

Four-Wheel Drive Systems - Raptor - Overview

2-Speed Torque On Demand with 4HI-LOC

2-Speed Torque On Demand with 4HI-LOC system consists of the following components:

- 4X4 Switch Module (Located in the instrument panel)
- TCCM (located near the passenger kick panel)
- IWE solenoid
- IWEs
- 4WD mode indicators and messages in the IPC message center
- Transfer case assembly
- Wheel speed signals from the ABS via HS-CAN

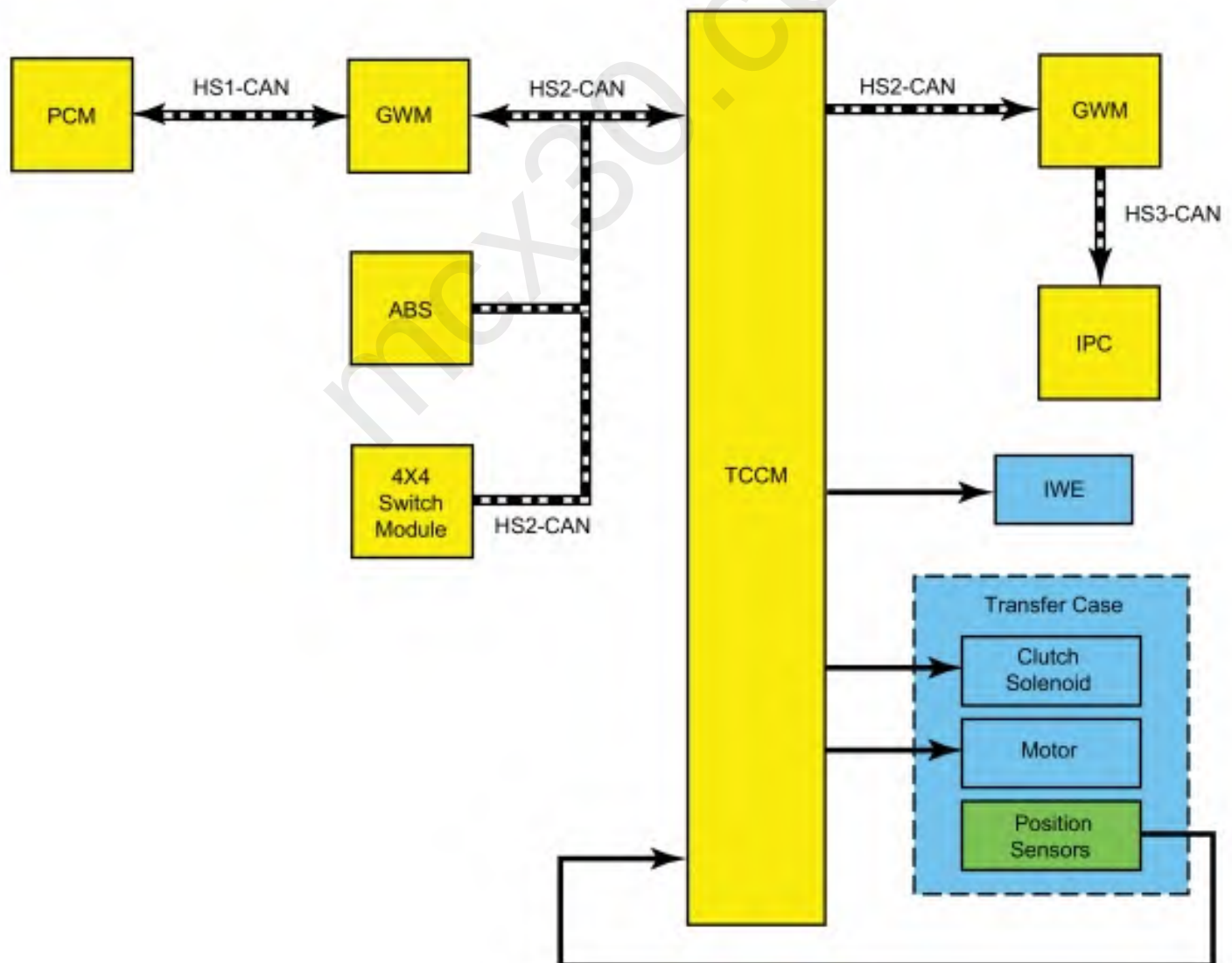
Vehicles equipped with the 2-speed torque-on-demand with 4HI-LOC system allow the operator to choose between 2WD and 3 different 4WD modes. The transfer case is shifted electronically based on the 4X4 Switch Module position. Under normal driving conditions, the unit is in 2WD (2H), but when desired, the operator may shift into 4WD AUTO (4A), 4WD high (4H), or 4WD low (4L). When shifting into or out of 4WD (4L) range, the TCCM requires that the vehicle speed is less than 5 km/h (3 mph) and the transmission is in NEUTRAL.

The transfer case is equipped with an electronically controlled clutch which is located inside the transfer case. The clutch provides torque to the front driveline in (4A) mode only.

Four-Wheel Drive Systems - Raptor - System Operation and Component Description

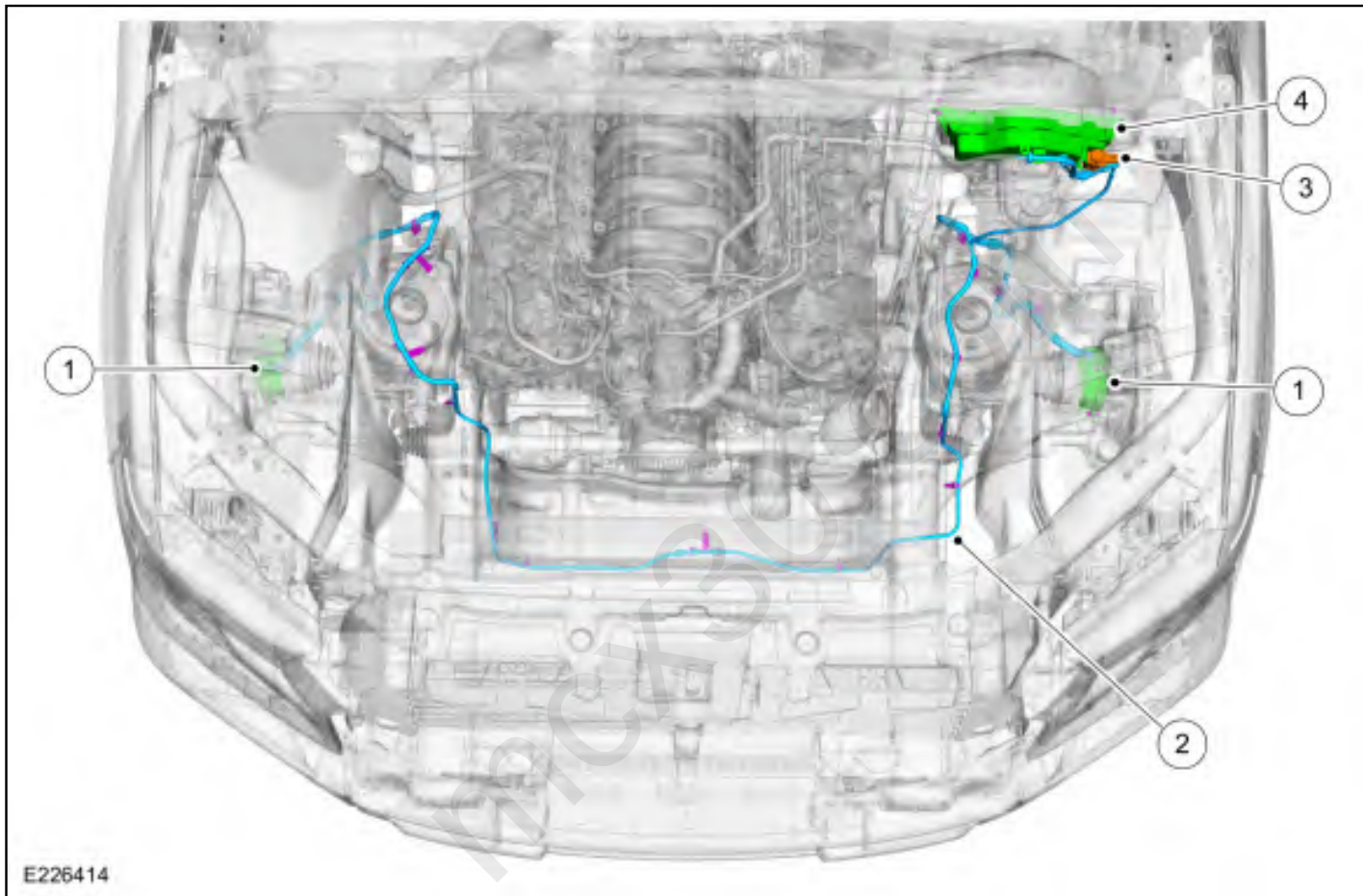
System Operation

System Diagram



IWE System

The IWE system consists of the following:



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1	IWEs (spring-loaded vacuum hubs)
2	Vacuum hoses
3	IWE solenoid
4	Vacuum reservoir

The IWE system, used on 2-Speed Torque On Demand with 4HI-LOC equipped vehicles, uses vacuum hubs that engage or disengage the front wheel hubs from the front halfshafts.

The IWE solenoid receives engine vacuum from the vacuum reservoir. When the 4WD system is in 2H mode, the

TCCM supplies a ground path to the IWE solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front halfshafts). When operating in any 4x4 mode, the TCCM does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the front hubs engaged to the front halfshafts. As a first step in service, eliminate obvious items such as loose wiring connections, loose vacuum connections or damaged vacuum lines.

Electronic Locking Differential (ELD) System

The Electronic Locking Differential (ELD) system consists of the following components:

- ELD field coil, located at the rear differential
- Rear differential
- 4X4 switch module (unique for ELD equipped vehicles, the ELD switch is integrated with the 4X4 switch module), located on the instrument panel.

Neutral Flat Tow

NOTE: 2WD vehicles cannot be towed with any wheels on the ground as vehicle or transmission damage may occur.

NOTE: Failing to put the transfer case into the NEUTRAL position damages vehicle components.

Vehicles equipped with a 4WD system have neutral flat tow software in the TCCM. Following the neutral flat tow activation procedure commands the transfer case shift motor into a neutral position. Locking the transfer case in neutral prevents damage to the transmission while towing a 4WD vehicle on all 4 wheels (such as when being towed behind a motorhome).

Terrain Management System

The Terrain Management System optimizes drivability and comfort as well as maximizing traction while operating on different types of terrain. The Terrain Management System automatically tailors your vehicle configuration for each mode selected. This is accomplished by changing the functionality of the several systems to enhance the traction and handling capabilities of the vehicle. It is recommended that terrain management modes that enable the ELD not be used on dry, hard surfaced roads. Doing so produces excessive noise, vibration and increase tire wear. Terrain Management modes are selected by using the buttons mounted on the steering wheel and selecting and changing Terrain Management modes through the message center.

Component Description

For mechanical component information,

Refer to: [Four-Wheel Drive Systems - Raptor, Vehicles With: 4HI-LOC Torque on Demand Transfer Case](#) (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

Four-Wheel Drive Systems - Overview

Electronic Shift-On-The-Fly (ESOF) System

The Electronic Shift-On-The-Fly (ESOF) system consists of the following components:

- MSS
- TCCM
- IWE solenoid
- IWEs
- 4WD mode indicators and messages in the IPC message center
- Transfer case assembly (includes shift motor and synchronization clutch)
- Wheel speed signals from the ABS via HS-CAN

Vehicles equipped with an Electronic Shift On-The-Fly (ESOF) system allow the operator to choose between 2-Wheel Drive (2WD) (2H) and 2 4WD modes. The transfer case is shifted electronically based on the MSS position. Under normal driving conditions, the transfer case is in 2WD (2H), but when desired, the operator may shift into 4WD high (4H) or 4WD low (4L). The operator can shift between 2WD (2H) and 4WD high (4H) at any speed. When shifting into or out of 4WD low (4L) range, the TCCM requires that the vehicle speed is less than 5 km/h (3 mph) and the transmission in NEUTRAL. The transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline during 2WD (2H) to 4WD high (4H) shifts.

2-Speed Torque-On-Demand

The 2-speed torque-on-demand system consists of the following components:

- MSS
- TCCM
- IWE solenoid
- IWEs
- 4WD mode indicators and messages in the IPC message center
- Transfer case assembly (includes shift motor and synchronization clutch)
- Wheel speed signals from the ABS via HS-CAN

Vehicles equipped with the 2-speed torque-on-demand system allow the operator to choose between 2WD and 3 different 4WD modes. The transfer case is shifted electronically based on the MSS position. Under normal driving conditions, the unit is in 2WD (2H), but when desired, the operator may shift into 4WD AUTO (4A), 4WD high (4H), or 4WD low (4L). When shifting into or out of 4WD (4L) range, the TCCM requires that the vehicle speed is less than 5 km/h (3 mph) and the transmission is in NEUTRAL.

The transfer case is equipped with an electronically controlled high capacity clutch which is located inside the transfer case. The clutch provides torque to the front driveline in all 4WD modes.

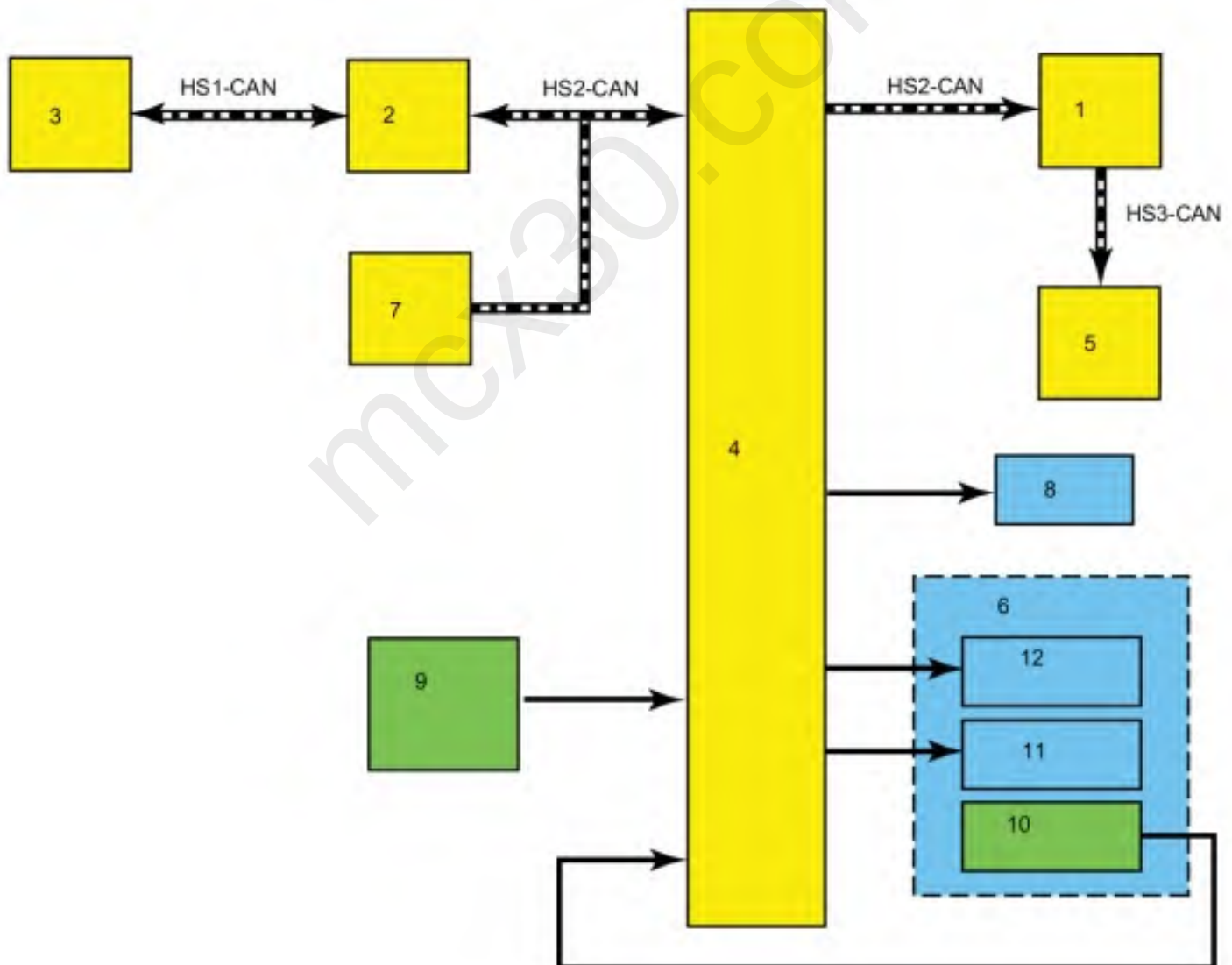
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Four-Wheel Drive Systems - System Operation and Component Description

System Operation

System Diagram

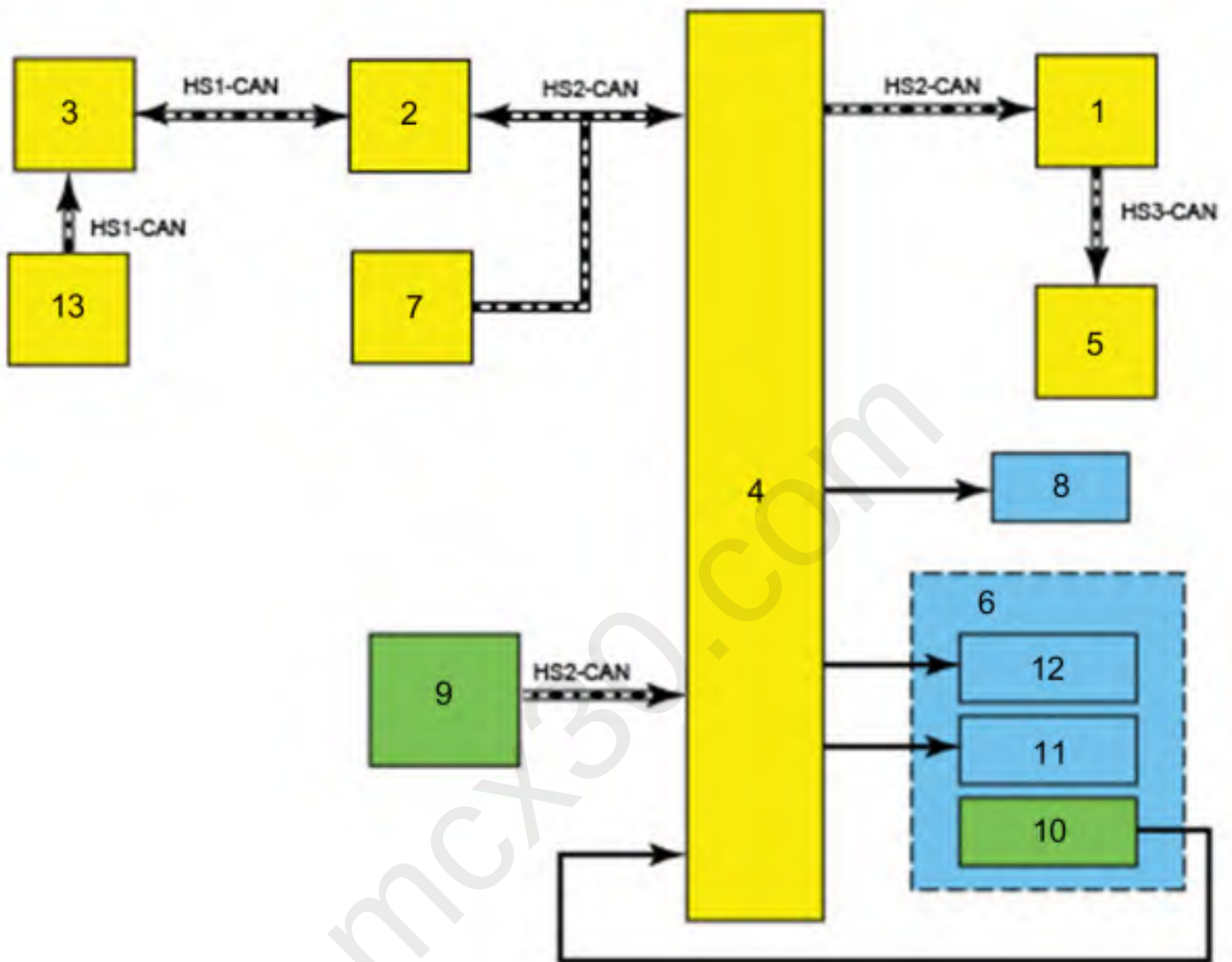


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Item	Description
1	GWM
2	GWM
3	PCM
4	TCCM
5	IPC
6	Transfer Case
7	ABS
8	IWE
9	Mode Select Switch
10	Position Sensors
11	Motor
12	Clutch Solenoid

System Diagram

Vehicles Equipped With The 3.5L GTDi, With 10R80 Transmission



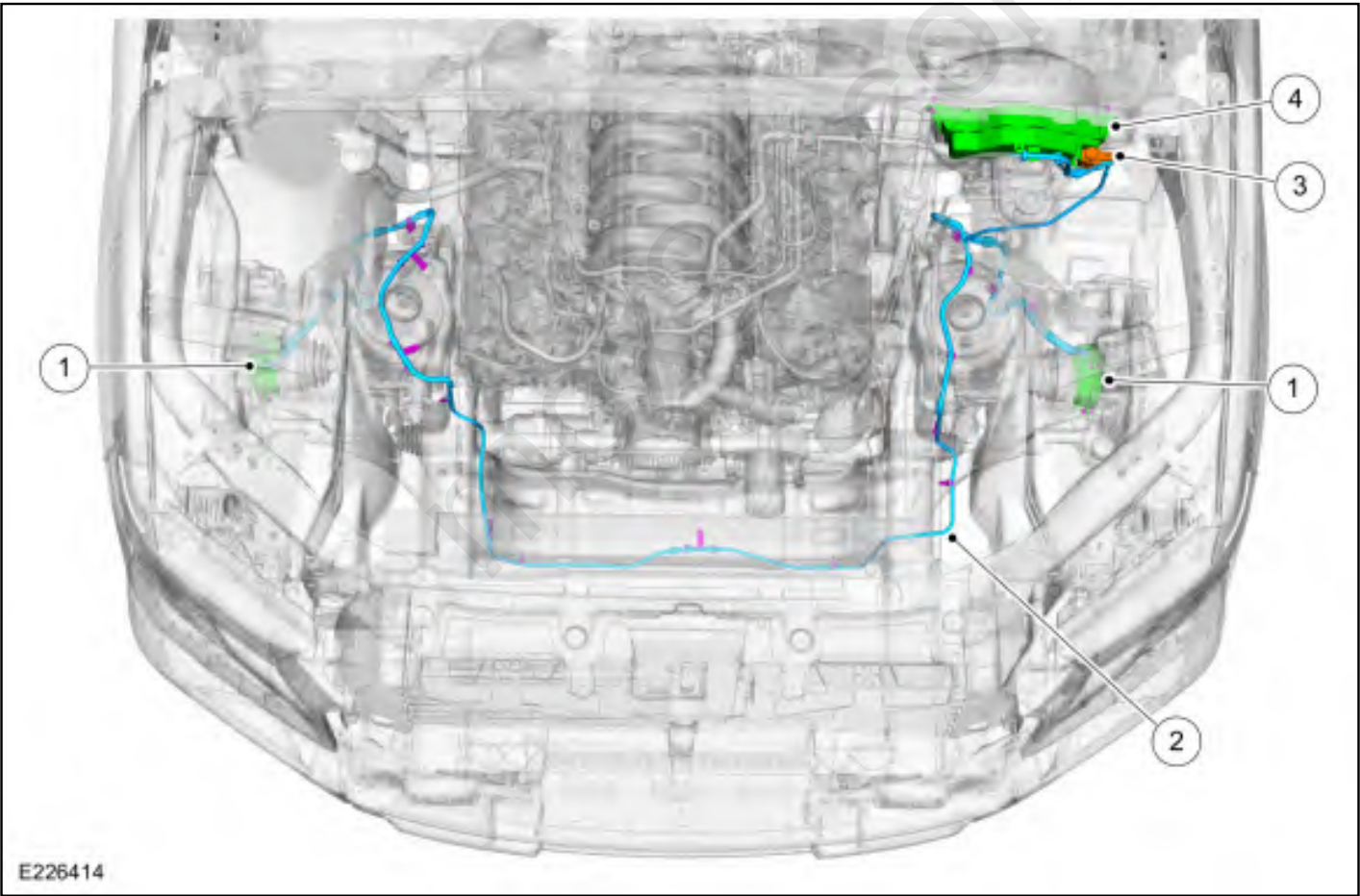
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Item	Description
1	GWM
2	GWM
3	PCM
4	TCCM

5	IPC
6	Transfer Case
7	ABS
8	IWE
9	Mode Select Switch
10	Position Sensors
11	Motor
12	Clutch Solenoid
13	TCM

IWE System

The IWE system consists of the following:



1	IWEs (spring-loaded vacuum hubs)
2	Vacuum hoses
3	IWE solenoid

The IWE system, used on Electronic Shift-On-The-Fly (ESOF) and 2-speed torque-on-demand equipped vehicles, uses vacuum hubs that engage or disengage the front wheel hubs from the front halfshafts.

The IWE solenoid receives engine vacuum from the vacuum reservoir. When the 4WD system is in 2H mode, the TCCM supplies a ground path to the IWE solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front halfshafts). When operating in any 4x4 mode, the TCCM does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the front hubs engaged to the front halfshafts. Vehicles equipped with a 2.7L EcoBoost engine are equipped with an engine mounted/cam-driven brake booster vacuum pump that supplies vacuum to the IWE vacuum reservoir. The brake vacuum pump is located on the backside of the cylinder head.

Refer to: [Brake Vacuum Pump - 2.7L EcoBoost \(238kW/324PS\)](#) (206-07 Power Brake Actuation, Removal and Installation).

As a first step in service, eliminate obvious items such as loose wiring connections, loose vacuum connections or damaged vacuum lines

Electronic Locking Differential (ELD) System

The Electronic Locking Differential (ELD) system consists of the following components:

- ELD field coil, located at the rear differential
- Rear differential
- MSS (unique for ELD equipped vehicles, the ELD switch is integrated with the MSS), located on instrument panel.

Neutral Flat Tow

NOTE: 2WD vehicles cannot be towed with any wheels on the ground as vehicle or transmission damage may occur.

NOTE: Failing to put the transfer case into the NEUTRAL position damages vehicle components.

Vehicles equipped with a 4WD system have neutral flat tow software in the TCCM. Following the neutral flat tow activation procedure commands the transfer case shift motor into a neutral position. Locking the transfer case in neutral prevents damage to the transmission while towing a 4WD vehicle on all 4 wheels (such as when being towed behind a motorhome).

Component Description

For component information,

Refer to: Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case (308-07 Four-Wheel Drive Systems) .

Refer to: Four-Wheel Drive Systems - Vehicles With: Electronic Shift Transfer Case (308-07 Four-Wheel Drive Systems) .

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Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case

Principles of Operation

The TCCM has a thermal hardware protection strategy which monitors the amount of energy going through the clutch. This strategy has 2 levels of protection:

- **NOTE:** *In this scenario the indicators in the instrument cluster switch between 4H and 4A, While the physical MSS remains in 4A.*

AUTOLOCK - If the system is in 4A and TCCM detects driving conditions that require greater 4X4 performance, the TCCM temporarily turns on 4H and informs the customer via the message center indicating 4x4 Temporarily Locked. The 4x4 system automatically returns to 4A after the system no longer detects these driving conditions and informs the customer via the message center indicating 4x4 Restored.

- **NOTE:** *The 4x4 Temporarily Disabled message can be dismissed by the customer however it's advisable to let the TCCM clear the message itself, which indicates that the 4x4 system has resumed normal operation.*

POWERTRAIN TORQUE PROTECTION - If the system is in 4H or 4L and TCCM detects excessive stress or high energy going through the clutch (clutch is slipping excessively while the system is commanding max clutch torque), clutch output will be turned off and the message center indicates 4x4 Temporarily Disabled. When the system has the ability to cool off, the 4x4 operation is automatically restored.

The 2-speed torque-on-demand system allows the operator to choose between 2H (4x2) and 3 different 4WD modes of operation: 4A (4X4 AUTO), 4H (4X4 HIGH) and 4L (4x4 LOW). When 4WD modes are selected the TCCM sends a duty cycle command to the transfer case coil which activates the clutch within the transfer case and transfers torque to the front driveline. When the 2H mode is selected, the TCCM duty cycle command is turned OFF and the IWEs located at each front wheel are disengaged to reduce additional drag from the front driveline.

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid commanded by the TCCM. When actuated, the IWE solenoid allows vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle. Note: When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 deg and 5 seconds have elapsed since the shift to 2H has been initiated.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the range fork within the transfer case between the HIGH range (2H, 4A and 4H) and LOW range (4L) positions. The electric shift motor only moves during a shift to and from 4L and Neutral, it does not move during any other mode shift. TCCM directly controls the electric shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The shift motor sense plate, an integral part of the shift motor assembly, informs the TCCM of the transfer case position.

This transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline as well as transfer torque in either of the 3 different 4WD modes. When the MSS is switched between 2H and 4A or 4H modes, the TCCM first energizes the clutch. When the transfer case front and rear output shafts are synchronized, the front axle IWEs are engaged.

When the front and rear drivelines are synchronized the TCCM sends a duty cycle command to the transfer case clutch coil as a torque request based on combination of

preemptive and wheel slip response algorithm. Preemptive response is based on steering wheel angle, vehicle speed, throttle positions and available powertrain torque. Wheel slip response is based on monitoring the average front and rear wheel speeds.

The TCCM has a cold strategy which is used to warm up the front axle in cold temperatures to improve driveline synchronization. When ambient temperature is below 32 F (0 C), the IWEs engage after the initial key cycle and a driven gear is selected. The hubs stay engaged regardless of 4x4 mode change for approximately 2 miles (3km). Once distance traveled has been achieved IWEs disengage if vehicle is in 2H. Distance traveled resets only if the temperature is below calibrated threshold and another key cycle has occurred or customer shifted to park and back to a driven gear within the same key cycle.

In 4A, the TCCM continuously monitors conditions and driver input to send torque automatically to the front driveline by controlling the transfer case clutch, providing 4WD capability. When 4WD is no longer needed (during cruising or steady state driving) system defaults back to RWD mode by setting the duty cycle output to 0. In situations where it is necessary to negotiate tight turns, clutch duty cycle output is reduced allowing slight difference between the front and rear driveshafts. However, the system is always on alert and when necessary, torque is sent automatically.

In 4H and 4L, the TCCM output behaves similarly to 4A mode but with increased duty cycle for greater 4WD performance.

TCCM increases the duty cycle to prevent or control slip under any of the following conditions:

- Slip is detected
- Heavy acceleration (throttle position)
- Straight-ahead steering wheel angle

Shifts from 2H mode to 4A or 4H mode can be made at any speed. When performing this shift, release the accelerator pedal prior to the shift and wait until the Shift in Progress message disappears in the IPC before accelerating, this improves the shift performance. The following are the inputs and outputs needed by the TCCM to execute a change between these modes and deliver the needed function:

Feature inputs

- MSS
- Steering wheel angle (from the ABS module)
- Transmission output torque (from the PCM/TCM)
- Wheel speed signal (transmitted from the ABS module)
- APP (from the PCM)
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature outputs:

- PWM signal to the transfer case clutch
- 4WD message center indicators
- IWE solenoid command output

Shifts between 4X4 AUTO (4A) and 4X4 (4H) modes can be made at any speed. Listed below are the inputs and outputs needed by the TCCM to execute a change between any of these modes.

Feature inputs:

- MSS

Feature outputs:

- PWM signal to the transfer case clutch
- 4WD message center indicators

When shifting into or out of 4L (4x4 LOW) mode, the vehicle speed must be less than 5 km/h (3 mph) and the transmission must be in neutral. The following are the inputs and outputs needed by the TCCM to execute a change to this mode and deliver the needed function.

Feature inputs:

- Steering wheel angle (from the ABS module)
- APP (from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed signal (transmitted from ABS module)
- TR position (from the PCM)
- Transmission output torque (from the PCM/ TCM)
- Steering wheel angle (from the ABS module)

Feature outputs:

- 4WD message center indicators
- PWM signal to the transfer case clutch
- IWE solenoid command output

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to Symptom Chart: Four-Wheel Drive Systems.

Visual Inspection Chart

Mechanical	Electrical

- Halfshafts
- IWEs
- Driveshaft and U-joints
- Vacuum leaks
- Fluid leaks
- Matching tire sizes
- Transfer case

- BJB
 - fuse 63 (25A)
 - fuse 71 (25A)
 - fuse 13 (10A)
 - fuse 29 (10A)
- Wiring, terminals or connectors
- MSS
- Transfer case clutch
- IWE solenoid
- Transfer case shift motor

DTC Chart: TCCM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

DTC	Description	Action
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	GO to Pinpoint Test C
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	GO to Pinpoint Test C
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	GO to Pinpoint Test C
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	GO to Pinpoint Test C
P0562:00	System Voltage Low: No Sub Type Information	GO to Pinpoint Test B
P0563:00	System Voltage High: No Sub Type Information	GO to Pinpoint Test B
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	GO to Pinpoint Test L
P1815:00	4-Wheel Drive Mode Select Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test L
P06B8:00	Internal Control Module Non-Volatile Random Access Memory (NVRAM) Error: No Sub Type Information	CLEAR the DTC. REPEAT the self-test. If the DTC still sets, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	GO to Pinpoint Test F
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	GO to Pinpoint Test F
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground: No Sub Type Information	GO to Pinpoint Test F
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	GO to Pinpoint Test E

P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	GO to Pinpoint Test E
P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P184B:00	Transfer Case Unable To Transition Between 4X4 High and 4X4 Low Range: No Sub Type Information	GO to Pinpoint Test E
P1853:00	Transfer Case Contact Plate 'B' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P1857:00	Transfer Case Contact Plate 'C' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P185A:00	Differential Lock-Up Input Switch Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P185B:00	Differential Lock-Up Indicator Circuit Low: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P185C:00	Differential Lock-Up Indicator Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P185D:00	Differential Lock-Up Control Circuit Performance: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P1861:00	Transfer Case Contact Plate 'D' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	GO to Pinpoint Test E
P187A:00	Transfer Case Control Module System Voltage Low - Rear Locking Differential Disabled	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P187C:00	Differential Lock-Up Control Circuit/Open: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).

P187D:00	Differential Lock-Up Control Circuit Low: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P187E:00	Differential Lock-Up Control Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P1886:00	4X4 Initialization Failure: No Sub Type Information	CLEAR the DTC. REPEAT the self-test. If the DTC still sets, CONFIRM the TCCM part number is correct for the vehicle.
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	GO to Pinpoint Test E
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test M
U0101:00	Lost Communication With TCM "A": No Sub Type Information	GO to Pinpoint Test P
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test N
U0140:00	Lost Communication With Body Control Module (BCM): No Sub Type Information	GO to Pinpoint Test O
U0418:00	Invalid Data Received From Brake System Control Module: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
U2300:54	Central Configuration: Missing Calibration	This DTC sets if one or more expected configuration data identifications is missing (gearbox type, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CARRY OUT a self-test. If U2300:54 returns, INSTALL a new TCCM.
U2300:55	Central Configuration: Not Configured	This DTC sets upon power up only until all expected configuration data parameters (gearbox type, axle ratio, tire circumference) are received from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CLEAR the DTCs. CARRY OUT self-test. If U2300:55 returns, INSTALL a new Terrain Management Module.

U2300:56	Central Configuration: Invalid / Incompatible Configuration	This DTC sets if a expected configuration data parameter is out of range (gearbox type, axle ratio, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CARRY OUT a self-test. If U2300:56 returns, INSTALL a new Terrain Management Module.
U2300:64	Central Configuration: Signal Plausibility Failure	This DTC sets if the expected axle ratio or tire circumference is out of range from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CARRY OUT a self-test. If U2300:64 returns, INSTALL a new Terrain Management Module.
U3000:04	Control Module: System Internal Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:04 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:41	Control Module: General Checksum Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:41 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:46	Control Module: Calibration / Parameter Memory Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:46 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:49 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U300D:11	Ignition Input On/Start: Circuit Short To Ground	GO to Pinpoint Test A

Symptom Chart: Four-Wheel Drive Systems

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action

No communication with the TCCM	- Scan tool - DLC - TCCM - Wiring, terminals or connectors	REFER to: Communications Network (418-00 Module Communications Network) .
The 4X4 mode indicators do not operate correctly/do not operate	- IPC 4WD system fault - HS-CAN - TCCM	To diagnose the 4X4 mode indicators do not operate correctly/do not operate, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .
The vehicle does not shift between 2H (2WD) and 4X4 modes correctly	- Wiring, terminals or connectors - MSS - IWE - IWE solenoid - Transfer case - Vacuum leaks - Front axle assembly - TCCM	GO to Pinpoint Test L
The vehicle does not shift between 4A (4X4 AUTO) and 4H (4X4) modes correctly	- Wiring, terminals or connectors - IWE - IWE solenoid - Transfer case - Vacuum leaks - Front axle assembly	GO to Pinpoint Test D

	• TCCM • MSS	
• Vehicle has no torque or inadequate torque at front wheels in 4A (4X4 AUTO) mode	• Transfer case and related components • IWE and related components • Wheel/tire assemblies	• GO to Pinpoint Test J
• The vehicle does not shift between 4H (4X4) and 4L (4X4 LOW) modes correctly	• Wiring, terminals or connectors • TR sensor • ABS wheel speed inputs • IWE • TCCM • Transmission drag torque	• GO to Pinpoint Test E
• 4WD does not engage at speed correctly	• Transfer case clutch • Transfer case • TCCM • Front axle assembly • Wiring, terminals or connectors	• GO to Pinpoint Test F

• The front axle does not engage/disengage correctly	• Wiring, terminals or connectors • Fuses • MSS • IWE • IWE solenoid • Transfer case • Vacuum leaks • Front axle assembly • TCCM	• GO to Pinpoint Test C
• The 4WD system jumps out of gear	• IWE vent line(s) • Transfer case • MSS	• GO to Pinpoint Test G
• Unable to achieve flat tow (neutral tow) mode	• Wiring, terminals or connectors • HS-CAN • IPC • TCCM • Door ajar switch • Ignition switch	• REFER to: Neutral Flat Tow Activation and Deactivation (308-07A Four-Wheel Drive Systems, General Procedures).
• Grinding noise from front axle when engaging 4x4 at speed.	• Torque on demand (TOD) clutch did not bring driveline up to speed. • Poor vacuum to IWE.	• GO to Pinpoint Test F • GO to Pinpoint Test F

• Unable to duplicate customer concern	• 4WD system and/or related components	• GO to Pinpoint Test J
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Symptom Chart — NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system.

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
• Grinding noise during 4WD system engagement, especially at high speeds	• Front halfshaft speeds not turning at the same speed • Transfer case clutch	• GO to Pinpoint Test C
• Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up)	• Unequal tire inflation pressures • Unmatched tire and wheel size • Unequal amounts of tire wear • Unmatched front and rear axle ratios	• GO to Pinpoint Test H
• The front axle makes noise in 2H mode only and generally under heavy throttle	• Vacuum leaks • Vacuum check valve • Vacuum reservoir • IWE solenoid • IWEs	• GO to Pinpoint Test I

• The transfer case makes noise	• Tire inflation pressure • Tire and wheel size • Tire tread wear • Internal components • Fluid level	• MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct. • CHECK tire tread wear to see if there is more than 1.6 mm (0.062 in) or 2/32 inch difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. • OPERATE the vehicle in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission. REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). If there is noise in all gears, DISASSEMBLE the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary • FILL with automatic transmission fluid.
• Transfer case whine — noise at all ranges	• Incorrect fluid level or fluid quality • Worn oil pump • Under-inflated or oversized tires	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.

Transfer case growl/rumble — noise at all ranges	Damaged or worn bearings or planetary gear	DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
Transfer case scraping/grating — noise at all ranges	Excessively stretched drive chain hitting the case	DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
Transfer case howl/hum — noise at all ranges or 4H only	Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
Vehicle binds in a turn/resists turning/pulsates in a straightline in 4WD mode	- Unmatched tire sizes - Unequal amounts of tire wear - Unequal tire inflation pressures - Throttle position failure - Transfer case - TCCM	GO to Pinpoint Test K

Pinpoint Tests

DTC U300D:11

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

The TCCM receives ignition switch position status from the hardwired run/start input circuit and the ignition switch position status message communicated by the BCM over the HS-CAN.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U300D:11	Ignition Input On/Start: Circuit Short To Ground	This DTC sets when a short to ground is detected by the TCCM, or if the ignition switch is not in RUN for the self-test.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- Ignition switch
- HS-CAN

PINPOINT TEST A : DTC U300D:11

A1 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDS

- Using a diagnostic scan tool, monitor the PIDs KEY_POS_4X4 and KEY_STATUS_4X4.
- Cycle the ignition switch between the OFF and ON positions.

Do the ignition PIDs match the ignition switch positions?

Yes	The system is functioning correctly at this time. CLEAR the DTCs.
No	If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 13 (10A). If the fuse is OK, REPAIR the open circuit. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. After the fault is repaired, CLEAR the DTCs. If the KEY_POS_4X4 PID did not match, DIAGNOSE the ignition switch, REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Wheel and Column Electrical Components) . After the fault is repaired, CLEAR the DTCs.

DTCS P0562:00, P0563:00

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

If the TCCM observes an overpower or underpower voltage condition, a DTC is set and all TCCM outputs are turned off (IWE engaged).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0562:00	System Voltage Low: No Sub Type Information	This DTC sets when the TCCM detects battery voltage less than 9 volts for 5 seconds or more at the TCCM.
P0563:00	System Voltage High: No Sub Type Information	This DTC sets when the TCCM detects battery voltage greater than 16 volts for 5 seconds or more at the TCCM.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM

PINPOINT TEST B : DTCS P0562:00, P0563:00

B1 RETRIEVE ALL CMDTCS IN ALL MODULES

NOTE: DTC P0562:00 or P0563:00 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

- Ignition ON.
- Enter the following diagnostic mode: Retrieve all CMDTCs.

Is DTC P0562:00 or P0563:00 present in one or more modules and P0563, P0620, P0625, P0626 or P065B present in the PCM?

Yes	For diagnosis of the battery and charging system, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to B2

B2 CHECK BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery Condition Test,
REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Does the battery pass the condition test?

Yes	GO to B3
No	CHARGE or INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

B3 CHECK THE CHARGING SYSTEM VOLTAGE

- **NOTE:** Do not allow the engine rpm to increase above 2,000 rpm while performing this step or the generator may self-excite and result in default charging system output voltage. If engine rpm has exceeded 2,000 rpm, shut the vehicle off and restart the engine before performing this step.

Start the engine

- Measure the voltage of the battery:
 - For DTC P0562:00, turn on the headlights and the HVAC fan on high and run the engine at 1,500 rpm for a minimum of 2 minutes.
 - For DTC P0563:00, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes.

Is the battery voltage between 13-15.2 volts?

Yes	For DTC P0562:00, GO to B4 For DTC P0563:00, GO to B6
No	To diagnose the charging system, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) . CLEAR all CMDTCs.

B4 CHECK VOLTAGE AND GROUND TO THE TCCM

- Ignition OFF.
- Disconnect TCCM C2371B.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to B6
No	GO to B5

B5 CHECK VOLTAGE TO THE TCCM

Is the voltage greater than 11 volts?

Yes	REPAIR the ground circuit. CLEAR all CMDTCs.
No	VERIFY BJB fuse 71 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR all CMDTCs.

B6 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.
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The Front Axle Does Not Engage/Disengage Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid commanded by the TCCM. When actuated, the IWE solenoid allows vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle. When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 deg and 5 seconds have elapsed since the shift to 2H has been initiated. If the TCCM observes an overpower or underpower voltage condition, a DTC is set and all TCCM outputs are turned off (IWEs engaged).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	This DTC sets when the TCCM detects there is a possible mechanical fault present with the IWE system based on wheel speed message data. When the DTC is present IWE solenoid output shall continue to operate normally.
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	This DTC sets when the TCCM detects a short to ground in the IWE solenoid circuit. The fault results in IWE disengaged all the time.
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	This DTC sets when the TCCM detects a short to voltage in the IWE solenoid circuit. The fault results in IWE engaged all the time.
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	This DTC sets when the TCCM detects an open circuit in the IWE solenoid circuit. The fault results in IWE engaged all the time.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks

- MSS

PINPOINT TEST C : THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY

C1 CHECK FOR TCCM DTCS

- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC C1979:11, GO to C17 For DTC C1979:12, GO to C16 For DTC C1979:13, GO to C18 For all other DTCs, REFER to the DTC chart: TCCM.
No	GO to C2

C2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle at operating temperature and the MSS in 2H mode, drive the vehicle at sustained Wide Open Throttle (WOT) for 5 seconds.

Is there a grinding noise from the axle system during Wide Open Throttle (WOT)?

Yes	GO to Pinpoint Test I
No	GO to C3

C3 CHECK TCCM OPERATION

- Ignition ON.
- Monitor the 4X4 indicator on the IPC while moving the MSS between 2H and 4H modes.

Does the 4X4 indicator illuminate when the MSS is in the 4H position and turn off when the MSS is in the 2H position?

Yes	GO to C4
No	GO to Pinpoint Test L

C4 CHECK THE IWE DISENGAGEMENT

- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWEs to disengage.*

With the vehicle in NEUTRAL, position it on a hoist.

REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- Place the MSS in 2H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either front halfshaft rotate?

Yes	GO to C7
No	GO to C5

C5 CHECK THE IWE ENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Place the MSS in 4H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did both front halfshafts rotate?

Yes	The front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test J
No	GO to C6

C6 CHECK THE IWE SOLENOID OUTPUT IN 4H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum less than 25 mm-Hg (1 in-Hg)

Yes	The IWE is mechanically stuck in the disengaged position. INSTALL a new IWE on the halfshaft(s) that did not rotate. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	REPLACE the IWE Solenoid.

C7 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running and the MSS in 2H, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)

Yes	GO to C9
No	GO to C8

C8 CHECK THE IWE SOLENOID INPUT VACUUM IN 2H

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)?

Yes	INSTALL a new IWE solenoid.
No	GO to Pinpoint Test I

C9 CHECK THE IWE VACUUM LINES FOR LEAKS

- Ignition OFF.
- Disconnect the output vacuum line at the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	The vacuum lines between the IWE solenoid and the RH or LH IWEs are leaking. INSTALL new vacuum lines as required.
No	GO to C10

C10 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect the output vacuum line from the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum.
- Remove the plug at the LH IWE vacuum line and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	REINSTALL the plug at the LH IWE vacuum line. GO to C11
No	INSPECT vacuum lines from IWE solenoid to LH IWE for obstruction. INSTALL new lines as required.

C11 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect the output vacuum line from the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe the vacuum reading.
- Remove the plug at the RH IWE vacuum line and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	The vacuum lines are not leaking or obstructed. GO to C12
No	INSPECT vacuum lines from the vacuum line “T” to the RH IWE for obstruction. INSTALL new lines as required.

C12 CHECK THE RH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the RH IWE.
- Connect a hand vacuum pump to the RH IWE port. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to C13

C13 CHECK THE RH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Did the RH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the RH IWE. GO to C14
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No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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C14 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm-Hg (20 in-Hg) of vacuum to the LH IWE port and observe vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to C15

C15 CHECK THE LH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the LH IWE. The front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test J
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C16 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect IWE C1291.
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the circuit. CLEAR the DTCs.
No	GO to C17

C17 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

Is the resistance greater than 10,000 ohms?

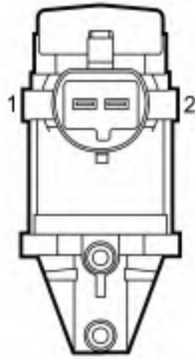
Yes	GO to C18
No	REPAIR the circuit.

C18 CHECK THE IWE SOLENOID RESISTANCE

NOTE: *If the temperatures (either ambient or in the engine compartment) are exceptionally high, a higher than normal resistance reading could result. A lower temperature could result in a lower resistance reading.*

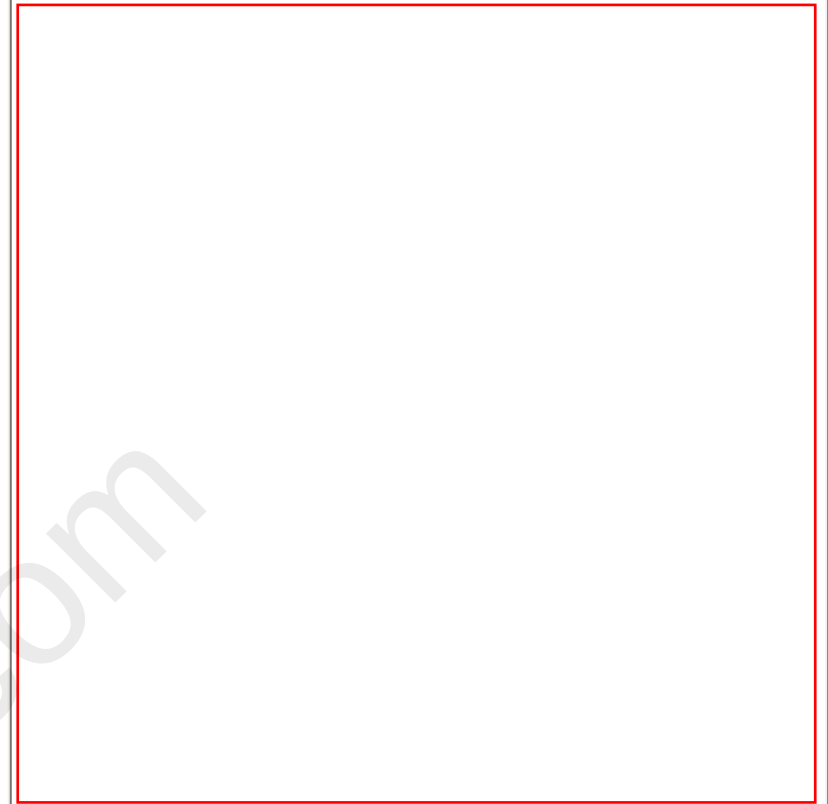
- Measure:

Positive Lead	Measurement / Action	Negative Lead



E191450

Pin 1, component side.



Pin 2, component side.

Is the resistance between 44 and 70 ohms?

Yes	GO to C19
No	INSTALL a new IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation). CLEAR the DTCs.

C19 CHECK FOR VOLTAGE TO THE IWE SOLENOID

- Connect TCCM C2371A.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to C20
No	CHECK BJB fuse 29 (10A). If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

C20 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect IWE solenoid C1291.
- Disconnect TCCM C2371A.
- Ignition ON.

Is the resistance less than 3 ohms?

Yes	GO to C21
No	REPAIR the circuit. CLEAR the DTCs.

C21 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Vehicle Does Not Shift Between 4A (4X4 AUTO) and 4H (4X4) Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

For locator views of the vacuum lines and vacuum reservoir,
REFER to: [Four-Wheel Drive Systems - Overview](#) (308-07A Four-Wheel Drive Systems, Description and Operation).

Normal Operation

In 2H mode, the TCCM supplies a ground path to the IWE solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In AUTO, 4H and 4L modes, the TCCM does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the hubs engaged. Systematically check the necessary inputs and outputs at the TCCM, internal components of the transfer case, MSS , IWE components and drive axles.

Possible Sources

- Wiring, terminals or connectors
- TCCM
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- MSS

PINPOINT TEST D : THE VEHICLE DOES NOT SHIFT BETWEEN 4A (4X4 AUTO) AND 4H (4X4) MODES CORRECTLY

D1 CHECK FOR TCCM DTCS

- Ignition ON.
- Using a diagnostic scan tool, carry out the TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to D2

D2 CHECK THE 4H INDICATOR

- Select 4H mode and observe the IPC.

Does the IPC indicator lamp indicate 4H (4X4) mode?

Yes	GO to D8
No	GO to D3

D3 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) PID

- Enter the following diagnostic mode on the scan tool: TCCM DataLogger
- Monitor the KEY_POS_4X4 PID while cycling through each position:

Does the ignition position PID match the ignition switch positions?

Yes	GO to D4
No	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Wheel and Column Electrical Components) .

D4 CHECK THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Monitor 4X4_SW PID while cycling the MSS through each position.

MSS Position	PID Status
2H	2-W Drive
4A	A4WD
4H	4W Hi
4L	4W Low

Does each PID status agree with each MSS position?

Yes	GO to D7
No	GO to D5

D5 CHECK THE MSS RESISTANCE VALUES

- Ignition OFF.
- Disconnect MSS C284.
- Refer to table below, measure:

Click to display connectors

Positive Lead	Measurement / Action	Negative Lead
MSS pin 2 component side.	Ω	MSS pin 3 component side.

MSS Position	Resistance ($\pm 1\%$)
2H	619 ohms
4A	270 ohms
4H	130 ohms
4L	62 ohms

Are the resistance values within specification?

Yes	GO to D6
No	INSTALL a new MSS. REFER to: Mode Select Switch (MSS) (308-07A Four-Wheel Drive Systems, Removal and Installation).

D6 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR AN OPEN

- Disconnect TCCM C2371A.

Are the resistances less than 3 ohms?

Yes	GO to D18
No	REPAIR the affected circuit(s). CLEAR the DTCs.

D7 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID IN 4H

- Switch the MSS to 4H mode.
- Monitor the 4WD_CLTCH_OS PID.

Does the PID read 0 to 10% at closed throttle?

Yes	GO to D18
No	DIAGNOSE any HS-CAN or PCM DTCs first. REFER to: Communications Network (418-00 Module Communications Network) . Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

D8 CHECK FOR WIND-UP IN 4H MODE

- Switch the MSS to 4H mode.
- Drive the vehicle on a dry, hard surface in tight turns while applying 10-15% throttle.

Is wind-up present in turns?

Yes	GO to D12
No	GO to D9

D9 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- **NOTE:** The TP_TCCM PID is APP as communicated by the PCM via HS-CAN .

Slowly move the accelerator pedal from closed throttle to WOT and observe the TP_TCCM PID.

Does the TP_TCCM PID vary between 0% at closed throttle and 100% at WOT ?

Yes	GO to D10
No	DIAGNOSE any HS-CAN or PCM DTCs first. REFER to: Communications Network (418-00 Module Communications Network) . Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

D10 CHECK FOR TRANSFER CASE CLUTCH ENGAGEMENT WITH THE TCCM 4WD PWM CLUTCH STATUS COMMAND (4WD_CLTCH_OS) ACTIVE COMMAND PID

- Using the 4WD_CLTCH_OS active command, engage the transfer case clutch to 90%.
- Drive the vehicle on a dry, hard surface in tight turns while applying 10-15% throttle.

Is wind-up present in turns?

Yes	END the active command. GO to D11
No	END the active command. GO to Pinpoint Test F

D11 CHECK THE IPC INDICATOR IN AUTO MODE

- Select 4A mode and observe the IPC.

Does the message center indicate 4A (4X4 AUTO) mode?

Yes	GO to D12
No	CHECK key status PID, GO to Pinpoint Test A

D12 CHECK FOR WIND-UP IN AUTO MODE

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

Is wind-up present in turns?

Yes	GO to D13
No	The system is operating correctly.

D13 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID AT CLOSED THROTTLE

- Monitor the 4WD_CLTCH_OS PID at closed throttle, KOEO.

Does the 4WD_CLTCH_OS PID indicate 0 to 10% clutch application at closed throttle?

Yes	GO to D14
No	GO to D16

D14 CHECK VOLTAGE ON THE CLUTCH CONTROL CIRCUIT USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- Ignition ON.
- Using the 4WD_CLTCH_OS active command, command the transfer case clutch to 4%.

Is the voltage approximately 0.2 to 0.4 volt?

Yes	END the active command. CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	GO to D15

D15 CHECK THE CLUTCH CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Transfer Case C350.
- Disconnect TCCM C2371B.

Is the resistance less than 3 ohms?

Yes	GO to D16
No	REPAIR the circuit. CLEAR the DTCs.

D16 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDS

- Enter the following diagnostic mode on the scan tool: ABS Module DataLogger.
- While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)

Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?

Yes	GO to D17
No	CHECK the ABS for faults. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

D17 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- **NOTE:** The TP_TCCM PID is APP as communicated by the PCM via HS-CAN.

Enter the following diagnostic mode on the scan tool: TCCM DataLogger.

- Slowly move the accelerator pedal from closed throttle to and observe the TP_TCCM PID.

Does the TP_TCCM PID vary between 0% at closed throttle and 100% at WOT?

Yes	GO to D18
No	DIAGNOSE any HS-CAN or PCM DTCs first. REFER to: Communications Network (418-00 Module Communications Network) . Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

D18 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Vehicle Does Not Shift Between 4H (4X4) and 4L (4X4 Low) Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The high-low shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gear set to the output shaft. The torque transmitted through the sun gear from the input shaft turns the front planetary gear set assembly. The front planetary gear set assembly, now engaged, provides transfer case speed reduction. Certain criteria, such as vehicle speed and TR selection must be met before this shift can occur. Systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	This DTC sets when the TCCM detects battery voltage less than 9 volts for 5 seconds or more at TCCM.
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Shift motor moves are prevented when this DTC is set.
P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set.
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P184B:00	Transfer Case Unable to Transition Between 4H and 4L: No Sub Type Information	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4H to 4L. Requested shift motor position is not reached.
P1853:00	Transfer Case Contact Plate 'B' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P1857:00	Transfer Case Contact Plate 'C' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P1861:00	Transfer Case Contact Plate 'D' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	This DTC sets when an invalid shift motor position is detected during selection of a new 4WD mode or during a motor movement. If the shift motor is not moving, shift motor movement is prevented. If the shift motor is moving when this DTC sets, the shift motor moves to the high-side mechanical stop.

P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	This DTC sets when TCCM detects a short to ground, a short to voltage or open circuit. The TCCM cannot complete mode change if a change in shift motor position is required.
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Possible Sources

- Wiring, terminals or connectors
- TR
- ABS wheel speed inputs
- Transfer case
- TCCM
- Transmission drag torque

PINPOINT TEST E : THE VEHICLE DOES NOT SHIFT BETWEEN 4H (4X4) AND 4L (4X4 LOW) MODES CORRECTLY

E1 CHECK FOR TCCM DTCS	
 WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: TCCM Self-Test.	
Are any DTCs present?	
Yes	For DTC P184B:00, GO to E18 For DTC P1839:00, GO to E13 For DTC P1840:00, GO to E16 For DTC P1841:00, GO to E17 For DTC P1849:00, P1853:00, P1857:00, P1861:00, P1867:00 GO to E8 For DTC P1891:00, GO to E10 For all other DTCs, the DTC Chart: TCCM.
No	GO to E2
E2 CHECK THE 4H TO 4L SHIFT	

- **NOTE:** When switching in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).

Drive the vehicle and shift MSS from 4H to 4L.

Does the transfer case shift from 4H to 4L correctly and the complaint is related to a clunk noise during the shift?

Yes	Transmission neutral drag is excessive. REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to E3

E3 CHECK THE NEUTRAL INDICATOR (NEUTRAL) PID

- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the NEUTRAL TCCM PID while shifting the transmission through gear ranges.

Does the NEUTRAL PID indicate True when the transmission is shifted to NEUTRAL?

Yes	GO to E4
No	For further diagnosis of the TR sensor, REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 2.7L EcoBoost (238kW/324PS) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) . REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L Duratec (209kW/284PS) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) . REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L EcoBoost (272kW/370PS) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) . REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 5.0L 32V Ti-VCT (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) .

E4 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDS

- Ignition OFF.
- Connect TCCM C2371A.
- Connect MSS.
- Ignition ON.
- Switch the MSS to 2H
- Enter the following diagnostic mode on the scan tool: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs with the vehicle stopped and while driving.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match with the vehicle stopped and at all speeds?

Yes	GO to E5
No	To diagnose the wheel speed concern. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . After the repair is complete, CLEAR the DTCs.

E5 CHECK THE ABS MODULE WHEEL SPEED PIDS

- Enter the following diagnostic mode on the scan tool:ABS DataLogger.
- Monitor the wheel speed PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)

Do the wheel speed PIDs indicate 0 km/h (0 mph)?

Yes	GO to E6
No	To DIAGNOSE the wheel speed concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . After the repair is complete, CLEAR the DTCs.

E6 CHECK THE TCCM 4WD MODES (4WD_MODES) PID WITH THE MSS IN 4H

- Start the engine.
- Switch the MSS to 4H
- Monitor the 4WD_MODES PID:

Does the 4WD_MODES PID indicate 4WD High?

Yes	GO to E7
No	GO to E8

E7 CHECK THE TCCM 4WD MODES (4WD_MODES) PID WITH THE MSS IN 4L

- Start the engine.
- Switch the MSS to 4L.
- Monitor the 4WD_MODES PID.

Does the 4WD_MODES PID indicate 4WD Low?

Yes	GO to E18
No	GO to E8

E8 CHECK TRANSFER PLATE CONTACT PLATE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect Transfer Case C350.
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s). CLEAR the DTCs.
No	GO to E9

E9 CHECK TRANSFER PLATE CONTACT PLATE CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.

Are the resistances greater than 10,000 ohms?

Yes	GO to E10
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E10 CHECK THE TRANSFER PLATE CONTACT PLATE CIRCUITS FOR AN OPEN

- Start the engine.

Are the resistances less than 3 ohms?

Yes	GO to E11
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E11 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to E12
No	INSTALL a new transfer case shift motor. CLEAR the DTCs. REPEAT the self-test. If the concern is still present, GO to E19

E12 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER WHILE COMMANDING THE TCCM CW RELAY (CW_SMD_OS) AND CCW RELAY (CCW_SMD_OS) PIDS ON

- Connect TCCM C2371A.
- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.

Are the voltages 11 volts or greater on the circuits when commanding the PIDs ON?

Yes	END the active commands, GO to E16
No	END the active commands, GO to E13

E13 CHECK THE TCCM VOLTAGE CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the voltage greater than 11 volts?

Yes	GO to E14
No	VERIFY BJB fuse 63 (25A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

E14 CHECK THE TRANSFER CASE CONTROL MODULE GROUND

- Ignition OFF.

Is the resistance less than 3 ohms?

Yes	GO to E15
No	REPAIR the circuit.

E15 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

- Disconnect Transfer Case C350.
- Disconnect TCCM C2371B.

Are the resistances less than 3 ohms?

Yes	GO to E16
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E16 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE

- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s). CLEAR the DTCs.
No	GO to E17

E17 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.

Are the resistances greater than 10,000 ohms?

Yes	GO to E19
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E18 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the MSS from 2H to 4H.

Does the transfer case shift motor rotate from the 2H position to the 4H position?

Yes	Disassemble transfer case. REFER to: Transfer Case - Vehicles With: 2-Speed Torque On Demand Transfer Case (308-07B Transfer Case, Disassembly and Assembly).
No	INSTALL a new transfer case shift motor. REFER to: Transfer Case Shift Motor (308-07A Four-Wheel Drive Systems, Removal and Installation).

E19 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

Four-Wheel Drive (4WD) Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the operator selects a transfer case mode from 2H mode, the TCCM engages a clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a mechanical engagement of the transfer case. The TCCM also removes the ground path from the IWE solenoid, which removes vacuum from the IWEs , allowing them to engage the front axle shaft. Systematically check the necessary inputs and outputs at the TCCM, internal components of the transfer case, IWE components and drive axles.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	This DTC sets when TCCM detects an open circuit. The TCCM disables transfer case clutch operation.
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Transfer case clutch operation, though disabled by the TCCM, is fully engaged when this DTC is present.
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground	This DTC sets when TCCM detects a short to ground. The TCCM disables transfer case clutch operation.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM
- Transfer case
- Front axle assembly
- Transfer case clutch

PINPOINT TEST F : FOUR-WHEEL DRIVE (4WD) DOES NOT ENGAGE AT SPEED CORRECTLY

F1 CHECK FOR TCCM DTCS



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: TCCM Self-Test.

Are any DTCs present?

Yes

For DTC P1825:00, GO to [F11](#) For DTC P1826:00, GO to [F12](#) For DTC P1827:00, GO to [F10](#) For all other DTCs, the DTC chart: TCCM.

No	GO to F2
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F2 CHECK 4X4 MODE ENGAGEMENT AT REST

- Switch the MSS from 4X2 mode to 4X4 mode.

Does 4X4 mode engage at rest correctly?

Yes	GO to F3
No	GO to Pinpoint Test C

F3 CHECK 4X2 MODE TO 4X4 MODE SHIFT AT SPEED

- Switch the MSS to 4X2 mode.
- Drive the vehicle and carry out a 4X2 mode to 4X4 mode shift while driving at approximately 16 km/h (10 mph).
- Stop the vehicle, shift to 4X2 mode, drive the vehicle and carry out a 4X2 mode to 4X4 mode shift while driving at approximately 64 km/h (40 mph).

Does 4X4 mode engage correctly at 16 km/h (10 mph) and at 64 km/h (40 mph)?

Yes	GO to Pinpoint Test J
No	GO to F4

F4 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD)

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs while driving in a straight line.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match?

Yes	GO to F5
No	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

F5 CHECK THE TRANSFER CASE CLUTCH LOCKUP USING TCCM 4WD PWM CLUTCH STATUS (4WD CLTCH_OUT) PID ACTIVE COMMAND

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Enter the following diagnostic mode: TCCM DataLogger.
- Switch the MSS to AUTO mode.
- Using the 4WD CLTCH_OUT active command, command the transfer case clutch to 98%.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F6
No	GO to F9

F6 CHECK THE TRANSFER CASE CLUTCH RELEASE USING TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- With the vehicle still in NEUTRAL and on a hoist, using the 4WD_CLTCH_OS active command, command the transfer case clutch to 0%.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F12
No	End the active command. GO to F7

F7 CHECK THE TRANSFER CASE ENGAGEMENT (ON A HOIST)

- Start the engine, switch the MSS to 4X2 mode.
- Place the transmission in DRIVE and increase speed to between 5 km/h (3 mph) and 8 km/h (5 mph).
- While observing the front driveshaft, switch the MSS to 4X4 mode.

Did the front driveshaft start to spin?

Yes	GO to F8
No	GO to F13

F8 CHECK THE TRANSFER CASE DISENGAGEMENT

- Switch the MSS to 4X2 mode while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	GO to F13
No	GO to Pinpoint Test C

F9 CHECK CLUTCH CONTROL CIRCUIT FOR VOLTAGE USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- Ignition ON.
- Using the 4WD_CLTCH_OS active command, command the transfer case clutch to 98%.

Is the voltage greater than 9 volts?

Yes	END the active command. INSTALL a new transfer case clutch. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). CLEAR the DTCs.
No	GO to F10

F10 CHECK CLUTCH CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371B.

Is the resistance greater than 10,000 ohms?

Yes	GO to F11
No	REPAIR the circuit. CLEAR the DTCs.

F11 CHECK CLUTCH CONTROL CIRCUIT FOR AN OPEN

Is the resistance less than 3 ohms?

Yes	GO to F12
No	REPAIR the circuit. CLEAR the DTCs.

F12 CHECK CLUTCH CONTROL CIRCUIT FOR A SHORT TO VOLTAGE USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- Connect Transfer Case C350.
- Connect TCCM C2371B.
- Ignition ON.
- Enter the following diagnostic mode: TCCM DataLogger .
- Using the 4WD_CLTCH_OS active command, command the transfer case clutch to 0%.

Is the voltage approximately 0.2 to 0.4 volt?

Yes	REPAIR the circuit. CLEAR the DTCs.
No	GO to F13

F13 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Four-Wheel Drive (4WD) System Jumps Out of Gear

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the 4WD system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected mode, systematically check the 4WD system components.

Possible Sources

- IWE vent lines
- MSS
- Transfer case

PINPOINT TEST G : THE FOUR-WHEEL DRIVE (4WD) SYSTEM JUMPS OUT OF GEAR

G1 CHECK FOR OBSTRUCTED IWE VENT LINES

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- **NOTE:** *The IWE vent port is the smaller of the 2 vacuum ports.*

Disconnect the LH IWE line from the vent port.

- Attach a hand vacuum pump to the IWE vent line.
- Attempt to draw and hold a vacuum.
- Connect the LH IWE line.
- Disconnect the RH IWE line from the vent port.
- Attempt to draw and hold a vacuum.

Can a vacuum be held on either IWE vent line?

Yes	INSTALL new IWE vent lines as necessary.
No	GO to G2

G2 CHECK THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- DRIVE the vehicle.
- Monitor the 4X4_SW PID while driving the vehicle in each MSS position.

MSS Position	Status
2H	2-W Drive
4A	A4WD
4H	4W Auto/Hi
4L	4W Low

Does the PID always agree with the MSS position?

Yes	GO to G3
No	GO to Pinpoint Test C

G3 CHECK THE 4WD INDICATORS

- Stop the vehicle.
- Shift the transmission into the NEUTRAL position.
- **NOTE:** 2H is indicated by the absence of 4X4 AUTO, 4H or 4L mode indicators in the IPC message center.

Observe the 4WD indicators in the IPC while cycling through each MSS position.

Do the 4WD indicators match MSS switch positions?

Yes	GO to Pinpoint Test C
No	GO to G4

G4 CHECK FOR TCCM DTCS

- Shift the transmission into the PARK position.
- Enter the following diagnostic mode: TCCM self-test.

Are DTCs present?

Yes	REFER to the DTC Chart: TCCM.
No	CHECK the transfer case fluid level. If the fluid level is OK, CHECK for internal transfer case faults. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up)

Normal Operation

In order for the 4WD system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Sources

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST H : VEHICLE PULSATES OR SHUDDERS IN A STRAIGHT LINE (STRAIGHTLINE DRIVELINE WIND-UP)

NOTE: 4X4 is not intended for driving on hard/dry surfaces; using 4X4 mode while driving on these surfaces may produce noises like intermittent clunking, but it does not damage driveline components.

H1 VERIFY THE CONCERN

- Drive the vehicle and shift from 2H mode to 4H mode. There should be minimal wind-up in 4H mode during straightline maneuvers (windup in turns is normal; 4H/4L is not intended for driving on hard/dry surfaces).

Is excessive wind-up present?

Yes	GO to H2
No	RETURN the vehicle to the customer. ADVISE about correct 4WD system operation and normal vehicle behavior.

H2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

- Check the wheel and tire sizes.

Do the 4 wheels and tire sizes match?

Yes	GO to H3
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H3 CHECK TIRE WEAR

- Check each of the 4 tires for wear.

Are the 4 tires worn evenly?

Yes	GO to H4
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H4 CHECK TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to the Safety Certification Label on driver door or door pillar.

Are the tire inflation pressures correct?

Yes	GO to H5
No	ADJUST the tire pressure as necessary. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match.
REFER to: [Rear Drive Axle and Differential](#) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Description and Operation).
REFER to: [Front Drive Axle](#) (205-03 Front Drive Axle/Differential, Diagnosis and Testing).

Do the front and rear axle ratios match?

Yes	RETURN the vehicle to the customer and ADVISE about correct 4WD system usage and normal vehicle behavior.
No	CHECK the VC label. INSTALL the correct axle(s). REFER to: Rear Drive Axle and Differential (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Front Drive Axle (205-03 Front Drive Axle/Differential, Diagnosis and Testing).

The Front Axle Makes Noise in 2H Mode Only and Generally Under Heavy Throttle

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation.
REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .

Normal Operation

In 2H mode, the TCCM provides a ground path to the IWE solenoid to supply vacuum to each IWE (disengaging the front hubs from the front axle). During certain conditions such as WOT maneuvers, manifold vacuum is lower than desired. To maintain uninterrupted IWE function in 2H, stored engine vacuum is sourced from the vacuum reservoir. A one-way check valve is implemented between the vacuum reservoir and the IWE solenoid to prevent the stored vacuum from escaping into the manifold during low engine vacuum conditions. For noise-free IWE operation under all conditions, the check valve must be operating correctly.

Possible Sources

- Vacuum leaks
- TCCM
- Transfer case clutch
- Front axle assembly
- Transfer case
- IWE solenoid

PINPOINT TEST I : THE FRONT AXLE MAKES NOISE IN 2H MODE ONLY AND GENERALLY UNDER HEAVY THROTTLE

I1 CHECK FOR TCCM DTCS					
 WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury. • Ignition ON. • Enter the following diagnostic mode on the scan tool: TCCM Self-Test. Are any DTCs present? <table><tr><td>Yes</td><td>REFER to the TCCM DTC chart.</td></tr><tr><td>No</td><td>GO to I2</td></tr></table>		Yes	REFER to the TCCM DTC chart.	No	GO to I2
Yes	REFER to the TCCM DTC chart.				
No	GO to I2				
I2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS					
• With the vehicle warm and the MSS in 2H mode, drive the vehicle at sustained WOT for 5 seconds. Is there a grinding noise from the axle system during WOT? <table><tr><td>Yes</td><td>GO to I3</td></tr><tr><td>No</td><td>IDENTIFY the customer concern and REFER to Symptom Chart: Four-Wheel Drive Systems.</td></tr></table>		Yes	GO to I3	No	IDENTIFY the customer concern and REFER to Symptom Chart: Four-Wheel Drive Systems.
Yes	GO to I3				
No	IDENTIFY the customer concern and REFER to Symptom Chart: Four-Wheel Drive Systems.				

I3 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Select 2H.
- **NOTE:** *The engine must be idling during the following steps to supply vacuum to the IWE solenoid.*

Start the engine.
- Disconnect the output vacuum line at the IWE solenoid while having the vacuum supply attached to the solenoid.
- With the engine running and the in 2H mode, measure the vacuum at the output port of the solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to I8
No	GO to I4

I4 CHECK THE IWE SOLENOID INPUT VACUUM

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine still running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	INSTALL a new IWE solenoid.
No	GO to I5

I5 CHECK SOURCE VACUUM TO THE VACUUM RESERVOIR

- Disconnect the source vacuum line from the vacuum reservoir.
- With the engine still running, measure the source vacuum being supplied to the vacuum reservoir.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to I6
No	REPAIR or INSTALL a new source vacuum line.

I6 CHECK THE VACUUM RESERVOIR

- Ignition OFF.
- Disconnect the vacuum line from the vacuum reservoir.
- Connect a hand vacuum pump to the source vacuum port on the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to I7
No	INSTALL a new vacuum reservoir.

I7 CHECK THE ONE-WAY VACUUM CHECK VALVE

- **NOTE:** *The check valve is between the IWE solenoid and the vacuum reservoir.*

Connect the vacuum lines to the IWE solenoid.

- Connect a hand vacuum pump to the IWE solenoid vacuum line at the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	Concern not present at this time. GO to Pinpoint Test J
No	REPAIR or INSTALL new vacuum lines or INSTALL a new one-way check valve.

I8 CHECK THE IWE VACUUM SYSTEM

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a hand vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit.
- Observe the vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to I12
No	GO to I9

I9 CHECK THE RH IWE LEAK RATE

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Disconnect the vacuum line from the larger port on the RH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the RH port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to I10
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

I10 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the LH port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to I11
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

I11 CHECK THE IWE VACUUM SUPPLY TUBE

- Disconnect both vacuum lines from the IWE solenoid.
- Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit and observe the vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to I12
No	INSTALL new vacuum lines as necessary.

I12 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 2H

- Connect a hand-held vacuum gauge to the LH vacuum supply tube.
- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWE to disengage.*

Start the engine.

- While maintaining the steering wheel straight, switch to 2H mode and wait for approximately 5 seconds, observe the vacuum gauge.
- Repeat these steps for the RH IWE.

Are the vacuum readings greater than 254 mm (10 in) Hg after 5 seconds have elapsed?

Yes	GO to I13
No	INSTALL new vacuum lines as necessary.

I13 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- With the vehicle in NEUTRAL, position it on a hoist.
- Disconnect the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the LH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the LH IWE. GO to I14

I14 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Disconnect the larger vacuum line at the RH IWE.
- Connect a hand vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the RH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the RH IWE. GO to I15

I15 CHECK THE LH IWE OPERATION

- Ignition OFF.
- Connect a hand vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?

Yes	GO to I16
No	INSTALL a new LH IWE.

I16 CHECK THE RH IWE OPERATION

- Connect a hand vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Yes	GO to Pinpoint Test J
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

Four-Wheel Drive (4WD) System Functional Test

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation.
REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When operating in 4WD modes, the transfer case clutch is energized and both IWEs are locked. When in 4L mode, the transfer case low range gear set provides an additional 2.64 gear reduction. When operating in 2H mode, the transfer case clutch is de-energized and both IWEs are unlocked. The transfer case has certain amount of clutch drag which can cause the front driveshaft to spin even when in 2H mode.”

Possible Sources

- Transfer case and related components
- IWEs and related components
- Wheel/tire assemblies

PINPOINT TEST J : FOUR-WHEEL DRIVE (4WD) SYSTEM FUNCTIONAL TEST

NOTE: 4X4 High and 4X4 Low are not intended for driving on hard/dry surfaces; using these modes while driving on these surfaces may produce noises like intermittent clunking, but does not damage driveline components.

J1 CHECK 2H MODE OPERATION

- Shift the transmission into the NEUTRAL position.
- Switch the MSS to 2H mode.

Are there any 4WD mode indicators present in the IPC message center?

Yes	GO to J2
No	GO to J4

J2 CHECK FOR TCCM DTCS

- Shift the transmission into the PARK position.
- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J3

J3 CHECK FOR WIND-UP IN 2H MODE

- Drive the vehicle on a dry, hard surface while executing turns and applying 10-15% throttle.

Is wind-up present in turns?

Yes	GO to Pinpoint Test E
No	To diagnose the 4X4 mode indicators do not operate correctly/do not operate, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

J4 CHECK AUTO MODE OPERATION

- Switch the MSS to 4A mode.

Is the 4X4 auto (4A) mode indicator on in the IPC message center?

Yes	GO to J7
No	GO to J5

J5 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs present?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J6

J6 CHECK FOR WIND-UP IN 4A MODE

- Drive the vehicle on a dry, hard surface, executing turns while applying the throttle.

Is wind-up present in turns?

Yes	GO to J7
No	GO to J8

J7 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the 4WD_CLTCH_OS PID.

Does the PID indicate 0% to 10% clutch application at closed throttle?

Yes	GO to J8
No	GO to J9

J8 CHECK FOR WIND-UP IN 4A MODE WITH 100% CLUTCH DUTY CYCLE

- Enter the following diagnostic mode: TCCM DataLogger.
- Command the 4WD_CLTCH_OS to 100%.
- Drive the vehicle on a dry, hard surface, executing turns.

Is wind-up present in turns?

Yes	GO to J9
No	CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

J9 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs.
- Drive the vehicle 30 km/h (18 mph).
- Record and compare the FRT_WHL_SPD and REAR_WHL_SPD PIDs.

Do the FRT_WHL_SPD and REAR_WHL_SPD PID values match within 1.5 km/h (1 mph)?

Yes	GO to J10
No	VERIFY all 4 tires are the same size and brand. INSTALL new tires as necessary. If the tires are OK, CHECK the ABS. and VERIFY that the 4 road tire sizes match. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

J10 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the TP_TCCM PID.
- **NOTE:** *The TP_TCCM PID is as communicated by the PCM via HS-CAN.*

Slowly move throttle from closed throttle to WOT and observe the TP_TCCM PID.

Does the TP_TCCM PID value vary between 0% at closed throttle and 100% at WOT?

Yes	GO to J11
No	CHECK the APP sensor and/or the PCM. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

J11 CHECK 4H MODE OPERATION

- Switch the MSS to 4H mode.

Does the 4X4 (4H) indicator illuminate in the IPC message center correctly?

Yes	GO to J14
No	GO to J12

J12 CHECK FOR TCCM DTCS

- Shift the transmission into the PARK position.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J13

J13 CHECK FOR WIND-UP IN 4H MODE

- Drive the vehicle on a dry, hard surface while executing turns and applying 10-15% throttle.

Is wind-up present in turns?

Yes	GO to Pinpoint Test F
No	GO to Pinpoint Test D

J14 CHECK FOR STRAIGHTLINE WIND-UP IN 4H MODE

- Drive the vehicle on a dry, hard surface.

Is straightline wind-up present?

Yes	GO to Pinpoint Test H
No	GO to J15

J15 CHECK WIND-UP IN TURNS IN 4H MODE

- Drive the vehicle in 4H mode while turning and applying 10-15% throttle.

Is wind-up present in turns?

Yes	GO to J16
No	GO to Pinpoint Test D

J16 CHECK 4L MODE OPERATION

- Bring the vehicle to a stop with the transmission in NEUTRAL, switch the MSS to 4L mode.

Does the 4WD LOW (4L) indicator in the IPC message center illuminate correctly?

Yes	GO to J19
No	GO to J17

J17 CHECK FOR TCCM DTCS

- Select PARK.
- Enter the following diagnostic mode: TCCM Self-Test .

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM .
No	GO to J18

J18 CHECK FOR WIND-UP IN 4L MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test K
No	GO to Pinpoint Test E

J19 CHECK FOR WIND-UP IN TURNS IN 4L MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present and 4L mode functioning?

Yes	GO to J20
No	CHECK for DTCs. REFER to the Inspection and Verification procedure. If no DTCs are present, GO to Pinpoint Test E

J20 CHECK 4L MODE TO 2H MODE SHIFT

- With the vehicle at a stop and transmission in NEUTRAL, switch the MSS from 4L mode to 2H mode.

Are there any 4WD mode indicators present in the message center?

Yes	GO to J21
No	GO to J23

J21 CHECK FOR TCCM DTCS

- Select PARK.
- Release the brake pedal.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J22

J22 CHECK FOR WIND-UP IN 2H MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test E
No	To diagnose the 4X4 mode indicators do not operate properly, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

J23 CHECK FOR TRANSFER CASE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	GO to J24

J24 CHECK FOR LH AND RH IWE (INTEGRATED WHEEL END) DISENGAGEMENT

- **NOTE:** *The engine must be at idle during the following steps to supply vacuum for IWE disengagement.*

Start the engine and allow to idle.

- Rotate the LH front tire one revolution forward and one revolution backward while observing the LF halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RF halfshaft and U-joint.

Does the LH or RH front halfshaft rotate?

Yes	GO to Pinpoint Test C
No	GO to J25

J25 CHECK FOR VACUUM LEAKS

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a hand vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit.
- Observe the vacuum reading.

Did the vacuum drop more than 25 mm (1 in) Hg per minute?

Yes	CHECK the IWE and related components for leaks.
No	GO to J26

J26 CHECK 2H MODE TO 4H MODE SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)

- Switch the MSS to 2H mode.
- Drive the vehicle on the road and shift from 2H mode to 4H mode while driving above 32 km/h (20 mph).

Does the transfer case shift to 4H mode satisfactorily?

Yes	The 4WD system is functioning correctly.
No	GO to Pinpoint Test F

Vehicle Binds in a Turn/Resists Turning/Pulsates in a Straightline in 4WD Mode

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the vehicle is operating in 4WD modes, all 4 wheels receive the same amount of torque and rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the 4WD system to function correctly, each tire must be in good condition and the front and rear axle ratios must match.

Possible Sources

- IPC Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Throttle position failure
- Transfer case
- TCCM

PINPOINT TEST K : VEHICLE BINDS IN A TURN/RESISTS TURNING/PULSATES IN A STRAIGHTLINE IN 4WD MODE

K1 VERIFY THE CONCERN

- **NOTE:** 4x4 High and 4x4 Low modes are not intended for driving on hard/dry surfaces; using these modes while driving on these surfaces may produce noise like intermittent clunking, but does not damage driveline components.”

Test drive the vehicle on a straight stretch of road in various 4x4 modes.

- Drive the vehicle through turns and parking lot maneuvers.

Does the vehicle bind, pulsate or shudder?

Yes	If the problem occurs in 4A mode, GO to K2 If in 4H mode or 4L mode, binding is a normal condition.
No	GO to Pinpoint Test H

K2 CHECK THE 4H AND 4A INDICATORS

- Review the test drive notes.

4x4 Auto (4A), did the 4X4 (4H) or powertrain malfunction indicator (wrench light) illuminate in the IPC message center?

Yes	If the powertrain malfunction indicator (wrench light) illuminated, GO to K4 If the 4H mode indicator illuminated, GO to K3
No	GO to K5

K3 VERIFY THE FAULT

- Review the test drive notes.

Was 4H mode selected when the 4H indicator was illuminated in the IPC message center?

Yes	The system is functioning correctly.
No	The fault may have been caused by an intermittent, un-commanded or autolock shift. GO to Pinpoint Test H

K4 CHECK FOR TCCM DTCS

- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM .
No	GO to K5

K5 VERIFY THE CONCERN WITH TRANSFER CASE CONNECTOR DISCONNECTED

- Select 4A mode.
- Disconnect Transfer Case.
- **NOTE:** Since the Transfer Case is disconnected you may get some DTC's and Check 4x4 illuminated in the IPC message center.

Test drive the vehicle in 4A on a straight stretch of road and in turns.

Is the concern present?

Yes	INSPECT the driveline components for damage or wear. REFER to Inspection and Verification.
No	GO to K6

K6 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Connect Transfer Case.
- Using the scan tool, clear the DTCs.
- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the 4WD_CLTCH_OS PID at closed throttle, KOEO.
- Select 4A mode.

Does the PID indicate 0% to 10% clutch application at closed throttle?

Yes	GO to K7
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No	CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
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K7 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDS

- Enter the following diagnostic mode: ABS Module Datalogger.
- While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)
- Compare the speedometer reading to the wheel speed sensor PIDs.

Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?

Yes	GO to K8
No	VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS for faults. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

K8 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- Enter the following diagnostic mode: TCCM Datalogger.
- **NOTE:** *The TP_TCCM PID is APP as communicated by the PCM via HS-CAN.*

Slowly move accelerator pedal from closed throttle to and observe the TP_TCCM PID.

Does the TP_TCCM PID value vary between 0% at closed throttle and 100% at WOT?

Yes	GO to K9
No	DIAGNOSE the PCM. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

K9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the front driveshaft by hand.

Does the front driveshaft rotate freely (does it require less than 45 Nm [33 lb-ft] to rotate)?

Yes	GO to K10
No	CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

K10 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Vehicle Does Not Shift Between 2H (2WD) and 4X4 Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The MSS communicates the operator's choice to the TCCM. The TCCM then controls the transfer case clutch, transfer case motor and IWEs as necessary. If the vehicle is not responding as intended, systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts. Check all circuits for opens and shorts to power or ground.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	This DTC sets when the TCCM senses an open circuit. 4WD system mode cannot be changed.
P1815:00	4-Wheel Drive Mode Select Short To Ground: No Sub Type Information	This DTC sets when the TCCM detects a short to ground. 4WD system mode cannot be changed.

Possible Sources

- Wiring, terminals or connectors
- MSS
- Transfer case
- TCCM

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST L : THE VEHICLE DOES NOT SHIFT BETWEEN 2H (2WD) AND 4X4 MODES CORRECTLY

L1 CHECK FOR TCCM DTCS	
• Ignition ON. • Enter the following diagnostic mode: TCCM Self-Test.	
Are any DTCs present?	
Yes	For DTC P1812:00, GO to L5 For DTC P1815:00, GO to L7 For all other DTCs, REFER to the DTC Chart: TCCM .
No	GO to L2
L2 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDS	

- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the KEY_POS_4X4 and KEY_STATUS_4X4 PIDs while cycling through each position.

Do the ignition PIDs match the ignition switch positions?

Yes	GO to L3
No	If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 13 (10A). If the fuse is OK, REPAIR the circuit for an open. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. After the fault is repaired, CLEAR the DTCs.

L3 CHECK THE TCCM MODULE SUPPLY VOLTAGE (VBAT_4X4) PID

- Start the engine.
- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the VBAT_4X4 PID.

Is the VBAT_4X4 PID greater than 12 volts?

Yes	GO to L4
No	To DIAGNOSE the low battery voltage and/or charging system concern, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .

L4 CHECK THE MSS POSITION MONITORING THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Monitor the 4X4_SW PID while switching to each MSS position.

Does the PID match the MSS position?

Yes	GO to L10
No	GO to L5

L5 CHECK THE MSS RESISTANCE VALUES

- Ignition OFF.
- Disconnect MSS C284.
- Refer to tables below, measure:

Click to display connectors

Positive Lead	Measurement / Action	Negative Lead
MSS pin 2 component side.	Ω	MSS, pin 3 component side.

MSS Position	Resistance ($\pm 1\%$)
2H	619 ohms
4A	270 ohms
4H	130 ohms
4L	62 ohms

Are the resistance values within specification?

Yes	GO to L6
No	INSTALL a new MSS. REFER to: Mode Select Switch (MSS) (308-07A Four-Wheel Drive Systems, Removal and Installation).

L6 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR SHORT TO VOLTAGE

- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to L7

L7 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.
- Disconnect TCCM C2371A.
- Disconnect MSS C284.

Is the resistance greater than 10,000 ohms?

Yes	GO to L8
No	REPAIR the affected circuit(s).

L8 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR AN OPEN

- Disconnect TCCM C2371A.

Are the resistances less than 3 ohms?

Yes	GO to L9
No	REPAIR the affected circuit(s).

L9 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.

Is the resistance greater than 10,000 ohms?

Yes	GO to L10
No	REPAIR the affected circuit(s).

L10 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
 - Refer to Wiring Diagrams Cell 34 and verify module ground to vehicle ground connection.
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

DTC U0100

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0100 when it has not received messages from the PCM for more than 5 seconds with ignition in RUN and battery voltage in range. Other modules that require data from the PCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100	Lost Communication With ECM/PCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the PCM over the HS-CAN are missing for longer than 5 seconds with ignition in RUN and battery voltage in range.

Possible Sources

- Communication concern
- Battery voltage concern
- PCM
- TCCM

PINPOINT TEST M : U0100

M1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to M2
No	REFER to: Communications Network (418-00 Module Communications Network) .

M2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0100?

Yes	GO to M3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.7L EcoBoost (238kW/324PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L Duratec (209kW/284PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 5.0L 32V Ti-VCT) .
No	GO to M4

M4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to M5

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is the DTC U0100 set in other modules on the network?

Yes	GO to M6
No	GO to M7

M6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.7L EcoBoost (238kW/324PS)) . REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS), Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.5L Duratec (209kW/284PS)) . REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 5.0L 32V Ti-VCT) . PROGRAM the PCM with the latest calibration level.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0121

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0121 when key messages such as wheel speed, brake pressure or torque are not received for longer than 5 seconds. This loss of key messages degrades the 4x4 system performance and/or inability to change 4x4 modes. Other modules that require data from the ABS module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Sets in continuous memory in the TCCM if ABS data messages received from the ABS Module over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- ABS module
- TCCM

PINPOINT TEST N : U0121

N1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE ABS (ANTI-LOCK BRAKE SYSTEM)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to N2
No	REFER to: Communications Network (418-00 Module Communications Network) .

N2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0121 retrieved again?

Yes	GO to N3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to N4

N4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE PCM SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	DIAGNOSE and REPAIR all charging or battery related DTCs first. REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to N5

N5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0121 set in other modules on the network?

Yes	GO to N6
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No	GO to N7
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N6 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0140

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0140 when key messages such as wheel speed, brake pressure or torque are not received for longer than 5 seconds. This loss of key messages degrades the 4x4 system performance and/or inability to change 4x4 modes. Other modules that require data from the BCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140	Lost Communication With Body Control Module (BCM): No Sub Type Information	Sets in continuous memory in the TCCM if BCM data messages received from the BCM over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- BCM module
- TCCM

PINPOINT TEST O : U0140

O1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE BCM (BODY CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to O2
No	REFER to: Communications Network (418-00 Module Communications Network) .

O2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 100 seconds.
- Repeat the TCCM self-test.

Is DTC U0140 retrieved again?

Yes	GO to O3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to O4

O4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test B
No	GO to O5

O5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0140 set in other modules on the network?

Yes	GO to O6
No	GO to O7

O6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the BCM module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern,   Click here to access Guided Routine (BCM).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

O7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.
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DTC U0101

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0101 when it has not received messages from the TCM for more than 5 seconds with ignition in RUN and battery voltage in range. Other modules that require data from the TCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101	Lost Communication With TCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the TCM over the HS-CAN are missing for longer than 5 seconds with ignition in RUN and battery voltage in range.

Possible Sources

- Communication concern
- Battery voltage concern
- TCM
- TCCM

PINPOINT TEST P : DTC U0101

P1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to P2
No	REFER to: Communications Network (418-00 Module Communications Network) .

P2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0101?

Yes	GO to P3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

P3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCM (TRANSMISSION CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the TCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).
No	GO to P4

P4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to P5

P5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0101 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is the DTC U0101 set in other modules on the network?

Yes	GO to P6
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No

GO to [P7](#)

P6 CHECK FOR CORRECT TCM (TRANSMISSION CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all TCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCM, REFER to: Transmission Control Module (TCM) - 3.0L Power Stroke Diesel/3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Transmission Strategy Download (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure they seat and latch correctly.

- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Four-Wheel Drive Systems - Vehicles With: Electronic Shift Transfer Case

Principles of Operation

The Electronic Shift-On-The-Fly (ESOF) system has 3 modes of operation: 2H (4X2), 4H (4X4 HIGH) and 4L (4X4 LOW). When 4H or 4L are selected, TCCM sends a duty cycle command to the synchronization coil which activates the clutch within the transfer case and moves the shift forks. When the 2H mode is selected, IWEs located at each front wheel are disengaged to reduce additional drag from the front driveline.

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid when commanded by the TCCM. When actuated, the IWE solenoid allows manifold vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle.

NOTE: When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 degrees and 5 seconds have elapsed since the shift to 2H has been initiated.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the 2 shift forks in the transfer case to change between the 2H and 4H modes, neutral and between the 4H and 4L modes. The TCCM directly controls the electric shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The shift motor sense plate, an integral part of the shift motor assembly, informs the TCCM of the transfer case position.

The transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline during 2H to 4H shifts. When the MSS is switched between 2H and 4H modes, the TCCM energizes the synchronization clutch. When the transfer case front and rear output shafts are synchronized, the spring-loaded lockup collar mechanically engages (4H) or disengages (2H) the mainshaft hub to the drive sprocket. Finally, the front axle IWEs are engaged (4H) or disengaged (2H) and the synchronization clutch is deactivated.

The TCCM features a cold temperature strategy which is used to warm up the front axle in cold

temperatures to improve driveline synchronization. When ambient temperature is below 32 F (0 C), IWEs will engage after the initial key cycle and a driven gear is selected. Hubs will stay engaged regardless of 4x4 mode change for approximately 2 miles (3km). Once distance traveled has been achieved IWEs will disengage if vehicle is in 2H. Distance traveled will reset only if the temperature is below calibrated threshold and another key cycle has occurred or customer shifted to park and back to a driven gear within the same key cycle.

Shifts from 2H mode to 4H mode can be made at any speed. The synchronization clutch is applied to equalize output shaft speeds before 4H mode is engaged. The following are the inputs and outputs needed by the TCCM to execute a change between these modes.

Feature inputs:

- Ambient air temperature from the PCM
- MSS
- Steering wheel angle (from the ABS module)
- Wheel speed signal from ABS module
- APP from PCM
- Transfer case shift motor contact plate position inputs A, B, C and D

Feature outputs:

- Transfer case electric shift motor outputs
- PWM signal to transfer case clutch
- 4WD message center and indicators
- IWE solenoid command output

When shifting into or out of 4L mode, the TCCM requires the vehicle speed to be less than 5 km/h (3 mph) and the transmission in NEUTRAL.

The following are the inputs and outputs needed by the TCCM to execute a change into or out of 4L mode:

Feature inputs:

- MSS
 - Wheel speed signal from ABS module
 - TR position from PCM
 - Transfer case shift motor contact plate position inputs A, B, C and D
- Feature outputs:

Feature outputs:

- Transfer case electric shift motor outputs
- PWM signal to transfer case clutch
- 4WD message center and indicators
- IWE solenoid command output

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Visual Inspection Chart

Mechanical	Electrical
• Halfshafts • IWEs • Driveshaft and U-joints • Vacuum leaks • Fluid leaks • Matching tire sizes • Transfer case	• BJB ○ fuse 71 (25A) ○ fuse 63 (25A) ○ fuse 29 (10A) ○ fuse 13 (10A) • Fuse 64 (15A) (2WD vehicles with ELD only) • Wiring, terminals or connectors • MSS • Synchronization clutch • IWE solenoid • Transfer case shift motor

DTC Chart: Transfer Case Control Module (TCCM)

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

DTC	Description	Action
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	GO to Pinpoint Test C
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	GO to Pinpoint Test C
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	GO to Pinpoint Test C
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	GO to Pinpoint Test C
P0562:00	System Voltage Low: No Sub Type Information	GO to Pinpoint Test L
P0563:00	System Voltage High: No Sub Type Information	GO to Pinpoint Test L
P06B8:00	Internal Control Module Non- Volatile Random Access Memory (NVRAM) Error: No Sub Type Information	CLEAR the DTC. REPEAT the self-test. If the DTC still sets, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	GO to Pinpoint Test A
P1815:00	4-Wheel Drive Mode Select Short To Ground: No Sub Type Information	GO to Pinpoint Test A
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	GO to Pinpoint Test F
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	GO to Pinpoint Test F
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground: No Sub Type Information	GO to Pinpoint Test F
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	GO to Pinpoint Test A
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	GO to Pinpoint Test A

P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P184A:00	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode: No Sub Type Information	GO to Pinpoint Test A
P184B:00	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range: No Sub Type Information	GO to Pinpoint Test B
P1853:00	Transfer Case Contact Plate 'B' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A
P1857:00	Transfer Case Contact Plate 'C' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A
P185A:00	Differential Lock-Up Input Switch Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P185D:00	Differential Lock-Up Control Circuit Performance: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P1861:00	Transfer Case Contact Plate 'D' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test A

P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	GO to Pinpoint Test A
P187A:00	Transfer Case Control Module System Voltage Low - Rear Locking Differential Disabled	REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P187C:00	Differential Lock-Up Control Circuit/Open: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P187D:00	Differential Lock-Up Control Circuit Low: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).

P187E:00	Differential Lock-Up Control Circuit High: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . REFER to: Electronic Locking Differential (ELD) (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	GO to Pinpoint Test A
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test I
U0101:00	Lost Communication With TCM "A": No Sub Type Information	GO to Pinpoint Test M
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test J
U0140:00	Lost Communication With Body Control Module (BCM): No Sub Type Information	GO to Pinpoint Test K
U0418:00	Invalid Data Received From Brake System Control Module: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

U2300:54	Central Configuration: Missing Calibration	This DTC can set if one or more expected configuration data identifications is missing (gearbox type, axle ratio, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If BCM DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no BCM DTCs are present, CLEAR the DTCs. CARRY OUT a TCCM self-test. If U2300:54 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U2300:55	Central Configuration: Not Configured	This DTC can set upon TCCM power up only until all expected configuration data parameters (gearbox type, axle ratio, tire circumference) are received from the BCM. CARRY OUT a self-test of the BCM. If BCM DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no BCM DTCs are present, CLEAR the DTCs. CARRY OUT TCCM self-test. If U2300:55 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).

U2300:56	Central Configuration: Invalid / Incompatible Configuration	This DTC can set if one expected configuration data parameter is out of range (gearbox type, axle ratio, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CLEAR the DTCs. CARRY OUT a TCCM self-test. If U2300:56 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U2300:64	Central Configuration: Signal Plausibility Failure	This DTC can set if the expected axle ratio or tire circumference is out of range from the BCM. CARRY OUT a self-test of the BCM. If BCM DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no BCM DTCs are present, CLEAR the DTCs. CARRY OUT a TCCM self-test. If U2300:64 returns, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:04	Control Module: System Internal Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:04 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).

U3000:41	Control Module: General Checksum Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:41 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:46	Control Module: Calibration / Parameter Memory Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:46 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:49 is retrieved, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U300D:11	Ignition Input On/Start: Circuit Short To Ground	GO to Pinpoint Test A

Symptom Chart

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

In most circumstances, the PCM sets DTCs to help guide with diagnostics. Refer to the DTC Chart before using the symptom chart. The Symptom column lists the vehicle condition. The Possible Sources column lists a detailed vehicle condition. The Action column lists the action to be performed to determine the cause of the condition. Each action lists the components that can cause the system and the individual components in that system. The components are listed in order of disassembly. Use the list of components and the required action to focus on disassembly inspections for the root cause of the concern.

Four-Wheel Drive (4WD) System

Symptom	Possible Sources	Action

• No communication with the TCCM	• Scan tool • DLC • TCCM • Wiring, terminals or connectors	• REFER to: Communications Network (418-00 Module Communications Network) .
• The 4X4 mode indicators do not operate correctly/do not operate	• IPC • 4WD system fault • HS-CAN • TCCM	• REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .
• The vehicle does not shift between 2H (2WD) and 4X4 modes correctly	• Wiring, terminals or connectors • MSS • Transfer case • TCCM	• GO to Pinpoint Test A
• The vehicle does not shift between 4H and 4L modes correctly	• Wiring, terminals or connectors • IWEs • IWE solenoid • Transfer case • Vacuum leaks • Front axle assembly	• GO to Pinpoint Test B

	• TCCM • MSS	
• The 4WD does not engage at speed correctly	• Transfer case and related components • IWEs and related components • Wheel/tire assemblies	• GO to Pinpoint Test F
• The transfer case jumps out of gear	• IWE vent lines • MSS • Transfer case	• GO to Pinpoint Test D
• Unable to duplicate customer concern	• 4WD system and/or related components	• GO to Pinpoint Test H
• Rear wheels binding when turning corners with the ELD MSS set to OFF	• Wiring, terminals or connectors • Fuses • MSS • IWEs • IWE solenoid • Transfer case • Vacuum leaks	• REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Rear Drive Axle and Differential (205-02B Rear Drive Axle/Differential - Vehicles With: Ford 9.75 Inch Ring Gear, Diagnosis and Testing).

	• Front axle assembly • TCCM	
• Unable to achieve flat tow (neutral tow) mode	• Wiring, terminals or connectors • HS-CAN • IPC • TCCM • Door ajar switch • Ignition switch	• REFER to: Neutral Flat Tow Activation and Deactivation (308-07A Four-Wheel Drive Systems, General Procedures).

Symptom Chart — NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system.

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
• Grinding noise during 4WD system engagement, especially at high speeds	• Front halfshaft speeds not turning at the same speed • Synchronization clutch	• GO to Pinpoint Test A

• Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up)	• Unequal tire inflation pressures • Unmatched tire and wheel size • Unequal amounts of tire wear • Unmatched front and rear axle ratios	• GO to Pinpoint Test G
• The front axle makes noise in 2H mode only and generally under heavy throttle	• Vacuum leaks • Vacuum check valve • Vacuum reservoir • IWE solenoid • IWEs	• GO to Pinpoint Test E
• The transfer case makes noise	• Tire inflation pressure • Tire and wheel size • Tire tread wear • Internal components • Fluid level	• MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct. • CHECK tire tread wear to see if there is more than 1.6 mm (0.062 in) or 2/32 inch difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. • OPERATE the vehicle

in all transmission gears.
If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission.

REFER to: [Diagnosis](#)

[By Symptom](#) (307-01A

Automatic Transmission

- 6-Speed Automatic

Transmission - 6R80,

Diagnosis and Testing).

If there is noise in all gears, DISASSEMBLE the transfer case.

REFER to: [Transfer](#)

[Case](#) (308-07B Transfer

Case, Diagnosis and

Testing).

CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage.

INSTALL new parts as necessary

- FILL with automatic transmission fluid.

• Transfer case whine — noise at all ranges	• Incorrect fluid level or fluid quality • Worn oil pump • Under-inflated or oversized tires	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
• Transfer case growl/rumble — noise at all ranges	• Damaged or worn bearings or planetary gear	• DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

• Transfer case scraping/grating — noise at all ranges	• Excessively stretched drive chain hitting the case	• DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
• Transfer case howl/hum — noise at all ranges or 4H only	• Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	• DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

Pinpoint Tests

The Vehicle Does Not Shift Between 2H and 4H Correctly and/or Grinding Noise Heard During 4WD Engagement at High Speeds

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The MSS communicates the operator's choice to the TCCM. The TCCM then controls the transfer case synchronization clutch, transfer case motor and IWEs as necessary. If the vehicle is not responding to the operator's intentions, systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts. Check all circuits for opens and shorts to power or ground.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1812:00	4-Wheel Drive Mode Select Circuit Failure: No Sub Type Information	This DTC sets when the TCCM detects an open circuit or short to battery. 4WD system mode cannot be changed.
P1815:00	4-Wheel Drive Mode Select Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. 4WD system mode cannot be changed.
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	This DTC sets when TCCM detects an open circuit. Shift motor moves are prevented when this DTC is set.
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Shift motor moves are prevented when this DTC is set.
P1841:00	P1841:00 — Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set.
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.
P184A:00	Transfer Case Unable To Transition Between 4x2 and 4x4 Mode: No Sub Type Information	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4H to 4L. Requested shift motor position is not reached.
P1853:00	Transfer Case Contact Plate 'B' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.
P1857:00	Transfer Case Contact Plate 'C' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.

P1861:00	Transfer Case Contact Plate 'D' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM will not complete mode change if a change in shift motor position is required.
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	This DTC sets when an invalid shift motor position is detected during selection of a new 4WD mode or during a motor movement. If the shift motor is not moving, shift motor movement will be prevented. If the shift motor is moving when this DTC sets, the shift motor will move to the high-side mechanical stop.
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	This DTC sets when TCCM detects a short to ground, a short to voltage or open circuit. The TCCM will not complete mode change if a change in shift motor position is required.
U300D:11	Ignition Input On/Start: Circuit Short To Ground	This DTC sets when the TCCM detects a short to ground.

Possible Sources

- Wiring, terminals or connectors
- MSS
- Transfer case
- Transfer case synchronization clutch
- IWEs
- IWE solenoid
- TCCM
- Front axle assembly

PINPOINT TEST A : THE VEHICLE DOES NOT SHIFT BETWEEN 2H AND 4H CORRECTLY AND/OR GRINDING NOISE HEARD DURING 4WD ENGAGEMENT AT HIGH SPEEDS

A1 CHECK FOR TCCM DTCS



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P184A:00, GO to A19 For DTC P1812:00, GO to A5 For DTC P1815:00, GO to A7 For DTC P1839:00, GO to A25 For DTC P1840:00, GO to A28 For DTC P1841:00, GO to A29 For DTC P1849:00, P1853:00, P1857:00, P1861:00, GO to A21 For DTC P1867:00, GO to A20 For DTC P1891:00, GO to A22 For all other DTCs, REFER to the TCCM DTC Chart.
No	GO to A2

A2 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDS

- Ignition ON.
- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the KEY_POS_4X4 and KEY_STATUS_4X4 PIDs while cycling through each ignition switch position.

Do the ignition PIDs match the ignition switch positions?

Yes	GO to A3
------------	--------------------------

No	If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 13 (10A). If the fuse is OK, REPAIR circuit CBB54 (VT/OG). If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. After the fault is repaired, CLEAR the DTCs. If the KEY_POS_4X4 PID did not match, to diagnose the ignition switch, REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Wheel and Column Electrical Components) . After the fault is repaired, CLEAR the DTCs.
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A3 CHECK THE TCCM MODULE SUPPLY VOLTAGE (VBAT_4X4) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Start the engine and monitor the VBAT_4X4 PID.

Is the VBAT_4X4 PID greater than 12 volts?

Yes	GO to A4
No	To DIAGNOSE the low battery voltage and/or charging system concern, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) . After the repair is complete, CLEAR the DTCs.

A4 CHECK THE MSS POSITION MONITORING THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the 4X4_SW PID while switching to each MSS position.

Does the 4X4_SW PID match the MSS position?

Yes	GO to A11
No	GO to A5

A5 CHECK THE MSS RESISTANCE VALUES

- Ignition OFF.
- Disconnect MSS C284..
- Measure:

Click to display connectors

Positive Lead	Measurement / Action	Negative Lead
MSS C284, pin 2 component side.	Ω	MSS C284, pin 3 component side.

MSS Position	Resistance ($\pm 1\%$)
2H	619 ohms
4A	270 ohms
4H	130 ohms
4L	62 ohms

Are the resistance values within specification?

Yes	GO to A6
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No	INSTALL a new MSS. REFER to: Mode Select Switch (MSS) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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A6 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect TCCM C2371A..
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s).
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No	GO to A7
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A7 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.

Are the resistances greater than 10,000 ohms?

Yes	GO to A8
------------	--------------------------

No	REPAIR the affected circuit(s).
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A8 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR AN OPEN

Are the resistances less than 3 ohms?

Yes	GO to A9
No	REPAIR the affected circuit(s).

A9 CHECK THE MSS CONTROL AND RETURN CIRCUITS FOR A SHORT TOGETHER

- Ignition OFF.

Is the resistance greater than 10,000 ohms?

Yes	GO to A10
No	REPAIR the affected circuit(s).

A10 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDS

- Connect TCCM C2371A.
- Connect MSS C284.
- Ignition ON.
- Set the MSS to 2H.
- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs with the vehicle stopped and while driving.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match with the vehicle stopped and at all speeds?

Yes	GO to A11
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No	To diagnose the wheel speed concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . After the repair is complete, CLEAR the DTCs.
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A11 CHECK THE TCCM 4WD MODES (4WD_MODES) PID WITH THE MSS IN 4H

- Start the engine.
- Enter the following diagnostic mode: TCCM DataLogger.
- Set the MSS to 4H.
- Monitor the 4WD_MODES PID.

Does the 4WD_MODES PID indicate 4WD High?

Yes	GO to A14
No	GO to A12

A12 CHECK FOR 4H WIND-UP

- Switch the MSS to 4H.
- Drive the vehicle on a dry, hard surface in turns.

Is wind-up present in turns?

Yes	GO to A15
No	GO to A13

A13 CHECK FOR TRANSFER CASE ENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft.
- Observe the front driveshaft.

Did the front driveshaft rotate?

Yes	GO to A14
No	GO to A18

A14 CHECK FOR IWE ENGAGEMENT

- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft and U-joint.

Did both front halfshafts rotate?

Yes	CHECK that all driveline fasteners are present and tightened to specification. REFER to: Specifications (205-01 Driveshaft, Specifications).
No	GO to Pinpoint Test C

A15 CHECK THE TRANSFER CASE SHIFT TO 2H

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- Command the Transfer Case Contact Plate Power (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs for the contact plate position with the MSS in the 2H position.

MSS Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	CLOSED	OPEN	CLOSED	CLOSED
4H Mode	OPEN	CLOSED	CLOSED	OPEN
4L Mode	OPEN	CLOSED	OPEN	CLOSED

Do the PIDs and message center indicate that vehicle shifted into 2H displayed in message center for approximately 4 seconds)?

Yes	GO to A16
No	GO to A20

A16 CHECK FOR IWE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either of the front halfshafts rotate?

Yes	GO to Pinpoint Test C
No	GO to A17

A17 CHECK FOR TRANSFER CASE DISENGAGEMENT

- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	CARRY OUT the Electronic Shift-On-The-Fly (ESOF) Functional Test. GO to Pinpoint Test H
No	GO to A18

A18 CHECK THE TRANSFER CASE CONTACT PLATE POSITION PIDS

- Enter the following diagnostic mode: TCCM Datalogger.
- Command the Transfer Case Contact Plate Power (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs for the contact plate position with the MSS in the 4H position.

Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	CLOSED	OPEN	CLOSED	CLOSED
4H Mode	OPEN	CLOSED	CLOSED	OPEN
4L Mode	OPEN	CLOSED	OPEN	CLOSED

Does the front driveshaft rotate?

Yes	GO to A31
No	GO to A19

A19 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the MSS from 2H to 4H.

Does the transfer case shift motor rotate from the 2H position to the 4H position?

Yes	GO to A31
No	GO to A20

A20 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s).
No	GO to A21

A21 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371A.
- Ignition ON.

Are the resistances greater than 10,000 ohms?

Yes	GO to A22
No	REPAIR the affected circuit(s).

A22 CHECK THE TRANSFER CASE CONTACT PLATE CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TCCM C2371A.
- Ignition ON.

Are the resistances less than 3 ohms?

Yes	GO to A23
No	REPAIR the affected circuit(s).

A23 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to A24
No	INSTALL a new transfer case shift motor. REFER to Transfer Case Shift Motor. CLEAR the DTCs. REPEAT the self-test, if the concern is still present, GO to A32

A24 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER WHILE COMMANDING THE TCCM CW RELAY (CW_SMD_OS) AND CCW RELAY (CCW_SMD_OS) PIDS ON

- Ignition ON.
- Connect TCCM C2371A.
- Enter the following diagnostic mode: TCCM DataLogger.

Are the voltages 9 volts or greater on the circuits when commanding the PIDs ON?

Yes	GO to A31
No	GO to A25

A25 CHECK THE TCCM VOLTAGE CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the voltage greater than 11 volts?

Yes	GO to A28
No	VERIFY BJB fuse 63 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

A26 CHECK TCCM GROUND CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the resistance less than 3 ohms?

Yes	GO to A28
No	REPAIR the circuit.

A27 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

Are the resistances less than 3 ohms?

Yes	GO to A28
No	REPAIR the affected circuit.

A28 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE

- Disconnect Transfer Case .

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to A29

A29 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to A30
No	REPAIR the circuit.

A30 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Verify module ground to vehicle ground connection.
Refer to Wiring Diagrams Cell 34 for schematic and connector information.
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

A31 SHIFT THE TRANSFER CASE TO 4H MANUALLY

- Remove the transfer case shift motor from the transfer case.
- Using a wrench, rotate the shift cam to the 4H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4H and the front driveshaft rotates?

Yes	GO to A32
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

A32 CHECK THE TORQUE REQUIRED TO SHIFT THE TRANSFER CASE

- Rotate the shift cam by hand through 4L, 4H and 2H positions.
- Measure the torque required to perform the shift.

Is the torque required to shift 45 Nm (33 lb-ft) or less?

Yes	GO to A33
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

A33 SHIFT THE TRANSFER CASE TO 2H MANUALLY

- Rotate the shift cam to the 2H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 2H and the front driveshaft does not rotate?

Yes	GO to A34
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

A34 SHIFT THE TRANSFER CASE TO 4L MANUALLY

- Rotate the shift cam by hand to the 4L position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4L and the front driveshaft rotates?

Yes	INSTALL a new transfer case shift motor. REFER to: Transfer Case Shift Motor (308-07A Four-Wheel Drive Systems, Removal and Installation). CLEAR the DTCs.
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

The Vehicle Does Not Shift Between 4H and 4L Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The high-low shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gear set to the output shaft. The torque transmitted through the sun gear from the input shaft turns the front planetary gear set assembly. The front planetary gear set assembly, now engaged, provides transfer

case speed reduction. Certain criteria, such as vehicle speed and TR selection must be met before this shift can occur. Systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P184B:00	Transfer Case Unable To Transition Between 4x4 High and 4x4 Low Range	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4H to 4L. Requested shift motor position is not reached.

Possible Sources

- TR
- Transmission drag torque
- ABS wheel speed inputs
- HS-CAN

PINPOINT TEST B : THE VEHICLE DOES NOT SHIFT BETWEEN 4H AND 4L MODES CORRECTLY

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

B1 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P184B:00, GO to B2 For all other DTCs, REFER to the TCCM DTC Chart.
No	GO to Pinpoint Test A

B2 CHECK THE 2H TO 4H SHIFT

- Drive the vehicle and shift MSS from 2H to 4H.

Does the vehicle shift between 2H and 4H correctly?

Yes	GO to B3
No	GO to Pinpoint Test A

B3 CHECK THE 4H TO 4L SHIFT

- **NOTE:** When shifting in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).

Drive the vehicle and shift MSS from 4H to 4L.

Does the transfer case shift from 4H to 4L correctly and the complaint is related to a clunk noise during the shift?

Yes	Transmission neutral drag is excessive. For transmission diagnosis, REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to B4

B4 CHECK THE TCCM NEUTRAL INDICATOR (NEUTRAL) AND ABS MODULE WHEEL SPEED PIDS

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the NEUTRAL PID while shifting the transmission through gear ranges.
- Enter the following diagnostic mode: ABS Module DataLogger.
- Monitor the wheel speed PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)

Does the NEUTRAL PID indicate True when the transmission is shifted to NEUTRAL and do the wheel speed PIDs indicate 0 km/h (0 mph)?

Yes	If all 5 PIDs are accurate, GO to Pinpoint Test A
No	If the Neutral PID do not indicate True when the transmission shifted to Neutral, REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). If the wheel speed PIDs do not indicate 0 km/h (0 mph), REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

The Front Axle Does Not Engage/Disengage Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In 2H mode, the TCCM supplies a ground path to the IWE solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In 4H or 4L modes, the TCCM does not supply the ground path to the IWE solenoid, vacuum is not applied to IWEs the and an internal spring in the IWEs keeps the hubs engaged.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	This DTC sets when the TCCM detects there is a possible mechanical fault present with the IWE system based on wheel speed message data. When the DTC is present IWE solenoid output shall continue to operate normally.
C1979:11	IWE Solenoid Circuit Failure: Short Circuit To Ground	This DTC sets when TCCM detects a short to ground. Fault results in IWEs disengaged all the time.
C1979:12	IWE Solenoid Circuit Failure: Short Circuit To Battery	This DTC sets when TCCM detects a short to voltage. Fault results in IWEs engaged all the time.
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	This DTC sets when TCCM detects an open circuit. Fault results in IWEs engaged all the time.

Possible Sources

- MSS
- IWEs
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- TCCM
- Wiring, terminals or connectors
- Fuses

PINPOINT TEST C : THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY

C1 CHECK FOR TCCM DTCS

- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC C1979:11, GO to C23 For DTC C1979:12, GO to C22 For DTC C1979:13, GO to C24 For all other DTCs, REFER to the DTC chart: TCCM.
No	GO to C2

C2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle at operating temperature and the MSS in 2H mode, drive the vehicle at sustained Wide Open Throttle (WOT) for 5 seconds.

Is there a grinding noise from the axle system during Wide Open Throttle (WOT)?

Yes	GO to Pinpoint Test A
No	GO to C3

C3 CHECK TCCM OPERATION

- Ignition ON.
- Monitor the 4X4 indicator on the IPC while moving the MSS between 2H and 4H modes.

Does the 4X4 indicator illuminate when the MSS is in the 4H position and turn off when the MSS is in the 2H position?

Yes	GO to C4
No	To diagnose the 4X4 indicator, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

C4 CHECK THE IWE DISENGAGEMENT

- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWEs to disengage.*

With the vehicle in NEUTRAL, position it on a hoist.

REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- Place the MSS in 2H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either front halfshaft rotate?

Yes	GO to C8
No	GO to C5

C5 CHECK THE IWE ENGAGEMENT

- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage.*

With the vehicle in NEUTRAL, position it on a hoist.

REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- Place the MSS in 4H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.

- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did both front halfshafts rotate?

Yes	The front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test H
No	GO to C6

C6 CHECK THE IWE SOLENOID OUTPUT IN 4H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum less than 25 mm-Hg (1 in-Hg)

Yes	The IWE is mechanically stuck in the disengaged position. INSTALL a new IWE on the halfshaft(s) that did not rotate. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to C7

C7 CHECK THE IWE SOLENOID

- Ignition OFF.
- Disconnect IWE solenoid.
- Start the engine.
- Measure the vacuum at the output port of the IWE solenoid.

Is the vacuum less than 25 mm-Hg (1 in-Hg)

Yes	GO to C24
No	INSTALL a new IWE solenoid. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C8 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running and the MSS in 2H, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)?

Yes	GO to C11
No	GO to C9

C9 CHECK THE IWE SOLENOID INPUT VACUUM

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)?

Yes	GO to C24
No	GO to C10

C10 CHECK THE VACUUM RESERVOIR

- Ignition OFF.
- With the source vacuum line still disconnected, connect a vacuum pump to the vacuum port on the vacuum reservoir and apply 508 mm-Hg (20 in-Hg) of vacuum.

Does the vacuum maintain or drop less than 25 mm-Hg (1 in-Hg) per minute?

Yes	REPAIR or INSTALL new vacuum lines or INSTALL a check valve.
No	INSTALL a new vacuum reservoir.

C11 CHECK THE IWE VACUUM LINES

- Ignition OFF.
- Disconnect the output vacuum line from the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	CHECK the individual vacuum lines for potential leaks, to verify proper IWE function, GO to C18
No	GO to C12

C12 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Remove the plug from the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

Did the vacuum pump draw a vacuum on the LH IWE vacuum line?

Yes	INSTALL a new vacuum line. CLEAR the DTCs.
No	GO to C14

C13 CHECK LH IWE VACUUM LINE FOR CRACKS

- Plug the IWE output vacuum circuit at the IWE solenoid connection and apply 508 mm-Hg (20 in-Hg) of vacuum.

Did the vacuum pump draw a vacuum on the LH IWE vacuum line.

Yes	VERIFY the RH IWE vacuum line, GO to C14
No	INSTALL a new vacuum line, to verify the RH IWE vacuum line, GO to C14

C14 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Remove the plug from the vacuum line at the RH IWE.
- Remove the plug from the IWE output vacuum circuit at the IWE solenoid connection.
- Connect a vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

Did the vacuum pump draw a vacuum on the RH IWE vacuum line?

Yes	INSTALL a new vacuum line. CLEAR the DTCs.
No	GO to C16

C15 CHECK RH IWE VACUUM LINE FOR CRACKS

- Plug the IWE output vacuum circuit at the LH IWE solenoid connection and apply 508 mm-Hg (20 in-Hg) of vacuum.

Did the vacuum pump draw a vacuum on the RH IWE vacuum line.

Yes	GO to C16
No	INSTALL a new vacuum line, to verify the RH IWE vacuum line, GO to C16

C16 CHECK THE RH IWE LEAK RATE

- Apply 508 mm-Hg (20 in-Hg) of vacuum to the RH IWE port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm-Hg (1 in-Hg) per minute?

Yes	GO to C17
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C17 CHECK THE RH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Did the RH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the RH IWE. GO to C18
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No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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C18 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm-Hg (20 in-Hg) of vacuum to the LH IWE port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm-Hg (1 in-Hg) per minute?

Yes	GO to C19
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C19 CHECK THE LH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the LH IWE. GO to C20
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C20 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect IWE solenoid C1291.
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the circuit. CLEAR the DTCs.
No	GO to C21

C21 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

Is the resistance greater than 10,000 ohms?

Yes	GO to C22
No	REPAIR the circuit.

C22 CHECK THE IWE SOLENOID RESISTANCE

- **NOTE:** *If the temperatures (either ambient or in the engine compartment) are exceptionally high, a higher than normal resistance reading could result. A lower temperature could result in a lower resistance reading.*

Measure:

Click to display connectors

Positive Lead	Measurement / Action	Negative Lead
Pin 1, component side.	Ω	Pin 2, component side.

Is the resistance between 44 and 70 ohms?

Yes	GO to C23
No	INSTALL a new IWE solenoid. CLEAR the DTCs.

C23 CHECK FOR VOLTAGE TO THE IWE SOLENOID

- Connect TCCM C2371A.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to C24
No	CHECK BJB fuse 29 (10A). If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

C24 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect IWE Solenoid C1291.
- Disconnect TCCM C2371A.

Is the resistance less than 3 ohms?

Yes	GO to C25
No	REPAIR the circuit. CLEAR the DTCs.

C25 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Transfer Case Jumps Out of Gear

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

Once the 4WD system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected position systematically check the 4WD system components.

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST D : THE TRANSFER CASE JUMPS OUT OF GEAR

D1 CHECK FOR OBSTRUCTED IWE VENT LINES

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- **NOTE:** *The IWE vent port is the smaller of the 2 vacuum ports.*

Disconnect the LH IWE line from the vent port.

- Attach a vacuum pump to the IWE vent line and attempt to hold a vacuum.
- Disconnect the RH IWE line from the vent port.
- Attach a vacuum pump to the IWE vent line and attempt to hold a vacuum.

Can a vacuum be held on either IWE vent line?

Yes	INSTALL new IWE vent lines as necessary.
No	GO to D2

D2 CHECK THE MSS POSITION MONITORING THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- Drive the vehicle.
- Dynamically monitor the 4X4_SW PID while driving the vehicle in each shift position.

Does the 4X4_SW PID always agree with the switch position?

Yes	GO to D3
No	GO to Pinpoint Test A

D3 CHECK THE 4WD INDICATORS

- Stop the vehicle.
- Transmission in NEUTRAL.
- Depress the brake pedal.
- Observe the 4WD indication in the message center while cycling through each MSS position.

Does the 4WD indicator(s) match the MSS?

Yes	GO to D4
No	To diagnose the 4WD, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

D4 CHECK FOR TCCM DTCS

- Transmission in PARK.
- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	REFER to the DTC Chart: TCCM.
No	CHECK the transfer case fluid level. If the fluid level is OK, CHECK for internal transfer case faults. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

The Front Axle Makes Noise In 2h Mode Only And Generally Under Heavy Throttle

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In 2H mode, the TCCM provides a ground path to the IWE solenoid to supply vacuum to each IWE (disengaging the front hubs from the front axle). During certain conditions such as WOT maneuvers, manifold vacuum is lower than desired. To maintain uninterrupted IWE function in 2H mode, stored engine vacuum is sourced from the vacuum reservoir. A one-way check valve is implemented between the manifold and IWE solenoid/vacuum reservoir to prevent the stored vacuum from escaping into the manifold during low engine vacuum conditions. For noise-free IWE operation under all conditions, the check valve must be operating correctly.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM
- Transfer case
- Front axle assembly
- Transfer case synchronization clutch

**PINPOINT TEST E : THE FRONT AXLE MAKES NOISE IN 2H MODE ONLY AND
GENERALLY UNDER HEAVY THROTTLE**

E1 CHECK FOR TCCM DTCS	
 WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.	
• Ignition ON. • Enter the following diagnostic mode on the scan tool: TCCM Self-Test.	
Are any DTCs present?	
Yes	REFER to the TCCM DTC chart.
No	GO to E2

E2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle warm and the MSS in 2H mode, drive the vehicle at sustained WOT for 5 seconds.

Is there a grinding noise from the axle system during WOT?

Yes	GO to E3
No	IDENTIFY the customer concern and REFER to Symptom Chart: Four-Wheel Drive Systems.

E3 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Select 2H.
- **NOTE:** *The engine must be idling during the following steps to supply vacuum to the IWE solenoid.*

Start the engine.
- Disconnect the output vacuum line at the IWE solenoid while having the vacuum supply attached to the solenoid.
- With the engine running and the in 2H mode, measure the vacuum at the output port of the solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to E8
No	GO to E4

E4 CHECK THE IWE SOLENOID INPUT VACUUM

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine still running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	INSTALL a new IWE solenoid. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to E5

E5 CHECK SOURCE VACUUM TO THE VACUUM RESERVOIR

- Disconnect the source vacuum line from the vacuum reservoir.
- With the engine still running, measure the source vacuum being supplied to the vacuum reservoir.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to E6
No	REPAIR or INSTALL a new source vacuum line.

E6 CHECK THE VACUUM RESERVOIR

- Ignition OFF.
- Disconnect the vacuum line from the vacuum reservoir.
- Connect a hand vacuum pump to the source vacuum port on the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to E7
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No	INSTALL a new vacuum reservoir.
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E7 CHECK THE ONE-WAY VACUUM CHECK VALVE

- **NOTE:** *The check valve is between the IWE solenoid and the vacuum reservoir.*

Connect the vacuum lines to the IWE solenoid.

- Connect a hand vacuum pump to the IWE solenoid vacuum line at the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	Concern not present at this time. GO to Pinpoint Test H
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No	REPAIR or INSTALL new vacuum lines or INSTALL a new one-way check valve.
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E8 CHECK THE IWE VACUUM SYSTEM

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a hand vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit.
- Observe the vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to E12
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No	GO to E9
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E9 CHECK THE RH IWE LEAK RATE

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Disconnect the vacuum line from the larger port on the RH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the RH port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to E10
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

E10 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the LH port and observe vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	GO to E11
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

E11 CHECK THE IWE VACUUM SUPPLY TUBE

- Disconnect both vacuum lines from the IWE solenoid.
- Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit and observe the vacuum reading.

Does the vacuum maintain or drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to E12
No	INSTALL new vacuum lines as necessary.

E12 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 2H

- Connect a hand-held vacuum gauge to the LH vacuum supply tube.
- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWE to disengage.*

Start the engine.

- While maintaining the steering wheel straight, switch to 2H mode and wait for approximately 5 seconds, observe the vacuum gauge.
- Repeat these steps for the RH IWE.

Are the vacuum readings greater than 254 mm (10 in) Hg after 5 seconds have elapsed?

Yes	GO to E13
No	INSTALL new vacuum lines as necessary.

E13 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- With the vehicle in NEUTRAL, position it on a hoist.
- Disconnect the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the LH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the LH IWE. GO to E14

E14 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Disconnect the larger vacuum line at the RH IWE.
- Connect a hand vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the RH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the RH IWE. GO to E15

E15 CHECK THE LH IWE OPERATION

- Ignition OFF.
- Connect a hand vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?

Yes	GO to E16
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

E16 CHECK THE RH IWE OPERATION

- Connect a hand vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Yes	GO to Pinpoint Test H
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

The 4WD Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the operator selects a transfer case mode from 2H mode, the TCCM engages the synchronization clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a further mechanical engagement of the transfer case. The TCCM also removes the ground path from the IWE solenoid, which removes vacuum from the IWEs, allowing them to engage. Systematically check the necessary inputs and outputs at the TCCM , internal components of the transfer case, IWE components and drive axles.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	This DTC sets when TCCM detects an open circuit. The TCCM disables transfer case synchronization clutch operation.
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Transfer case synchronization clutch operation, though disabled by the TCCM, is fully engaged when this DTC is present.
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground	This DTC sets when TCCM detects a short to ground. The TCCM disables transfer case synchronization clutch operation.

Possible Sources

- Transfer case synchronization clutch
- Transfer case
- TCCM
- Front axle assembly
- Wiring, terminals or connectors

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST F : THE 4WD DOES NOT ENGAGE AT SPEED CORRECTLY

F1 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P1825:00, GO to F8 or DTC P1826:00, GO to F10 For DTC P1827:00, GO to F9 For all other DTCs, REFER to the DTC Chart: TCCM.
No	GO to F2

F2 CHECK 4H ENGAGEMENT AT REST

- Switch the MSS from 2H to 4H.
- Confirm 4H engagement by driving the vehicle and check for wind-up in turns.

Does 4H engage at rest correctly?

Yes	GO to F3
No	GO to Pinpoint Test A

F3 CHECK 2H TO 4H SHIFT AT SPEED

- Switch the MSS to 2H.
- Drive the vehicle and carry out a 2H to 4H shift while driving approximately at 16 km/h (10 mph).
- **NOTE:** When performing 2H to 4H or 4H to 2H shift, release the accelerator pedal prior to the shift and wait until Shift in Progress disappears.

Stop the vehicle, shift to 2H, drive the vehicle and carry out a 2H to 4H shift while driving at approximately 64 km/h (40 mph).

Does 4H engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?

Yes	GO to Pinpoint Test C
No	GO to F4

F4 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDS

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs while driving in a straight line.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match?

Yes	GO to F5
No	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

F5 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH LOCK-UP USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Ignition ON.
- Switch the MSS to 4H.
- Active command the 4WD_CLTCH_OS PID to 98%.
- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Remove the transfer case shift motor from the transfer case, leaving the electrical connector connected.
- Using a wrench, shift the transfer case shift cam to 2H.

- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F6
No	GO to F7

F6 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH RELEASE USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Active command the 4WD_CLTCH_OS PID to 0%.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F10
No	END the active command. GO to F7

F7 CHECK FOR VOLTAGE TO THE TRANSFER CASE SYNCHRONIZATION CLUTCH USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Ignition ON.
- Enter the following diagnostic mode: TCCM DataLogger.
- Using the 4WD_CLTCH_OUT active command, command the transfer case clutch to 98%.

Is the voltage greater than 9 volts?

Yes	END the active command. INSTALL a new transfer case synchronization clutch. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). CLEAR the DTCs.
No	GO to F8

F8 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR AN OPEN

Is the resistance less than 3 ohms?

Yes	GO to F9
No	REPAIR the circuit. CLEAR the DTCs.

F9 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case.
- Ignition ON.
- Disconnect TCCM C2371B.

Is the resistance greater than 10,000 ohms?

Yes	GO to F10
No	REPAIR the circuit.

F10 CHECK THE TRANSFER CASE SYNCHRONIZATION CLUTCH CIRCUIT FOR A SHORT TO VOLTAGE

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to F11

F11 CHECK TRANSFER CASE SYNCHRONIZATION CLUTCH

- Ignition OFF.

Is the resistance between 1-3 ohms?

Yes	GO to F12
No	INSTALL a new transfer case synchronization clutch. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

F12 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they are seated correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

Vehicle Pulsates Or Shudders In A Straight Line (Straightline Driveline Wind-Up)

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

In order for the 4WD system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Sources

- Unequal tire inflation pressures
- Unmatched and wheel size
- Unequal amounts of tire wear
- Unmatched front and rear axle ratios

PINPOINT TEST G : VEHICLE PULSATES OR SHUDDERS IN A STRAIGHT LINE
(STRAIGHTLINE DRIVELINE WIND-UP)



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

G1 VERIFY THE CONCERN

NOTE: 4X4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.

- Drive the vehicle and shift from 2H to 4H. There should be minimal wind-up in 4H mode during straight line maneuvers (wind-up in turns is normal; 4X4 high/low is not intended for driving on hard/dry surfaces).

Is excessive wind-up present?

Yes	GO to G2
No	RETURN the vehicle to the customer. ADVISE about correct system operation and normal vehicle behavior.

G2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

- Check the wheel and tire sizes.

Do the 4 wheel and tire sizes match?

Yes	GO to G3
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G3 CHECK TIRE WEAR

- Check each of the 4 tires for wear.

Are the 4 tires worn evenly?

Yes	GO to G4
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G4 CHECK TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to VC label.

Are the tire inflation pressures correct?

Yes	GO to G5
No	ADJUST the tire pressure as necessary. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match.

Do the front and rear axle ratios match?

Yes	RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior.
No	CHECK the vehicle VC label. INSTALL the correct axle(s). REFER to: Rear Drive Axle and Differential (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Front Drive Axle (205-03 Front Drive Axle/Differential, Diagnosis and Testing).

Electronic Shift-On-The-Fly (ESOF) Functional Test

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation.
REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When operating in 4H or 4L mode, the transfer case and both IWEs are locked. When in 4L mode, the transfer case low range gear set provides an additional 2.64 gear reduction. When operating in 2H mode, the transfer case and both IWEs are unlocked.

NOTE:

Possible Sources

- 4WD system and/or related components

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST H : ELECTRONIC SHIFT-ON-THE-FLY (ESOF) SYSTEM

FUNCTIONAL TEST

NOTE: 4X4 High and 4X4 Low are not intended for driving on hard/dry surfaces; using these modes while driving on these surfaces may produce noises like intermittent clunking, but will not damage driveline components.

H1 CHECK FOR IPC DTCS

- Ignition ON.
- Enter the following diagnostic mode: IPC Self-Test.

Does the message center display 4X2 for approximately 4 seconds?

Yes	If DTC U0102:00 is retrieved, REFER to: Communications Network (418-00 Module Communications Network) . For all other DTCs, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .
No	GO to H2

H2 CHECK 2H OPERATION

- Switch the MSS from 4H to 2H while monitoring the message center.

Does the message center display 4X2 for approximately 4 seconds?

Yes	GO to H5
No	GO to H3

H3 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs present?

Yes	REFER to the TCCM DTC Chart
No	GO to H4

H4 CHECK FOR WIND-UP IN 2H

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test A
No	To diagnose the indicator light, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

H5 CHECK FOR STRAIGHTLINE WIND-UP IN 4H MODE

- Drive the vehicle on a dry, hard surface.

Is straightline wind-up present?

Yes	GO to Pinpoint Test G
No	GO to H6

H6 CHECK WIND-UP IN TURNS IN 4H MODE

- Drive the vehicle in 4H mode while turning.

Is wind-up present in turns?

Yes	GO to H7
No	GO to Pinpoint Test A

H7 CHECK 4L OPERATION

- Bring the vehicle to a stop with the transmission in NEUTRAL and switch the MSS to 4L.

Does the 4X4 LOW indicator illuminate correctly?

Yes	GO to H10
No	GO to H8

H8 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs present?

Yes	REFER to the TCCM DTC Chart
No	GO to H9

H9 CHECK FOR WIND-UP IN 4L

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test A
No	GO to Pinpoint Test B

H10 CHECK FOR 4L WIND-UP IN TURNS

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present and 4L functioning?

Yes	GO to H11
No	CHECK for TCCM DTCs. REFER to the TCCM DTC Chart.

H11 CHECK 4L TO 2H SHIFT

- With the vehicle at a stop and transmission in NEUTRAL, switch the MSS from 4L to 2H.

Does the message center display 4X2 for approximately 4 seconds?

Yes	GO to H14
No	GO to H12

H12 CHECK FOR TCCM DTCs

- Select PARK.
- Enter the following diagnostic mode: TCCM Self-Test .

Are DTCs retrieved?

Yes	REFER to the TCCM DTC Chart.
No	GO to H13

H13 CHECK FOR WIND-UP IN 2H

- Switch the MSS to 2H.
- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test B
No	To diagnose the 4WD indicators do not operate correctly, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

H14 CHECK FOR TRANSFER CASE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	GO to H15

H15 CHECK FOR AND RH IWE DISENGAGEMENT

NOTE: The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage.

- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft and U-joint.

Does the LH or RH front halfshaft rotate?

Yes	GO to Pinpoint Test C
No	GO to H16

H16 CHECK FOR IWE VACUUM LEAKS

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit.
- Observe the vacuum reading.

Did the vacuum drop more than 25 mm (1 in) Hg per minute?

Yes	CHECK the IWE and related components for leaks. GO to Pinpoint Test C
No	GO to H17

H17 CHECK 2H TO 4H SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)

- Switch the MSS to 2H.
- **NOTE:** *When performing 2H to 4H or 4H to 2H shift, release the accelerator pedal prior to the shift and wait until Shift in Progress disappears.*

Drive the vehicle on the road and shift from 2H to 4H while driving above 32 km/h (20 mph).

Does the transfer case shift to 4H satisfactorily?

Yes	The 4WD system is functioning correctly.
No	GO to Pinpoint Test F

DTC U0100

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0100 when it has not received messages from the PCM for more than 5 seconds. Other modules that require data from the PCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100	Lost Communication With ECM/PCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the PCM over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- PCM
- TCCM

PINPOINT TEST I : U0100

I1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)	
• Ignition ON. • Connect a diagnostic scan tool. • Check that a vehicle session can be established using a diagnostic scan tool.	
Can a vehicle session be established?	
Yes	GO to I2
No	REFER to: Communications Network (418-00 Module Communications Network) .
I2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S	

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0100?

Yes	GO to I3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

I3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 2.7L EcoBoost (238kW/324PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L Duratec (209kW/284PS)) . REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 5.0L 32V Ti-VCT) .
No	GO to I4

I4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test L
No	GO to I5

I5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Are any of the DTCs U0100 set in other modules on the network?

Yes	GO to I6
No	GO to I7

I6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 2.7L EcoBoost (238kW/324PS)) . REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS), Removal and Installation). REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 3.5L Duratec (209kW/284PS)) . REFER to: Powertrain Control Module (PCM) (303-14 Electronic Engine Controls - 5.0L 32V Ti-VCT) . PROGRAM the PCM with the latest calibration level.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

I7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0121

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0121 when key messages such as wheel speed, brake pressure or torque are not received for longer than 5 seconds. This loss of key messages degrades the 4x4 system performance and/or inability to change 4x4 modes. Other modules that require data from the ABS module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Sets in continuous memory in the TCCM if ABS data messages received from the ABS Module over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- ABS module
- TCCM

PINPOINT TEST J : U0121

J1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to J2
No	REFER to: Communications Network (418-00 Module Communications Network) .

J2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0121 retrieved again?

Yes	GO to J3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

J3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to J4

J4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test L
No	GO to J5

J5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0121 set in other modules on the network?

Yes	GO to J6
No	GO to J7

J6 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

J7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0140

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0140 when key messages are not received from the BCM for longer than 90 seconds. This loss of key messages degrades the 4X4 system functionality. Other modules that require data from the BCM module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140	Lost Communication With Body Control Module (BCM): No Sub Type Information	Sets in continuous memory in the TCCM if BCM data messages received from the BCM over the HS-CAN are missing for longer than 90 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- BCM module

- TCCM

PINPOINT TEST K : U0140

K1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE BCM (BODY CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to K2
No	REFER to: Communications Network (418-00 Module Communications Network) .

K2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 100 seconds.
- Repeat the TCCM self-test.

Is DTC U0140 retrieved again?

Yes	GO to K3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

K3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any DTCs recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).
No	GO to K4

K4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test L
No	GO to K5

K5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

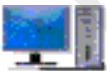
Is DTC U0140 set in other modules on the network?

Yes	GO to K6
No	GO to K7

K6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the BCM module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern,   Click here to access Guided Routine (BCM).
No	The system is operating correctly at this time. The concern may have been caused by poor module connections. ADDRESS the root cause of any connector or pin issues.

K7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTCS P0562:00 or P0563:00

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

If the TCCM observes an overpower or a low voltage condition, a DTC is set and all TCCM outputs are turned off (IWEs engaged).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0562:00	Battery Voltage Low: No Sub Type Information	This DTC sets when the TCCM detects battery voltage less than 9 volts for 5 seconds or more at TCCM.
P0563:00	Battery Voltage High: No Sub Type Information	This DTC sets when the TCCM detects battery voltage greater than 16 volts for 5 seconds or more at TCCM.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM

PINPOINT TEST L : DTCS P0562:00 OR P0563:00

L1 RETRIEVE ALL CMDTCS IN ALL MODULES

NOTE: DTC P0562:00 or P0563:00 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

- Ignition ON.
- Enter the following diagnostic mode: Retrieve All CMDTCs.

Is DTC P0562:00 or P0563:00 present in one or more modules and P0563, P0620, P0625, P0626 or P065B present in the PCM?

Yes	For diagnosis of the battery and charging system, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to L2

L2 CHECK BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery — Condition Test,
REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Does the battery pass the condition test?

Yes	GO to L3
No	CHARGE or INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

L3 CHECK THE CHARGING SYSTEM VOLTAGE

- **NOTE:** *Do not allow the engine rpm to increase above 2,000 rpm while performing this step or the generator may self excite and result in default charging system output voltage. If engine rpm has gone above 2,000 rpm, shut the vehicle OFF and restart the engine before performing this step.*

Start the engine

- Measure the voltage of the battery:
 - For DTC P0562:00, turn on headlights and HVAC fan on high and run engine at 1,500 rpm for a minimum of 2 minutes.
 - For DTC P0563:00, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes.

Is the battery voltage between 13-15.2 volts?

Yes	For DTC P0562:00, GO to L4 For DTC P0563:00, GO to L6
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No	To DIAGNOSE the charging system, REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) . CLEAR all CMDTCs.
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L4 CHECK VOLTAGE AND GROUND TO THE TCCM

- Ignition OFF.
- Disconnect TCCM C2371B.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to L6
No	GO to L5

L5 CHECK VOLTAGE TO THE TCCM

Is the voltage greater than 11 volts?

Yes	REPAIR the circuit. CLEAR all CMDTCs .
No	VERIFY BJB fuse 71 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR all CMDTCs.

L6 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

DTC U0101

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0101 when it has not received messages from the TCM for more than 5 seconds with ignition in RUN and battery voltage in range. Other modules that require data from the TCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101	Lost Communication With TCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the TCM over the HS-CAN are missing for longer than 5 seconds with ignition in RUN and battery voltage in range.

Possible Sources

- Communication concern
- Battery voltage concern
- TCM
- TCCM

PINPOINT TEST M : DTC U0101

M1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE TCM (TRANSMISSION CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to M2
No	REFER to: Communications Network (418-00 Module Communications Network) .

M2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0101?

Yes	GO to M3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCM (TRANSMISSION CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the TCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).
No	GO to M4

M4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	REFER to: Charging System - 2.7L EcoBoost (238kW/324PS) (414-00 Charging System - General Information) . REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to M5

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0101 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is the DTC U0101 set in other modules on the network?

Yes	GO to M6
No	GO to M7

M6 CHECK FOR CORRECT TCM (TRANSMISSION CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all TCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCM, REFER to: Transmission Control Module (TCM) - 3.0L Power Stroke Diesel/3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Transmission Strategy Download (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

Four-Wheel Drive Systems - Raptor, Vehicles With: 4HI-LOC Torque on Demand Transfer Case

Principles of Operation

Terrain Management System

The Terrain Management System optimizes drivability and comfort as well as maximizing traction while operating on different types of terrain. The terrain management system automatically tailors your vehicle configuration for each mode selected. This is accomplished by changing the functionality of the following systems. It is recommended that terrain management modes that enable the ELD not be used on dry, hard surfaced roads. Doing so will produce excessive noise, vibration and increase tire wear.

- Electronically power-assisted steering system adjusts steering effort and feel based on your selected mode.
- Electronic stability control and traction control help maintain vehicle control in adverse conditions or high performance driving.
- Electronic throttle control enhances the powertrain response to driver inputs.
- Transmission controls are optimized with shift schedules tuned to each terrain.
- Transfer case; automatically engages specific 4WD modes depending on the selected terrain mode.
- ELD engages automatically during certain terrain modes.

Terrain Management System uses several messages displayed in the message center to inform the driver of current operational status:

- SELECTED 4X4 MODE NOT AVAILABLE IN CURRENT TERRAIN MODE
- LOCKING DIFFERENTIAL NOT AVAILABLE IN CURRENT TERRAIN MODE
- TERRAIN MANAGEMENT SYSTEM FAULT
- SELECTED TERRAIN MODE PRECONDITIONS NOT MET

Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case

The TCCM has a thermal hardware protection strategy which monitors the amount of energy going through the clutch. This strategy has 2 levels of protection:

- AUTOLOCK - If the system is in 4A and TCCM detects driving conditions that require greater 4X4 performance, the TCCM temporarily turns on 4H from 4A after detecting the driving condition and informs the customer via the message center indicating 4X4 TEMPORARILY LOCKED. The 4x4 system automatically returns to 4A after the system no longer detects these driving conditions and informs the customer via the message center indicating 4X4 RESTORED.

NOTE: The 4x4 Temporarily Disabled message can be dismissed by the customer however it's advisable to let the TCCM clear the message itself, which indicates that the 4x4 system has resumed normal operation.

The 2-speed 4HI-LOC torque-on-demand system allows the operator to choose between 2H (4x2) and 3 different 4WD modes of operation: 4A (4X4 AUTO), 4H (4X4 HIGH) and 4L (4x4 LOW). When 4A mode is selected the TCCM sends a duty cycle command to the transfer case coil which activates the clutch within the transfer case and transfers

torque to the front driveline. When 4H or 4L modes are selected, the transfer case physically locks the front and rear drive-lines, bypassing the transfer case clutch, for increased off-road performance. When the 2H mode is selected, the TCCM duty cycle command is turned OFF and the IWEs located at each front wheel are disengaged to reduce additional drag from the front driveline.

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid commanded by the TCCM. When actuated, the IWE solenoid allows vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle. Note: When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 deg and 5 seconds have elapsed since the shift to 2H has been initiated.

The electronic shift motor is mounted externally to the transfer case. This motor drives a rotary cam, which moves the shift fork within the transfer case. The shift fork moves during any of the following 4x4 mode changes:

- Shifting between 2H/4A and 4H
- Shifting between 2H/4A/4H and 4L
- Shifting to NEUTRAL (for Neutral Tow) from any 4x4 state.

The TCCM directly controls this shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The shift motor sense plate, an integral part of the shift motor assembly, informs the TCCM of the transfer case position.

This transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline as well as transfer torque in 4A mode. When the 4X4 switch module is switched between 2H and 4A or 4H modes, the TCCM first energizes the clutch. When the transfer case front and rear output shafts are synchronized, the front axle IWEs are engaged.

4Auto mode:

When the front and rear drivelines are synchronized the TCCM sends a duty cycle command to the transfer case clutch coil as a torque request based on combination of preemptive and wheel slip response algorithm. Preemptive response is based on steering wheel angle, vehicle speed, throttle positions and available powertrain torque. Wheel slip response is based on monitoring the average front and rear wheel speeds.

The TCCM has a cold strategy which is used to warm up the front axle in cold temperatures to improve driveline synchronization. When ambient temperature is below 32 F (0 C), the IWEs engage after the initial key cycle and a driven gear is selected. The hubs stay engaged regardless of 4x4 mode change for approximately 2 miles (3km). Once distance traveled has been achieved IWEs disengage if vehicle is in 2H. Distance traveled resets only if the temperature is below calibrated threshold and another key cycle has occurred or customer shifted to park and back to a driven gear within the same key cycle.

In 4A, the TCCM continuously monitors conditions and driver input to send torque automatically to the front driveline by controlling the transfer case clutch, providing 4WD capability. When 4WD is no longer needed (during cruising or steady state driving) system defaults back to RWD mode by setting the duty cycle output to 0. In situations where it is necessary to negotiate tight turns, clutch duty cycle output is reduced allowing slight difference between the front and rear driveshafts. However, the system is always on alert and when necessary, torque is applied to the front drive shafts automatically.

TCCM increases the duty cycle to prevent or control slip under any of the following conditions:

- Slip is detected
- Heavy acceleration (throttle position)
- Straight-ahead wheel angle

Shifts from 2H mode to 4A or 4H mode can be made at any speed. When performing this shift, release the accelerator pedal prior to the shift and wait until the Shift in Progress

message disappears in the IPC before accelerating, this improves the shift performance. The following are the inputs and outputs needed by the TCCM to execute a change between these modes and deliver the needed function:

Feature inputs

- 4X4 switch module
- Steering wheel angle (from the ABS module)
- Transmission output torque (from the PCM/TCM)
- Wheel speed signal (transmitted from the ABS module)
- APP (from the PCM)
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature outputs:

- PWM signal to the transfer case clutch
- 4WD message center indicators
- IWE solenoid command output

Shifts between 4X4 AUTO (4A) and 4X4 (4H) modes can be made at any speed. Listed below are the inputs and outputs needed by the TCCM to execute a change between any of these modes.

Feature inputs:

- 4X4 switch module
- Steering wheel angle (from the ABS module)
- Transmission output torque (from the PCM/TCM)
- Wheel speed signal (transmitted from the ABS module)
- APP (from the PCM)
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature outputs:

- PWM signal to the transfer case clutch
- 4WD message center indicators

When shifting into or out of 4L (4x4 LOW) mode, the vehicle speed must be less than 5 km/h (3 mph) and the transmission must be in neutral. The following are the inputs and outputs needed by the TCCM to execute a change to this mode and deliver the needed function.

Feature inputs:

- Steering wheel angle (from the ABS module)
- APP (from the PCM)
- 4X4 switch module
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed signal (transmitted from ABS module)
- TR position (from the PCM)

- Transmission output torque (from the PCM/ TCM)
- Steering wheel angle (from the ABS module)

Feature outputs:

- 4WD message center indicators
- PWM signal to the transfer case clutch
- IWE solenoid command output

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to Symptom Chart: Four-Wheel Drive Systems.

Visual Inspection Chart

Mechanical	Electrical
• Halfshafts • IWEs • Driveshaft and U-joints • Vacuum leaks • Fluid leaks • Matching tire sizes • Transfer case	• BJB ◦ fuse 63 (25A) ◦ fuse 71 (25A) ◦ fuse 13 (10A) ◦ fuse 29 (10A) (IWE) ◦ fuse 64 (15A) (2WD vehicle with ELDonly) • Wiring, terminals or connectors • 4X4 switch module • Transfer case clutch • IWE solenoid • Transfer case shift motor

DTC Chart: TCCM

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

DTC	Description	Action
C1979:00	IWE Solenoid Circuit Failure: No Sub Type Information	GO to Pinpoint Test C
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	GO to Pinpoint Test C
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	GO to Pinpoint Test C
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	GO to Pinpoint Test C
P0562:00	System Voltage Low: No Sub Type Information	GO to Pinpoint Test B
P0563:00	System Voltage High: No Sub Type Information	GO to Pinpoint Test B
P06B8:00	Internal Control Module Non-Volatile Random Access Memory (NVRAM) Error: No Sub Type Information	CLEAR the DTC. REPEAT the self-test. If the DTC still sets, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
P1812:00	4-Wheel Drive Mode Select Short To Ground: No Sub Type Information	GO to Pinpoint Test L
P1815:00	4-Wheel Drive Mode Select Short To Ground: No Sub Type Information	GO to Pinpoint Test L
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	GO to Pinpoint Test F
P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	GO to Pinpoint Test F
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground: No Sub Type Information	GO to Pinpoint Test F
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	GO to Pinpoint Test E
P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	GO to Pinpoint Test E
P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P184A:00	Transfer Case Unable To Transition Between 4x2LOW and 4x4 High Mode	GO to Pinpoint Test E
P184B:00	Transfer Case Unable To Transition Between 4X4 High and 4X4 Low Range: No Sub Type Information	GO to Pinpoint Test E
P1853:00	Transfer Case Contact Plate 'B' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P1857:00	Transfer Case Contact Plate 'C' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P185A:00	Differential Lock-Up Input Switch Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).

P185B:00	Differential Lock-Up Indicator Circuit Low: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P185C:00	Differential Lock-Up Indicator Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P185D:00	Differential Lock-Up Control Circuit Performance: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P1861:00	Transfer Case Contact Plate 'D' Short Circuit To Ground: No Sub Type Information	GO to Pinpoint Test E
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	GO to Pinpoint Test E
P187A:00	Transfer Case Control Module System Voltage Low - Rear Locking Differential Disabled	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P187C:00	Differential Lock-Up Control Circuit/Open	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P187D:00	Differential Lock-Up Control Circuit Low: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P187E:00	Differential Lock-Up Control Circuit High: No Sub Type Information	REFER to: Electronic Locking Differential (ELD) (205-02A Rear Drive Axle/ Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing).
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	CLEAR the DTC. REPEAT the self-test. If the DTC still sets, GO to Pinpoint Test E
U0100:00	Lost Communication With ECM/PCM "A": No Sub Type Information	GO to Pinpoint Test M
U0101:00	Lost Communication With TCM "A": No Sub Type Information	GO to Pinpoint Test P
U0121:00	Lost Communication With Anti-Lock Brake System (ABS) Control Module: No Sub Type Information	GO to Pinpoint Test N
U0138:00	Lost Communication with All Terrain Control Module	GO to Pinpoint Test U

U0140:00	Lost Communication With Body Control Module (BCM): No Sub Type Information	GO to Pinpoint Test O
U0155:00	Lost Communication With Instrument Panel Cluster (IPC) Control Module	GO to Pinpoint Test V
U0418:00	Invalid Data Received From Brake System Control Module: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
U0439:00	Invalid Data Received From All Terrain Control Module: No Sub Type Information	To diagnose the wheel speed sensor concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
U2300:54	Central Configuration: Missing Calibration	This DTC sets if one or more expected configuration data identifications is missing (gearbox type, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CARRY OUT a self-test. If U2300:54 returns, INSTALL a new TCCM.
U2300:55	Central Configuration: Not Configured	This DTC sets upon power up only until all expected configuration data parameters (gearbox type, axle ratio, tire circumference) are received from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CLEAR the DTCs. CARRY OUT self-test. If U2300:55 returns, INSTALL a new Terrain Management Module.
U2300:56	Central Configuration: Invalid / Incompatible Configuration	This DTC sets if a expected configuration data parameter is out of range (gearbox type, axle ratio, tire circumference) from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CARRY OUT a self-test. If U2300:56 returns, INSTALL a new Terrain Management Module.
U2300:64	Central Configuration: Signal Plausibility Failure	This DTC sets if the expected axle ratio or tire circumference is out of range from the BCM. CARRY OUT a self-test of the BCM. If DTCs are present, REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) . If no DTCs are present, CARRY OUT a self-test. If U2300:64 returns, INSTALL a new Terrain Management Module.
U3000:04	Control Module: System Internal Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:04 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).

U3000:46	Control Module: Calibration / Parameter Memory Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:46 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U3000:49	Control Module: Internal Electronic Failure	CLEAR the DTC. REPEAT the self-test. If DTC U3000:49 is retrieved again, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
U300D:11	Ignition Input On/Start: Circuit Short To Ground	GO to Pinpoint Test A

DTC Chart: All-Terrain Control Module

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

NOTE: The 4X4 switch module is known by the scan tool as the All-Terrain Control Module.

DTC	Description	Action
B11D9:16	Vehicle Battery: Circuit Voltage Below Threshold	GO to Pinpoint Test Q
B11D9:17	Vehicle Battery: Circuit Voltage Above Threshold	GO to Pinpoint Test R
U0102:00	Lost Communication with Transfer Case Control Module: No Sub Type Information	GO to Pinpoint Test S
U0140:00	Lost Communication With Body Control Module (BCM): No Sub Type Information	GO to Pinpoint Test T
U0422:00	Invalid Data Received From Body Control Module: No Sub Type Information	RETRIEVE and REPAIR all non-network DTCs in the BCM. REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
U3000:49	Control Module: Internal Electronic Failure	NOTE: The 4X4 switch module is known by the scan tool as the All-Terrain Control Module. CLEAR the DTCs. CYCLE the ignition. CARRY OUT the Terrain Management module self-test. RETRIEVE and RECORD all DTCsRoad test the vehicle, If the DTC returns, INSTALL a new 4X4 switch module.

Symptom Chart: Four-Wheel Drive Systems

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.
REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
No communication with the TCCM	- Scan tool - DLC - TCCM - Wiring, terminals or connectors	REFER to: Communications Network (418-00 Module Communications Network) .
The 4X4 mode indicators do not operate correctly/do not operate	- IPC 4WD system fault - HS-CAN - TCCM	To diagnose the 4X4 mode indicators do not operate correctly/do not operate, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .
The vehicle does not shift between 2H (2WD) and 4X4 modes correctly	- Wiring, terminals or connectors - IWE - IWE solenoid - Transfer case - Vacuum leaks - Front axle assembly - TCCM	GO to Pinpoint Test L
The vehicle does not shift between 4A (4X4 AUTO) and 4H (4X4) modes correctly	- Wiring, terminals or connectors - IWE - IWE solenoid - Transfer case - Vacuum leaks - Front axle assembly	GO to Pinpoint Test D

	• TCCM • 4X4 switch module	
• Vehicle has no torque or inadequate torque at front wheels in 4A (4X4 AUTO) mode	• Transfer case and related components • IWE and related components • Wheel/tire assemblies	• GO to Pinpoint Test J
• The vehicle does not shift between 4H (4X4) and 4L (4X4 LOW) modes correctly	• Wiring, terminals or connectors • TR sensor • ABS wheel speed inputs • IWE • TCCM • Transmission drag torque	• GO to Pinpoint Test E
• 4WD does not engage at speed correctly	• Transfer case clutch • Transfer case • TCCM • Front axle assembly • Wiring, terminals or connectors	• GO to Pinpoint Test F

• The front axle does not engage/disengage correctly	• Wiring, terminals or connectors • Fuses • 4X4 switch module • IWE • IWE solenoid • Transfer case • Vacuum leaks • Front axle assembly • TCCM	• GO to Pinpoint Test C
• The 4WD system jumps out of gear	• IWE vent line(s) • Transfer case • 4X4 switch module	• GO to Pinpoint Test G
• Unable to achieve flat tow (neutral tow) mode	• Wiring, terminals or connectors • HS-CAN • IPC • TCCM • Door ajar switch • Ignition switch	• REFER to: Neutral Flat Tow Activation and Deactivation (308-07A Four-Wheel Drive Systems, General Procedures).
• Unable to duplicate customer concern	• 4WD system and/or related components	• GO to Pinpoint Test J

Symptom Chart — NVH

NOTE: NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms,

refer to 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system.

Diagnostics in this manual assume a certain skill level and knowledge of Ford-specific diagnostic practices.

REFER to: [Diagnostic Methods](#) (100-00 General Information, Description and Operation).

Symptom	Possible Sources	Action
Grinding noise during 4WD system engagement, especially at high speeds	- Front halfshaft speeds not turning at the same speed - Transfer case clutch	GO to Pinpoint Test C
Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up)	- Unequal tire inflation pressures - Unmatched tire and wheel size - Unequal amounts of tire wear - Unmatched front and rear axle ratios	GO to Pinpoint Test H
The front axle makes noise in 2H mode only and generally under heavy throttle	- Vacuum leaks - Vacuum check valve - Vacuum reservoir - IWE solenoid - IWEs	GO to Pinpoint Test I
The transfer case makes noise	- Tire inflation pressure - Tire and wheel size - Tire tread wear - Internal components - Fluid level	- VERIFY that all tires and wheels are the same size and that the air pressures are correct. - CHECK tire tread wear to see if there is more than 1.6 mm (0.062 in) or 2/32 inch difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. - OPERATE the vehicle in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission.

		REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing). If there is noise in all gears, DISASSEMBLE the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary • FILL with automatic transmission fluid.
• Transfer case whine — noise at all ranges	• Incorrect fluid level or fluid quality • Worn oil pump • Under-inflated or oversized tires	• CHECK that the transfer case is filled to the correct level and with the specified fluid. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • DISASSEMBLE the transfer case. CHECK the oil pump for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). • CONFIRM that the tires and wheels are correct for the vehicle. CHECK that the tire inflation pressures are correct.
• Transfer case growl/rumble — noise at all ranges	• Damaged or worn bearings or planetary gear	• DISASSEMBLE the transfer case. CHECK the bearings or planetary gear for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
• Transfer case scraping/grating — noise at all ranges	• Excessively stretched drive chain hitting the case	• DISASSEMBLE the transfer case. CHECK the drive chain for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

Transfer case howl/hum — noise at all ranges or 4H only	Worn or damaged sun (input) gear, clutch pack (intermediate) gear or output shaft gear	DISASSEMBLE the transfer case. CHECK the gears for wear or damage. REPAIR as necessary. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
Vehicle binds in a turn/resists turning/pulsates in a straightline in 4WD mode	- Unmatched tire sizes - Unequal amounts of tire wear - Unequal tire inflation pressures - Throttle position failure - Transfer case - TCCM	GO to Pinpoint Test K

Pinpoint Tests

DTC U300D:11

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

The TCCM receives ignition switch position status from the hardwired run/start input circuit and the ignition switch position status message communicated by the BCM over the HS-CAN.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U300D:11	Ignition Input On/Start: Circuit Short To Ground	This DTC sets when a short to ground is detected by the TCCM, or if the ignition switch is not in RUN for the self-test.

Possible Sources

- Fuse
- Wiring, terminals or connectors

- Ignition switch
- HS-CAN

PINPOINT TEST A : DTC U300D:11

A1 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDS

- Using a diagnostic scan tool, monitor the PIDs KEY_POS_4X4 and KEY_STATUS_4X4.
- Cycle the ignition switch between the OFF and ON positions.

Do the ignition PIDs match the ignition switch positions?

Yes	The system is functioning correctly at this time. CLEAR the DTCs.
No	If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 13 (10A). If the fuse is OK, REPAIR the open circuit. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. After the fault is repaired, CLEAR the DTCs. If the KEY_POS_4X4 PID did not match, DIAGNOSE the ignition switch, REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Wheel and Column Electrical Components) . After the fault is repaired, CLEAR the DTCs.

DTCS P0562:00, P0563:00

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

If the TCCM observes an overpower or underpower voltage condition, a DTC is set and all TCCM outputs are turned off (IWE engaged).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P0562:00	System Voltage Low: No Sub Type Information	This DTC sets when the TCCM detects battery voltage less than 9 volts for 5 seconds or more at the TCCM.
P0563:00	System Voltage High: No Sub Type Information	This DTC sets when the TCCM detects battery voltage greater than 16 volts for 5 seconds or more at the TCCM.

Possible Sources

- Fuse

- Wiring, terminals or connectors
- TCCM

PINPOINT TEST B : DTCS P0562:00, P0563:00

B1 RETRIEVE ALL CMDTCS IN ALL MODULES

NOTE: DTC P0562:00 or P0563:00 can be set if the vehicle has been recently jump started, the battery has been recently charged or the battery has been discharged. The battery may become discharged due to excessive load(s) on the charging system from aftermarket accessories or if the battery has been left unattended with the accessories on.

- Ignition ON.
- Enter the following diagnostic mode: Retrieve all CMDTCs.

Is DTC P0562:00 or P0563:00 present in one or more modules and P0563, P0620, P0625, P0626 or P065B present in the PCM?

Yes	For diagnosis of the battery and charging system, REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to B2

B2 CHECK BATTERY CONDITION

- Ignition OFF.
- Carry out the Battery Condition Test,
REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Does the battery pass the condition test?

Yes	GO to B3
No	CHARGE or INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

B3 CHECK THE CHARGING SYSTEM VOLTAGE

- **NOTE:** Do not allow the engine rpm to increase above 2,000 rpm while performing this step or the generator may self-excite and result in default charging system output voltage. If engine rpm has exceeded 2,000 rpm, shut the vehicle off and restart the engine before performing this step.

Start the engine

- Measure the voltage of the battery:
 - For DTC P0562:00, turn on the headlights and the HVAC fan on high and run the engine at 1,500 rpm for a minimum of 2 minutes.
 - For DTC P0563:00, turn off all accessories and run the engine at 1,500 rpm for a minimum of 2 minutes.

Is the battery voltage between 13-15.2 volts?

Yes	For DTC P0562:00, GO to B4 For DTC P0563:00, GO to B6
No	To diagnose the charging system, REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) . CLEAR all CMDTCs.

B4 CHECK VOLTAGE AND GROUND TO THE TCCM

- Ignition OFF.
- Disconnect TCCM C2371B.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to B6
No	GO to B5

B5 CHECK VOLTAGE TO THE TCCM

Is the voltage greater than 11 volts?

Yes	REPAIR the ground circuit. CLEAR all CMDTCs.
No	VERIFY BJB fuse 71 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR all CMDTCs.

B6 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Front Axle Does Not Engage/Disengage Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation and Fault Conditions

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid commanded by the TCCM. When actuated, the IWE solenoid allows vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle. When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 deg and 5 seconds have elapsed since the shift to 2H has been initiated. If the TCCM observes an overpower or underpower voltage condition, a DTC is set and all TCCM outputs are turned off

(IWEs engaged).

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
C1979:00	IWESolenoid Circuit Failure: No Sub type Information	This DTC sets when the TCCM detects there is a possible mechanical fault present with the IWE system based on wheel speed message data. When the DTC is present IWE solenoid output shall continue to operate normally.
C1979:11	IWE Solenoid Circuit Failure: Circuit Short To Ground	This DTC sets when the TCCM detects a short to ground in the IWE solenoid circuit. The fault results in IWE disengaged all the time.
C1979:12	IWE Solenoid Circuit Failure: Circuit Short To Battery	This DTC sets when the TCCM detects a short to voltage in the IWE solenoid circuit. The fault results in IWE engaged all the time.
C1979:13	IWE Solenoid Circuit Failure: Circuit Open	This DTC sets when the TCCM detects an open circuit in the IWE solenoid circuit. The fault results in IWE engaged all the time.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks
- 4X4 switch module

PINPOINT TEST C : THE FRONT AXLE DOES NOT ENGAGE/DISENGAGE CORRECTLY

C1 CHECK FOR TCCM DTCS	
• Enter the following diagnostic mode: TCCM Self-Test.	
Are any DTCs present?	
Yes	For DTC C1979:11, GO to C17 For DTC C1979:12, GO to C16 For DTC C1979:13, GO to C18 For all other DTCs, REFER to the DTC chart: TCCM.
No	GO to C2

C2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- With the vehicle at operating temperature and the 4X4 switch module in 2H mode, drive the vehicle at sustained Wide Open Throttle (WOT) for 5 seconds.

Is there a grinding noise from the axle system during Wide Open Throttle (WOT)?

Yes	GO to Pinpoint Test I
No	GO to C3

C3 CHECK TCCM OPERATION

- Ignition ON.
- Monitor the 4X4 indicator on the IPC while moving the 4X4 switch module between 2H and 4H modes.

Does the 4X4 indicator illuminate when the 4X4 switch module is in the 4H position and turn off when the 4X4 switch module is in the 2H position?

Yes	GO to C4
No	GO to Pinpoint Test L

C4 CHECK THE IWE DISENGAGEMENT

- **NOTE:** The engine must be idling during the following steps to supply the vacuum required for the IWEs to disengage.

With the vehicle in NEUTRAL, position it on a hoist.

REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).

- Place the 4X4 switch module in 2H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either front halfshaft rotate?

Yes	GO to C7
No	GO to C5

C5 CHECK THE IWE ENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Place the 4X4 switch module in 4H.
- Start the engine.
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did both front halfshafts rotate?

Yes	The front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test J
No	GO to C6

C6 CHECK THE IWE SOLENOID OUTPUT IN 4H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum less than 25 mm-Hg (1 in-Hg)

Yes	The IWE is mechanically stuck in the disengaged position. INSTALL a new IWE on the halfshaft(s) that did not rotate. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	INSTALL a new IWE Solenoid.

C7 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Disconnect the output vacuum line at the IWE solenoid.
- With the engine running and the 4X4 switch module in 2H, measure the vacuum at the output port of the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)

Yes	GO to C9
No	GO to C8

C8 CHECK THE IWE SOLENOID INPUT VACUUM IN 2H

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm-Hg (10 in-Hg)?

Yes	INSTALL a new IWE solenoid.
No	GO to Pinpoint Test I

C9 CHECK THE IWE VACUUM LINES FOR LEAKS

- Ignition OFF.
- Disconnect the output vacuum line at the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	The vacuum lines between the IWE solenoid and the RH or LH IWEs are leaking. INSTALL new vacuum lines as required.
No	GO to C10

C10 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect the output vacuum line from the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum.
- Remove the plug at the LH IWE vacuum line and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	REINSTALL the plug at the LH IWE vacuum line. GO to C11
No	INSPECT vacuum lines from IWE solenoid to LH IWE for obstruction. INSTALL new lines as required.

C11 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect the output vacuum line from the IWE solenoid.
- Disconnect and plug the LH and RH IWE vacuum lines at the IWE.
- Connect a vacuum pump to the IWE output vacuum circuit at the IWE solenoid connection. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe the vacuum reading.
- Remove the plug at the RH IWE vacuum line and observe the vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	The vacuum lines are not leaking or obstructed. GO to C12
No	INSPECT vacuum lines from the vacuum line “T” to the RH IWE for obstruction. INSTALL new lines as required.

C12 CHECK THE RH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the RH IWE.
- Connect a hand vacuum pump to the RH IWE port. Apply 508 mm-Hg (20 in-Hg) of vacuum and observe vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to C13

C13 CHECK THE RH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Did the RH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the RH IWE. GO to C14
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C14 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm-Hg (20 in-Hg) of vacuum to the LH IWE port and observe vacuum reading.

Does the vacuum drop more than 25 mm-Hg (1 in-Hg) per minute?

Yes	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	GO to C15

C15 CHECK THE LH IWE OPERATION

- Connect a vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152-203 mm-Hg (6-8 in-Hg) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152-203 mm-Hg (6-8 in-Hg) and engage when the vacuum is released?

Yes	CONNECT the vacuum line to the LH IWE. The front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test J
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

C16 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect IWE C1291.
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the circuit. CLEAR the DTCs.
No	GO to C17

C17 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

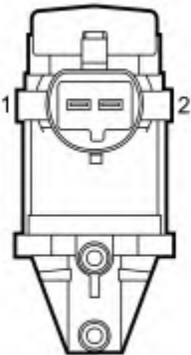
Is the resistance greater than 10,000 ohms?

Yes	GO to C18
No	REPAIR the circuit.

C18 CHECK THE IWE SOLENOID RESISTANCE

NOTE: If the temperatures (either ambient or in the engine compartment) are exceptionally high, a higher than normal resistance reading could result. A lower temperature could result in a lower resistance reading.

- Measure:

Positive Lead	Measurement / Action	Negative Lead
 E191450 Pin 1, component side.		Pin 2, component side.

Is the resistance between 44 and 70 ohms?

Yes	GO to C19
No	INSTALL a new IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation). CLEAR the DTCs.

C19 CHECK FOR VOLTAGE TO THE IWE SOLENOID

- Connect TCCM C2371A.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to C20
No	CHECK BJB fuse 29 (10A). If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

C20 CHECK THE IWE SOLENOID CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect IWE solenoid C1291.
- Disconnect TCCM C2371A.
- Ignition ON.

Is the resistance less than 3 ohms?

Yes	GO to C21
No	REPAIR the circuit. CLEAR the DTCs.

C21 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Vehicle Does Not Shift Between 4A (4X4 AUTO) and 4H (4X4) Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

For locator views of the vacuum lines and vacuum reservoir,

REFER to: [Four-Wheel Drive Systems - Overview](#) (308-07A Four-Wheel Drive Systems, Description and Operation).

Normal Operation

In 2H mode, the TCCM supplies a ground path to the IWE solenoid to apply vacuum to the IWEs (disengaging the front hubs from the front axle). In AUTO, 4H and 4L modes, the TCCM does not supply the ground path to the IWE solenoid, vacuum is not applied to the IWEs and an internal spring keeps the hubs engaged. Systematically check the necessary inputs and outputs at the TCCM, internal components of the transfer case, 4X4 switch module, IWE components and drive axles.

Possible Sources

- Wiring, terminals or connectors
- TCCM
- IWE
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- 4X4 switch module

PINPOINT TEST D : THE VEHICLE DOES NOT SHIFT BETWEEN 4A (4X4 AUTO) AND 4H (4X4) MODES CORRECTLY

D1 CHECK THE TRANSFER CASE SHIFT TO 2H

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- Command the Transfer Case Contact Plate Power (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs for the contact plate position with the MSS in the 2H position.

MSS Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	CLOSED	OPEN	CLOSED	CLOSED
4H Mode	OPEN	CLOSED	CLOSED	OPEN
4L Mode	OPEN	CLOSED	OPEN	CLOSED

Do the PIDs and message center indicate that vehicle shifted into 2H displayed in message center for approximately 4 seconds)?

Yes	GO to D2
No	GO to D6

D2 CHECK FOR IWE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the LH front tire one revolution forward and one revolution backward while observing the LH front halfshaft.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RH front halfshaft.

Did either of the front halfshafts rotate?

Yes	GO to Pinpoint Test C
No	GO to D3

D3 CHECK FOR TRANSFER CASE DISENGAGEMENT

- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	CThe front axle is operating properly at this time. CARRY OUT the 4WD Functional Test. GO to Pinpoint Test J. GO to Pinpoint Test J
No	GO to D4

D4 CHECK THE TRANSFER CASE CONTACT PLATE POSITION PIDS

- Enter the following diagnostic mode: TCCM Datalogger.
- Command the Transfer Case Contact Plate Power (PLATE_PWR_OS) PID to energize the transfer case gearmotor encoder assembly.
- Monitor the Transfer Case Contact Plate Switch A (PLATE_A), B (PLATE_B), C (PLATE_C) and D (PLATE_D) PIDs for the contact plate position with the MSS in the 4H position.

Position	Contact Plate Position			
	PLATE_A	PLATE_B	PLATE_C	PLATE_D
2H Mode	CLOSED	OPEN	CLOSED	CLOSED
4H Mode	OPEN	CLOSED	CLOSED	OPEN
4L Mode	OPEN	CLOSED	OPEN	CLOSED

Does the front driveshaft rotate?

Yes	GO to D17
No	GO to D5

D5 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the MSS from 2H to 4H.

Does the transfer case shift motor rotate from the 2H position to the 4H position?

Yes	GO to D17
No	GO to D6

D6 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s).
No	GO to D7

D7 CHECK TRANSFER CASE CONTACT PLATE CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371A.
- Ignition ON.

Are the resistances greater than 10,000 ohms?

Yes	GO to D8
No	REPAIR the affected circuit(s).

D8 CHECK THE TRANSFER CASE CONTACT PLATE CIRCUITS FOR AN OPEN

- Ignition OFF.
- Disconnect TCCM C2371A.
- Ignition ON.

Are the resistances less than 3 ohms?

Yes	GO to D9
No	REPAIR the affected circuit(s).

D9 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to D10
No	INSTALL a new transfer case shift motor. REFER to Transfer Case Shift Motor. CLEAR the DTCs. REPEAT the self-test, if the concern is still present, GO to D18

D10 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER WHILE COMMANDING THE TCCM CW RELAY (CW_SMD_OS) AND CCW RELAY (CCW_SMD_OS) PIDS ON

- Ignition ON.
- Connect TCCM C2371A.
- Enter the following diagnostic mode: TCCM DataLogger.

Are the voltages 9 volts or greater on the circuits when commanding the PIDs ON?

Yes	GO to D17
No	GO to D11

D11 CHECK THE TCCM VOLTAGE CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the voltage greater than 11 volts?

Yes	GO to D14
No	VERIFY BJB fuse 63 (25A) is OK. If OK, REPAIR the open circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

D12 CHECK TCCM GROUND CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the resistance less than 3 ohms?

Yes	GO to D13
No	REPAIR the circuit.

D13 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

Are the resistances less than 3 ohms?

Yes	GO to D14
No	REPAIR the affected circuit.

D14 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE

- Disconnect Transfer Case .

Is any voltage present?

Yes	REPAIR the circuit.
No	GO to D15

D15 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to D16
No	REPAIR the circuit.

D16 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Verify module ground to vehicle ground connection.
Refer to Wiring Diagrams Cell 34 for schematic and connector information.
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

D17 SHIFT THE TRANSFER CASE TO 4H MANUALLY

- Remove the transfer case shift motor from the transfer case.
- Using a wrench, rotate the shift cam to the 4H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4H and the front driveshaft rotates?

Yes	GO to D18
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

D18 CHECK THE TORQUE REQUIRED TO SHIFT THE TRANSFER CASE

- Rotate the shift cam by hand through 4L, 4H and 2H positions.
- Measure the torque required to perform the shift.

Is the torque required to shift 45 Nm (33 lb-ft) or less?

Yes	GO to D19
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

D19 SHIFT THE TRANSFER CASE TO 2H MANUALLY

- Rotate the shift cam to the 2H position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 2H and the front driveshaft does not rotate?

Yes	GO to D20
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

D20 SHIFT THE TRANSFER CASE TO 4L MANUALLY

- Rotate the shift cam by hand to the 4L position.
- Rotate the rear driveshaft and watch the front driveshaft.

Does the transfer case shift to 4L and the front driveshaft rotates?

Yes	INSTALL a new transfer case shift motor. REFER to: Transfer Case Shift Motor (308-07A Four-Wheel Drive Systems, Removal and Installation). CLEAR the DTCs.
No	REPAIR the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

D21 CHECK FOR TCCM DTCS

- Ignition ON.
- Using a diagnostic scan tool, carry out the TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to D22

D22 CHECK THE 4H INDICATOR

- Select 4H mode and observe the IPC.

Does the IPC indicator lamp indicate 4H (4X4) mode?

Yes	GO to D27
No	GO to D23

D23 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) PID

- Enter the following diagnostic mode on the scan tool: TCCM DataLogger
- Monitor the KEY_POS_4X4 PID while cycling through each position:

Does the ignition position PID match the ignition switch positions?

Yes	GO to D24
No	REFER to: Steering Wheel and Column Electrical Components (211-05 Steering Wheel and Column Electrical Components) .

D24 CHECK THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- **NOTE:** Diagnose any intermodule no communications DTCs before proceeding with this test step.

Monitor 4X4_SW PID while cycling the 4X4 switch module through each position.

4X4 Switch Module Position	PID Status
2H	2-W Drive
4A	4W A
4H	4W Hi
4L	4W Low

Does each PID status agree with each 4X4 switch module position?

Yes	GO to D36
No	GO to D25

D25 CHECK THE POWER TO THE 4X4 SWITCH MODULE

- Ignition OFF.
- Disconnect 4X4 Switch Module C2071.

Are the voltage values within specification?

Yes	GO to D26
No	INSTALL a new 4X4 switch module. REFER to: Mode Select Switch (MSS) (308-07A Four-Wheel Drive Systems, Removal and Installation).

D26 CHECK THE GROUND CIRCUIT TO THE 4X4 SWITCH MODULE

- Ignition OFF.

Is the resistance less than 3 ohms?

Yes	INSTALL a new 4X4 switch module. REFER to: Mode Select Switch (MSS) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	REPAIR the circuit.

D27 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- **NOTE:** The TP_TCCM PID is APP as communicated by the PCM via HS-CAN .

Slowly move the accelerator pedal from closed throttle to WOT and observe the TP_TCCM PID.

Does the TP_TCCM PID vary between 0% at closed throttle and 100% at WOT ?

Yes	GO to D28
No	DIAGNOSE any HS-CAN or PCM DTCs first. REFER to: Communications Network (418-00 Module Communications Network) . Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

D28 CHECK FOR TRANSFER CASE CLUTCH ENGAGEMENT WITH THE TCCM 4WD PWM CLUTCH STATUS COMMAND (4WD_CLTCH_OS) ACTIVE COMMAND PID

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	END the active command. CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	END the active command. GO to D29

D29 CHECK THE IPC INDICATOR IN AUTO MODE

- Select 4A mode and observe the IPC.

Does the message center indicate 4A (4X4 AUTO) mode?

Yes	GO to D30
No	To diagnose the 4X4 mode indicators do not operate correctly/do not operate, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

D30 CHECK FOR WIND-UP IN AUTO MODE

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

Is wind-up present in turns?

Yes	GO to D31
No	The system is operating correctly.

D31 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID AT CLOSED THROTTLE

- Monitor the 4WD_CLTCH_OS PID at closed throttle, KOEO.

Does the 4WD_CLTCH_OS PID indicate 0 to 10% clutch application at closed throttle?

Yes	GO to D32
No	GO to D34

D32 CHECK VOLTAGE ON THE CLUTCH CONTROL CIRCUIT USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- Ignition ON.
- Using the 4WD_CLTCH_OS active command, command the transfer case clutch to 4%.

Is the voltage approximately 0.2 to 0.4 volt?

Yes	END the active command. CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	GO to D33

D33 CHECK THE CLUTCH CONTROL CIRCUIT FOR AN OPEN

- Ignition OFF.
- Disconnect Transfer Case C350.
- Disconnect TCCM C2371B.

Is the resistance less than 3 ohms?

Yes	GO to D34
No	REPAIR the circuit. CLEAR the DTCs.

D34 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDS

- Enter the following diagnostic mode on the scan tool: ABS Module DataLogger.
- While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)

Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?

Yes	GO to D35
No	CHECK the ABS for faults. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

D35 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- **NOTE:** *The TP_TCCM PID is APP as communicated by the PCM via HS-CAN.*

Enter the following diagnostic mode on the scan tool: TCCM DataLogger.

- Slowly move the accelerator pedal from closed throttle to and observe the TP_TCCM PID.

Does the TP_TCCM PID vary between 0% at closed throttle and 100% at WOT?

Yes	GO to D36
No	DIAGNOSE any HS-CAN or PCM DTCs first. REFER to: Communications Network (418-00 Module Communications Network) . Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

D36 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Vehicle Does Not Shift Between 4H (4X4) and 4L (4X4 Low) Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The high-low shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gear set to the output shaft. The torque transmitted through the sun gear from the input shaft turns the front planetary gear set assembly. The front planetary gear set assembly, now engaged, provides transfer case speed reduction. Certain criteria, such as vehicle speed and TR selection must be met before this shift can occur. Systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1839:00	Transfer Case Shift Motor Open Circuit: No Sub Type Information	This DTC sets when the TCCM detects battery voltage less than 9 volts for 5 seconds or more at TCCM.

P1840:00	Transfer Case Shift Motor Short Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Shift motor moves are prevented when this DTC is set.
P1841:00	Transfer Case Shift Motor Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set.
P1849:00	Transfer Case Contact Plate 'A' Short Circuit To Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P184A:00	Transfer Case Unable to Transition Between 4X2 Low and 4X4 High Mode	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4L to 4H. Requested shift motor position is not reached.
P184B:00	Transfer Case Unable to Transition Between 4H and 4L: No Sub Type Information	This DTC sets when target shift motor position is not reached after the maximum number of allowed blocked shift retries for 4H to 4L. Requested shift motor position is not reached.
P1853:00	Transfer Case Contact Plate 'B' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P1857:00	Transfer Case Contact Plate 'C' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P1861:00	Transfer Case Contact Plate 'D' Short Circuit to Ground: No Sub Type Information	This DTC sets when TCCM detects a short to ground. Shift motor moves are prevented when this DTC is set. The TCCM cannot complete mode change if a change in shift motor position is required.
P1867:00	Transfer Case Contact Plate General Circuit Failure: No Sub Type Information	This DTC sets when an invalid shift motor position is detected during selection of a new 4WD mode or during a motor movement. If the shift motor is not moving, shift motor movement is prevented. If the shift motor is moving when this DTC sets, the shift motor moves to the high-side mechanical stop.
P1891:00	Transfer Case Contact Plate Ground Return Open Circuit: No Sub Type Information	This DTC sets when TCCM detects a short to ground, a short to voltage or open circuit. The TCCM cannot complete mode change if a change in shift motor position is required.

Possible Sources

- Wiring, terminals or connectors
- TR
- ABS wheel speed inputs
- Transfer case
- TCCM
- Transmission drag torque

PINPOINT TEST E : THE VEHICLE DOES NOT SHIFT BETWEEN 4H (4X4) AND 4L (4X4 LOW) MODES CORRECTLY

E1 CHECK FOR TCCM DTCS



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: TCCM Self-Test.

Are any DTCs present?

Yes	For DTCs P184A, P184B:00, GO to E18 For DTC P1839:00, GO to E13 For DTC P1840:00, GO to E16 For DTC P1841:00, GO to E17 For DTCs P1849:00, P1853:00, P1857:00, P1861:00, P1867:00, GO to E8 For DTC P1891:00, GO to E10 For all other DTCs, the DTC Chart: TCCM.
No	GO to E2

E2 CHECK THE 4H TO 4L SHIFT

- **NOTE:** When switching in or out of 4L, the transmission must be in NEUTRAL and the vehicle stopped or moving less than 5 km/h (3 mph).

Shift the 4X4 switch module from 4H to 4L.

Does the transfer case shift from 4H to 4L correctly and the complaint is related to a clunk noise during the shift?

Yes	Transmission neutral drag is excessive. REFER to: Diagnosis By Symptom (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Diagnosis and Testing).
No	GO to E3

E3 CHECK THE NEUTRAL INDICATOR (NEUTRAL) PID

- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the NEUTRAL TCCM PID while shifting the transmission through gear ranges.

Does the NEUTRAL PID indicate True when the transmission is shifted to NEUTRAL?

Yes	GO to E4
No	For further diagnosis of the TR sensor, REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L EcoBoost (272kW/370PS) (307-01 Automatic Transmission - 6-Speed Automatic Transmission - 6R80) .

E4 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD) PIDS

- Ignition OFF.
- Connect TCCM C2371A.
- Connect 4X4 Switch Module C2071.
- Ignition ON.
- Switch the 4X4 switch module to 2H
- Enter the following diagnostic mode on the scan tool: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs with the vehicle stopped and while driving.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match (within 5%) with the vehicle stopped and at all speeds?

Yes	GO to E5
No	To diagnose the wheel speed concern. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . After the repair is complete, CLEAR the DTCs.

E5 CHECK THE ABS MODULE WHEEL SPEED PIDS

- Enter the following diagnostic mode on the scan tool:ABS DataLogger.
- Monitor the wheel speed PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)

Do the wheel speed PIDs indicate 0 km/h (0 mph)?

Yes	GO to E6
No	To DIAGNOSE the wheel speed concern, REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) . After the repair is complete, CLEAR the DTCs.

E6 CHECK THE TCCM 4WD MODES (4WD_MODES) PID WITH THE MSS IN 4H

- Start the engine.
- Switch the 4X4 switch module to 4H.
- Monitor the 4WD_MODES PID:

Does the 4WD_MODES PID indicate 4WD High?

Yes	GO to E7
No	GO to E8

E7 CHECK THE TCCM 4WD MODES (4WD_MODES) PID WITH THE MSS IN 4L

- Start the engine.
- Switch the 4X4 switch module to 4L.
- Monitor the 4WD_MODES PID.

Does the 4WD_MODES PID indicate 4WD Low?

Yes	GO to E18
No	GO to E8

E8 CHECK TRANSFER PLATE CONTACT PLATE CIRCUITS FOR A SHORT TO VOLTAGE

- Disconnect Transfer Case C350.
- Disconnect TCCM C2371A.
- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s). CLEAR the DTCs.
No	GO to E9

E9 CHECK TRANSFER PLATE CONTACT PLATE CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.

Are the resistances greater than 10,000 ohms?

Yes	GO to E10
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E10 CHECK THE TRANSFER PLATE CONTACT PLATE CIRCUITS FOR AN OPEN

- Start the engine.

Are the resistances less than 3 ohms?

Yes	GO to E11
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E11 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

Are the resistances greater than 10,000 ohms?

Yes	GO to E12
No	INSTALL a new transfer case shift motor. CLEAR the DTCs. REPEAT the self-test. If the concern is still present, GO to E19

E12 CHECK THE SHIFT MOTOR CIRCUITS FOR POWER WHILE COMMANDING THE TCCM CW RELAY (CW_SMD_OS) AND CCW RELAY (CCW_SMD_OS) PIDS ON

- Connect TCCM C2371A.
- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.

Are the voltages 11 volts or greater on the circuits when commanding the PIDs ON?

Yes	END the active commands, GO to E16
No	END the active commands, GO to E13

E13 CHECK THE TCCM VOLTAGE CIRCUIT

- Ignition OFF.
- Disconnect TCCM C2371B.

Is the voltage greater than 11 volts?

Yes	GO to E14
No	VERIFY BJB fuse 15 (25A) is OK. If OK, REPAIR the circuit. If not OK, REFER to the Wiring Diagrams manual to identify possible causes of the circuit short. CLEAR the DTCs.

E14 CHECK THE TRANSFER CASE CONTROL MODULE GROUND

- Ignition OFF.

Is the resistance less than 3 ohms?

Yes	GO to E15
No	REPAIR the circuit.

E15 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR AN OPEN

- Disconnect Transfer Case C350.
- Disconnect TCCM C2371B.

Are the resistances less than 3 ohms?

Yes	GO to E16
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E16 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO VOLTAGE

- Ignition ON.

Is any voltage present?

Yes	REPAIR the affected circuit(s). CLEAR the DTCs.
No	GO to E17

E17 CHECK THE TRANSFER CASE SHIFT MOTOR CIRCUITS FOR SHORT TO GROUND

- Ignition OFF.

Are the resistances greater than 10,000 ohms?

Yes	GO to E19
No	REPAIR the affected circuit(s). CLEAR the DTCs.

E18 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the 4X4 switch module from 2H to 4H.

Does the transfer case shift motor rotate from the 2H position to the 4H position?

Yes	Disassemble transfer case. REFER to: Transfer Case - Vehicles With: 2-Speed Torque On Demand Transfer Case (308-07B Transfer Case, Disassembly and Assembly).
No	INSTALL a new transfer case shift motor. REFER to: Transfer Case Shift Motor (308-07A Four-Wheel Drive Systems, Removal and Installation).

E19 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

Four-Wheel Drive (4WD) Does Not Engage at Speed Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the operator selects a transfer case mode from 2H mode, the TCCM engages a clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a mechanical engagement of the transfer case. The TCCM also removes the ground path from the IWE solenoid, which removes vacuum from the IWEs , allowing them to engage the front axle shaft. Systematically check the necessary inputs and outputs at the TCCM, internal components of the transfer case, IWE components and drive axles.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
P1825:00	4-Wheel Drive Clutch Relay Open Circuit: No Sub Type Information	This DTC sets when TCCM detects an open circuit. The TCCM disables transfer case clutch operation.

P1826:00	4-Wheel Drive Low Clutch Relay Circuit To Battery: No Sub Type Information	This DTC sets when TCCM detects a short to voltage. Transfer case clutch operation, though disabled by the TCCM, is fully engaged when this DTC is present.
P1827:00	4-Wheel Drive Low Clutch Relay Circuit To Ground	This DTC sets when TCCM detects a short to ground. The TCCM disables transfer case clutch operation.

Possible Sources

- Fuse
- Wiring, terminals or connectors
- TCCM
- Transfer case
- Front axle assembly
- Transfer case clutch

PINPOINT TEST F : FOUR-WHEEL DRIVE (4WD) DOES NOT ENGAGE AT SPEED CORRECTLY

F1 CHECK FOR TCCM DTCS



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: TCCM Self-Test.

Are any DTCs present?

Yes	For DTC P1825:00, GO to F11 For DTC P1826:00, GO to F12 For DTC P1827:00, GO to F10 For all other DTCs, the DTC chart: TCCM.
No	GO to F2

F2 CHECK 4X4 MODE ENGAGEMENT UNDER NO LOAD

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Start the engine.
- Select DRIVE.
- Allow the driveline to idle.
- Switch the 4X4 switch module from 2H mode to 4H or 4A.

Does 4X4 mode engage at rest correctly?

Yes	GO to F3
No	GO to Pinpoint Test J

F3 CHECK 4X2 MODE TO 4X4 MODE SHIFT AT SPEED

- Switch the 4X4 switch module to 4X2 mode.
- Drive the vehicle and carry out a 4X2 mode to 4X4 mode shift while driving at approximately 16 km/h (10 mph).
- Stop the vehicle, shift to 4X2 mode, drive the vehicle and carry out a 4X2 mode to 4X4 mode shift while driving at approximately 64 km/h (40 mph).

Does 4X4 mode engage correctly at 16 km/h (10 mph) and at 64 km/h (40 mph)?

Yes	GO to Pinpoint Test J
No	GO to F4

F4 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED (FRT_WHL_SPD) AND AVERAGE REAR WHEEL SPEED (REAR_WHL_SPD)

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs while driving in a straight line.

Do the FRT_WHL_SPD and REAR_WHL_SPD PIDs match?

Yes	GO to F5
No	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

F5 CHECK THE TRANSFER CASE CLUTCH LOCKUP USING TCCM 4WD PWM CLUTCH STATUS (4WD CLTCH_OUT) PID ACTIVE COMMAND

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Enter the following diagnostic mode: TCCM DataLogger.
- Switch the 4X4 switch module to AUTO mode.
- Using the 4WD CLTCH_OUT active command, command the transfer case clutch to 98%.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F6
No	GO to F9

F6 CHECK THE TRANSFER CASE CLUTCH RELEASE USING TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- With the vehicle still in NEUTRAL and on a hoist, using the 4WD_CLTCH_OS active command, command the transfer case clutch to 0%.
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate when the rear driveshaft is rotated?

Yes	GO to F12
No	End the active command. GO to F7

F7 CHECK THE TRANSFER CASE ENGAGEMENT (ON A HOIST)

- Start the engine, place the 4X4 switch module to 4X2 mode.
- Place the transmission in DRIVE and increase speed to between 5 km/h (3 mph) and 8 km/h (5 mph).
- While observing the front driveshaft, switch the 4X4 switch module to 4X4 mode.

Did the front driveshaft start to spin?

Yes	GO to F8
No	GO to F13

F8 CHECK THE TRANSFER CASE DISENGAGEMENT

- Switch the 4X4 switch module to 4X2 mode while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	GO to F13
No	GO to Pinpoint Test C

F9 CHECK CLUTCH CONTROL CIRCUIT FOR VOLTAGE USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- Ignition ON.
- Using the 4WD_CLTCH_OS active command, command the transfer case clutch to 98%.

Is the voltage greater than 9 volts?

Yes	END the active command. INSTALL a new transfer case clutch. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing). CLEAR the DTCs.
No	GO to F10

F10 CHECK CLUTCH CONTROL CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect Transfer Case .
- Disconnect TCCM C2371B.

Is the resistance greater than 10,000 ohms?

Yes	GO to F11
No	REPAIR the circuit. CLEAR the DTCs.

F11 CHECK CLUTCH CONTROL CIRCUIT FOR AN OPEN

Is the resistance less than 3 ohms?

Yes	GO to F12
No	REPAIR the circuit. CLEAR the DTCs.

F12 CHECK CLUTCH CONTROL CIRCUIT FOR A SHORT TO VOLTAGE USING THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) ACTIVE COMMAND

- Connect Transfer Case C350.
- Connect TCCM C2371B.
- Ignition ON.
- Enter the following diagnostic mode: TCCM DataLogger .
- Using the 4WD_CLTCH_OS active command, command the transfer case clutch to 0%.

Is the voltage approximately 0.2 to 0.4 volt?

Yes	REPAIR the circuit. CLEAR the DTCs.
No	GO to F13

F13 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the 4WD system engages the user selected mode, that mode should be maintained. If the 4WD system does not stay in the selected mode, systematically check the 4WD system components.

Possible Sources

- IWE vent lines
- 4X4 switch module
- Transfer case

PINPOINT TEST G : THE FOUR-WHEEL DRIVE (4WD) SYSTEM JUMPS OUT OF GEAR

G1 CHECK FOR OBSTRUCTED IWE VENT LINES	
• With the vehicle in NEUTRAL, position it on a hoist. REFER to: Jacking and Lifting - Overview (100-02 Jacking and Lifting, Description and Operation). • NOTE: <i>The IWE vent port is the smaller of the 2 vacuum ports.</i> Disconnect the LH IWE line from the vent port. • Attach a hand vacuum pump to the IWE vent line. • Attempt to draw and hold a vacuum. • Connect the LH IWE line. • Disconnect the RH IWE line from the vent port. • Attempt to draw and hold a vacuum.	
Can a vacuum be held on either IWE vent line?	
Yes	INSTALL new IWE vent lines as necessary.
No	GO to G2
G2 CHECK THE TCCM 4WD SWITCH STATUS (4X4_SW) PID	

- Ignition ON.
- Enter the following diagnostic mode: TCCM Datalogger.
- DRIVE the vehicle.
- Monitor the 4X4_SW PID while driving the vehicle in each 4X4 switch module position.

MSS Position	Status
2H	2-W Drive
4A	A4WD
4H	4W Auto/Hi
4L	4W Low

Does the PID always agree with the 4X4 switch module position?

Yes	GO to G3
No	GO to Pinpoint Test C

G3 CHECK THE 4WD INDICATORS

- Stop the vehicle.
- Shift the transmission into the NEUTRAL position.
- **NOTE:** 2H is indicated by the absence of 4X4 AUTO, 4H or 4L mode indicators in the IPC message center.

Observe the 4WD indicators in the IPC while cycling through each 4X4 switch module position.

Do the 4WD indicators match 4X4 switch module switch positions?

Yes	GO to Pinpoint Test C
No	GO to G4

G4 CHECK FOR TCCM DTCS

- Shift the transmission into the PARK position.
- Enter the following diagnostic mode: TCCM self-test.

Are DTCs present?

Yes	REFER to the DTC Chart: TCCM.
No	CHECK the transfer case fluid level. If the fluid level is OK, CHECK for internal transfer case faults. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

Vehicle Pulsates or Shudders in a Straight Line (Straightline Driveline Wind-up

Normal Operation

In order for the 4WD system to function correctly, tires and wheels must be the same size, be in good condition and the front and rear axle ratios must match.

Possible Sources

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

PINPOINT TEST H : VEHICLE PULSATES OR SHUDDERS IN A STRAIGHT LINE (STRAIGHTLINE DRIVELINE WIND-UP)

NOTE: 4X4 is not intended for driving on hard/dry surfaces; using 4X4 mode while driving on these surfaces may produce noises like intermittent clunking, but it does not damage driveline components.

H1 VERIFY THE CONCERN

- Drive the vehicle and shift from 2H mode to 4H mode. There should be minimal wind-up in 4H mode during straightline maneuvers (windup in turns is normal; 4H/4L is not intended for driving on hard/dry surfaces).

Is excessive wind-up present?

Yes	GO to H2
No	RETURN the vehicle to the customer. ADVISE about correct 4WD system operation and normal vehicle behavior.

H2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

- Check the wheel and tire sizes.

Do the 4 wheels and tire sizes match?

Yes	GO to H3
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H3 CHECK TIRE WEAR

- Check each of the 4 tires for wear.

Are the 4 tires worn evenly?

Yes	GO to H4
No	ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H4 CHECK TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to the Safety Certification Label on driver door or door pillar.

Are the tire inflation pressures correct?

Yes	GO to H5
No	ADJUST the tire pressure as necessary. ADVISE the customer that 4WD systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

H5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match.

REFER to: [Rear Drive Axle and Differential](#) (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Description and Operation).

REFER to: [Front Drive Axle](#) (205-03 Front Drive Axle/Differential, Diagnosis and Testing).

Do the front and rear axle ratios match?

Yes	RETURN the vehicle to the customer and ADVISE about correct 4WD system usage and normal vehicle behavior.
No	CHECK the VC label. INSTALL the correct axle(s). REFER to: Rear Drive Axle and Differential (205-02A Rear Drive Axle/Differential - Vehicles With: Ford 8.8 Inch Ring Gear, Diagnosis and Testing). REFER to: Front Drive Axle (205-03 Front Drive Axle/Differential, Diagnosis and Testing).

The Front Axle Makes Noise in 2H Mode Only and Generally Under Heavy Throttle

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation.

REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .

Normal Operation

In 2H mode, the TCCM provides a ground path to the IWE solenoid to supply vacuum to each IWE (disengaging the front hubs from the front axle). During certain conditions such as WOT maneuvers, manifold vacuum is lower than desired. To maintain uninterrupted IWE function in 2H, stored engine vacuum is sourced from the vacuum reservoir. A one-way check valve is implemented between the vacuum reservoir and the IWE solenoid to prevent the stored vacuum from escaping into the manifold during low engine vacuum conditions. For noise-free IWE operation under all conditions, the check valve must be operating correctly.

Possible Sources

- Vacuum leaks
- TCCM
- Transfer case clutch
- Front axle assembly
- Transfer case
- IWE solenoid

PINPOINT TEST I : THE FRONT AXLE MAKES NOISE IN 2H MODE ONLY AND GENERALLY UNDER HEAVY THROTTLE

I1 CHECK FOR TCCM DTCS



WARNING: When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: TCCM Self-Test.

Are any DTCs present?

Yes	REFER to the TCCM DTC chart.
No	GO to I2

I2 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2H

- Select 2H.
- **NOTE:** *The engine must be idling during the following steps to supply vacuum to the IWE solenoid.*

Start the engine.
- Disconnect the output vacuum line at the IWE solenoid while having the vacuum supply attached to the solenoid.
- With the engine running and the in 2H mode, measure the vacuum at the output port of the solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to I7
No	GO to I3

I3 CHECK THE IWE SOLENOID INPUT VACUUM

- Disconnect the supply vacuum line at the IWE solenoid.
- With the engine still running, measure the supply line vacuum to the IWE solenoid.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	INSTALL a new IWE solenoid.
No	GO to 14

I4 CHECK SOURCE VACUUM TO THE VACUUM RESERVOIR

- Disconnect the source vacuum line from the vacuum reservoir.
- With the engine still running, measure the source vacuum being supplied to the vacuum reservoir.

Is the vacuum greater than 254 mm (10 in) Hg?

Yes	GO to 15
No	REPAIR or INSTALL a new source vacuum line.

I5 CHECK THE VACUUM RESERVOIR

- Ignition OFF.
- Disconnect the vacuum line from the vacuum reservoir.
- Connect a hand vacuum pump to the source vacuum port on the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum drop less than 25 mm (1 in) Hg per minute?

Yes	GO to 16
No	INSTALL a new vacuum reservoir.

I6 CHECK THE ONE-WAY VACUUM CHECK VALVE

- **NOTE:** *The check valve is between the IWE solenoid and the vacuum reservoir.*

Connect the vacuum lines to the IWE solenoid.

- Connect a hand vacuum pump to the IWE solenoid vacuum line at the vacuum reservoir and apply 508 mm (20 in) Hg of vacuum.

Does the vacuum drop less than 25 mm (1 in) Hg per minute?

Yes	Concern not present at this time. GO to Pinpoint Test J
No	REPAIR or INSTALL new vacuum lines or INSTALL a new one-way check valve.

I7 CHECK THE IWE VACUUM SYSTEM

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a hand vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit.
- Observe the vacuum reading.

Does the vacuum drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to I11
No	GO to I8

I8 CHECK THE RH IWE LEAK RATE

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Disconnect the vacuum line from the larger port on the RH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the RH port and observe vacuum reading.

Does the vacuum drop less than 25 mm (1 in) Hg per minute?

Yes	GO to I9
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No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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I9 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the LH port and observe vacuum reading.

Does the vacuum drop less than 25 mm (1 in) Hg per minute?

Yes	GO to I10
No	INSTALL a new LH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

I10 CHECK THE IWE VACUUM SUPPLY TUBE

- Disconnect both vacuum lines from the IWE solenoid.
- Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit and observe the vacuum reading.

Does the vacuum drop less than 25 mm (1 in) Hg per minute?

Yes	CONNECT the vacuum lines to the solenoid. GO to I11
No	INSTALL new vacuum lines as necessary.

I11 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 2H

- Connect a hand-held vacuum gauge to the LH vacuum supply tube.
- **NOTE:** *The engine must be idling during the following steps to supply the vacuum required for the IWE to disengage.*

Start the engine.
- While maintaining the steering wheel straight, switch to 2H mode and wait for approximately 5 seconds, observe the vacuum gauge.
- Repeat these steps for the RH IWE.

Are the vacuum readings greater than 254 mm (10 in) Hg after 5 seconds have elapsed?

Yes	GO to I12
No	INSTALL new vacuum lines as necessary.

I12 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- With the vehicle in NEUTRAL, position it on a hoist.
- Disconnect the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the LH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the LH IWE. GO to I13

I13 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Disconnect the larger vacuum line at the RH IWE.
- Connect a hand vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

Did the hand vacuum pump draw a vacuum on the RH IWE vacuum line?

Yes	INSTALL a new vacuum line.
No	CONNECT the vacuum line to the RH IWE. GO to I14

I14 CHECK THE LH IWE OPERATION

- Ignition OFF.
- Connect a hand vacuum pump with gauge to the larger port of the LH IWE.
- Observe the LH halfshaft while rotating the LH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the LH IWE.

Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg and engage when the vacuum is released?

Yes	GO to I15
No	INSTALL a new LH IWE.

I15 CHECK THE RH IWE OPERATION

- Connect a hand vacuum pump with gauge to the larger port of the RH IWE.
- Observe the RH halfshaft while rotating the RH front tire. Apply between 152 and 203 mm (6 to 8 in) Hg of vacuum and release the vacuum to manually disengage and engage the RH IWE.

Yes	GO to Pinpoint Test J
No	INSTALL a new RH IWE. REFER to: Integrated Wheel End (IWE) (308-07A Four-Wheel Drive Systems, Removal and Installation).

Four-Wheel Drive (4WD) System Functional Test

Locator views for the vacuum lines and vacuum reservoir are located in Description and Operation.
REFER to: Four-Wheel Drive Systems (308-07 Four-Wheel Drive Systems) .

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When operating in 4WD modes, the transfer case clutch is energized and both IWEs are locked. When in 4L mode, the transfer case low range gear set provides an additional 2.64 gear reduction. When operating in 2H mode, the transfer case clutch is de-energized and both IWEs are unlocked. The transfer case has certain amount of clutch drag which can cause the front driveshaft to spin even when in 2H mode.”

Possible Sources

- Transfer case and related components
- IWEs and related components
- Wheel/tire assemblies

PINPOINT TEST J : FOUR-WHEEL DRIVE (4WD) SYSTEM FUNCTIONAL TEST

NOTE: 4X4 High and 4X4 Low are not intended for driving on hard/dry surfaces; using these modes while driving on these surfaces may produce noises like intermittent clunking, but does not damage driveline components.

J1 CHECK 2H MODE OPERATION

- Shift the transmission into the NEUTRAL position.
- Switch the 4X4 switch module to 2H mode.

Are there any 4WD mode indicators present in the IPC message center?

Yes	GO to J2
No	GO to J4

J2 CHECK FOR TCCM DTCS

- Shift the transmission into the PARK position.
- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J3

J3 CHECK FOR WIND-UP IN 2H MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test E
No	To diagnose the 4X4 mode indicators do not operate correctly/do not operate, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

J4 CHECK AUTO MODE OPERATION

- Switch the 4X4 switch module to 4A mode.

Is the 4X4 auto (4A) mode indicator on in the IPC message center?

Yes	GO to J7
No	GO to J5

J5 CHECK FOR TCCM DTCS

- Ignition ON.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs present?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J6

J6 CHECK FOR WIND-UP IN 4A MODE

- Drive the vehicle on a dry, hard surface, executing turns while applying the throttle.

Is wind-up present in turns?

Yes	GO to J7
No	GO to J8

J7 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the 4WD_CLTCH_OS PID.

Does the PID indicate 0% to 10% clutch application at closed throttle?

Yes	GO to J8
No	GO to J9

J8 CHECK FOR WIND-UP IN 4A MODE WITH 98% CLUTCH DUTY CYCLE

- Enter the following diagnostic mode: TCCM DataLogger.
- Command the 4WD_CLTCH_OS to 98%.
- Drive the vehicle on a dry, hard surface, executing turns.

Is wind-up present in turns?

Yes	GO to J9
No	CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

J9 CHECK THE TCCM AVERAGE FRONT WHEEL SPEED

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the FRT_WHL_SPD and REAR_WHL_SPD PIDs.
- Drive the vehicle 30 km/h (18 mph).
- Record and compare the FRT_WHL_SPD and REAR_WHL_SPD PIDs.

Do the FRT_WHL_SPD and REAR_WHL_SPD PID values match within 1.5 km/h (1 mph)?

Yes	GO to J10
No	VERIFY all 4 tires are the same size and brand. INSTALL new tires as necessary. If the tires are OK, CHECK the ABS. and VERIFY that the 4 road tire sizes match. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

J10 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- Enter the following diagnostic mode: TCCM DataLogger.
- Monitor the TP_TCCM PID.
- **NOTE:** *The TP_TCCM PID is as communicated by the PCM via HS-CAN.*

Slowly move throttle from closed throttle to WOT and observe the TP_TCCM PID.

Does the TP_TCCM PID value vary between 0% at closed throttle and 100% at WOT?

Yes	GO to J11
No	CHECK the APP sensor and/or the PCM. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

J11 CHECK 4H MODE OPERATION

- Switch the 4X4 switch module to 4H mode.

Does the 4X4 (4H) indicator illuminate in the IPC message center correctly?

Yes	GO to J14
No	GO to J12

J12 CHECK FOR TCCM DTCS

- Shift the transmission into the PARK position.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J13

J13 CHECK FOR WIND-UP IN 4H MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test F
No	GO to Pinpoint Test D

J14 CHECK FOR STRAIGHTLINE WIND-UP IN 4H MODE

- Drive the vehicle on a dry, hard surface.

Is straightline wind-up present?

Yes	GO to Pinpoint Test H
No	GO to J15

J15 CHECK WIND-UP IN TURNS IN 4H MODE

- Drive the vehicle in 4H mode while turning.

Is wind-up present in turns?

Yes	GO to J16
No	GO to Pinpoint Test D

J16 CHECK 4L MODE OPERATION

- Bring the vehicle to a stop with the transmission in NEUTRAL, switch the 4X4 switch module to 4L mode.

Does the 4WD LOW (4L) indicator in the IPC message center illuminate correctly?

Yes	GO to J19
No	GO to J17

J17 CHECK FOR TCCM DTCS

- Select PARK.
- Enter the following diagnostic mode: TCCM Self-Test .

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM .
No	GO to J18

J18 CHECK FOR WIND-UP IN 4L MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test K
No	GO to Pinpoint Test E

J19 CHECK FOR WIND-UP IN TURNS IN 4L MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present and 4L mode functioning?

Yes	GO to J20
No	CHECK for DTCs. REFER to the Inspection and Verification procedure. If no DTCs are present, GO to Pinpoint Test E

J20 CHECK 4L MODE TO 2H MODE SHIFT

- With the vehicle at a stop and transmission in NEUTRAL, switch the 4X4 switch module from 4L mode to 2H mode.

Are there any 4WD mode indicators present in the message center?

Yes	GO to J21
No	GO to J23

J21 CHECK FOR TCCM DTCS

- Select PARK.
- Release the brake pedal.
- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM.
No	GO to J22

J22 CHECK FOR WIND-UP IN 2H MODE

- Drive the vehicle on a dry, hard surface while executing turns.

Is wind-up present in turns?

Yes	GO to Pinpoint Test E
No	To diagnose the 4X4 mode indicators do not operate properly, REFER to: Instrumentation, Message Center and Warning Chimes (413-01 Instrumentation, Message Center and Warning Chimes) .

J23 CHECK FOR TRANSFER CASE DISENGAGEMENT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the rear driveshaft while observing the front driveshaft.

Does the front driveshaft rotate?

Yes	REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
No	GO to J24

J24 CHECK FOR LH AND RH IWEIWE (INTEGRATED WHEEL END) DISENGAGEMENT

- **NOTE:** *The engine must be at idle during the following steps to supply vacuum for IWE disengagement.*

Start the engine and allow to idle.

- Rotate the LH front tire one revolution forward and one revolution backward while observing the LF halfshaft and U-joint.
- Rotate the RH front tire one revolution forward and one revolution backward while observing the RF halfshaft and U-joint.

Does the LH or RH front halfshaft rotate?

Yes	GO to Pinpoint Test C
No	GO to J25

J25 CHECK FOR VACUUM LEAKS

- Ignition OFF.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a hand vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit.
- Observe the vacuum reading.

Did the vacuum drop more than 25 mm (1 in) Hg per minute?

Yes	CHECK the IWE and related components for leaks.
No	GO to J26

J26 CHECK 2H MODE TO 4H MODE SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)

- Switch the 4X4 switch module to 2H mode.
- Drive the vehicle on the road and shift from 2H mode to 4H mode while driving above 32 km/h (20 mph).

Does the transfer case shift to 4H mode satisfactorily?

Yes	The 4WD system is functioning correctly.
No	GO to Pinpoint Test F

Vehicle Binds in a Turn/Resists Turning/Pulsates in a Straightline in 4WD Mode

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

When the vehicle is operating in 4WD modes, all 4 wheels receive the same amount of torque and rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the 4WD system to function correctly, each tire must be in good condition and the front and rear axle ratios must match.

Possible Sources

- IPC Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Throttle position failure
- Transfer case
- TCCM

PINPOINT TEST K : VEHICLE BINDS IN A TURN/RESISTS TURNING/PULSATES IN A STRAIGHTLINE IN 4WD MODE

K1 VERIFY THE CONCERN

- **NOTE:** 4x4 High and 4x4 Low modes are not intended for driving on hard/dry surfaces; using these modes while driving on these surfaces may produce noise like intermittent clunking, but does not damage driveline components.”

Test drive the vehicle on a straight stretch of road in various 4x4 modes.

- Drive the vehicle through turns and parking lot maneuvers.

Does the vehicle bind, pulsate or shudder?

Yes	If the problem occurs in 4A mode, GO to K2 If in 4H mode or 4L mode, binding is a normal condition.
No	GO to Pinpoint Test H

K2 CHECK THE 4H AND 4A INDICATORS

- Review the test drive notes.

4x4 Auto (4A), did the 4X4 (4H) or powertrain malfunction indicator (wrench light) illuminate in the IPC message center?

Yes	If the powertrain malfunction indicator (wrench light) illuminated, GO to K4 If the 4H mode indicator illuminated, GO to K3
No	GO to K5

K3 VERIFY THE FAULT

- Review the test drive notes.

Was 4H mode selected when the 4H indicator was illuminated in the IPC message center?

Yes	The system is functioning correctly.
No	The fault may have been caused by an intermittent, un-commanded or autolock shift. GO to Pinpoint Test H

K4 CHECK FOR TCCM DTCS

- Enter the following diagnostic mode: TCCM Self-Test.

Are DTCs retrieved?

Yes	REFER to the DTC Chart: TCCM .
No	GO to K5

K5 VERIFY THE CONCERN WITH TRANSFER CASE CONNECTOR DISCONNECTED

- Select 4A mode.
- Disconnect Transfer Case.
- **NOTE:** Since the Transfer Case is disconnected you may get some DTC's and Check 4x4 illuminated in the IPC message center.

Test drive the vehicle in 4A on a straight stretch of road and in turns.

Is the concern present?

Yes	INSPECT the driveline components for damage or wear. REFER to Inspection and Verification.
No	GO to K6

K6 CHECK THE TCCM 4WD PWM CLUTCH STATUS (4WD_CLTCH_OS) PID

- Connect Transfer Case.
- Using the scan tool, clear the DTCs.
- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the 4WD_CLTCH_OS PID at closed throttle, KOEO.
- Select 4A mode.

Does the PID indicate 0% to 10% clutch application at closed throttle?

Yes	GO to K7
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No	CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).
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K7 CHECK THE ABS MODULE WHEEL SPEED SENSOR PIDS

- Enter the following diagnostic mode: ABS Module Datalogger.
- While driving the vehicle at 30 km/h (18 mph), monitor the following wheel speed sensor PIDs:
 - Left Front Wheel Speed Sensor (LF_WSPD)
 - Left Rear Wheel Speed Sensor (LR_WSPD)
 - Right Front Wheel Speed Sensor (RF_WSPD)
 - Right Rear Wheel Speed Sensor (RR_WSPD)
- Compare the speedometer reading to the wheel speed sensor PIDs.

Do the wheel speed sensor PIDs and speedometer speeds match within 1.5 km/h (1 mph)?

Yes	GO to K8
No	VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS for faults. REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .

K8 CHECK THE TCCM ABSOLUTE THROTTLE POSITION (TP_TCCM) PID

- Enter the following diagnostic mode: TCCM Datalogger.
- **NOTE:** *The TP_TCCM PID is APP as communicated by the PCM via HS-CAN.*

Slowly move accelerator pedal from closed throttle to and observe the TP_TCCM PID.

Does the TP_TCCM PID value vary between 0% at closed throttle and 100% at WOT?

Yes	GO to K9
No	DIAGNOSE the PCM. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

K9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT

- With the vehicle in NEUTRAL, position it on a hoist.
REFER to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
- Rotate the front driveshaft by hand.

Does the front driveshaft rotate freely (does it require less than 45 Nm [33 lb-ft] to rotate)?

Yes	GO to K10
No	CHECK the transfer case. REFER to: Transfer Case (308-07B Transfer Case, Diagnosis and Testing).

K10 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

The Vehicle Does Not Shift Between 2H (2WD) and 4X4 Modes Correctly

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The 4X4 switch module is not wired directly to the TCCM. Instead, the 4X4 switch module communicates the operator's choice to the TCCM via the HS-CAN2. The TCCM then controls the transfer case clutch, transfer case motor and IWEs as necessary. If the vehicle is not responding as intended, systematically check the necessary inputs and outputs of the TCCM, components of the transfer case, IWE components and halfshafts. Check all circuits for opens and shorts to power or ground. Resolve all no communication DTCs before proceeding with other testing.

Possible Sources

- Wiring, terminals or connectors
- 4X4 switch module
- Transfer case
- TCCM

 **WARNING:** When directed to drive the vehicle as part of this test, drive the vehicle on a hard surface in an area without traffic to prevent a crash. Failure to follow these instructions may result in personal injury.

PINPOINT TEST L : THE VEHICLE DOES NOT SHIFT BETWEEN 2H (2WD) AND 4X4 MODES CORRECTLY

L1 CHECK THE TCCM IGNITION POSITION (KEY_POS_4X4) AND IGNITION STATUS (KEY_STATUS_4X4) PIDS	
• Enter the following diagnostic mode: TCCM Datalogger. • Monitor the KEY_POS_4X4 and KEY_STATUS_4X4 PIDs while cycling through each position.	
Do the ignition PIDs match the ignition switch positions?	
Yes	GO to L2
No	If the KEY_STATUS_4X4 PID did not match, CHECK BJB fuse 13 (10A). If the fuse is OK, REPAIR the circuit for an open. If the fuse is not OK, REFER to the Wiring Diagrams manual to identify the possible causes of the circuit short. After the fault is repaired, CLEAR the DTCs.
L2 CHECK THE TCCM MODULE SUPPLY VOLTAGE (VBAT_4X4) PID	

- Start the engine.
- Enter the following diagnostic mode: TCCM Datalogger.
- Monitor the VBAT_4X4 PID.

Is the VBAT_4X4 PID greater than 12 volts?

Yes	GO to L3
No	To DIAGNOSE the low battery voltage and/or charging system concern, REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .

L3 CHECK THE 4X4 SWITCH MODULE POSITION MONITORING THE TCCM 4WD SWITCH STATUS (4X4_SW) PID

- Monitor the 4X4_SW PID while switching to each 4X4 switch module position.

Does the PID match the 4X4 switch module position?

Yes	GO to L6
No	GO to L4

L4 CHECK THE 4X4 SWITCH MODULE VOLTAGE CIRCUIT

- Disconnect 4X4 Switch Module C2071.
- Ignition ON.
- **NOTE:** *If any lost communication DTCS were retrieved resolve them first before proceeding with this pinpoint test step.*

Is the voltage 11 volts or greater?

Yes	GO to L5
No	CHECK BCM fuse 33, (7.5A), if OK REPAIR the open circuit. If not OK, REFER to the wiring diagram manual to repair the short circuit.

L5 CHECK THE 4X4 SWITCH MODULE GROUND CIRCUIT

- Ignition OFF.

Is the resistance less than 3 ohms?

Yes	INSTALL a new 4X4 switch module.
No	REPAIR the circuit.

L6 CHECK FOR CORRECT TCCM OPERATION

- Ignition OFF.
- Disconnect and inspect all TCCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
 - Refer to Wiring Diagrams Cell 34 and verify module ground to vehicle ground connection.
- Connect all TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. ADDRESS the root cause of the connector or pin issues.

DTC U0100

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0100 when it has not received messages from the PCM for more than 5 seconds with ignition in RUN and battery voltage in range. Other modules that require data from the PCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0100	Lost Communication With ECM/PCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the PCM over the HS-CAN are missing for longer than 5 seconds with ignition in RUN and battery voltage in range.

Possible Sources

- Communication concern
- Battery voltage concern
- PCM
- TCCM

PINPOINT TEST M : U0100

M1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE PCM (POWERTRAIN CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to M2
No	REFER to: Communications Network (418-00 Module Communications Network) .

M2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0100?

Yes	GO to M3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

M3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE PCM (POWERTRAIN CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the PCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS)) .
No	GO to M4

M4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to M5

M5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0100 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is the DTC U0100 set in other modules on the network?

Yes	GO to M6
No	GO to M7

M6 CHECK FOR CORRECT PCM (POWERTRAIN CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all PCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the PCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new PCM. REFER to: Powertrain Control Module (PCM) (303-14C Electronic Engine Controls - 3.5L EcoBoost (272kW/370PS), Removal and Installation). PROGRAM the PCM with the latest calibration level.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

M7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0121

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0121 when key messages such as wheel speed, brake pressure or torque are not received for longer than 5 seconds. This loss of key messages degrades the transmission functionality. Other modules that require data from the ABS module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

U0121	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Sets in continuous memory in the TCCM if ABS data messages received from the ABS Module over the HS-CAN are missing for longer than 5 seconds.
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Possible Sources

- Communication concern
- Battery voltage concern
- ABS module
- TCCM

PINPOINT TEST N : U0121

N1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to N2
No	REFER to: Communications Network (418-00 Module Communications Network) .

N2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0121 retrieved again?

Yes	GO to N3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

N3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to N4

N4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE PCM SELF-TEST

- Using a diagnostic scan tool, perform the PCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	DIAGNOSE and REPAIR all charging or battery related DTCs first. REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to N5

N5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0121 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0121 set in other modules on the network?

Yes	GO to N6
No	GO to N7

N6 CHECK FOR CORRECT ABS (ANTI-LOCK BRAKE SYSTEM) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the ABS module connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the ABS module connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new ABS module. REFER to: Anti-Lock Brake System (ABS) Module (206-09 Anti-Lock Brake System (ABS) and Stability Control, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

N7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0140

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0140 when key messages are not received from the BCM for longer than 90 seconds. This loss of key messages degrades the 4x4 system functionality. Other modules that require data from the BCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140	Lost Communication With Body Control Module (BCM): No Sub Type Information	Sets in continuous memory in the TCCM if BCM data messages received from the BCM over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- BCM module
- TCCM

PINPOINT TEST O : U0140

O1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE BCM (BODY CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to O2
No	REFER to: Communications Network (418-00 Module Communications Network) .

O2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 100 seconds.
- Repeat the TCCM self-test.

Is DTC U0140 retrieved again?

Yes	GO to O3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

O3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE ABS (ANTI-LOCK BRAKE SYSTEM) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the ABS module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to O4

O4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test B
No	GO to O5

O5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0140 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0140 set in other modules on the network?

Yes	GO to O6
No	GO to O7

O6 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the BCM module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the BCM module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern,   Click here to access Guided Routine (BCM).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

O7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.
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DTC U0101

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets DTC U0101 when it has not received messages from the TCM for more than 5 seconds with ignition in RUN and battery voltage in range. Other modules that require data from the TCM all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0101	Lost Communication With TCM "A": No Sub-Type Information	Sets in continuous memory in the TCCM if powertrain data messages received from the TCM over the HS-CAN are missing for longer than 5 seconds with ignition in RUN and battery voltage in range.

Possible Sources

- Communication concern
- Battery voltage concern
- TCM
- TCCM

PINPOINT TEST P : DTC U0101

P1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE TCM (TRANSMISSION CONTROL MODULE)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to P2
No	REFER to: Communications Network (418-00 Module Communications Network) .

P2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CONTINUOUS MEMORY DTC (DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 10 seconds.
- Repeat the TCCM self-test.

Is DTC U0101?

Yes	GO to P3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

P3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCM (TRANSMISSION CONTROL MODULE) KOEO (KEY ON, ENGINE OFF) SELF-TEST

- Using a diagnostic scan tool, perform the TCM KOEO self-test.

Are any DTCs recorded?

Yes	REFER to: Diagnostic Trouble Code (DTC) Charts and Pinpoint Tests - 3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Diagnosis and Testing).
No	GO to P4

P4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to P5

P5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) S U0101 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is the DTC U0101 set in other modules on the network?

Yes	GO to P6
No	GO to P7

P6 CHECK FOR CORRECT TCM (TRANSMISSION CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all TCM connectors.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCM connectors. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCM, REFER to: Transmission Control Module (TCM) - 3.0L Power Stroke Diesel/3.5L EcoBoost (272kW/370PS) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Removal and Installation). PROGRAM the TCM with the latest calibration level. PERFORM the Solenoid Body Strategy Data Download procedure. REFER to: Transmission Strategy Download (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, General Procedures).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

P7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Check for the following:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure they seat and latch correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC B11D9:16

Normal Operation and Fault Conditions

The terrain management module requires an operating voltage between 9 and 16 volts. The terrain management module receives this voltage from the IPC as it is located internally inside the IPC. Excessive resistance or an open in one or more of the power or ground circuits to the IPC, a discharged battery or a inoperative charging system may result in the terrain management module setting a DTC.

AWD: DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
B11D9:16	Battery Voltage Low: Circuit Voltage Below Threshold	This DTC sets in continuous memory if the voltage supplied to the terrain management module falls below 9 volts for more than 10 seconds.

Possible Sources

- Fuses
- Wiring, terminals or connectors
- Terrain management module
- IPC power or ground circuits

Visual Inspection and Diagnostic Pre-checks

- Make sure the vehicle battery terminals and cables are free of any corrosion and other contaminants.
- Make sure the vehicle battery terminals are tightened to their correct torque specifications.

PINPOINT TEST Q : DTC (DIAGNOSTIC TROUBLE CODE) B11D9:16

Q1 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

- Ignition ON.
- Using a diagnostic scan tool, clear the Diagnostic Trouble Codes (DTCs).
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the IPC self-test.

Is DTC B11D9:16 still present?

Yes	GO to Q2
No	The system is operating correctly at this time. The DTC may have been set due to a previous low battery voltage condition.

Q2 CHECK FOR CHARGING SYSTEM DIAGNOSTIC TROUBLE CODES (DTCs) IN THE BCM (BODY CONTROL MODULE)

- Using a diagnostic scan tool, perform the BCM self-test.

Are any charging system Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to Q3

Q3 CHECK THE BATTERY CONDITION AND STATE OF CHARGE

- Check the battery condition and verify the battery is fully charged.
REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Diagnosis and Testing).

Is the battery OK and fully charged?

Yes	GO to Q4
No	If the battery is discharged, DIAGNOSE the cause of the low battery condition. REFER to: Battery (414-01 Battery, Mounting and Cables, Diagnosis and Testing). If the battery condition fails, INSTALL a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Q4 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) VOLTAGE PID

- Measure and record the voltage at the battery.
- Using a diagnostic scan tool, view the IPC Parameter Identifications (PIDs).
- Monitor the IPC voltage (MODULE_VOLT) PID

Is the voltage within 0.2 volt of the recorded battery voltage?

Yes	GO to Q7
No	GO to Q5

Q5 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) VOLTAGE SUPPLY

- Ignition OFF.
- Disconnect IPC C220.
- Ignition ON.

Is the voltage greater than 11 volts?

Yes	GO to Q6
No	REPAIR the circuit for high circuit resistance.

Q6 CHECK THE IPC (INSTRUMENT PANEL CLUSTER) GROUND

Is the voltage greater than 11 volts?

Yes	GO to Q7
No	REPAIR the circuit for high circuit resistance.

Q7 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC connector and related in-line connectors.
- Repair:
 - corrosion (install new connector or terminals – clean module pins)
 - damaged or bent pins – install new terminals/pins
 - pushed-out pins – install new pins as necessary
- Reconnect the IPC connector and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (IPC).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC B11D9:17

Refer to Wiring Diagrams Cell 60 for schematic and connector information.

Normal Operation and Fault Conditions

The terrain management module requires an operating voltage between 9 and 16 volts. The terrain management module receives this voltage from the IPC as it is located internally inside the IPC. A malfunctioning charging system may result in the terrain management module setting a DTC in the terrain management module.

An overcharging condition in the charging system results in the terrain management module setting a DTC. This DTC may also set in the terrain management module due to battery charging or vehicle jump starting events.

AWD: DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions

B11D9:17	System Voltage High: Circuit Voltage Above Threshold	This DTC sets in continuous memory if the voltage supplied to the AWD module is above 16 volts for more than 10 seconds.
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Possible Sources

- Charging system concern
- AWD module

PINPOINT TEST R : B11D9:17

R1 CHECK FOR OVERCHARGING DIAGNOSTIC TROUBLE CODES (DTCS) SET IN OTHER MODULES

- Ignition ON.
- Using a diagnostic scan tool, perform self-test on all modules.
- Retrieve the continuous memory DTCs from all modules.

Is DTC B1317, B1676, P0563 (PCM), U3003:17 or U3006:17 set in more than one module?

Yes	DIAGNOSE the overcharging condition. REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to R2

R2 CHECK THE BATTERY VOLTAGE

- Turn off all interior/exterior lights and accessories.
- Start and run the engine at approximately 2,000 rpm for 3 minutes while monitoring the battery voltage.

Does the battery voltage rise to 15.5 volts or higher?

Yes	DIAGNOSE the overcharging condition. REFER to: Charging System - 3.5L Duratec (209kW/284PS)/3.5L EcoBoost (272kW/370PS)/5.0L 32V Ti-VCT (414-00 Charging System - General Information) .
No	GO to R3

R3 RECHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) B11D9:17

- Ignition OFF.
- Ignition ON.
- Using a diagnostic scan tool, clear the continuous memory DTCs.
- Carry out the terrain management module self-test.

Is DTC B11D9:17 present?

Yes	  Click here to access Guided Routine (IPC).
No	The system is operating correctly at this time. The DTC may have been set previously during battery charging or while jump starting the vehicle.

U0102:00

Normal Operation and Fault Conditions

Terrain Management Module DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0102:00	Lost Communication with Transfer Case Control Module: No Sub Type Information	Sets in continuous memory in the terrain management module if data messages received from the TCCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- GWM concern
- TCCM
- Terrain management module concern

PINPOINT TEST S : U0102:00

S1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to S2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

S2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the TCCM pass the network test?

Yes	GO to S3
No	REFER to: Communications Network (418-00 Module Communications Network) .

S3 PERFORM THE TERRAIN MANAGEMENT MODULE SELF-TEST

- Using a diagnostic scan tool, perform the Terrain Management module self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to DTC Chart: Terrain Management Module.
No	GO to S4

S4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to S5

S5 PERFORM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case (308-07 Four-Wheel Drive Systems) .
No	GO to S6

S6 RECHECK THE TERRAIN MANAGEMENT MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the terrain management module DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Check the IPC Diagnostic Trouble Codes (DTCs).

Is DTC B11D9:17 still present?

Yes	GO to S7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

S7 CHECK FOR OTHER CAUSES OF COMMUNICATION NETWORK CONCERN

NOTE: If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the PMI or the PMI may not have been carried out.

- CHECK the vehicle service history for recent service actions related to the TCCM, GWM or IPC. If recent service history is found:
 - verify correct replacement module was installed
 - HVBOM may be used to verify correct part fitment
 - verify the configuration of replacement module was correct
 - re-configure module using as-built data if prior configuration is suspect
 - verify the module was not obtained from a like vehicle and installed into customer vehicle
 - return the swapped module to source vehicle and obtain new replacement module
- Operate the system and determine if the observable symptom is still present.

Is the observable symptom still present?

Yes	GO to S8
No	The system is operating correctly at this time. The concern may have been due to incorrect parts replacement procedures or incorrect module configuration.

S8 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect TCCM connector and related in-line connectors.
- Repair:
 - corrosion (install new connector or terminals – clean module pins)
 - damaged or bent pins – install new terminals/pins
 - pushed-out pins – install new pins as necessary
- Reconnect the TCCM connector and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0140:00

Normal Operation and Fault Conditions

Terrain Management Module DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0140:00	Lost Communication With Body Control Module: No Sub Type Information	Sets in continuous memory in the Terrain Management Module if data messages received from the BCM through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- GWM concern
- BCM
- All-Terrain Control Module

PINPOINT TEST T : U0140:00

T1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to T2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

T2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the BCM pass the network test?

Yes	GO to T3
No	REFER to: Communications Network (418-00 Module Communications Network) .

T3 PERFORM THE TERRAIN MANAGEMENT MODULE SELF-TEST

- Using a diagnostic scan tool, perform the terrain management module self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to DTC Chart: terrain management module.
No	GO to T4

T4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to T5

T5 PERFORM THE BCM (BODY CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the BCM self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) present?

Yes	REFER to: Body Control Module (BCM) (419-10 Multifunction Electronic Modules) .
No	GO to T6

T6 RECHECK THE TERRAIN MANAGEMENT MODULE DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the IPC Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Check the IPC Diagnostic Trouble Codes (DTCs).

Is DTC U0140:00 or DTC U0422:82 still present?

Yes	GO to T7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

T7 CHECK FOR OTHER CAUSES OF COMMUNICATION NETWORK CONCERN

NOTE: *If new modules were installed prior to the DTC being set, the module configuration may be incorrectly set during the PMI, or the PMI may not have been carried out.*

- CHECK the vehicle service history for recent service actions related to the BCM, GWM or IPC. If recent service history is found:
 - verify correct replacement module was installed
 - HVBOM may be used to verify correct part fitment
 - verify the configuration of replacement module was correct
 - re-configure module using as-built data if prior configuration is suspect
 - verify the module was not obtained from a like vehicle and installed into customer vehicle
 - return the swapped module to source vehicle and obtain new replacement module
- Operate the system and determine if the observable symptom is still present.

Is the observable symptom still present?

Yes	GO to T8
No	The system is operating correctly at this time. The concern may have been due to incorrect parts replacement procedures or incorrect module configuration.

T8 CHECK FOR CORRECT BCM (BODY CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect all BCM connectors and related in-line connectors.
- Repair:
 - corrosion (install new connector or terminals – clean module pins)
 - damaged or bent pins – install new terminals/pins
 - pushed-out pins – install new pins as necessary
- Reconnect all the BCM connectors and related in-line connectors. Make sure they seat and latch correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern,   Click here to access Guided Routine (BCM).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

U0138:00

Normal Operation and Fault Conditions

IPC DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0138:00	Lost Communication with All Terrain Control Module	Sets in continuous memory in the TCCM if data messages received from the Terrain Management module through the GWM are missing for 5 seconds or longer.

Possible Sources

- Communication concern
- GWM concern
- TCCM
- All-Terrain Control Module

PINPOINT TEST U : U0138:00

U1 VERIFY THE CUSTOMER CONCERN

- Ignition ON.
- Verify there is an observable symptom present.

Is an observable symptom present?

Yes	GO to U2
No	CLEAR the DTC. The system is operating normally at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

U2 CHECK THE COMMUNICATION NETWORK

- Using a diagnostic scan tool, perform the network test.

Does the TCCM pass the network test?

Yes	GO to U3
No	REFER to: Communications Network (418-00 Module Communications Network) .

U3 PERFORM THE TERRAIN CONTROL MODULE SELF-TEST

- Using a diagnostic scan tool, perform the Terrain Control Module self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) recorded?

Yes	RESOLVE any non-network DTCs first, REFER to DTC Chart: Terrain Control Module.
No	GO to U4

U4 CHECK THE GWM (GATEWAY MODULE A) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, check the GWM Continuous Memory Diagnostic Trouble Codes (CMDTCs).

Are any Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Communications Network (418-00 Module Communications Network) .
No	GO to U5

U5 PERFORM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Are any non-network Diagnostic Trouble Codes (DTCs) recorded?

Yes	REFER to: Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case (308-07 Four-Wheel Drive Systems) .
No	GO to U6

U6 RECHECK THE IPC (INSTRUMENT PANEL CLUSTER) DIAGNOSTIC TROUBLE CODES (DTCS)

- Using a diagnostic scan tool, clear the IPC Diagnostic Trouble Codes (DTCs).
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Check the Terrain Control Module Diagnostic Trouble Codes (DTCs).

Is DTC U0138:00 still present?

Yes	GO to U7
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

U7 CHECK FOR OTHER CAUSES OF COMMUNICATION NETWORK CONCERN

NOTE: *If new modules were installed prior to the DTC being set, the module configuration can be incorrectly set during the PMI or the PMI may not have been carried out.*

- CHECK the vehicle service history for recent service actions related to the TCCM, GWM or IPC. If recent service history is found:
 - verify correct replacement module was installed
 - HVBOM may be used to verify correct part fitment
 - verify the configuration of replacement module was correct
 - re-configure module using as-built data if prior configuration is suspect
 - verify the module was not obtained from a like vehicle and installed into customer vehicle
 - return the swapped module to source vehicle and obtain new replacement module
- Operate the system and determine if the observable symptom is still present.

Is the observable symptom still present?

Yes	GO to U8
No	The system is operating correctly at this time. The concern may have been due to incorrect parts replacement procedures or incorrect module configuration.

U8 CHECK FOR CORRECT ALL-TERRAIN CONTROL MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the All-Terrain Control Module connector and related in-line connectors.
- Repair:
 - corrosion (install new connector or terminals – clean module pins)
 - damaged or bent pins – install new terminals/pins
 - pushed-out pins – install new pins as necessary
- Reconnect the All-Terrain Control Module connector and related in-line connectors. Make sure it seats and latches correctly.
- Operate the system and determine if the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable Technical Service Bulletins (TSBs). If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no Technical Service Bulletins (TSBs) address this concern, INSTALL a new 4X4 switch module.
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

DTC U0155

Refer to Wiring Diagrams Cell 34 for schematic and connector information.

Normal Operation

The TCCM sets the DTC U0155 when key messages are not received for longer than 5 seconds. This loss of key messages degrades the 4x4 system performance and/or inability to change 4x4 modes. Other modules that require data from the IPC module all set communication DTCs and may also exhibit system function concerns.

DTC Fault Trigger Conditions

DTC	Description	Fault Trigger Conditions
U0155	Lost Communication With Instrument Panel Cluster (IPC): No Sub Type Information	Sets in continuous memory in the TCCM if IPCdata messages received from the IPC over the HS-CAN are missing for longer than 5 seconds.

Possible Sources

- Communication concern
- Battery voltage concern
- IPC module
- TCCM

PINPOINT TEST V : DTC U0155

V1 VERIFY THE SCAN TOOL COMMUNICATES WITH THE IPC (INSTRUMENT PANEL CLUSTER)

- Ignition ON.
- Connect a diagnostic scan tool.
- Check that a vehicle session can be established using a diagnostic scan tool.

Can a vehicle session be established?

Yes	GO to V2
No	REFER to: Communications Network (418-00 Module Communications Network) .

V2 CHECK THE TCCM (TRANSFER CASE CONTROL MODULE) CMDTC (CONTINUOUS MEMORY DIAGNOSTIC TROUBLE CODE) S

- Using a diagnostic scan tool, perform the TCCM self-test.
- Clear the DTCs.
- Wait 100 seconds.
- Repeat the TCCM self-test.

Is DTC U0140 retrieved again?

Yes	GO to V3
No	The system is operating correctly at this time. The DTC may have been set due to high network traffic or an intermittent fault condition.

V3 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE IPC (INSTRUMENT PANEL CLUSTER) MODULE SELF-TEST

- Using a diagnostic scan tool, perform the IPC module self-test.

Are any DTCs recorded?

Yes	REFER to: Anti-Lock Brake System (ABS) and Stability Control (206-09 Anti-Lock Brake System (ABS) and Stability Control) .
No	GO to V4

V4 RETRIEVE THE RECORDED DTC (DIAGNOSTIC TROUBLE CODE) S FROM THE TCCM (TRANSFER CASE CONTROL MODULE) SELF-TEST

- Using a diagnostic scan tool, perform the TCCM self-test.

Is DTC P0562:00 or P0563:00 recorded?

Yes	GO to Pinpoint Test B
No	GO to V5

V5 CHECK FOR DTC (DIAGNOSTIC TROUBLE CODE) U0155 SET IN OTHER MODULES

- Using a diagnostic scan tool, clear all DTCs.
- Ignition OFF.
- Ignition ON.
- Wait 10 seconds.
- Using a diagnostic scan tool, perform the continuous memory self-test.
- Retrieve the CMDTCs from all modules.

Is DTC U0155 set in other modules on the network?

Yes	GO to V6
No	GO to V7

V6 CHECK FOR CORRECT IPC (INSTRUMENT PANEL CLUSTER) MODULE OPERATION

- Ignition OFF.
- Disconnect and inspect the IPC module connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the IPC module connector. Make sure it seat and latches correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern,   Click here to access Guided Routine (IPC).
No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.

V7 CHECK FOR CORRECT TCCM (TRANSFER CASE CONTROL MODULE) OPERATION

- Ignition OFF.
- Disconnect and inspect the TCCM connector.
- Repair:
 - corrosion (install new connector or terminals - clean module pins)
 - damaged or bent pins - install new terminals/pins
 - pushed-out pins - install new pins as necessary
- Reconnect the TCCM connector. Make sure it seats and latches correctly.
- Operate the system and verify the concern is still present

Is the concern still present?

Yes	CHECK OASIS for any applicable TSBs. If a TSB exists for this concern, DISCONTINUE this test and FOLLOW TSB instructions. If no TSBs address this concern, INSTALL a new TCCM. REFER to: Transfer Case Control Module (TCCM) (308-07A Four-Wheel Drive Systems, Removal and Installation).
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No	The system is operating correctly at this time. The concern may have been caused by module connections. ADDRESS the root cause of any connector or pin issues.
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Neutral Flat Tow Activation and Deactivation - Raptor

Activation

 **WARNING:** Shifting the transfer case to its neutral position for neutral flat towing may allow the vehicle to be able to roll even if the transmission is in park (P). Make sure the foot brake is depressed and the vehicle is in a secure and safe position while the transfer case is being shifted to its neutral position. Failure to follow this instruction may result in serious personal injury.

 **WARNING:** Do not disconnect the battery during neutral flat towing. Doing so will prevent the transfer case from shifting properly and may allow the vehicle to roll even if the transmission is in park (P). Failure to follow this instruction may result in serious personal injury.

NOTICE: 2WD vehicles cannot be flat towed with any of the wheels on the ground. Vehicle or transmission damage will occur.

NOTICE: Failure to put the transfer case in its NEUTRAL position will damage vehicle components.

NOTE: *You can only tow a 4WD vehicle with all wheels on the ground by placing the transfer case in its NEUTRAL position and engaging the four-wheel-down towing feature. Perform the following steps after positioning your vehicle behind the tow vehicle and properly securing them together.*

NOTE: *Neutral flat tow status can be checked at any time by opening the driver door or turning the ignition to the ACC or ON position and checking the display in the IPC.*

NOTE: *Make sure you properly secure your vehicle to the tow vehicle.*

1. Put the ignition in the ON position, but do not start the engine. If your vehicle has an ignition key, turn the key to on. If your vehicle has intelligent access, press the engine START/STOP button once without pressing the brake pedal.

2. Press and hold the brake pedal.
3. Rotate the four-wheel drive switch to 2H.
4. Shift the transmission to NEUTRAL.
5. Enable Neutral Tow through the information display by selecting Settings from the cluster menu.
6. Then select Advanced Settings.
7. Then select Vehicle.
8. Then select Neutral Tow.

NOTE: *If completed successfully, the IPC displays "NEUTRAL TOW LEAVE IN N" or "NEUTRAL TOW ENABLED LEAVE TRANSMISSION IN NEUTRAL", indicating that the vehicle is safe to tow with all wheels on the ground.*

NOTE: *If the message is not shown in the display, the entire procedure must be performed again.*

NOTE: *An audible noise may be heard as the transfer case shifts into neutral position, this is normal operation.*

9. Leave the transmission in position N and turn the ignition as far as it will go toward the off position (it will not turn fully off when the transmission is in position N). If your vehicle has an ignition key, you must leave the key in the ignition while towing. To lock and unlock your vehicle, use the keyless entry keypad or extra set of keys. If your vehicle has intelligent access, press the engine START/STOP button once without pressing the brake pedal. You do not need to leave your keys in the vehicle. You can lock and unlock your vehicle as you normally do.
10. Release the brake pedal.

Deactivation

 **WARNING:** Shifting the transfer case to its neutral position for neutral flat towing may allow the vehicle to be able to roll even if the transmission is in park (P). Make sure the foot brake is depressed and the vehicle is in a secure and safe position while the transfer case is being shifted to its neutral position. Failure to follow this instruction may result in serious personal injury.

 **WARNING:** Do not disconnect the battery during neutral flat towing. Doing so will prevent

the transfer case from shifting properly and may allow the vehicle to roll even if the transmission is in park (P). Failure to follow this instruction may result in serious personal injury.

NOTE: *Neutral flat tow status can be checked at any time by opening the driver door or turning the ignition to the ACC or ON position and checking the display in the IPC.*

1. Turn the ignition to the ON position. Do not start the engine. If your vehicle has an ignition key, turn the key to on. If your vehicle has intelligent access, press the engine START/STOP button once without pressing the brake pedal.
2. Press and hold the brake pedal.
3. Shift the transmission out of NEUTRAL and into any gear.
4. Release the brake pedal.
 - If completed successfully, the IPC displays 4X2, then "NEUTRAL TOW DISABLED".
 - If the indicator light and message do not display, the entire procedure must be performed again.
 - An audible noise may be heard as the transfer case shifts out of NEUTRAL position, this is normal operation.

Neutral Flat Tow Activation and Deactivation

Activation

 **WARNING:** Shifting the transfer case to its neutral position for neutral flat towing may allow the vehicle to be able to roll even if the transmission is in park (P). Make sure the foot brake is depressed and the vehicle is in a secure and safe position while the transfer case is being shifted to its neutral position. Failure to follow this instruction may result in serious personal injury.

 **WARNING:** Do not disconnect the battery during neutral flat towing. Doing so will prevent the transfer case from shifting properly and may allow the vehicle to roll even if the transmission is in park (P). Failure to follow this instruction may result in serious personal injury.

NOTICE: 2WD vehicles cannot be flat towed with any of the wheels on the ground. Vehicle or transmission damage will occur.

NOTICE: Failure to put the transfer case in its NEUTRAL position will damage vehicle components.

NOTE: You can only tow a 4WD vehicle with all wheels on the ground by placing the transfer case in its NEUTRAL position and engaging the four-wheel-down towing feature. Perform the following steps after positioning your vehicle behind the tow vehicle and properly securing them together.

NOTE: Neutral flat tow status can be checked at any time by opening the driver door or turning the ignition to the ACC or ON position and checking the display in the IPC.

1. Turn the ignition to the ON position. Do not start the engine. If your vehicle has an ignition key, turn the key to on. If your vehicle has intelligent access, press the engine START/STOP button once without pressing the brake pedal.
2. Press and hold the brake pedal.
3. Shift the MSS to 2H.

4. Shift the transmission to NEUTRAL.
5. Rotate the MSS from 2H to 4L and back to 2H 5 times within 7 seconds.
 - If completed successfully, the IPC displays "NEUTRAL TOW LEAVE IN N" or "NEUTRAL TOW ENABLED LEAVE TRANSMISSION IN NEUTRAL", indicating that the vehicle is safe to tow with all wheels on the ground.
 - If the message is not shown in the display, the entire procedure must be performed again.
 - An audible noise may be heard as the transfer case shifts into neutral position, this is normal operation.
6. Leave the transmission in position N and turn the ignition as far as it will go toward the off position (it will not turn fully off when the transmission is in position N). If your vehicle has an ignition key, you must leave the key in the ignition while towing. To lock and unlock your vehicle, use the keyless entry keypad or extra set of keys. If your vehicle has intelligent access, press the engine START/STOP button once without pressing the brake pedal. You do not need to leave your keys in the vehicle. You can lock and unlock your vehicle as you normally do.
7. Release the brake pedal.

Deactivation

 **WARNING:** Shifting the transfer case to its neutral position for neutral flat towing may allow the vehicle to be able to roll even if the transmission is in park (P). Make sure the foot brake is depressed and the vehicle is in a secure and safe position while the transfer case is being shifted to its neutral position. Failure to follow this instruction may result in serious personal injury.

 **WARNING:** Do not disconnect the battery during neutral flat towing. Doing so will prevent the transfer case from shifting properly and may allow the vehicle to roll even if the transmission is in park (P). Failure to follow this instruction may result in serious personal injury.

NOTE: *Neutral flat tow status can be checked at any time by opening the driver door or turning the ignition to the ACC or ON position and checking the display in the IPC.*

1. Turn the ignition to the ON position. Do not start the engine. If your vehicle has an ignition key, turn the key to on. If your vehicle has intelligent access, press the engine START/STOP button once without pressing the brake pedal.
2. Press and hold the brake pedal.
3. Shift the transmission out of NEUTRAL and into any gear.

4. Release the brake pedal.

- If completed successfully, the IPC displays 4X2, then "NEUTRAL TOW DISABLED".
- If the indicator light and message do not display, the entire procedure must be performed again.
- An audible noise may be heard as the transfer case shifts out of NEUTRAL position, this is normal operation.

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Integrated Wheel End (IWE)

Special Tool(s) / General Equipment

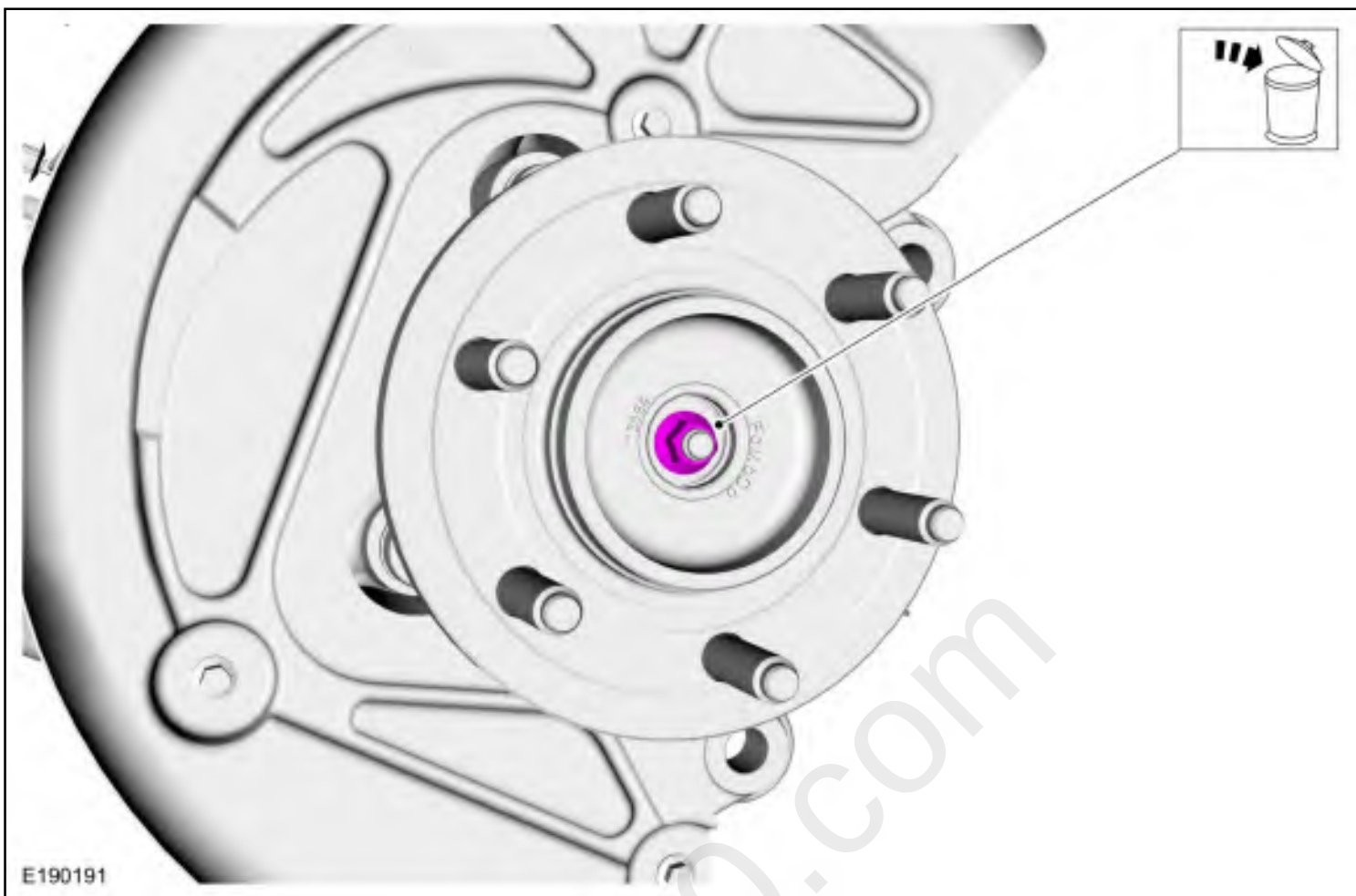
	204-592 Separator, Lower Arm Ball Joint TKIT-2006C-FFMFLM TKIT-2006C-LM TKIT-2006C-ROW
Tie Rod End Remover	

Removal

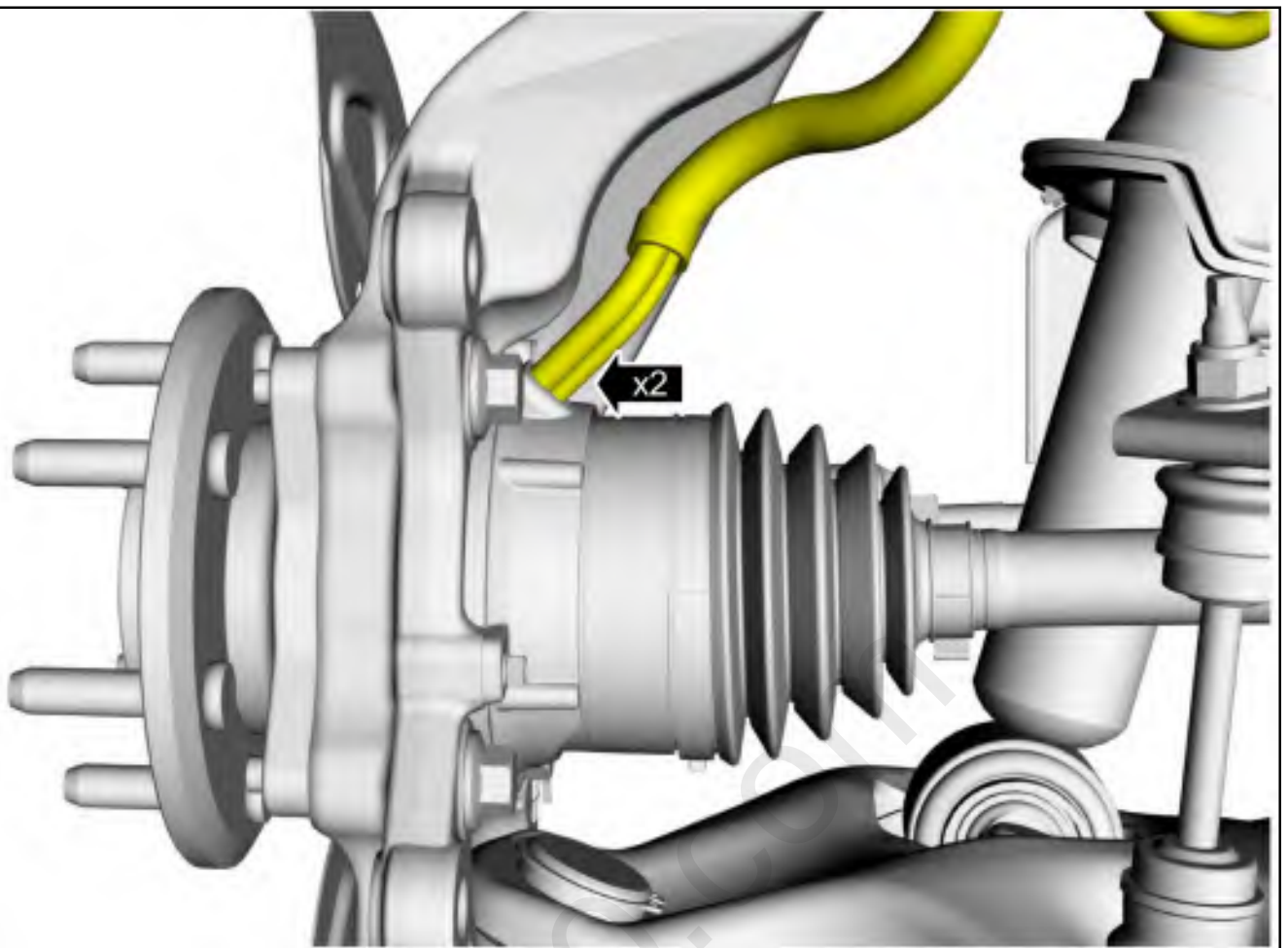
1. Remove the brake disc.
Refer to: [Brake Disc](#) (206-03 Front Disc Brake, Removal and Installation).
2. Remove the wheel hub nut dust cap.



3. Remove and discard the wheel hub nut.

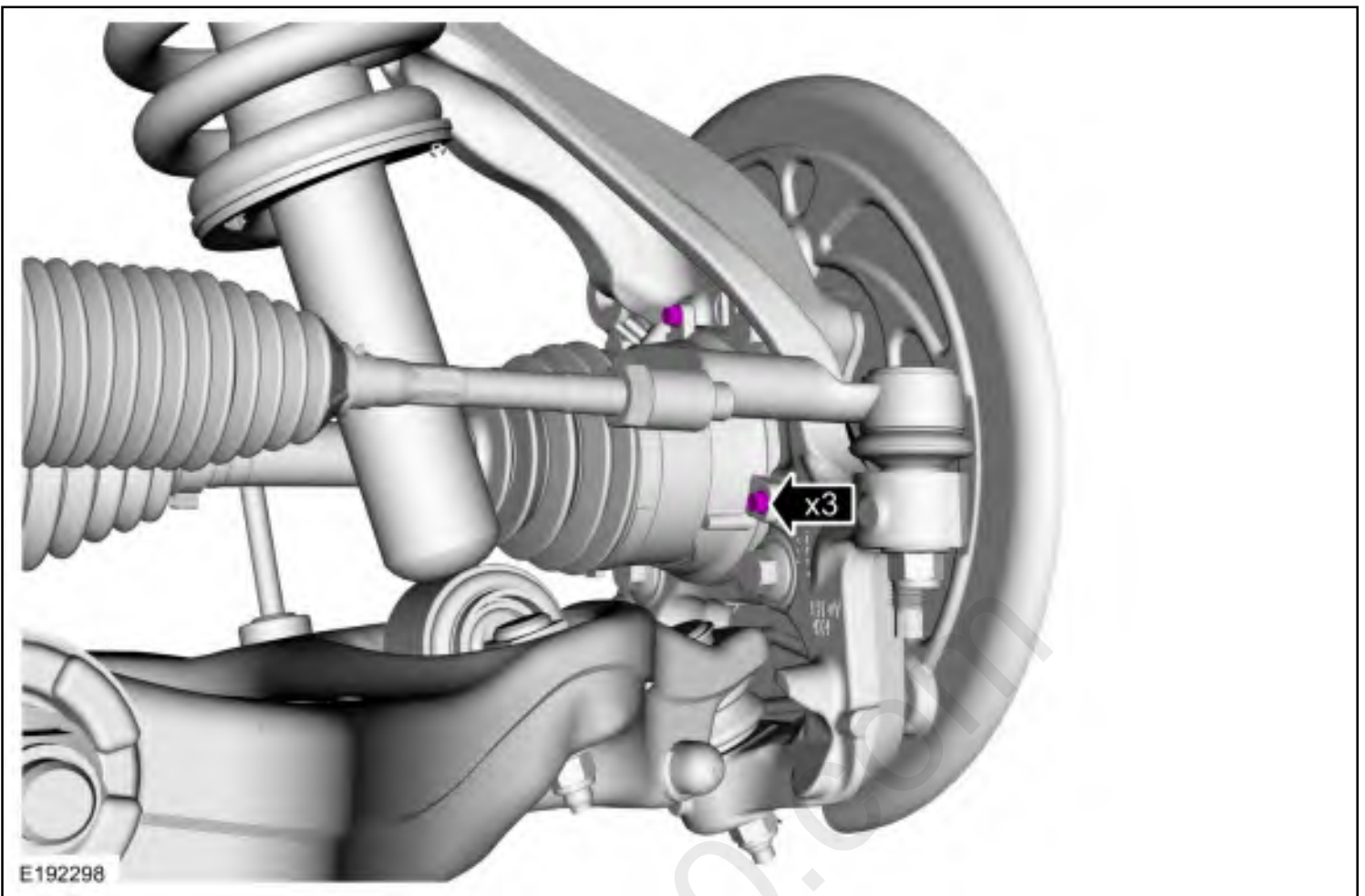


4. Disconnect the vacuum tubes from the IWE and position aside.



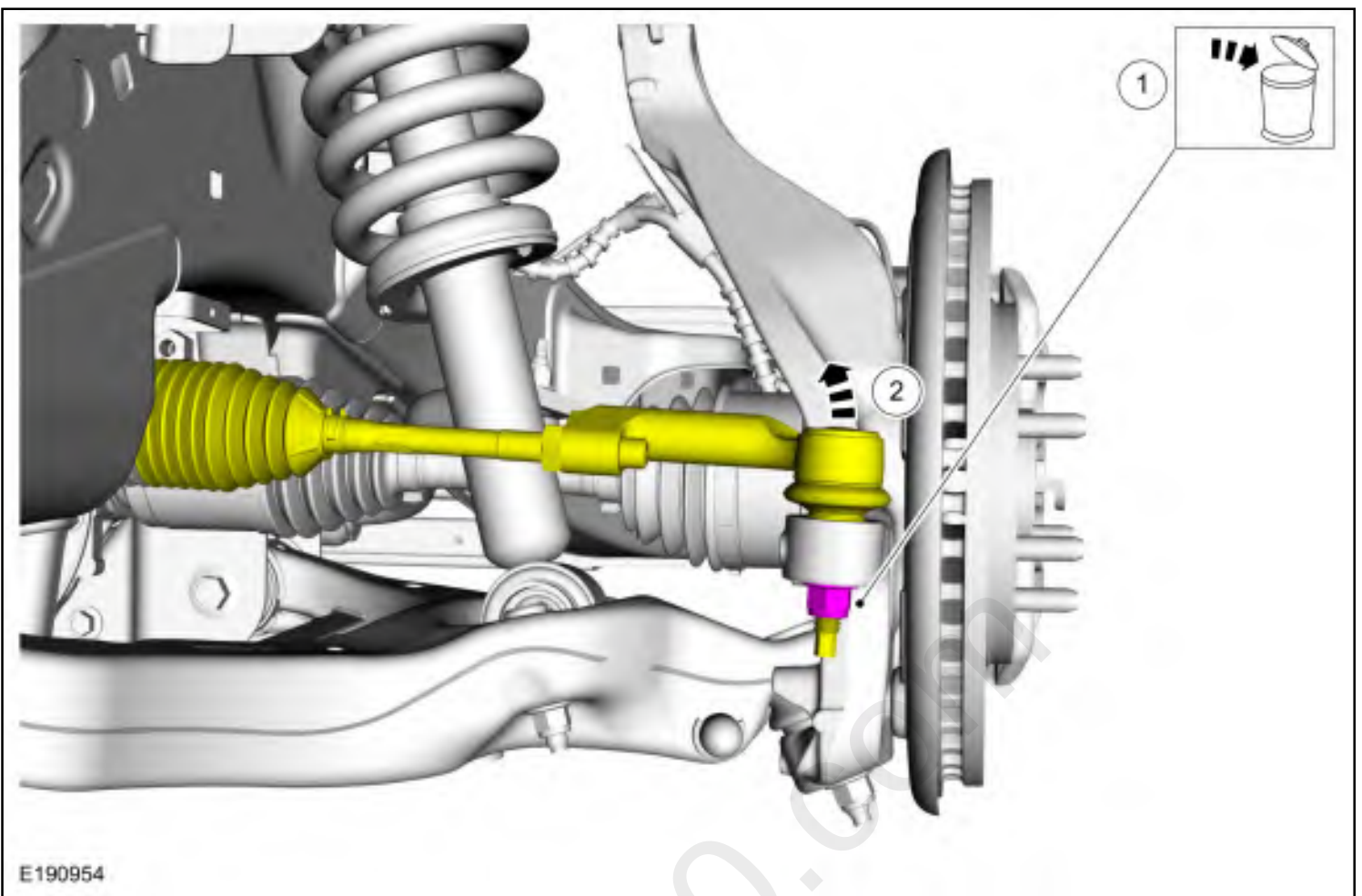
E193165

5. Remove the IWE-to-wheel knuckle retaining bolts.

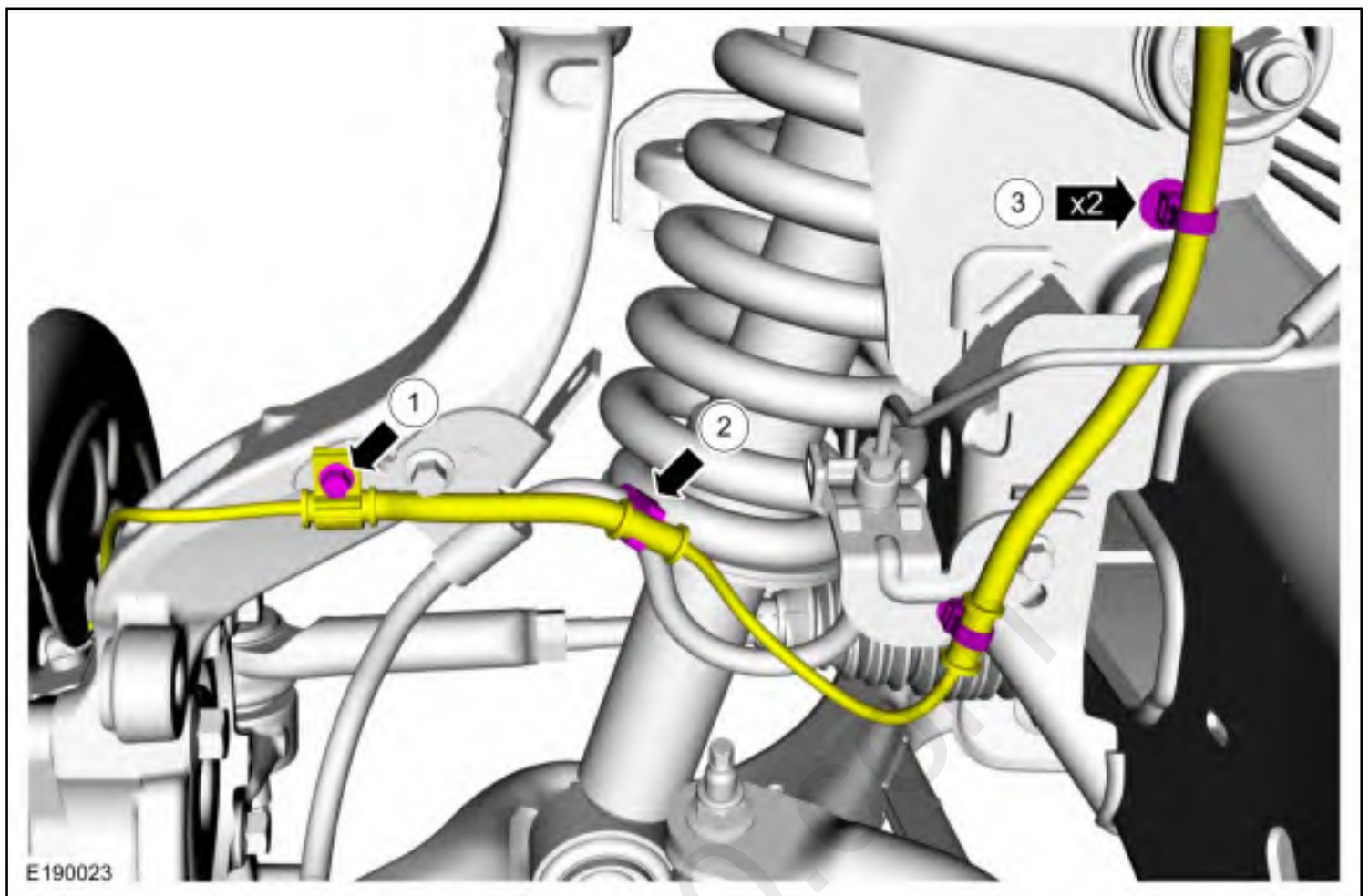


1. Remove and discard the outer tie rod end nut.
2. **NOTICE: Do not use a hammer to separate the outer tie-rod end from the wheel knuckle or damage to the wheel knuckle may result.**

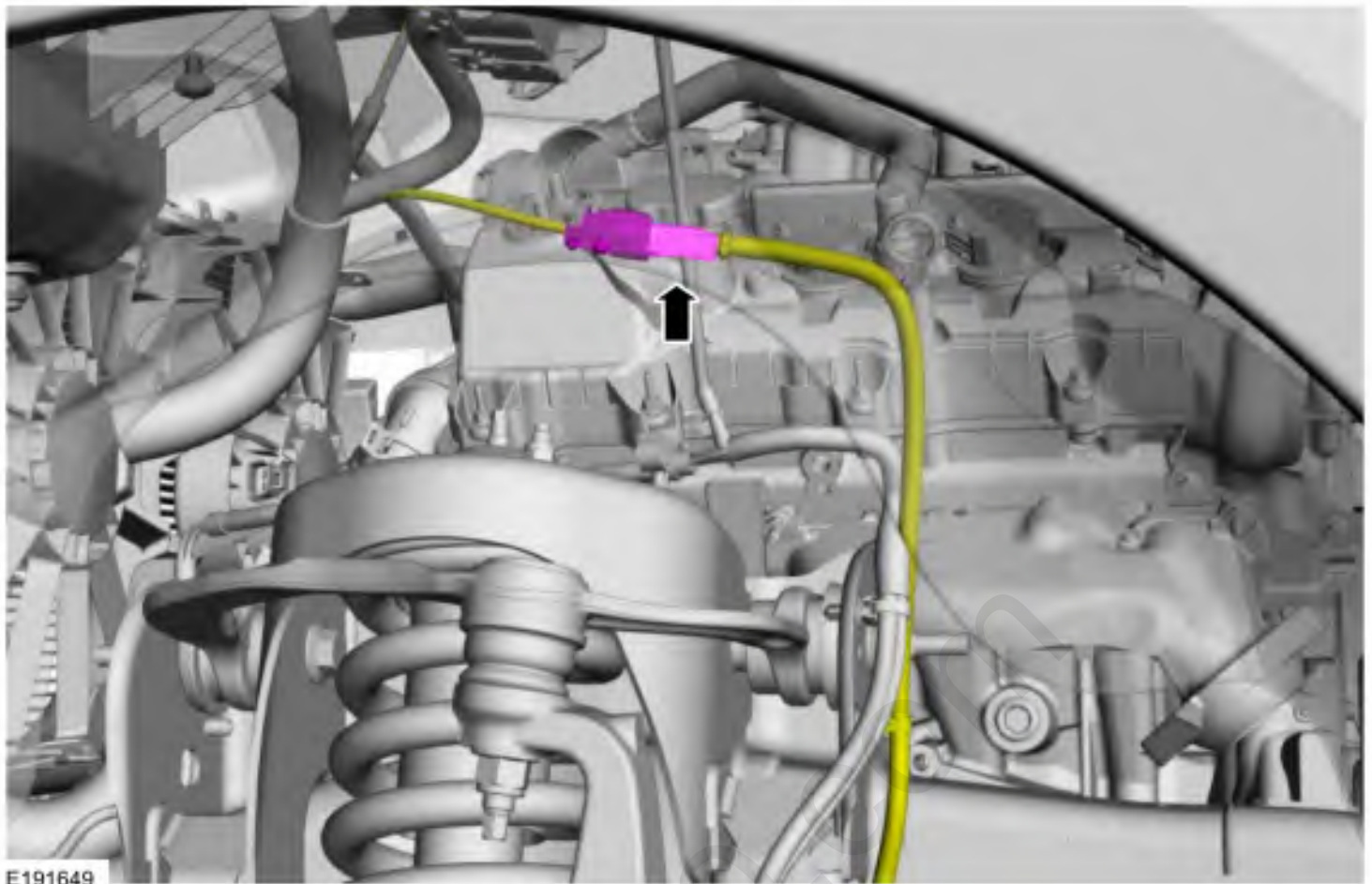
Separate the outer tie rod end from the wheel knuckle.
Use the General Equipment: Tie Rod End Remover



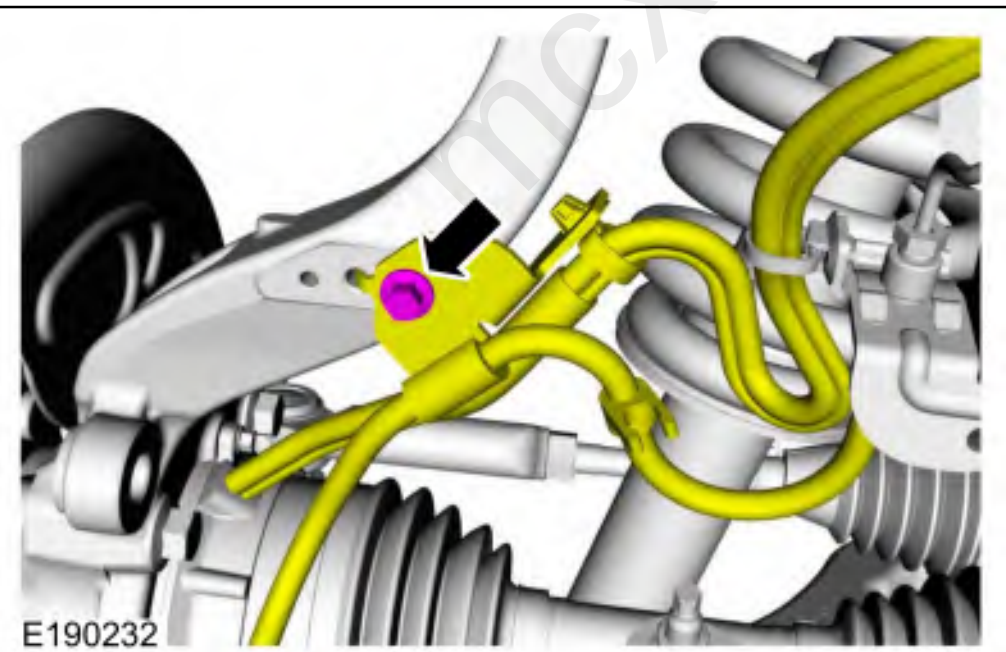
1. Remove the wheel speed sensor wire bracket bolt.
2. Unclip the wheel speed sensor wire from the brake hose.
3. Unclip the 2 wheel speed sensor wire retainers and position aside the wheel speed sensor wire.



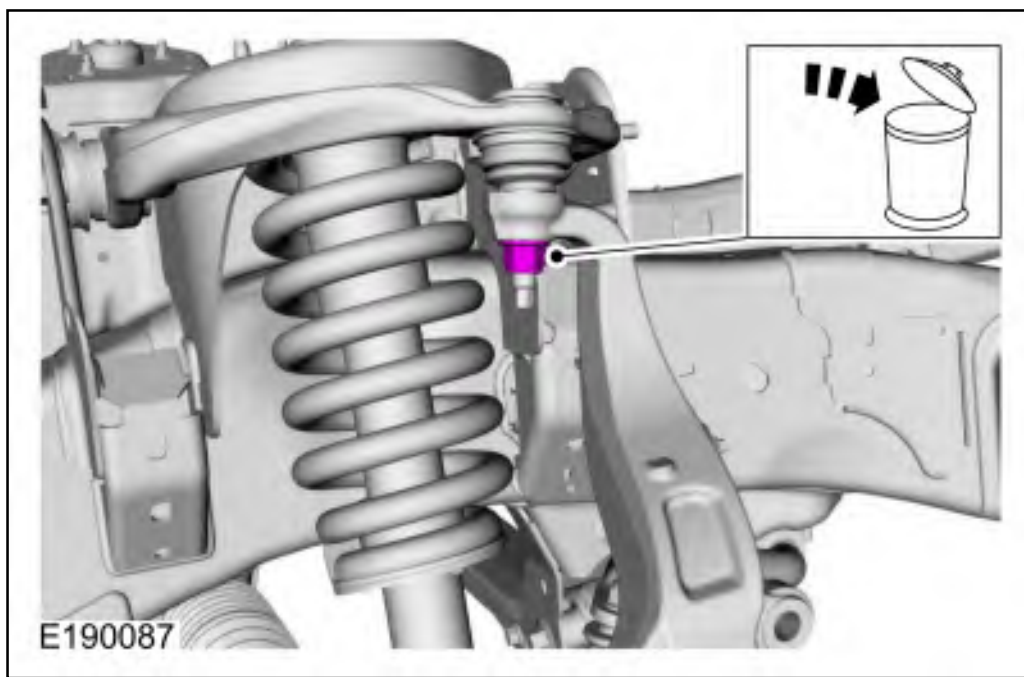
8. Disconnect the wheel speed sensor electrical connector.



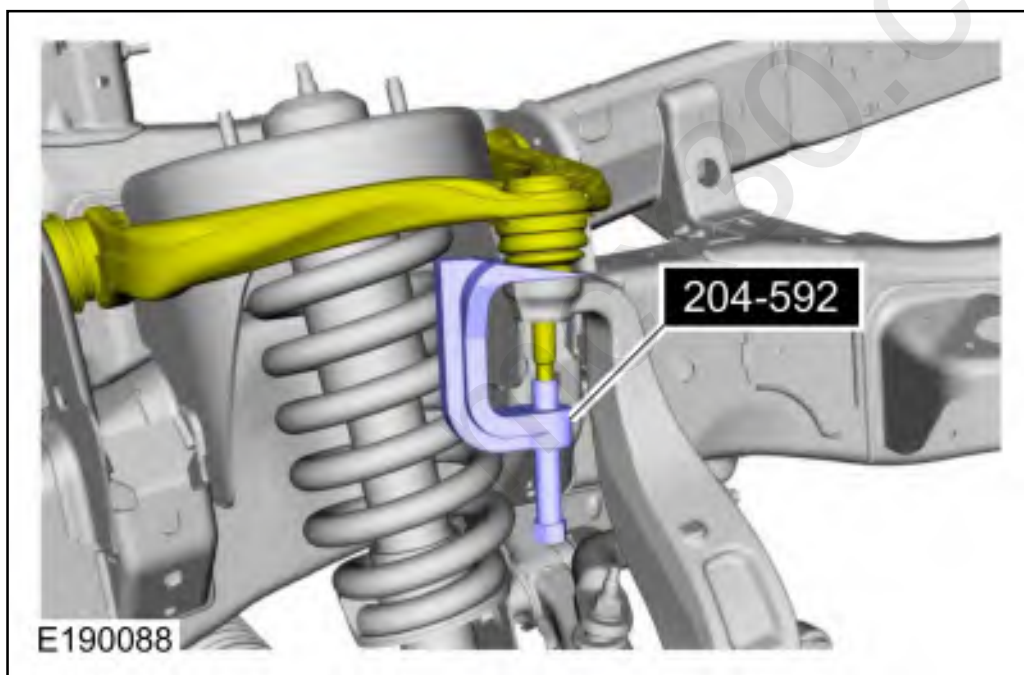
9. Remove the front brake flexible hose bracket bolt and position the brake hose aside.



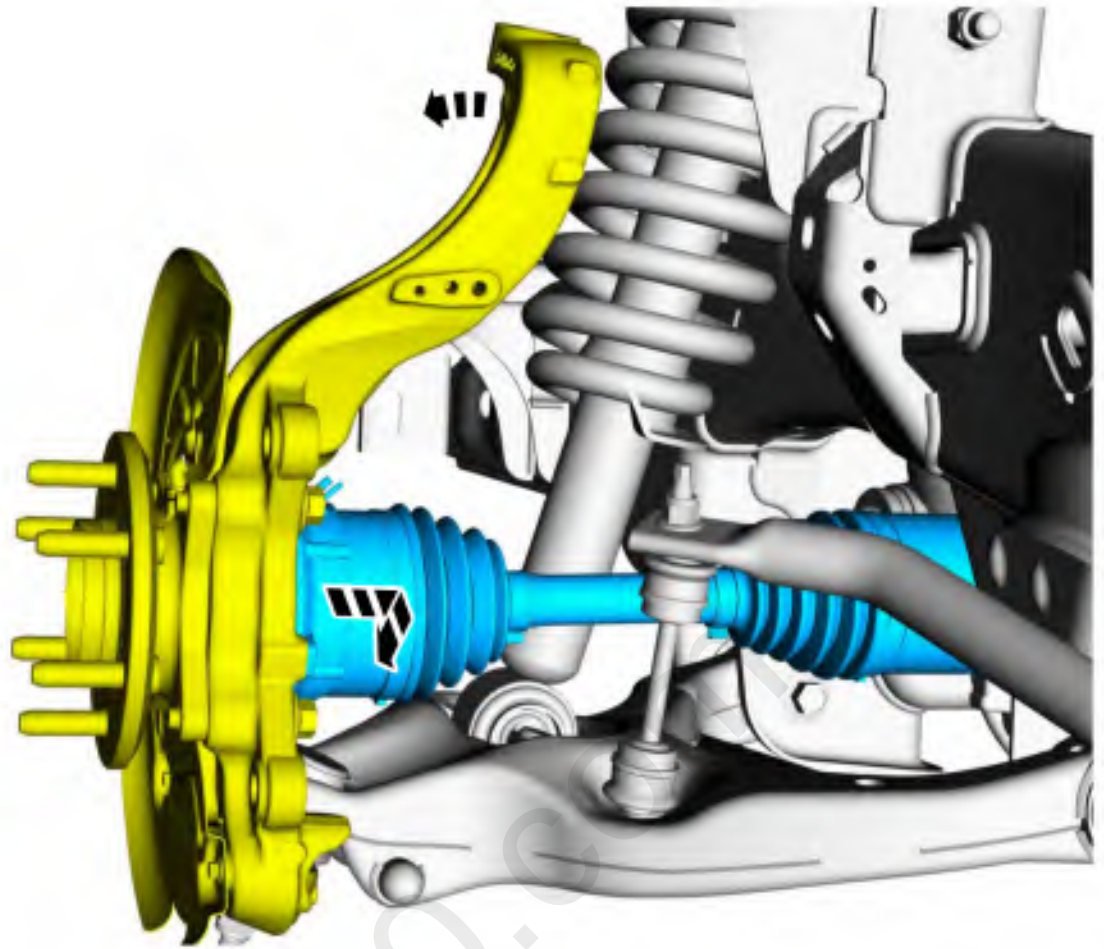
10. Remove and discard the upper ball joint nut.



11. Separate the upper ball joint from the wheel knuckle.
Use Special Service Tool: 204-592 Separator, Lower Arm Ball Joint.

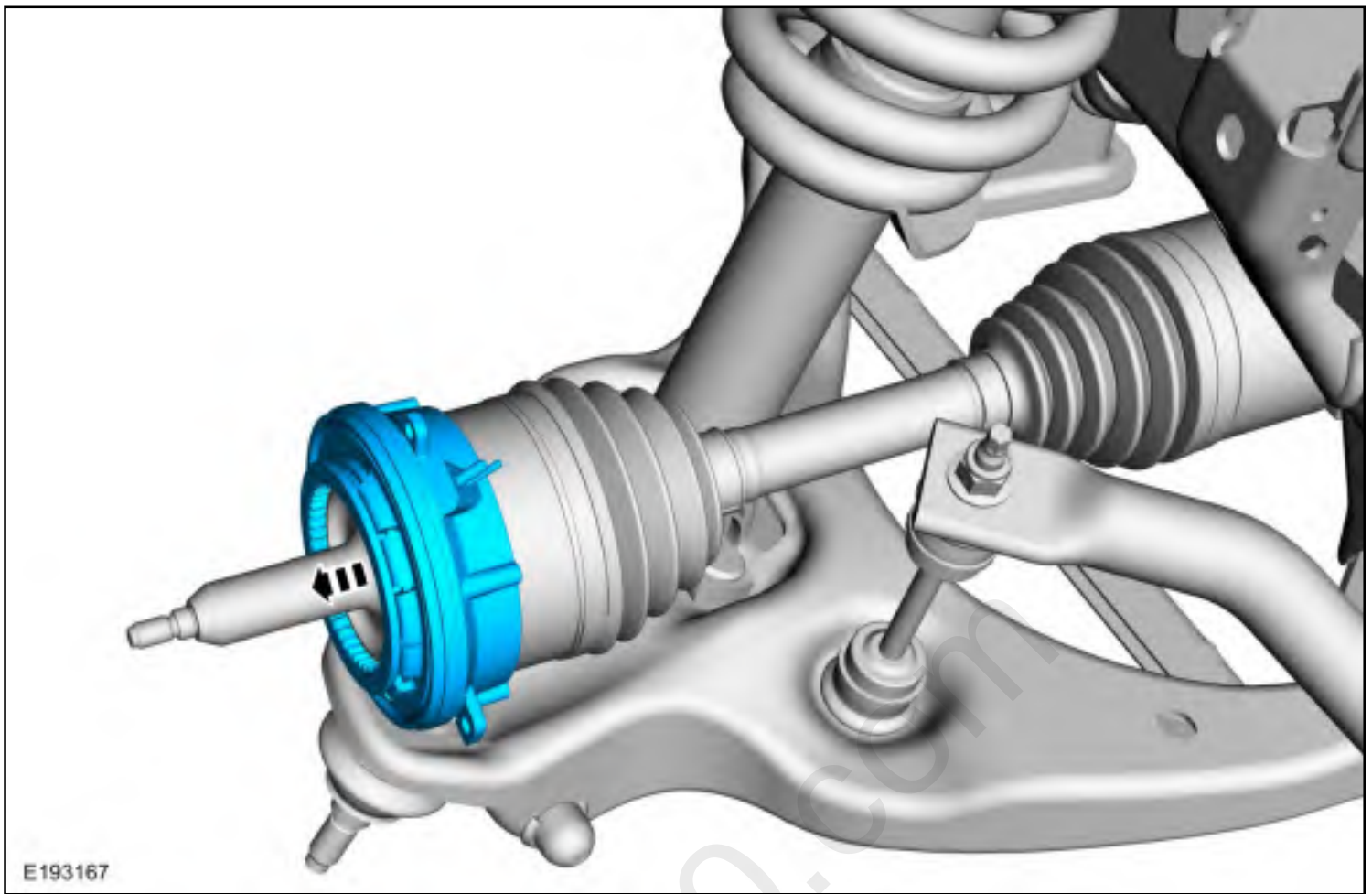


12. Position the wheel knuckle to gain access and remove the CV shaft joint outboard end and IWE disconnect from the steering knuckle hub bearing.



E193166

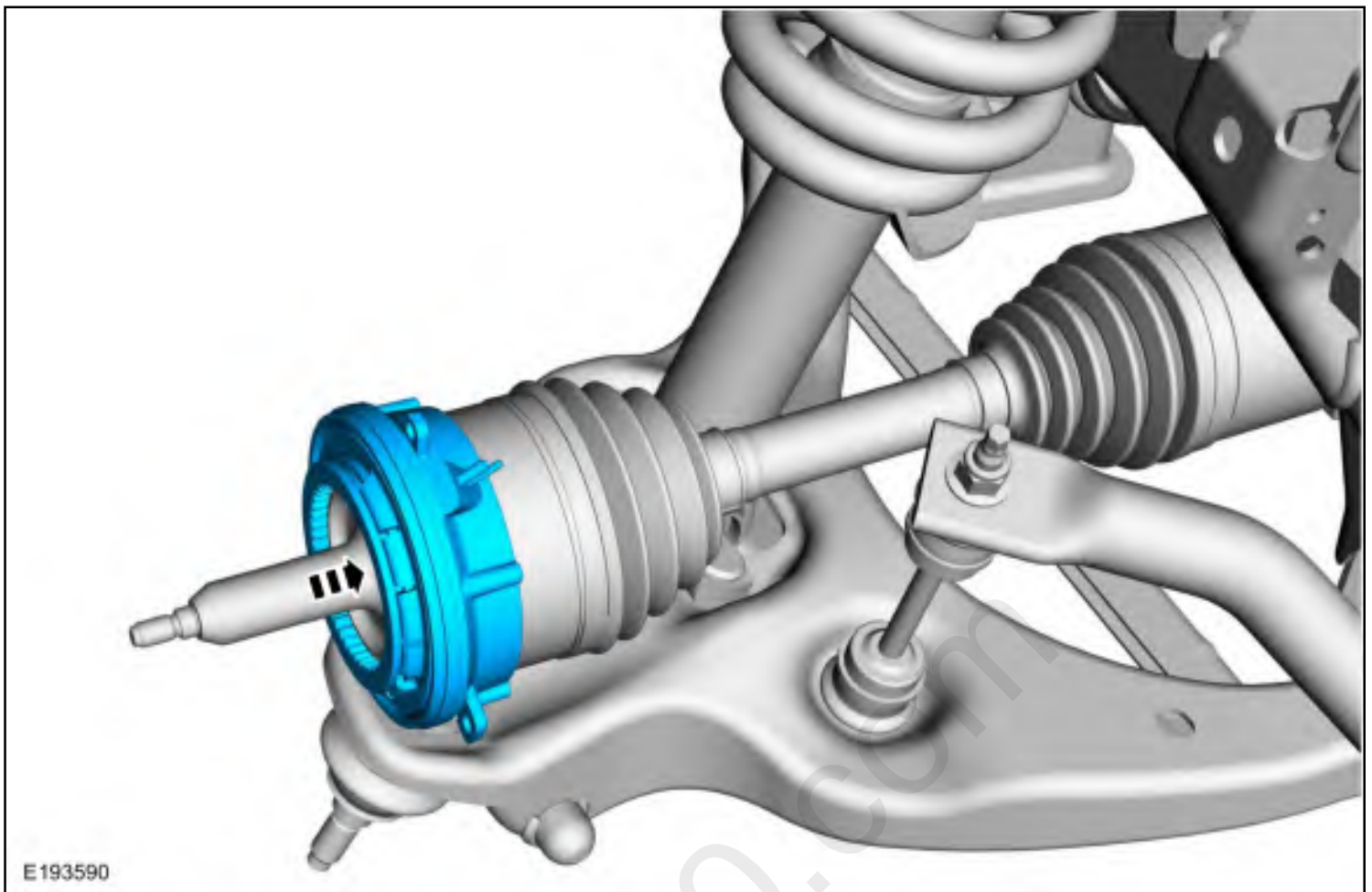
13. Remove the IWE disconnect from the outboard CV joint housing.



Installation

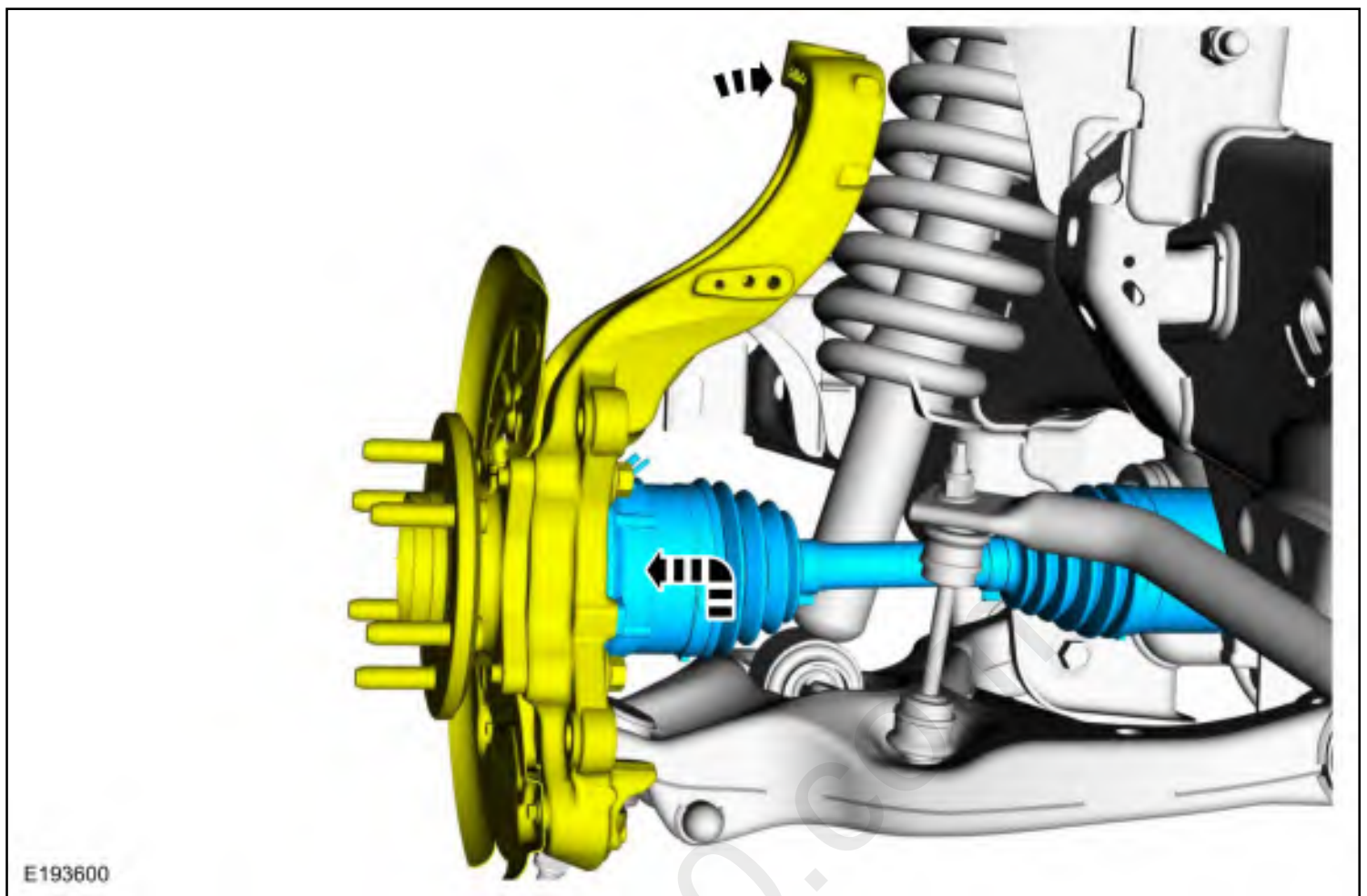
1. **NOTICE:** Do not dislodge the IWE seal spring when installing the IWE on halfshaft outboard end or component damage may occur.

Install the IWE onto the halfshaft outboard end making sure the IWE splines line up to the outboard halfshaft splines.

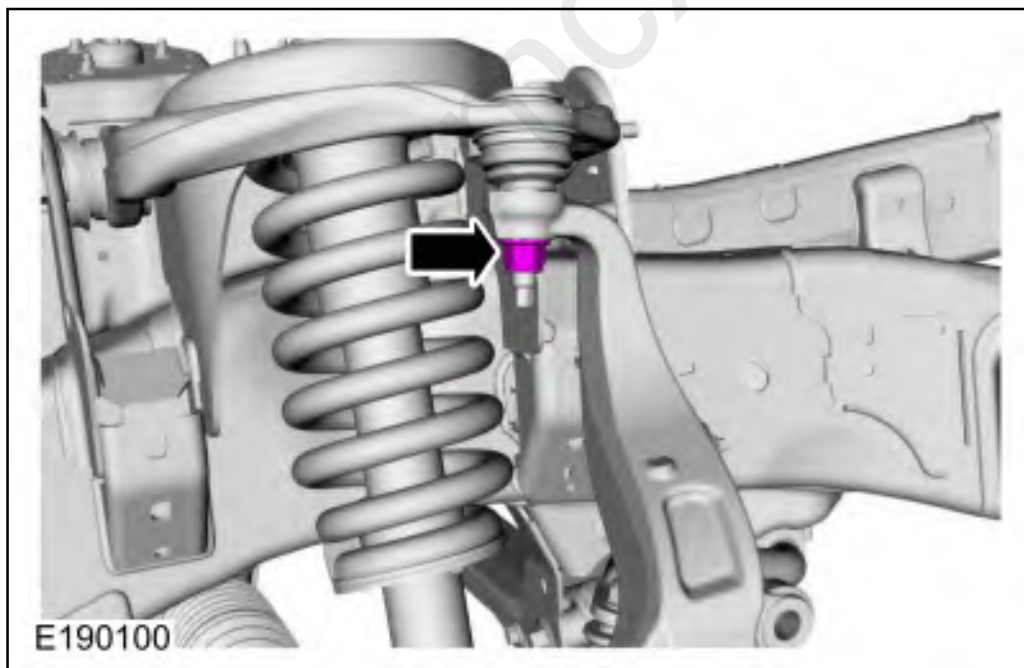


2. **NOTE:** Allow the wheel knuckle to swing outward while keeping the halfshaft pushed inward.

Once clearance is available, install the halfshaft outboard end into the wheel knuckle hub bearing.

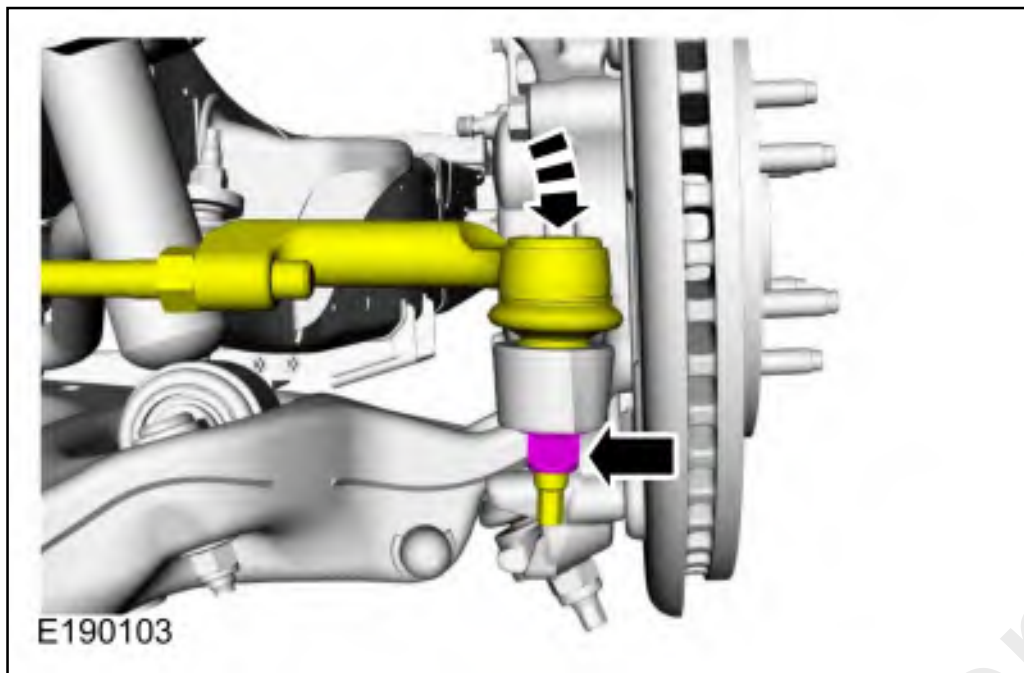


3. Connect the upper ball joint and install a new nut.
Torque: 46 lb.ft (63 Nm)

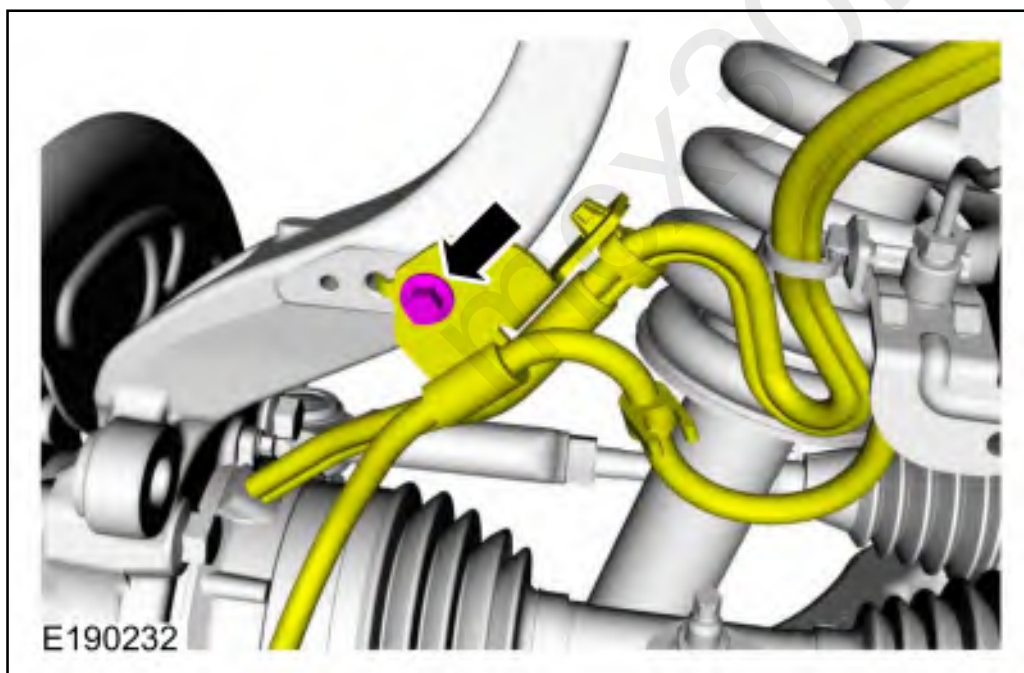


4. Connect the tie rod and install a new nut.

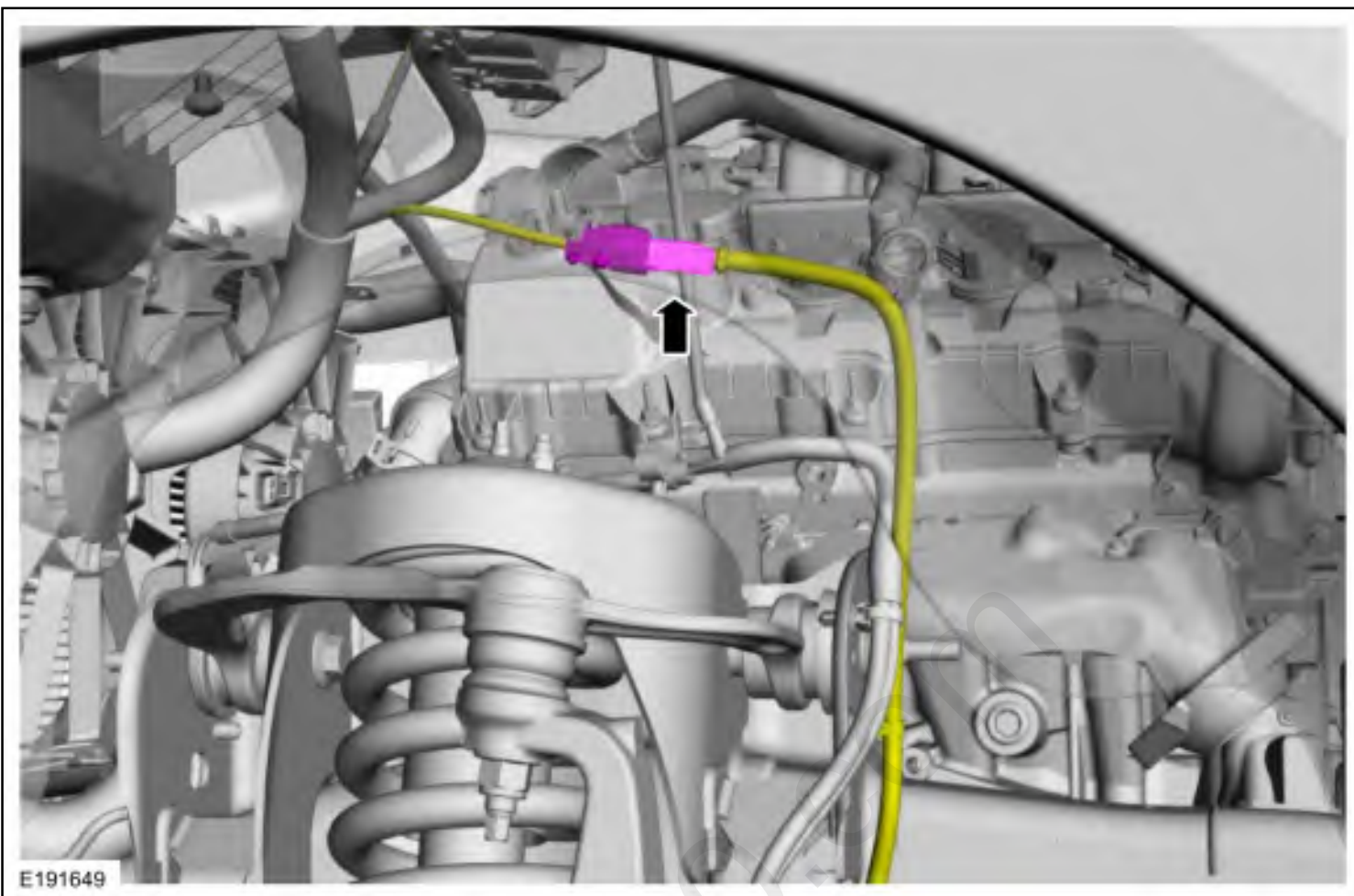
Torque: 85 lb.ft (115 Nm)



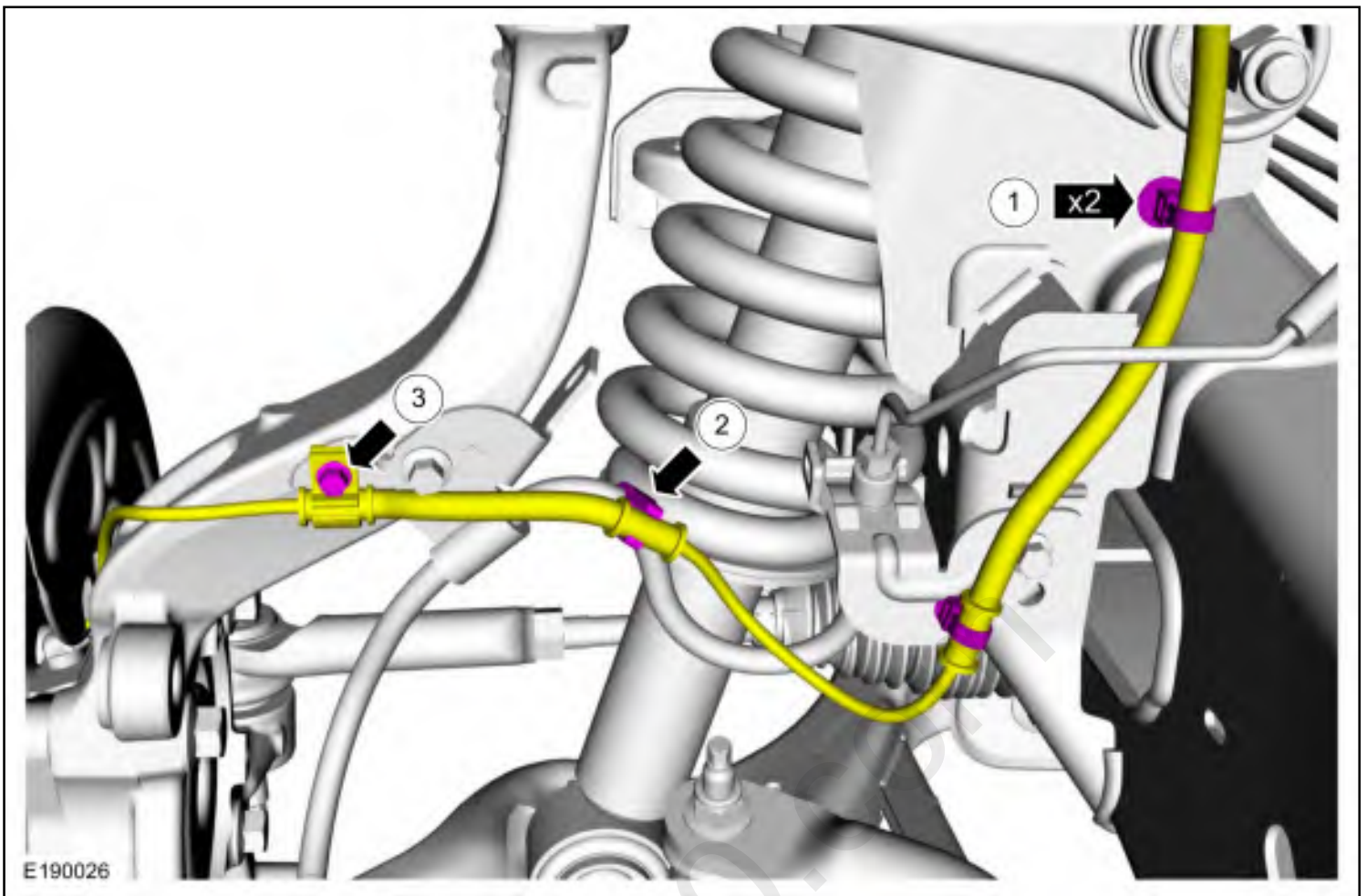
5. Position the front brake flexible hose bracket and install the bolt.
Torque: 22 lb.ft (30 Nm)



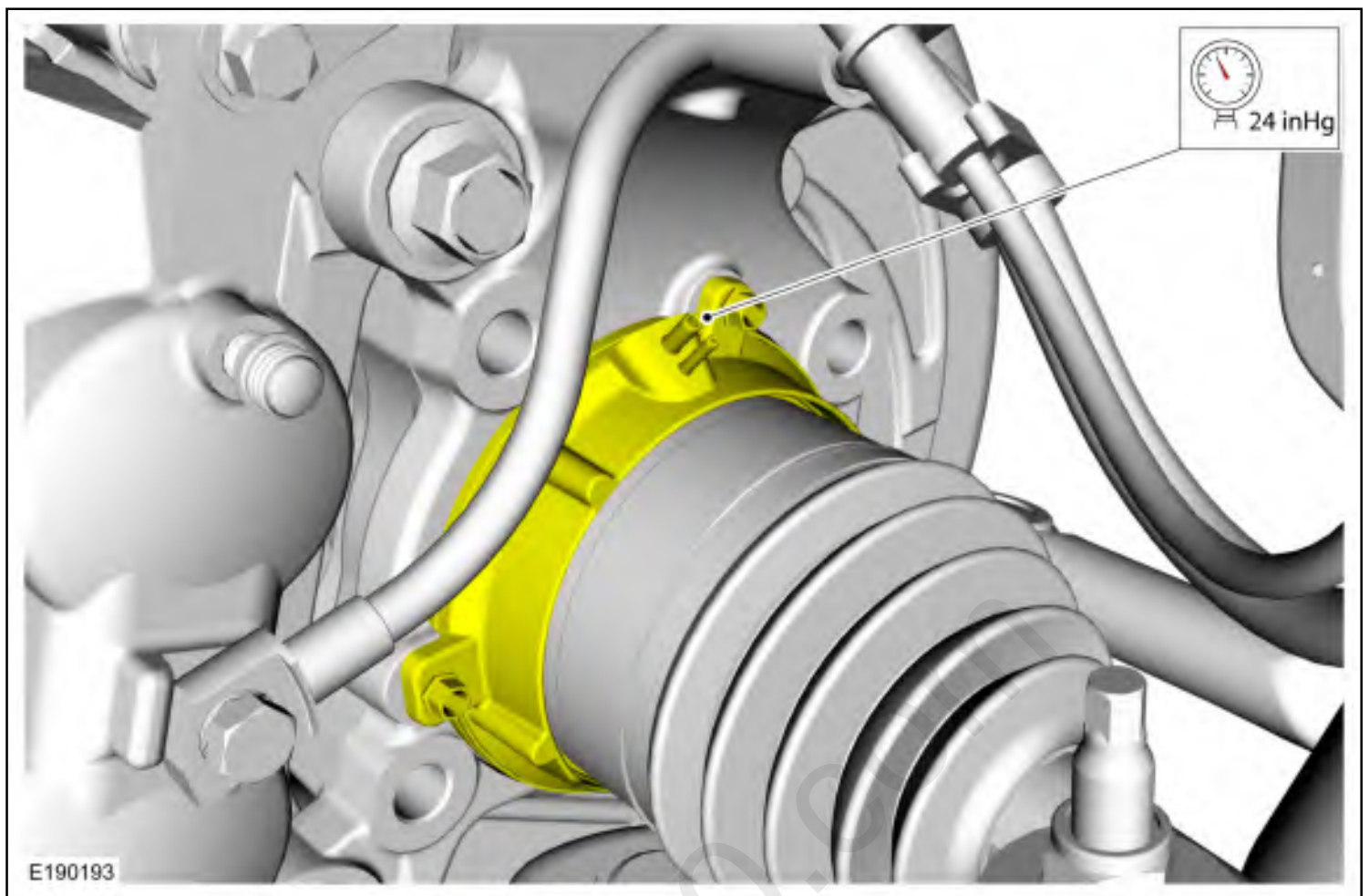
6. Position the harness and connect the wheel speed sensor harness.



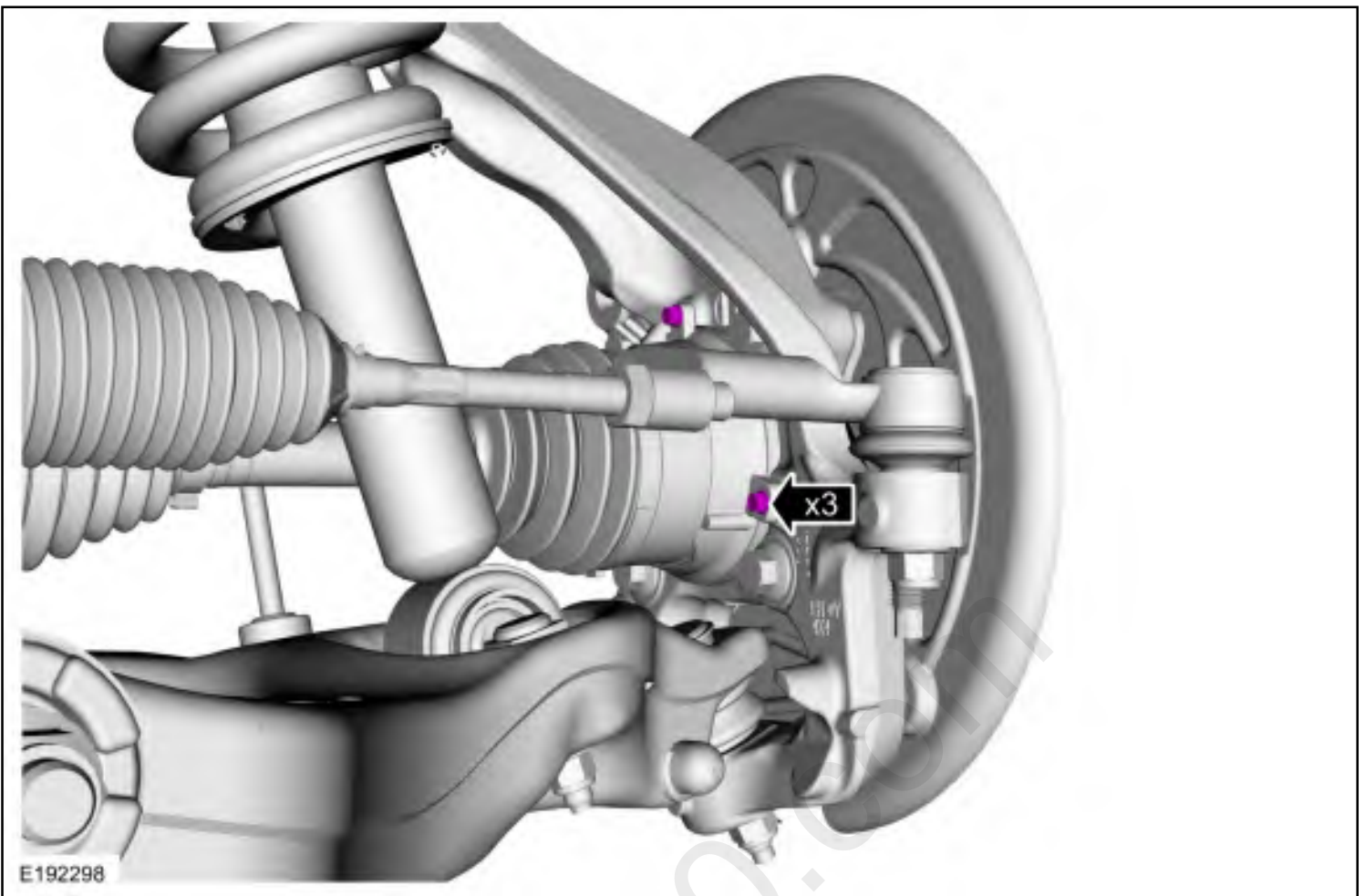
1. Position the wheel speed sensor wire and clip the 2 wheel speed sensor wire retainers.
2. Clip the wheel speed sensor wire to the brake hose.
3. Install the wheel speed sensor wire bracket bolt.
Torque: 106 lb.in (12 Nm)



8. Using a hand vacuum pump apply and hold 24 inHg of vacuum to the IWE actuator through the large port on IWE to retract the actuator.



9. Install the IWE-to-wheel knuckle retaining bolts.
Torque: 106 lb.in (12 Nm)



10. **NOTICE:** Measure the depth of the CV shaft threaded end to the inner bearing race (shown in illustration). The minimum depth is 15.5 mm (0.61 in). If the depth is less than 15.5 mm (0.61 in) rotate the CV shaft to clear a binding condition between the IWE and CV splines. Installing the axle nut and tightening without the proper depth of protrusion will result in damage to the IWE.

Measure the CV shaft threaded end to the inner bearing race.

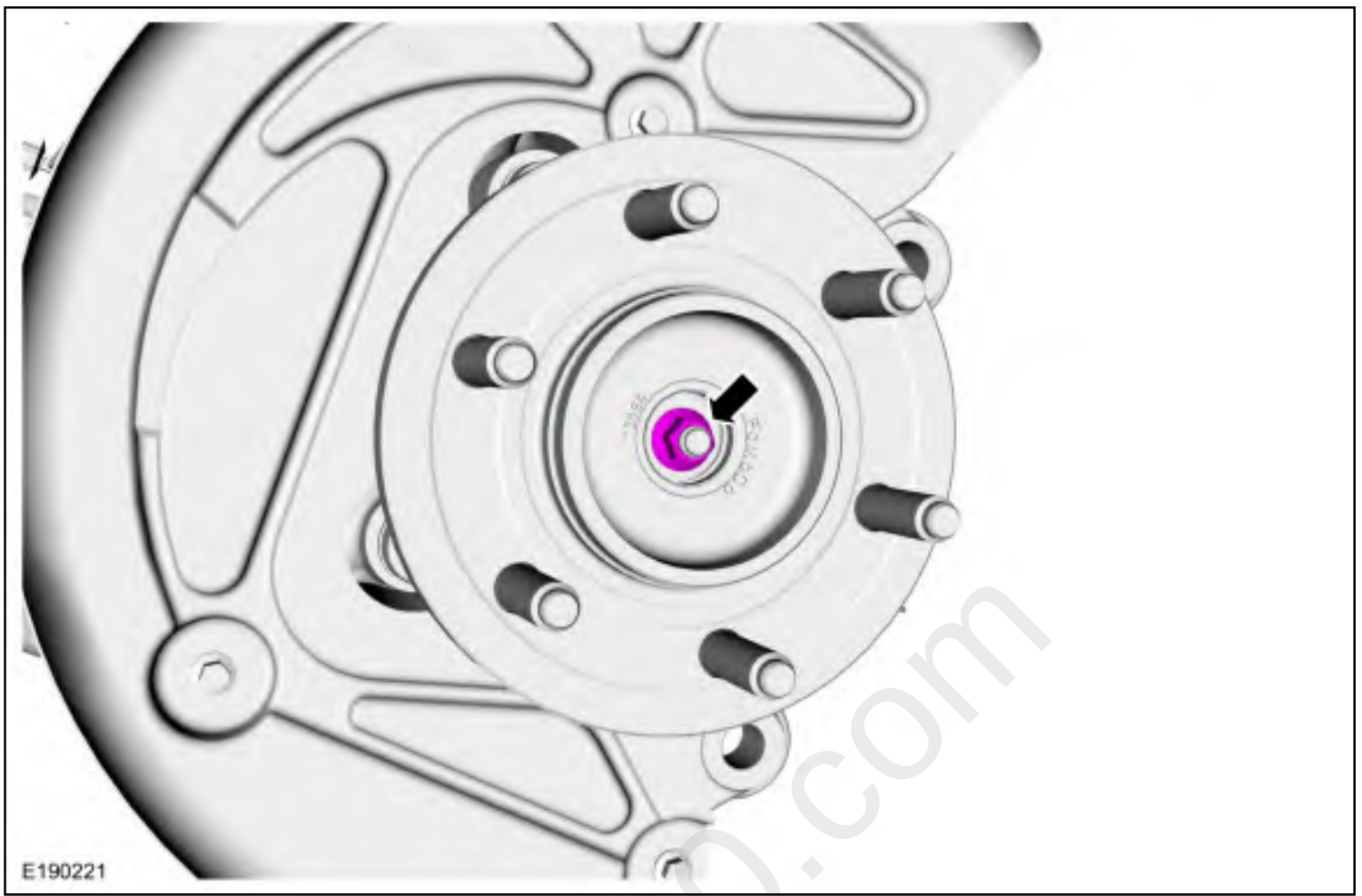


E190195

11. **NOTICE:** Verify the spline engagement by checking for spline lash before installing the wheel hub nut or component damage may occur.

NOTE: *With vacuum still applied to the IWE.*

- Install the new the axle nut.
Torque: 30 lb.ft (40 Nm)
- Verify free rotation of the hub with no CV joint rotation. No clicking or grinding noise should be present.
- Release vacuum and rotate bearing slightly to engage actuator (may hear single click when IWESystem engages). Verify hub and CV joint rotate together.



12. **NOTE:** *If the dust cap to bearing interface is damaged, damaged parts must be replaced.*

Install the dust cap.



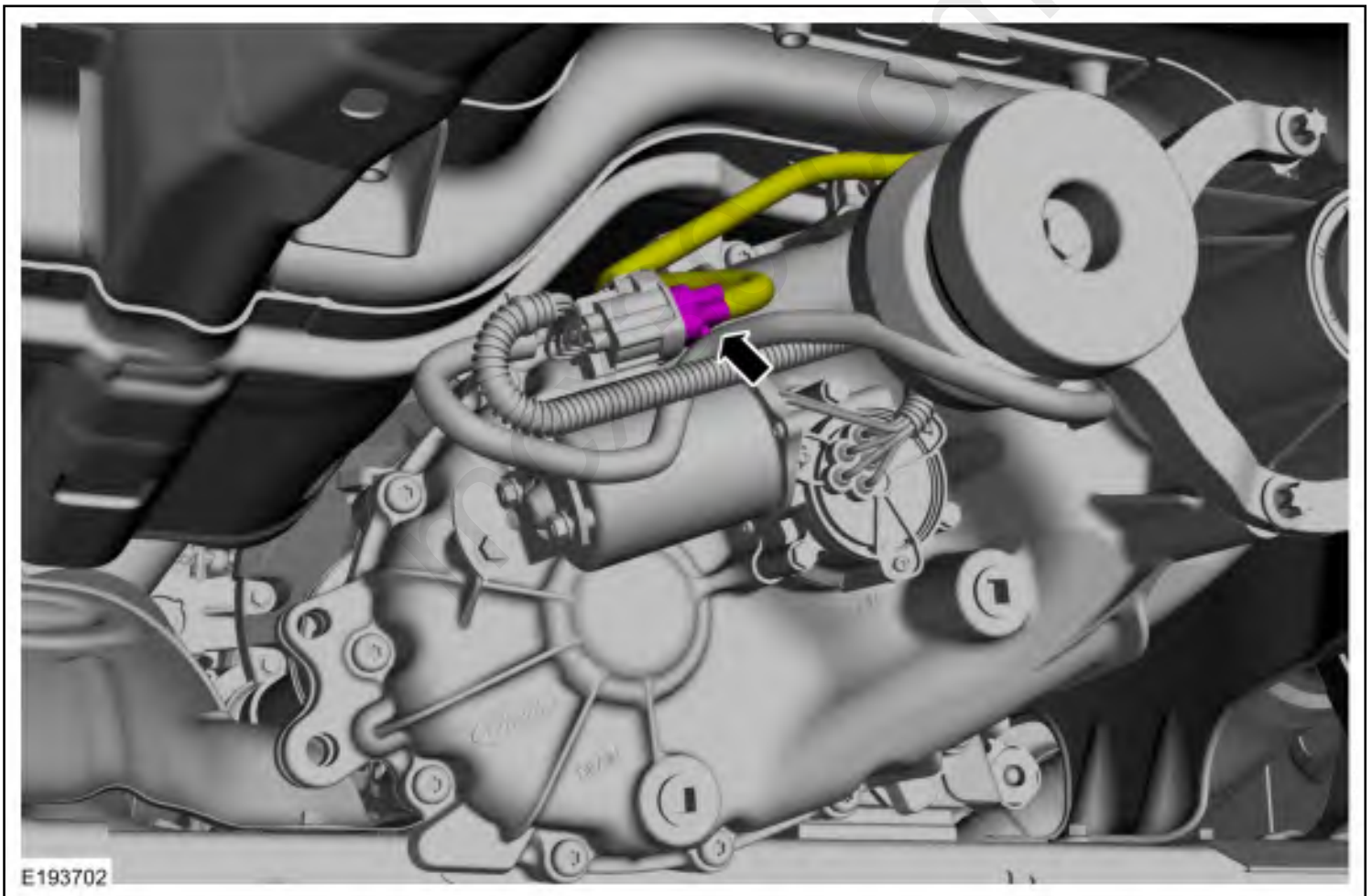
13. Install the brake disc.

Refer to: [Brake Disc](#) (206-03 Front Disc Brake, Removal and Installation).

Transfer Case Shift Motor

Removal

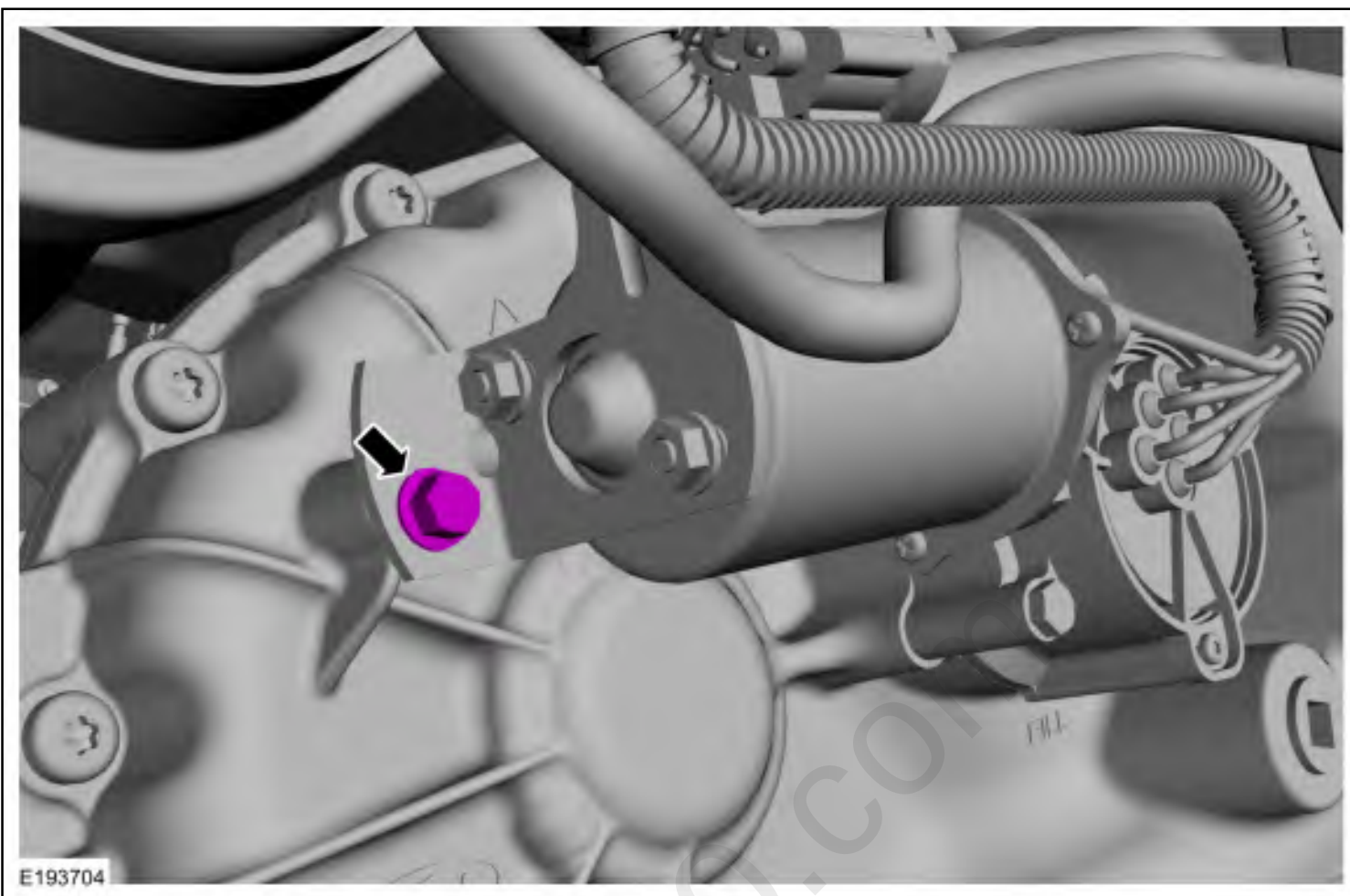
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the harness connector.



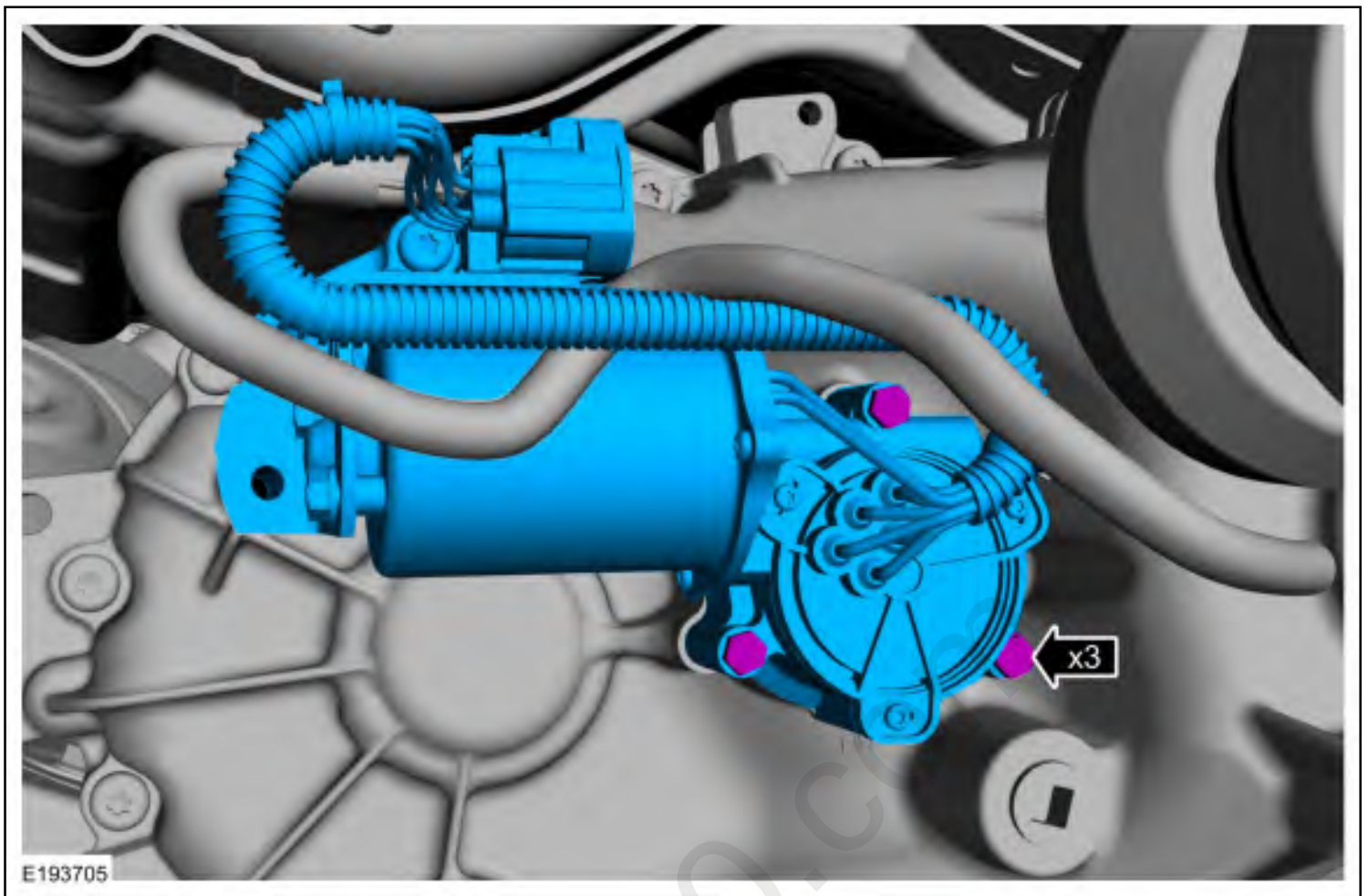
3. Remove the coil wire pin from the electrical connector.
 1. Remove the inner retainer from the wire connector.
 2. Press the release tab and remove the coil wire pin.



4. Remove the transfer case shift motor bracket bolt.

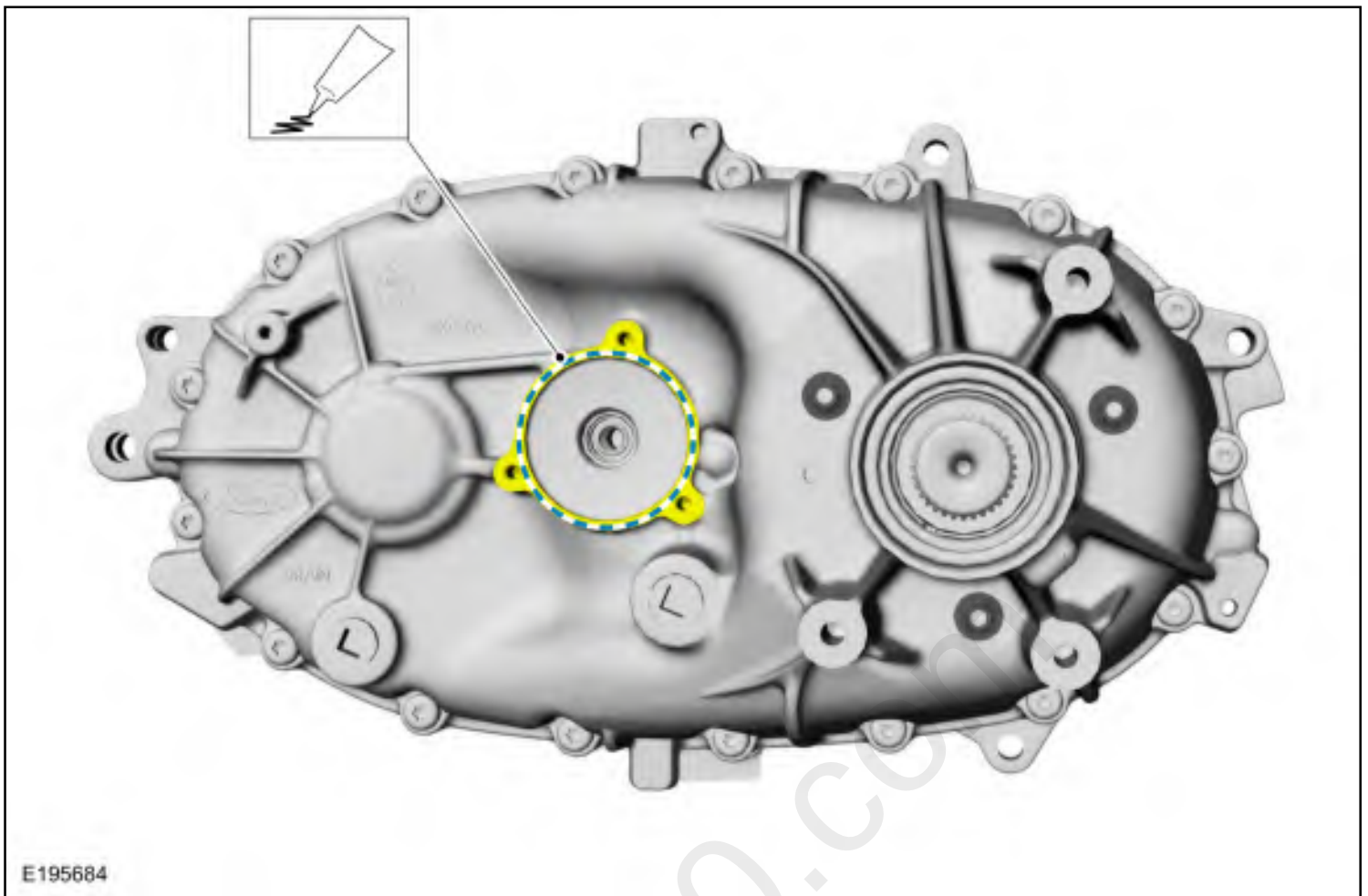


5. Remove the mounting bolts and the transfer case shift motor.



Installation

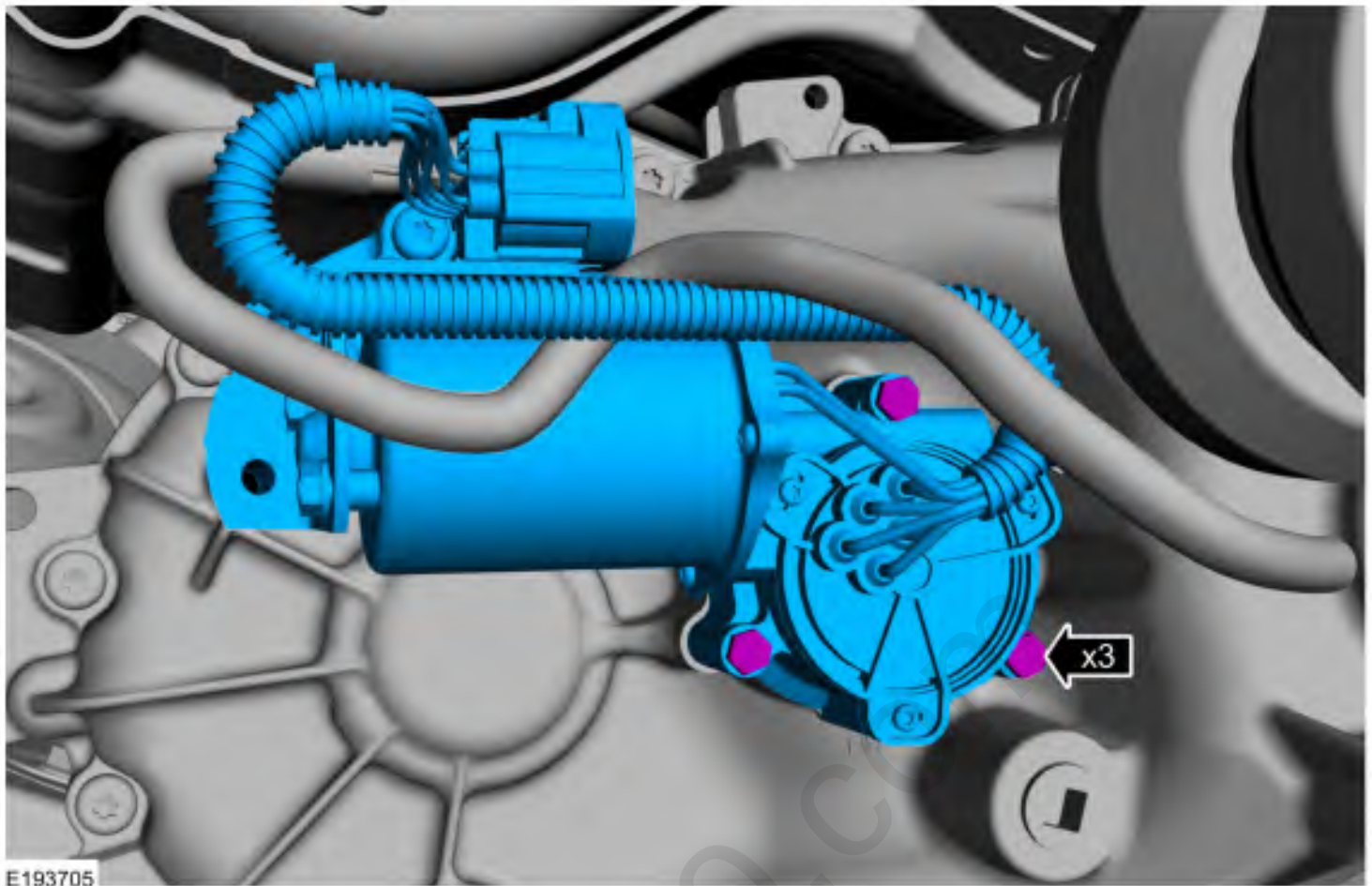
1. Apply a small bead of silicone sealant to the transfer case shift motor mating surface.



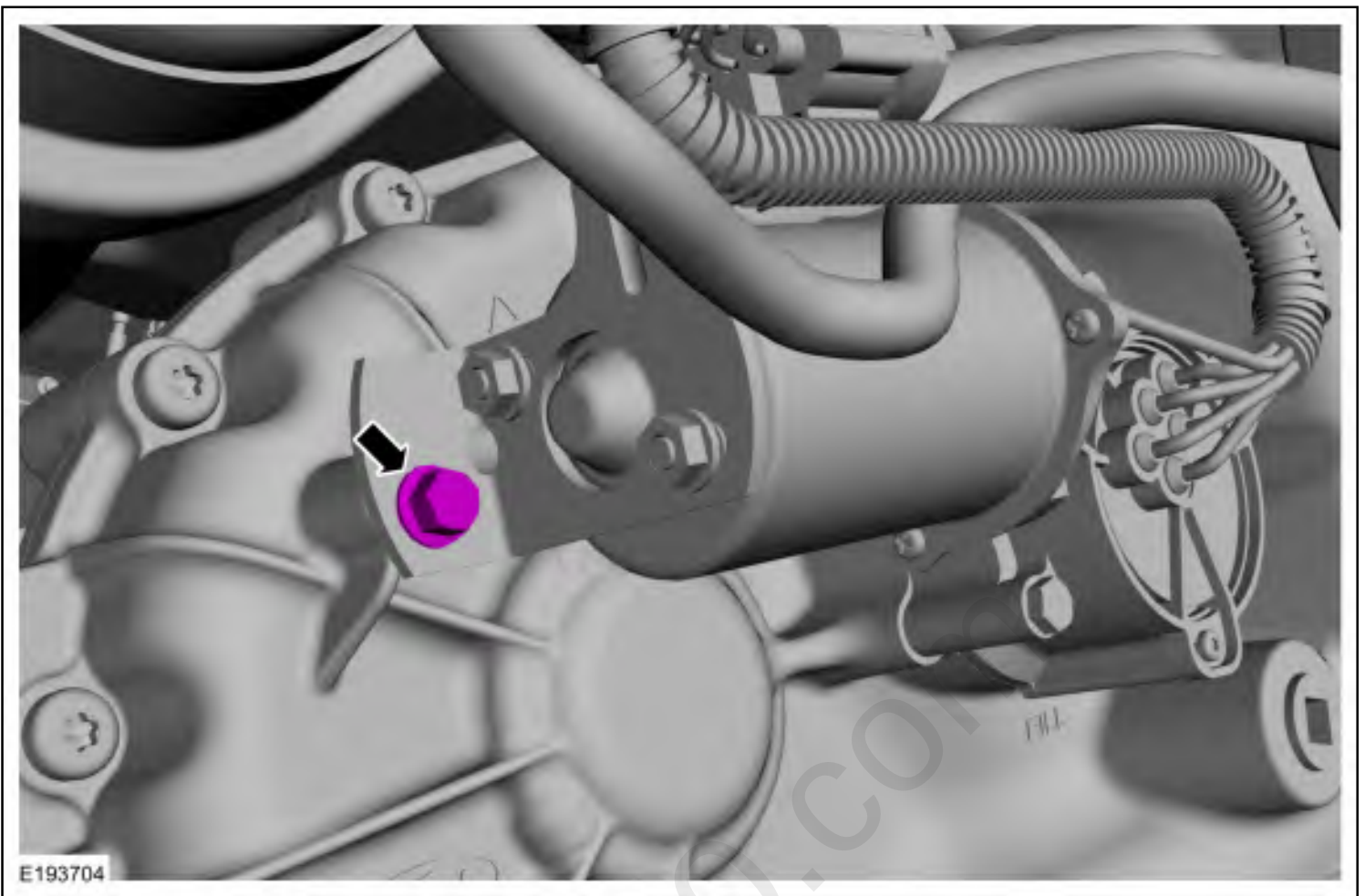
2. **NOTICE:** New shift motor bracket nuts are loose and are tightened last. Failure to follow the steps in the correct order may result in damage to the component.

Install the transfer case shift motor and bolts.

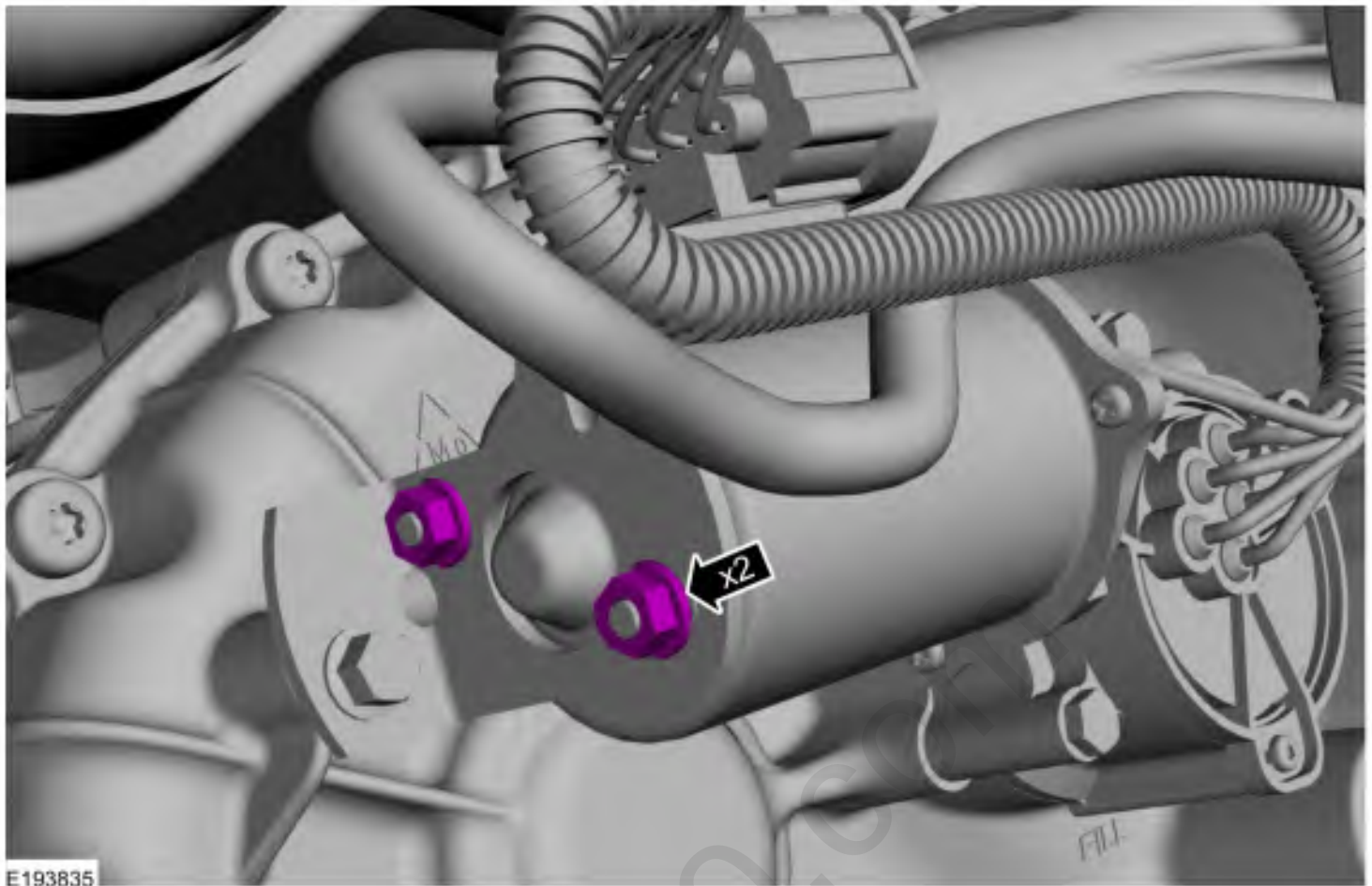
Torque: 89 lb.in (10 Nm)



3. Install the transfer case shift motor bracket bolt.
Torque: 89 lb.in (10 Nm)



4. Secure the transfer case shift motor bracket nuts.
Torque: 27 lb.in (3 Nm)



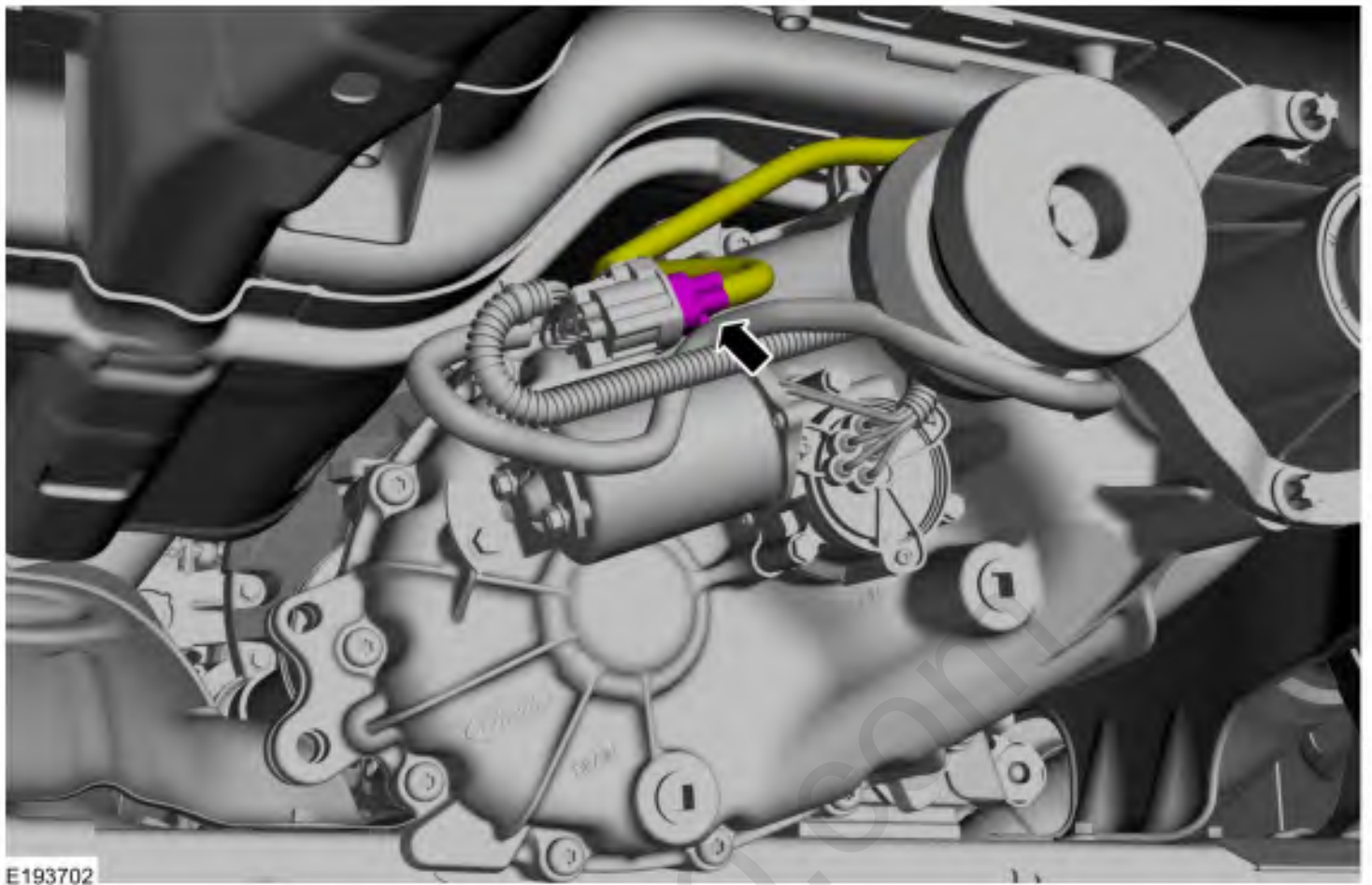
5. **NOTE:** After the wire is inserted into the connector, gently pull the wire back to verify the pin is locked inside the connector.

Install the coil wire pin in the electrical connector.

1. Insert the coil wire pin in the electrical connector.
2. Install the inner connector retainer.



6. Connect the harness connector.

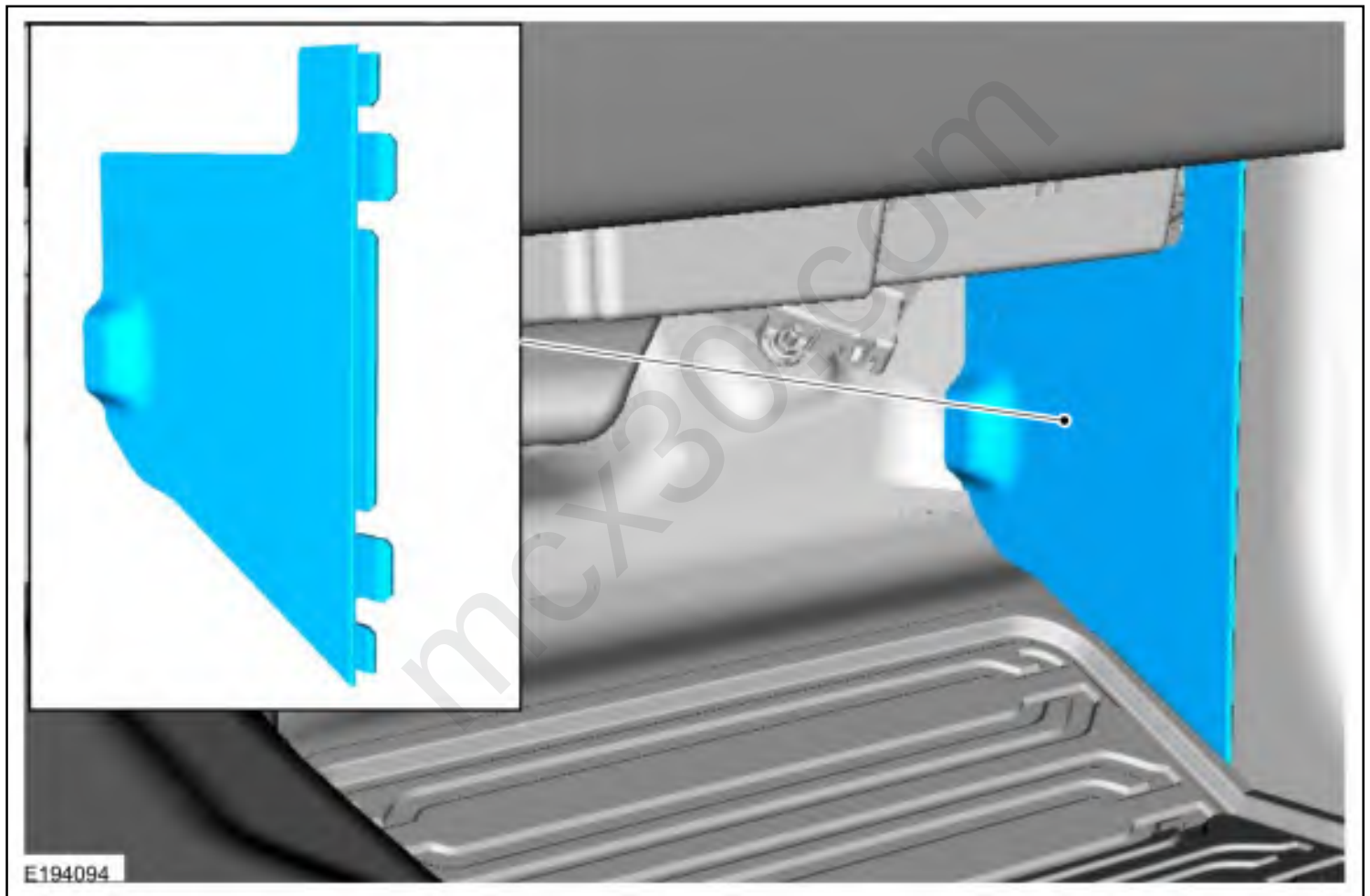


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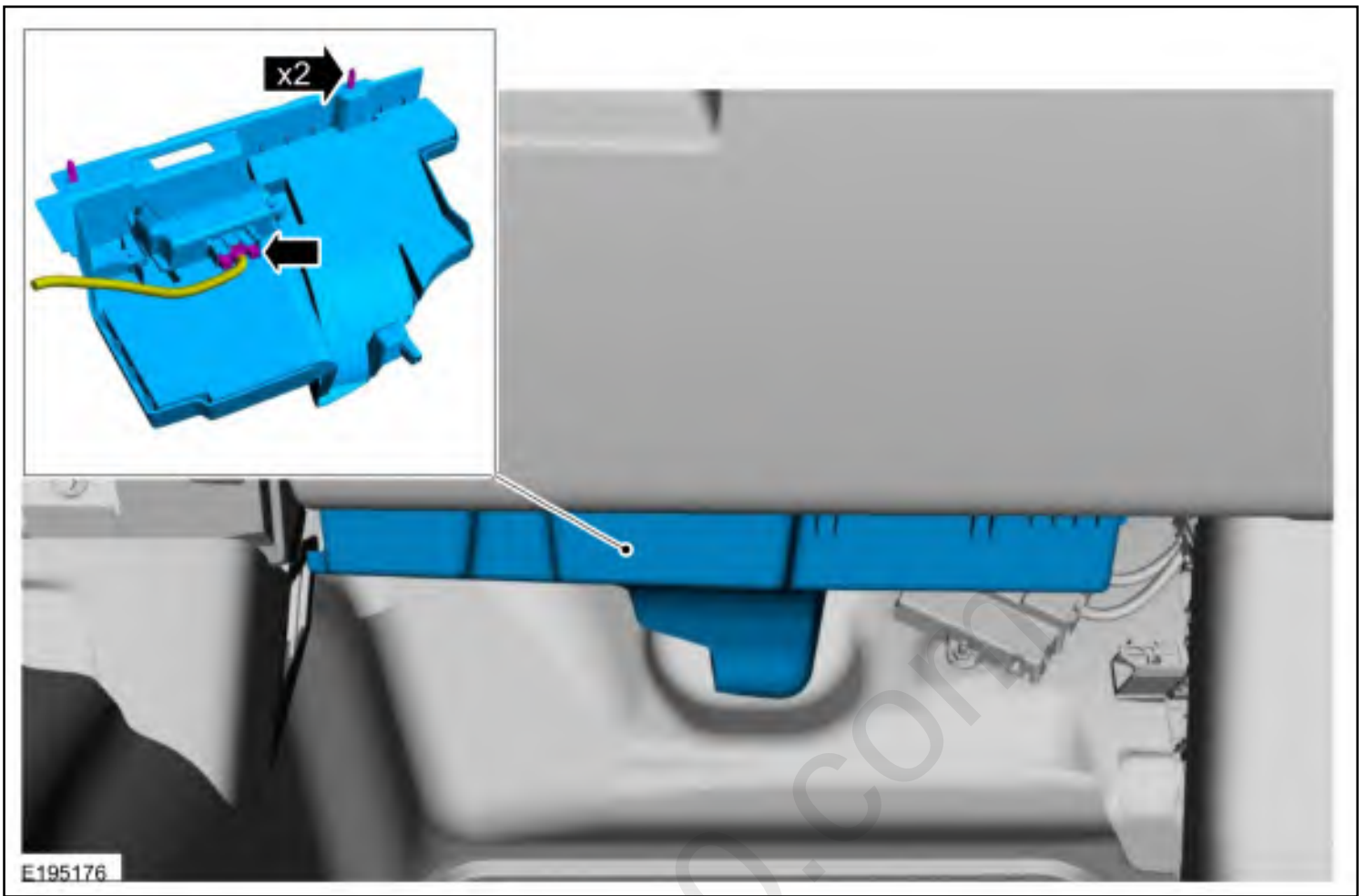
Transfer Case Control Module (TCCM)

Removal

1. Remove the CJB cover.

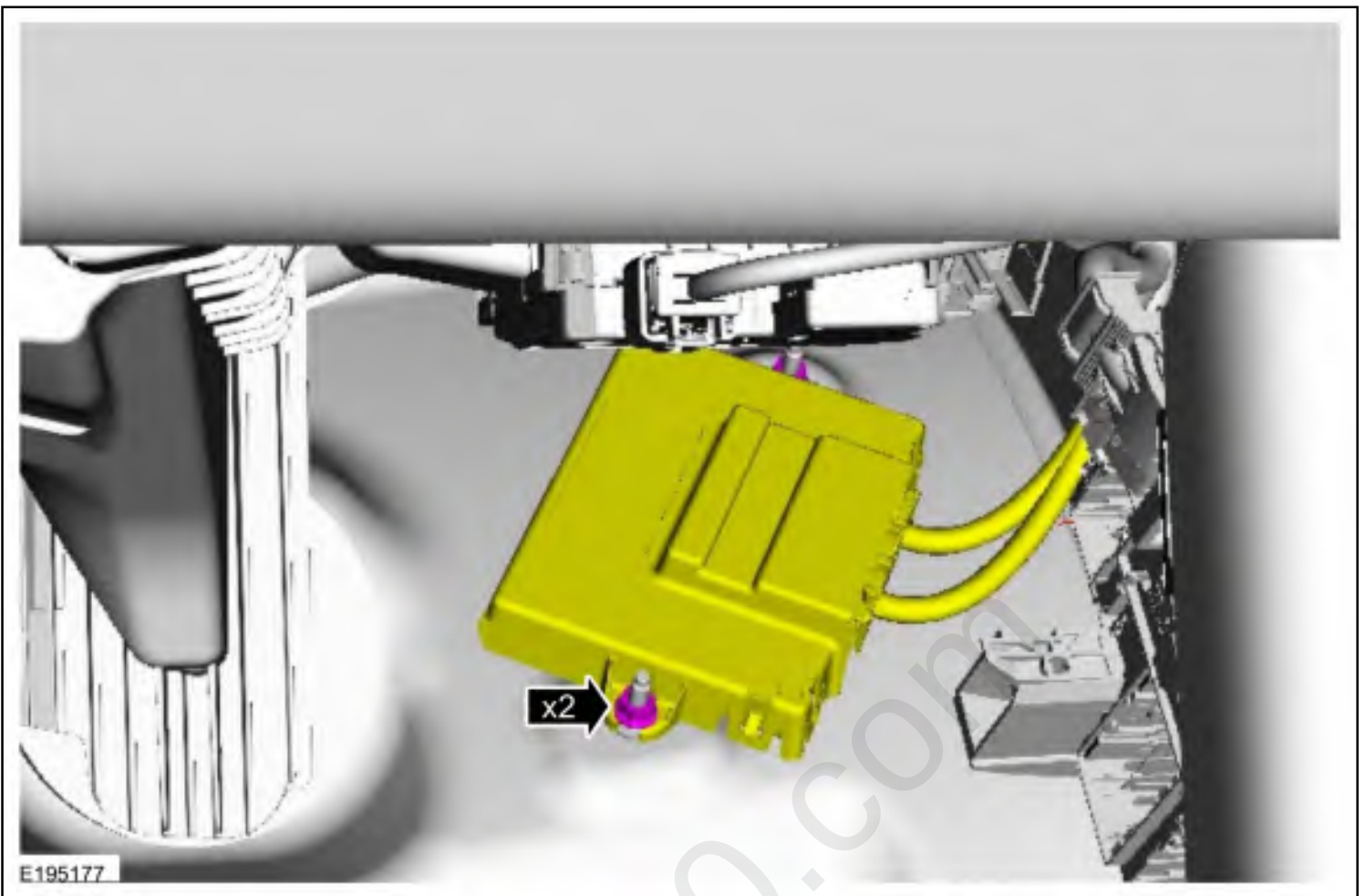


2. Remove and disconnect the lower access panel.

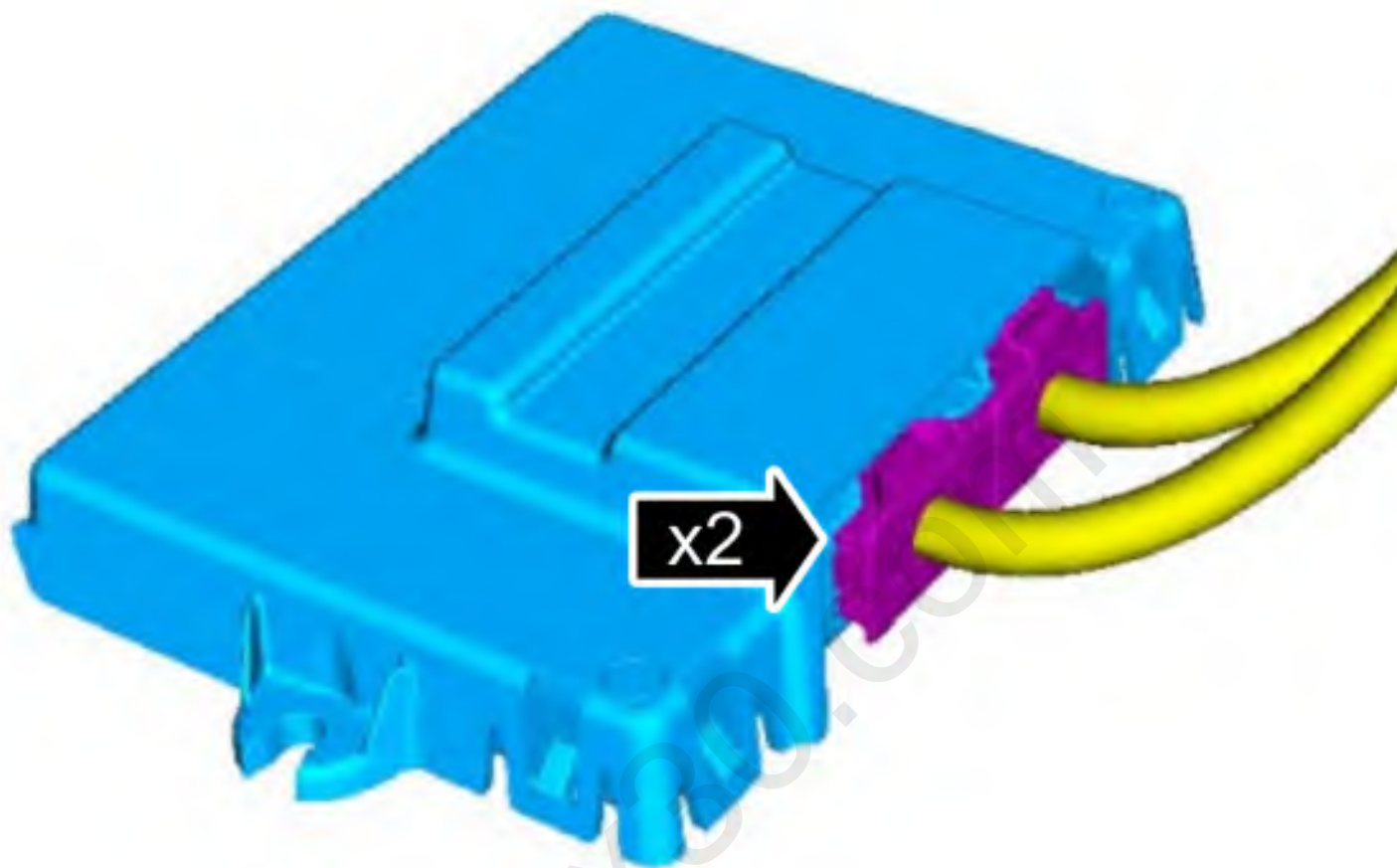


3. **NOTE:** The TCCM has slotted mounting holes. It is not necessary to remove the LH TCCM nut when removing the TCCM.

Loosen the LH TCCM nut and remove the RH TCCM nut.
Torque: 62 lb.in (7 Nm)



4. Disconnect the electrical connectors and remove the TCCM.



E194096



Installation

1. To install, reverse the removal procedure.

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Mode Select Switch (MSS)

Special Tool(s) / General Equipment

Interior Trim Remover

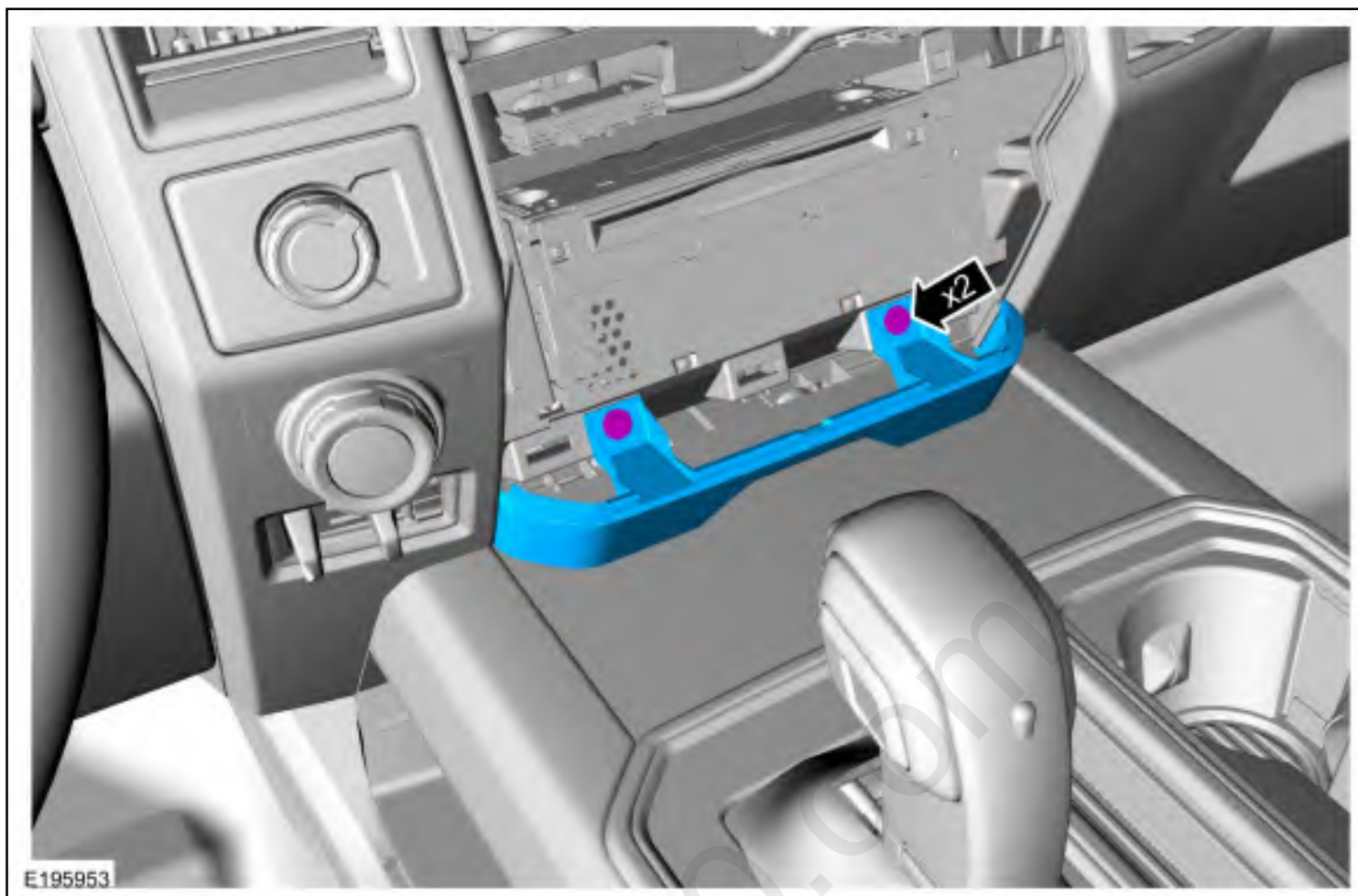
Removal

All vehicles

1. Remove the HVAC control module.
Refer to: [Heating, Ventilation and Air Conditioning \(HVAC\) Control Module](#) (412-00 Climate Control System - General Information, Removal and Installation).

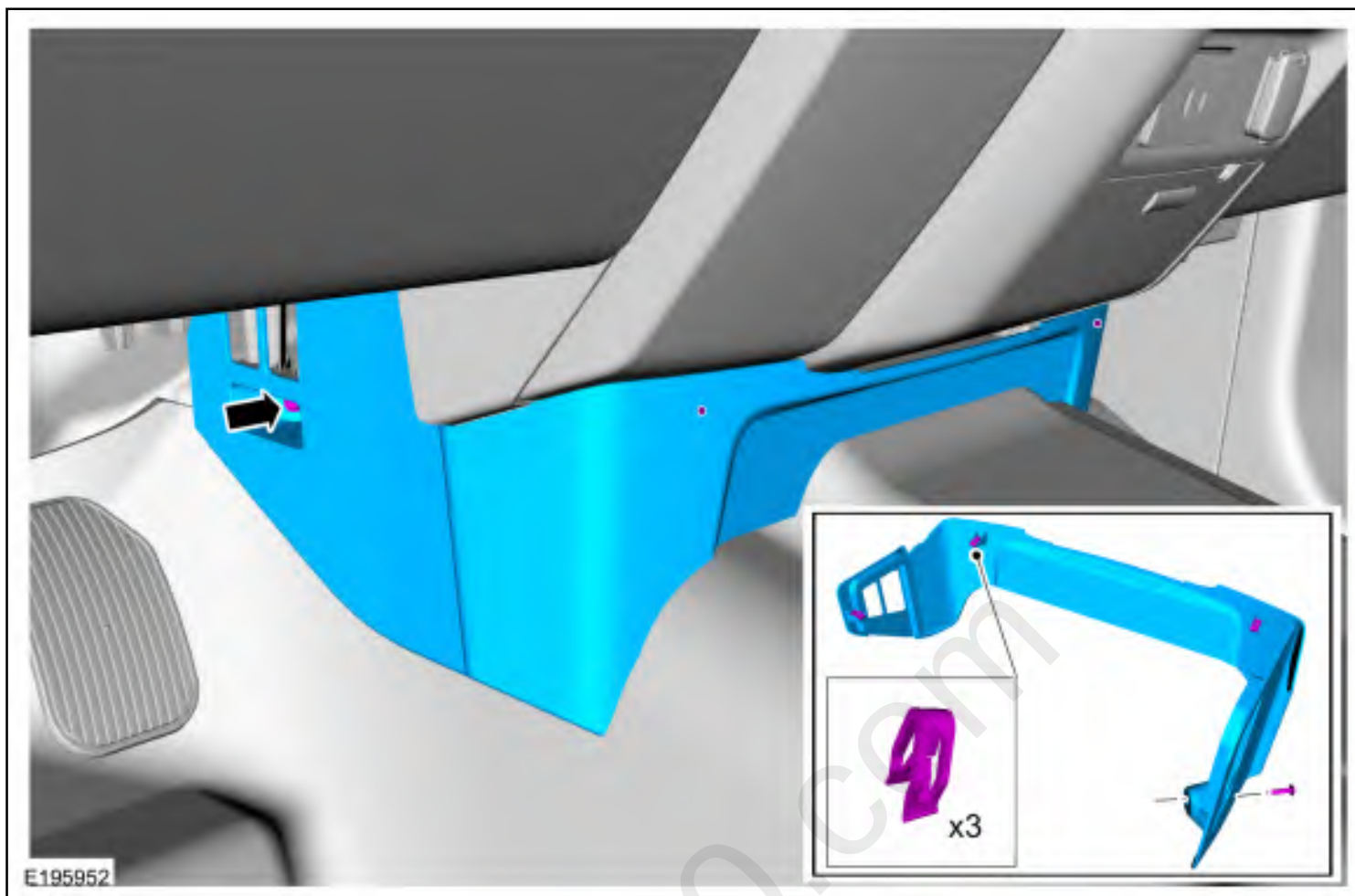
Vehicles equipped with floor console

2. Remove the screws and the center instrument panel lower finish panel.



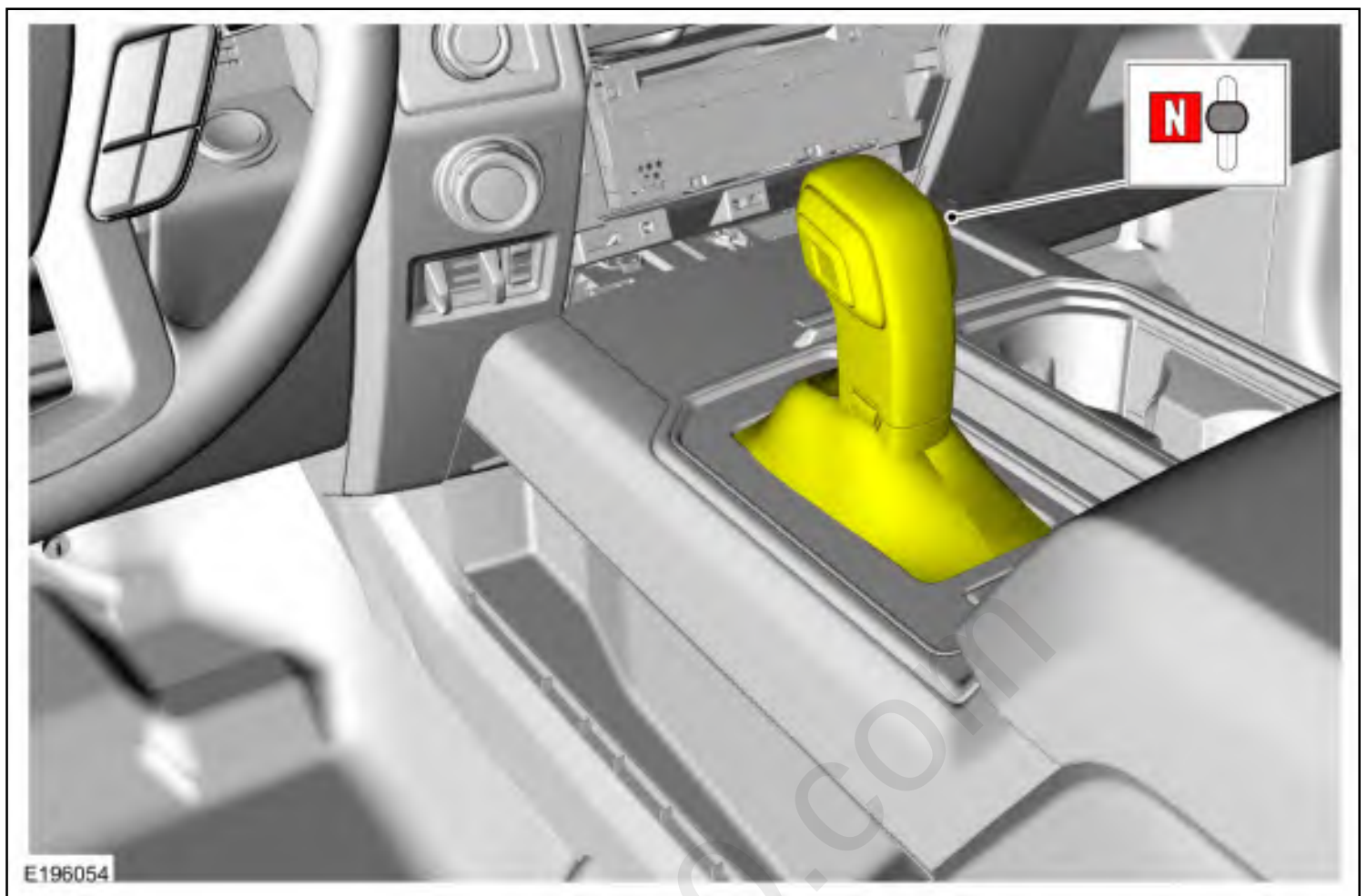
Vehicles without floor Console

3. Remove the screw, detach the clips and remove the center instrument panel lower finish panel.

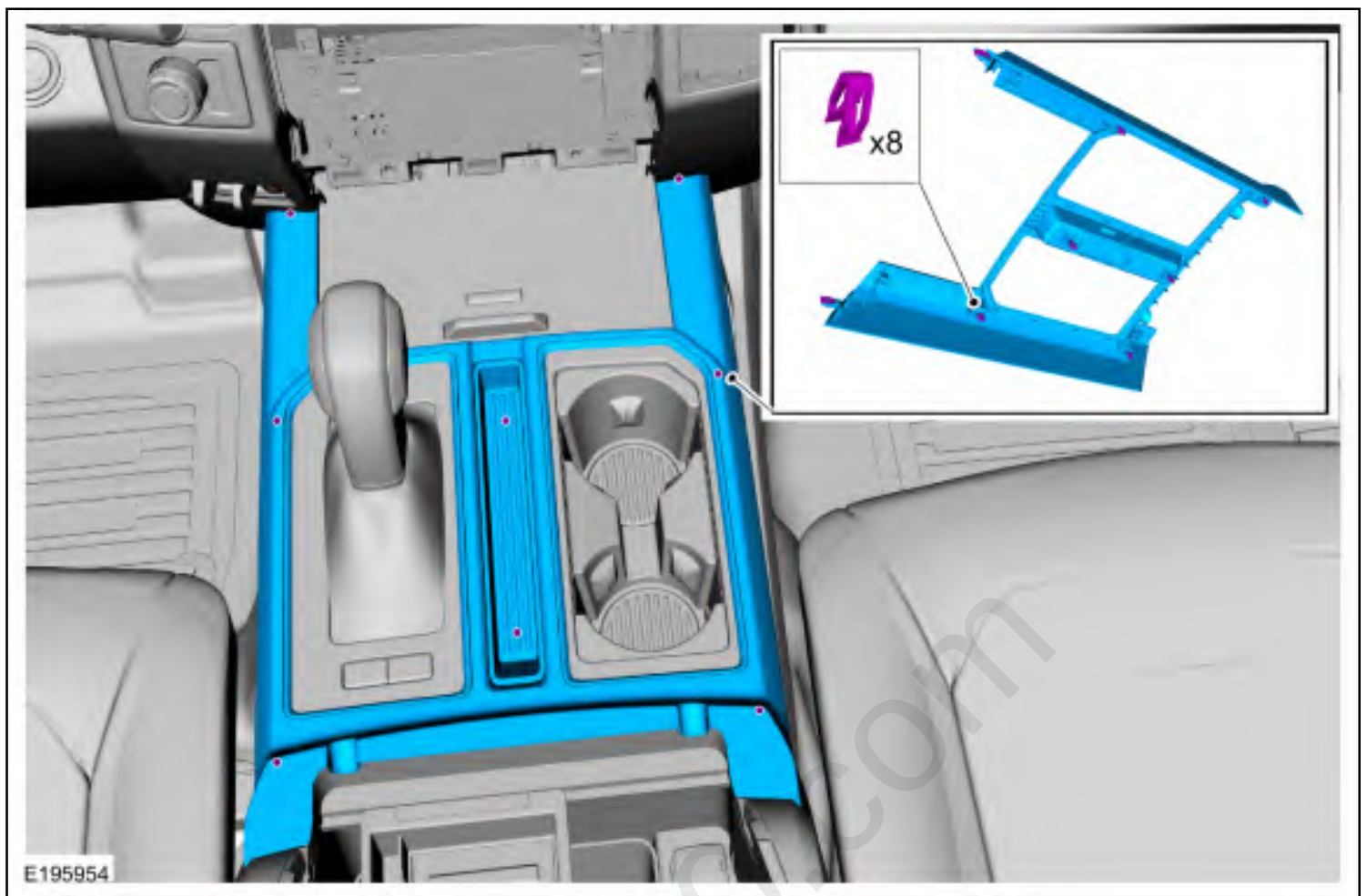


Vehicles equipped with floor console

4. Place the transmission selector lever in the NEUTRAL position.



5. Detach the clips and remove the floor console upper finish panel.

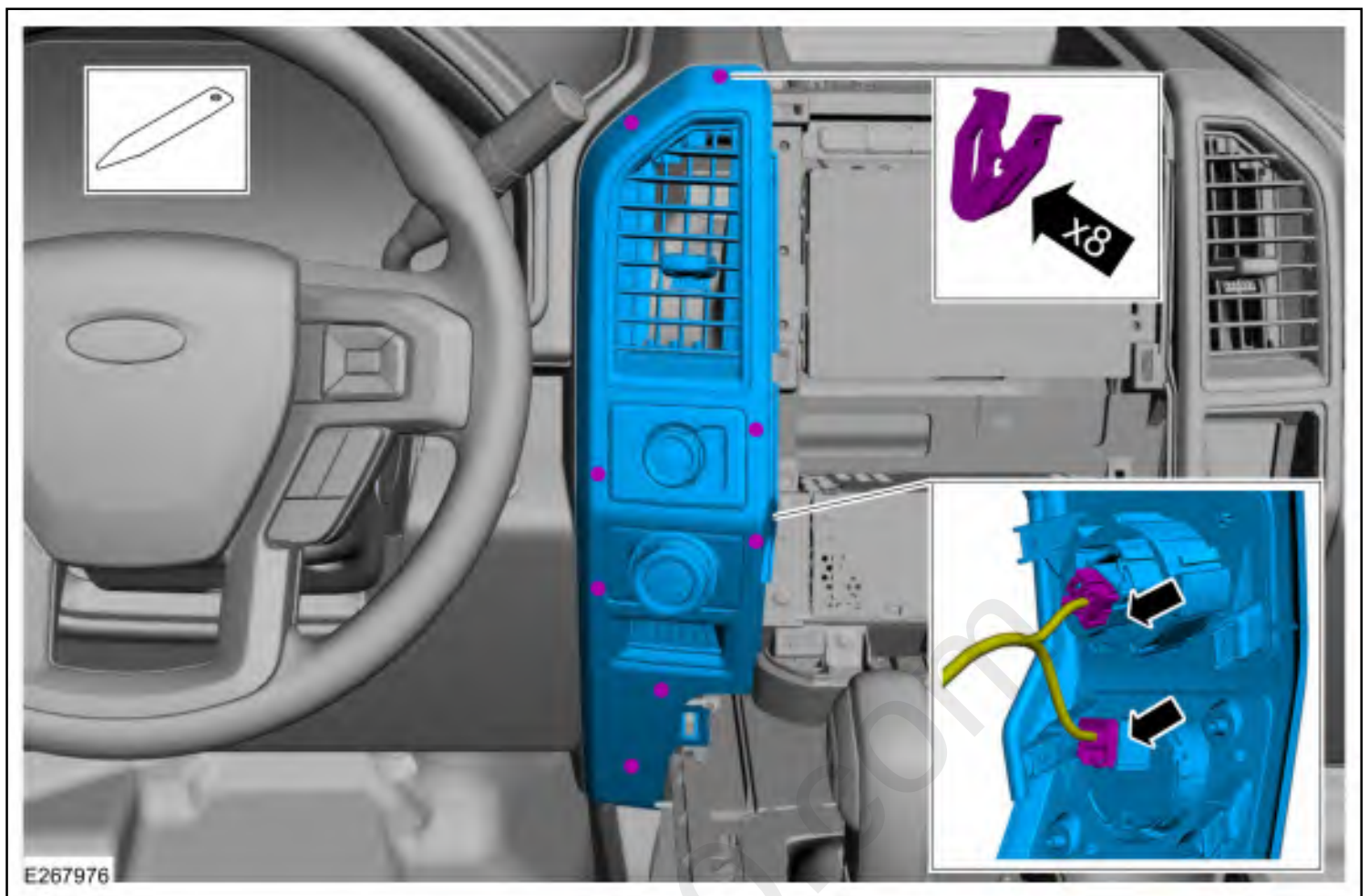


All vehicles

6. **NOTE:** *Vehicle with floor console shown, without floor console similar.*

Release the clips, remove the instrument panel center finish panels and disconnect the electrical connectors.

Use the General Equipment: Interior Trim Remover



7. **NOTE:** Vehicle with floor console shown, without floor console similar.

- 1) Carefully pry the MSS (mode select switch) from the Center Register
- 2) Remove the the MSS (mode select switch) from Center Register.



Installation

1. To install, reverse the removal procedure.

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Mode Select Switch (MSS) - Raptor

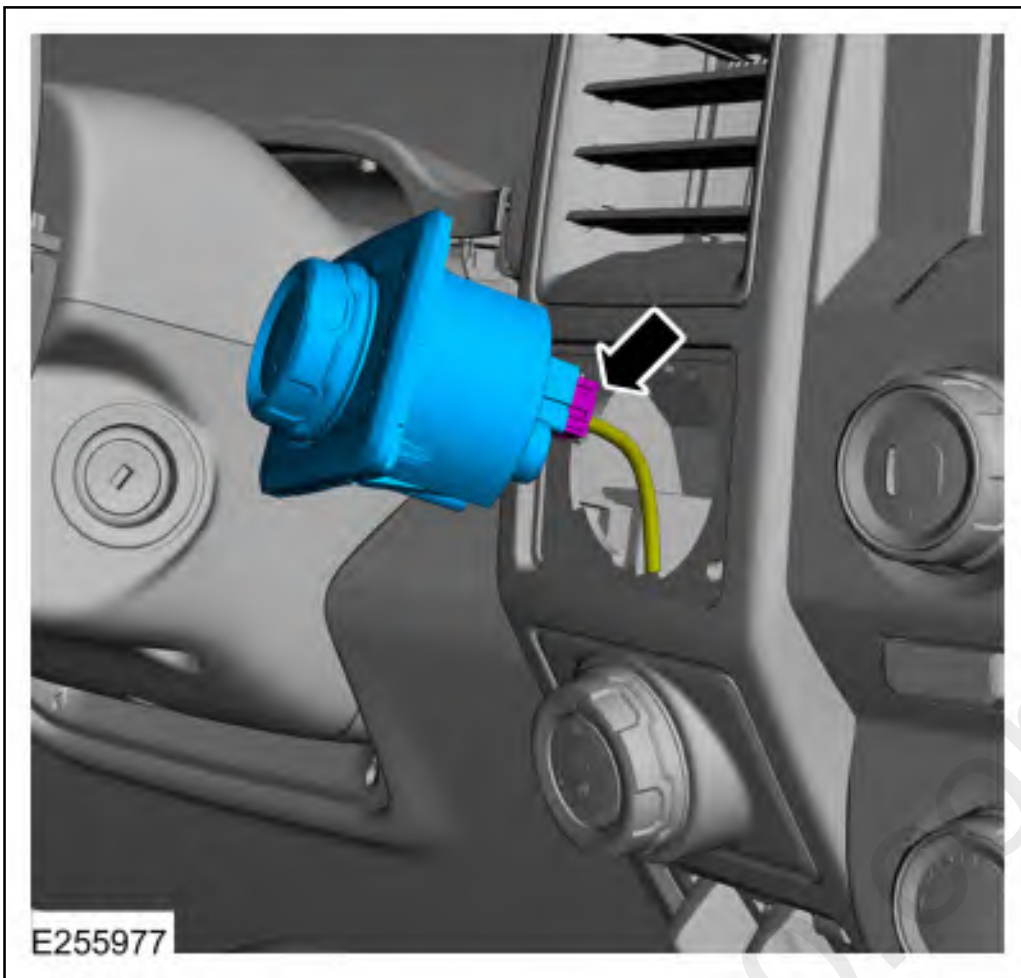
Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Carefully pry the MSS from the instrument panel.



2. Disconnect the MSS harness connector and remove the switch.



Installation

1. To install, reverse the removal procedure.

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Specifications

Materials

Name	Specification
Motorcraft® Thread Sealant with PTFE TA-24-B	WSK-M2G350-A2
Motorcraft® Ultra Silicone Sealant TA-29	-
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV WSS-M2C938-A

Item	Fill Capacity
<i>Material:</i> Motorcraft® MERCON® LV Automatic Transmission Fluid / XT-10-QLVC (MERCON® LV) (WSS-M2C938-A)	1.4L (2.9 pt)
<i>Material:</i> Motorcraft® Thread Sealant with PTFE / TA-24-B (WSK-M2G350-A2)	-
<i>Material:</i> Motorcraft® Ultra Silicone Sealant / TA-29	-

Transfer Case

Base Part Number: Base Part Number: 7251

Electronic Shift-On-The-Fly (ESOF) System

The ESOF transfer case system consists of the following components:

- MSS, located on the instrument panel
- Transfer case assembly (includes shift motor and synchronization clutch)
- TCCM

The Borg-Warner 4469 electronic shift transfer case is a 2-piece magnesium design. The unit transfers engine power from the transmission to the front and rear axles. Vehicles equipped with an ESOF system allow the operator to choose between 2WD(2H) and 2 different 4WD modes. The transfer case is shifted electronically based on the MSS position. Under normal driving conditions, the transfer case is in 2WD (2H), but when desired, the operator may shift into 4WD high (4H) or 4WD low (4L). The operator can shift between 2WD (2H) and 4WD high (4H) at any speed. When shifting into or out of 4WD low (4L) range, the TCCM requires that the vehicle speed is less than 5 km/h (3 mph) and the transmission in NEUTRAL.

The transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline during 2WD (2H) to 4WD high (4H) shifts. The transfer case is lubricated by a positive displacement fluid pump that channels fluid flow through holes in the rear output shaft.

2-Speed Torque-On-Demand

The 2-speed torque-on-demand transfer case system consists of the following components:

- MSS, located on the instrument panel
- Transfer case assembly (includes shift motor and synchronization clutch)

- TCCM

The Borg-Warner 4467 2-speed torque-on-demand transfer case is a 2-piece magnesium design. The transfer case transfers engine power from the transmission to the front and rear axles. Vehicles equipped with the 2-speed torque-on-demand system allow the operator to choose between 2WD and 3 different 4WD modes. The transfer case is shifted electronically based on the MSS position. Under normal driving conditions, the unit is in 2WD (2H), but when desired, the operator may shift into 4WD high (4H), 4WD low (4L) or 4WD AUTO (4A). When shifting into or out of 4WD (4L) range, the TCCM requires that the vehicle speed is less than 5 km/h (3 mph) and the transmission is in NEUTRAL.

The transfer case is equipped with an electronically controlled high torque capacity clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline during 2WD (2H) to 4WD high (4H) or 4WD AUTO (4A) shifts. The clutch also provides torque to the front driveline in all 4WD modes. The transfer case is lubricated by a positive displacement fluid pump that channels fluid flow through holes in the rear output shaft.

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Transfer Case

Base Part Number: Base Part Number: 7251

Vehicles equipped with 2-Speed Torque On Demand transfer case

REFER to: [Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case](#)
(308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

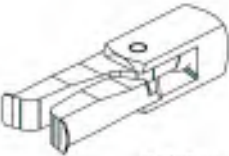
Vehicles equipped with Electronic Shift transfer case REFER to: [Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case](#) (308-07A Four-Wheel Drive Systems, Diagnosis and Testing).

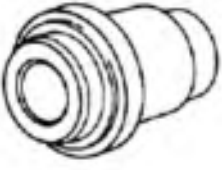
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Transfer Case - Vehicles With: 2-Speed Torque On Demand Transfer Case

Base Part Number: Base Part Number: 7251

Special Tool(s) / General Equipment

 E133913	205-153 (T80T-4000-W) Handle
 E231407	205-293 (T89P-4850-A) Installer, Differential Oil Seal TKIT-1989-F TKIT-1989-FLM TKIT-1989-FM TKIT-1989-LM
 E231408	205-504 Installer, Halfshaft Pilot Bearing TKIT-2002N-F/FM TKIT-2002N-FLM TKIT-2002N-LM
 E142012	307-318 Remover, Stator Bearing TKIT-1994-FH TKIT-1994-FMH/FLMH TKIT-1994-LMH/MH

 E231409	307-582A Cover Axle Seal Installer TKIT-2008AS-FLM
 E231410	308-047 (T77F-1102-A) Remover, Bearing Cup
 E231411	308-085 (T83T-7025-C) Installer, Input Shaft Bearing TKIT-1983-F TKIT-1983-FLM TKIT-1983-FX
 E231411	308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal TKIT-1996-F/FM TKIT-1996-FLM2
Slide Hammer	
Adjustable Mounting Arm	

Materials

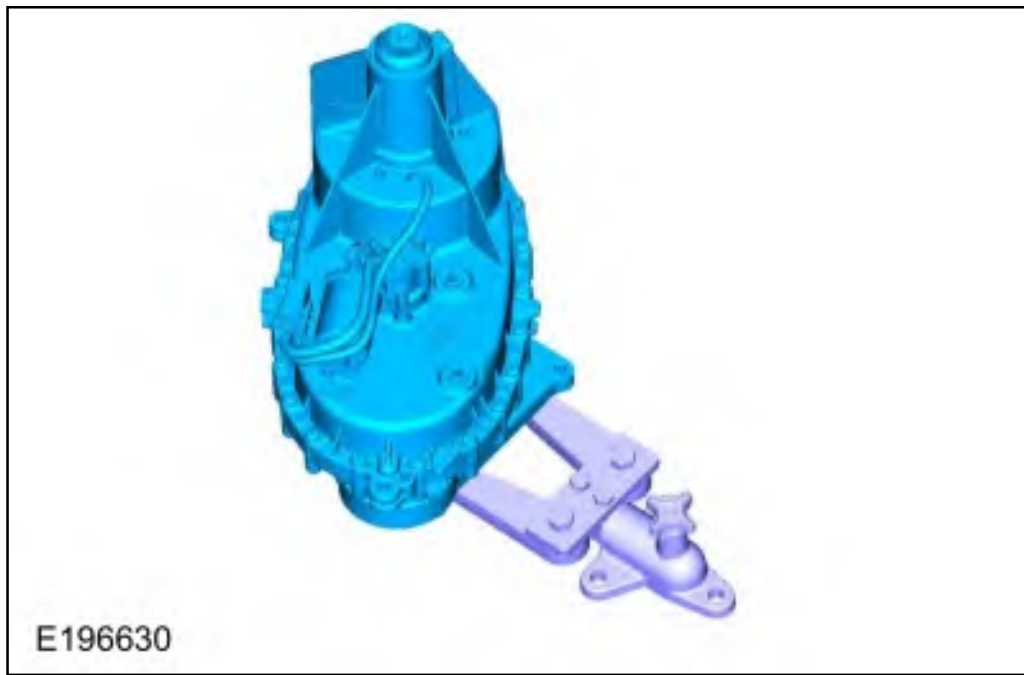
Name	Specification
Motorcraft® Ultra Silicone Sealant TA-29	-

DISASSEMBLY

- NOTICE: Seal all openings before cleaning the transfer case exterior. This will prevent entry of dirt and water, which may cause damage to internal components.**

Using a transmission adjustable mounting arm, secure the transfer case to the bench. Clean the transfer case with solvent and dry with compressed air.

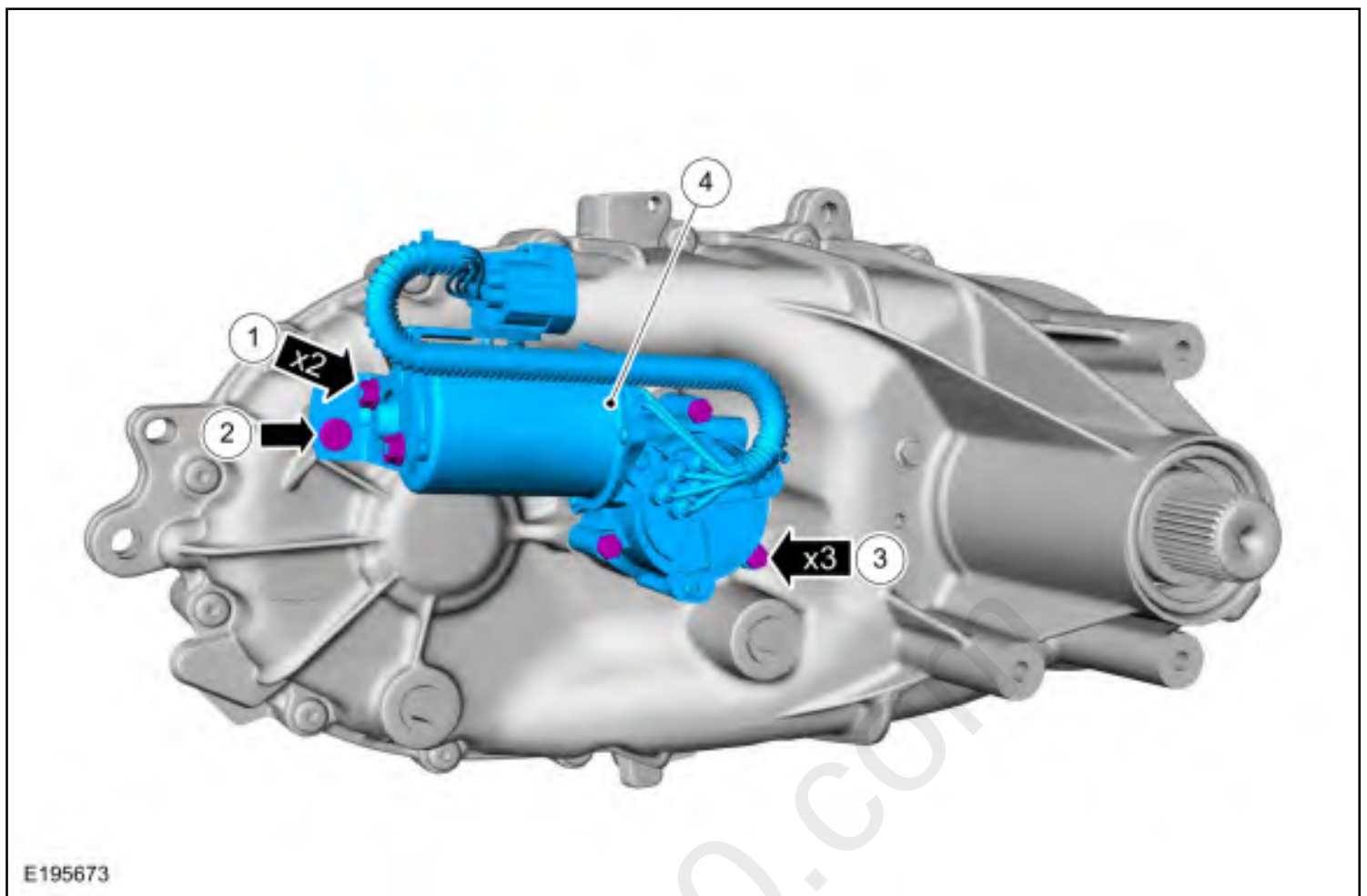
Use the General Equipment: Adjustable Mounting Arm



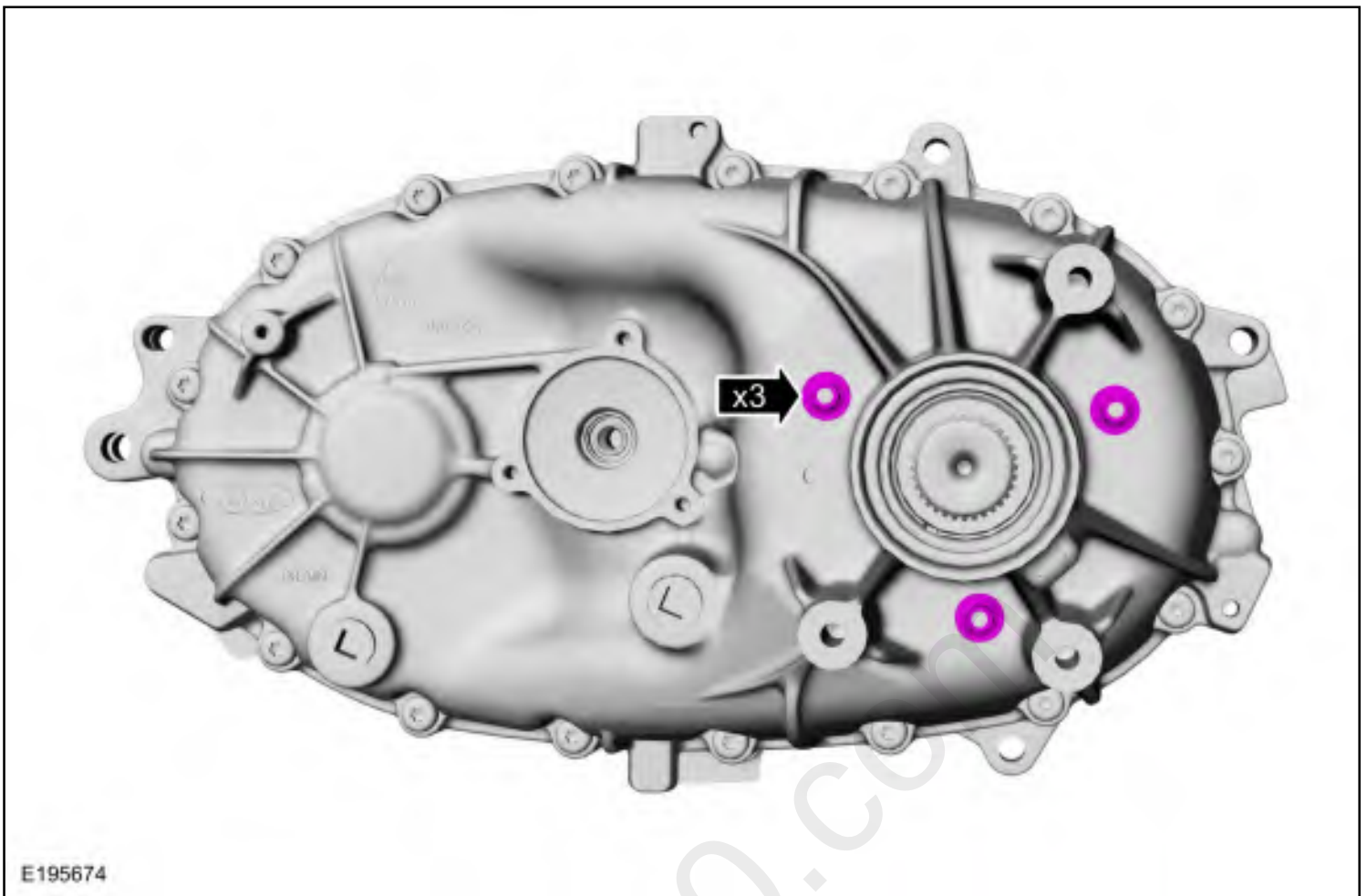
2. Remove the transfer case rear seal.
Refer to: [Transfer Case Rear Seal](#) (308-07B Transfer Case, Removal and Installation).
3.
Remove the coil wire pin from the electrical connector.
 1. Remove the inner retainer from the wire connector.
 2. Press the release tab and remove the coil wire pin.



1. Loosen the transfer case shift motor bracket nuts.
2. Remove the transfer case shift motor bracket bolt.
3. Remove the transfer case shift motor bolts.
4. Remove the transfer case shift motor.

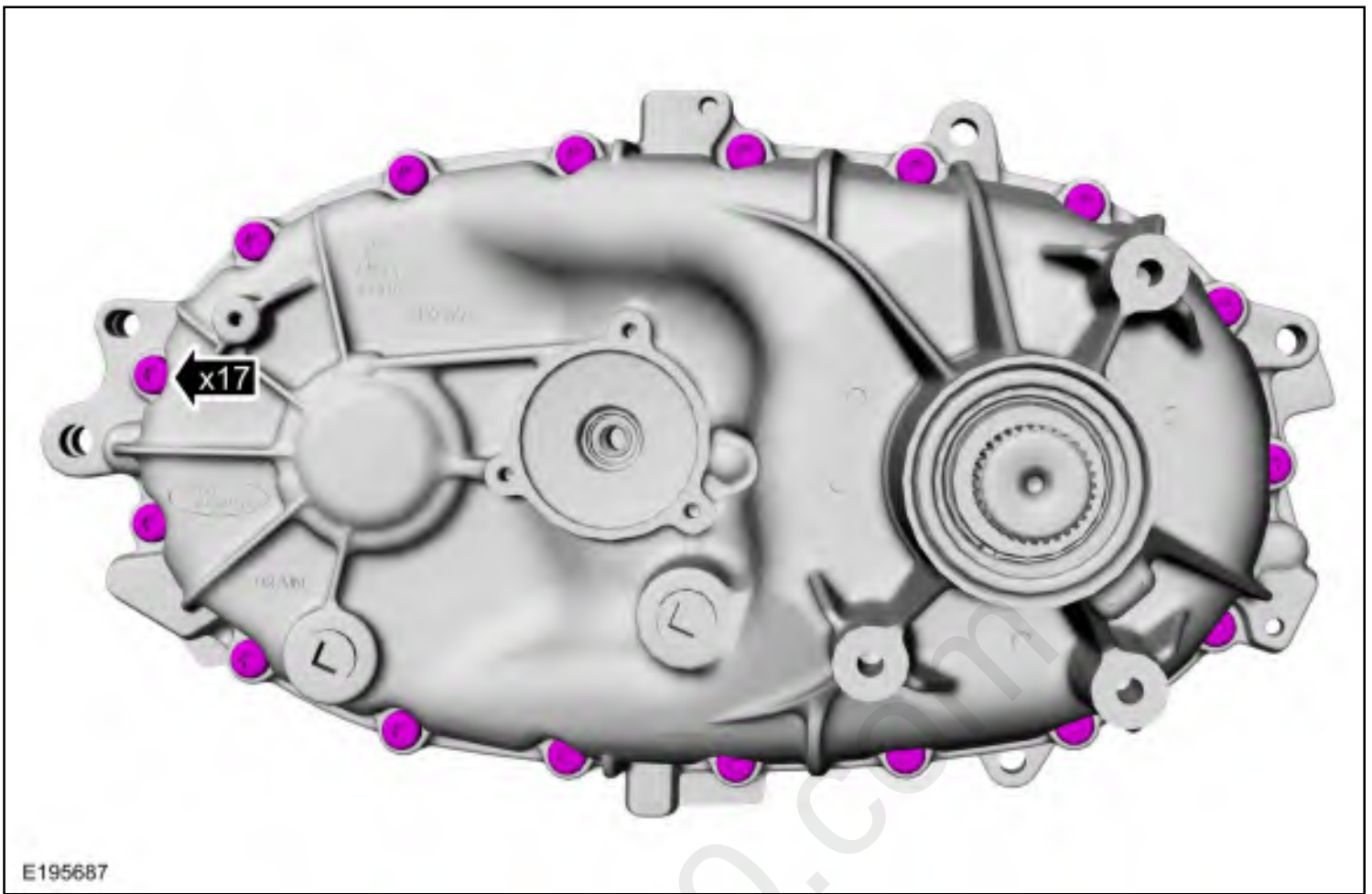


5. Remove the coil nuts and washers.

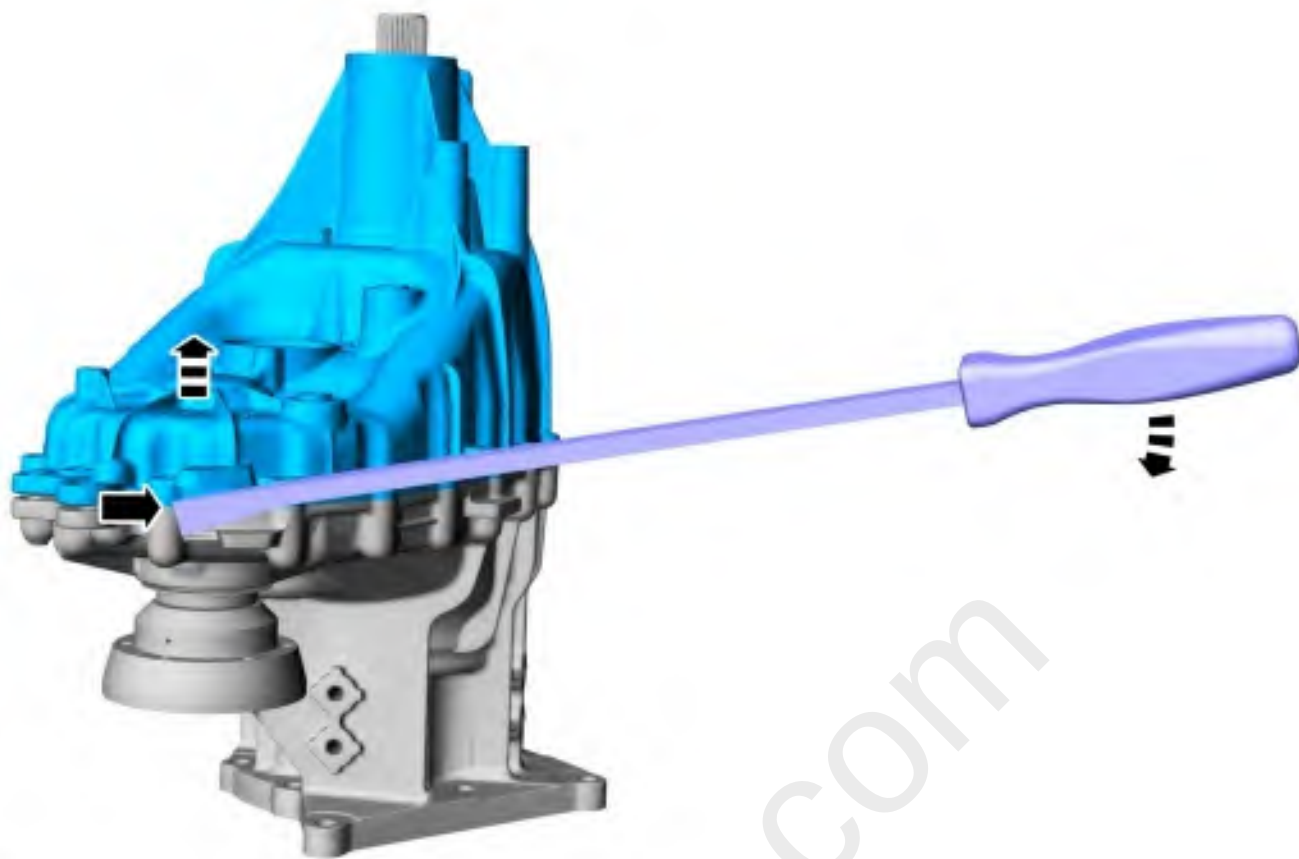


6. **NOTE:** The transfer case bolts are self tapping, and it is normal to find metal shavings while removing the cover.

Remove the transfer case bolts.



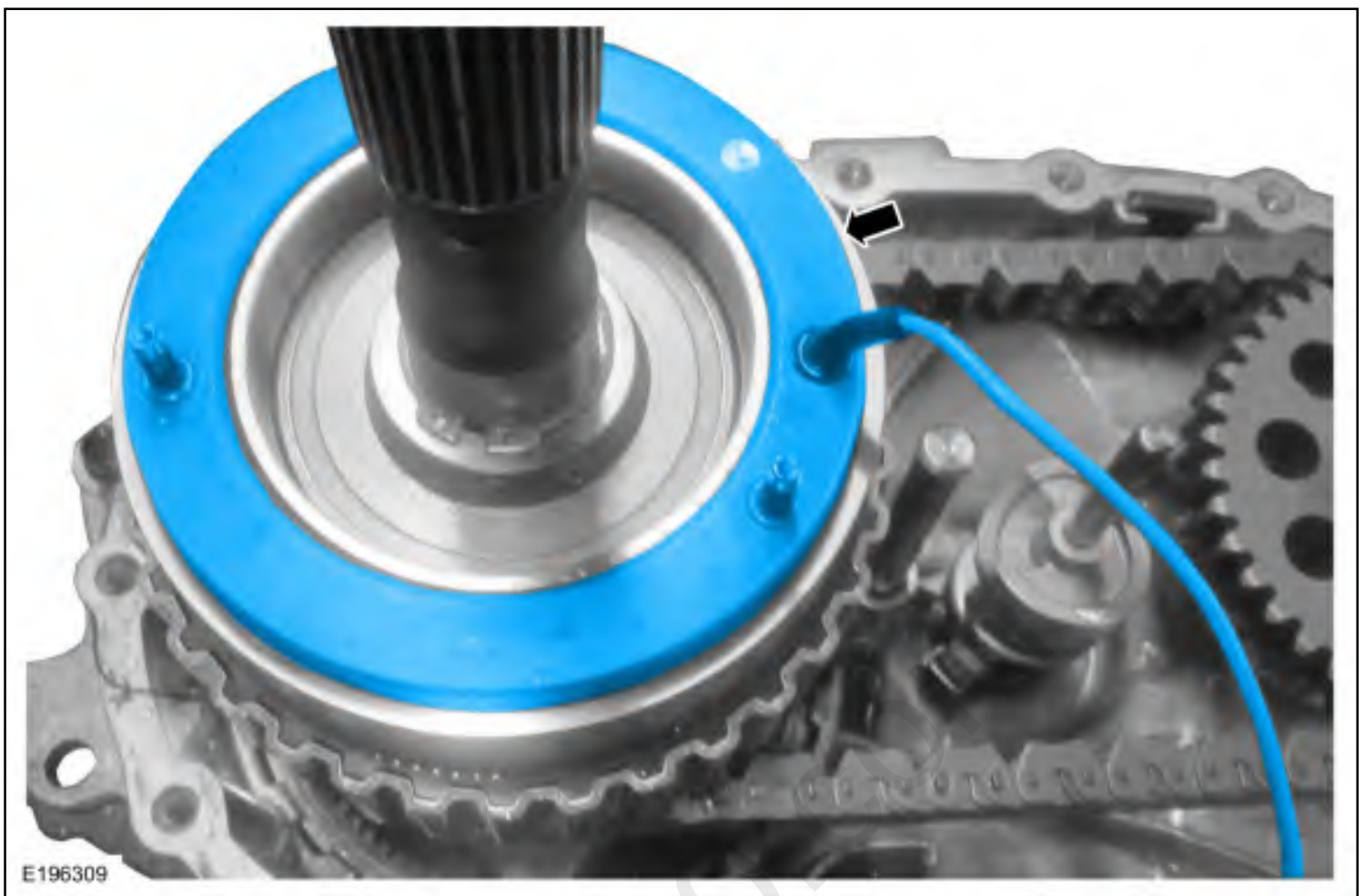
7. Using the pry bosses, separate the transfer case covers.



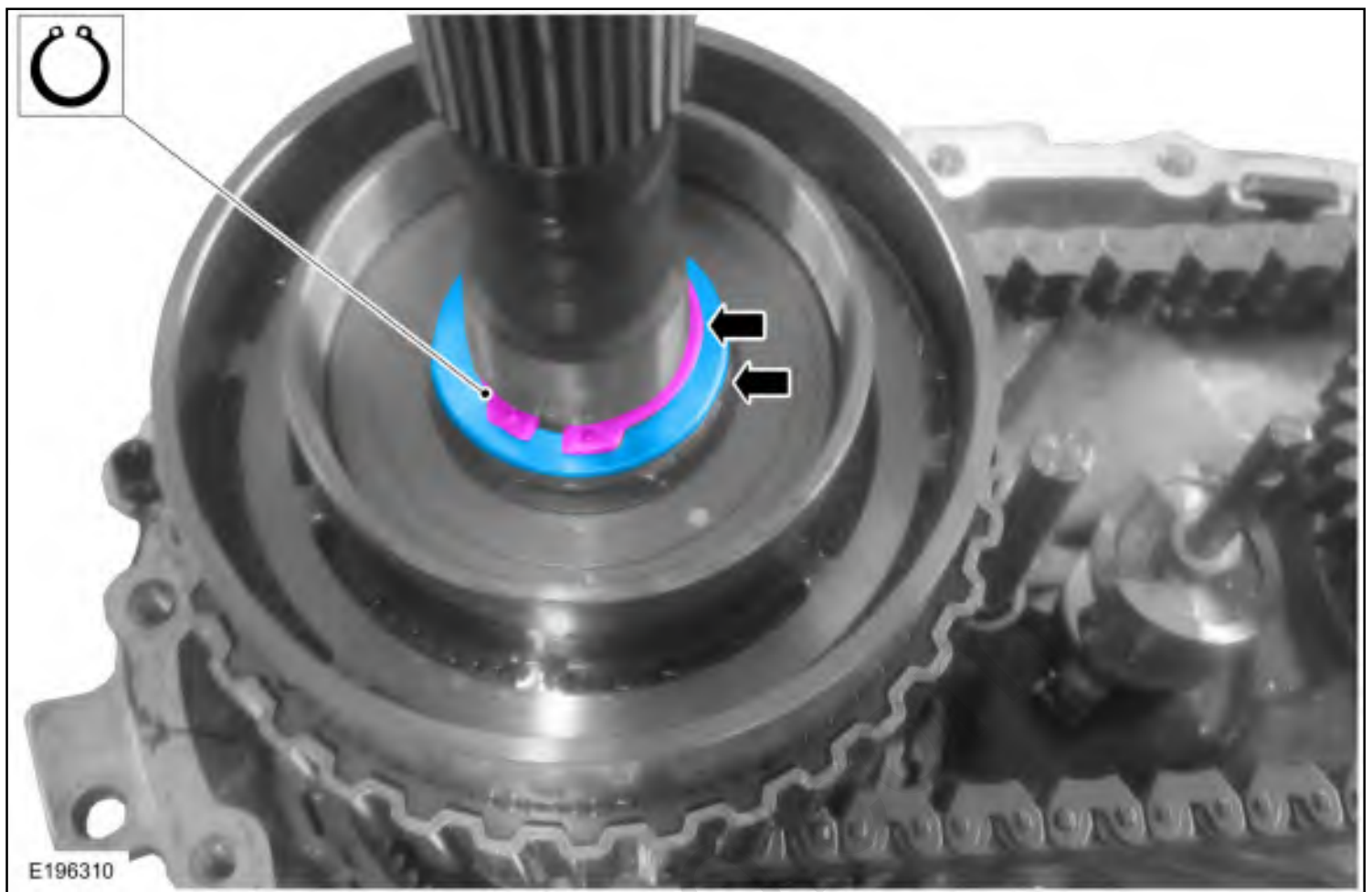
E195688



8. Remove the transfer case field coil.



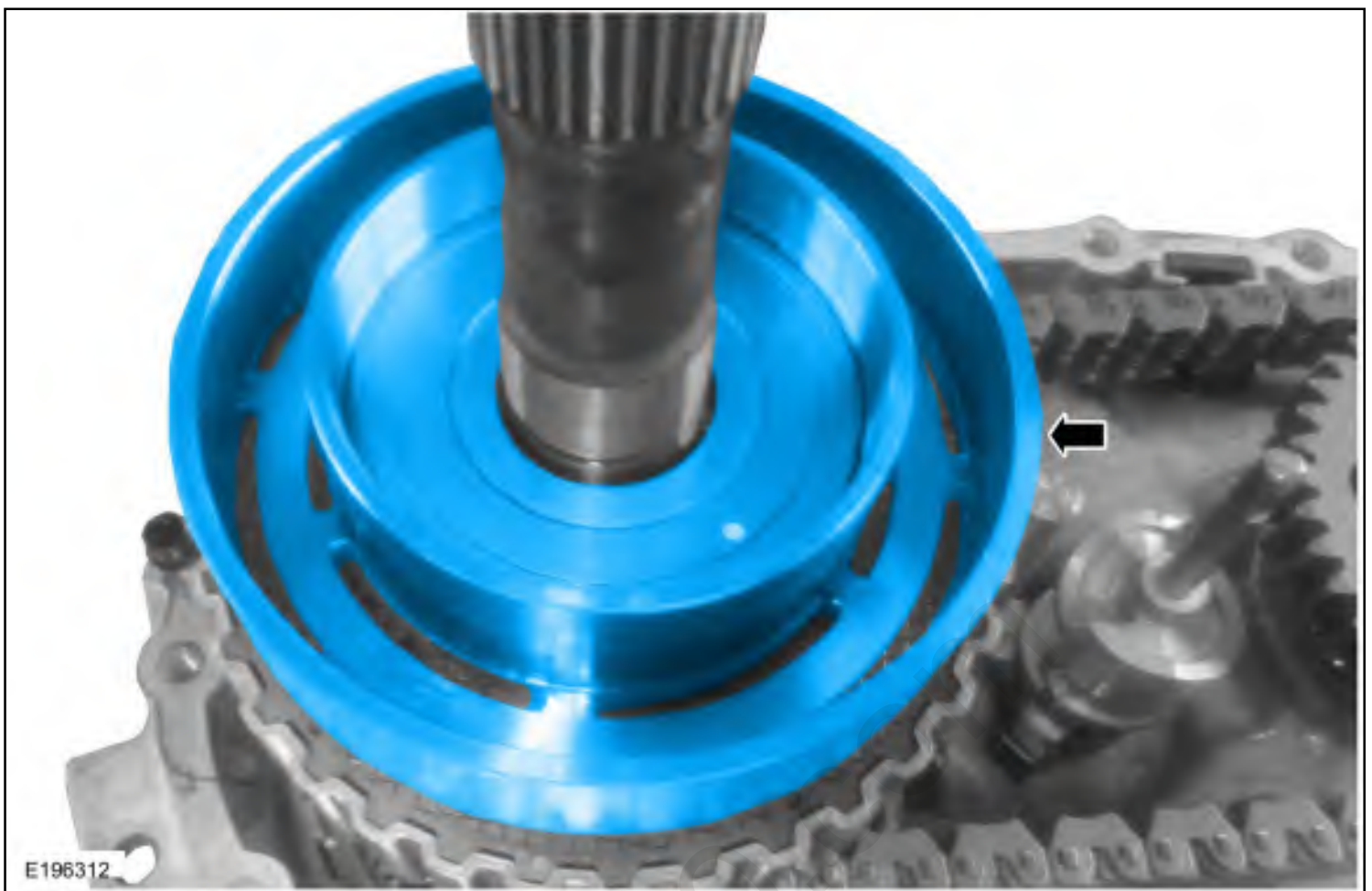
9. Remove the coil housing snap ring and spacer.



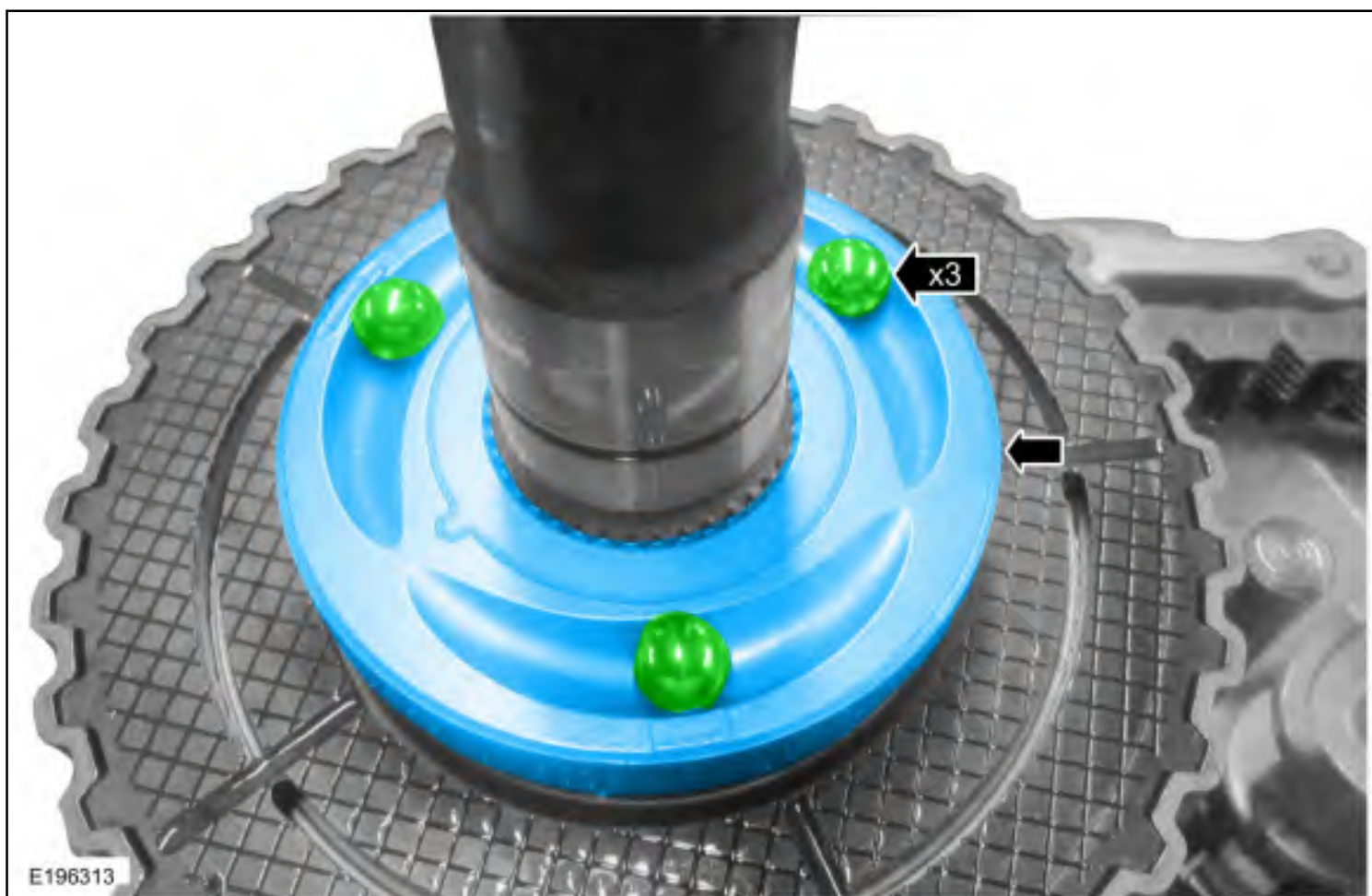
10. Remove the caged thrust bearing assembly.
 - Install a new bearing as necessary.



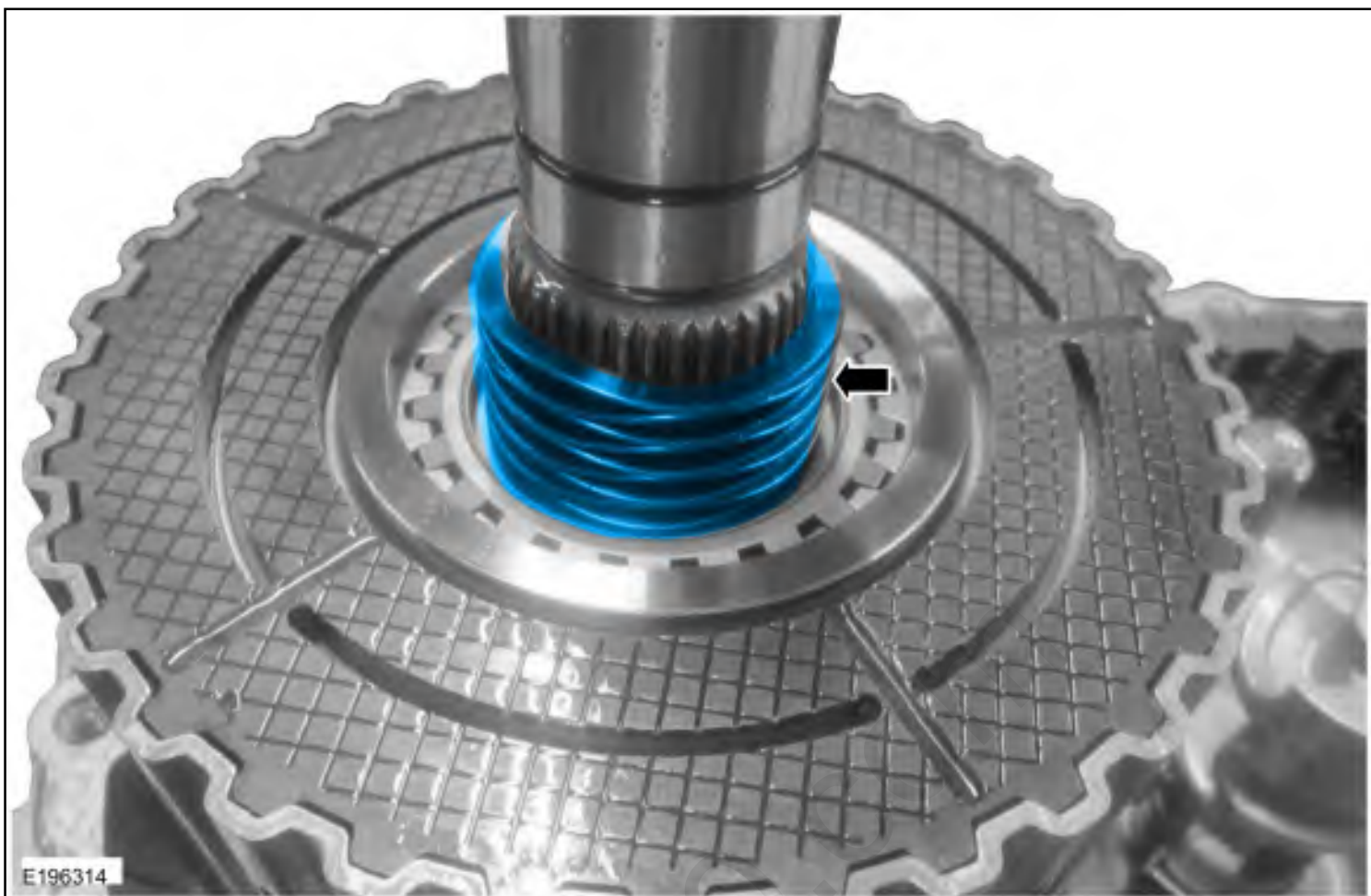
11. Remove the coil housing.



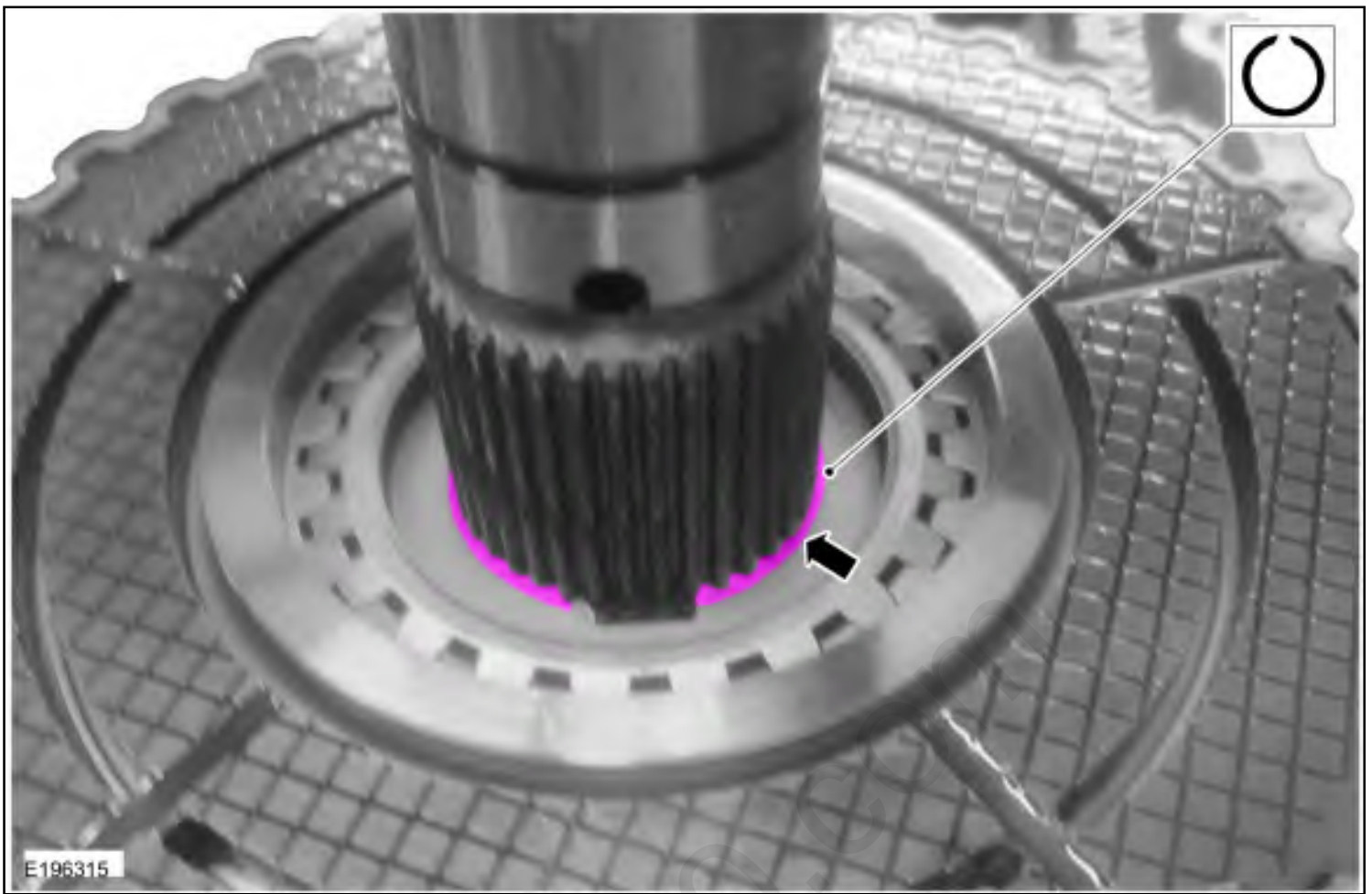
12. Remove the steel balls and the cam.



13. Remove the wave spring.



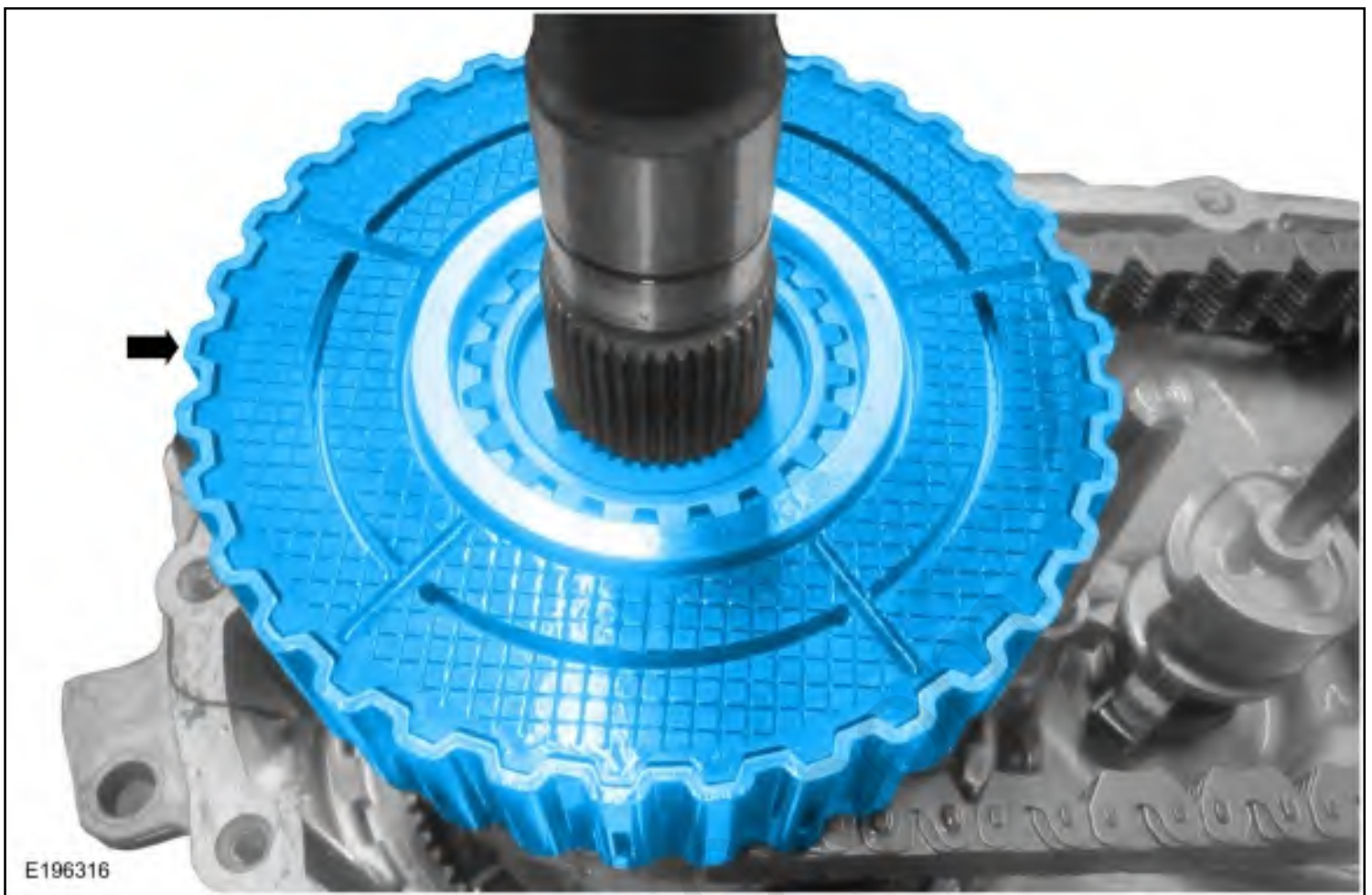
14. Remove clutch pack circlip.



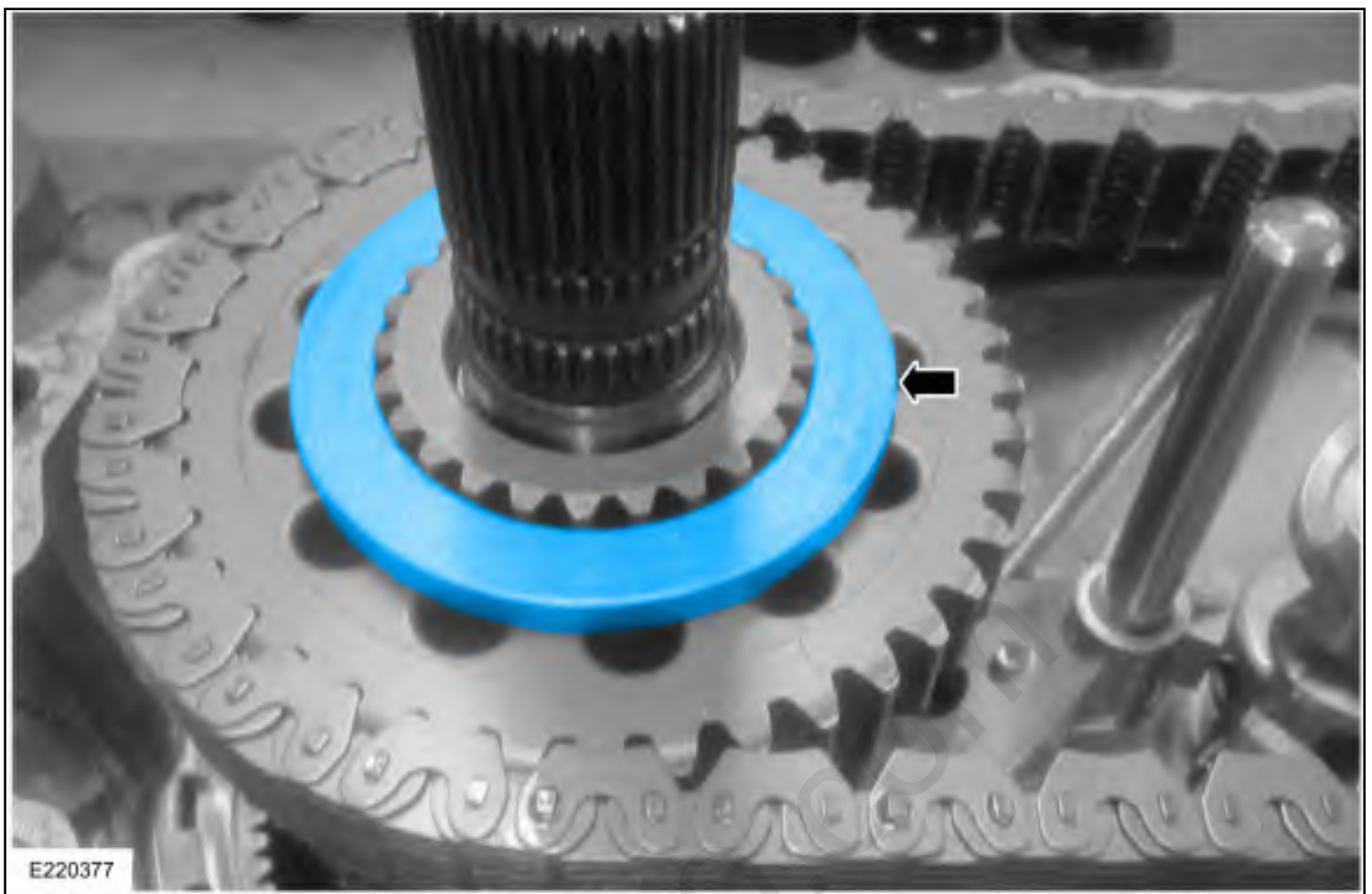
15. **NOTICE:** When removing the clutch pack assembly, do not separate the clutch pack assembly. Keep tension on the clutch pack during removal. Set the clutch pack assembly on the bench in the same position as located in the transfer case. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem will occur.

NOTICE: If the clutch pack is disassembled, a new clutch pack and armature must be installed. Failure to install a new clutch pack can result in component failure.

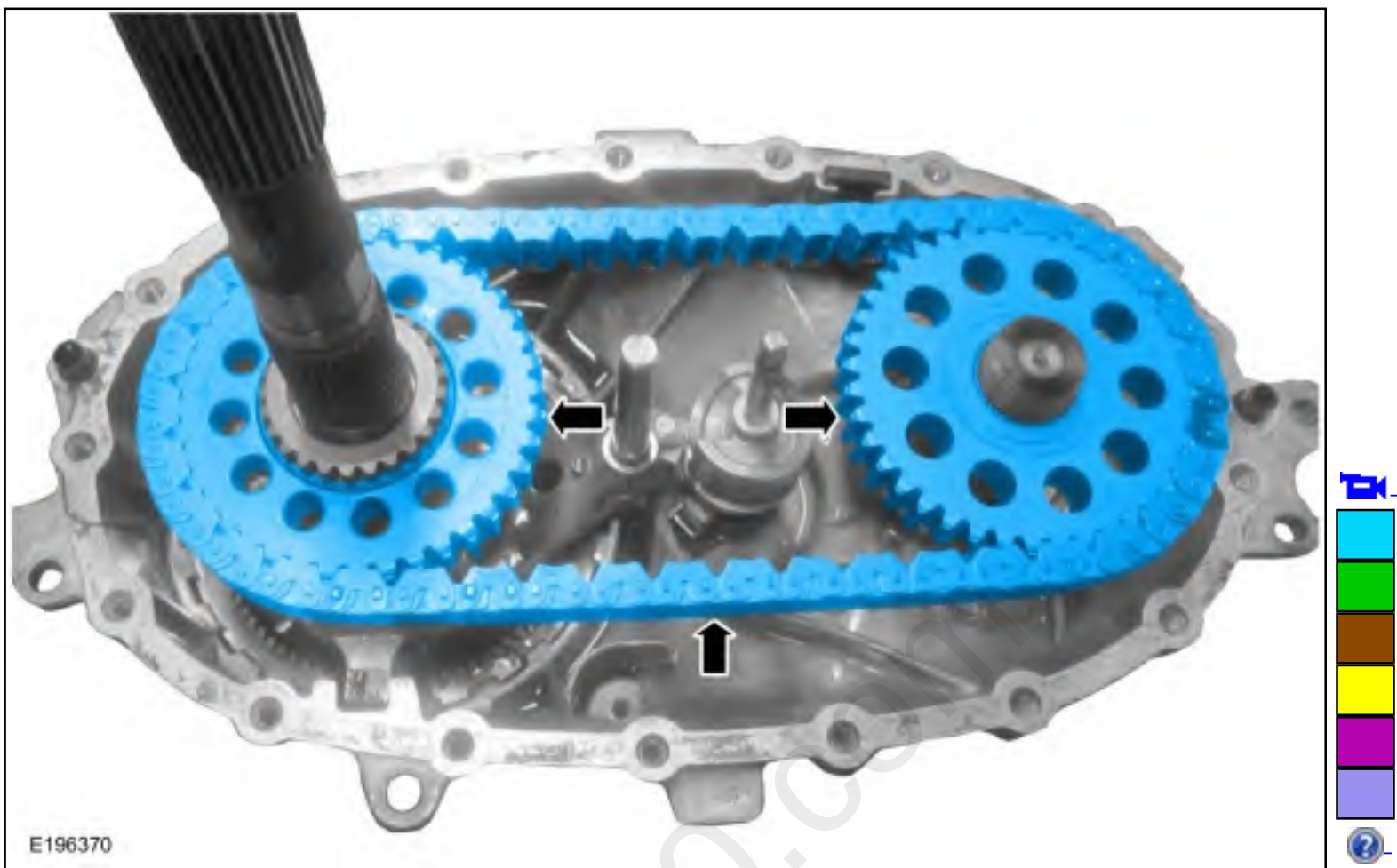
Remove the clutch pack assembly with the armature.



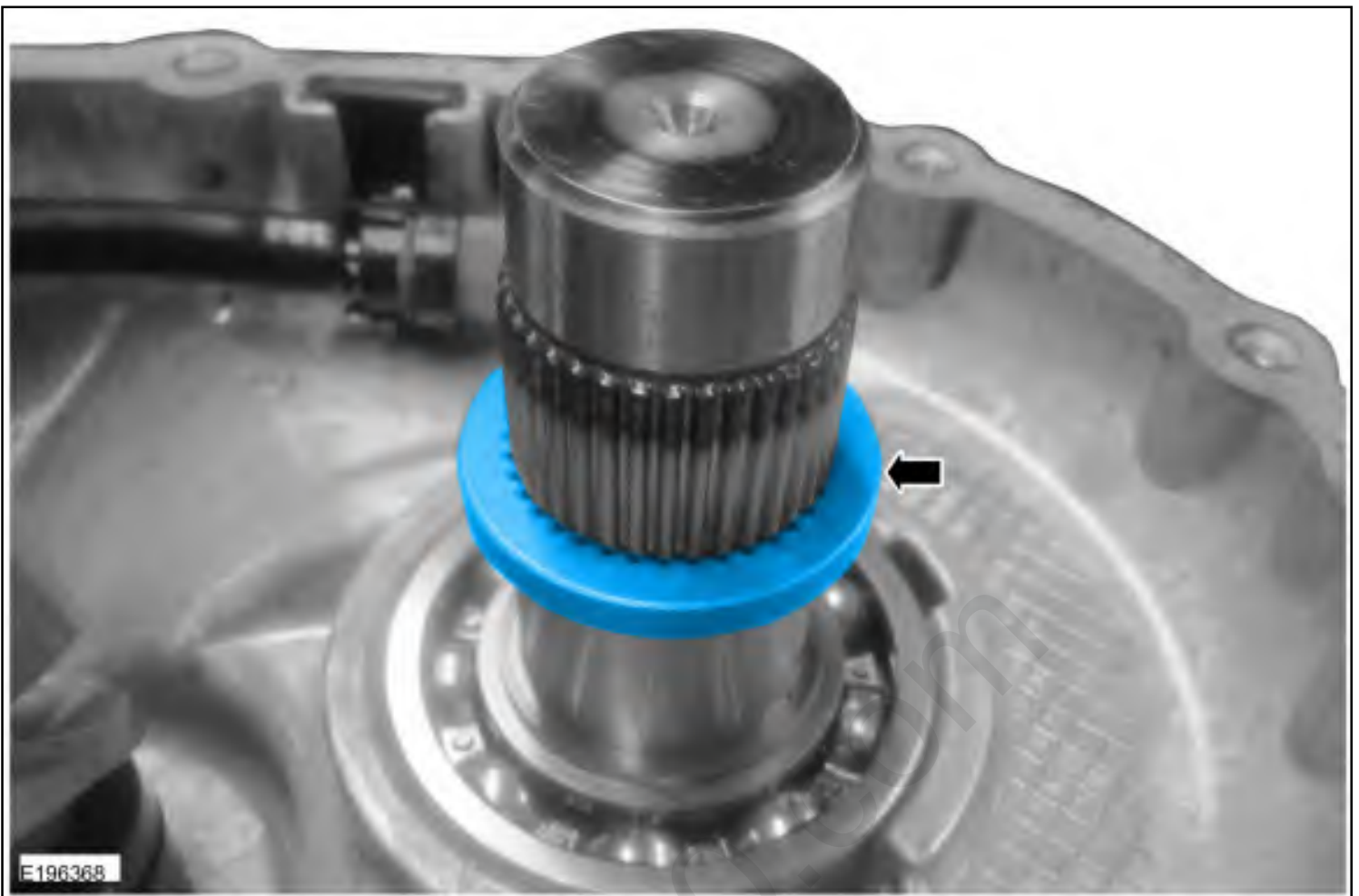
16. Remove the clutch pack spacer.



17. Remove the drive chain and the sprockets as an assembly.
 - Install new components as necessary.



18. Remove the output shaft sprocket spacer.



19. Remove the thrust bearing assembly.
- **NOTE:** *The upper thrust washer may be attached to the sprocket.*
- Remove the thrust washer.
- Remove the thrust bearing.
 - Remove the thrust washer.
 - Install new components as necessary.

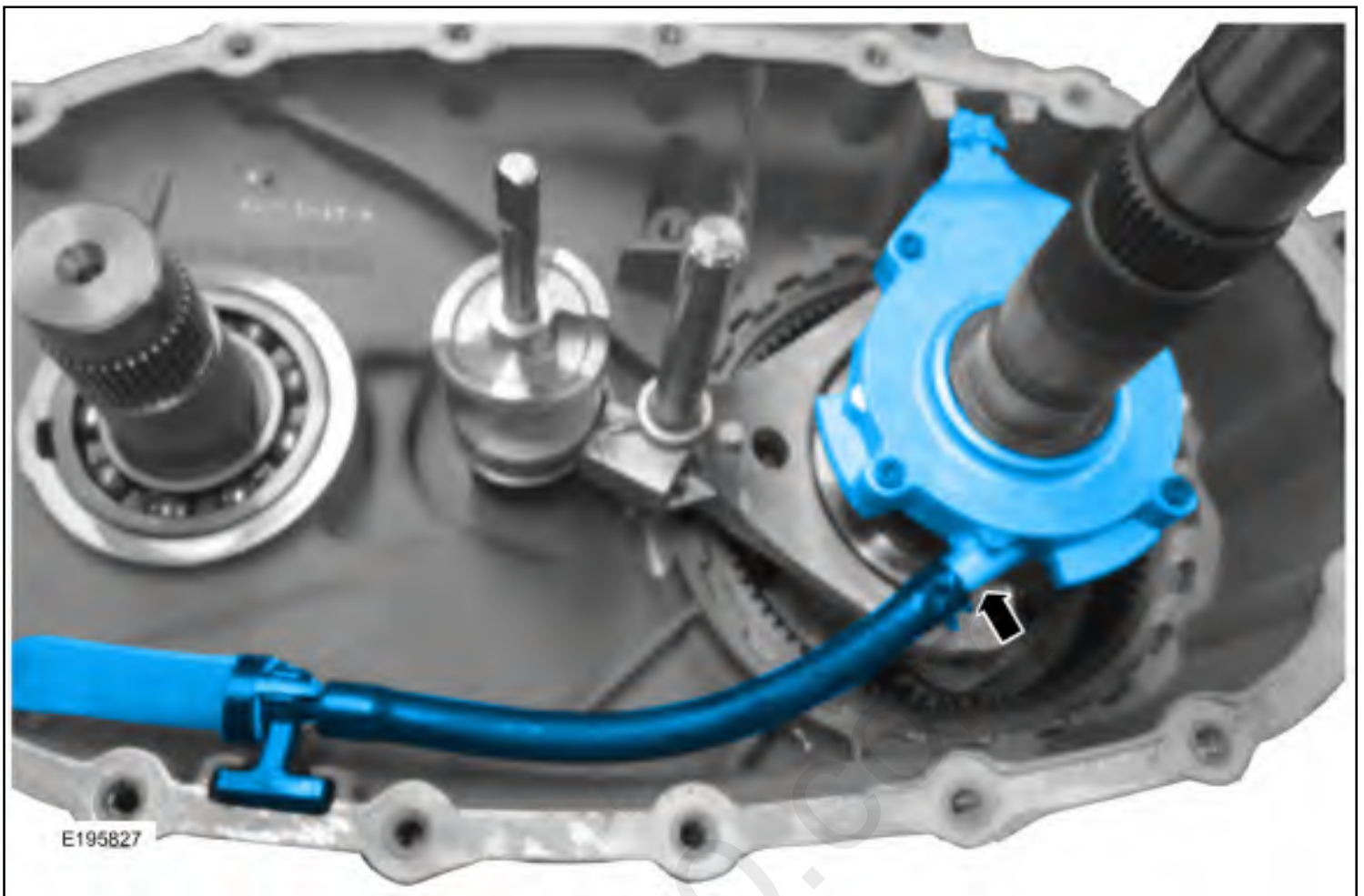


20. Remove the magnet from its slot in the case.



21. **NOTE:** *The pump assembly is not repairable.*

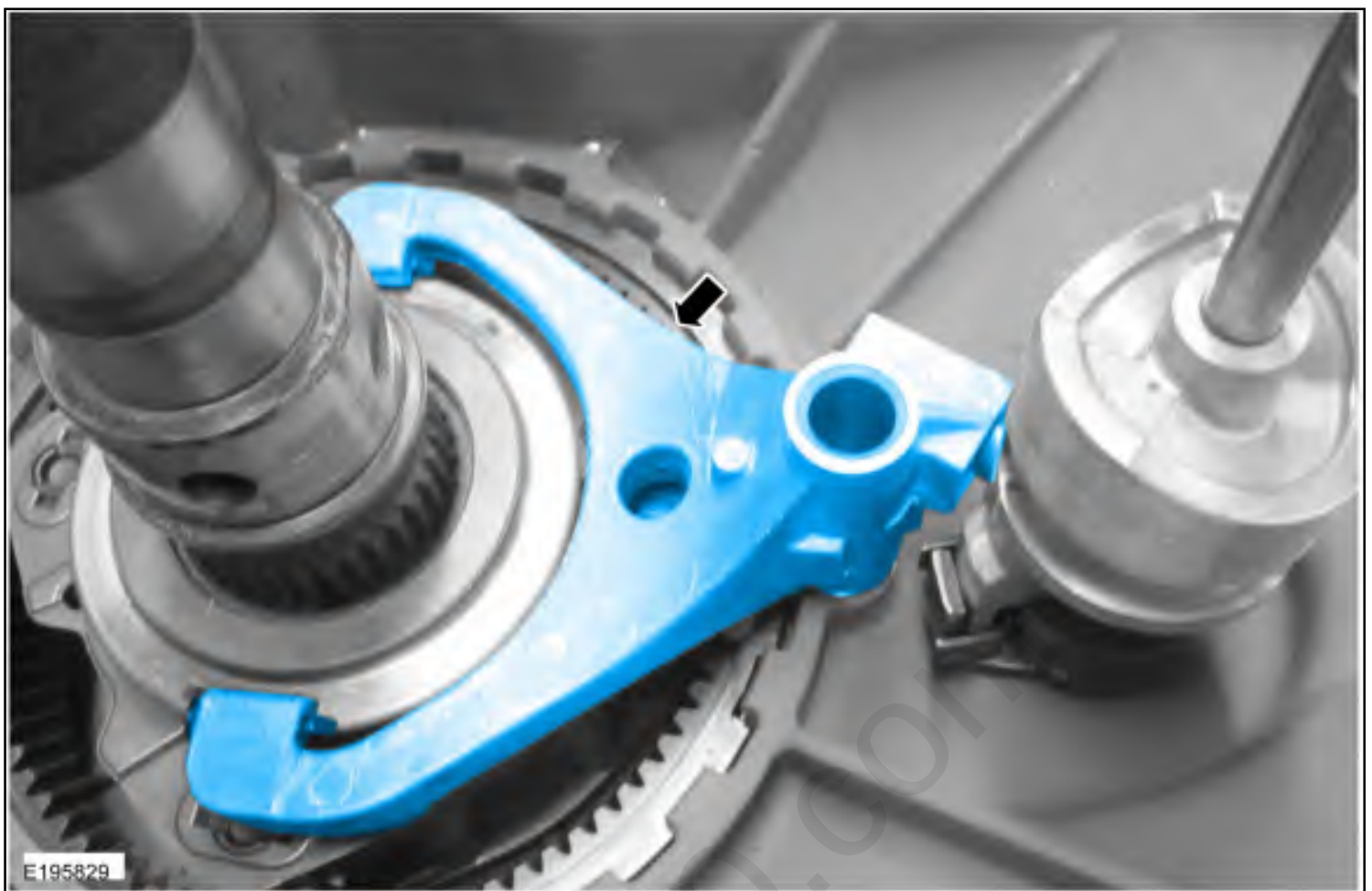
Remove the oil pump assembly.



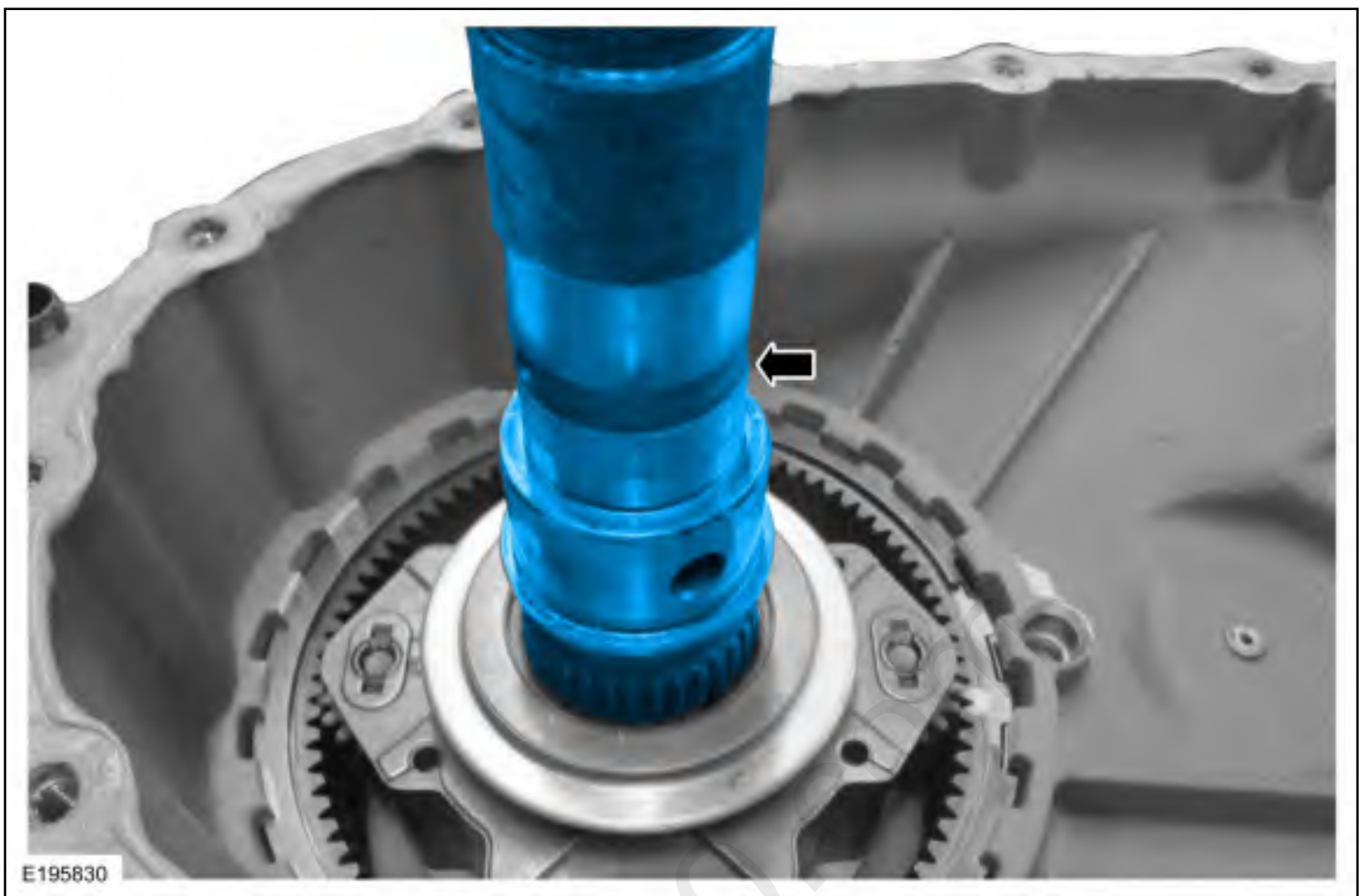
22. Remove the shift rail.



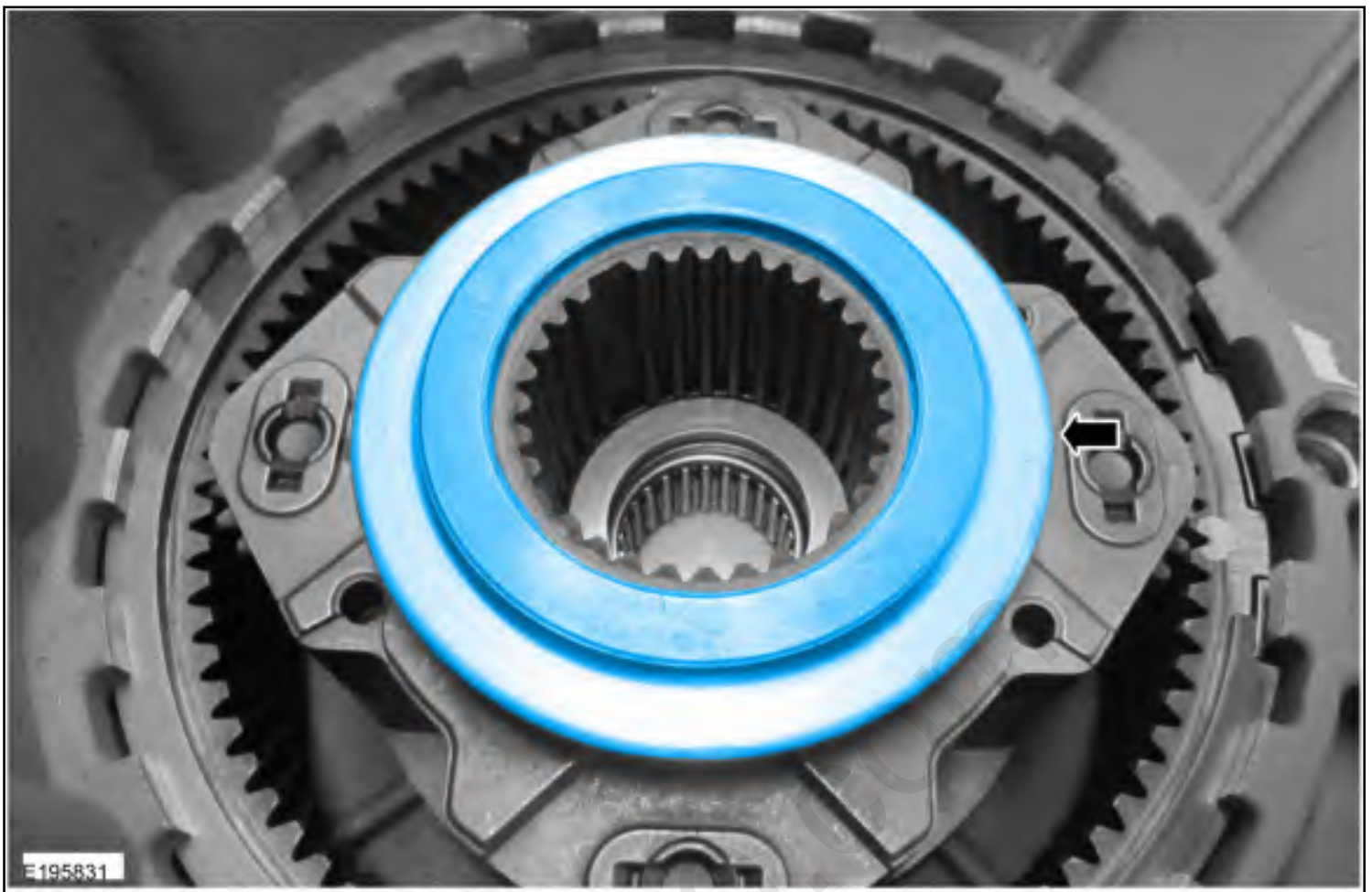
23. Remove the shift fork.



24. Remove the output shaft.



25. Remove the reduction hub.

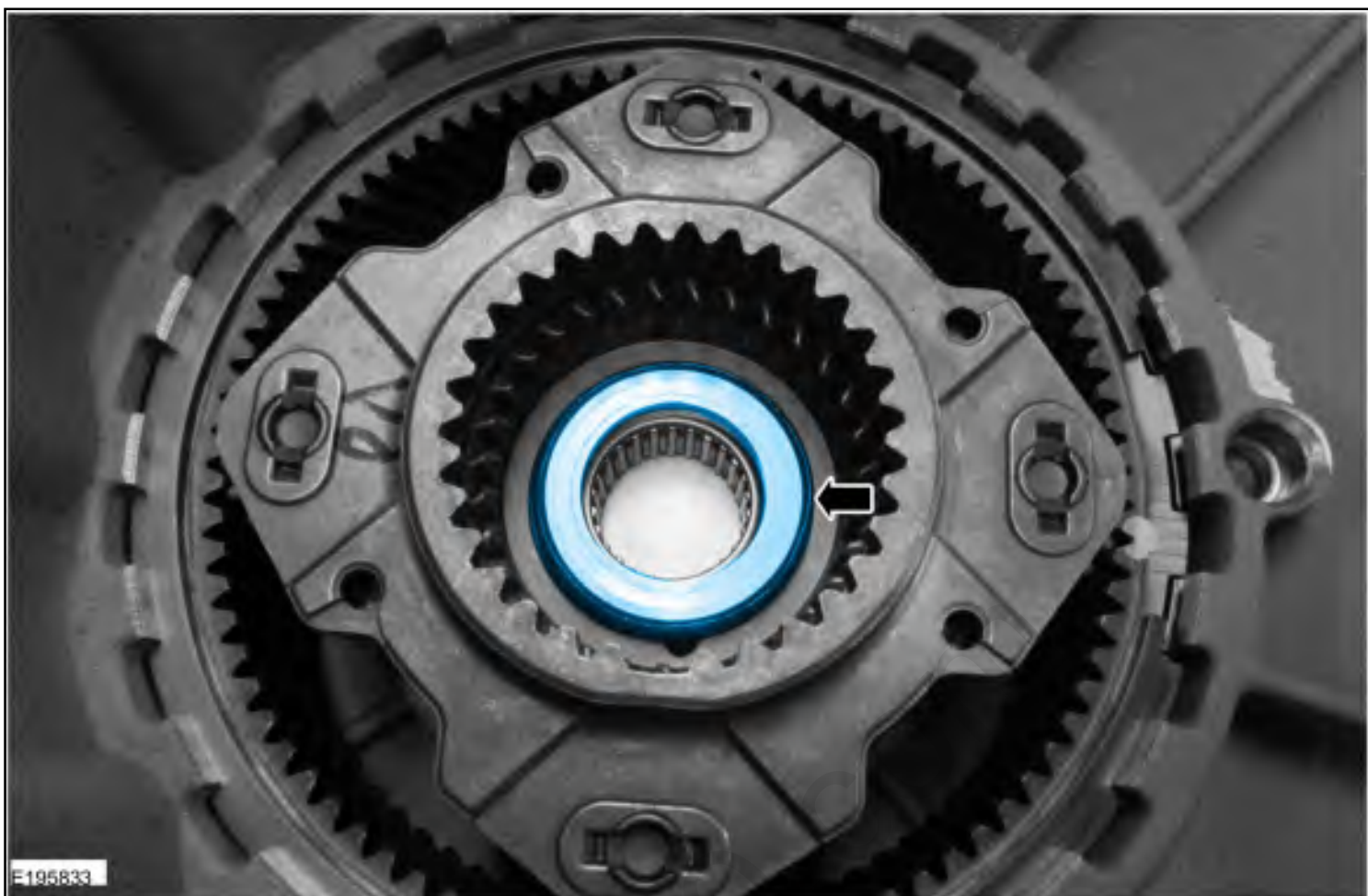


26. **NOTE:** *The electric shift cam is serviced as an assembly. Do not disassemble the shift cam assembly.*

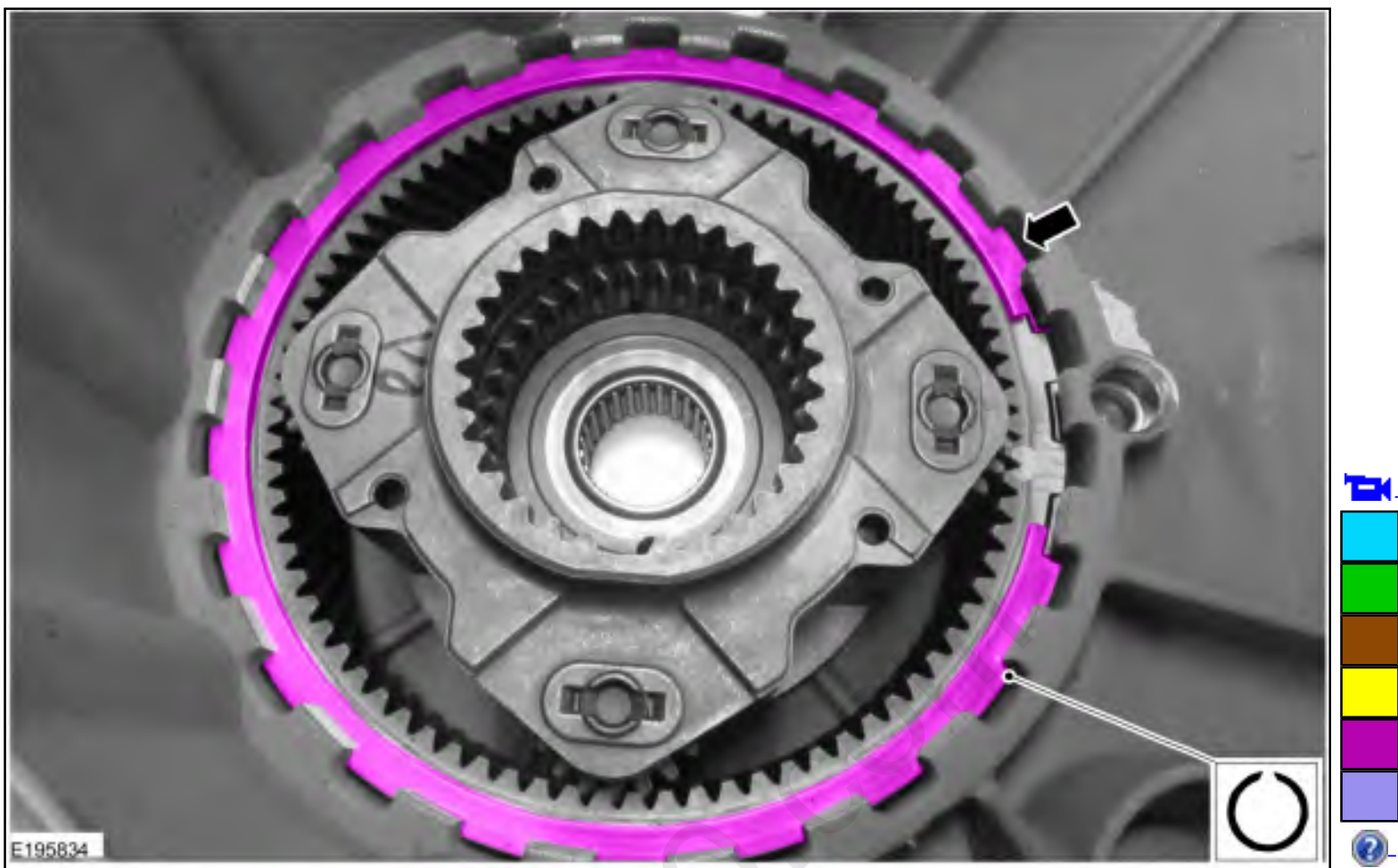
Remove the electric shift cam assembly.



27. Remove the planet carrier thrust bearing.



28. Remove the ring gear circlip.

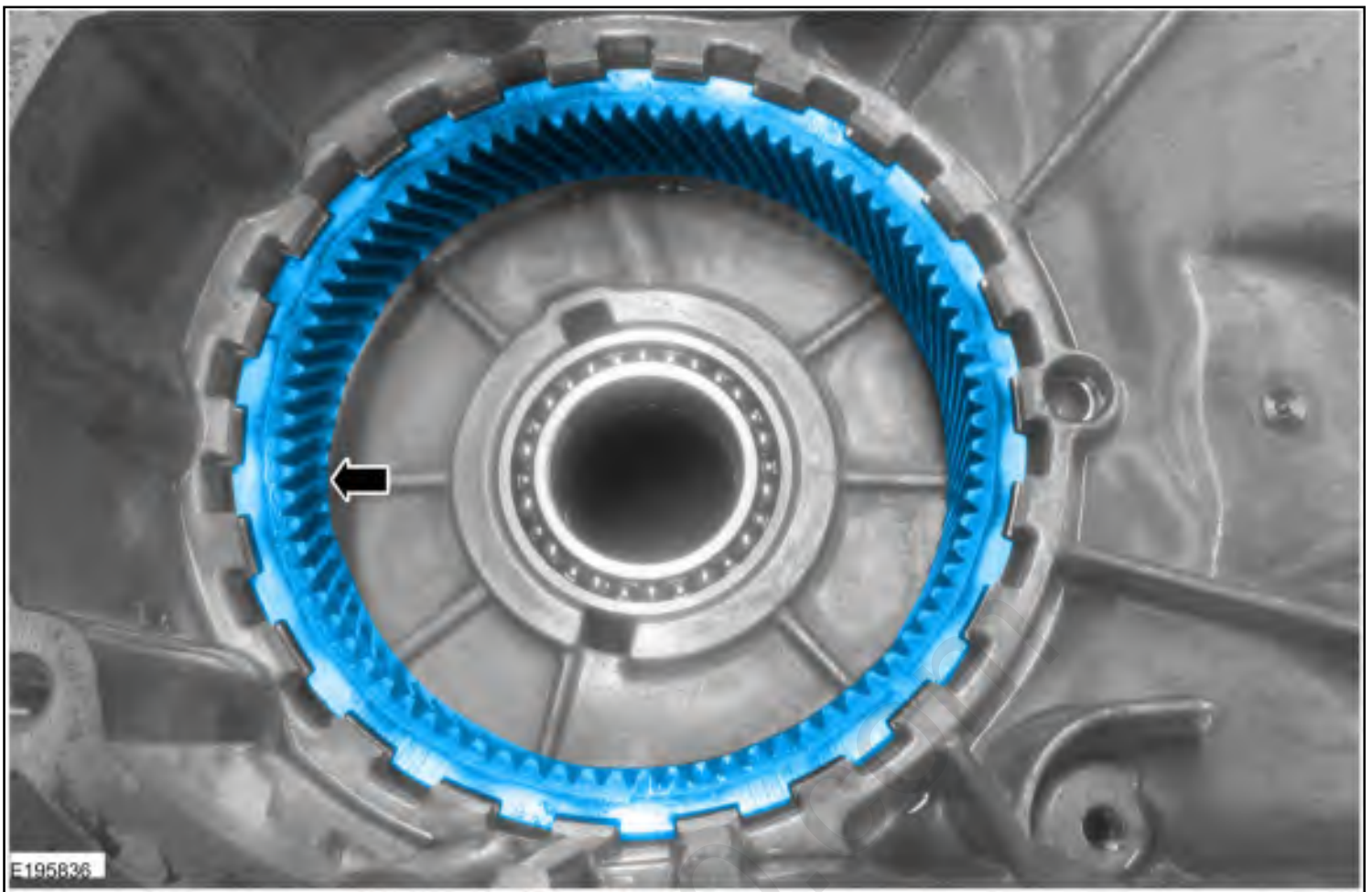


29. **NOTE:** *Replace the inner planet carrier needle bearing if necessary.*

Remove the front planet carrier.

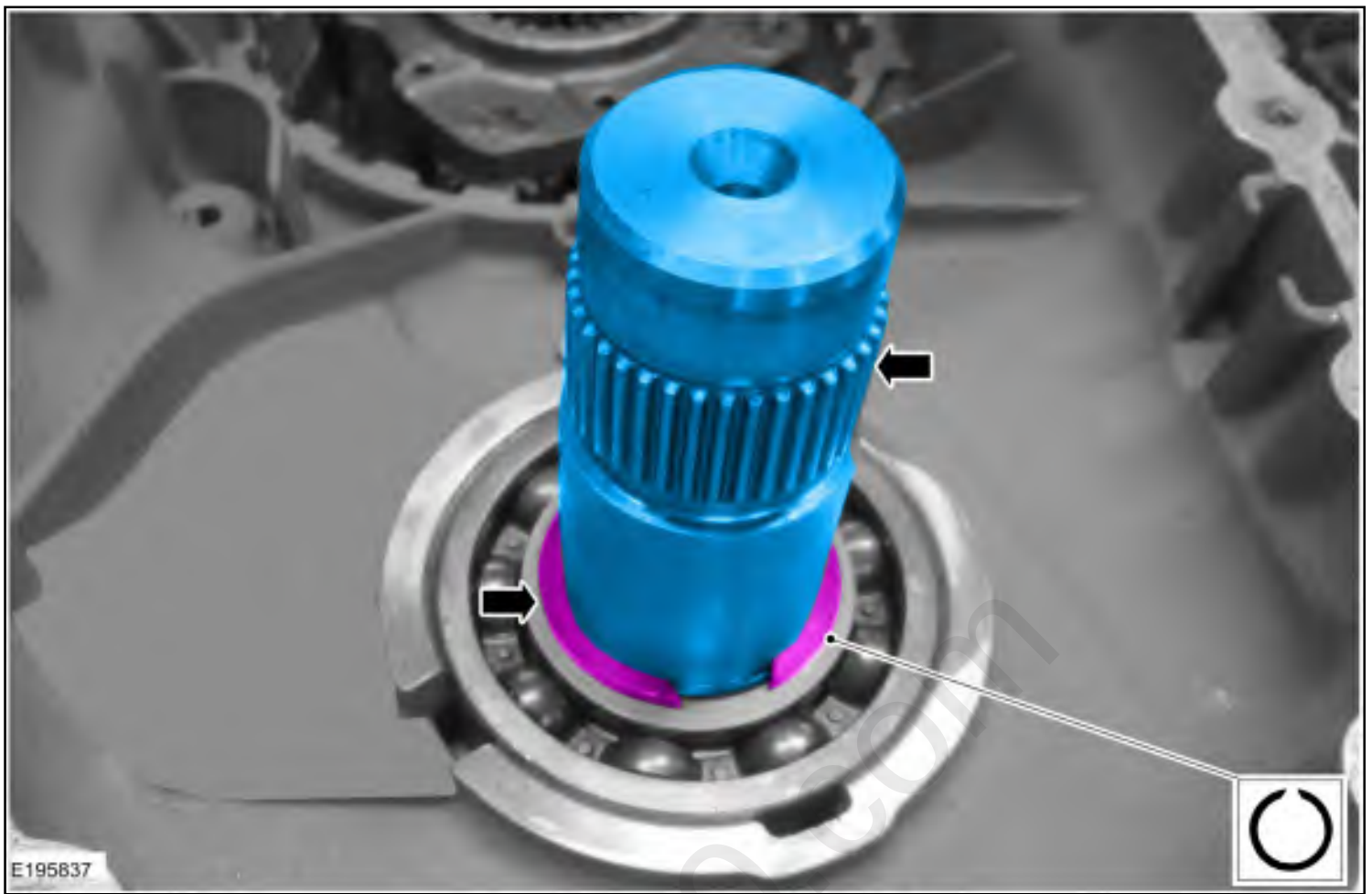


30. Remove the ring gear.

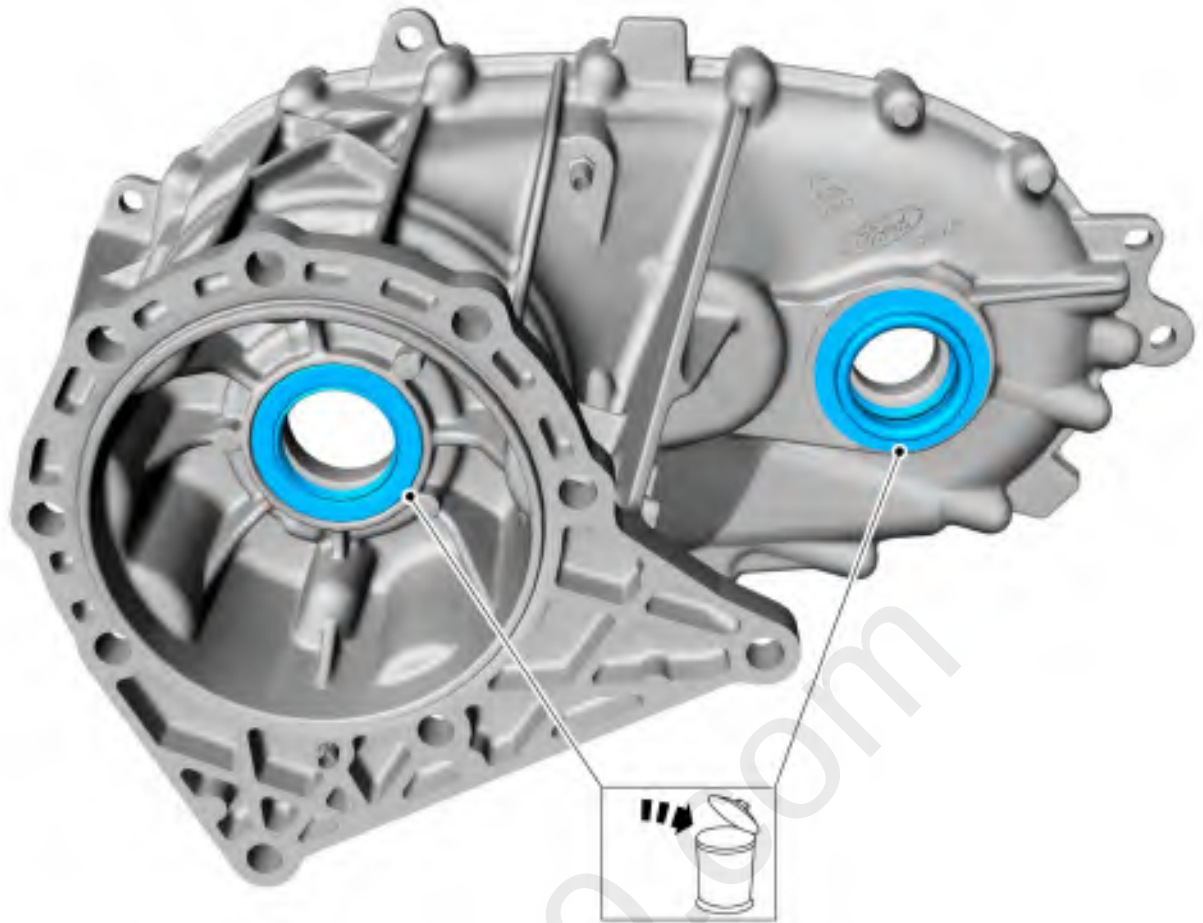


31. **NOTICE:** Do not let the front output shaft fall while removing the snap ring or damage to the component may occur.

Remove the output shaft circlip and the out put shaft.



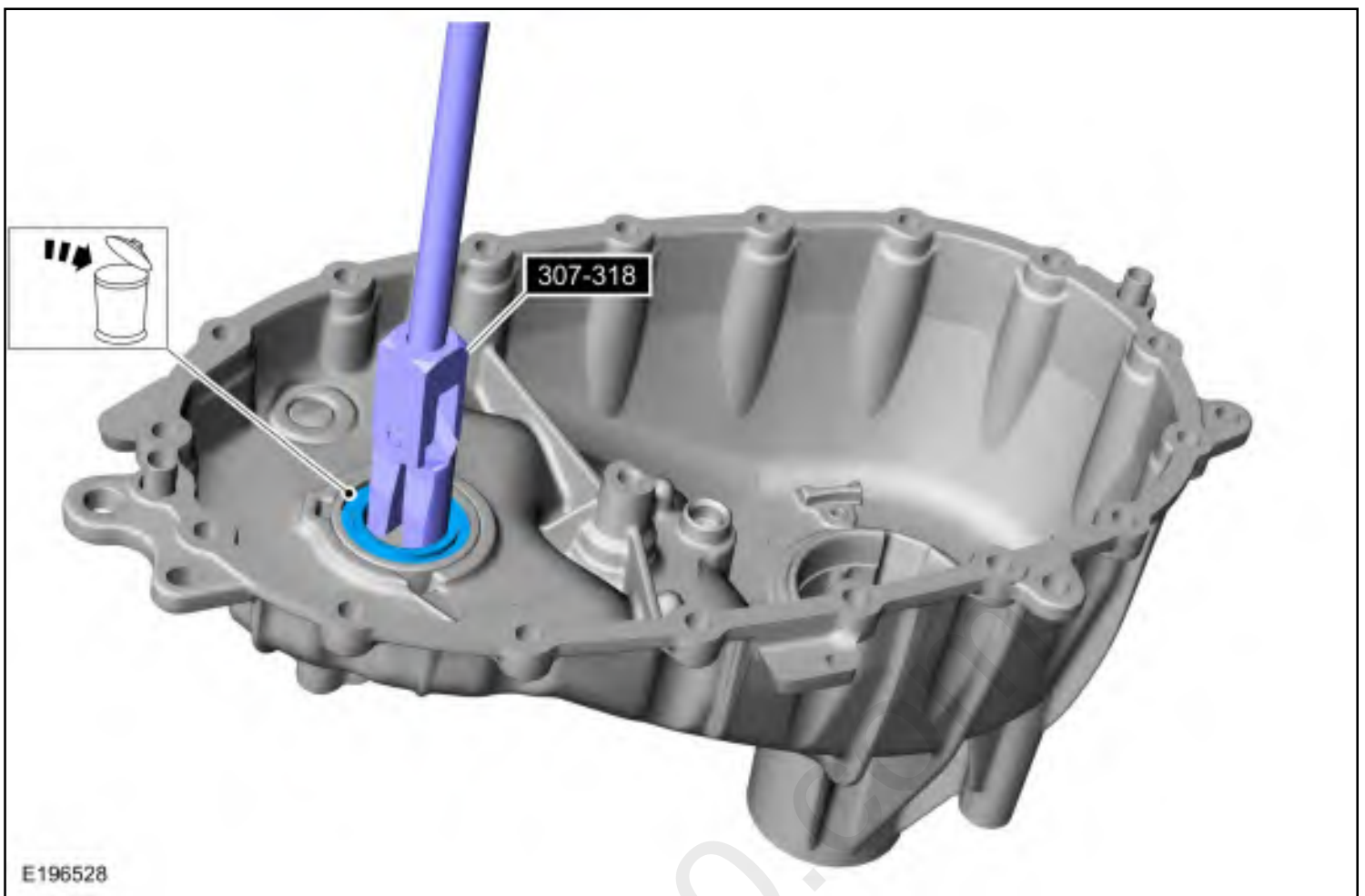
32. Remove and discard the front input shaft seal and the front output shaft seal.



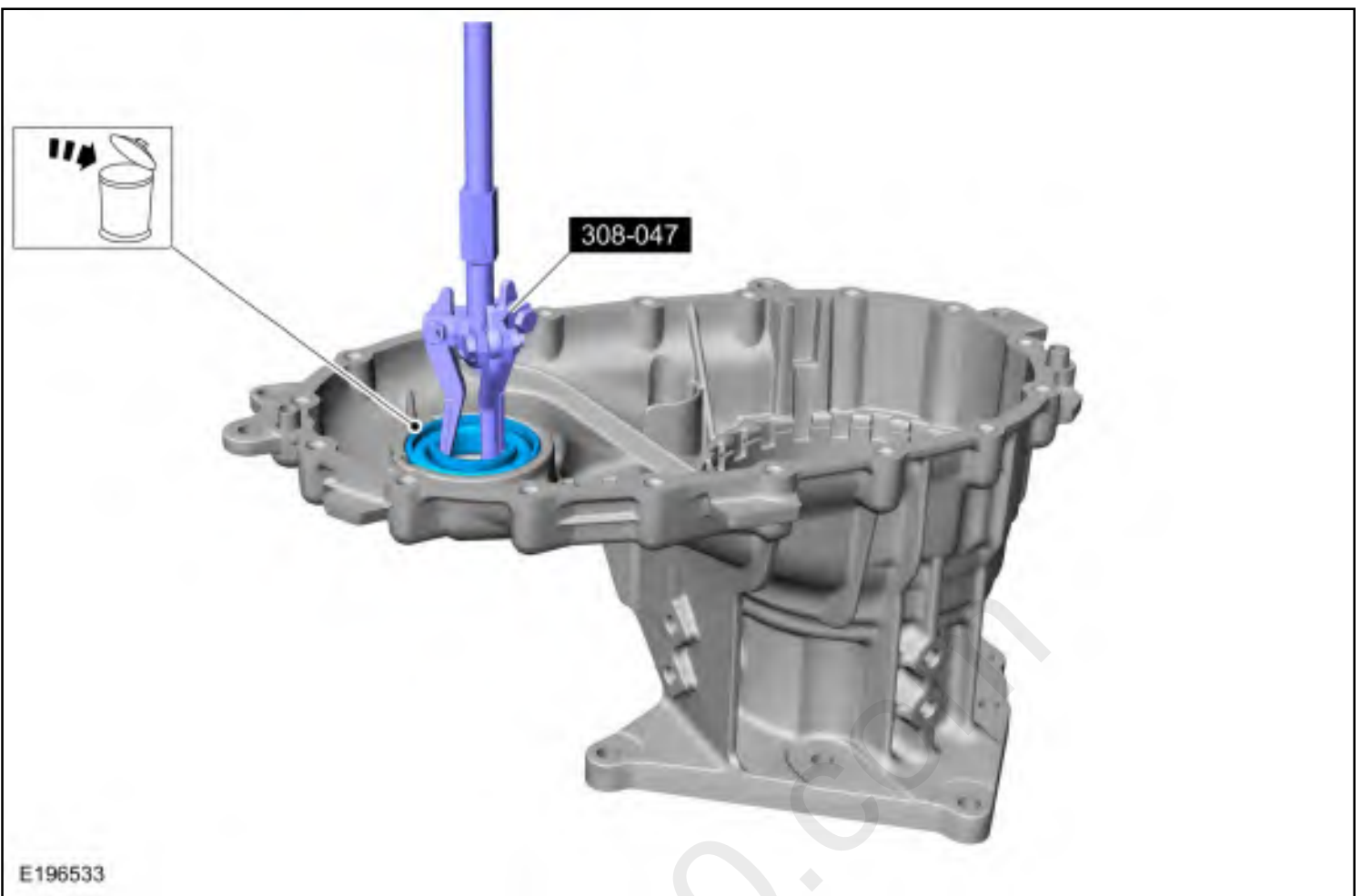
33. Using the special tool with the Slide Hammer, remove the rear output shaft bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



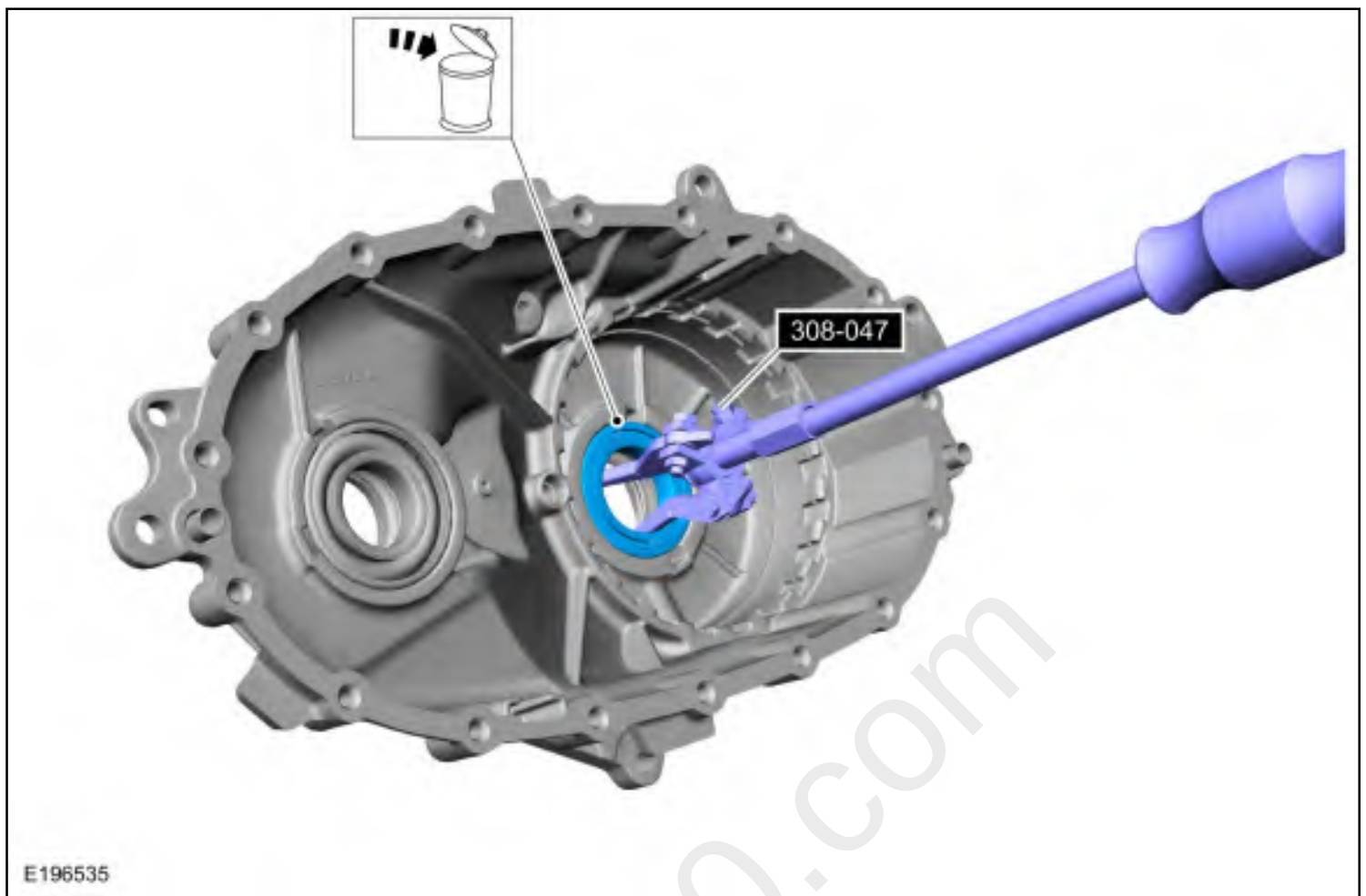
34. Using the special tool and a Slide Hammer, remove the front output shaft support bearing.
Use Special Service Tool: 307-318 Remover, Stator Bearing.
Use the General Equipment: Slide Hammer



35. Using the special tool with the Slide Hammer, remove the front output shaft bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



36. Using the special tool and a Slide Hammer, remove the front planet carrier bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



37. Clean and inspect the components of the transfer case for damage and install new components as necessary.

ASSEMBLY

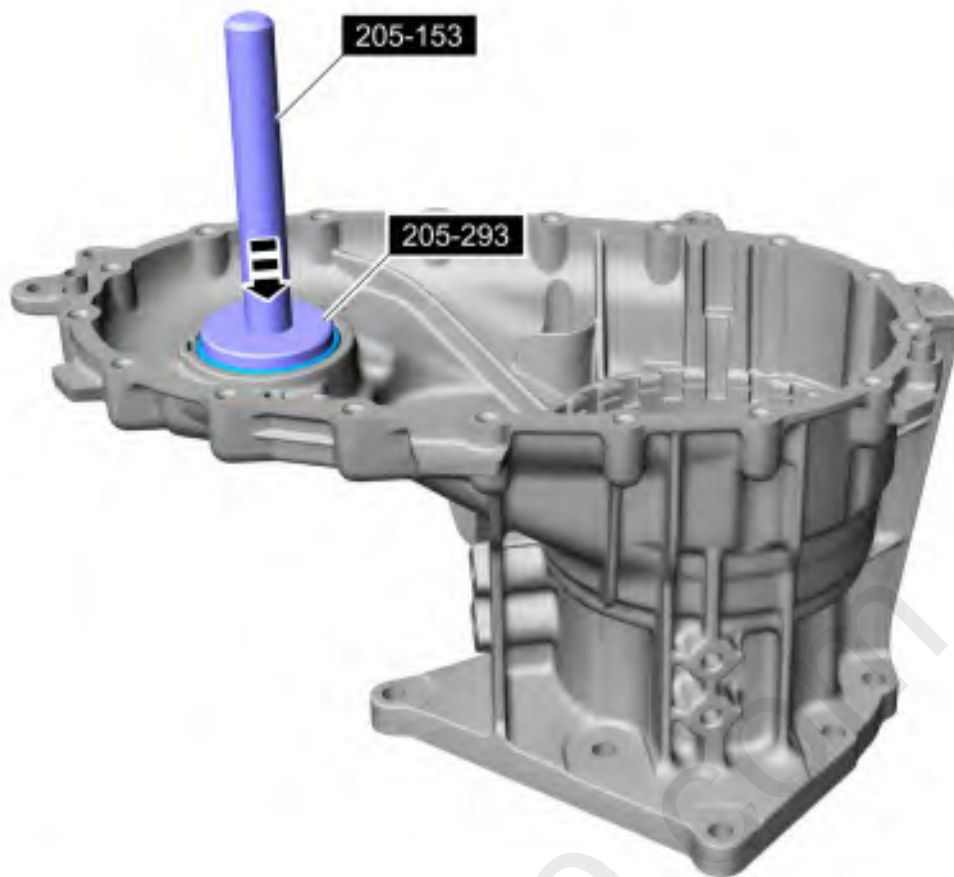
NOTE: Lubricate all internal components with the recommended transfer case lubricant during reassembly.

1. Using the special tools, install the front planet carrier bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-504 Installer, Halfshaft Pilot Bearing.



E196536

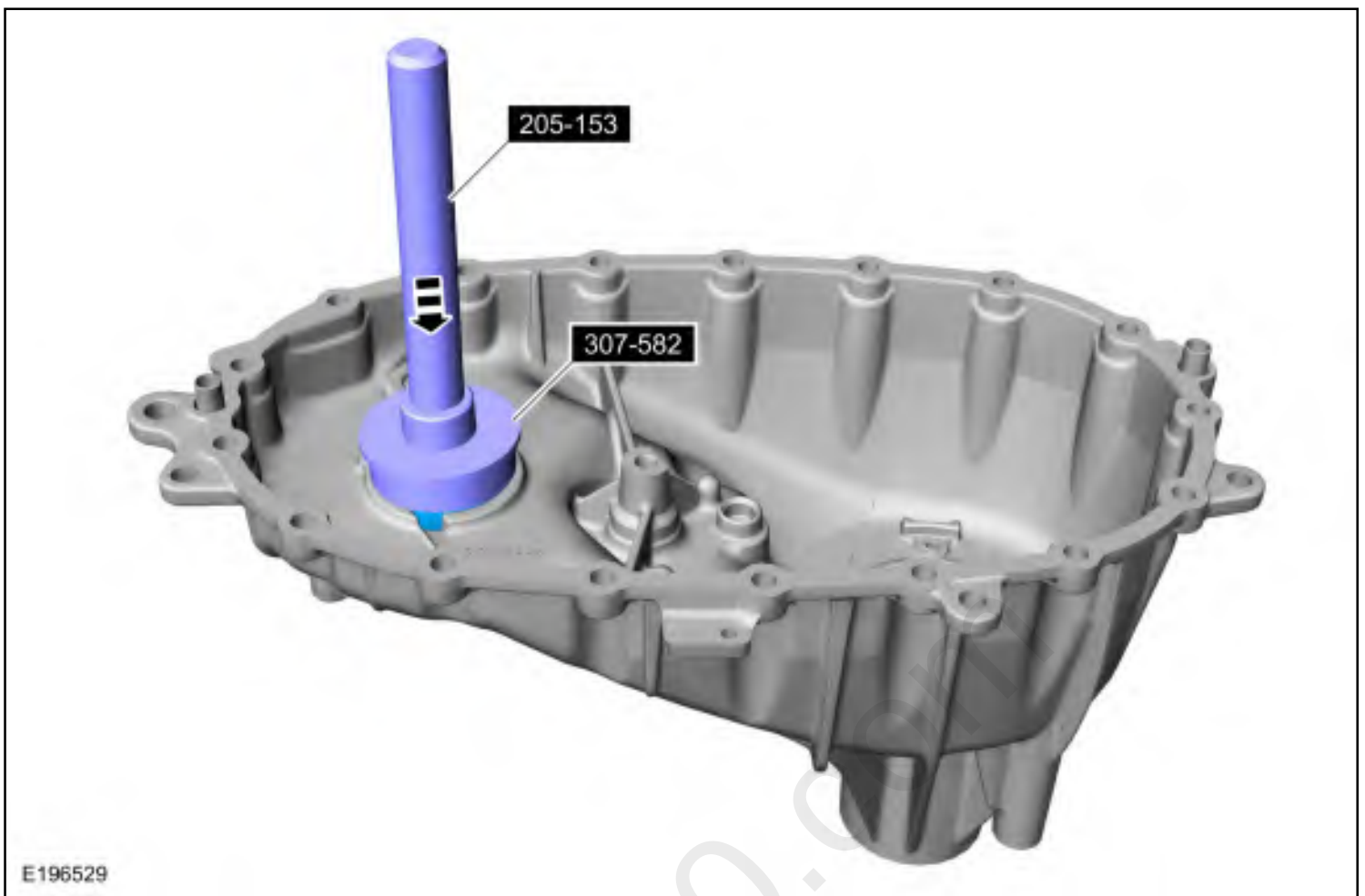
2. Using the special tools, install the front output shaft bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-293 (T89P-4850-A) Installer, Differential Oil Seal.



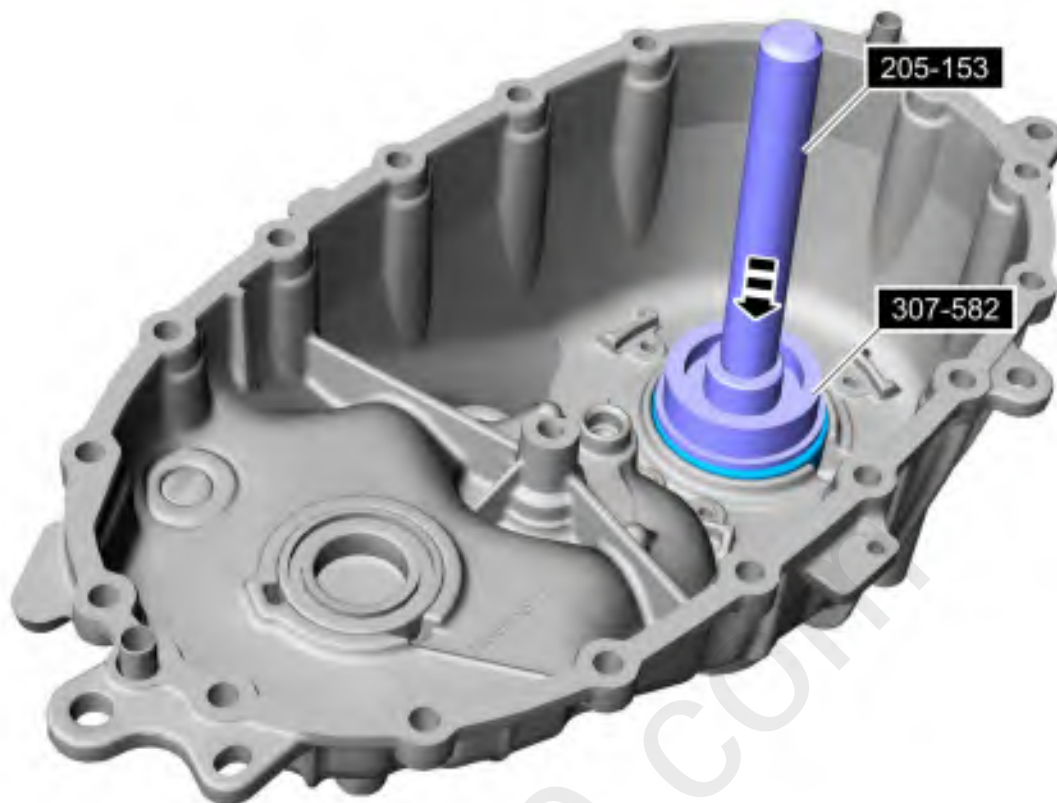
E196534



3. Using the special tool, install the front output shaft support bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 307-582A Cover Axle Seal Installer.

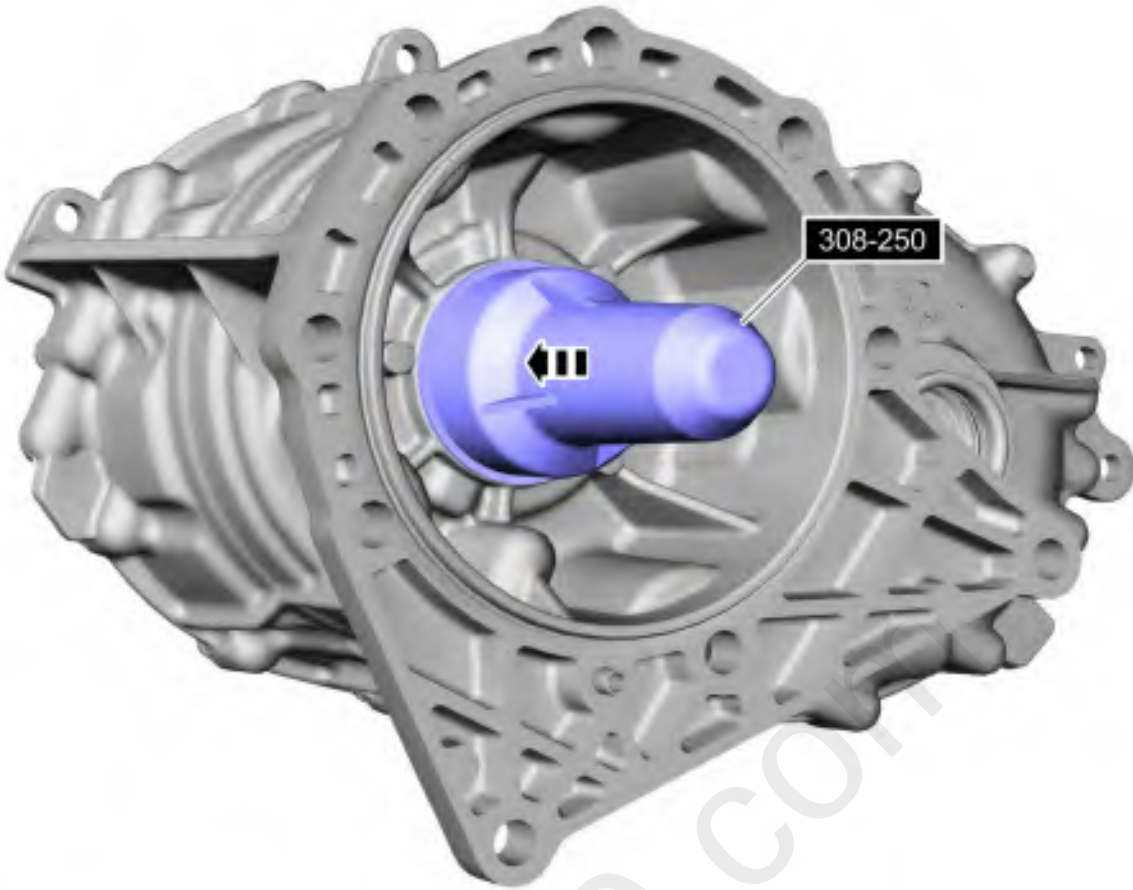


4. Using the special tool, install the rear output shaft bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 307-582A Cover Axle Seal Installer.



E196527

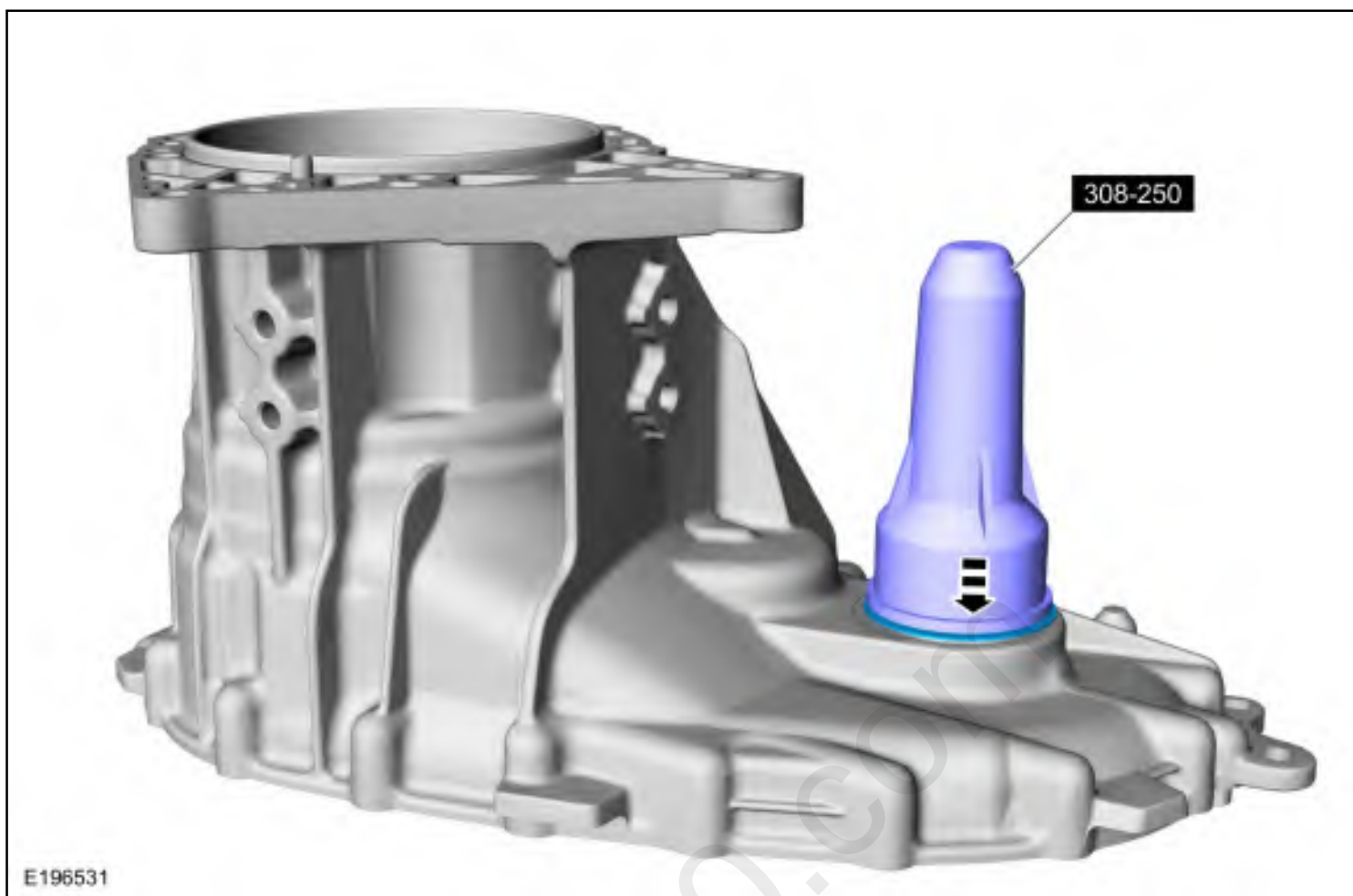
5. Using the special tool, install the input shaft seal.
Use Special Service Tool: 308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal.



E196532

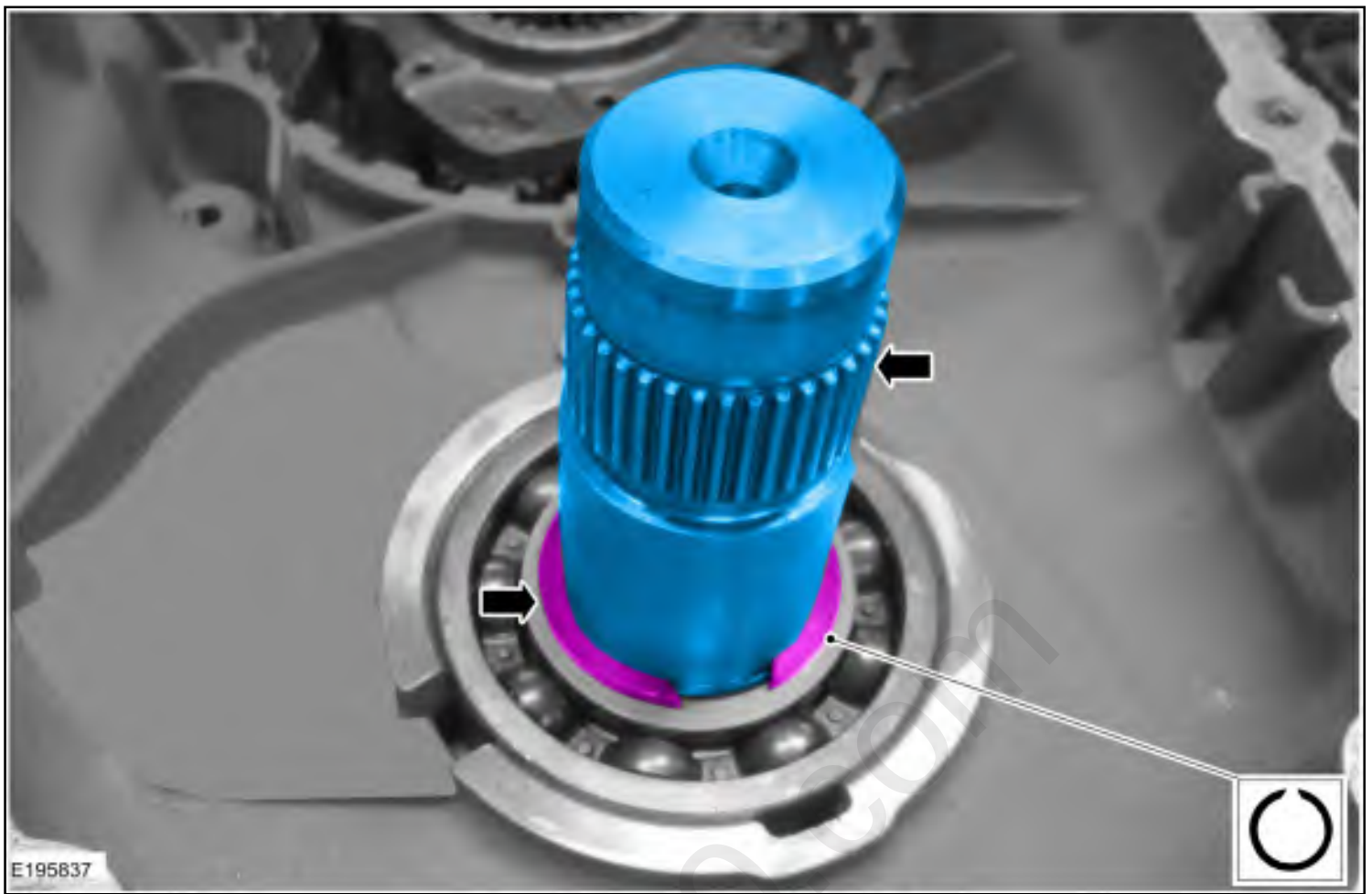


6. Using the special tool, install the front output shaft seal.
Use Special Service Tool: 308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal.

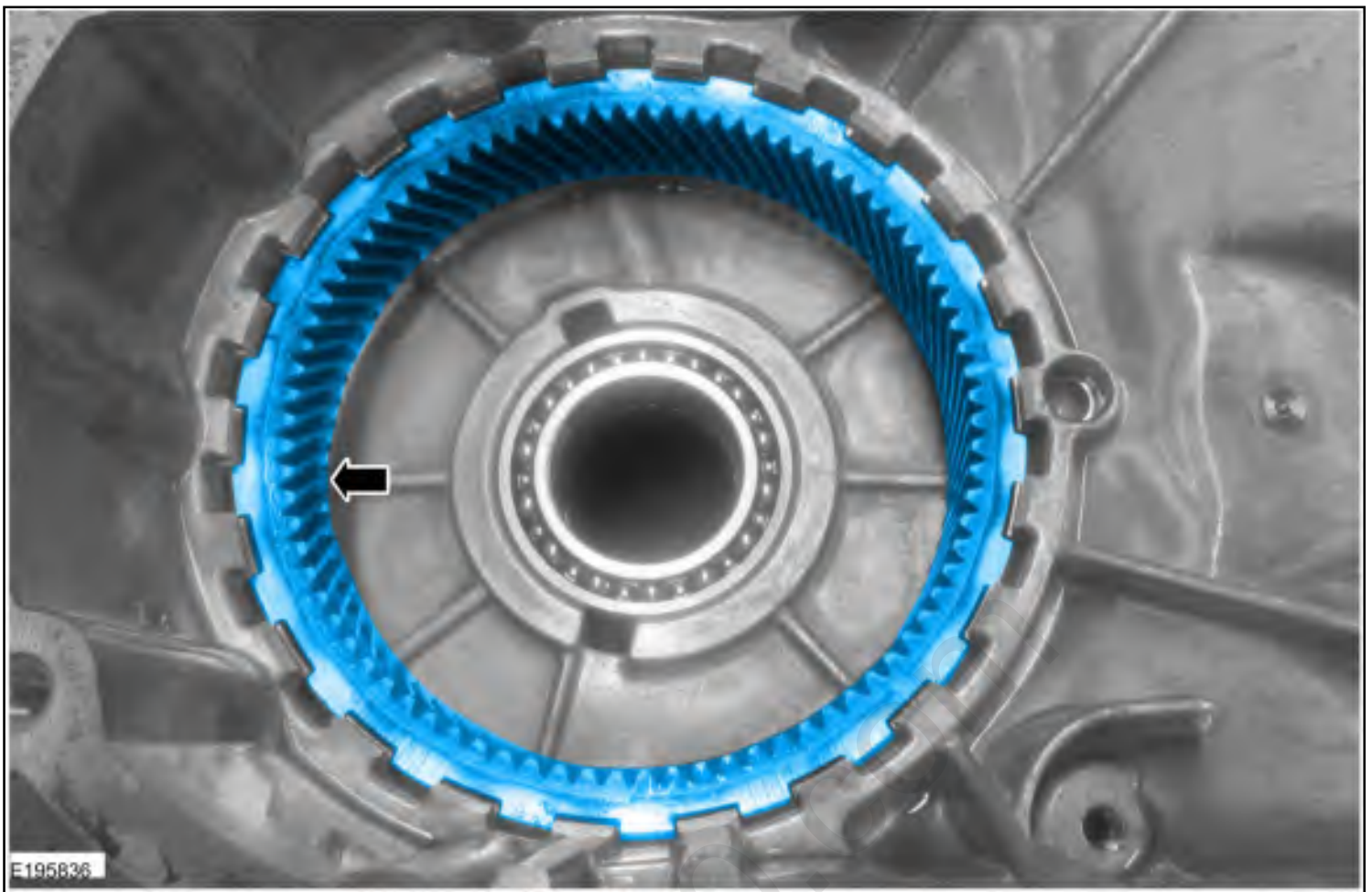


7. **NOTICE: Do not let the front output shaft fall while removing the snap ring or damage to the component may occur.**

Install the output shaft and the out put shaft circlip.



8. Install the ring gear.



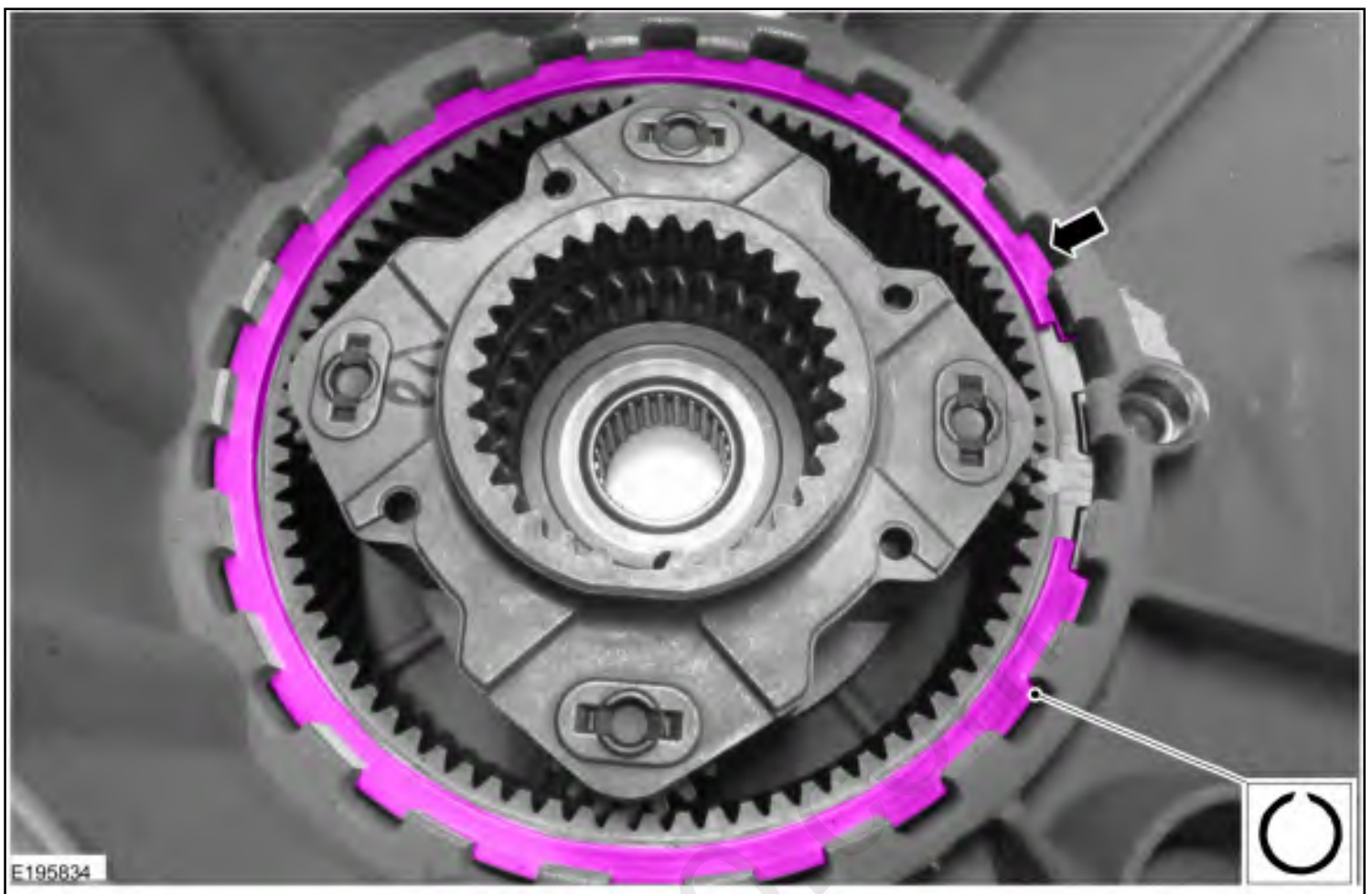
9. If removed, using a press and the special tool, install the needle bearing into the front planet carrier.
Use Special Service Tool: 308-085 (T83T-7025-C) Installer, Input Shaft Bearing.

10. **NOTE:** *Replace the inner planet carrier needle bearing if necessary.*

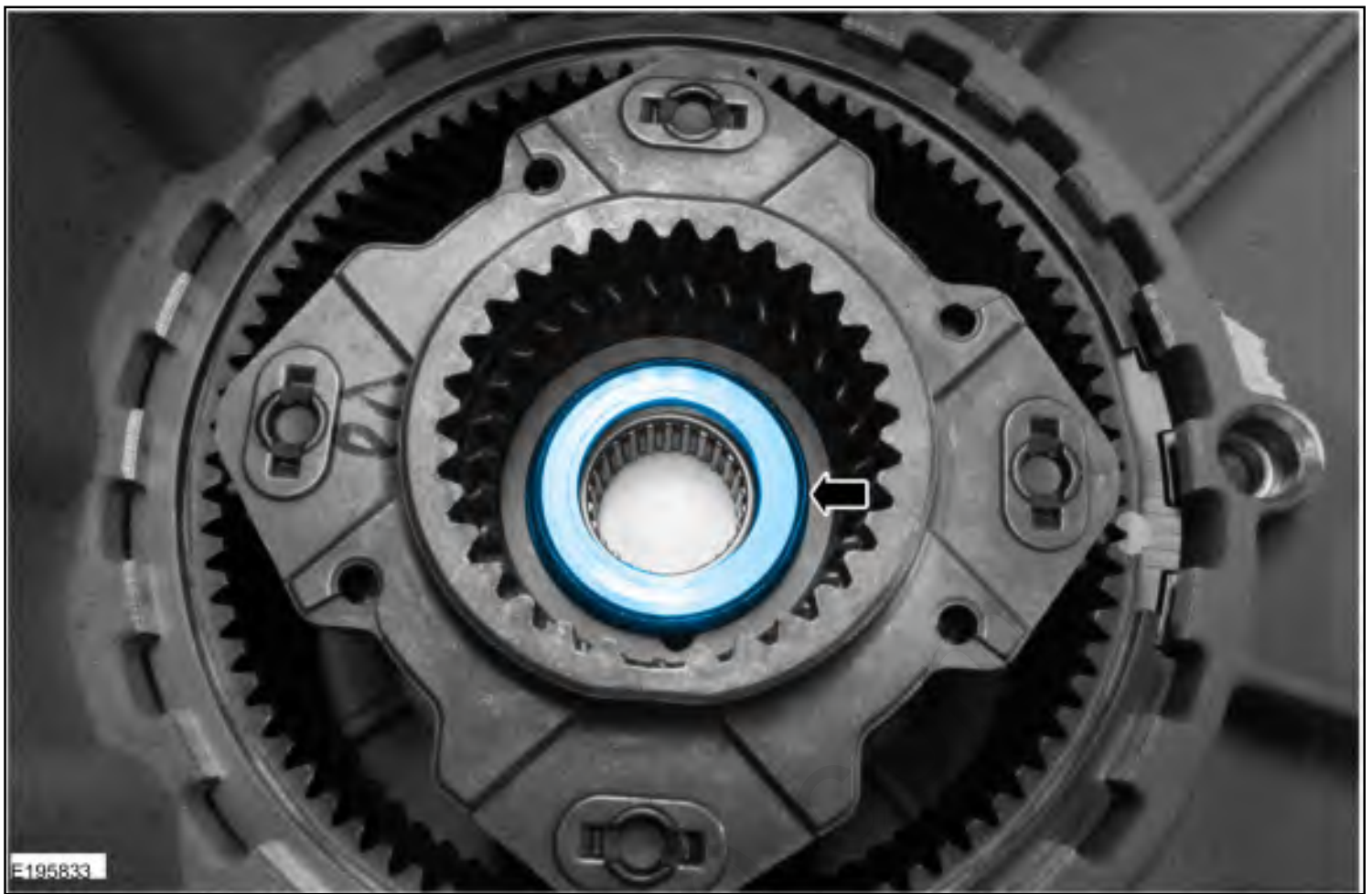
Install the front planet carrier.



11. Install the ring gear circlip.



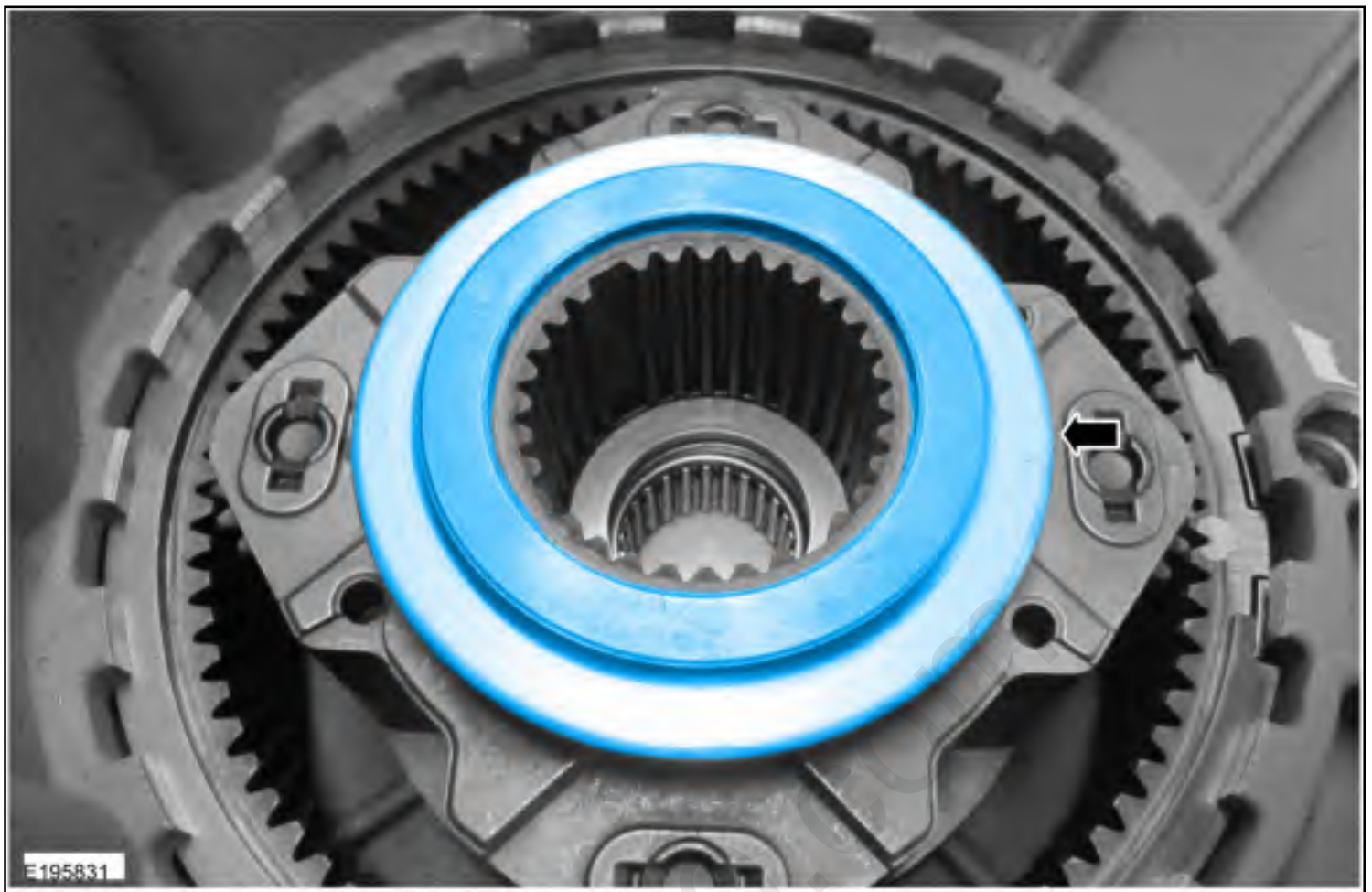
12. Install the planet carrier thrust bearing.



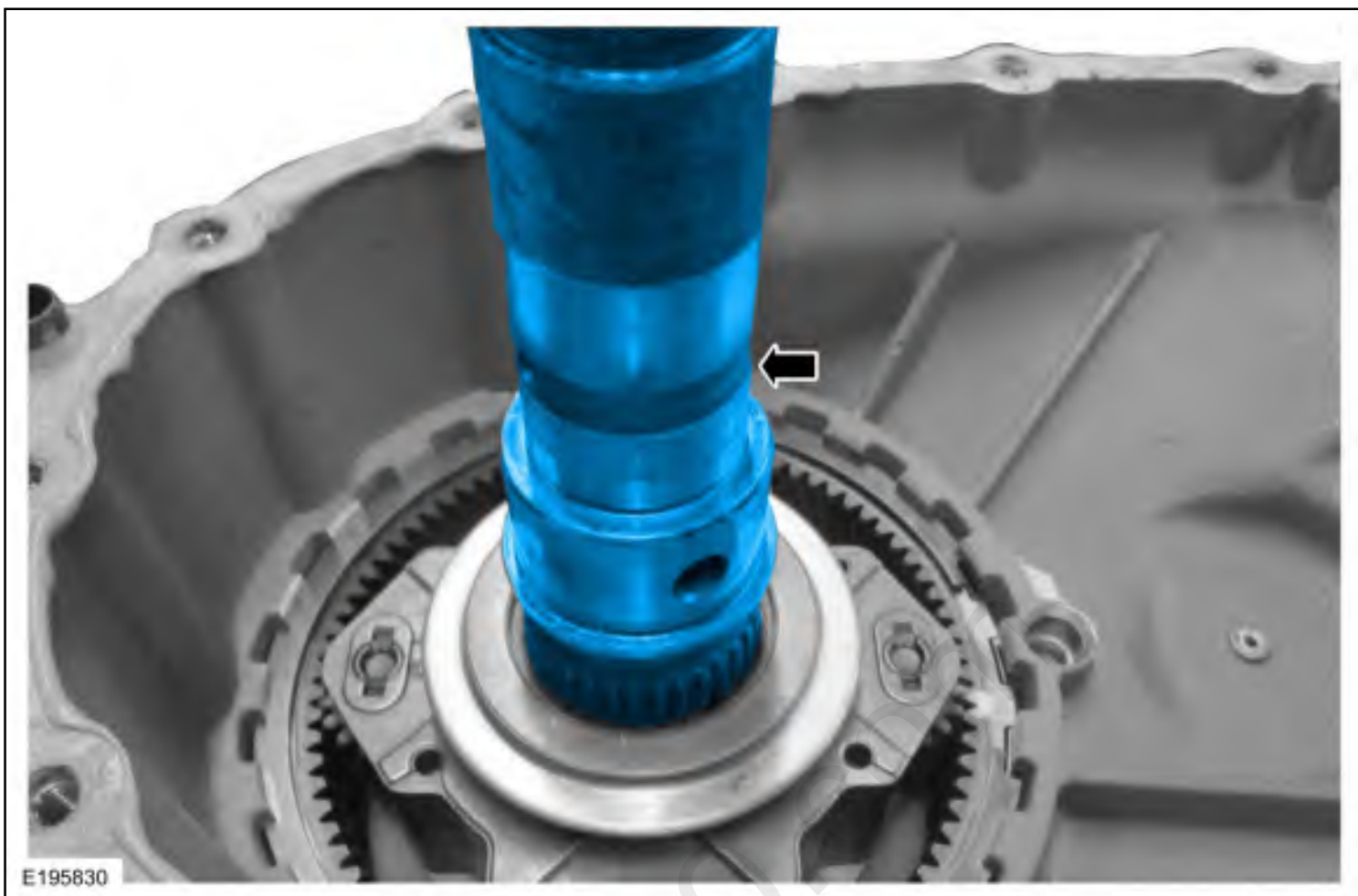
13. Install the electric shift cam assembly.



14. Install the reduction hub.



15. Install the output shaft.



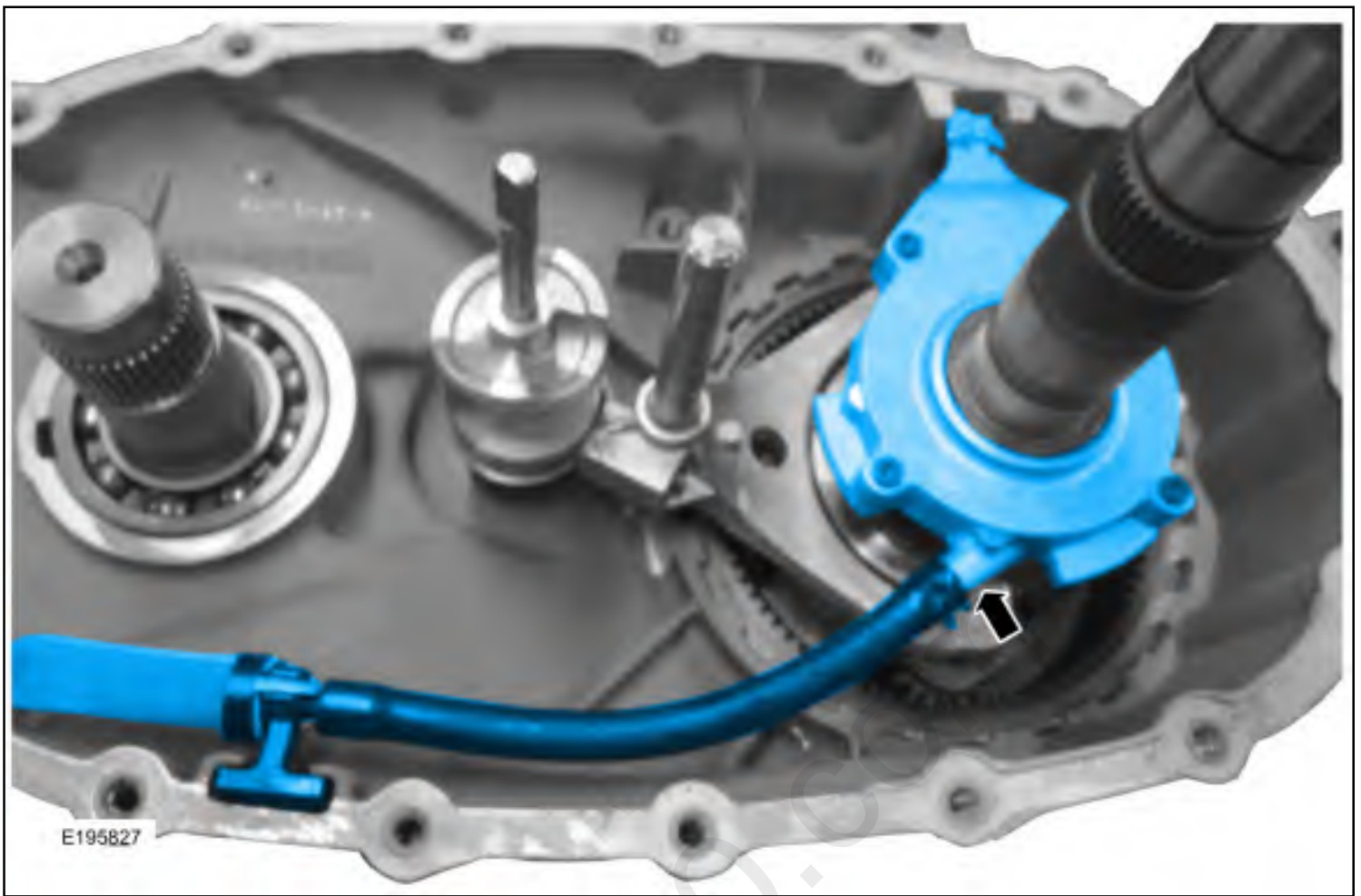
16. Install the shift fork.



17. Install the shift rail.



18. Install the oil pump assembly.



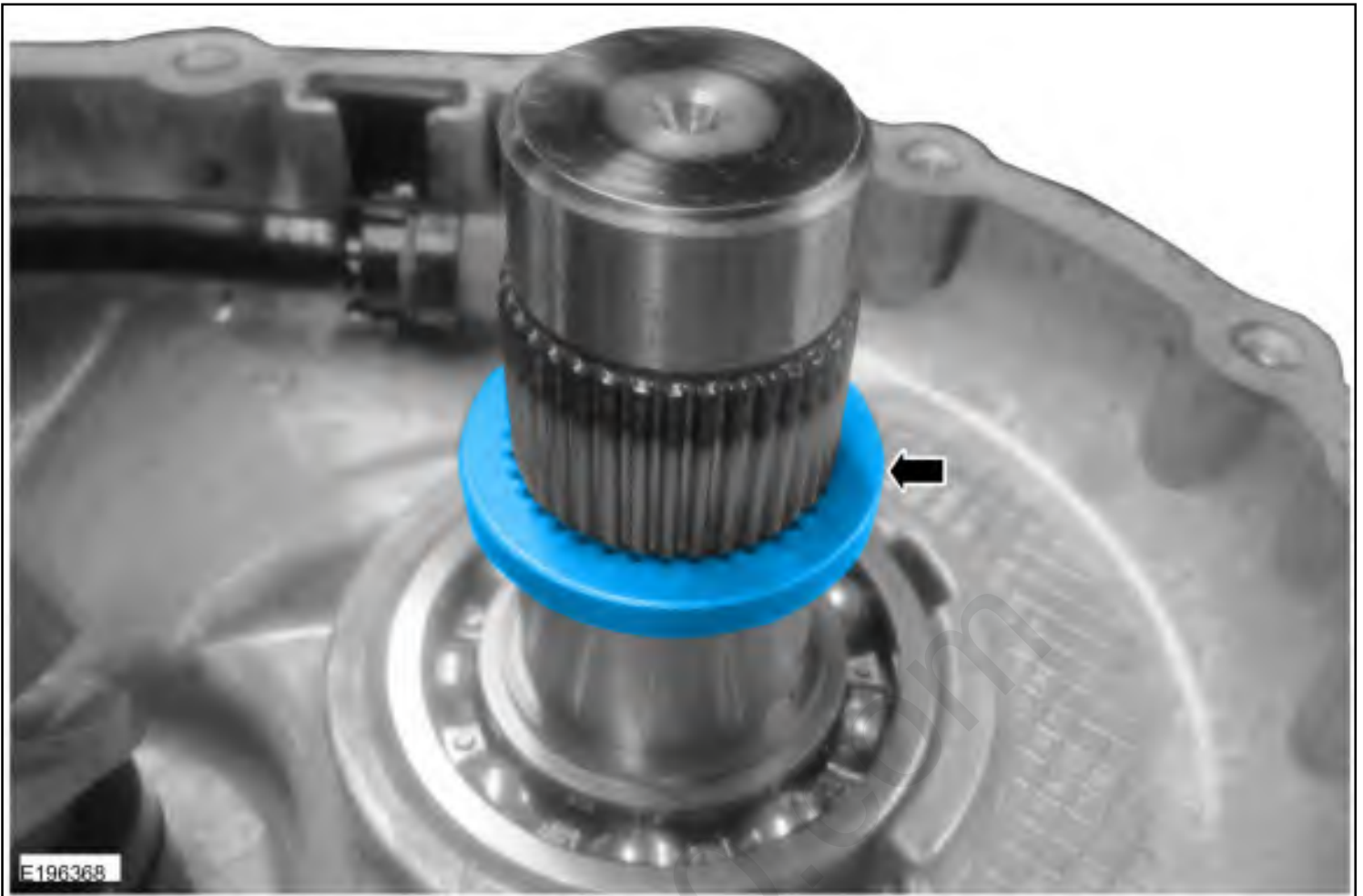
19. Install the magnet into its slot in the case.



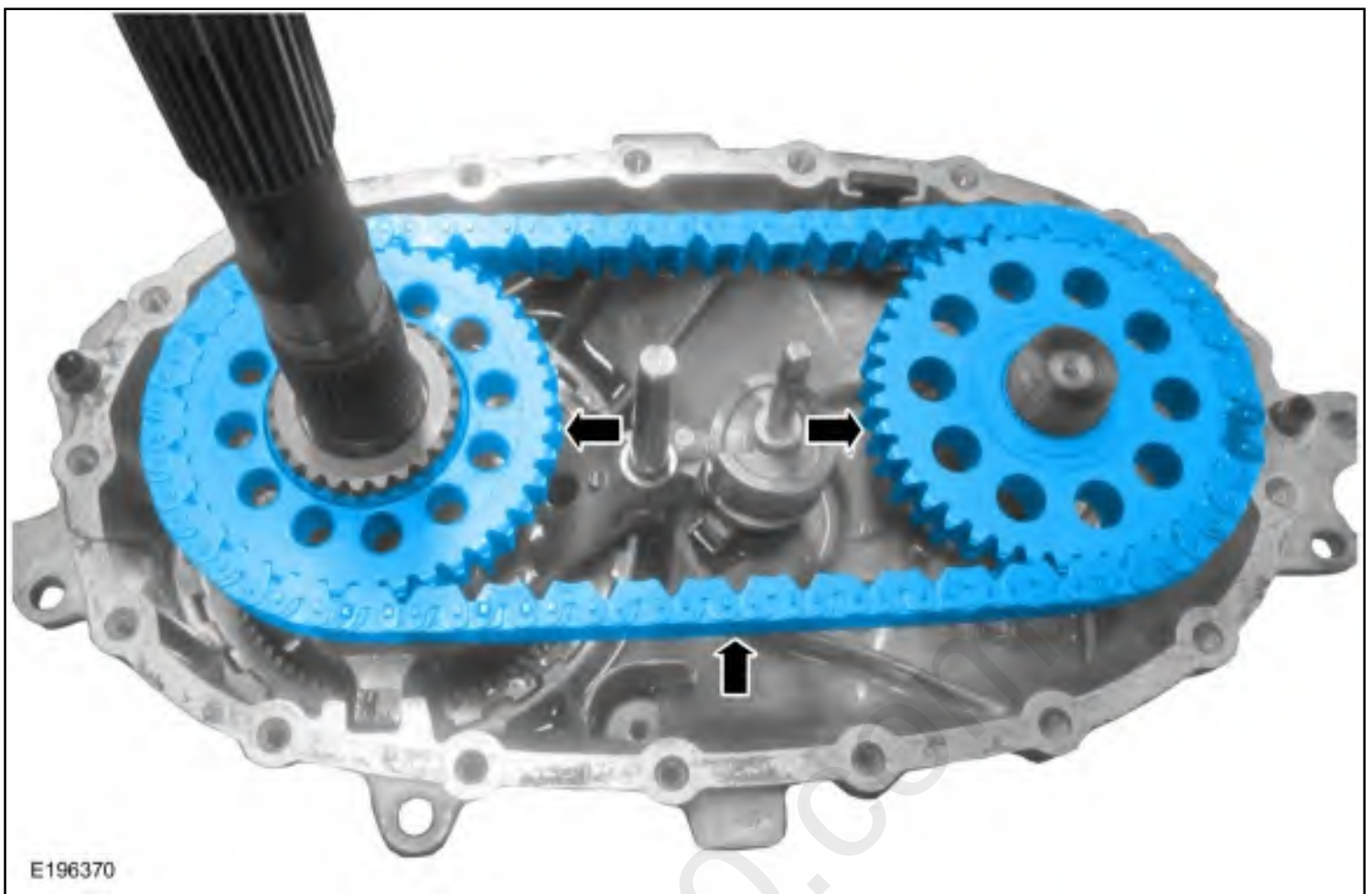
- 20.
- Install the thrust bearing assembly.
- Install the thrust washer.
 - Install the thrust bearing.
 - Install the thrust washer.



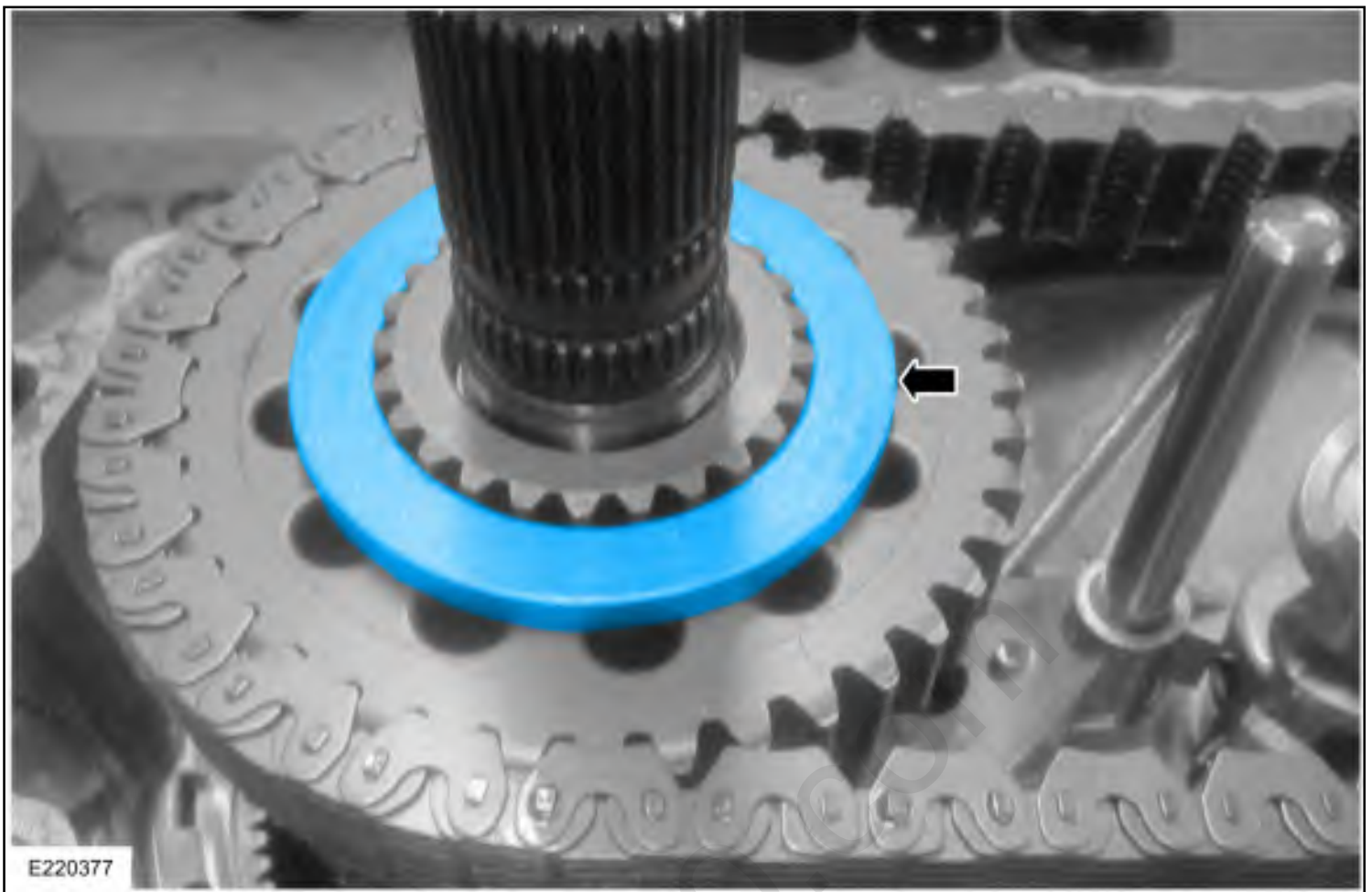
21. Install the output shaft sprocket spacer.



22. Install the drive chain and the sprockets as an assembly.



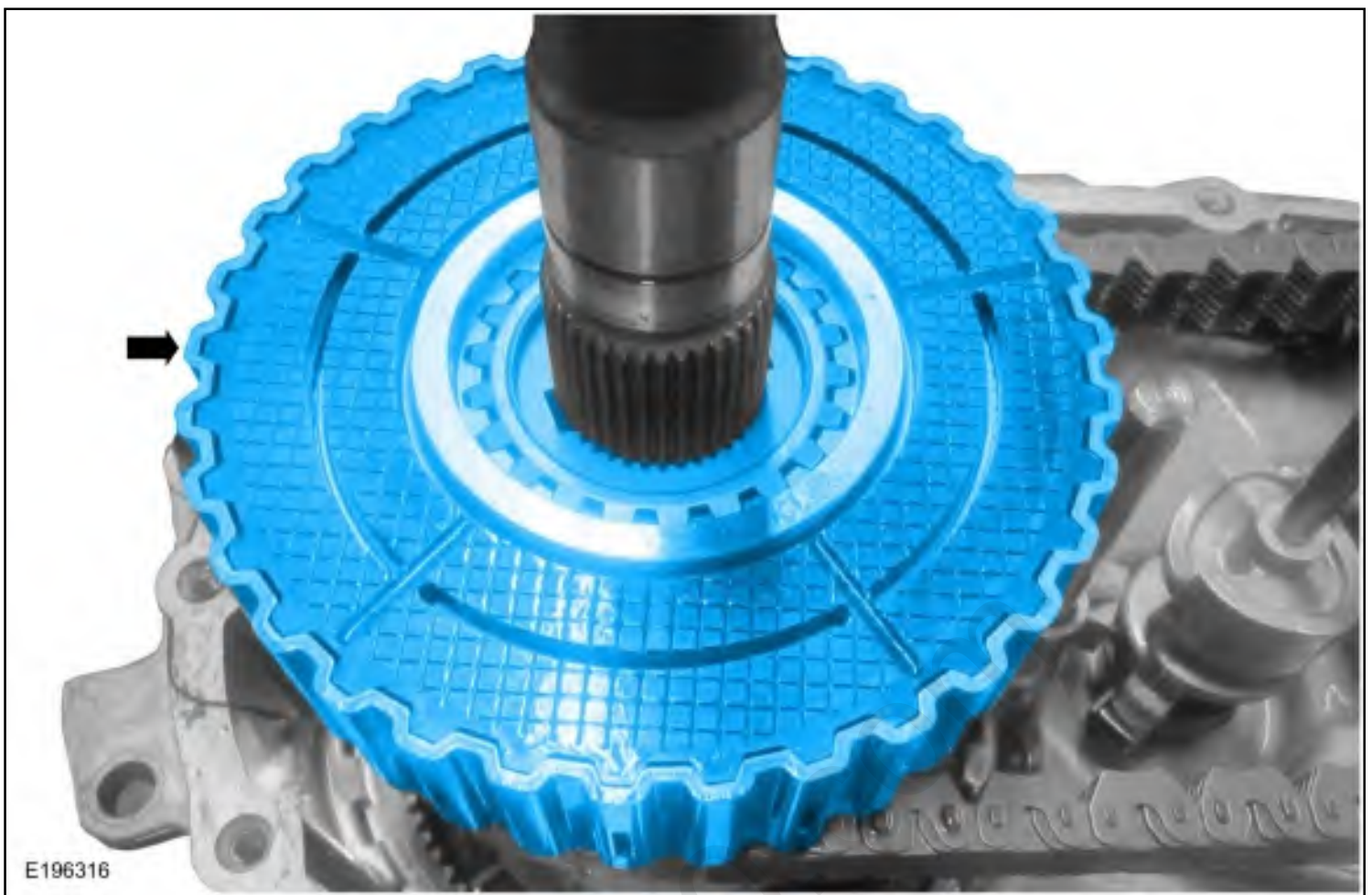
23. Install the clutch pack spacer.



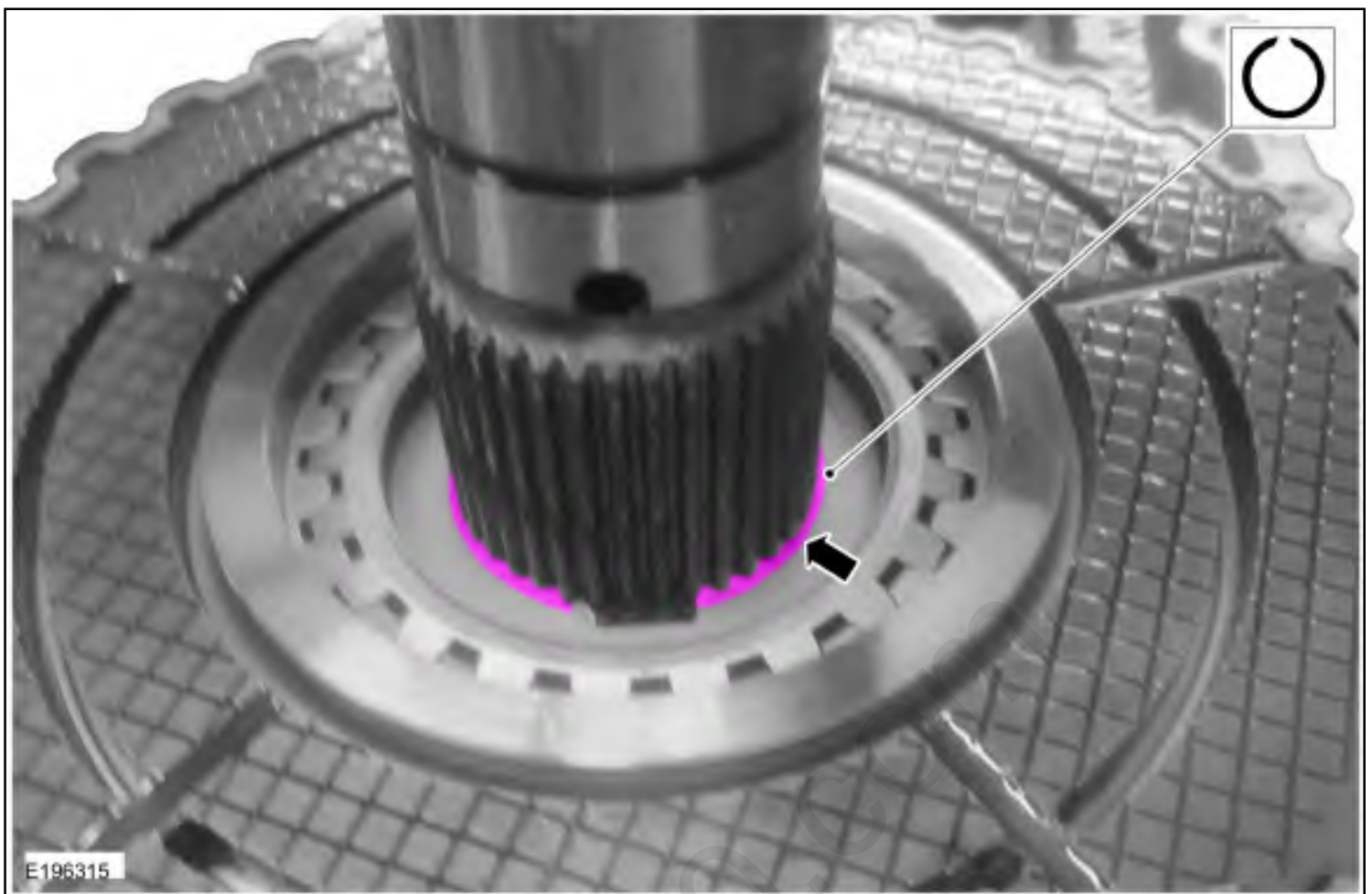
24. **NOTICE:** When installing the clutch assembly, do not separate the clutch pack assembly. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem will occur.

NOTICE: If the clutch pack is disassembled, a new clutch pack and armature must be installed. Failure to install a new clutch pack can result in component failure.

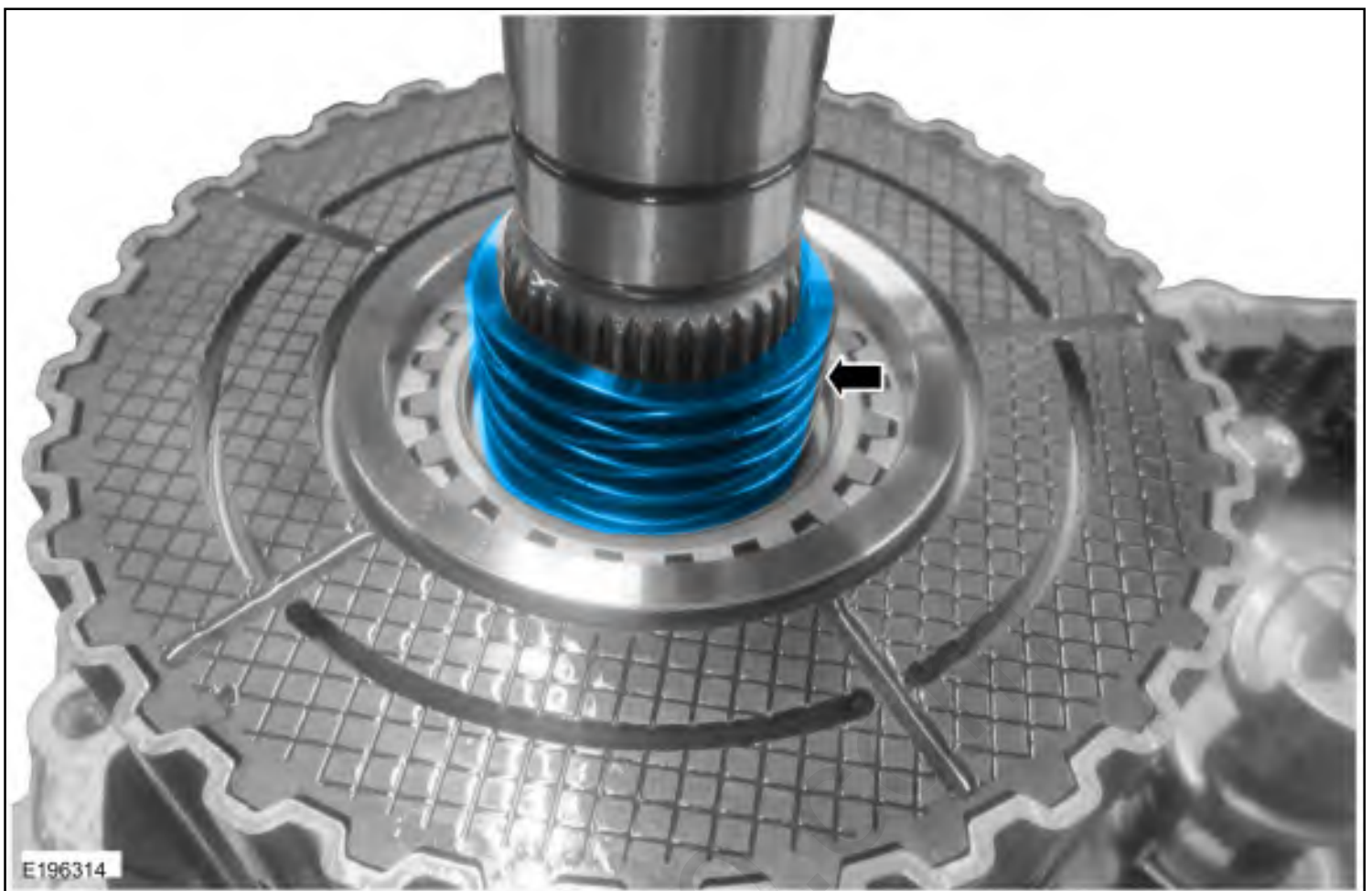
Install the clutch pack assembly with the armature.



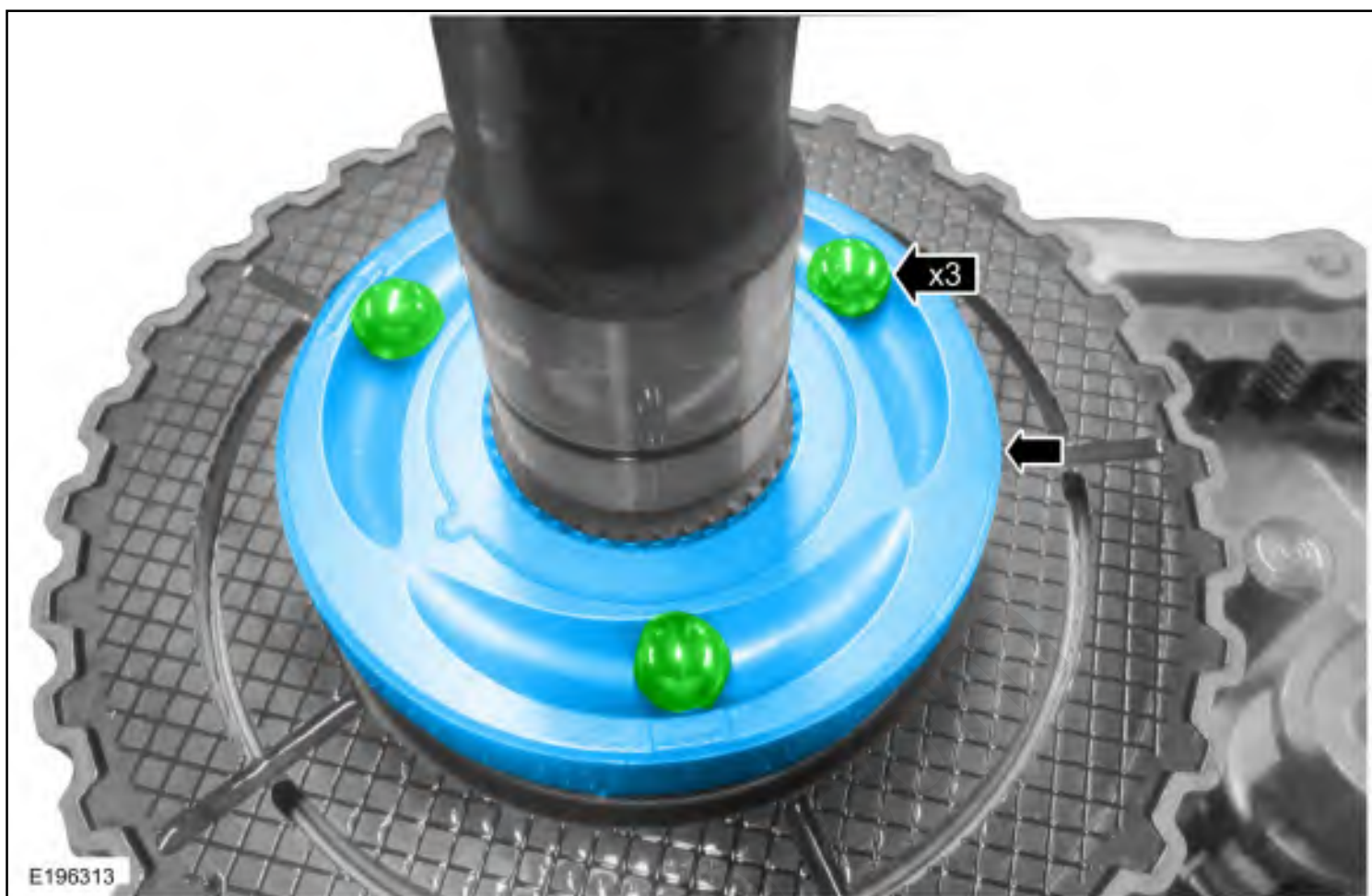
25. Install the clutch pack circlip.



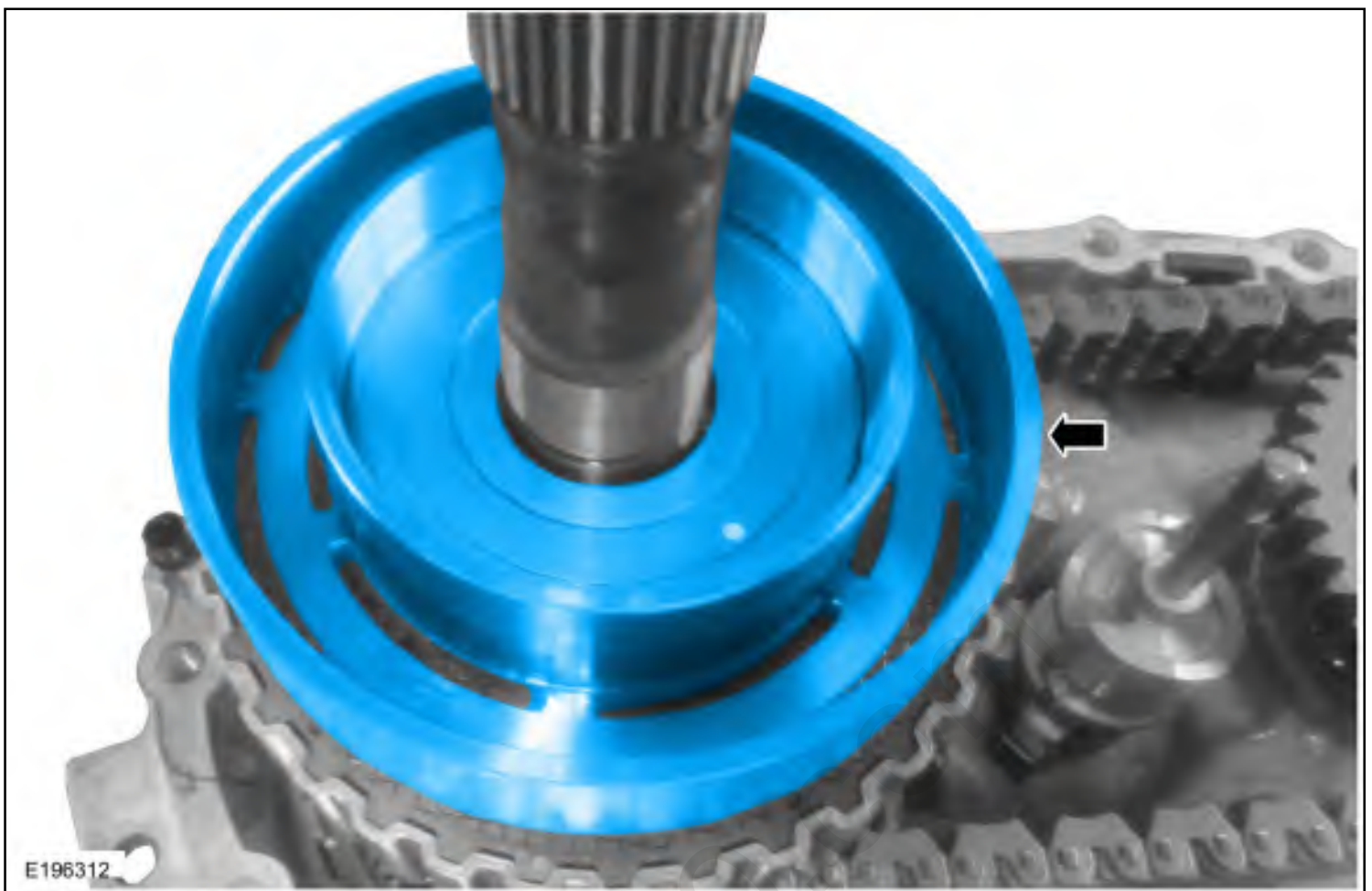
26. Install the wave spring.



27. Install the cam and the steel balls.



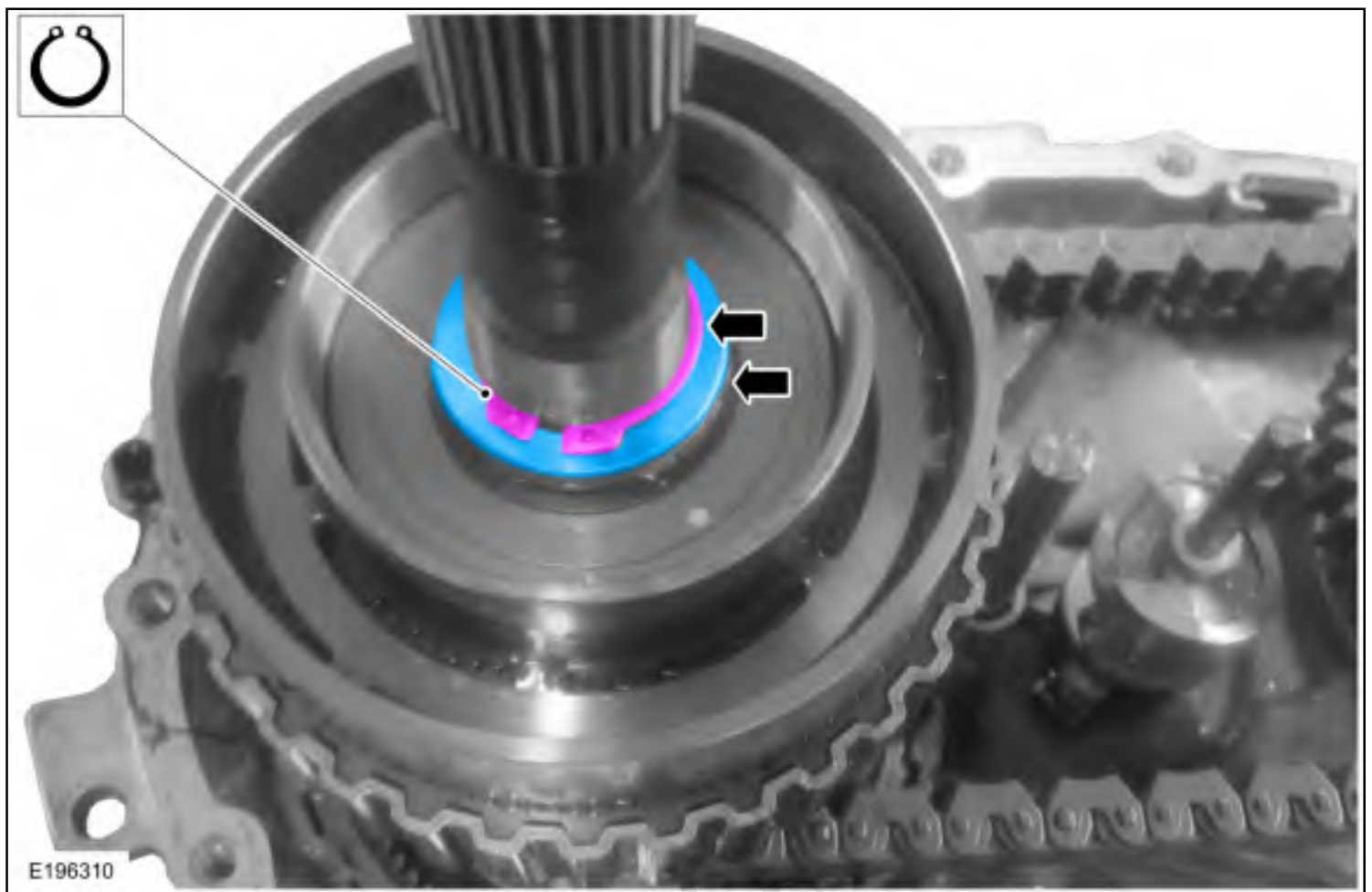
28. Install the coil housing.



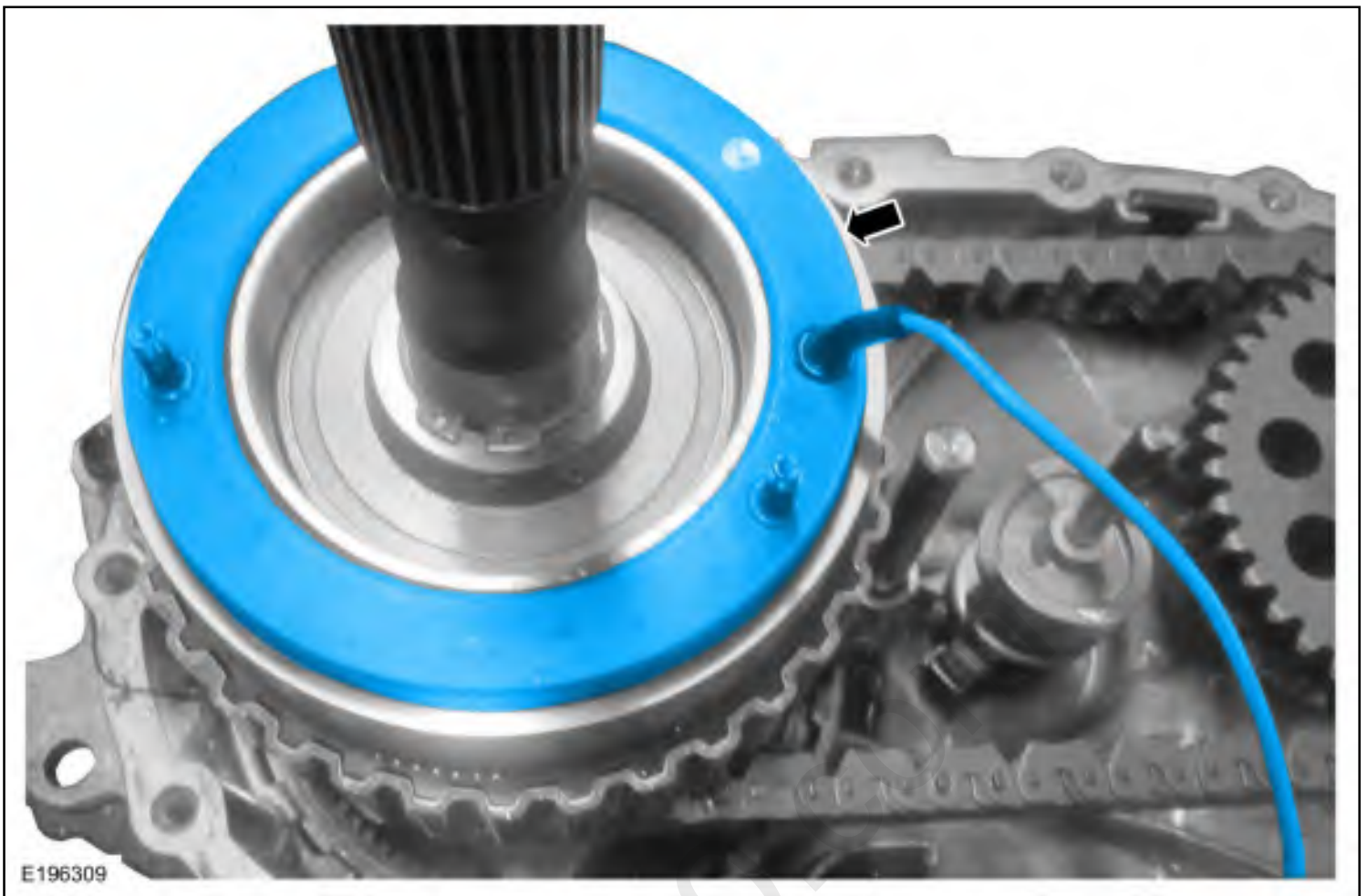
29. Install the coil housing thrust bearing assembly.



30. Install the coil housing spacer and snap ring.



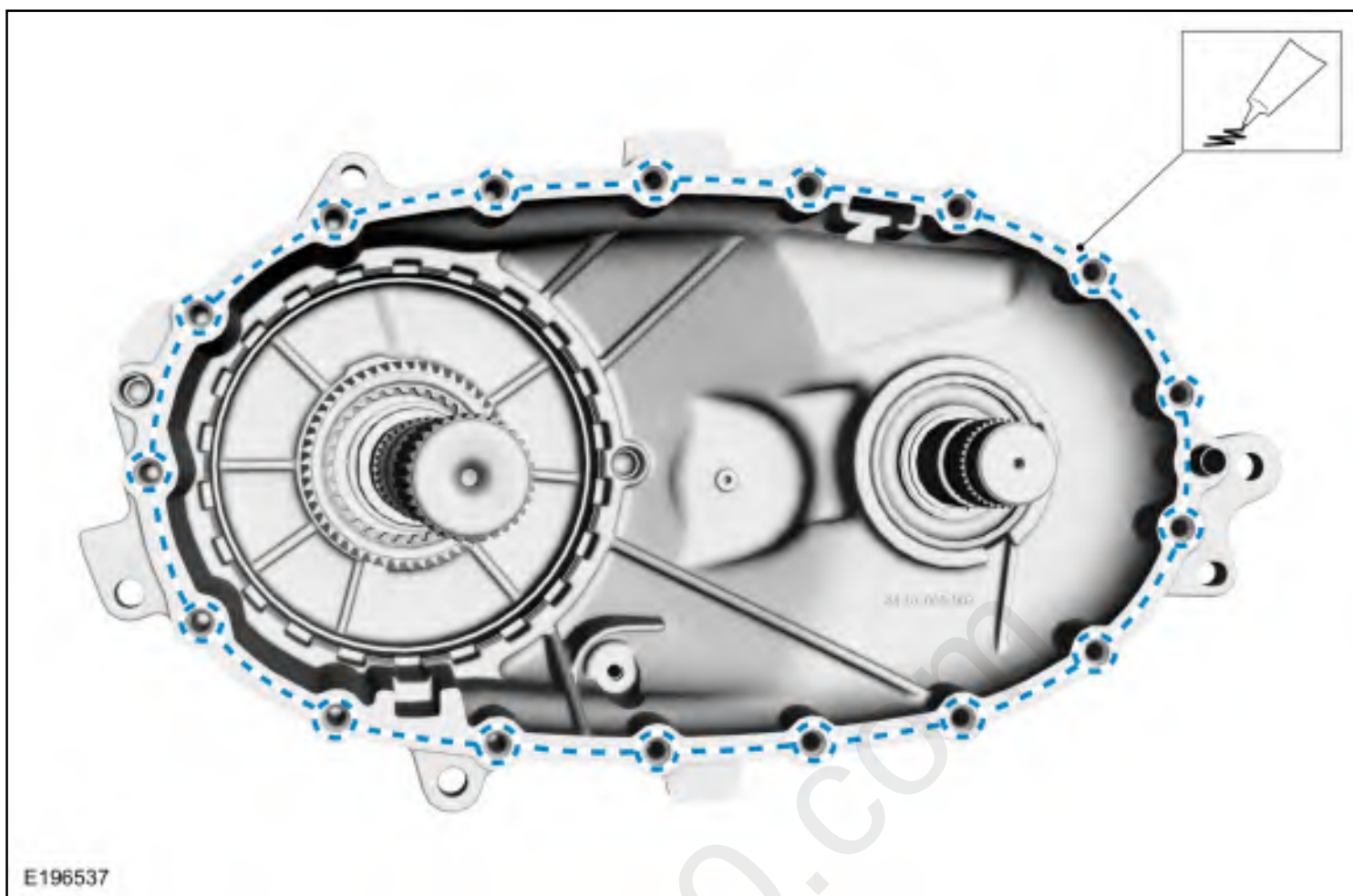
31. Install the transfer case field coil.



32. **NOTE:** Only apply enough silicone sealant to seal the transfer case halves together.

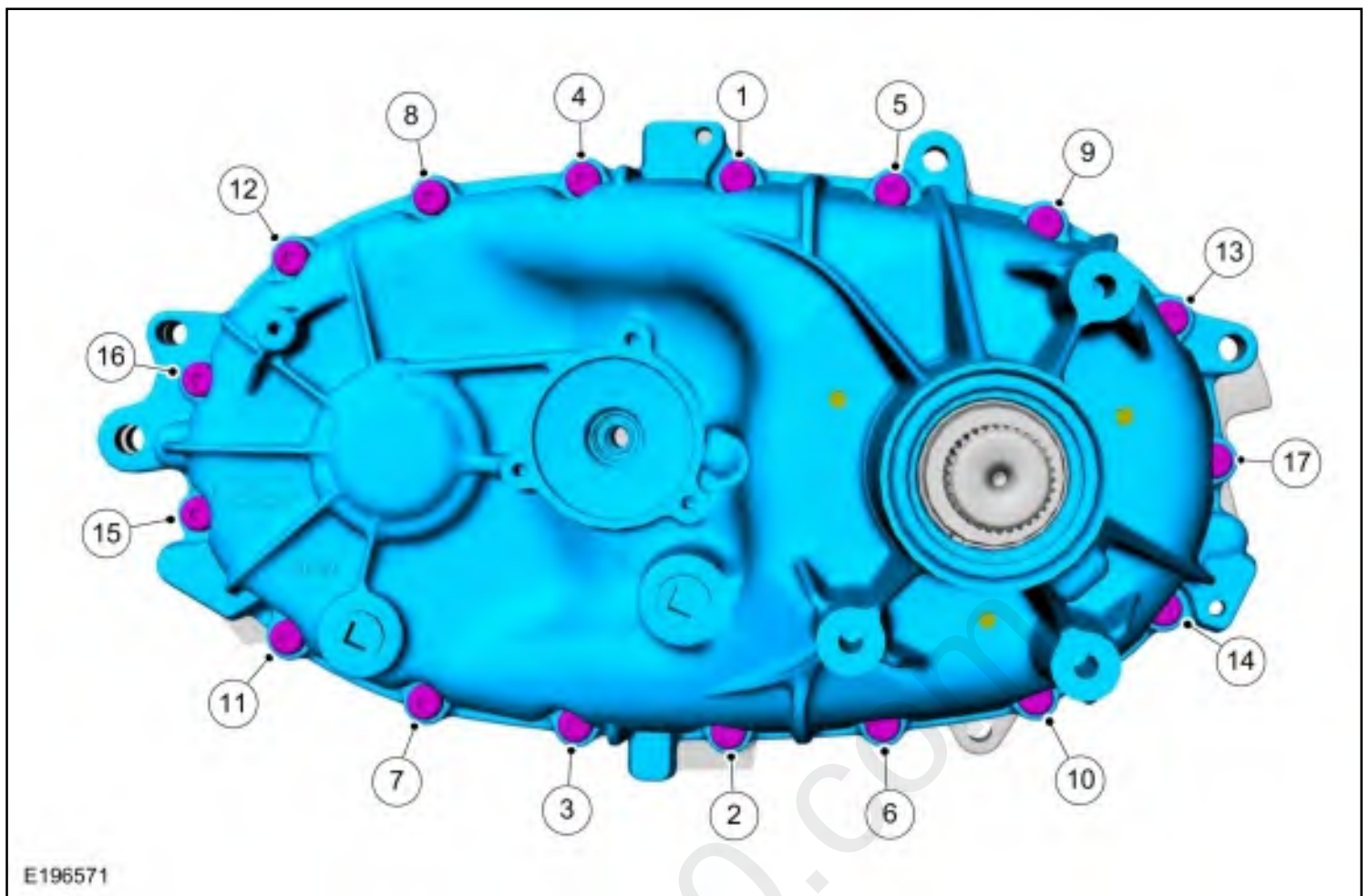
Apply a small bead of silicone sealant to the mating surface of the case half.

Material: Motorcraft® Ultra Silicone Sealant / TA-29

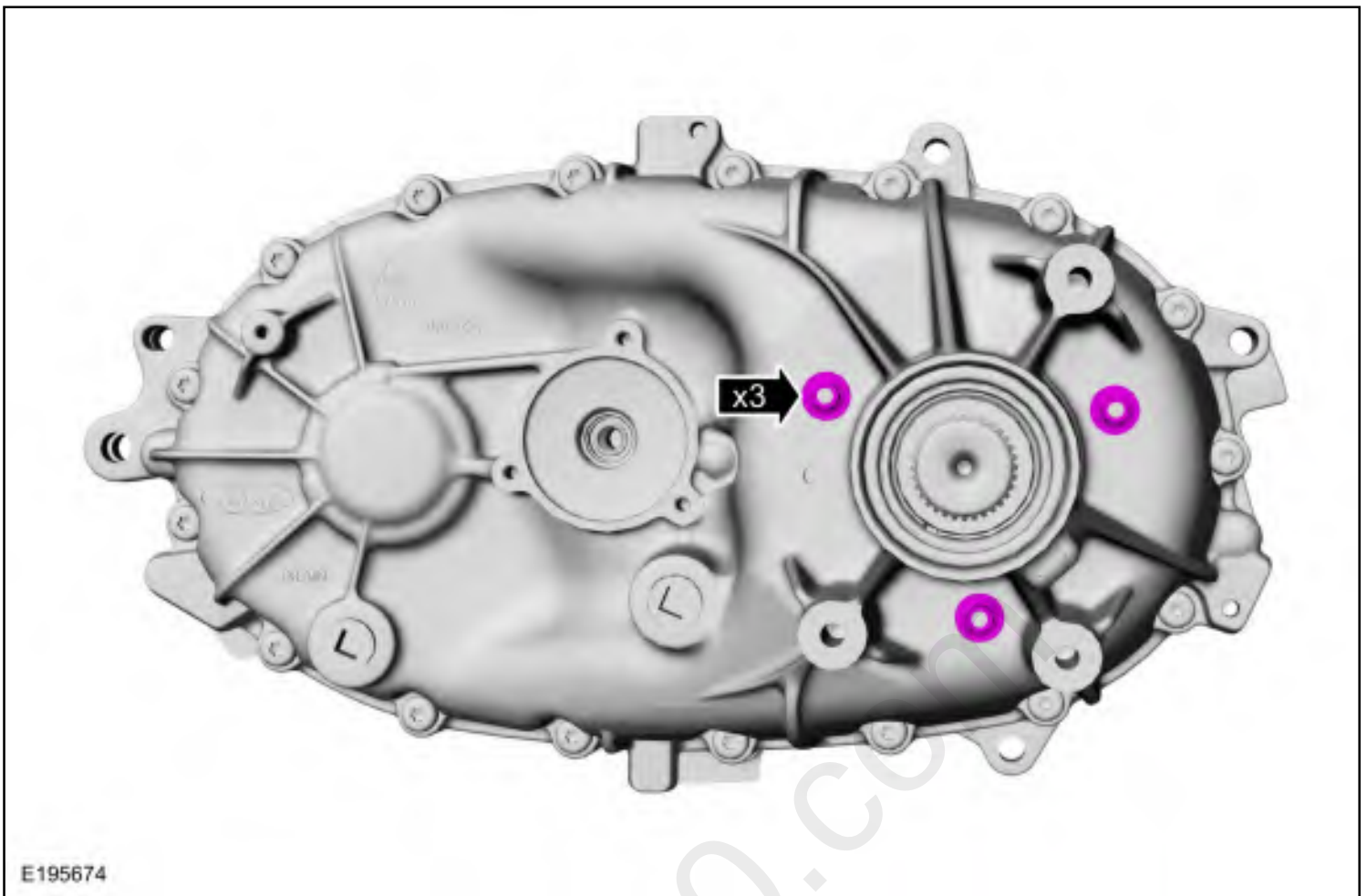


33. **NOTE:** Position the field coil bolts to align with the field coil bolt holes in the rear case. Position field coil wire through the field coil wire through hole in the case.

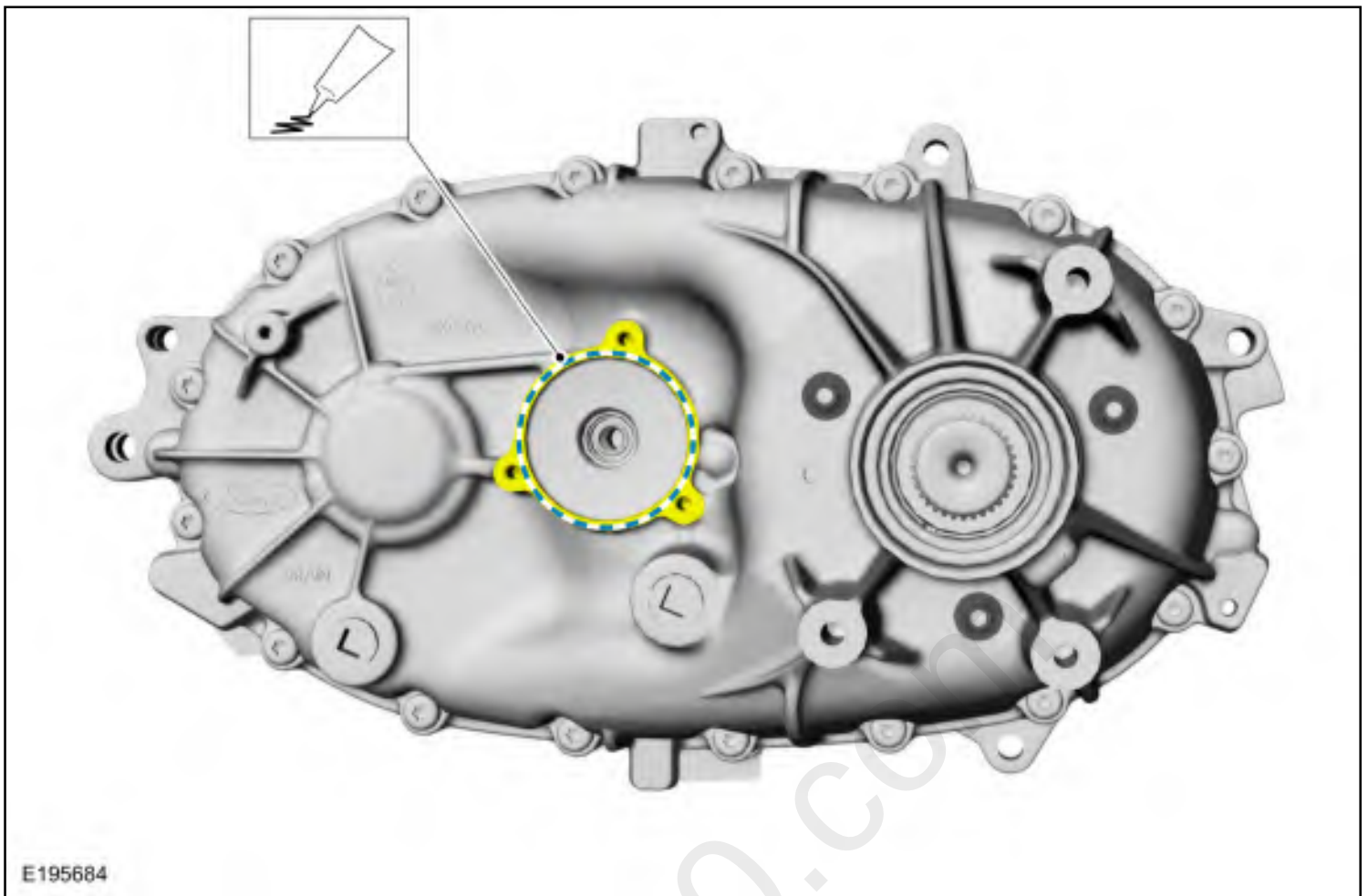
Position the transfer case halves and tighten the bolts in the sequence shown.
Torque: 21 lb.ft (29 Nm)



34. Install the coil washers and nuts.
Torque: 89 lb.in (10 Nm)

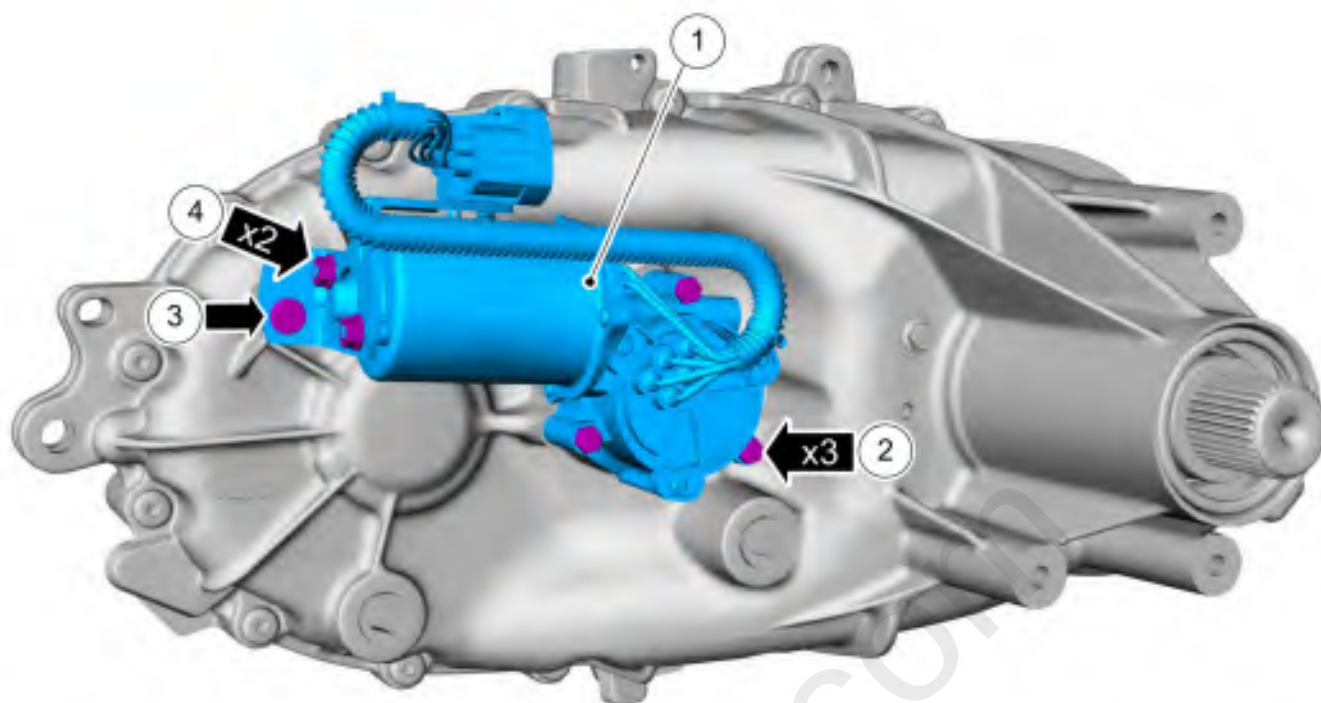


35. Install the transfer case rear seal.
Refer to: [Transfer Case Rear Seal](#) (308-07B Transfer Case, Removal and Installation).
36. Apply a small bead of silicone sealant to the transfer case shift motor mating surface.
Material: Motorcraft® Ultra Silicone Sealant / TA-29



37. **NOTICE:** When installing the shift motor, tighten the bracket nuts last. Failure to follow the steps in the correct order may result in damage to the component.

1. Install the transfer case shift motor.
2. Install the transfer case shift motor bolts.
Torque: 89 lb.in (10 Nm)
3. Install the transfer case shift motor bracket bolt.
Torque: 89 lb.in (10 Nm)
4. Tighten the transfer case shift motor bracket nuts.
Torque: 27 lb.in (3 Nm)



E195676

38. **NOTE:** After the coil wire is inserted into the connector, gently pull the wire back to verify the pin is locked inside the connector.

Install the coil wire pin in the electrical connector.

1. Insert the coil wire pin in the electrical connector.
2. Install the inner connector retainer.



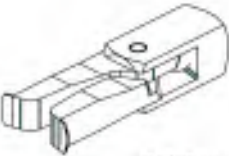
39. Remove the transfer case from the transmission adjustable mounting arms.
Use the General Equipment: Adjustable Mounting Arm

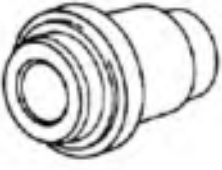


Transfer Case - Vehicles With: Electronic Shift Transfer Case

Base Part Number: Base Part Number: 7251

Special Tool(s) / General Equipment

 E133913	205-153 (T80T-4000-W) Handle
 E231407	205-293 (T89P-4850-A) Installer, Differential Oil Seal TKIT-1989-F TKIT-1989-FLM TKIT-1989-FM TKIT-1989-LM
 E231408	205-504 Installer, Halfshaft Pilot Bearing TKIT-2002N-F/FM TKIT-2002N-FLM TKIT-2002N-LM
 E142012	307-318 Remover, Stator Bearing TKIT-1994-FH TKIT-1994-FMH/FLMH TKIT-1994-LMH/MH

 E231409	307-582A Cover Axle Seal Installer TKIT-2008AS-FLM
 E231410	308-047 (T77F-1102-A) Remover, Bearing Cup
 E231411	308-085 (T83T-7025-C) Installer, Input Shaft Bearing TKIT-1983-F TKIT-1983-FLM TKIT-1983-FX
 E231411	308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal TKIT-1996-F/FM TKIT-1996-FLM2
Slide Hammer	
Adjustable Mounting Arm	

Materials

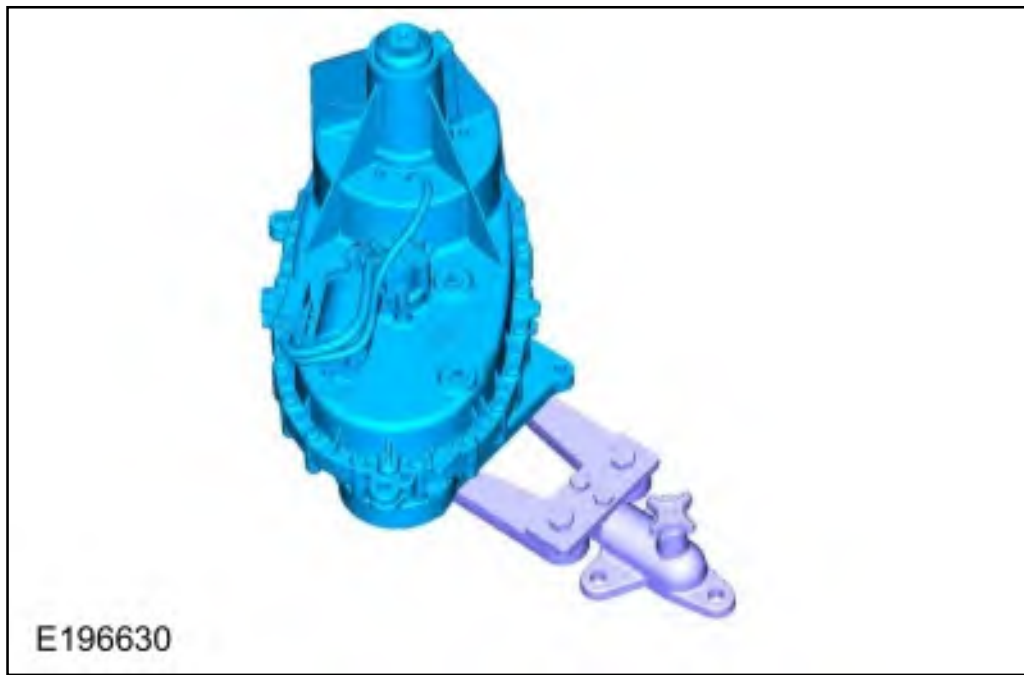
Name	Specification
Motorcraft® Ultra Silicone Sealant TA-29	-

DISASSEMBLY

- NOTICE: Seal all openings before cleaning the transfer case exterior. This will prevent entry of dirt and water, which may cause damage to internal components.**

Using a transmission adjustable mounting arm, secure the transfer case to the bench. Clean the transfer case with solvent and dry with compressed air.

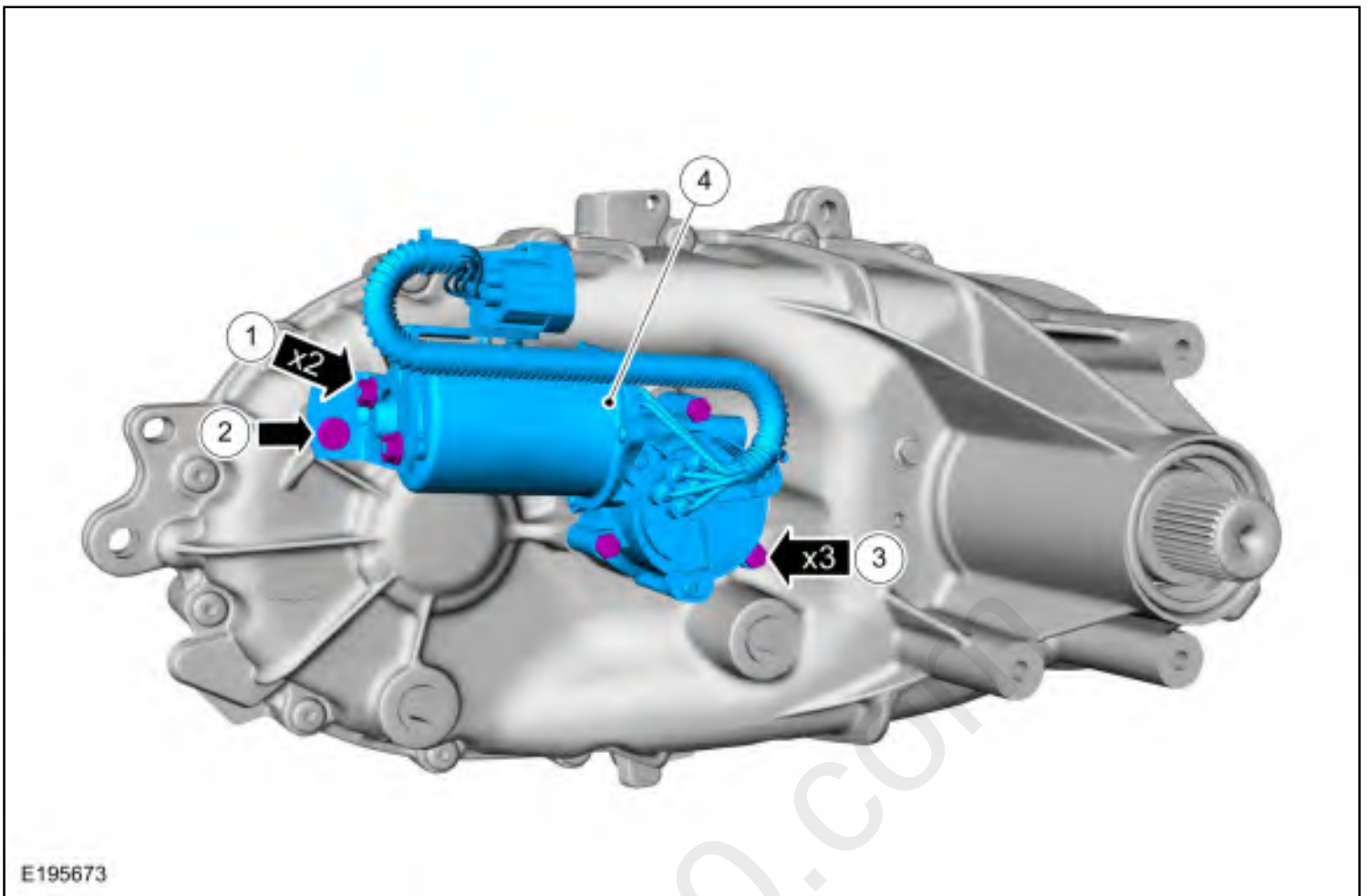
Use the General Equipment: Adjustable Mounting Arm



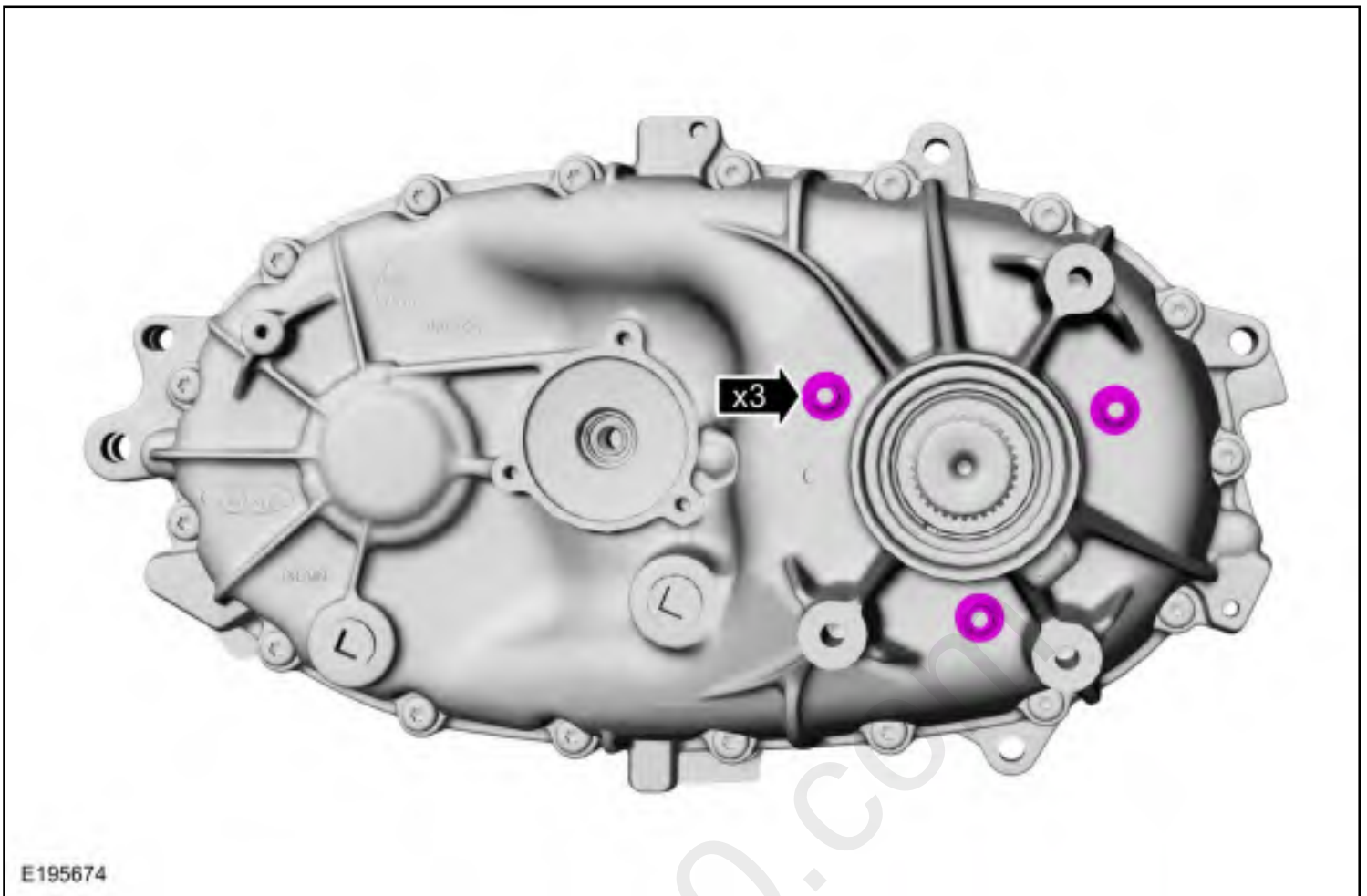
2. Remove the transfer case rear seal.
Refer to: [Transfer Case Rear Seal](#) (308-07B Transfer Case, Removal and Installation).
3.
Remove the coil wire pin from the electrical connector.
 1. Remove the inner retainer from the wire connector.
 2. Press the release tab and remove the coil wire pin.



1. Loosen the transfer case shift motor bracket nuts.
2. Remove the transfer case shift motor bracket bolt.
3. Remove the transfer case shift motor bolts.
4. Remove the transfer case shift motor.

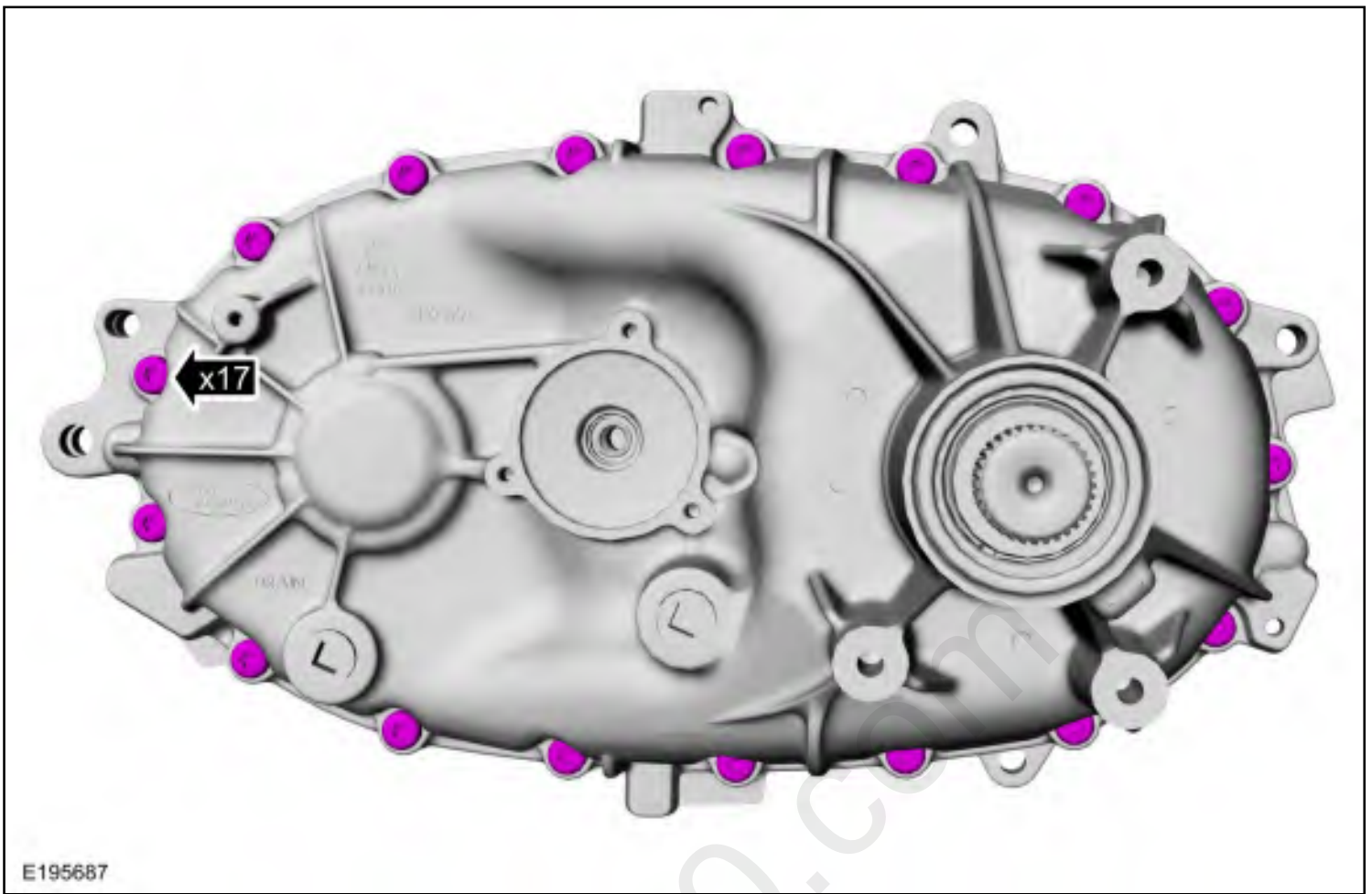


5. Remove the coil nuts and washers.



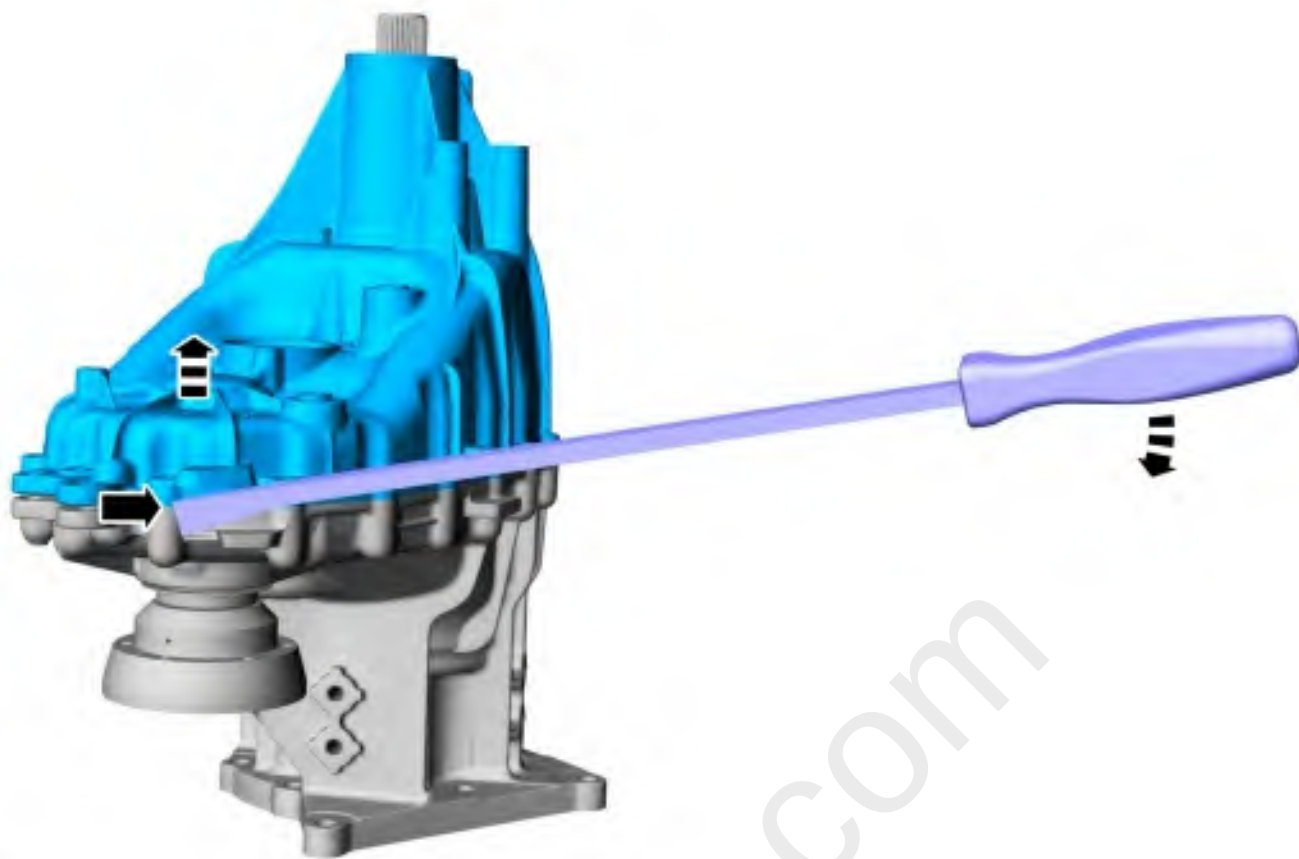
6. **NOTE:** The transfer case bolts are self tapping, and it is normal to find metal shavings while removing the cover.

Remove the transfer case bolts.



7. **NOTE:** Use care not damage the field coil wire.

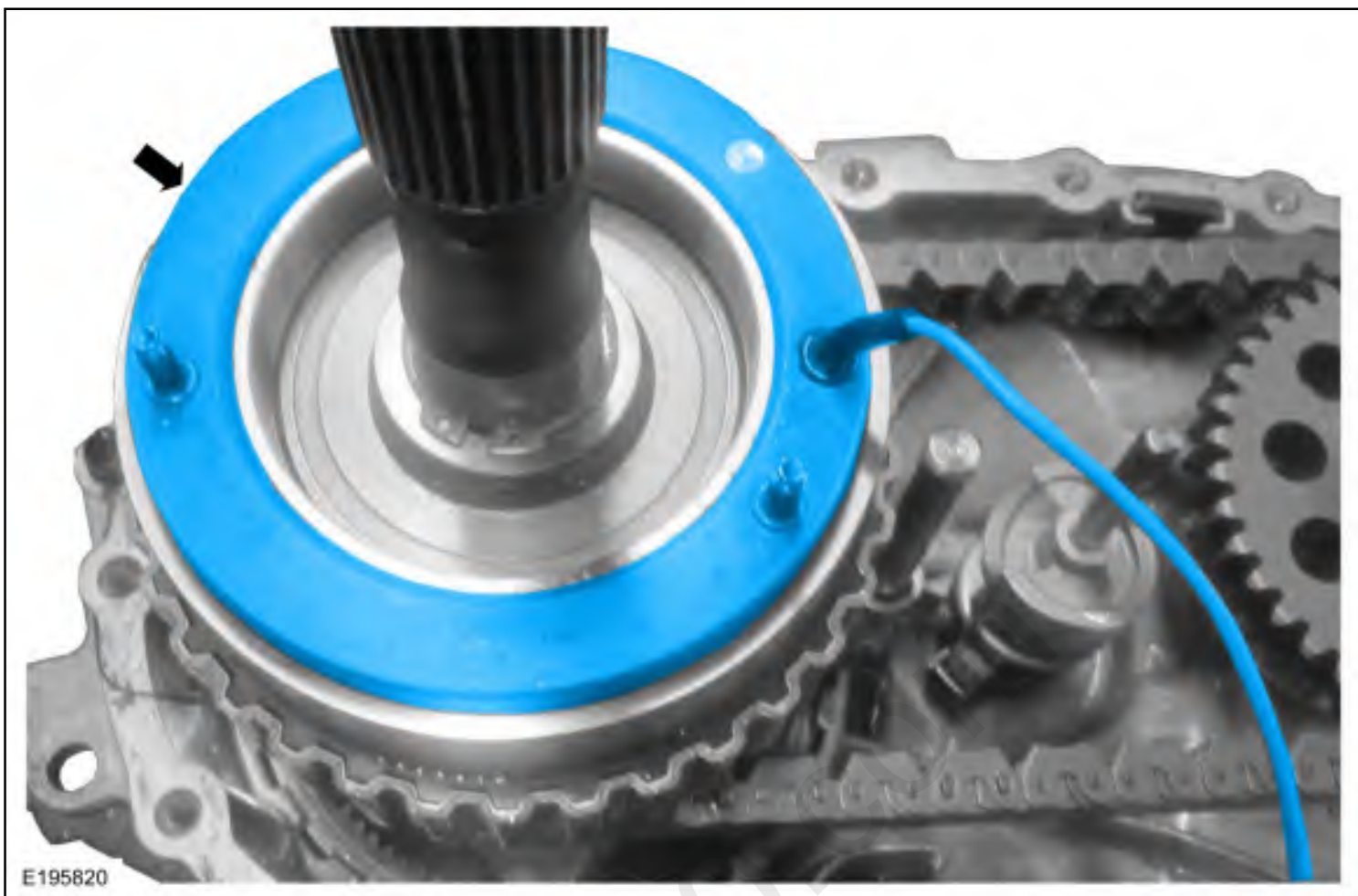
Using the pry bosses, separate the transfer case covers.



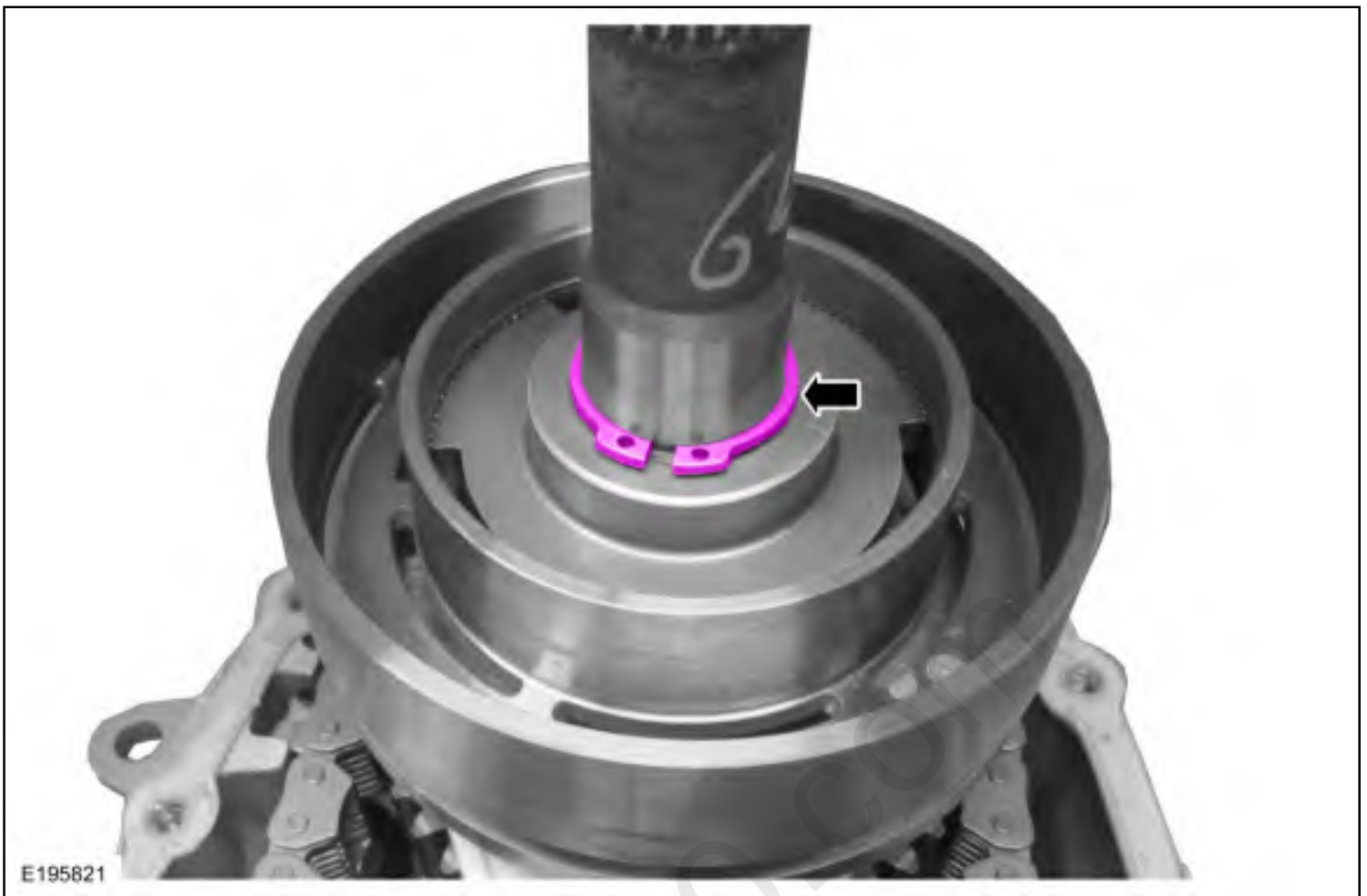
E195688



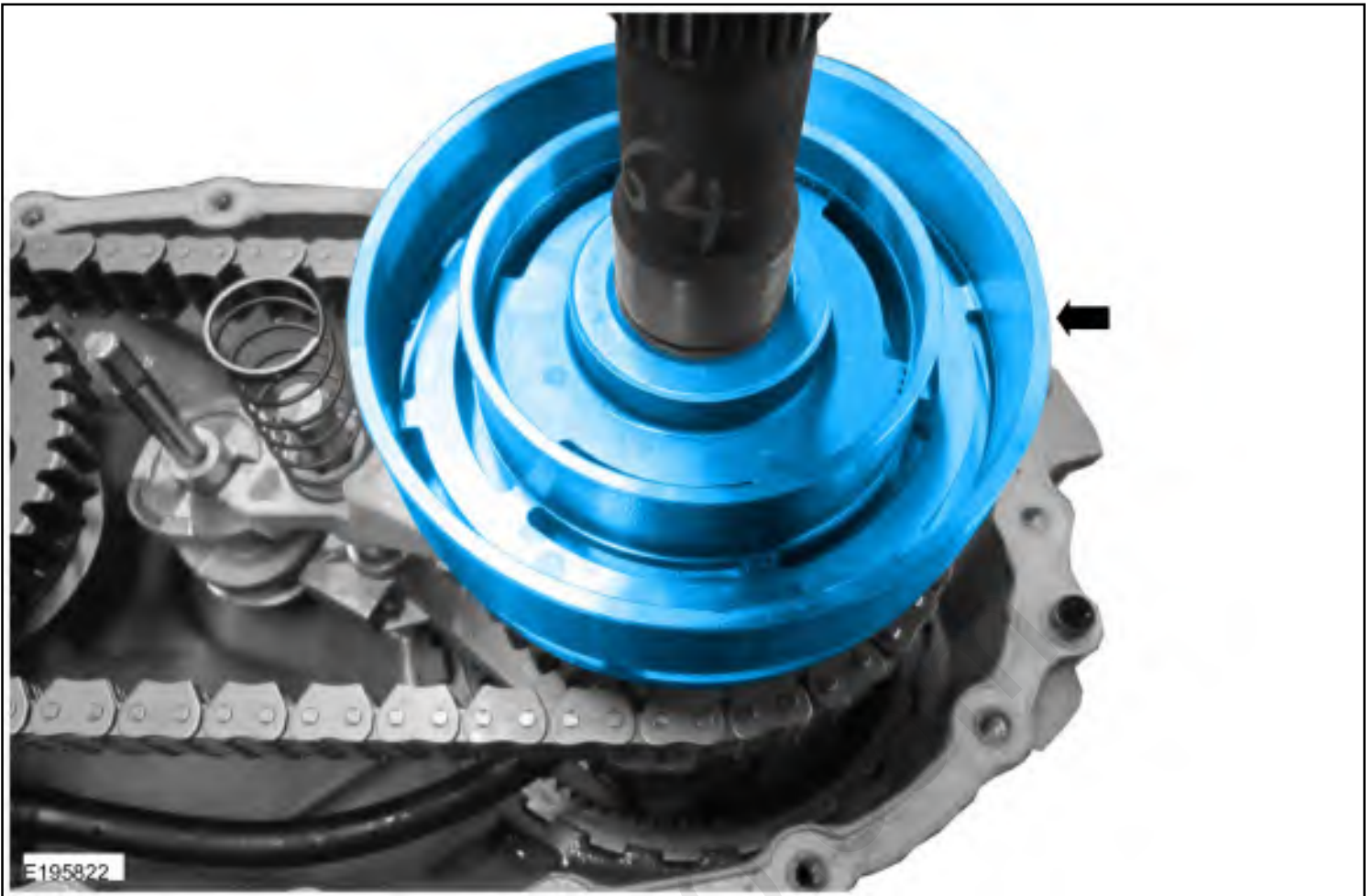
8. Remove the transfer case field coil.



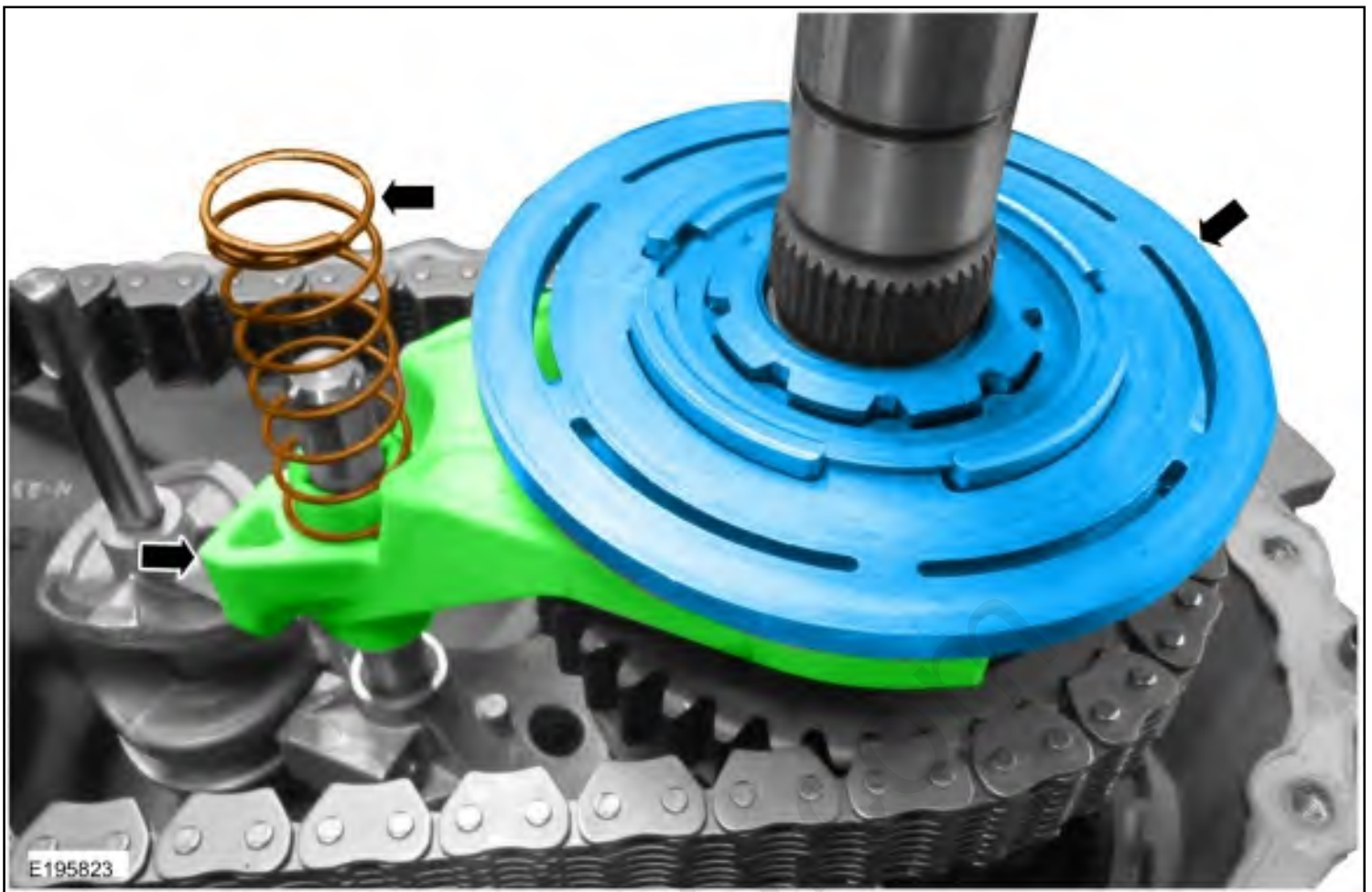
9. Remove the field coil housing snap ring.



10. Remove the field coil housing.



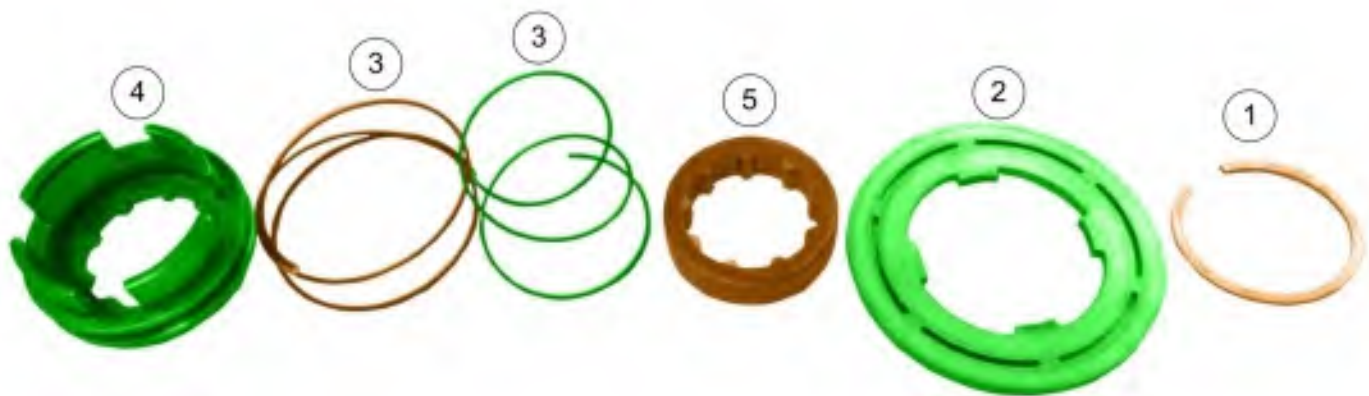
11. Remove the lock up hub, shift fork and shift fork spring.



12. **NOTE:** Remove the lockup hub assembly as a single unit. If disassembly is required, proceed with the following.

Disassemble the lockup hub assembly.

1. Remove the lockup hub snap ring.
2. Separate the lockup collar.
3. Separate the 2 lockup springs.
4. Separate the lockup hub.
5. Remove the armature.



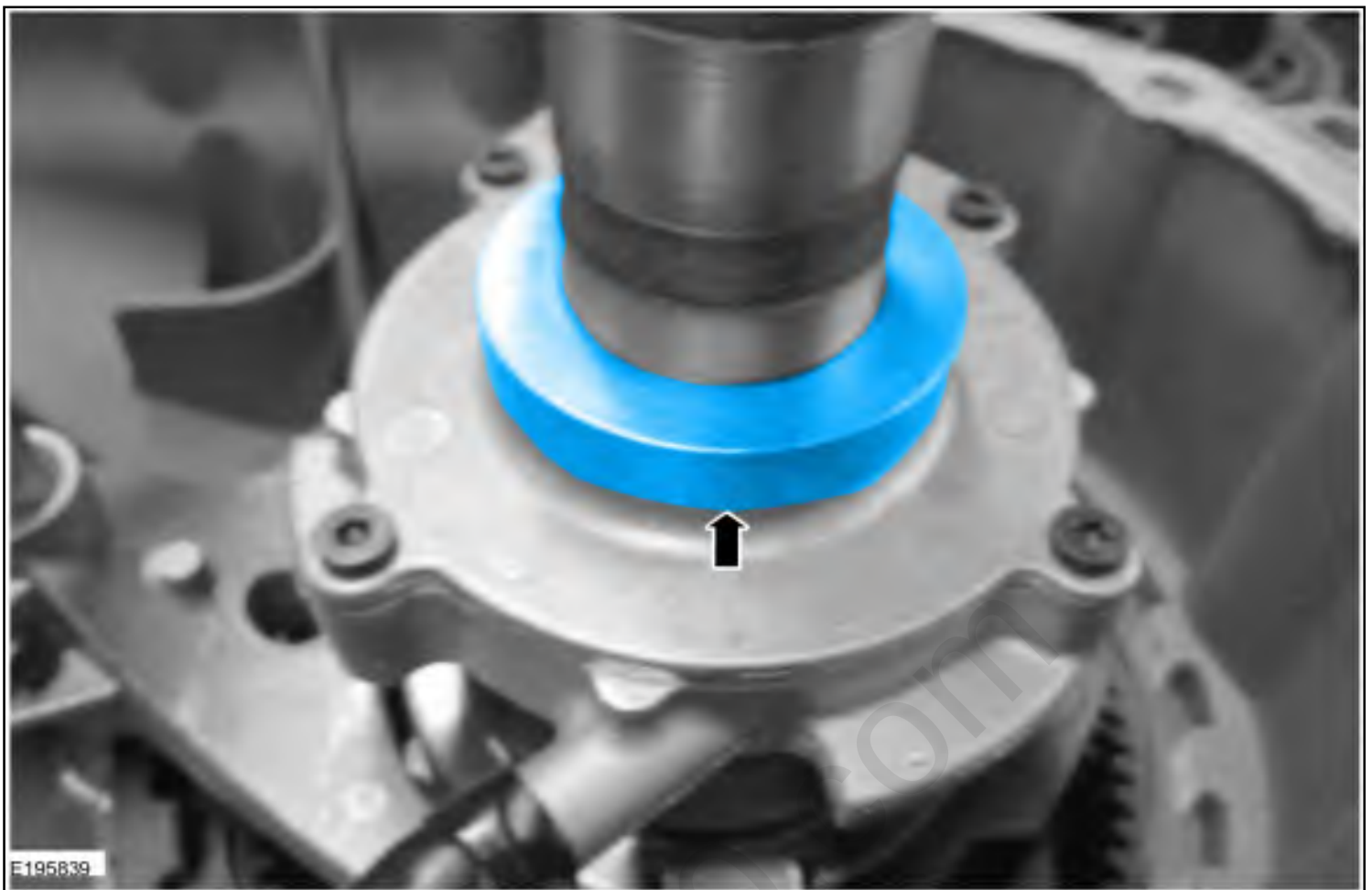
E195824

13. **NOTE:** Remove the drive chain and sprockets as an assembly.

Remove the drive chain and sprockets.



14. Remove the sprocket thrust washer.

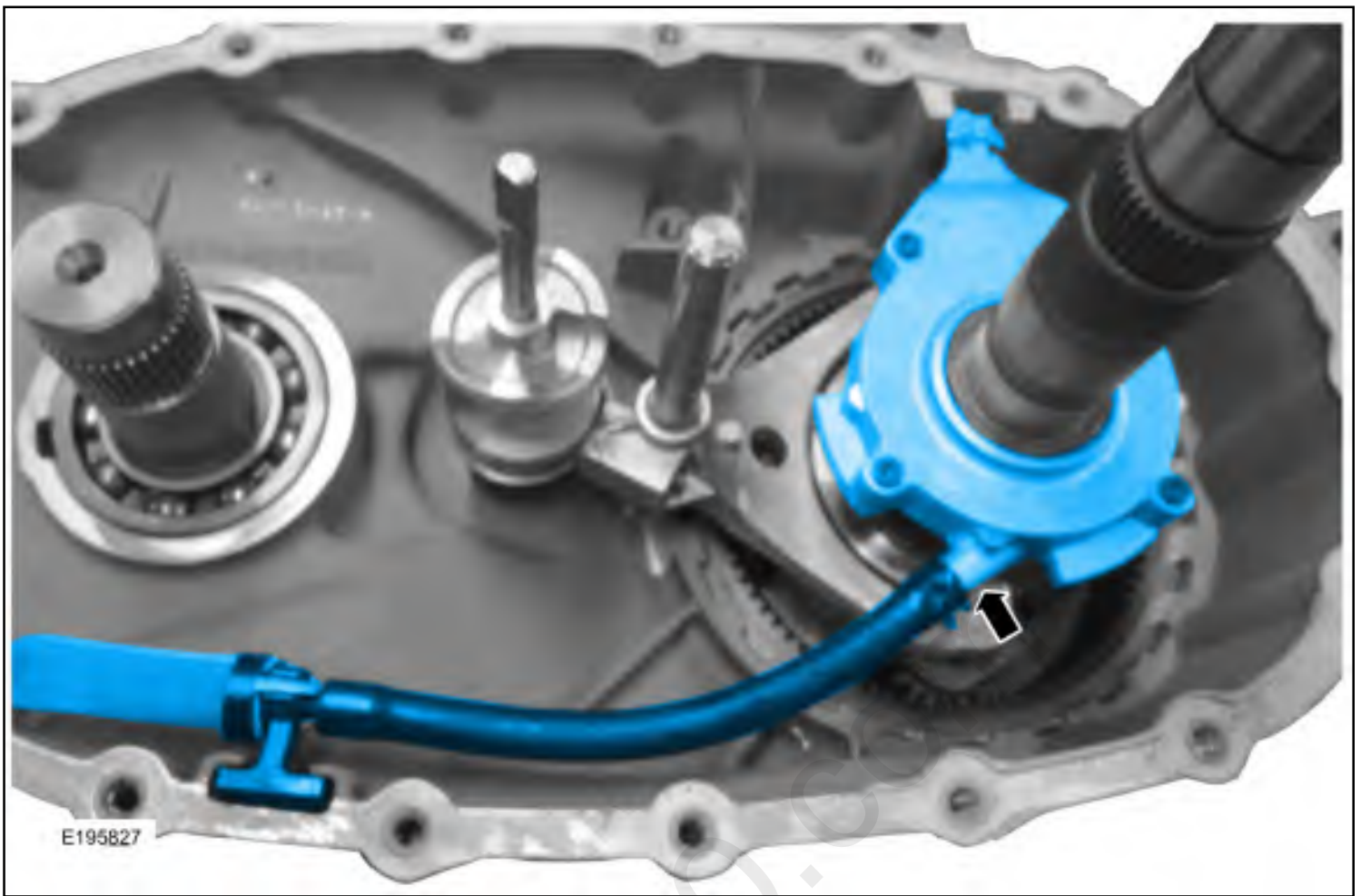


15. Remove the magnet from its slot in the case.



16. **NOTE:** *The pump assembly is not repairable.*

Remove the oil pump assembly.



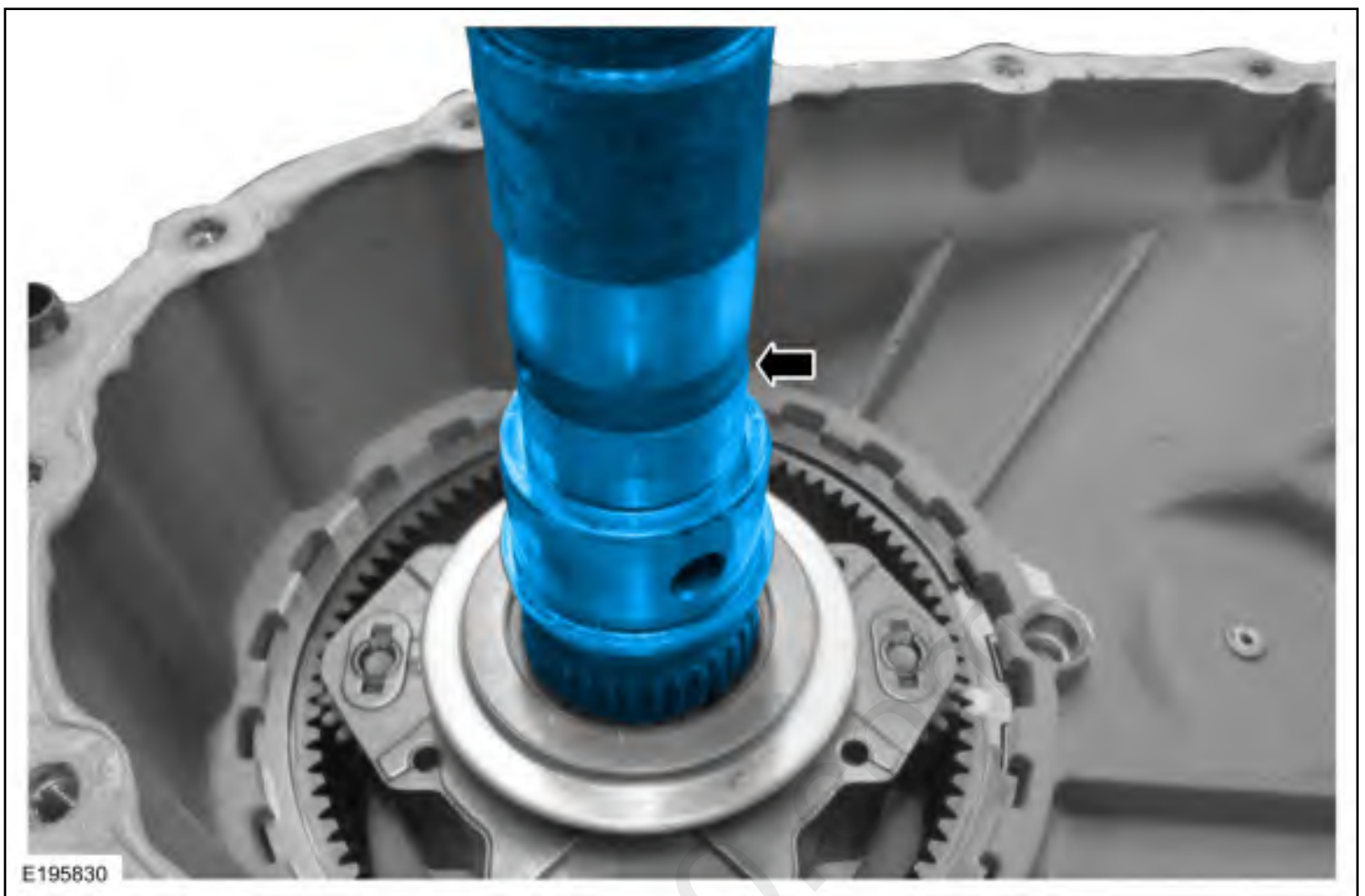
17. Remove the shift rail.



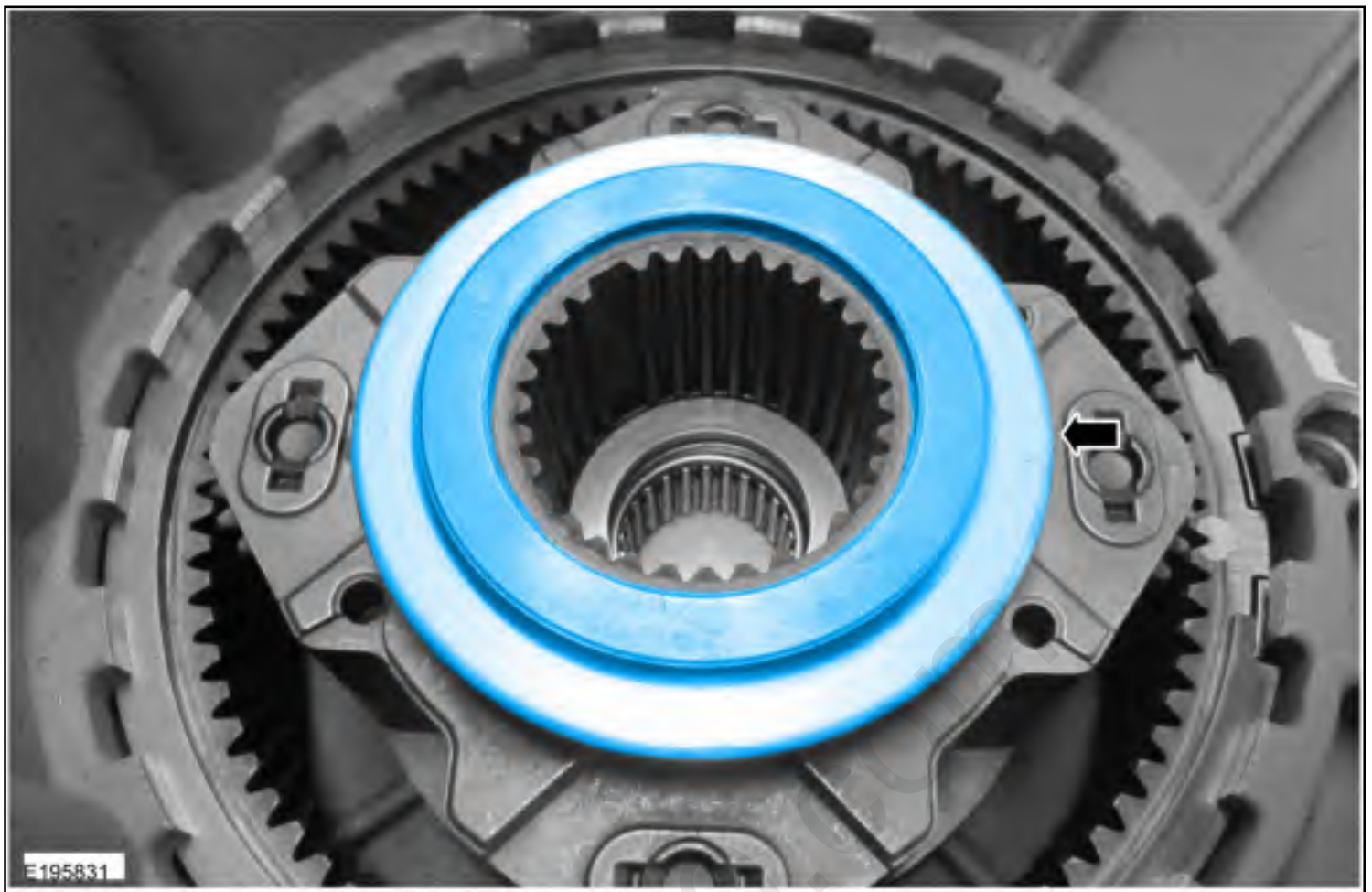
18. Remove the shift fork.



19. Remove the output shaft.



20. Remove the reduction hub.

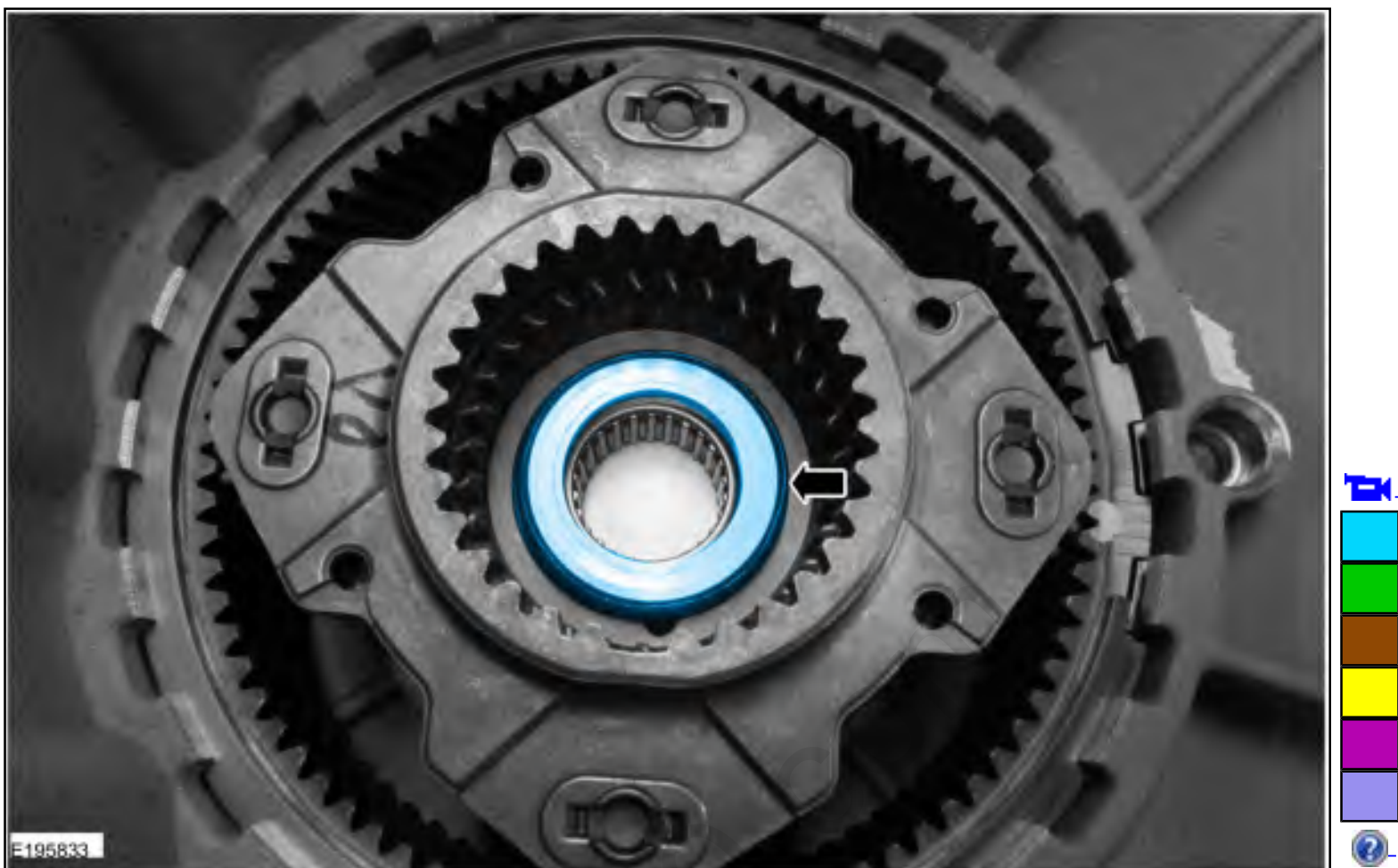


21. **NOTE:** *The electric shift cam is serviced as an assembly. Do not disassemble the shift cam assembly.*

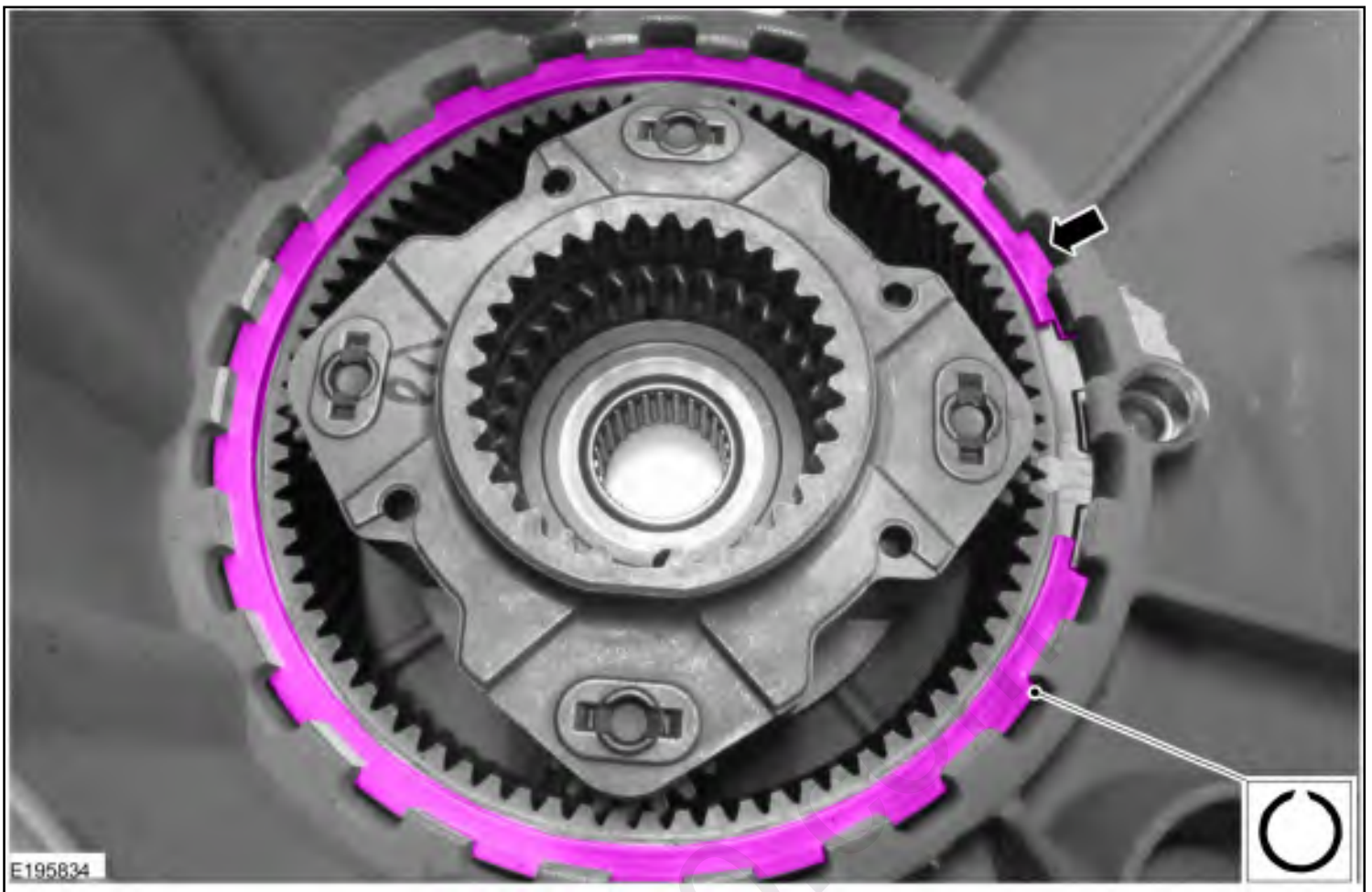
Remove the electric shift cam assembly.



22. Remove the planet carrier thrust bearing.



23. Remove the ring gear circlip.

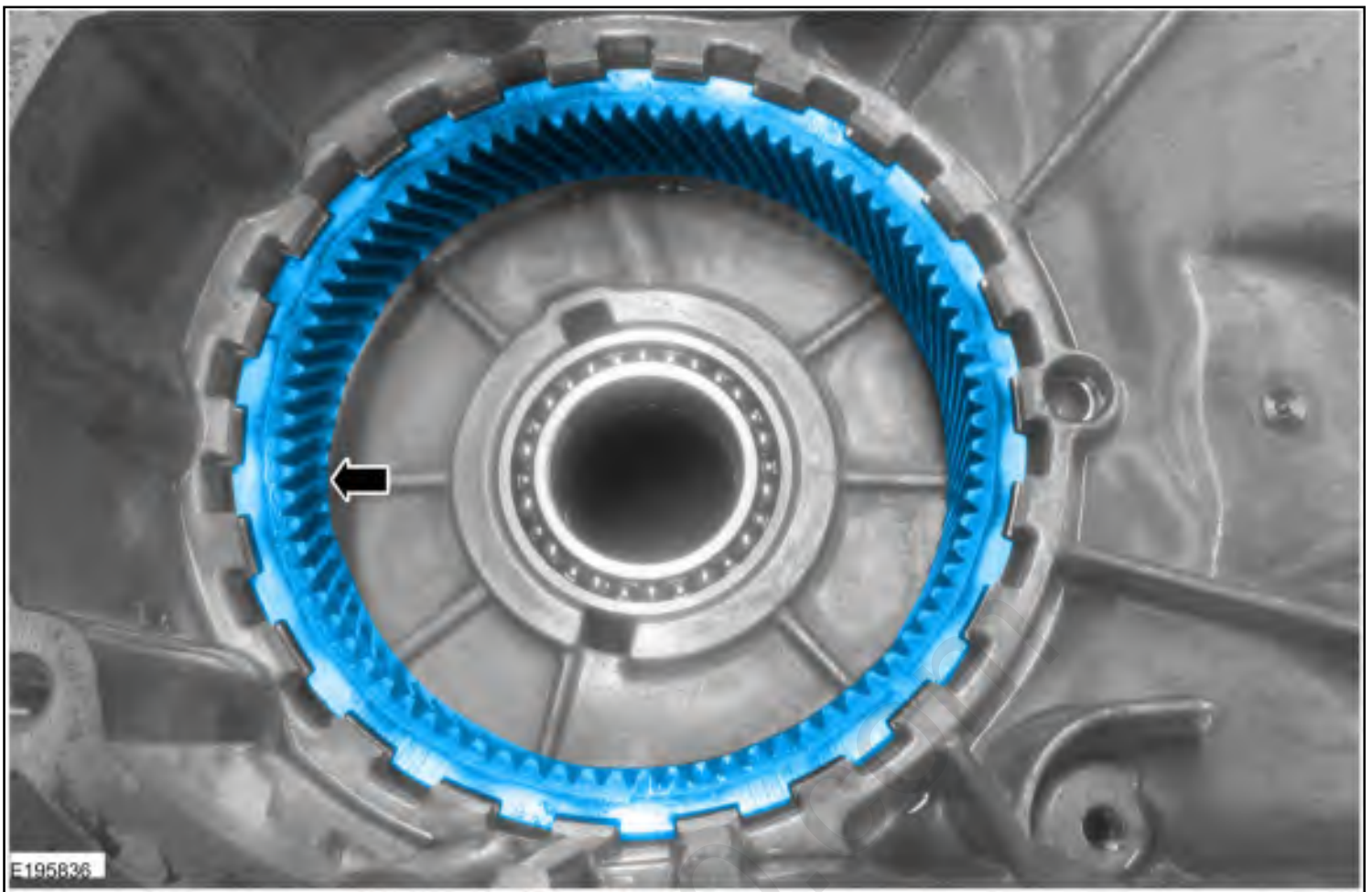


24. **NOTE:** *Replace the inner planet carrier needle bearing if necessary.*

Remove the front planet carrier.

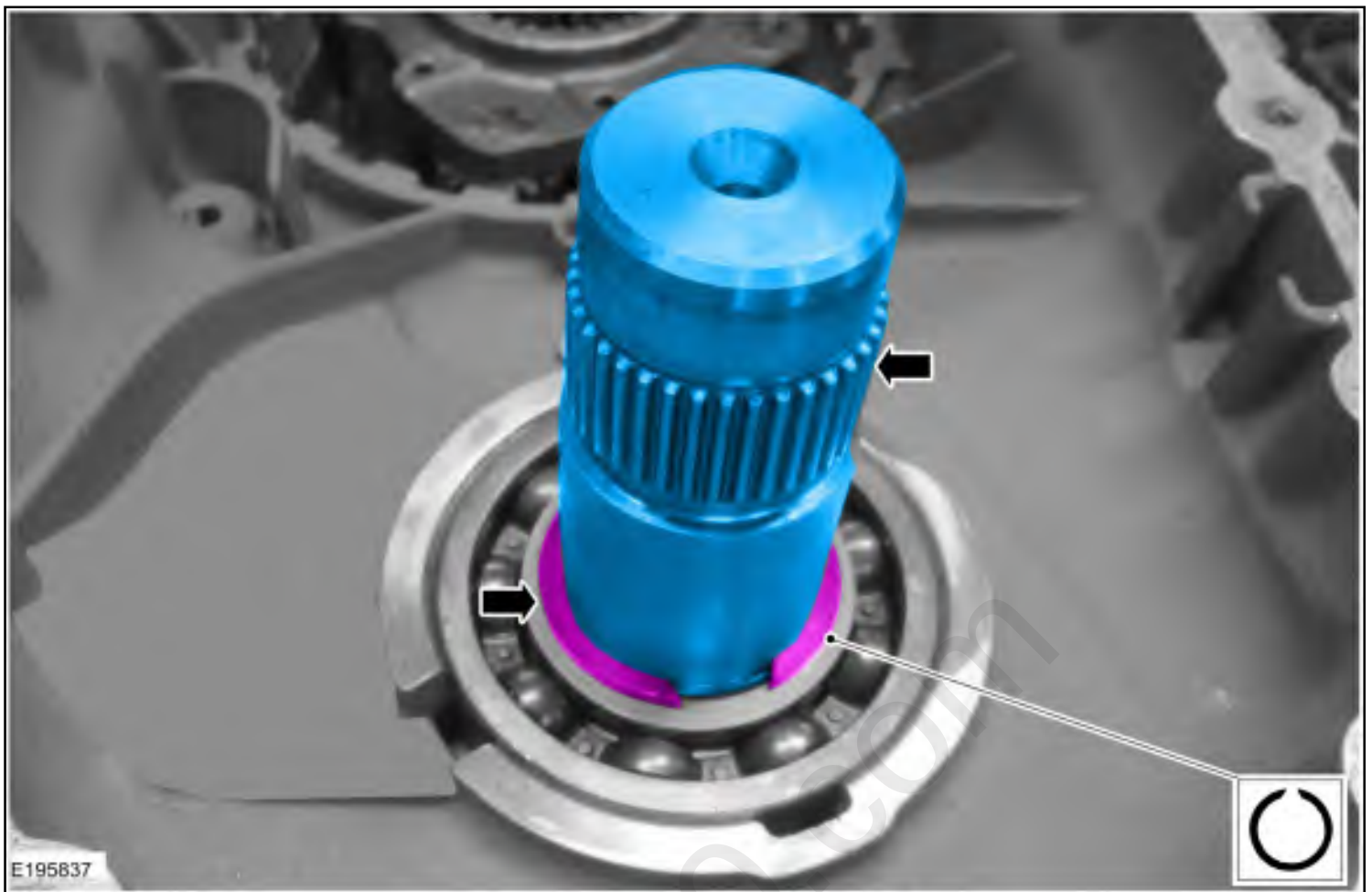


25. Remove the ring gear.

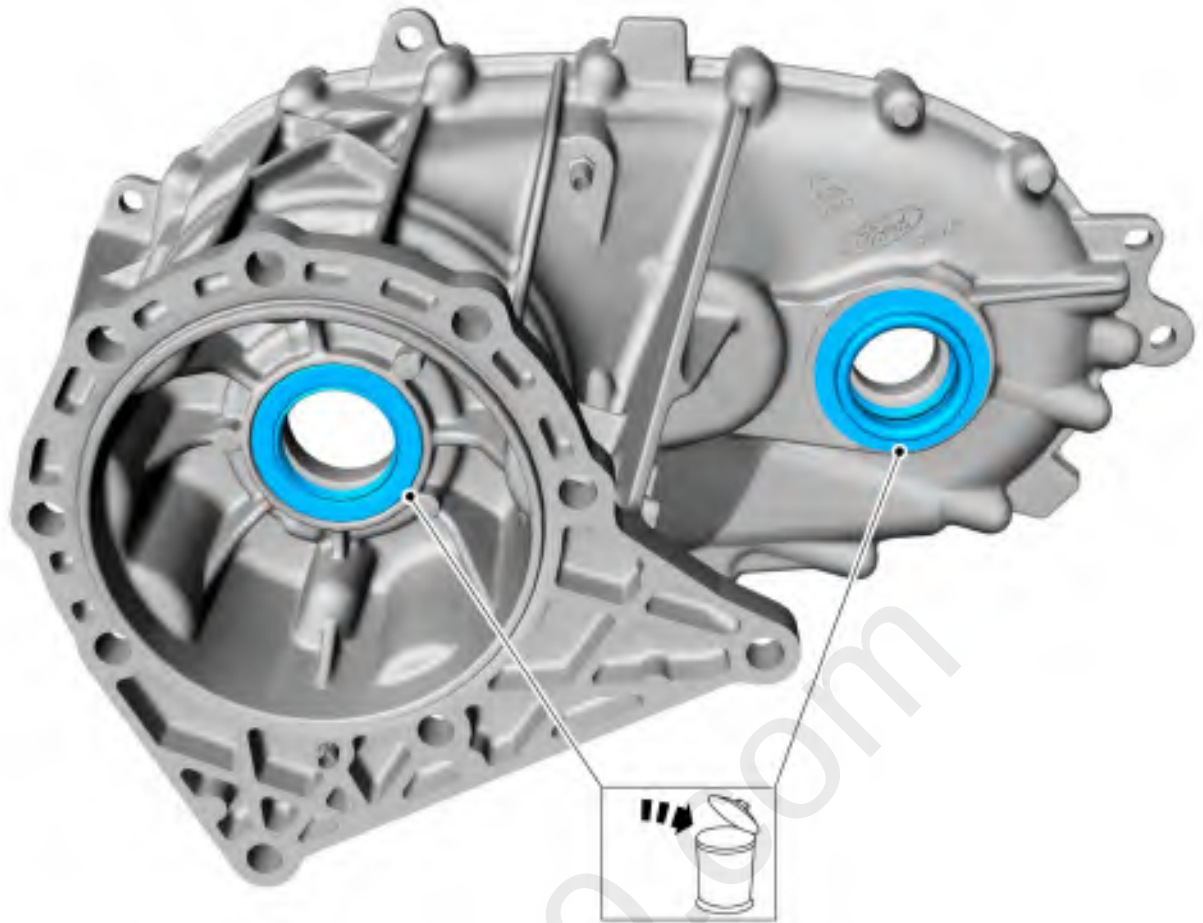


26. **NOTICE:** Do not let the front output shaft fall while removing the snap ring or damage to the component may occur.

Remove the output shaft circlip and the out put shaft.



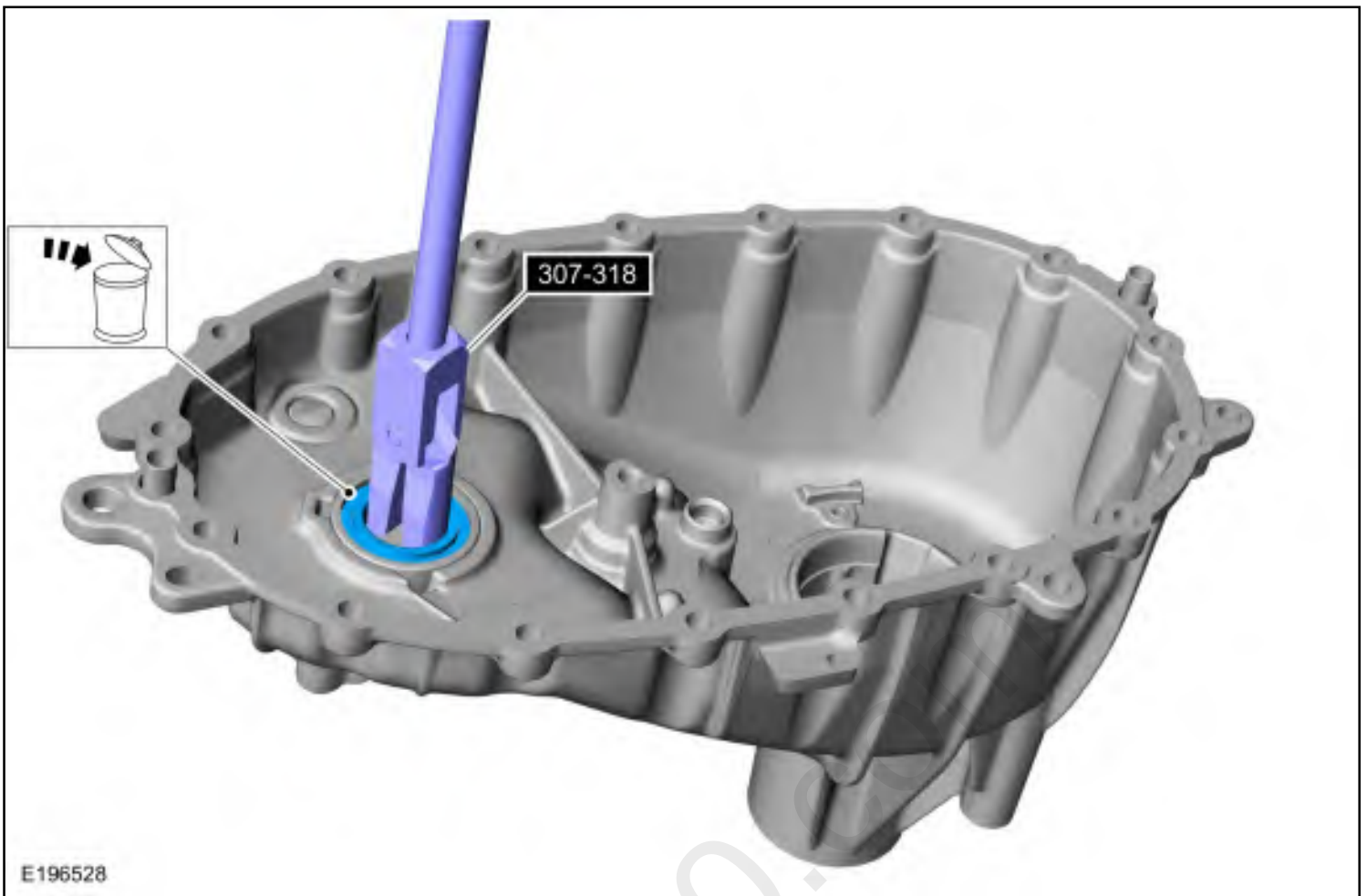
27. Remove and discard the front input shaft seal and the front output shaft seal.



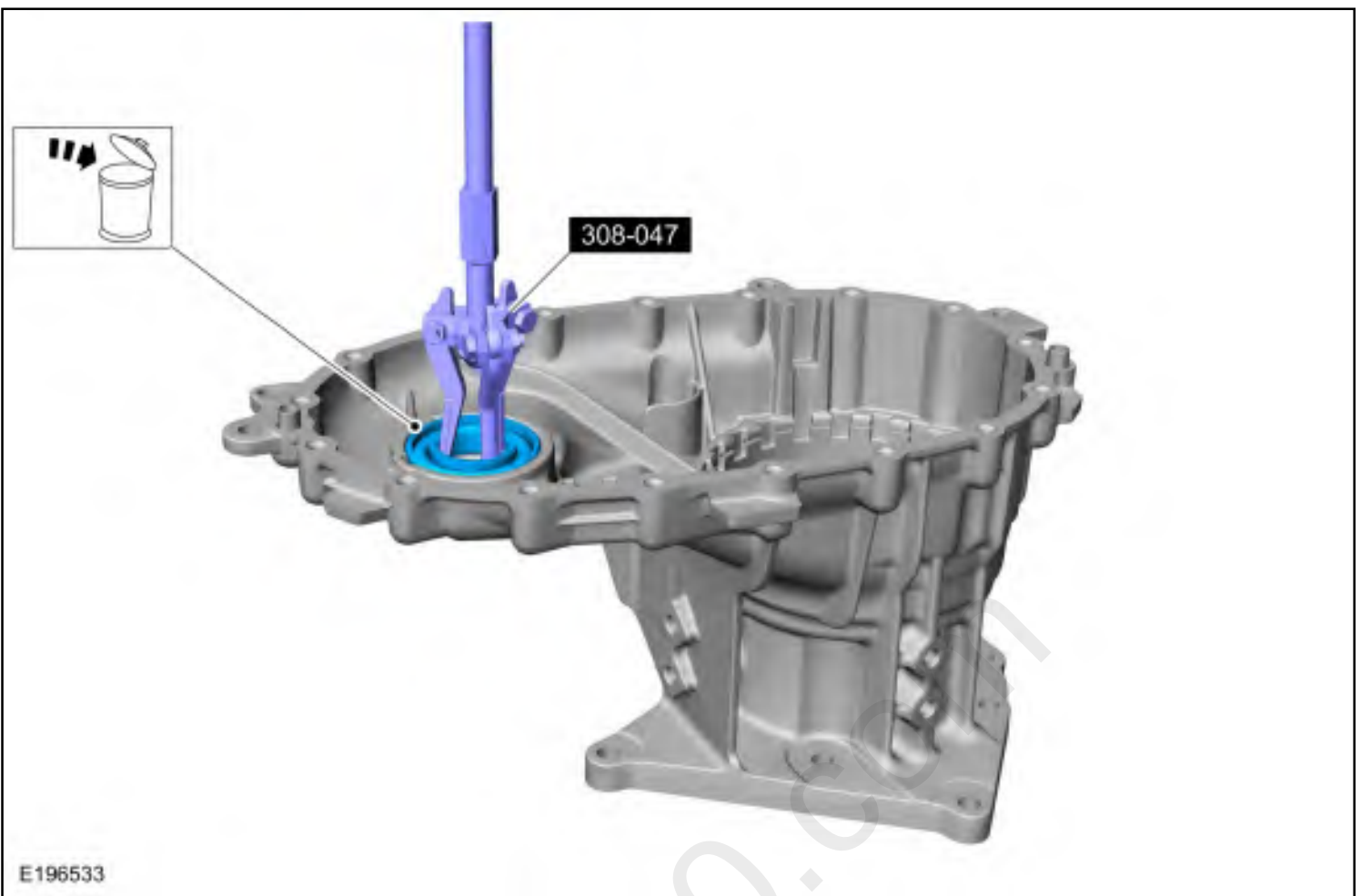
28. Using the special tool with the Slide Hammer, remove the rear output shaft bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



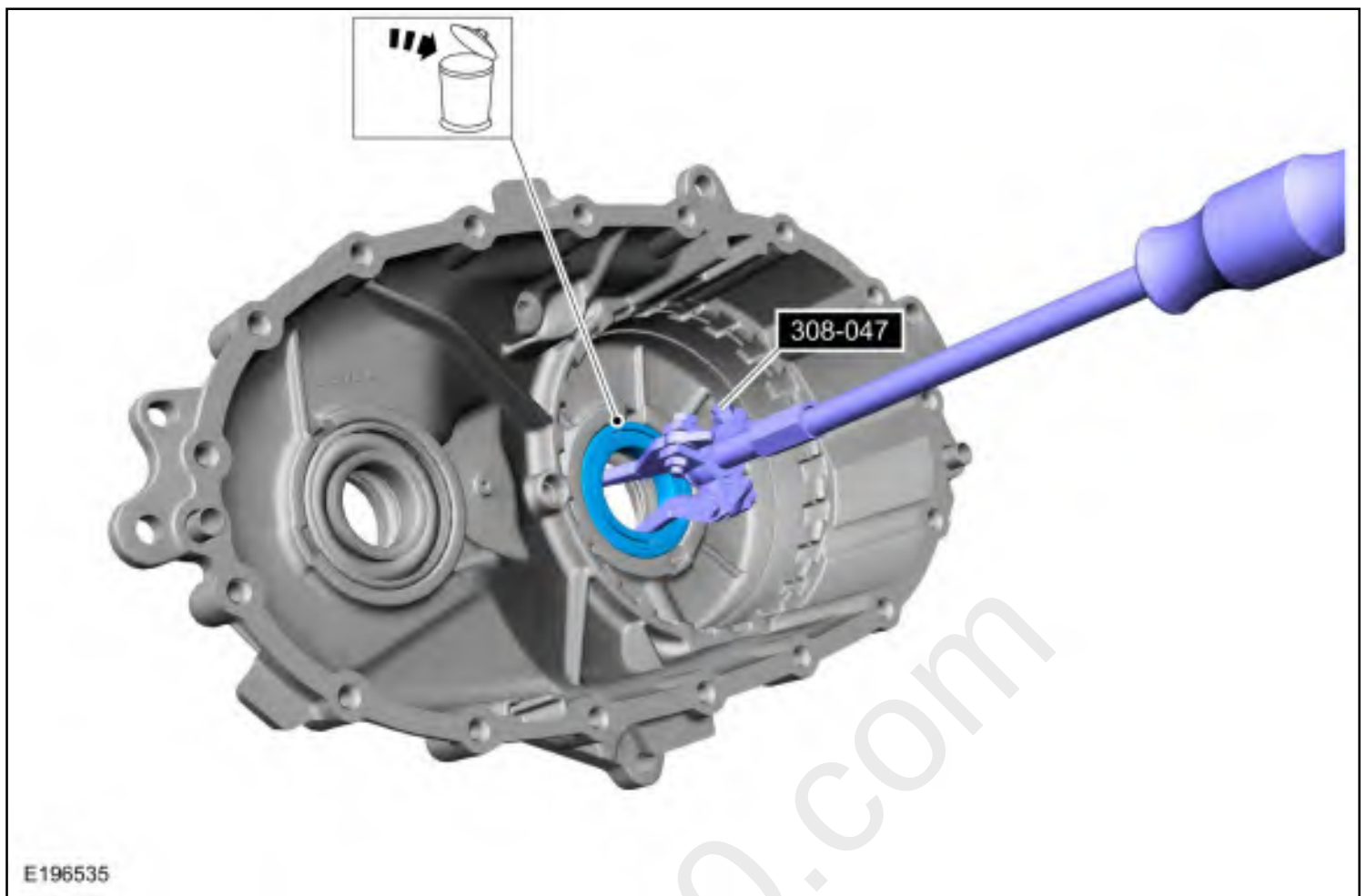
29. Using the special tool and a Slide Hammer, remove the front output shaft support bearing.
Use Special Service Tool: 307-318 Remover, Stator Bearing.
Use the General Equipment: Slide Hammer



30. Using the special tool with the Slide Hammer, remove the front output shaft bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



31. Using the special tool and a Slide Hammer, remove the front planet carrier bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



32. Clean and inspect the components of the transfer case for damage and install new components as necessary.

ASSEMBLY

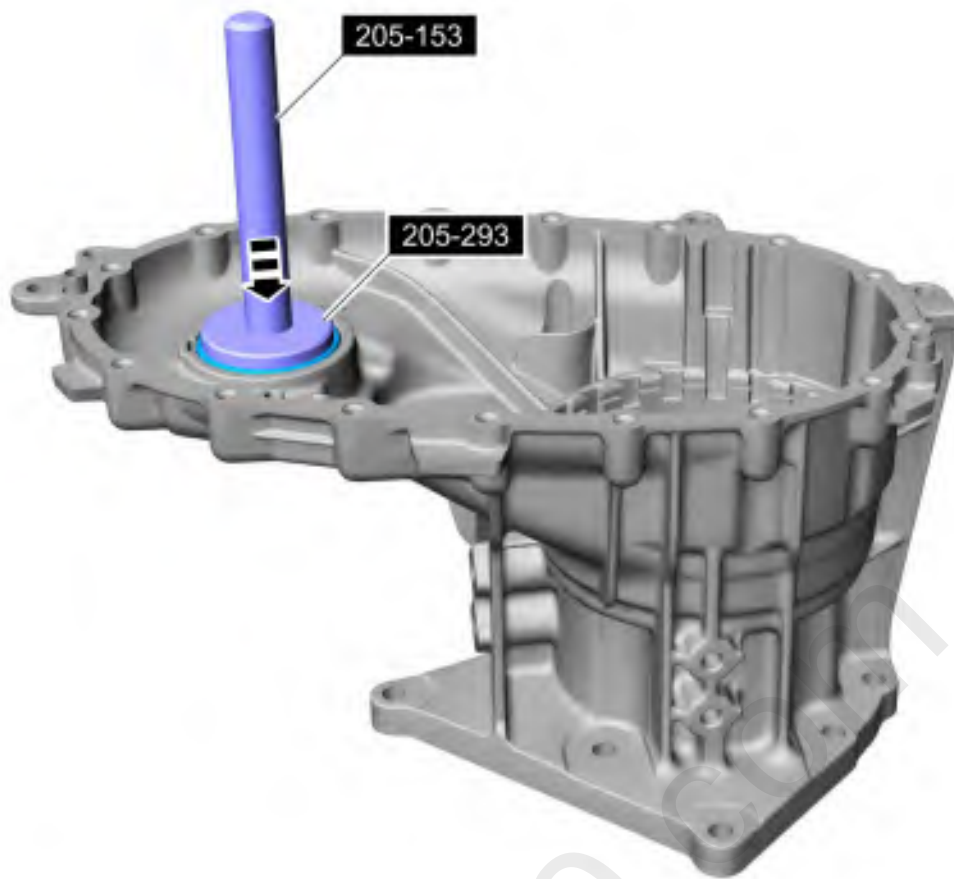
1. Using the special tools, install the front planet carrier bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-504 Installer, Halfshaft Pilot Bearing.



E196536



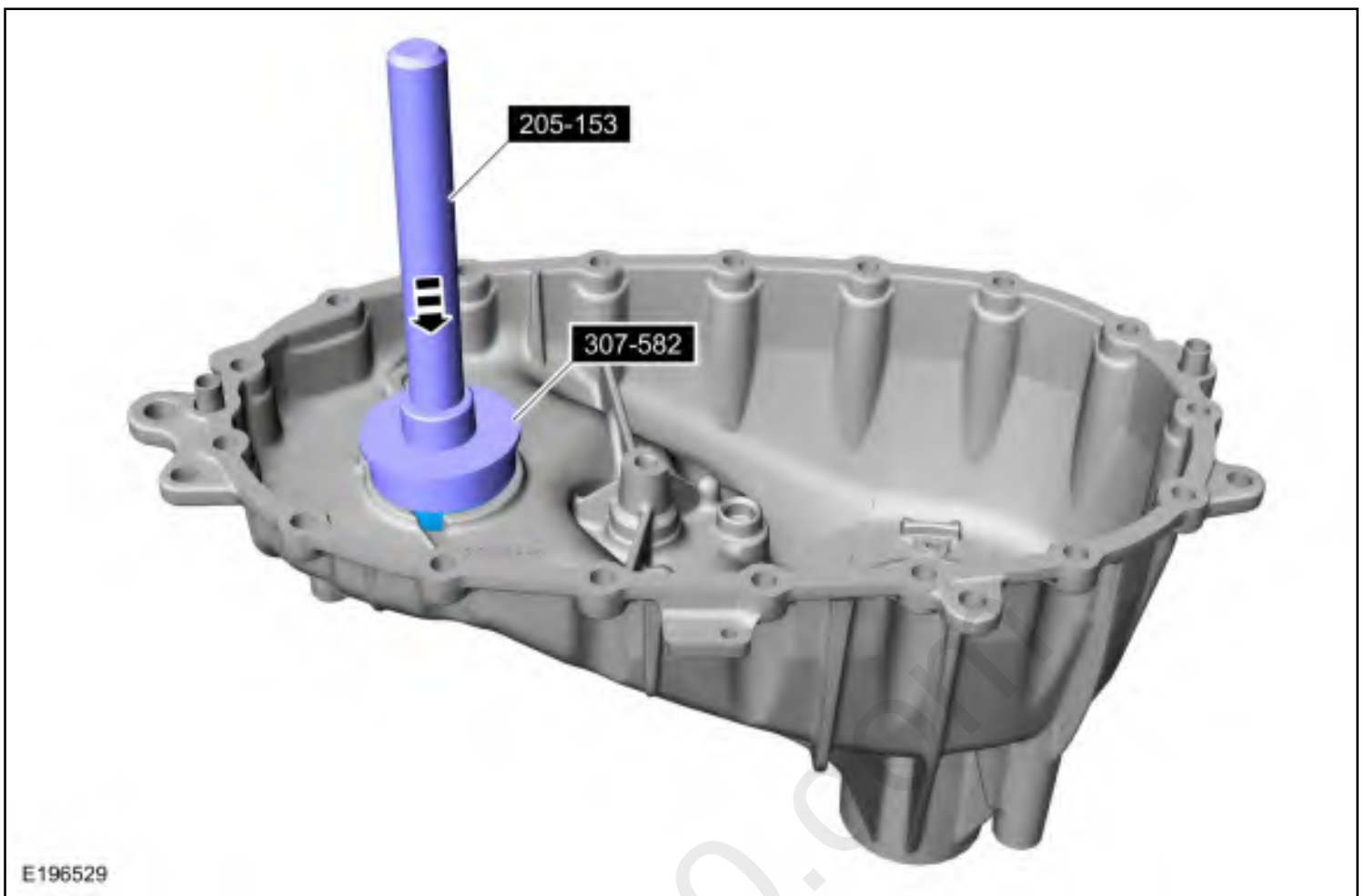
2. Using the special tools, install the front output shaft bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-293 (T89P-4850-A) Installer,
Differential Oil Seal.



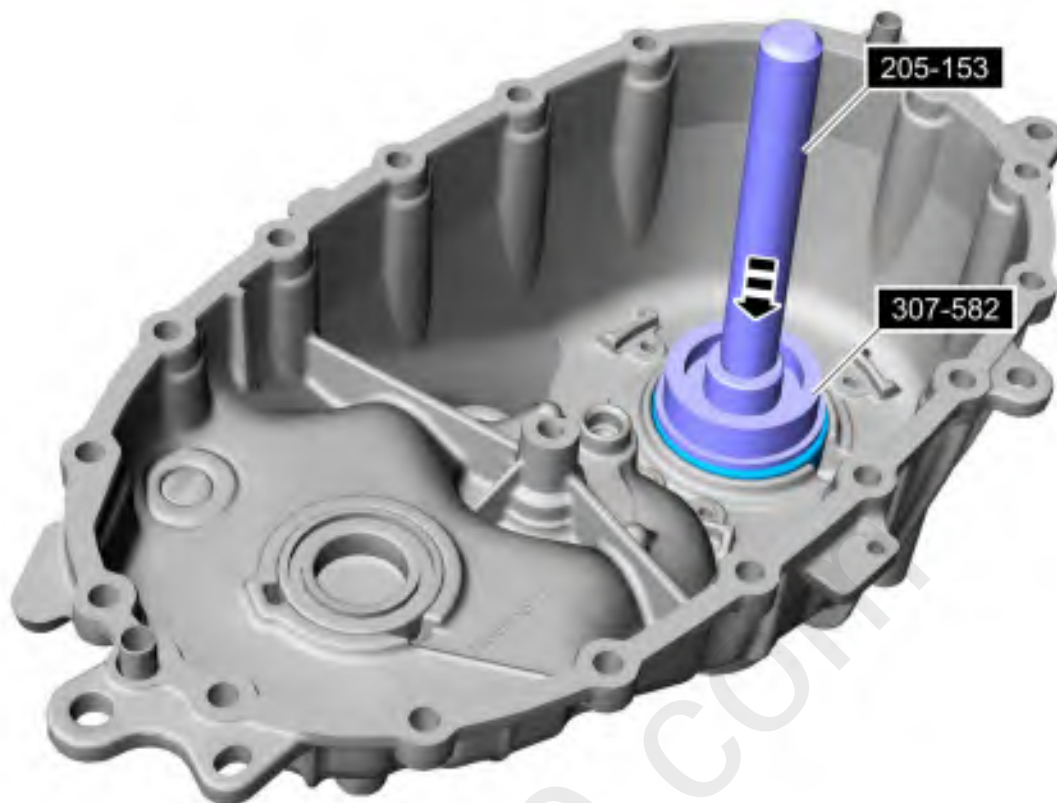
E196534



3. Using the special tool, install the front output shaft support bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 307-582A Cover Axle Seal Installer.

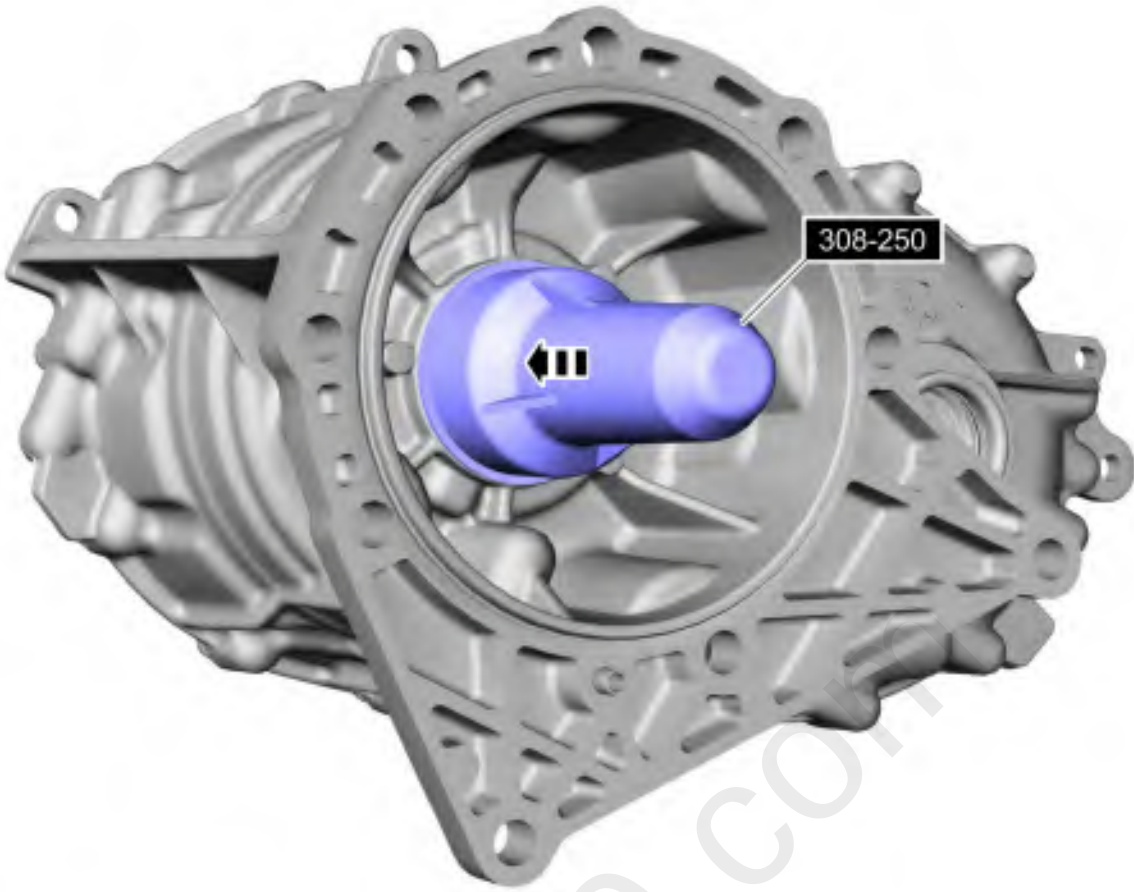


4. Using the special tool, install the rear output shaft bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 307-582A Cover Axle Seal Installer.



E196527

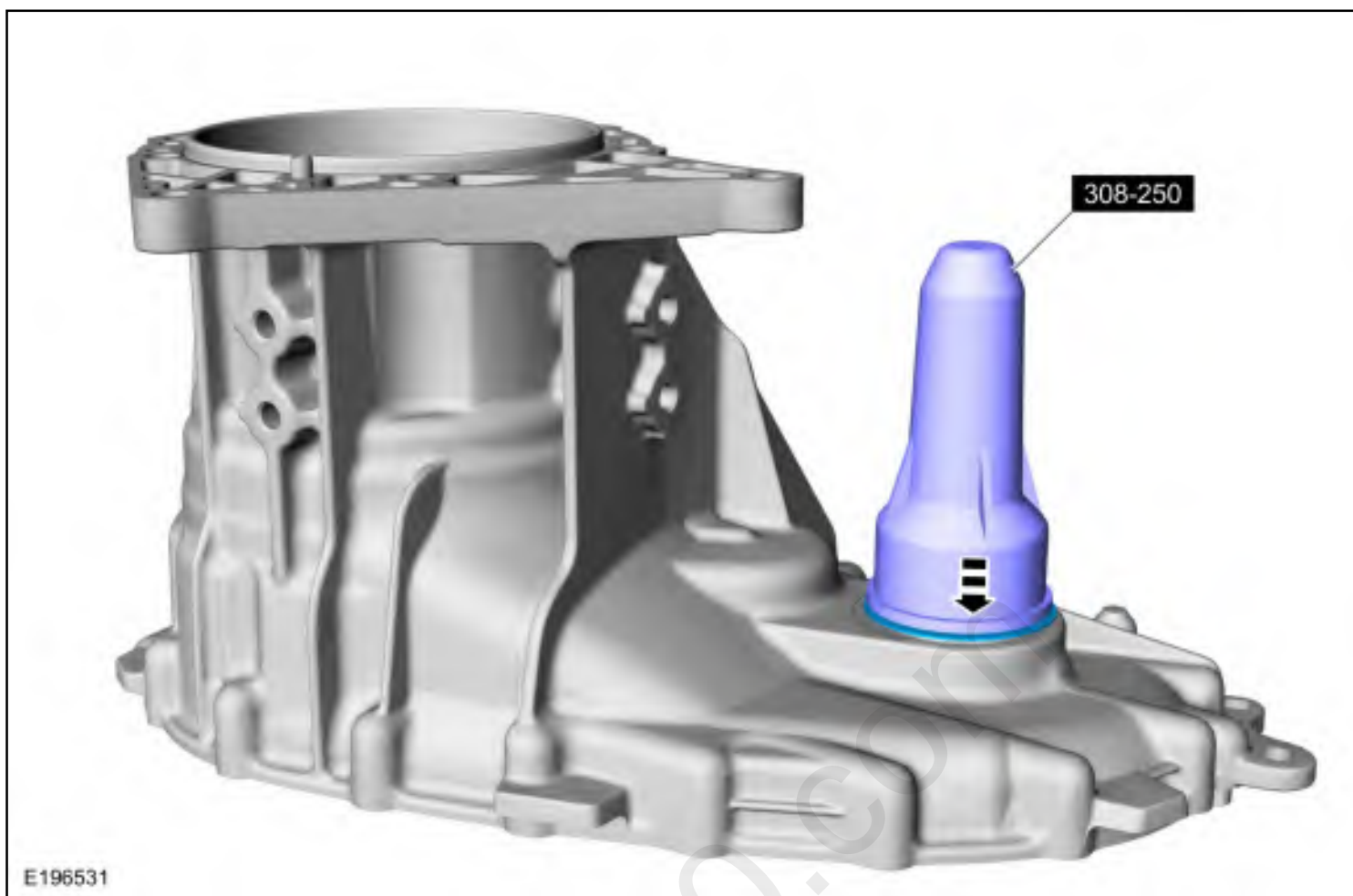
5. Using the special tool, install the input shaft seal.
Use Special Service Tool: 308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal.



E196532

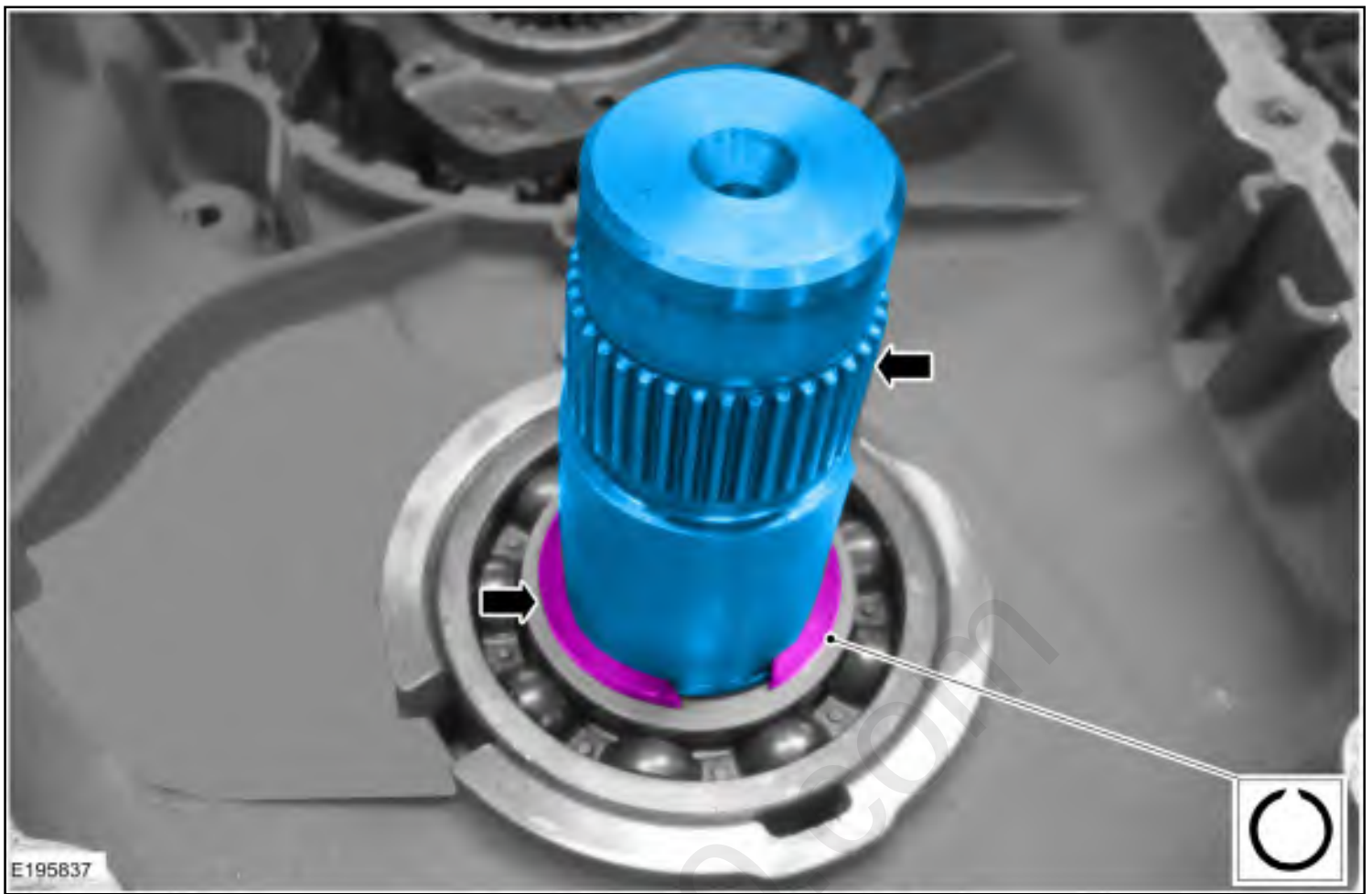


6. Using the special tool, install the front output shaft seal.
Use Special Service Tool: 308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal.

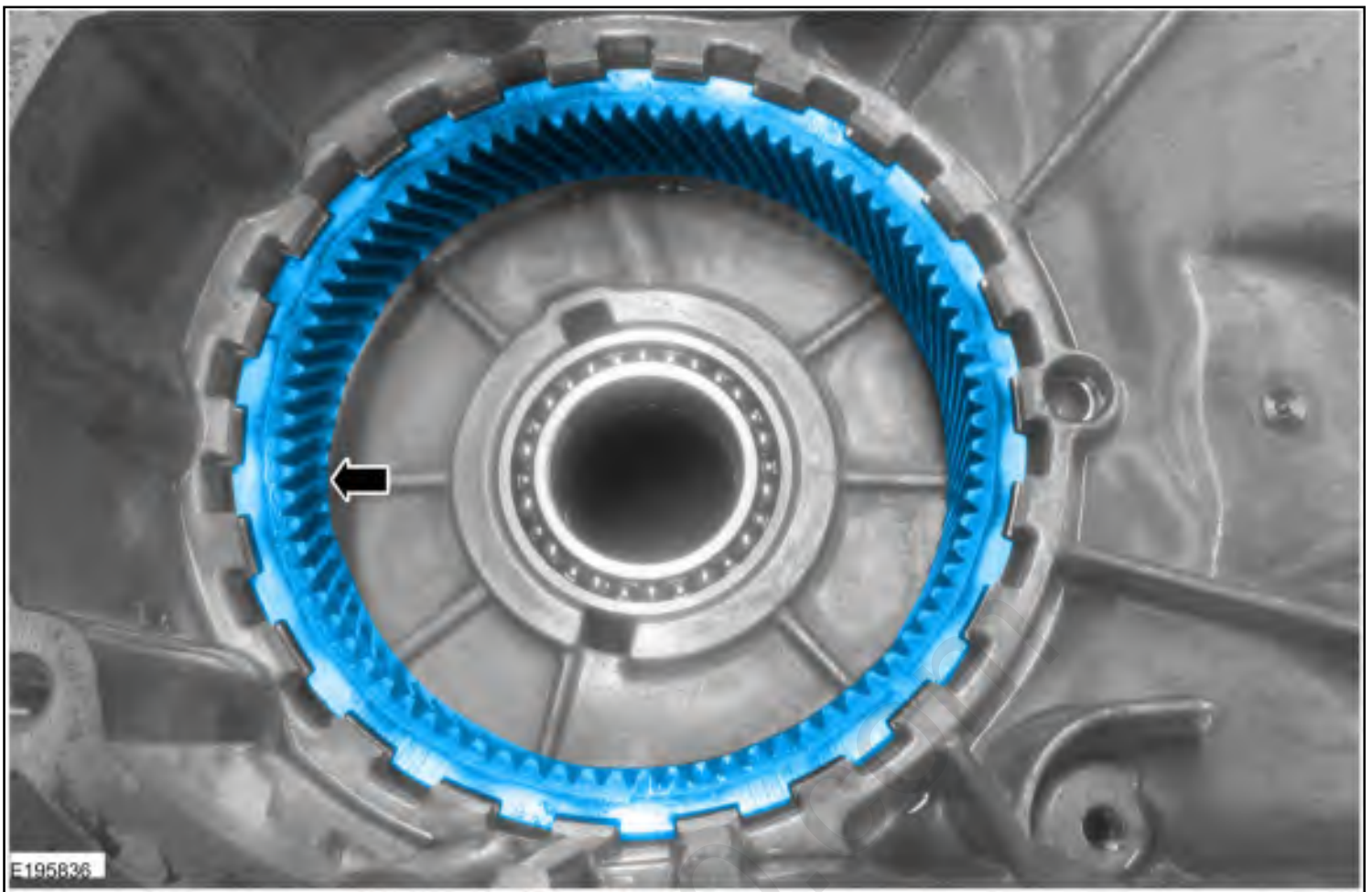


7. **NOTICE: Do not let the front output shaft fall while removing the snap ring or damage to the component may occur.**

Install the output shaft and the out put shaft circlip.



8. Install the ring gear.



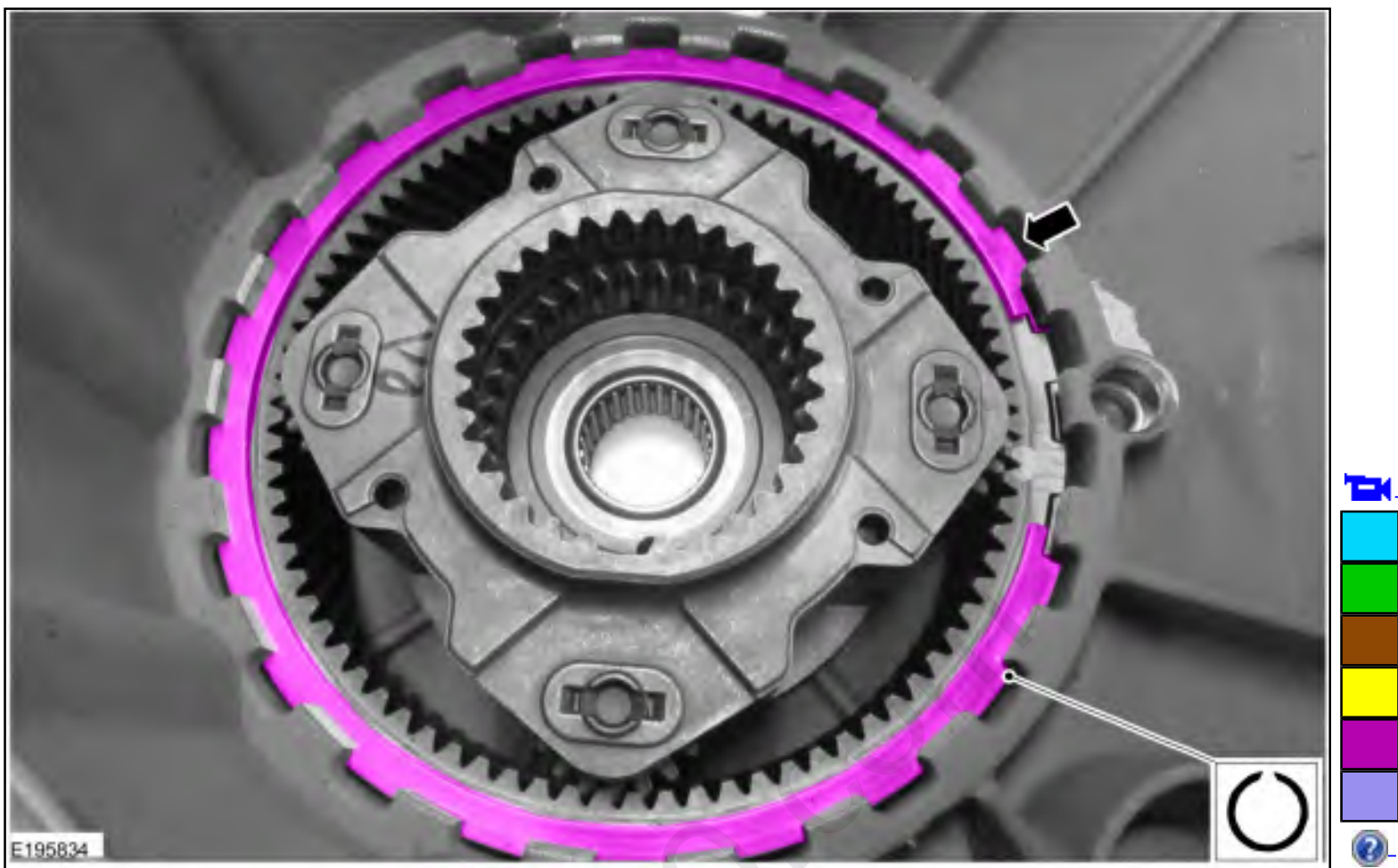
9. If removed, using a press and the special tool, install the needle bearing into the front planet carrier.
Use Special Service Tool: 308-085 (T83T-7025-C) Installer, Input Shaft Bearing.

10. **NOTE:** *Replace the inner planet carrier needle bearing if necessary.*

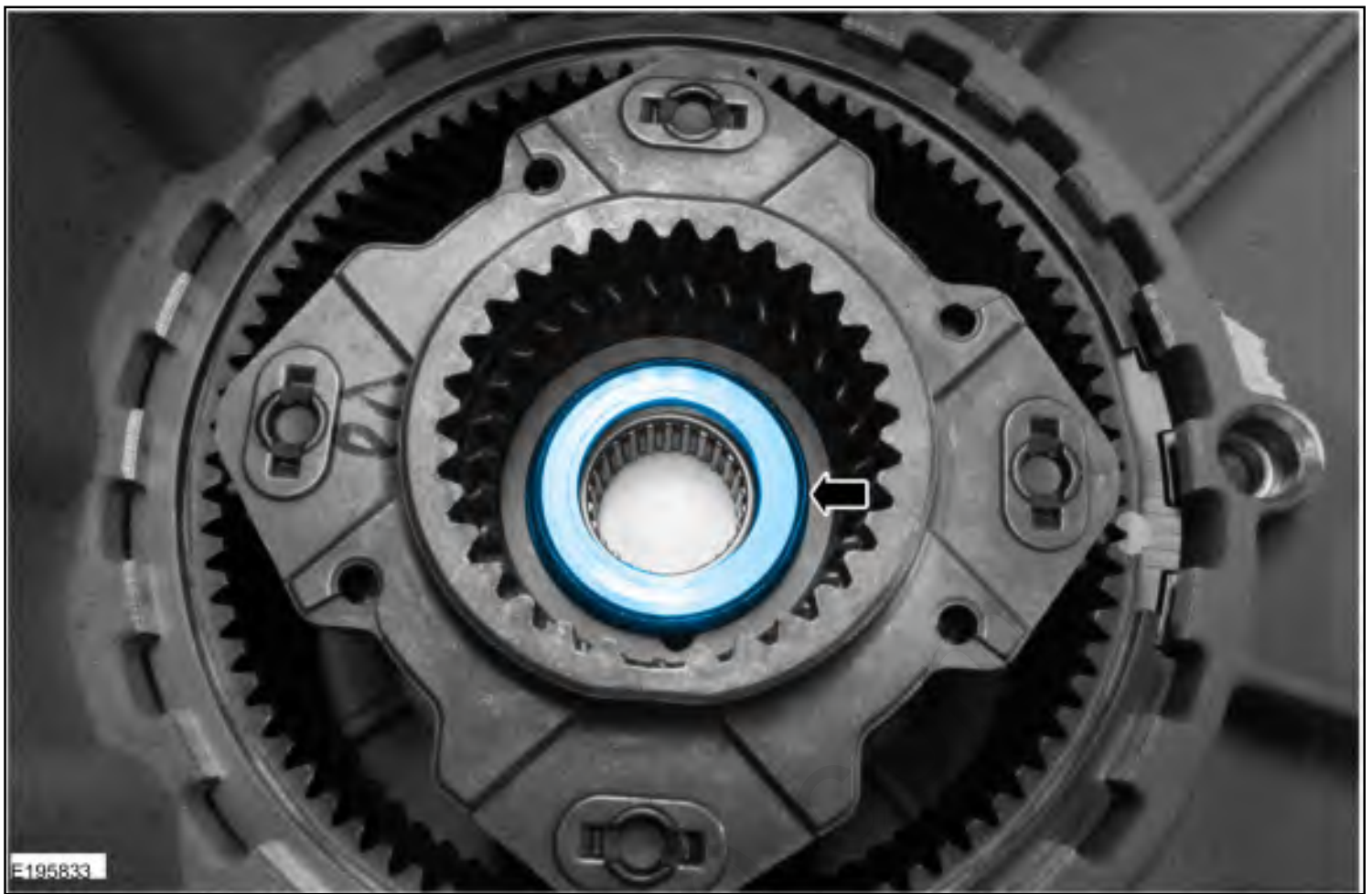
Install the front planet carrier.



11. Install the ring gear circlip.



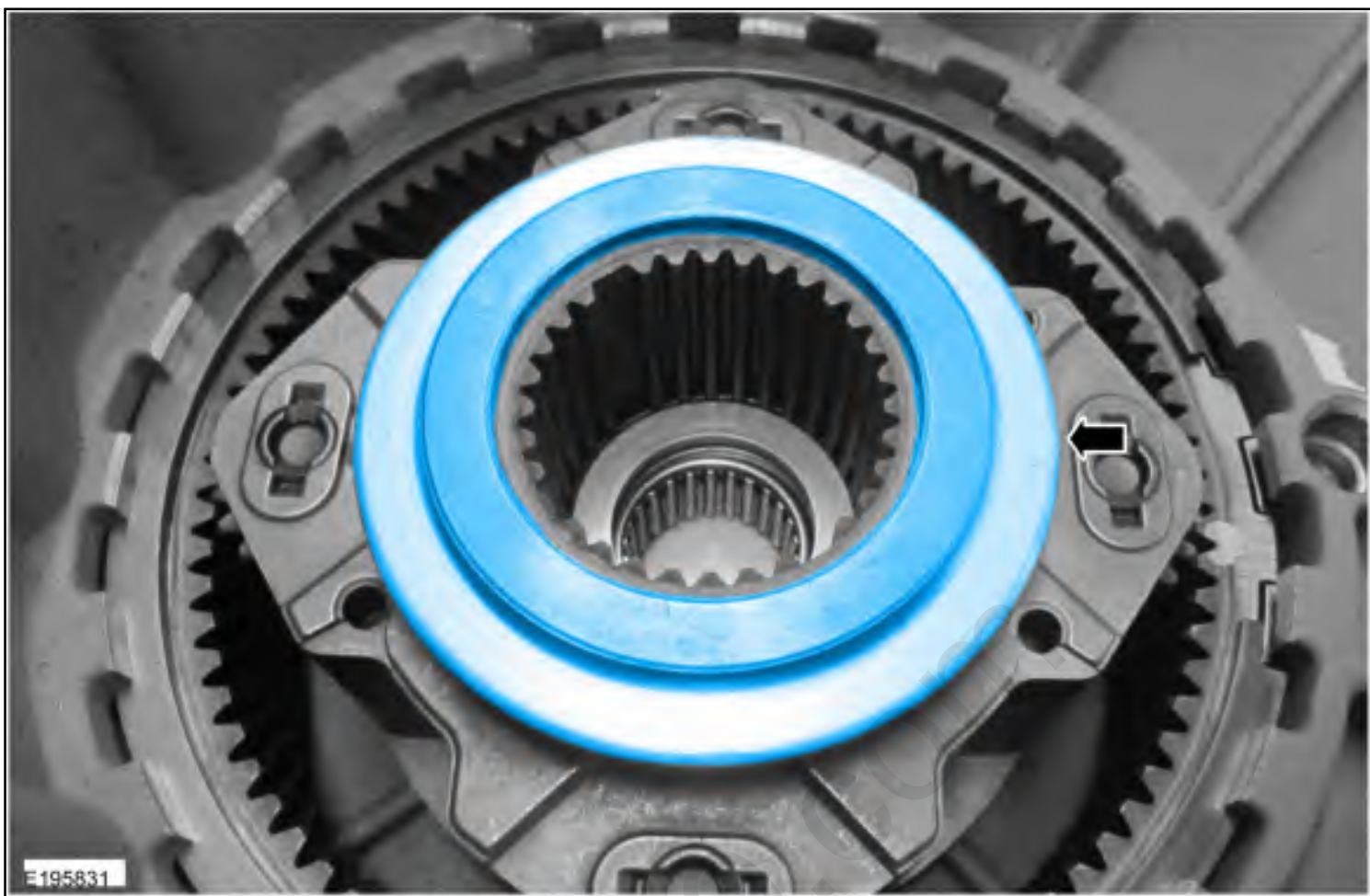
12. Install the planet carrier thrust bearing.



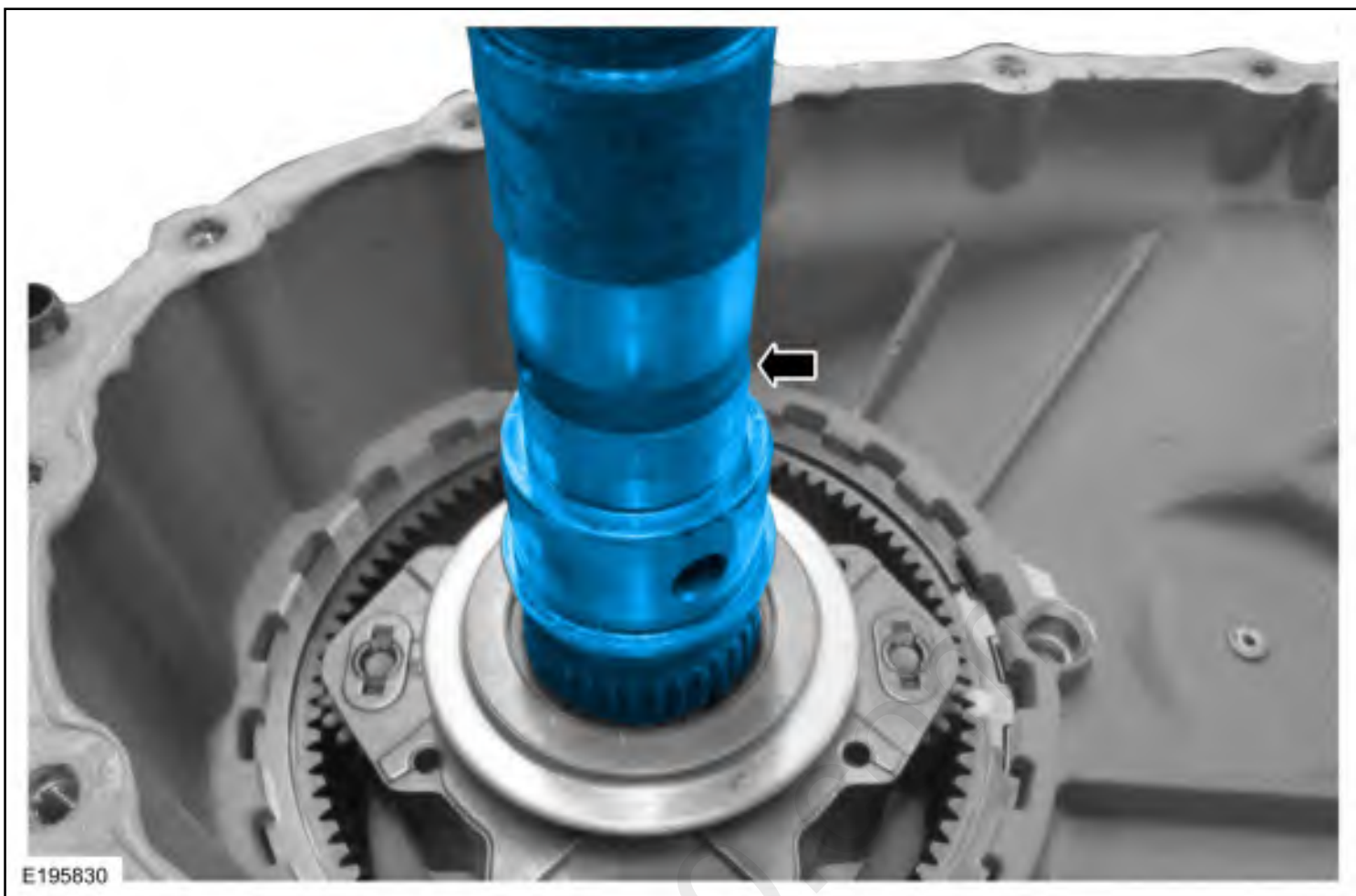
13. Install the electric shift cam assembly.



14. Install the reduction hub.



15. Install the output shaft.



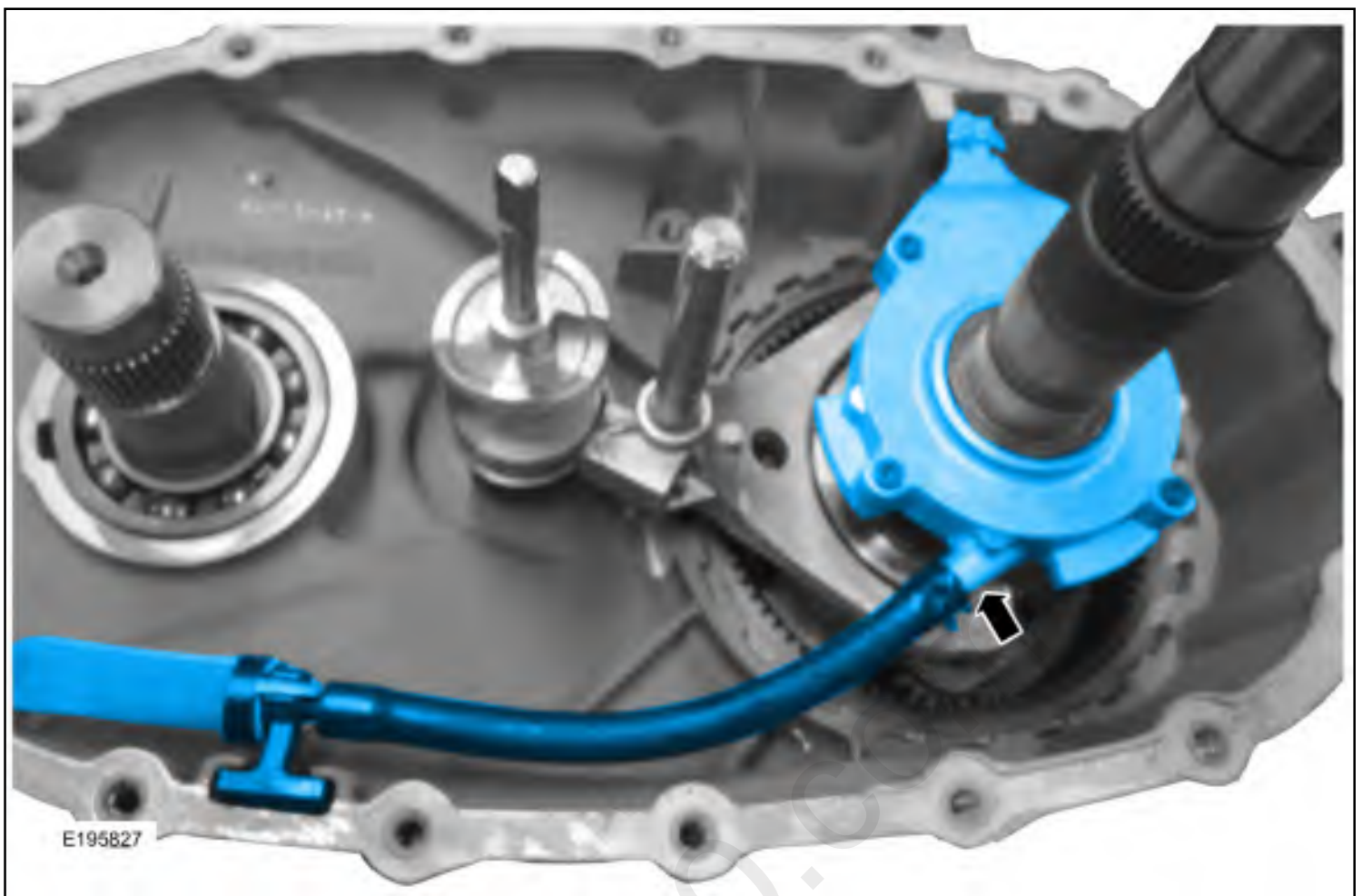
16. Install the shift fork.



17. Install the shift rail.

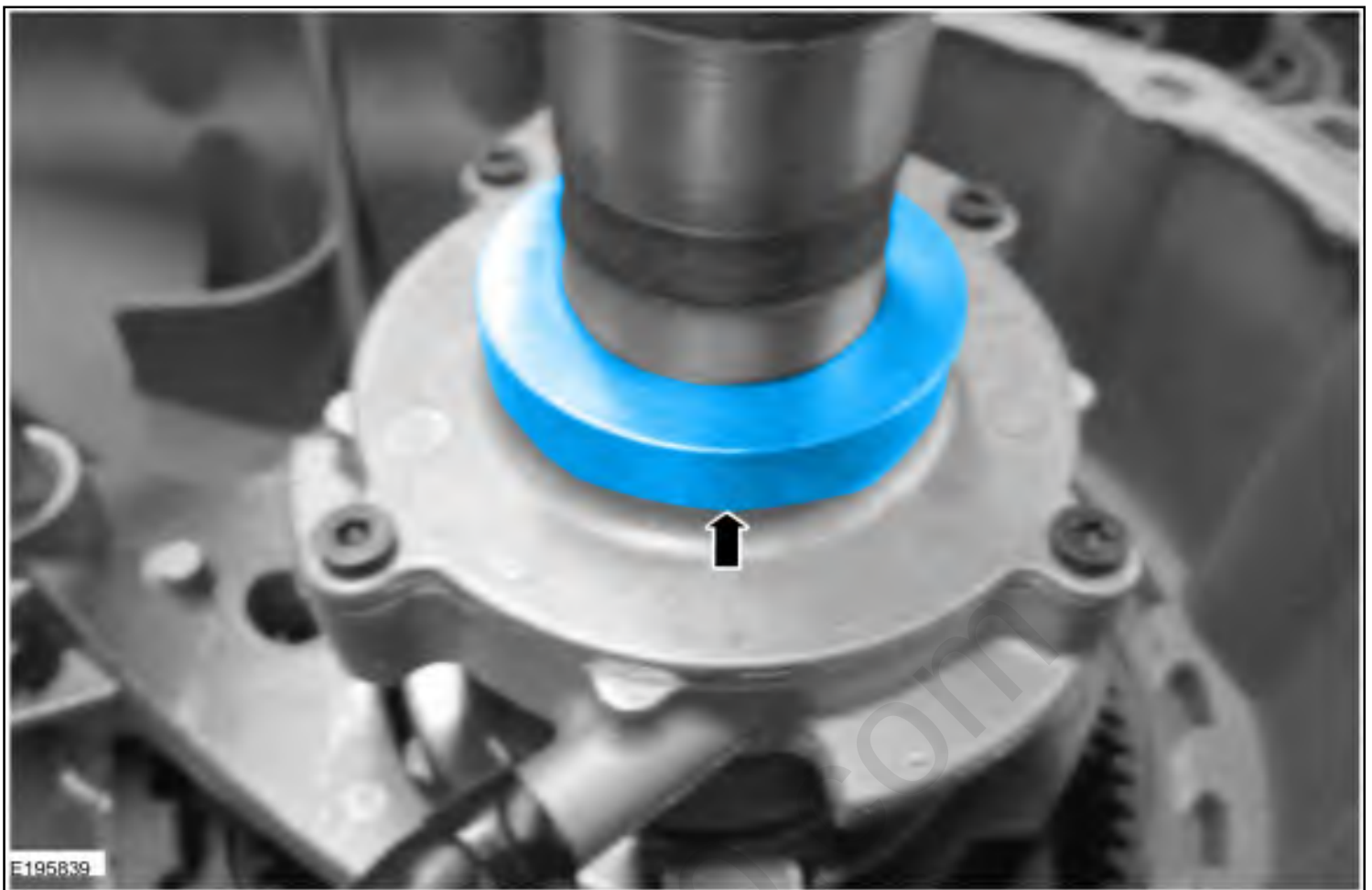


18. Install the oil pump assembly.





20. Install the sprocket thrust washer.

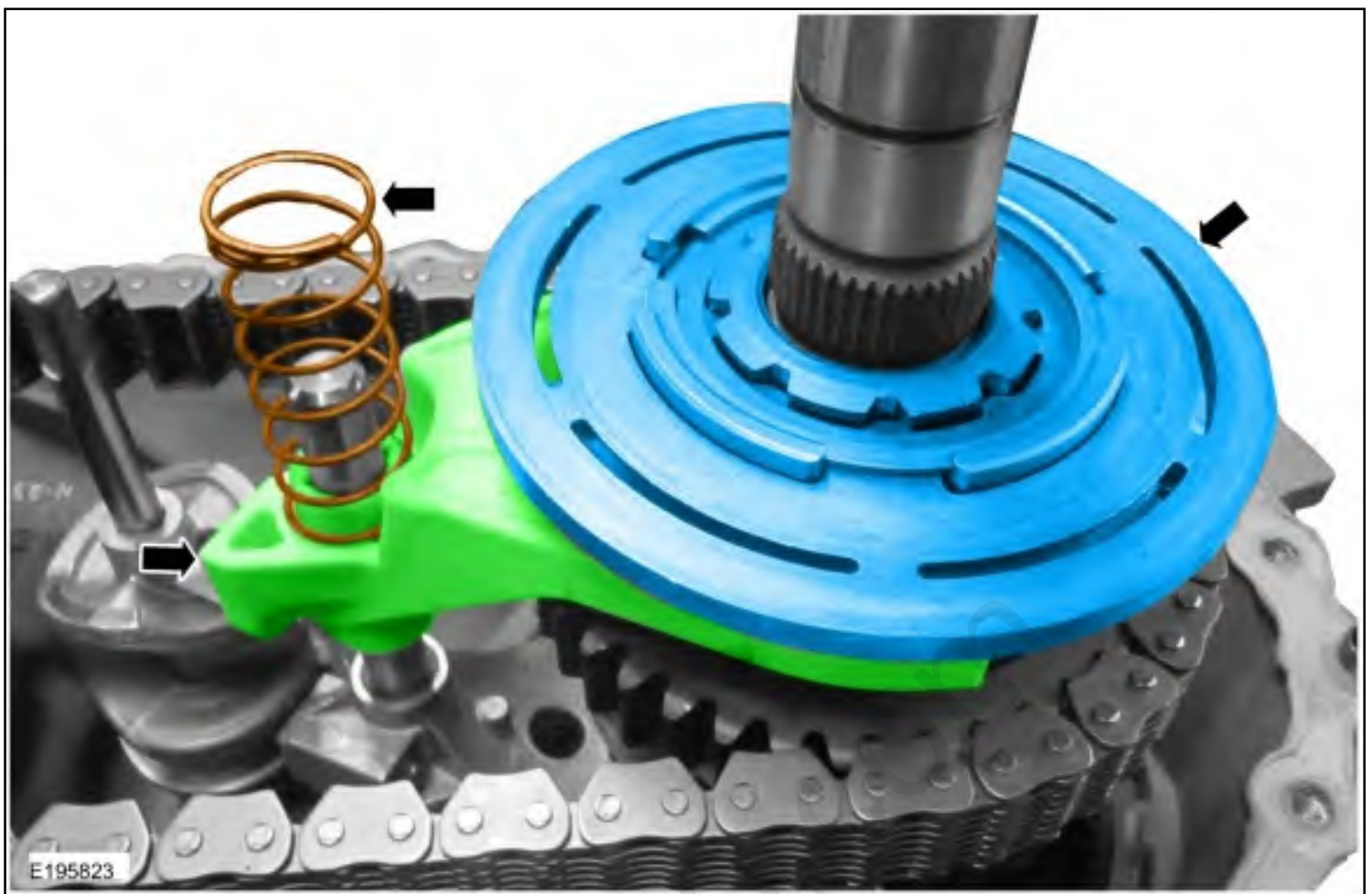


21. **NOTE:** *Install the drive chain and sprockets as an assembly.*

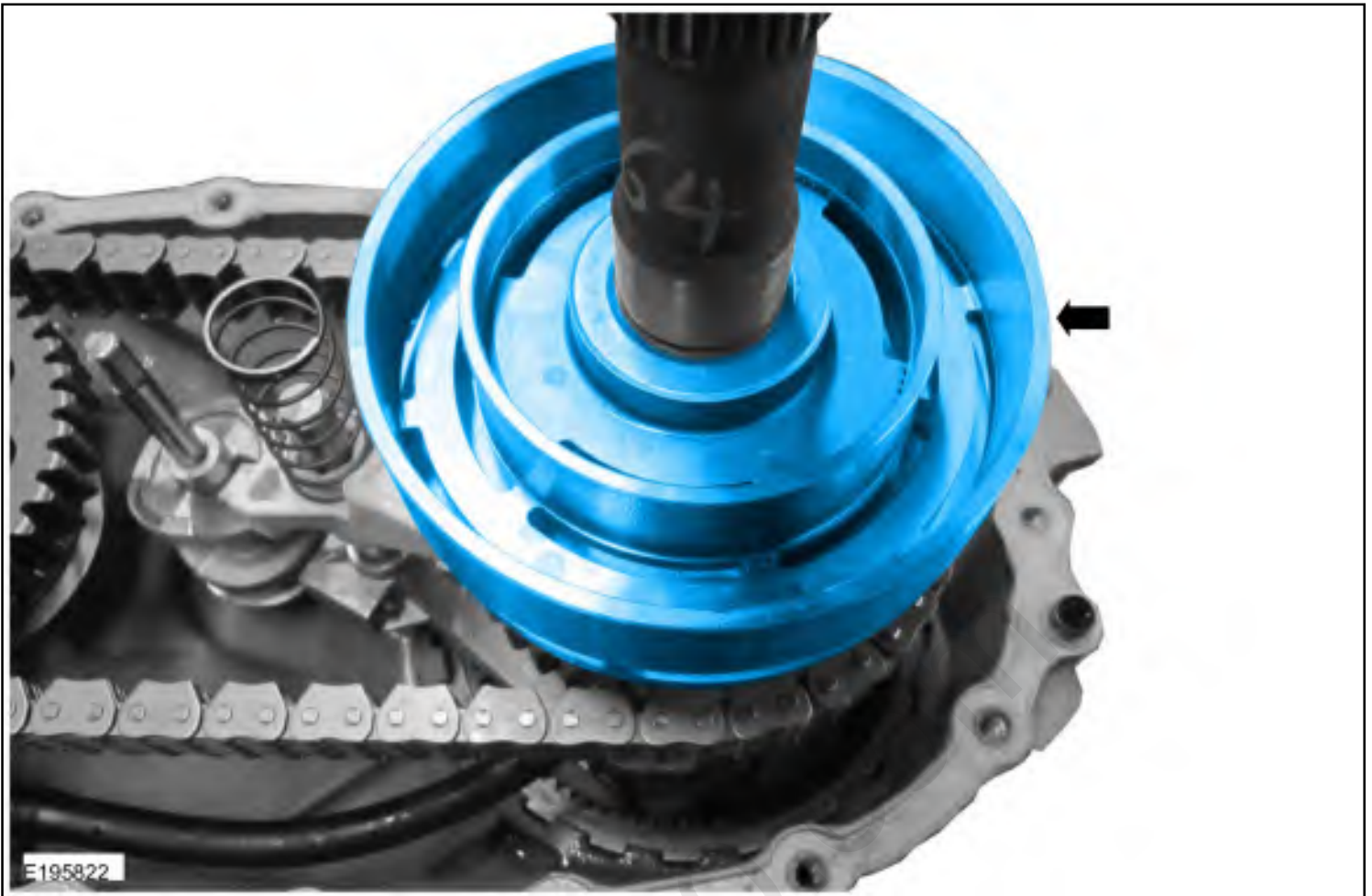
Install the drive chain and sprockets.



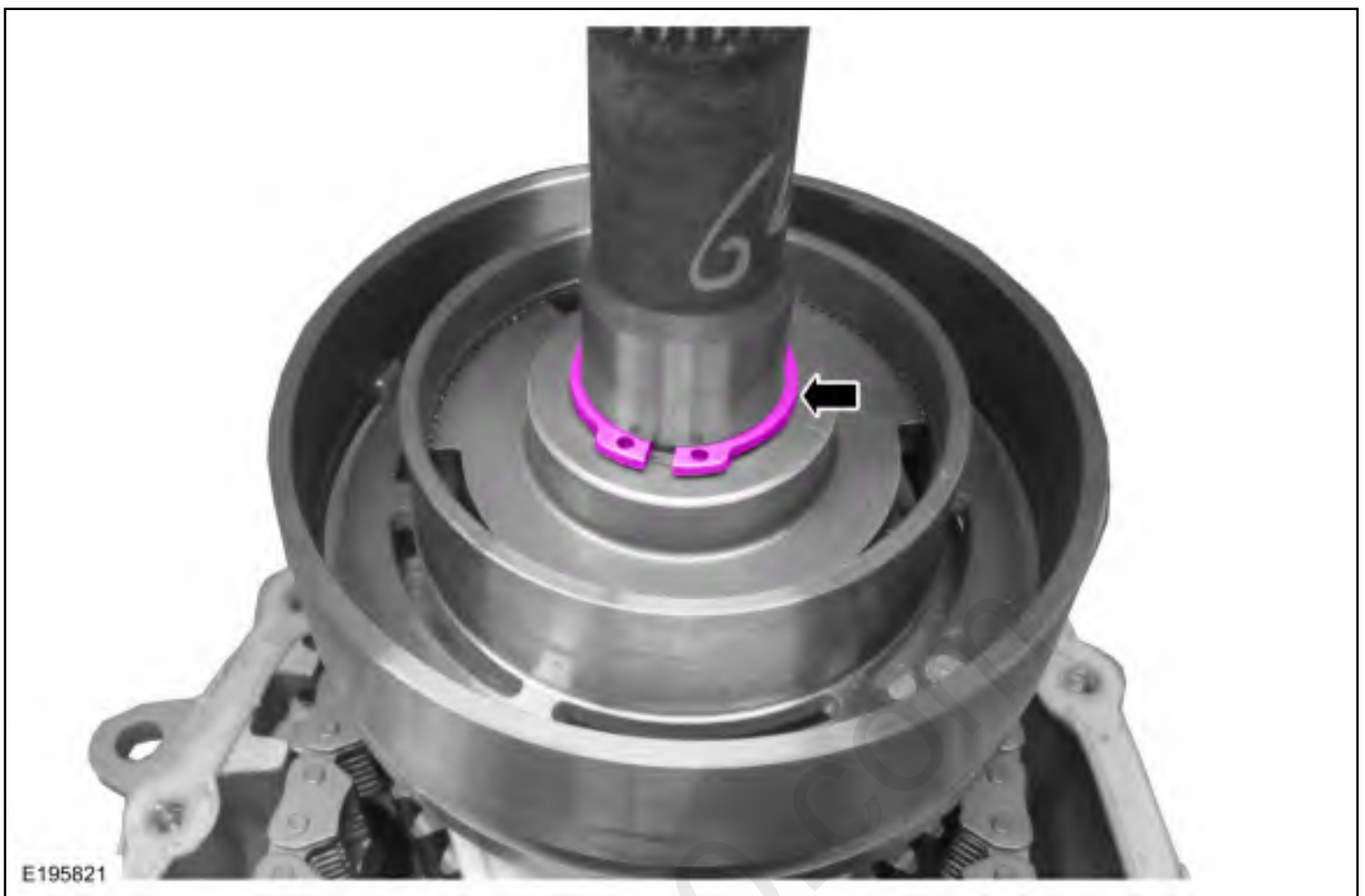
22. Install the lock up hub, shift fork and shift fork spring.



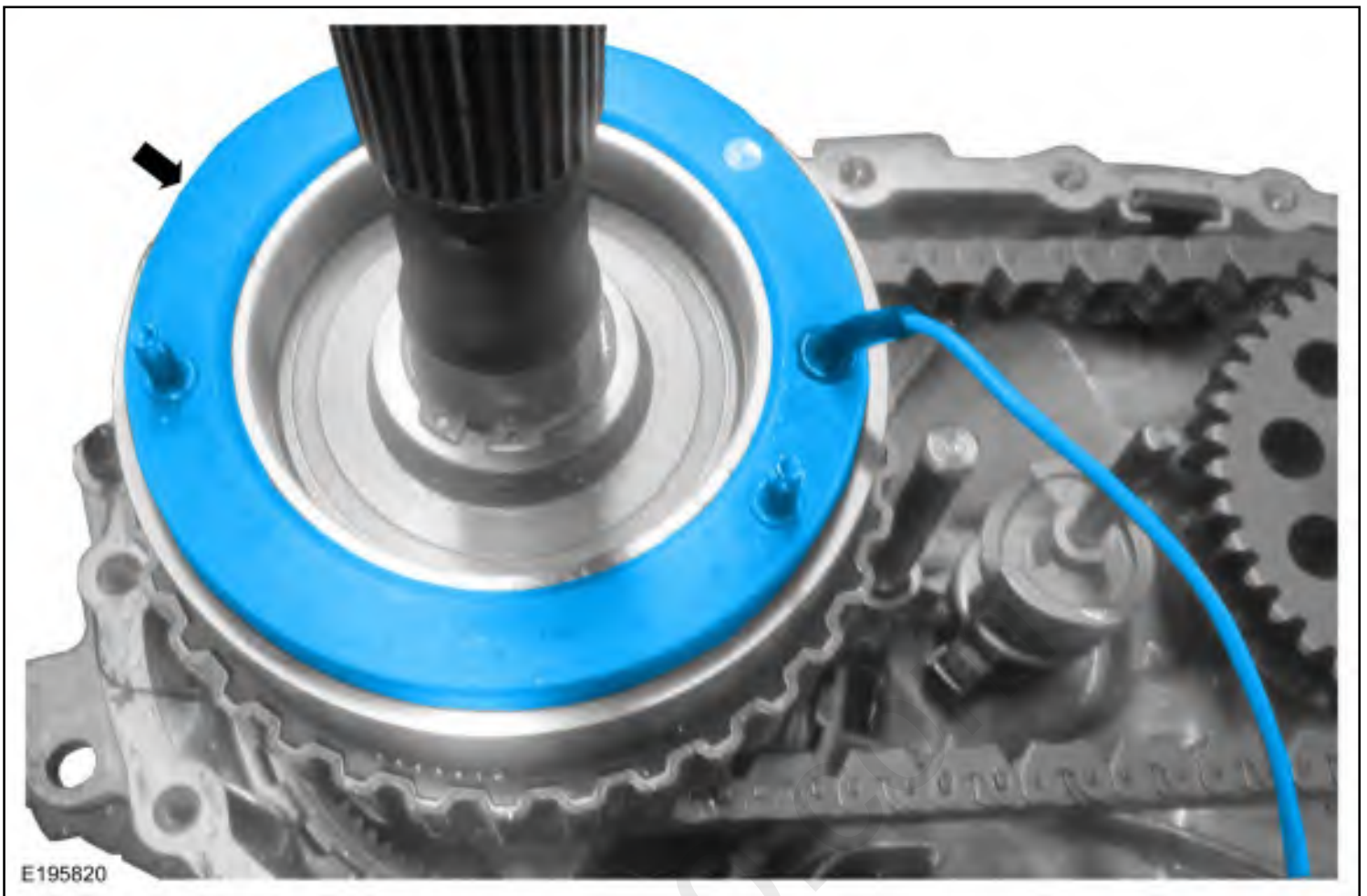
23. Install the field coil housing.



24. Install the field coil housing snap ring.



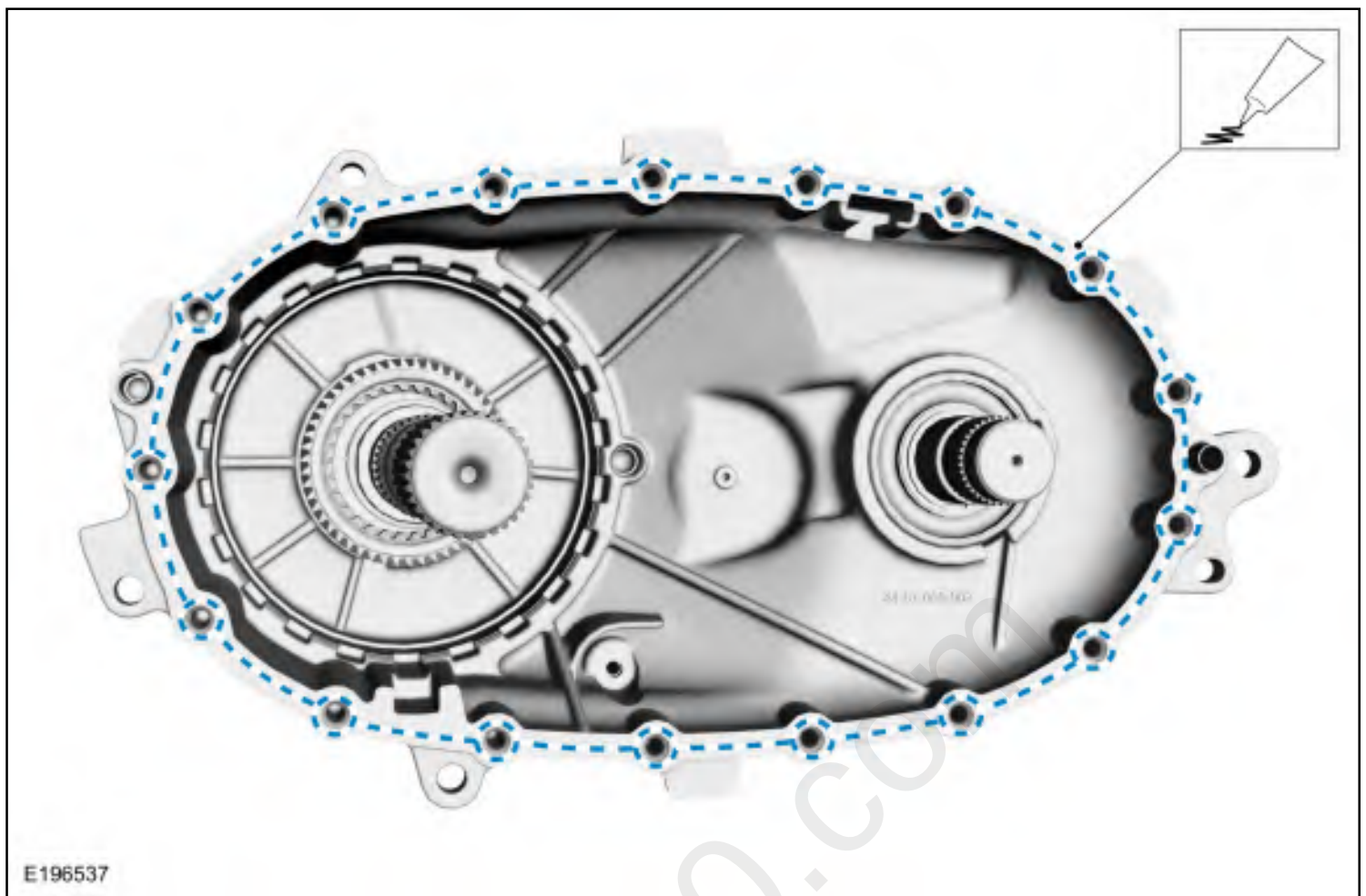
25. Install the transfer case field coil.



26. **NOTE:** Only apply enough silicone sealant to seal the transfer case halves together.

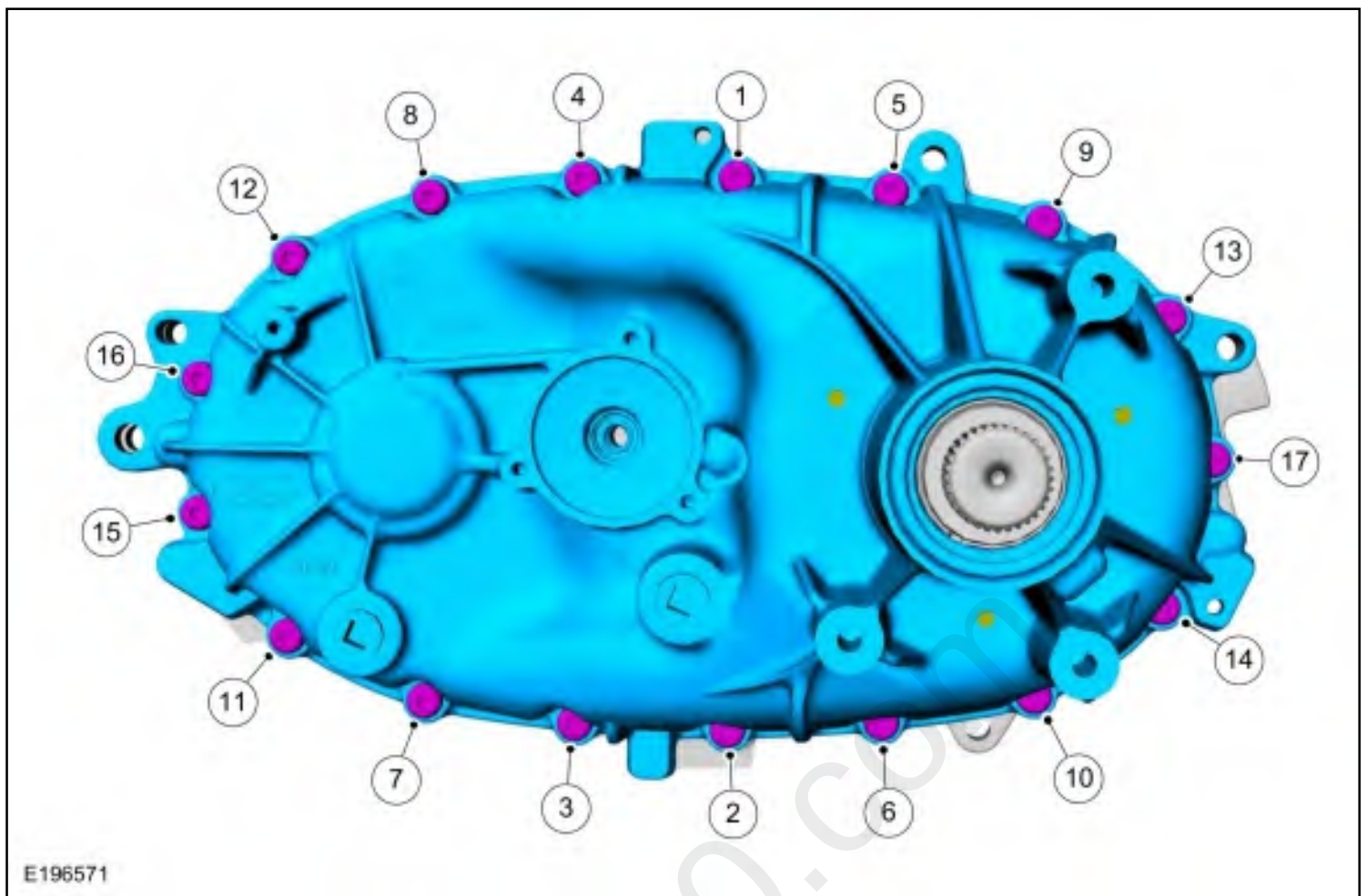
Apply a small bead of silicone sealant to the mating surface of the case half.

Material: Motorcraft® Ultra Silicone Sealant / TA-29

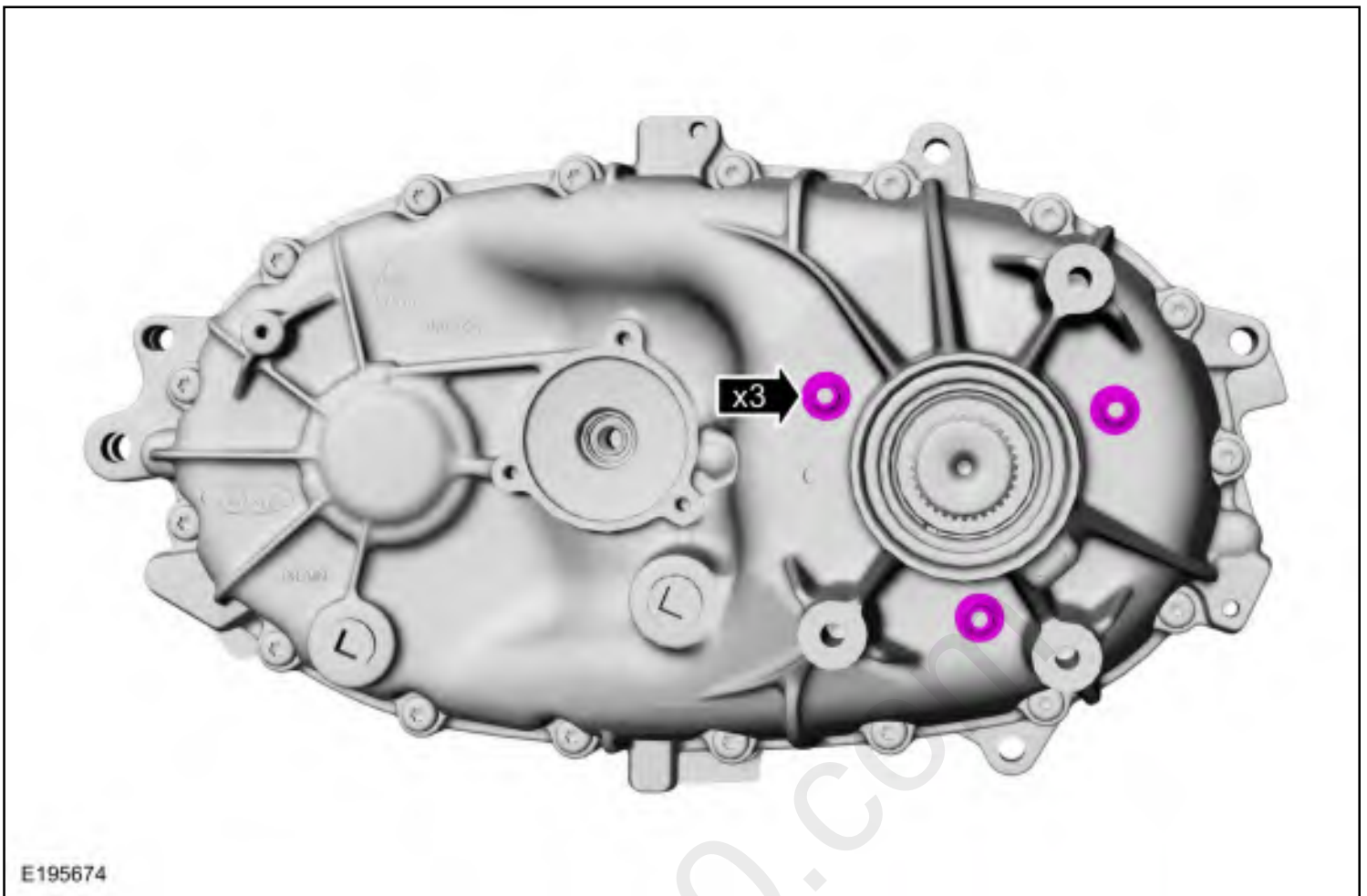


27. **NOTE:** Position the field coil bolts to align with the field coil bolt holes in the rear case. Position field coil wire through the field coil wire through hole in the case.

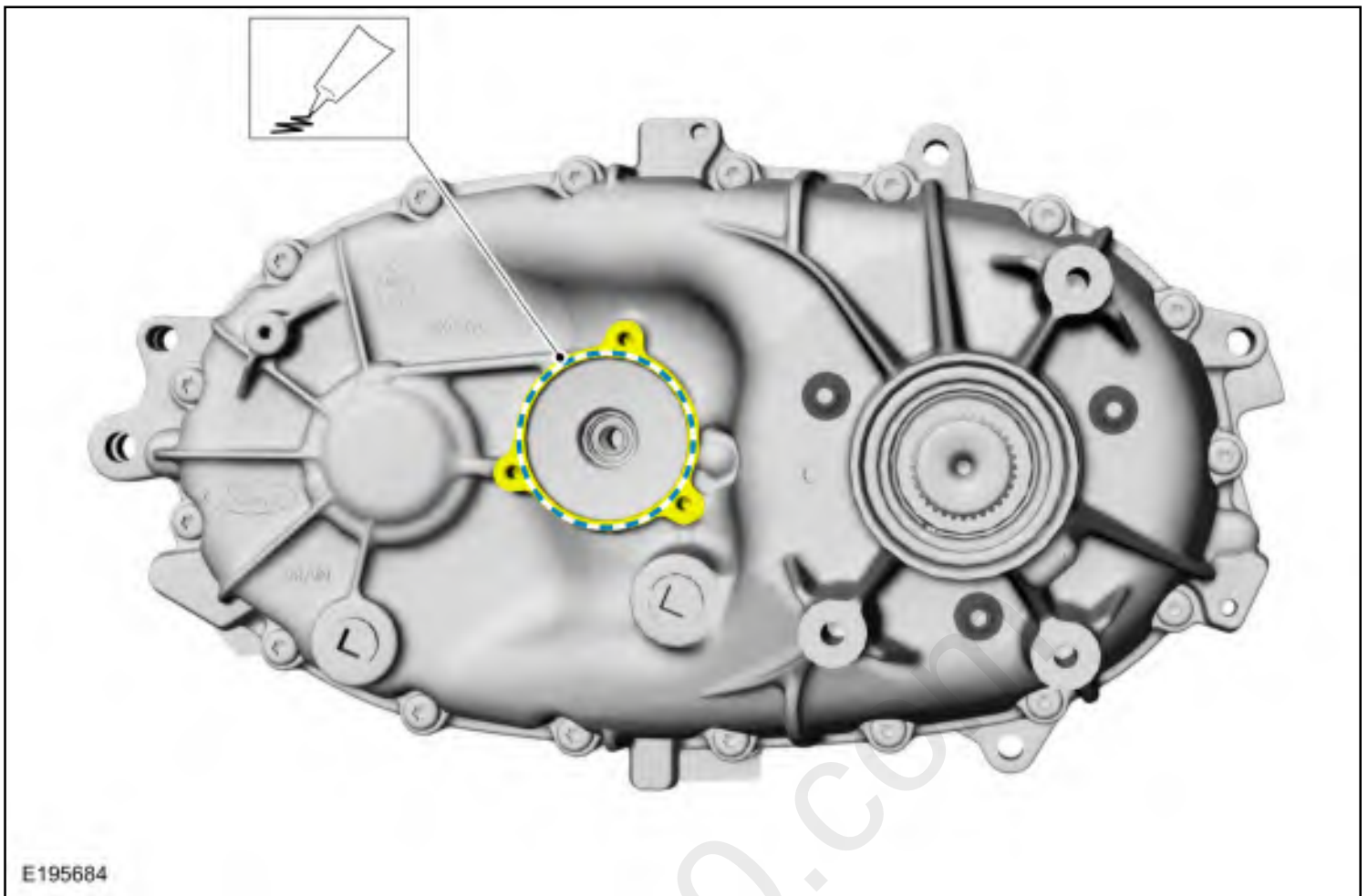
Position the transfer case halves and tighten the bolts in the sequence shown.
Torque: 18 lb.ft (24 Nm)



28. Install the transfer case field coil washers and the nuts.
Torque: 89 lb.in (10 Nm)

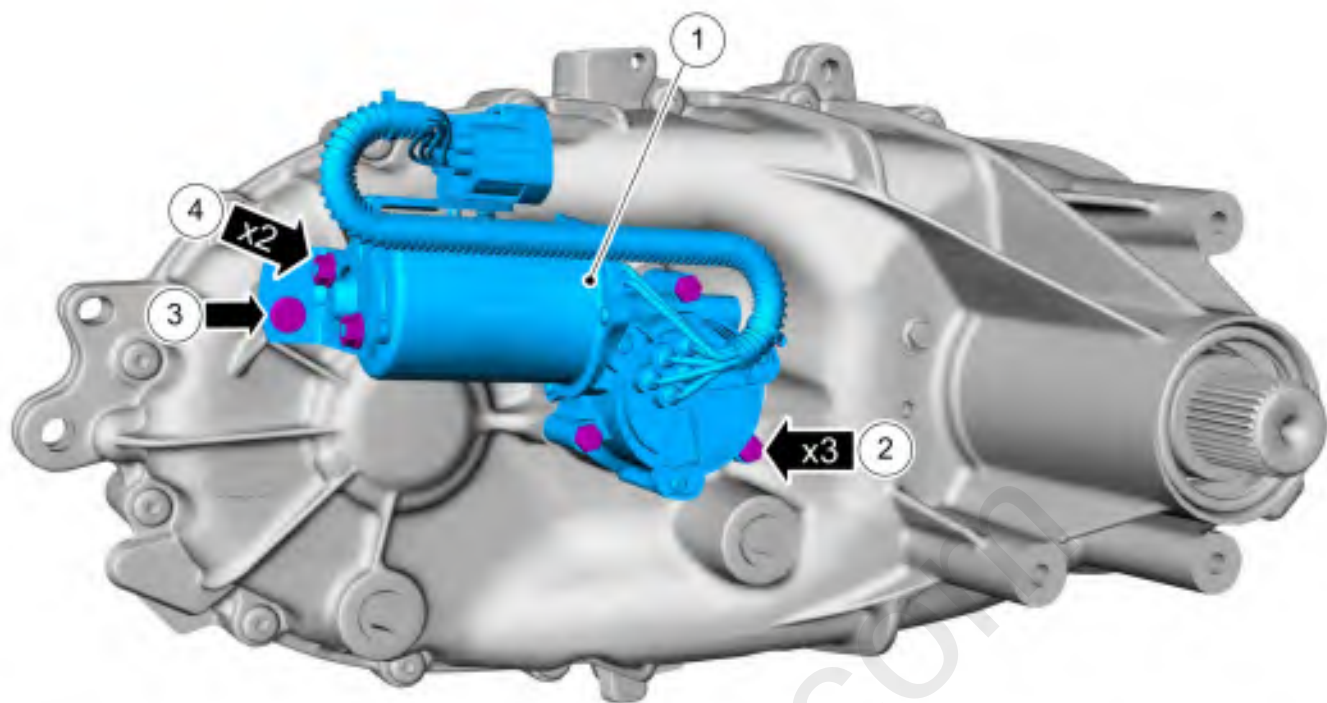


29. Install the transfer case rear seal.
Refer to: [Transfer Case Rear Seal](#) (308-07B Transfer Case, Removal and Installation).
30. Apply a small bead of silicone sealant to the transfer case shift motor mating surface.
Material: Motorcraft® Ultra Silicone Sealant / TA-29



31. **NOTICE:** When installing the shift motor, tighten the bracket nuts last. Failure to follow the steps in the correct order may result in damage to the component.

1. Install the transfer case shift motor.
2. Install the transfer case shift motor bolts.
Torque: 89 lb.in (10 Nm)
3. Install the transfer case shift motor bracket bolt.
Torque: 89 lb.in (10 Nm)
4. Tighten the transfer case shift motor bracket nuts.
Torque: 27 lb.in (3 Nm)



E195676

32. **NOTE:** After the coil wire is inserted into the connector, gently pull the wire back to verify the pin is locked inside the connector.

Install the coil wire pin in the electrical connector.

1. Insert the coil wire pin in the electrical connector.
2. Install the inner connector retainer.



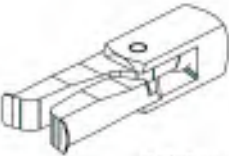
33. Remove the transfer case from the transmission adjustable mounting arms.
Use the General Equipment: Adjustable Mounting Arm

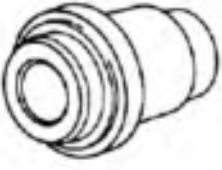


Transfer Case - Raptor, Vehicles With: 2-Speed Torque On Demand Transfer Case

Base Part Number: Base Part Number: 7251

Special Tool(s) / General Equipment

 E133913	205-153 (T80T-4000-W) Handle
 E231407	205-293 (T89P-4850-A) Installer, Differential Oil Seal TKIT-1989-F TKIT-1989-FLM TKIT-1989-FM TKIT-1989-LM
 E231408	205-504 Installer, Halfshaft Pilot Bearing TKIT-2002N-F/FM TKIT-2002N-FLM TKIT-2002N-LM
 E142012	307-318 Remover, Stator Bearing TKIT-1994-FH TKIT-1994-FMH/FLMH TKIT-1994-LMH/MH

 E231409	307-582A Cover Axle Seal Installer TKIT-2008AS-FLM
 E231410	308-047 (T77F-1102-A) Remover, Bearing Cup
 E231411	308-085 (T83T-7025-C) Installer, Input Shaft Bearing TKIT-1983-F TKIT-1983-FLM TKIT-1983-FX
 E231411	308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal TKIT-1996-F/FM TKIT-1996-FLM2
Slide Hammer	
Adjustable Mounting Arm	

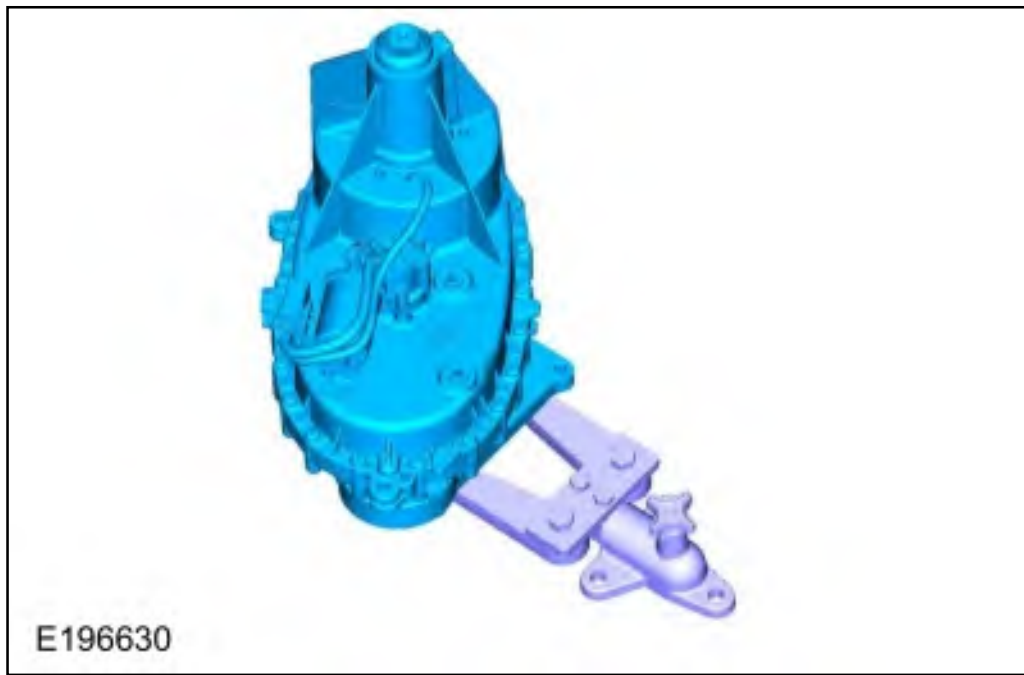
Materials

Name	Specification
Motorcraft® Ultra Silicone Sealant TA-29	-

DISASSEMBLY

- NOTICE:** Seal all openings before cleaning the transfer case exterior. This will prevent entry of dirt and water, which may cause damage to internal components.

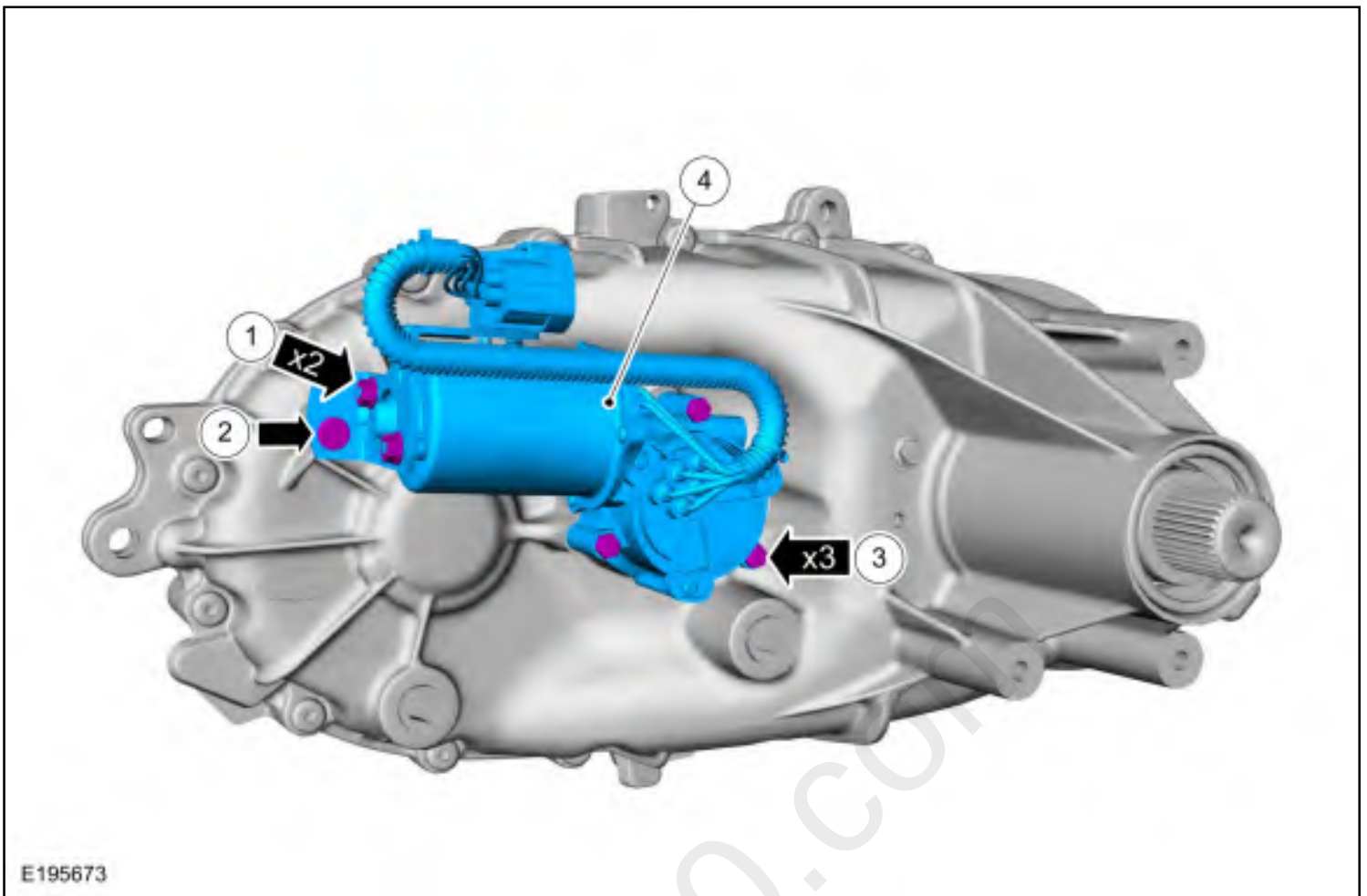
Using a transmission adjustable mounting arm, secure the transfer case to the bench. Clean the transfer case with solvent and dry with compressed air.
Use the General Equipment: Adjustable Mounting Arm



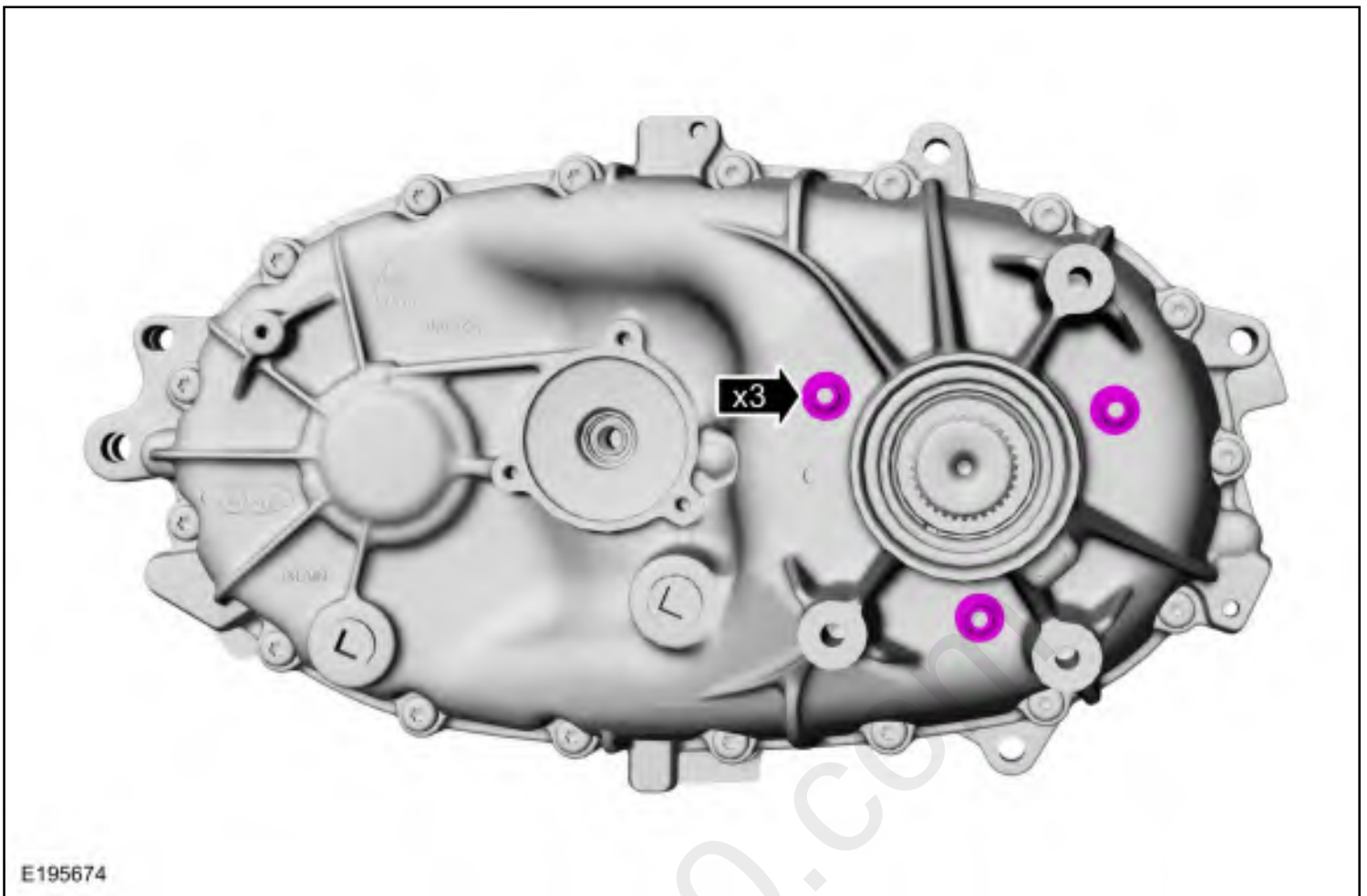
2. Remove the transfer case rear seal.
Refer to: [Transfer Case Rear Seal](#) (308-07B Transfer Case, Removal and Installation).
3.
Remove the coil wire pin from the electrical connector.
 1. Remove the inner retainer from the wire connector.
 2. Press the release tab and remove the coil wire pin.



1. Loosen the transfer case shift motor bracket nuts.
2. Remove the transfer case shift motor bracket bolt.
3. Remove the transfer case shift motor bolts.
4. Remove the transfer case shift motor.

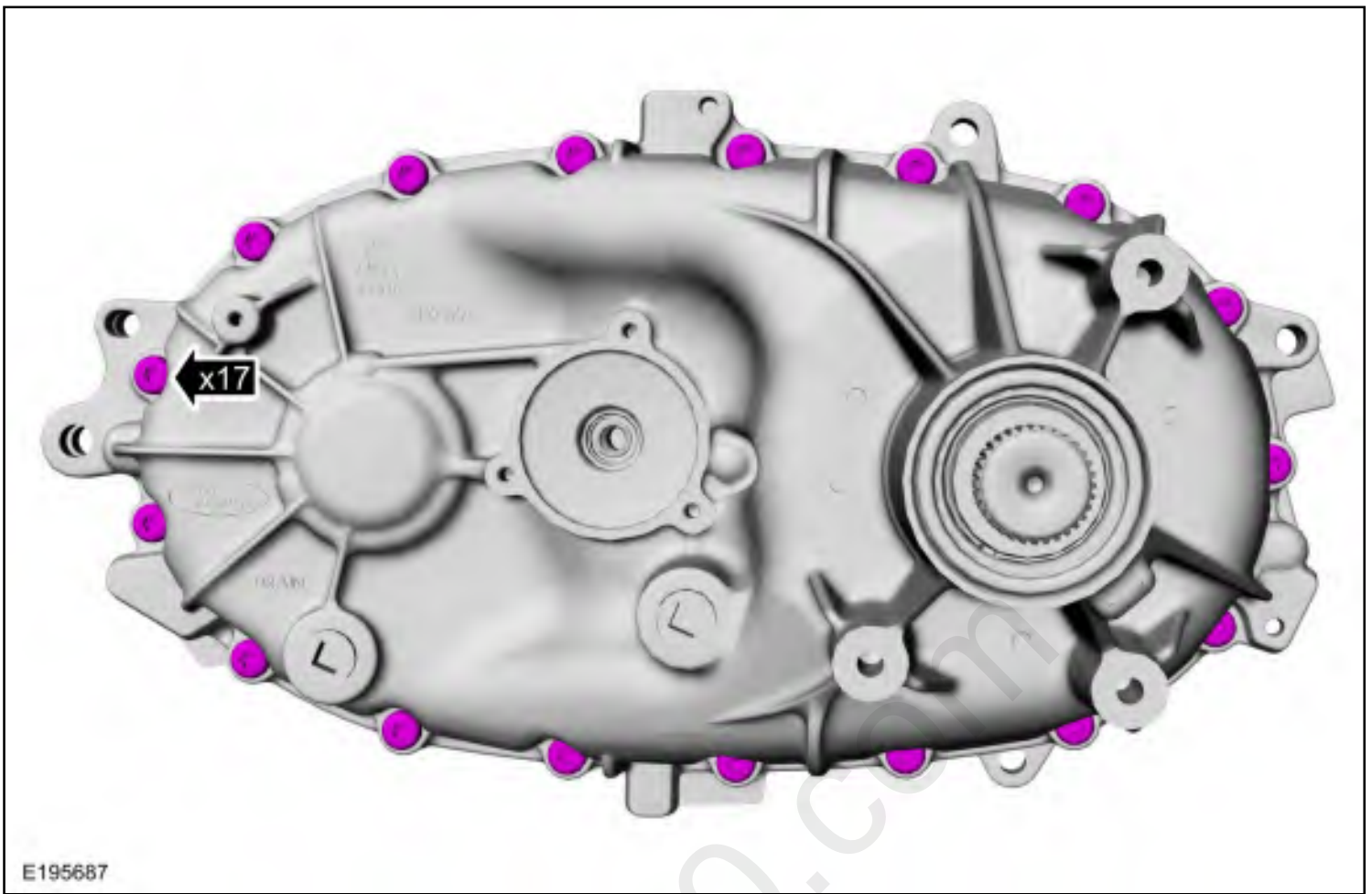


5. Remove the coil nuts and washers.

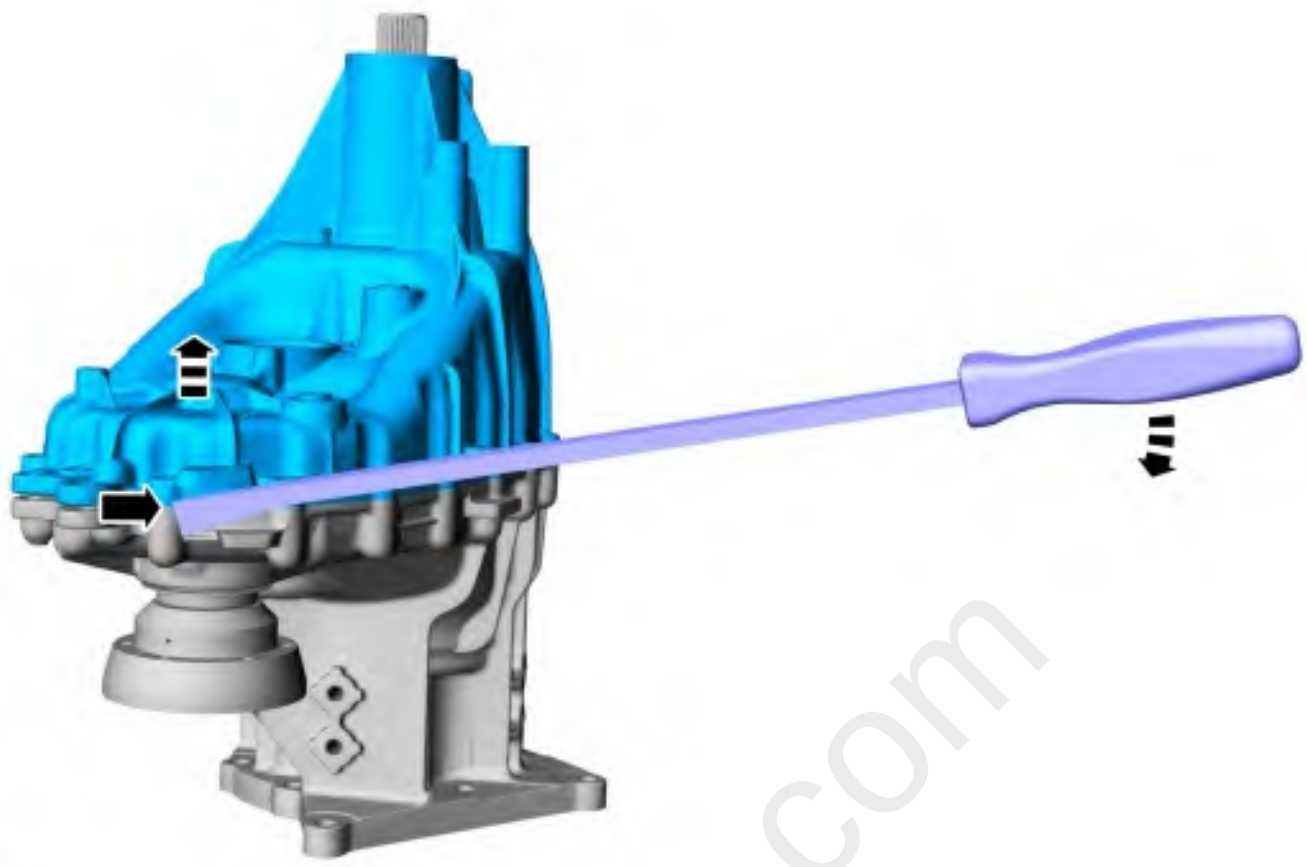


6. **NOTE:** The transfer case bolts are self tapping, and it is normal to find metal shavings while removing the cover.

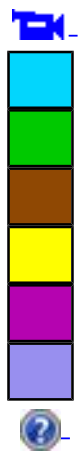
Remove the transfer case bolts.



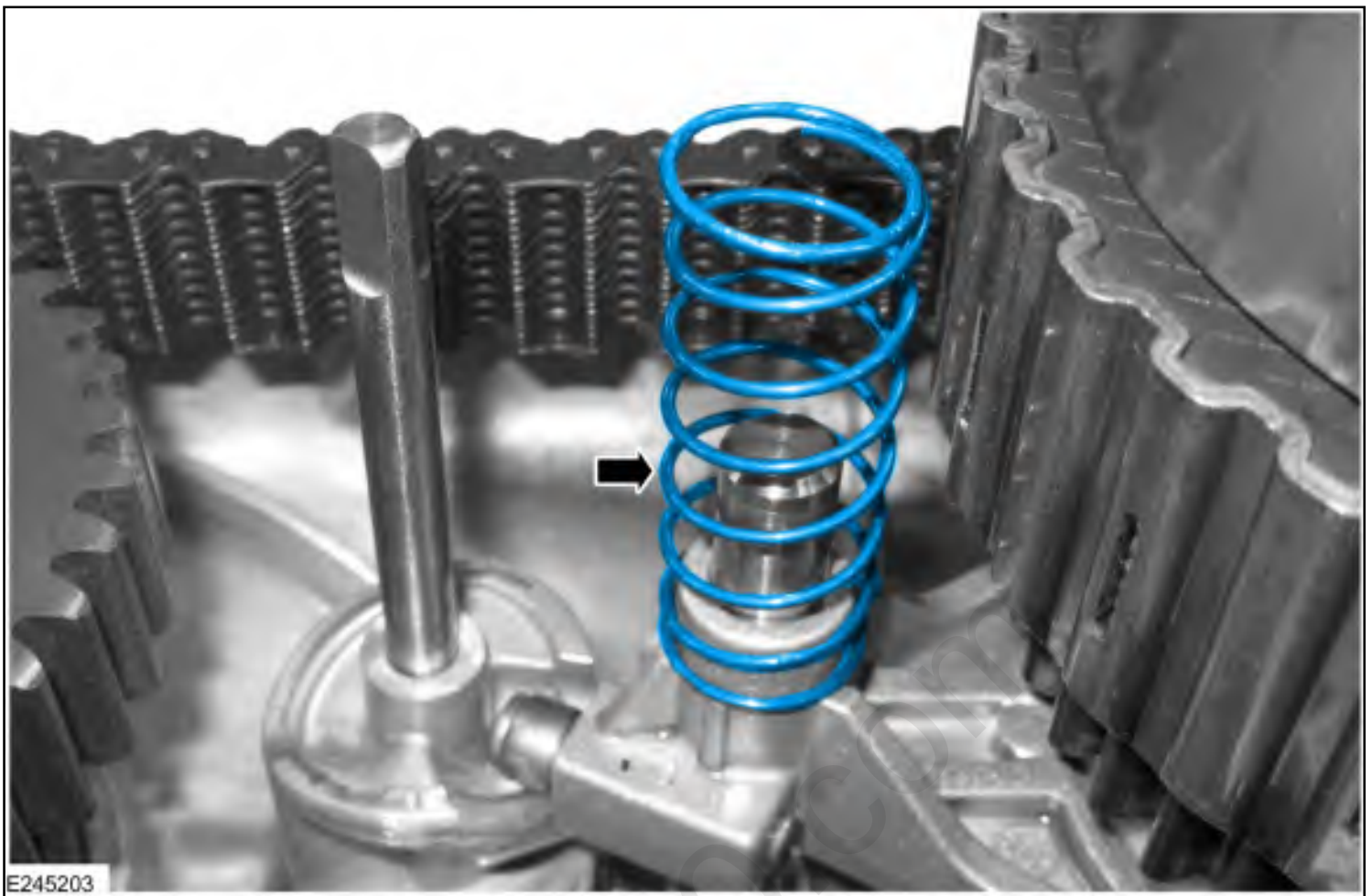
7. Using the pry bosses, separate the transfer case covers.



E195688



8. Remove the lock up fork spring.



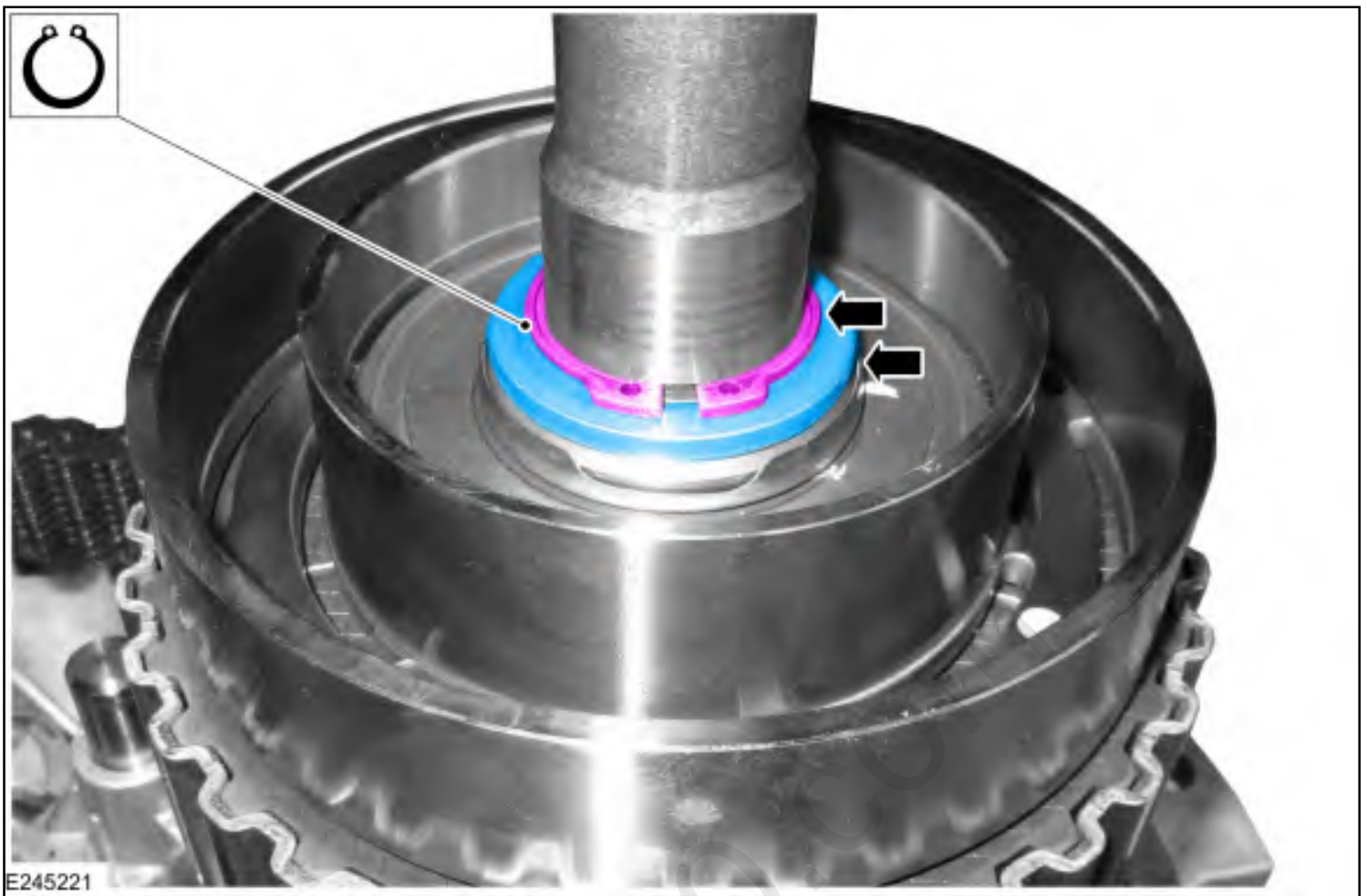
9. Remove the transfer case field coil.



E245200



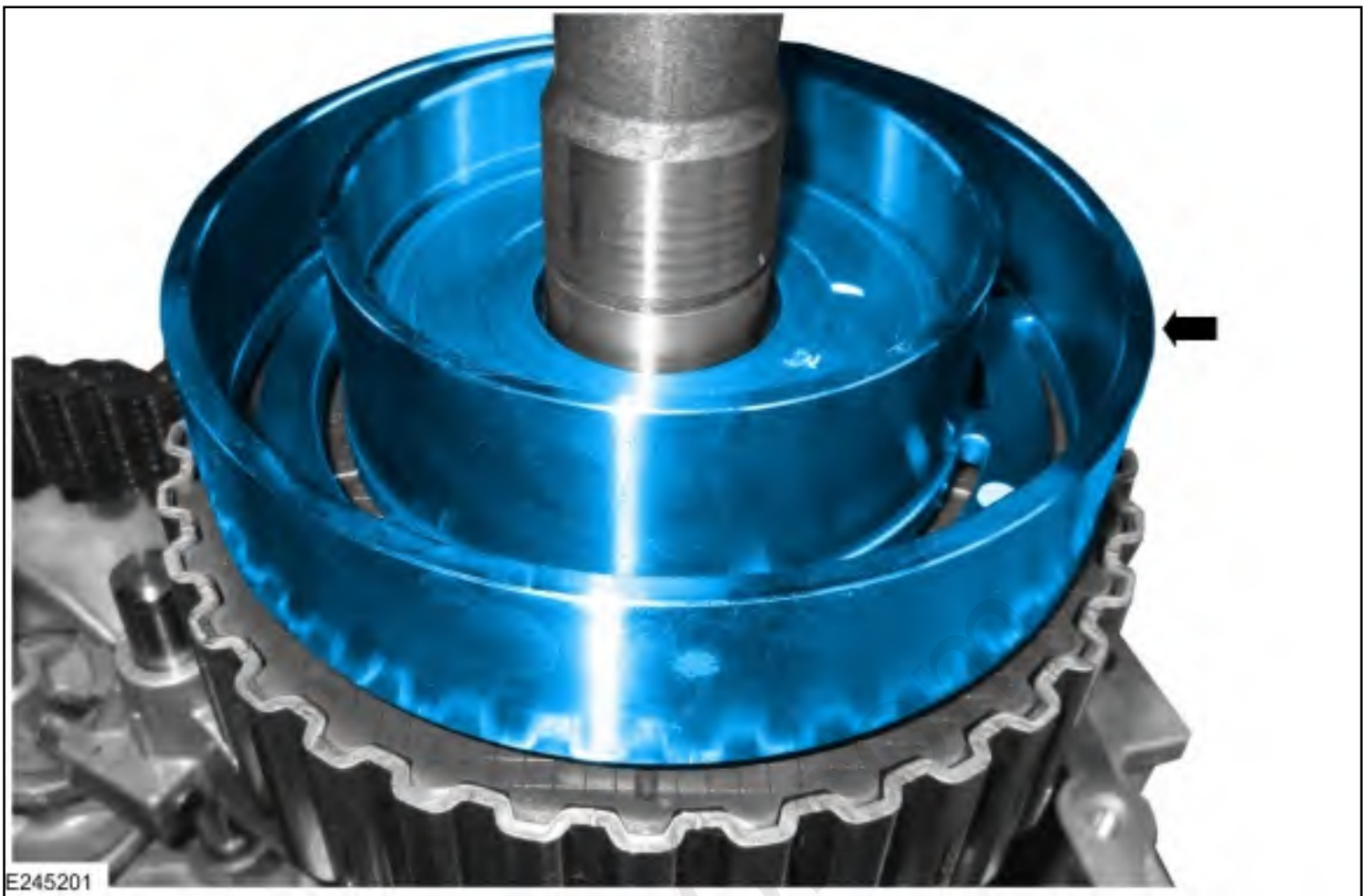
10. Remove the coil housing snap ring and spacer.



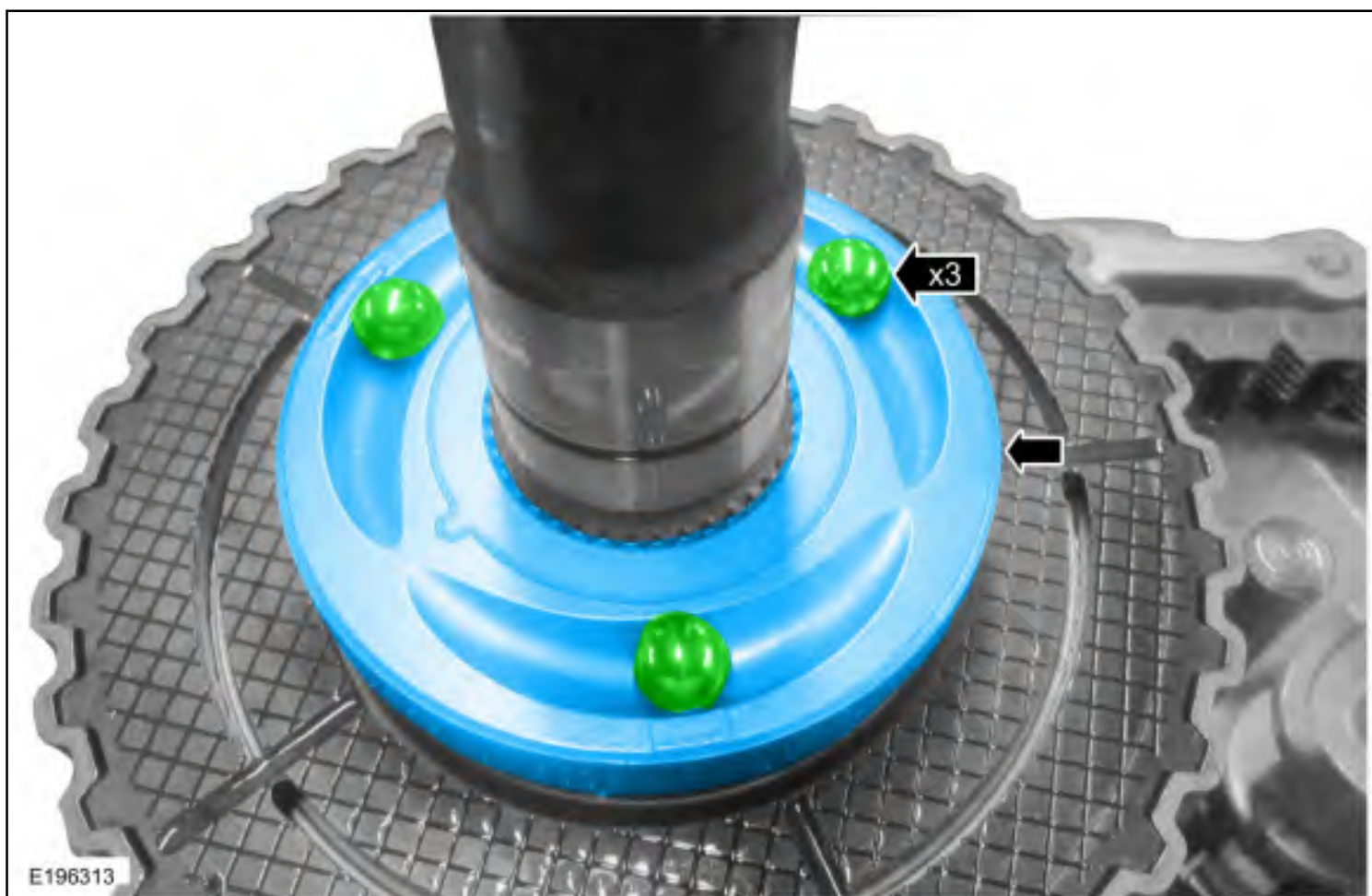
11. Remove the caged thrust bearing assembly.
 - Install a new bearing as necessary.



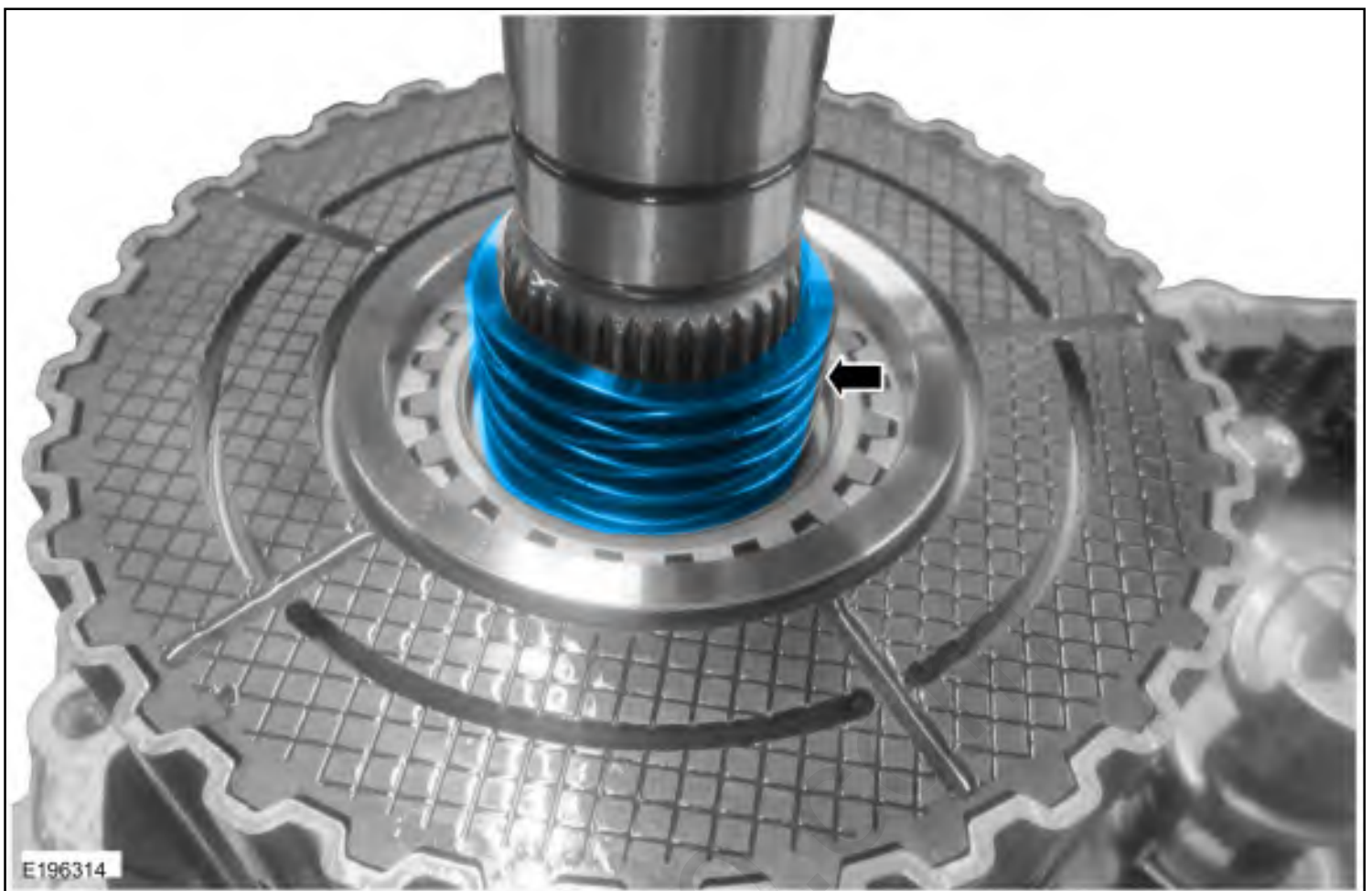
12. Remove the coil housing.



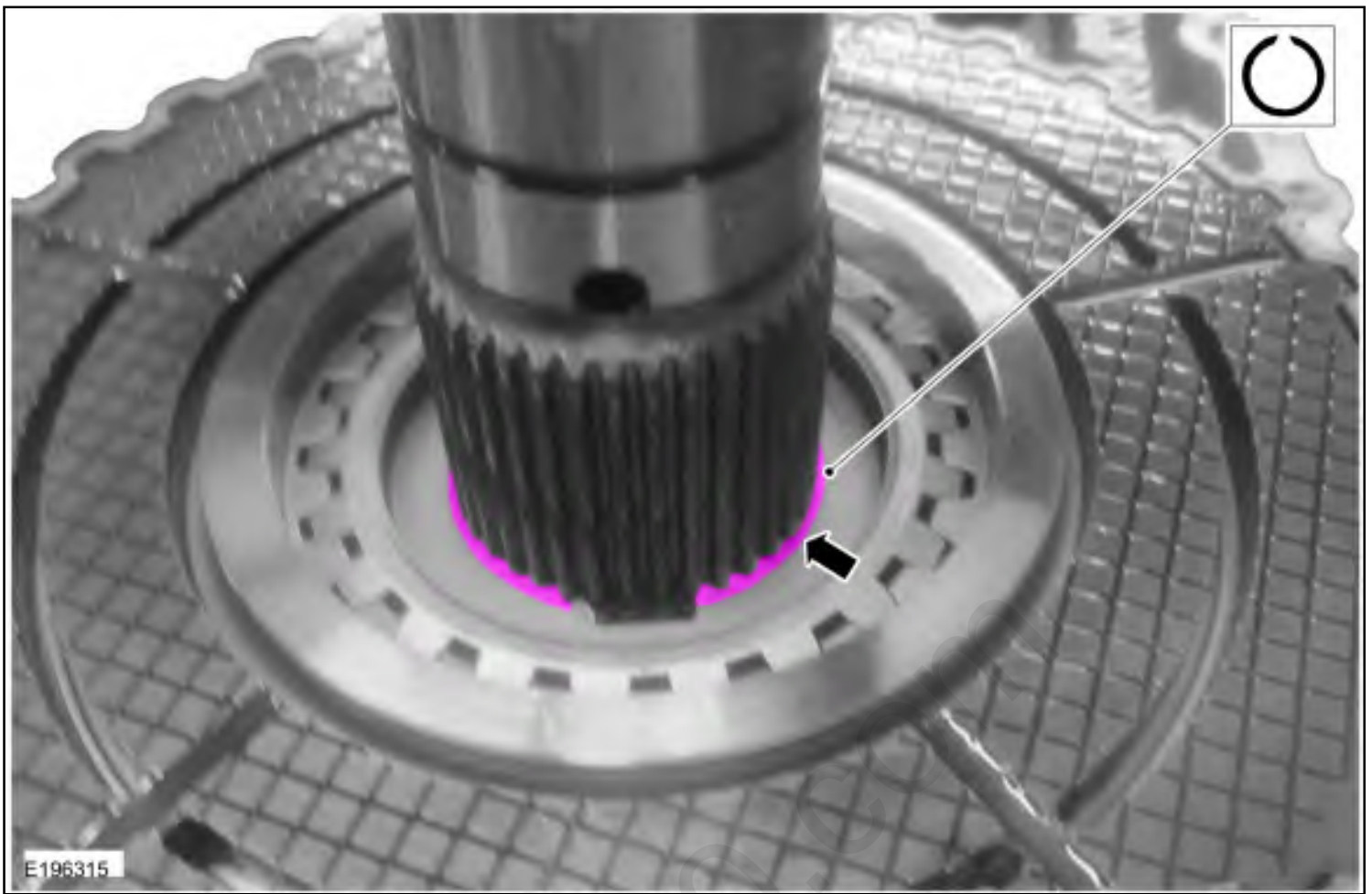
13. Remove the steel balls and the cam.



14. Remove the wave spring.



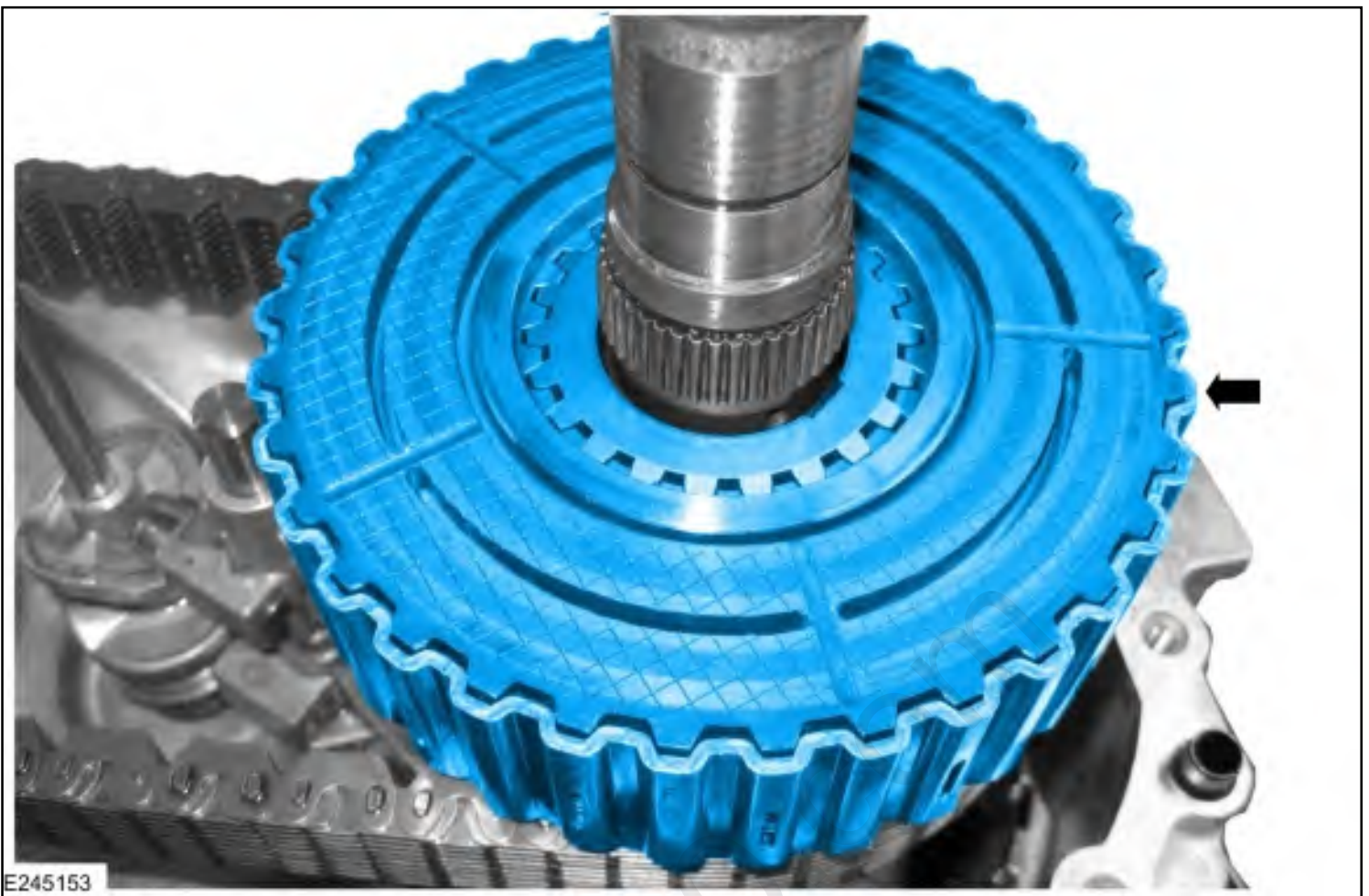
15. Remove clutch pack circlip.



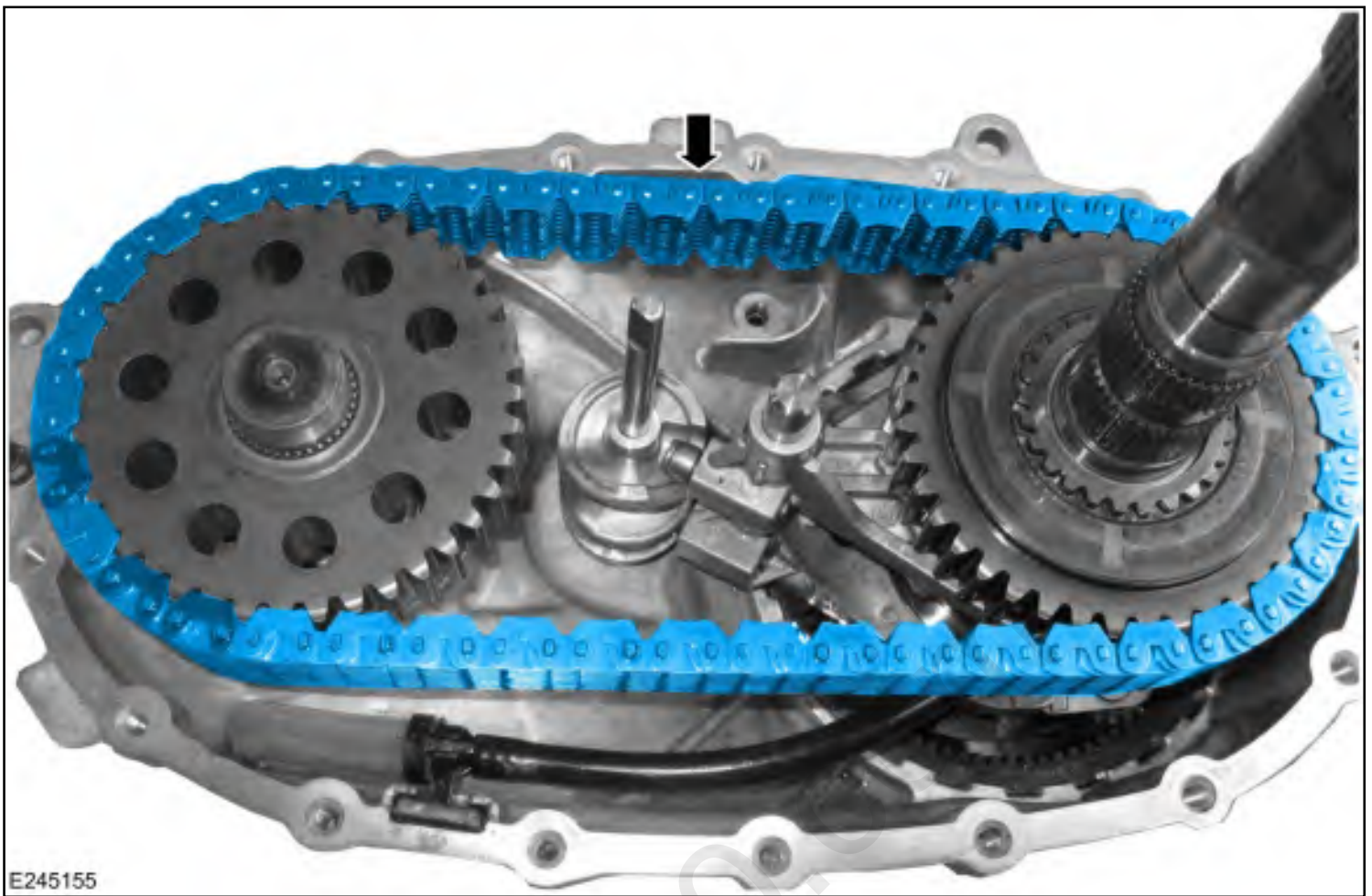
16. **NOTICE:** When removing the clutch pack assembly, do not separate the clutch pack assembly. Keep tension on the clutch pack during removal. Set the clutch pack assembly on the bench in the same position as located in the transfer case. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem will occur.

NOTICE: If the clutch pack is disassembled, a new clutch pack and armature must be installed. Failure to install a new clutch pack can result in component failure.

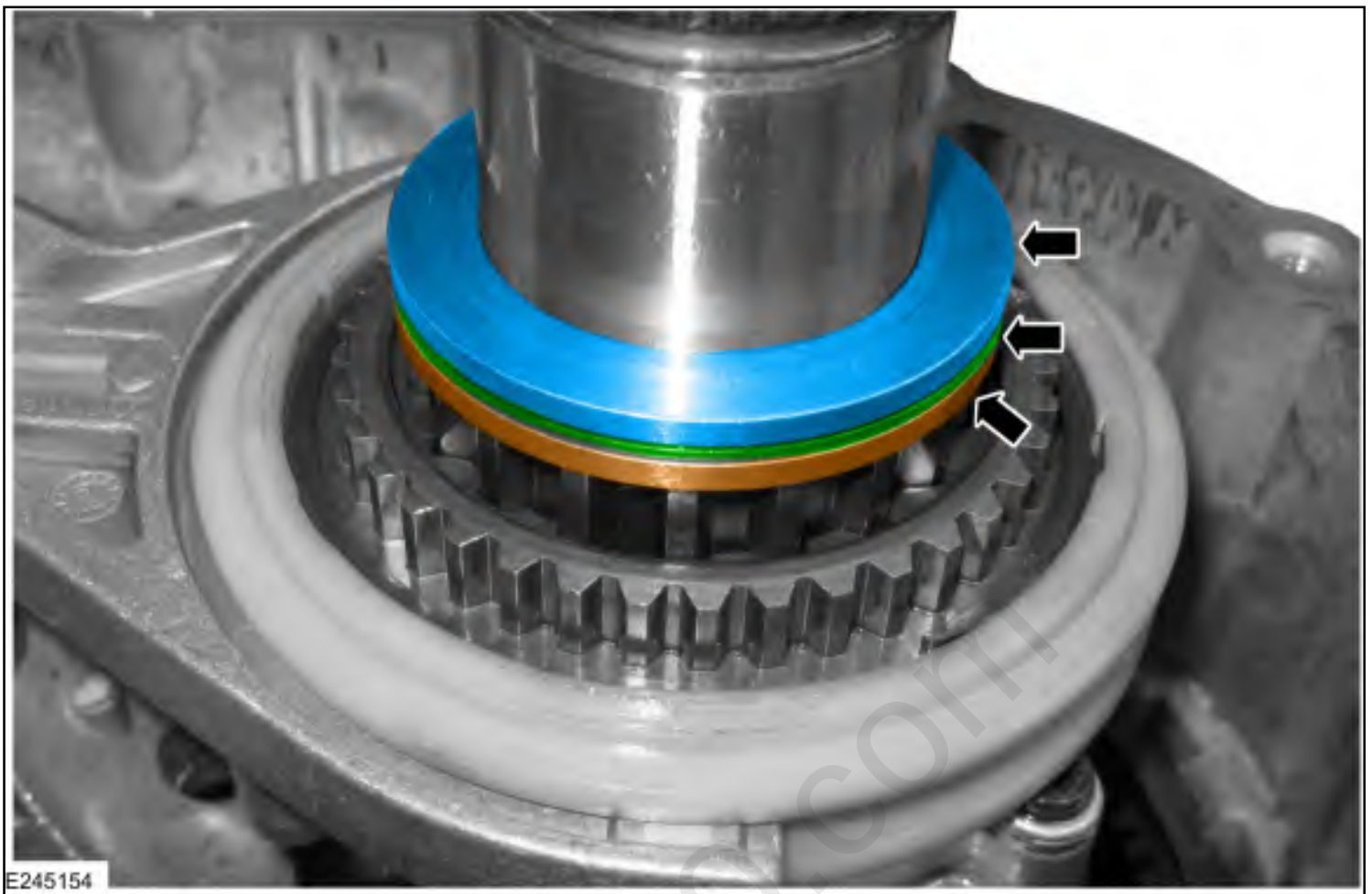
Remove the clutch pack assembly with the armature.



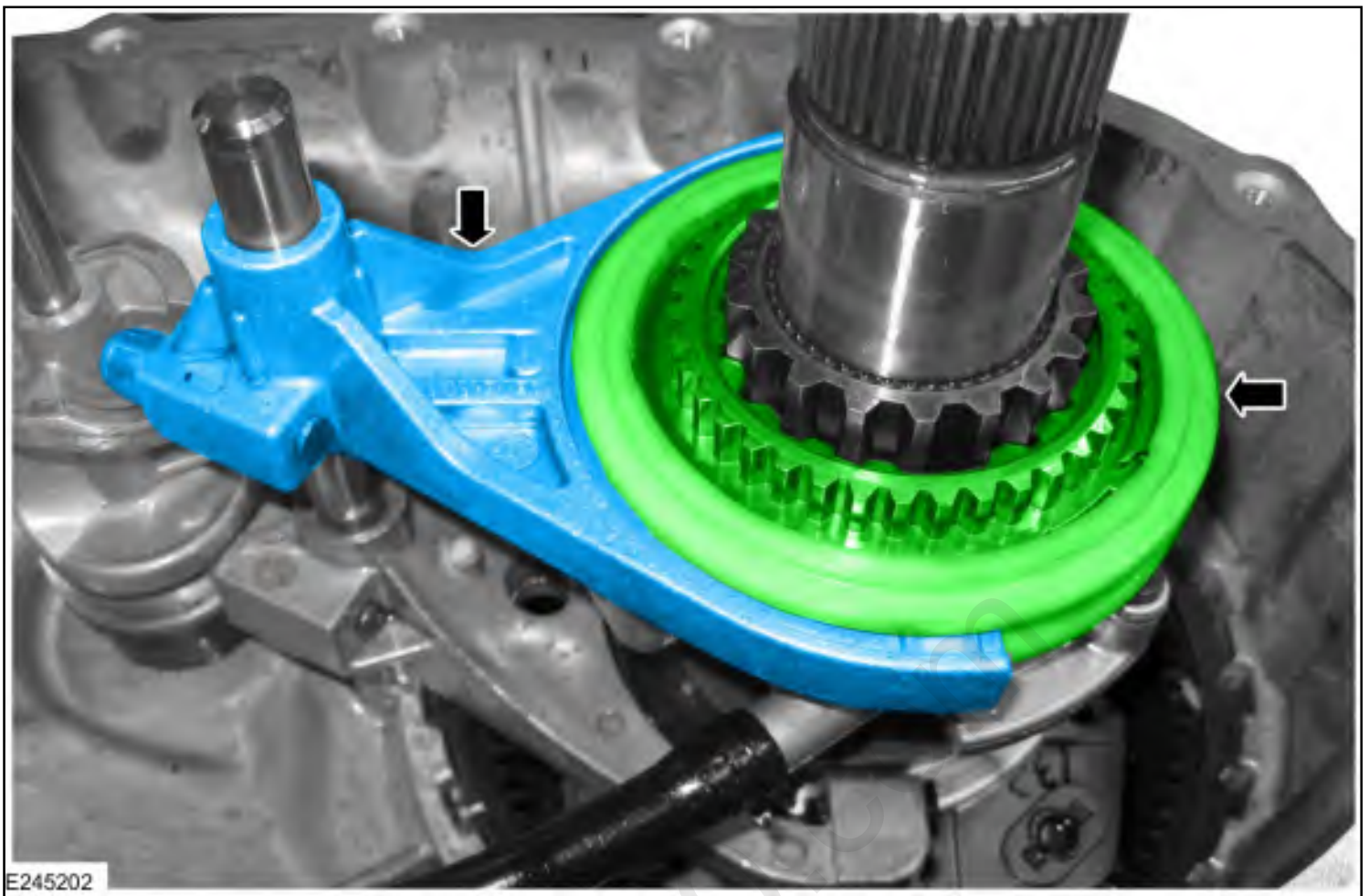
17. Remove the drive chain and the sprockets as an assembly.
 - Install new components as necessary.



18. Remove the thrust bearing assembly.
- **NOTE:** *The upper thrust washer may be attached to the sprocket.*
- Remove the thrust washer.
- Remove the thrust bearing.
 - Remove the thrust washer.
 - Install new components as necessary.



19. Remove the lock up fork and the lock up hub.



20. Remove the lock up hub spacer.

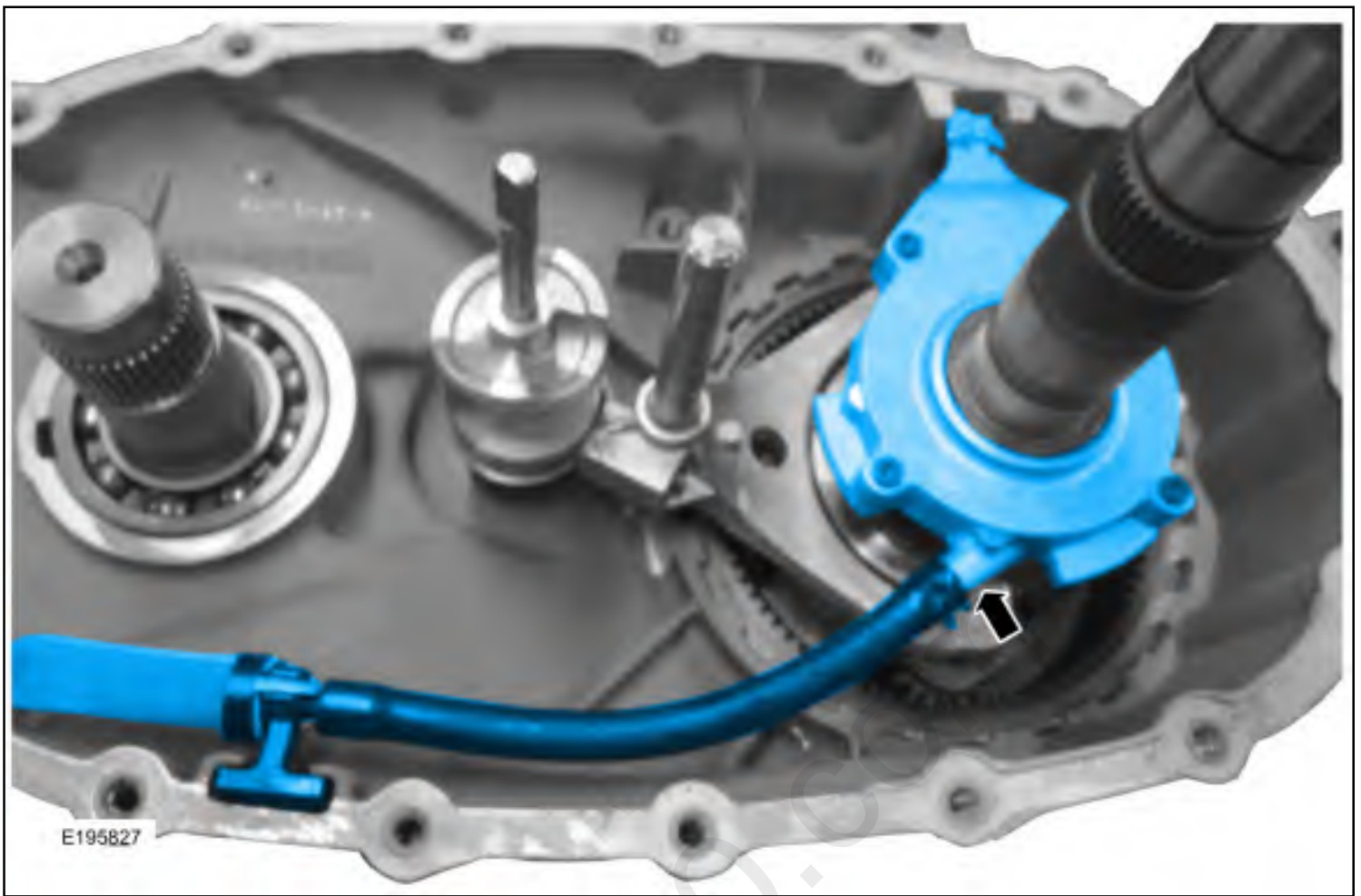


21. Remove the magnet from its slot in the case.



22. **NOTE:** *The pump assembly is not repairable.*

Remove the oil pump assembly.



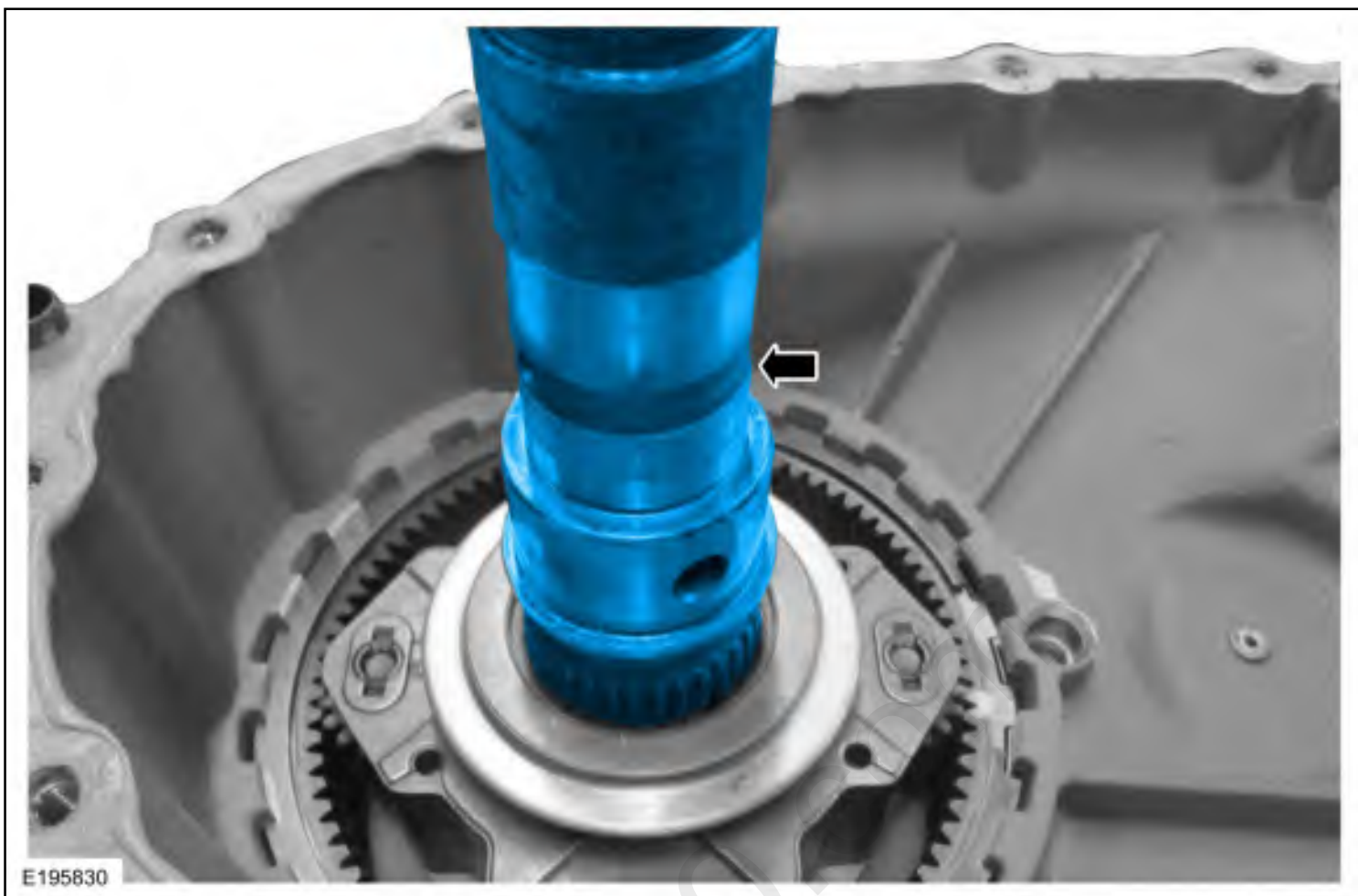
23. Remove the shift rail.



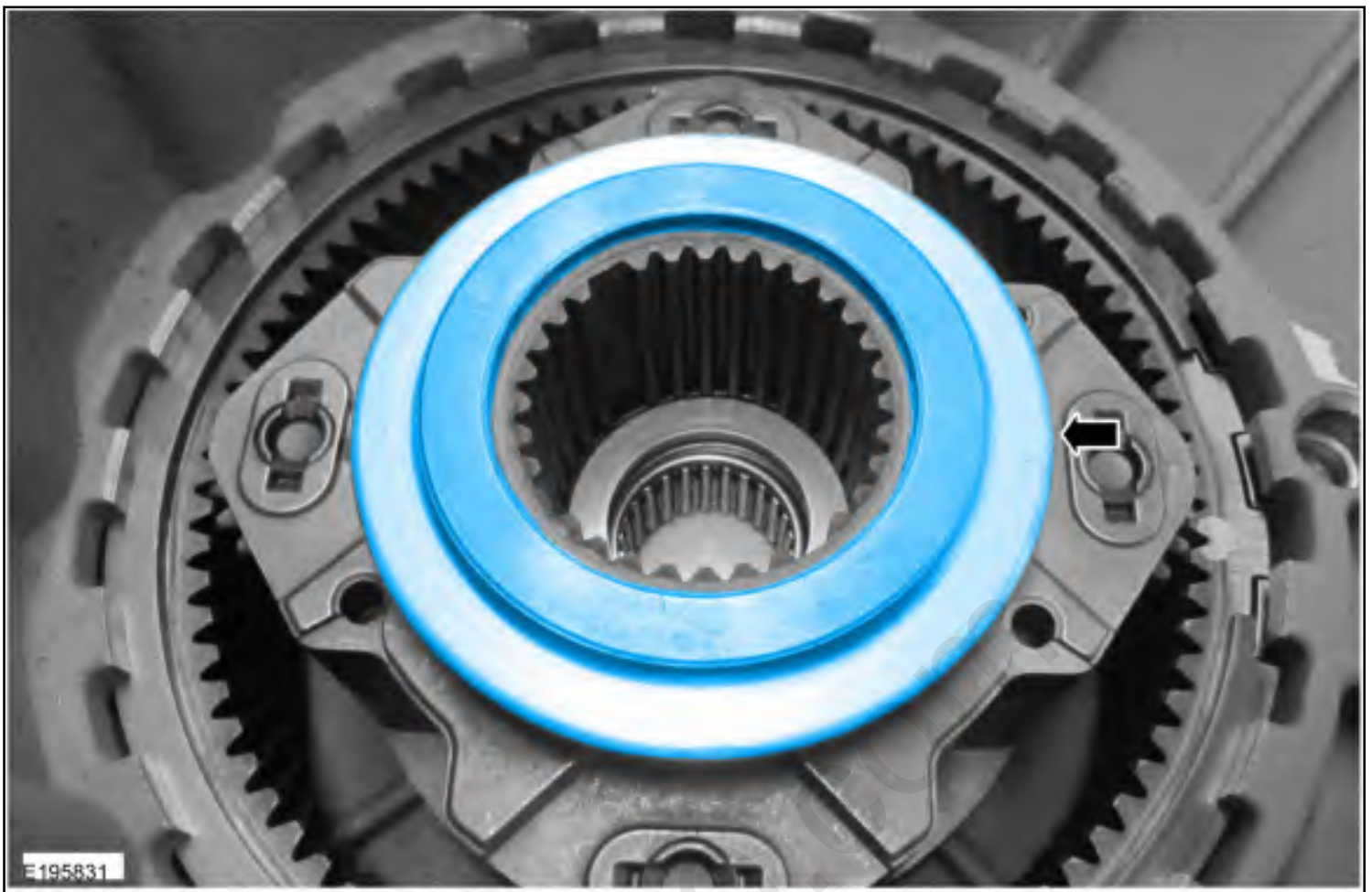
24. Remove the shift fork.



25. Remove the output shaft.



26. Remove the reduction hub.

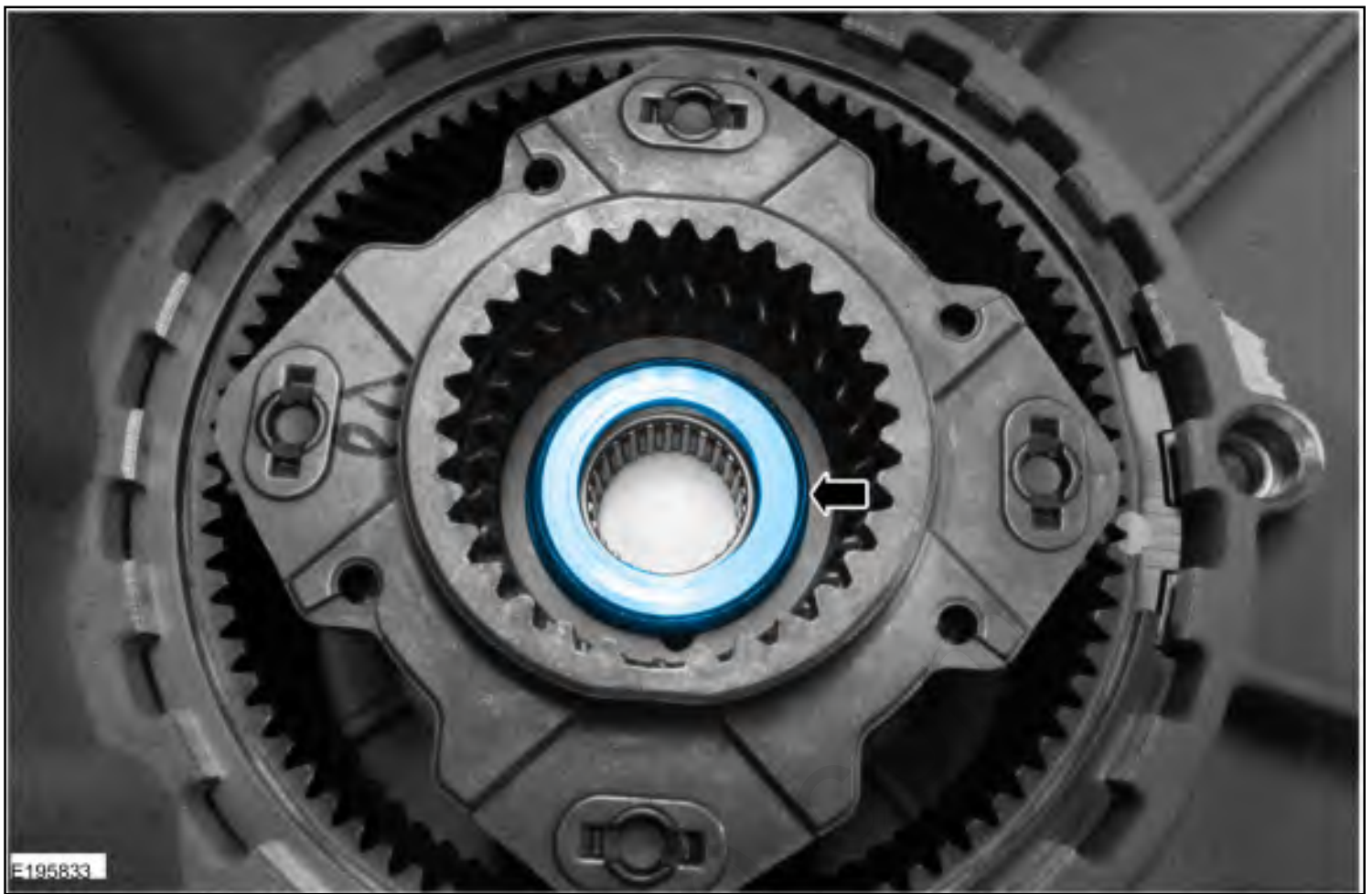


27. **NOTE:** *The electric shift cam is serviced as an assembly. Do not disassemble the shift cam assembly.*

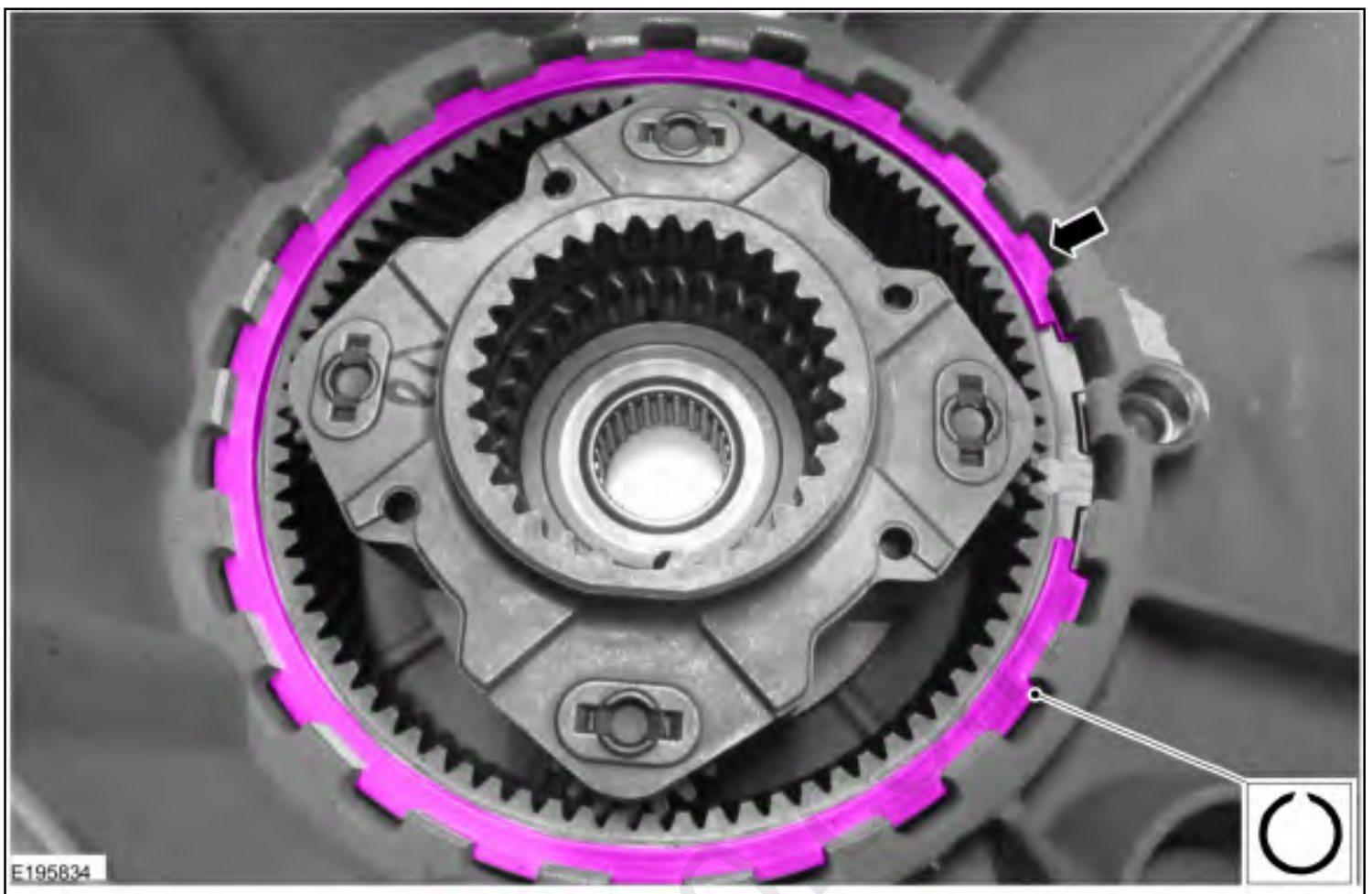
Remove the electric shift cam assembly.



28. Remove the planet carrier thrust bearing.



29. Remove the ring gear circlip.

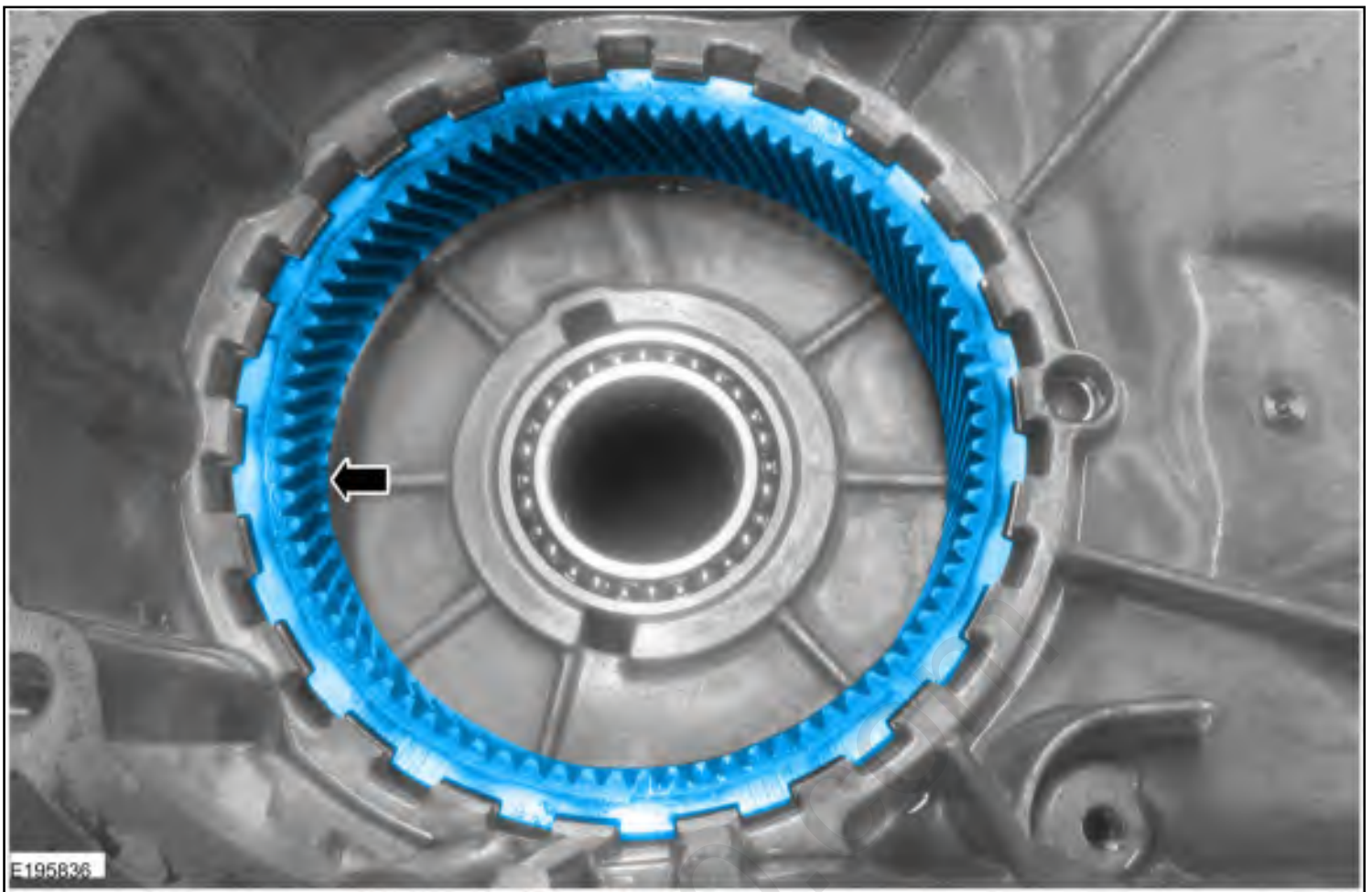


30. **NOTE:** *Replace the inner planet carrier needle bearing if necessary.*

Remove the front planet carrier.

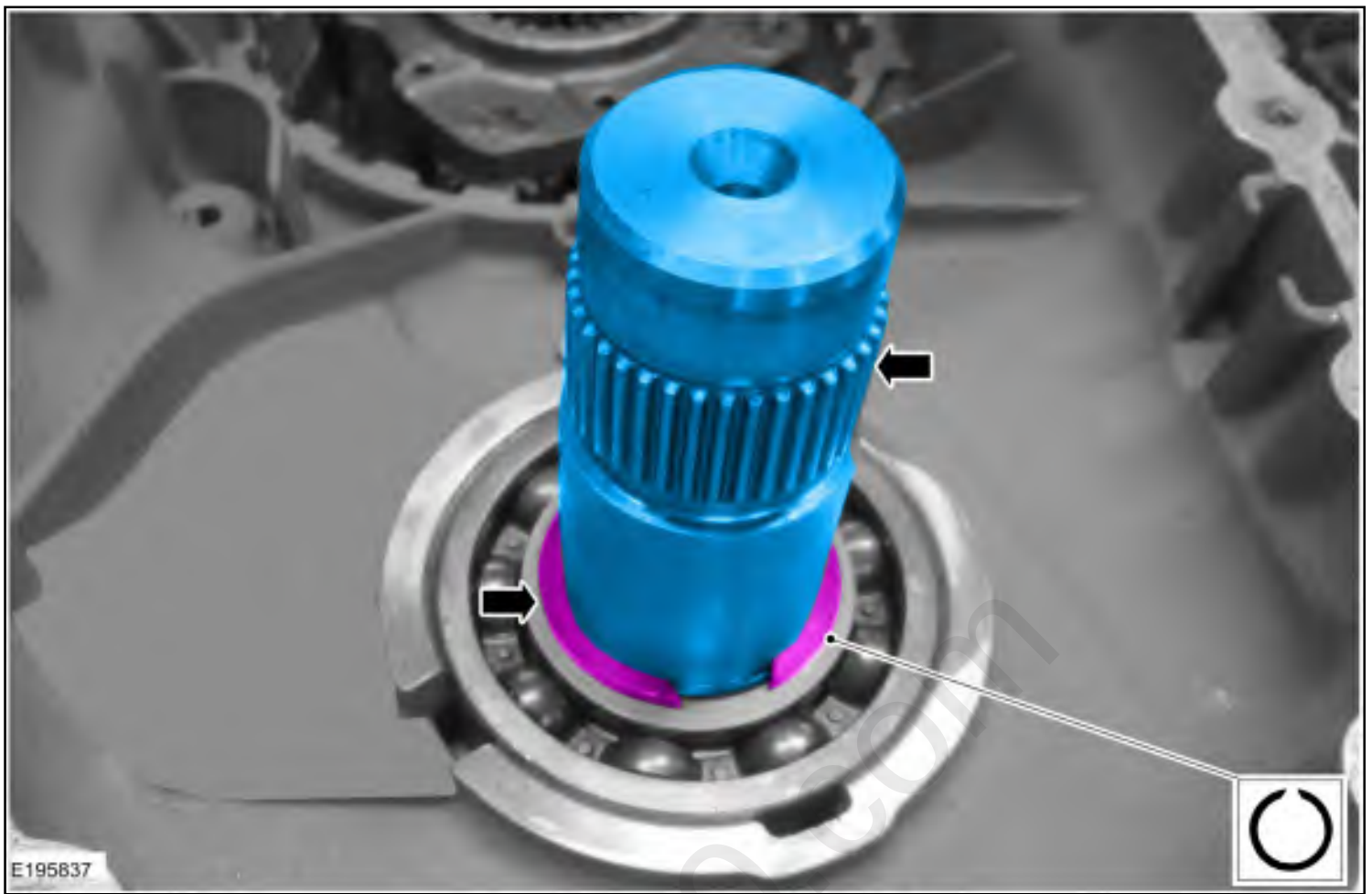


31. Remove the ring gear.

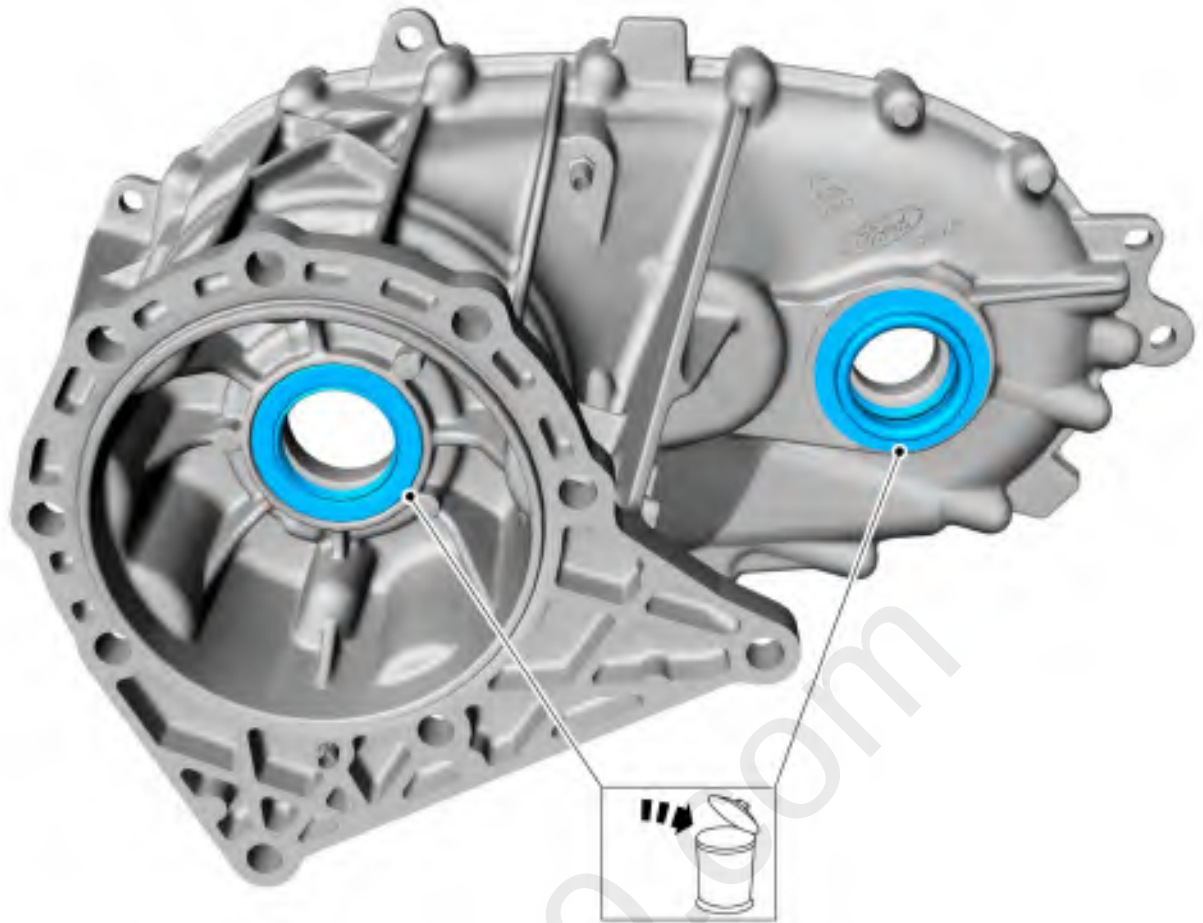


32. **NOTICE:** Do not let the front output shaft fall while removing the snap ring or damage to the component may occur.

Remove the output shaft circlip and the out put shaft.



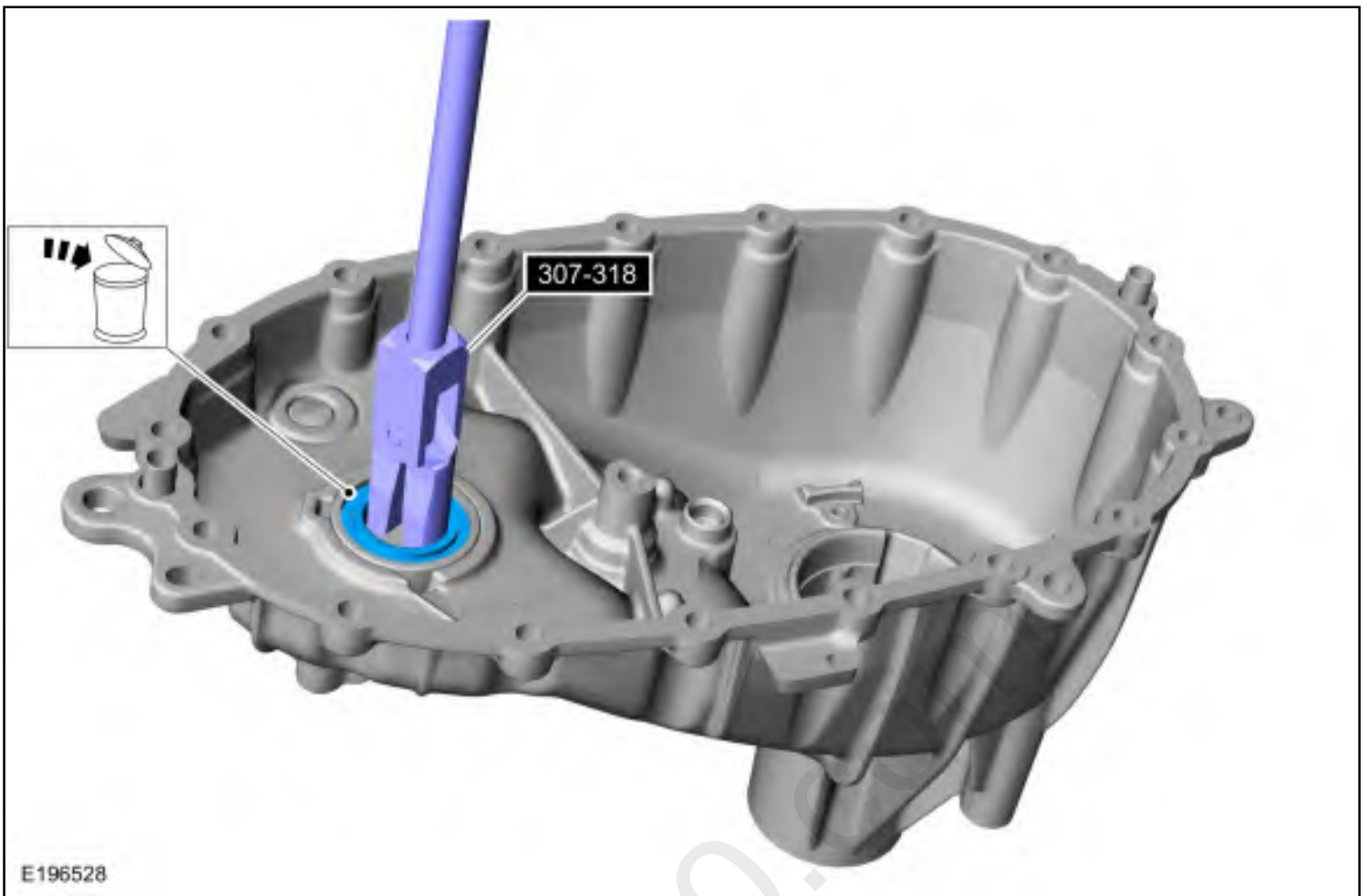
33. Remove and discard the front input shaft seal and the front output shaft seal.



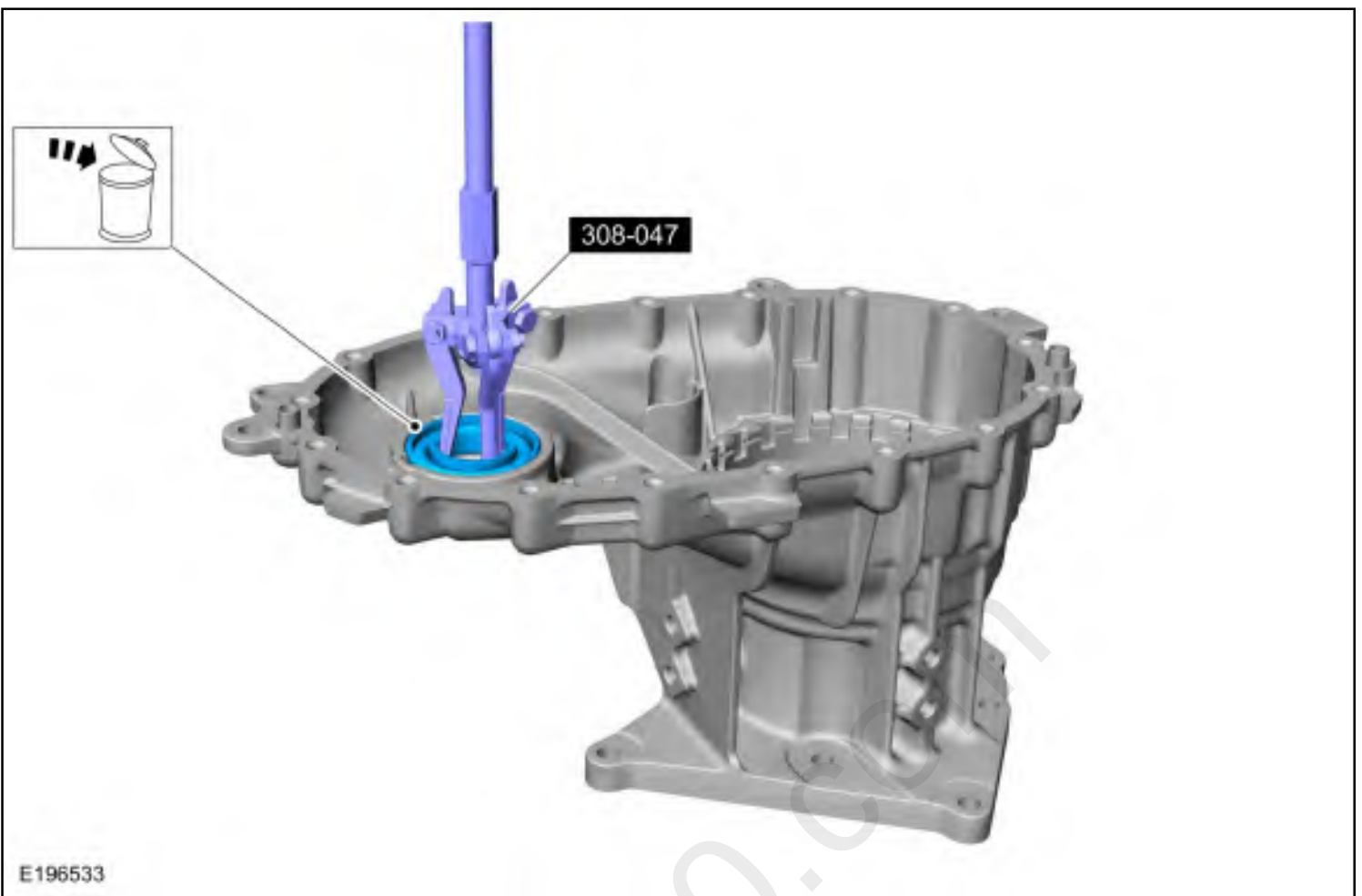
34. Using the special tool with the Slide Hammer, remove the rear output shaft bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



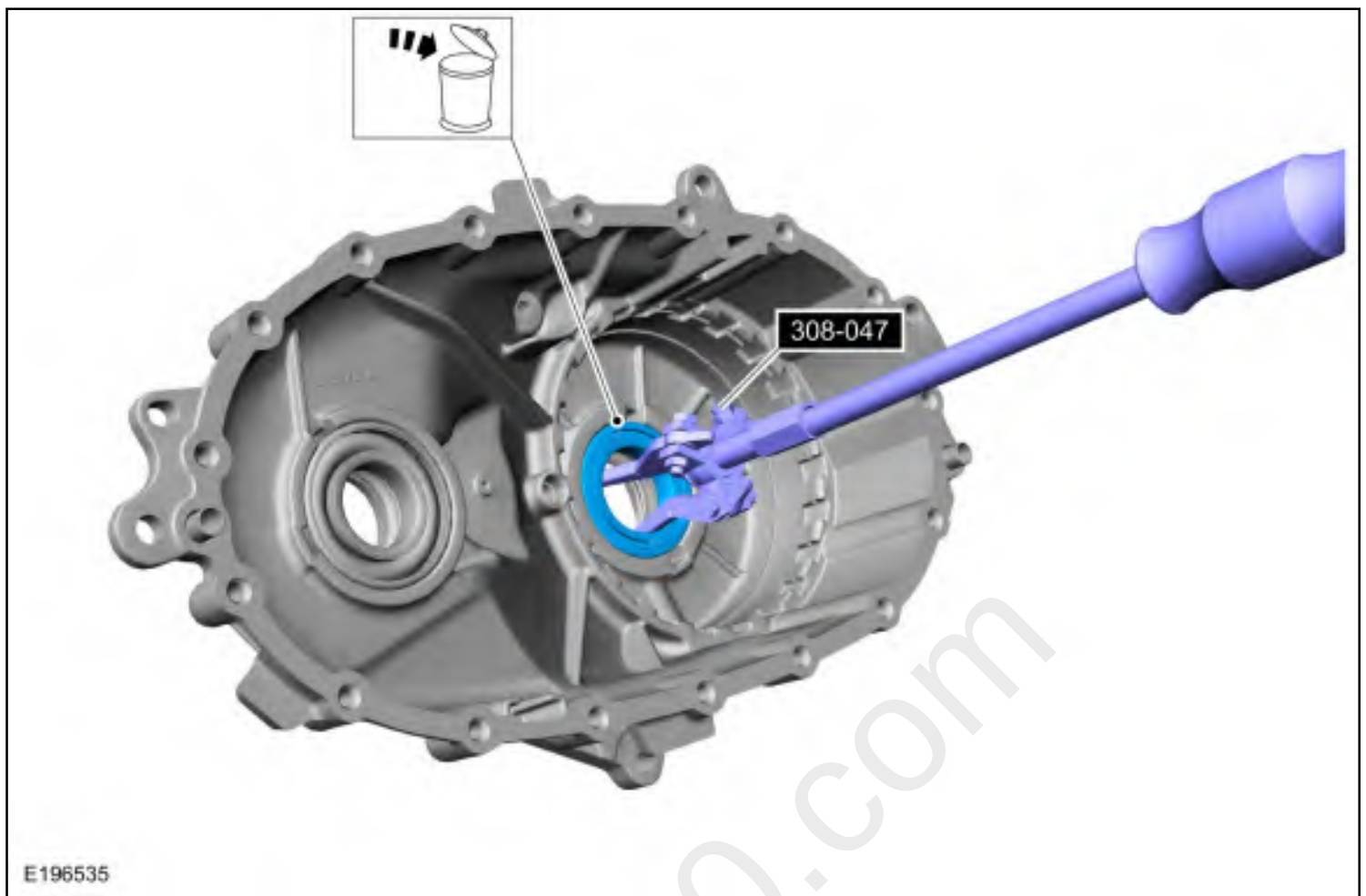
35. Using the special tool and a Slide Hammer, remove the front output shaft support bearing.
Use Special Service Tool: 307-318 Remover, Stator Bearing.
Use the General Equipment: Slide Hammer



36. Using the special tool with the Slide Hammer, remove the front output shaft bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



37. Using the special tool and a Slide Hammer, remove the front planet carrier bearing.
Use Special Service Tool: 308-047 (T77F-1102-A) Remover, Bearing Cup.
Use the General Equipment: Slide Hammer



38. Clean and inspect the components of the transfer case for damage and install new components as necessary.

ASSEMBLY

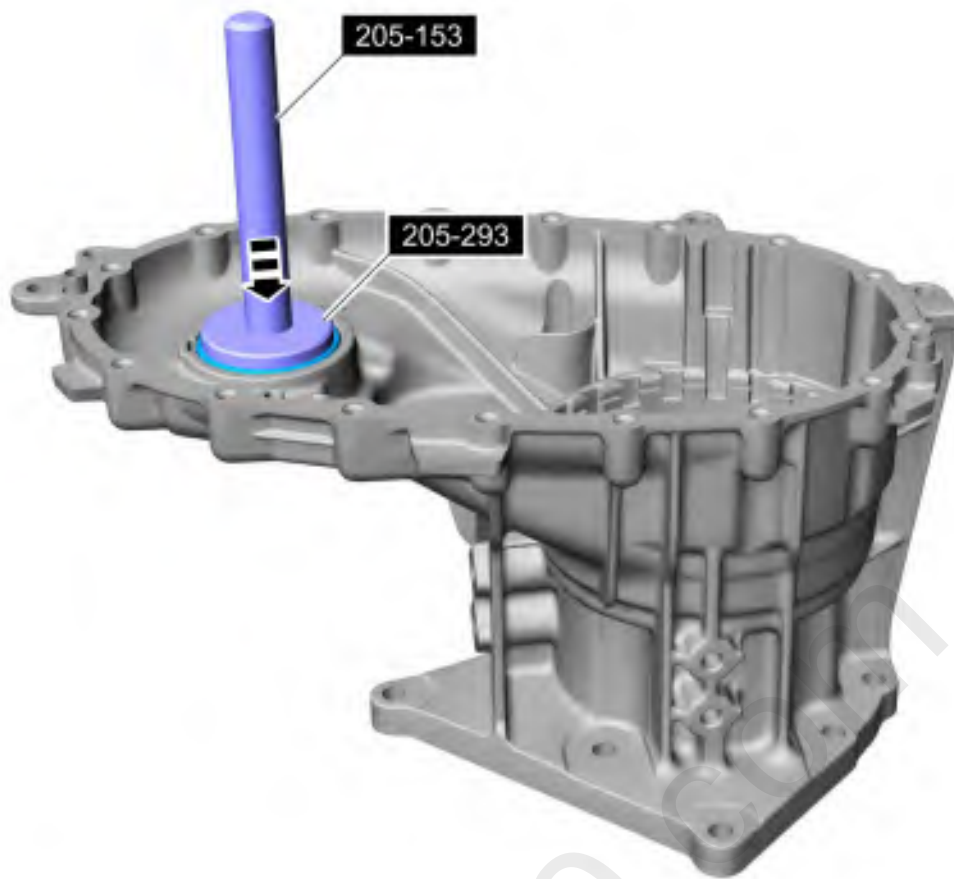
NOTE: *Lubricate all internal components with the recommended transfer case lubricant during reassembly.*

1. Using the special tools, install the front planet carrier bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-504 Installer, Halfshaft Pilot Bearing.



E196536

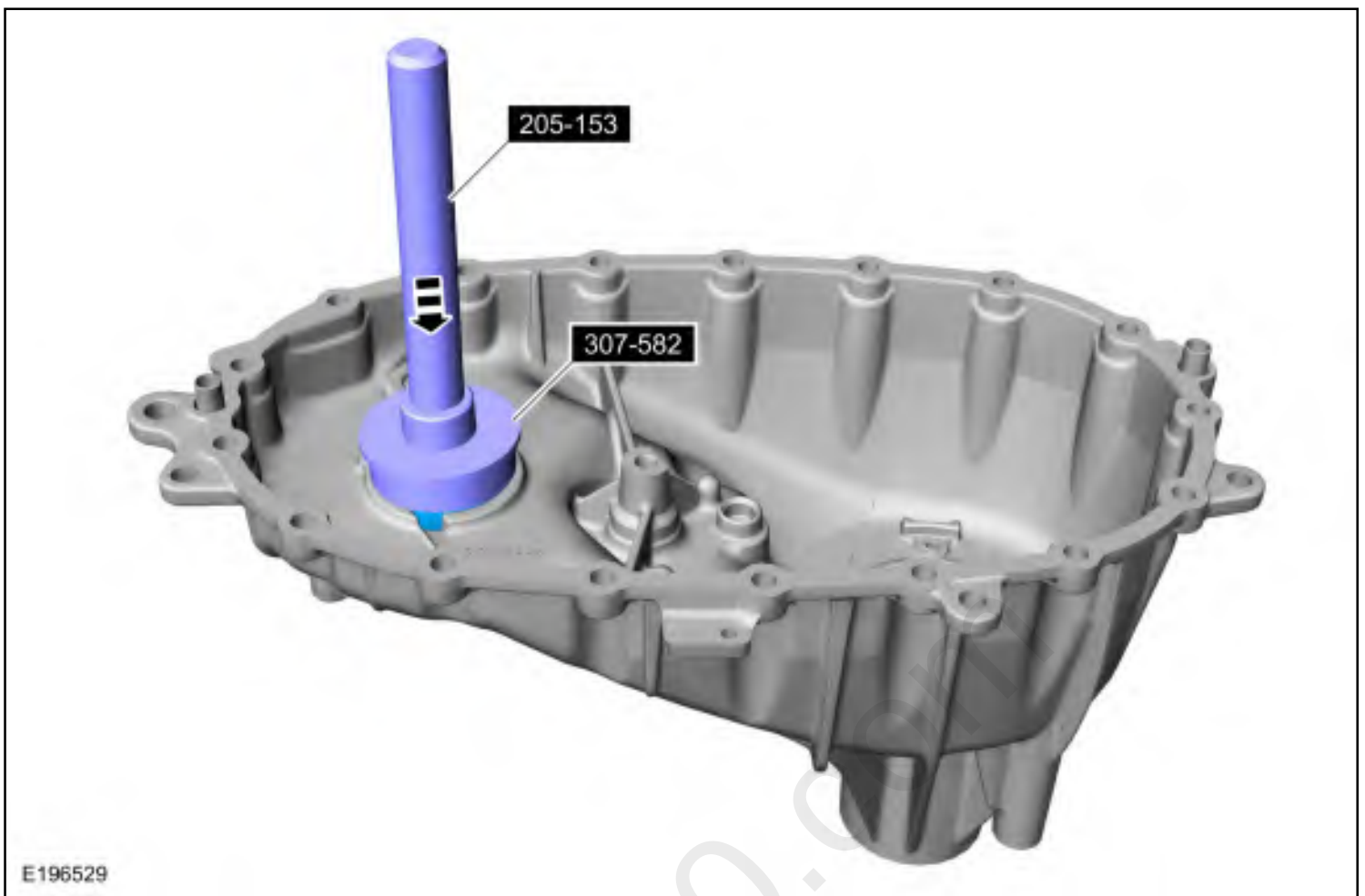
2. Using the special tools, install the front output shaft bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 205-293 (T89P-4850-A) Installer,
Differential Oil Seal.



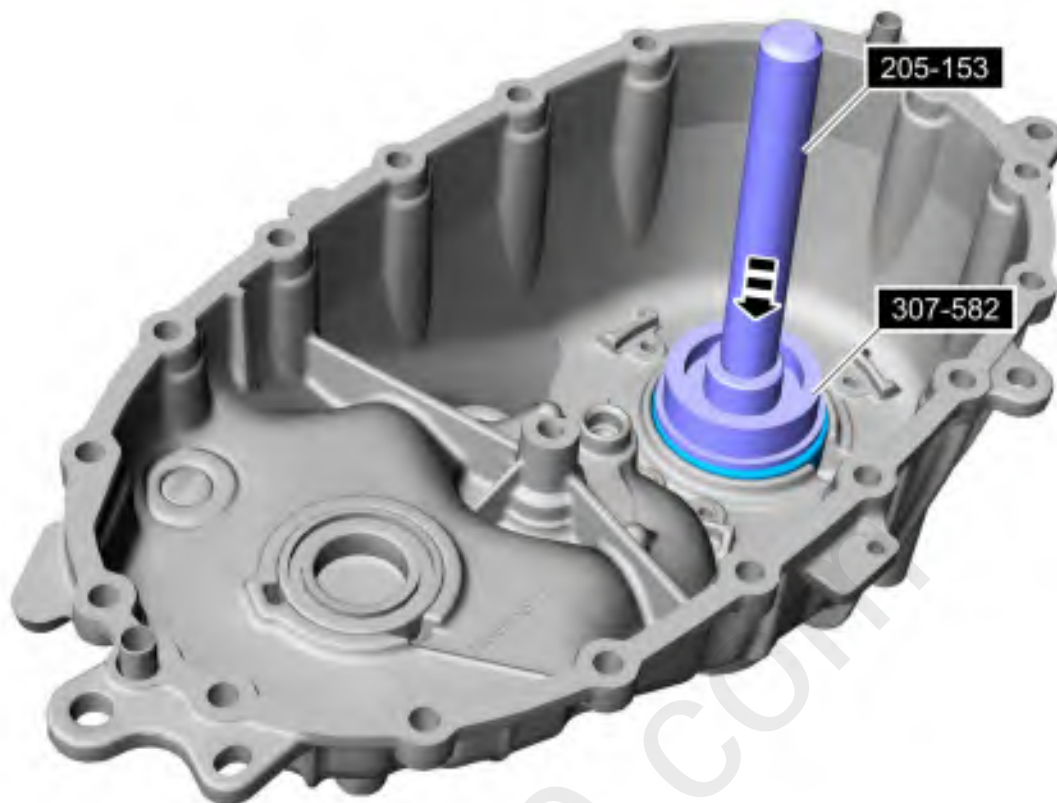
E196534



3. Using the special tool, install the front output shaft support bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 307-582A Cover Axle Seal Installer.

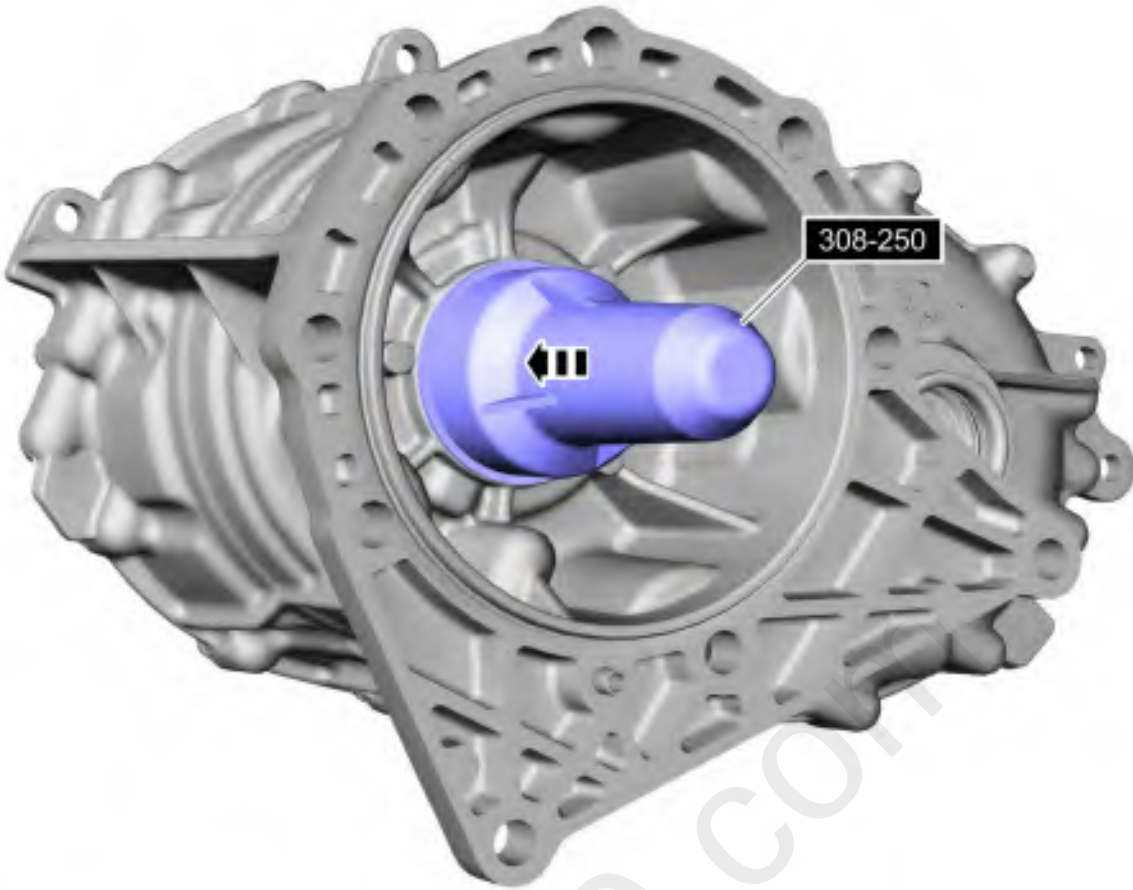


4. Using the special tool, install the rear output shaft bearing.
Use Special Service Tool: 205-153 (T80T-4000-W) Handle. , 307-582A Cover Axle Seal Installer.



E196527

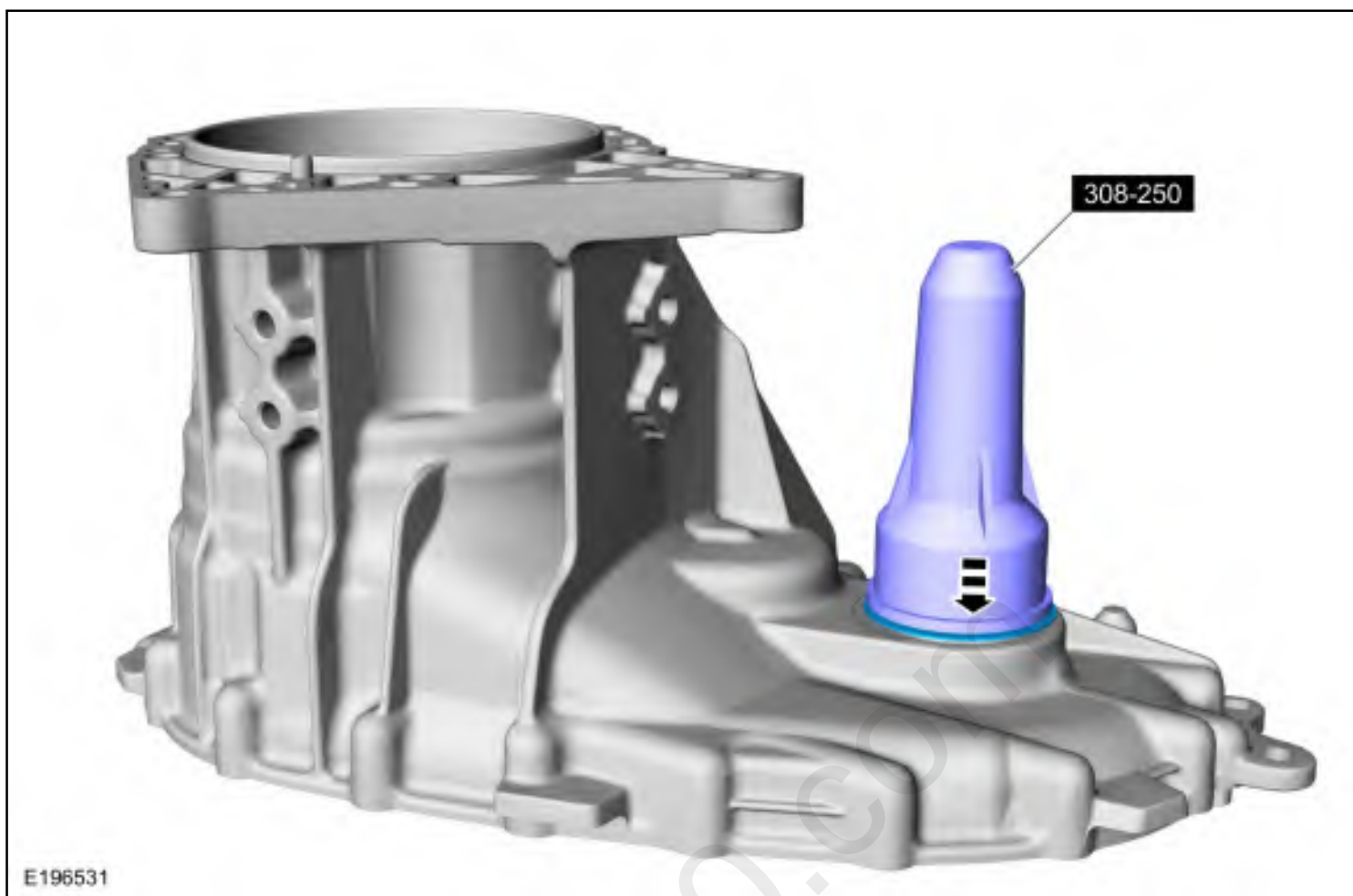
5. Using the special tool, install the input shaft seal.
Use Special Service Tool: 308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal.



E196532

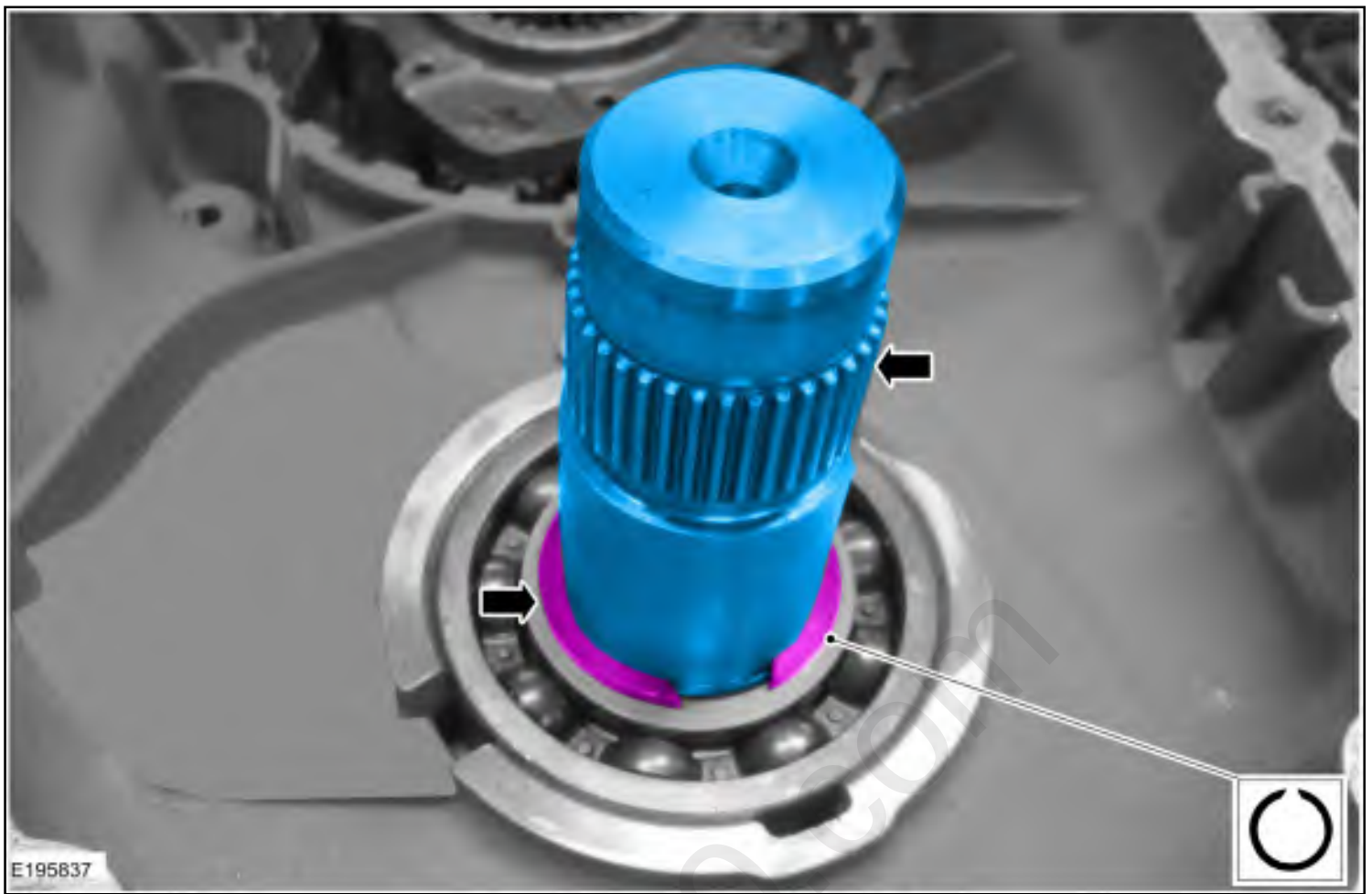


6. Using the special tool, install the front output shaft seal.
Use Special Service Tool: 308-250 (T96T-7127-B) Installer, Output Shaft Oil Seal.

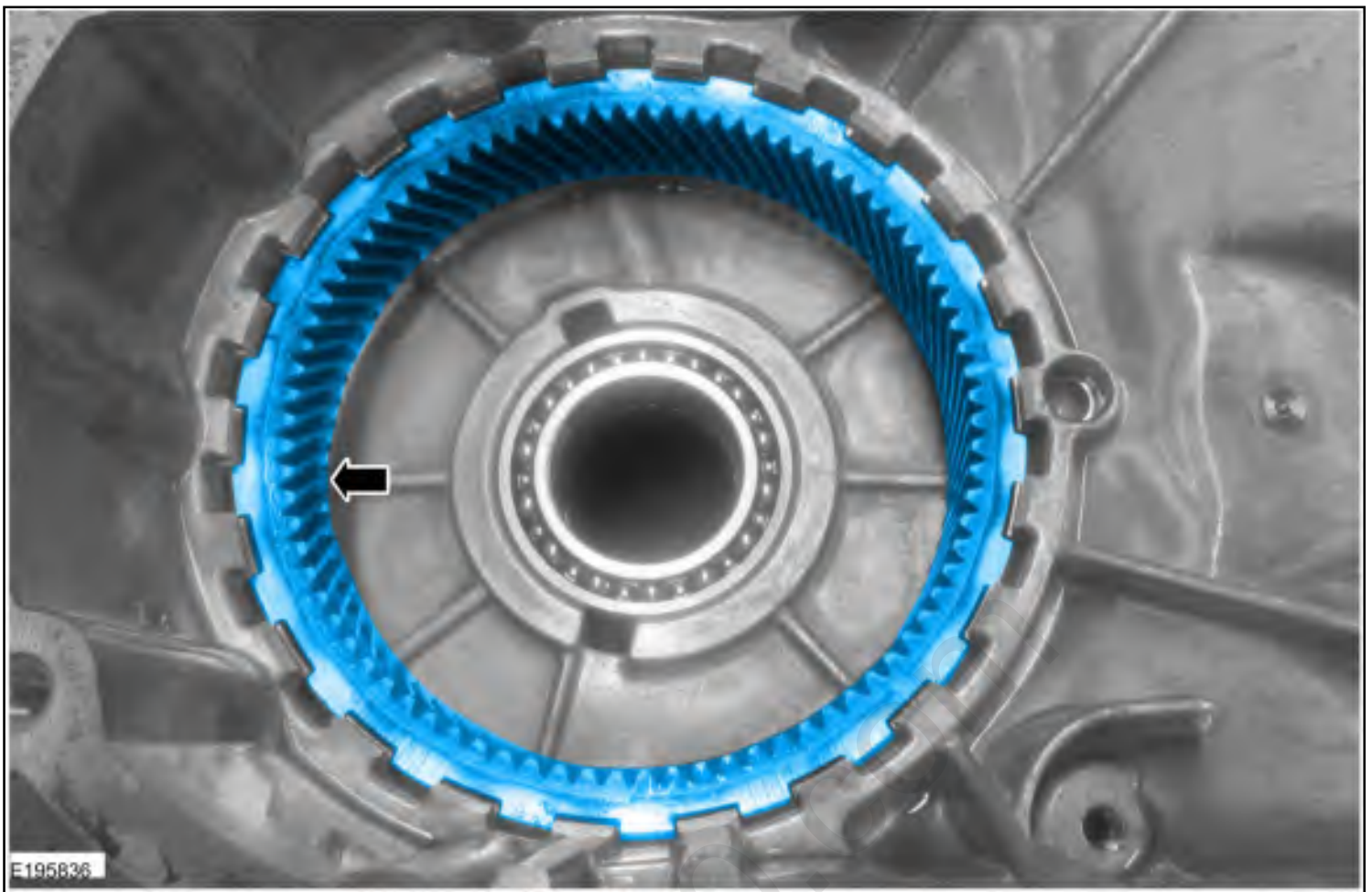


7. **NOTICE: Do not let the front output shaft fall while removing the snap ring or damage to the component may occur.**

Install the output shaft and the out put shaft circlip.



8. Install the ring gear.



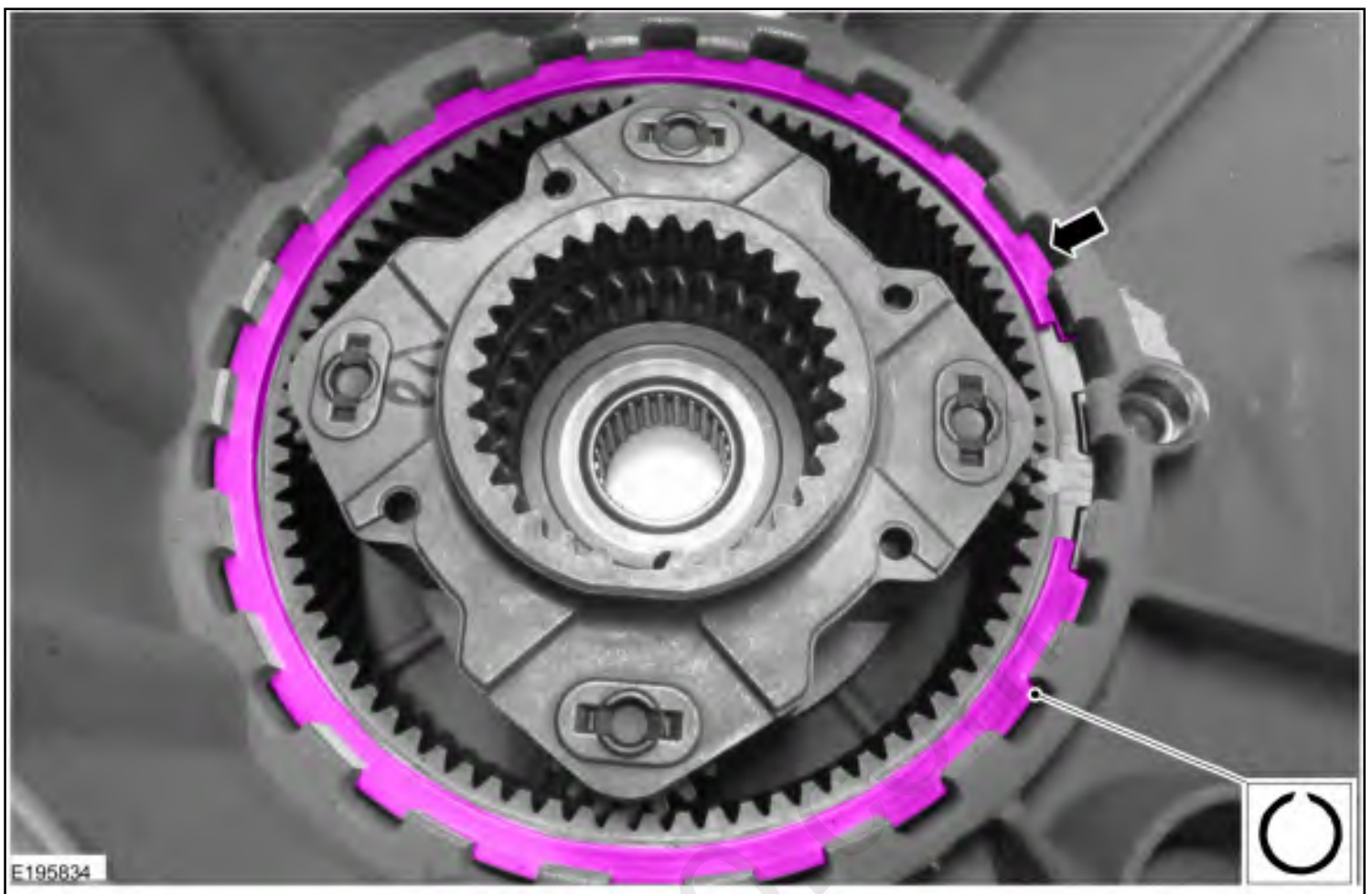
9. If removed, using a press and the special tool, install the needle bearing into the front planet carrier.
Use Special Service Tool: 308-085 (T83T-7025-C) Installer, Input Shaft Bearing.

10. **NOTE:** *Replace the inner planet carrier needle bearing if necessary.*

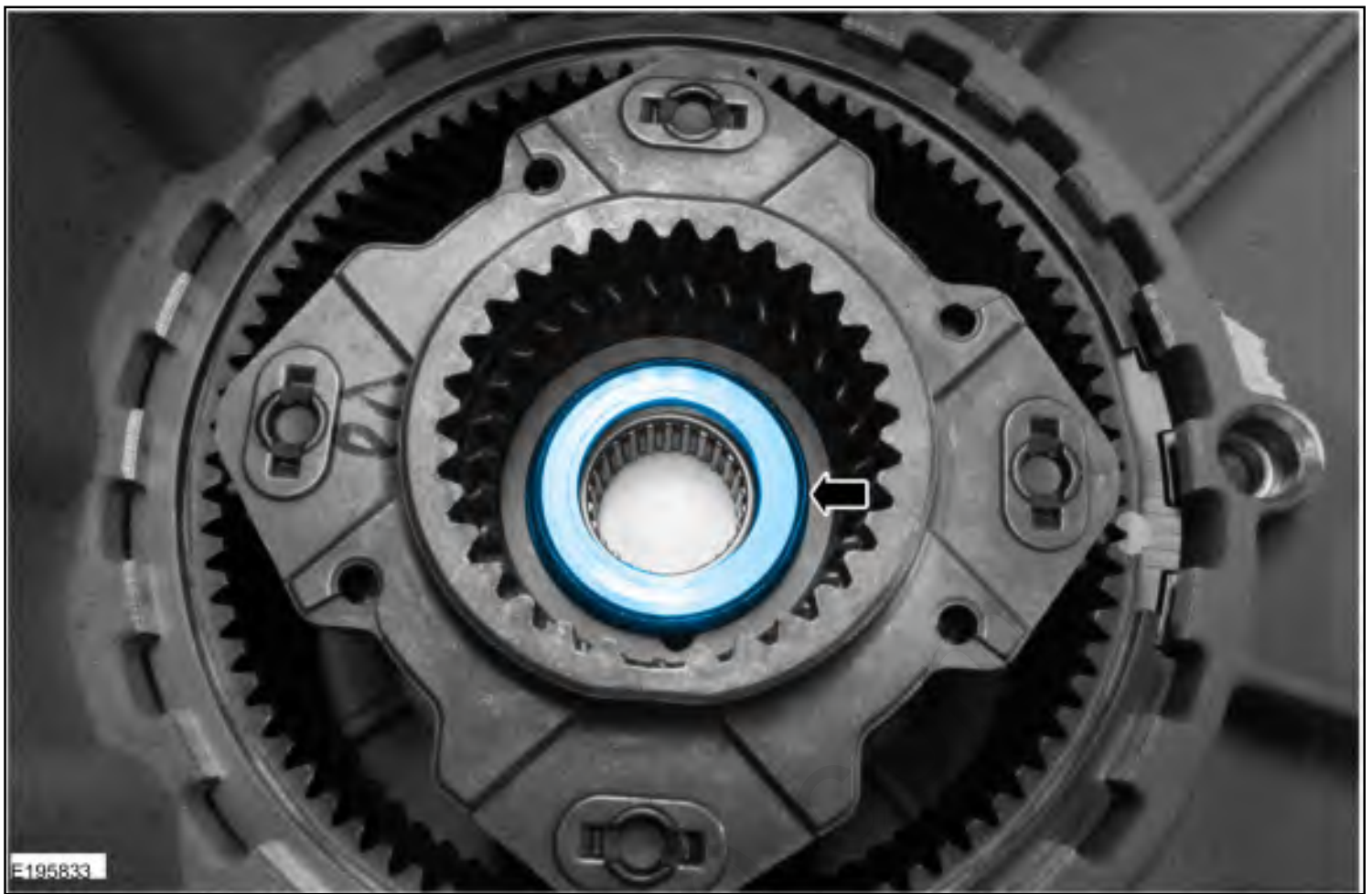
Install the front planet carrier.



11. Install the ring gear circlip.



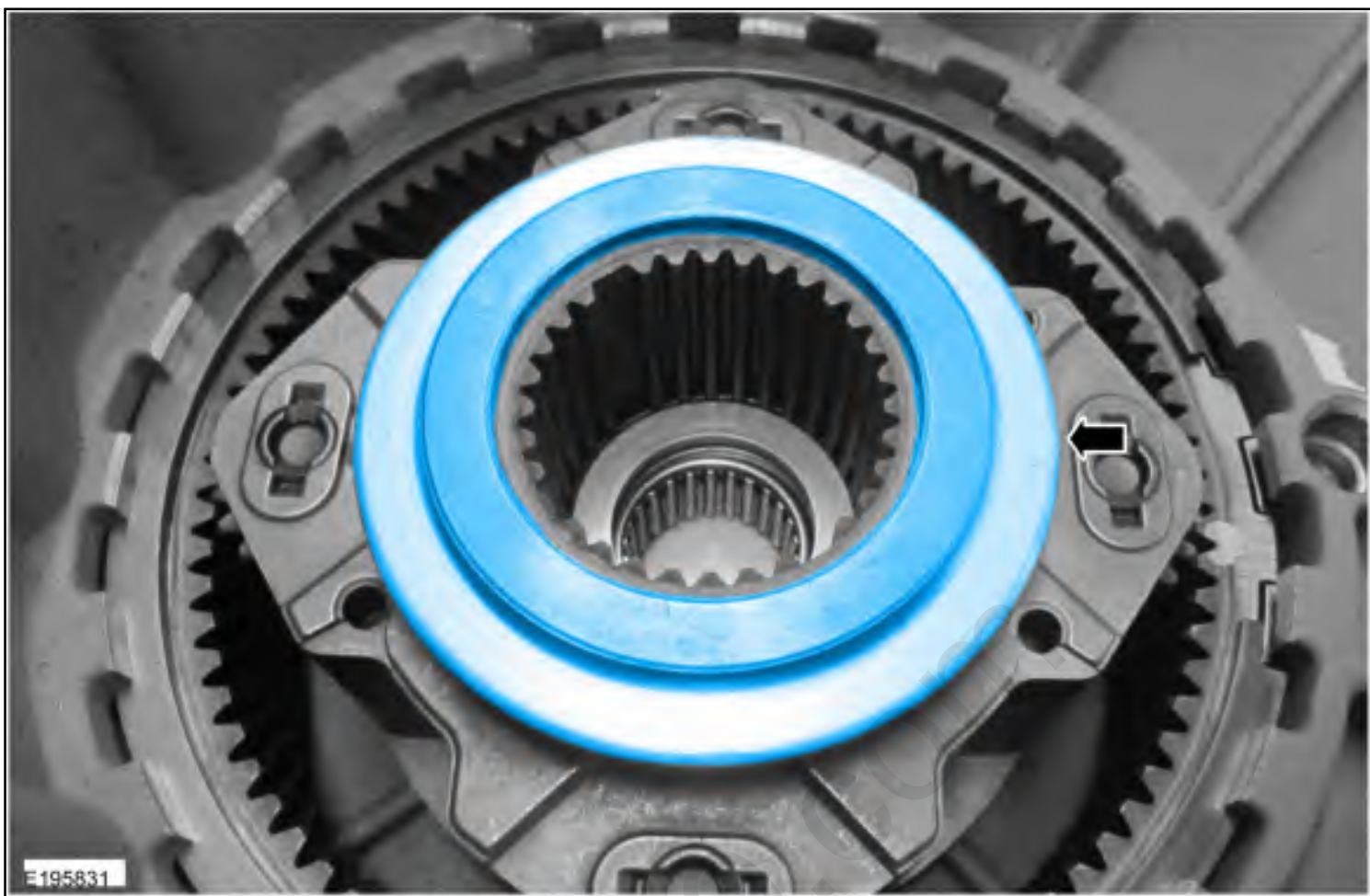
12. Install the planet carrier thrust bearing.



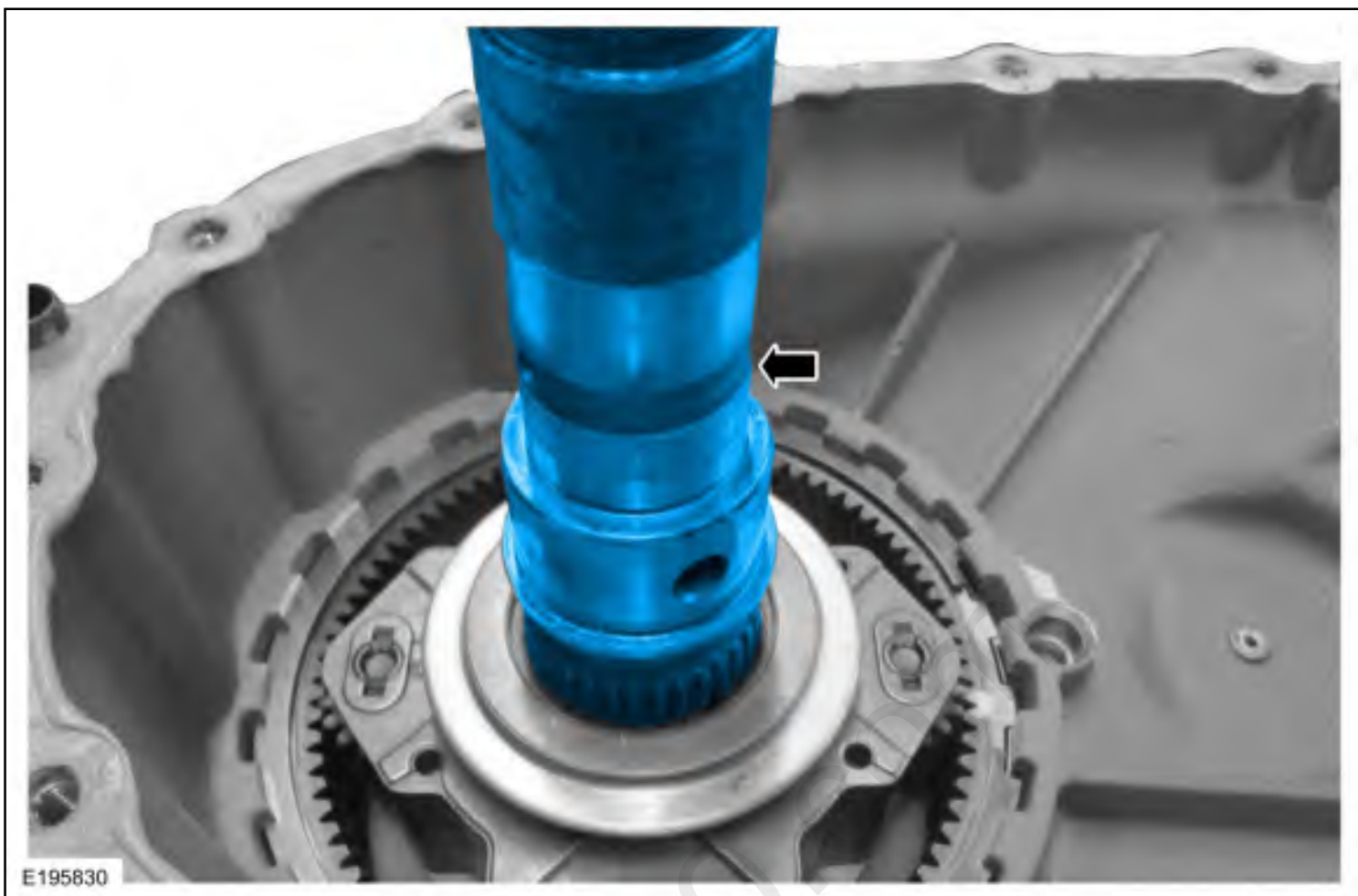
13. Install the electric shift cam assembly.



14. Install the reduction hub.



15. Install the output shaft.



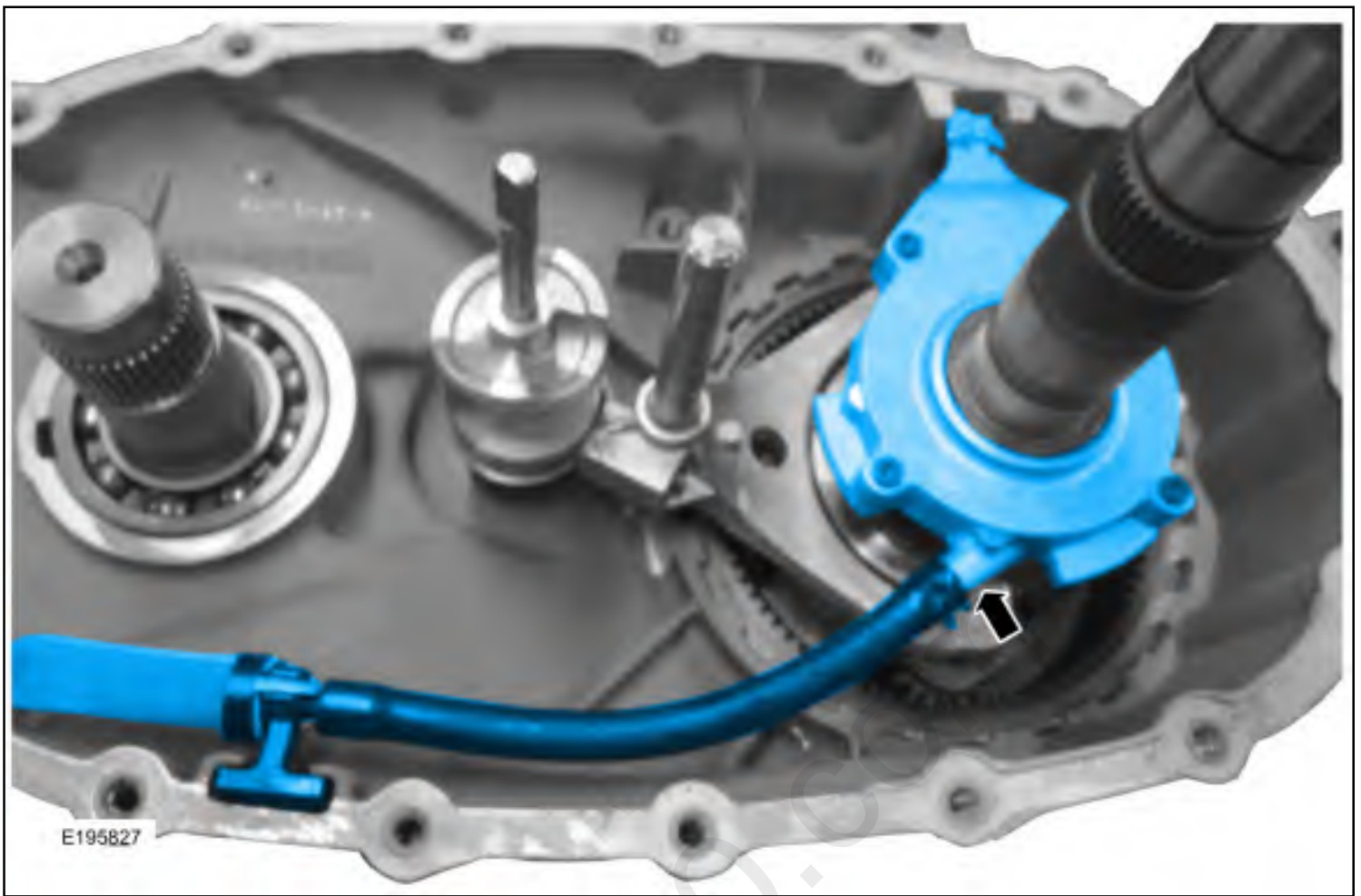
16. Install the shift fork.



17. Install the shift rail.



18. Install the oil pump assembly.

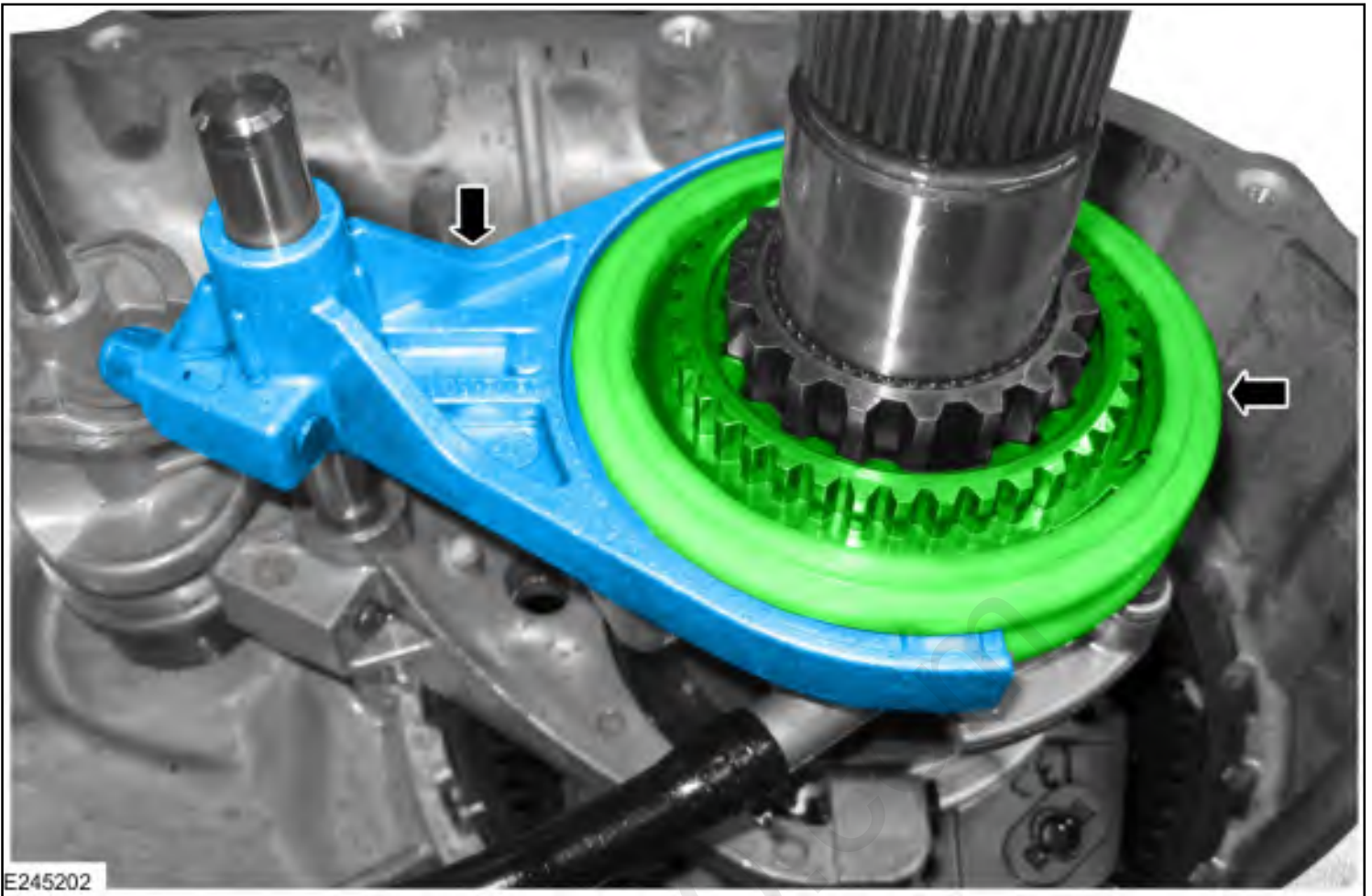




20. Install the lock up hub spacer.



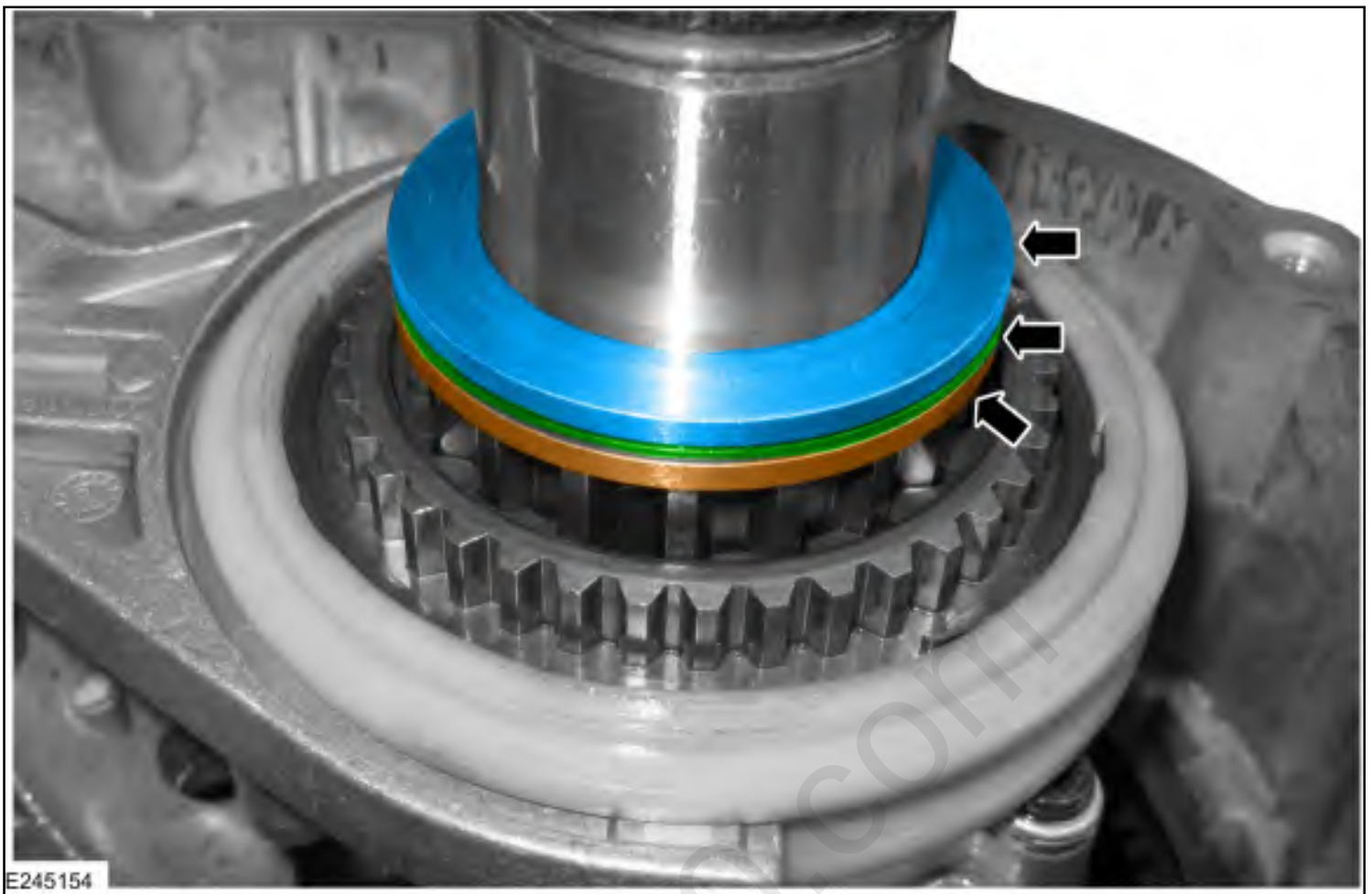
21. Install the lock up fork and the lock up hub.



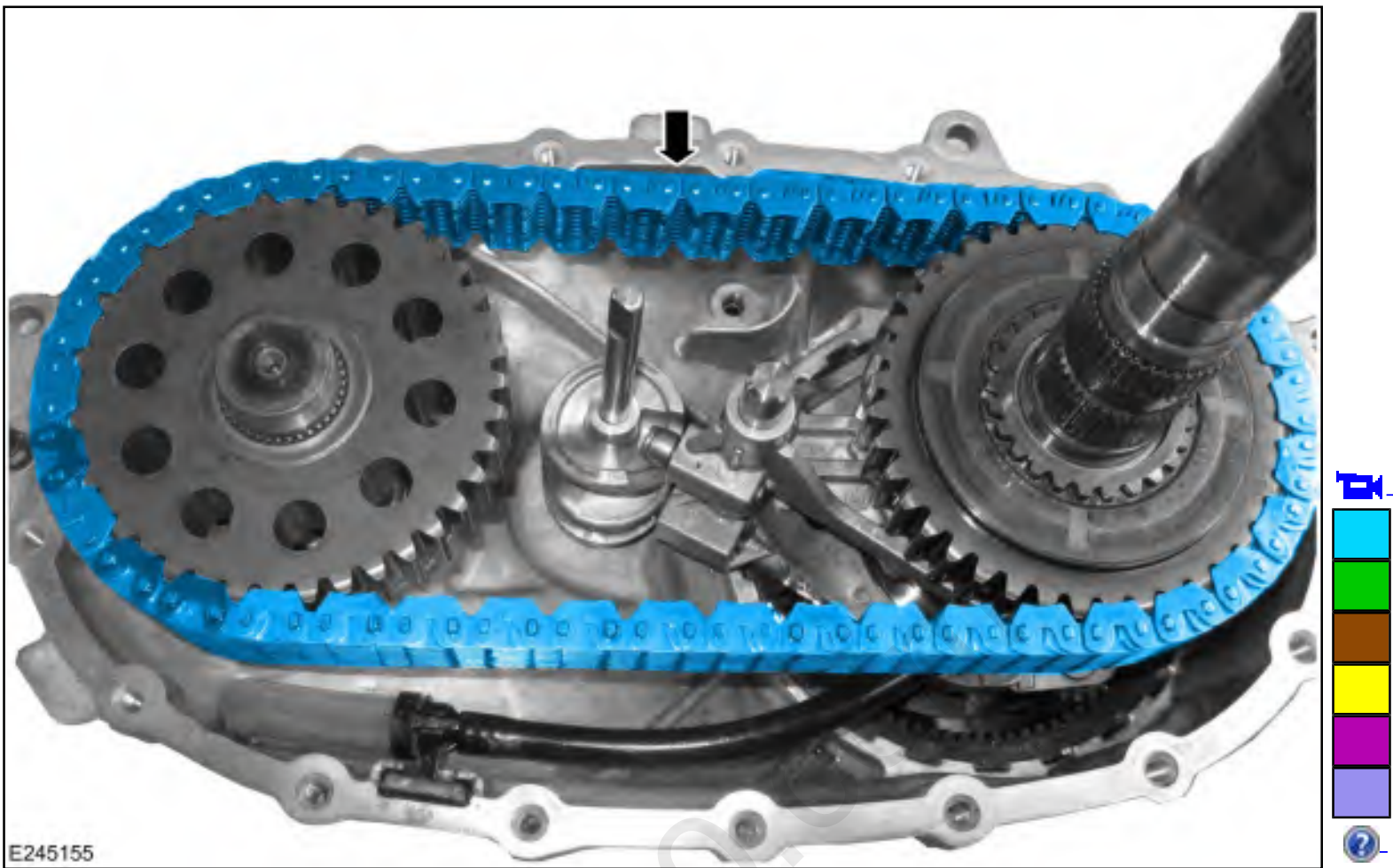
22.

Install the thrust bearing assembly.

- Install the thrust washer.
- Install the thrust bearing.
- Install the thrust washer.



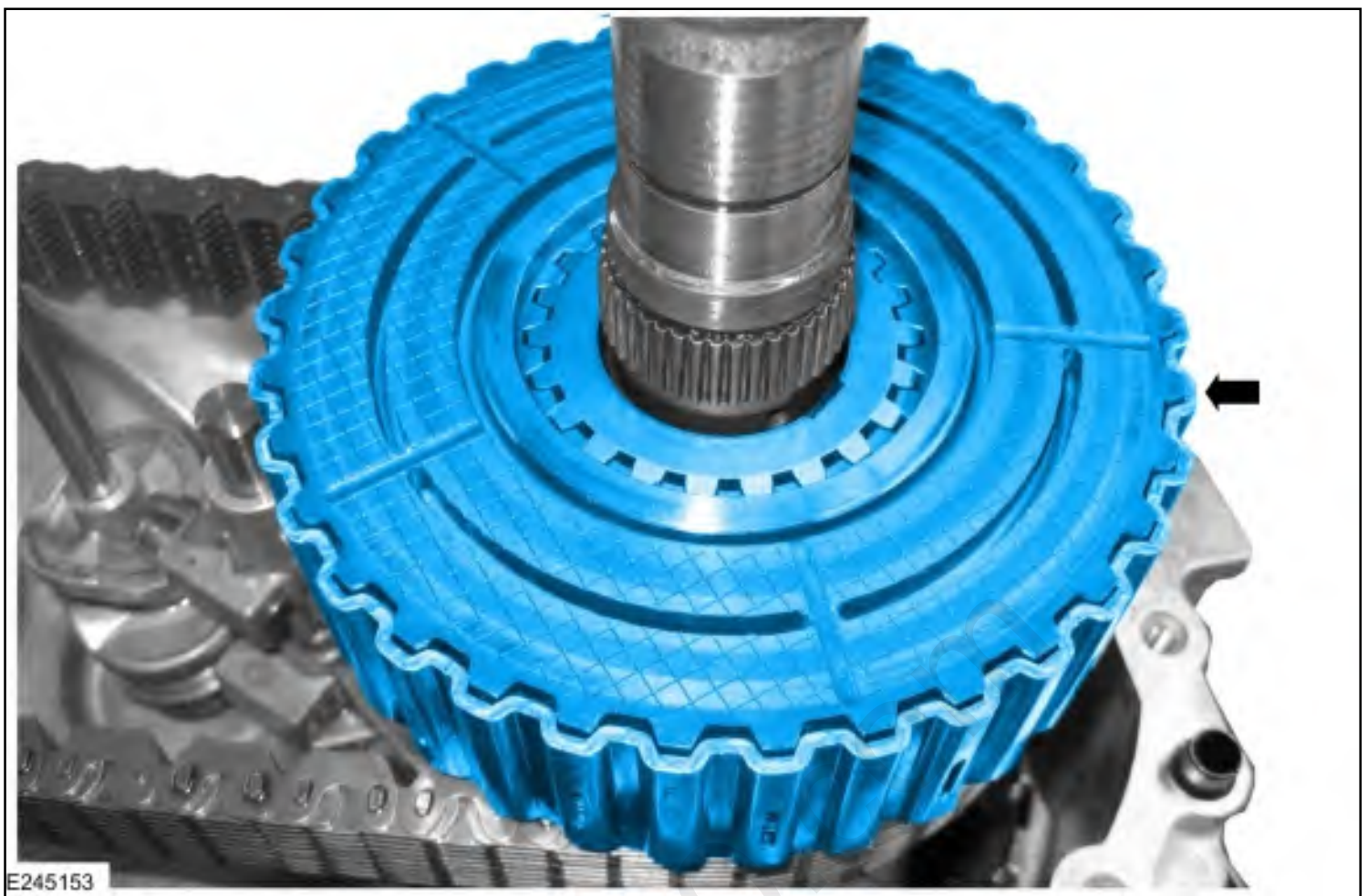
23. Install the drive chain and the sprockets as an assembly.



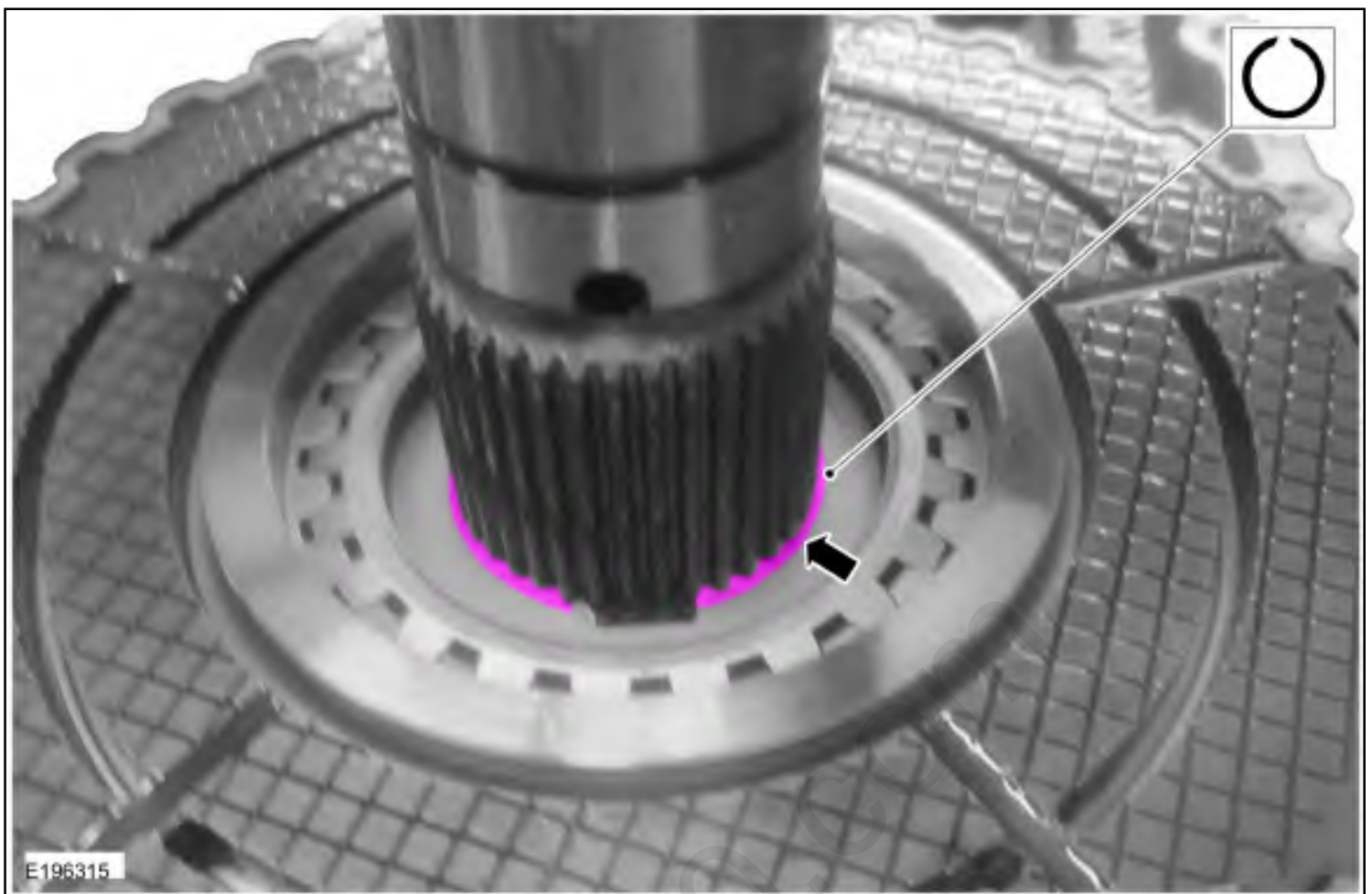
24. **NOTICE:** When installing the clutch assembly, do not separate the clutch pack assembly. The thrust washer in the lower clutch pack uses tabs to hold it in place. If the thrust washer is not in place, a transfer case clearance problem will occur.

NOTICE: If the clutch pack is disassembled, a new clutch pack and armature must be installed. Failure to install a new clutch pack can result in component failure.

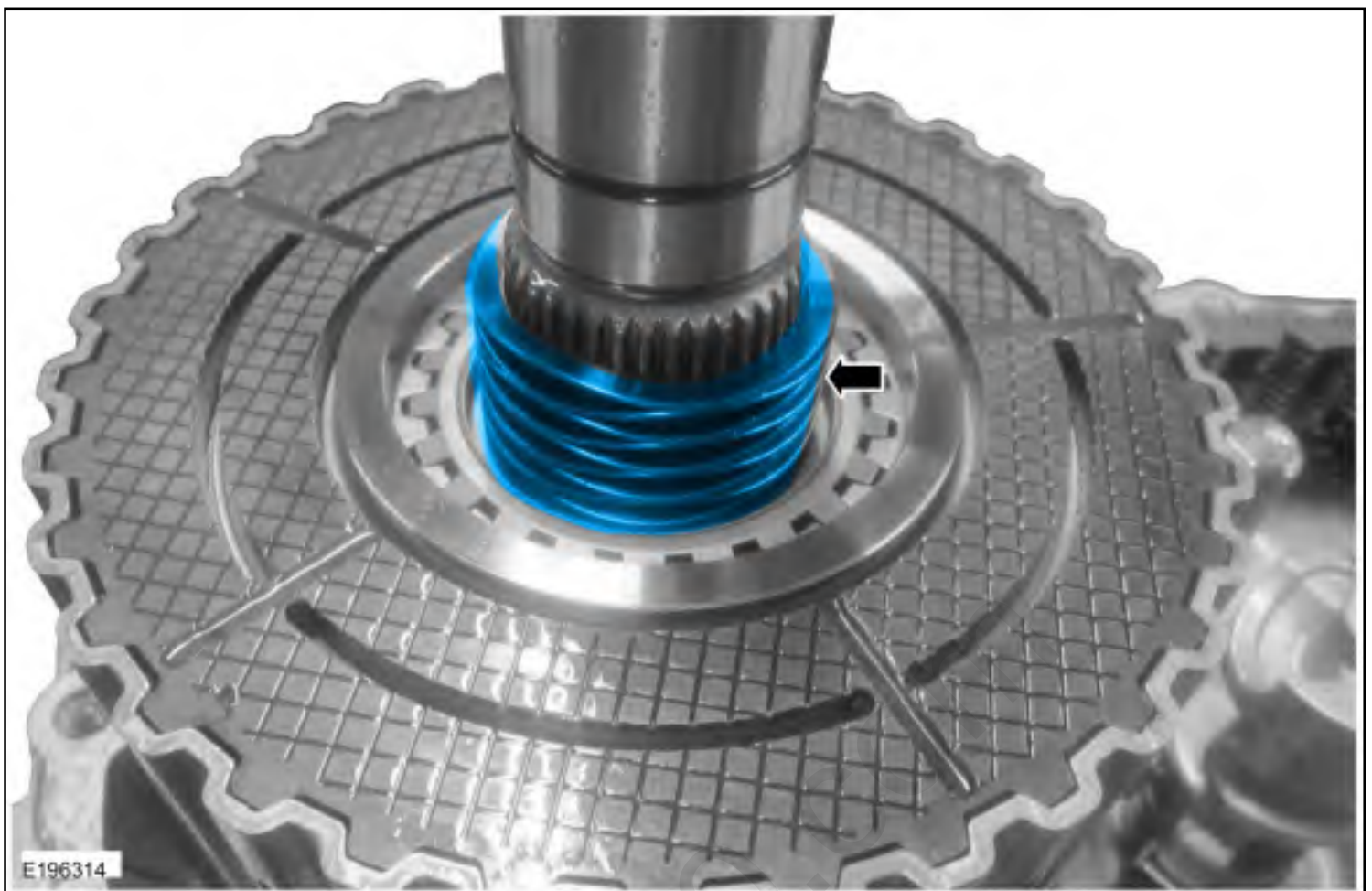
Install the clutch pack assembly with the armature.



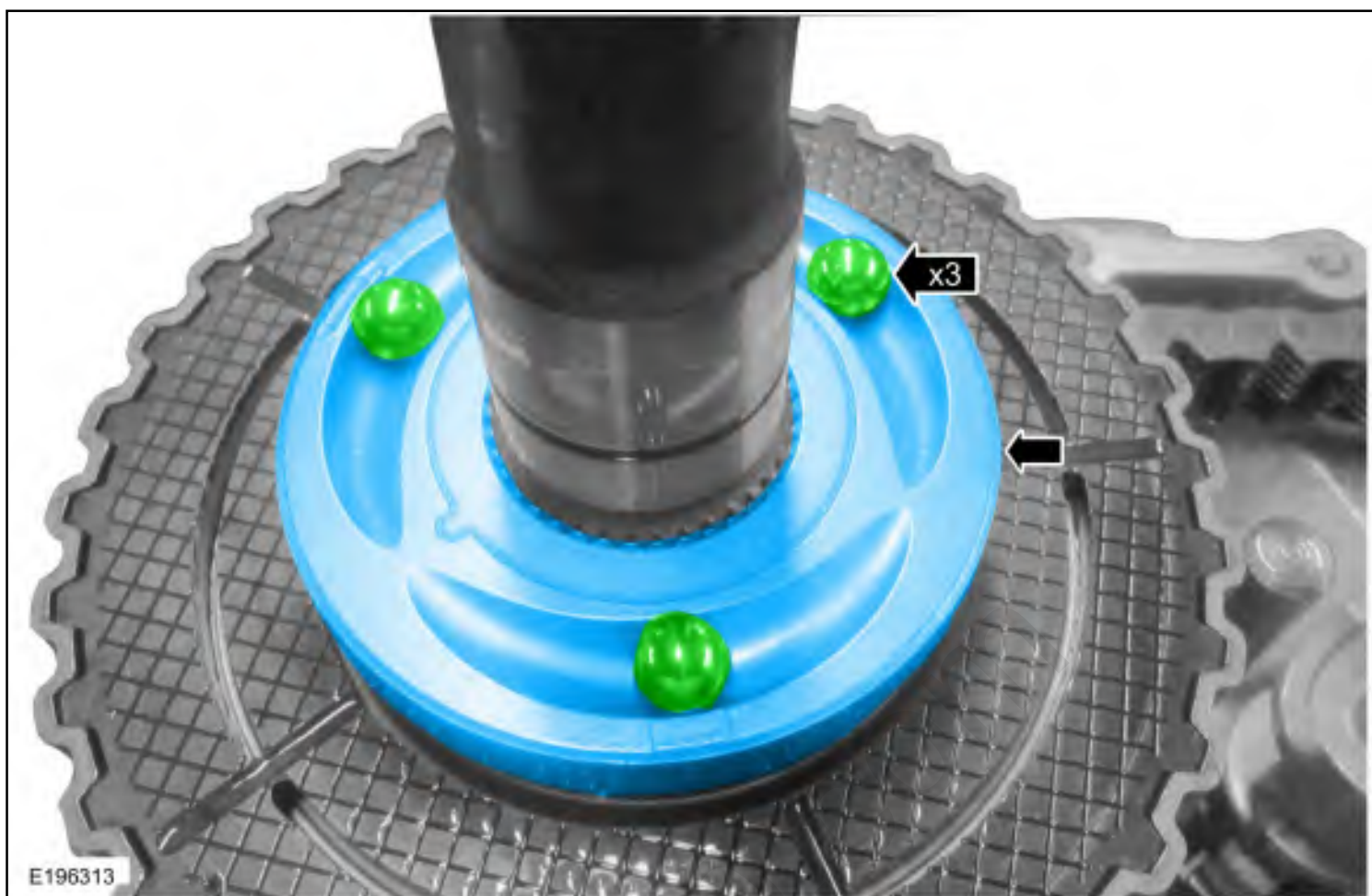
25. Install the clutch pack circlip.



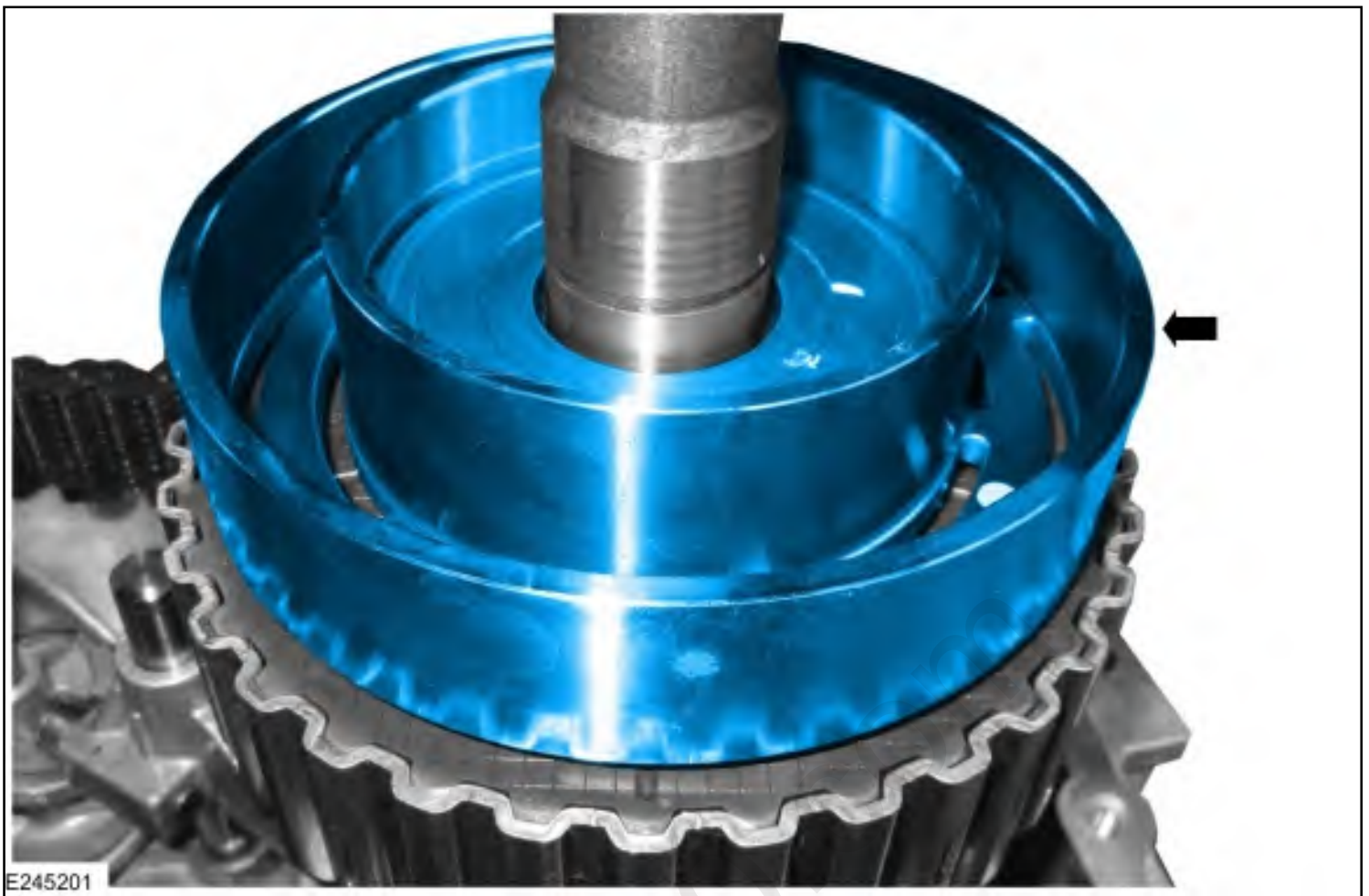
26. Install the wave spring.



27. Install the cam and the steel balls.



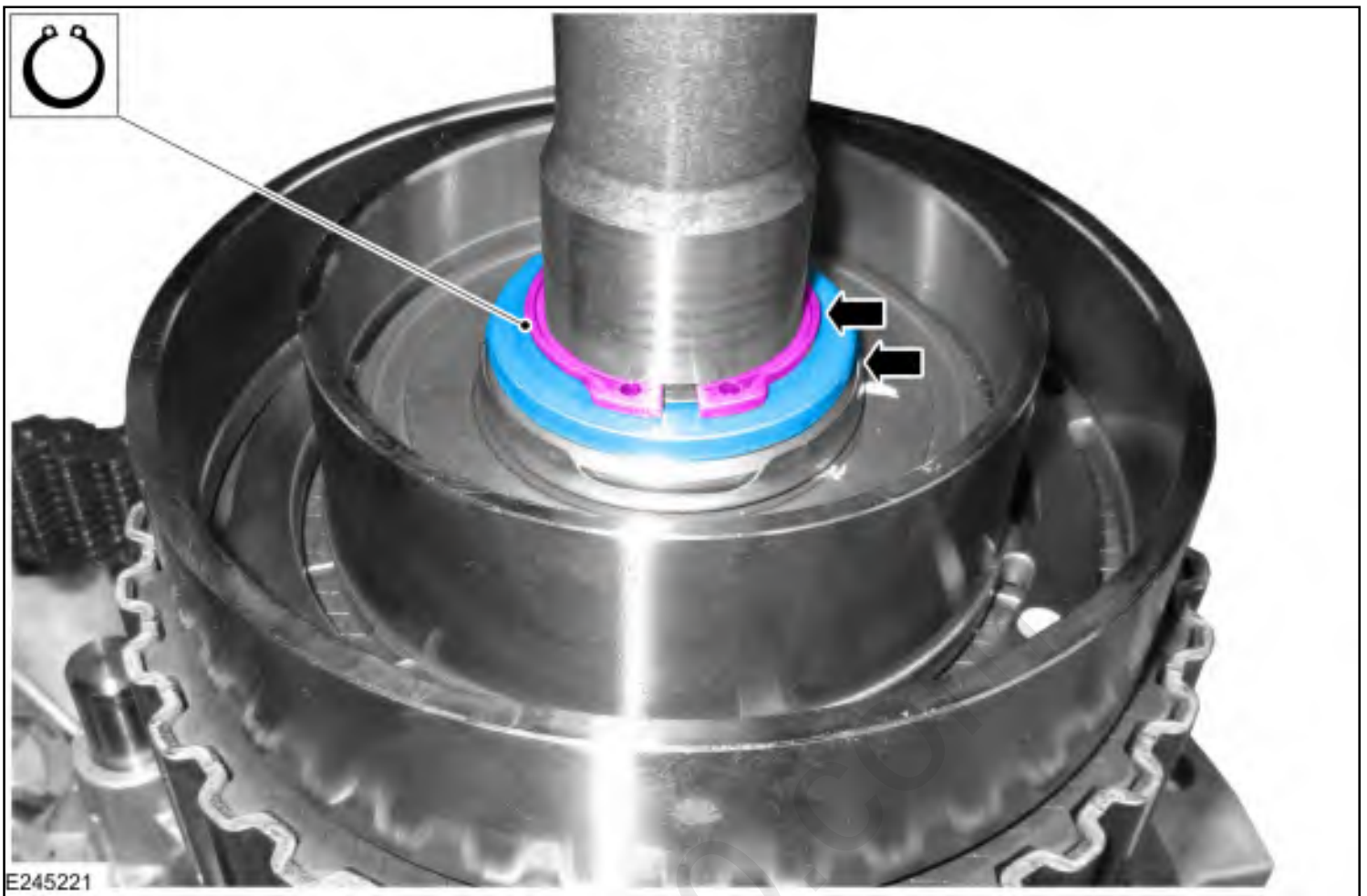
28. Install the coil housing.



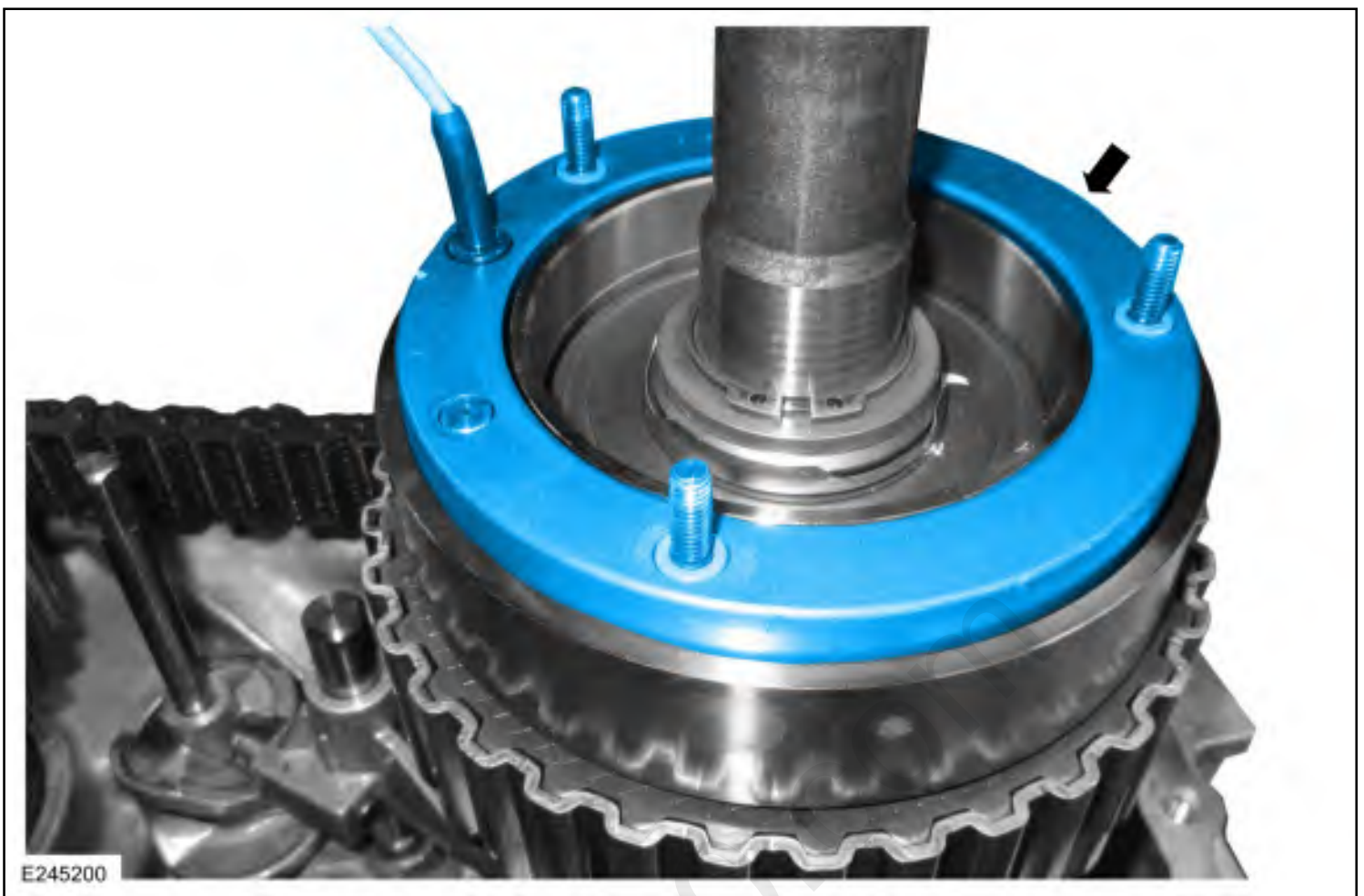
29. Install the coil housing thrust bearing assembly.



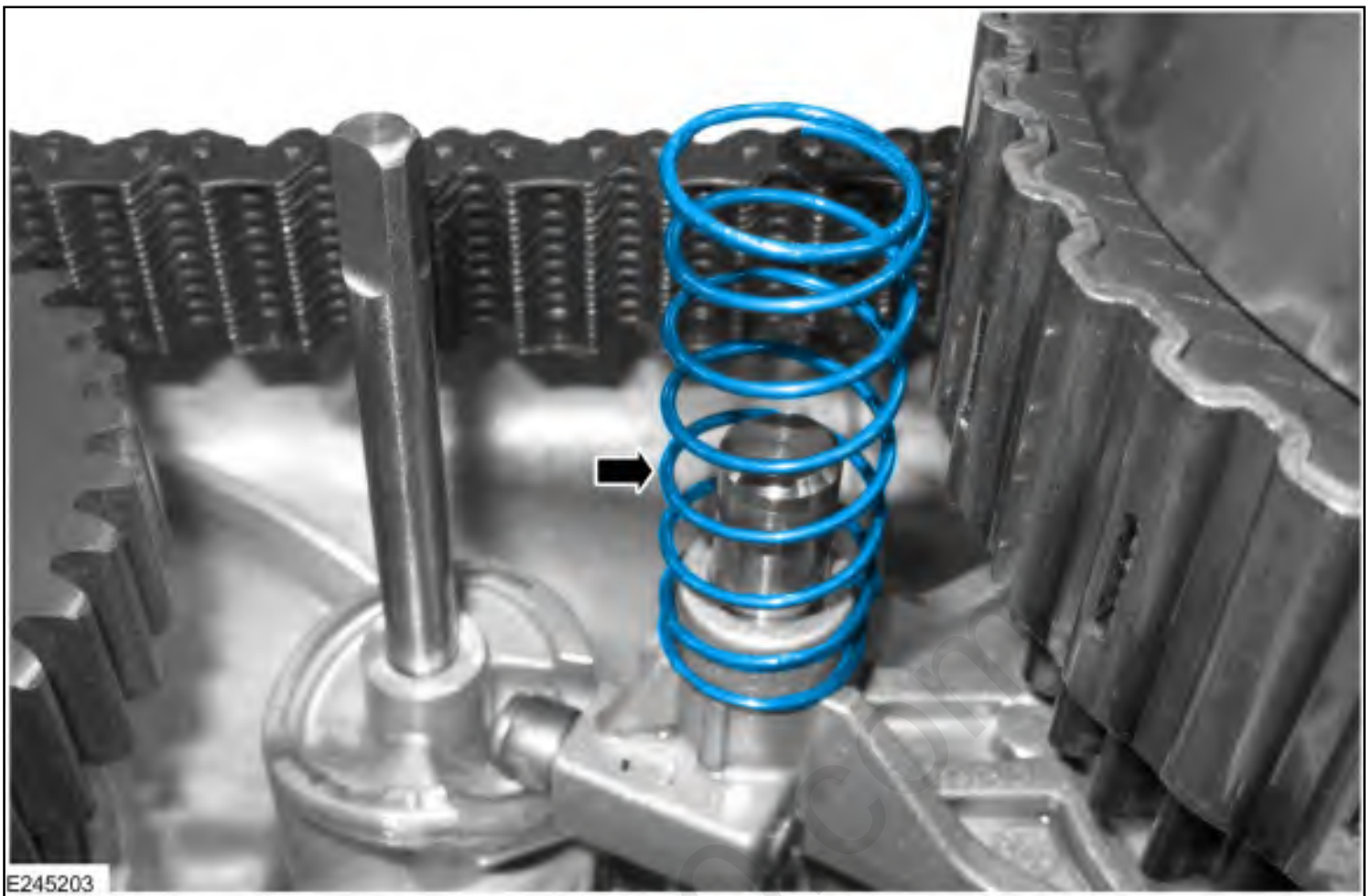
30. Install the coil housing spacer and snap ring.



31. Install the transfer case field coil.



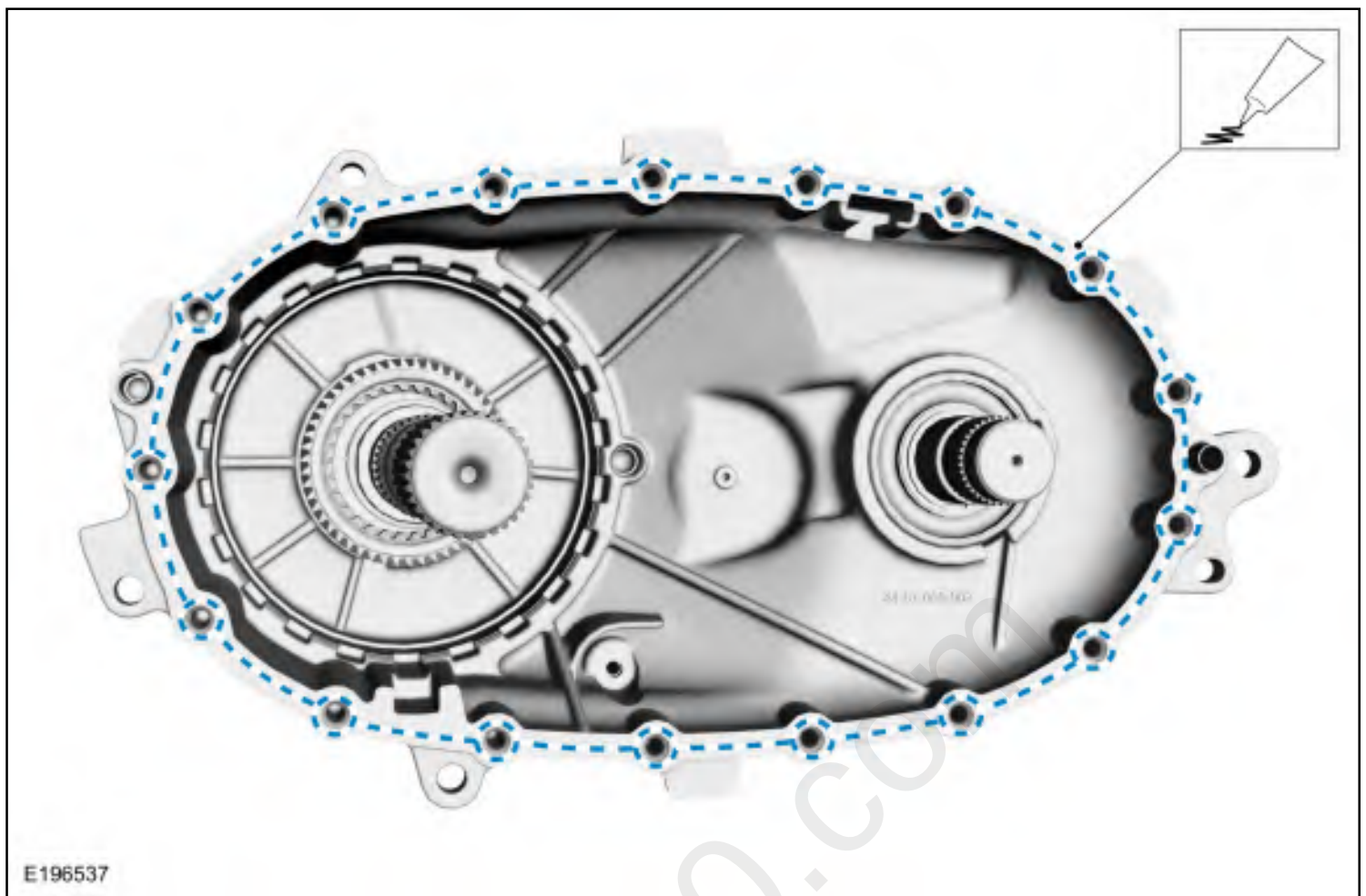
32. Install the lock up fork spring.



33. **NOTE:** Only apply enough silicone sealant to seal the transfer case halves together.

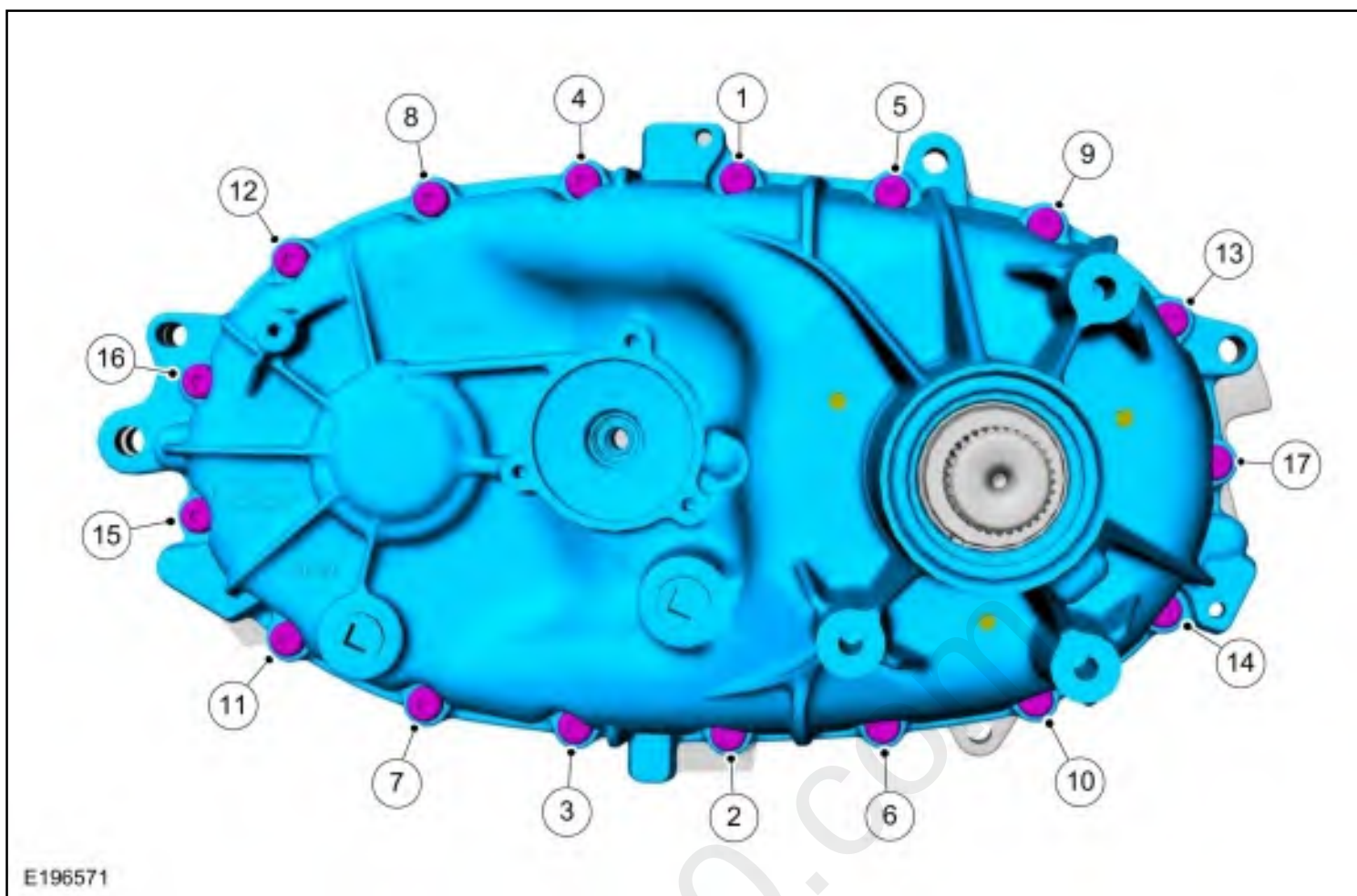
Apply a small bead of silicone sealant to the mating surface of the case half.

Material: Motorcraft® Ultra Silicone Sealant / TA-29

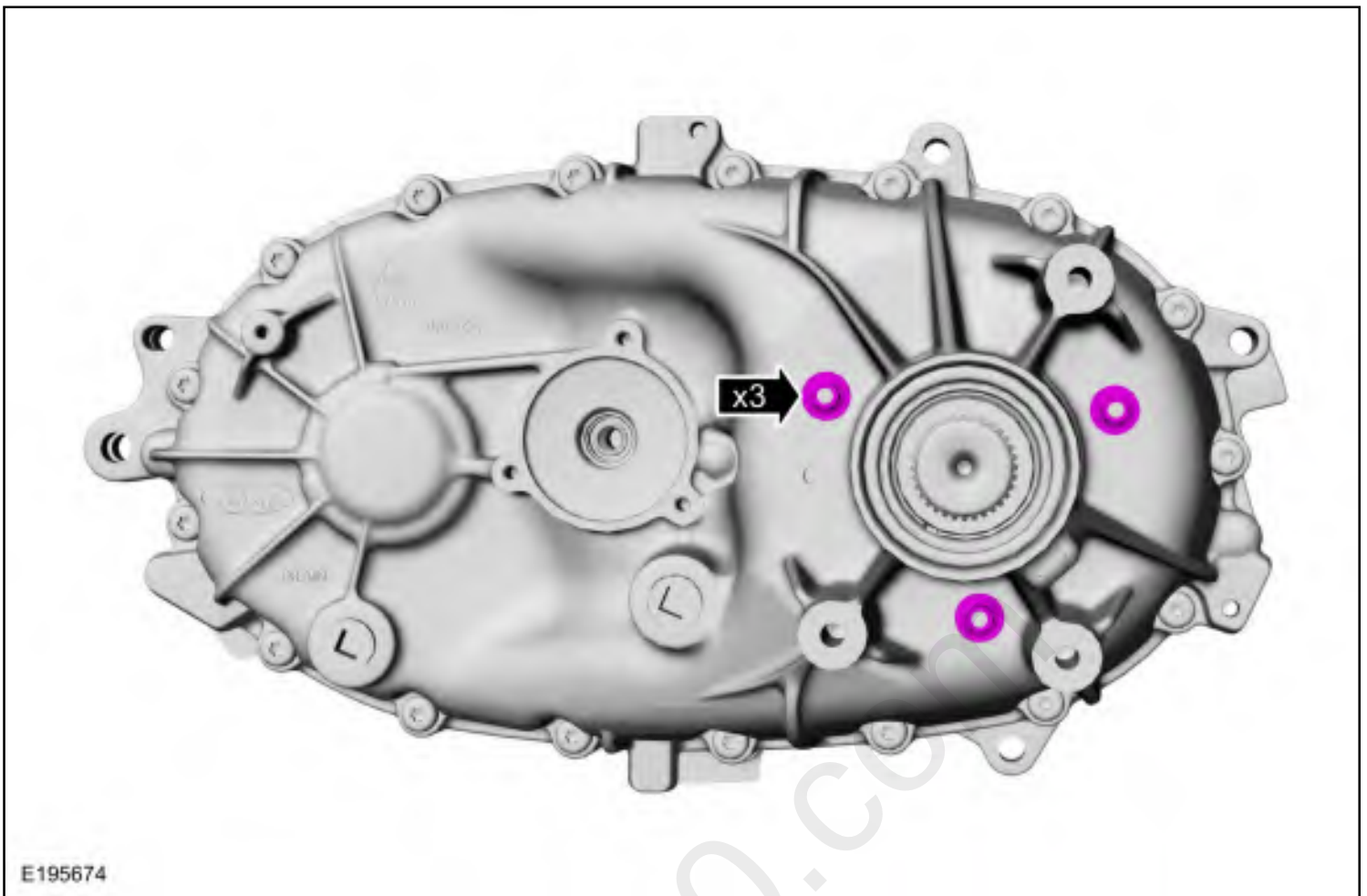


34. **NOTE:** Position the field coil bolts to align with the field coil bolt holes in the rear case. Position field coil wire through the field coil wire through hole in the case.

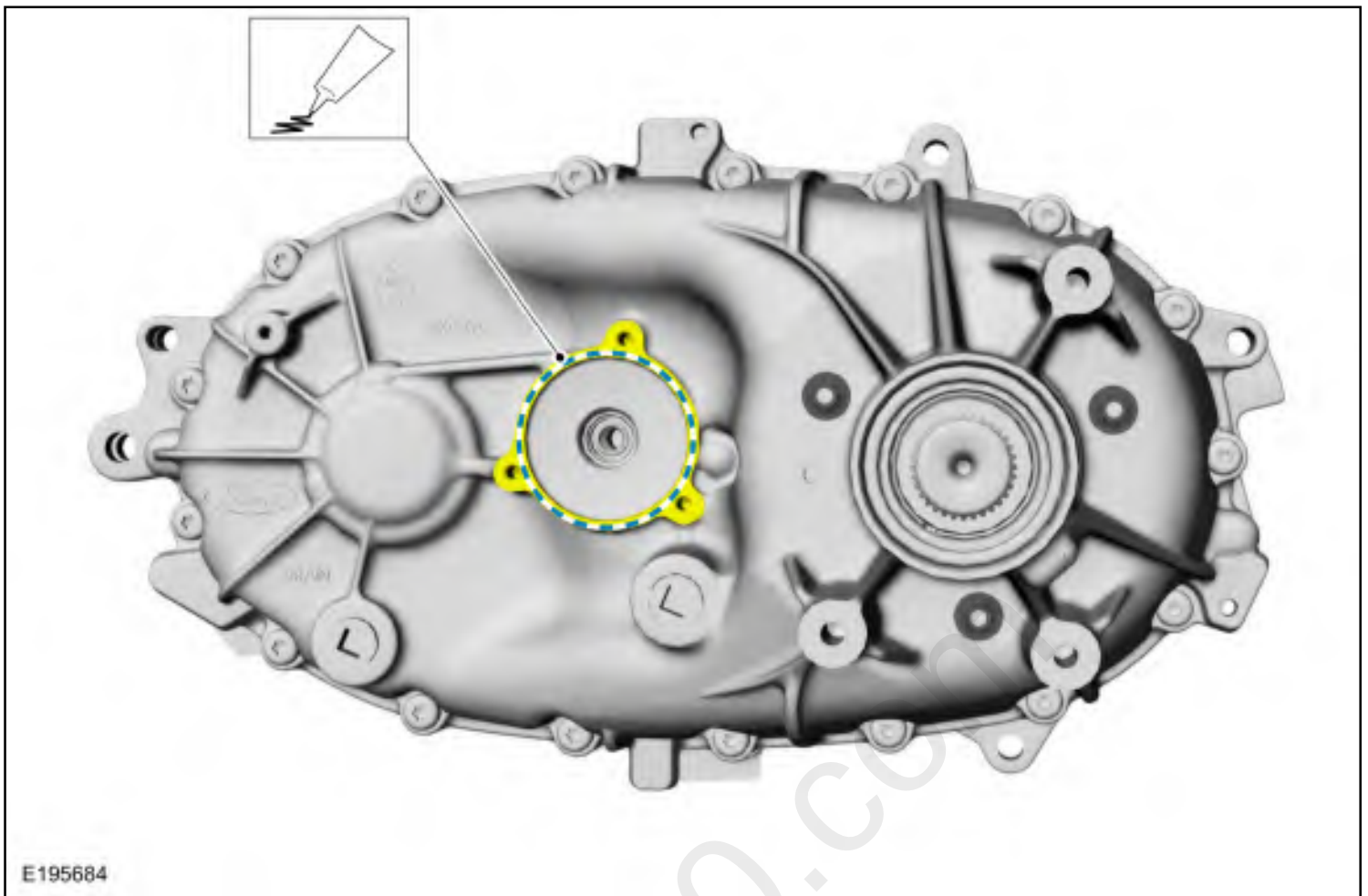
Position the transfer case halves and tighten the bolts in the sequence shown.
Torque: 21 lb.ft (29 Nm)



35. Install the coil washers and nuts.
Torque: 89 lb.in (10 Nm)

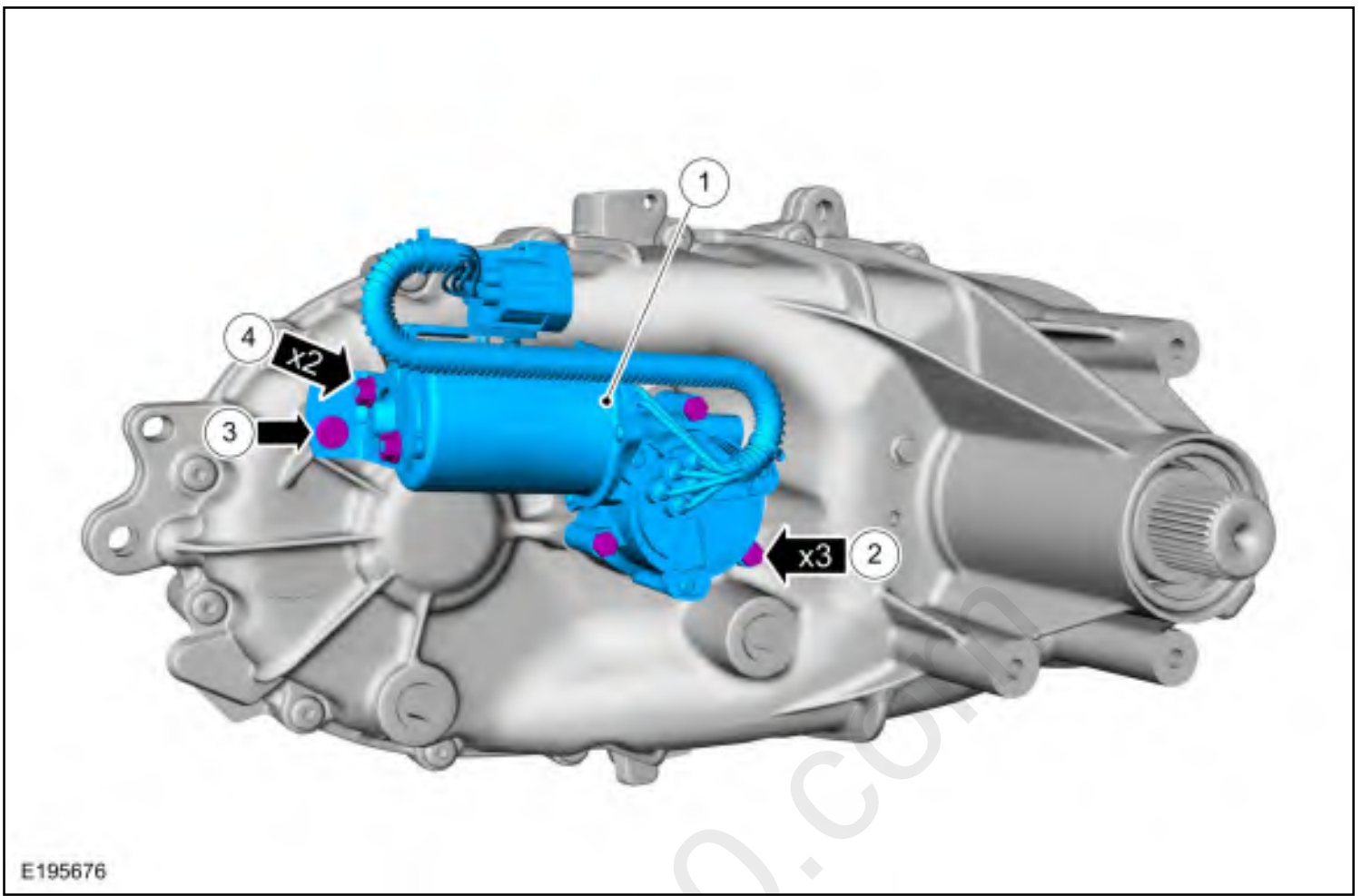


36. Install the transfer case rear seal.
Refer to: [Transfer Case Rear Seal](#) (308-07B Transfer Case, Removal and Installation).
37. Apply a small bead of silicone sealant to the transfer case shift motor mating surface.
Material: Motorcraft® Ultra Silicone Sealant / TA-29



38. **NOTICE:** When installing the shift motor, tighten the bracket nuts last. Failure to follow the steps in the correct order may result in damage to the component.

1. Install the transfer case shift motor.
2. Install the transfer case shift motor bolts.
Torque: 89 lb.in (10 Nm)
3. Install the transfer case shift motor bracket bolt.
Torque: 89 lb.in (10 Nm)
4. Tighten the transfer case shift motor bracket nuts.
Torque: 27 lb.in (3 Nm)



39. **NOTE:** After the coil wire is inserted into the connector, gently pull the wire back to verify the pin is locked inside the connector.

Install the coil wire pin in the electrical connector.

1. Insert the coil wire pin in the electrical connector.
2. Install the inner connector retainer.



40. Remove the transfer case from the transmission adjustable mounting arms.
Use the General Equipment: Adjustable Mounting Arm



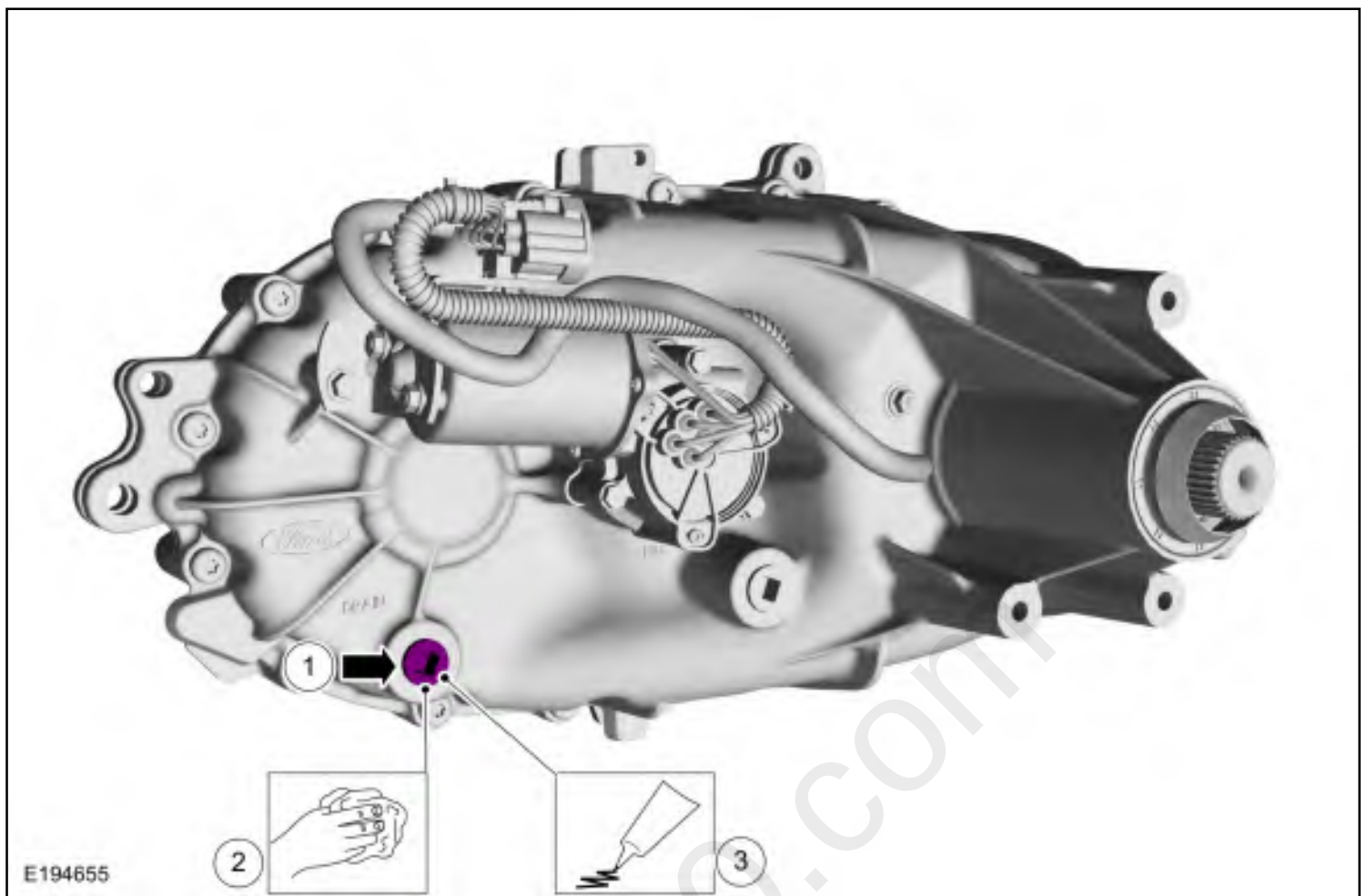
Transfer Case Draining and Filling

Materials

Name	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC	MERCON® LV WSS-M2C938-A

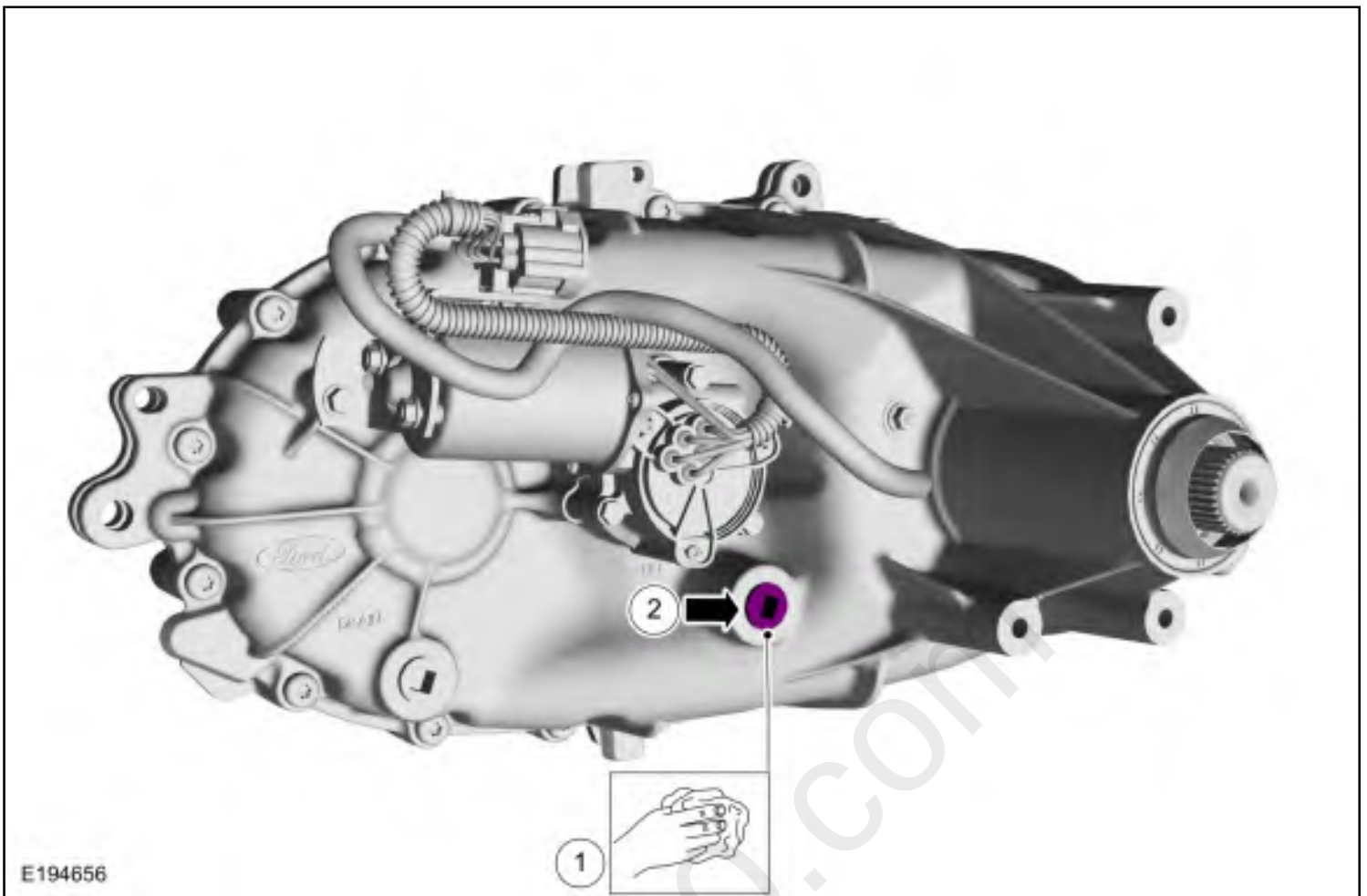
Draining

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
1. Remove the drain plug and drain the fluid.
2. Clean the drain plug and the area around drain plug.
3. Apply thread sealant to the drain plug threads and install the drain plug.
Torque: 133 lb.in (15 Nm)



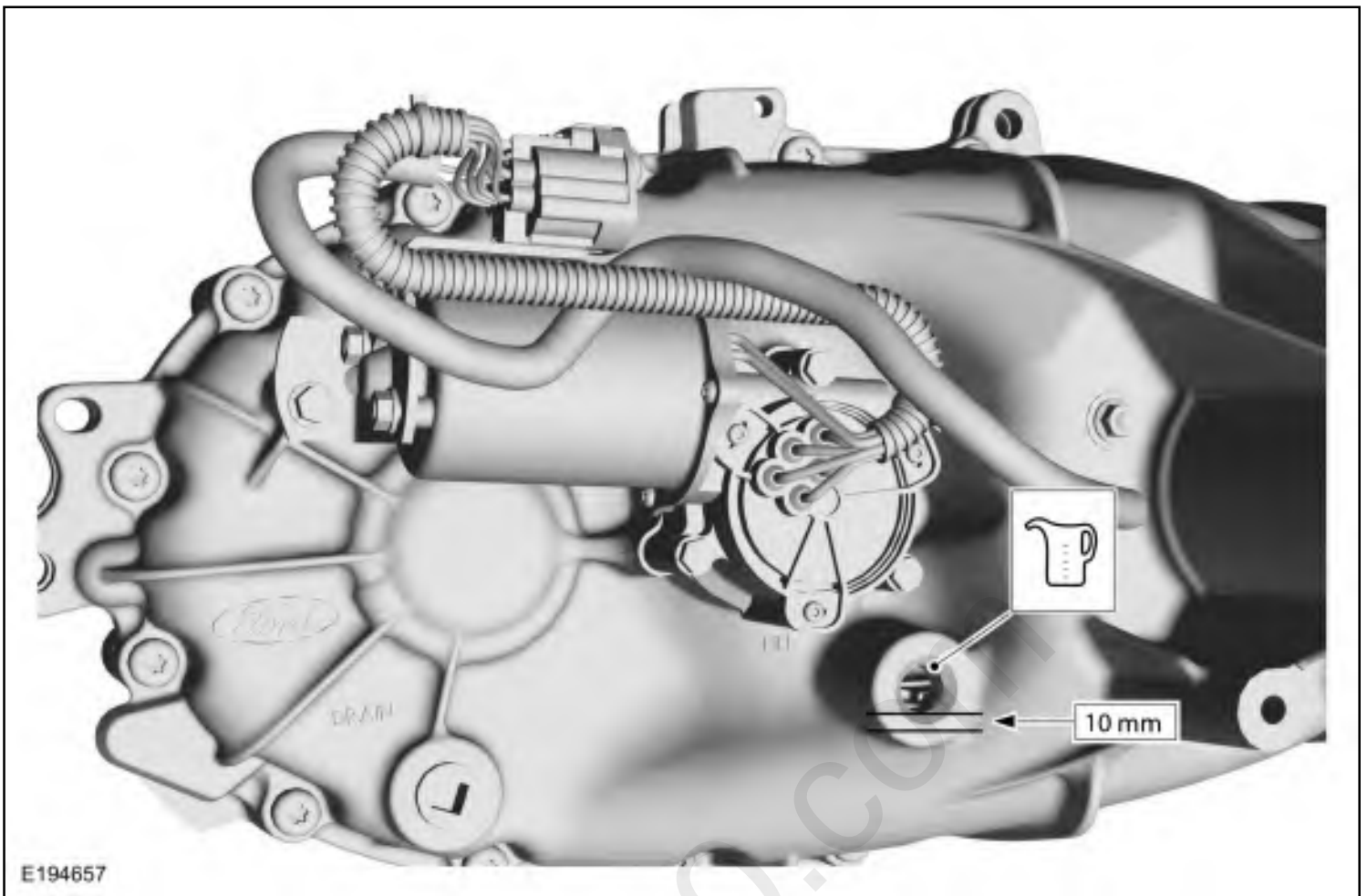
Filling

1. Clean the fill plug and the area around fill plug.
2. Remove the fill plug.

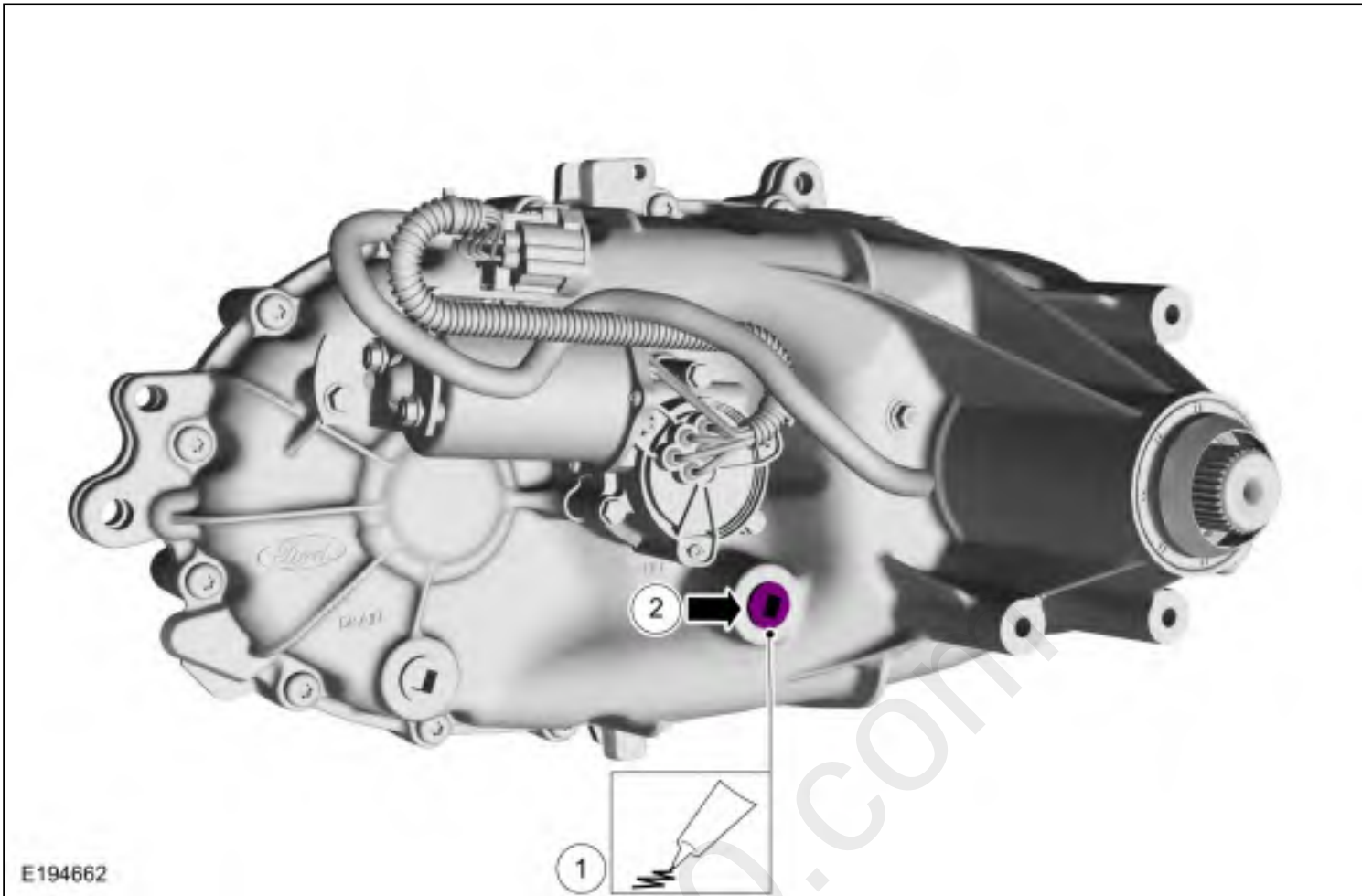


2. Fill the transfer case with 1.4L (2.9 pt) of clean fluid. The transfer case fluid must be within 10mm (0.393 in) below the fill plug hole.

Material: Motorcraft® MERCON® LV Automatic Transmission Fluid / XT-10-QLVC (MERCON® LV) (WSS-M2C938-A)

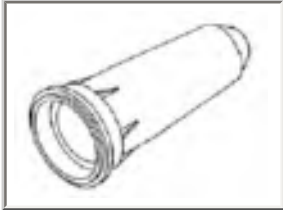


1. Apply thread sealant to the fill plug threads.
 2. Install the fill plug.
- Torque: 133 lb.in (15 Nm)*



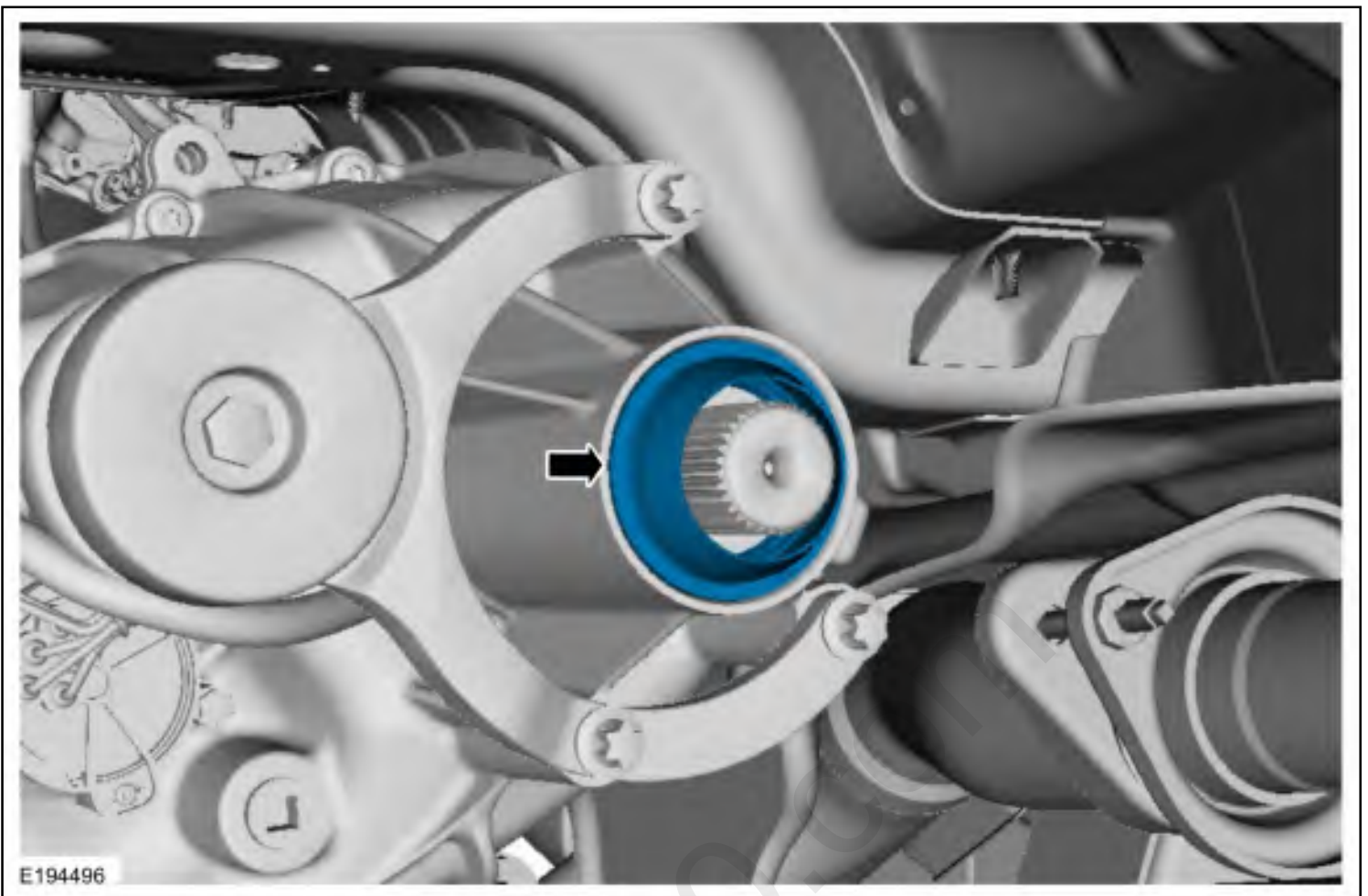
Transfer Case Rear Seal

Special Tool(s) / General Equipment

	308-249 (T96T-7127-A) Installer, Input Shaft Oil Seal TKIT-1996-F/FM TKIT-1996-FLM2
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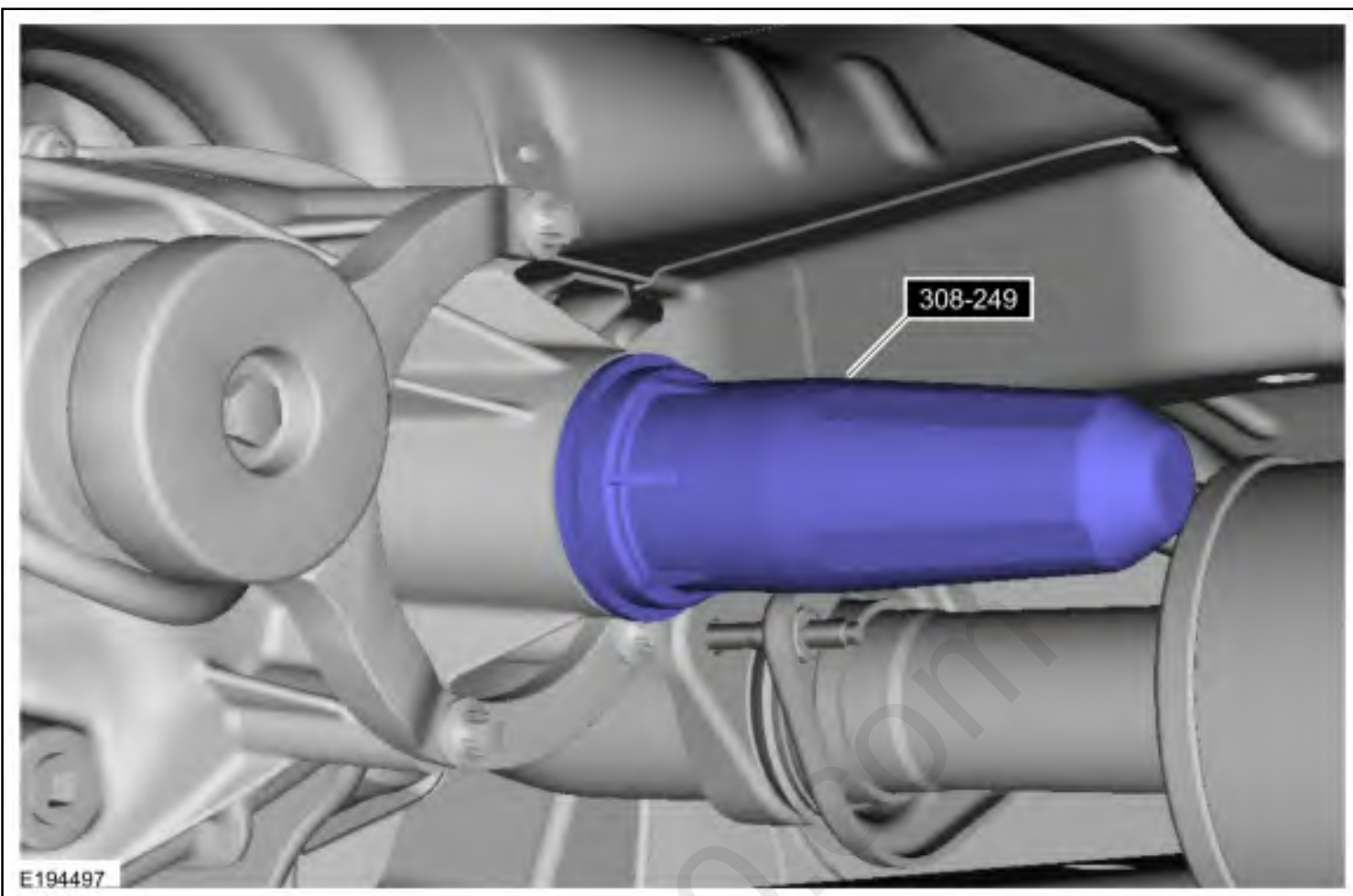
Removal

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Remove the rear driveshaft.
Refer to: [Rear Driveshaft](#) (205-01 Driveshaft, Removal and Installation).
3. Remove the rear output shaft seal.



Installation

1. Using the special tool, install the rear output shaft seal.
Use Special Service Tool: 308-249 (T96T-7127-A) Installer, Input Shaft Oil Seal.



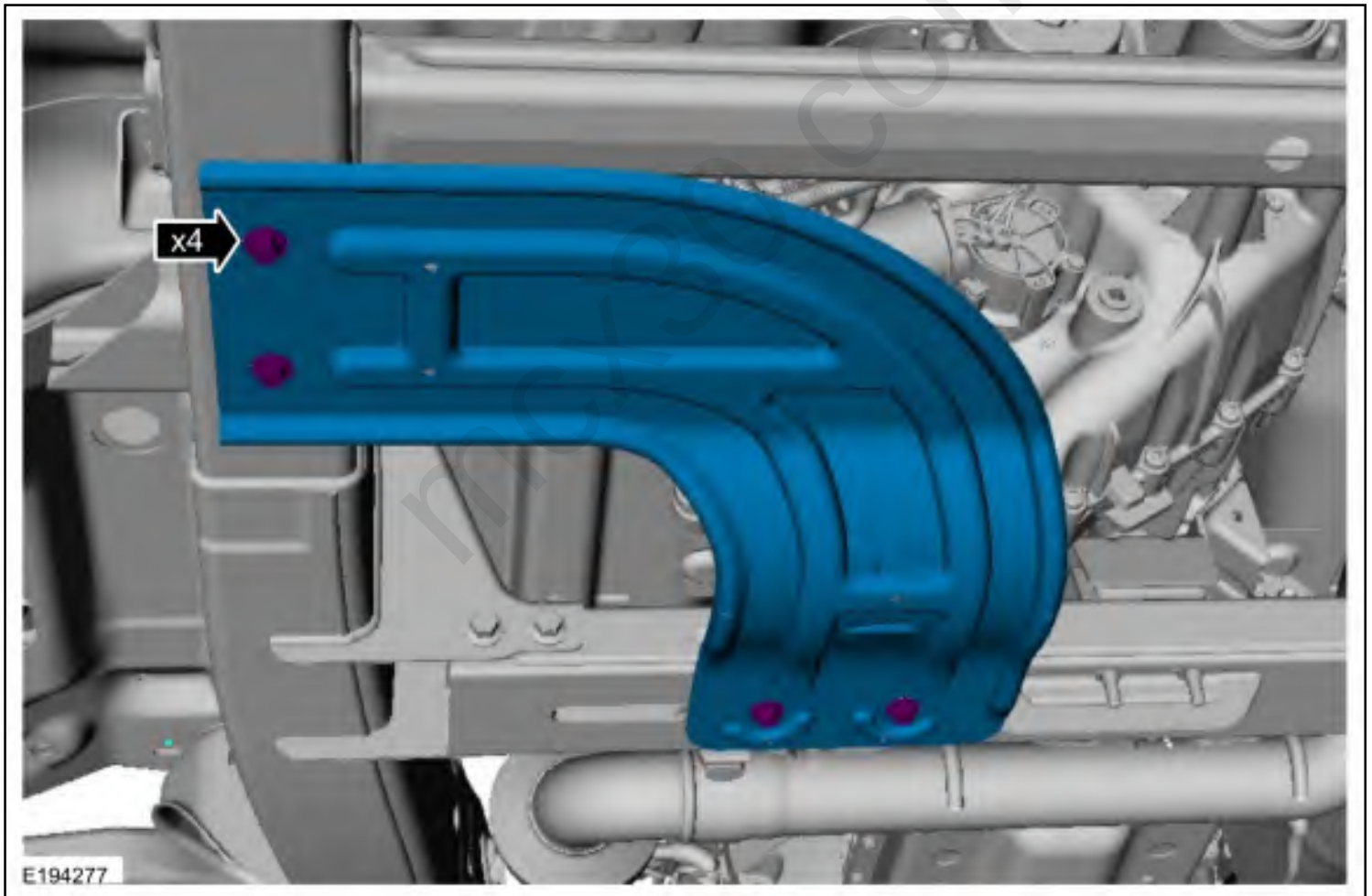
2. Install the rear driveshaft.

Refer to: [Rear Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

Transfer Case

Base Part Number: Base Part Number: 7251

1. With the vehicle in Neutral, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. If equipped.
Remove the skid plate bolts and the skid plate.



3. Drain the fluid if the transfer case is to be disassembled.
Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case, General Procedures).

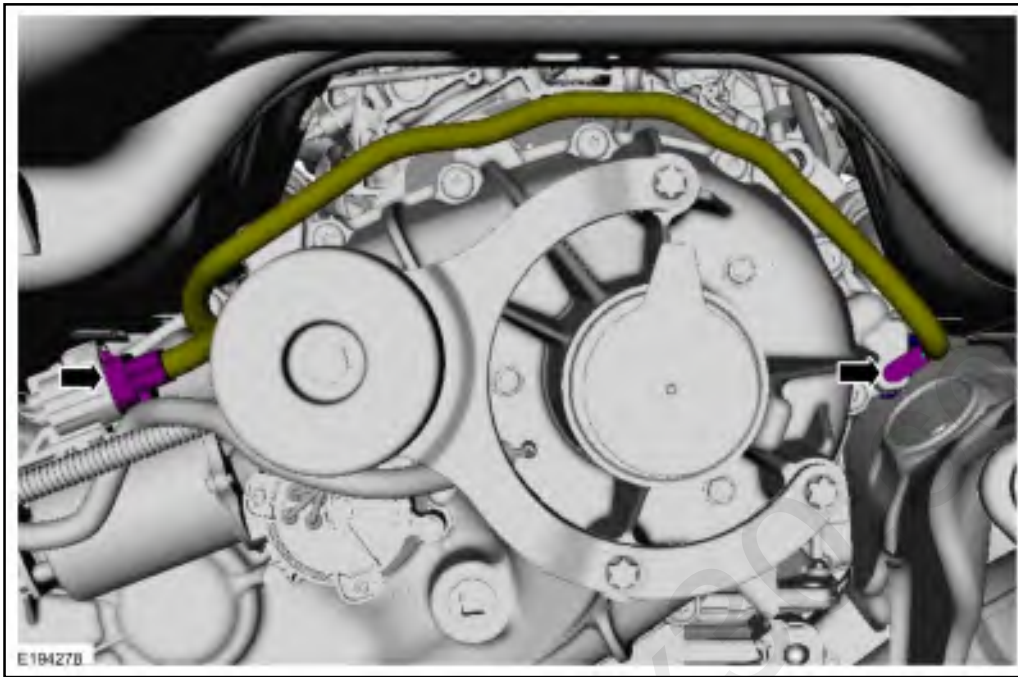
4. Remove the front driveshaft.

Refer to: [Front Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

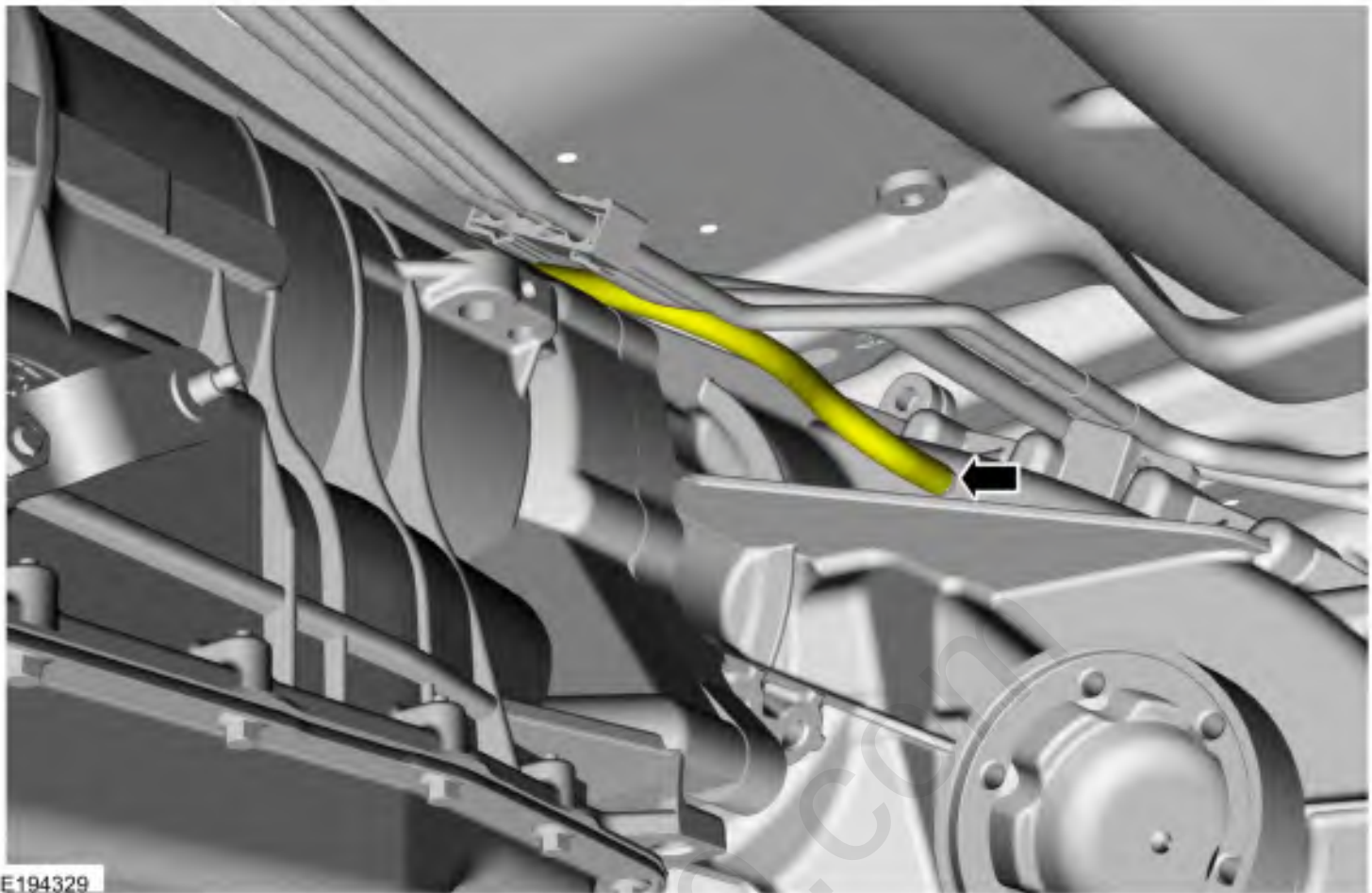
5. Remove the rear driveshaft.

Refer to: [Rear Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

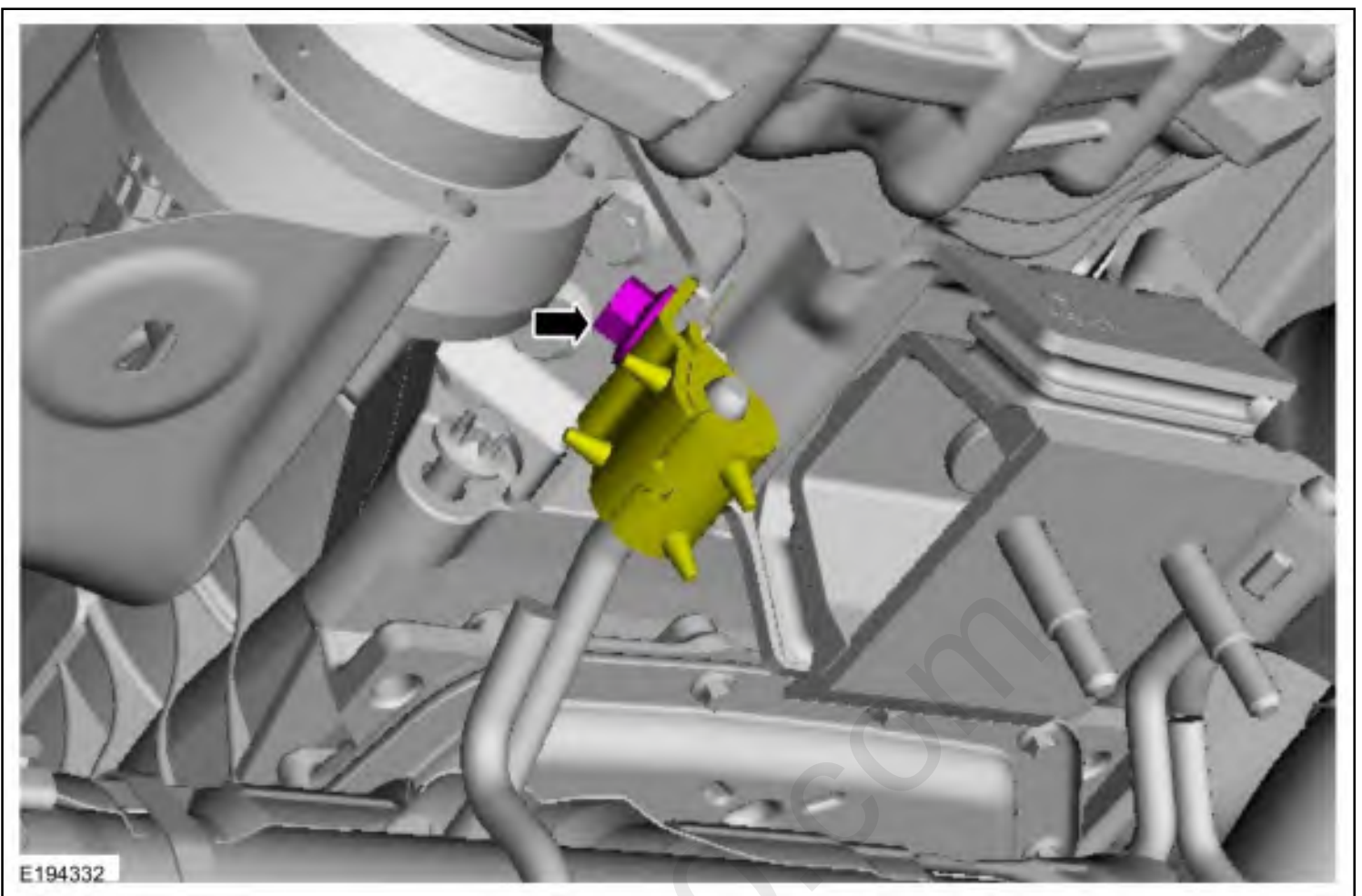
6. Disconnect the shift motor electrical connector and detach the harness retainer clip from the transfer case.



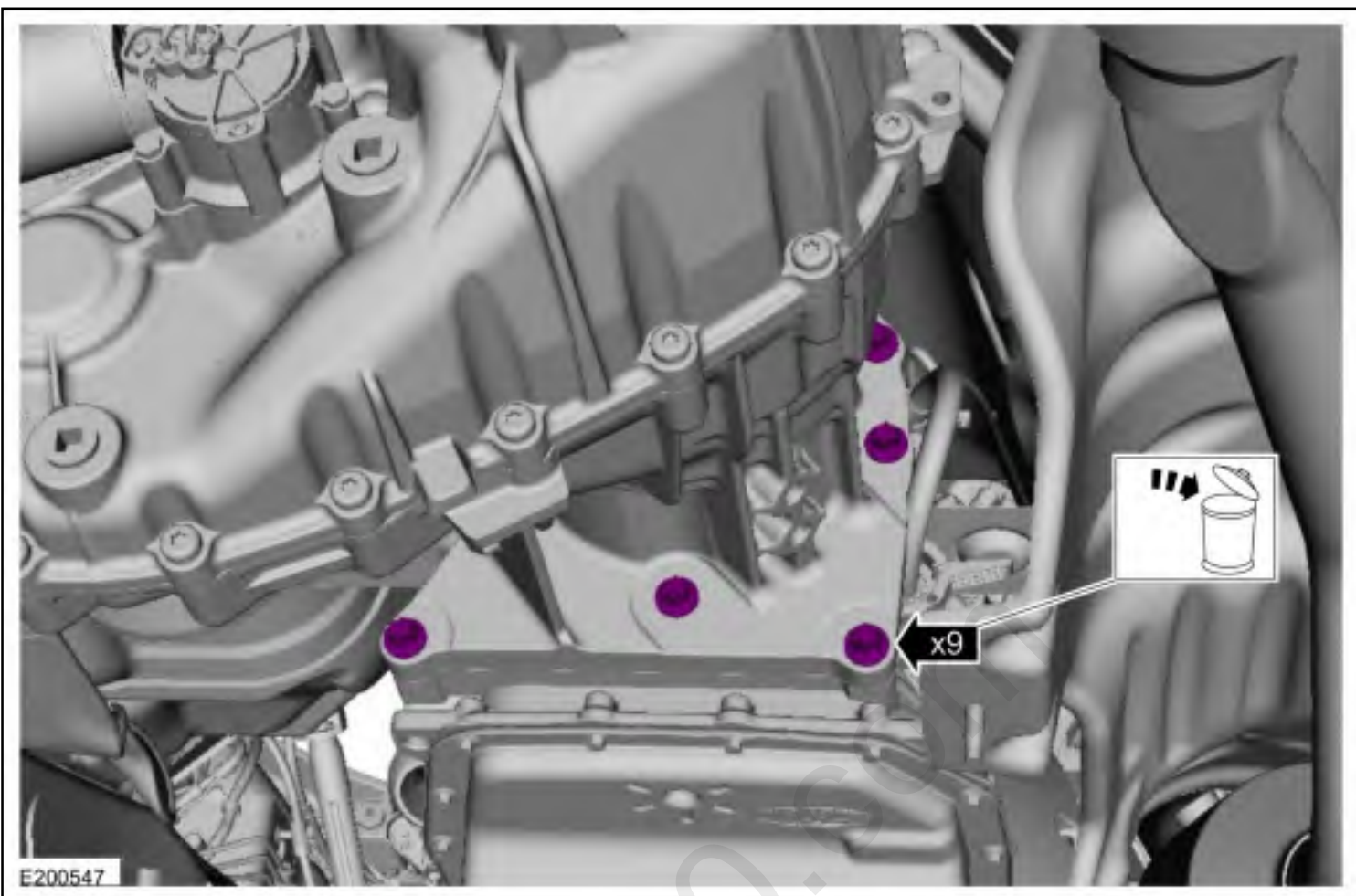
7. Disconnect the vent hose from the transfer case.



8. Remove the transmission support crossmember.
Refer to: [Transmission Support Crossmember](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
9. Remove the bolt from the LH exhaust support bracket.

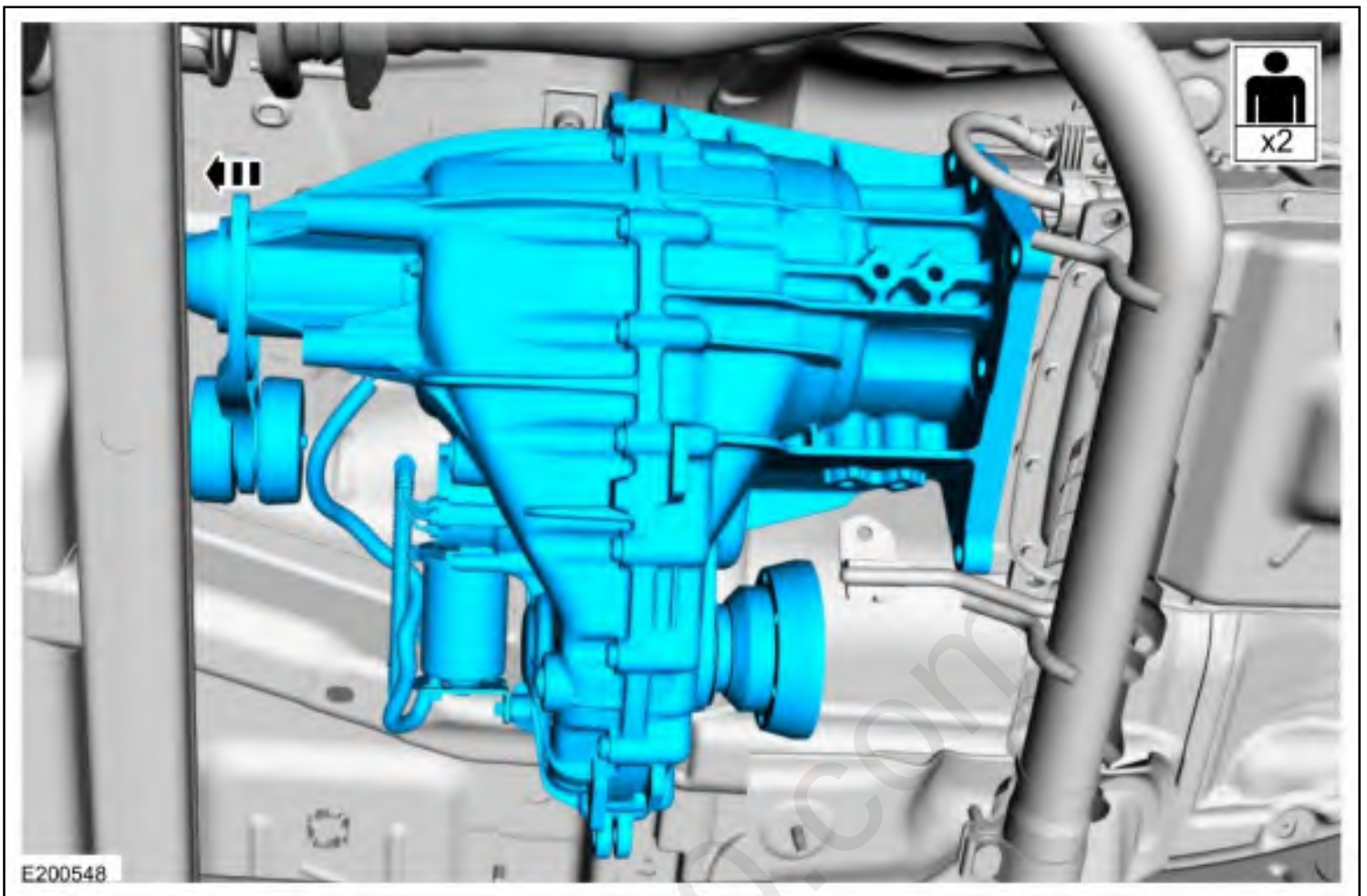


10. Refer to: [Transmission Support Insulator](#) (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
Refer to: [Transmission Support Insulator](#) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Removal and Installation).
11. Remove and discard the transfer case-to-transmission bolts.



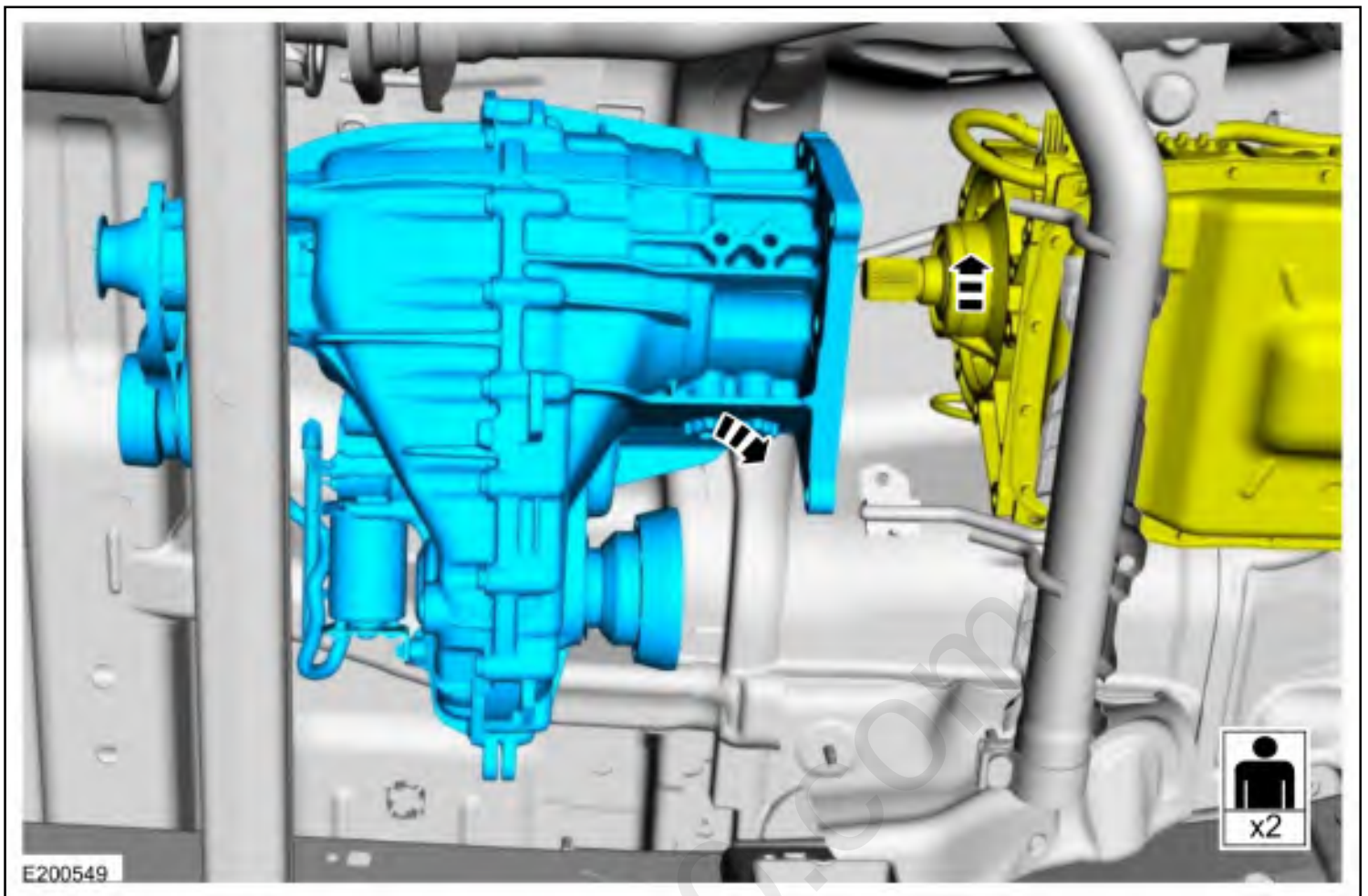
12. **NOTE:** *The transfer case will need to be positioned on top of the crossmember and will require the help of an assistant.*

Separate the transfer case from the transmission and move the transfer case rearward.



13. **NOTE:** *An assistant will be required to remove the transfer case.*

Raise the transmission for clearance. Remove the transfer case and lower it from the vehicle.



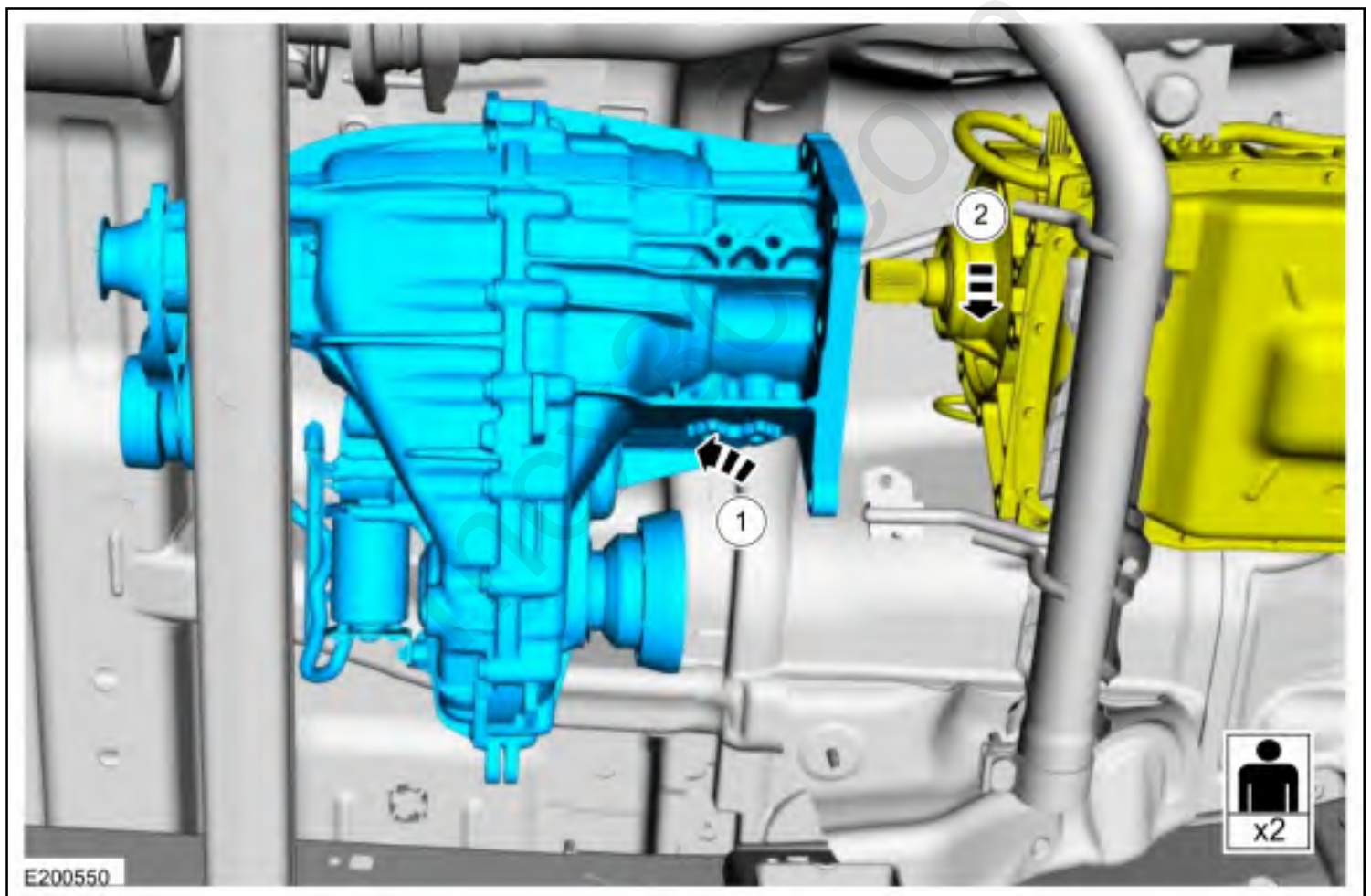
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Transfer Case

Base Part Number: Base Part Number: 7251

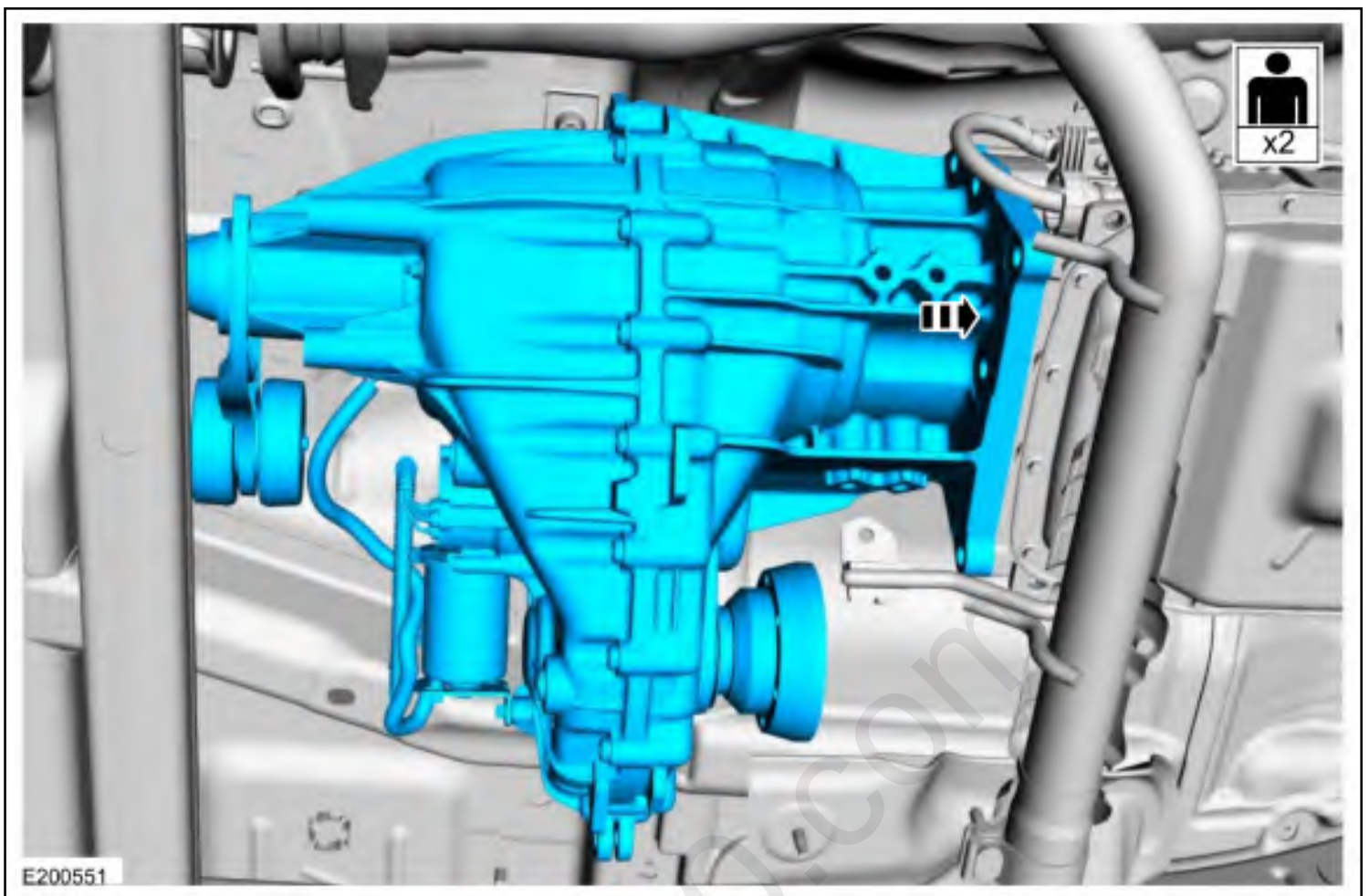
1. **NOTE:** *The help of an assistant will be required.*

Position the transfer case on the crossmember. Lower the transmission approximately 25.4 mm (1 in).



2. **NOTE:** *The help of an assistant will be required.*

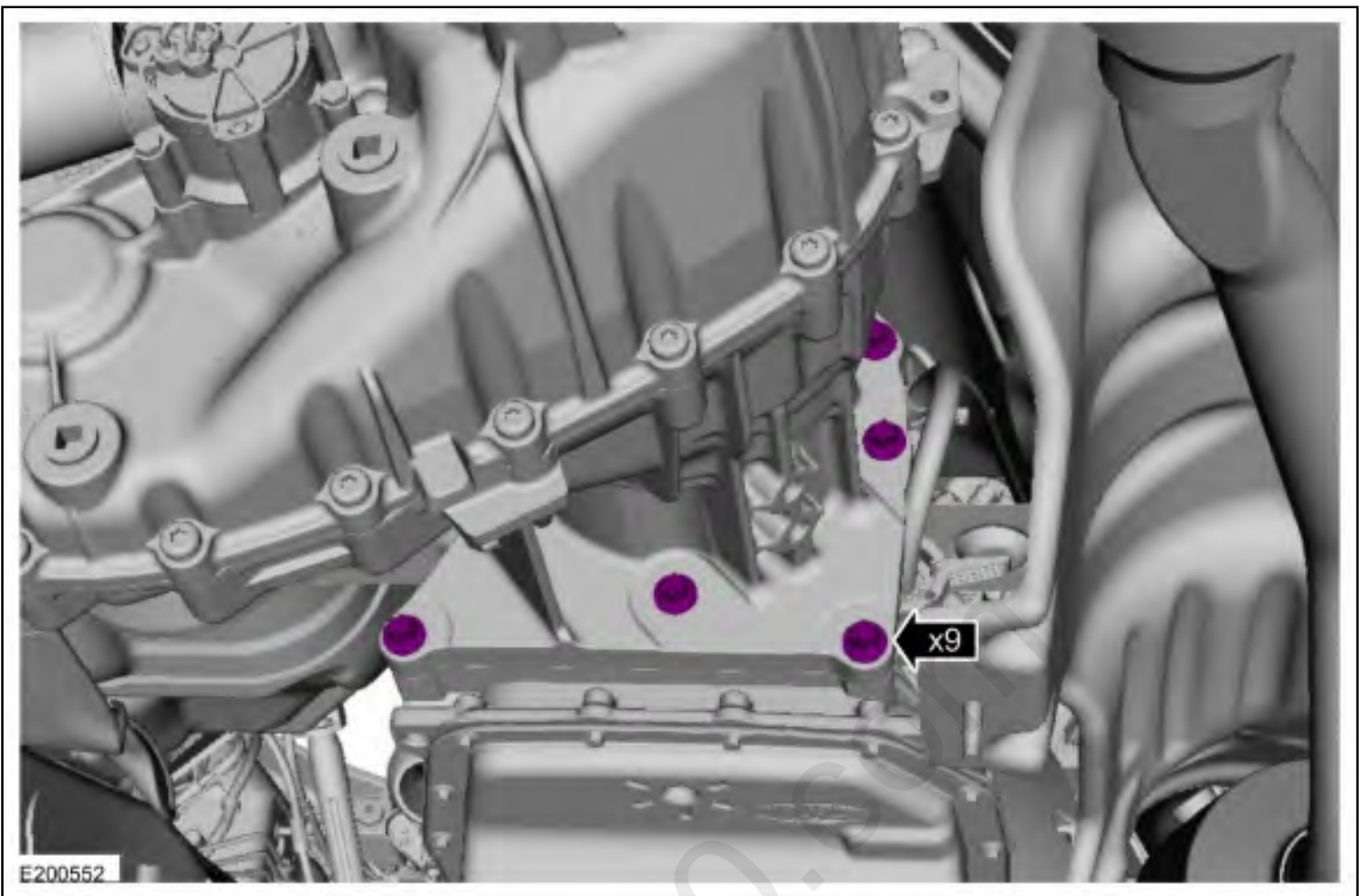
Position the transfer case to the transmission and onto the output shaft.



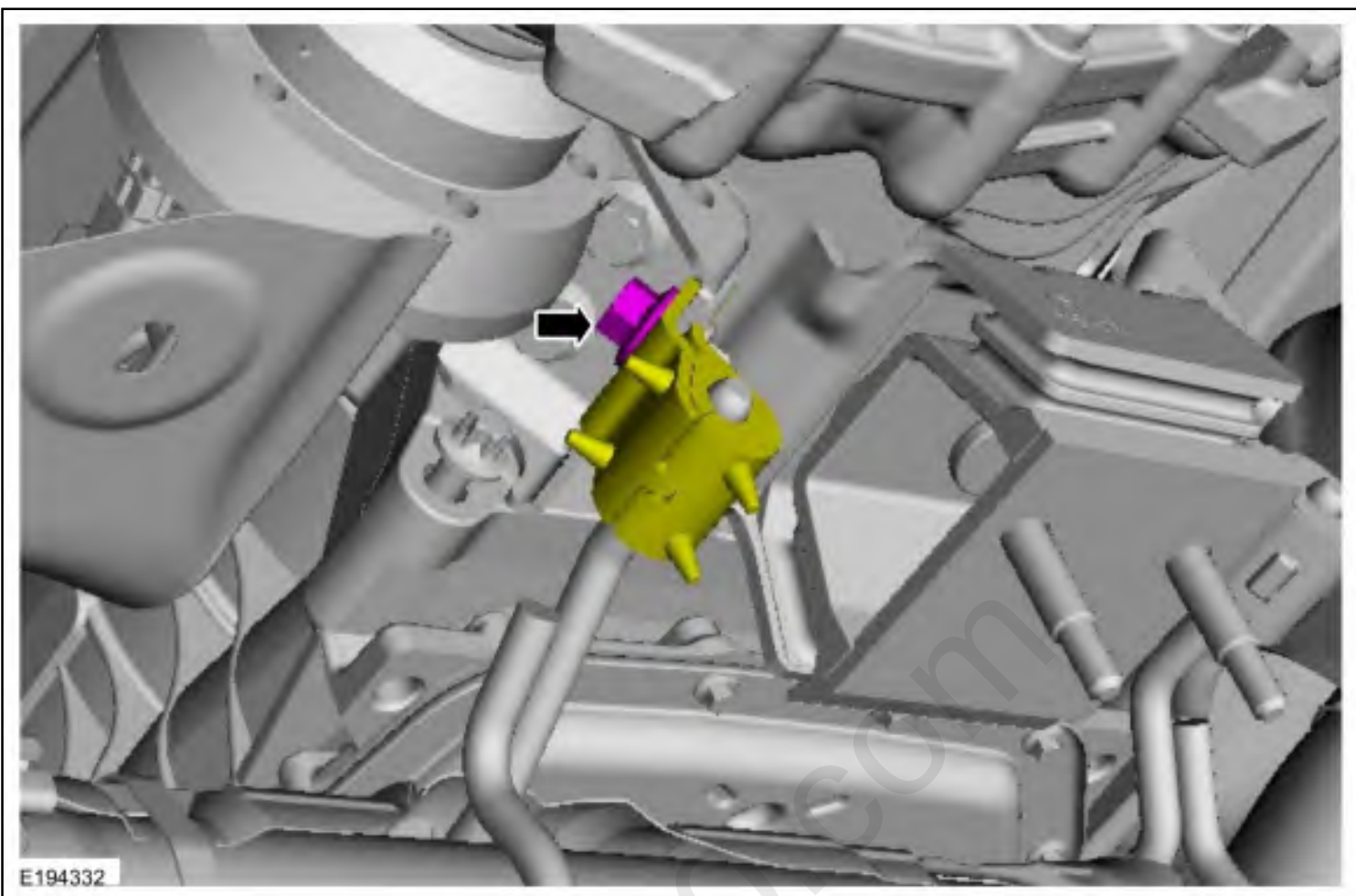
3. **NOTE:** *Do not reuse the old transfer case-to-transmission bolts.*

Install new transfer case-to-transmission bolts.

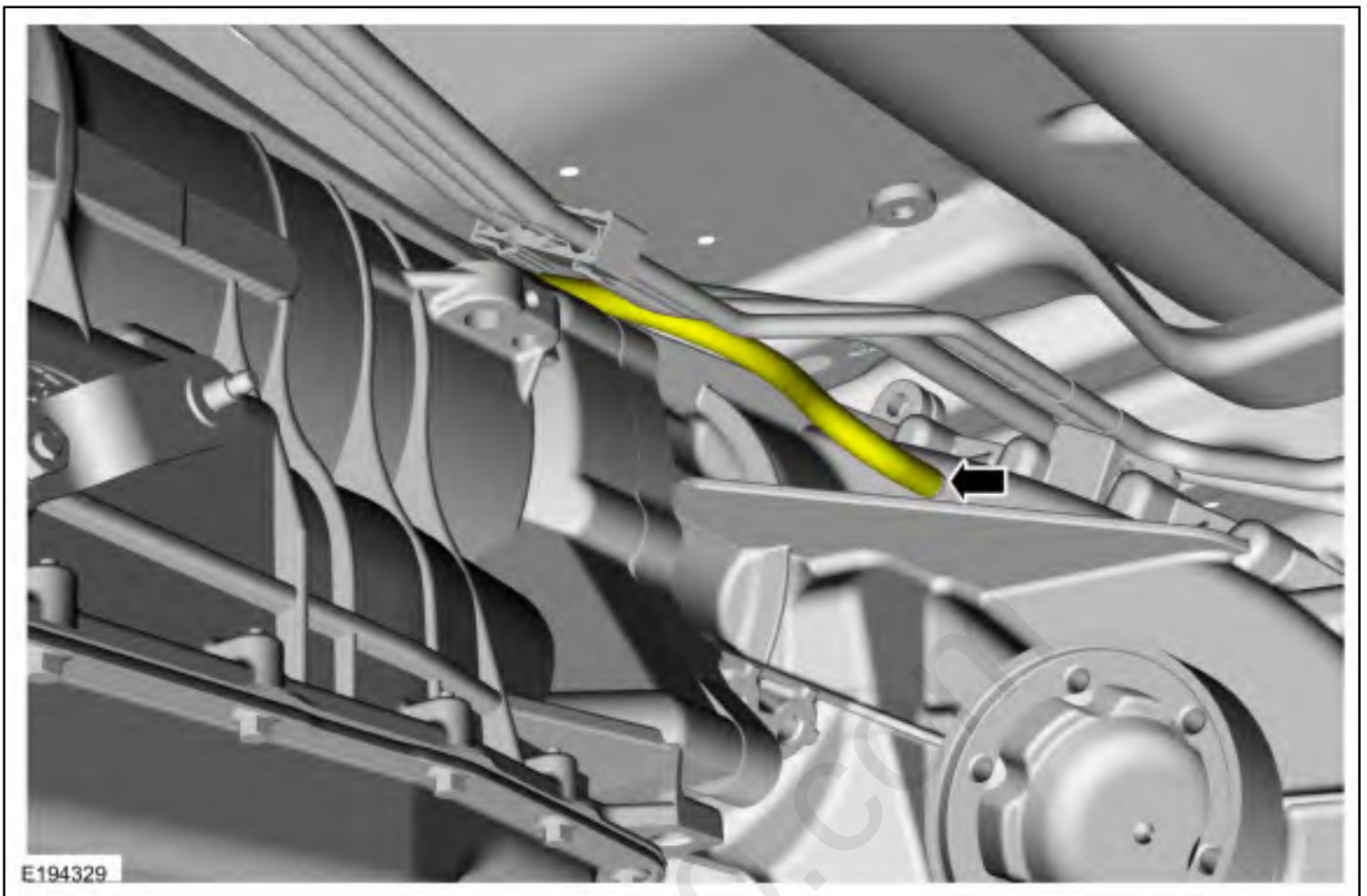
Torque: 168 lb.in (19 Nm)



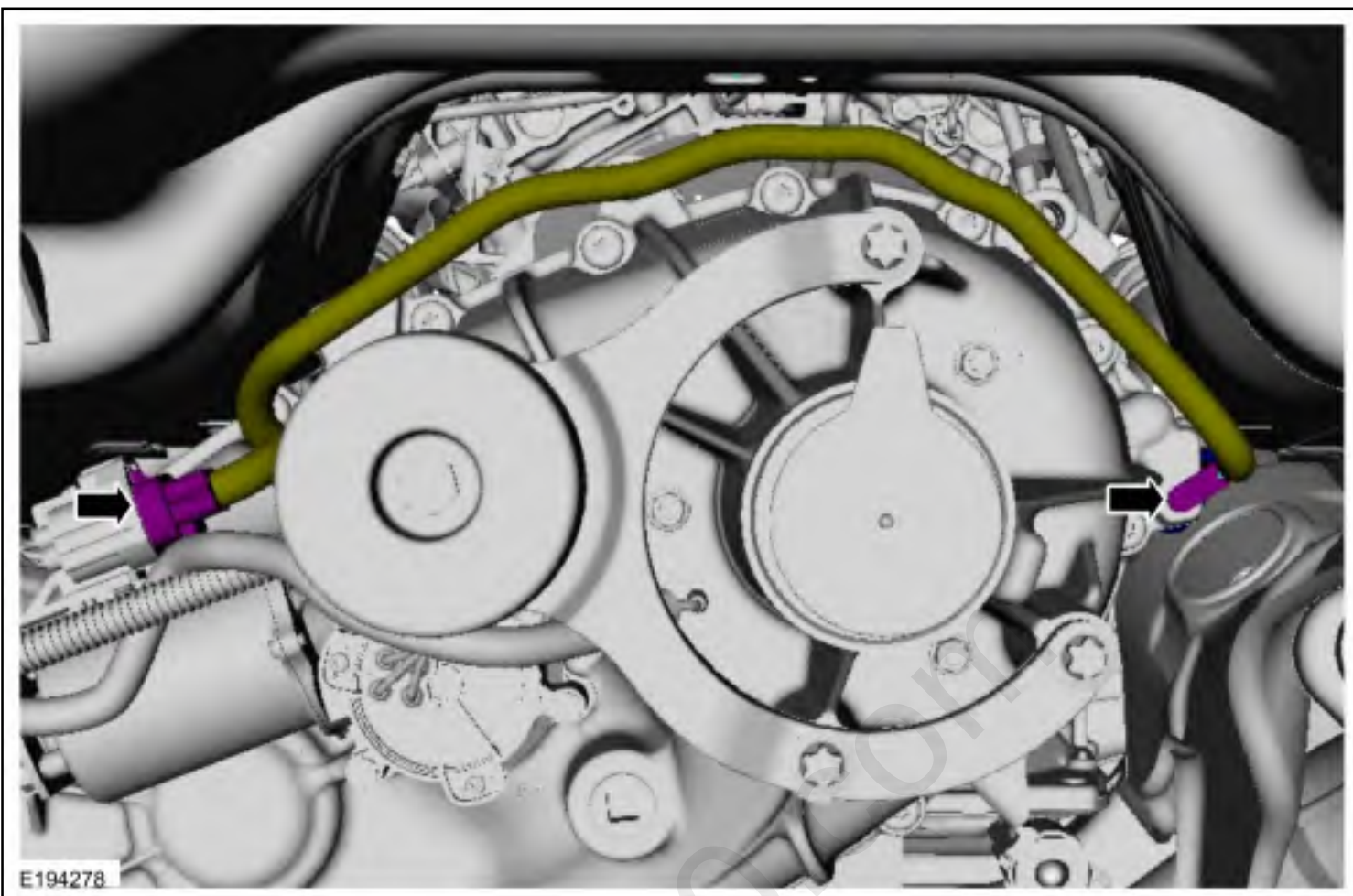
4. Refer to: [Transmission Support Insulator](#) (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
Refer to: [Transmission Support Insulator](#) (307-01B Automatic Transmission - 10-Speed Automatic Transmission - 10R80, Removal and Installation).
5. Install the LH exhaust support bracket and bolt.
Torque: 26 lb.ft (35 Nm)



6. Install the transmission support crossmember.
Refer to: [Transmission Support Crossmember](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
7. Connect the vent hose to the transfer case.



8. Connect the shift motor electrical connector and attach the harness retainer clip to the transfer case.



9. **NOTE:** *Align the index marks made during removal.*

Install the rear driveshaft.

Refer to: [Rear Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

10. **NOTE:** *Align the index marks made during removal.*

Install the front driveshaft.

Refer to: [Front Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

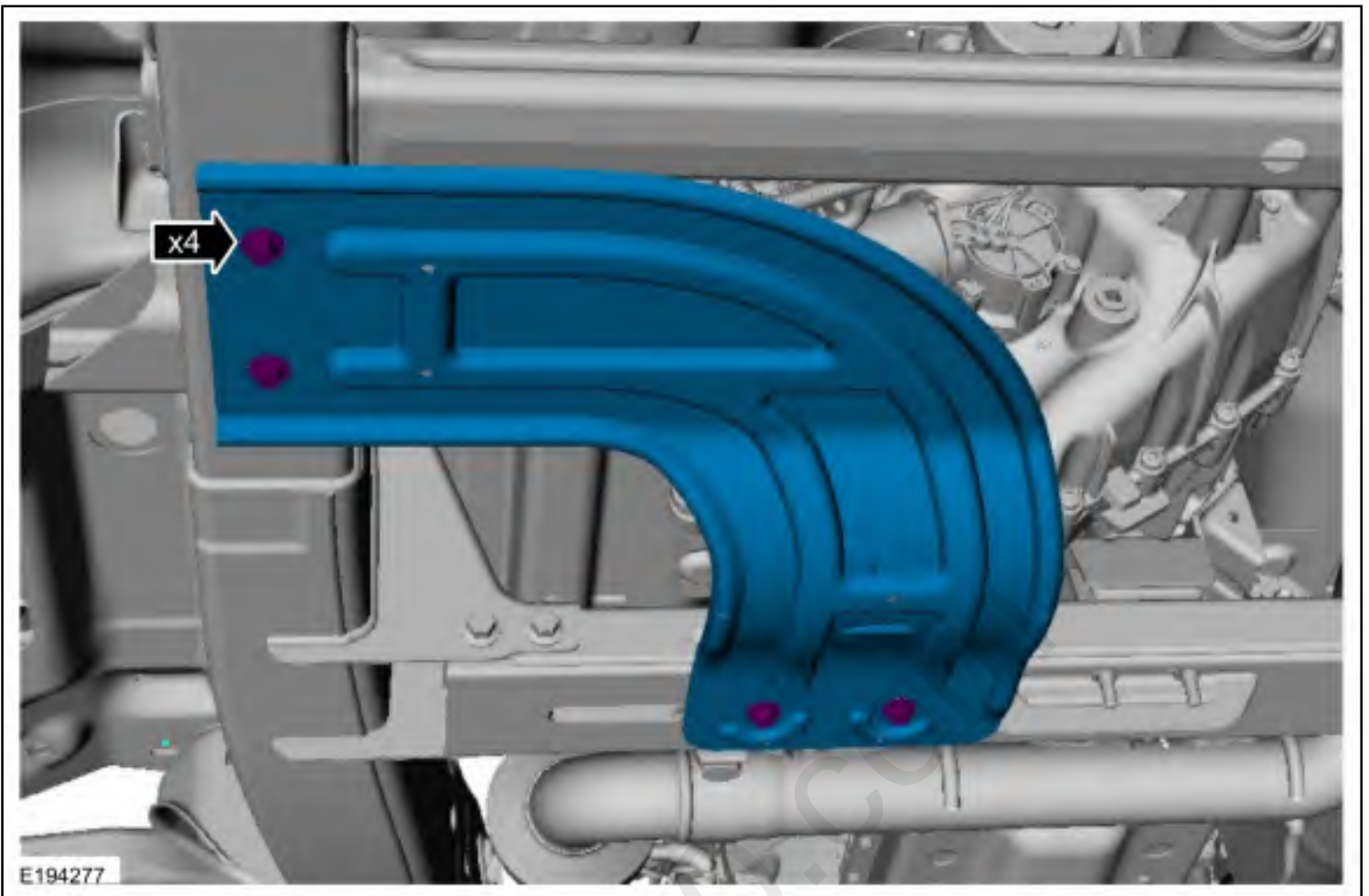
11. Check the transfer case fluid level.

Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case, General Procedures).

12. If equipped.

Position the skid plate and install the skid plate bolts.

Torque: 30 lb.ft (40 Nm)



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Exhaust System

Overview

NOTICE: Do not use leaded fuel in a vehicle equipped with a catalytic converter. In a vehicle that is continually misfueled, the lead in the fuel will be deposited in the catalytic converter and completely blanket the catalyst. Lead reacts with platinum to "poison" the catalyst. Continuous use of leaded fuel can destroy the catalyst and render the catalytic converter useless. The addition of lead to the catalytic converter can also solidify the catalyst, causing excessive back pressure in the exhaust system and possibly causing engine damage.

NOTICE: Extremely high temperatures of 1,100°C (2,012°F) or above due to misfiring or an over-rich fuel/air mixture will cause the ceramic substrate to sinter or burn, destroying the catalytic converter. Do not continue to operate the vehicle if the engine is misfiring, there is a power loss or other unusual operating conditions, such as engine overheating and backfiring.

NOTICE: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

The exhaust system provides an exit for exhaust gases and reduces engine noise by passing exhaust gases through the catalytic converters and a muffler assembly. The catalytic converters also play a major role in reducing air pollutants.

- a exhaust Y-pipe dual catalytic converter.
- a intermediate pipe.
- a muffler inlet pipe.
- isolators installed on the body and muffler hangers.

The catalytic converter plays a major role in the emission control system by operating as a gas reactor. Its function is to speed the heat-producing chemical reaction of components in the exhaust gases to reduce air pollutants.

The catalyst material inside the catalytic converter consists of a ceramic substrate.

The catalytic converter is designed to provide a long life. No maintenance is necessary.

Sound insulators and shields, attached to the underbody, protect the vehicle from exhaust system heat and should be inspected at regular intervals to make sure they are not dented or out of position. If a sound insulator and shield is damaged or shows evidence of deterioration, install a new insulator and shield. The sound insulators and shields for the muffler, muffler pipe and catalytic converter pipe are installed separately.

Some exhaust fasteners must be discarded and new ones installed as indicated in the procedures. Discard any damaged or heavily corroded fasteners and install new ones as necessary. Some exhaust fasteners are of a prevailing torque design. Use only new fasteners with the same part number as the original. Tighten the fasteners to the specified torque during reassembly to make sure of correct retention of exhaust components.

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Exhaust System

Symptom Chart(s)

Symptom Chart: Symptom Chart - Exhaust System

Verify the customer concern. Inspect the components of the exhaust system for obvious signs of damage or other mechanical concerns using the following chart.

Visual Inspection Chart - Mechanical

Mechanical
• Exhaust pipe pinched or crushed • Damaged muffler • Broken or damaged exhaust hanger brackets • Damaged catalytic converter • Loose or damaged heat shields

Verify the exhaust system is installed correctly, with clamps correctly located and tightened to specifications. If the fault is not visually evident, determine the symptom. GO to Symptom Chart below.

Symptom Chart

Condition	Possible Sources	Actions

Vehicle has low or no power — vehicle performance complaint	- Exhaust pipe pinched or crushed - Damaged catalytic converter - Loose obstruction in exhaust	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
	Restricted exhaust (possible frozen condensate in muffler)	CHECK drain holes for foreign material. PARK the vehicle inside to thaw. TEST the vehicle for normal operation. If the concern is still present, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Burning smell — usually occurs at idle, with possible traces of smoke	- Foreign material caught in exhaust system - Missing heat shields	INSPECT the exhaust system for foreign material or missing heat shields. REPAIR or INSTALL new components as necessary.
Odor — described as a sulfur or rotten egg smell	- Catalytic converter - Excessive sulfur content in fuel	At times, a slight sulfur smell is normal for catalytic converters. The cause is the sulfur content in the gasoline being used. ADVISE the customer no repair is required.
	- Rich fuel conditions - Misfire conditions	REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Visible rust on surface of exhaust pipes	Catalytic converter/exhaust system	Surface rust is a characteristic of materials used on exhaust systems. Exposure to heat or road salt may result in surface rust. INSPECT for perforations. If there are no perforations, the condition is normal.

Symptom Chart

Condition	Possible Sources	Actions
Rattle, squeaks or buzz type noise — from the bottom of the vehicle	Loose or damaged heat shield	INSPECT the exhaust system for loose or missing heat shields or foreign material trapped between the heat shields and the exhaust system components. If any heat shields are loose, INSTALL worm gear clamp 7L5Z-5A231-AA and tighten to 7 Nm. If the heat shields are missing or a rattle, noise or buzz condition persists, INSTALL a new heat shield or component as necessary.
	Loose or damaged exhaust isolators	VERIFY the exhaust isolators are correctly installed. INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Damaged exhaust isolator hanger bracket	INSPECT the exhaust system components for damage or broken hangers. INSTALL new components as necessary. CHECK for loose or damaged exhaust hanger brackets or fasteners. TIGHTEN the bolts to specification or INSTALL new components as necessary.

	Loose or damaged catalytic converter or muffler	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler, then the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Drone or clunk type noise — from the bottom of the vehicle	Loose or damaged exhaust isolators	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Exhaust grounded to chassis	INSPECT for signs of exhaust components-to-body contact. REPAIR or INSTALL new components as necessary.
Whistles, boom, hum or ticking type noise — noise tends to change as the engine warms. The noises are often accompanied by exhaust fumes	Exhaust system leak	INSPECT the entire exhaust system for leaks. CHECK for punctures, loose or damaged clamps/fasteners, gaskets, sensors or broken welds. EXAMINE the chassis for grayish-white or black exhaust soot, which indicates exhaust leakage at that point. To magnify a small leak, have an assistant hold a shop towel over the tail pipe outlet while listening for a leak. REPAIR or INSTALL new components as necessary.

	Catalytic converter	MOVE the exhaust system to simulate the bouncing action of the vehicle, checking for exhaust-to-body contact while moving the exhaust system. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
	Exhaust muffler/resonator drain hole enlarged due to corrosion	CONFIRM the drain holes are the noise source. INSTALL new components as necessary.
Hissing or rushing noise — high frequency sound and the vehicle performance is unaffected	Exhaust system Exhaust flow through pipes	CHECK the exhaust system for leaks. Using a rubber mallet, TAP on the exhaust components to duplicate the noise concern. Lightly TAP on the muffler and the catalytic converter. DETERMINE if there are loose or broken baffles in the muffler, or a loose or broken element in the catalytic converter. REPAIR or INSTALL new components as necessary.
Pinging noise — occurs when exhaust system is hot, engine turned off	Catalytic converter/exhaust system	Cool down pinging is a result of the exhaust system expanding and contracting during heating and cooling. This is a normal condition.
Vibration — occurs at idle and at low speeds. Also accompanied by a clunk or buzz type noise	Loose or damaged exhaust isolator	INSPECT the exhaust isolators for wear or damage. INSTALL new isolators as necessary.
	Loose or damaged exhaust isolator hanger brackets	INSPECT the exhaust isolator hanger brackets for wear or damage. INSTALL or REPAIR as necessary.

	Exhaust system grounded to chassis	REPAIR or INSTALL new components as necessary.
Engine drumming noise — normally accompanied by vibration	Damaged or misaligned exhaust system	INSPECT the exhaust system for loose or damaged fasteners or isolators. REPAIR or INSTALL new components as necessary.
Sputter type noise — noise worse when cold, lessens or disappears when the vehicle is at operating temperature	Damaged or worn exhaust system	INSPECT the exhaust system for leaks or damage. REPAIR as necessary.
Thumping noise — from the bottom of the vehicle, worse during acceleration	Misaligned exhaust system	CHECK the exhaust system to chassis clearance. CHECK the exhaust system isolators for damage. REPAIR as necessary.
Engine vibration — is felt with increases and decreases in engine rpm	Strain on exhaust system isolators	REPAIR or INSTALL new components as necessary.
Drumming noise — occurs inside the vehicle during idle or high idle, hot or cold. Very low-frequency drumming is very rpm dependent	Exhaust system vibration excites the body resonances inducing interior noise	REPAIR or INSTALL new components as necessary.

Muffler and Tailpipe

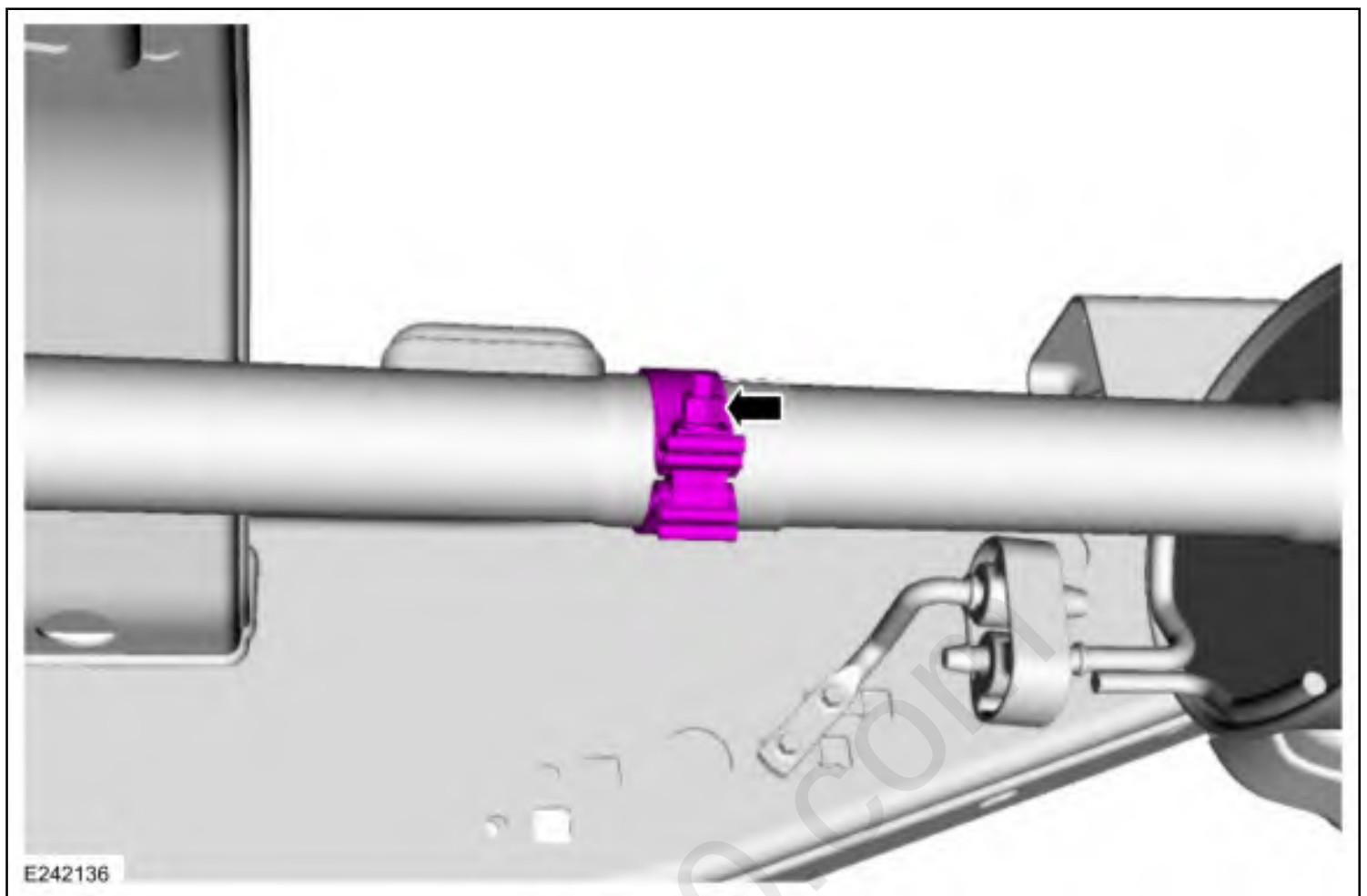
Removal

NOTE: *Muffler and tailpipe assemblies will vary in configuration with different wheelbases and powertrains. Typical application shown.*

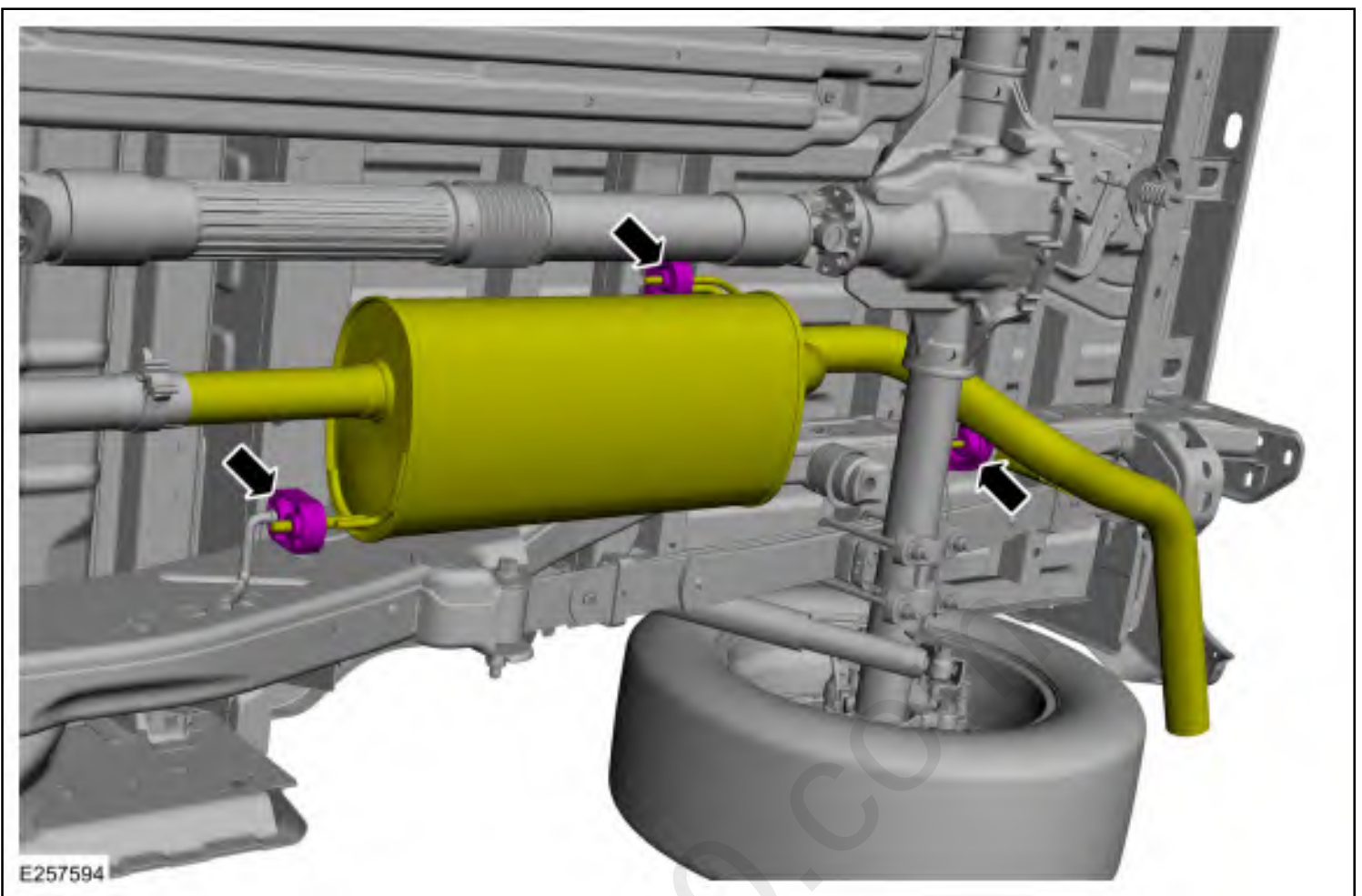
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Clean all exhaust connections before reassembly.*

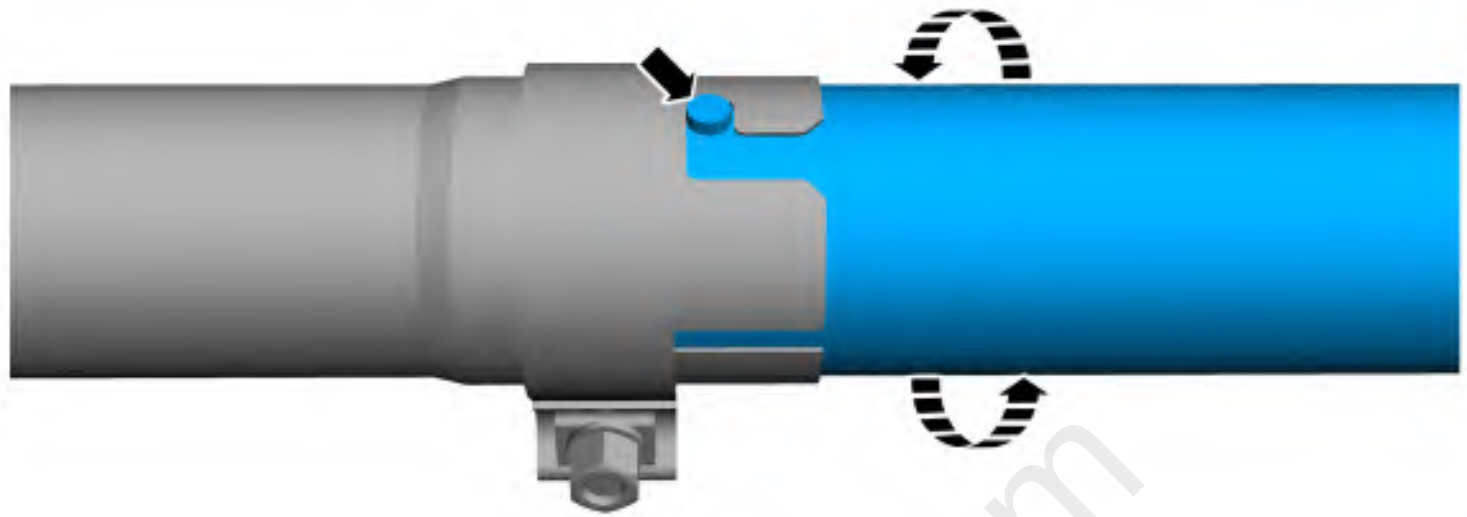
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Loosen the clamp.
Torque: 41 lb.ft (55 Nm)



3. Slide the muffler and tailpipe rearward out of the isolators.



4. Release the locator tab out of the muffler inlet pipe and remove the muffler and tailpipe.



E257593



Installation

1. To install, reverse removal procedure.
2. Check the exhaust system for leaks.

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Catalytic Converter LH

Base Part Number: Base Part Number: 5E214

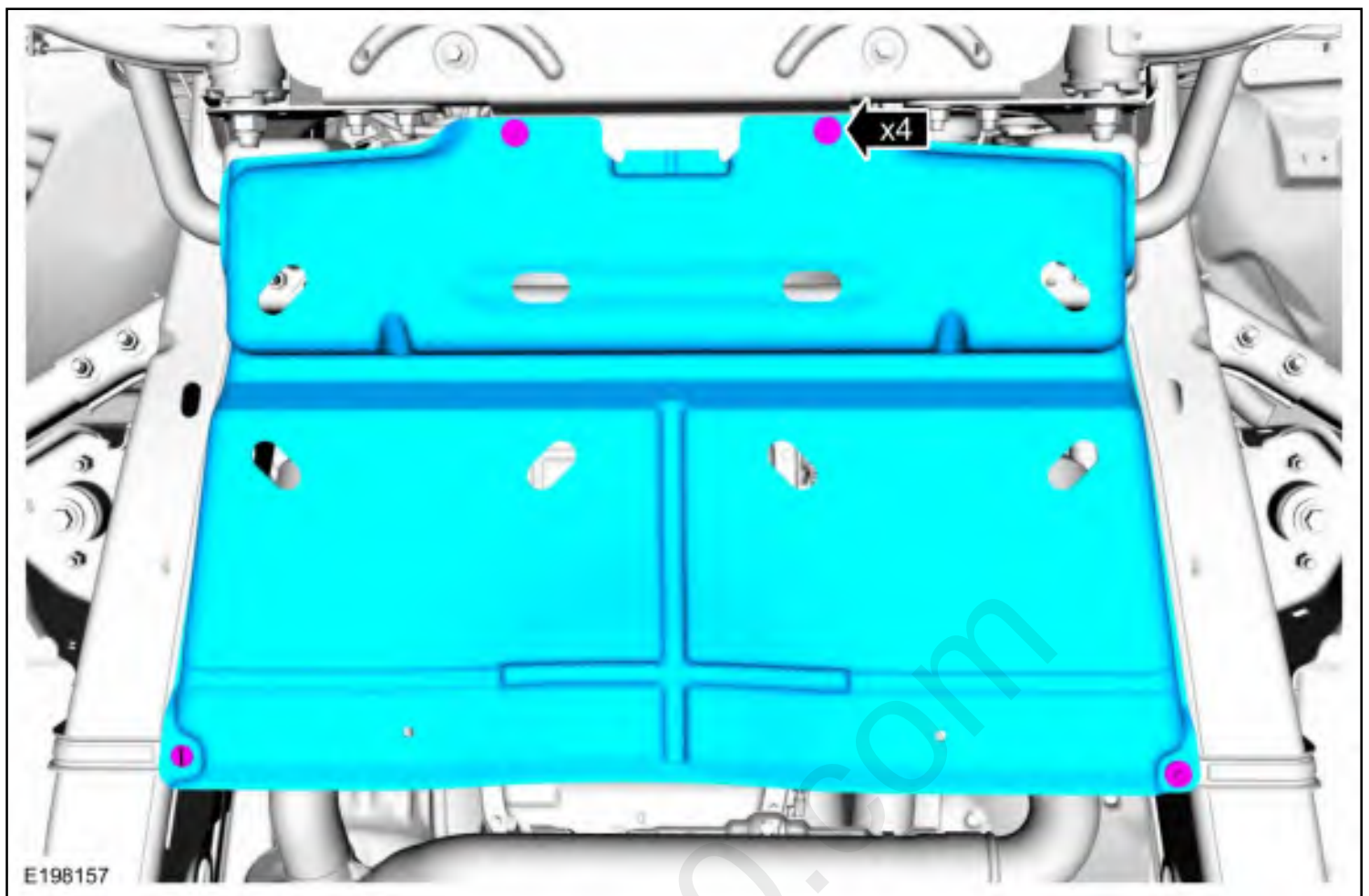
Removal

NOTE: *If the catalytic converter is not being replaced, the HO2S and the catalyst monitor sensor do not need to be removed from the catalytic converter. Disconnecting the electrical connectors is still necessary.*

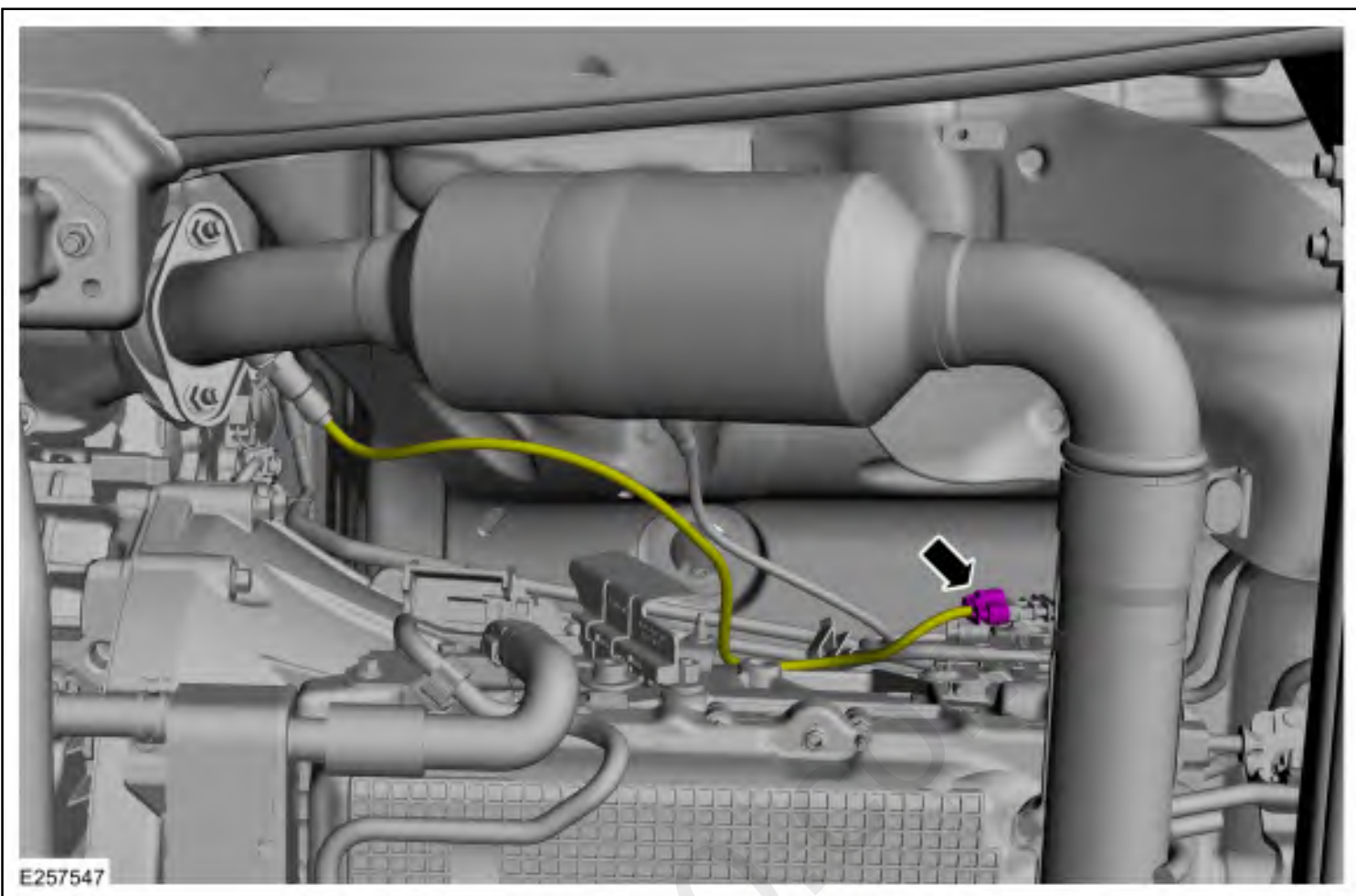
NOTE: *The exhaust Y-pipe dual catalytic converter is a 2-piece assembly. The LH and RH converters can be serviced separately as needed.*

NOTE: *Clean all exhaust connections before reassembly.*

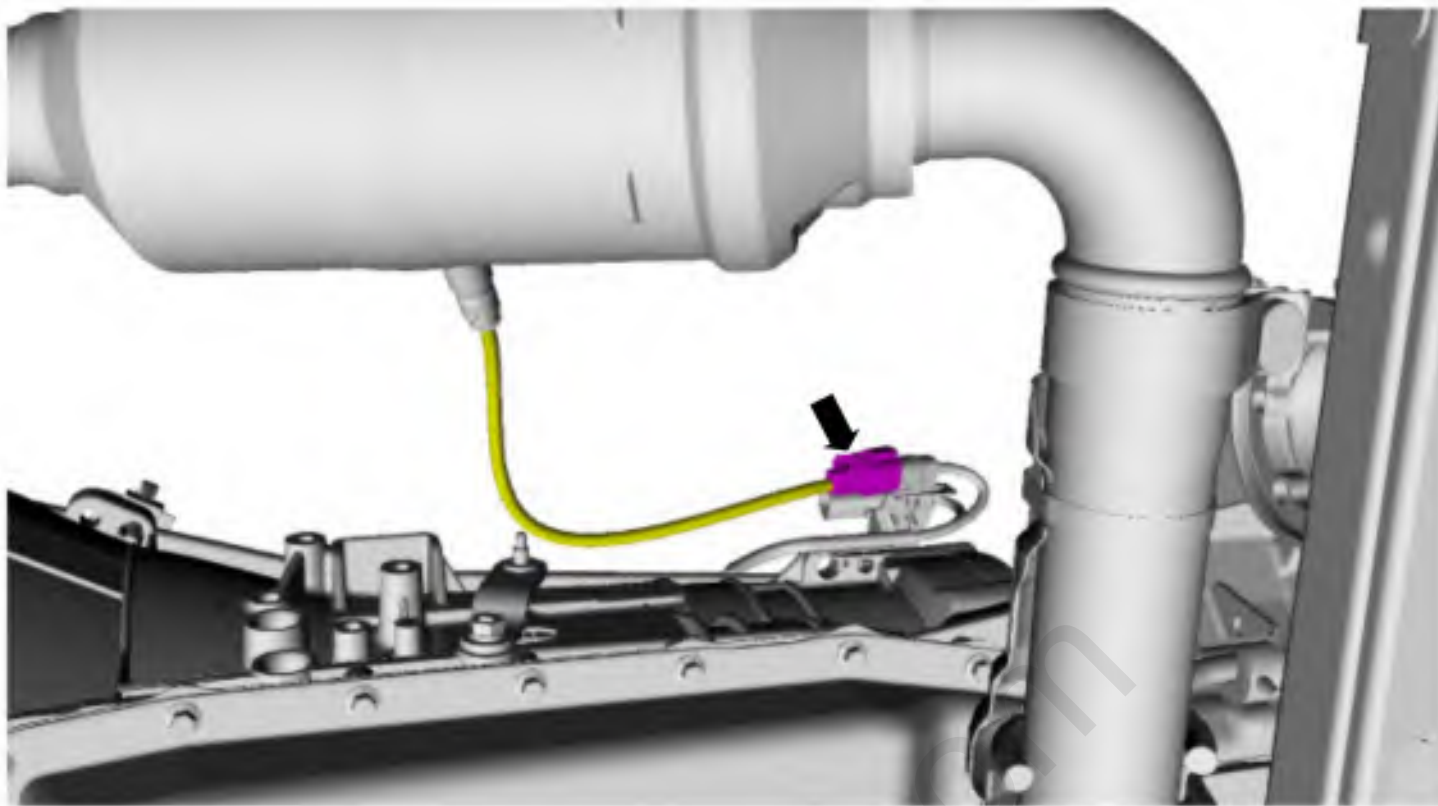
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. If equipped, remove the underbody shield.



3. Disconnect the HO2S electrical connector.



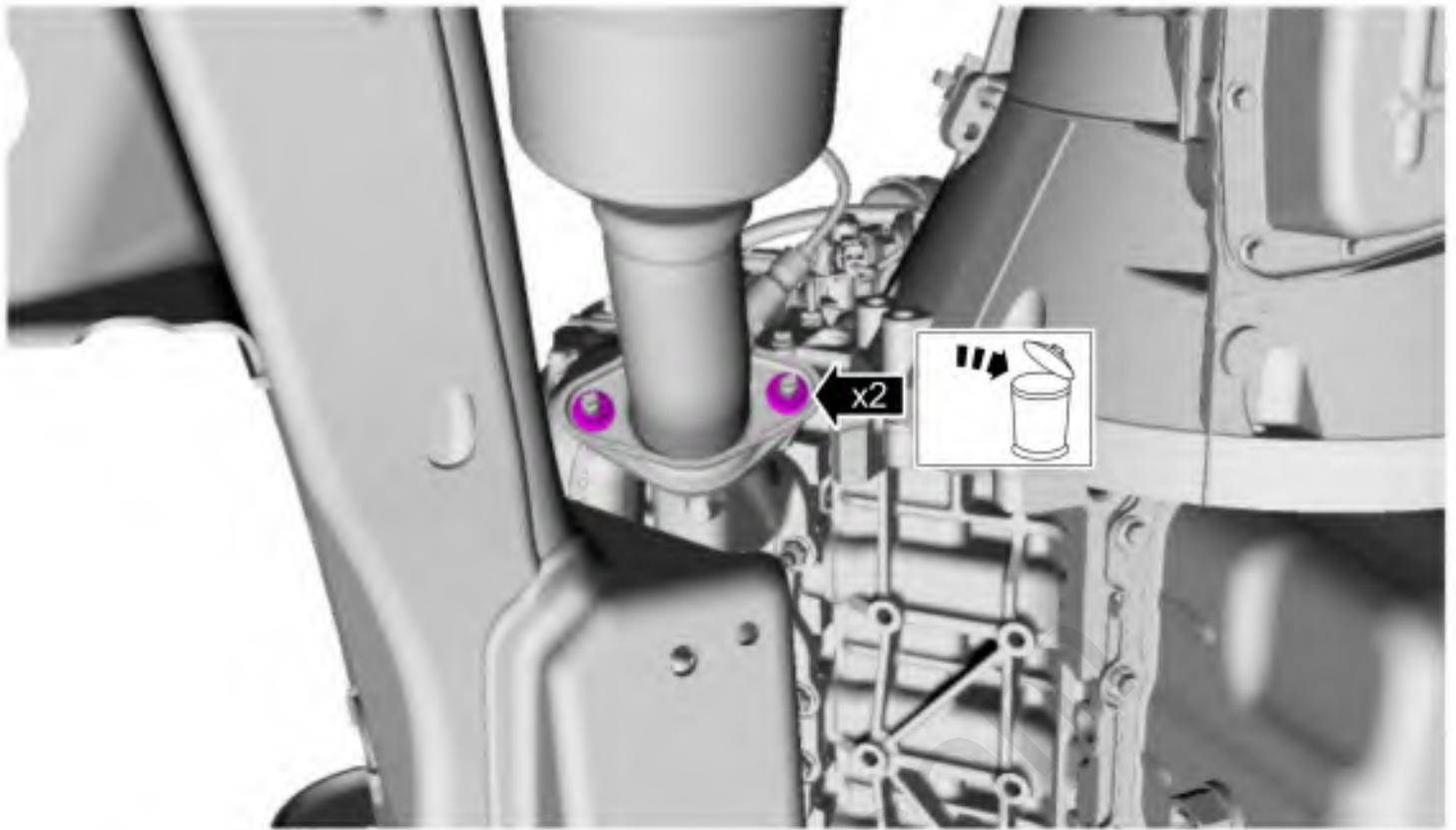
4. Disconnect the HO2S electrical connector.



E194624

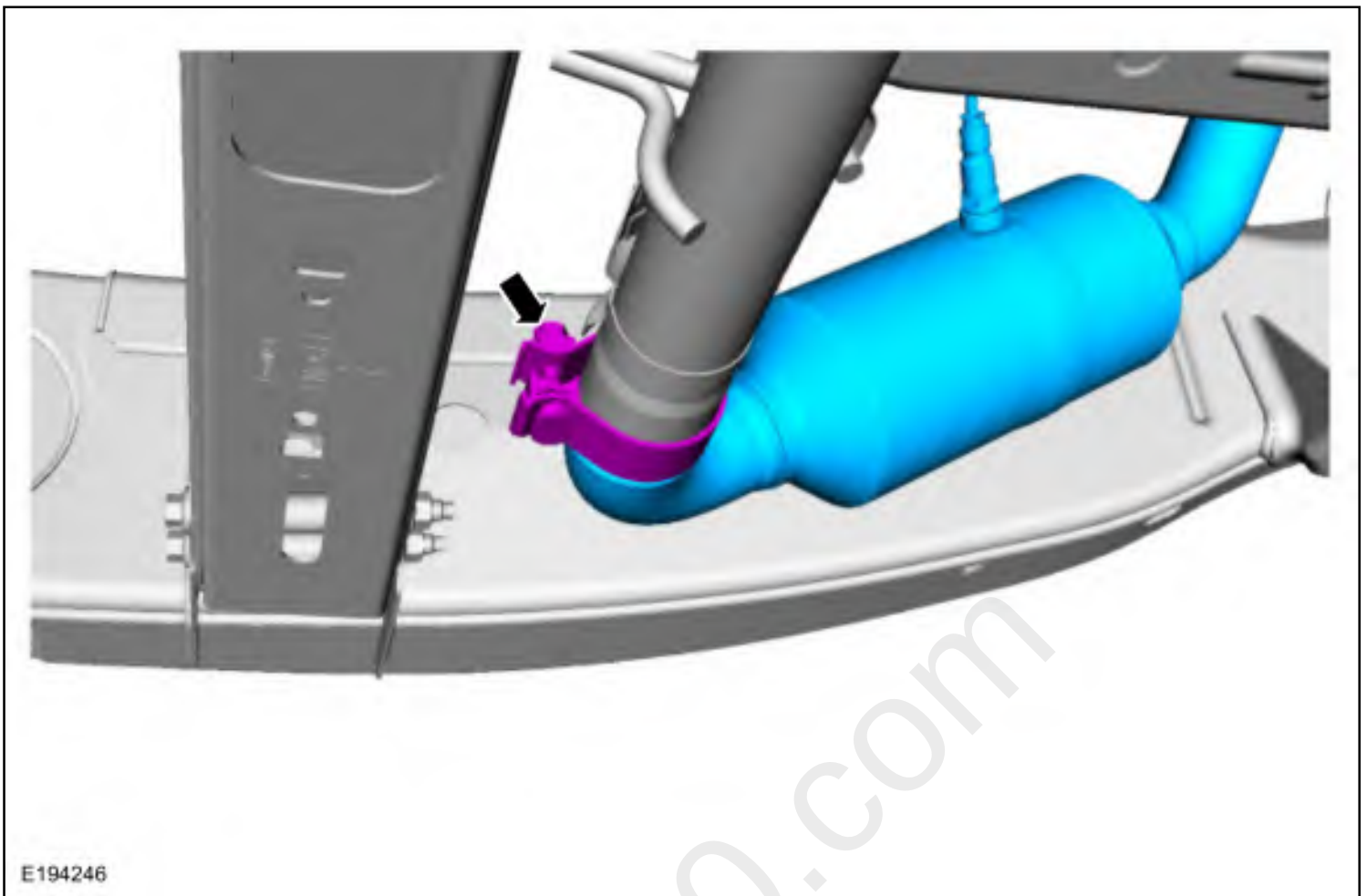


5. Remove the LH catalytic converter nuts and discard.



E194625

6. Loosen the clamp and remove the LH catalytic converter.

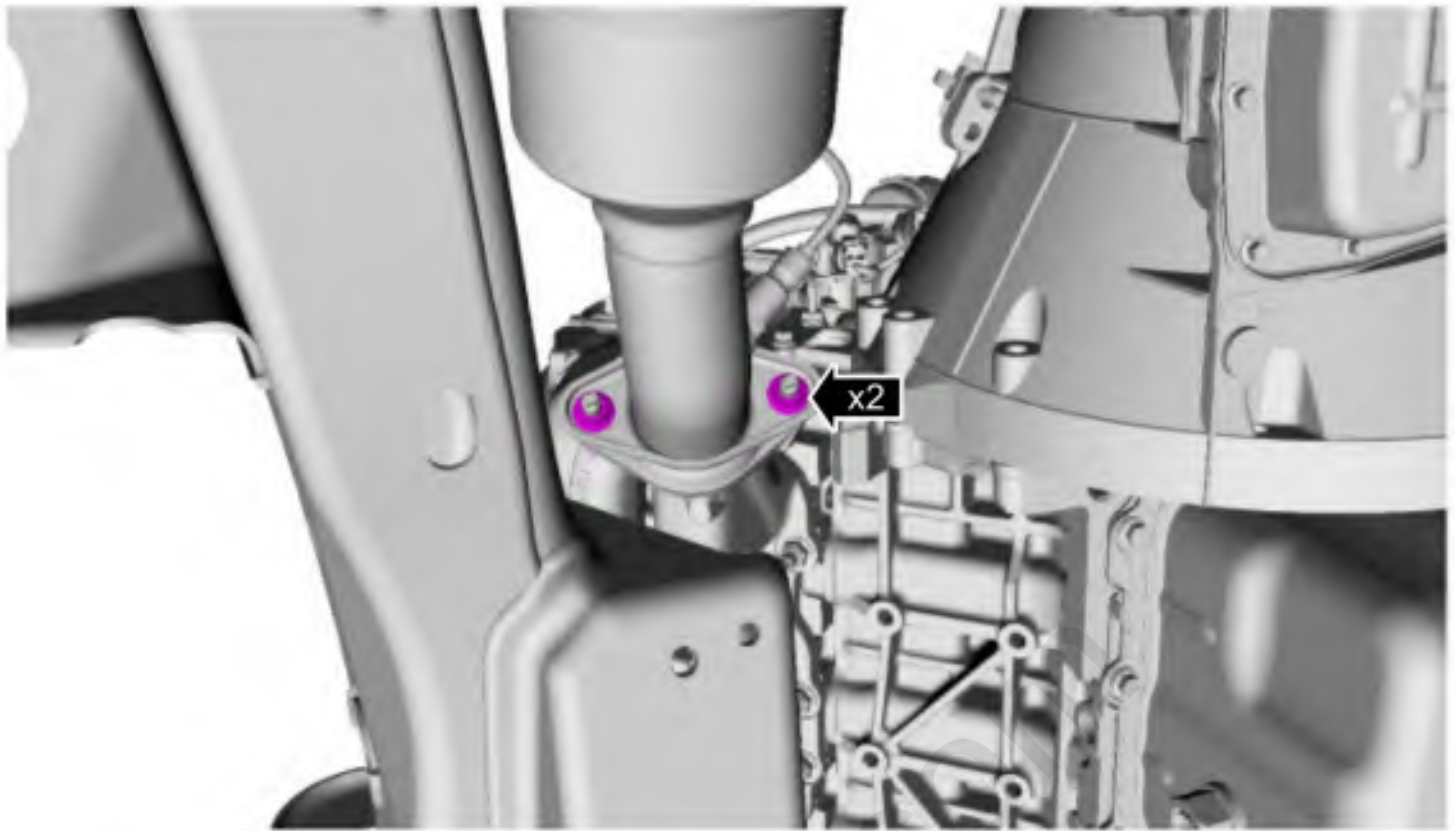


Installation

1. **NOTE:** *Evenly tighten the LH catalytic converter nuts.*

Position the LH catalytic converter in vehicle with a new gasket. Install the new LH catalytic converter nuts.

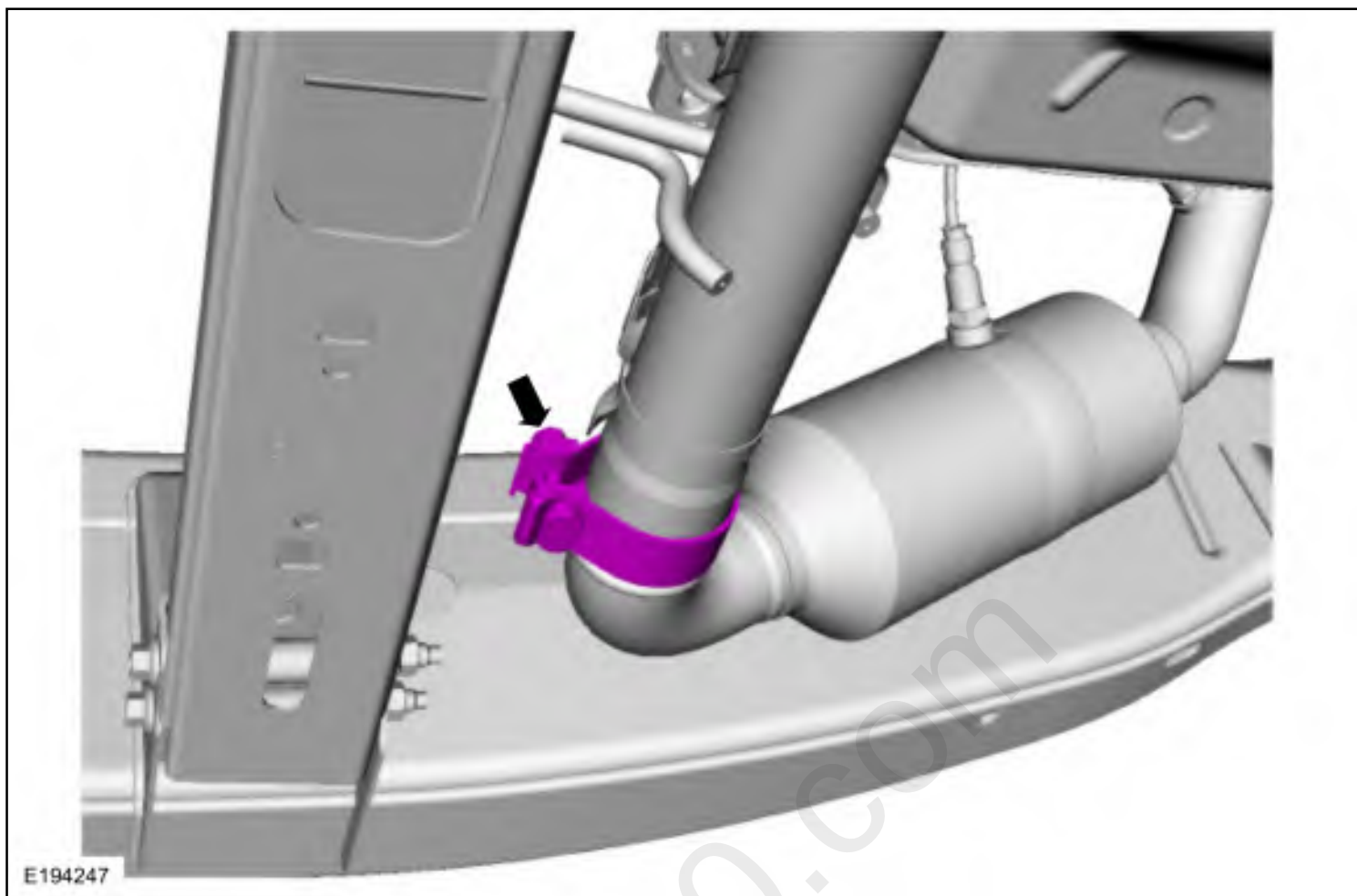
Torque: 30 lb.ft (40 Nm)



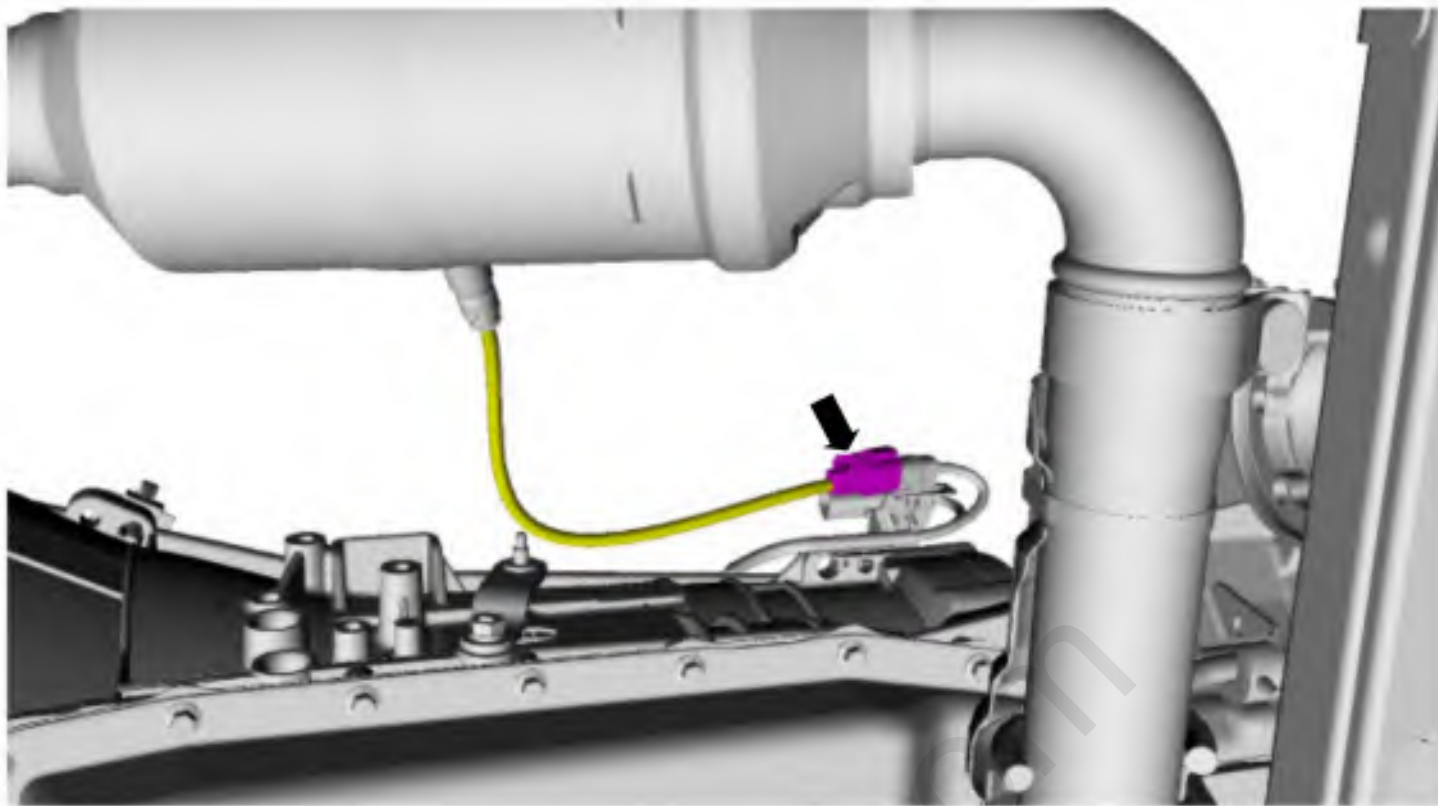
E194626



2. Tighten the clamp.
Torque: 41 lb.ft (55 Nm)



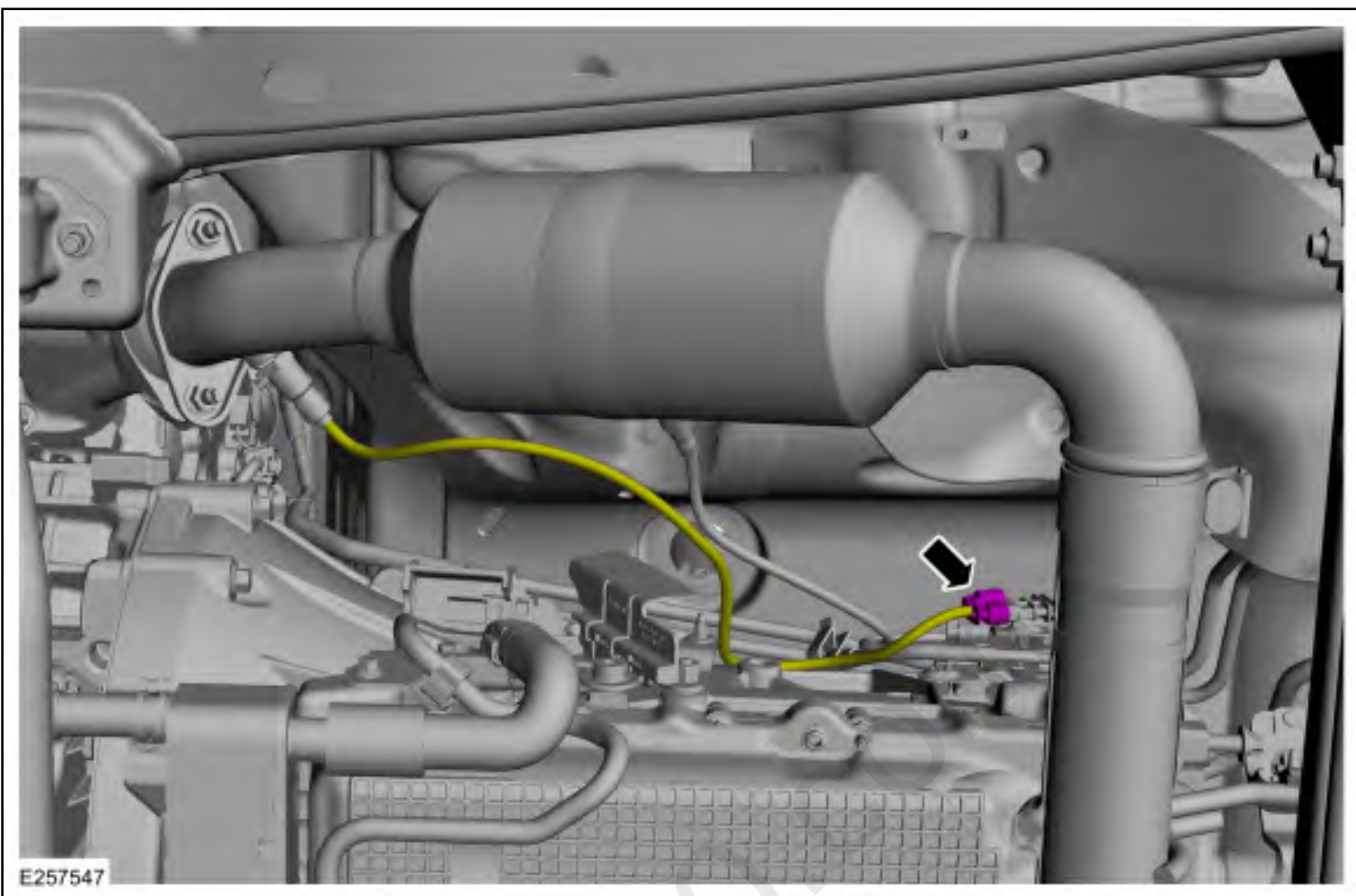
3. Connect the HO2S electrical connector.



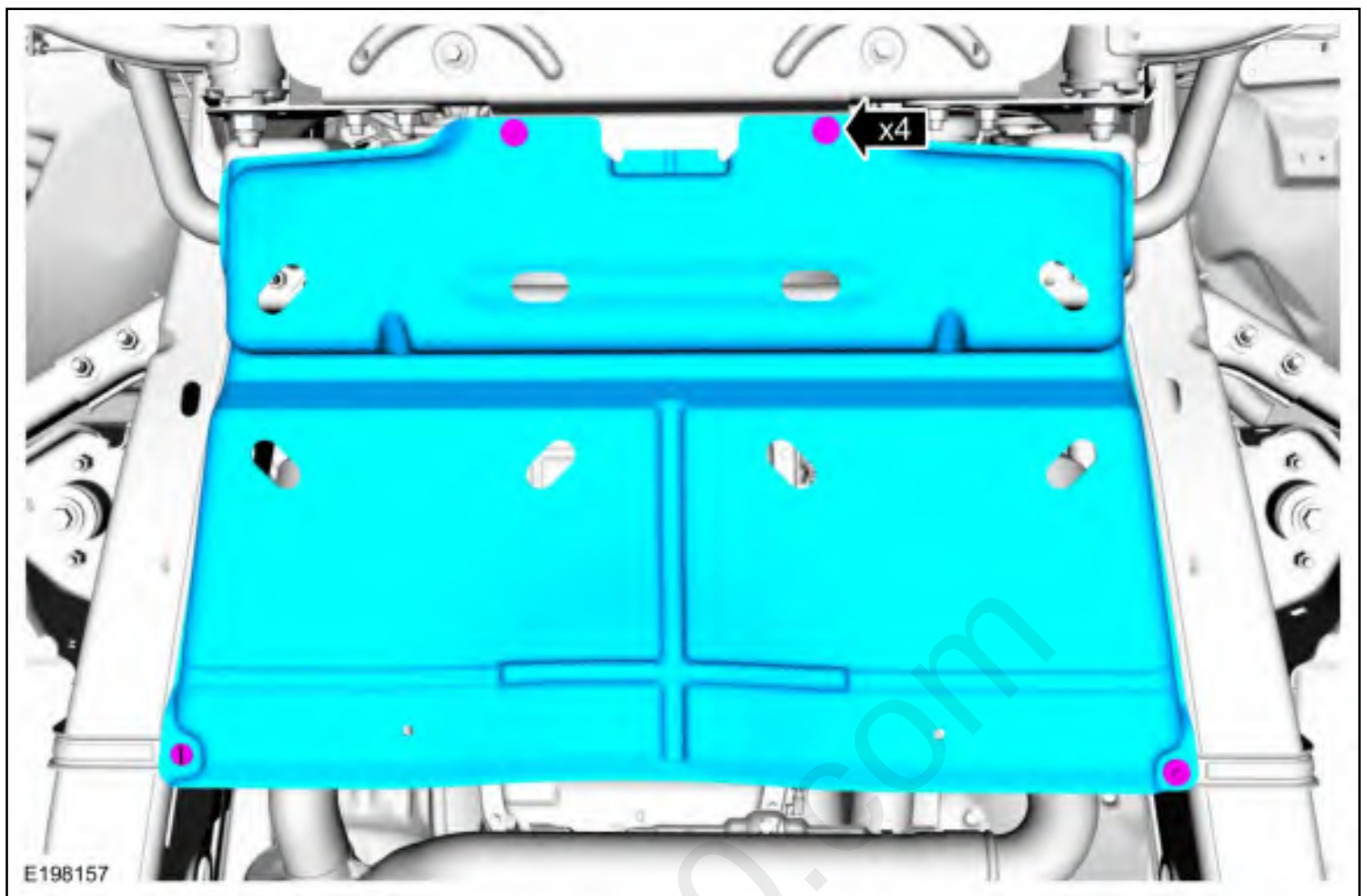
E194624



4. Connect the HO2S electrical connector.



5. If equipped, install the underbody shield.
Torque: 71 lb.in (8 Nm)



6. Check the exhaust system for leaks.

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Muffler Inlet Pipe

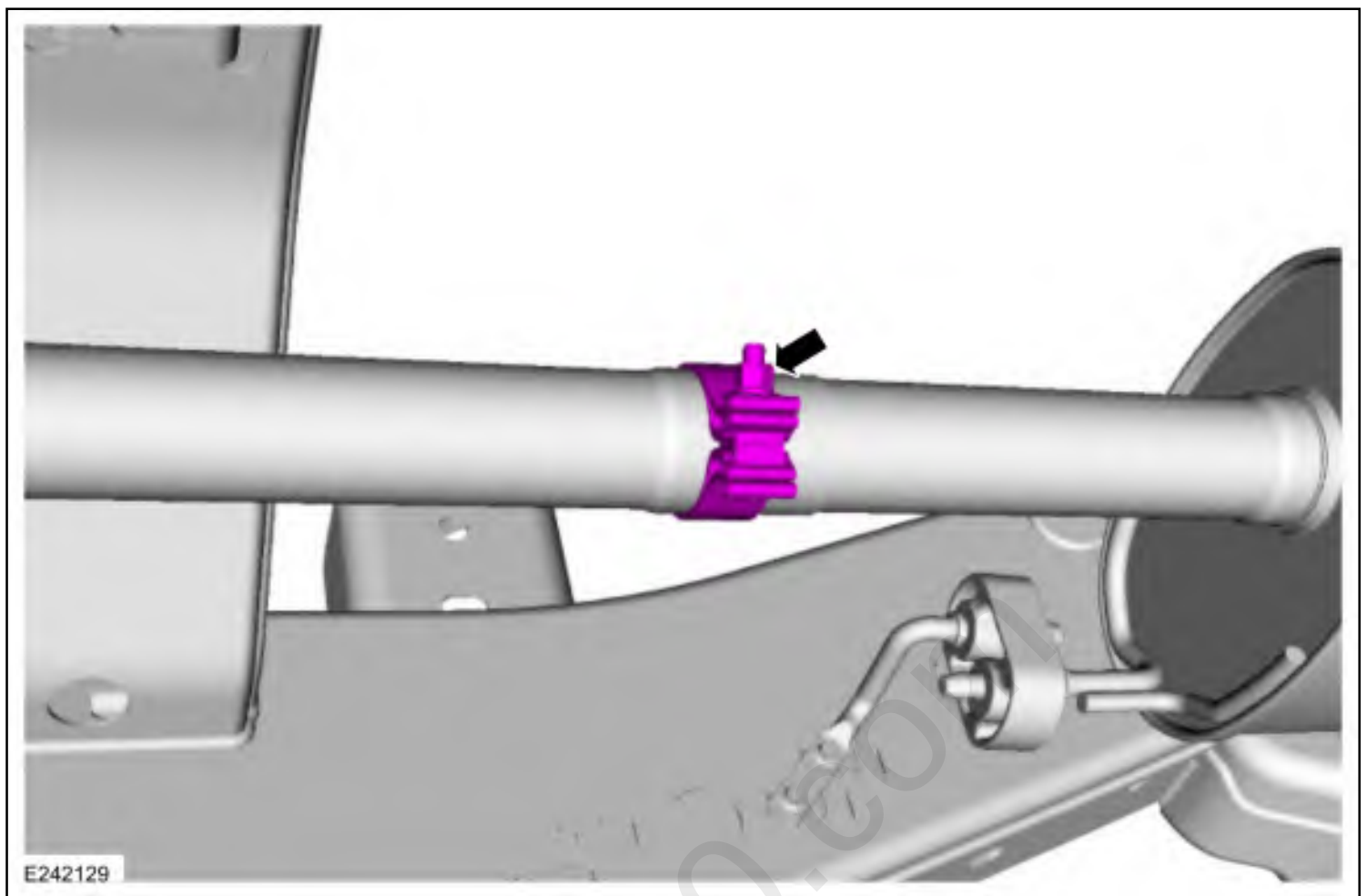
Removal

NOTE: *Muffler inlet pipes will vary in configuration with different wheelbases and powertrains. Typical application shown.*

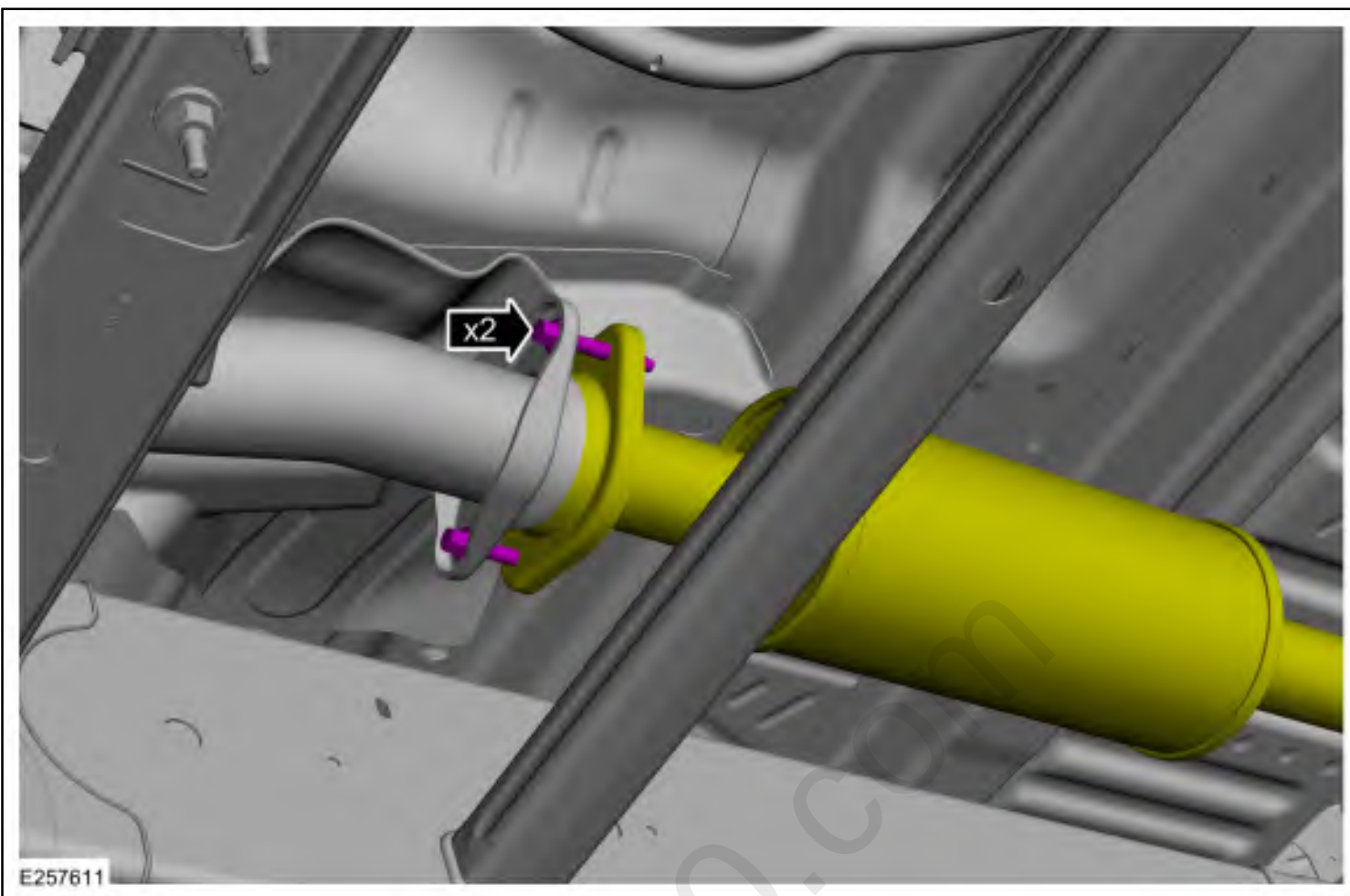
NOTE: *Removal steps in this procedure may contain installation details.*

NOTE: *Clean all exhaust connections before reassembly.*

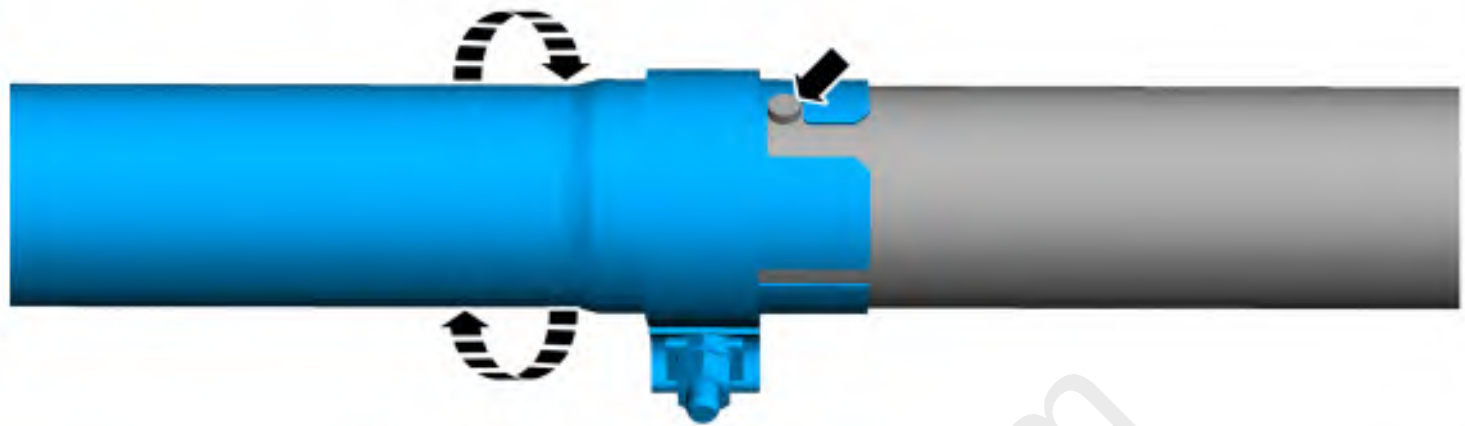
1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Loosen the clamp.
Torque: 41 lb.ft (55 Nm)



3. Remove the bolts and the muffler inlet pipe.
Torque: 30 lb.ft (40 Nm)



4. During removal, the locator tab needs to be released out of the muffler inlet pipe.



E257610



Installation

1. To install, reverse removal procedure.
2. Check the exhaust system for leaks.

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Catalytic Converter RH

Base Part Number: Base Part Number: 5G218

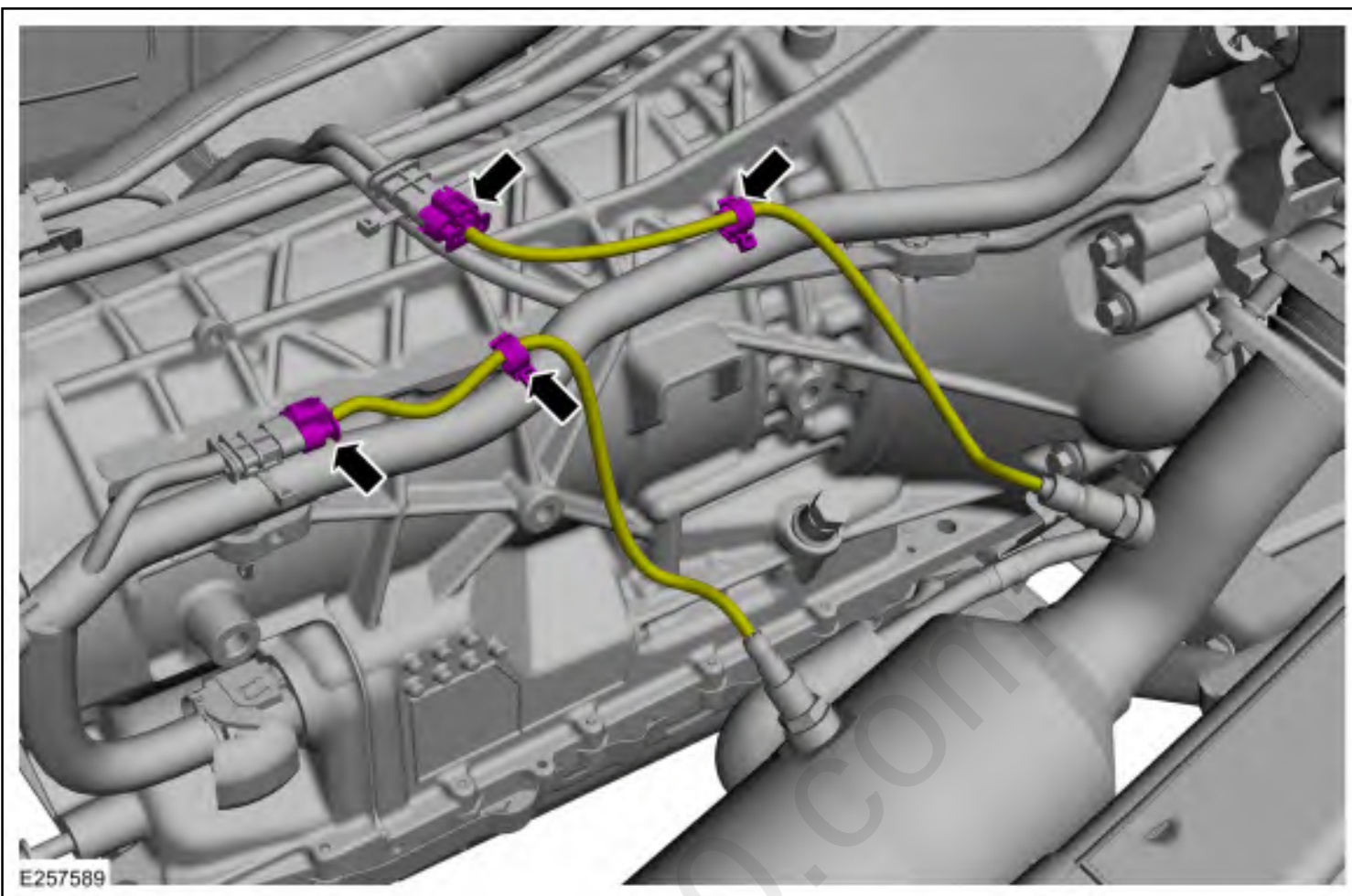
Removal

NOTE: *If the catalytic converter is not being replaced, the HO2S and the catalyst monitor sensor do not need to be removed from the catalytic converter. Disconnecting the electrical connectors is still necessary.*

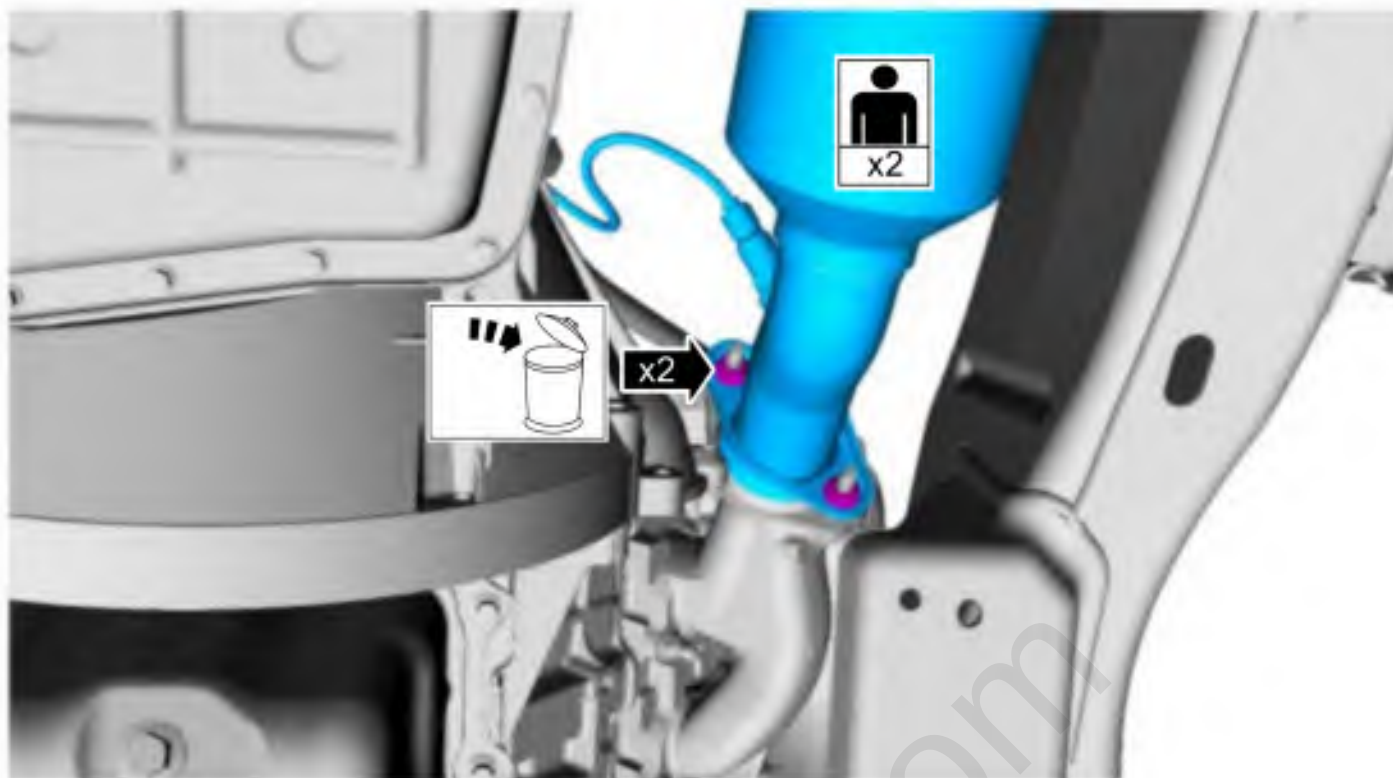
NOTE: *The exhaust Y-pipe dual catalytic converter is a 2-piece assembly. The LH and RH converters can be serviced separately as needed.*

NOTE: *Clean all exhaust connections before reassembly.*

1. With the vehicle in NEUTRAL, position it on a hoist.
Refer to: [Jacking and Lifting - Overview](#) (100-02 Jacking and Lifting, Description and Operation).
2. Remove the LH catalytic converter.
Refer to: Catalytic Converter LH (309-00 Exhaust System - 5.0L 32V Ti-VCT) .
3. Remove the muffler inlet pipe.
Refer to: Muffler Inlet Pipe (309-00 Exhaust System - 5.0L 32V Ti-VCT) .
4. Remove the transmission support insulator.
Refer to: [Transmission Support Insulator](#) (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
5. Remove the retainers and disconnect the electrical connectors.



6. Remove the RH catalytic converter nuts and discard. Remove the RH catalytic converter.



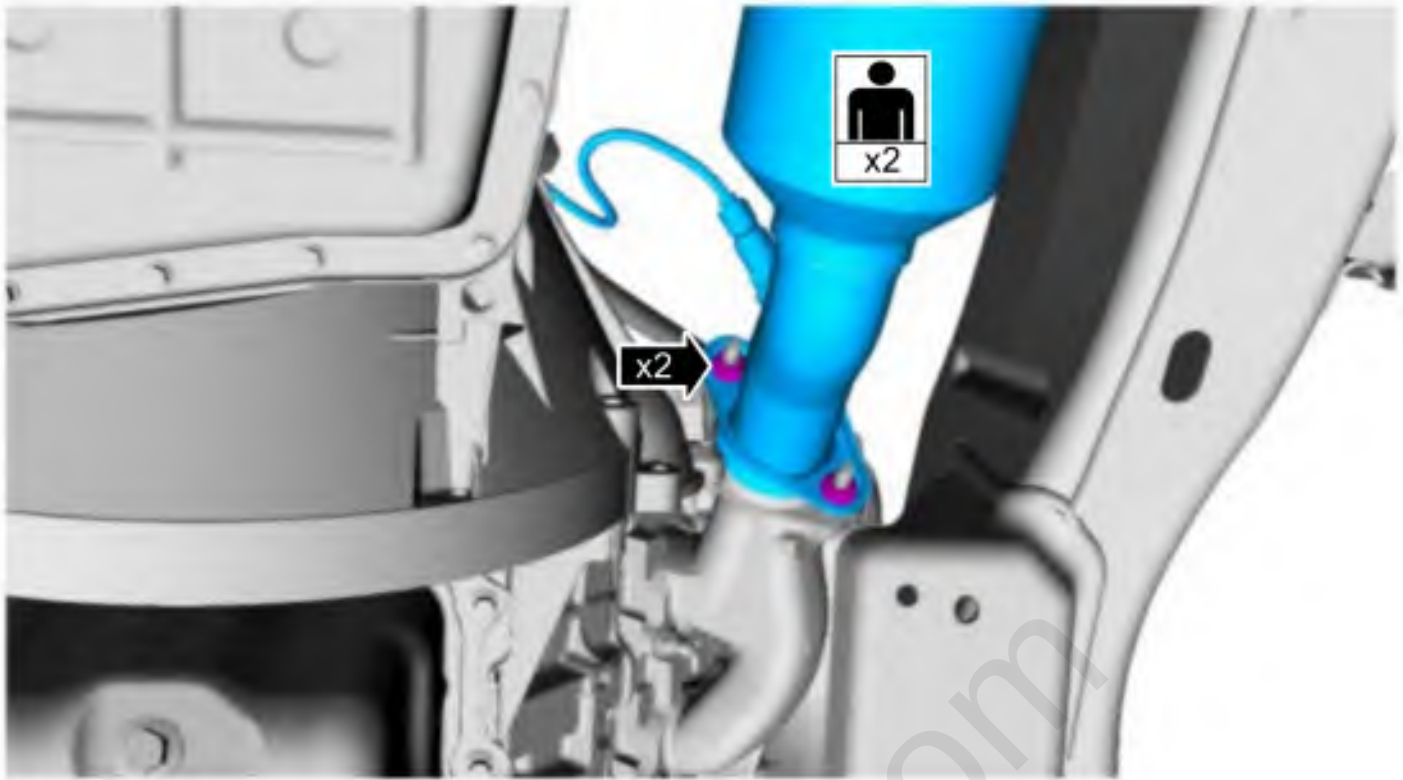
E194637



Installation

1. **NOTE:** *Loosely install the new RH catalytic converter nuts. Do not tighten at this time.*

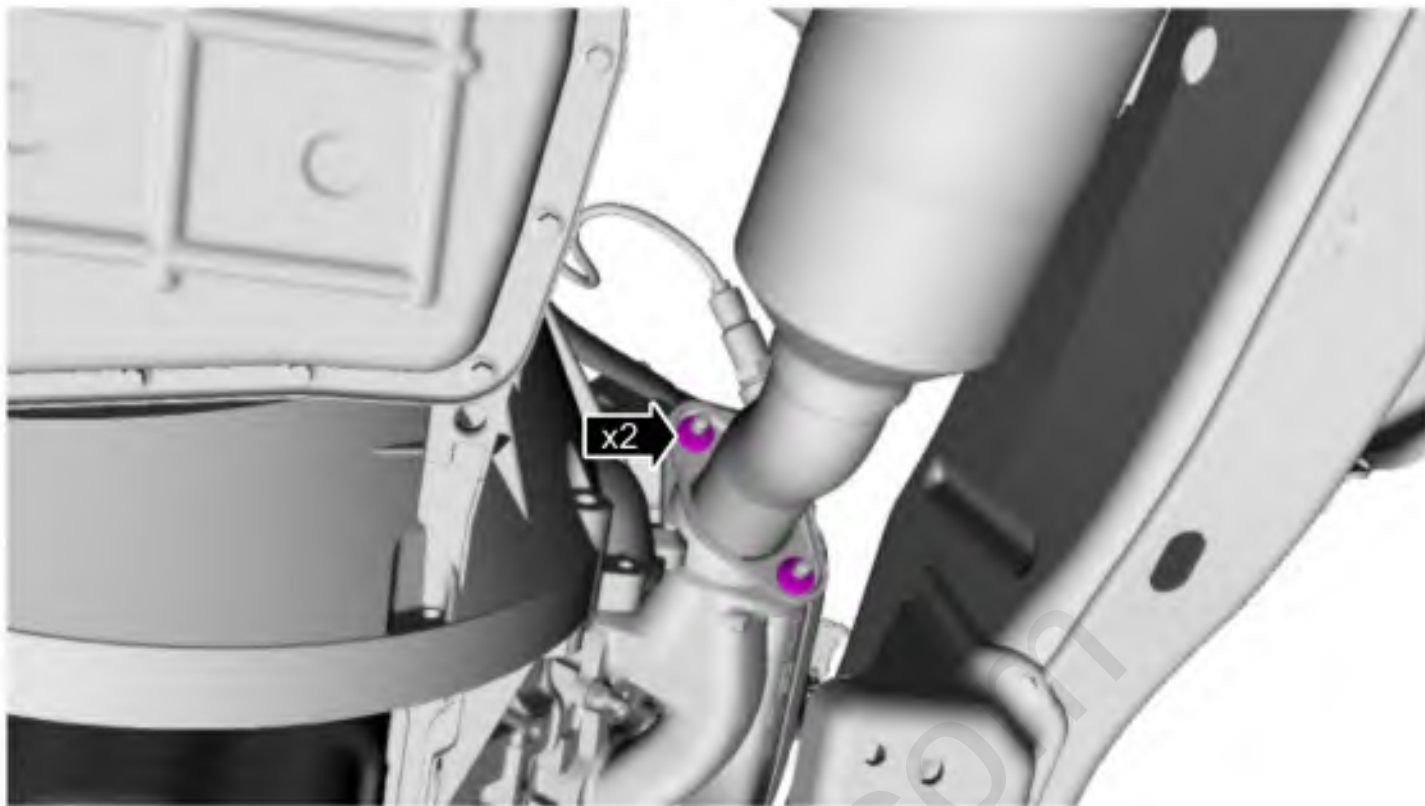
Position the RH catalytic converter in the vehicle. Loosely install the new RH catalytic converter nuts.



E215359

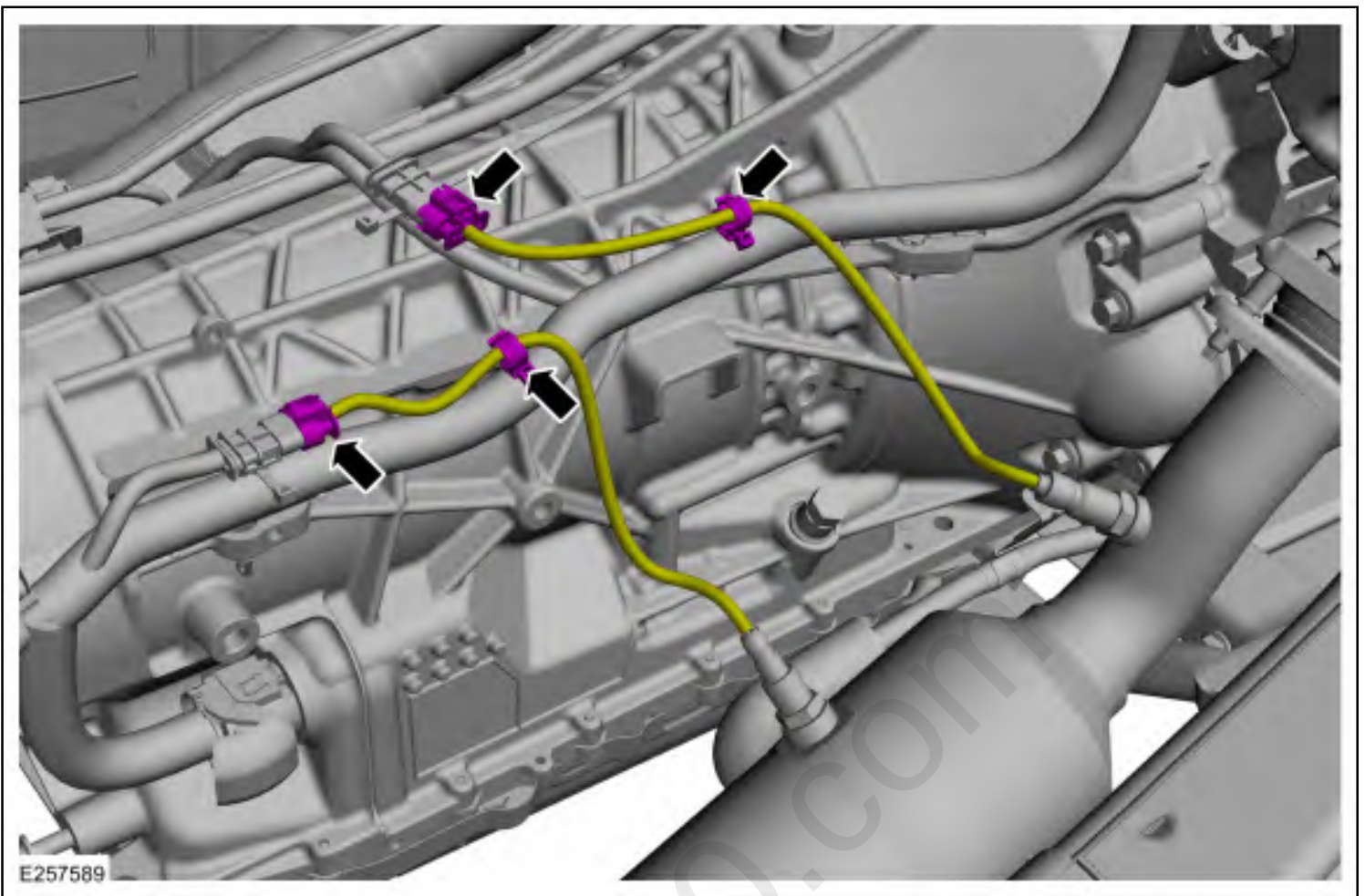
2. Install the transmission support insulator.
Refer to: [Transmission Support Insulator](#) (307-01A Automatic Transmission - 6-Speed Automatic Transmission - 6R80, Removal and Installation).
3. **NOTE:** *Evenly tighten the RH catalytic converter nuts.*

Tighten the RH catalytic converter nuts.
Torque: 30 lb.ft (40 Nm)



E194638

4. Install the retainers and connect the electrical connectors.



5. Install the LH catalytic converter.
Refer to: Catalytic Converter LH (309-00 Exhaust System - 5.0L 32V Ti-VCT) .
6. Install the muffler inlet pipe.
Refer to: Muffler Inlet Pipe (309-00 Exhaust System - 5.0L 32V Ti-VCT) .
7. Check the exhaust system for leaks.