
REAR FINAL DRIVE

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17.1 REAR FINAL DRIVE

1 Warning and Precaution

1.1 Warning

- (1) It is not recommended to use non-original replacement parts, because they can damage some units and affect vehicle safety.
- (2) Do not use non-standard final drive oil to avoid damaging final drive.

1.2 Precautions

In order to ensure safe and reliable operation of vehicle and drive shaft, the correct repair and maintenance is very important. Some of these operations need to use some special designed tools, and these tools can only be used in the corresponding repair and maintenance operations.

2 Overview

2.1 Description

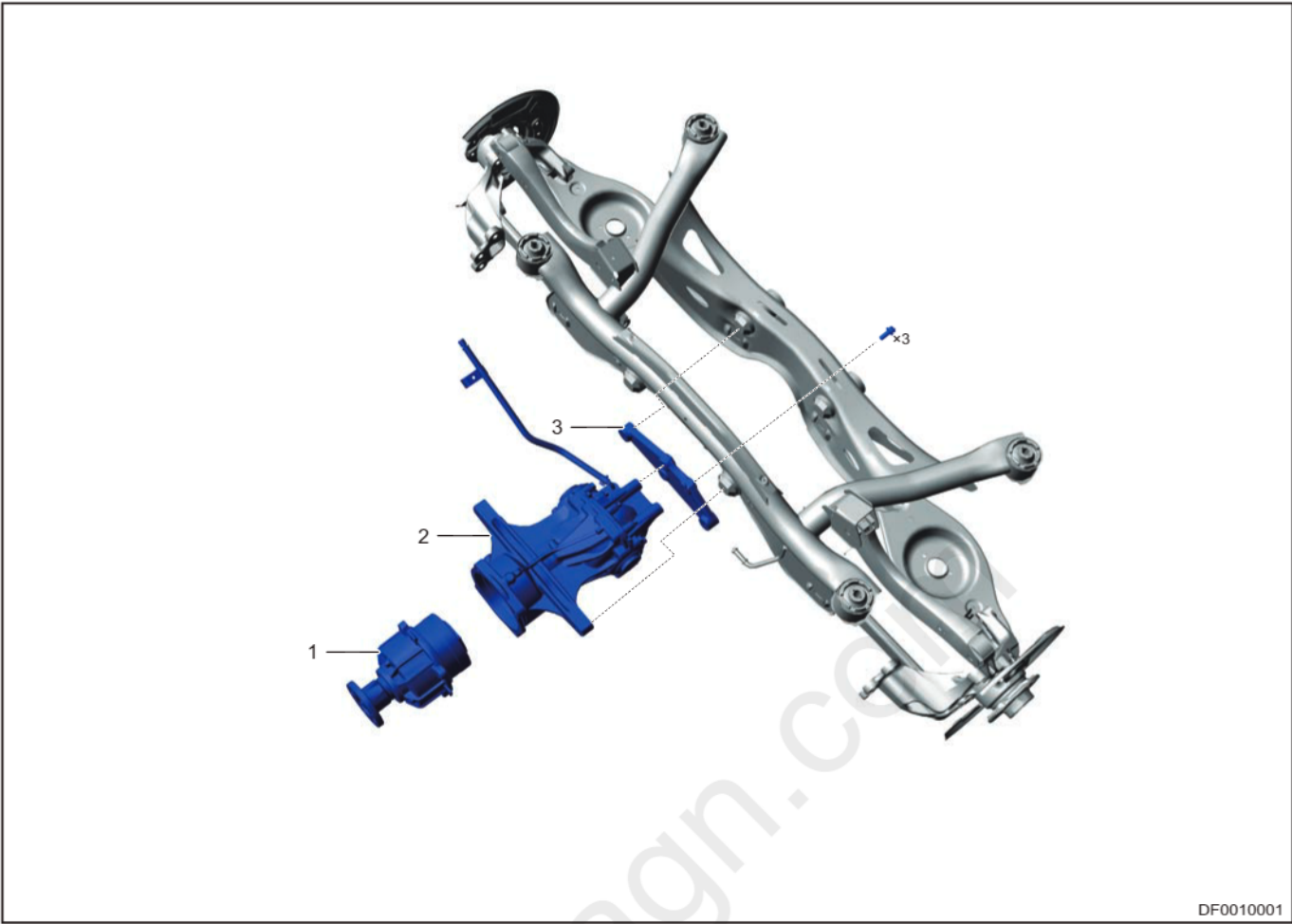
Dana Spicer M150 single speed rear axle is an integral rear final drive, which adopts a hypoid gear design. The center axis of drive gear is located below the center axis of driven gear. Drive gear and driven gear consist of a ring gear with a diameter of 150 mm and a driven gear matched with it. Drive gear is positioned between driven gear and internal drive gear conical bearing with selectable gaskets, and supported by two conical rolling shafts. Drive gear bearing is adjusted by drive gear nut and gasket during pre-installation. The whole rear axle housing is composed of bracket and rear cover. The connecting part of rear cover is sealed with RTV sealant.

Differential case is an integral unit with two openings for the assembly of internal components and flow of lubricant. The differential shaft is fixed by fixing pin. Differential assembly is placed in the bracket housing. Differential adjusts the clearance through adjusting shim between outer rolling bearing cup and bracket, and is fixed by movable bearing cap and bracket.

The rear axle drive gear obtains power from engine through transmission and propeller shaft. Drive gear rotates the differential by engaging with driven gear, which is fixed on outer edge of differential case with bolts. Differential side gear is connected to drive shaft of vehicle. Drive shaft is connected to tires. During steering, differential gear system applies torque separately to drive shafts, so that they rotate at different speeds. In differential case, two drive gears are placed on differential shaft fixed to case. These drive gears engage with differential side gear. When differential case rotates, drive shaft and wheels also rotate. When one wheel and axle shaft need to be rotated faster than the other one (such as when steering), the differential gear on the faster side will make drive gear to rotate on differential side gear with low speed, so that the axle shafts on both sides to rotate at different speeds. When driving straight ahead, the differential drive gear will not rotate on the drive gear matching shaft. This is because the torque input by drive gear acts equally on both side gears, and drive gear rotates together with drive gear matching shaft, rather than rotating around it.

2.2 System Component Diagram

Rear Final Drive Assembly



1	Torque Manager	2	Rear Final Drive
3	Rear Final Drive Bracket		

2.3 Specifications

Torque Specification

Description	Torque (N·m)
Torque Manager Control Unit Fixing Bolt	8 ± 1
Rear Final Drive Bracket Fixing Bolt	110 - 130
Rear Final Drive Filler Plug/Drain Plug	24 - 34

Terminal No.	Terminal Definition	Terminal No.	Terminal Definition
12	Power Supply Negative	25	Power Supply Negative
13	Power Supply Positive	26	Power Supply Positive

4 Diagnosis Contents

4.1 Problem Symptoms Table

Hint:

- Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair, replace or adjust faulty components as necessary.

Symptom	Suspected Area
AWD malfunction indicator ON	Torque manager damage
	AWD module damage
	Abnormal control circuit
	Abnormal vehicle speed signal

4.2 Diagnosis Procedure

Hint:

- Use following procedures to troubleshoot the final drive control system.

1	Vehicle brought to workshop
---	-----------------------------

Next

2	Check battery voltage
---	-----------------------

Check if battery voltage is normal.

NG

Replace battery.

OK

3	Customer problem analysis
---	---------------------------

Next

4	Read DTCs
---	-----------

Check if battery voltage is normal.

NG

Repair according to Problem Symptoms Table.

OK

5	Read DTCs (current DTC and history DTC)
---	---

Check if battery voltage is normal.

NG

Troubleshoot according to intermittent DTC fault flow.

OK

6

Repair according to DTC

Next

7

Adjust, repair or replace

Next

8

Conduct test and confirm malfunction has been repaired

Check if battery voltage is normal.

Next

End.

4.3 DTC Confirmation Procedure

Confirm that battery voltage is normal before performing following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic interface.
- Turn ENGINE START STOP switch to ON.
- Using diagnostic tester, record and clear DTCs stored in AWD control module assembly.
- Turn ENGINE START STOP switch to OFF and wait for several seconds.
- Using the diagnostic tester, select Read DTCs.
- If DTC is detected, malfunction indicated by DTC is current. Go to DTC chart, and perform troubleshooting.
- If no DTC is detected, malfunction indicated by DTC is intermittent. Please refer to Intermittent DTC Troubleshooting.

4.4 Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the followings:

- Check if connector is loose.
- Check if wire harness is worn, pierced, pinched or partially broken.
- Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
- If possible, try to duplicate conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Check for broken, bent, protruded or corroded terminals.
- Check and clean all wire harness connectors and body ground parts related to DTC.
- If multiple trouble codes were set, refer to circuit diagrams to look for any common body ground circuit or power supply circuit applied to DTC.
- Refer to any Technical Bulletin that may apply to this malfunction.

4.5 Body Ground Inspection

Body ground points are very important to the proper operation of circuits. Body ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance.

This situation may change the way in which a circuit operates. Circuits are very sensitive to proper body ground. A loose or corroded body ground can affect the control circuit. Check the body ground points as follows:

- (1) Remove body ground bolt or nut.
- (2) Check all contact surfaces for tarnish, dirt and rust, etc.
- (3) Clean as necessary to ensure that contact is in good condition.
- (4) Reinstall body ground bolt or nut securely.
- (5) Check if there are add-on accessories that interfere with body ground circuit.
- (6) If several wire harnesses are crimped into one body ground terminal, check for proper crimps. Make sure all wire harnesses are clean, securely fastened with providing a good body ground path.

4.6 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
P172813	Electromagnetic Coupling Coil Open Circuit
P172912	Electromagnetic Coupling Coil Circuit Short to Power Supply
P173011	Electromagnetic Coupling Coil Circuit Short to Ground
P177198	Electromagnetic Coupler Overheating
P177398	Electromagnetic Coupler Close to Overheating
P30031C	System Voltage Out of Range
U000188	Bus Off
U010000	CAN Communication Error - Lost Communication with EMS
U010100	CAN Communication Error - Lost Communication with TCU
U012200	CAN Communication Error - Lost Communication with ESC
U012800	CAN Communication Error - Lost Communication with EPB
U015100	CAN Communication Error - Lost Communication with ACM
U015500	CAN Communication Error - Lost Communication with IPC
U021200	CAN Communication Error - Lost Communication with SCM
U024800	CAN Communication Error - Lost Communication with PEPS
U040181	CAN Communication Error - Invalid Data Length Received from EMS
U040186	CAN Communication Error - Invalid Data Received from EMS
U040281	CAN Communication Error - Invalid Data Length Received from TCU
U040286	CAN Communication Error - Invalid Data Received from TCU
U041681	CAN Communication Error - Invalid Data Length Received from ESC
U041686	CAN Communication Error - Invalid Data Received from ESC
U041781	CAN Communication Error - Invalid Data Length Received from EPB
U041786	CAN Communication Error - Invalid Data Received from EPB
U042381	CAN Communication Error - Invalid Data Length Received from IPC
U042386	CAN Communication Error - Invalid Data Received from IPC
U042681	CAN Communication Error - Invalid Data Length Received from PEPS

 **Caution**

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

Confirmation procedure:
Confirm that battery voltage is 9 to 16 V under starting state before performing following procedures.

1

Check fuse

(a) Check if the fuses RF28 20A, RF05 5A in instrument panel fuse box are blown.

NG

Replace fuse.

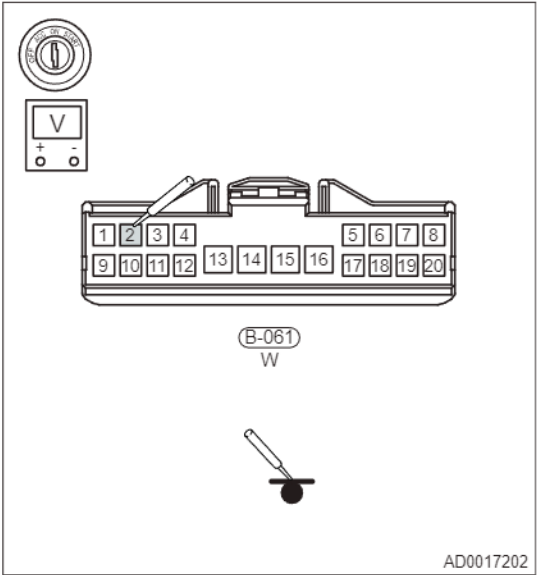
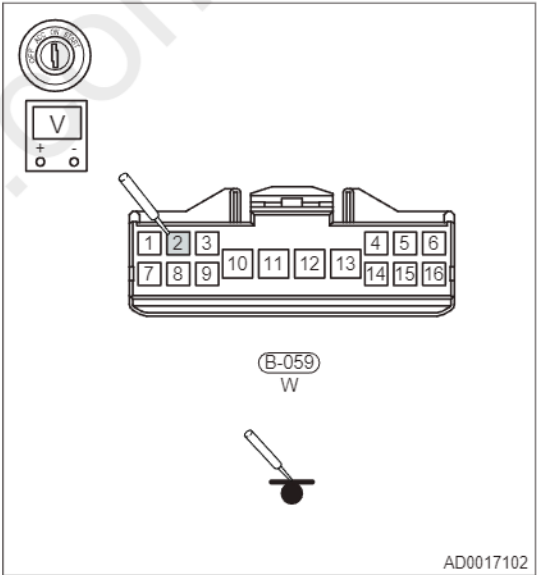
OK

2

Check instrument panel fuse box output voltage

- (a) Turn ENGINE START STOP switch to ON.
- (b) Measure voltage between instrument panel fuse box B-059 terminal 2, B-061 terminal 2 and body ground (using a digital multimeter).

Multimeter Connection	Condition	Specified Condition
B-059 (2) - Body ground	ON	12V
B-061 (2) - Body ground	ON	12V



NG

Replace instrument panel fuse box assembly.

OK

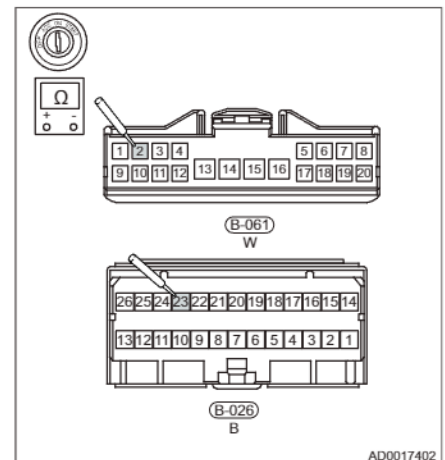
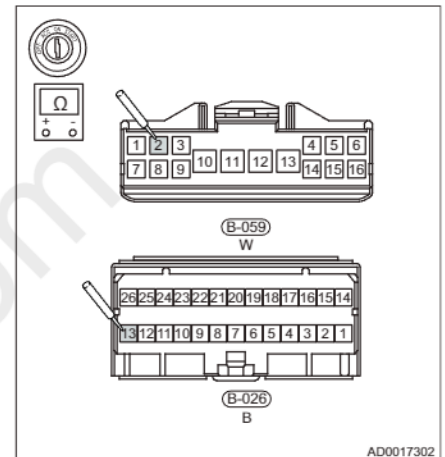
3

Check wire harness for open

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the negative battery cable.
- (c) Disconnect 4WD coupler module connector B-026, instrument panel fuse box connectors B-059 and B-061.
- (d) Using ohm band of digital multimeter, measure if resistance between B-059 (2) - B-026 (13) and B-061 (2) - B-026 (23) is normal to check wire harness for open.

OK

Multimeter Connection	Condition	Specified Condition
B-059 (2) - B-026 (13)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-061 (2) - B-026 (23)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$



OK

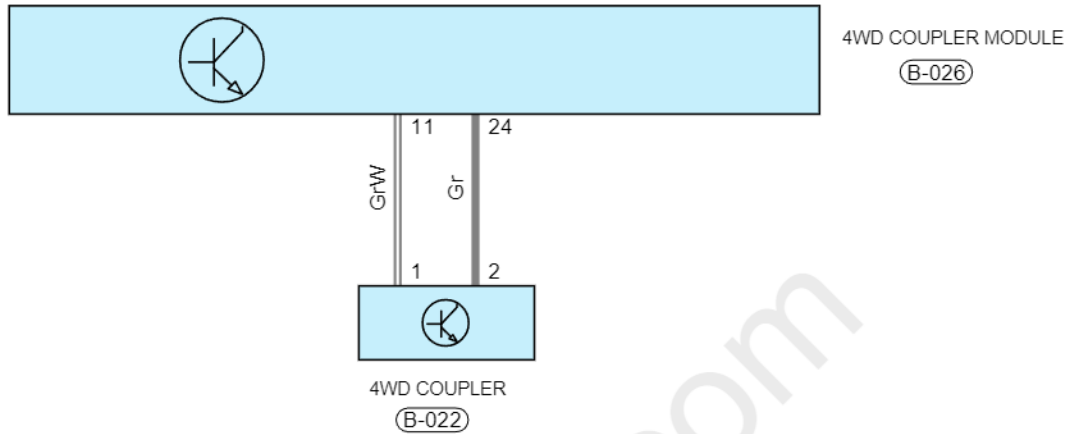
Replace 4WD coupler module assembly.

NG

Handle and repair related wire harness.

DTC	P172813	Electromagnetic Coupling Coil Open Circuit
DTC	P172912	Electromagnetic Coupling Coil Circuit Short to Power Supply
DTC	P173011	Electromagnetic Coupling Coil Circuit Short to Ground

Circuit Diagram



AWD003001

Description

DTC	DTC Definition	Possible Cause	Repair Advice
P172813	Electromagnetic Coupling Coil Open Circuit	- Wire harness or connector failure - Electromagnetic coupler failure	- Check wire harness or connector - Check electromagnetic coupler
P172912	Electromagnetic Coupling Coil Circuit Short to Power Supply		
P173011	Electromagnetic Coupling Coil Circuit Short to Ground		

⚠ Caution

- When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

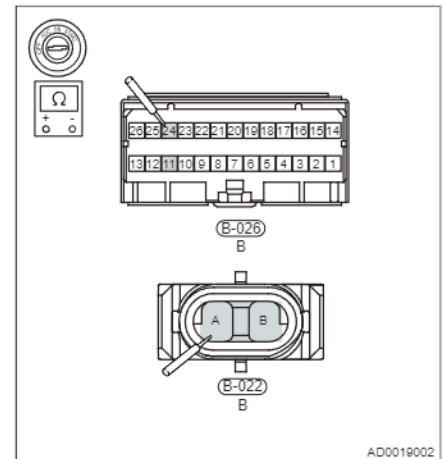
1	Check wire harness for open or short
---	--------------------------------------

- Disconnect electromagnetic coupler connector B-022 and 4WD coupler module connector B-026.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Check for broken, bent, protruded or corroded terminals.
- Check if related connector pins are in good condition.

- (e) Using ohm band of digital multimeter, measure resistance of connecting wire harness between B-022 (1) - B-026 (11) and B-022 (2) - B-026 (24) to check wire harness for open.

OK

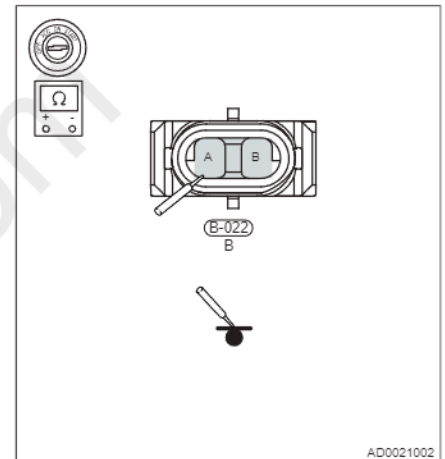
Multimeter Connection	Condition	Specified Condition
B-026 (11) - B-022 (A)	Always	$\leq 1 \Omega$
B-026 (24) - B-022 (B)	Always	$\leq 1 \Omega$



- (f) Using ohm band of digital multimeter, measure resistance between terminals 1 and 2 of connector B-022 and body ground respectively to check wire harness for short to body ground.

OK

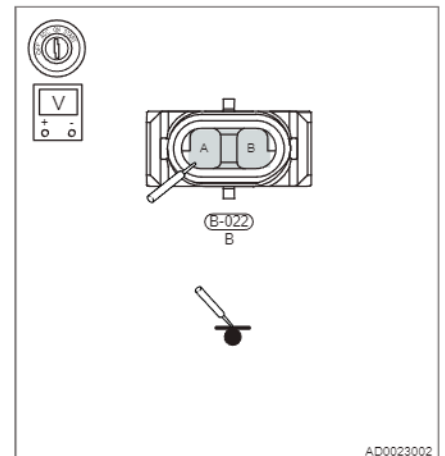
Multimeter Connection	Condition	Specified Condition
B-022 (A) - Body ground	Always	∞
B-022 (B) - Body ground	Always	∞



- (g) Connect the negative battery cable, turn ENGINE START STOP switch to ON, (confirm that connectors B-026 and B-022 are disconnected). Using voltage band of digital multimeter, measure voltage between terminal A and B of connector B-022 and body ground respectively to check wire harness for short to power supply.

OK

Multimeter Connection	Condition	Specified Condition
B-022 (A) - Body ground	Always	0V
B-022 (B) - Body ground	Always	0V



OK

Replace electromagnetic coupler assembly.

NG

Repair or replace wire harness.

DTC	U000188	Bus Off
DTC	U010000	CAN Communication Error - Lost Communication with EMS
DTC	U010100	CAN Communication Error - Lost Communication with TCU
DTC	U012200	CAN Communication Error - Lost Communication with ESC

DTC	U012800	CAN Communication Error - Lost Communication with EPB
DTC	U015100	CAN Communication Error - Lost Communication with ACM
DTC	U015500	CAN Communication Error - Lost Communication with IPC
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DTC	U040181	CAN Communication Error - Invalid Data Length Received from EMS
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DTC	U040281	CAN Communication Error - Invalid Data Length Received from TCU
DTC	U040286	CAN Communication Error - Invalid Data Received from TCU
DTC	U041681	CAN Communication Error - Invalid Data Length Received from ESC
DTC	U041686	CAN Communication Error - Invalid Data Received from ESC
DTC	U041781	CAN Communication Error - Invalid Data Length Received from EPB
DTC	U041786	CAN Communication Error - Invalid Data Received from EPB
DTC	U042381	CAN Communication Error - Invalid Data Length Received from IPC
DTC	U042386	CAN Communication Error - Invalid Data Received from IPC
DTC	U042681	CAN Communication Error - Invalid Data Length Received from PEPS
DTC	U042686	CAN Communication Error - Invalid Data Received from PEPS
DTC	U042981	CAN Communication Error - Invalid Data Length Received from SCM
DTC	U042986	CAN Communication Error - Invalid Data Received from SCM
DTC	U045281	CAN Communication Error - Invalid Data Length Received from ACM
DTC	U045286	CAN Communication Error - Invalid Data Received from SACM

Description

DTC	DTC Definition
U000188	Bus Off
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U015100	CAN Communication Error - Lost Communication with ACM

DTC	DTC Definition
U015500	CAN Communication Error - Lost Communication with IPC
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U041786	CAN Communication Error - Invalid Data Received from EPB
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U042986	CAN Communication Error - Invalid Data Received from SCM
U045281	CAN Communication Error - Invalid Data Length Received from ACM
U045286	CAN Communication Error - Invalid Data Received from SACM

1

Refer to "CAN Network System" for troubleshooting

5 On-vehicle Service

5.1 Final Drive Maintenance

Final drive oil is recommended to be replaced every 50,000 km after warranty period. Oil standard:

Oil Type	Total Capacity (After-sales Maintenance Oil Capacity)
Sinopec GL5 80W-90 Gear Oil	0.445 ± 0.03 L

5.2 Replacement of Rear Final Drive Oil

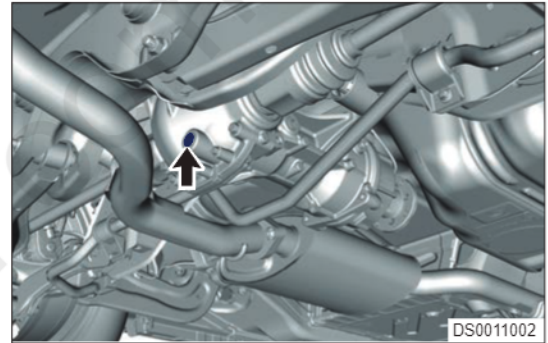
⚠ Caution

- Replace rear final drive oil only when engine stops and rear final drive cools down.
- Used filler plug and drain plug are non-reusable.

■ Rear Final Drive Oil Draining

- (1) Park vehicle on a level ground.
- (2) Turn off all electrical equipment and the ENGINE START STOP switch.
- (3) Raise the vehicle to a proper height.
- (4) Put a recovering container under transmission drain hole.
- (5) Remove drain plug (with magnet) (arrow) with a tool.

Tightening torque: 24 - 34 N·m



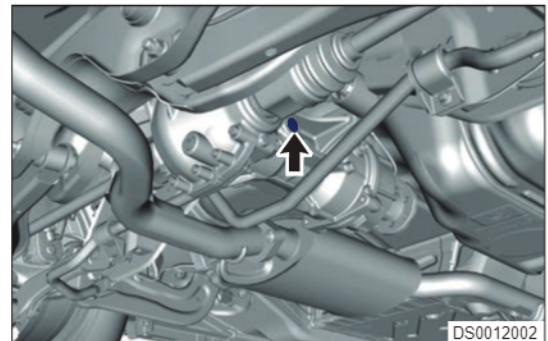
■ Rear Final Drive Oil Filling

⚠ Caution

- Gear oil type: Sinopec GL5 80W-90 gear oil, oil capacity: 445 ml ± 30 ml.

- (1) Make sure that rear final drive drain plug is tightened in place.
- (2) Remove filler plug (with magnet) (arrow) with a tool.

Tightening torque: 24 - 34 N·m



- (3) Fill rear final drive oil from fill plug.
- (4) Replace filler plug with a new one after filling, and tighten it in place according to torque.

5.3 Rear Final Drive Assembly

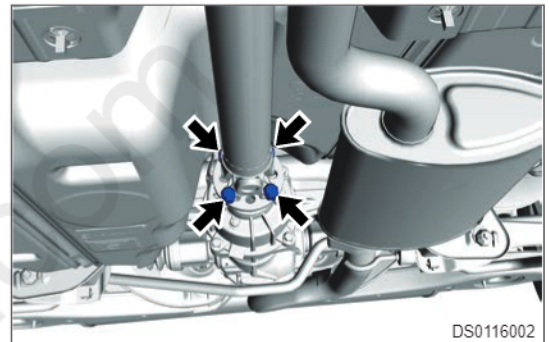
■ Removal

Caution

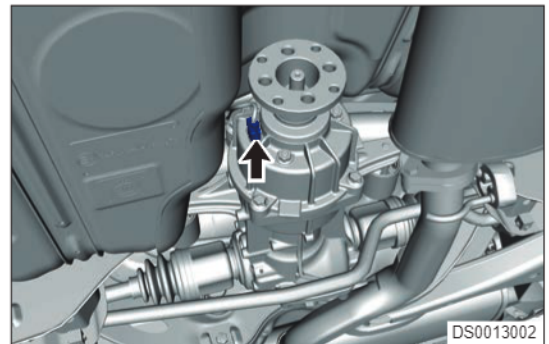
- If gear loaded housing is submerged in water, especially if it exceeds the breather valve, it is recommended to drain gear lubricant daily and check internal components for any damage and/or contamination caused by water.
- Clean, test and replace damaged parts before assembly and refilling of specified gear lubricant.

- (1) Disconnect the negative battery cable.
- (2) Drain the final drive oil.
- (3) Remove the rear left drive shaft assembly.
- (4) Remove the rear right drive shaft assembly.
- (5) Remove the rear final drive assembly.
 - 1) Remove 4 fixing bolts (arrow) between propeller shaft and torque manager flange.

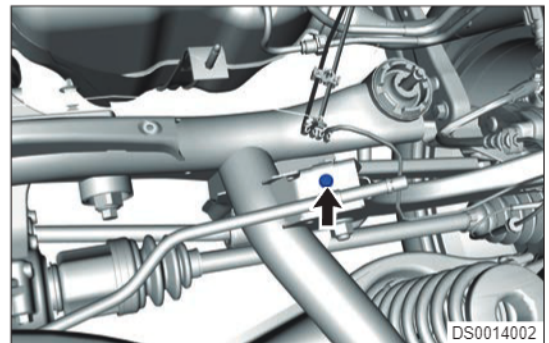
Tightening torque: 71.5 ± 6.5 N·m



- 2) Disconnect the torque manager connector (arrow).

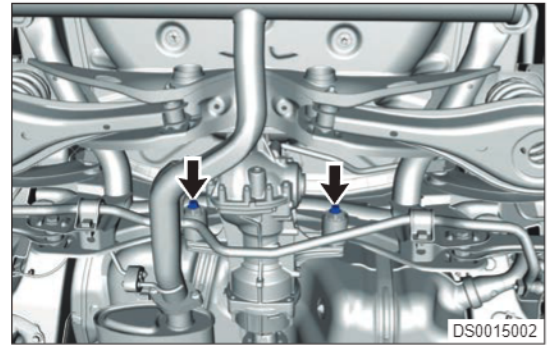


- 3) Remove fixing bolt (arrow) between rear final drive breather pipe and rear sub frame.

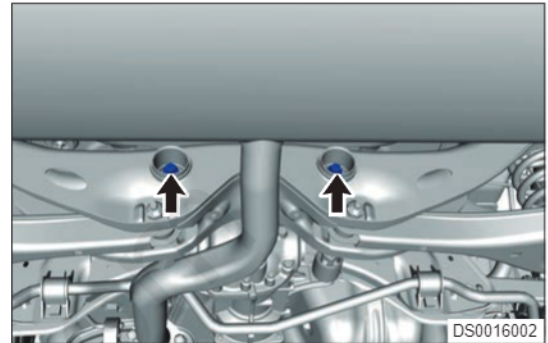


- 4) Place jack firmly in a proper position under rear final drive assembly.

- 5) Remove 2 fixing bolts (arrow) between rear final drive and front part of rear sub frame.



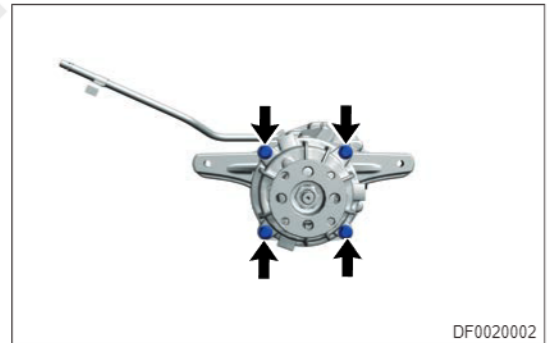
- 6) Remove 2 fixing bolts (arrow) between rear final drive and rear part of rear sub frame.



- 7) Remove the rear final drive assembly.

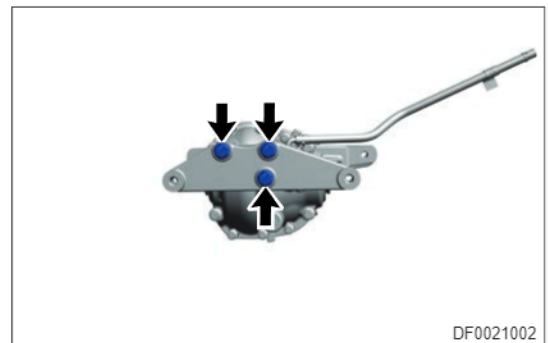
■ Disassembly

- (1) Remove 4 fixing bolts (arrow) between torque manager and rear final drive.



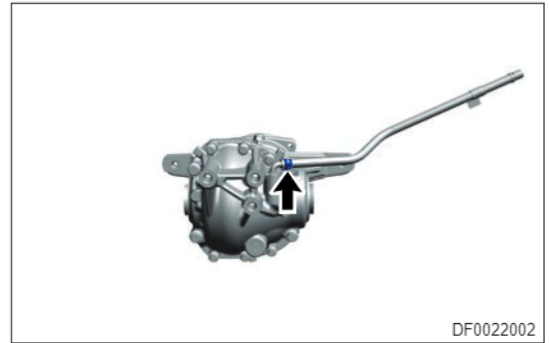
- (2) Remove the torque manager.
- (3) Remove 3 fixing bolts (arrow) between rear final drive bracket and rear final drive.

Tightening torque: 110 - 130 N·m



- (4) Remove the rear final drive bracket.

- (5) Remove clamp (arrow) and breather pipe.



■ Reassembly

- (1) Install breather pipe and clamp.
- (2) Install the rear final drive bracket.
- (3) Install 3 fixing bolts between rear final drive bracket and rear final drive.

Tightening torque: 110 - 130 N·m

- (4) Install the torque manager.
- (5) Install 4 fixing bolts between torque manager and rear final drive.

■ Installation

- (1) Install the rear final drive assembly.
- (2) Install 2 fixing bolts (arrow) between rear final drive and rear part of rear sub frame.

Tightening torque: 120 ± 10 N·m

- (3) Install 2 fixing bolts (arrow) between rear final drive and front part of rear sub frame.

Tightening torque: 120 ± 10 N·m

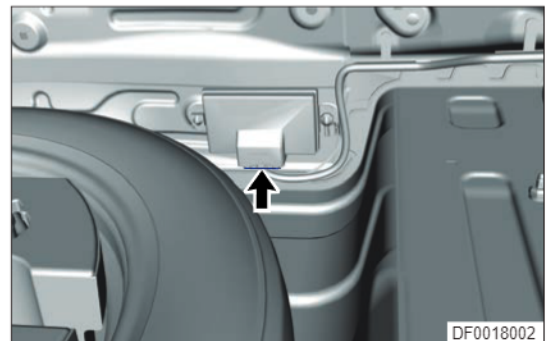
- (4) Install fixing bolt between rear final drive breather pipe and rear sub frame.
- (5) Install the torque manager connector.
- (6) Install 4 fixing bolts between propeller shaft and torque manager flange.

Tightening torque: 71.5 ± 6.5 N·m

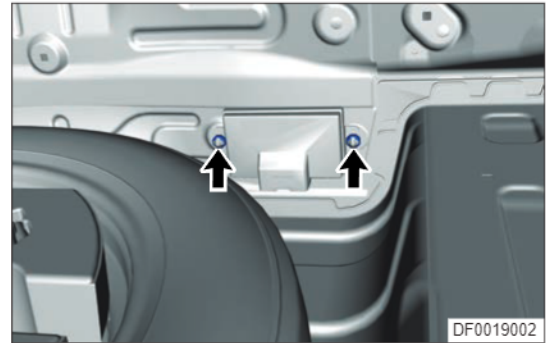
5.4 Torque Manager Control Unit

■ Removal

- (1) Disconnect the negative battery cable.
- (2) Remove the torque manager control unit.
 - 1) Disconnect the torque manager control unit connector (arrow).



- 2) Remove 2 fixing nuts (arrow) from torque manager control unit.



- 3) Remove the torque manager control unit.

■ Installation

- (1) Install the torque manager control unit.
- (2) Install 2 fixing nuts to torque manager control unit.

Tightening torque: 8 ± 1 N·m

- (3) Install the torque manager control unit connector.
- (4) Connect the negative battery cable.

5.5 Drive Shaft Oil Seal (Final Drive Side)

■ Replacement

⚠ Warning

- **Be sure to wear necessary safety equipment to prevent accidents.**
- **Make sure that safety lock of lifter has been locked, when removing and installing chassis parts.**

Hint:

- Use same procedures for right and left sides.
 - Procedures listed below are for left side.
- (1) Remove the rear left wheel.
 - (2) Drain the final drive oil.
 - (3) Remove the rear left drive shaft.
 - (4) Remove the drive shaft oil seal.
 - 1) Using a screwdriver with the tip wrapped with protective tape, remove drive shaft oil seal.

⚠ Caution

- **Ensure that the transmission oil has been drained before removal.**
- **Oil seal is a non-reusable part, which must be replaced after each removal.**

- (5) Install the drive shaft oil seal.
 - 1) Install new drive shaft oil seal in position with a tool.
- (6) Install the rear left drive shaft.
- (7) Fill the final drive oil.
- (8) Install the rear left wheel.