

GROUP 37

ELECTRIC POWER STEERING (EPS)

CONTENTS

SERVICE SPECIFICATIONS.....	37-3	.....	37-19
LUBRICANT.....	37-3	Code No.C1550 ECU internal error.....	37-21
SEALANT.....	37-3	Code No.C1561 Engine revolution data (CAN).....	37-21
SPECIAL TOOLS.....	37-4	Code No.C1564 Vehicle speed data invalid	37-22
TROUBLESHOOTING.....	37-6	Code No.C1565 Engine revolution data invalid	37-23
DIAGNOSIS TROUBLESHOOTING FLOW	37-6	Code No.C1566 Invalid data received from AWC	37-24
DIAGNOSTIC FUNCTION	37-7	.....	37-24
CHECK OF ELECTRIC POWER STEERING	37-7	Code No. C1657 Implausible coding data ..	37-25
WARNING LAMP	37-8	Code No. U0100 Engine CAN timeout	
DIAGNOSIS CODE CHART	37-8	Code No. U0114 4WD CAN timeout	
DIAGNOSIS CODE PROCEDURES	37-9	Code No. U0141 ETACS CAN timeout	37-26
Code No.C1510 Torque sensor main		Code No. U1073 Bus-off	37-27
Code No.C1511 Torque sensor sub	37-9	Code No. U1190 No receive fault detect signal	
Code No.C1512 Torque sensor main/sub voltage	37-11	.....	37-27
.....		Code No. U1195 Coding not completed	
Code No.C1513 Torque sensor power supply	37-12	Code No. U1197 Coding data unavailable ..	37-28
Code No.C1514 Torque sensor power supply too low	37-14	TROUBLE SYMPTOM CHART.....	37-29
.....		SYMPTOM PROCEDURES	37-29
Code No.C1521 Motor turning angle (output)		Inspection Procedure 1: M.U.T.-III cannot communicate	
Code No.C1522 Motor turning angle range	37-15	with electric power steering system <ECU power supply	
Code No.C1530 Motor FET driver		circuit system check>.....	37-29
Code No.C1531 Motor current too low		Inspection Procedure 2: Electric power steering system	
Code No.C1532 Motor output current too large		warning display illuminates but diagnosis code is not	
Code No.C1533 Motor terminal initial voltage		stored.	37-30
Code No.C1534 Motor terminal monitor voltage		Inspection Procedure 3: The steering has become	
Code No.C1535 Motor output current		heavy, but electric power steering warning display does	
Code No.C1536 Motor terminal voltage too high	37-16	not illuminate. (Power supply voltage assist fall)	
.....		.....	37-31
Code No.C1540 Power supply voltage too high	37-18	DATA LIST REFERENCE TABLE.....	37-32
.....		ACTUATOR TEST REFERENCE TABLE ..	37-36
Code No.C1541 Power supply voltage too low		CHECK AT ELECTRIC POWER STEERING-ECU	
.....		.....	37-36
ON-VEHICLE SERVICE		ON-VEHICLE SERVICE	37-37

STEERING WHEEL PLAY CHECK	37-37	.....	37-43
STEERING ANGLE CHECK.....	37-38	REMOVAL AND INSTALLATION	37-43
BALL JOINT DUST COVER CHECK	37-38	INSPECTION.....	37-45
BALL JOINT ROTATION TORQUE CHECK	37-38	DISASSEMBLY AND REASSEMBLY	37-46
STATIONARY STEERING FORCE CHECK	37-39	INSPECTION.....	37-47
RETURN CHECK OF STEERING WHEEL	37-39		
INSPECTION OF STEERING COLUMN SHAFT ASSEMBLY IMPACT ABSORBING MECHANISM	37-40	POWER STEERING GEAR BOX AND LINKAGE	37-48
		REMOVAL AND INSTALLATION	37-48
		INSPECTION.....	37-48
		DISASSEMBLY AND REASSEMBLY	37-48
STEERING WHEEL	37-41		
REMOVAL AND INSTALLATION	37-41	ELECTRIC POWER STEERING CONTROL UNIT (EPS-ECU).....	37-51
STEERING COLUMN SHAFT ASSEMBLY		REMOVAL AND INSTALLATION	37-51

SERVICE SPECIFICATIONS

M1372000302252

Item		Standard value	Limit
Steering wheel free play mm	Engine running	–	30 or less
	Engine stopped	16.5 or less	–
Steering angle	Inner wheel	38° 50' ± 1° 30' (Difference between right and left wheels must be 2°00' or less)	–
	Outer wheel (reference value)	32° 20'	–
Tie rod end ball joint turning torque N·m		3.92 or less	–
Stationary steering force N	Steering force	29 or less	–
	Fluctuation band	5.9 or less	–
Total rotational torque of steering column shaft N·m	Total rotational torque	1.77 or less	–
	Torque fluctuation	0.6 or less	–
Total rotational torque of pinion N·m	Total rotational torque	0.7 – 1.3 N·m	–
	Torque fluctuation	0.7 or less	–
Band crimped value mm		2.4 – 2.8	–

LUBRICANT

M1372000401074

Item	Specified lubricant	Quantity
Bellows	Silicone grease	As required

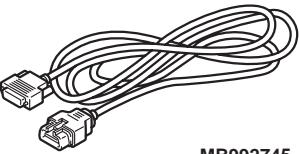
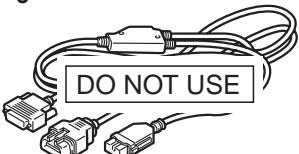
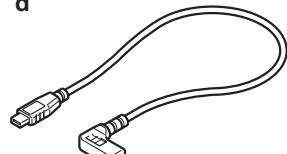
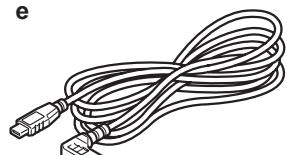
SEALANT

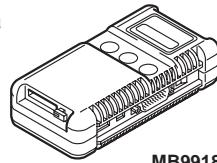
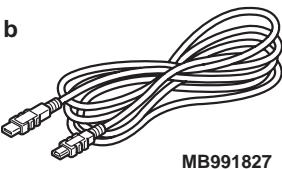
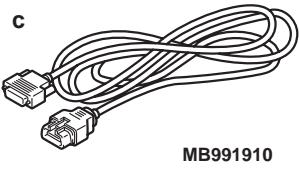
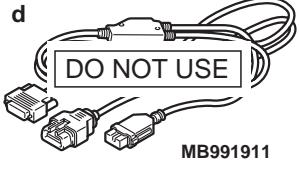
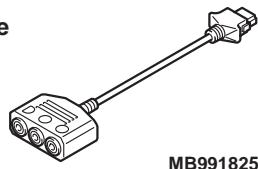
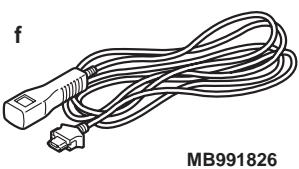
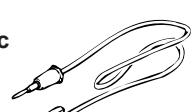
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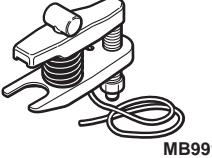
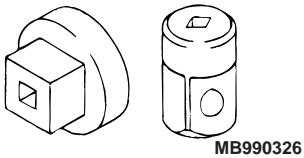
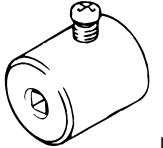
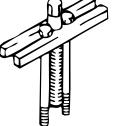
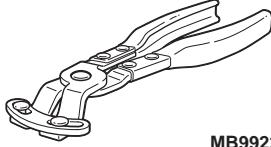
Item	Specified sealant	Quantity
Tie-rod bellows outer side	3M ATD Part No. 8663 or equivalent	As required

SPECIAL TOOLS

M1372000601852

Tool	Number	Name	Use
a 	MB992744	a. MB992744 b. MB992745 c. MB992746 d. MB992747 e. MB992748	a. Vehicle communication interface-Lite (V.C.I.-Lite) b. V.C.I.-Lite main harness A (for vehicles with CAN communication) c. V.C.I.-Lite main harness B (for vehicles without CAN communication) d. V.C.I.-Lite USB cable short e. V.C.I.-Lite USB cable long
b 	MB992745		
c 	MB992746		
d 	MB992747		
e 	MB992748 ACB05421AB		

Tool	Number	Name	Use
 a  b  c  d  e  f  MB991955	MB991955 a. MB991824 b. MB991827 c. MB991910 d. MB991911 e. MB991825 f. MB991826	M.U.T.-III sub-assembly a. Vehicle Communication Interface (V.C.I.) b. M.U.T.-III USB cable c. M.U.T.-III main harness A (Vehicles with CAN communication system) d. M.U.T.-III main harness B (Vehicles without CAN communication system) e. M.U.T.-III measurement adapter f. M.U.T.-III trigger harness	 CAUTION For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly. Electrical power steering check (Diagnosis code display, data list display and actuator test display by M.U.T.-III)
 a  b  c  d  MB991223	MB991223 a. MB991219 b. MB991220 c. MB991221 d. MB991222	Harness set a. Check harness b. LED wiring harness c. LED wiring harness adapter d. Probe	Continuity check and voltage measurement at harness wire or connector a. Contact pressure inspection at connector pin b. Power supply circuit inspection c. Power supply circuit inspection d. Commercial tester connection

Tool	Number	Name	Use
 MB992006	MB992006	Extra fine probe	Making voltage and resistance measurement during troubleshooting
 MB991897	MB991897 or MB992011	Ball joint remover	Knuckle and ball joint disconnection <i>NOTE: Steering linkage puller (MB990635 or MB991113) is also used to disconnect knuckle and tie rod end ball joint.</i>
 MB990326	MB990326	Preload socket	<ul style="list-style-type: none"> • Ball joint rotation torque measurement • Steering column shaft total rotation torque measurement
 MB991006	MB991006	Preload socket	Steering gear total pinion torque measurement
 MB990803	MB990803	Steering wheel puller	Steering wheel disconnection
 MB992209	MB992209	Bellows band clipping tool	Tie-rod bellows band installation
 MB992249	MB992249	Variable spanner	Tie-rod removal and installation

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

M1372007300309

Refer to GROUP 00 – Contents of Troubleshooting .

DIAGNOSTIC FUNCTION

M1372007400191

HOW TO READ DIAGNOSIS CODE

Connect the M.U.T.-III to the 16-pin diagnosis connector, and read a diagnosis code (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Diagnosis Function).

HOW TO ERASE DIAGNOSIS CODE

Connect the M.U.T.-III to the 16-pin diagnosis connector, and erase a diagnosis code (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Diagnosis Function).

Display item list

Item No.	Item name	Data item	Unit
01	Odometer	Total driving distance when the diagnosis code is generated	km
02	Ignition cycle	Number of times the ignition switch is turned "ON" or "LOCK (OFF)" after the past failure transition	Number of counts is displayed.
04	Accumulated minute	Cumulative time for current malfunction of diagnosis code	min
06	Torque sensor (main)	Voltage of the main torque sensor when the diagnosis code is generated	V
07	Torque sensor (sub)	Voltage of the sub torque sensor when the diagnosis code is generated	V
08	Torque sensor (power supply)	Voltage of torque sensor power supply when the diagnosis code is generated	V
09	Resolver voltage 1	Voltage of the motor angle sensor signal when the diagnosis code is generated.	V
10	Resolver voltage 2		V
11	Relay voltage	Voltage of power supply relay when the diagnosis code is generated	V
12	Vehicle speed	Vehicles speed when the diagnosis code is generated	km/h
13	Engine flag (EPS control)	Engine status for EPS when the diagnosis code is generated.	OFF/ON
14	Assist flag for EV	Not used.	–

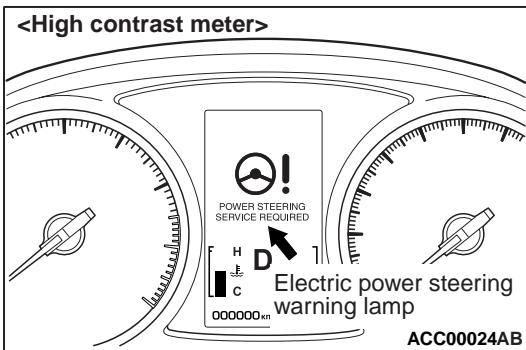
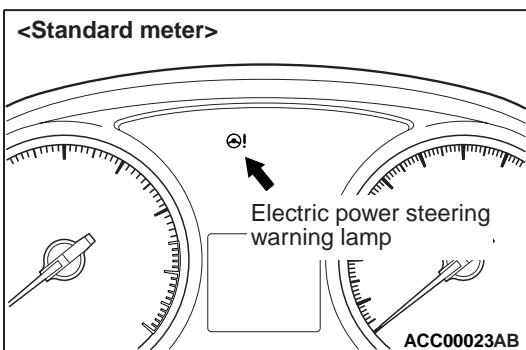
CHECK OF FREEZE FRAME DATA

The freeze frame data can be checked by using M.U.T.-III (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points – Diagnosis Function).

When detecting the trouble and storing the diagnosis code, the ECU connected to CAN bus line obtains the data when the diagnosis code is confirmed, and then stores the ECU status of that time. By analysing each data from M.U.T.-III, the troubleshooting can be performed more efficiently. The displayed items are as the table below.

CHECK OF ELECTRIC POWER
STEERING WARNING LAMP

M1372013400264



- If the electric power steering warning lamp does not operate, the electric power steering system or the combination meter may be defective. Check for diagnosis code, and carry out diagnosis (Refer to [P.37-8](#)). If no diagnosis codes are set, carry out diagnosis by referring to the electric power steering warning lamp-related inspection items on the trouble symptom chart (Refer to [P.37-29](#)).

DIAGNOSIS CODE CHART

M1372007500358

CAUTION

- During diagnosis, a diagnosis code associated with other system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for diagnosis code(s). If diagnosis code(s) are set, erase them all.
- If more than three minutes elapse after the ignition switch is turned ON without starting engine, the electric power steering-ECU may set diagnosis codes U0100 as past trouble.

NOTE: For electric power steering system the power supply may not shut off immediately after the ignition switch is turned "OFF".

Diagnosis code No.	Diagnostic item	Reference pages
C1510	Torque sensor main	P.37-9
C1511	Torque sensor sub	
C1512	Torque sensor main/sub voltage	P.37-11
C1513	Torque sensor power supply	P.37-12
C1514	Torque sensor power supply too low	P.37-14
C1521	Motor turning angle (output)	P.37-15
C1522	Motor turning angle range	

Diagnosis code No.	Diagnostic item	Reference pages
C1530	Motor FET driver	P.37-16
C1531	Motor current too low	
C1532	Motor output current too large	
C1533	Motor terminal initial voltage	
C1534	Motor terminal monitor voltage	
C1535	Motor output current	
C1536	Motor terminal voltage too high	
C1540	Power supply voltage too high	P.37-18
C1541	Power supply voltage too low	P.37-19
C1550	ECU internal error	P.37-21
C1561	Engine revolution data (CAN)	P.37-21
C1564	Vehicle speed data invalid	P.37-22
C1565	Engine revolution data invalid	P.37-23
C1566	Invalid data received from AWC	P.37-24
C1657	Implausible coding data	P.37-25
U0100	Engine CAN timeout	P.37-26
U0114	4WD CAN timeout	
U0141	ETACS CAN timeout	
U1073	Bus-off	P.37-27
U1190	No receive fault detect signal	P.37-27
U1195	Coding not completed	P.37-28
U1197	Coding data unavailable	

DIAGNOSIS CODE PROCEDURES

Code No.C1510 Torque sensor main

Code No.C1511 Torque sensor sub

△ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the torque sensor from the EPS-ECU.

FUNCTION

The voltage based on the input torque is output to the EPS-ECU from the torque sensor main and sub for motor control.

TROUBLE JUDGEMENT

Check Conditions

With the torque sensor power supply ON, 5 V is supplied to the torque sensor.

Judgement Criterion

- The torque sensor main output voltage or the torque sensor sub output voltage is more than 4.7 V or less than 0.3 V.

- The torque sensor main output voltage or the torque sensor sub output voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the torque sensor main system or the torque sensor sub system.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1510 and C1511.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective torque sensor of the steering column shaft assembly
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the torque sensor or loose connector contact
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- Erase the diagnosis code.
- Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- Check if the diagnosis code is set.

Q: Is the diagnosis codes C1510 or C1511 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. Voltage measurement at EPS-ECU connector (TSM, TSS, GND terminal)

- The steering is in the neutral position.
- Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- Measure the voltage between the EPS-ECU connector (TSM terminal) and the EPS-ECU

connector (GND terminal) or body earth. <main system>

OK: 2.5 ± 0.05 V

- Measure the voltage between the EPS-ECU connector (TSS terminal) and the EPS-ECU connector (GND terminal) or body earth. <sub system>

OK: 2.5 ± 0.05 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check of short to power supply, short to earth, and open circuit in TSM and TSS line between EPS-ECU connector and torque sensor

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 7.

STEP 5. M.U.T.-III data list

- The steering is in the neutral position.

- Check the following data list.

- Item No. 01: Torque sensor (main)
- Item No. 02: Torque sensor (sub)

Q: Is the check result normal?

YES : Go to Step 7.

NO : Go to Step 6.

STEP 6. Check whether the diagnosis code is reset.

- Erase the diagnosis code.

- Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

- Check if the diagnosis code is set.

Q: Is the diagnosis codes C1510 or C1511 set?

YES : Replace the EPS-ECU (Refer to P.37-51).

Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).Then go to Step 7.

STEP 7. Check whether the diagnosis code is reset.

- Erase the diagnosis code.

- Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

- Check if the diagnosis code is set.

Q: Is the diagnosis codes C1510 or C1511 set?

YES : Replace the steering column shaft assembly (Refer to P.37-43). Then go to Step 8.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 8. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1510 or C1511 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1512 Torque sensor main/sub voltage

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the torque sensor from the EPS-ECU.

FUNCTION

The voltage based on the input torque is output to the EPS-ECU from the torque sensor main and torque sensor sub, and the sum of the torque sensor main output voltage and sub output voltage values are monitored for motor control.

TROUBLE JUDGEMENT

Check Conditions

With the torque sensor power supply ON, 5 V is supplied to the torque sensor.

Judgement Criterion

The sum of the torque sensor main output voltage and sub output voltage does not meet a predetermined value stored in the microcomputer, and the microcomputer determines that a problem has occurred in the mutual monitoring for the sensor main/sub systems.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1512.

PROBABLE CAUSES

- Malfunction of CAN bus line

- Defective torque sensor of the steering column shaft assembly
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the torque sensor or loose connector contact
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1512 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. Voltage measurement at EPS-ECU connector (TSM, TSS, GND terminal)

- (1) The steering is in the neutral position.
- (2) Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- (3) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (4) Measure the voltage between the EPS-ECU connector (TSM terminal) and the EPS-ECU connector (GND terminal) or body earth. <main

system>

OK: 2.5 ± 0.05 V

(5) Measure the voltage between the EPS-ECU connector (TSS terminal) and the EPS-ECU connector (GND terminal) or body earth. <sub system>

OK: 2.5 ± 0.05 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check of short to power supply, short to earth, and open circuit in TSM and TSS line between EPS-ECU connector and torque sensor

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 7.

STEP 5. M.U.T.-III data list

(1) The steering is in the neutral position.

(2) Check the following data list.

- Item No. 01: Torque sensor (main)
- Item No. 02: Torque sensor (sub)

Q: Is the check result normal?

YES : Go to Step 7.

NO : Go to Step 6.

STEP 6. Check whether the diagnosis code is reset.

(1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF)

position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1512 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).
Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions). Then go to Step 7.

STEP 7. Check whether the diagnosis code is reset.

(1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1512 set?

YES : Replace the steering column shaft assembly (Refer to [P.37-43](#)). Then go to Step 8.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 8. Check whether the diagnosis code is reset.

(1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1512 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1513 Torque sensor power supply

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the EPS-ECU from the torque sensor.

- The torque sensor power supply monitor voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer deter-

FUNCTION

To output the voltage based on the input torque from the torque sensor to the EPS-ECU, the voltage is supplied to the torque sensor.

TROUBLE JUDGEMENT

Check Conditions

With the battery voltage exceeding 7.5 V, the torque sensor power supply turns ON.

Judgement Criterion

- The torque sensor power supply voltage is more than 5.3 V or less than 4.7 V. This indicates that there is a problem in the torque sensor power supply voltage.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1513.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective torque sensor of the steering column shaft assembly
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the torque sensor or loose connector contact
 - Open circuit between the body earth and the EPS-ECU or loose connector contact
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE**STEP 1. M.U.T.-III CAN bus diagnostics**

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1513 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. Voltage measurement at EPS-ECU connector (TSV, TSE terminal)

- (1) The steering is in the neutral position.
- (2) Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- (3) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (4) Measure the voltage between the EPS-ECU connector (TSV terminal) and the EPS-ECU connector (TSE terminal).

OK: 5 ± 0.2 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check of short to power supply, short to earth, and open circuit in TSV and TSE line between EPS-ECU connector and torque sensor**Q: Is the check result normal?**

YES : Go to Step 5.

NO : Go to Step 7.

STEP 5. M.U.T.-III data list

(1) The steering is in the neutral position.

(2) Check the following data list [P.37-32](#).

- Item No. 03: Torque sensor (power supply)

Q: Is the check result normal?

YES : Go to Step 7.

NO : Go to Step 6.

STEP 6. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1513 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)). Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions). Then go to Step 7.

STEP 7. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1513 set?

YES : Replace the steering column shaft assembly (Refer to [P.37-43](#)). Then go to Step 8.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 8. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1513 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1514 Torque sensor power supply too low**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the torque sensor from the EPS-ECU.

FUNCTION

To output the voltage based on the input torque from the torque sensor to the EPS-ECU, the voltage is supplied to the torque sensor.

TROUBLE JUDGEMENT**Check Conditions**

Torque sensor power supply ON

Judgement Criterion

The torque sensor power supply monitor voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the torque sensor power supply voltage.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1514.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective torque sensor of the steering column shaft assembly
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the torque sensor or loose connector contact
 - Open circuit between the body earth and the EPS-ECU or loose connector contact
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE**STEP 1. M.U.T.-III CAN bus diagnostics**

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1514 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. Voltage measurement at EPS-ECU connector (TSV, TSE terminal)

- (1) The steering is in the neutral position.
- (2) Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- (3) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (4) Measure the voltage between the EPS-ECU connector (TSV terminal) and the EPS-ECU connector (TSE terminal).

OK: 5 ± 0.2 V

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 4.

STEP 4. Check of short to earth, and open circuit in TSV and TSE line between EPS-ECU connector and torque sensor

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 7.

STEP 5. M.U.T.-III data list

- (1) The steering is in the neutral position.
- (2) Check the following data list [P.37-32](#).
 - Item No. 03: Torque sensor(power supply)

Q: Is the check result normal?

YES : Go to Step 7.

NO : Go to Step 6.

STEP 6. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.

- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1514 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)). Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 7. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1514 set?

YES : Replace the steering column shaft assembly (Refer to [P.37-43](#)). Then go to Step 8.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 8. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1514 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1521 Motor turning angle (output)

Code No.C1522 Motor turning angle range

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the resolver from the EPS-ECU.

FUNCTION

To output the voltage based on the motor rotation angle to the EPS-ECU, the voltage is supplied to the resolver.

TROUBLE JUDGEMENT

Check Conditions

The power supply circuit system diagnosis code (No. C1540, C1541) is not set.

Judgement Criterion

The resolver input voltage or the resolver output voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the resolver system.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1521 and C1522.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective resolver of the steering column shaft assembly
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the resolver or loose connector contact
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1521 or C1522 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. Check of short to power supply, short to earth, and open circuit in S1+, S3-, S2+, S4-, R1+, R2- line between EPS-ECU connector and resolver**Q: Is the check result normal?**

YES : Go to Step 4.

NO : Go to Step 6.

STEP 4. M.U.T.-III data listCheck the following data list [P.37-32](#).

- Item No. 04: Motor current
- Item No. 05: Motor current (target)
- Item No. 17: Motor electric angle
- Item No. 18: Motor speed

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 7.

STEP 5. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1521 or C1522 set?YES : Replace the EPS-ECU (Refer to [P.37-51](#)). Then go to Step 6.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 6. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1521 or C1522 set?YES : Replace the steering column shaft assembly (Refer to [P.37-48](#)). Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 7. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1521 or C1522 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1530 Motor FET driver**Code No.C1531 Motor current too low****Code No.C1532 Motor output current too large****Code No.C1533 Motor terminal initial voltage****Code No.C1534 Motor terminal monitor voltage****Code No.C1535 Motor output current****Code No.C1536 Motor terminal voltage too high****CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the motor from the EPS-ECU.

FUNCTION

The voltage controlled by the torque sensor and resolver is supplied to the motor from the EPS-ECU.

TROUBLE JUDGEMENT**Check Conditions**

The battery voltage is more than 8 V or less than 17 V.

Judgement Criterion

The motor voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the motor system.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1530, C1531, C1532, C1533, C1534, C1535, and C1536.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective motor of the steering column shaft assembly
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the motor or loose connector contact
 - Open circuit between the body earth and the EPS-ECU or loose connector contact
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE**STEP 1. M.U.T.-III CAN bus diagnostics**

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes

C1530,C1531,C1532,C1533,C1534,C1535 or C1536 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. Check of short to power supply, short to earth, and open circuit in V, W, U line between EPS-ECU connector and motor**Q: Is the check result normal?**

YES : Go to Step 4.

NO : Go to Step 7.

STEP 4. Check of open circuit in GND line between EPS-ECU connector and body earth connector**Q: Is the check result normal?**

YES : Go to Step 5.

NO : Go to Step 7.

STEP 5. M.U.T.-III data list

Check the following data list [P.37-32](#).

- Item No. 04: Motor current
- Item No. 05: Motor current (target)
- Item No. 06: Motor current (unlimited target)
- Item No. 17: Motor electric angle
- Item No. 18: Motor speed
- Item No. 19: Motor voltage
- Item No. 25: Motor relay

Q: Is the check result normal?

YES : Go to Step 8.

NO : Go to Step 6.

STEP 6. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes

C1530,C1531,C1532,C1533,C1534,C1535 or C1536 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)). Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 7. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes

C1530,C1531,C1532,C1533,C1534,C1535 or C1536 set?

YES : Replace the steering column shaft assembly (Refer to [P.37-48](#)). Then go to Step 8.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 8. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1530,C1531,C1532,C1533,C1534,C1535 or C1536 set?
YES : Return to Step 1.
NO : This diagnosis is complete.

Code No.C1540 Power supply voltage too high**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the EPS-ECU from the battery or the ignition switch.

FUNCTION

To control the steering column shaft assembly, the battery voltage is supplied to the EPS-ECU.

TROUBLE JUDGEMENT**Check Conditions**

- Power supply voltage is more than 17 V.
- The power supply voltage is more than a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the power supply system.

Judgement Criterion

The power supply monitor voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the power supply system.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1540.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective battery
- Charging system failed
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE**STEP 1. M.U.T.-III CAN bus diagnostics**

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3
NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1540 set?

YES : Go to Step 3
NO : This diagnosis is complete.

STEP 3. Check the battery voltage.

Start the engine and measure the battery voltage (Refer to GROUP 54A – Battery).

Q: Is the check result normal?

YES : Go to Step 4
NO : Check the battery and repair if necessary (Refer to GROUP 54A – Battery).Then go to Step 7.

STEP 4. Check the charging system.

Start the engine and measure the charging system (Refer to GROUP 16 – On-vehicle Service/Alternator Output Line Voltage Drop Test).

Q: Is the check result normal?

YES : Go to Step 5
NO : Check the charging system and repair if necessary (Refer to GROUP 16 – Alternator Assembly).Then go to Step 7.

STEP 5. M.U.T.-III data list

Check the following data list [P.37-32](#).

- Item No. 22: Power relay voltage
- Item No. 23: Ignition voltage

Q: Is the check result normal?

YES : Go to Step 7

NO : Go to Step 6

STEP 6. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1540 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)). Then go to Step 7.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 7. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1540 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1541 Power supply voltage too low

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the EPS-ECU from the battery or the ignition switch.

FUNCTION

To control the steering column shaft assembly, the battery voltage is supplied to the EPS-ECU for energisation.

TROUBLE JUDGEMENT

Check Conditions

The ETACS power supply circuit system diagnosis code is not set.

Judgement Criterion

- Power supply voltage is less than 8V.
- The power supply monitor voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the power supply system.

Fail Safe, Back Up Function

The EPS-ECU tapers the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1541.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective battery
- Charging system failed
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU, the ETACS-ECU and the fusible link or loose connector contact
 - Open circuit between the body earth and the EPS-ECU or loose connector contact
- Malfunction of the ETACS-ECU
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1541 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. Check the battery voltage.

Start the engine and measure the battery voltage
(Refer to GROUP 54A – Battery).

Q: Is the check result normal?

YES : Go to Step 4

NO : Check the battery and repair if necessary
(Refer to GROUP 54A – Battery). Then go to Step 10.

STEP 4. Check the charging system.

Start the engine and measure the charging system
(Refer to GROUP 16 – On-vehicle Service/Alternator Output Line Voltage Drop Test)

Q: Is the check result normal?

YES : Go to Step 5

NO : Check the charging system and repair if necessary (Refer to GROUP 16 – Alternator Assembly).Then go to Step 10.

STEP 5. Voltage measurement at the EPS-ECU connector (IG1, +BB, GND terminal)

- (1) Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Measure the voltage between the EPS-ECU connector (IG1 terminal) and the EPS-ECU connector (GND terminal) or body earth.

OK: Approximately system voltage

- (4) Measure the voltage between the EPS-ECU connector (+BB terminal) and the EPS-ECU connector (GND terminal) or body earth.

OK: Approximately system voltage

Q: Is the check result normal?

YES : Go to Step 8

NO : Go to Step 6

STEP 6. Check of short to power supply, short to earth, and open circuit in +BB line between fusible link and EPS-ECU connector

Q: Is the check result normal?

YES : Go to Step 7

NO : Repair the fusible link, connector(s) or wiring harness.

STEP 7. Check of short to power supply, short to earth, and open circuit in IG1 line between EPS-ECU connector and ETACS-ECU connector

Q: Is the check result normal?

YES : Go to Step 8

NO : Repair the connector(s) or wiring harness.

STEP 8. M.U.T.-III data list

Check the following data list [P.37-32](#).

- Item No. 22: Power relay voltage
- Item No. 23: Ignition voltage

Q: Is the check result normal?

YES : Go to Step 10

NO : Go to Step 9

STEP 9. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1541 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).Then go to Step 10.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunctions).

STEP 10. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis code C1541 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1550 ECU internal error**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Power is supplied to the EPS-ECU from the battery.

FUNCTION

The motor current is controlled according to the information on motor and resolver, and the information on CAN bus.

Code No.C1561 Engine revolution data (CAN)**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

EPS-ECU receives engine revolution signal from the engine-ECU.

FUNCTION

The engine speed signal is sent to the EPS-ECU for motor control.

TROUBLE JUDGEMENT**Check Conditions**

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The engine circuit system diagnosis code is not set.

Judgement Criterion

- The engine speed signal sent to the EPS-ECU is no signal.
- The engine speed signal is not sent from the engine-ECU, and the microcomputer determines that there is a problem in the engine speed measurement system.

TROUBLE JUDGEMENT**Judgement Criterion**

The system data is out of the prestored control range, and the microcomputer determines that there is an internal problem.

Fail Safe, Back Up Function

The EPS-ECU stops the motor control and illuminates the electric power steering warning display, then sets the diagnosis code No. C1550.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU

Fail Safe, Back Up Function

• The EPS-ECU illuminates the electric power steering warning display, and sets the diagnosis code No. C1561. Normally the assist operation is continued while the vehicle is driven, but deactivated after the vehicle stopped.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU
- Malfunction of the engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1561 set?

YES : Go to Step 3.

NO : This diagnosis is complete.

STEP 3. M.U.T.-III data list

Check the following service data [P.37-32](#).

- Item No. 07: Engine speed

Q: Is the check result normal?

YES : Go to Step 5.

NO : Perform troubleshooting for engine-ECU (Refer to GROUP 13A – Troubleshooting/Inspection Chart for Diagnosis code). Then go to Step 4.

STEP 4. Check whether the diagnosis code is reset

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1561 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).

Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

STEP 5. Check whether the diagnosis code is reset.

(1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1561 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1564 Vehicle speed data invalid

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

EPS-ECU receives vehicle speed signal from the engine-ECU.

FUNCTION

The vehicle speed signal is sent to the EPS-ECU for motor control.

TROUBLE JUDGEMENT

Check Conditions

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The engine circuit system diagnosis code is not set.

Judgement Criterion

If the microcomputer receives abnormal vehicle speed signal from the engine-ECU consecutively twice, it determines that the vehicle speed calculation system is defective.

Fail Safe, Back Up Function

The EPS-ECU illuminates the electric power steering warning display, and sets the diagnosis code No. C1564 to limit assist operation.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU
- Malfunction of the engine-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

(1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1564 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. M.U.T.-III data list

Check the following service data [P.37-32](#).

- Item No. 08: Vehicle speed

Q: Is the check result normal?

YES : Go to Step 5

NO : Perform troubleshooting for engine-ECU
(Refer to GROUP 13A – Troubleshooting .
Then go to Step 4.

STEP 4. Check whether the diagnosis code is reset

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Code No.C1565 Engine revolution data invalid**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

EPS-ECU receives engine revolution signal from the engine-ECU.

FUNCTION

The engine speed signal is sent to the EPS-ECU for motor control.

TROUBLE JUDGEMENT**Check Conditions**

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The engine circuit system diagnosis code is not set.

Judgement Criterion

If the microcomputer receives abnormal engine speed signal from the engine-ECU consecutively twice, it determines that the engine speed calculation system is defective.

Fail Safe, Back Up Function

The EPS-ECU displays the electric power steering warning symbol, and stores diagnosis code No. C1565 to limit the power assistance.

Q: Is the diagnosis codes C1564 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).

Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

STEP 5. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1564 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU
- Malfunction of the engine-ECU

DIAGNOSIS PROCEDURE**STEP 1. M.U.T.-III CAN bus diagnostics**

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1565 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. M.U.T.-III data list

Check the following service data [P.37-32](#).

- Item No. 07: Engine speed

Q: Is the check result normal?

YES : Go to Step 5

NO : Perform troubleshooting for engine-ECU
(Refer to GROUP 13A –
Troubleshooting/Inspection Chart for
Diagnosis code . Then go to Step 4.

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).
Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP
00 – How to Cope with Intermittent
Malfunction).

STEP 4. Check whether the diagnosis code is reset

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1565 set?

STEP 5. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1565 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No.C1566 Invalid data received from AWC

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

An additional torque signal is sent from the 4WD-ECU to the EPS-ECU.

FUNCTION

The additional torque signal is sent to the EPS-ECU in order to control the motor.

TROUBLE JUDGEMENT

Check Conditions

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The AWC circuit system diagnosis code is not set.

Judgement Criterion

If the microcomputer receives abnormal additional torque signal from the 4WD-ECU consecutively twice, it determines that the AWC system is defective.

Fail Safe, Back Up Function

The EPS-ECU stores diagnosis code No. C1566.

PROBABLE CAUSES

- Malfunction of CAN bus line

- Malfunction of the EPS-ECU
- Malfunction of the 4WD-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1566 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. M.U.T.-III data list

Check the following service data [P.37-32](#).

- Item No. 09: Add torque indication status

Q: Is the check result normal?

YES : Go to Step 5

NO : Perform troubleshooting for 4WD-ECU (Refer to GROUP 27C – Troubleshooting/Inspection Chart for Diagnosis code . Then go to Step 4.

STEP 4. Check whether the diagnosis code is reset

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1566 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).

Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

Code No. C1657 Implausible coding data**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

EPS-ECU receives variant coding data from the ETACS-ECU.

FUNCTION

The coding data is sent to the EPS-ECU for motor control.

TROUBLE JUDGEMENT**Check Conditions**

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The ETACS circuit system diagnosis code is not set.

Judgement Criterion

- The coding data from the ETACS-ECU are not matched twice consecutively.
- The abnormal coding data is sent from the ETACS-ECU, and the microcomputer determines that there is a problem in the system.

Fail Safe, Back Up Function

The EPS-ECU stores diagnosis code No. C1657.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU
- Malfunction of the ETACS-ECU

STEP 5. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1566 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

DIAGNOSIS PROCEDURE**STEP 1. M.U.T.-III CAN bus diagnostics**

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.

- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1657 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. M.U.T.-III other system diagnosis code

Use M.U.T.-III to check whether the ETACS-ECU-related or engine ECU-related diagnosis code is set or not.

Q: Is any diagnosis code set?

YES : Troubleshoot for the relevant diagnosis code.

NO : Go to Step 4

STEP 4. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1657 set?

YES : Replace the EPS-ECU (Refer to P.37-51).

Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP

00 – How to Cope with Intermittent

Malfunction .

STEP 5. Check whether the diagnosis code is reset.

(1) Erase the diagnosis code.

(2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.

(3) Check if the diagnosis code is set.

Q: Is the diagnosis codes C1657 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No. U0100 Engine CAN timeout

Code No. U0114 4WD CAN timeout

Code No. U0141 ETACS CAN timeout

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

The signals from the engine-ECU, 4WD-ECU and ETACS-ECU are sent to the EPS-ECU.

FUNCTION

The signals from the engine-ECU, 4WD-ECU and ETACS-ECU are sent to the EPS-ECU for motor control.

TROUBLE JUDGEMENT

Check Conditions

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The diagnosis code related to engine circuit system, 4WD circuit system and ETACS circuit system is set.

Judgement Criterion

The signals from the engine-ECU, 4WD-ECU and ETACS-ECU are not sent, and the microcomputer determines that there is a problem in the system.

Fail Safe, Back Up Function

- The EPS-ECU stores diagnosis code No. U0100, U0114 or U0141. If diagnosis code No. U0100 is stored, the ECU displays the electric power steering warning symbol to limit the power assistance.

PROBABLE CAUSES

- Malfunction of CAN bus line

- Malfunction of the EPS-ECU
- Malfunction of the engine-ECU
- Malfunction of the ETACS-ECU
- Malfunction of the 4WD-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2.

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes U0100, U0114 or U0141 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. M.U.T.-III diagnosis code

Use M.U.T.-III to check if the same diagnosis code (time-out) is set in the other ECU.

Q: Is any diagnosis code set?

YES (Code No. U0100 is set) : Replace the engine ECU, and then go to Step 4.

YES (Code No. U0114 is set) : Replace the 4WD-ECU, and then go to Step 4.

YES (Code No. U0141 is set) : Replace the ETACS-ECU, and then go to Step 4.

NO (No diagnosis code is set.) : Go to Step 4

STEP 4. Check whether the diagnosis code is reset

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the LOCK (OFF) position to the ON position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes U0100, U0114 or U0141 set?

YES : Replace the EPS-ECU (Refer to [P.37-51](#)).

Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

STEP 5. Check whether the diagnosis code is reset

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the LOCK (OFF) position to the ON position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes U0100, U0114 or U0141 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

Code No. U1073 Bus-off**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

Signals from the ECUs communicate with the EPS-ECU.

FUNCTION

The signals from the ECUs communicate with the EPS-ECU for motor control.

TROUBLE JUDGEMENT**Check Conditions**

IG1 voltage: 10 V or more

Judgement Criterion

The signals from the ECUs cannot communicate (bus off), and the microcomputer determines that there is a problem in the system.

Fail Safe, Back Up Function

The EPS-ECU displays the electric power steering warning symbol, and stores diagnosis code No. U1073.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU

Code No. U1190 No receive fault detect signal**⚠ CAUTION**

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

A fault detection enabling/inhibiting signal is sent from the ETACS-ECU to the EPS-ECU.

TROUBLE JUDGEMENT**Check Conditions**

Ignition switch: ON position

Judgement Criterion

When the microcomputer cannot receive any fault detection enabling/inhibiting signal from the ETACS-ECU, it determines that there is a problem in the system.

Fail Safe, Back Up Function

The EPS-ECU stores diagnosis code No. U1190.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the ETACS-ECU

Code No. U1195 Coding not completed
Code No. U1197 Coding data unavailable

⚠ CAUTION

- If there is any problem in the CAN bus lines, an incorrect diagnosis code may be set. Prior to this diagnosis, diagnose the CAN bus lines (Refer to GROUP 54C, CAN Bus Diagnostics Table).
- Whenever ECU is replaced, ensure that the CAN bus lines are normal.

OPERATION

EPS-ECU receives variant coding data from the ETACS-ECU.

FUNCTION

The coding data is sent to the EPS-ECU for motor control.

TROUBLE JUDGEMENT

Check Conditions

- The power supply circuit system diagnosis code (No. C1540, C1541) is not set.
- The ETACS circuit system diagnosis code is not set.

Judgement Criterion

- The electric power steering-ECU coding is not completed.
- The abnormal coding data is sent from the ETACS-ECU, and the microcomputer determines that there is a problem in the system.

Fail Safe, Back Up Function

The EPS-ECU prohibits the motor control, and stores diagnosis codes No. U1195 and U1197.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Malfunction of the EPS-ECU
- Malfunction of the ETACS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 3

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table). On completion, go to Step 2

STEP 2. Diagnosis code recheck after resetting CAN bus lines

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes U1195, U1197 set?

YES : Go to Step 3

NO : This diagnosis is complete.

STEP 3. M.U.T.-III other system diagnosis code

Use M.U.T.-III to check whether the ETACS-ECU-related or engine ECU-related diagnosis code is set or not.

Q: Is any diagnosis code set?

YES : Troubleshoot for the relevant diagnosis code.

NO : Go to Step 4

STEP 4. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes U1195, U1197 set?

YES : Replace the EPS-ECU (Refer to P.37-51). Then go to Step 5.

NO : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction .

STEP 5. Check whether the diagnosis code is reset.

- (1) Erase the diagnosis code.
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Check if the diagnosis code is set.

Q: Is the diagnosis codes U1195, U1197 set?

YES : Return to Step 1.

NO : This diagnosis is complete.

TROUBLE SYMPTOM CHART

M1372007600496

CAUTION

During diagnosis, a diagnosis code associated with other system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for diagnosis code(s). If diagnosis code(s) are set, erase them all.

Trouble symptom	Inspection procedure	Reference pages or actions
M.U.T.-III cannot communicate with electric power steering system <ECU power supply circuit system check>.	1	P.37-29
Electric power steering system warning display illuminates but diagnosis code is not stored.	2	P.37-30
The steering has become heavy, but the electric power steering warning display does not illuminate (This is normal, because the electric power steering is limiting assist operation). <i>NOTE: If the vehicle is driven under heavy load (e.g. consecutively turning the steering to full lock or severe cornering), the electric power steering motor drive circuit will become hot. In this case, the electric power steering system will limit assist operation by decreasing the motor current to avoid damage. In this case, the steering will become heavy, but the electric power steering warning lamp does not illuminate. If the circuit temperature reduces after a while, the assist operation will return to the normal level.</i>	—	Reproduce the steering operation, which your customer did. Check the M.U.T.-III data list item to No.A55 from No.A11, and confirm that the electric power steering system limited the assist operation (Refer to P.37-32). Note that this is not a failure.
The steering has become heavy, but the electric power steering warning display does not illuminate (Power supply voltage assist fall). <i>NOTE: If the system voltage is lower than the rated value, motor rated output does not come out.</i>	3	P.37-31
When the ignition switch is turned on, the system does not perform the bulb check for the electric power steering warning lamp (The electric power steering warning lamp does not illuminate until the engine is started). <i>NOTE: The ignition switch is turned to the ON position (within approximately 3 second) again immediately after it is turned to the LOCK (OFF) position, the electric power steering warning lamp does not illuminate.</i>	—	Replace the meter assembly (Refer to GROUP 54A – Combination Meter).

SYMPTOM PROCEDURES

Inspection Procedure 1: M.U.T.-III cannot communicate with electric power steering system <ECU power supply circuit system check>.

COMMENTS ON TROUBLE SYMPTOM

If the M.U.T.-III cannot communicate with the electric power steering system, the CAN bus lines may be defective. If the electric power steering system does not operate, the EPS-ECU or its power supply may

be defective.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective harness wire(s) or connector(s)

- Short or open circuit between the EPS-ECU and the ETACS-ECU, the fusible link or loose connector contact
- Open circuit between the body earth and the EPS-ECU or loose connector contact
- Malfunction of the ETACS-ECU
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table).

STEP 2. Voltage measurement at the EPS-ECU connector (IG1, +BB, GND terminal)

- (1) Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Measure the voltage between the EPS-ECU connector (IG1 terminal) and the EPS-ECU connector (GND terminal) or body earth.

OK: Approximately system voltage

- (4) Measure the voltage between the EPS-ECU connector (+BB terminal) and the EPS-ECU

connector (GND terminal) or body earth.

OK: Approximately system voltage

Q: Is the check result normal?

YES : Go to Step 5.

NO : Go to Step 3.

STEP 3. Check of short to power supply, short to earth, and open circuit in +BB line between fusible link and EPS-ECU connector

Q: Is the check result normal?

YES : Go to Step 4.

NO : Repair the fusible link, connector(s) or wiring harness.

STEP 4. Check of short to power supply, short to earth, and open circuit in IG1 line between EPS-ECU connector and ETACS-ECU connector

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair the connector(s) or wiring harness.

STEP 5. Retest the system

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

NO : Replace the EPS-ECU (Refer to P.37-51).

Inspection Procedure 2: Electric power steering system warning display illuminates but diagnosis code is not stored.

COMMENTS ON TROUBLE SYMPTOM

The CAN bus lines may be defective. If the electric power steering system does not operate, the combination meter or the EPS-ECU may be defective.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective harness wire(s) or connector(s)
 - Short or open circuit between the EPS-ECU and the ETACS-ECU, the fusible link or loose connector contact
 - Open circuit between the body earth and the EPS-ECU or loose connector contact
- Malfunction of the ETACS-ECU
- Malfunction of the combination meter
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table).

STEP 2. Check by M.U.T.-III "Special Function"

Using M.U.T.-III, select "Test" from the special function of the combination meter. Execute the following item to check the liquid crystal display. (Refer to GROUP 54A – Combination Meter)

- Item 2: LCD(AUTO)

Q: Is the check result normal?

YES : Go to Step 3.

NO : Replace the combination meter.

STEP 3. Voltage measurement at the EPS-ECU connector (IG1, +BB, GND terminal)

- (1) Measure the EPS-ECU voltage without disconnecting the connector (by backprobing).
- (2) Turn the ignition switch from the "LOCK" (OFF) position to the "ON" position.
- (3) Measure the voltage between the EPS-ECU connector (IG1 terminal) and the EPS-ECU connector (GND terminal) or body earth.

OK: Approximately system voltage

- (4) Measure the voltage between the EPS-ECU connector (+BB terminal) and the EPS-ECU connector (GND terminal) or body earth.

OK: Approximately system voltage

Q: Is the check result normal?

YES : Go to Step 6.

NO : Go to Step 4.

STEP 4. Check of short to power supply, short to earth, and open circuit in +BB line between fusible link and EPS-ECU connector

Q: Is the check result normal?

YES : Go to Step 5.

NO : Repair the fusible link, connector(s) or wiring harness.

STEP 5. Check of short to power supply, short to earth, and open circuit in IG1 line between EPS-ECU connector and ETACS-ECU connector

Q: Is the check result normal?

YES : Go to Step 6.

NO : Repair the connector(s) or wiring harness.

STEP 6. Retest the system

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

NO : Replace the EPS-ECU (Refer to [P.37-51](#)).

Inspection Procedure 3: The steering has become heavy, but electric power steering warning display does not illuminate. (Power supply voltage assist fall)

COMMENTS ON TROUBLE SYMPTOM

Intermittent failure may be present in the power supply system. Check the battery and the alternator to confirm that normal direct voltage flows.

PROBABLE CAUSES

- Malfunction of CAN bus line
- Defective battery
- Charging system failed
- Malfunction of the EPS-ECU

DIAGNOSIS PROCEDURE

STEP 1. M.U.T.-III CAN bus diagnostics

Use M.U.T.-III to diagnose the CAN bus lines.

Q: Is the check result normal?

YES : Go to Step 2.

NO : Repair the CAN bus lines (Refer to GROUP 54C – CAN Bus Diagnostics Table).

STEP 2. M.U.T.-III data list

Check the following service data [P.37-32](#).

- Item No. B11: Odometer:rec.V1
- Item No. B12: Power relay voltage:rec V1
- Item No. B13: Vehicle speed:rec.V1
- Item No. B21: Odometer:rec.V2
- Item No. B22: Power relay voltage:rec V2
- Item No. B23: Vehicle speed:rec.V2
- Item No. B31: Odometer:rec.V3
- Item No. B32: Power relay voltage:rec V3
- Item No. B33: Vehicle speed:rec.V3
- Item No. B41: Odometer:rec.V4
- Item No. B42: Power relay voltage:rec V4
- Item No. B43: Vehicle speed:rec.V4
- Item No. B51: Odometer:rec.V5
- Item No. B52: Power relay voltage:rec V5
- Item No. B53: Vehicle speed:rec.V5

Q: Is the check result normal?

YES : Go to Step 3.

NO : Check the combination meter and repair if necessary (Refer to GROUP 54A-combination meter). Then go to Step 5.

STEP 3. Check the battery voltage.

Start the engine and measure the battery voltage
(Refer to GROUP 54A – Battery Test).

Q: Is the check result normal?

YES : Go to Step 4.

NO : Check the battery and repair if necessary
(Refer to GROUP 54A – Charging System , Removal and Installation).

STEP 4. Check the charging system.

Start the engine and measure the charging system
(Refer to GROUP 16 – Charging System).

Q: Is the check result normal?

YES : Go to Step 5.

NO : Check the charging system and repair if necessary (Refer to GROUP 16 – Alternator Assembly).

STEP 5. Retest the system

Q: Is the check result normal?

YES : Intermittent malfunction (Refer to GROUP 00 – How to Cope with Intermittent Malfunction).

NO : Replace the EPS-ECU (Refer to [P.37-51](#)).

DATA LIST REFERENCE TABLE

M1372007700200

The following items can be read by the M.U.T.-III from the EPS-ECU input data.

When the system is normal.

Item No.	Check item	Check condition	Normal condition
01	Torque sensor (main)	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel with a vehicle stationary. 	Centre position Approximately 2.5 V
			Steering wheel turned to right 2.5 – 4.7 V
			Steering wheel turned to left 0.3 – 2.5 V
02	Torque sensor (sub)	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel with a vehicle stationary. 	Centre position Approximately 2.5 V
			Steering wheel turned to right 2.5 – 0.3 V
			Steering wheel turned to left 4.7 – 2.5 V
03	Torque sensor (power supply)	Start the engine.	4.7 – 5.3 V
04	Motor current	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	Approximately 82 Arms or less (When the steering wheel is not operated, approximately battery voltage)
05	Motor current (target)	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	Approximately 82 Arms or less (When the steering wheel is not operated, approximately battery voltage)
06	Motor current (unlimited target)	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	Approximately 82 Arms or less

Item No.	Check item	Check condition	Normal condition
07	Engine speed	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	Tachometer displayed value and M.U.T.-III displayed value agree with each other.
08	Vehicle speed	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	Speed meter displayed value and M.U.T.-III displayed value agree with each other.
09	Add torque indication status	<ul style="list-style-type: none"> Start the engine. Vehicle stationary. S-AWC and EPS warning lamp turn off. 	Approximately 0 Nm
11	Ignition switch	Ignition switch: LOCK (OFF)	OFF
		Ignition switch: ON	ON
17	Motor electric angle	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	0 - 360 deg
			Motor angle
18	Motor speed	<ul style="list-style-type: none"> Start the engine. Turn the steering wheel to the left and right with a vehicle stationary. 	Rated value: 1130 rpm (neutral: 0 rpm)
19	Motor voltage	Start the engine.	2.1 – 11.7 V
22	Power relay voltage	Ignition switch: ON	Initialisation
		Start the engine.	Battery voltage
23	Ignition voltage	Ignition switch: ON	Battery voltage
24	Power relay	Ignition switch: ON	OFF
		Start the engine.	ON
25	Motor relay	Ignition switch: ON	OFF
		Start the engine.	ON
A11*	Odometer :rec.A1	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Odometer value
A12*	Motor current (target) :rec.A1	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value: 82 Arms or less
A13*	Motor cur. (unltd target) :rec.A1	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value (before the assist limitation)
A14*	Motor current :rec.A1	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Actual current value
A15*	Vehicle speed :rec.A1	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	CAN vehicle speed
A21*	Odometer :rec.A2	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Odometer value
A22*	Motor current (target) :rec.A2	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value: 82 Arms or less

Item No.	Check item	Check condition	Normal condition
A23*	Motor cur. (unltd target) :rec.A2	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value (before the assist limitation)
A24*	Motor current :rec.A2	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Actual current value
A25*	Vehicle speed :rec.A2	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	CAN vehicle speed
A31*	Odometer :rec.A3	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Odometer value
A32*	Motor current (target) :rec.A3	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value: 82 Arms or less
A33*	Motor cur. (unltd target) :rec.A3	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value (before the assist limitation)
A34*	Motor current :rec.A3	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Actual current value
A35*	Vehicle speed :rec.A3	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	CAN vehicle speed
A41*	Odometer :rec.A4	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Odometer value
A42*	Motor current (target) :rec.A4	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value: 82 Arms or less
A43*	Motor cur. (unltd target) :rec.A4	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value (before the assist limitation)
A44*	Motor current :rec.A4	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Actual current value
A45*	Vehicle speed :rec.A4	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	CAN vehicle speed
A51*	Odometer :rec.A5	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Odometer value
A52*	Motor current (target) :rec.A5	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value: 82 Arms or less
A53*	Motor cur. (unltd target) :rec.A5	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Current value (before the assist limitation)
A54*	Motor current :rec.A5	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	Actual current value

Item No.	Check item	Check condition	Normal condition
A55*	Vehicle speed :rec.A5	Assist limitation does not occur.	Initialisation
		Assist limitation occurs.	CAN vehicle speed
B11*	Odometer :rec.V1	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Odometer value when battery voltage down occurs.
B12*	Power relay voltage :rec V1	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Relay contact voltage
B13*	Vehicle speed :rec.V1	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Vehicle speed when battery voltage down occurs.
B21*	Odometer :rec.V2	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Odometer value when battery voltage down occurs.
B22*	Power relay voltage :rec V2	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Relay contact voltage
B23*	Vehicle speed :rec.V2	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Vehicle speed when battery voltage down occurs.
B31*	Odometer :rec.V3	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Odometer value when battery voltage down occurs.
B32*	Power relay voltage :rec V3	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Relay contact voltage
B33*	Vehicle speed :rec.V3	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Vehicle speed when battery voltage down occurs.
B41*	Odometer :rec.V4	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Odometer value when battery voltage down occurs.
B42*	Power relay voltage :rec V4	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Relay contact voltage
B43*	Vehicle speed :rec.V4	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Vehicle speed when battery voltage down occurs.

Item No.	Check item	Check condition	Normal condition
B51*	Odometer :rec.V5	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Odometer value when battery voltage down occurs.
B52*	Power relay voltage :rec V5	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Relay contact voltage
B53*	Vehicle speed :rec.V5	Battery voltage down does not occur.	Initialisation
		Battery voltage down occurs.	Vehicle speed when battery voltage down occurs.

*NOTE: * : The service data which begins with A or B must be used when the steering has become heavy without setting any diagnosis code.*

When the EPS-ECU shut off electric power steering system operation.

When the diagnosis system stops the EPS-ECU, the M.U.T.-III display data will be unreliable.

ACTUATOR TEST REFERENCE TABLE

The M.U.T.-III activates the following actuators for testing.

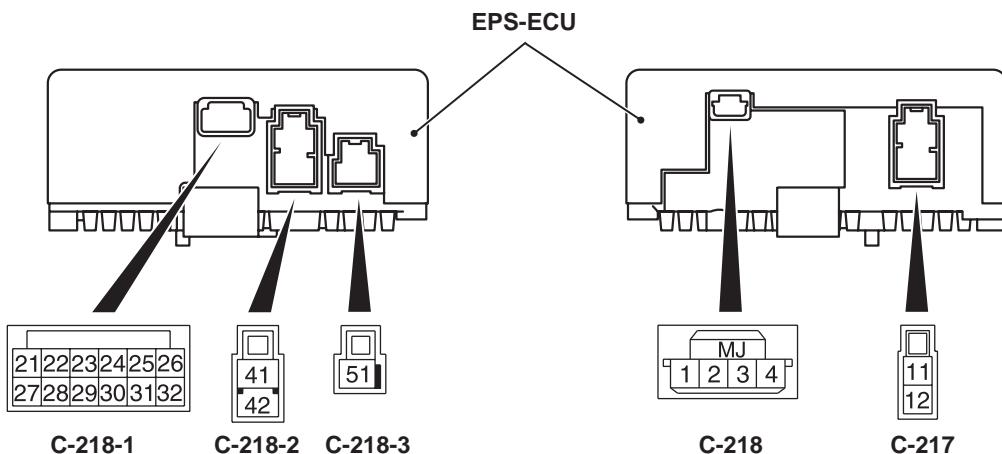
M1372007800092
NOTE: Actuator testing is only possible when the vehicle is stationary.

NOTE: If the EPS-ECU runs down, actuator testing cannot be carried out.

No.	Check item	Driven component
10	Input vehicle speed	Steering assist control

CHECK AT ELECTRIC POWER STEERING-ECU

M1372008000226



AC612830AD

CONNECTOR: C-217

Terminal No.	Terminal code	Check item	Checking requirement	Normal condition
11	+BB	Battery power supply	Always	Battery voltage
12	GND	Earth	Always	1 V or less

CONNECTOR: C-218

Terminal No.	Terminal code	Check item	Checking requirement	Normal condition
1	IG1	Ignition key signal	Ignition switch: ON	Battery voltage
			Ignition switch: OFF	1 V or less
2	-	-	-	-
3	CANL	CAN_L	-	-
4	CANH	CAN_H	-	-

CONNECTOR: C-218-1

Terminal No.	Terminal code	Check item	Checking requirement	Normal condition
21	S1+	S1+(Cosine+)	Start the engine.	2 V or less
22	S3-	S3-(Cosine-)	Start the engine.	2 V or less
23	S2+	S2+(Sine+)	Start the engine.	2 V or less
24	TSS	Torque sensor sub signal	Start the engine.	4.7 V or less
25	S4-	S4-(Sine-)	Start the engine.	2 V or less
26	TSM	Torque sensor main signal	Start the engine.	4.7 V or less
27	R1+	R1+(Exciter+)	Start the engine.	2 V or less
28	R2-	R2-(Exciter-)	Start the engine.	2 V or less
29	-	-	-	-
30	TSV	Torque sensor power supply	Start the engine.	5.3 V or less
31	TSE	Torque sensor earth	Always	1 V or less
32	-	-	-	-

CONNECTOR: C-218-2

Terminal No.	Terminal code	Check item	Checking requirement	Normal condition
41	V	Motor V	Start the engine.	Battery voltage or less
42	W	Motor W	Start the engine.	Battery voltage or less

CONNECTOR: C-218-3

Terminal No.	Terminal code	Check item	Checking requirement	Normal condition
51	U	Motor U	Start the engine.	Battery voltage or less

ON-VEHICLE SERVICE

STEERING WHEEL PLAY CHECK

M1372001001262

- With the engine running, position the front wheel in the straight ahead direction.

- Measure the circumferential steering wheel play until the front wheels actually start operating while turning the steering wheel slightly in the left and right directions.

Limit value: 30 mm or less

3. If the steering wheel play exceeds the limit value, check the steering shaft joint or steering linkage for looseness, and replace or repair the faulty components if necessary.
4. If the steering wheel play still exceeds the limit value after Step 3 is performed, position the steering wheel in the straight ahead position, and then apply the force (approximately 5 N) in the circumferential direction.
At this time, check if the circumferential steering wheel play is within the standard value.

Standard value: 16.5 mm or less

5. If the steering wheel play is outside the standard value after Step 4 is performed, remove the steering gear and linkage, and check and adjust the pinion total rotation torque (Refer to P.37-48).

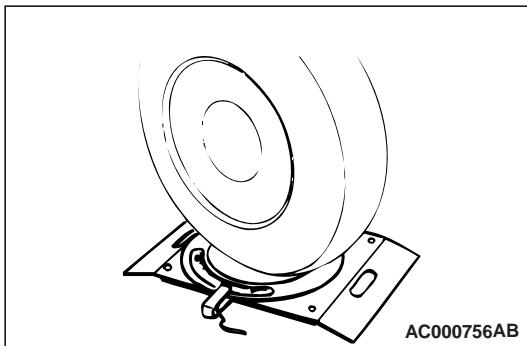
STEERING ANGLE CHECK

M1372001101850

⚠ CAUTION

After adjusting the steering angle, always perform calibration to make ASC-ECU learn the neutral position of the steering wheel sensor. (Refer to GROUP 35C, On-vehicle Service – Steering Wheel Sensor Calibration.) <Vehicles with ASC>

1. Check that the wheel alignment is normal. (Refer to GROUP 33 – On-vehicle Service, Front Wheel Alignment Check and Adjustment (Refer to .)

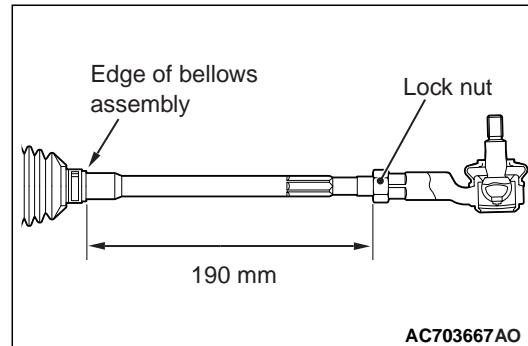


AC000756AB

2. Place the front wheel onto the turning radius gauge, and measure the steering angle.

Standard value:

Inner wheel	$38^\circ 50' \pm 1^\circ 30'$ (Difference between right and left wheels must be $2^\circ 00'$ or less)
Outer wheel (Reference value)	$32^\circ 20'$



AC703667AO

3. If the measured value is not within the standard value, adjust the tie-rod ends (right and left), and repeat Steps 1 and 2.
4. If the measured value is not within the standard value after performing Step 3, replace the steering gear and linkage assembly. (Refer to P.37-48.)

BALL JOINT DUST COVER CHECK

M1372008600820

1. Using your fingers, press the dust cover to check for a crack or damage.
2. If there are any cracks in the dust cover or it is damaged, replace the tie-rod end (Refer to P.37-48).

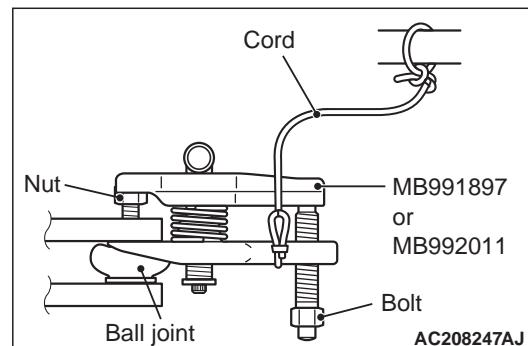
NOTE: If the dust cover has a crack or damage, the ball joint could be damaged.

BALL JOINT ROTATION TORQUE CHECK

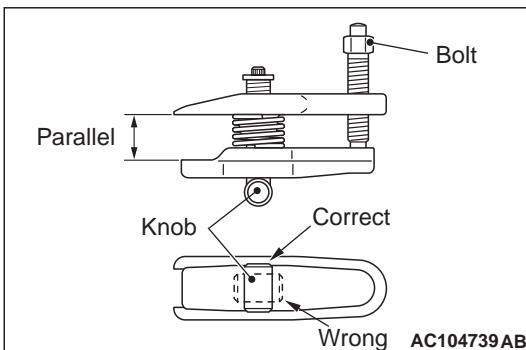
M1372011600381

⚠ CAUTION

- To prevent the ball joint thread from being damaged during operation, just loosen the tie-rod end mounting nut from the ball joint (do not remove it.). To remove the ball joint, use the special tools.
- To prevent the special tool from dropping off, suspend it with a cord.



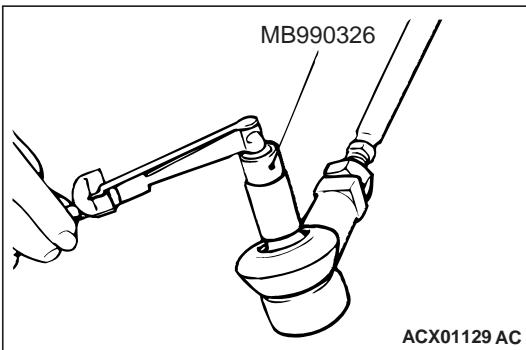
1. Use the special tool ball joint remover (MB991897 or MB992011) to disconnect the tie-rod from the knuckle.



2. Turn the bolt and knob to make the special tool jaws parallel, then hand-tighten the bolt. After tightening, check that the jaws are still parallel.

NOTE: To adjust the special tool jaws to be parallel, set the knob as shown in the figure so that it functions as a fulcrum of the jaws.

3. Turn the bolt and disconnect the tie-rod end from the steering knuckle.



4. Operate the ball joint stud to the right and to the left five times respectively, and install the nut to the stud. Use the special tool preload socket (MB990326) to measure the rotation torque of the ball joint.

Standard value: 0.3 – 3.9 N·m

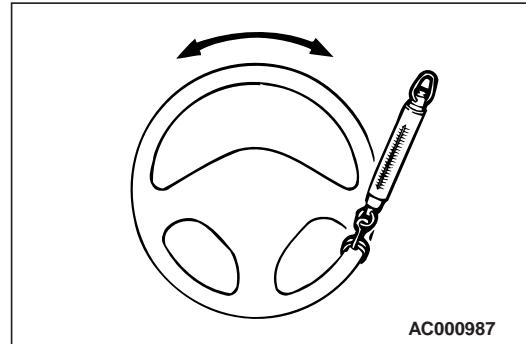
5. If the measurement is greater than the standard value, replace the tie-rod end (Refer to P.37-48).
6. If any looseness or scraping feeling is experienced in the ball joint, even when the measurement is within the range of the standard value, the ball joint should be judged to be faulty. In this case, replace the tie-rod end (Refer to P.37-48).

STATIONARY STEERING FORCE CHECK

M1372001701205

1. Park the vehicle on a level paved road, position the steering wheel in the straight ahead direction.

2. Start the engine.



3. Position a spring scale on the circumference of the steering wheel, and measure the steering force at the time when the steering wheel is turned clockwise or anticlockwise $\pm 90^\circ$ from the neutral position.

At the same time, verify that the steering force does not vary excessively in both directions.

Standard value:

Steering force	29 N or less
Fluctuation band	5.9 N or less

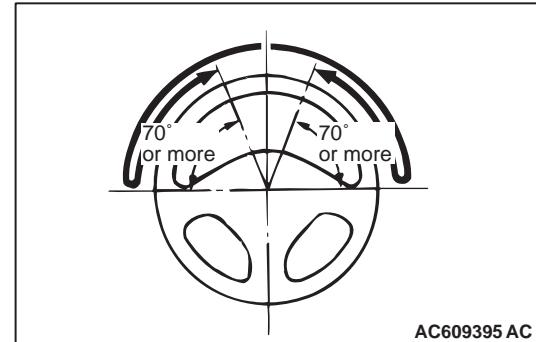
4. If not within the standard value, check and adjust the suspected components.

RETURN CHECK OF STEERING WHEEL

M1372001800908

Test-drive the vehicle, and check the following items:

1. Make a gentle or a sharp turn, and check that the steering force and returning performance do not differ in right and left wheels by the operator's feeling.



2. Turn the steering wheel at a 90° angle and keep it for a few seconds while driving at about 35 km/h speed and then check that the steering wheel returns more than 70° when taking hand off.

INSPECTION OF STEERING COLUMN SHAFT ASSEMBLY IMPACT ABSORBING MECHANISM

M1372013500874

If a collision accident occurs or severe impact is applied on the steering wheel, the collision energy absorbing mechanism may have operated. Once the mechanism has operated, it will be inoperative even if it has suffered no apparent damage. Determine if the steering column shaft can be reused by the following procedure. If the collision energy absorbing mechanism has already operated, replace the steering column shaft assembly (Refer to P.37-43).

If any excessive radial free play on the steering wheel is found with the tilt lever in the lock position, always replace the steering shaft assembly.

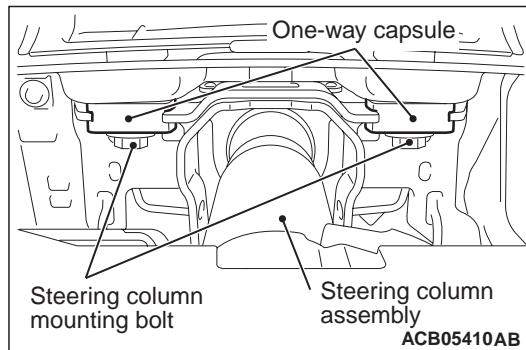
WARNING

- **If the vehicle continues to be driven after the collision absorbing mechanism has operated, the steering column shaft may be damaged while it is in use.**
- **If there is a slack in the one-way capsule, do not attempt to repair it but replace the steering column shaft assembly.**

INSPECTION PROCEDURE

1. Remove the ignition key cover, lower column cover, and upper column cover.
2. Release the tilt lever lock.

3. Loosen the two upper steering column mounting bolts by two turns.



4. Hold the one-way capsules as shown in the figure, and then try to rock them. If there is a slack in either of the capsules, replace the steering column shaft assembly (Refer to P.37-43).

CAUTION

- Be careful that nothing is pinched between the one-way capsules and the body.
- When the replacement, removal, or installation of the steering column shaft assembly is performed, tighten the mounting bolt of the one-way capsule side to the specified torque first.

5. If no malfunction has been found after the inspection, hand-tighten the steering column mounting bolts, and then tighten them to the specified torque.

Tightening torque: $21 \pm 3 \text{ N}\cdot\text{m}$

STEERING WHEEL

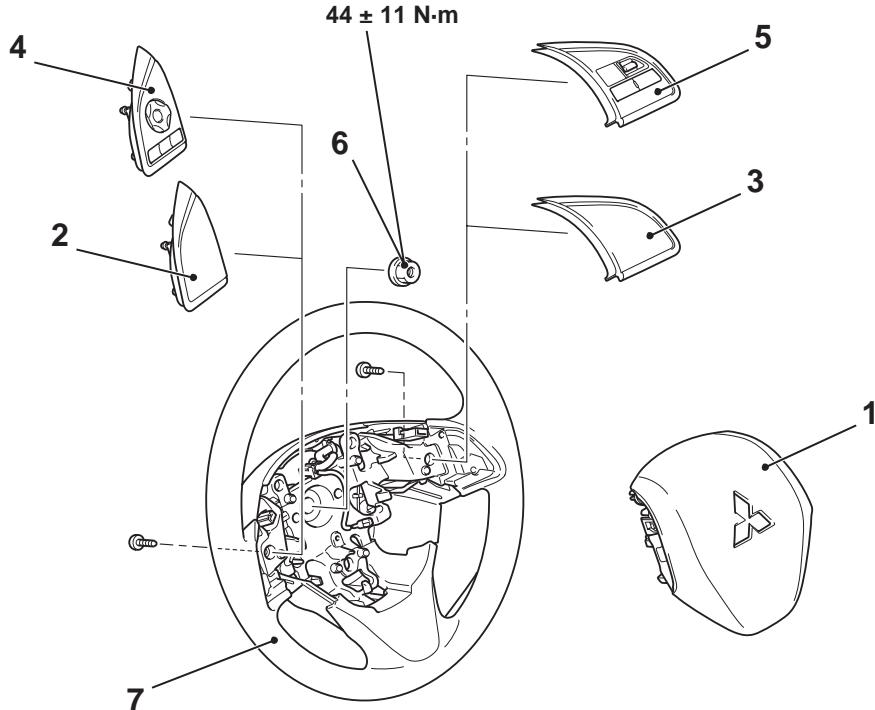
REMOVAL AND INSTALLATION

M1372011401971

⚠ CAUTION

- Before removing the steering wheel and driver's air bag module assembly, refer to GROUP 52B – Service Precautions and Driver's Air Bag Module and Clock Spring .
- After the installation, perform a calibration for the ASC-ECU to learn the steering wheel sensor neutral point. (Refer to GROUP 35C – On-vehicle Service, Steering Wheel Sensor Calibration)
<Vehicles with ASC>.

Pre-removal Operation	Post-installation Operation
Steering Wheel Straight-ahead Position Check	<ul style="list-style-type: none"> Steering Wheel Straight-ahead Position Check Steering Wheel Shake Check



ACB06020AB

Removal steps

>>A<<

- Driver's air bag module (GROUP 52B - Driver's air bag module and clock spring)
- Bezel cover (LH) <Vehicles without steering wheel remote control switch>
- Bezel cover (RH) <Vehicles without cruise control switch>
- Steering wheel remote control switch <Vehicles with audio remote control switch or steering wheel voice control switch>

Removal steps (Continued)

- Cruise control switch
<Vehicles with cruise control switch>
- Steering wheel nut
- Steering wheel assembly

<<A>> >>A<<

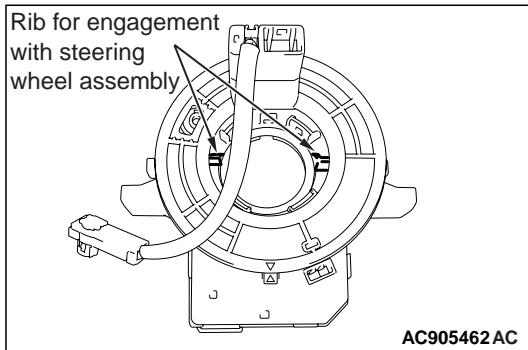
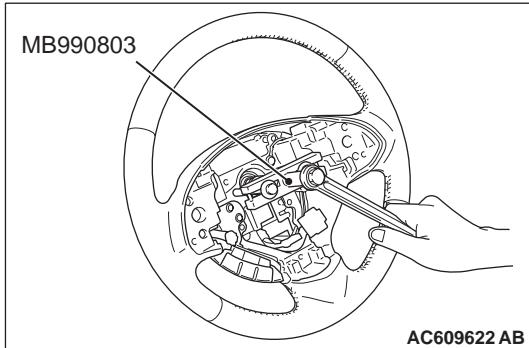
REMOVAL SERVICE POINTS

<<A>> STEERING WHEEL ASSEMBLY
REMOVAL

- Position the steering wheel in a straight ahead position.

CAUTION

Use the special tool to remove the steering wheel since the steering column collision adsorbing mechanism may be damaged.



2. Use special tool steering wheel puller (MB990803) to remove the steering wheel.

INSTALLATION SERVICE POINT

**>>A<< STEERING WHEEL ASSEMBLY/DRIVER'S AIR BAG MODULE
INSTALLATION**

CAUTION

When installing the steering wheel assembly and air bag module, do not trap the clock spring harness.

1. After centring the clock spring (Refer to 52B – Driver's air bag module and clock spring)

2. After checking that the clock spring centre alignment is already performed, install the steering wheel assembly so that its boss part is aligned with the rib of the clock spring slowly.
3. Install the driver's airbag module.
4. After the installation, check that there is no abnormality when the steering wheel is fully turned to left and right.

STEERING COLUMN SHAFT ASSEMBLY

REMOVAL AND INSTALLATION

M1372011501688

⚠ CAUTION

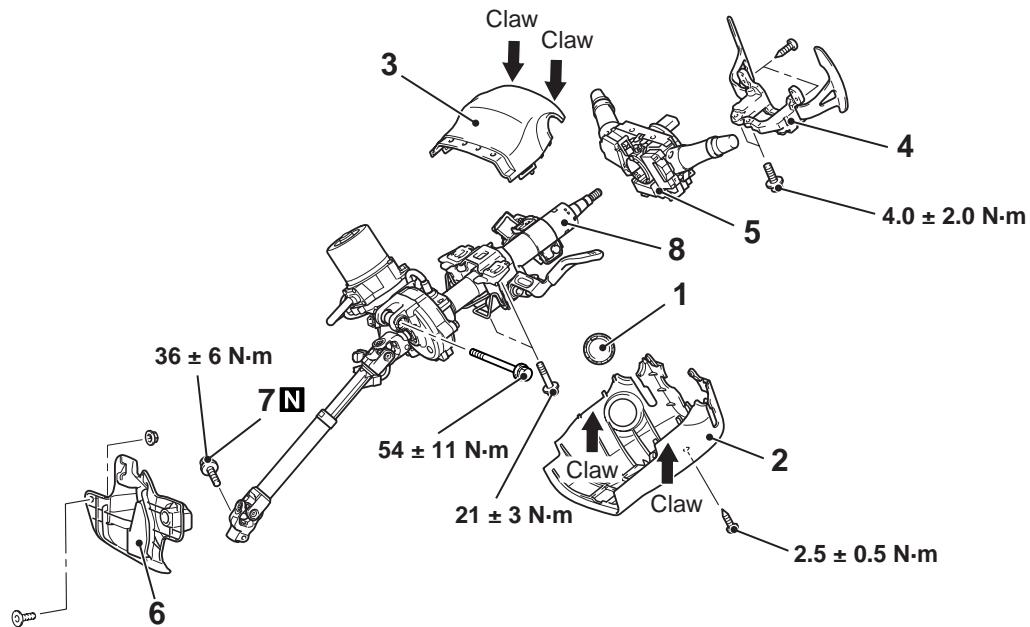
- Before removing the steering wheel, driver's air bag module assembly and knee air bag module refer to GROUP 52B – Service Precautions , Driver's Air Bag Module and Clock Spring and Knee Air Bag Module <Vehicles with knee air bag>.
- After the installation, perform a calibration for the ASC-ECU to learn the steering wheel sensor neutral point. (Refer to GROUP 35C – On-vehicle Service, Steering Wheel Sensor Calibration) <Vehicles with ASC>.
- Do not reuse the part that has been dropped because its internal components may be defective even if it has no apparent damage.
- Always keep the steering column shaft assembly away from the matter that generates magnetic force.
- For the steering column shaft assembly, parts cannot be disassembled.
- Be careful when removing and installing the steering column shaft assembly, because it is heavy.

Pre-removal Operation

- Steering Wheel Straight-ahead Position Check
- Steering Wheel Assembly Removal (Refer to P.37-41).
- Knee Air Bag Module Removal (Refer to GROUP 52B – Knee Air Bag Module) <Vehicles with knee air bag>.

Post-installation Operation

- Knee Air Bag Module Installation (Refer to GROUP 52B – Knee Air Bag Module) <Vehicles with knee air bag>.
- Steering Wheel Assembly Installation (Refer to P.37-41).
- Steering Wheel Straight-ahead Position Check



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Removal steps

- Ignition key cover <vehicles with KOS>
- Steering column lower cover
- Steering column upper cover
- Paddle shift assembly <Vehicles with paddle shift>
- Column switch assembly (Refer to GROUP 54A – Column Switch)

>>B<<

<<A>> >>A<<

Removal steps (Continued)

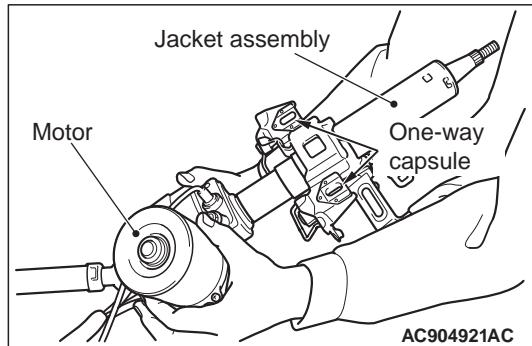
- Steering shaft cover
- Steering column bolt (Steering column shaft assembly and steering gear & linkage connection)
- EPS-ECU bracket (Refer to P.37-51)
- Steering column shaft assembly

REMOVAL SERVICE POINT

<<A>> STEERING COLUMN SHAFT
ASSEMBLY REMOVAL

1. Ensure that the tilt lever is in the lock position.
2. Remove the steering column shaft assembly mounting bolt.

CAUTION



- Hold the motor shown because improper installation may result when the jacket assembly comes off or turns.
- Do not apply any load to the harness because an open circuit may occur.
- Do not release the tilt lever because the jacket assembly may come off.
- Do not subject separation capsule to any shocks because the collision energy absorbing mechanism may not work normally or the steering column shaft may fall down after installing.

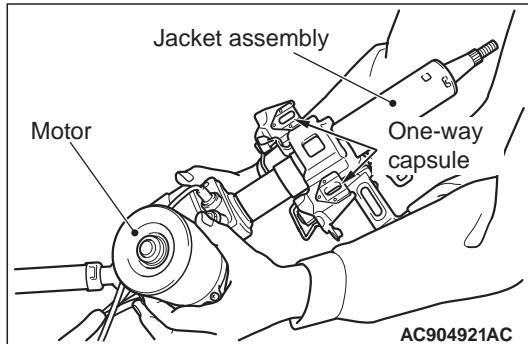
3. Remove the steering column shaft assembly.

INSTALLATION SERVICE POINTS

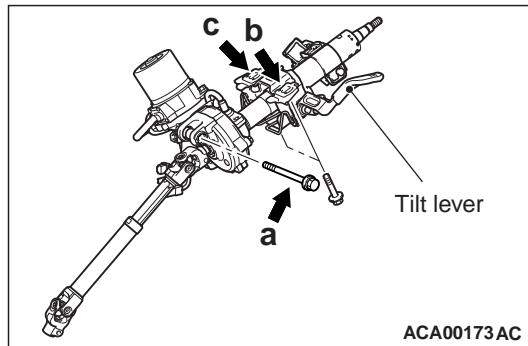
>>A<< STEERING COLUMN SHAFT
ASSEMBLY INSTALLATION

1. Ensure that the tilt lever is in the lock position.

CAUTION



- Hold the motor shown because improper installation may result when the jacket assembly comes off or turns.
- Do not apply any load to the harness because an open circuit may occur.
- Do not release the tilt lever until the steering column shaft assembly is installed to the vehicle, because the mounting position to the vehicle may be misaligned or the installation to the vehicle may become difficult.
- Do not subject the separation capsule to any shocks because the collision energy absorbing mechanism may not work normally or the steering column shaft may fall down after installing.
- Connect the motor harness to EPS-ECU without excessive bend or twisting.

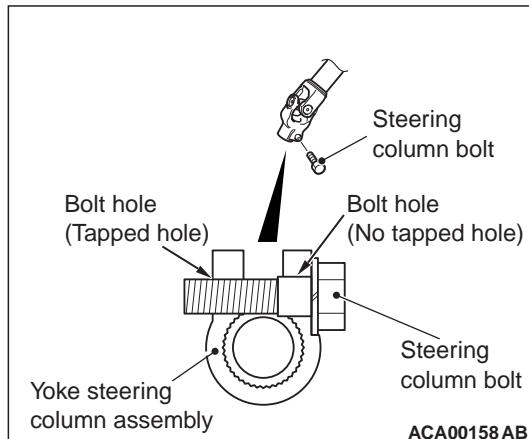


2. Hand-tighten the mounting bolts in the order of a, b, c, and tighten them in the order of c, b, a to the specified torque.

Tightening torque:

- Mounting bolt a: $54 \pm 11 \text{ N}\cdot\text{m}$
- Mounting bolt b, c: $21 \pm 3 \text{ N}\cdot\text{m}$

**>>B<< STEERING COLUMN BOLT
(STEERING COLUMN SHAFT ASSEMBLY
AND STEERING GEAR & LINKAGE
CONNECTION) INSTALLATION**



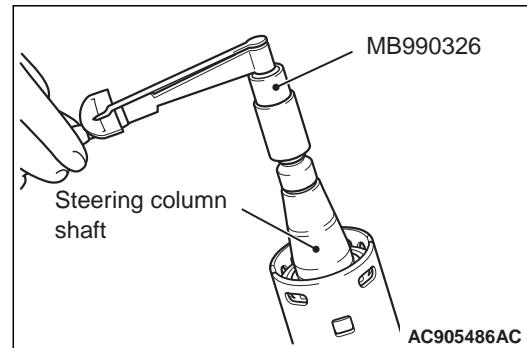
Insert the steering column bolt into the non-threaded bolt hole, and tighten it to the specified torque.

Tightening torque : $36 \pm 6 \text{ N}\cdot\text{m}$

INSPECTION

M1372011001531

**STEERING COLUMN SHAFT TOTAL
ROTATION TORQUE CHECK**



1. Install the nut to the end of the steering column shaft. Then use the preload socket (Special tool: MB990326) to rotate the shaft at a rate of one turn per 4 to 6 seconds, and then measure the total rotation torque.

Standard value:

Total rotation torque: 1.77 N·m or less

Torque fluctuation: 0.6 N·m or less

NOTE: Rotate by 180° in left and right directions from the neutral position, and measure the total rotation torque.

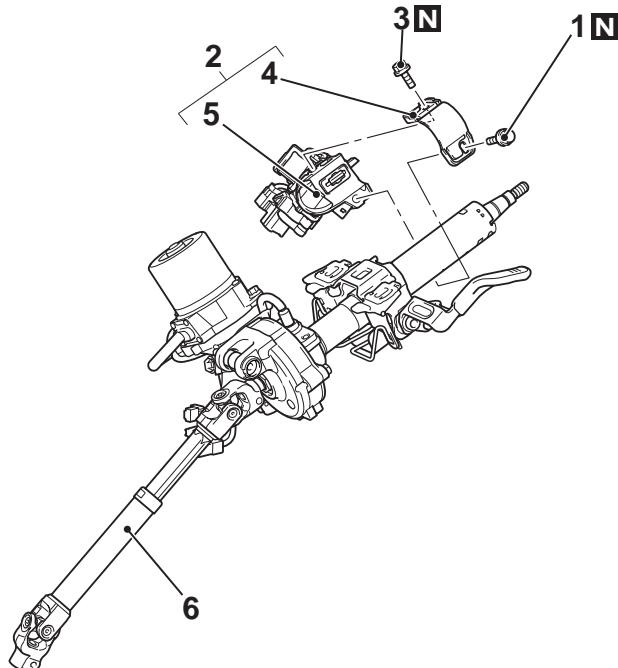
2. When the measured value is not within the standard value, replace the steering column shaft assembly (Refer to P.37-43)

DISASSEMBLY AND REASSEMBLY

M1372011700634

CAUTION

When replacing the electric steering lock, complete the chassis number registration. (Refer to GROUP 42B – On-vehicle Service, Registration when Replacing OSS-ECU and Electric Steering Lock.)



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		Disassembly steps
<<A>>	>>A<<	1. Steering lock bolt (Lower)
		2. Steering lock bracket and steering lock
<<A>>	>>A<<	3. Steering lock bolt (Upper)
	>>A<<	4. Steering lock bracket
	>>A<<	5. Mechanical steering lock <Vehicles without KOS>/Electric steering lock <Vehicle with KOS>
		6. Steering column shaft assembly

NOTE:

- A steering lock, a steering lock bracket and a steering lock bolt are supplied as a single unit. A mechanical steering lock assembly (a mechanical steering lock, a steering lock bracket, a steering lock bolt, a key reminder switch/key ring

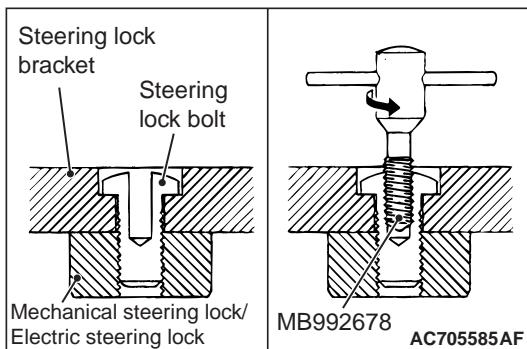
antenna assembly and an ignition switch are included.) <vehicles without KOS> or an electric steering lock assembly (a electric steering lock, a steering lock bracket and a steering lock bolt are included.) <vehicles with KOS> is also supplied.

- When the steering lock assembly is supplied, the steering lock bracket is assembled to the steering lock and the steering lock bolt head (upper) is broken off.
- For removal and installation of key reminder switch/key ring antenna and ignition switch, Refer to GROUP 54A – Ignition Switch Removal and Installation .

DISASSEMBLY SERVICE POINT

<<A>> STEERING LOCK BOLT REMOVAL

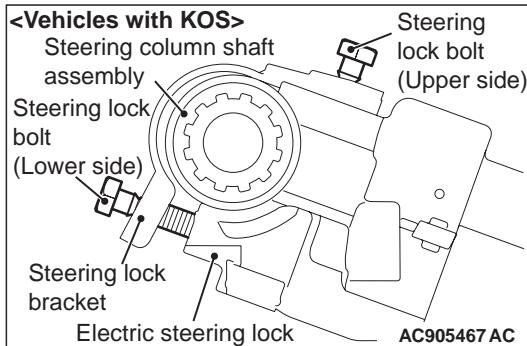
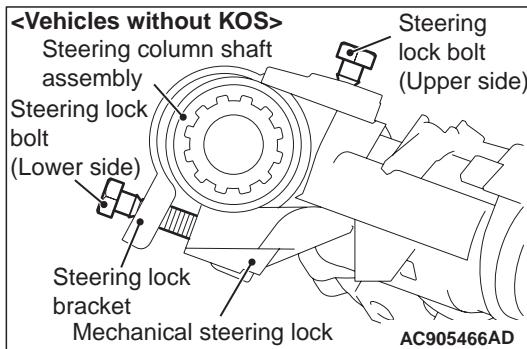
1. Use a drill to make a hole just deeply enough for the tap to stand on the steering lock bolt.



2. Remove the steering lock bolt using the screw extractor (Recommended tool: MB992684), or equivalent.

REASSEMBLY SERVICE POINT

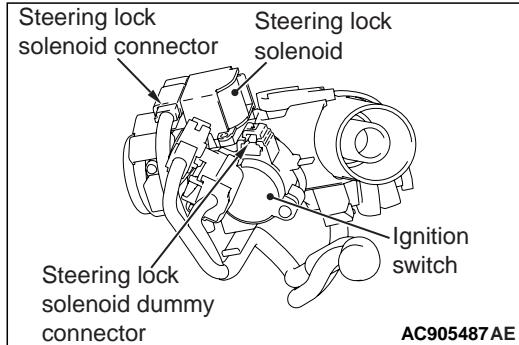
>>A<< MECHANICAL STEERING LOCK <VEHICLES WITHOUT KOS>/ELECTRIC STEERING LOCK <VEHICLE WITH KOS>/STEERING LOCK BRACKET/STEERING LOCK BOLT INSTALLATION



1. Secure the steering lock bracket to the steering lock with steering lock bolt (Upper). Tighten the steering lock bolt until its head is broken off.

2. Insert the steering lock into the tip of the column shaft, fit the protrusion of the steering lock to the hole of the steering column shaft assembly, install the steering lock and tighten the steering lock bolt (lower) until its head is broken off.

CAUTION

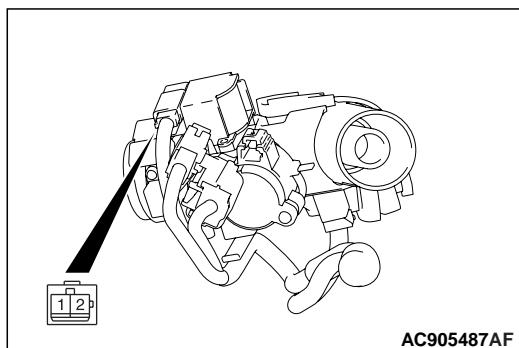


As for the mechanical steering lock for vehicles with CVT, connect the body side wiring harness connector to the steering lock solenoid connector. Do not connect the harness connector to the steering lock solenoid dummy connector. As for the mechanical steering lock for vehicles with M/T, connect the body side wiring harness connector to the steering lock solenoid dummy connector.

INSPECTION

M1372011001542

STEERING LOCK SOLENOID CONTINUITY CHECK <VEHICLES WITHOUT KOS (VEHICLES WITH CVT)>



Disconnect the steering lock solenoid connector, and then perform the continuity check.

Terminal number	Normal value
1 – 2	Continuity exists (2 Ω or less)

POWER STEERING GEAR BOX AND LINKAGE

REMOVAL AND INSTALLATION

Remove the front axle crossmember assembly, and then remove and install the steering gear and linkage.(Refer to GROUP 32 – Crossmember .)

INSPECTION

STEERING GEAR TOTAL PINION
TORQUE CHECK

CAUTION

When holding the steering gear in a vice, secure its mounting positions. If it is secured in any other place, the gear housing may become deformed or damaged.

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1. Using special tool preload socket (MB991006), rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion torque.

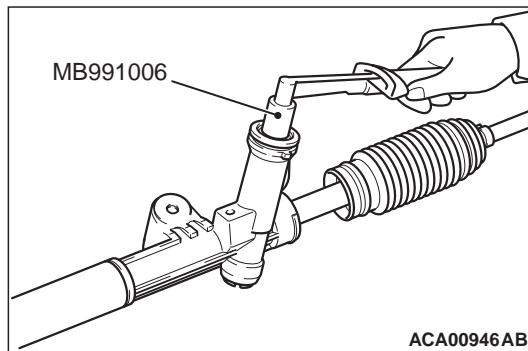
Standard value:

Total rotational torque: 0.7 – 1.3 N·m

Torque fluctuation: 0.7 N·m or less

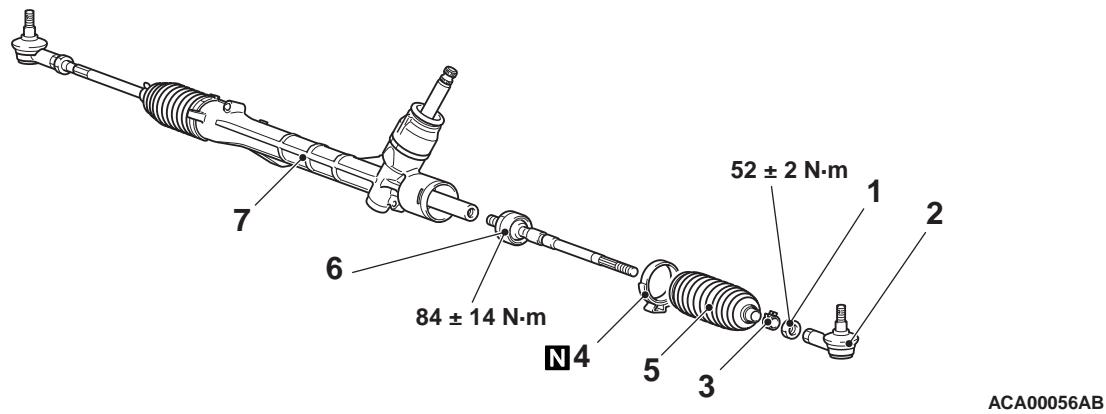
NOTE: When measuring, remove the bellows from the rack housing. Measure the pinion torque through the whole stroke of the rack.

2. If not within the specification, replace the steering gear and linkage assembly (Refer to P.37-48).



DISASSEMBLY AND REASSEMBLY

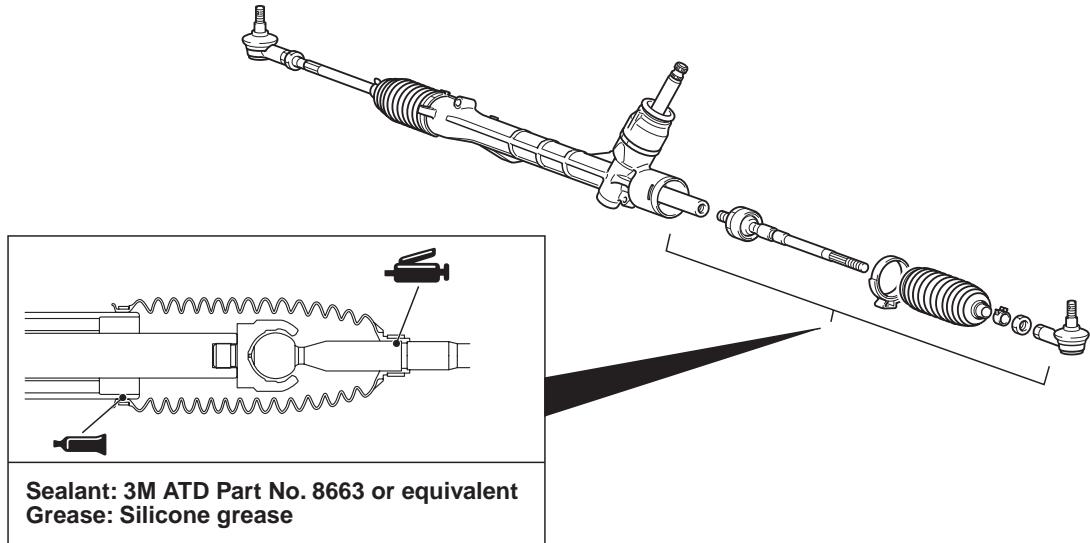
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Disassembly steps	
>>C<<	1. Lock nut
>>C<<	2. Tie-rod end
	3. Clip
>>B<<	4. Band
	5. Bellows

Disassembly steps	
<<A>>	6. Tie-rod
>>A<<	7. Gear housing

GREASE/SEALANT APPLICATION POINTS



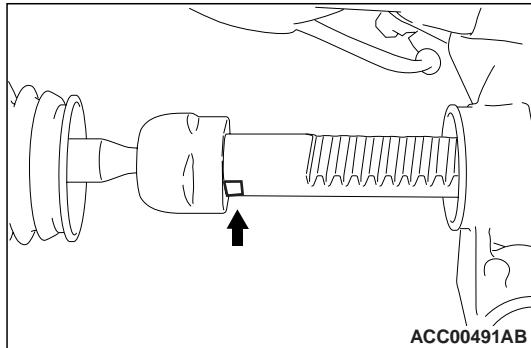
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DISASSEMBLY SERVICE POINT

<>A<> TIE-ROD REMOVAL

CAUTION

Be careful not to damage the rack sealing face.



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Roll back the right bellows and turn the steering wheel anticlockwise to the stop. Then counterhold the rack at the flattened surfaces as shown to remove the tie rod.

>>B<> BAND INSTALLATION

CAUTION

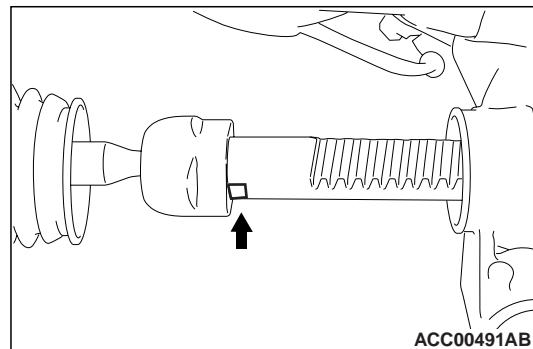
- Hold the rack housing, and use special tool bellows band crimping tool (MB992209) to crimp the bellows band securely.
- Crimp the bellows band until special tool (MB992209) touches the stopper.

REASSEMBLY SERVICE POINTS

>>A<< TIE-ROD INSTALLATION

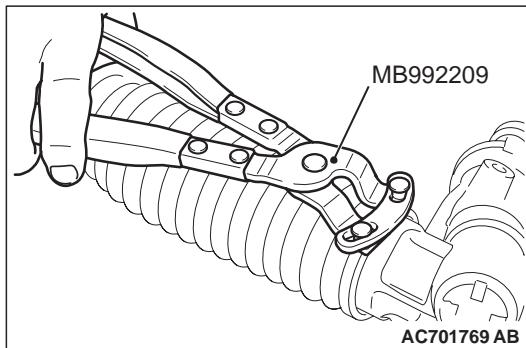
CAUTION

Be careful not to damage the rack sealing face.

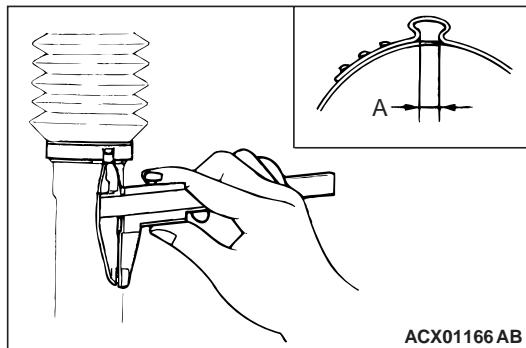


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Turn the steering wheel anticlockwise to the stop. Then counterhold the rack at the flattened surfaces as shown to remove the tie rod.



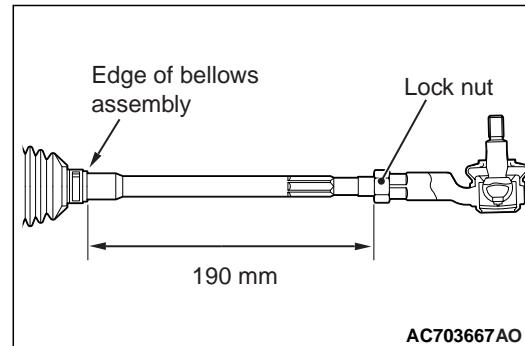
1. Use special tool (MB992209) to crimp the bellows band.



2. Check that crimped width (A) is within the standard value.

Standard value (A): 2.4 – 2.8 mm

>>C<< TIE-ROD END/LOCK NUT INSTALLATION



Screw in the tie-rod to the length shown in the figure, and hand-tighten the lock nut.

NOTE: Install the steering gear & linkage to the body, adjust the toe-in, and then tighten the lock nut to the specified torque.

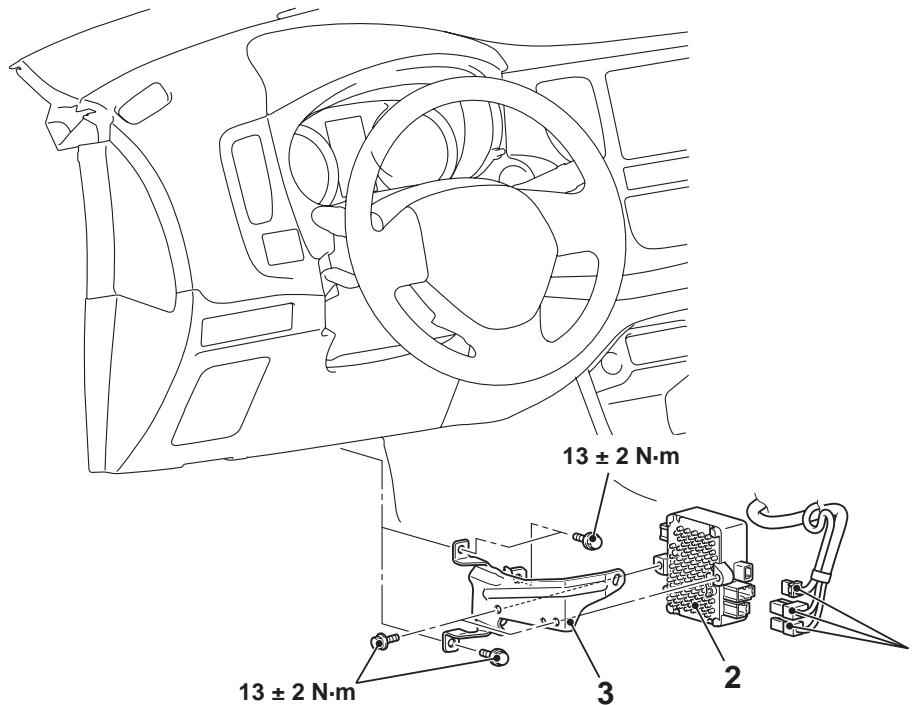
ELECTRIC POWER STEERING CONTROL UNIT (EPS-ECU)

REMOVAL AND INSTALLATION

M1372006300210

⚠ CAUTION

- Do not reuse the product that has been dropped because its internal components may be defective even if it has no apparent damage.
- Always keep EPS-ECU away from the matter that generates magnetic force.



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>>A<< **Removal steps**

1. EPS-ECU connector
2. EPS-ECU
3. EPS-ECU bracket

INSTALLATION SERVICE POINTS

>>A<< EPS-ECU CONNECTOR CONNECTION

⚠ CAUTION

Connect the motor harness to EPS-ECU without excessive bend or twisting.
Connect the connector securely.