrical load where total vehicle current drain exceeds 50A
- Un-recognized batteries fitted or BMS damaged or removed
- Start-Stop / ECO button is pressed (LED illuminated)
- Accelerator 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

Start-Stop Deselection (Button with LED illuminated)

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

Vehicle Modification Considerations

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

Impacts to Start-Stop Behavior

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 65A. 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 load more than 5 mA (milliamps) when off.

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: 4.4 Battery and Cables (page 53).
Battery Monitoring Sensor.

Start-Stop is only designed to operate with batteries that are calibrated by 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 as for a Smart Regenerative Charging (SRC) vehicle.

Refer to: 4.3 Charging System (page 50).
SRC.

The system uses signals from switches/sensors on the brake and accelerator pedals along with and 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. The driver may need to use the Start-Stop deselect button to disable Start-Stop when such devices are being used. The starter relay should never be bypassed or driven directly.

4.9 Information and Entertainment System

4.9.1 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 Display, Wireless Accessory Charging Module (WACM), Remote CD Mechanism (RCDM), Telematics Control Unit (TCU) and Speakers execution.

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

AHU/Multimedia ICE Packs

AHU/ICE Pack	Description
0	Pre Equipment Pack (No speakers) - no audio
30	Pre Equipment Pack - with speakers
1	Radio/CD, MP3 capability, AUX, USB & Bluetooth
2	Radio/CD, MP3 capability, AUX, USB & Bluetooth with DAB
153	Radio/CD, 3.5" TFT display, MP3 capability, AUX, USB, SYNC & Bluetooth
154	Radio/CD, 3.5" TFT display, MP3 capability, AUX, USB, SYNC & Bluetooth with DAB
9	Radio/CD/ 6" Touch Screen/ AUX/USB/ Navigation/ SYNC 3.2 / Rear View Camera
10	Radio/CD/ 6" Touch Screen/ AUX/USB/ SYNC 3.2 / Rear View Camera
18	Low Radio with Rear View Camera
22	High Radio HD with SDARS/ Navigation/ SYNC 3.2/ Rear View Camera
23	High Radio HD with SDARS/ SYNC 3.2 / Rear View Camera

DAB= Digital Audio Broadcasting, CHR = Connected HMI Radio, TFT= Thin Film Transistor

AHU/Multimedia ICE Pack Content

Description	0	30	1	2	153	154	9	10	18	22	23
Less ICE pack	X	X	-	-	-	-	-	-	-	-	-
Ultra Low Audio, USB and Bluetooth	-	-	X	-	-	-	-	-	-	-	-
Ultra Low Audio, USB, Bluetooth and DAB	-	-	-	X	-	-	-	-	-	-	-
ICE- Low Audio	-	-	-	-	X	-	-	-	-	-	-
ICE - Low Audio with DAB and USB	-	-	-	-	-	X	-	-	-	-	-
ICE - Mid Audio, DAB and TMC	-	-	-	-	-	-	-	-	-	-	-
ICE - 5th channel/TMC/DAB/PD	-	-	-	-	-	-	X	X	-	-	-
ICE- Low Audio	-	-	-	-	-	-	-	-	X	-	-
Single Tuner with SDARS	-	-	-	-	-	-	-	-	-	-	X
Single Tuner with SDARS / Audio High Definition	-	-	-	-	-	-	-	-	-	X	-
Less auxiliary CD Player	X	X	X	X	X	X	X	X	X	X	X
Single slot CD Player[1]	-	-	-	-	-	X	X	X	X	X	X
2 Radio speakers	-	X	-	-	-	-	-	-	-	-	-
4 Speakers front only	-	-	X	X	X	X	X	X	X	-	X
Less radio speakers	X	-	-	-	-	-	-	-	-	-	-
4 Radio speakers [1]	-	X	-	-	-	-	-	-	-	-	-
4 Speakers front/2 speakers rear[1]	-	-	X	X	X	X	X	X	-	-	X
9 Radio speakers Premium	-	-	-	-	-	-	-	-	-	X	-
Less diversity antenna	X	X	X	X	-	-	-	-	X	-	X
Diversity antenna	-	-	-	-	X	X	X	X	-	X	-
AM/FM	X	X	X	-	X	-	-	-	X	X	X
AM/FM and DAB	-	-	-	X	-	X	X	X	-	-	-
Glass antenna (Phase Diversity)[3]	-	-	-	-	-	X	X	X	-	-	-
Rear bumper (Phase Diversity)[3]	-	-	-	-	-	X	X	X	-	-	-
Less multi-function Display	X	X	X	X	-	-	-	-	-	-	-
4" Screen	-	-	-	-	X	X	-	-	X	-	-
6" Touch Screen	-	-	-	-	-	-	X	X	-	X	X
Less accessory USB unit	X	X	-	-	-	-	-	-	-	-	-
Accessory media hub 1x USB	-	-	X	X	X	X	-	-	X	-	-
Accessory media hub 2x USB	-	-	-	-	-	-	X	X	-	X	X
Less microphone	X	X	-	-	-	-	-	-	-	-	-
Microphone	-	-	X	X	X	X	X	X	X	X	X
Less Media Gateway module	X	X	X	X	X	X	-	-	X	-	-
SYNC 3	-	-	-	-	-	-	X	X	-	X	X
Less navigation center	X	X	X	X	X	X	-	-	X	-	X
Navigation center	-	-	-	-	-	-	X	-	-	X	-
Less Steering Wheel radio controls	X	X	-	-	-	-	-	-	-	-	-
Steering Wheel radio controls	-	-	X	X	X	X	X	X	X	X	X
Low series analog cluster	X	X	X	X	X	-	-	-	X	-	-
Mid series analog cluster	-	-	-	-	-	X	-	-	-	-	X
High series analog cluster	-	-	-	-	-	-	X	X	-	X	-

Description	0	30	1	2	153	154	9	10	18	22	23
Less integrated control panel	X	X	X	X	-	-	-	-	-	-	-
Unbranded ICP/Mini EFP (5 Button)	-	-	-	-	-	-	X	X	-	X	X
Unbranded ICP/Mini EFP (10 Button)	-	-	-	-	X	X	-	-	X	-	-
Less cellphone interface system	X	X	X	X	X	X	X	X	X	X	X
Cell interface system - Passport[(1)]	-	-	-	-	X	X	X	X	X	X	X
Less wireless charging	X	X	X	X	X	X	X	X	X	X	X
Wireless charging[(2)]	X	X	X	X	X	X	X	X	X	X	X

TMC= Traffic Message Channel, PD = Pure Data based on Audio, SDARS= Satellite Digital Audio Receiver System, ICP= Instrument Control Panel, EFP = Electronic Finish Panel

[(1)] Optional due to packaging execution

[(2)] Remote CD and wireless charging commodities are optional due to packaging execution. User will be able to choose between each of them or leave it without any of those and have a storage bin.

[(3)] Glass antenna or rear bumper antenna will be used dependent on Body Style

4.10 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.

4.11 Exterior Lighting

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

4.11.1 Reversing Lamps

Reversing lamps are activated by the reversing switch on the transmission and sensed by the Body Control Module (BCM) which is controlled by the BCM high side driver.

The load on the reversing lamps should not exceed a total of 3A (32W).

4.11.2 Additional External Lamps

Lighting Loads

BCM Outputs	Controlling Device	Max. Load (A)	Vehicle
License Plate	BCM	1	2x5W
Position/Parking Lamp Left Front	BCM	1	1x5W
Position/Parking Lamp Left Rear	BCM	1	1x5W
Position/Parking Lamp Right Front	BCM	1	1x5W
Position/Parking Lamp Right Rear	BCM	1	1x5W
Direction Indication Front Left	BCM	3.3	1x24W + 1x5W
Direction Indication Rear Left	BCM	2.9	1x21W
Direction Indication Front Right	BCM	3.3	1x24W + 1x5W
Direction Indication Rear Right	BCM	2.9	1x21W
Daytime Running Lamp Left	BCM	3.1	1x15W
Daytime Running Lamp Right	BCM	3.1	1x15W

Lighting Fuses		
F49	20A	Left Low Beam
31	20A	Right Low Lamp
F64	5A	Left and Right DC Motor Leveling

4.11.3 Lamps – Hazard / Direction Indication

The maximum permissible load with the standard system is:

- 1x24W — front indicator, 1x21W rear indicator + 1x5W side repeaters (left hand side)
- 1x24W — front indicator, 1x21W rear indicator + 1x5W side repeaters (right hand side)

50W per side maximum load.

4.11.4 Lamps – Front and Rear Fog

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 lamps - 2x55W (relay controlled)
- Rear fog lamps - 2x21W (high side driver controlled)

4.11.5 Electrically Operated Door Mirrors

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

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

4.12 Interior Lighting

4.12.1 Additional Internal Lamps

Additional cabin interior lighting may be obtained by directly accessing the connector inside the dome lamp in the cabin.

Additional load space interior lighting may be obtained by directly accessing the connector inside the load space lamps in the load space area.

CAUTION: The maximum total internal lamp load must not exceed 10A (120W).

Power for the Interior Lamps - The Interior lamps are controlled by separate pins on the BCM:

- Front lamps, Trunk/Cargo lamps and Courtesy Dome lamps: pin C6-17 (2.9A max)
- On demand map, Battery saver and Glove box lamps: C6-72 (3.36A max)

For additional information on BCM

Refer to: 4.2 Communications Network (page 43).

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

The maximum loads for all interior lamps (vanity, map, courtesy) are 120W total. Courtesy lamps have maximum loads of:

Van

- 1st Row Courtesy Dome lamps
- Trunk/Cargo lamps

Wagon

- 1st, 2nd and 3rd row Courtesy Dome lamps
- 2x trunk lamps

Lamps that are controlled by the battery save circuit will extinguish 30 to 180 minutes after ignition off (dependent on vehicle configuration).

Fluorescent lighting 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 enhanced bright lamps are required for the cargo area of a van, it is recommended to fit the Ford Enhanced Load Space Lighting. For further information on required parts and configurations to order please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

4.13 Cruise Control

4.13.1 Adaptive Cruise Control

CAUTION: For modified 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. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

NOTE: Do not obstruct the cruise control radar, see clearance zone 2 in figure E267576.

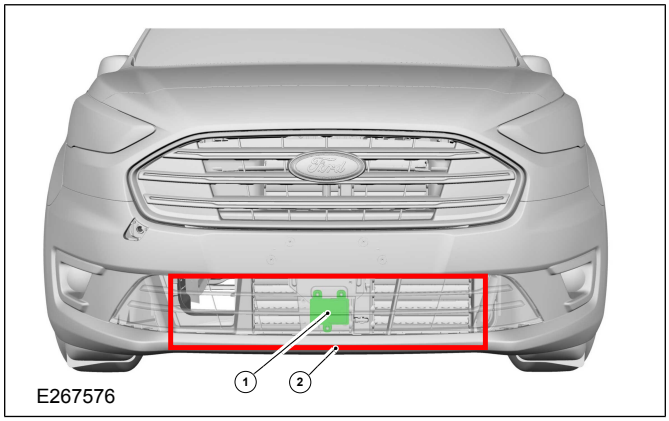
NOTE: Do not paint the front grill of the vehicle as this may affect the functionality of the cruise control radar.

NOTE: Changes to the vehicle attitude requires the radar to be vertically re-centered and the alignment process performed.

NOTE: Changes to wheel size requires a corresponding change in the PCM or inconsistent behavior will result.

NOTE: Changes to the wheelbase can result in inconsistent ACC behavior.

NOTE: Do not relocate the radar or radar cover or performance will degrade.

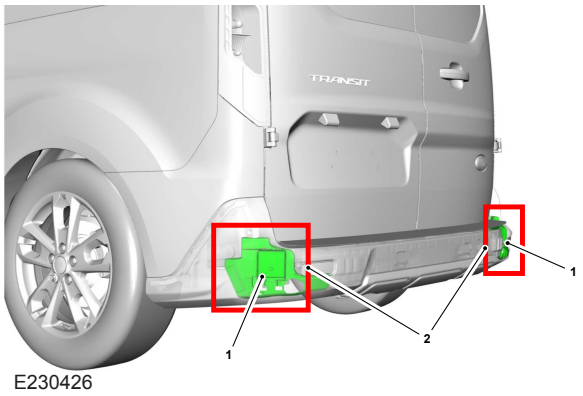


Item	Description
1	Adaptive Cruise Control Radar
2	Adaptive Cruise Control Radar clearance zone

4.14 Blind Spot Information System

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

Multiple-beam Radar location



E230426

Item	Description
1	Multiple-beam Radar Modules
2	Clearance Zone (Boundary of field of view)

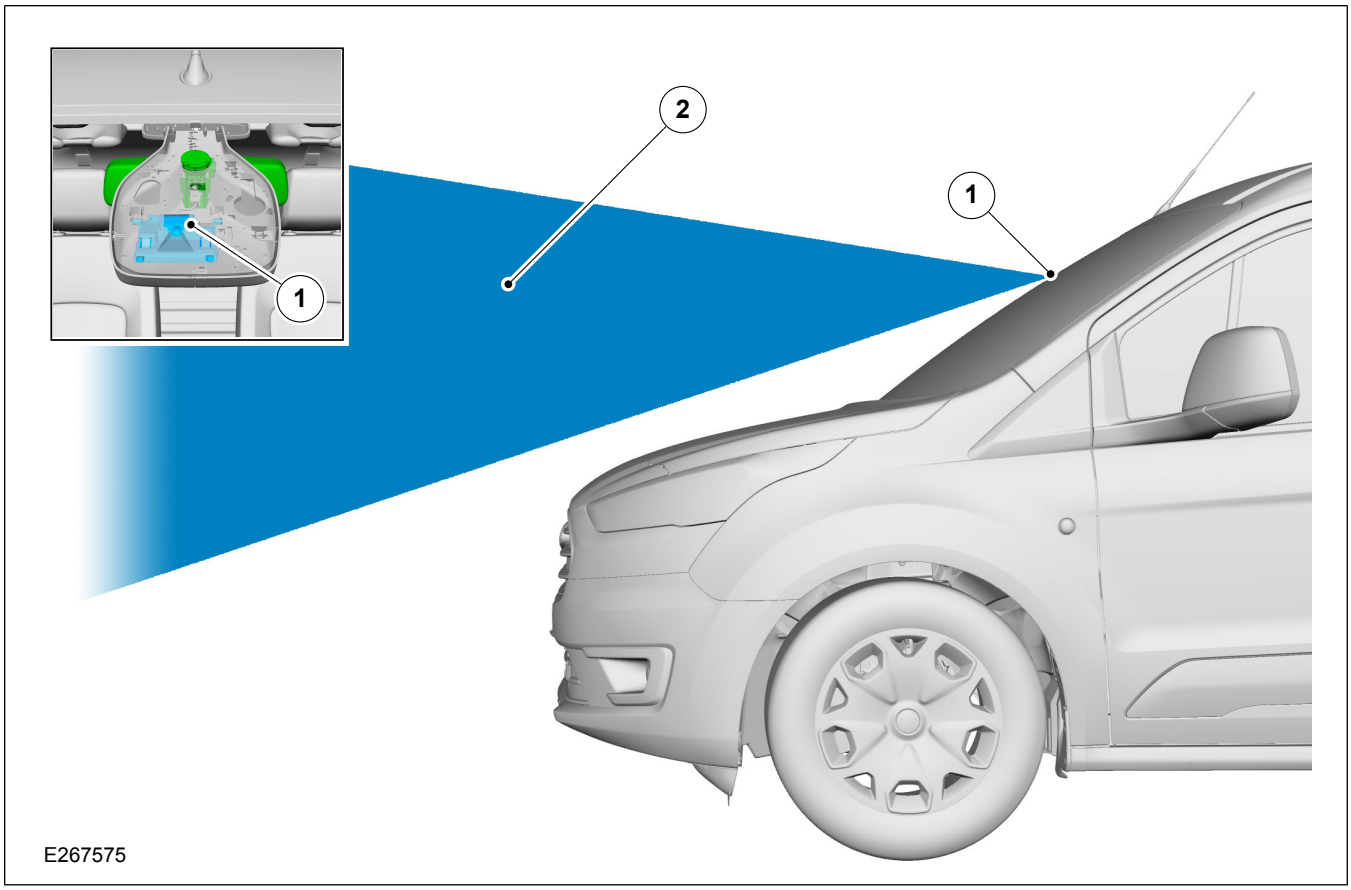
4.15 Lane Keeping System

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

NOTE: For modified vehicles fitted with a lane keeping system, where vehicles mass or geometry is significantly altered, the alignment process must be performed.

NOTE: Relocation of the sensor from the installed position can lead to inconsistent and erratic performance.

Lane keeping system camera location and view



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

4.16 Handles, Locks, Latches and Entry Systems

4.16.1 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 utilized to override the third party control system to trigger a crash unlock feature within the locking system in case of a relevant event.

For derivatives requiring no doors, to ensure door ajar warnings do not appear on the instrument cluster and the interior lamp does not stay on, for any doors that are not fitted the Body Control Module (BCM) must be connected in the following way:

- C6-16 Ajar lift gate and cargo door switch - Ground

4.16.2 Central Locking

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 cannot be guaranteed.

BCM	Function
C6-1	Central Lock
C6-63	Driver Door Unlock
C6-10	Liftgate Release
C6-11	Central Deadlock

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 BCM (Ford Dealerships can set this). There is also the option to configure via the instrument cluster once the configurable parameter has been set.
2. Slam locking – this is a configurable parameter in BCM (dealerships can only switch off this feature, but not switch on).
3. N1 lock reconfiguration into no deadlocks – this can be reconfigured to be central-locking only by a Ford Dealer (via Dealership hotline).
4. Auto unlock - There is an option to configure central unlock where the driver's door, when opened, will automatically unlock all doors except any doors controlled by the third button on the key fob.

Drive-Away Locking Disable

The following parameter (automatic locking by speed) is configured as follows:

- IDS parameter 32 - Change 0x02 [on] to 0x01 [off].

4.17 Fuses and Relays

4.17.1 Fuses

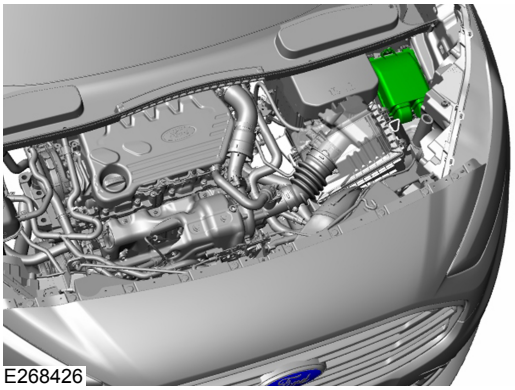
WARNING: No increase in existing vehicle standard fuse capacity is allowed under any circumstances. There are no spare fuses in the Engine Junction Box (EJB) or Body Control Module (BCM). The vehicle modifier must provide additional fuses as required. Please refer to below chart.

NOTE: Only use Ford fuses as shown in below table. Other fuses may interfere with the validated fusing strategy.

Ford Fuses

Part Number	Ampere Rating (A)	Color
M-Case		
GU5T-14G593-AEA	15	
GU5T-14G593-AFA	20	
GU5T-14G593-AGA	25	
GU5T-14G593-AHA	30	
GU5T-14G593-AJA	40	
GU5T-14G593-AKA	50	
GU5T-14G593-ALA	60	
Micro Fuse		
DG9T-14A094-HB	10	Red
DG9T-14A094-JB	15	Blue
DG9T-14A094-KB	20	Yellow
DG9T-14A094-FB	5	Tan

Engine Junction Box


E268426

4.17.2 Windscreen Wipers

The base wiper system should not be tampered with (controlled by BCM 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: 5.8 Glass, Frames and Mechanisms (page 94).

4.18 Electrical Connectors and Connections

4.18.1 Connectors

Cutting into the original wiring system

WARNING: Do not use connectors which cut through the outer covering and in to the core wires.

CAUTION: Only use Ford approved connectors.

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
- Long term risk of a faulty connection developing
- Potential fire risk from over-loading

All connections into the existing wiring must be permanently insulated. Exterior connections must be water-proof 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: 4.1 Wiring Installation and Routing Guides (page 35).

NOTE: Ford approved jumper harnesses should be used.

4.18.2 Adding connectors

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

Both features adopt a 20A fusing strategy. With a single battery system, continued loading of these features will lead to battery drain, and risk vehicle starting. If continuous power is required, a second battery option should be installed and the customer connection points, where fitted, utilized. At engine OFF, all power outlets are connected to the battery state of charge. The power will be deactivated at 60% state of charge. If peripherals require charging for long durations at engine OFF, it is recommended that the high capacity, high powered AGM option (HFQ) is selected. This will provide a longer time until the 60% state of charge is reached.

4.19 Grounding

NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://https://fordbbas.com/, or please contact bbasqa@ford.com

4.19.1 Ground 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.

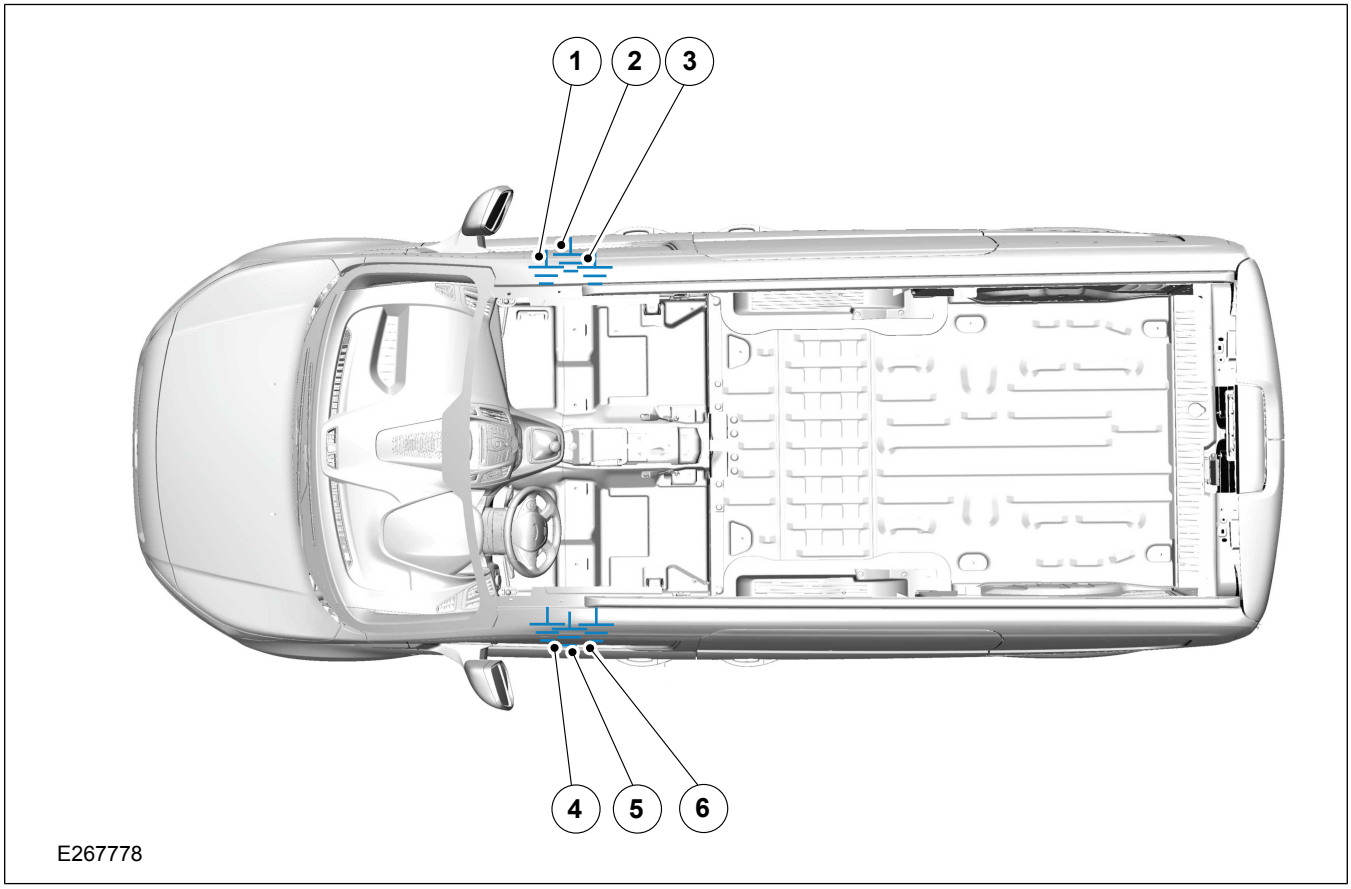
NOTE: The Ground Point (GP) numbers are only for reference to show the location of the GP.

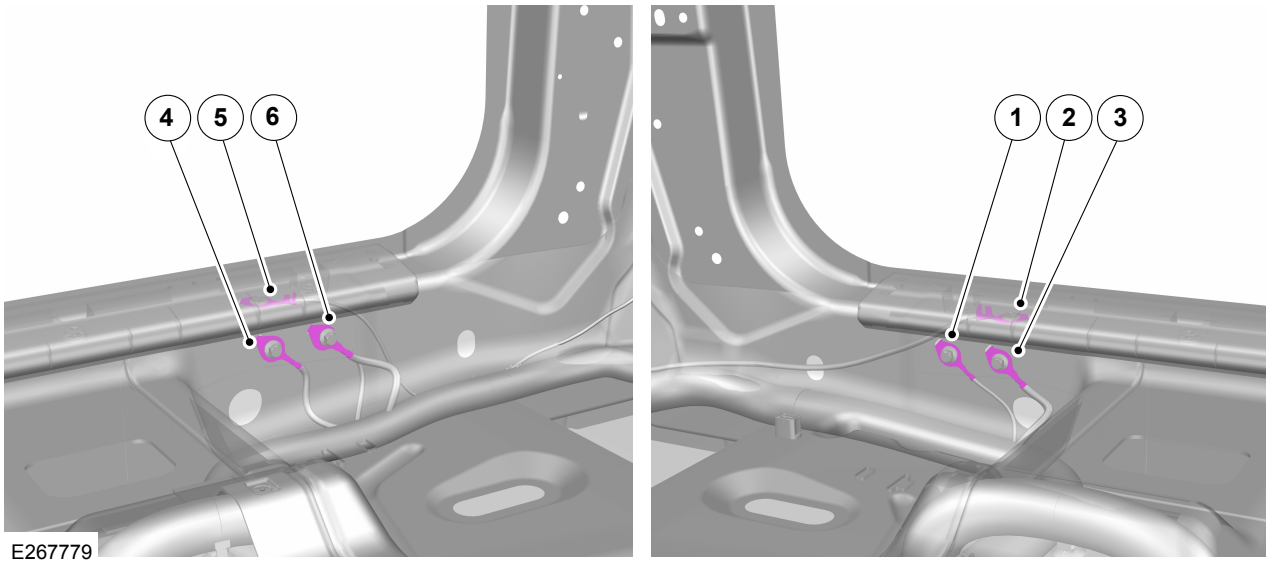
Ground wires should be brought back to the Ford ground points provided, please refer to the following figures. For very high current users, it is recommended that the ground connection is made directly to the ground point. For High Current Supply and Ground Connections

Refer to: 4.4 Battery and Cables (page 53).

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.

Recommended Ground Point Locations





Ground Point	Location	Type	Harness
1	Door sill RHS	Signal	14A005
2	Door sill RHS	Signal	14A005
3	Door sill RHS	Signal	14A005
4	Door sill LHS	Signal	14401
5	Door sill LHS	Signal	14A005
6	Door sill LHS	Signal	14A005

Ford Part Number 6G9T-10N006-CC - M6 screw fixing - Torque 10.5Nm

5.1.1 Body Structures - General Information

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

- Make sure that the vehicle structural integrity is maintained
- Do not drill into closed frame body members
- Make sure that the design for the body alterations or additional structure disperse the load evenly

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

- Re-paint metal edges after cutting 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 material, and underbody corrosion protection.

Refer to: 5.12 Corrosion Prevention (page 99).

- Make sure that fixings in the 'B' pillar, 'C' pillar and/or 'D' pillar area do not encroach on the seatbelts or seatbelt reels

  Refer to: 5.9 Airbag Supplemental Restraint System (SRS) (page 95).

For load compartment tie downs (Load lashing points)

Refer to: 5.3 Loadspace (page 86).

WARNINGS:

Before drilling Boron steel parts, see figure E172290 in this section.

Before drilling the floor, check the Precautionary Drill Zones, see Figure E172552 in this section.

For additional Precautionary/No Drill Zones

Refer to: 4.1 Wiring Installation and Routing Guides (page 35).
Refer to: 5.5 Body Closures (page 88).

5.1.2 Welding

WARNING: Do not weld Boron steel parts, see figure E172290 in this section.

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

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.

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.

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: After bare metal has been cleaned, do not touch anymore with the bare hands. The dampness of your hands will corrode the metal.

Procedure:

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

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

The following points must be noted when welding:

- Zinc starts to melt at about 788ºF (420ºC)
- Zinc vaporizes at a temperature of about 1652ºF (900ºC)
- 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 on the affected areas is therefore vital:

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

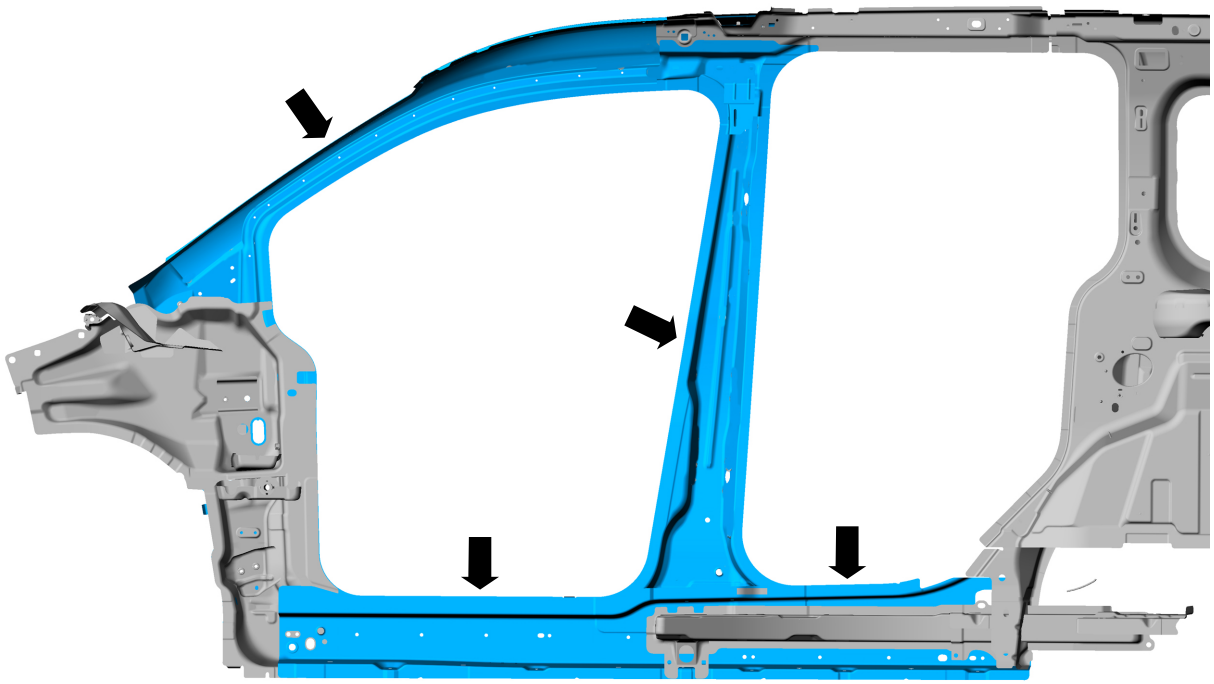
NOTE: Only apply a small amount of panel cleaner to the cleaning cloth when cleaning the area. Make sure that no cleaner reaches the connecting flange, so that the welding primer is not washed away again.

Priming after welding

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

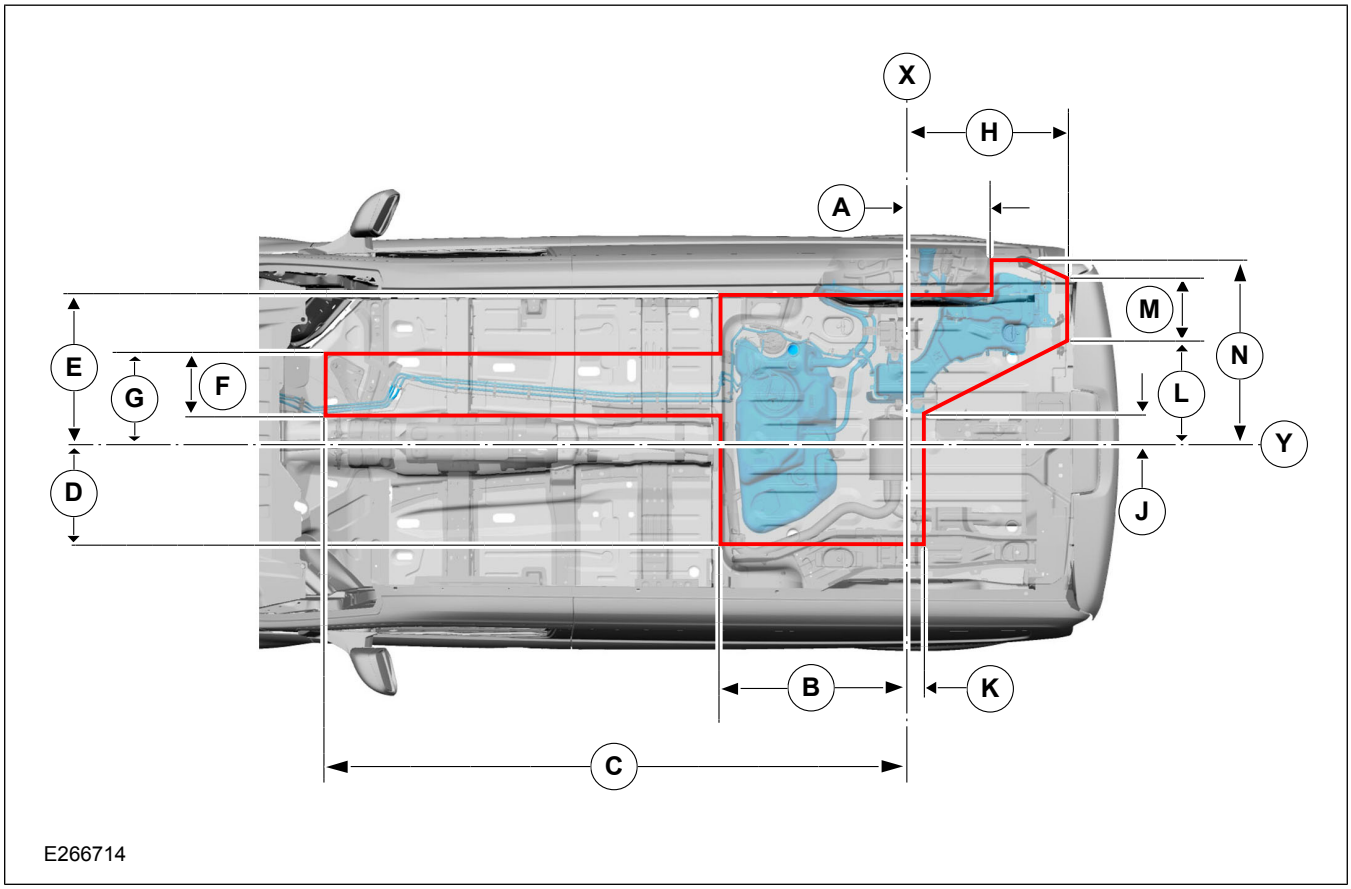
5.1.3 Boron Steel Parts

Boron Steel Parts - Precautionary Drill or No-Weld Zones



E172290

5.1.4 Floor 'Precautionary Drill Zones' - Fuel Tank and AdBlue Tank



Floor 'Precautionary Drill Zones' Dimensions			
X	Center Line Rear Wheel Axle	Y	Center Line of Vehicle
A	13.78" (350mm)	G	15.35" (390mm)
B	33.46" (850mm)	H	22.83" (580mm)
C	L1 = 86.61" (2200mm)	J	5.11" (130mm)
C	L2 = 102.36" (2600mm)	K	1.97" (50mm)
D	17.72" (450mm)	L	17.72" (450mm)
E	25.59" (650mm)	M	11.02" (280mm)
F	4.72" (120mm)	N	31.50" (800mm)

5.1.5 Front End Integrity for Cooling, Crash, Aerodynamics and Lighting

Cooling Continuous air flow through the front end and engine compartment is not to be hindered by adding any additional equipment. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

Lighting Do not alter the lighting system.

Crash Do not cut, drill or weld any parts that are load path relevant in case of crash. Do not add material in the crash zone. This could affect the crash sensor calibration.

The side airbag system is not permitted if:

- A swiveling device is fitted on the front seats
- Any additional material or structure is attached to the 'B' pillar inner and/or outer area

5.2 Racking Systems

5.2.1 Racking Systems

For attaching a racking system it is recommended to use the marked areas shown in figures E172553 and E172554.

- 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
- Ensure proper sealing against ingress of water, salt, dust, after cutting or drilling the body. Use Ford approved sealing and finishing material, and underbody corrosion protection
- To minimize stress in the 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
- Do not attach load bearing fixings only to the lining
- For increased crash performance the racking system should be designed with diagonal reinforcements
- The vehicle should be equipped with Ford standard option bulkhead to give best protection to driver and front passengers
- Preferably, there should be a rack each side to balance the vehicle load

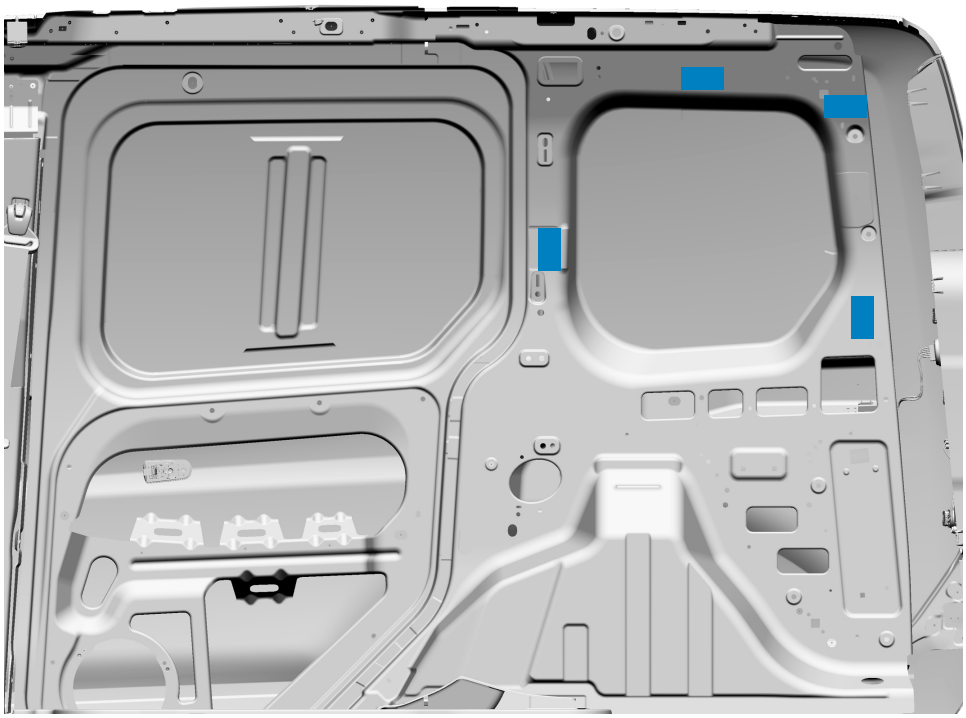
For additional information

Refer to: 5.12 Corrosion Prevention (page 99).

For additional information on Precautionary/No Drill Zones

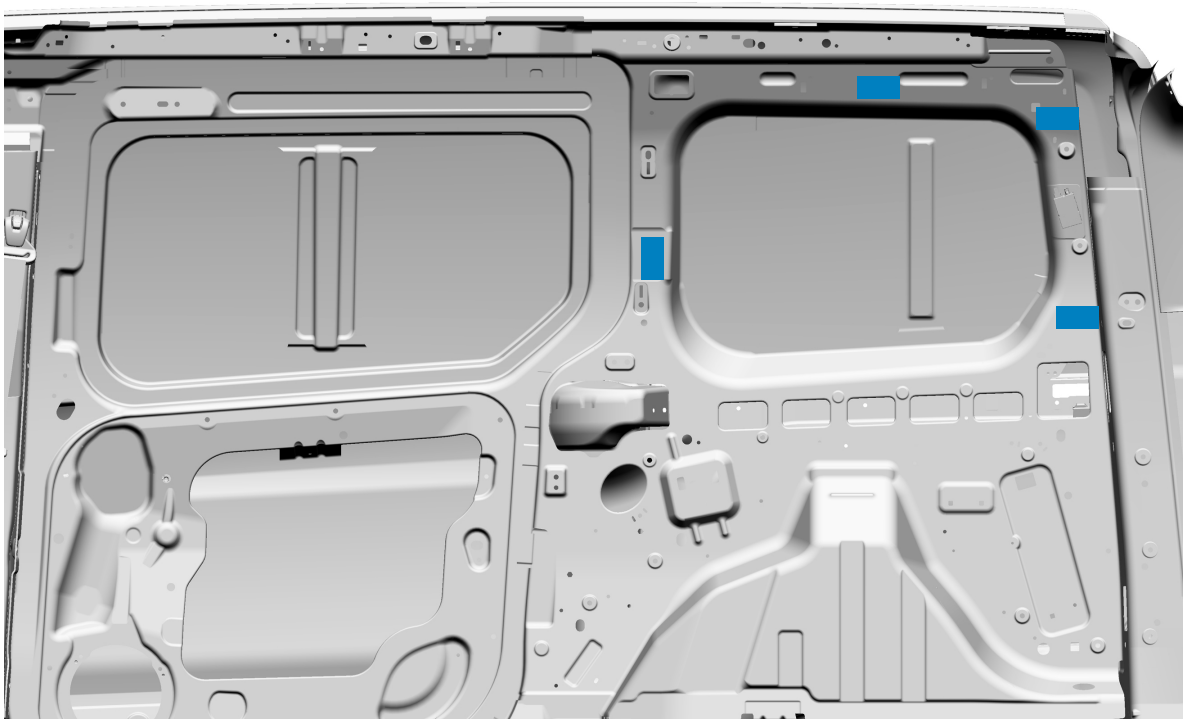
Refer to: 4.1 Wiring Installation and Routing Guides (page 35).
Refer to: 5.1 Body (page 81).
Refer to: 5.5 Body Closures (page 88).

Recommended Fixing Locations L1



E172553

Recommended Fixing Locations L2



E172554

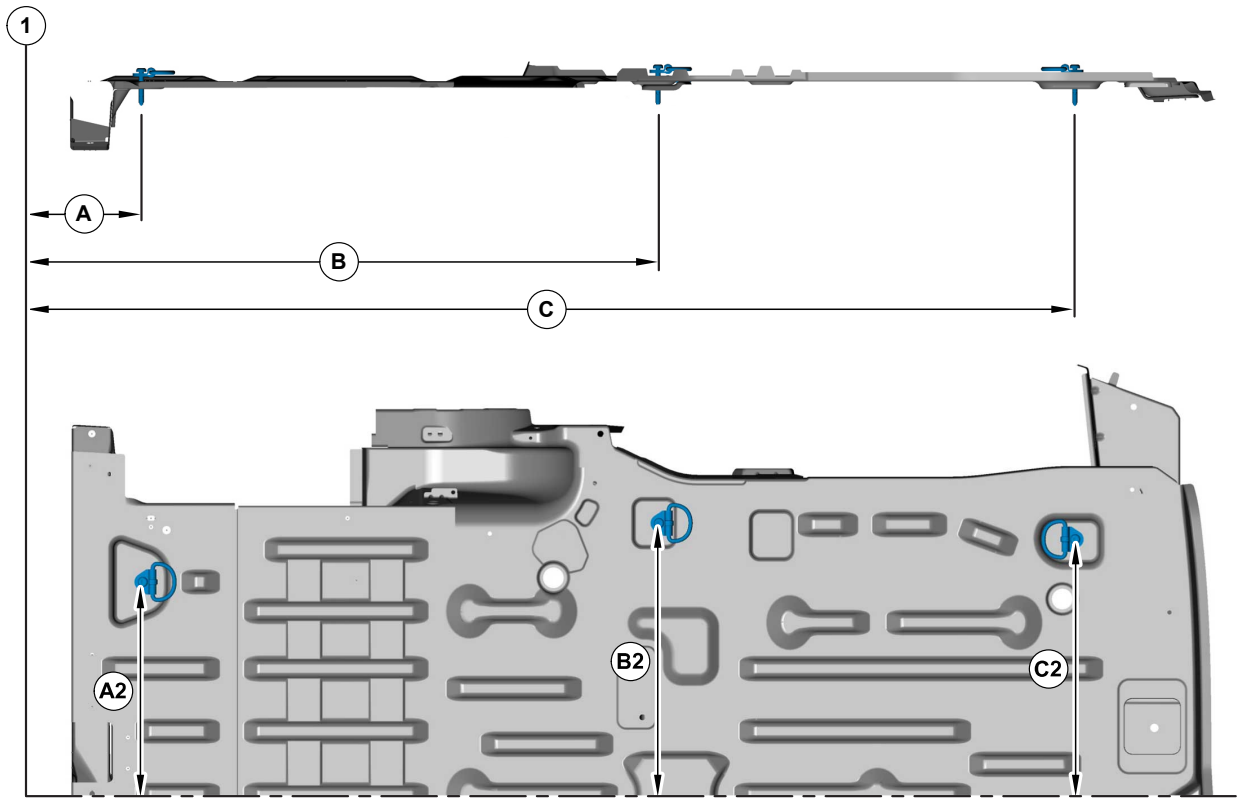
5.3 Loadspace

5.3.1 Load Compartment Tie Downs for Van and Kombi

All vehicles are fitted with load compartment tie downs, these are all 'D' rings as shown in E172555. Not all vehicles will have all locations shown, it will depend on the base vehicle. For additional fixing locations:

Refer to: 5.2 Racking Systems (page 84).

Load tie down locations



E172555

Dimensions for Load Tie Downs

Dimension	L1	L2
Dimension from 'B' Pillar (1)		
A	5.43" (138mm)	5.43" (138mm)
B	28.98" (736mm)	44.72" (1136mm)
C	60.67" (1541mm)	76.42" (1941mm)
From Centre of Vehicle		
A2	16.22" (412mm)	
B2	20.67" (525mm)	
C2	19.45" (494mm)	

L1 = 104.80" (662mm) wheel base, L2 = 120.55" (3062mm) wheel base

5.4 Front End Body Panels

5.4.1 Partitions (Bulkhead) - Driver and Front Passenger(s) Protection on Van

CAUTION: Bulkheads serve an important function and are legally required in some territories.

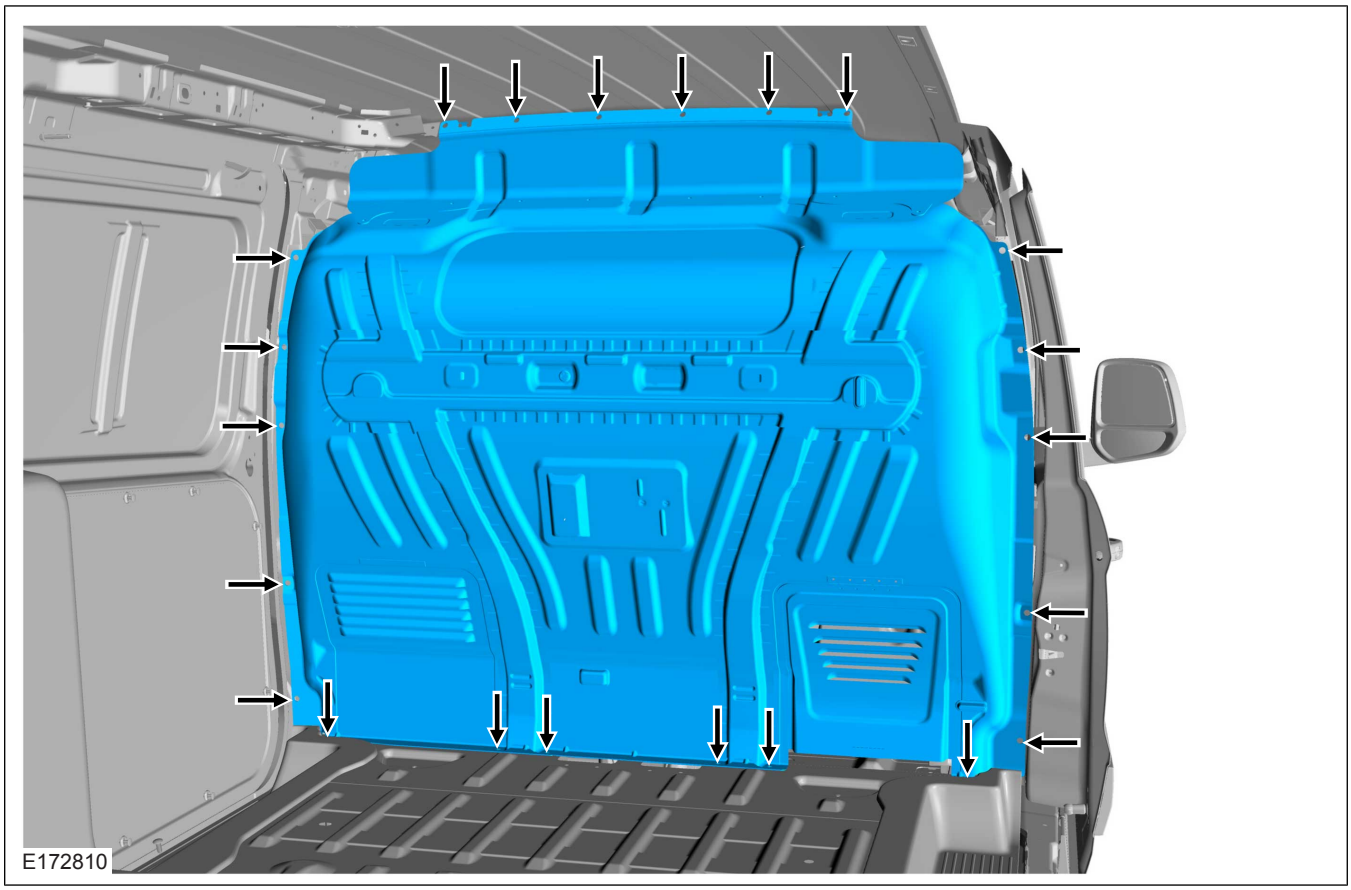
It is the Vehicle Modifier's responsibility to ensure local current legislation, governing bulkheads and protective window grilles, is met. It is also the modifier's responsibility to ensure legal load constraint requirements if using a non Ford standard bulkhead.

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 be also 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 weld nuts for M6. The standard range of Ford bulkheads can be retro-fitted at these points.

Van Steel Bulkhead Fixing Holes



5.5 Body Closures

5.5.1 Security, Anti-Theft and Locking System

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

However, in case a modification is required, please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

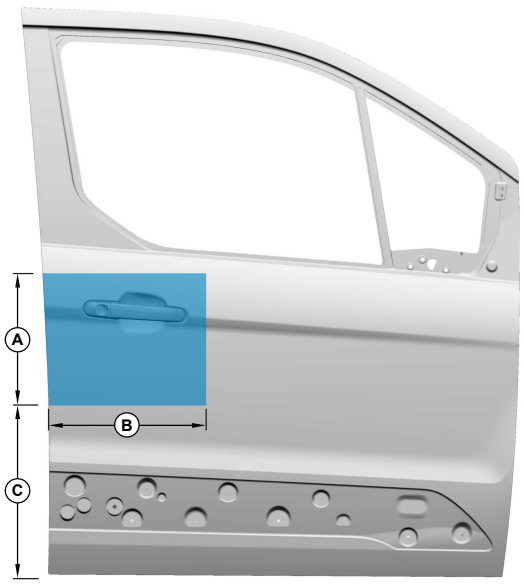
To avoid locking system security complications, it is recommended to discuss with your local Ford dealer prior to modifications taking place.

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 if you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com. 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.

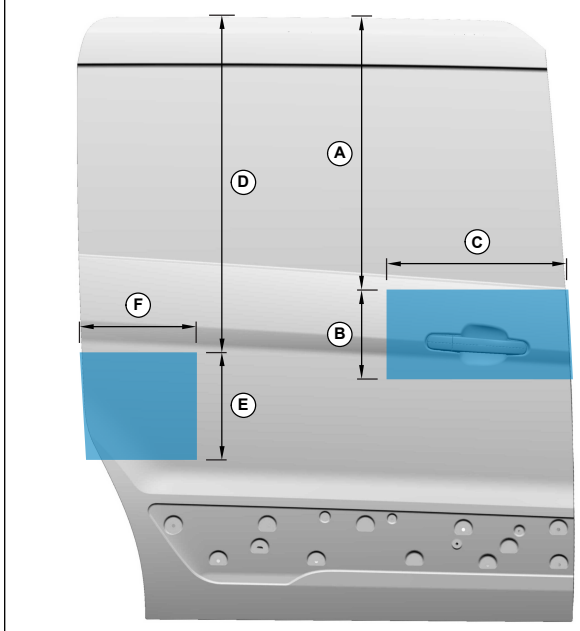
No Drill Zone - Driver and Passenger Doors



E172557

Item	Description
A	13.78" (350mm)
B	13.39" (340mm)
C	14.37" (365mm)

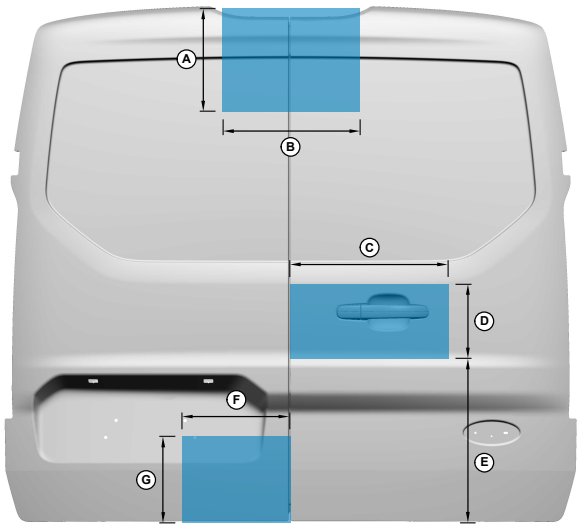
No Drill Zone - Side Sliding Doors



E172558

Item	Description
A	28.54" (725mm)
B	9.25" (235mm)
C	8.46" (215mm)
D	27.36" (695mm)
E	16.14" (410mm)
F	5.71" (145mm)

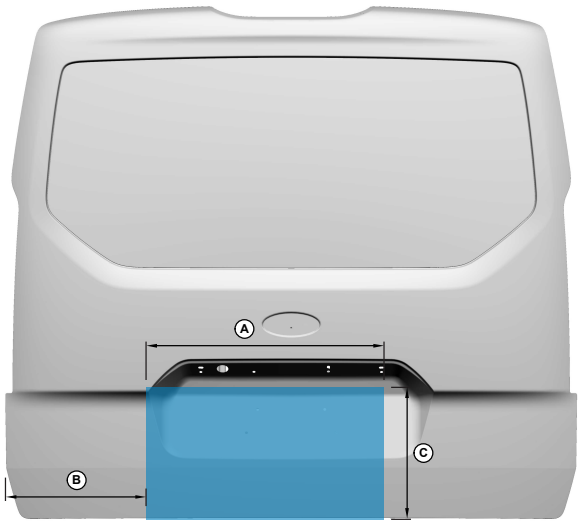
No Drill Zone - Rear Cargo Doors



E172559

Item	Description
A	8.46" (215mm)
B	9.45" (240mm)
C	14.96" (380mm)
D	5.12" (130mm)
E	18.50" (470mm)
F	7.68" (195mm)
G	5.511" (140mm)

No Drill Zone - Lift-Gate



E172560

Item	Description
A	23.82" (605mm)
B	14.76"(375mm)
C	15.16" (385mm)

5.6 Interior Trim

5.6.1 Load Compartment Interior Lining

Do not damage the lock, hinge, latch or check arm system (i.e. electrical cables or 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.

5.6.2 Plywood Lining/Cladding

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

For Additional information

Refer to: 4.1 Wiring Installation and Routing Guides (page 35).
Refer to: 5.5 Body Closures (page 88).
Refer to: 5.1 Body (page 81).

- Panels should be precision cut by machine, not by hand jigsaw, to reduce rough edges and splinters
- Panels should be pre drilled
- Do not drill through floor panels, use existing load lashing points when securing the panels
- It is recommended that when fitting a plywood floor that it is joint free
- Use aluminum floor trims
- Plywood should be water resistant (WBP, water and boil proof)
- It is recommended to use 9mm thickness for floors and 6mm thickness for side and door lining

If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

5.7 Seats

NOTE: When reassembling the seat and the seat belt use specified bolts and ensure to apply the specified torque. For torque specifications please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

5.7.1 Van

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

5.7.2 Heated Seats

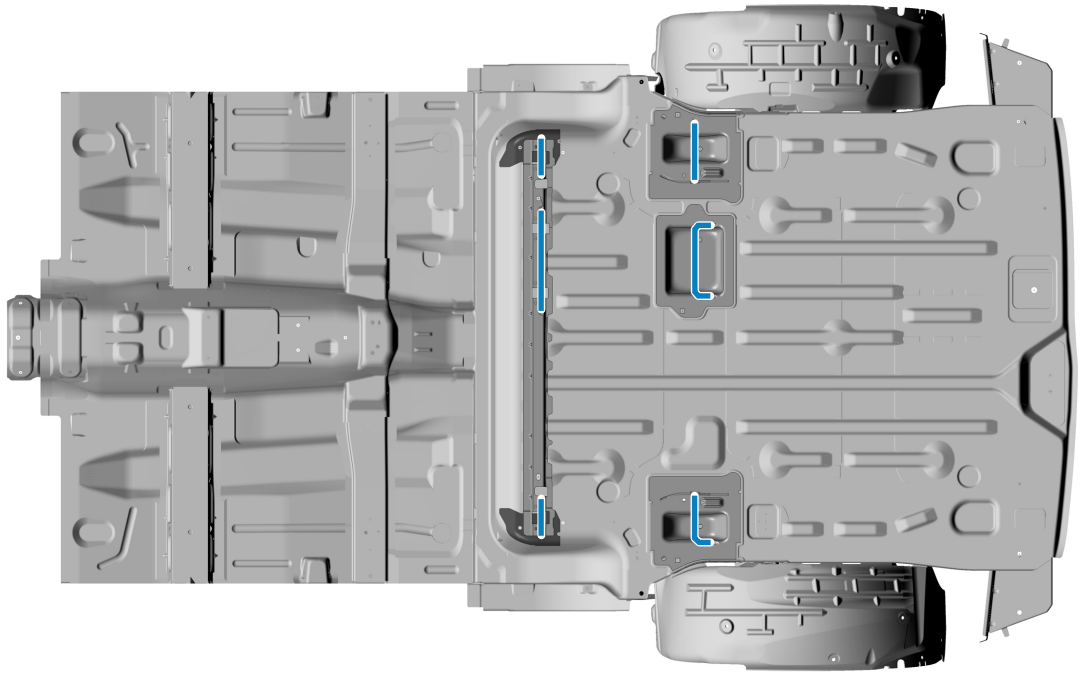
WARNING: The electrical feed for the original heated Ford seat must not be used for other purposes, e.g. other electrical consumers.

It is not advisable to retrofit heated seats due to potential airbag operation or malfunction (potentially caused by an incorrect configuration).

5.7.3 Rear Seat Fixing Positions

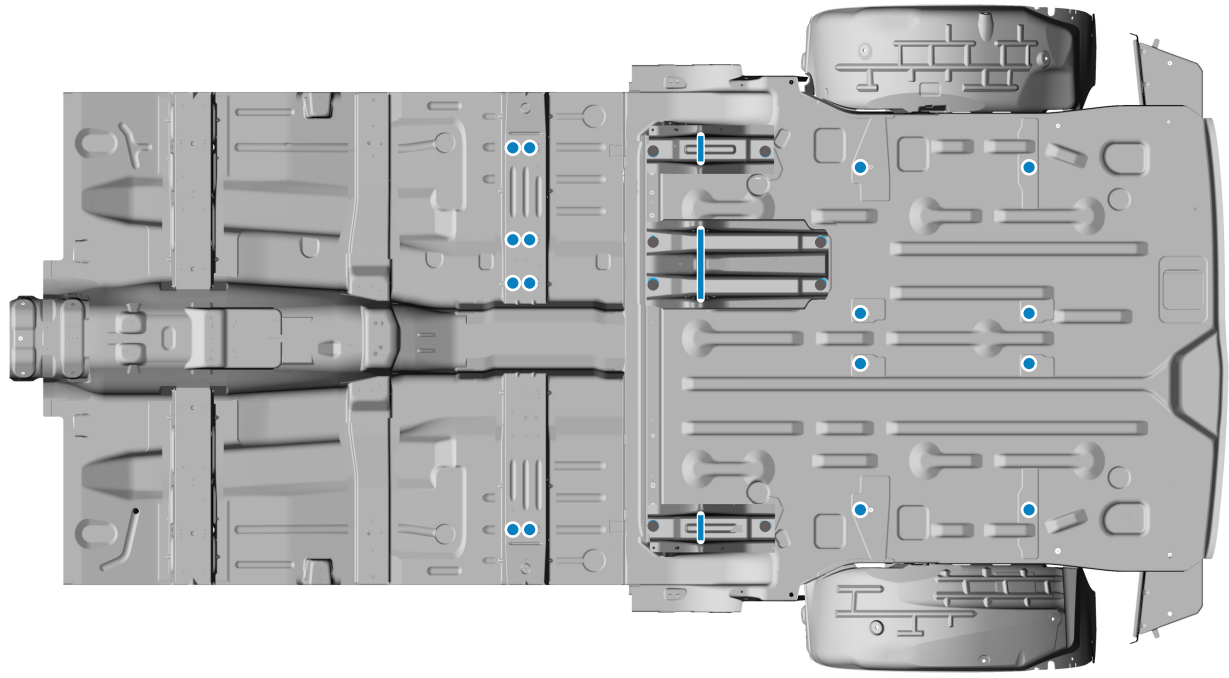
The following figures show the second and third row seat fixing positions in the floor. These positions are dependent on the wheelbase.

Wagon L1 - Second Row Seat Fixing Locations



E172561

Wagon L2 - Second and Third Row Seat Fixing Locations



E172562

All Wagons have second row seats but not all L2 vehicles have a third row of seats. Seat fixing locations are dependent on the base vehicle ordered.

NOTE: If a Wagon L2 vehicle is ordered with 2 rows of seats, it will not have the fixing locations and reinforcements required for a third row of seats.

If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

5.8 Glass, Frames and Mechanisms

5.8.1 Heated Windshield and Heated Rear Window

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

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

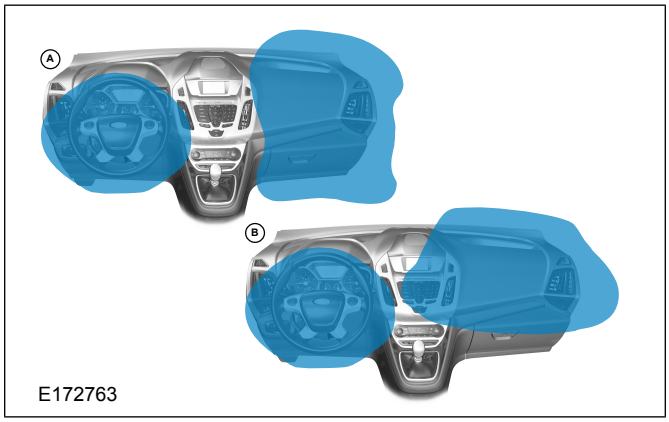
NOTE: If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

5.9 Airbag Supplemental Restraint System (SRS)

5.9.1 Airbags

Front Airbag Deployment Zones

WARNING: Do not place accessories in the deployment zone of the driver and passenger airbags as they may impair airbag deployment.



Side and Curtain Airbag Deployment Zones

WARNING: Do not place accessories in the deployment zone of the side and curtain airbags as they may impair airbag deployment.

NOTE: It is recommended to specify a base vehicle without airbags if planning modifications in this area.

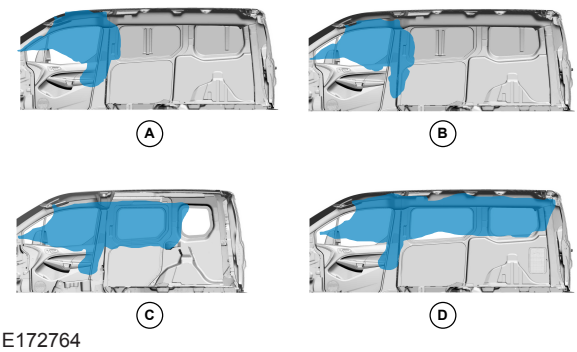
NOTE: All Wagon M1 vehicles are specified with side and curtain airbags as standard fitment.

Side Airbags (Seat Mounted): The side airbags on this vehicle have not been validated for use with swiveling front seats. Do not specify a base vehicle with side airbags if planning to retrofit a swiveling device on the front seats and/or an armrest on the outer side of the front seats; this may affect the function and/or deployment of the side airbags. Ensure any seat covers installed are designed to be used with side airbag equipped seats.

Curtain Airbags: Extensive modifications 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.

Curtain Airbag Deployment



Item	Description
A	Van with Single Passenger Seat
B	Van with Dual Passenger Seat
C	Wagon L1 with Single Passenger Seat
D	Wagon L2 with Single Passenger Seat

Restraints Control Module (RCM)

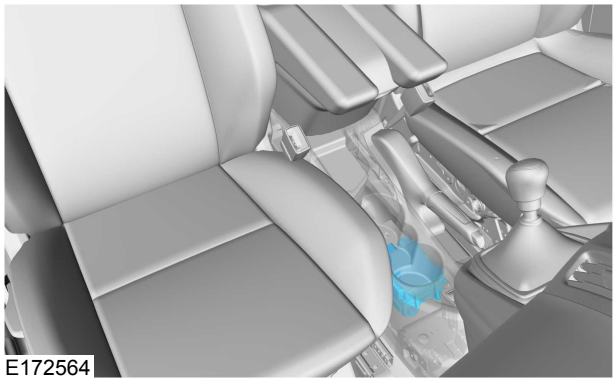
The RCM is located between the front seats, underneath the parking brake console, see figure E172564.

WARNINGS:

Modifications or reinforcements in the area of the RCM may affect the side airbag deployment timing and result in uncontrolled side airbag deployment.

The RCM device is protected by 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)



Front and Side Sensors

The airbag sensor for the front airbags is located behind the front grille, see figure E172565.

The pressure sensors for the side airbags are located in the first row doors, see figure E172566.

The crash sensors for the side airbags are located either at the bottom of the 'B' pillars or 'C' Pillars, please check both locations, see figure E172567.

WARNINGS:

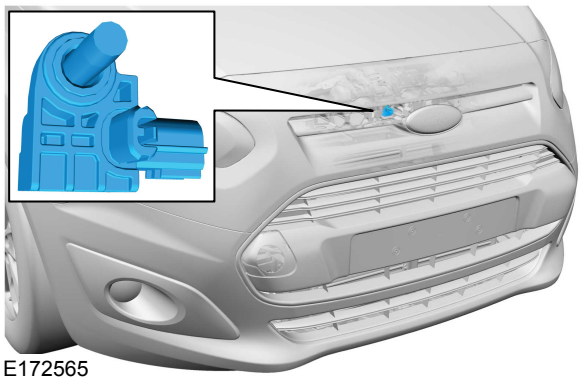
Modifications or reinforcements in the area of the sensors may affect the side airbags deployment timing and result in uncontrolled side airbag deployment.

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

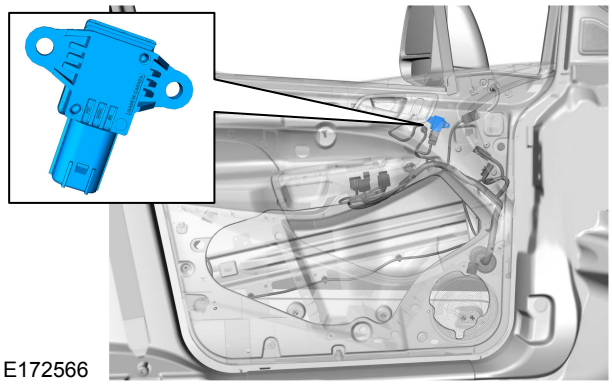
If the battery is disconnected

Refer to: 4.4 Battery and Cables (page 53).

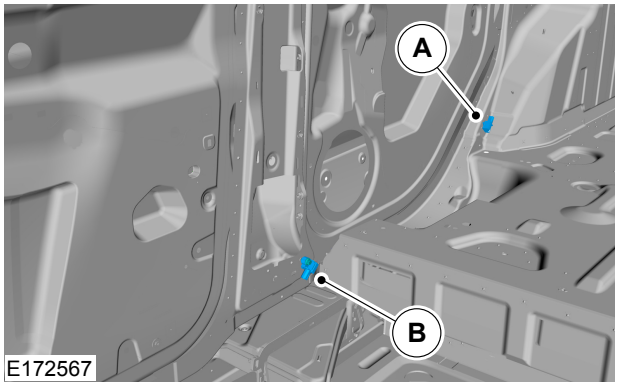
Front Sensor


E172565

Front Door Pressure Sensor


E172566

Side Sensors



E172567

Item	Description
A	'C' Pillar
B	'B' Pillar

5.10 Seatbelt Systems

5.10.1 Seatbelts

WARNING: Follow removal and installation procedures for the seatbelt system to ensure correct function of the restraints system.

The removal and reinstallation of the seatbelt, buckle or any component of the seatbelt system should be avoided. However if removal and re-installation of the system is required during the modification, follow the removal and installation guidelines of the seatbelt system as described in the workshop manual. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

When removing the seatbelt system, a seatbelt webbing forked retainer should be applied to the webbing 7.87" (200mm) below the webbing button stop. This prevents a situation where all the webbing runs back into the retractor and the retractor becomes locked.

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

5.10.2 Driver Belt Minder

Driver belt minder is a legal requirement for an M1 vehicle. A switch is provided in the driver's buckle to sense the seatbelt wearing status of the driver. If an M1 vehicle is modified, this function must be retained.

5.11 Roof

5.11.1 Roof Mounted Units

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

5.11.2 Roof Racks

Roof Rail Positions

E172844

Item	Description
A	Roof Rails on panoramic roof.
B	Roof Rails on steel roof.

NOTE: If roof rails are required on a vehicle it is recommended to order them on the base vehicle. If you require further help or information please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

NOTE: Refer to the Owner's Manual for maximum roof load, including roof rack.

NOTE: Maximum roof rack length should consider liftgate in fully opened position.

Roof racks may be fitted to the roof rails on all van, wagon variants, providing the following is satisfied:

- The carried load does not exceed the recommended weight stated in the Owner's Manual
- The load is evenly distributed (Modifier to ensure Owner’s information book identifies this limitation)
- It is recommended that the rack leading edge should not be located forward of the rear edge of the driver’s door, or 'B' pillar

5.12 Corrosion Prevention

5.12.1 General

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

If drilling is required, however:

- Re-paint metal edges and protect against corrosion after cutting or drilling operations
- Endeavor to remove all swarf from inside the side member and treat to prevent corrosion
- Apply corrosion protection inside and outside of the chassis frame

For Welding:

Refer to: 5.1 Body (page 81).

5.12.2 Repairing Damaged Paint

After cutting or reworking any sheet metal on the vehicle the damaged paint must be repaired.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance where possible. For specifications please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

5.12.3 Under Body Protection and Material

WARNING: Do not over-coat or contaminate surfaces of components such as brakes or catalytic converters.

Ensure all materials are compatible with the relevant Ford specifications and maintain the original performance where possible.

Some proprietary products affect the original coatings. For specifications of corrosion protection materials, please go to the Body Builders Advisory Service, https://fordbbas.com/, or please contact bbasqa@ford.com

5.12.4 Painting Road Wheels

WARNING: Do not paint wheel clamp surfaces in contact with other wheels, brake drum or disc, hub and holes or surface under wheel nuts. Any further treatment in these areas may affect the wheel clamp performance and the vehicle safety. Mask the wheel when changing the color or repairing paint.

5.12.5 Contact Corrosion

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

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

Index

L

M

N

P

R

S

T

U

V

W