ELECTRONIC POWER STEERING

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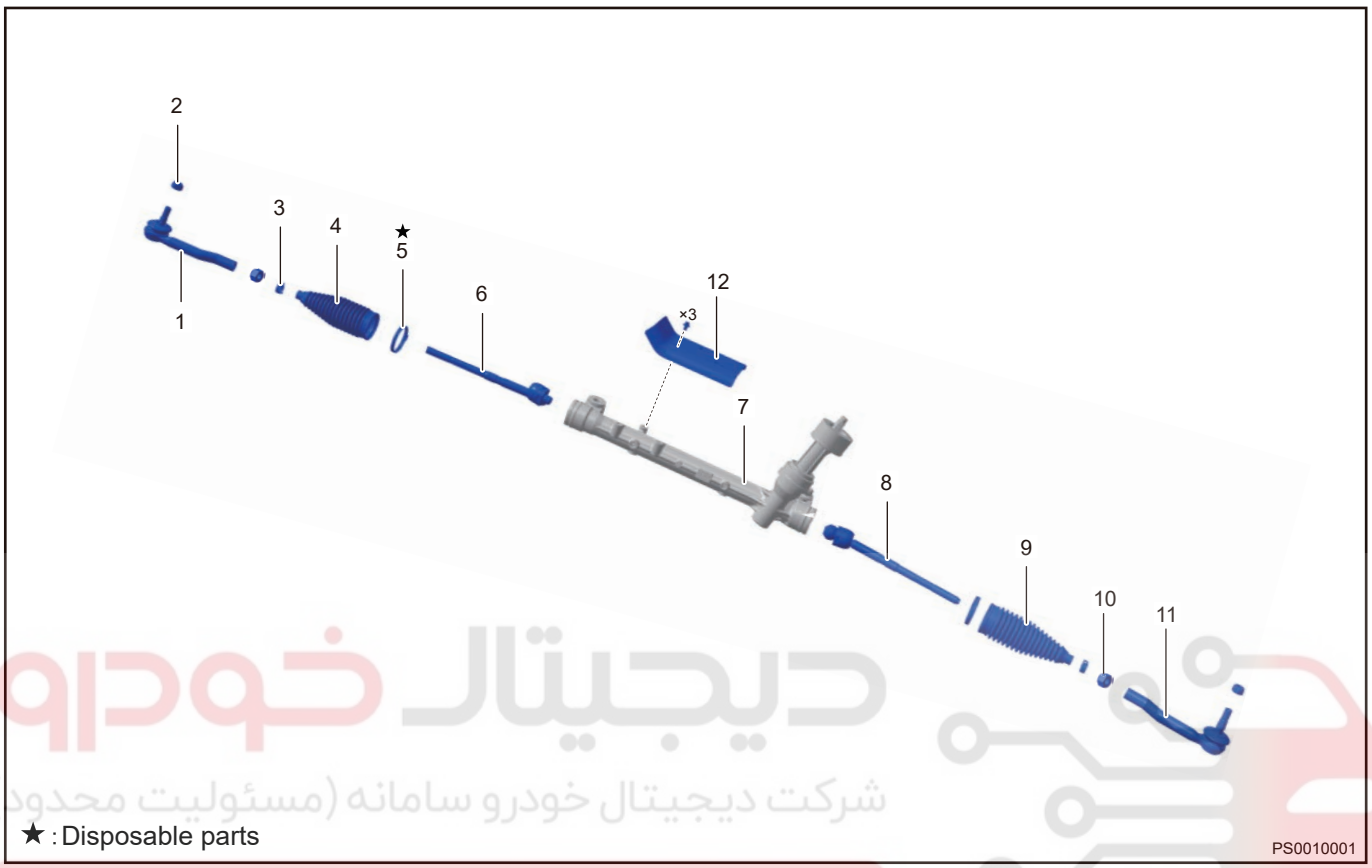
GENERAL INFORMATION

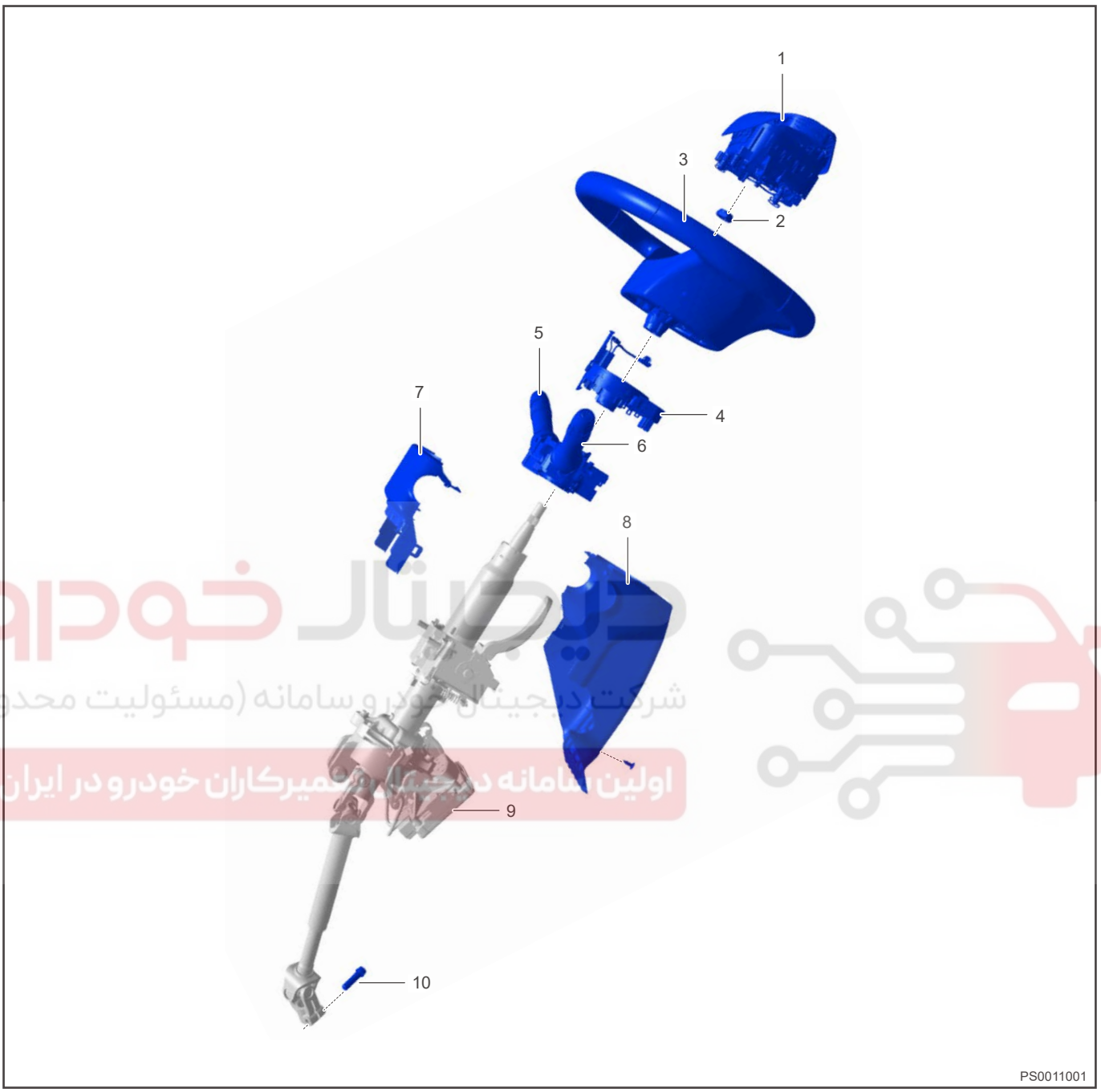
Description



1	Right Steering Tie Rod Ball Pin	7	Steering Gear Assembly
2	Steering Tie Rod Ball Pin Locking Nut	8	Left Steering Tie Rod Assembly
3	Elastic Clamp	9	Left Steering Tie Rod Boot
4	Right Steering Tie Rod Boot	10	Steering Tie Rod Fixing Nut
5	Clamping Ring	11	Left Steering Tie Rod Ball Pin
6	Right Steering Tie Rod Assembly	12	Steering Gear Heat Insulator

This vehicle adopts the electronic power steering system, which can reduce the workload when driver operates the steering wheel, thus improving operation convenience and driving safety.

Electronic Steering Column



1	Driver Airbag	6	Headlight/Turn Signal Light / Fog Light Switch
2	Steering Wheel Assembly Fixing Nut	7	Combination Switch Upper Cover
3	Steering Wheel Assembly	8	Combination Switch Lower Cover
4	Spiral Cable	9	Electronic Steering Column with Intermediate Shaft Assembly
5	Wiper Switch	10	Locking Bolt

Operation
When driver rotates the steering wheel, torque sensor installed on steering column sends detected torque acting on steering wheel to steering assist control unit. Based on information such as steering torque, vehicle speed (provided by vehicle CAN line), steering wheel rotation angle, steering wheel rotation speed and characteristic curve stored in control unit, control unit calculates required steering torque based on specified algorithm, and controls motor operation. The steering assist is provided by motor drive column, thus steering rack operates.

EPS corner calibration and soft stop position learning (for offline calibration of four-wheel alignment diagnostic tester)

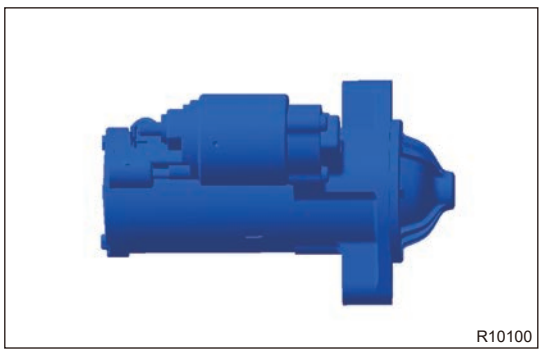
1. Start vehicle;
2. Turn steering wheel to left and right more than ± 45° at a speed of < 200°/s;
3. Perform four-wheel alignment on vehicle;
4. The ignition switch is turned off and turned on within 3 seconds (+15 on);
5. Fix the steering wheel horizontally;
6. Connect the diagnostic tester, enter corner calibration interface, and confirm directly until the calibration is completed according to the prompt of diagnostic tester;
7. Calibration is completed;
8. (After the four-wheel alignment is completed), drive out the four-wheel alignment station, turn the steering wheel left and right to the limit position, and keep the hand force not less than 10 N m for more than 1 second, and ensure that the steering wheel hits the limit position and then returns to the center position;
9. The software completes soft stop position learning.

Caution
In step 2, if the steering speed is too fast or the steering angle is insufficient, it cannot be calibrated. In step 4, if the vehicle is not powered on in 3 seconds, it cannot be calibrated. In step 8, when turning to the limit position for the first time, ensure that the hand force exceeds 10 N.m. If above requirements are not fully met, the soft stop position learning will be advanced, resulting in an abnormal power when it is not turned to the limit position under individual operating conditions.

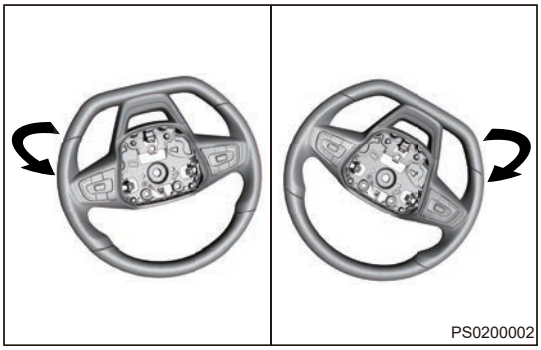
Assembly of Steering Wheel and Electronic Steering Column

1. Align steering wheel scale mark with column scale mark, then turn steering wheel to extreme position, check steering wheel angle, and ensure the deviation of both rotation corners is ⩽10°. If the deviation is >10°, check them after checking one side.

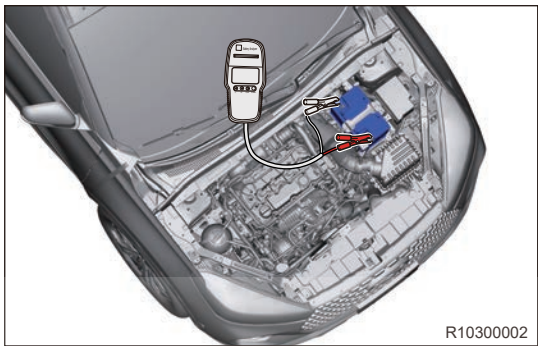
2. Align steering wheel scale mark with column scale mark.


R10100

3. Turn steering wheel to limit position, comparing the difference between rotation angles.



4. If visually measure that deviation is between 10° and 20°, pull the steering wheel and turn scale mark to other side of steering wheel.



Hint:
The scales of steering wheel and column can only assist in assembly, but it cannot be finally positioned, and check left and right strokes as acceptance standard for final position.

Adjustment of Toe-in and Steering Wheel Angle

Hint:
Steering wheel centering or steering performance are affected by manufacturing error, requirements for four wheels alignment toe-in and steering wheel centering are as following:

1. Confirm the left and right strokes of steering wheel after it is assembled (Assembly method: Visually align steering column scale with steering wheel scale, then turn left and right to the limit position and check the corner. If the deviation is >10°, move it back by one gear tooth and control the steering deviation angle within the range of 10°. For details, see the assembly of steering wheel and electric steering column);
2. Before performing four-wheel alignment, first rotate steering wheel to left and right to determine rotation angle of one side is not less than 45°, then returns to horizontal position;
3. Fix the steering wheel horizontally;
4. Use calibration device to complete center position calibration of steering wheel rotation angle (for calibration methods, refer to EPS corner calibration);
5. When adjusting front wheel toe-in, it is necessary to adjust steering gear left and right tie rods. Loosen locking nut of steering gear tie rod when adjusting, use wrench to rotate inner lever in hexagonal position of outer lever, until toe-in value reaches specified value, then tighten locking nut. If threads exposed outside on left and right levers are greatly not equal (difference between left and right levers threads exposed outside are more than 3 threads), please recheck if steering wheel is centered. It is necessary to set outer lever flat square position with wrench while tightening, tighten torque of nut is 55 ± 5 N m;
6. After the four wheels alignment is completed and exiting the four wheels alignment station, turn the steering wheel to the limit position (make sure the steering wheel has hit the limit position) and return to the middle position, and the vehicle is turned off.

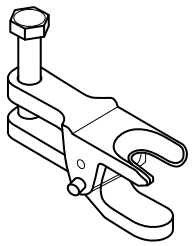
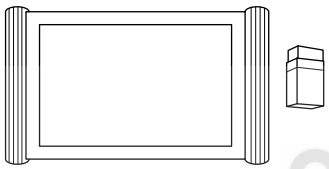
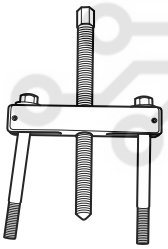
Specifications

Torque Specifications

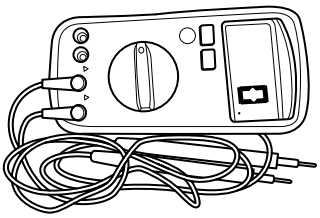
Description	Torque (N•m)
Steering Wheel Assembly Fixing Nut	30 ± 3
Steering Column Assembly Upper Bracket Fixing Bolt	25 ± 3
Steering Column Assembly Lower Bracket Fixing Bolt	50 ± 5
Fixing Bolt Between Sub Frame and Body	220 ± 22
Fixing Bolt Between Rear Mounting Lower Body and Sub Frame	150 ± 10
Fixing Nut Between Front Stabilizer Bar and Stabilizer Link	60 ± 6
Coupling Bolt Between Steering Column with Intermediate Shaft Assembly and Steering Gear Input Shaft (This bolt cannot be reused and new bolt must be used for any tightening operation)	49 ± 3
Fixing Bolt and Nut Between Steering Gear and Sub Frame	180 ± 18
Fixing Nut Between Steering Gear Ball Joint and Steering Knuckle	45 ± 5

Tools

Special Tools

Tool Name	Tool Drawing
Ball Pin Separator	 RCH0024006
X-431 PAD Diagnostic Tester	 RCH0001006
Steering Wheel Remover	 RCH001406

General Tool

Tool Name	Tool Drawing
Digital Multimeter	 RCH0002006

DIAGNOSIS & TEST

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
Steering wheel free play is too large	Suspension or steering parts (loose or worn)
	Front hub bearing (worn or loose)
	Steering gear bracket (loose)
	Gear clearance (improper)
	Steering shaft (worn or loose)
Sideslip	Tire pressure
	Brake lag
	Wheel alignment (wrong)
	Steering column (worn or damaged)
	Steering or suspension parts (loose or worn)
Running deviation	Tire pressure (too high or too low)
	Different tire wear (diameter difference occurs)
	Wheel alignment (wrong)

Diagnostic Help

1. Connect diagnostic tester (the latest software) to diagnostic connector, and make it communicate with vehicle electronic module through data network.
2. Confirm that malfunction is current, and carry out diagnostic test and repair procedures.
3. If Diagnostic Trouble Code (DTC) cannot be cleared, it indicates that there is a current malfunction.
4. Only use a digital multimeter to measure voltage of electronic system.
5. Refer to any Technical Bulletin that may apply to this malfunction.
6. Visually check related wire harness and connector.
7. Check and clean Electronic Power Steering controller (EPS controller) ground related to latest DTC.
8. If numerous trouble codes are set, refer to circuit diagram and look for any common ground circuit or power supply circuit applied to DTC.

Intermittent Troubleshooting

If malfunction is intermittent, perform the followings:

1. Check if connector is loose.
2. Check if wire harness is worn, pierced, pinched or partially broken.
3. Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
4. If possible, try to duplicate the conditions under which DTC was set.
5. Look for data that has changed or DTC to reset during wiggling test.

6. Look for broken, bent, protruded or corroded terminals.
7. Inspect sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
8. Check and clean all wire harness connectors and ground parts related to DTC.
9. Refer to any Technical Bulletin that may apply to this malfunction.

Ground Inspection

Ground points are very important to normal work of circuit, and they 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 grounding. A loose or corroded ground can seriously affect the control circuit. Check the ground points as follows:

1. Remove 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 ground bolt or nut securely.
5. Check if any additional accessories interfere with ground circuit.
6. If several wire harnesses are crimped into one ground terminal, check for proper crimp condition. Make sure that all wire harnesses are clean and securely fastened while providing a proper ground path.

DTC Confirmation Procedure

Confirm that battery voltage is over 12V before performing following procedures

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic connector, and make it communicate with vehicle electronic module through data network.
- Turn ENGINE START STOP switch to ON.
- Use diagnostic tester to record and clear DTCs stored in EPS system.
- Turn the ENGINE START STOP switch to OFF and wait for several seconds.
- Turn ENGINE START STOP switch to ON, select “Read DTC”.
- If DTC is not detected, malfunction indicated by DTC is intermittent.

Calibration

Calibrating Steering Angle Sensor

Prerequisites for sensor calibration:

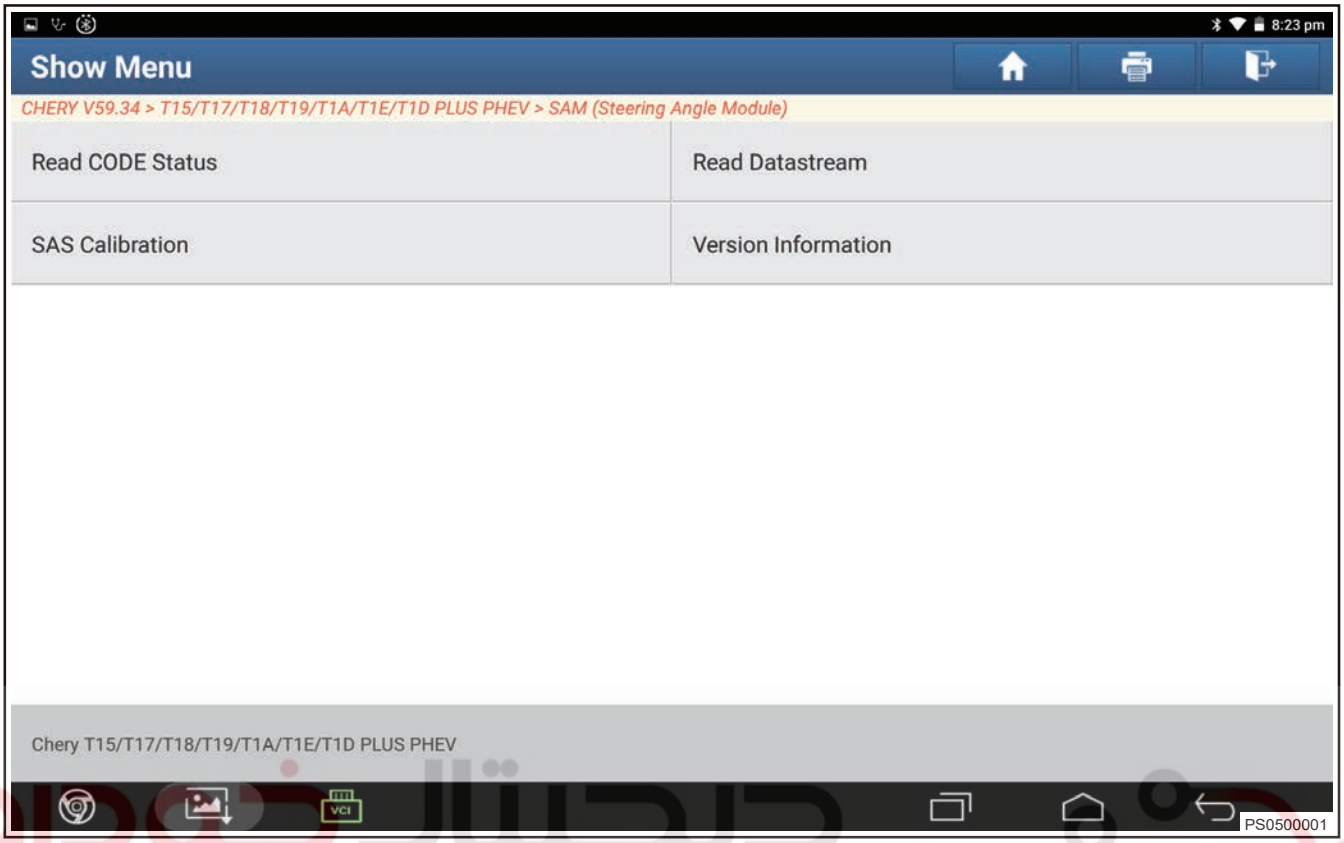
- Perform zero point calibration after steering angle sensor is installed.
- Calibration should be performed at front (four) wheel alignment station (make sure that the four wheel alignment parameters are correct).
- Before calibrating, straighten up the vehicle and wheels must be in straight lines along proceeding direction. Difference between the two angles should meet toe-in of four wheel alignment parameters value. Steering wheel must be adjusted to center.
- Before calibrate a calibrated sensor again, always calibrate it again to make it return uncalibrated state.

Caution
Steering wheel must be centered in the actual calibration. If not, even the data is correct, it can cause wrong calibration when performing four-wheel alignment. This problem may not be detected at factory. Long-term cumulative errors may be caused or overrange phenomenon and ESP light illumination problem may occur when turning steering wheel to limit position during actual driving. Therefore, when performing four-wheel alignment, the steering wheel must be centered.

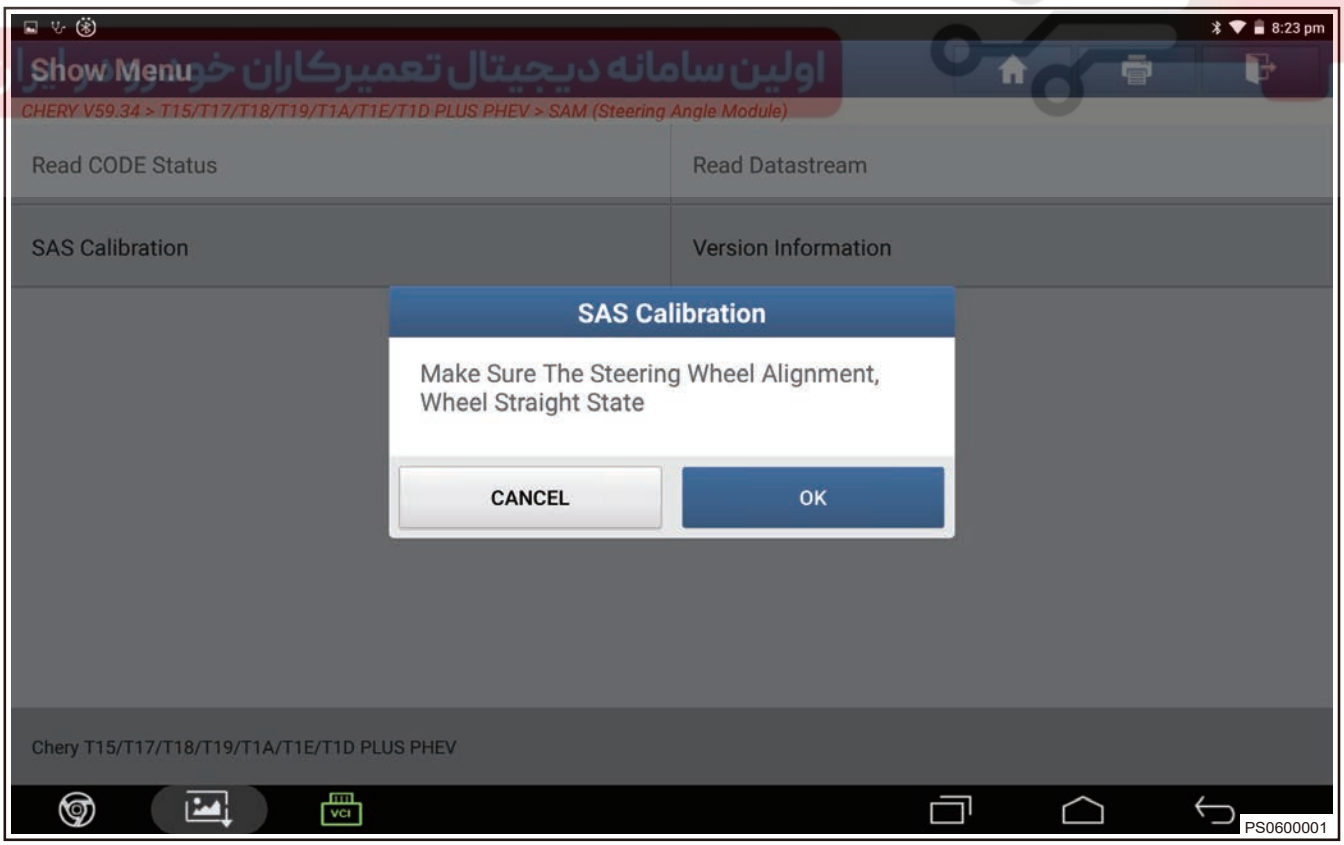
Operation Step

1. Connect the diagnostic tester.
2. Turn ENGINE START STOP switch to ON.
3. Place the steering wheel to center position (straighten up the vehicle, wheels must be in straight lines along proceeding direction, and center steering wheel).
4. Power should not be cut during calibration.
5. Use diagnostic tester to enter “SAM (Steering Angle Module)”.

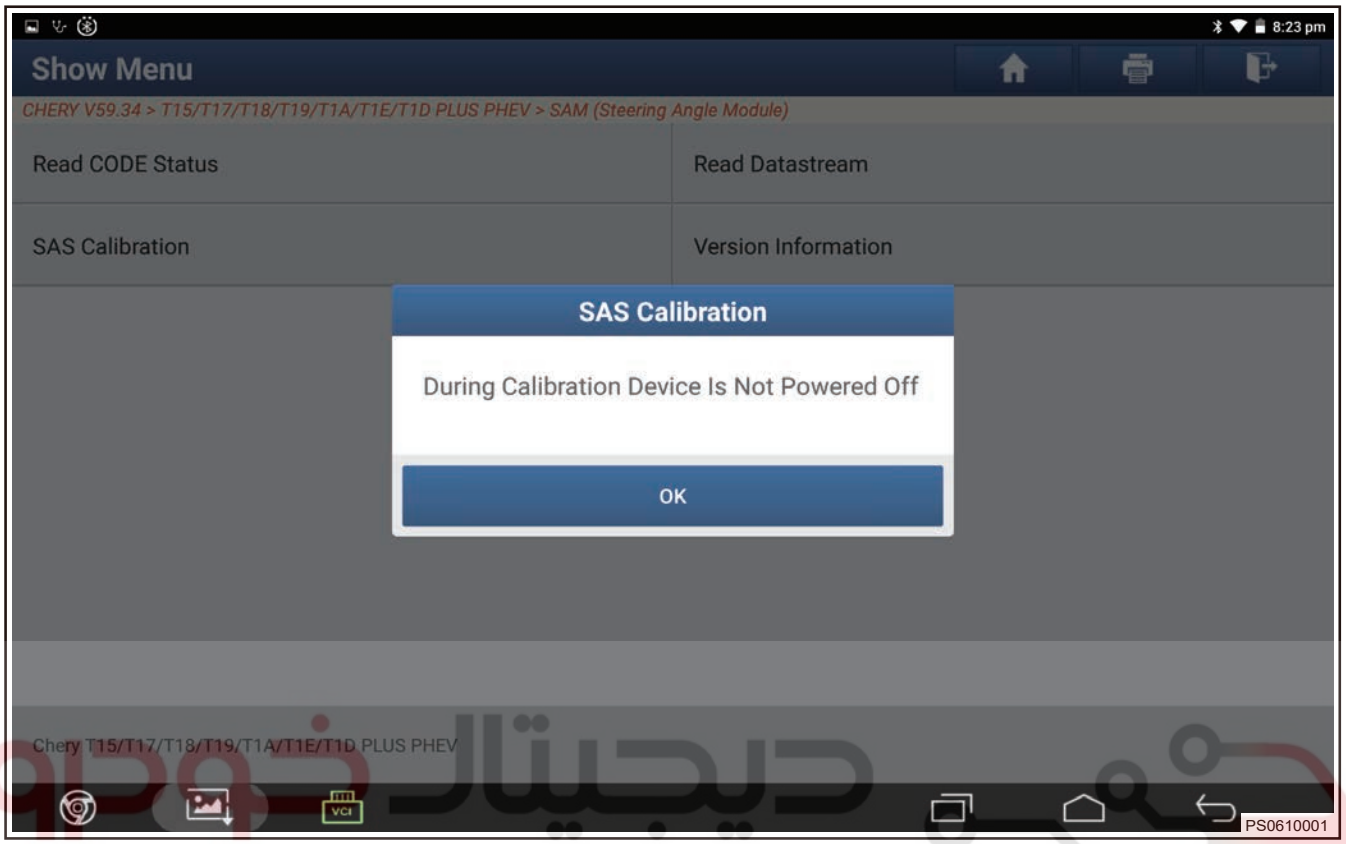
6. Click “SAS Calibration”.



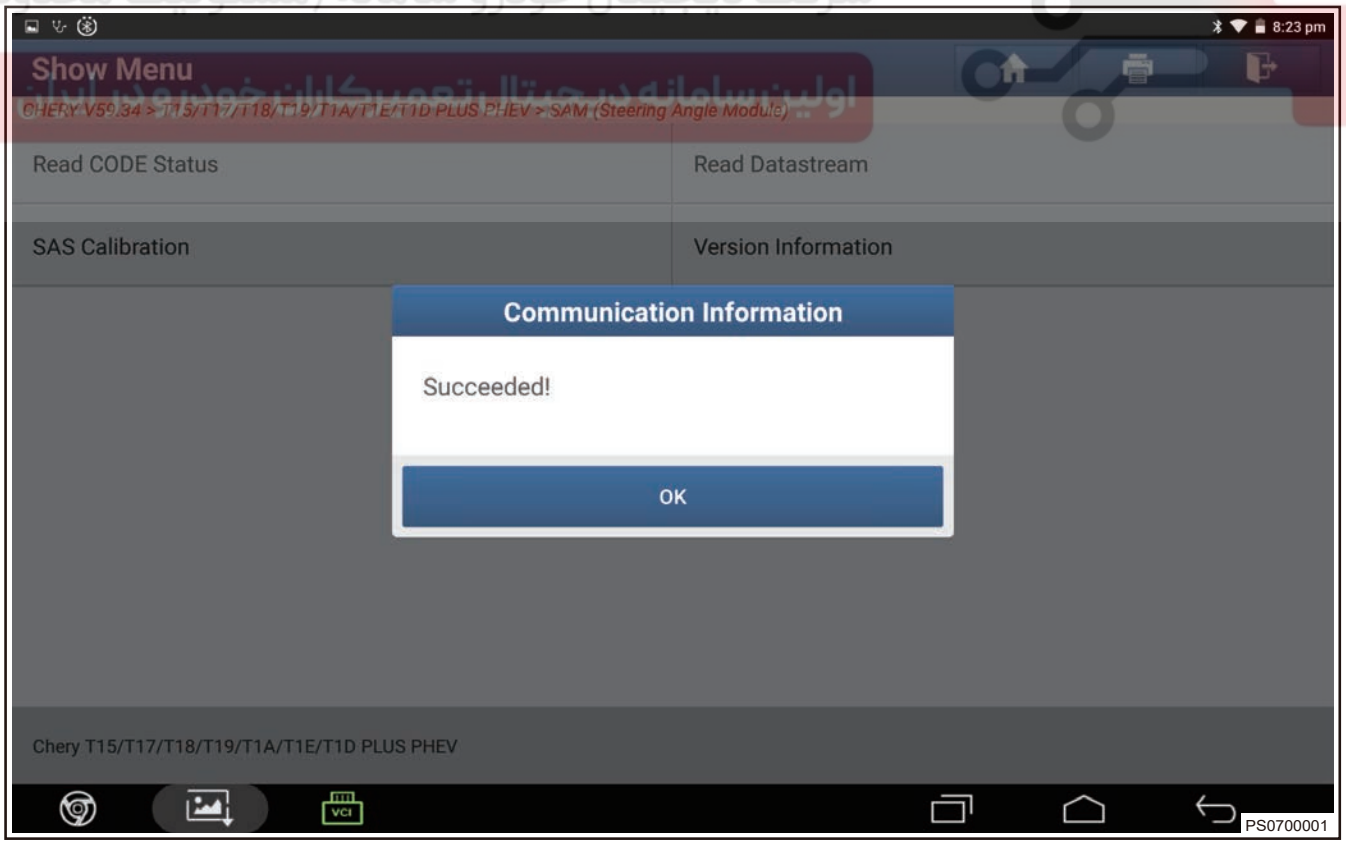
7. Diagnostic tester will detect sensor malfunction and calibration automatically; if sensor has malfunction, it will exit calibration.
8. Prompt: “Make Sure The Steering Wheel Alignment, Wheel Straight State”.



9. Prompt: “During Calibration Device Is Not Powered Off”.



10. Diagnostic tester will prompt whether calibration is success or not.



Warning
Never cut off the power during calibration. (Power applied to equipment and steering angle sensor must not be cut off during calibration. Also, diagnostic tester and sensor must be connected properly. Otherwise, calibration cannot be performed properly. If any of them are connected poorly, electrical overload of the products can be caused worst of all.)

Caution
The steering angle sensor should to be calibrated again after four wheel alignment is performed.

Motor Position Sensor Calibration

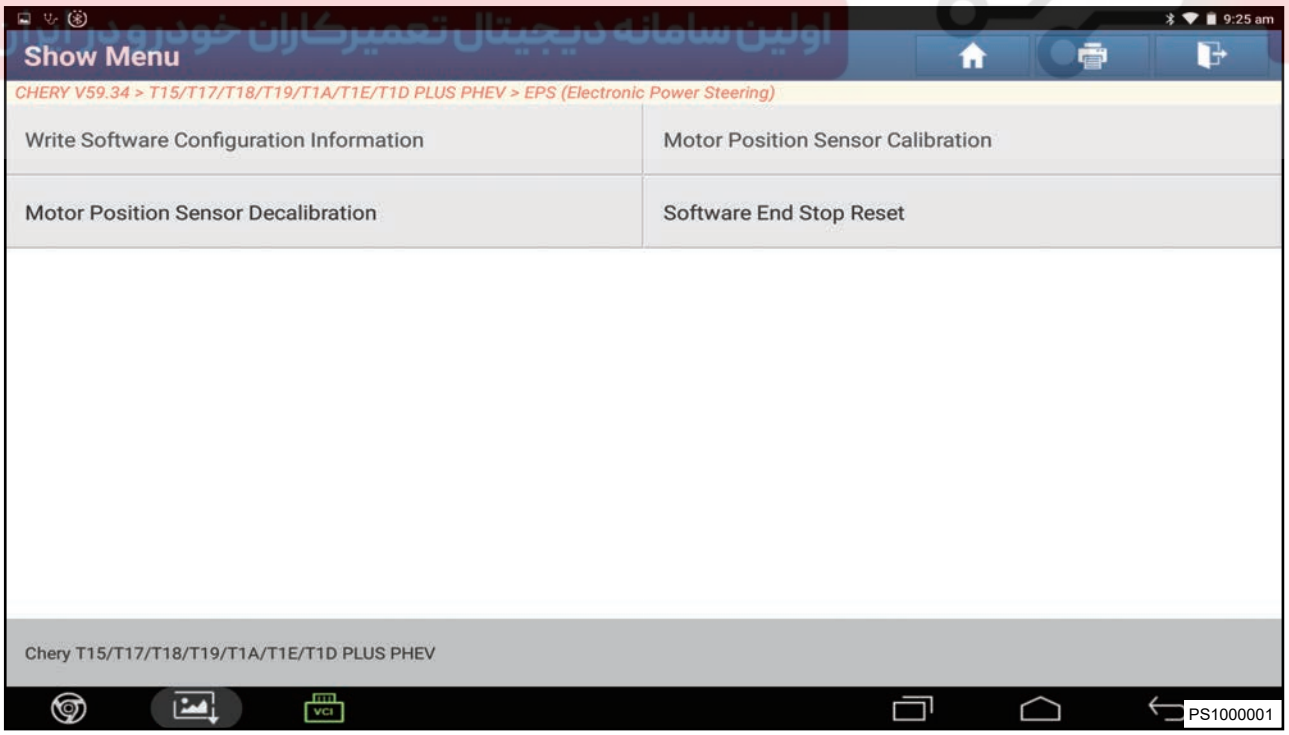
Hint:

- It is necessary to perform motor position sensor calibration after replacing motor.

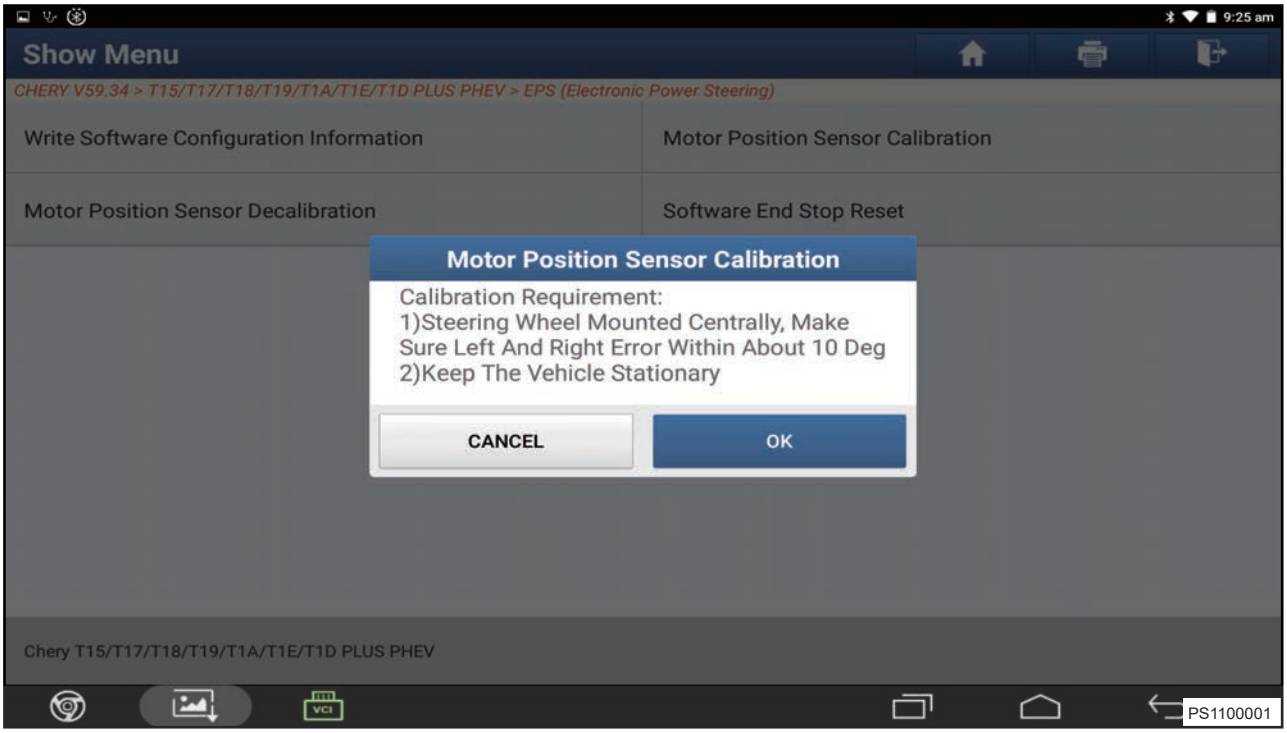
Operation Step

1. Connect the diagnostic tester.
2. Turn ENGINE START STOP switch to ON.
3. Using diagnostic tester, enter “EPS (Electronic Power Steering)”.
4. Click “Special Function”.

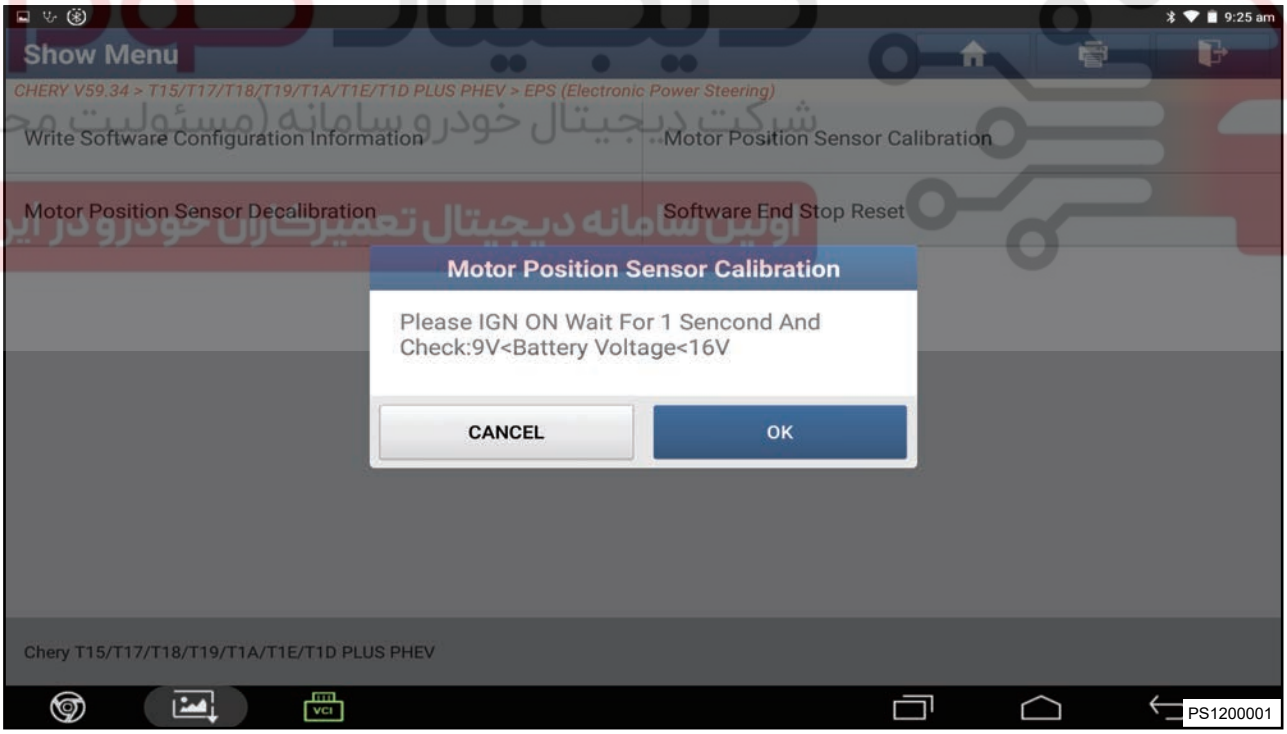
5. Enter next interface and click “Motor Position Sensor Calibration”.



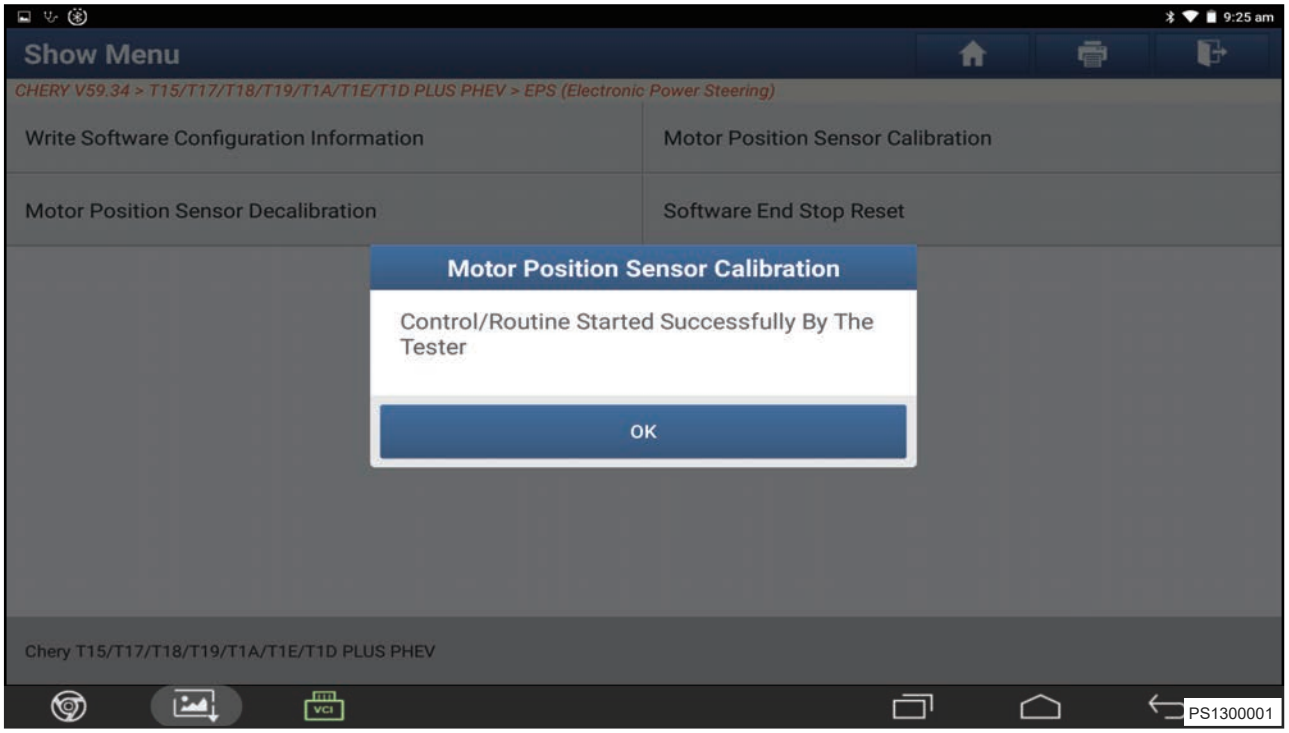
6. Hint: “Calibration requirement: 1) Steering wheel mounted centrally. Make sure error between left and right is within about 10 deg. (2) Keep the vehicle stationary” Then click “OK”.



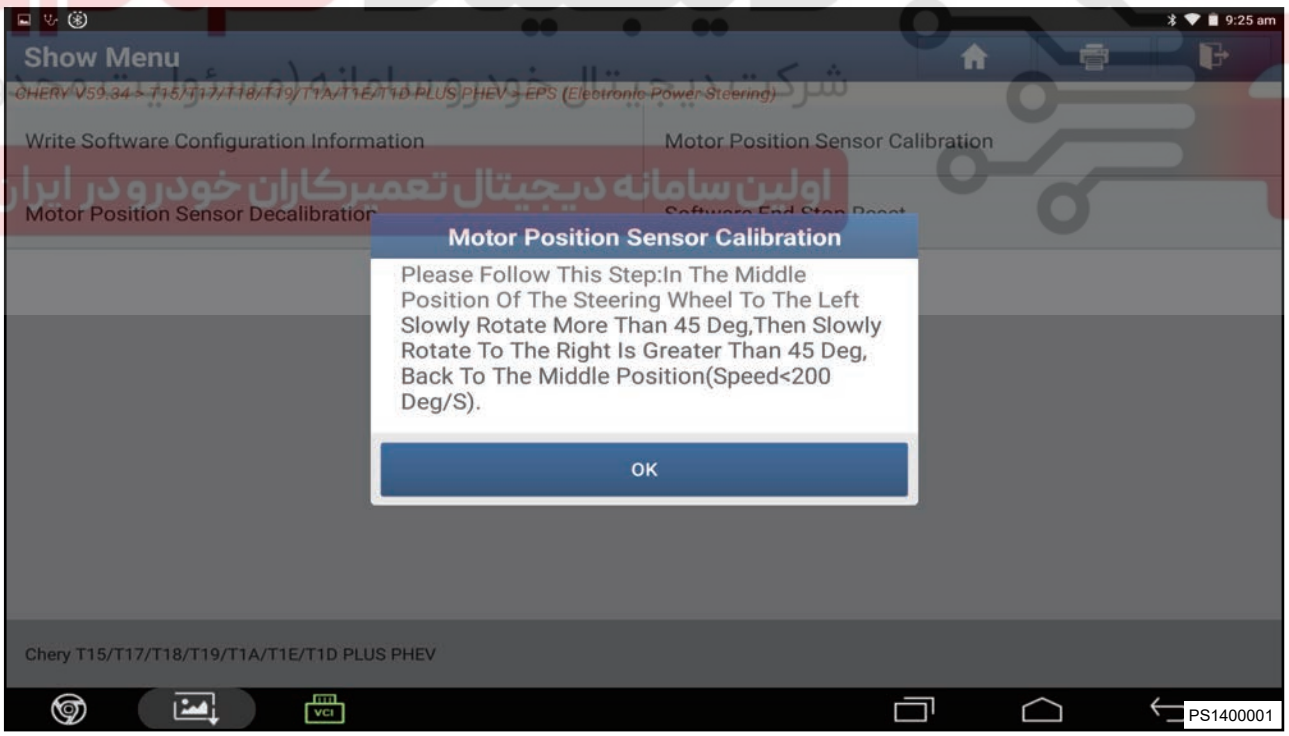
7. Hint: “Please IGN ON Wait For 1 Second And Check: 9 V < Battery Voltage < 16 V”, then click “OK”.



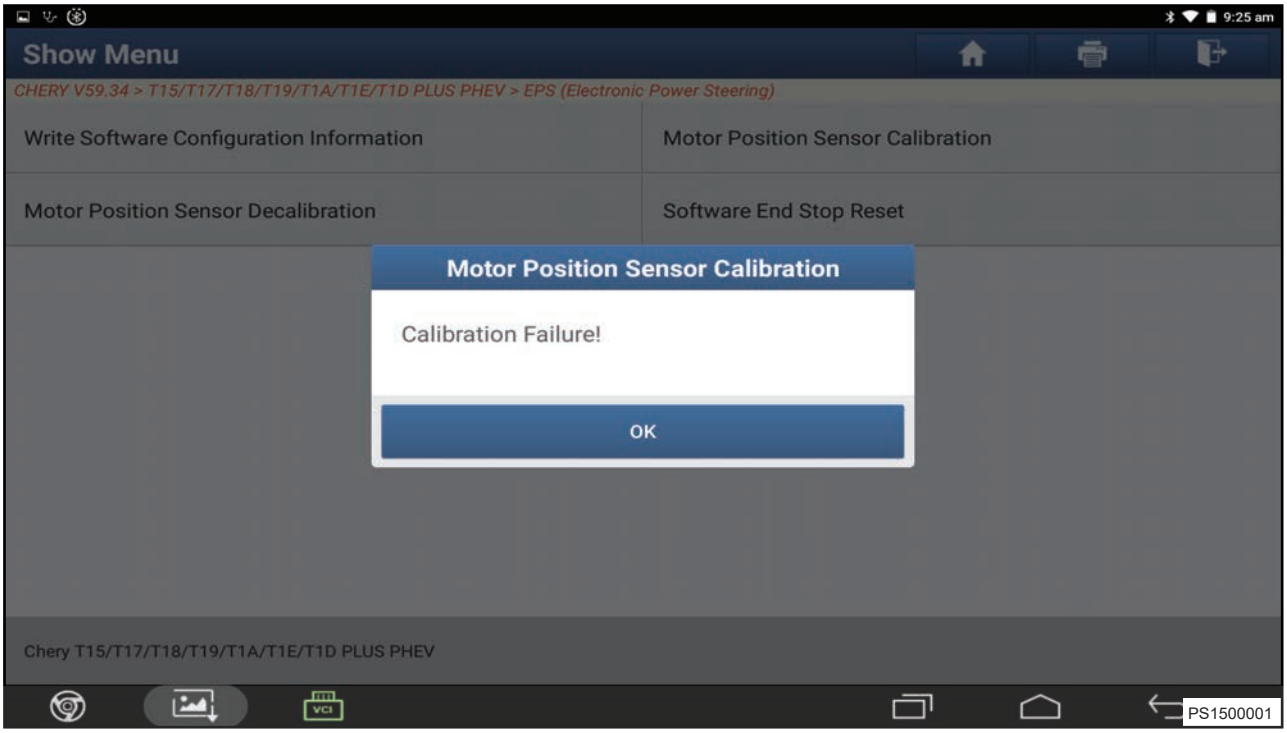
8. Hint: “Control/Routine Started successfully By The Tester”, then click “OK”.



9. Hint: “Please Follow This Step: In The Middle Position Of The Steering wheel To The Left Slowly Rotate More Than 45 Deg, Then Slowly Rotate To The Right Is Greater Than 45 Deg, Back To The Middle Position (Speed < 200 Deg/s), then click “OK”.



10. Hint: “Calibration Success!”, then click “OK”.



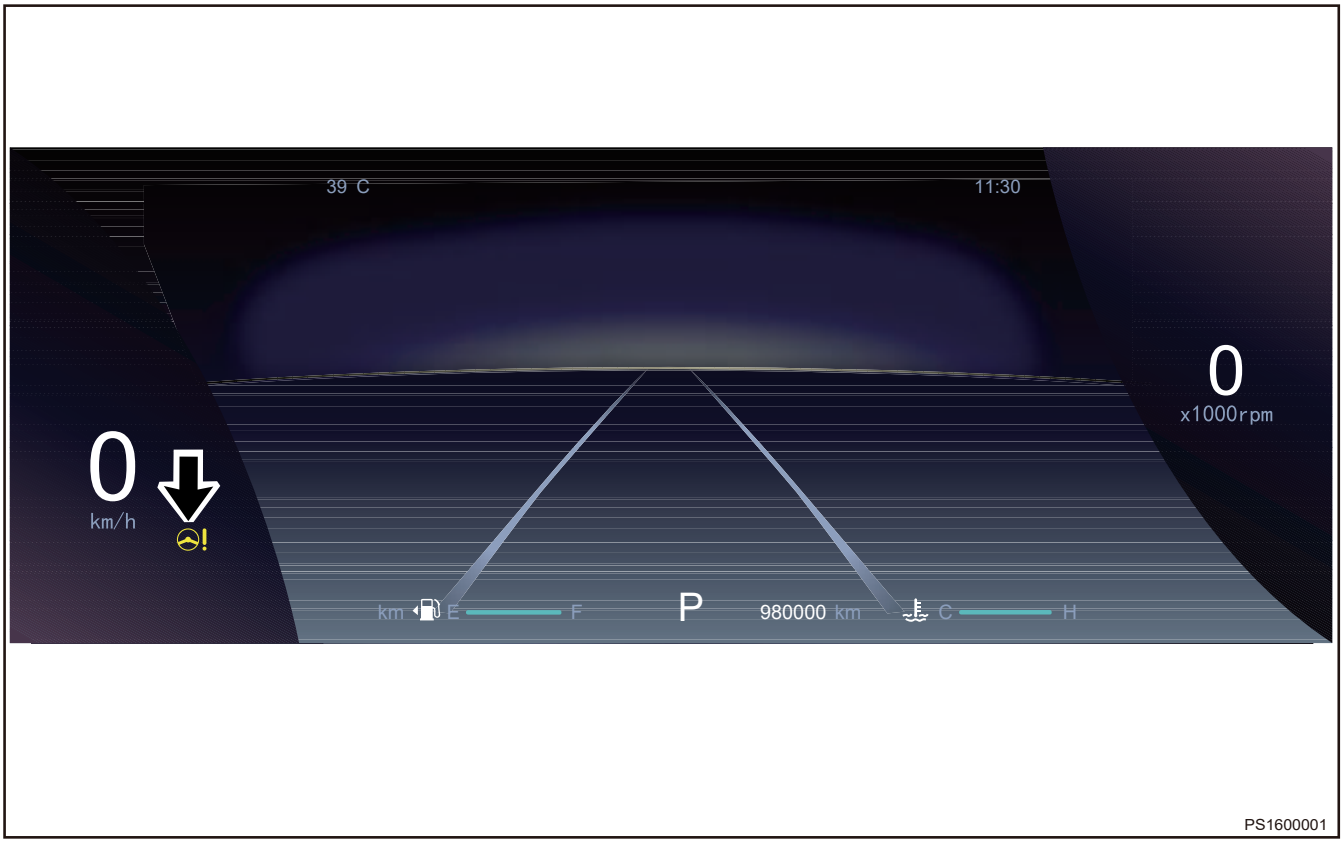
Electronic Power Steering System (EPS) Self-learning

Hint:

- Electronic Power Steering (EPS) uses the torque generated by motor as the power source of the steering system, instead of the power source of the hydraulic pump driven by the engine in general vehicles.

Operation Step

1. If the vehicle battery is disconnected, after reconnecting the battery or starting, due to the angle initialization of the electronic steering system, the instrument cluster yellow indicator flashes, turn the steering wheel to the left and right to the limit position to complete the angle reset, the instrument cluster yellow indicator goes out.



Caution
• Frequent operating and turning the steering wheel for long periods of time may damage the mechanism in the electronic power steering system (EPS). • It is prohibited to turn the steering wheel left and right frequently and quickly in the park idle state to prevent the system from overheating; if the system overheats, the phenomenon of heavy steering will appear, which is normal, then you should stop turning the steering wheel and turn the vehicle power to OFF/ACC mode until the system cools down.

Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
C1200-44	Data Flash Operation Error-Data Memory Failure
C1201-44	Data Flash Verify Error-Data Memory Failure
C1202-49	ECU Hardware Error-Internal Electronic Failure
C1203-00	ECU Reset Error
C1204-48	ECU Sw Monitoring Error-Supervision Software Failure

DTC	DTC Definition
C1205-45	Flash Code Verify Error-Program Memory Failure
C1206-07	High Friction-Mechanical Failure
C1207-49	Index Sensor Error-Internal Electronic Failure
C1208-49	Output Stage Error-Internal Electronic Failure
C1209-49	Phase Current Error-Internal Electronic Failure
C120A-49	Rotor Position Sensor Error-Internal Electronic Failure
C120C-07	Steering Oscillation-Mechanical Failure
C120D-00	Steering Angle Implausible-No Sub Type Information
C120E-00	Steering Angle No Initialization-No Sub Type Information
C120F-00	Steering Angle Sensor Not Calibrated-No Sub Type Information
C1210-49	Steering Angle Sensor Self Test Error-Internal Electronic Failure
C1211-1C	Supply Voltage Abnormal During Initialization-Circuit Voltage Out of Range
C1212-1C	Supply Voltage Uncritical Too High Warning-Circuit Voltage Out of Range
C1213-1C	High Power Supply Voltage
C1214-17	Supply Voltage Too High
C1215-1C	Supply Voltage Uncritical Too Low Warning-Circuit Voltage Out of Range
C1216-1C	Low Power Supply Voltage
C1217-16	Supply Voltage Too Low
C1218-4B	Over Temperature Reduction-Over Temperature
C1219-4B	Temperature Out Of Range-Over Temperature
C121A-49	Torque Sensor Error-Internal Electronic Failure
C121B-46	XCP Flash Data Changed-Calibration / Parameter Memory Failure
C121C-00	Software Configuration Invalid-No Sub Type Information
C122D-48	ECU SW Information Error-Supervision Software Failure
C1205-00	LKA Torque Request Overrun
U0073-88	CAN Bus Off

DTC	DTC Definition
U0100-87	Lost Communication with Engine Control System Module
U0129-87	Lost Communication With Brake System Control Module
U0140-87	Lost Communication with BCM
U0146 – 87	Lost Communication with Central Gateway
U1162-87	Lost Communication with Front Camera Module
U0142-87	Lost Communication with Around View Monitor Module
U0401-81	Invalid Data Received from EMS-Invalid Serial Data Received
U0418-81	Invalid Data Received from BSM-Invalid Serial Data Received
U0422-81	Invalid Data Received from BCM-Invalid Serial Data Received
U1405-81	Invalid Data Received From FCM
U0443-81	Invalid Data Received From AVM-Invalid Serial Date Received

DTC diagnosis procedure

DTC	**C1200-44**	**Data Flash Operation Error-Data Memory Failure**
DTC	**C1201-44**	**Data Flash Verify Error-Data Memory Failure**
DTC	**C1202-49**	**ECU Hardware Error-Internal Electronic Failure**
DTC	**C1203-00**	**ECU Reset Error**
DTC	**C1204-48**	**ECU Sw Monitoring Error-Supervision Software Failure**
DTC	**C1205-45**	**Flash Code Verify Error-Program Memory Failure**
DTC	**C1207-49**	**Index Sensor Error-Internal Electronic Failure**
DTC	**C121A-49**	**Torque Sensor Error-Internal Electronic Failure**
DTC	**C121B-46**	**XCP Flash Data Changed-Calibration / Parameter Memory Failure**

DTC	Descript-ion	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunc-tion Light
C1200-44	Data Flash Operation Error-Data Memory Failure	Data memory failure	Input failure	• Wire harness or connector • Electronic Power Steering EPS	/	Incorrect

DTC	Descript-ion	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunc-tion Light
C1201-44	Data Flash Verify Error-Data Memory Failure	Data memory failure	Input failure		No assist	Correct
C1202-49	ECU Hardware Error-Internal Electronic Failure	Interior electric fault	Output failure		No assist	Correct
C1203-00	ECU Reset Error	No subtype information	Output failure		/	Incorrect
C1204-48	ECU Sw Monitorin-g Error-Supervisi-on Software Failure	Internal software failure	Output failure		No assist	Correct
C1205-45	Flash Code Verify Error-Program Memory Failure	Procedure memory failed	Input failure		No assist	Correct
C1207-49	Index Sensor Error-Internal Electronic Failure	Interior electric fault	Input failure		Disable end stop and active return function	Correct
C121A-49	Torque Sensor Error-Internal Electronic Failure	Interior electric fault	Input failure		No assist/	Correct

DTC	Descript-ion	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunc-tion Light
C121B-46	XCP Flash Data Changed-Calibratio-n / Paramet-er Memory Failure	Calibration parameter storage space failure	Input failure		/	Incorrect

DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing the following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

1	**Check battery voltage**

(a) Connect negative battery terminal cable, and turn ENGINE START STOP switch to ON to make engine run normally.

(b) Check battery voltage with voltage band of multimeter.

Multimeter Connection	Condition	Specified Condition
Battery (+) - Battery (-)	ENGINE START STOP switch ON	Not less than 12 V

NG → **Check and repair battery**

OK

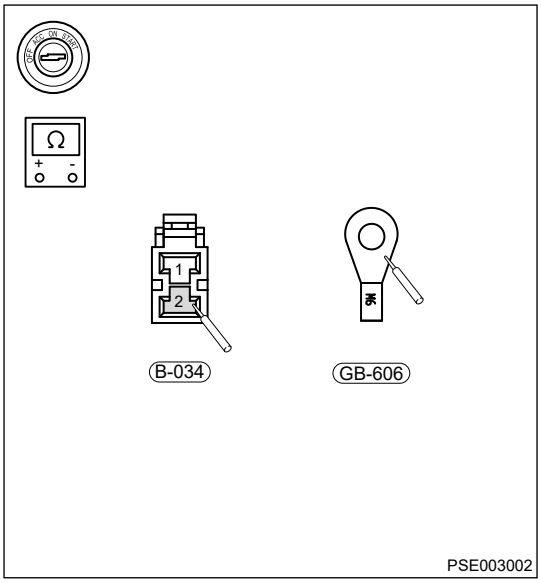
2	**Inspect ground and power supply circuit**

(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect the EPS connector.

(c) Check for continuity between EPS B-034 (A2) terminal and ground GB-606.

(d) Check for continuity between EPS B-034 (A1) terminal and B-020 (R3) terminal.



OK	**Replace EPS**
NG	**Replace or repair wire harness**

DTC	**C120D-00**	**Steering Angle Implausible-No Sub Type Information**
DTC	**C120E-00**	**Steering Angle No Initialization-No Sub Type Information**
DTC	**C120F-00**	**Steering Angle Sensor Not Calibrated-No Sub Type Information**
DTC	**C1210-49**	**Steering Angle Sensor Self Test Error-Internal Electronic Failure**

DTC	Description	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunction Light
C120D-00	Steering Angle Implausible-No Sub Type Information	No subtype information	Input failure	• Angel sensor • Wire harness or connector • Electronic Power Steering EPS	Steering angle is invalid. Disable end stop and active return function	Correct
C120E-00	Steering Angle No Initialization-No Sub Type Information	No subtype information	Input failure		Steering angle is invalid. Disable end stop and active return function	Correct

DTC	Descripti-on	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunc-tion Light
C120F-00	Steering Angle Sensor Not Calibrate-d-No Sub Type Informati-on	No subtype information	Input failure		Steering angle is invalid. Disable end stop and active return function	Correct
C1210-49	Steering Angle Sensor Self Test Error-Internal Electronic Failure	Interior electric fault	Input failure		Steering angle is invalid. Disable end stop and active return function	Correct

DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing the following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

1	**Check steering angle calibration**

(a) Turn ENGINE START STOP switch to ON.

(b) Connect the diagnostic tester, read data streams of steering angle sensor.

(c) Check if steering angle sensor angle is normal and calibration is successful.

NG → **Recalibrate steering angle sensor**

OK

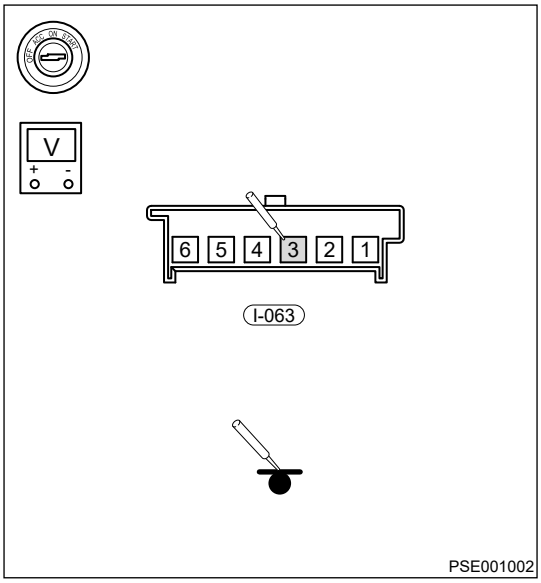
2	**Check angle sensor power supply**

(d) Turn ENGINE START STOP switch to OFF.

(e) Disconnect the angle sensor I-063.

(f) Perform the voltage inspection.

Multimeter Connection	Condition	Specified Condition
I-063 (3) - Body ground	ENGINE START STOP switch ON	12 - 14 V



NG → **Repair or replace power supply wire harness**

OK

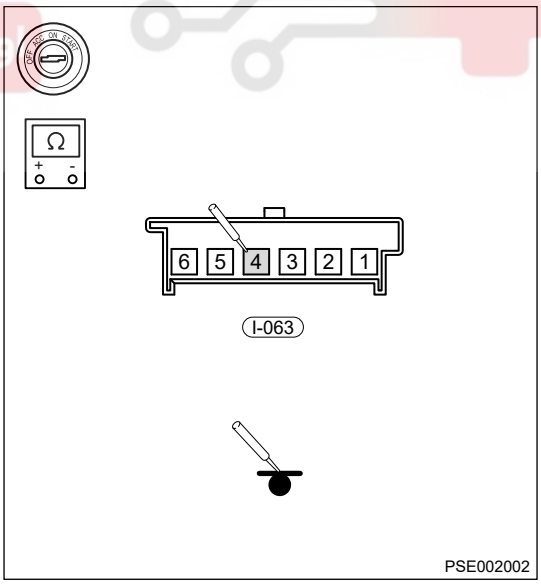
3	**Check angle sensor ground**

(g) Turn ENGINE START STOP switch to OFF.

(h) Disconnect the angle sensor I-063.

(i) Check for continuity between I-063 (4) and body ground GI-502 with multimeter ohm band.

Multimeter Connection	Condition	Specified Condition
I-063 (4) - Body ground	ENGINE START STOP switch “OFF”	⩽ 1 Ω



NG → **Repair or replace ground point**

OK → **Replace EPS**

DTC	**C1208-49**	**Output Stage Error-Internal Electronic Failure**
DTC	**C1209-49**	**Phase Current Error-Internal Electronic Failure**
DTC	**C120A-49**	**Rotor Position Sensor Error-Internal Electronic Failure**

DTC	Description	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunction Light
C1208-49	Output Stage Error-Internal Electronic Failure	Interior electric fault	Output failure	• Electronic Power Steering EPS	No assist	Correct
C1209-49	Phase Current Error-Internal Electronic Failure	Interior electric fault	Output failure		No assist	Correct
C120A-49	Rotor Position Sensor Error-Internal Electronic Failure	Interior electric fault	Input failure		No assist	Correct

DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing the following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

1	**Replace EPS**

(a) Replace EPS.
(b) Connect diagnostic tester and clear DTCs.
(c) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
(d) Read the fault information and confirm that the fault has been solved.

NG → **Replace with a new ECM to check if fault reoccurs**

OK → **Conduct test and confirm malfunction has been repaired.**

DTC	**C1211-1C**	**Supply Voltage Abnormal During Initialization-Circuit Voltage Out of Range**
DTC	**C1212-1C**	**Supply Voltage Uncritical Too High Warning-Circuit Voltage Out of Range**
DTC	**C1213-1C**	**High Power Supply Voltage**
DTC	**C1214-17**	**Supply Voltage Too High**
DTC	**C1215-1C**	**Supply Voltage Uncritical Too Low Warning-Circuit Voltage Out of Range**
DTC	**C1216-1C**	**Low Power Supply Voltage**
DTC	**C1217-16**	**Supply Voltage Too Low**

DTC	Description	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunction Light
C1211-1C	Supply Voltage Abnormal During Initialization-Circuit Voltage Out of Range	Circuit voltage is out of range	Input failure	• Battery • Wire harness or connector	No assist	Incorrect
C1212-1C	Supply Voltage Uncritical Too High Warning-Circuit Voltage Out of Range	Circuit voltage is out of range	Input failure		/	Incorrect
C1213-1C	High Power Supply Voltage	Circuit voltage is out of range	Input failure		Reduce assist	Incorrect
C1214-17	Supply Voltage Too High	Circuit voltage is more than threshold	Input failure		No assist	Incorrect
C1215-1C	Supply Voltage Uncritical Too Low Warning-Circuit Voltage	Circuit voltage is out of range	Input failure		/	Incorrect

DTC	Descripti-on	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunc-tion Light
	Out of Range					
C1216-1C	Low Power Supply Voltage	Circuit voltage is out of range	Input failure		Reduce assist	Incorrect
C1217-16	Supply Voltage Too Low	Circuit voltage below threshold	Input failure		No assist	Incorrect

DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing the following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

1	**Check battery voltage**

(a) Check if battery voltage is normal.

(b) Check battery voltage with voltage band of multimeter.

NG → **Check and repair battery**

OK

2	**Check fuse**

(a) Turn ENGINE START STOP switch to OFF.

(b) Remove fuse EF48 (80 A) from engine compartment fuse and relay

(c) Check if fuse is blown.

NG → **Replace fuse**

OK

3	**Check power supply voltage**

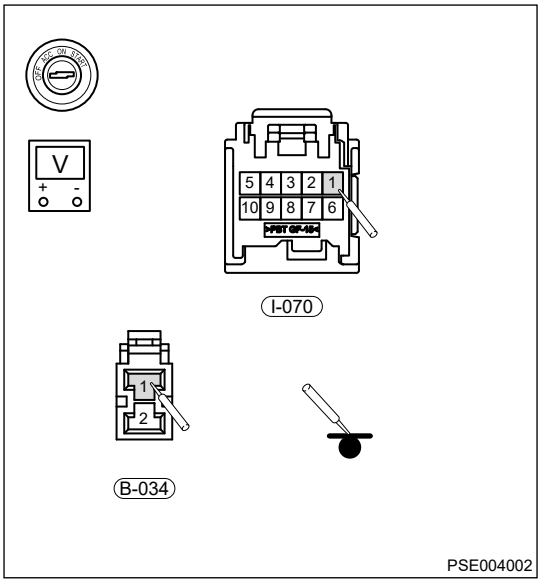
(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect the EPS I-070 (B1) and B-034 (A1).

(c) Turn ENGINE START STOP switch to ON.

(d) Voltage Inspection

Multimeter Connection	Condition	Specified Condition
I－070 (B1) - Body ground	ENGINE START STOP switch ON	12 - 14 V
B-034 (A1) - Body ground	ENGINE START STOP switch ON	12 - 14 V



NG → **Repair or replace power supply wire harness**

OK →

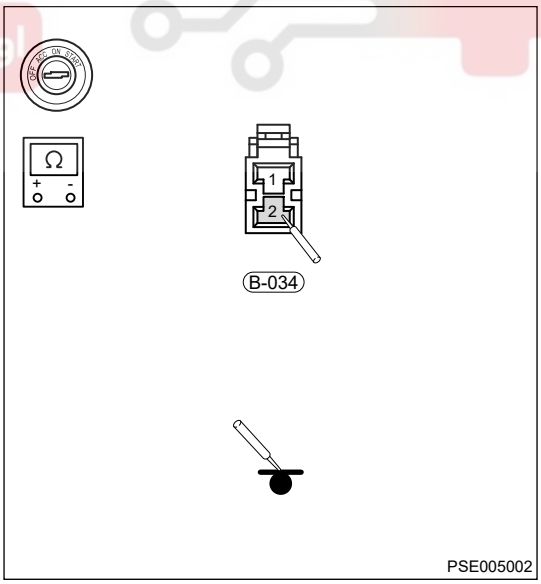
4	**Check ground**

(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect the EPS B-034 (A2).

(c) Perform the resistance inspection.

Multimeter Connection	Condition	Specified Condition
B-034 (A2) - Body ground	ENGINE START STOP switch “OFF”	⩽ 1 Ω



NG → **Repair or replace ground point**

OK →

5	Check wire harness and connector

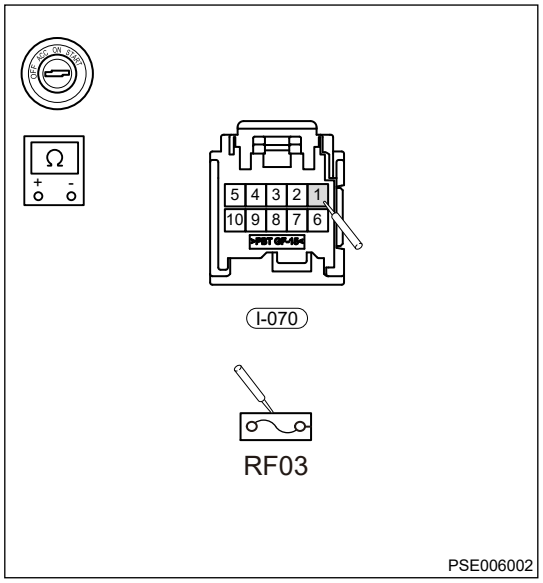
(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect the EPS I-070 and B-034.

(c) Check for continuity between I-070 (B1) and instrument panel fuse and relay box fuse RF03 with multimeter ohm band.

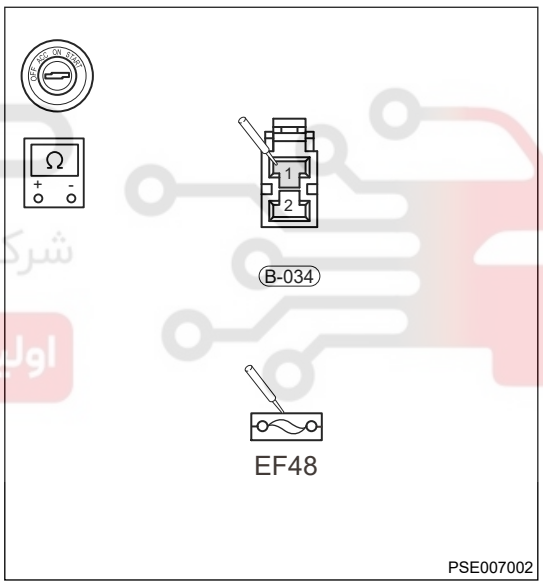
(d) Check for continuity between B-034 (A1) and engine compartment fuse and relay box EF48 with multimeter ohm band.

Multimeter Connection	Condition	Specified Condition
I－070 (B1) - RF03	ENGINE START STOP switch “OFF”	⩽ 1 Ω
B-034 (A1) - EF48	ENGINE START STOP switch “OFF”	⩽ 1 Ω



(e) Check for continuity between I-070 (B1) and body ground, B-034 (A1) and body ground with ohm band of multimeter.

Multimeter Connection	Condition	Specified Condition
I-070 (B1) - Ground	ENGINE START STOP switch “OFF”	∞
B-034 (A1) - Ground	ENGINE START STOP switch “OFF”	∞



NG	**System operates normally**
OK	**Repair or replace control circuit wire harness and connector**

DTC	**C1218-4B**	**Over Temperature Reduction-Over Temperature**
DTC	**C1219-4B**	**Temperature Out Of Range-Over Temperature**

DTC	Description	Fault Class Definition	Fault Type	Possible Causes	Malfunction Protection Measures	Malfunction Light
C1218-4B	Over Temperature Reduction-Over Temperature	Temperature too high	Input failure	• Steering gear • Electronic Power Steering EPS	Reduce assist	Incorrect
C121A-4B	Temperature Out Of Range-Over Temperature	Temperature too high	Input failure		Reduce assist.	Incorrect

DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing the following procedures.

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

1	**Parked in the shade to dissipate heat**

(a) Parked in the shade to dissipate heat.

NG → **Replace EPS**

OK

2	**Reconfirm DTCs**

(a) Connect diagnostic tester and clear DTCs.

(b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.

(c) Read the fault information and confirm that the fault has been solved.

NG → **Replace with a new ECM to check if fault reoccurs**

OK → **Conduct test and confirm malfunction has been repaired.**

DTC	**C121C-00**	**Software Configuration Invalid-No Sub Type Information**
DTC	**U0073-88**	**CAN Bus Off**
DTC	**U0100-87**	**Lost Communication with Engine Control System Module**
DTC	**U0129-87**	**Lost Communication With Brake System Control Module**
DTC	**U0140-87**	**Lost Communication with BCM**
DTC	**U0146 - 87**	**Lost Communication with Central Gateway**
DTC	**U1162-87**	**Lost Communication with Front Camera Module**
DTC	**U0142-87**	**Lost Communication with Around View Monitor Module**
DTC	**U0401-81**	**Invalid Data Received from EMS-Invalid Serial Data Received**
DTC	**U0418-81**	**Invalid Data Received from BSM-Invalid Serial Data Received**
DTC	**U0422-81**	**Invalid Data Received from BCM-Invalid Serial Data Received**
DTC	**U1405-81**	**Invalid Data Received From FCM**
DTC	**U0443-81**	**Invalid Data Received From AVM-Invalid Serial Date Received**

DTC Confirmation Procedure
Refer to Network Malfunction Diagnosis.

ON-VEHICLE SERVICE

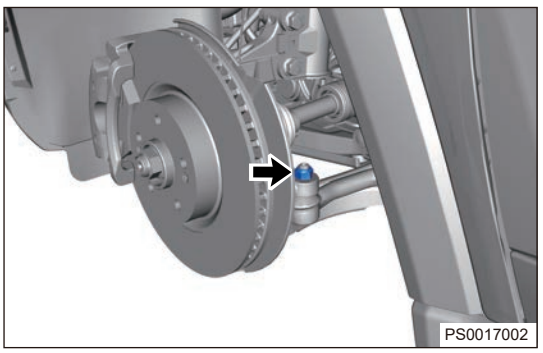
Ball Pin Assembly

Removal

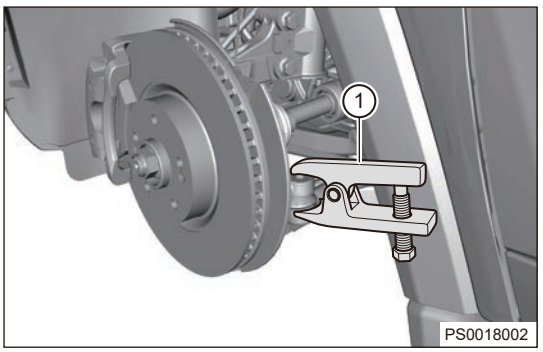
1. Set the steering wheel to straight-ahead position.
2. Turn off all electrical equipment and ENGINE START STOP switch.
3. Disconnect the negative battery cable.
4. Remove the front left wheel.
5. Remove the ball pin assembly.

   a. Remove locking nut (arrow) between left steering tie rod ball pin assembly and front left steering knuckle assembly.

   Tightening torque: 45 ± 5 N·m



   b. Install ball pin separator (1), and separate steering tie rod ball pin from steering knuckle assembly.



   c. Remove the ball pin assembly.

Inspection

1. Check tie rod ball pin for looseness. Replace ball pin assembly if necessary.
2. Check tie rod ball pin bush rubber for damage. Replace ball pin assembly if necessary.

Installation

1. Installation is in the reverse order of removal.

Caution
• After installing tie rod ball pin assembly, it is necessary to perform wheel alignment procedure.

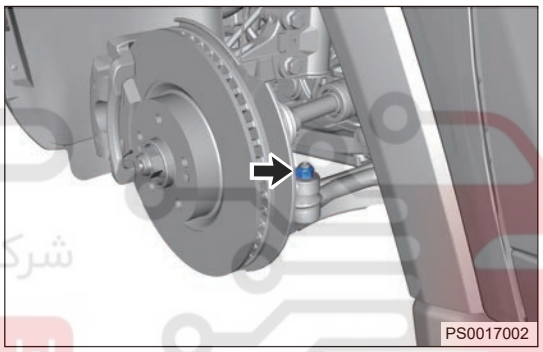
Steering Gear Assembly

Removal

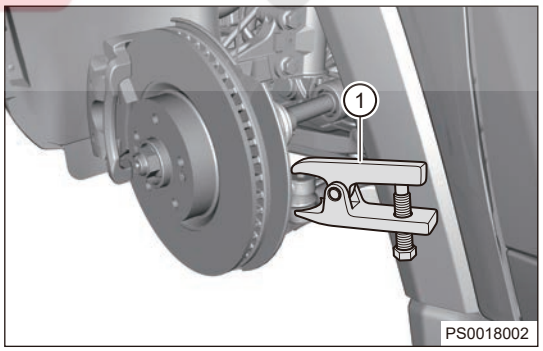
1. Set the front wheels to straight-ahead position.
2. Turn off all electrical equipment and ENGINE START STOP switch.
3. Disconnect the negative battery cable.
4. Remove front left and front right wheels.
5. Remove the engine compartment lower protector assembly.
6. Using a transmission carrier, support front sub frame welding assembly.
7. Remove front left and front right control arm assemblies.
8. Remove the tie rod ball pin.

   a. Remove coupling nut (arrow) between left steering tie rod ball pin assembly and front left steering knuckle assembly.

   Tightening torque: 45 ± 5 N·m

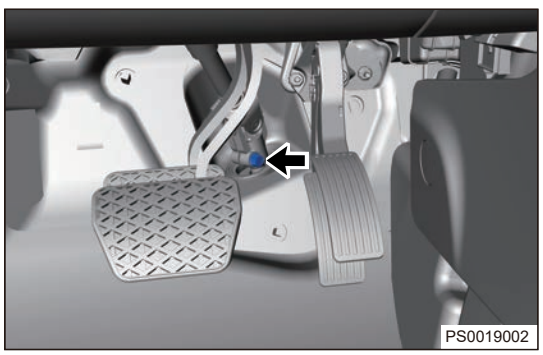


   b. Install ball pin separator (1), and separate steering tie rod ball pin from steering knuckle assembly.

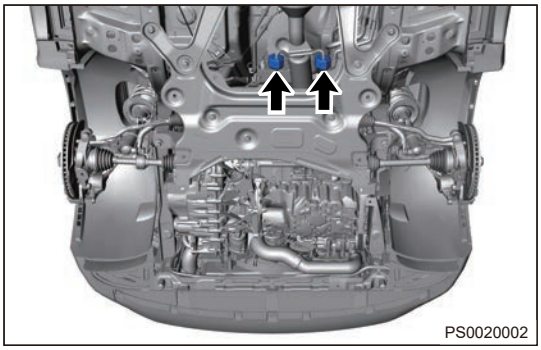


9. Remove coupling bolt (arrow) between steering column with intermediate shaft assembly and steering gear input shaft.

   Tightening torque: 49 ± 3 N·m

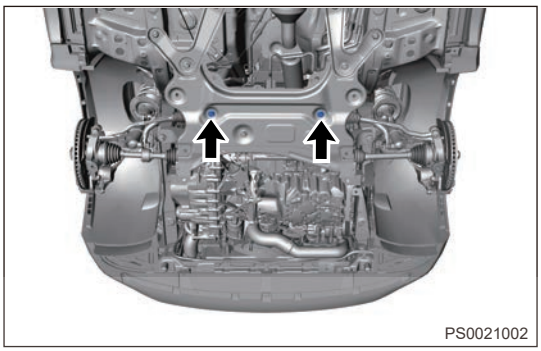


10. Remove 2 hanger blocks from the front sub frame assembly.


PS0020002

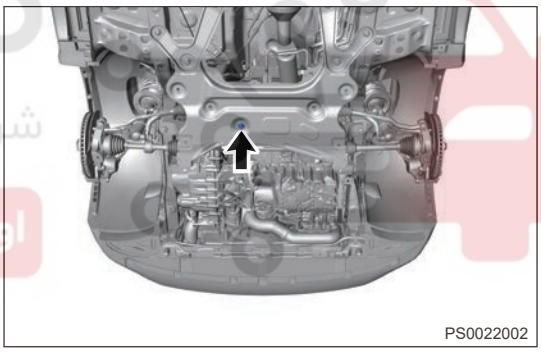
11. Remove 2 fixing bolts (arrow) fixing steering gear assembly from sub frame.

    Tightening torque: 180 ± 18 N·m


PS0021002

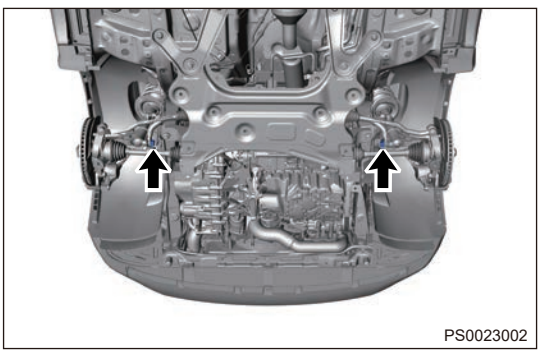
12. Remove coupling bolt (arrow) between rear mounting lower body and sub frame.

    Tightening torque: 150 ± 10 N•m


PS0022002

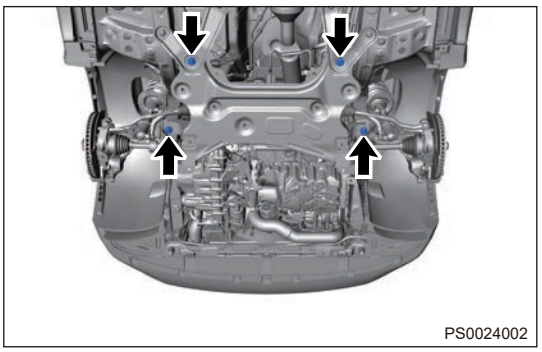
13. Remove coupling nut (arrow) between front stabilizer bar and stabilizer link.

    Tightening torque: 60 ± 6 N•m


PS0023002

14. Remove 4 fixing bolts (arrow) between sub frame and vehicle body, and lower sub frame slowly.

    Tightening torque: 220 ± 22 N•m



15. Remove the steering gear assembly.

Inspection

1. Check if steering gear dust boot is damaged, clamp is loose. Replace them if necessary to prevent water and micro dust from entering and causing parts failure prematurely.
2. Check if steering gear is damaged. Replace the steering gear assembly if necessary.

Installation

1. Installation is in the reverse order of removal.

Caution
• Install coupling bolt between steering column lower joint and steering gear input shaft securely. • After installing steering gear assembly, perform front wheel alignment procedure.

Steering Wheel Assembly

Removal

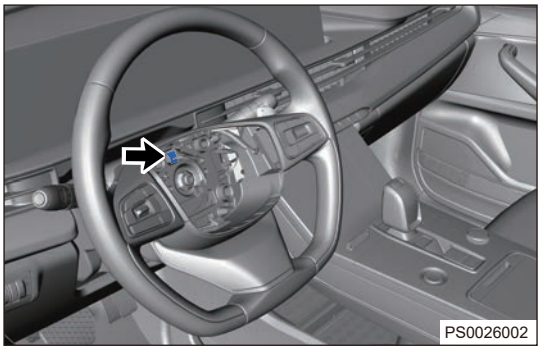
Warning
Be sure to read precautions for SRS airbag before removing steering wheel.

1. Set the steering wheel to straight-ahead position.
2. Turn off all electrical equipment and ENGINE START STOP switch.
3. Disconnect the negative battery cable.

Caution
Wait at least 90 seconds after disconnecting the negative battery cable to prevent airbag and belt pretensioner from being activated.

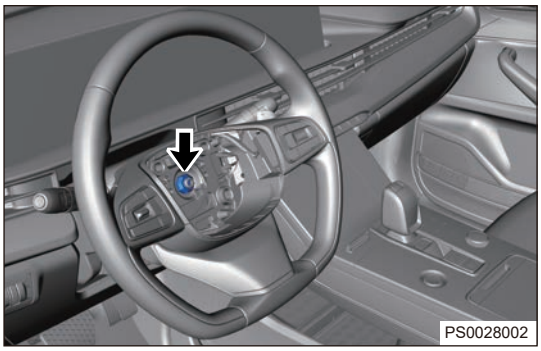
4. Remove the driver airbag assembly.
5. Remove the steering wheel assembly.

a. Disconnect the steering wheel quick button connector (arrow).



b. Secure steering wheel assembly, and put matchmarks on steering wheel assembly and steering column assembly, then remove steering wheel assembly fixing nut (arrow).

Tightening torque: 30 ± 3 N•m



c. As shown in the illustration, install the steering wheel remover, and then tighten it with a wrench to loosen steering wheel assembly from steering column assembly.

d. Remove the steering wheel assembly.

Caution
• Be careful when removing steering wheel assembly, to prevent damage to airbag connector and horn connector on spiral cable.

Inspection

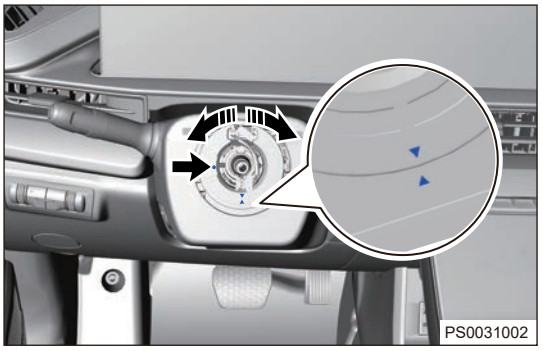
1. Check steering wheel assembly for damage or deformation. Replace steering wheel assembly if necessary.
2. Check spline in steering wheel assembly for damage. Replace steering wheel assembly if necessary.

Installation

Caution
• Check that front wheels are in straight-ahead position before installing steering wheel assembly. • It is necessary to perform steering angle sensor calibration after installing steering wheel assembly.

1. Adjust spiral cable to correct position (arrow).

   Hint:
   Fully turn spiral cable inner circle clockwise when realigning the center, and then turn it counterclockwise to align with the center while yellow ball occurs in the clear vertical window. Failure to follow these instructions may affect normal function of airbag system and cause injury to driver.



2. Pass airbag connector and horn connector through the hole of steering wheel assembly, and connect steering wheel quick button connector. Then align the matchmarks on steering wheel assembly and steering column assembly to install the steering wheel assembly.

3. Other installation procedures are in the reverse order of removal.

Caution
• Tighten steering wheel assembly fixing nut to specified torque. • Install each connector in place. • After repairing, check that airbag system operates normally.

Combination Switch Cover

Removal

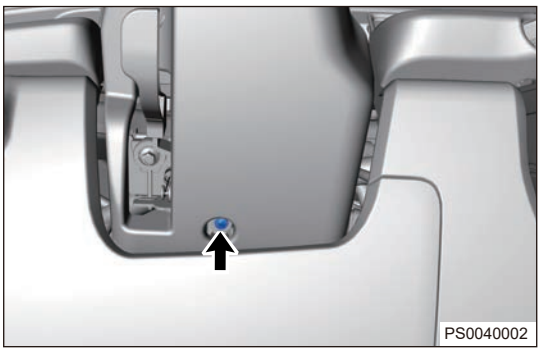
1. Set the steering wheel to straight-ahead position.

2. Turn off all electrical equipment and ENGINE START STOP switch.

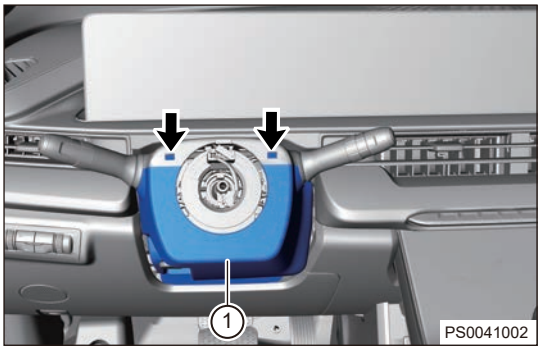
3. Disconnect the negative battery cable.

4. Remove the combination switch cover.

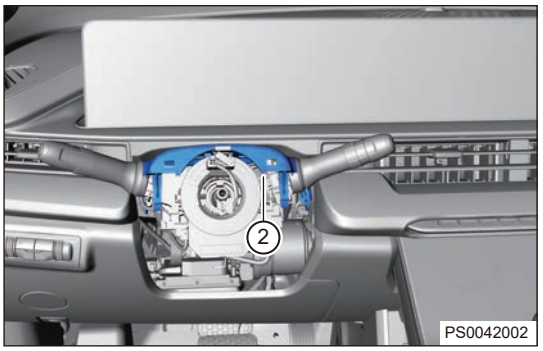
   a. Remove fixing screw (arrow) from lower part of combination switch cover.



b. Disengage connecting clips (arrow) between upper cover and lower cover, and separate upper cover and lower cover, then remove lower cover (1).



c. Disengage combination switch upper cover from instrument cluster trim frame upper curtain trim strip, remove upper cover (2).



Caution
• Operate carefully to prevent damage to components during removal.

Inspection

1. Check combination switch upper and lower covers for damage or deformation. Replace upper and lower covers if necessary.
2. Check if upper and lower cover clips are normal. Replace upper and lower covers if necessary.

Installation

1. Loosen steering wheel adjusting handle, and adjust steering column assembly to uppermost position, then tighten adjusting handle to uppermost position.
2. Insert steering column lower cover from right side of combination switch at an angle, and then install adjusting handle into cover hole.
3. After adjusting lower cover, install upper cover and fix upper and lower cover clips in place, then install self-tapping screws.

Caution
• Tighten self-tapping screws in place. • Operate carefully to prevent damage to components during installation.

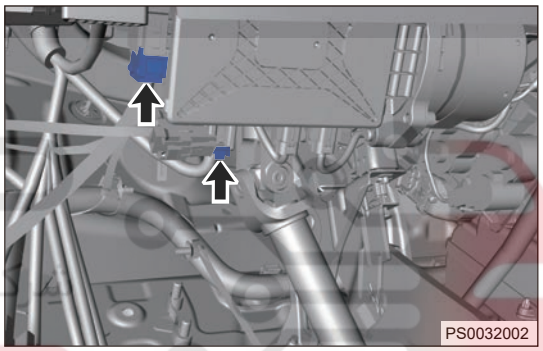
Steering Column with Intermediate Shaft Assembly

Removal

1. Set the steering wheel to straight-ahead position.
2. Turn off all electrical equipment and ENGINE START STOP switch.

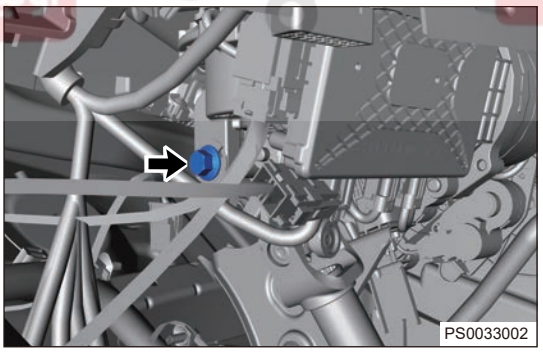
3. Disconnect the negative battery cable.
4. Remove the driver airbag assembly.
5. Remove the steering wheel assembly.
6. Remove the combination switch cover assembly.
7. Remove the spiral cable.
8. Remove the combination switch assembly.
9. Remove the lower left protector assembly.
10. Remove coupling bolt between steering column with intermediate shaft assembly and steering gear input shaft.
11. Remove the steering column with intermediate shaft assembly.

    a. Disconnect 2 connectors (arrow) from EPS controller.



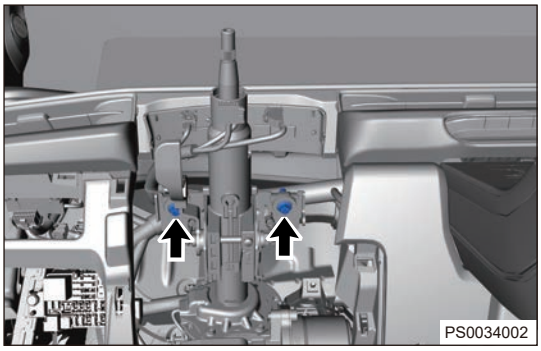
    b. Remove 1 fixing bolt (arrow) from steering column lower bracket.

    Tightening torque: 50 ± 5 N m



c. Remove 2 fixing nuts (arrow) from steering column upper bracket.

Tightening torque: 25 ± 3 N•m



d. Remove the steering column with intermediate shaft assembly.

Caution
• Wear glove during removal, prevent hands are contacted with steering column, which may cause rust. • DO NOT hold steering column handle position, but steering column position; do not bump, strike steering column when taking, carrying or assembling it, prevent steering column from collapse. • DO NOT touch interior ornaments when removing steering column with intermediate shaft assembly to avoid scratching interior ornaments.

Installation

1. Installation is in the reverse order of removal.

Caution
• Wear glove during removal, prevent hands are contacted with steering column, which may cause rust. • DO NOT hold steering column handle position, but steering column position; do not bump, strike steering column when taking, carrying or assembling it, prevent steering column from collapse. • Do not release steering column adjustment handle before tightening upper bracket bolt to prevent bracket from improper installation. • Adjustment handle is in locking state after steering column is assembled, do not transfer to next station, prevent handle is knocked during operation, which may cause person damage or handle breakage. • DO NOT touch interior ornaments when installing steering column with intermediate shaft assembly to avoid scratching interior ornaments.

2. It is necessary to perform motor position sensor calibration after assembling.