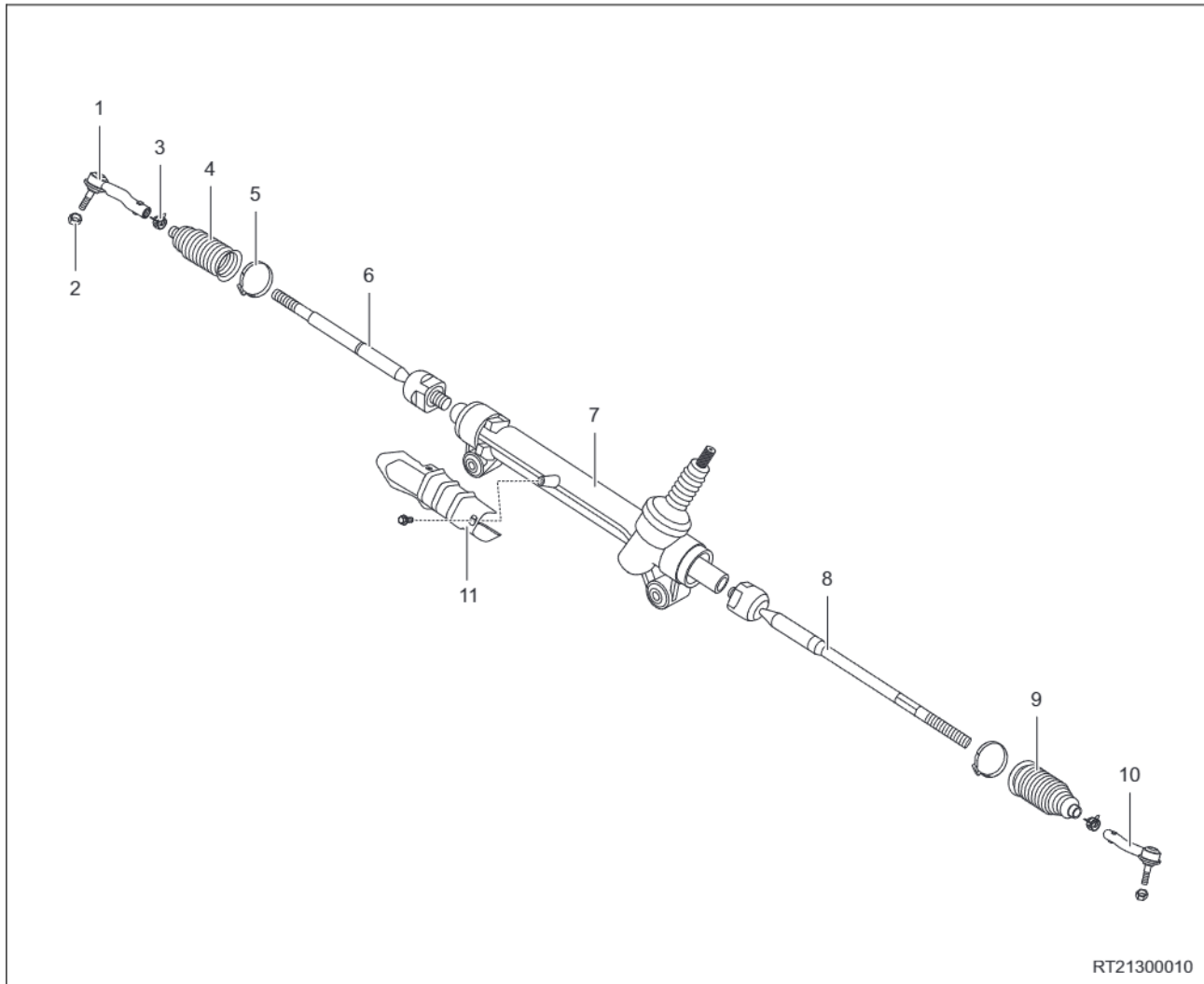


ELECTRONIC POWER STEERING

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GENERAL INFORMATION

Description



30

1 - Right Steering Tie Rod Ball Pin	2 - Tie Rod Ball Pin Locking Nut
3 - Tie Rod Dust Boot Clamp	4 - Right Steering Tie Rod Dust Boot
5 - Clamp	6 - Right Steering Tie Rod Assembly
7 - Steering Gear Assembly	8 - Left Steering Tie Rod Assembly
9 - Left Steering Tie Rod Dust Boot	10 - Left Steering Tie Rod Ball Pin
11 - Steering Gear Heat Shield	

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

Operation

The circular motion of the steering wheel is converted into linear motion of the rack by engaging the rack and pinion inside the steering gear. The rack can push and pull the tie rod by lateral motion, thus changing the direction of the front wheel.

The EPS controller controls the rotating direction of steering motor and the assisting current level based on the torque sensor signals to finish the steering assist. When the vehicle is not turning, the EPS controller does not send command to the steering motor controller, and the steering motor does not operate.

Specifications

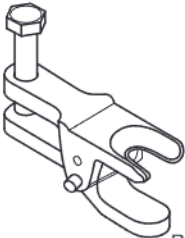
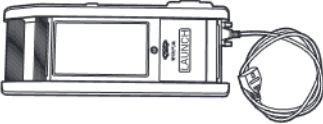
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Torque Specifications

Description	Torque (N·m)
Ball Pin Locking Nut	35 ± 3
Coupling Bolt between Steering Gear Input Shaft and Steering Column with Intermediate Shaft Assembly	60 ± 5
Steering Gear Fixing Bolt	120 ± 10

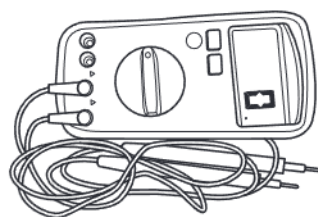
Tools

Special Tools

Ball Pin Separator	 RCH0000024
X-431 3G Diagnostic Tester	 RCH0000001

General Tool

Digital Multimeter

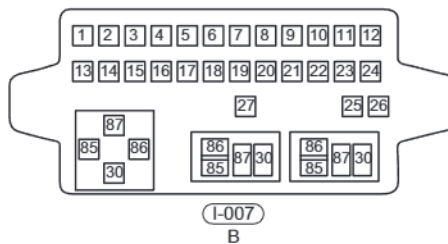
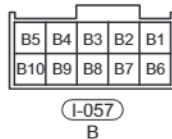
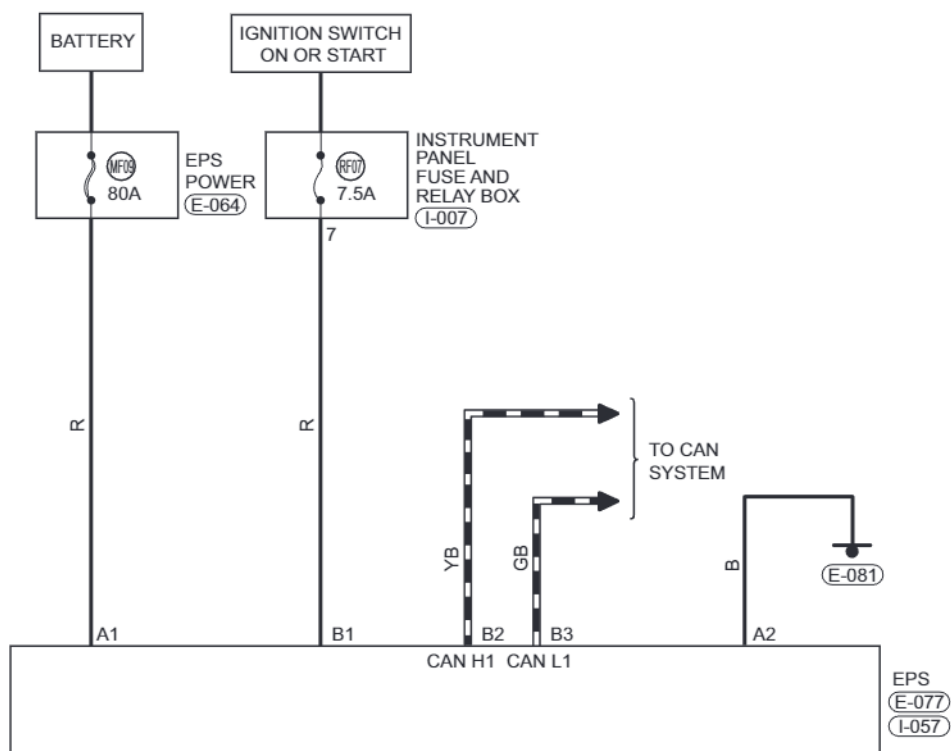


RCH0000002

30

Circuit Diagram

30



ET21300010

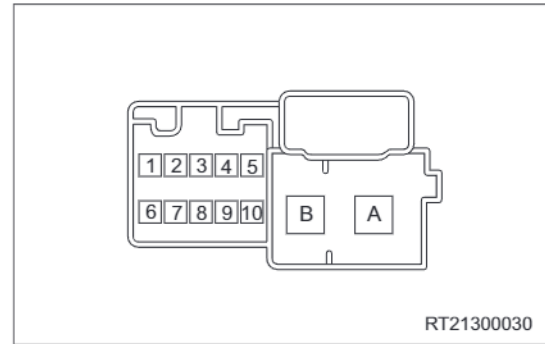
EPS Controller Pin Definition

Vehicle supply: controller supply connector (connector A)

Pin	Definition
A	supply positive
B	supply negative

Vehicle signal: controller signal connector (connector B)

Pin	Definition
1	IGN signal
2	CAN High
3	CAN Low
4	-
5	-
6	Signal ground
7	-
8	-
9	-
10	-



30

DIAGNOSIS & TESTING

Diagnosis Help

1. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC), and make it communicate with vehicle electronic module by the data network.
2. Confirm that the malfunction exists, and perform the diagnosis tests and service procedures.
3. If the Diagnostic Trouble Codes (DTC) cannot be cleared, it indicates that there is a current malfunction.
4. Only the digital multimeter can be used when measuring the voltage of the electronic system.
5. Refer to any Technical Bulletin applied to the malfunction.
6. Visually check the related wire harness.
7. Check and clean the Electronic Power Steering controller (EPS controller) ground related to the latest DTC.
8. If numerous trouble codes are set, refer to the circuit diagram and look for any common ground circuit or power supply circuit applied to the DTC.

Intermittent DTC Troubleshooting

If it is an intermittent problem, perform the following procedures:

1. Check the connector for looseness.
2. Check the wire harness for wear, piercing, pinch or partial break.
3. Observe the diagnostic tester data related to this circuit.
4. Wiggle the related wire harness and connector and observe if the signal is interrupt in the related circuit.
5. Try to duplicate the conditions under which the DTC is set.
6. Check for the data that has changed or the DTC that has been reset during the wiggle test.
7. Check if the terminals are broken, bent, protruded out or corroded.
8. Check the sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign matter.
9. A data recorder and/or oscilloscope can be helpful in diagnosing the intermittent malfunction.

Ground Inspection

Groundings are often exposed to moisture, dirt or other corrosive areas. Corrosion (rust) may form additional resistance. This additional resistance will change the way in which a circuit works. A loose or corroded ground can drastically affect the electronically controlled circuit. Perform the following operations:

1. Remove the ground bolt or nut.
2. Check all the contact surfaces for tarnish, dirt, rust, etc.
3. Clean as necessary to ensure that the contacting is in a good condition.
4. Reinstall the bolt or nut securely.
5. Check for the accessories which may interfere with the ground circuit.
6. If several wires are crimped into one ground terminal, check for proper crimps. Make sure that all the wire harnesses are clean, securely fastened and good contacted without crimping any excessive insulation coat.

Diagnostic Trouble Code (DTC) Chart

Code Name	Code Name
C1301	Steering Angle Sensor Electrical Error
C1302	Steering Angle Sensor Not Trimmed
C1307	Sensor Supply Voltage Error
C1308	Fail safety Relay Error
C1315	W/LAMP Fault
C1323	ECU Hardware Fault
C1332	Torque Sensor Error
C1351	Motor Position Sensor Error
C1352	Motor Error
C1901	Battery Under Voltage Error
C1902	Battery Over Voltage Error
C1910	IGN Voltage Error
U0155	ICM Update Error
U0418	Vehicle Speed Error
U1000	EMS Signal Error
U1027	CAN Update Error

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DTC	C1301	Steering Angle Sensor Electrical Error
DTC	C1302	Steering Angle Sensor Not Trimmed
DTC	C1307	Sensor Supply Voltage Error
DTC	C1323	ECU Hardware Fault
DTC	C1332	Torque Sensor Error
DTC	C1351	Motor Position Sensor Error
DTC	C1352	Motor Error

DTC	DTC Definition	Possible causes
C1301	Steering Angle Sensor Electrical Error	• EPS booster assembly circuit • EPS booster assembly fault
C1302	Steering Angle Sensor Not Trimmed	
C1307	Sensor Supply Voltage Error	
C1323	ECU Hardware Fault	
C1332	Torque Sensor Error	
C1351	Motor Position Sensor Error	
C1352	Motor Error	

CAUTION

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

Diagnosis Procedure

1	Check EPS booster assembly power supply and ground circuit
----------	---

- a. Check EPS booster assembly power supply and ground circuit.

NG

Repair or replace wire harness or connector

OK

2**Check for DTCs**

- a. Using X-431 3G diagnostic tester, read the EPS DTC.
- b. Check if DTC C1301, C1302, C1307, C1323, C1332, C1351 or C1352 still exists.

NG**Replace EPS booster assembly****OK****30**

The system is operating normally.
Reassemble the vehicle and perform a road test to confirm that the malfunction reported by the customer has been repaired.

DTC

C1901

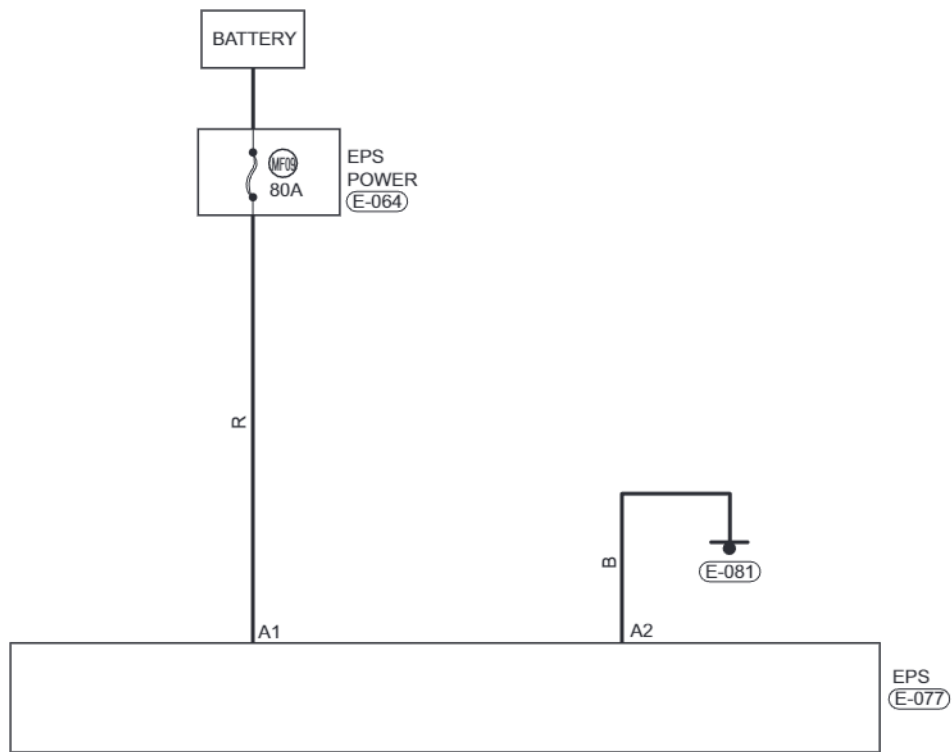
Battery Under Voltage Error

DTC

C1902

Battery Over Voltage Error

30



ET21300020

DTC	DTC Definition	Possible causes
C1901	Battery Under Voltage Error	• Fuse • Wire harness or connector • Battery • Battery terminal • EPS booster assembly
C1902	Battery Over Voltage Error	

CAUTION

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

30**Diagnosis Procedure****1 Check battery**

- a. Check if battery voltage is normal.

NG**Recharge or replace battery****OK****2 Check battery terminals**

- a. Check if battery terminals are loose or corroded.

NG**Tighten or replace battery terminals****OK****3 Check EPS ground point**

- a. Turn ignition switch to LOCK.
b. Check EPS ground point E-081.

NG**Repair or replace ground wire harness or ground point****OK**

4 Check EPS power supply connector

- a. Disconnect EPS power supply connector E-077.
- b. Check connector.

NG

Repair or replace EPS power supply connector

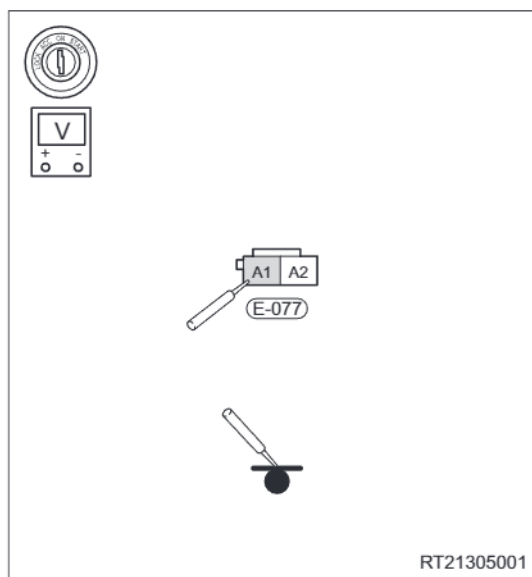
30**OK****5 Check EPS power supply voltage**

- a. Measure voltage between EPS power supply connector E-077 terminal A1 and body ground.

Multimeter Connection	Condition	Specified Condition
E-077 (A1) - Body ground	Always	11 to 14 V

OK

Go to step 8

**NG****6 Check EPS power supply fuse**

- a. Check EPS power supply fuse MF09 (80A) outside the engine compartment fuse and relay box.

NG

Replace EPS power supply fuse

OK

7

Check wire harness and connector (EPS - EPS power supply)

- Disconnect EPS power supply connector E-064.
- Check wire harness between the connector terminals.

Check for Open

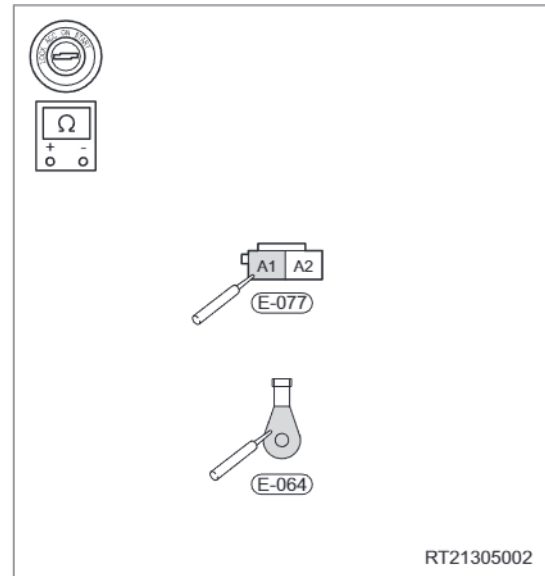
Multimeter Connection	Specified Condition
E-064 - E-077 (A1)	Continuity

Check for Short

Multimeter Connection	Specified Condition
E-077 (A1) - Body ground	No continuity

NG

Repair or replace wire harness or connector



OK

30

Repair or replace engine compartment fuse and relay box or wire harness (engine compartment fuse and relay box - battery)

8

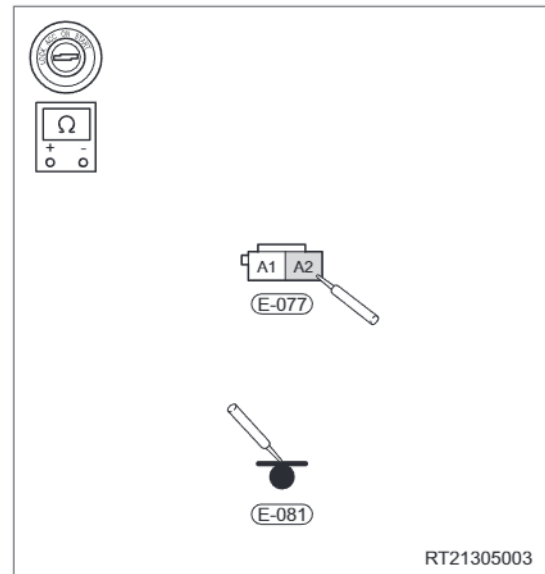
Check EPS ground circuit

- Disconnect EPS connector E-077.
- Check wire harness between terminal A2 of E-077 and ground point E-081.

Multimeter Connection	Condition	Specified Condition
E-077 (A2) - E-081	Always	Continuity

NG

Repair or replace wire harness or connector



OK

9**Check for DTCs**

- a. Using X-431 3G diagnostic tester, read the EPS DTC.
- b. Check if DTC C1901 or C1902 still exists.

NG**Replace EPS booster assembly****OK****30**

The system is operating normally.

Reassemble the vehicle and perform a road test to confirm that the malfunction reported by the customer has been repaired.

DTC	DTC Definition	Possible causes
C1910	IGN Voltage Error	- Fuse - Wire harness or connector - EPS booster assembly

 CAUTION

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

30**Diagnosis Procedure****1 Check EPS ground point**

- Turn ignition switch to LOCK.
- Check EPS ground point E-081.

NG**Repair or replace ground wire harness or ground point****OK****2 Check EPS connector**

- Disconnect two EPS connectors.
- Check connectors.

NG**Repair or replace EPS connector****OK**

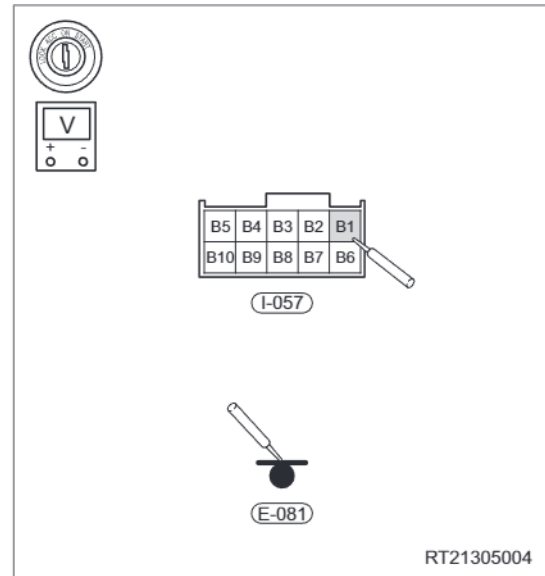
3 Check EPS ignition switch voltage

- a. Measure voltage between terminal B1 of EPS connector B I-057 and body ground.

Multimeter Connection	Condition	Specified Condition
I-057 (B1) - Body ground	Ignition switch ON	11 to 14 V

OK

Go to step 8



NG

4 Check EPS fuse

- a. Unplug EPS fuse RF07 (7.5 A) from instrument panel fuse and relay box.
b. Check resistance of fuse.

Standard resistance: less than 1 Ω

NG

Replace fuse

OK

30

5 Check wire harness and connector (EPS - instrument panel fuse and relay box)

- Disconnect instrument panel fuse and relay box connector I-007.
- Check wire harness between connector terminals.

Check for Open

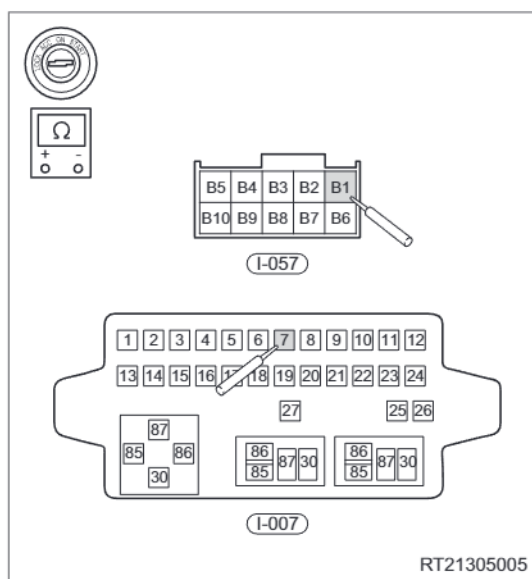
Multimeter Connection	Specified Condition
I-007 (7) - I-057 (B1)	Continuity

Check for Short

Multimeter Connection	Specified Condition
I-007 (7) - Body ground	No continuity

NG

Repair or replace wire harness or connector



OK

Repair or replace instrument panel fuse and relay box or wire harness (instrument panel fuse and relay box - ignition switch)

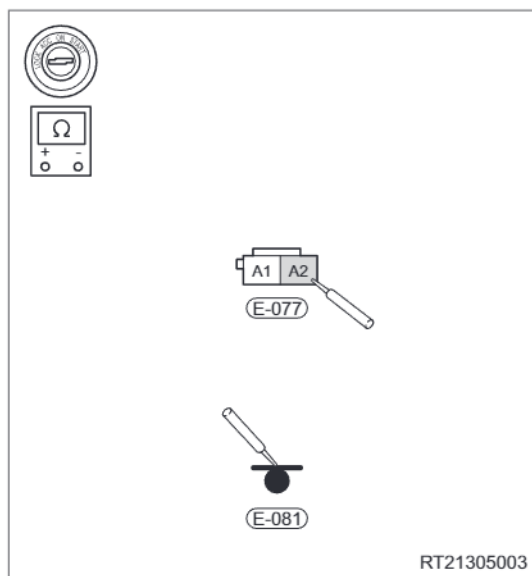
6 Check EPS ground circuit

- Disconnect EPS connector E-077.
- Check wire harness between terminal A2 of E-077 and ground point E-081.

Multimeter Connection	Condition	Specified Condition
E-077 (A2) - E-081	Always	Continuity

NG

Repair or replace wire harness or connector



OK

7**Check for DTCs**

- a. Using X-431 3G diagnostic tester, read the EPS DTC.
- b. Check if DTC C1910 still exists.

NG**Replace EPS booster assembly****OK****30**

The system is operating normally.
Reassemble the vehicle and perform a road test to confirm that the malfunction reported by the customer has been repaired.

ON-VEHICLE SERVICE

Ball Pin Assembly

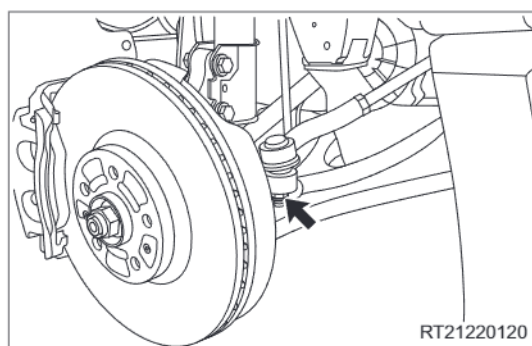
Removal

HINT:

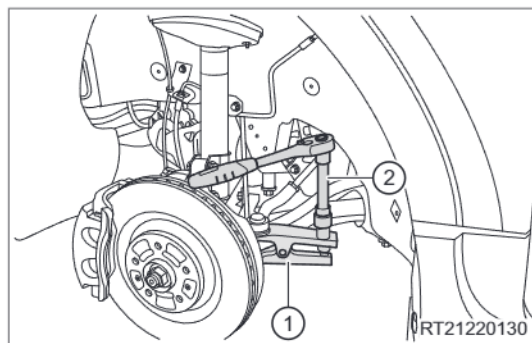
- Use the same procedures for the right side and left side.
- Procedures listed below are for the left side.

30

1. Turn the steering wheel to the straight ahead position.
2. Turn off all the electrical equipment and ignition switch.
3. Disconnect the negative battery cable.
4. Remove the front left wheel ([See page 24-9](#)).
5. Remove the tie rod ball pin.
 - a. Remove the left side steering tie rod assembly ball pin and locking nut (arrow) of front left steering knuckle assembly.
(Tightening torque: $35 \pm 3 \text{ N}\cdot\text{m}$)



- b. Install ball pin separator (1), and tighten ball pin separator bolt with wrench (2), then separate the tie rod ball pin from the steering knuckle assembly.



- c. Remove the ball pin from the steering gear tie rod.

Inspection

1. Check the tie rod ball pin for looseness and the rubber boot for damage. Replace the ball pin assembly if necessary.
2. Check the tie rod ball pin dust boot for damage. If damaged, replace the dust boot.

Installation

Installation is in the reverse order of removal.

CAUTION

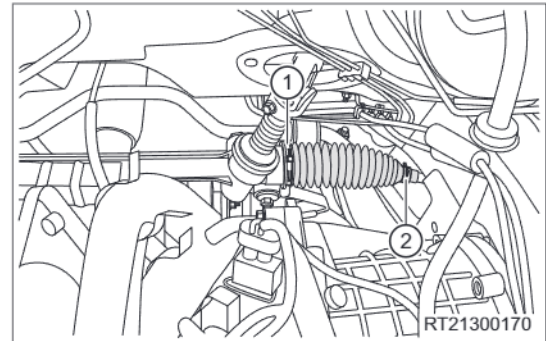
- After installing the tie rod ball pin assembly, it is necessary to perform the wheel alignment procedure ([See page 23-50](#)).

Steering Tie Rod Assembly

Removal

HINT:

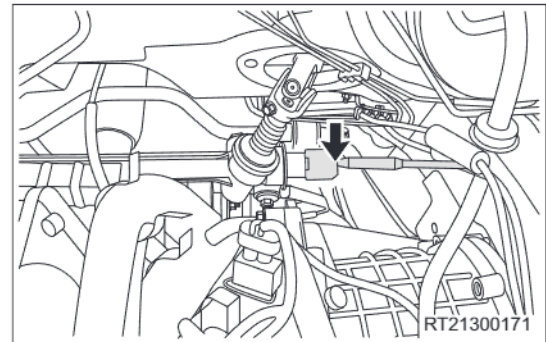
- Use the same procedures for the right side and left side.
 - Procedures listed below are for the left side.
1. Remove engine trim cover assembly (See page 10-10).
 2. Remove air filter assembly (See page 10-17).
 3. Remove front wheel (See page 24-9).
 4. Remove ball pin assembly (See page 30-22).
 5. Remove steering tie rod assembly.
 - a. Remove steering tie rod boot clamp (2).
 - b. Remove steering tie rod boot clamping ring (1) and remove steering tie rod boot.



CAUTION

- Operate carefully to prevent damage to the boot.
- It is necessary to replace with new clamping ring when reinstall the tie rod boot.

- c. Using a wrench, remove steering tie rod assembly (arrow).



Inspection

1. Check tie rod dust boot for damage and clamp for normal conditions. Replace the tie rod boot and clamp if necessary to prevent water and micro dust from entering and causing parts failure prematurely.
2. Check tie rod for deformation or wear and ball for insufficient lubrication. Replace tie rod assembly or add grease if necessary.

Installation

Installation is in the reverse order of removal.

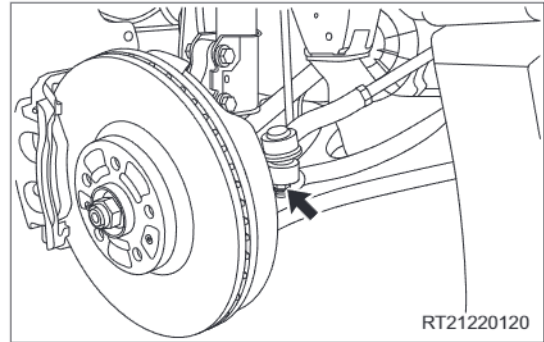
CAUTION

- It is necessary to apply thread seal gum to the tie rod ball pin.
- It is necessary to fit the tie rod ball pin face and the rack face closely.

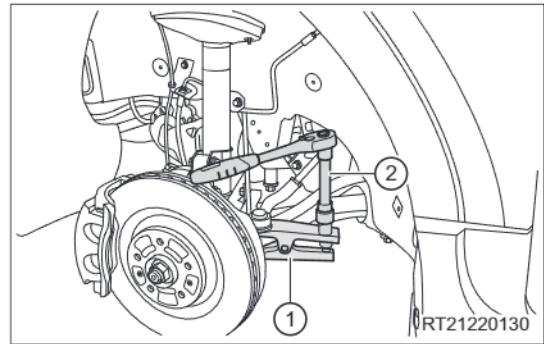
Steering Gear Assembly

Removal

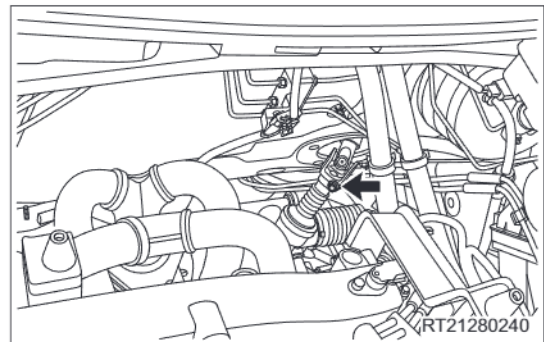
1. Turn the steering wheel to the straight ahead position.
2. Turn off all the electrical equipment and ignition switch.
3. Disconnect the negative battery cable.
4. Remove the front wheels (See page 24-9).
5. Remove steering tie rod ball pin.
 - a. Remove the left side steering tie rod assembly ball pin and locking nut (arrow) of front left steering knuckle assembly.
(Tightening torque: $35 \pm 3 \text{ N}\cdot\text{m}$)



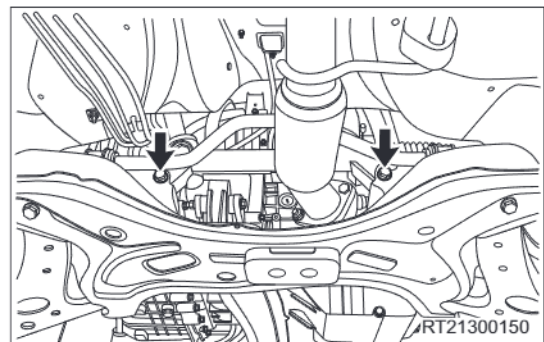
- b. Install ball pin separator (1), and tighten ball pin separator bolt with wrench (2), then separate the tie rod ball pin from the steering knuckle assembly.



6. Remove the coupling bolt (arrow) between steering column with intermediate shaft assembly and steering gear input shaft.
(Tightening torque: $60 \pm 5 \text{ N}\cdot\text{m}$)



7. Remove two fixing bolts on both sides of steering gear brackets.
(Tightening torque: $120 \pm 10 \text{ N}\cdot\text{m}$)



8. Remove steering gear assembly.

Inspection

1. Check the steering gear dust boot for damage and the clamp for looseness. Replace them if necessary. Otherwise, it is easy for water and dust to enter, and cause parts failure prematurely.
2. Check the steering gear for damage. Replace the power steering gear if necessary.

Installation

Installation is in the reverse order of removal.

30

HINT:

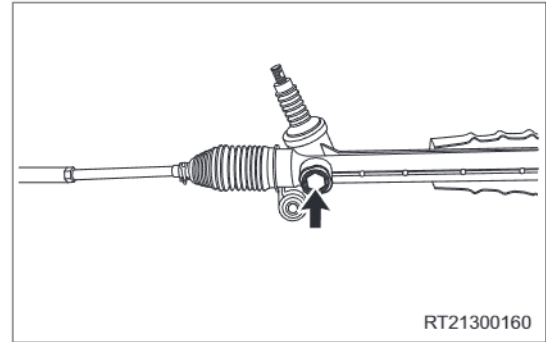
When installing the coupling bolt between the steering column lower universal joint and the steering gear input shaft, it is necessary to assemble it reliably.

CAUTION

- Perform the front wheel alignment procedure after installing the steering gear ([See page 23-50](#)).

Steering Gear Clearance Adjustment

1. Position the wheels straight ahead.
2. Turn the steering wheel to the right and left.
3. If there is noise in the steering gear, adjust the bolt (arrow) until the collision noise cannot be heard when turning the steering wheel.



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4. Retighten the bolt in 1/8 turn (approximately 45°).
5. Perform a road test.
6. Loosen the bolt by 15° if the steering gear cannot return to the center position by itself.
7. Perform a road test.

