GROUP 1

BRAKING EQUIPMENT

CONTENTS

1.1. MECHANICAL CONDITION AND OPERATION 1-2

1.1.1. Service brake pedal/hand lever pivot 1-2
1.1.2. Pedal/hand lever condition and travel of the brake operating device 1-2
1.1.3. Vacuum pump or compressor and reservoirs 1-2
1.1.4. Low pressure warning gauge or indicator. 1-2
1.1.6. Parking brake activator, lever control, parking brake ratchet, electronic parking brake 1-2
1.1.8. Couplings for trailer brakes (electrical & pneumatic). 1-7
1.1.9. Energy storage reservoir pressure tank 1-7
1.1.11. Rigid brake pipes 1-7
1.1.12. Flexible brake hoses 1-7
1.1.13. Brake linings and pads 1-8
1.1.14. Brake drums, brake discs 1-8
1.1.15. Brake cables, rods, levers, linkages 1-10
1.1.16. Brake actuators (including spring brakes or hydraulic cylinders) 1-10
1.1.17. Load sensing valve 1-10
1.1.18. Slack adjusters and indicators 1-10
1.1.19. Endurance braking system (where fitted or required). 1-10
1.1.20. Automatic operation of trailer brakes 1-10
1.1.22. Test connections (where fitted or required). 1-11
1.1.23. Overrun brake 1-11

1.2. SERVICE BRAKING PERFORMANCE AND EFFICIENCY 1-11

1.2.1. Performance 1-11
1.2.2. Efficiency 1-11

1.3. SECONDARY (EMERGENCY) BRAKING PERFORMANCE AND EFFICIENCY (IF MET BY SEPARATE SYSTEM) 1-11

1.3.1. Performance 1-11
1.3.2. Efficiency 1-11

1.4. PARKING BRAKING PERFORMANCE AND EFFICIENCY 1-12

1.4.1. Performance 1-12
1.4.2. Efficiency 1-12

1.5. ENDURANCE BRAKING SYSTEM PERFORMANCE. 1-12

1.6. ANTI-LOCK BRAKING SYSTEM (ABS). 1-12

1.7. ELECTRONIC BRAKE SYSTEM (EBS) 1-13

1.8. BRAKE FLUID 1-13

1.1. MECHANICAL CONDITION AND OPERATION

1.1.1. Service brake pedal/hand lever pivot

M90101010A0013

"Not Applicable"

1.1.2. Pedal/hand lever condition and travel of the brake operating device

M90101020A0010

"Not Applicable"

1.1.3. Vacuum pump or compressor and reservoirs

M90101030A0009

"Not Applicable"

1.1.4. Low pressure warning gauge or indicator

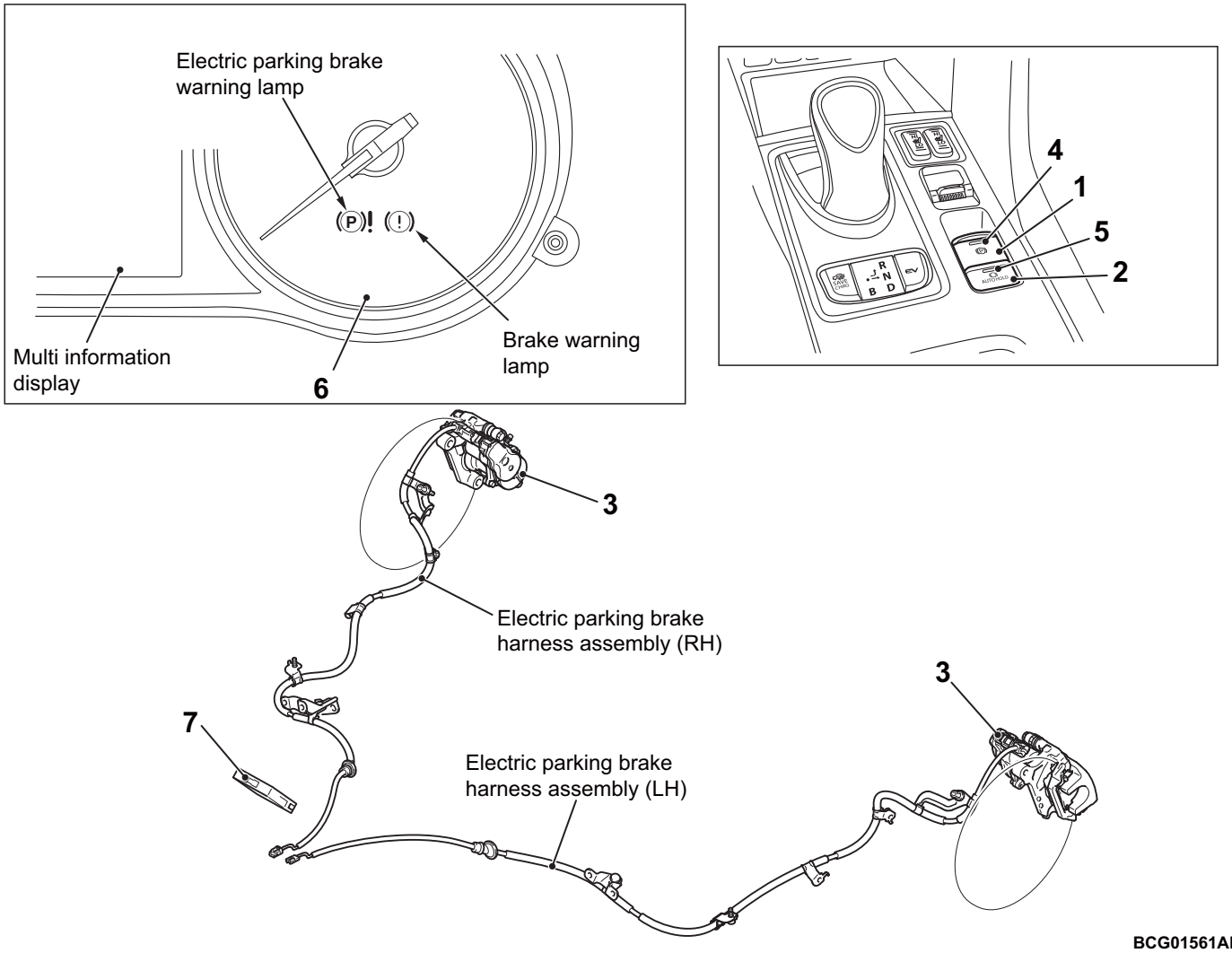
M90101040A0009

"Not Applicable"

1.1.6. Parking brake activator, lever control, parking brake ratchet, electronic parking brake

M90101060A0029

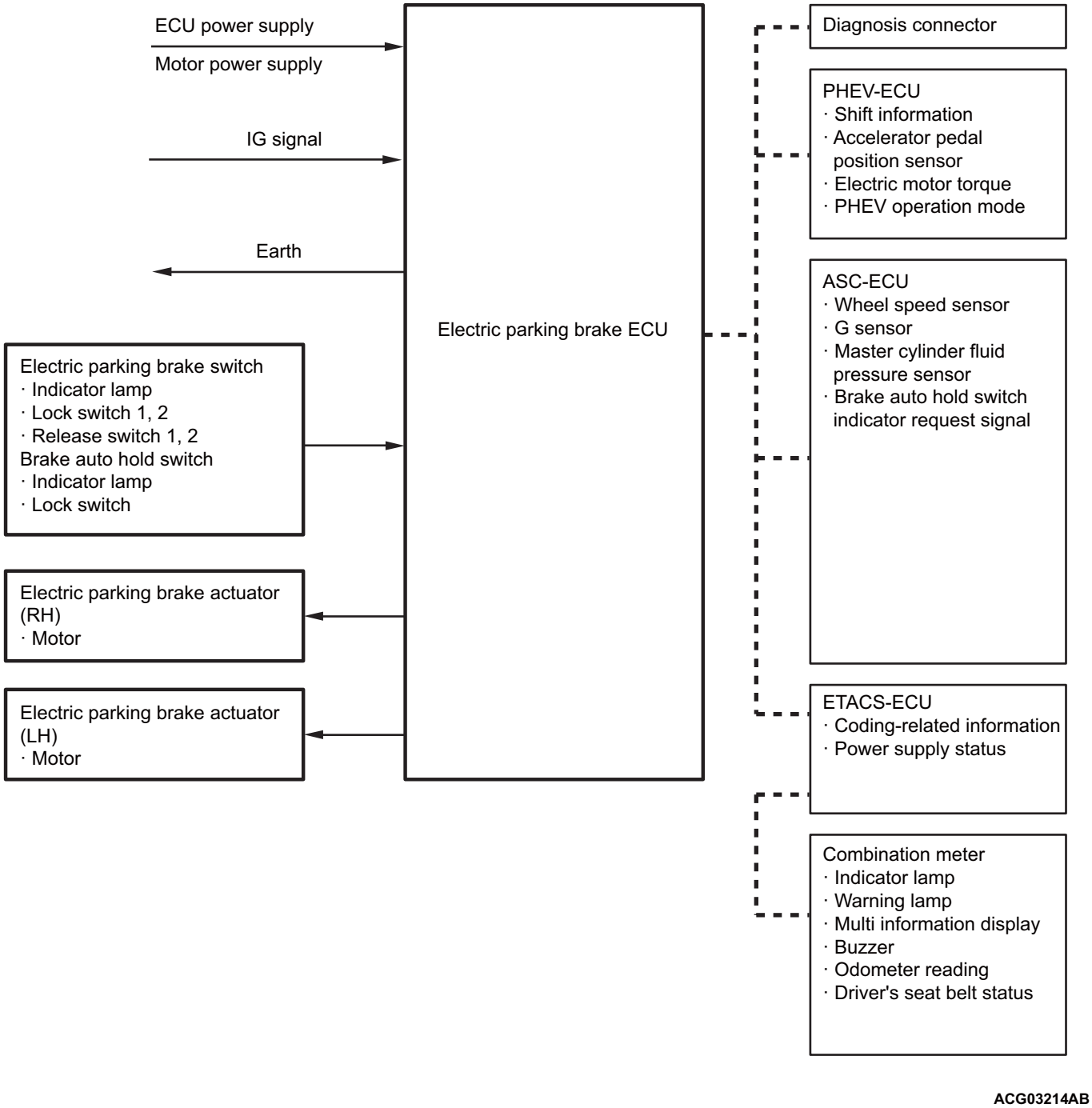
CONSTRUCTION DIAGRAM



BCG01561AB

Item		Number	Outline of function
Sensor	Electric parking brake switch	1	Sends a signal to the electric parking brake ECU to apply and release the electric parking brake.
	Brake auto hold switch	2	The electric parking brake ECU provides the ASC-ECU with the brake auto hold switch ON/OFF information.
CAN bus signal	Shift information	-	Detects which range the selector lever is in, and sends a signal to the electric parking brake ECU via CAN bus lines.
	Accelerator pedal position sensor	-	Detects how deeply the accelerator pedal is depressed, and sends a signal to the electric parking brake ECU via CAN bus lines.
	Electric motor torque	-	Is provided to the electric parking brake ECU via the CAN bus lines.
	PHEV operation mode	-	Is provided to the electric parking brake ECU via the CAN bus lines.
	Wheel speed sensor	-	Detects the speed of road wheels, and sends a signal to the electric parking brake ECU via CAN bus lines.
	G sensor	-	Is incorporated in the ASC-ECU, detects longitudinal acceleration, and sends a signal to the electric parking brake ECU via CAN bus lines.
	Master cylinder fluid pressure sensor	-	Sends a signal to the electric parking brake ECU via the CAN bus lines. The system determines whether the brake pedal is depressed or not by using the signal.
	Brake auto hold switch indicator illumination request signal	-	Is provided to the electric parking brake ECU via the CAN bus lines.
	Coding information	-	Is sent to the electric parking brake ECU via the CAN bus lines.
	Power supply status	-	Is provided to the electric parking brake ECU via the CAN bus lines.
	Odometer reading	-	Is sent to the electric parking brake ECU via the CAN bus lines.
	Driver's seat belt fastened or unfastened	-	Is sent to the electric parking brake ECU via the CAN bus lines.
Actuator	Electric parking brake actuator	3	Activates the electric motor in accordance with the command from the electric parking brake ECU to regulate the parking brake.
	Electric parking brake switch indicator lamp	4	Informs the driver of the system status by flash, illuminating or turning off the indicator lamp according to the signal from electric parking brake ECU.
	Brake auto hold switch indicator lamp	5	The electric parking brake ECU activates or deactivates the brake auto hold switch indicator lamp according to the request sent by the ASC-ECU.
	Combination meter	6	Receives a signal from the electric parking brake ECU, and triggers the warning lamp, the multi-information display or the buzzer to alert the driver of the system status.
Diagnosis connector		-	Outputs the diagnosis codes and allows communication with the M.U.T.-IIISE.
Electric parking brake ECU		7	Controls actuators (described above) based on the signals coming from each sensor.
			Controls the self-diagnostics and fail-safe functions.
			Controls the diagnostic function (M.U.T.-IIISE compatible).

SYSTEM CONFIGURATION DIAGRAM



ACG03214AB

NOTE: Dashed lines indicate the CAN bus communication lines.

SENSORS

ELECTRIC PARKING BRAKE SWITCH

The electric parking brake switch is located on the front floor console panel. When the electric parking brake switch is operated regardless of the power supply mode of the electric motor switch, the electric parking brake is activated.

To apply (lock) the electric parking brake

1. Pull up the electric parking brake switch with the brake pedal depressed.
2. When the parking brake is applied, the brake warning lamp and the indicator lamp on the electric parking brake switch will illuminate.

   NOTE:
   - When the power supply mode of the electric motor switch is turned to ON, if the parking brake is applied, the electric parking brake switch indicator lamp comes on for a while.
   - When parking on sharp grades, pull up the electric parking brake switch twice (once more after the operation is completed once). The maximum effect of the parking brake will be obtained.

To apply the electric parking brake during driving (Emergency brake)

⚠ CAUTION

Use the emergency brake only in emergency. By the excessive use of the brake, the brake parts are possibly worn early and the brake is disabled by the overheat.

1. When you cannot avoid collision by depressing the brake pedal, you can allow the ASC-ECU to activate an emergency braking (brake all four wheels) by pulling the electric parking brake switch

   NOTE: Just in case the ASC-ECU fails, the electric parking brake ECU will brake the rear wheels only instead.
2. While holding it, the brake is applied. At this time, the warning display appears with a buzzer sound, but you should continue to pull and hold the electric parking brake switch.

To release the electric parking brake

1. Turn the power supply mode of the electric motor switch to ON, and press the electric parking brake switch with the brake pedal depressed.

   NOTE: When you depress the accelerator pedal, the electric parking brake will be disengaged automatically. For details, refer to "Automatic operation".
2. When the parking brake is released, the brake warning lamp and the indicator lamp on the electric parking brake switch will go out.

   NOTE: When the power supply mode of the electric motor switch is other than ON, the parking brake cannot be released.

BRAKE AUTO HOLD SWITCH

The brake auto hold switch (indicator) is located on the front floor console panel.

1. The electric parking brake ECU provides the ASC-ECU with the brake auto hold switch ON/OFF information. The ASC-ECU controls the brake auto hold function according to the ON/OFF information.
2. The electric parking brake ECU activates or deactivates the brake auto hold switch indicator lamp according to the request sent by the ASC-ECU.

ACTUATORS

ELECTRIC PARKING BRAKE ACTUATOR

- The electric parking brake actuator, which incorporates an electric motor, regulates the parking brake by actuating the electric motor.
- If the electric parking brake fails due to a flat battery or any other reason, it can be released by operating the electric parking brake actuator manually.

ELECTRIC PARKING BRAKE SWITCH INDICATOR LAMP AND COMBINATION METER

- The electric parking brake ECU illuminates the indicator lamp on the electric parking brake switch as described in the table below.
- The electric parking brake ECU illuminates the warning lamp on the combination meter as described in the table below. In addition, the ECU displays a warning notice on the multi-information display in the combination meter.

Warning lamp, indicator lamp and multi information display illumination pattern

State	Brake warning lamp	Electric parking brake warning lamp	Multi-information display	Electric parking brake switch indicator lamp
For approximately 3 seconds after the power supply mode of the electric motor switch is turned to ON (Initial check for the warning lamp).	Illuminates	Illuminates	-	-
The electric parking brake is applied.	Illuminates*1	-	-	Illuminates*1
The electric parking brake is applied during driving (Emergency brake) *2.	Illuminates	-	RELEASE PARKING BRAKE	Illuminates
The vehicle is held stationary by the electric parking brake instead of the ASC-ECU (brake auto hold mode).	Illuminates	-	PARKING BRAKE ENGAGED	Illuminates
The electric parking brake is released.	-	-	-	-
The driver attempted to release the electric parking brake without depressing the brake pedal when the electrical parking switch is OFF.	Illuminates	-	PRESS BRAKE PEDAL TO RELEASE	Illuminates
The vehicle starts off when the seat belt is not worn and the electric parking brake is not released.	Illuminates	-	RELEASE PARKING BRAKE	Illuminates
The overheat protection mode for electric motor is triggered.	Flash (1 Hz)	-	PARKING BRAKE TEMPORARILY NOT AVAILABLE	Flash (1 Hz)
You make the system enter the maintenance mode (by using the M.U.T.-IIISE).	Flash (1 Hz)	-	-	Flash (1 Hz)
You make the system enter the maintenance mode (by using the switch).	Flash (1 Hz)	Illuminates	PARKING BRAKE SERVICE REQUIRED	Flash (1 Hz)

NOTE:

- *1: When the power supply mode of the electric motor switch is other than ON, if the parking brake is applied, the electric parking brake switch indicator lamp comes on for a while. The brake warning lamp does not come on.
- *2: The buzzer (incorporated in the combination meter) sounds.
- : For how the warning lamp, the indicator lamp and the multi-information display work when a malfunction occurs, refer to GROUP 36 - ELECTRIC PARKING BRAKE WARNING LAMP AND BRAKE WARNING LAMP CHECK.

ELECTRIC PARKING BRAKE ECU

- The electric parking brake ECU determines the vehicle status according to the electric parking brake switch signal and CAN communication, and regulates the parking brake by actuating the electric parking brake actuator.
- The electric parking brake ECU supports self-diagnosis and memory functions. If the self-diagnosis finds a malfunction, the ECU will activate the indicator lamp, the warning lamp or the multi-information display to alert the driver of the system status.

Automatic operation

When you depress the accelerator pedal with all of the conditions below satisfied, the electric parking brake ECU will determine that the driver is starting the vehicle, and release the parking brake automatically.

Vehicle condition

- The vehicle stationary
- Ready indicator is illuminated.
- Selector lever: "D" or "R" position
- Seat belt (driver's side): Fastened
- Electric parking brake: apply

NOTE: The automatic operation works only when the driver's seat belt is fastened. If you start the vehicle without fastening the seat belt, the multi-information display should show "RELEASE PARKING BRAKE".

Overheat protection mode for electric motor

When the electric parking brake switch is operated repeatedly within a short time, the system will take the measures below for 60 seconds to protect the electric parking brake actuator (electric motor) from overheating. In 60 seconds, the system will reset the switch operation counter, and then resume to the normal operation.

Measures

- The system does not accept any operations of the electric parking brake switch for 60 seconds. However, the system enables the driver to operate the switch once to release the parking brake when the electric motor is locked with the overheat protection mode triggered (the system does not enable the driver to operate the switch to apply the parking brake).
- When the ASC-ECU requests the system to apply the parking brake, the system accepts the request.
- The system perform the followings while the electric motor is disabled to run:
  - Electric parking brake switch indicator lamp: Flashes for 60 seconds
  - Parking brake warning lamp: Flashes for 60 seconds
  - Multi-information display: "PARKING BRAKE TEMPORARILY NOT AVAILABLE" is displayed

Maintenance mode

The electric parking brake ECU will enter the maintenance mode when the switch is operated in certain ways. When the system enters the maintenance mode, the electric parking brake will be released to facilitate replacement of the rear brake pad or the rear disc brake rotor.

1.1.8. Couplings for trailer brakes (electrical & pneumatic)

M90101080A0009

"Not Applicable"

1.1.9. Energy storage reservoir pressure tank

M90101090A0009

"Not Applicable"

1.1.11. Rigid brake pipes

M90101110A0009

"Not Applicable"

1.1.12. Flexible brake hoses

M90101120A0009

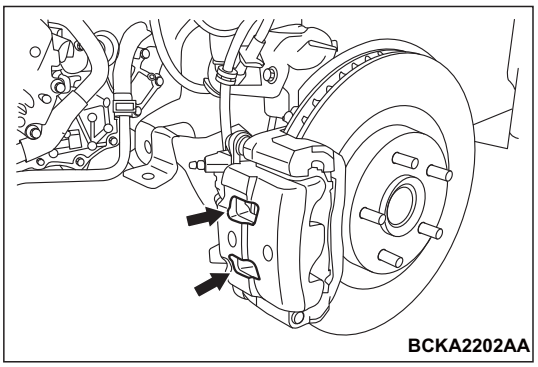
"Not Applicable"

1.1.13. Brake linings and pads

M90101130A0029

<FRONT>

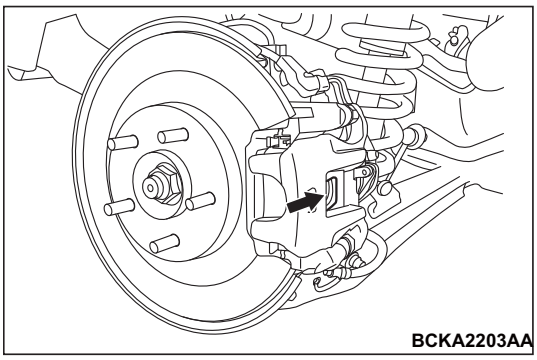
⚠ CAUTION
If there is a significant difference in thickness between the brake pads at right and left, check the sliding area and the run-out of the brake disc.



1. Visually check the thickness of brake pad from the inspection hole of the calliper body.
   Standard value: 10.0 mm
   Limit: 2.0 mm
2. If the brake pad thickness is less than the limit value, replace the brake pad.

<REAR>

⚠ CAUTION
If there is a significant difference in thickness between the brake pads at right and left, check the sliding area and the run-out of the brake disc.



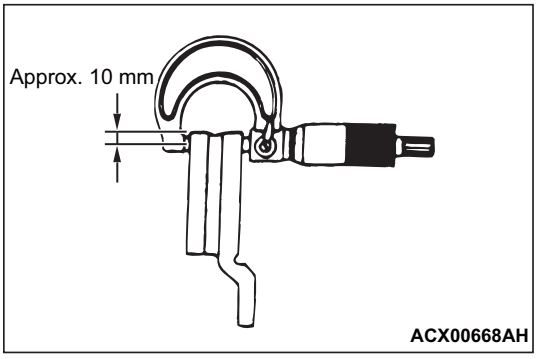
1. Visually check the thickness of brake pad from the inspection hole of the calliper body.
   Standard value: 9.0 mm
   Limit: 2.0 mm
2. If the brake pad thickness is less than the limit value, replace the brake pad.

1.1.14. Brake drums, brake discs

M90101140A0029

BRAKE DISC THICKNESS CHECK

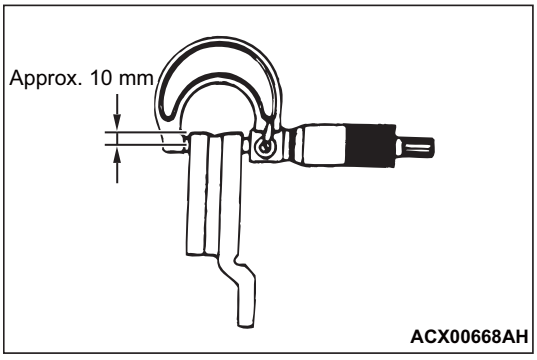
1. Remove contaminants or corrosion from the brake disc surface.



2. Use a micrometer to measure the brake disc thickness at minimum eight points which are 10 mm inward from its circumference.
   <Front>
   Standard value: 28.0 mm
   Limit: 26.4 mm
   <Rear>
   Standard value: 10.0 mm
   Limit: 8.4 mm
3. If the brake disc thickness is worn beyond the limit value at more than one point, replace the brake disc and check its run-out.

BRAKE DISC THICKNESS UNEVENNESS CHECK AND CORRECTION

1. Remove contaminants or corrosion from the brake disc surface.



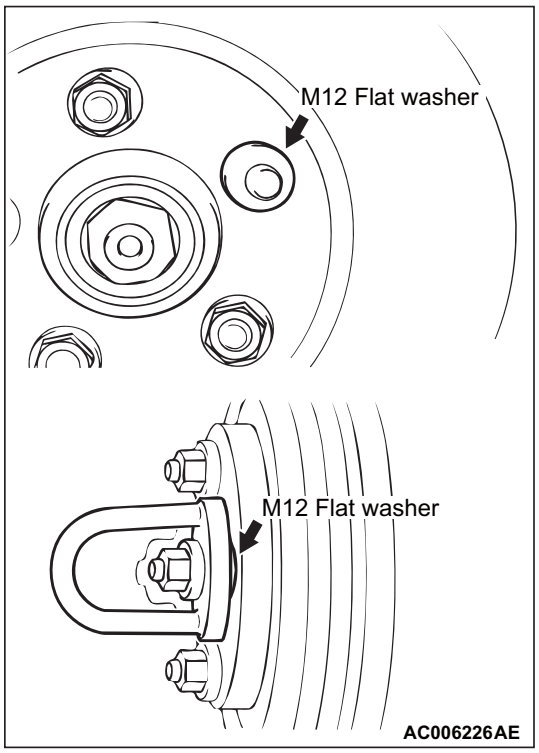
2. Use a micrometer to measure the brake disc thickness at minimum eight points which are 10 mm inward from its circumference. Then record the measurements.
3. If the brake disc thickness unevenness (the difference between the maximum and minimum values measured above) is 0.015 mm or less, it is within the standard value.

4. If the brake disc thickness unevenness exceeds the standard value, grind it according to the procedure below while it is mounted on the vehicle.

   NOTE: If it is suspected that the brake disc thickness will become less than the limit value after the grinding, replace the brake disc and check its run-out.

   (1) Check for wheel bearing looseness in the axial direction.

⚠ CAUTION

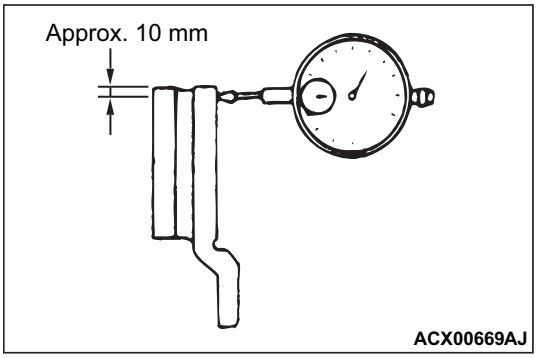


- **Insert M12 plain washer and then install the adapter as shown before grinding. Failure to use the M12 plain washer will cause the brake disc to be deformed and earth incorrectly.**
- **To grind the brake disc, ensure that all the nuts (M12×1.5) are tightened evenly and in a diagonal sequence to the specified torque (98 ± 10 N·m). Failure to use all the nuts (M12×1.5), excessive or uneven tightening torque will cause the brake disc to deform or judder.**

   (2) Correct the brake disc uneven thickness by grinding it while in place on the vehicle.

BRAKE DISC RUN-OUT CHECK AND CORRECTION

1. Check for wheel bearing looseness in the axial direction.
2. If the axial play is within the limit value, secure the brake disc by tightening the nut (M12×1.5) evenly to the specified torque (98 ± 10 N·m).If the axial play still exceeds the limit value, replace the wheel bearing. Then secure the brake disc by tightening the nut (M12×1.5) evenly to the specified torque (98 ± 10 N·m).

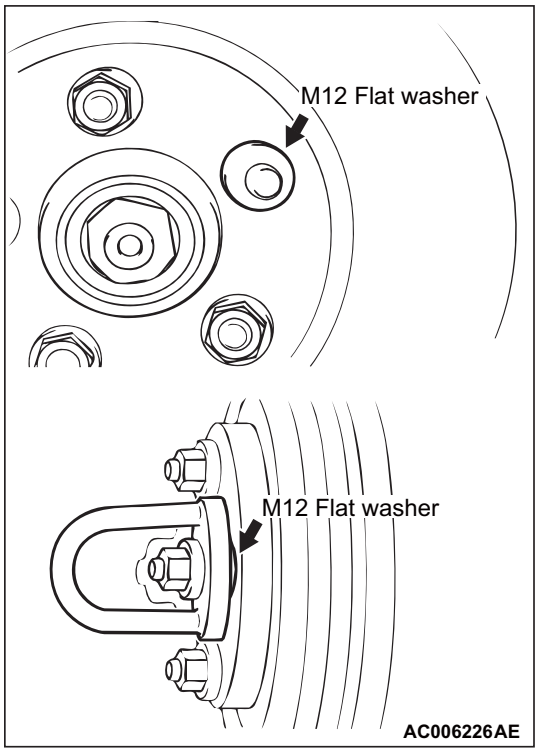


3. Place a dial gauge ca. 5 mm inward from the circumference of the brake disc to measure its run-out.

   Limit:
   0.06 mm <Front>
   0.08 mm <Rear>

4. If the brake disc run-out exceeds the limit value, rephase the brake disc to the hub so that the minimum brake disc run-out is obtained.

⚠ CAUTION



- **Insert M12 plain washer and then install the adapter as shown before grinding. Failure to use the M12 plain washer will cause the brake disc to be deformed and earth incorrectly.**
- **To grind the brake disc, ensure that all the nuts (M12×1.5) are tightened evenly and in a diagonal sequence to the specified torque (98 ± 10 N·m). Failure to use all the nuts (M12×1.5), excessive or uneven tightening torque will cause the brake disc to deform or judder.**

5. If the brake disc run-out exceeds the limit value after rephasing, grind the disc while in place on the vehicle so that the brake disc run-out is within the limit value.

   NOTE: If it is suspected that the brake disc thickness will be below the limit value, replace the brake disc. Then rephase the brake disc so that the minimum brake disc run-out is obtained, or grind the disc while in place on the vehicle so that its run-out is below the limit value.

1.1.15. Brake cables, rods, levers, linkages

M90101150A0009

"Not Applicable"

1.1.16. Brake actuators (including spring brakes or hydraulic cylinders)

M90101160A0009

"Not Applicable"

1.1.17. Load sensing valve

M90101170A0009

"Not Applicable"

1.1.18. Slack adjusters and indicators

M90101180A0009

"Not Applicable"

1.1.19. Endurance braking system (where fitted or required)

M90101190A0009

"Not Applicable"

1.1.20. Automatic operation of trailer brakes

M90101200A0009

"Not Applicable"

1.1.22. Test connections (where fitted or required)

M90101220A0009

"Not Applicable"

1.1.23. Overrun brake

M90101230A0009

"Not Applicable"

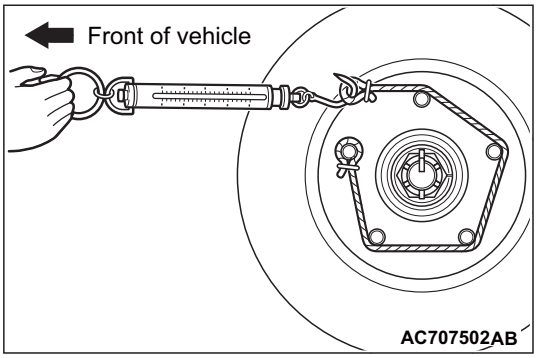
1.2. SERVICE BRAKING PERFORMANCE AND EFFICIENCY

1.2.1. Performance

M90102010A0022

BRAKE DRAG FORCE CHECK

1. Remove the brake pad, shim and clip.



2. Using a spring scale, measure the hub sliding torque in the forward direction with the brake pad, shim and clip removed.
3. Install the brake pad, shim and clip.
4. Turn the power supply mode of the electric motor switch to ON, and depress the brake pedal lightly two or three times. Then turn the power supply mode of the electric motor switch to OFF. (Depressing force: approximately 50 - 100 N)
5. Turn the brake disc 10 times in the forward direction.
6. Using a spring scale, measure the hub sliding torque in the forward direction with the brake pad, shim and clip installed.
7. Obtain the disc brake drag force (difference between measured values of item 2 and item 6).

   Standard value:
   68 N or less <Front>
   68 N or less <Rear>
8. If the brake drag force exceeds the standard value, disassemble the brake calliper assembly to check for fouling/rust on the piston sliding section and piston seal deterioration, and confirm whether the guide pin and lock pin slide properly.

1.2.2. Efficiency

M90102020A0009

"Not Applicable"

1.3. SECONDARY (EMERGENCY) BRAKING PERFORMANCE AND EFFICIENCY (IF MET BY SEPARATE SYSTEM)

1.3.1. Performance

M90103010A0008

The FCM has the same system as the basic brake.
(Refer to 1.2.1. Performance P.1-11)

1.3.2. Efficiency

M90103020A0008

"Not Applicable"

1.4. PARKING BRAKING PERFORMANCE AND EFFICIENCY

1.4.1. Performance

M90104010A0008

Refer to 1.2.1. Performance P.1-11.

1.4.2. Efficiency

M90104020A0008

"Not Applicable"

1.5. ENDURANCE BRAKING SYSTEM PERFORMANCE

M90105000A0008

"Not Applicable"

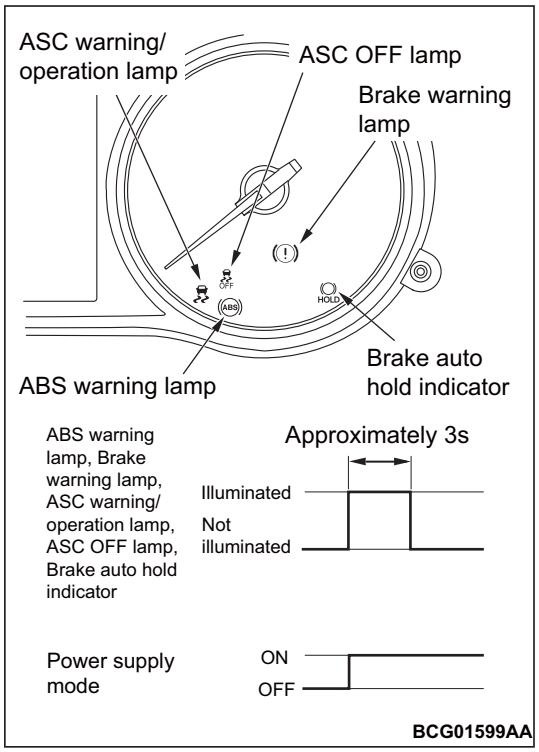
1.6. ANTI-LOCK BRAKING SYSTEM (ABS)

M90106000A0013

ABS WARNING LAMP, ASC WARNING/OPERATION LAMP, BRAKE WARNING LAMP AND BRAKE AUTO HOLD INDICATOR CHECK

Check that ABS and brake warning lamps, ASC warning/operation lamp, brake auto hold indicator illuminate as follows.

NOTE: The brake warning lamp is used as a warning lamp for parking brake, brake fluid level, and EBD control.



1. When the power supply mode of the electric motor switch is turned to ON, ABS and brake warning lamps, ASC warning/operation lamp, ASC OFF lamp, brake auto hold indicator illuminate.
2. The ABS and brake warning lamps, ASC warning/operation lamp, ASC OFF lamp, brake auto hold indicator illuminate for three seconds[*1] and then turn OFF[*2].
3. Otherwise, check the diagnosis code.

NOTE:

- [*1]: The ABS warning lamp, ASC warning/operation lamp, ASC OFF lamp may stay ON until the vehicle speed reaches 10 km/h. As far as ASC-ECU sets any diagnosis code related to the wheel speed sensor malfunction or the motor malfunction as past trouble, ASC-ECU continues illuminating the ABS warning lamp until it verifies that the malfunction for that code is resolved (startup check).
  If the steering wheel sensor or the G and yaw rate sensor system was detected to be defective during power supply mode of the electric motor switch being ON at the last time, the ASC warning/operation lamp and the ASC OFF lamp will illuminate until the vehicle speed reaches approx. 10 km/h, then the steering wheel is turned to either right or left and then the ECU determines that the system is normal.
- [*2]: The brake warning lamp does not turn OFF when the parking brake is applied or the brake fluid level is lowered.

1.7. ELECTRONIC BRAKE SYSTEM (EBS)

M90107000A0009

"Query raised for this content"

1.8. BRAKE FLUID

M90108000A0009

"Not Applicable"

GROUP 2

STEERING

CONTENTS

2.1. MECHANICAL CONDITION 2-2
- 2.1.1. Steering gear condition 2-2
- 2.1.2. Steering gear casing attachment . . . 2-2
- 2.1.3. Steering linkage condition 2-2
- 2.1.4. Steering linkage operation 2-2
- 2.1.5. Power steering 2-2

2.2. STEERING WHEEL, COLUMN AND HANDLE BAR 2-2
- 2.2.1. Steering wheel/handle bar condition 2-2
- 2.2.2. Steering column/yokes and forks and steering dampers 2-2

2.3. STEERING PLAY. 2-2

2.4. WHEEL ALIGNMENT (X)2 2-2

2.5. TRAILER STEERED AXLE TURNTABLE. 2-2

2.6. ELECTRONIC POWER STEERING (EPS) 2-3

2.1. MECHANICAL CONDITION

2.1.1. Steering gear condition

M90201010A0009

"Not Applicable"

2.1.2. Steering gear casing attachment

M90201020A0009

"Not Applicable"

2.1.3. Steering linkage condition

M90201030A0009

"Not Applicable"

2.1.4. Steering linkage operation

M90201040A0011

"Not Applicable"

2.1.5. Power steering

M90201050A0009

"Not Applicable"

2.2. STEERING WHEEL, COLUMN AND HANDLE BAR

2.2.1. Steering wheel/handle bar condition

M90202010A0008

"Not Applicable"

2.2.2. Steering column/yokes and forks and steering dampers

M90202020A0008

"Not Applicable"

2.3. STEERING PLAY

M90203000A0008

"Not Applicable"

2.4. WHEEL ALIGNMENT (X)2

M90204000A0008

"Not Applicable"

2.5. TRAILER STEERED AXLE TURNTABLE

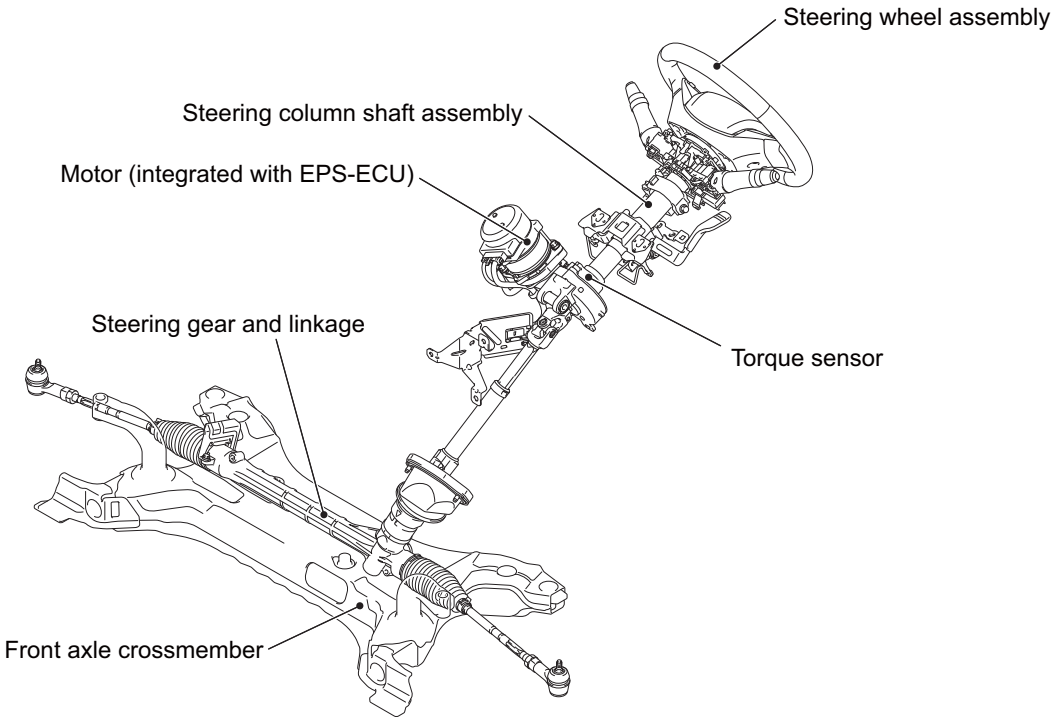
M90205000A0008

"Not Applicable"

2.6. ELECTRONIC POWER STEERING (EPS)

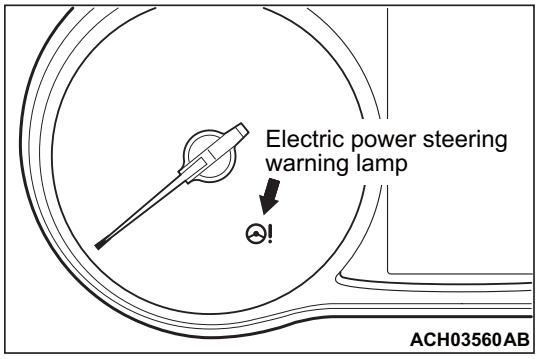
M90206000A0013

CONSTRUCTION DIAGRAM



BCH03751AA

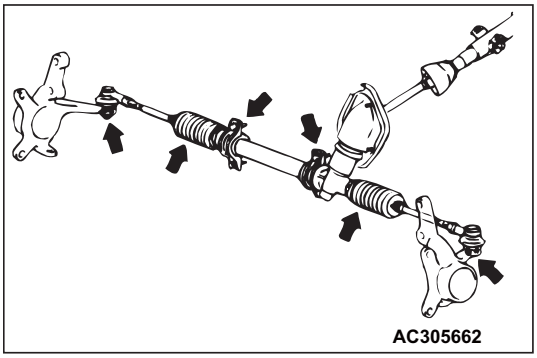
CHECK OF ELECTRIC POWER STEERING WARNING LAMP



ACH03560AB

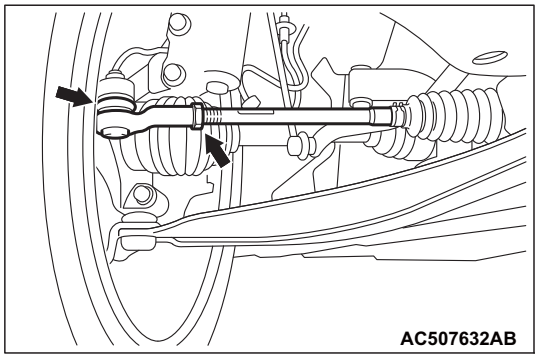
If the electric power steering warning lamp does not operate, the electric power steering system or the combination meter may be defective. Check for diagnosis code, and carry out diagnosis. If no diagnosis codes are set, carry out diagnosis by referring to the electric power steering warning lamp-related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

CHECK STEERING LINKAGE FOR DAMAGE AND LOOSE CONNECTIONS (INCLUDING SEALS AND BOOTS)



AC305662

1. Move the steering wheel bit by bit to the left or right, and check to be sure that there is no play or looseness in the linkage coupling, that the installation is not loose, and that the rod or arm is not bent or damaged.



2. Check to be sure that the seal and boot of the ball joint are correctly installed (in the correct position), and that they are not damaged.
3. Check tie-rod end lock nut for looseness. If lock nut is loose, adjust toe-in and then tighten lock nut to the specified torque.

   Tightening torque: 52 ± 2 N·m

GROUP 3

VISIBILITY

CONTENTS

3.1. FIELD OF VISION 3-2
3.2. CONDITION OF GLASS 3-2
3.3. REAR-VIEW MIRRORS OR DEVICES 3-2
3.4. WINDSCREEN WIPERS 3-2
3.5. WINDSCREEN WASHERS 3-2
3.6. DEMISTING SYSTEM (X)2 3-2

3.1. FIELD OF VISION

M90301000A0008

"Not Applicable"

3.2. CONDITION OF GLASS

M90302000A0008

"Not Applicable"

3.3. REAR-VIEW MIRRORS OR DEVICES

M90303000A0008

"Not Applicable"

3.4. WINDSCREEN WIPERS

M90304000A0008

"Not Applicable"

3.5. WINDSCREEN WASHERS

M90305000A0008

"Not Applicable"

3.6. DEMISTING SYSTEM (X)2

M90306000A0008

"Not Applicable"

GROUP 4

LAMPS, REFLECTORS AND ELECTRICAL EQUIPMENT

CONTENTS

4.1. HEADLAMPS 4-3
4.1.1. Condition and operation 4-3
4.1.2. Alignment 4-4
4.1.3. Switching 4-7
4.1.4. Compliance with requirements1 4-10
4.1.5. Levelling devices (where mandatory) 4-10
4.1.6. Headlamp cleaning device (where mandatory) 4-12

4.2. FRONT AND REAR POSITION LAMPS, SIDE MARKER LAMPS, END OUTLINE MARKER LAMPS AND DAYTIME RUNNING LAMPS . . 4-13
4.2.1. Condition and operation 4-13
4.2.2. Switching 4-13
4.2.3. Compliance with requirements1 4-13

4.3. STOP LAMPS 4-14
4.3.1. Condition and operation 4-14
4.3.2. Switching 4-14
4.3.3. Compliance with requirements1 4-21

4.4. DIRECTION INDICATOR AND HAZARD WARNING LAMPS 4-22
4.4.1. Condition and operation 4-22
4.4.2. Switching 4-22
4.4.3. Compliance with requirements1 4-22
4.4.4. Flashing frequency 4-22

4.5. FRONT AND REAR FOG LAMPS 4-22
4.5.1. Condition and operation 4-22
4.5.2. Alignment (X)2 4-22
4.5.3. Switching 4-22
4.5.4. Compliance with requirements1 4-22

4.6. REVERSING LAMPS 4-22
4.6.1. Condition and operation 4-22
4.6.2. Compliance with requirements1 4-22
4.6.3. Switching 4-22

Continued on next page

4.7. REAR REGISTRATION PLATE LAMP 4-23
4.7.1. Condition and operation 4-23
4.7.2. Compliance with requirements1. 4-23

4.8. RETRO-REFLECTORS, CONSPICUITY (RETRO REFLECTING) MARKINGS AND REAR MARKING PLATES 4-23
4.8.1. Condition 4-23
4.8.2. Compliance with requirements1. 4-23

4.9. TELL-TALES MANDATORY FOR LIGHTING EQUIPMENT 4-23
4.9.1. Condition and operation 4-23
4.9.2. Compliance with requirements1. 4-23

4.10. ELECTRICAL CONNECTIONS BETWEEN TOWING VEHICLE AND TRAILER OR SEMI-TRAILER 4-23

4.11. ELECTRICAL WIRING 4-23

4.12. NON OBLIGATORY LAMPS AND RETRO-REFLECTORS (X)2 . . . 4-24

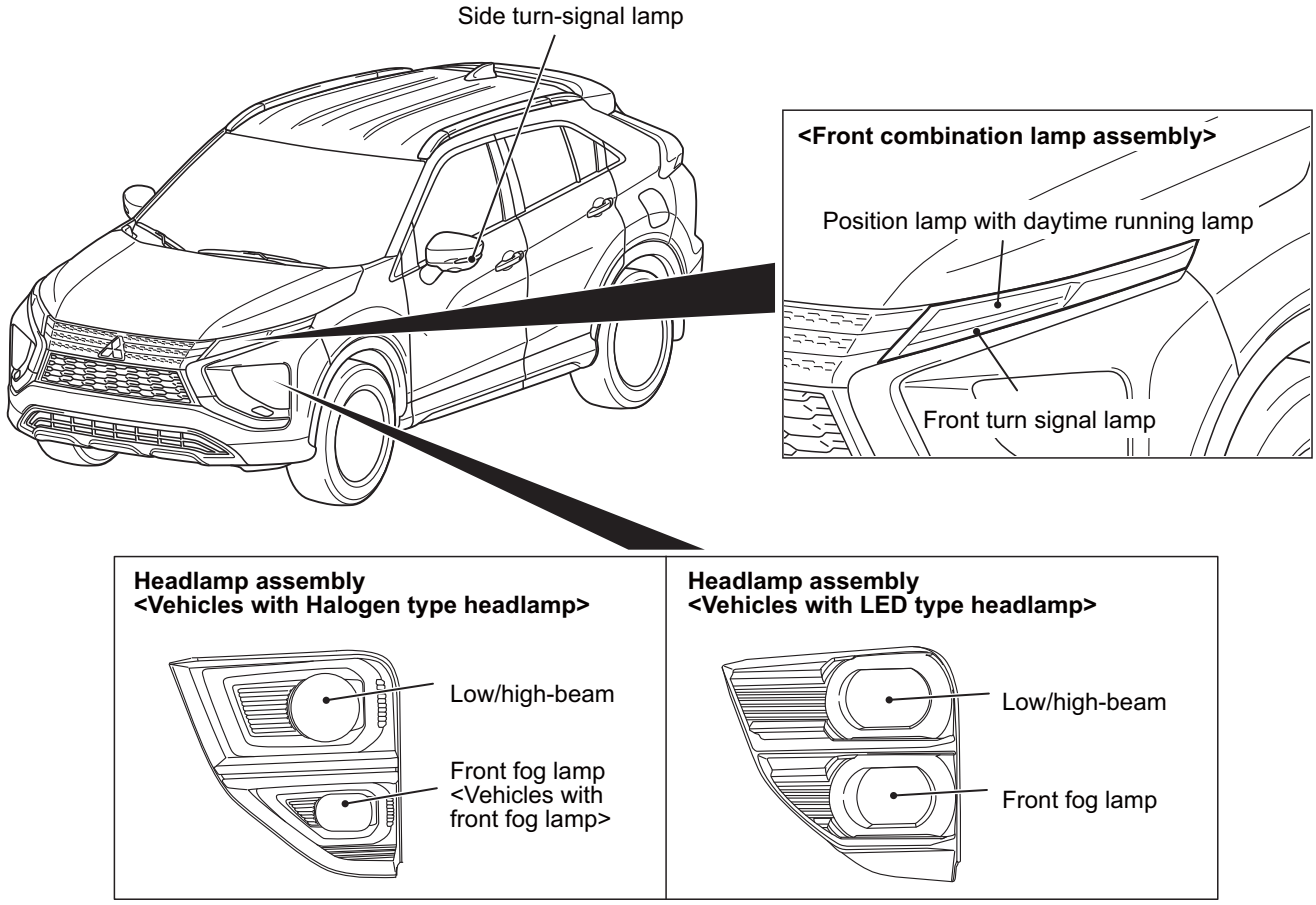
4.13. BATTERY(IES) 4-24

4.1. HEADLAMPS

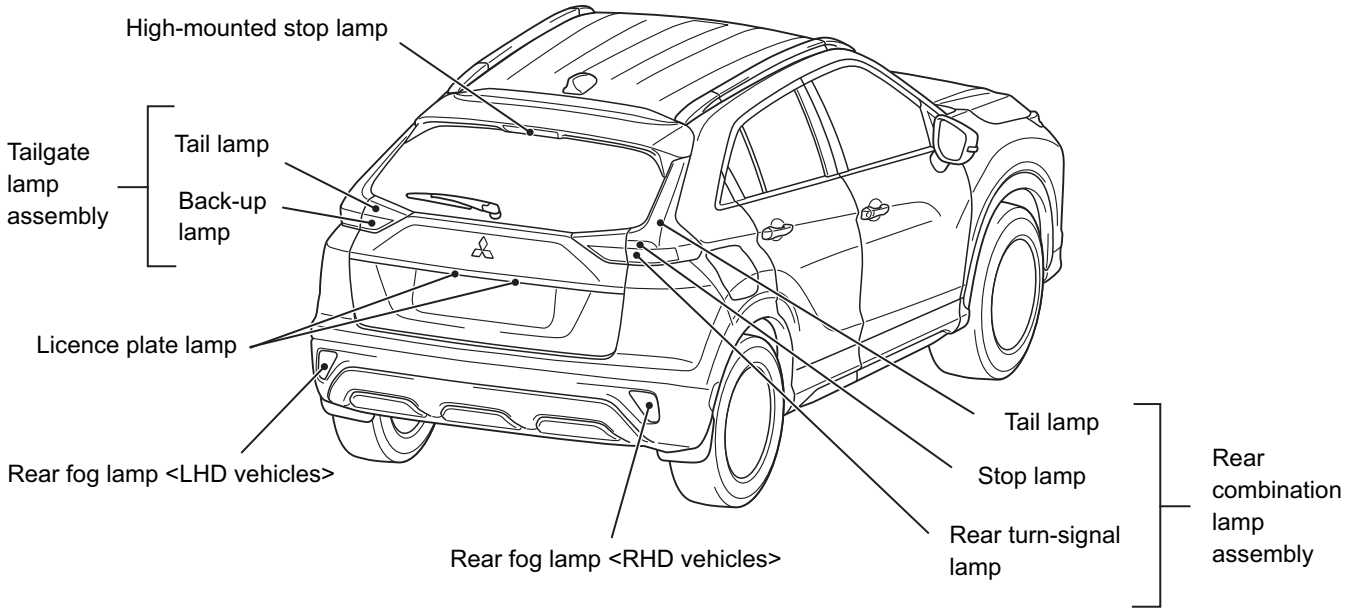
4.1.1. Condition and operation

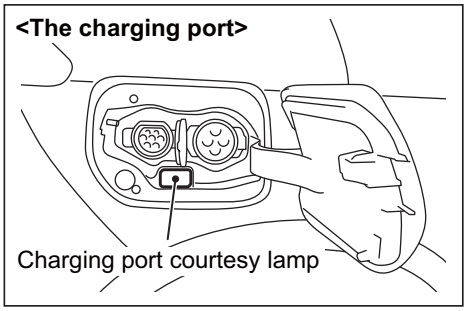
M90401010A0524

Construction diagram



BCKA3413AA



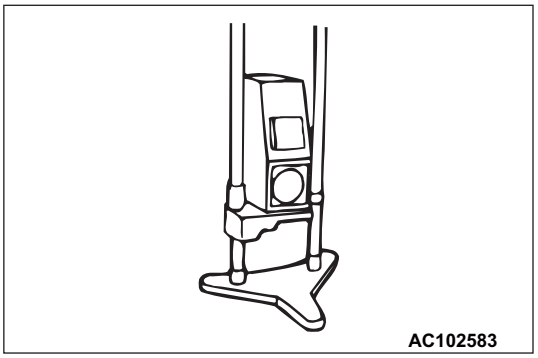


BCKA3414AA

4.1.2. Alignment

M90401020A0524

<USING A BEAM SETTING EQUIPMENT>



1. The headlamps should be aimed with the proper beam setting equipment, and in accordance with the equipment manufacture's instructions.
2. Alternately turn the adjusting screw to adjust the headlamp aiming.

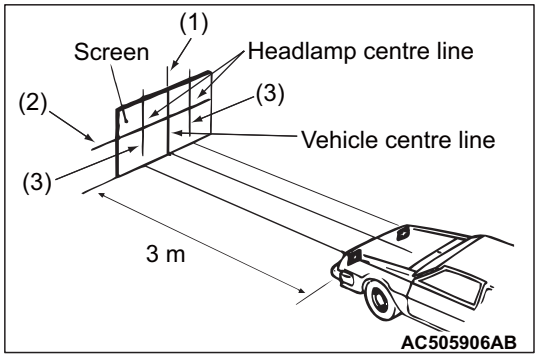
<USING A SCREEN> (LOW-BEAM)

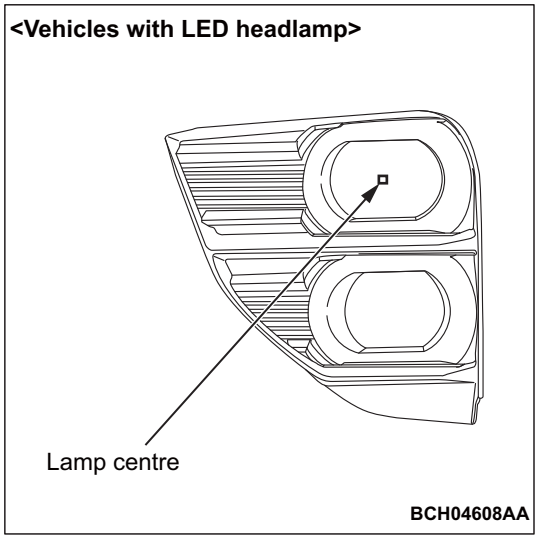
PRE-AIMING INSTRUCTION

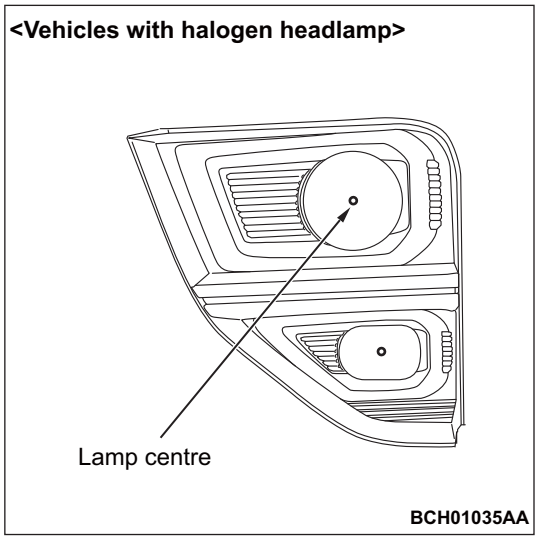
1. Inspect for badly rusted or faulty headlamp assemblies.
2. These conditions must be corrected before a satisfactory adjustment can be made.
3. Inspect tyre inflation, and adjust if it is necessary.
4. If the fuel tank is not filled up, put weight in the luggage compartment to make up for the fuel shortage so that the weight will become 90% of full-state weight or heavier. (0.8 kg per litter)
5. There should be no other load in the vehicle other than driver or substituted weight of approximately 75 kg placed in driver's position.
6. Turn the headlamp levelling switch to the switch position "0."
7. Thoroughly clean the headlamp lenses.

⚠ CAUTION

Check that the square shaped marking (LED headlamp) or round shaped marking (halogen headlamp) is on the lens surface.







8. Place the vehicle on a level floor, perpendicular to a flat screen 3 m away from the headlamp centre position of the low-beam.
9. Rock vehicle sideways to allow vehicle to assume its normal position.
10. To correct for distortion of the suspension, rock the bumpers on the front/rear side of the vehicle up and down three times alternately.
11. Turn the power supply mode of the electric motor switch to ON (READY indicator illuminates). Then press the A/C OFF switch to turn OFF the A/C system.
12. Four lines of adhesive tape (or equivalent markings) are required on screen or wall:
    (1) Position a vertical tape or mark so that it is aligned with the vehicle centre line.
    (2) Measure the distance from the headlamp centre position to the floor. Transfer the measurement to the screen. Horizontal tape or mark on the screen is for reference of vertical adjustment.
    (3) Measure the distance from the centre line of the vehicle to the centre of each headlamp. Transfer the measurement to the screen. Vertical tape or mark on the screen with reference to the centre line of each headlamp.

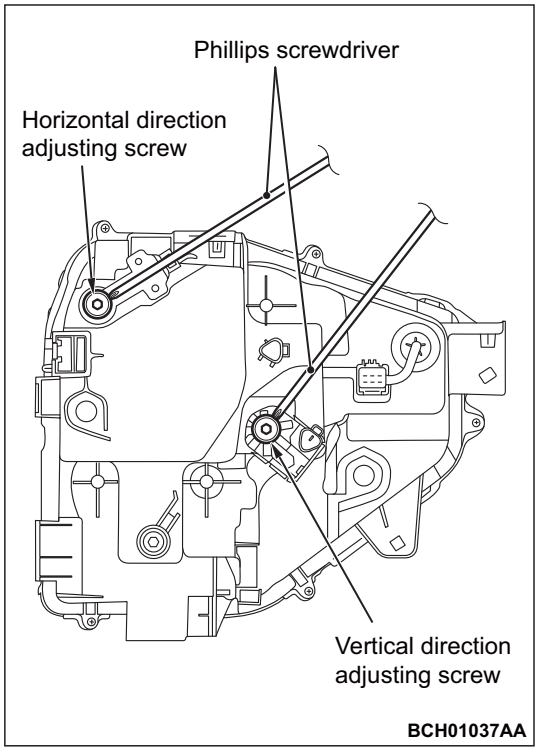
HEADLAMP ADJUSTMENT

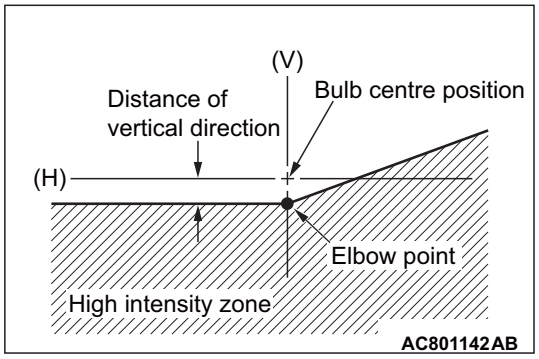
⚠ CAUTION
If the charge level of the drive battery is low during adjustment, the engine may operate or the cooling fan may rotate depending on conditions such as coolant temperature. If the maintenance work is performed in the engine compartment at this time, injury or damage may occur.

⚠ CAUTION
Do not cover a headlamp for more than three minutes to prevent the plastic headlamp lens deformation.

1. The low-beam headlamp should project on the screen upper edge of the beam (cut-off).

⚠ CAUTION
Be sure to adjust the aiming adjustment screw in the tightening direction.





2. If not the case, turn the adjusting screws to achieve the specified low-beam cut-off location on the aiming screen.

   Standard value:
   Vertical direction; 36 mm (0.63°) below horizontal (H)
   Horizontal direction; Elbow point intersects the vertical line (V)

   Limit:
   Vertical direction; ±15 mm (±0.29°) from the horizontal cut-off line
   Horizontal direction; ± 26 mm (± 0.5°) from the vertical line (V)

NOTE: The illustration shows LH drive vehicles. For RH drive vehicles, it is symmetrical.

4.1.3. Switching

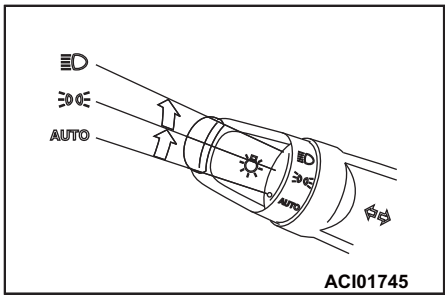
M90401030A0524

Headlamps

NOTE:

- When entering a country in which vehicles are driven on the opposite side of the road to the country in which your vehicles is supplied, necessary measures have to be taken to avoid dazzling oncoming traffic. However, headlamps on this vehicle do not need any adjustment.
- Do not leave the lights on for a long time while the Plug-in Hybrid EV System is stationary (not operating). A run-down auxiliary battery could result.
- When it rains, or when the vehicle has been washed, the inside of the lens sometimes becomes foggy, but this does not indicate a functional problem. When the lamp is switched on, the heat will remove the fog. However, if water gathers inside the lamp, we recommend you to have checked.

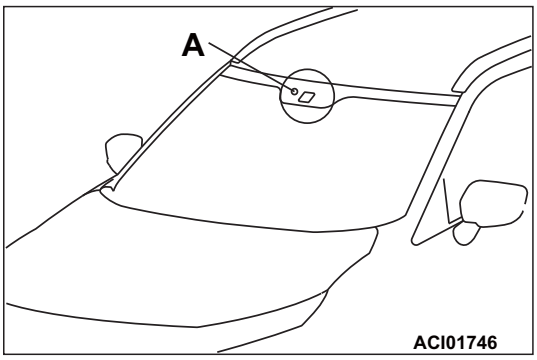
Rotate the switch to turn on the lamps.



AUTO	With the operation mode of the power switch is in ON, headlamps, position, tail, licence plate, instrument panel lamps turn on and off automatically in accordance with outside light level. {Daytime running lamps will go on while the tail lamps are off.} All lamps turn off automatically when the operation mode of the power switch is put in OFF.
	Position, tail, licence plate and instrument panel lamps on
	Headlamps and other lamps go on

NOTE:

- When the headlamps are turned off by the automatic on/off control with the operation mode of the power switch in ON, the front fog lamp (if so equipped) and rear fog lamps also go off. When the headlamps are subsequently turned back on by the automatic on/off control, the front fog lamps also come on but the rear fog lamp stay off. If you wish to turn the rear fog lamp back on, operate the switch again.



- Do not cover the sensor (A) for the automatic on/off control by affixing a sticker or label to the windscreen.
- If the lamps do not turn on or off with the switch in the "AUTO" position, manually operate the switch and we recommend you to have your vehicle checked.

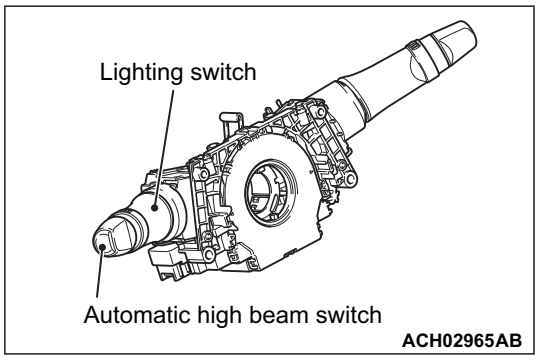
AUTOMATIC HIGH BEAM SYSTEM

⚠ CAUTION

The automatic high beam system may not work correctly under certain external factors.

External factors	Detail
Weather	Too bad weather such as fog, snow, heavy rain
Windshield glass	• Dirt, condensation, icing on the windshield • Cracks or breakage around the FCM/LDW/AHB sensor detection portion
Preceding vehicle or oncoming vehicle	• No exterior lamps of a preceding vehicle or oncoming vehicle is turned on • Only right or left exterior lamps are turned on, or the vehicle is a motorbike. • There is any light source, which is similar to vehicle exterior lamps • A preceding vehicle is equipped with a reflection plate
Road conditions	• On too steep gradients • The vehicle is driven on a winding road or around a tight bend • Driving on poor surface such as cobbled • There is too bright a luminous body in front of the vehicle (e.g. reflective traffic sign, an electric noticeboard, a delineator).
Vehicle condition	The vehicle is inclined due to overload, flat tyre, or towing, etc.
System	• The temperature in the FCM/LDW/AHB is 100°C or more, or -40 °C or less. • The system can detect no illumination or light source as the camera in the FCM/LDW/AHB is hindered by an object.

AUTOMATIC HIGH BEAM SWITCH

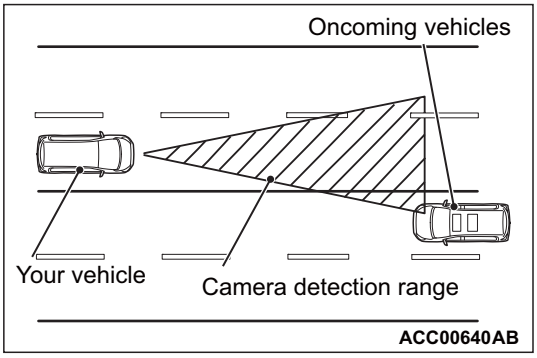


The automatic high beam switch is installed on the lighting switch side of the column switch assembly.

OPERATION

When the FCM/LDW/AHB-ECU (integrated sensor) and the front lamp sensor sense a light source (illuminant) ahead of the vehicle, the system controls the low beam and high beam automatically to suit each driving situation.

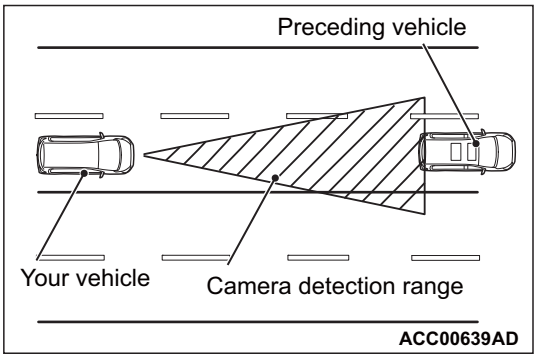
When an oncoming vehicle is approaching



- The system turns on the low-beam when it detects that an oncoming vehicle is approaching.
- The system switches from the low-beam into the high-beam when the oncoming vehicle is out of the detection range of the sensor, which is integrated in the FCM/LDW/AHB-ECU, for a certain period.

NOTE: The detection range of the sensor, which is integrated in the FCM/LDW/AHB-ECU, depends on its environment.

When you overtake a preceding vehicle or the system misses it.



- The system turns on the low-beam when it detects that a preceding vehicle is approaching.
- The system switches from the low-beam into the high-beam when the preceding vehicle is out of the detection range of the sensor, which is integrated in the FCM/LDW/AHB-ECU, for a certain period.

NOTE: The detection range of the sensor, which is integrated in the FCM/LDW/AHB-ECU, depends on its environment.

Operation conditions for the automatic high beam system

If the condition below is satisfied, the automatic high beam system will be activated.

- Always observe the following procedures from step 1.
  1. Turn the power supply mode of the electric motor switch to ON.
  2. Turn on the low-beam headlamps. (Set the lighting switch to "AUTO" or "HEAD" position.)
  3. Turn on the automatic high beam switch.

Switching conditions between headlamp low-beam and high-beam

The system switches the headlamp beams as below:

Switching from low-beam to high-beam

If all of the conditions below are satisfied, the system will switch the headlamps from the low-beam to high-beam.

- The vehicle speed is 40 km/h or more.
- It is dark in front of or around the vehicle. (Darkness, under which the automatic lighting system turns on the headlamps)
- When there are no preceding vehicle or oncoming vehicles
- When there are a few street lamps (Including few tunnel lamps)

Switching from high-beam to low-beam

The system switches the headlamp beams if any of the conditions below is satisfied.

- The vehicle speed is less than 30 km/h.
- It is bright in front of or around the vehicle.
- When the tail lamps of a preceding vehicle or the headlamps of an oncoming vehicle are turned on
- When there are many street lamps (Including many tunnel lamps)

4.1.4. Compliance with requirements1.

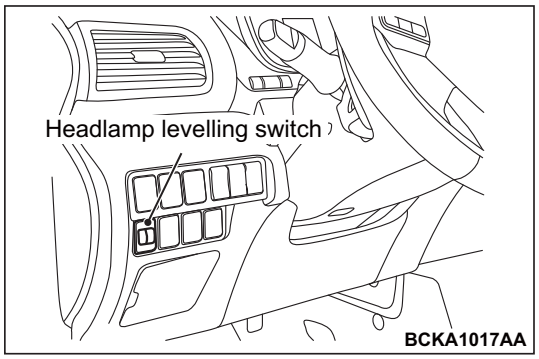
M90401040A0008

"Not Applicable"

4.1.5. Levelling devices (where mandatory)

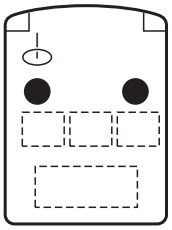
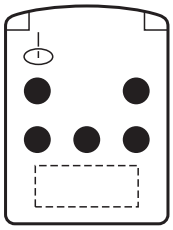
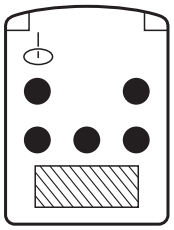
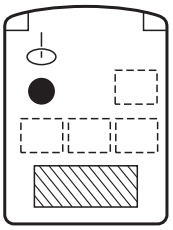
M90401050A0524

Headlamp manual levelling system



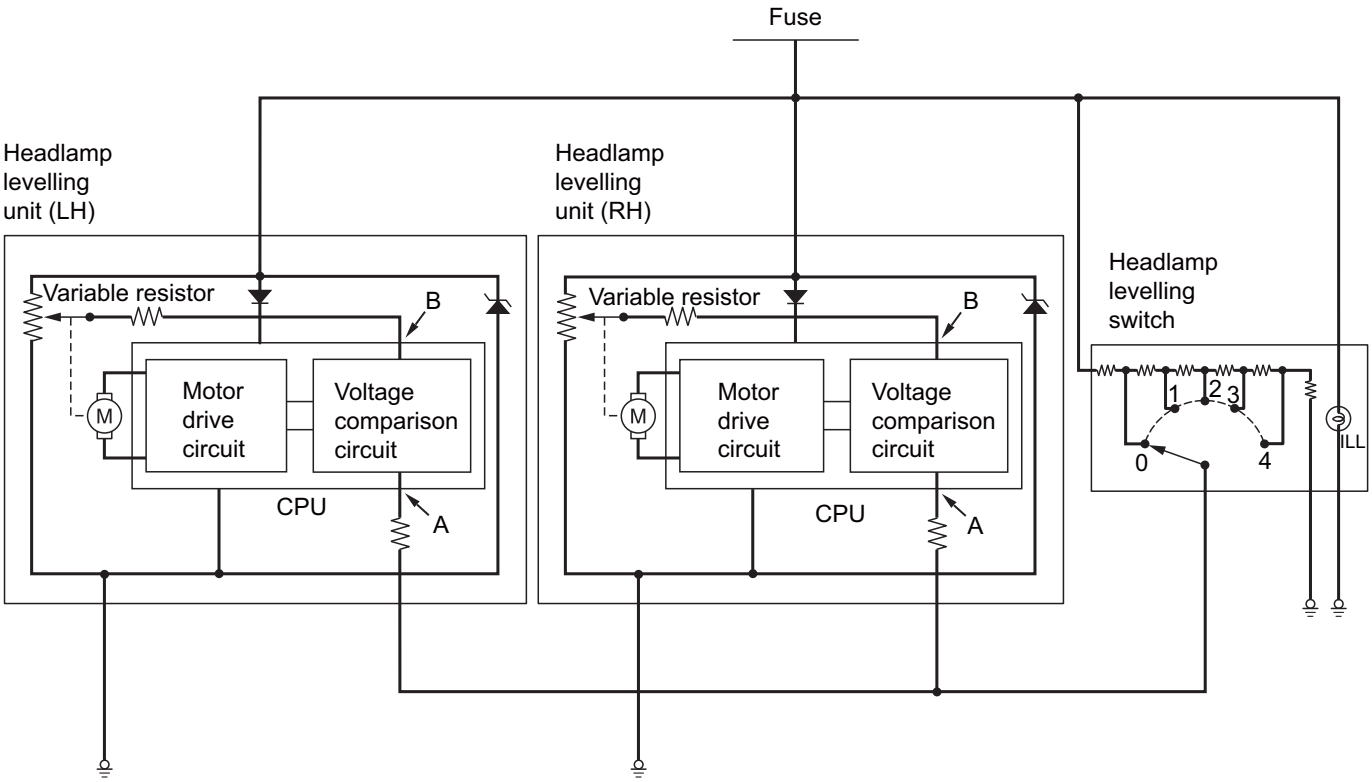
The beam direction of the headlamps changes according to the number of passengers and the amount of load. The headlamp manual levelling function is a system that allows the driver to change the direction of headlamp beam so that the drivers of oncoming cars are not dazzled by the headlamps. The headlamp levelling switch allows changing the direction in five steps: 0 to 4.

Relationship between the switch positions and the number of passengers/loads

Passenger and load	 AC607611	 AC607612	 AC607613	 AC607614
	One or two passengers	Five passengers	Five passengers and heavy loads	Driver and heavy loads
Switch position	0	1	2	2

NOTE: Each switch position is for reference. In each switch position, when the headlamp beam is too high, turn the switch to one-level higher position.

Operation



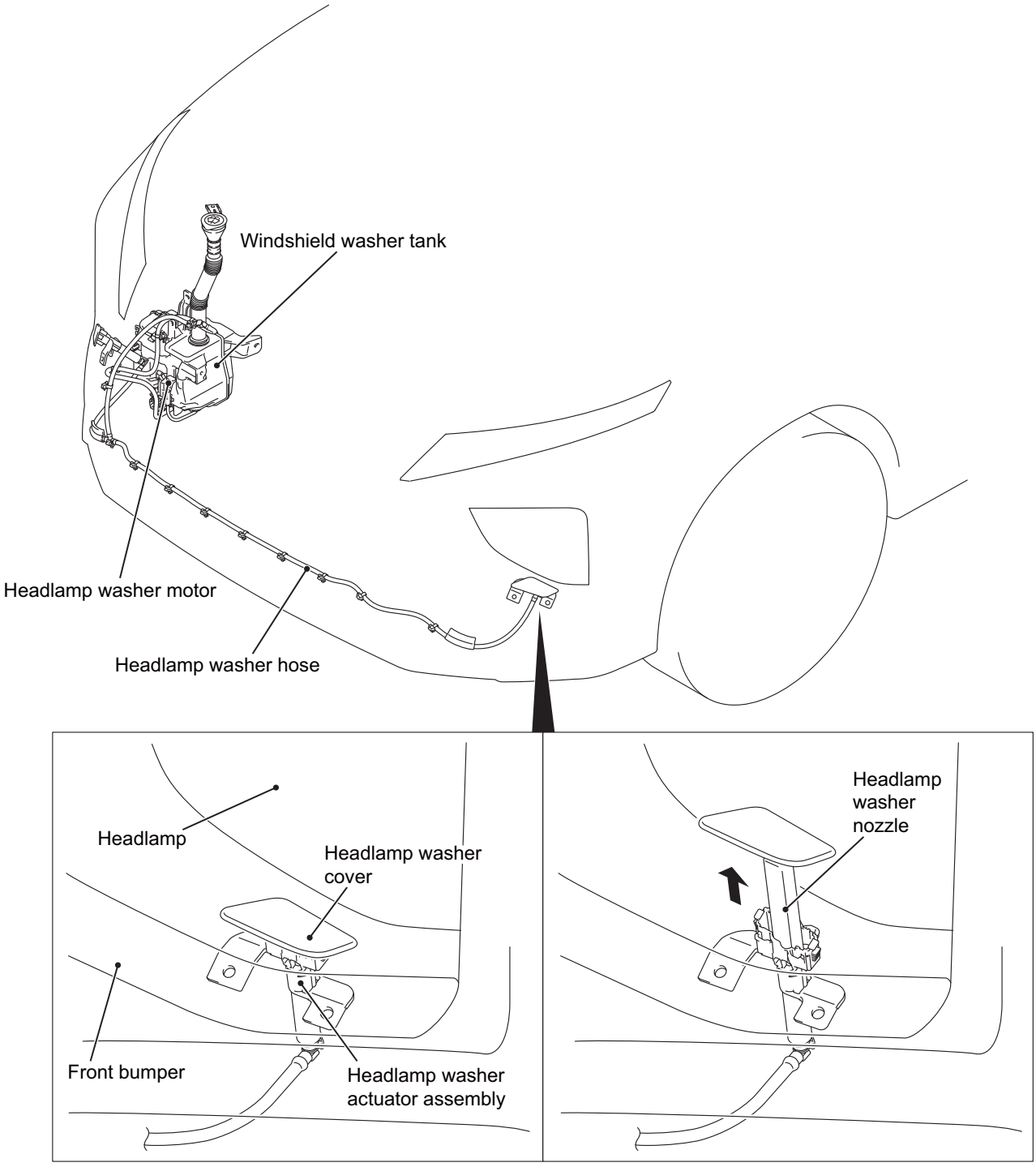
AC314086AB

1. The headlamp levelling switch increases the resistance as it is turned from 0 to 4. Turning the headlamp levelling switch changes the voltage at point A. When the headlamp levelling switch is turned from 0 to 4, the voltage at point A decreases. Upon detection of this voltage change, the headlamp levelling unit turns the motor to lower the beam direction. At this time, the resistance of the variable resistor in the headlamp assembly changes, and the voltage at point B decreases gradually. When the voltages at points A and B become equal, the headlamp levelling unit stops the motor.
2. Turning the headlamp levelling switch from 4 to 0 increases the voltage at point A, and then the headlamp levelling unit turns the motor in the direction opposite to that mentioned in Item 1, increasing the voltage at point B. When the voltages at points A and B become equal, the headlamp levelling unit stops the motor.
3. The headlamp levelling unit detects voltage changes caused by headlamp levelling switch operation, and turns the motor to change the directions of the headlamp reflectors for the adjustment of the headlamp beam direction.

4.1.6. Headlamp cleaning device (where mandatory)

M90401060A0522

CONSTRUCTION DIAGRAM



BCKA2362AA

- The headlamp washer can be operated with the electric motor switch at the ON or ACC position and the headlamp switch at the ON position. Push the headlamp washer button located at the end of the wiper and washer lever once and the washer will be sprayed onto the headlamps.
- A headlamp washer mechanism that thrusts out and retracts nozzles, utilizing the water pressure produced by motors has been adopted as an option. This mechanism contributes to better appearances of vehicles when their washer nozzles are not in use.

- The headlamp washer tank used for this mechanism is also used for the windshield and rear window washers.

4.2. FRONT AND REAR POSITION LAMPS, SIDE MARKER LAMPS, END OUTLINE MARKER LAMPS AND DAYTIME RUNNING LAMPS

4.2.1. Condition and operation

M90402010A0008

Refer to 4.1.1. Condition and operation P.4-3.

4.2.2. Switching

M90402020A0008

"Not Applicable"

4.2.3. Compliance with requirements1.

M90402030A0008

"Not Applicable"

4.3. STOP LAMPS

4.3.1. Condition and operation

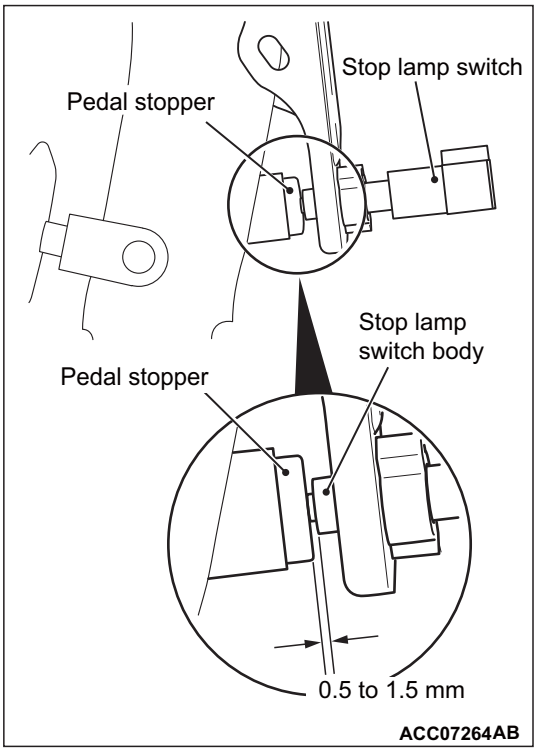
M90403010A0008

"Not Applicable"

4.3.2. Switching

M90403020A0140

BRAKE PEDAL CHECK



Check that the clearance between the stop lamp switch and the pedal stopper is as shown in the figure.

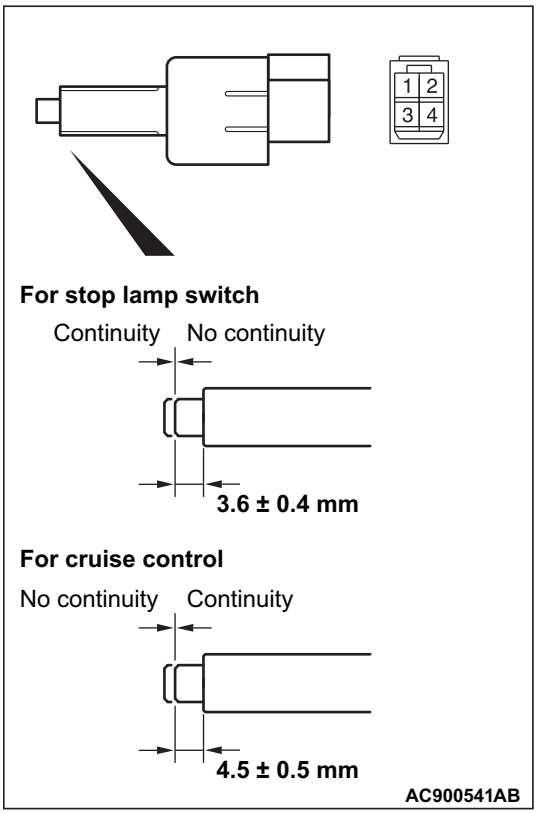
⚠ CAUTION

Make sure that the stop lamp is not illuminated when the brake pedal is not depressed.

STOP LAMP SWITCH CHECK

⚠ CAUTION

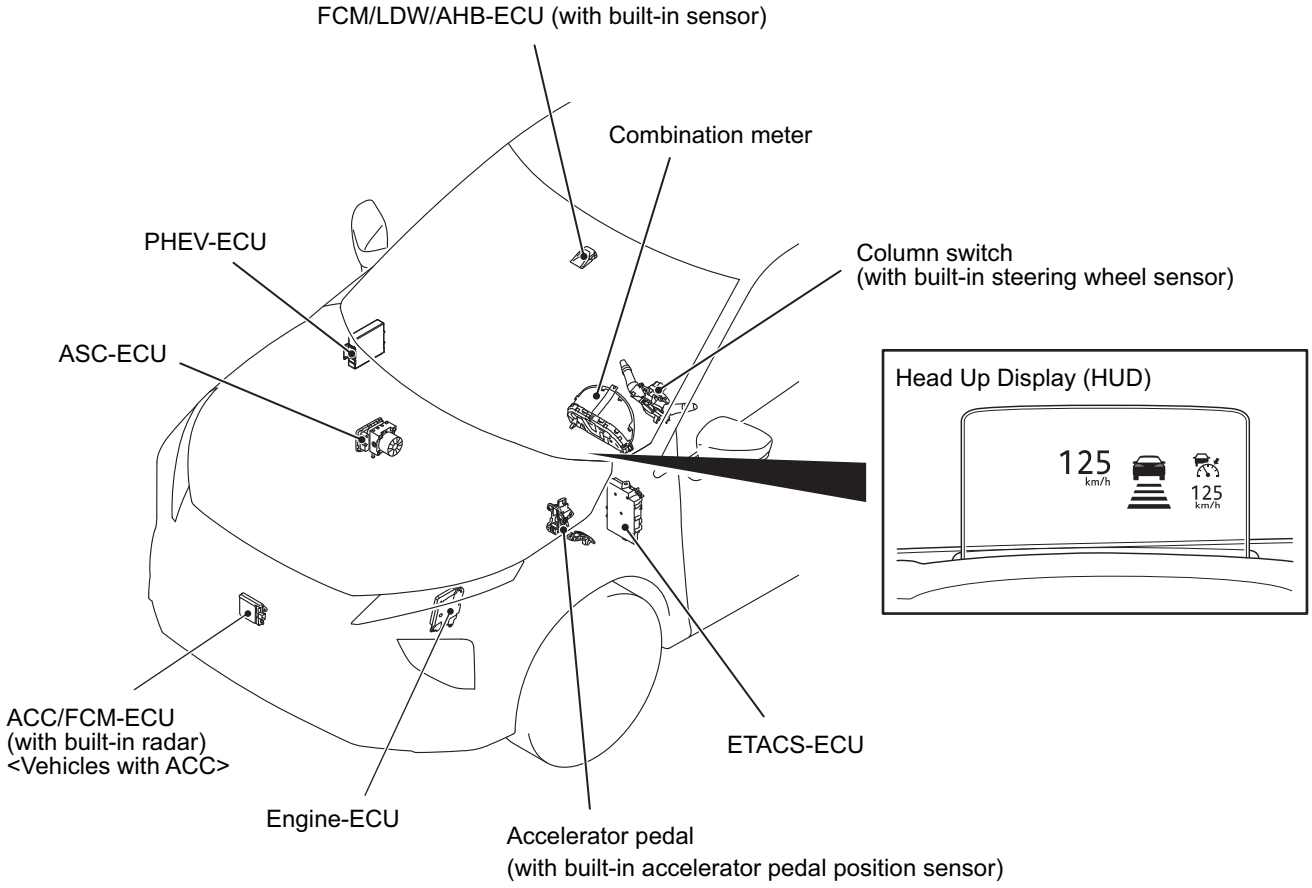
Do not apply lubricant (grease or silicon system sprayer etc.) to the switch and the switch installation section to avoid malfunction of the switch. In addition, do not use gloves which have lubricant (grease or silicon system sprayer etc.) on them.



Check for continuity between the terminals of the switch.

Check condition	Terminal connector of tester	Normal condition
At free position	1 - 2 (for stop lamp switch)	Continuity exists (2 Ω or less)
	3 - 4 (for cruise control)	No continuity
Press the plunger from the edge of the outer case by the dimension shown in the figure.	1 - 2 (for stop lamp switch)	No continuity
	3 - 4 (for cruise control)	Continuity exists (2 Ω or less)

FCM/LDW/AHB
CONSTRUCTION DIAGRAM

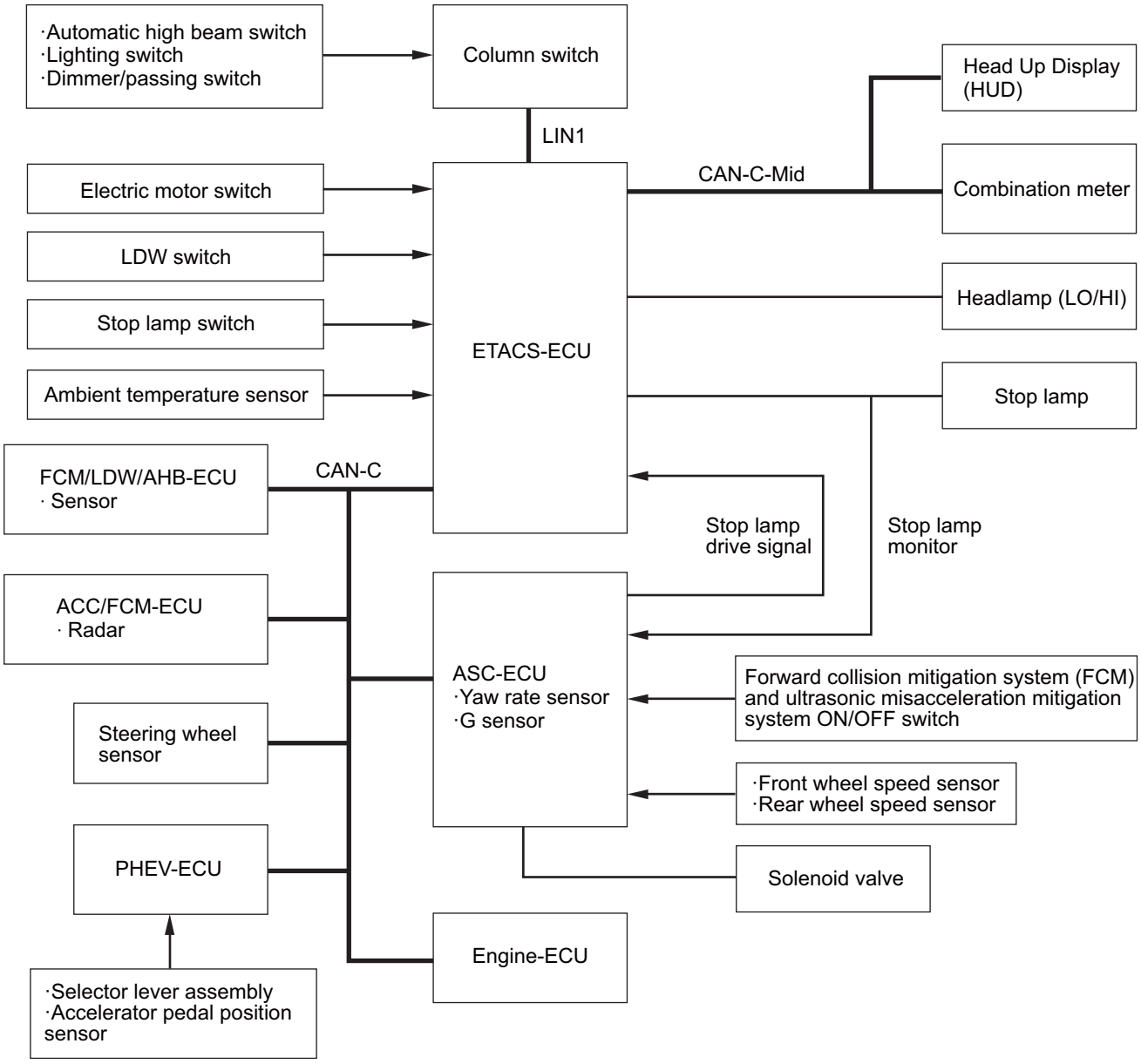


BCKA1015AA

Main components and functions

Component name	Functional Description
FCM/LDW/AHB-ECU (with built-in sensor)	• Uses a built-in sensor to recognise a vehicle travelling ahead, a pedestrian, a lane and the headlamp beams which a travelling-ahead or oncoming vehicle casts. • Controls the Forward Collision Mitigation (FCM), the Lane Departure Warning System (LDW) and the automatic high beam system according to the sensor detection and CAN bus communication. • Switches ON/OFF of FCM function and FCM alarm timing setting based on a forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch signal received from ASC-ECU via CAN communication. • It requests the combination meter to provide status information on the functions and visual warnings via CAN communication. It also requests the ASC-ECU to control the brakes via CAN communication. • Adjusts the axis of the built-in sensor, and detects any blockage or malfunction.
ACC/FCM-ECU (with built-in radar) <Vehicles with ACC>	• Switches ON/OFF of FCM function and FCM alarm timing setting based on each FCM status received from FCM/LDW/AHB-ECU via CAN communication. • Controls the FCM function according to the radar detection and CAN bus communication. • It requests the combination meter to provide status information on the functions and visual warnings via CAN communication. It also requests the ASC-ECU to control the brakes via CAN communication. • Adjusts the axis of the built-in radar, and detects any blockage or malfunction.
ASC-ECU	• Controls the brakes according to request signals received from the FCM/LDW/AHB-ECU or ACC/FCM-ECU via CAN communication. • Activates the stop lamps when the automatic braking is triggered. • Requests the engine-ECU to provide "engine braking" effect according to the request from the FCM/LDW/AHB-ECU or ACC/FCM-ECU. • Sends the signals of the forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch to the ECUs via CAN communication.
Engine-ECU	Controls the engine torque according to request signals received from the ASC-ECU.
PHEV-ECU	• Sends accelerator pedal position sensor signals to the ECUs via CAN communication. • Informs the ECUs of the selector lever position via CAN communication.
Combination meter	• The FCM/LDW/AHB-ECU or ACC/FCM-ECU informs the combination meter of status information and requests it to provide visual warnings. Based on these, the combination meter controls the multi-information display, the indicator lamps, the warning lamps and the buzzer. • Requests warning indication on Head Up Display (HUD) by using CAN communication. <Vehicles with Head Up Display (HUD)>
ETACS-ECU	• Incorporates the circuit where the ASC-ECU activates the stop lamps when the FCM activates the automatic braking. • Sends LDW switch signals to the ECUs via CAN communication. • Switches high and low beam headlamps according to request signals received from the FCM/LDW/AHB-ECU. • Informs the ECUs of ambient temperature via CAN communication. • Sends stop lamp switch signals to the ECUs via CAN communication.
Column switch (with built-in steering wheel sensor)	Informs the ECUs of a steering wheel angle and angular velocity via CAN communication.
Head Up Display (HUD) <Vehicles with Head Up Display (HUD)>	Displays an alarm based on the alarm indication request received from the combination meter via CAN communication.

SCHEMATIC DIAGRAM



BCH02951AC

Fail-safe and self-diagnosis functions

The FCM/LDW/AHB-ECU or ACC/FCM-ECU constantly monitors the input and output signals. If the system detects a malfunction, it will send a failure signal to the combination meter and prohibit the FCM/LDW/automatic high beam system control under circumstances. The combination meter will provide a visual and audible warning to inform the driver of it. The FCM/LDW/AHB-ECU or ACC/FCM-ECU has the following functions for easier system checks.

- Diagnosis code set
- Service data output
- Freeze frame data output

All the above items can be diagnosed using M.U.T.-IIISE.

Sensor calibration

If the FCM/LDW/AHB-ECU or ACC/FCM-ECU is replaced or removed and installed, calibration the sensor or radar by using the M.U.T.-IIISE.

NOTE: For how to calibration the sensor, refer to the WORKSHOP MANUAL.

FORWARD COLLISION MITIGATION (FCM)

The forward collision damage mitigation braking system (FCM) measures the relative speed and the relative distance with the vehicle or the pedestrian in front of the vehicle with a sensor or radar. When judging that there is a danger of collision, it activates an alarm or the automatic brake etc. to reduce collision damage or avoid collision.

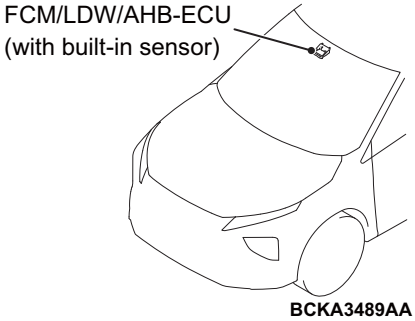
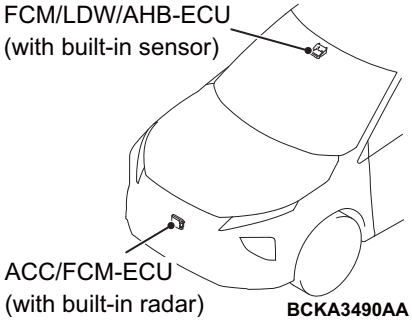
FUNCTION

The FCM has the following functions:

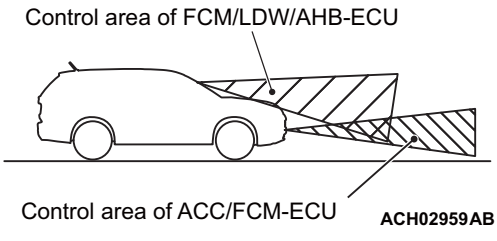
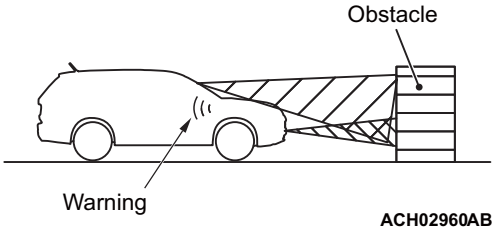
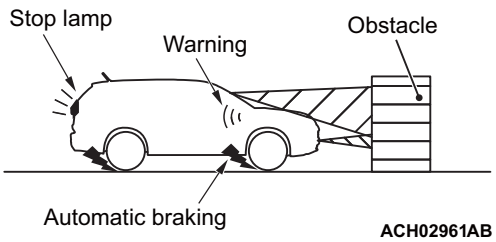
Function	General
Forward collision warning function	Alarms the driver with the alarm indication and alarm sound. NOTE: • The alarm indication is displayed on the combination meter and the Head Up Display (HUD) <Vehicles with Head Up Display (HUD)>. • A buzzer of the combination meter sounds an alarm.
FCM brake prefill function	Increases the brake fluid pressure in advance to enhance the response during the driver's braking operation.
FCM brake assist function	When the driver quickly steps on the brake pedal, the brake assist is operated at earlier timing than usual.
FCM braking function	Operates the automatic brake in the following two stages. 1. Decelerates with weak automatic braking and urges the driver to avoid collision. 2. When a collision cannot be avoided, strong automatic braking reduces damage at the time of the collision or avoids collision.

SPECIFICATION

FCM operates by control only with FCM/LDW/AHB-ECU (Type 1) or by control with two ECUs of FCM/LDW/AHB-ECU and ACC/FCM-ECU (Type 2).

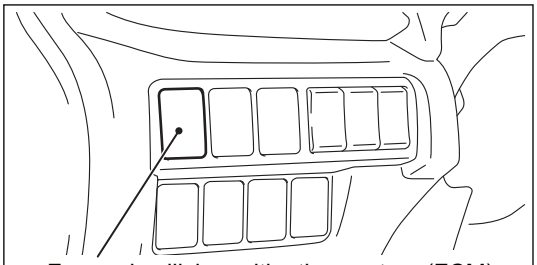
		Type 1	Type 2
Sensor			
Target to be controlled		Vehicles and pedestrians	
Vehicle speed at which forward collision warning function operates (km/h)	Against a vehicle	Approx. 15 - 140	Approx. 15 - 180
	Against a pedestrian	Approx. 7 - 65	
Vehicle speed at which FCM brake prefill function operates (km/h)	Against a vehicle	Approx. 5 - 80	Approx. 5 - 180
	Against a pedestrian	Approx. 5 - 65	
Vehicle speed at which FCM brake assist function operates (km/h)	Against a vehicle	Approx. 15 - 80	Approx. 15 - 180
	Against a pedestrian	Approx. 15 - 65	
Vehicle speed at which FCM braking function operates (km/h)	Against a moving vehicle	Approx. 5 - 80	Approx. 5 - 180
	Against a stationary vehicle	Approx. 5 - 80	
	Against a pedestrian	Approx. 5 - 65	
Relative speed (against a vehicle) with a possibility of collision avoidance (km/h)		Less than about 40	

OPERATION

Case	Operation		
	Alarm indication	**Alarm sound**	**Function**
When there is no danger of collision 	No alarm indication	No buzzer sound	-
When there is a danger of collision 	 ACH02956	Sound a buzzer	• Forward collision warning function operates. • FCM brake prefill function operates. • FCM brake assist function operates.
When the risk of collision is high or collision cannot be avoided 	 ACH02956	Sound a buzzer	FCM braking function operates.*

NOTE: *: If two seconds elapse after the forward collision mitigation brake stops the vehicle, it can be deactivated automatically.

FORWARD COLLISION MITIGATION SYSTEM (FCM) AND ULTRASONIC MISACCELERATION MITIGATION SYSTEM ON/OFF SWITCH



Forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch BCH00680AA

The forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch is installed at the instrument panel left lower side. You can switch the FCM (on and off) and the forward collision warning function timing ("FAR", "MIDDLE" and "NEAR") by operating this switch.

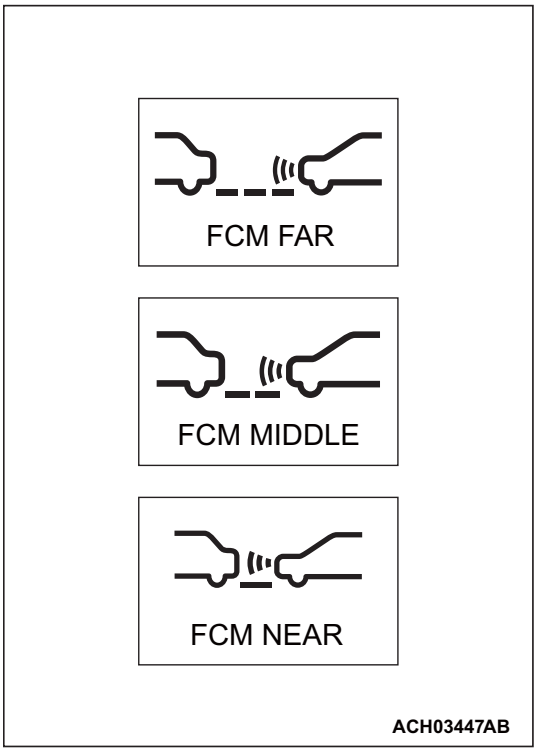
How to switch on and off the FCM

- The FCM is toggled between on and off when the forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch is pressed and held. When the FCM is toggled, the system will inform the driver of it by the indicator of combination meter*.

  NOTE:

  - *: If the FCM is toggled off, "FCM OFF indicator" will be illuminate on the combination meter. If the FCM is toggled on, a current forward collision warning function timing will be shown on the combination meter LCD screen.
  - Because the forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch is shared with the ultrasonic misacceleration mitigation system, the FCM and ultrasonic misacceleration mitigation system are switched ON/OFF in an interlocked manner.

How to switch the forward collision warning function timing



The forward collision warning function timing is toggled when the forward collision mitigation system (FCM) and ultrasonic misacceleration mitigation system ON/OFF switch is pressed briefly with the FCM activated. When the FCM is toggled, the system will inform the driver of it by the combination meter LCD display.

NOTE: The timing of forward collision mitigation brake does not change.

4.3.3. Compliance with requirements1.

"Not Applicable"

M90403030A0008

4.4. DIRECTION INDICATOR AND HAZARD WARNING LAMPS

4.4.1. Condition and operation

M90404010A0008

"Not Applicable"

4.4.2. Switching

M90404020A0008

"Not Applicable"

4.4.3. Compliance with requirements1.

M90404030A0008

"Not Applicable"

4.4.4. Flashing frequency

M90404040A0008

"Not Applicable"

4.5. FRONT AND REAR FOG LAMPS

4.5.1. Condition and operation

M90405010A0008

"Not Applicable"

4.5.2. Alignment (X)2

M90405020A0008

"Not Applicable"

4.5.3. Switching

M90405030A0008

"Not Applicable"

4.5.4. Compliance with requirements1.

M90405040A0008

"Not Applicable"

4.6. REVERSING LAMPS

4.6.1. Condition and operation

M90406010A0008

"Not Applicable"

4.6.2. Compliance with requirements1.

M90406020A0008

"Not Applicable"

4.6.3. Switching

M90406030A0008

"Not Applicable"

4.7. REAR REGISTRATION PLATE LAMP

4.7.1. Condition and operation

M90407010A0008

"Not Applicable"

4.7.2. Compliance with requirements1.

M90407020A0008

"Not Applicable"

4.8. RETRO-REFLECTORS, CONSPICUITY (RETRO REFLECTING) MARKINGS AND REAR MARKING PLATES

4.8.1. Condition

M90408010A0008

"Not Applicable"

4.8.2. Compliance with requirements1.

M90408020A0008

"Not Applicable"

4.9. TELL-TALES MANDATORY FOR LIGHTING EQUIPMENT

4.9.1. Condition and operation

M90409010A0008

"Not Applicable"

4.9.2. Compliance with requirements1.

M90409020A0008

"Not Applicable"

4.10. ELECTRICAL CONNECTIONS BETWEEN TOWING VEHICLE AND TRAILER OR SEMI-TRAILER

M90410000A0008

"Not Applicable"

4.11. ELECTRICAL WIRING

M90411000A0015

"Query raised for this content"

4.12. NON OBLIGATORY LAMPS AND RETRO-REFLECTORS (X)2

M90412000A0008

Refer to 4.1.1. Condition and operation P.4-3.

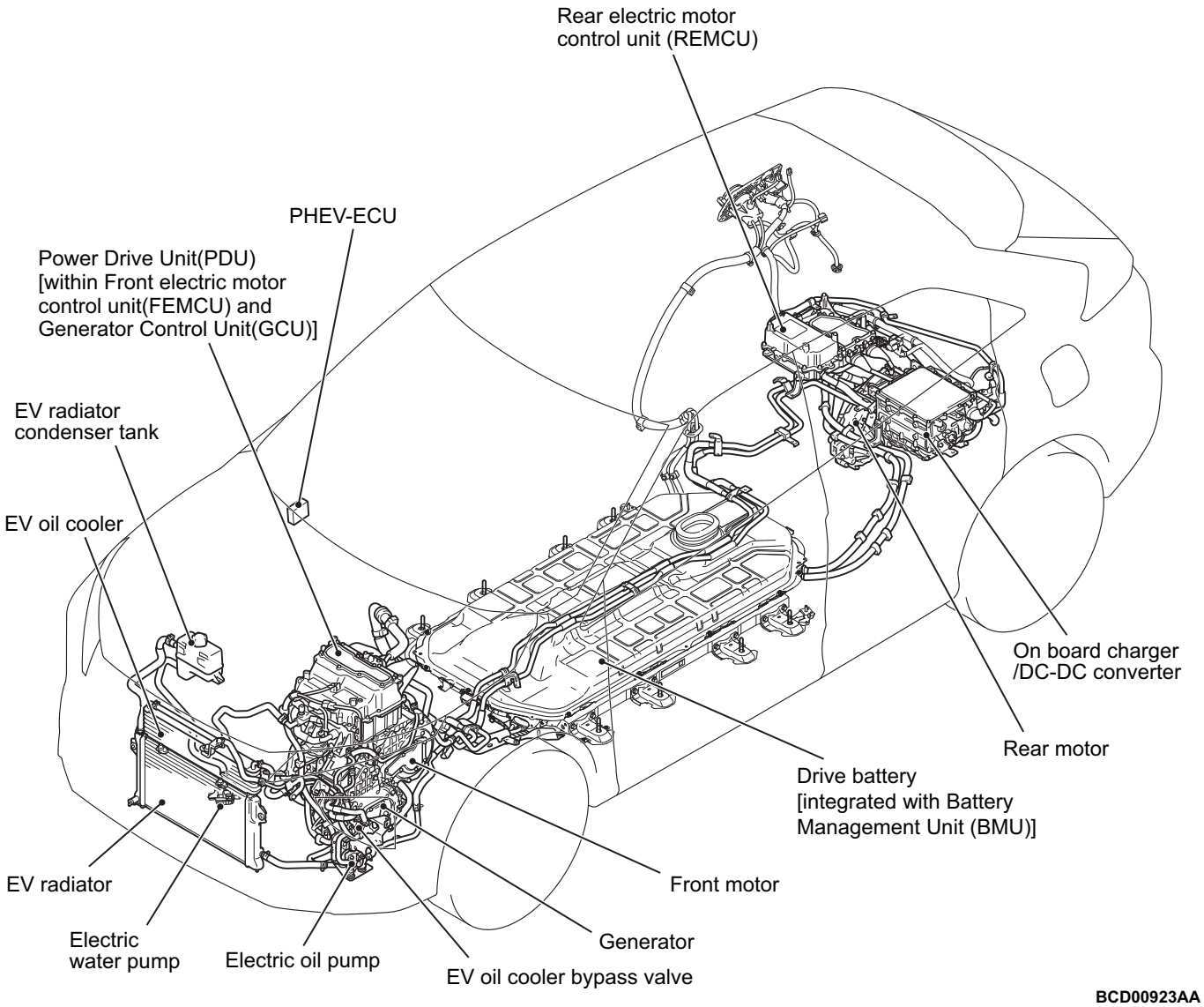
4.13. BATTERY(IES)

M90413000A0013

A plug-in hybrid EV system is introduced. This system consists of the components below:

- PHEV-ECU and BMU (battery management unit): A 4WD control system is integrated further into the whole vehicle integrated control.
- Drive battery: Housed in a metal case, the drive battery is cooled by evaporator and warmed by a PTC heater to maintain the optimum temperature.
- FEMCU (front electric motor control unit) (integrated into Power Drive Unit) and REMCU (Rear electric motor control unit): Compact and light-weight IGBT (Insulated Gate Bipolar Transistor) is used.
- Front/rear motor: An individual motor is used for each of the front and rear axles. These motors, which are controlled by the PHEV-ECU, realises a twin-motor 4WD system, which eliminates mechanical connection such as a propeller shaft.
- Generator (integrated into Power Drive Unit): A compact and light-weight generator not only generates electricity but also starts the engine.
- On-board charger (OBC) and DC/DC converter: It boasts of high efficiency, high power (which shortens charging time), compactness and light weight.
- Two methods are used in an EV cooling system: Water cooling and oil cooling are used. The water-cooling system consists of an EV radiator, an electric water pump, an EV radiator condenser tank. The oil-cooling system for cooling a front motor and a generator consists of an EV oil cooler, an electric oil pump and a EV oil cooler bypass valve.

CONSTRUCTION DIAGRAM



PRECAUTIONS ON HOW TO USE THE HIGH-VOLTAGE VEHICLE

This vehicle has a high-voltage (300 V) circuit. If the vehicle is handled incorrectly, electric leakage or shock may result. Also, the service technicians/engineers who perform inspection and service related to the high-voltage circuit of the electric vehicles are obligated to observe national legal requirements.

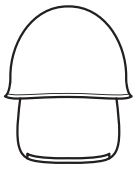
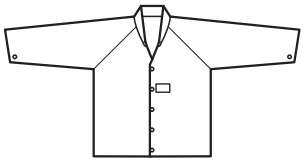
INSPECTION/TEST OF PROTECTIVE EQUIPMENT, BLOTTER STORAGE

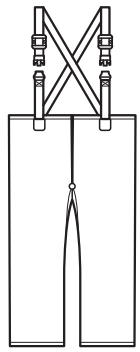
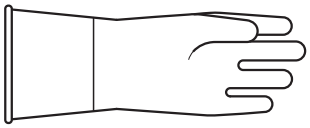
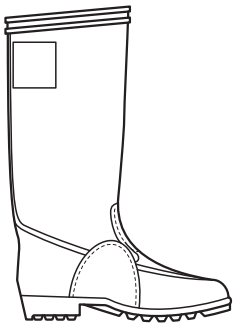
Check and store the protective equipment in accordance with national legal requirements.

PROTECTIVE EQUIPMENT

⚠ CAUTION

- **Use protective equipment which complies with national legal requirements.**
- **Use insulating protective equipment which meets the requirements to withstand DC 500 V and AC 500 V.**

Protective equipment	Name	Use
	Electric insulation helmet (with shield)	• When you may contact with the exposed live wirings while handling the damaged vehicle • Alternatively, when you prevent the electric shock according to need
	Electric insulation jacket	• When you may contact with the exposed live wirings while handling the damaged vehicle • Alternatively, when you prevent the electric shock according to need

Protective equipment	Name	Use
	Electric insulation trousers	• When you may contact with the exposed live wirings while handling the damaged vehicle • Alternatively, when you prevent the electric shock according to need
	Electric insulation glove	• Service plug removal and installation • Work on live wirings when there is a problem • When you may contact with the exposed live wirings while handling the damaged vehicle • Alternatively, when you prevent the electric shock according to need
	Electric insulation boots	• When you may contact with the exposed live wirings while handling the damaged vehicle • Alternatively, when you prevent the electric shock according to need

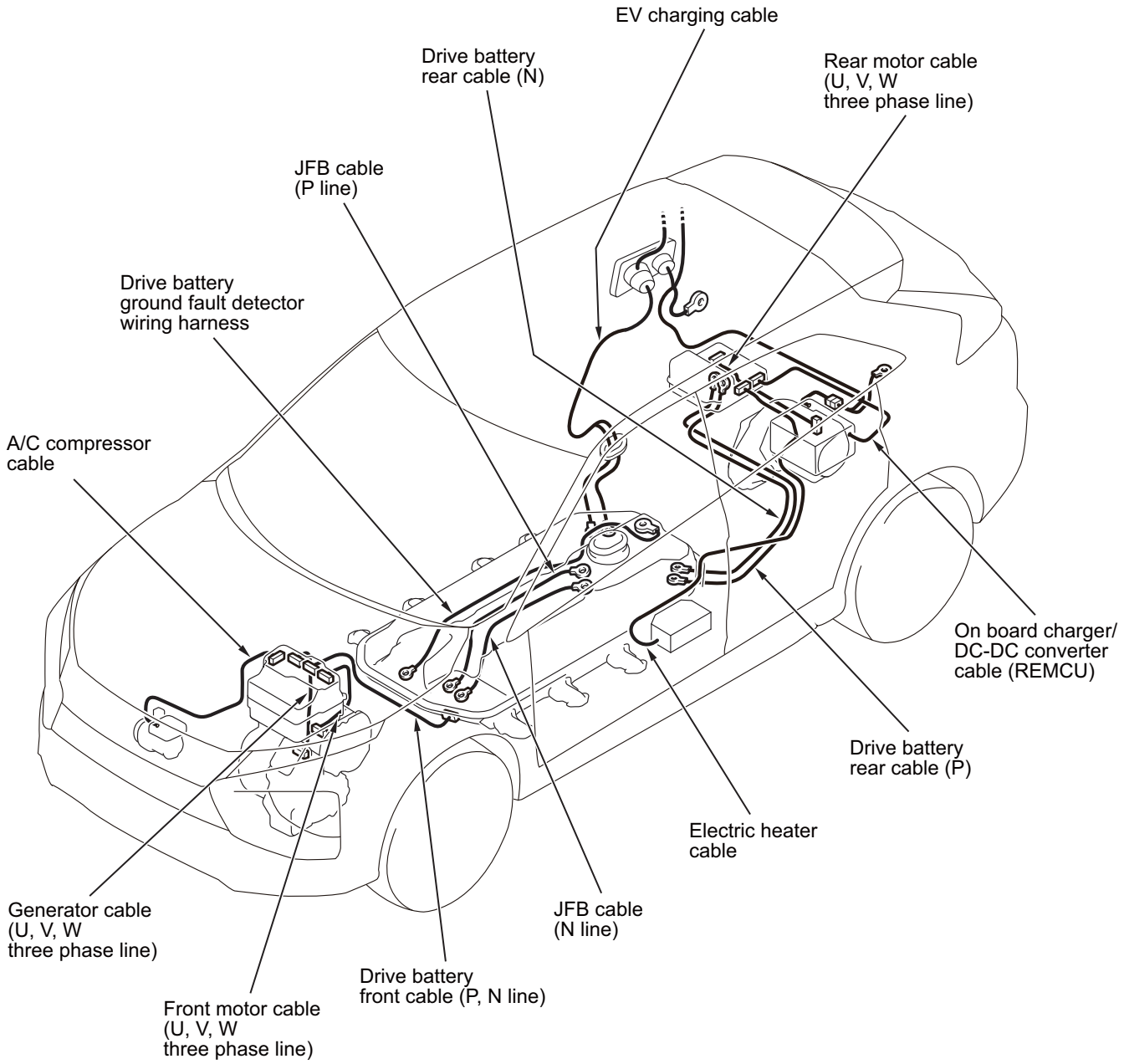
TESTER AND SPECIAL TOOL

Be sure to use the tester and special tools specified in this manual.

HIGH-VOLTAGE COMPONENTS

The high-voltage components are described below. Also, wiring harness and connectors of high-voltage circuit are unified with a colour of orange.

- Drive battery
- Power drive unit [incorporating generator control unit (GCU) and front electric motor control unit (FEMCU)]
- Rear electric motor control unit (REMCU)
- Front motor and rear motor
- Generator
- On board charger/DC-DC converter
- AC inverter <Vehicles with AC power supply>
- DC-DC converter <Vehicles with heated windshield>
- Electric heater <Vehicles with electric heater>
- Drive battery cable
- EV charging cable (Normal charger)
- EV charging cable (Quick charger)
- Service plug
- Wiring harness and connector
- A/C compressor

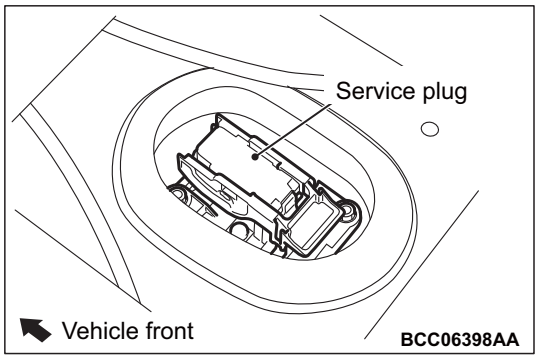


BCF00760AD

SERVICE PRECAUTIONS

⚠ DANGER

When adjusting the high-voltage components, be sure to disconnect the service plug in order to shut off the high-voltage. If the high-voltage cannot be shut off after the following work, or if the high-voltage shut-off work is difficult because of the accidental damages.



Remove the service plug under the rear centre seat according to the following procedure, which shuts off the high-voltage to the high-voltage system. Also, when installing the service plug and the service lid, check the precautions.

SERVICE PLUG AND SERVICE LID REMOVAL STEPS

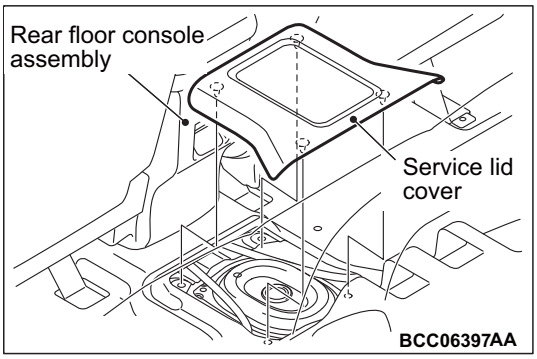
Prepare the service plug removal steps check sheet.

1. Turn off the power supply mode of the electric motor switch.

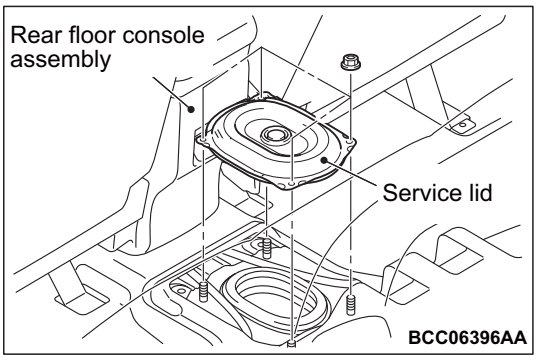
⚠ WARNING

- ***To avoid causing any trouble to the electric motor unit components, do not disconnect the auxiliary battery negative terminal for two minutes after turning off the power supply mode of the electric motor switch.***
- ***The voltage of the smooth condenser in the inverter must be decreased thoroughly. Therefore, do not remove the service plug for 5 minutes after the negative terminal of the auxiliary battery is disconnected.***

2. Disconnect the negative terminal of the auxiliary battery.



3. Remove the service lid cover.



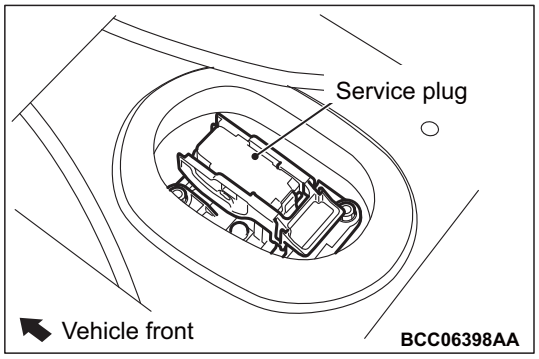
4. Remove the service lid mounting nut, and then remove the service lid.

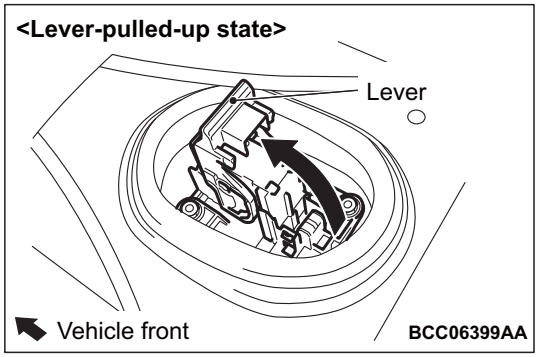
⚠ DANGER

- ***Wear the electric insulation gloves when pulling out the service plug.***
- ***Do not lift the lever of service plug by halve. It is dangerous because the current is supplied during the lifting operation. Be sure to remove the service plugs all at once.***

⚠ WARNING

The voltage of the smooth condenser in the inverter must be decreased thoroughly. Therefore, do not remove the service plug for 5 minutes after the negative terminal of the auxiliary battery is disconnected.

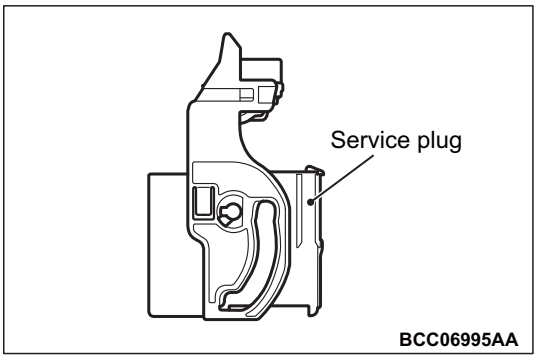




5. Lift the service plug lever.

⚠ DANGER

After removing the service plug, insulate the plug installed part of the drive battery securely.



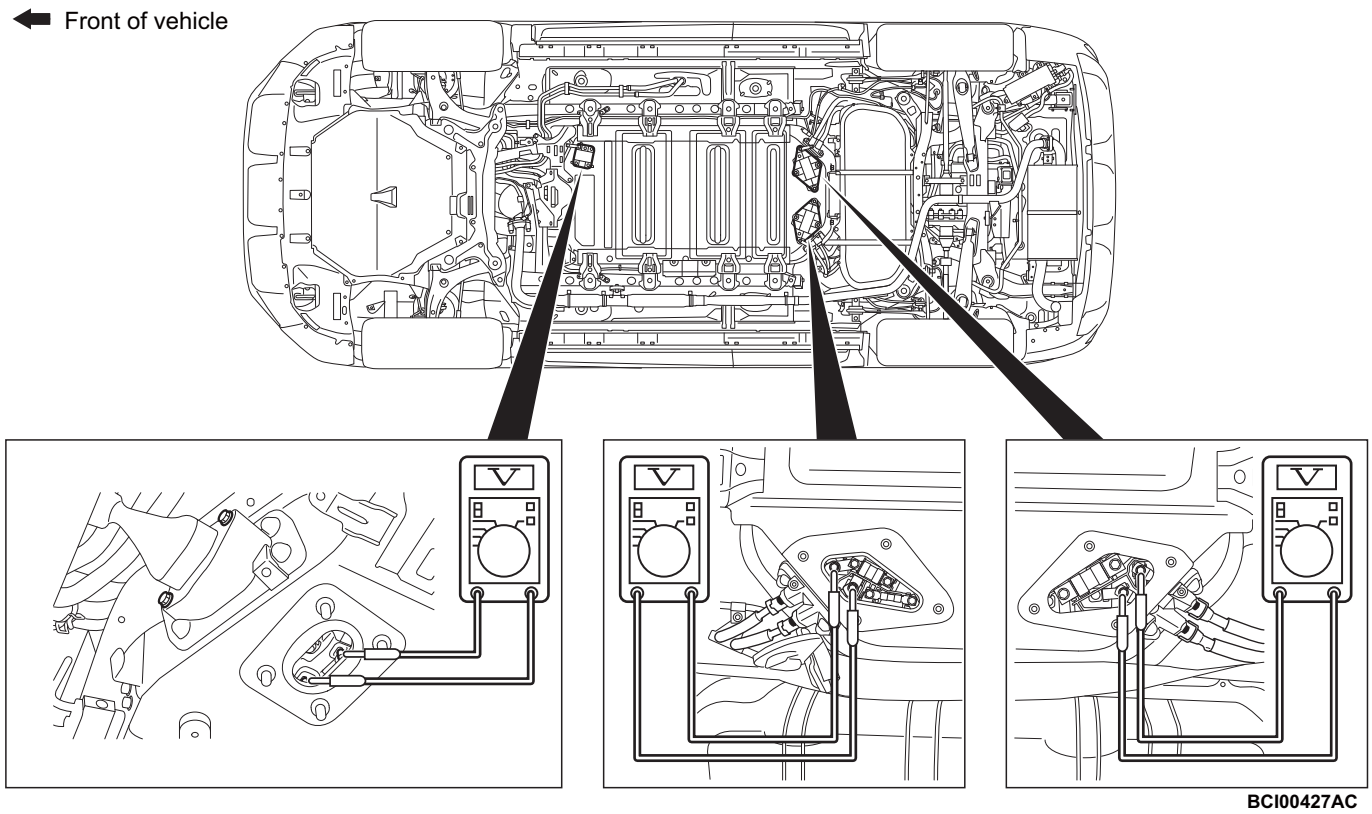
6. Remove the service plug.

⚠ DANGER

During inspection, wear the electric insulation gloves. If the high-voltage cannot be shut off after the inspection.

7. When removing and installing each high-voltage part, be sure to perform the following inspection beforehand.

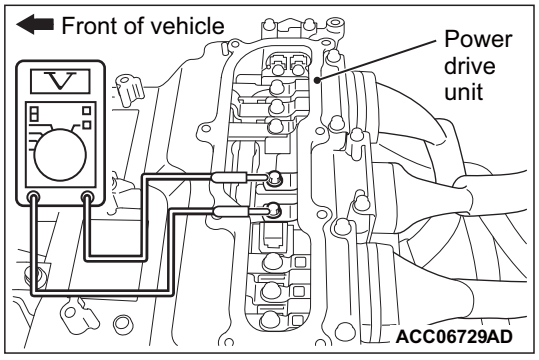
When the drive battery is removed and installed



Remove the work-hole lid from the bottom of the drive battery, and use a high-voltage multimeter to measure the voltages between the terminals shown.

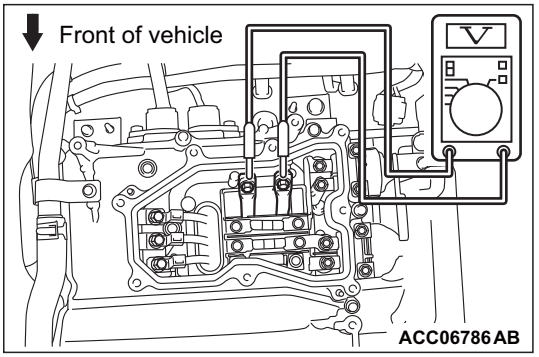
Normal voltage: Approx. 0 V

When the other high-voltage parts are removed and installed



Remove the service lid on the power drive unit inside the engine compartment, and use a high-voltage multimeter to measure the voltages between the terminals shown.

Normal voltage: Approx. 0 V



Remove the service lid on the REMCU inside the luggage compartment, and use a high-voltage multimeter to measure the voltages between the terminals shown.

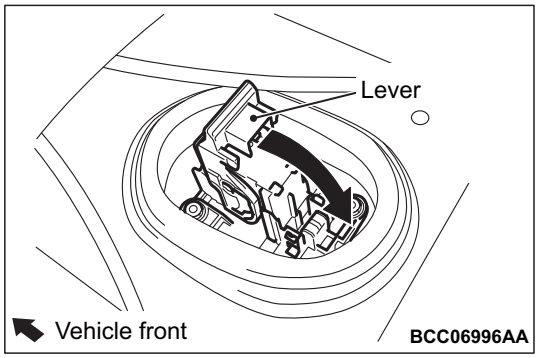
Normal voltage: Approx. 0 V

SERVICE PLUG AND SERVICE LID INSTALLATION STEPS

⚠ *DANGER*

Wear the electric insulation gloves when installing the service plug.

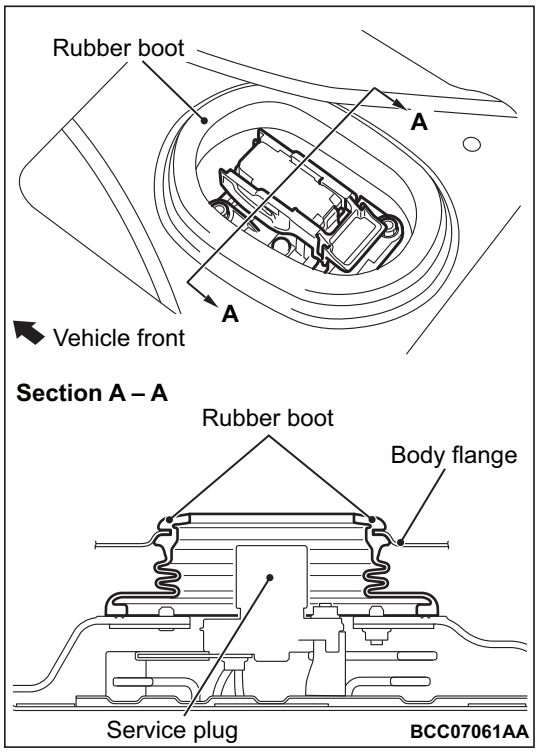
⚠ CAUTION



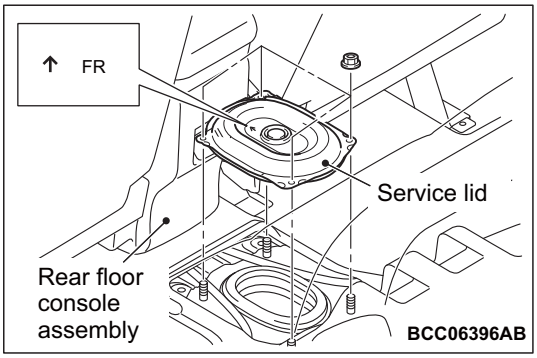
Pull the service plug lever down until it clicks, because the interlock switch does not operate unless the service plug lever is pulled down properly.

1. Install the service plug.

⚠ CAUTION

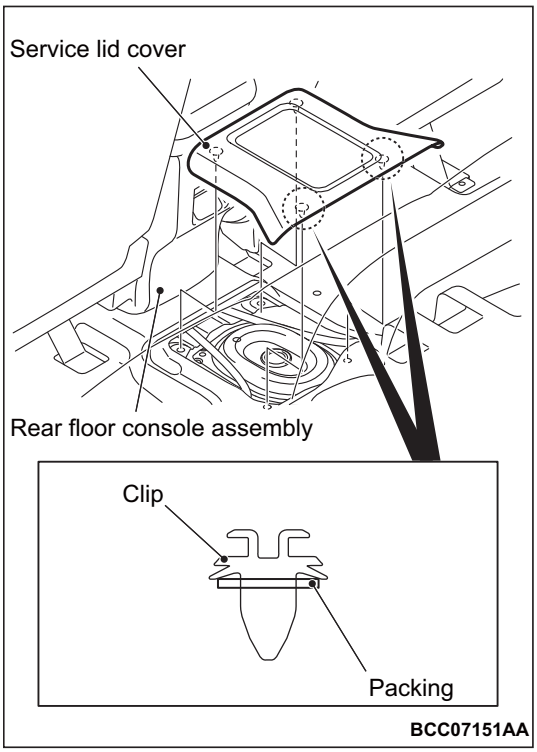


If the rubber boot around the service plug is released, water may enter the inside of the drive battery, resulting in short-circuit. Therefore, check that the rubber boot is engaged with the body flange before installing the service lid.



2. The arrow on the service lid should face towards the front of the vehicle.
3. Tighten the service lid mounting nuts.

⚠ CAUTION



The service lid cover mounting clip (two at the rear of the vehicle) is assembled with a packing to avoid water entry. When you install the service lid, make sure that this packing is not deformed or missing.

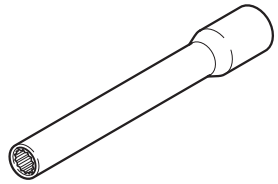
4. Install the service lid cover.

ACTION WHEN HIGH VOLTAGE CANNOT BE SHUT OFF

TOOL

⚠ CAUTION

- **Use protective equipment which complies with national legal requirements.**
- **Use insulating protective equipment which meets the requirements to withstand DC 500 V and AC 500 V.**
- **In order to prevent a short circuit in the system caused by bolt falling off, use a tool with magnetic tip.**
- **When using an extension tool, be sure to use an insulated tool.**

Tool	Name	Use
	Electric insulation socket	**⚠ CAUTION** **This tool is the insulation tool which prevents the circuit of the equipment from shorting caused by tool dropping, etc. It does not isolate the operator from the equipment. When using this tool, be sure to wear the electric insulation gloves.** • When shutoff of the high-voltage is difficult, and the drive battery cable and the EV charger cable (quick charging) connected to the drive battery are removed • When shutoff of the high-voltage is difficult, and the drive battery cable and the motor (electric motor unit) cable connected to inverter are removed • Alternatively, when a short circuit of the equipment may be present with the damaged vehicle, etc.

⚠ DANGER

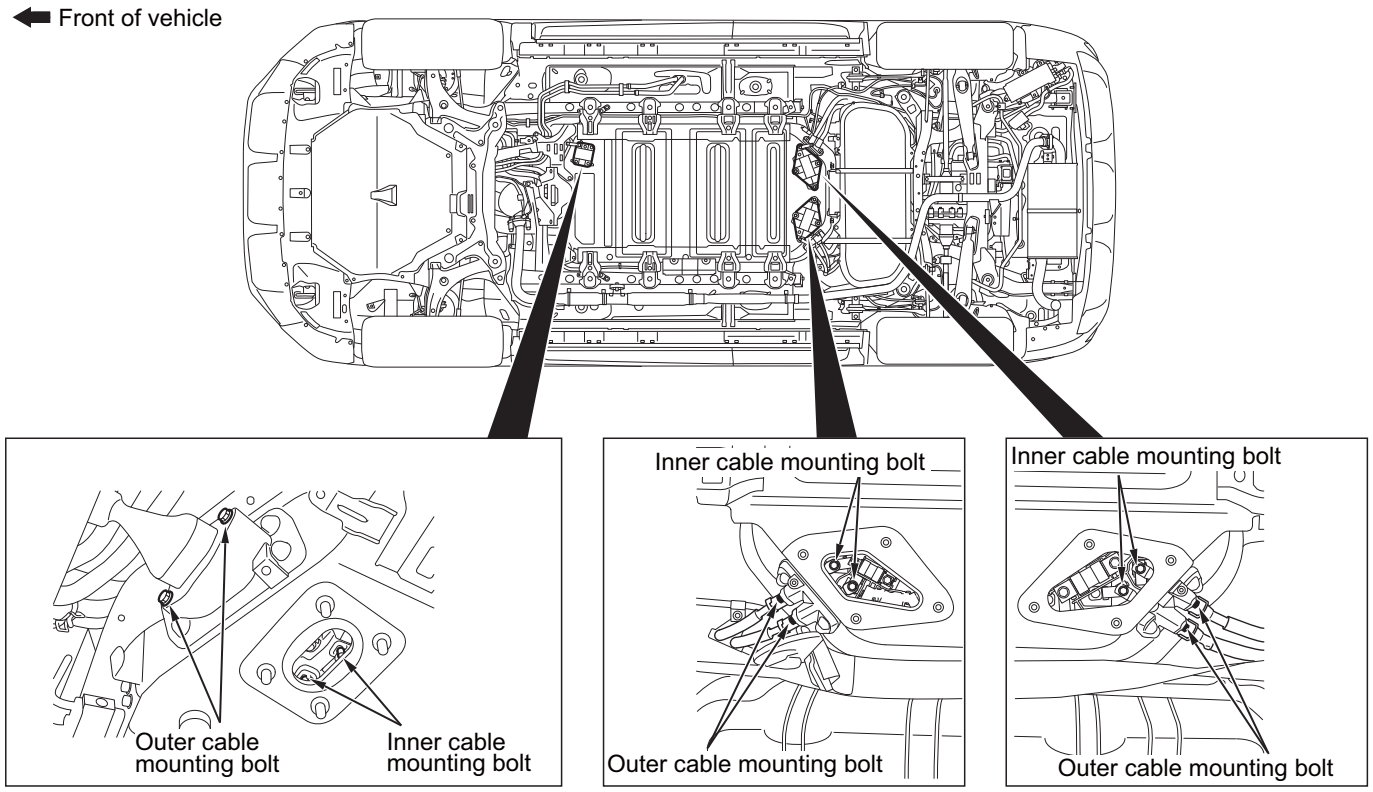
Be sure to wear the electric insulation gloves (special tool) during this work.

⚠ DANGER

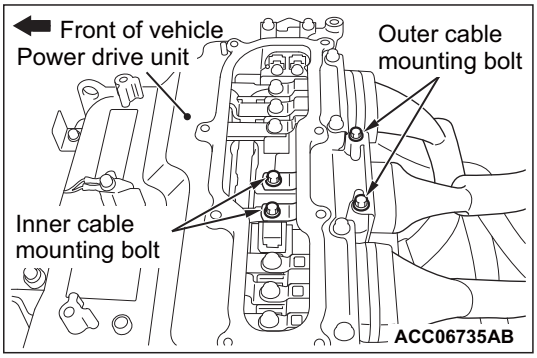
Be sure to wear the electric insulation socket (MB992337) during this work.

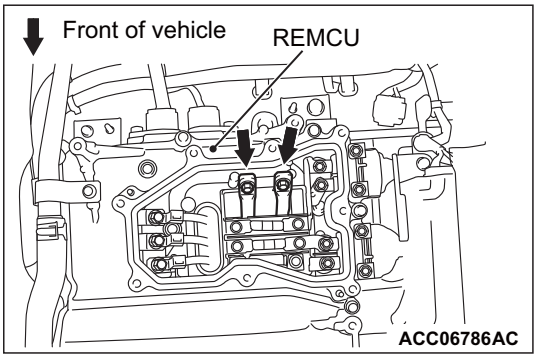
When the high-voltage remains even after the shut-off of the high-voltage is performed, or when the high-voltage shut-off work itself is difficult because of the accidental damages, perform the security according to the following procedure.

1. Remove the work-hole lid.



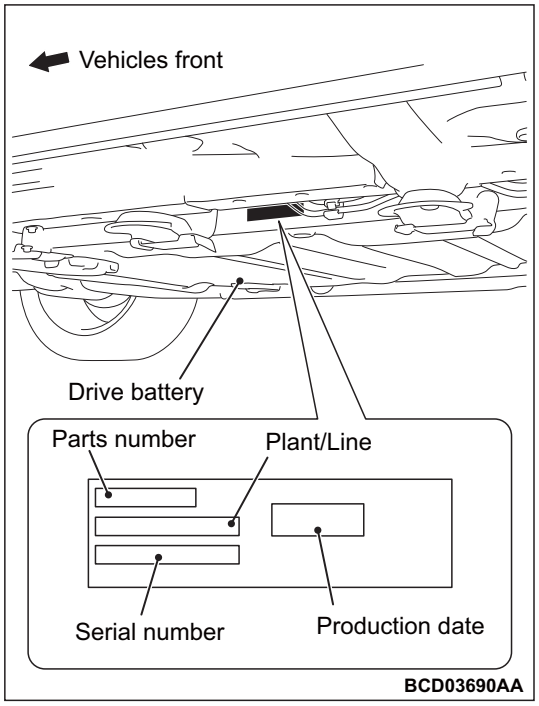
2. Remove the six inner cable mounting bolts.
3. Remove the six outer cable mounting bolts.
4. Pull off the drive battery cables (front and rear) and the EV charging cable (quick charger) from the drive battery.





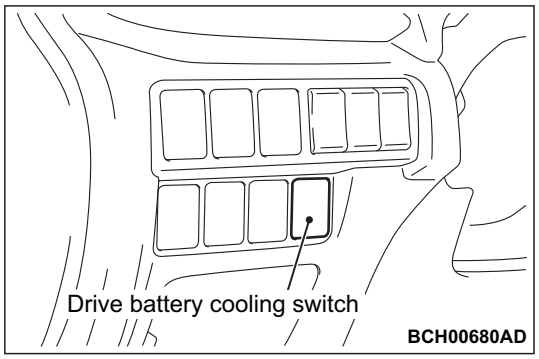
5. If steps 1 to 4 are difficult to perform or it is necessary to carry out any service work in the engine compartment or the electric motor unit compartment, disconnect the drive battery cable at the REMCU side of the power drive unit.

LABEL LOCATION

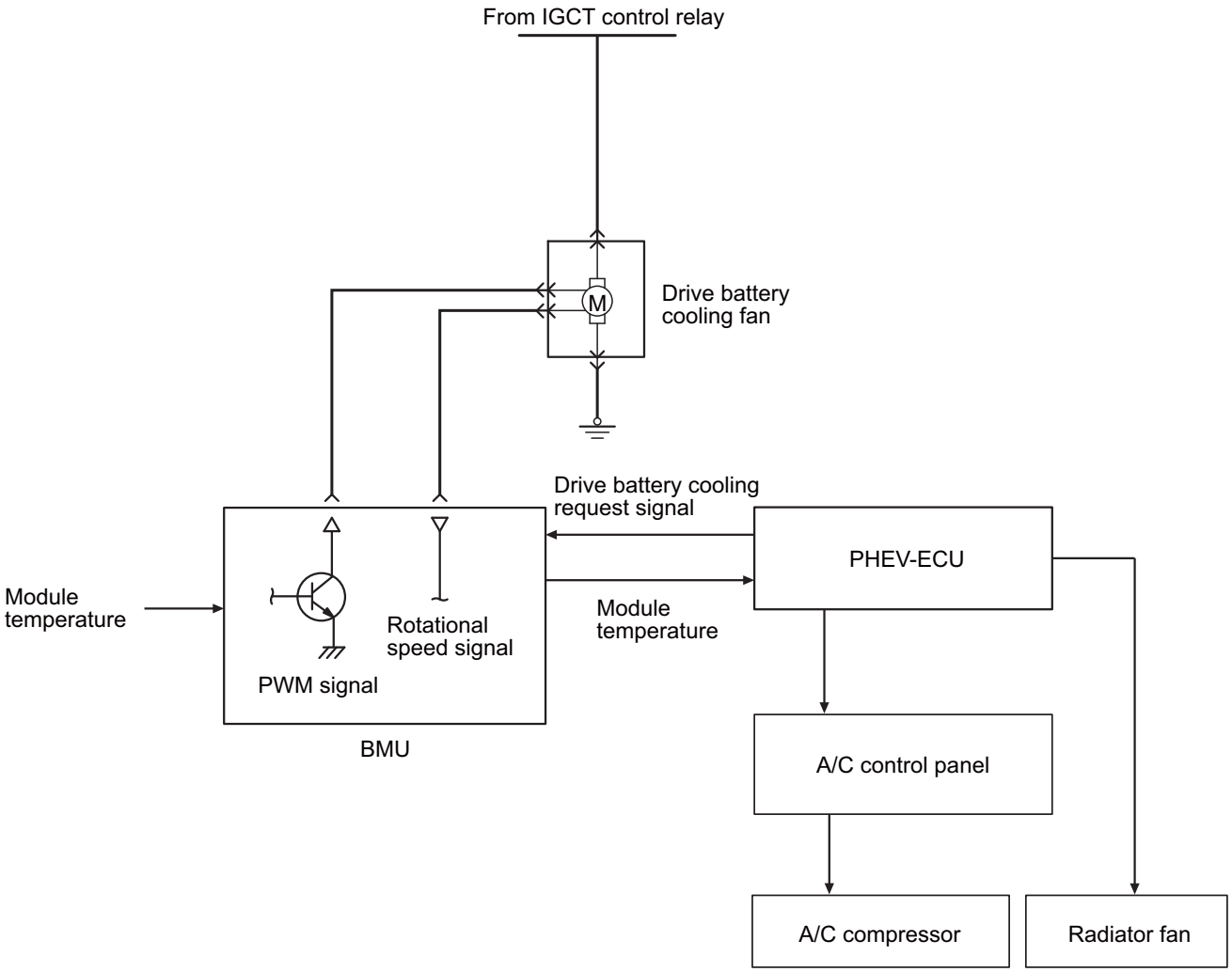


DRIVE BATTERY COOLING CONTROL

- During the charge, currents are input into the drive battery to complete the charge. When the READY indicator is illuminated, the currents are input into the drive battery.This causes the temperatures in the drive battery to easily increase. For this reason, the BMU drives the drive battery cooling fan, according to the drive battery cooling request signal from the PHEV-ECU. The air circulation in the drive battery cools the temperatures.



Considering the operating noise of the cooling fan etc., it is possible to turn on/off the cooling control by the drive battery cooling switch.



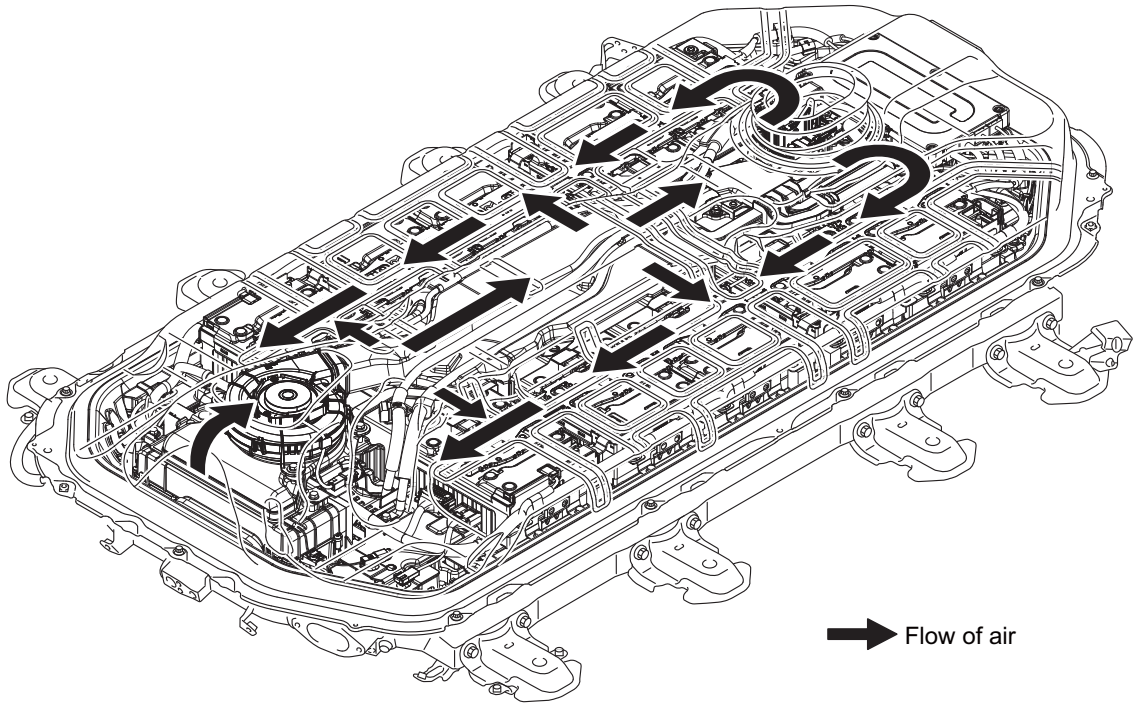
AKC00412 AC

When the charge is performed or when the READY indicator is illuminated, the BMU should send the module temperature information to the PHEV-ECU through the CAN.
The PHEV-ECU should send the driving battery cooling request signal to the BMU when one of the following two conditions is met:

- When the difference between the highest module temperature and the lowest module temperature exceeds the specified temperature.
- When the highest module temperature exceeds the specified temperature.

To the drive battery cooling fan, the BMU inputs the PWM signal in accordance with the drive battery cooling request signal. Therefore, the drive battery cooling fan is driven.
When the drive battery temperature increases and is higher than the specified temperature, the PHEV-ECU should drive the radiator fan or send the compressor operation request signal to the compressor & heater controller through the CAN. Thus, the drive battery cooling evaporator cools the air in the drive battery.

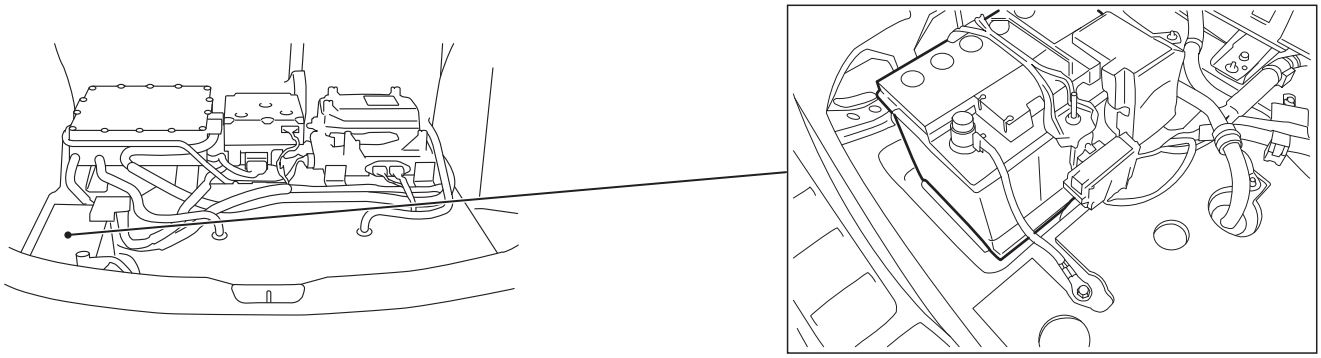
Cooling air flow in drive battery



BCKA3814AA

The cooling air is designed to flow among the modules to balance the temperatures.

AUXILIARY BATTERY



BCKA3986AA

Item	LN2
Voltage V	12
Capacity (20-hour rate) Ah	59
Electrolytic fluid specific gravity (fully charged state at 20°C)	1.250 - 1.290

GROUP 5

AXLES, WHEELS, TYRES AND SUSPENSION

CONTENTS

5.1. AXLES 5-2
5.1.1. Axles 5-2
5.1.2. Stub axles 5-6
5.1.3. Wheel bearings 5-6

5.2. WHEELS AND TYRES 5-6
5.2.1. Road wheel hub 5-6
5.2.2. Wheels 5-6
5.2.3. Tyres 5-7

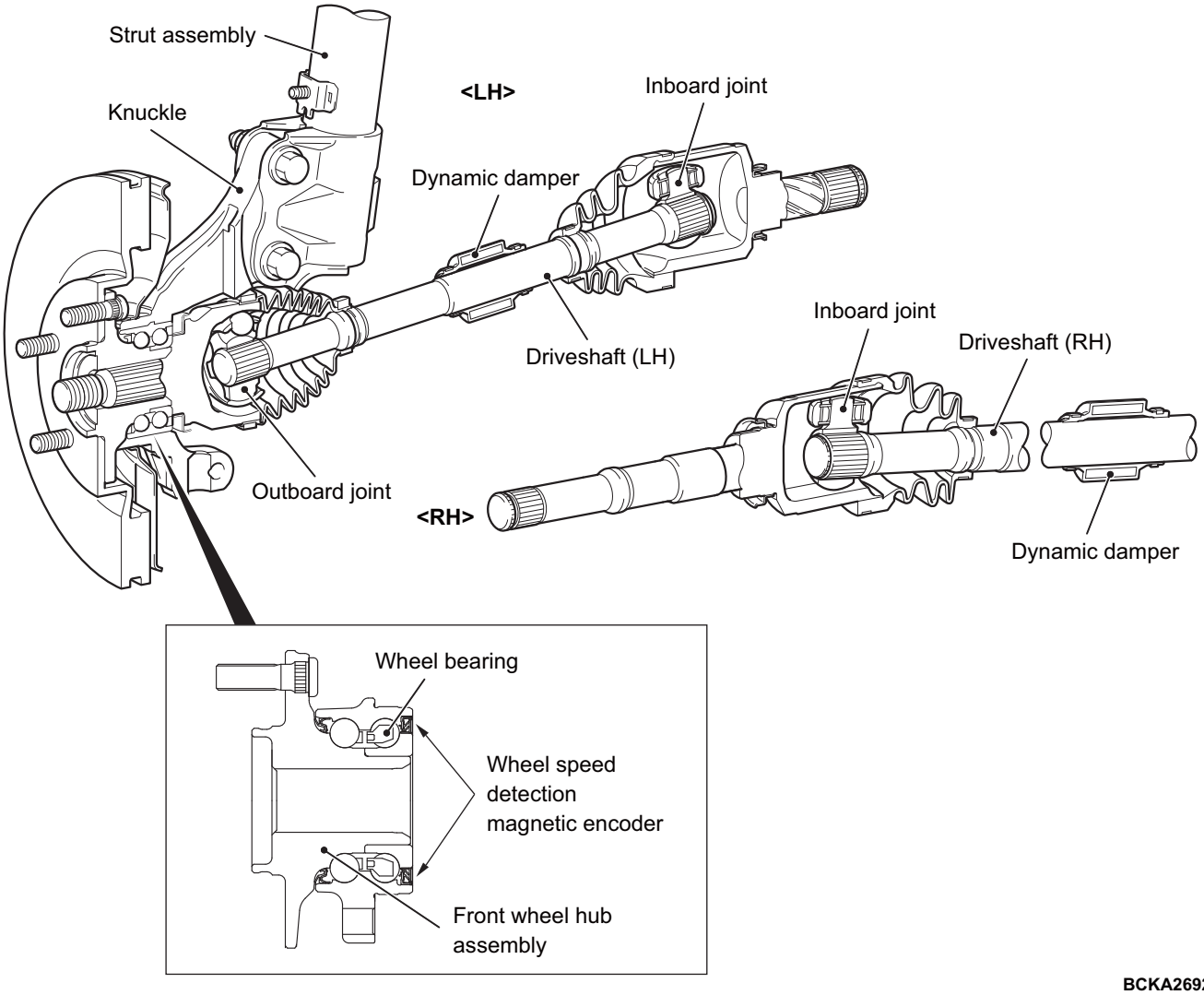
5.3. SUSPENSION SYSTEM 5-10
5.3.1. Springs and stabiliser 5-10
5.3.2. Shock absorbers 5-10
5.3.2.1. efficiency testing of damping (X)2 5-10
5.3.3. Torque tubes, radius arms, wishbones and suspension arms 5-10
5.3.4. Suspension joints 5-10
5.3.5. Air suspension 5-10

5.1. AXLES

5.1.1. Axles

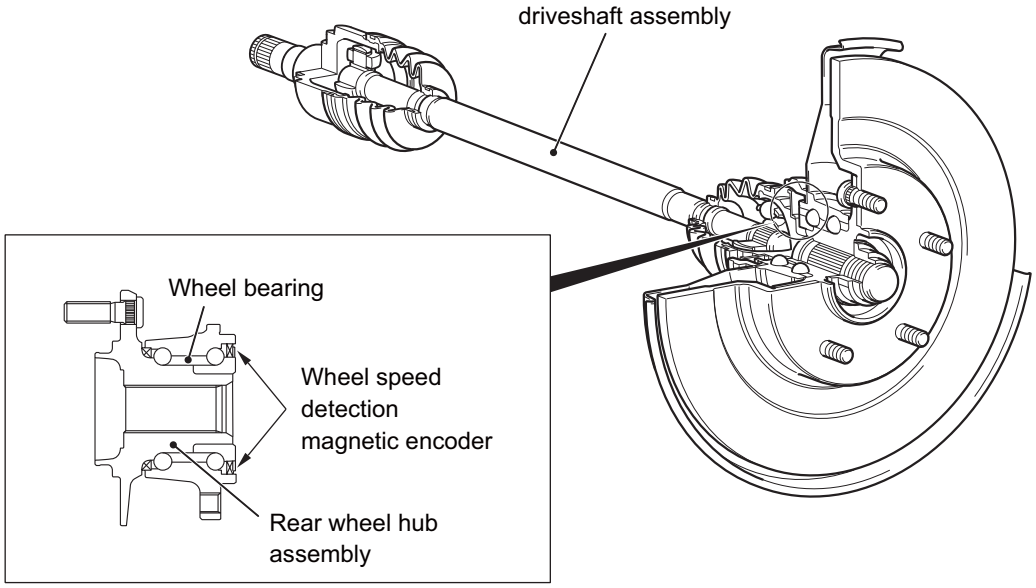
M90501010A0021

CONSTRUCTION DIAGRAM



BCKA2692AA

CONSTRUCTION DIAGRAM

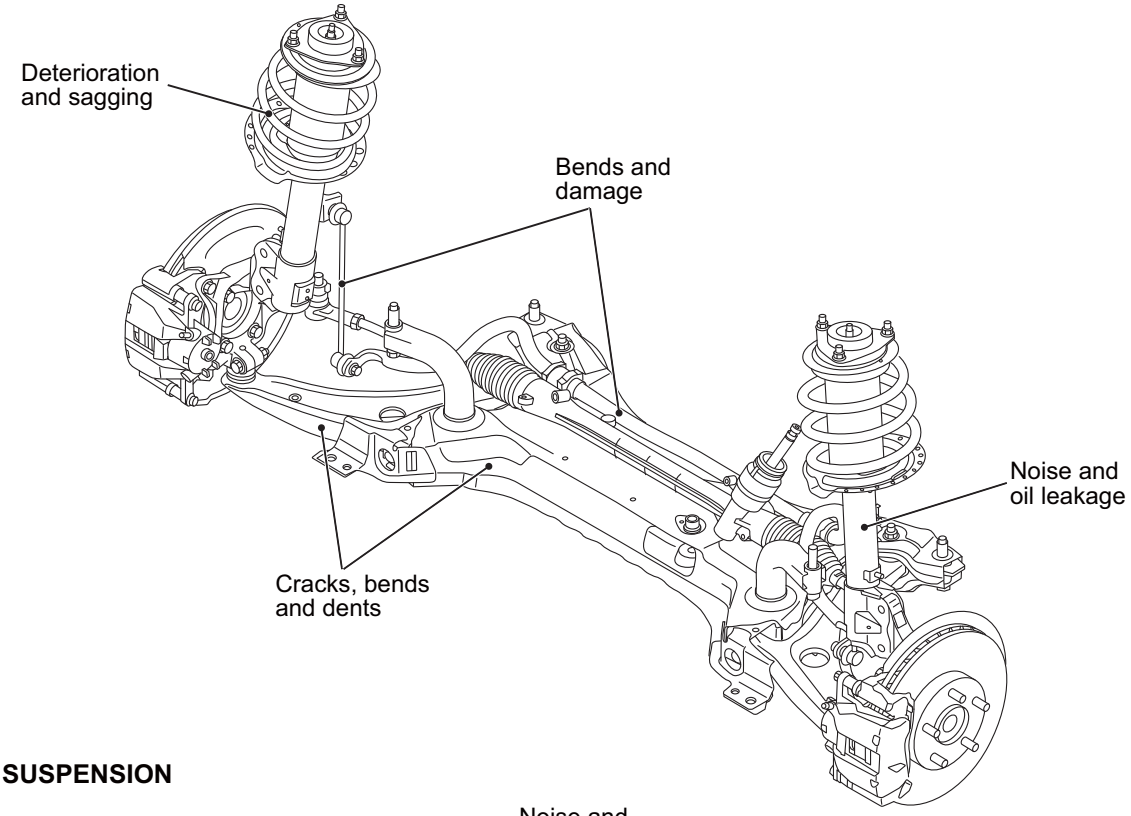


BCKA2693AA

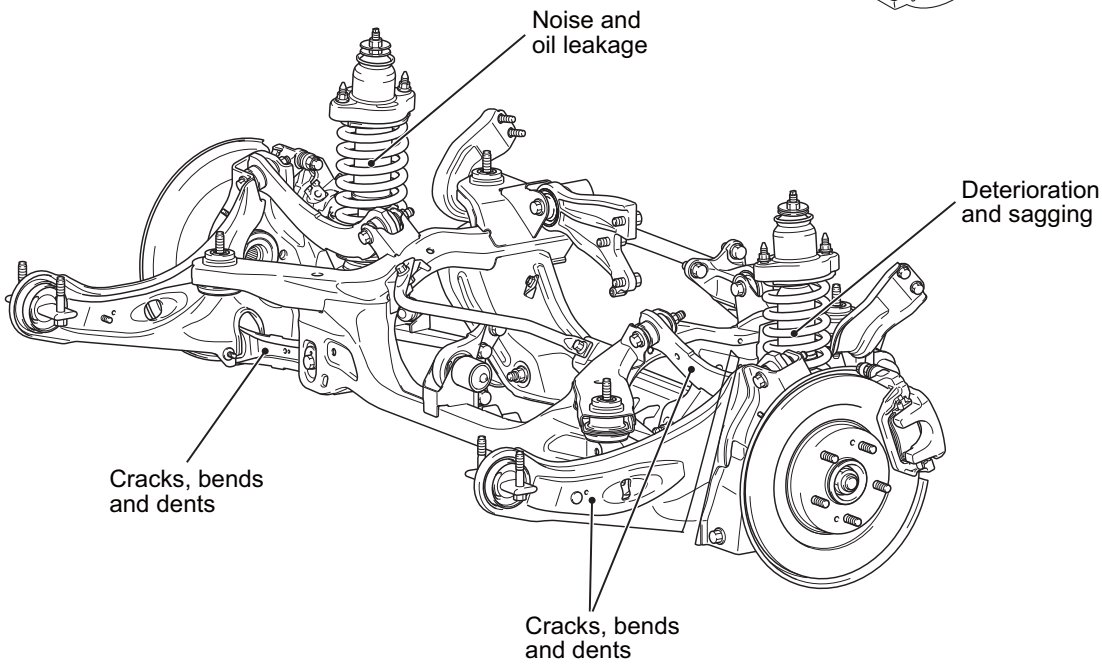
CHECK SUSPENSION SYSTEM FOR DAMAGE AND LOOSENESS

1. Check each portion of suspension for damage visually.
2. Check each installation bolt and nut for looseness by spanner or similar tool.

FRONT SUSPENSION

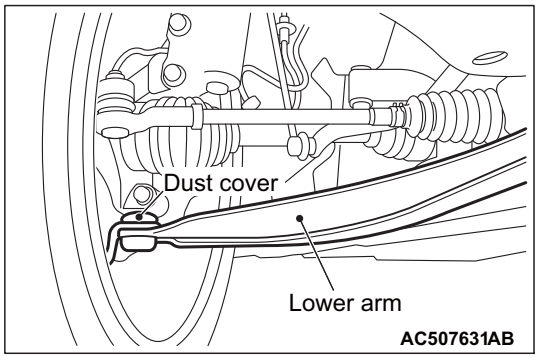


REAR SUSPENSION



BCKA3969AA

LOWER ARM BALL JOINT AXIAL PLAY CHECK

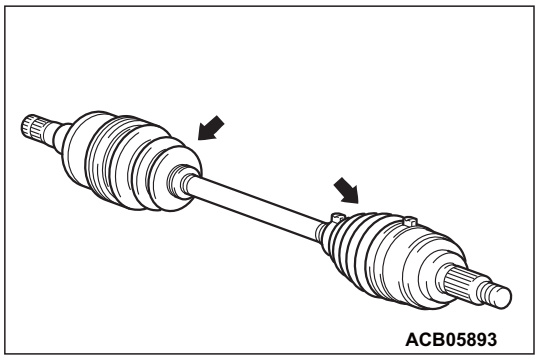


1. Raise the vehicle.
2. Move the lower arm up and down with your hands to check for an excessive play in the axial direction of the ball joint. If there is an excessive play, replace the lower arm assembly.

DUST COVERS FOR DAMAGE

Check dust covers for damage.

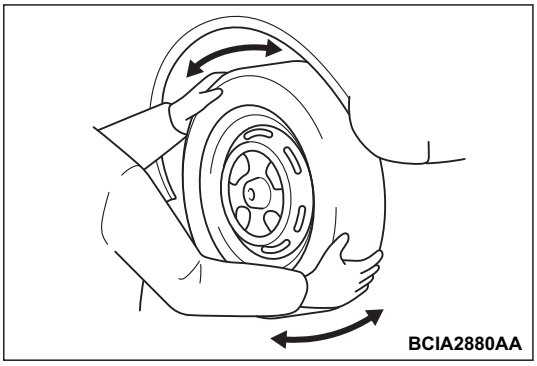
CHECK DRIVESHAFT BOOTS FOR DAMAGE



Check the driveshaft boots for damage.

CHECK FRONT AND REAR WHEEL BEARINGS FOR PLAY

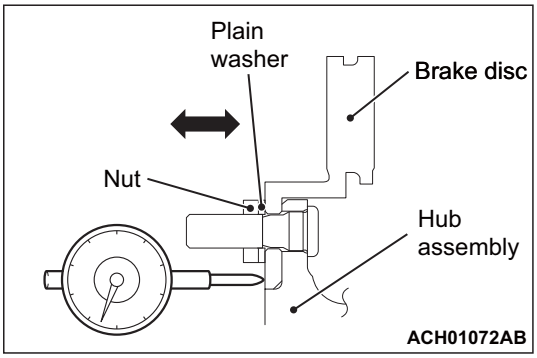
1. Raise the vehicle.
2. Rotate the tyre to check whether the tyre rotates smoothly without abnormal noise.



3. Put your hands on the outer circumference of the tyre and move it toward the axle to check that there is no looseness by feeling with your hands.
4. If there is looseness, depress the brake pedal and check again whether the looseness disappears. If the looseness is still present, it is caused by the suspension components and it is not caused by the wheel bearing.
5. If looseness is found in steps 2 through 4, check the bearing for looseness by using a dial gauge.

<WHEEL BEARING FOR PLAY MEASUREMENT>

1. Remove the wheel assembly and the brake pad assembly.
2. Insert M12 plain washers, and tighten the nuts (M12 × 1.5) diagonally and evenly to the specified torque (98±10N·m) to secure the brake disc to the hub assembly.



3. Set a dial gauge as shown in the figure. Move the hub in the axial direction and measure the axial play.

   Limit:
   0.05 mm <Front>
   0.05 mm <Rear>

4. On completion, install the wheel assembly and the brake pad assembly.

5.1.2. Stub axles

M90501020A0009

"Not Applicable"

5.1.3. Wheel bearings

M90501030A0009

"Not Applicable"

5.2. WHEELS AND TYRES

5.2.1. Road wheel hub

M90502010A0009

"Not Applicable"

5.2.2. Wheels

M90502020A0017

SPECIFICATIONS

Road wheel and tyre

Item		Standard
Wheel	Type	Aluminium type
	Size	18 × 7J
	Amount of wheel offset (inset) (mm)	38
	PCD (mm)	114.3
Tyre	Size	225/55R18 98H

NOTE: PCD indicates the pitch circle diameter of the wheel installation holes.

5.2.3. Tyres

M90502030A0017

SPECIFICATIONS

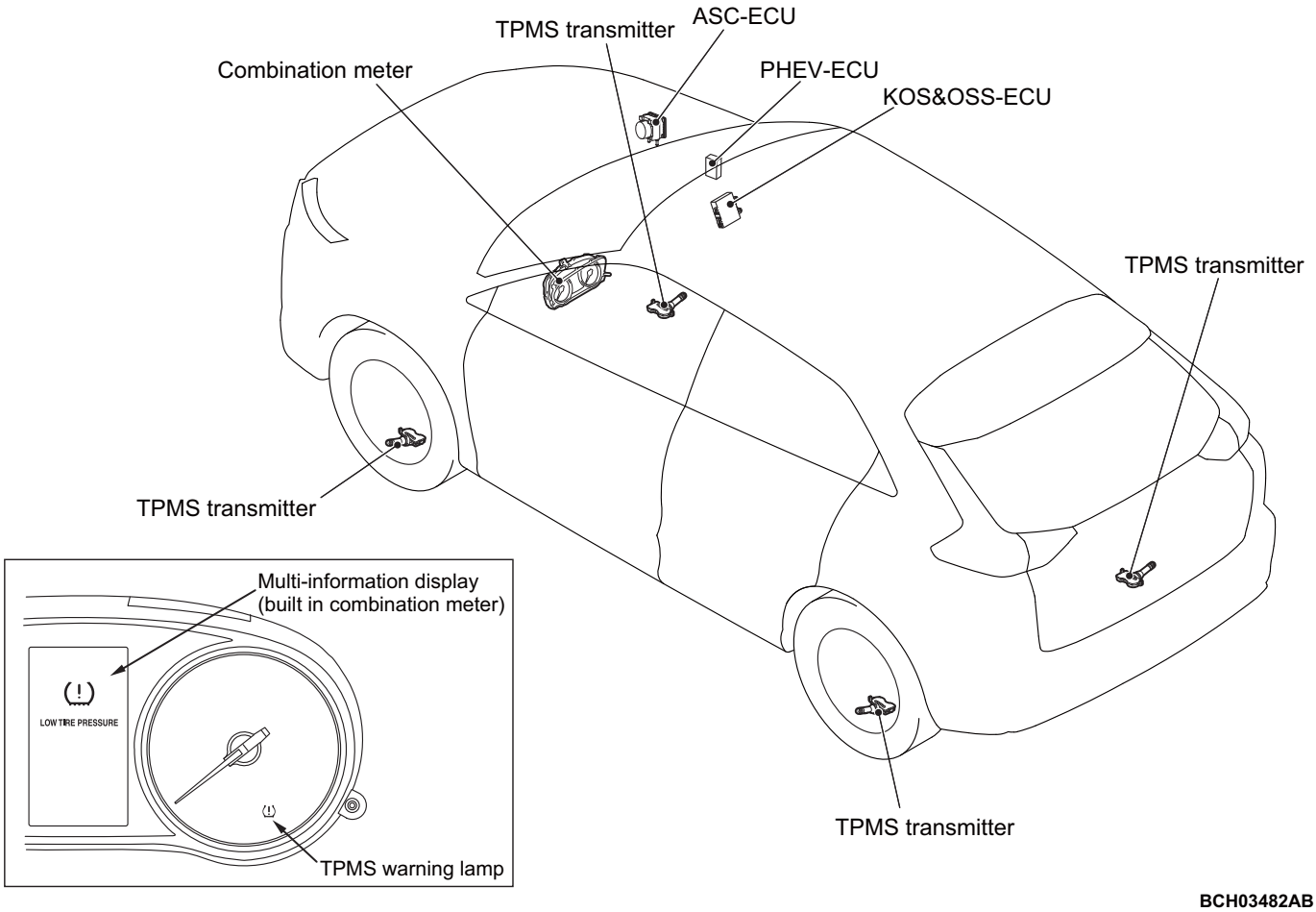
Refer to 5.2.2. Wheels SPECIFICATIONS P.5-6.

TYRE PRESSURE MONITORING SYSTEM (TPMS)

GENERAL INFORMATION

When the tyre pressure becomes under the specified value, the TPMS function warns the driver of that state by illuminating the TPMS warning lamp and the multi-information display in the combination meter warn the driver when there is a TPMS-related problem.

CONSTRUCTION DIAGRAM



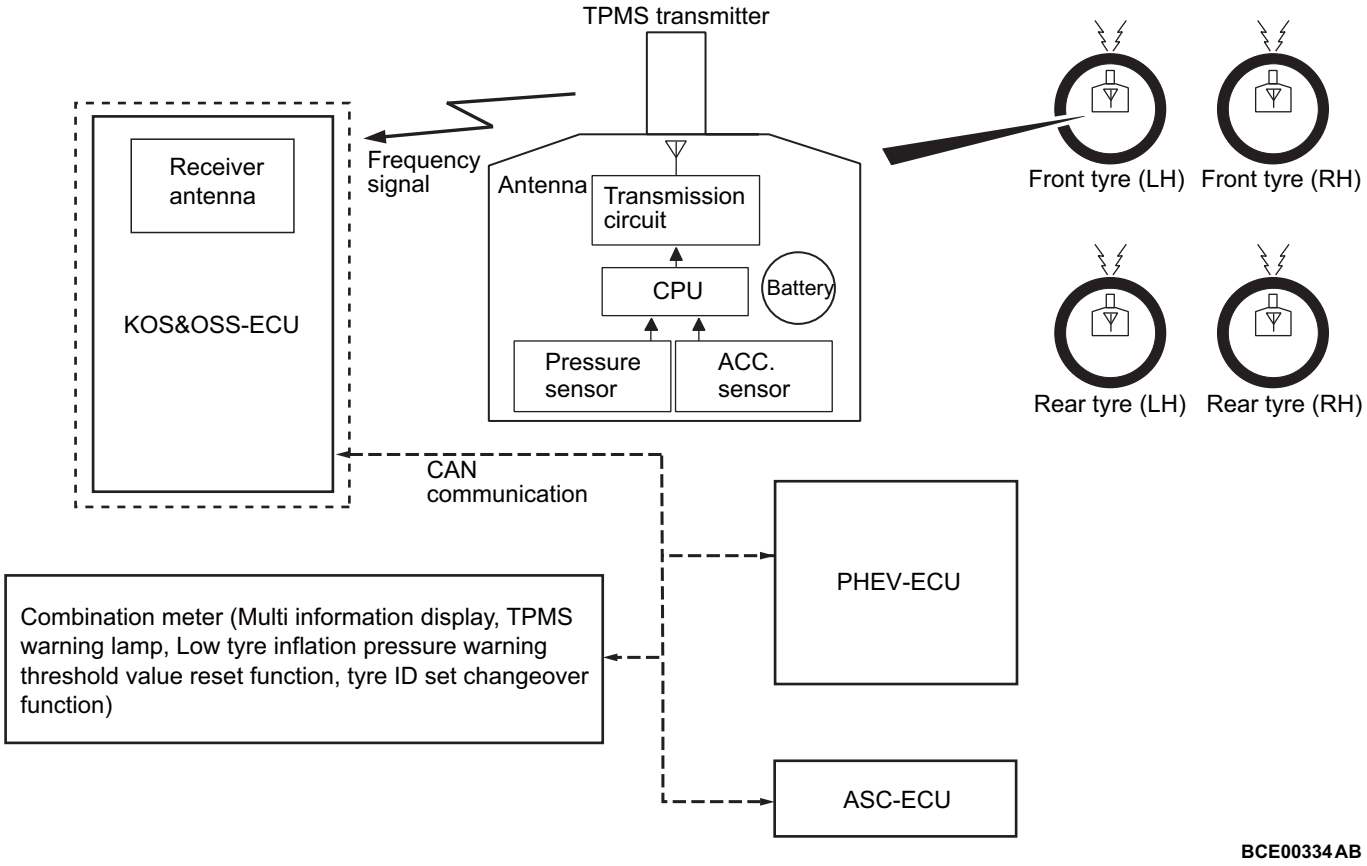
BCH03482AB

Main components and functions

Parts name	Functional description
KOS&OSS-ECU	Wireless communication with the TPMS transmitter
ASC-ECU	Receives the vehicle speed signals via CAN.
PHEV-ECU	Receives the atmospheric pressure signal via CAN.
TPMS transmitter	Measure tyre pressure directly, then send radio frequency signal to receiver antenna module.
Combination meter (Multi information display, TPMS warning lamp, low tyre inflation pressure warning threshold value reset function, tyre ID set changeover function)	Communicates with KOS&OSS-ECU via CAN. Receives the warning request or warning information from KOS&OSS-ECU, activates* the warning lamp. Warning symbol and message is additionally displayed on the multi information display. When executing the low tyre inflation pressure warning threshold value reset function and the tyre ID set changeover function, the execution menu is displayed.

NOTE: *: Illuminates for tyre pressure warning. Flashes for about 1 minute and then continuously illuminated for TPMS malfunction warning.

System configuration



TYRE PRESSURE MONITORING SYSTEM (TPMS) FUNCTION

When the tyre pressure becomes under the specified value, the TPMS function warns the driver of that state by illuminating the TPMS warning lamp.

OPERATION

- The signals from the TPMS transmitter are received by the KOS&OSS-ECU via receiver antenna.
- KOS&OSS-ECU processes input signals from each TPMS transmitter as well as vehicle speed signals from the ASC-ECU. It receives the atmospheric pressure signal from PHEV-ECU, and when the atmospheric pressure is low (such as at high altitude), it calibrates the tyre pressure received from TPMS transmitter and makes a judgement of warning. When the road tyre pressure is low, it sends a warning signal causing the TPMS warning lamp to be illuminated. When the TPMS has problems, it sends a warning signal causing the TPMS warning lamp to be flashed*.

  NOTE: *: Change to continuous illumination after flashing for about 1 minute.
- For 3 seconds after the power supply mode of the electric motor switch is turned to on, KOS&OSS-ECU illuminates the TPMS warning lamp to check any breaks in the TPMS warning lamp circuit.
- By connecting the M.U.T.-IIISE to the diagnosis connector, data stored in KOS&OSS-ECU (data of tyre pressure and TPMS transmitter ID, the alarm status and warning history, etc.) can be displayed and TPMS transmitter ID can be registered.
- Two sets of four TPMS transmitters can be registered as sets 1 and 2.

  NOTE: If the TPMS transmitter is replaced, register the ID codes of all TPMS transmitters again about the ID set of tyre which includes the replaced transmitter using the M.U.T.-IIISE.
- Low tyre inflation pressure warning threshold value reset and tyre ID set changeover can be performed. (By registering two sets at the dealer in advance, the tyre ID set can be freely switched by operating the combination meter.)

  NOTE: When the tyre ID set is switched, the low tyre inflation pressure warning threshold value will be automatically reset.

TPMS TRANSMITTER (TYRE PRESSURE SENSOR)

The TPMS transmitter combines the valve and tyre pressure sensor in a single unit. The TPMS transmitters are mounted inside the tyres. The TPMS transmitter measures tyre pressure directly with its tyre pressure sensor and sends radio frequency signals to KOS&OSS-ECU. The TPMS transmitter includes acceleration sensor that senses tyre rotation, and change tyre pressure sampling and data transmission timing when vehicle is running.

NOTE: Use only genuine wheels. The use of non-genuine wheels may cause the improper installation of the TPMS transmitters, possibly resulting in air leakage and damage to the TPMS transmitter.

TYRE PRESSURE SAMPLING TIMING

Vehicle status	Sampling timing
At vehicle moving	once every 5 seconds
At vehicle stationary	once every 1 minute

NOTE: Vehicle moving = vehicle speed: approximately 25 km/h or more

DATA TRANSMISSION TIMING

Vehicle status	Transmission timing
At vehicle moving	once every 1 minute*
At vehicle stationary	once every 13 hours

If a sampled pressure varies by ±10 kPa from the last transmitted pressure value, an additional transmission will occur.

NOTE: *: Once every 15 seconds for first 30 transmission after vehicle starts moving.

5.3. SUSPENSION SYSTEM

5.3.1. Springs and stabiliser

M90503010A0009

"Not Applicable"

5.3.2. Shock absorbers

M90503020A0009

"Not Applicable"

5.3.2.1. efficiency testing of damping (X)2

M90503021A0009

"Not Applicable"

5.3.3. Torque tubes, radius arms, wishbones and suspension arms

M90503030A0009

"Not Applicable"

5.3.4. Suspension joints

M90503040A0009

"Not Applicable"

5.3.5. Air suspension

M90503050A0009

"Not Applicable"

GROUP 6

CHASSIS AND CHASSIS ATTACHMENTS

CONTENTS

6.1. CHASSIS OR FRAME AND ATTACHMENTS 6-2

6.1.1. General condition 6-2
6.1.2. Exhaust pipes and silencers 6-2
6.1.3. Fuel tank and pipes (including heating fuel tank and pipes) 6-2
6.1.4. Bumpers, lateral protection and rear underrun devices 6-2
6.1.5. Spare wheel carrier (if fitted) 6-2
6.1.6. Mechanical coupling and towing device 6-2
6.1.7. Transmission 6-2
6.1.8. Engine mountings 6-2
6.1.9. Engine performance (X) 2 6-2

6.2. CAB AND BODYWORK 6-3

6.2.1. Condition 6-3
6.2.2. Mounting 6-3
6.2.3. Doors and door catches 6-3
6.2.4. Floor 6-3
6.2.5. Driver's seat 6-3
6.2.6. Other seats 6-3
6.2.7. Driving controls 6-3
6.2.8. Cab steps 6-3
6.2.9. Other interior and exterior fittings and equipment 6-3
6.2.10. Mudguards (wings), spray suppression devices 6-3
6.2.11. Stand 6-3
6.2.12. Handgrips and footrests 6-3

6.1. CHASSIS OR FRAME AND ATTACHMENTS

6.1.1. General condition

M90601010A0008

"Not Applicable"

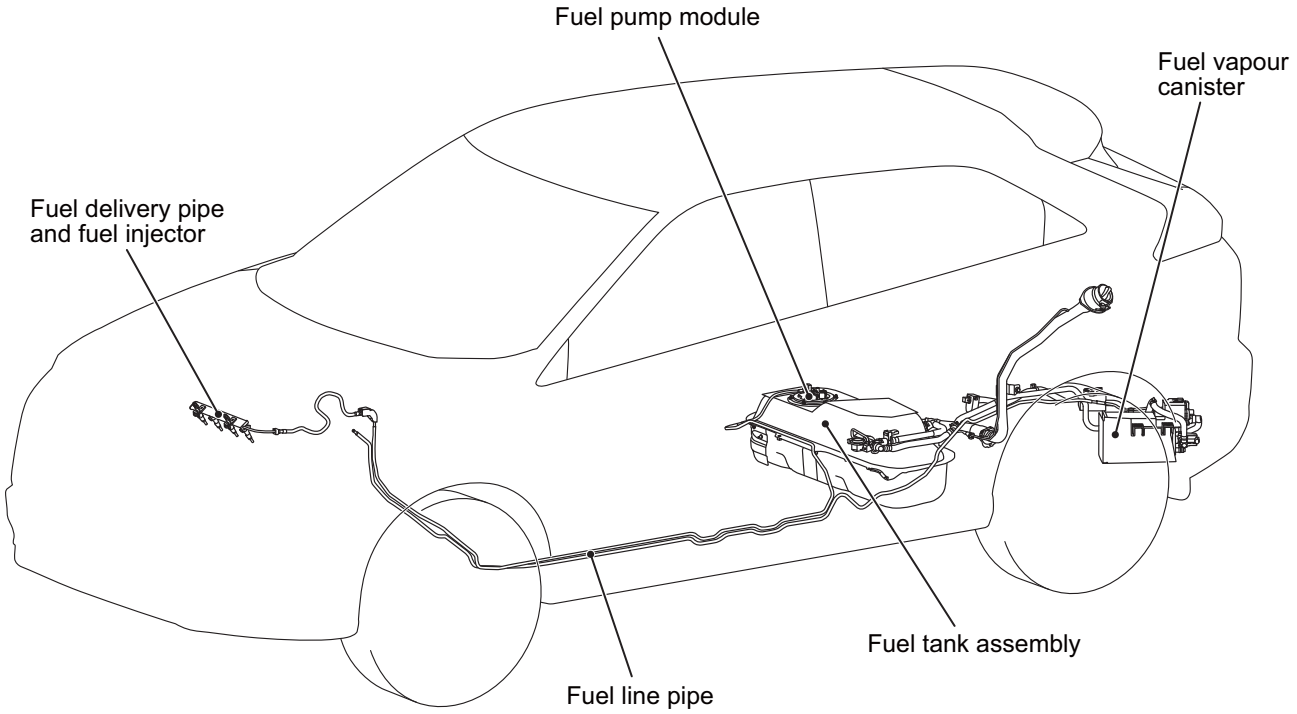
6.1.2. Exhaust pipes and silencers

M90601020A0008

"Not Applicable"

6.1.3. Fuel tank and pipes (including heating fuel tank and pipes)

M90601030A0016



BCKA3971AA

6.1.4. Bumpers, lateral protection and rear underrun devices

M90601040A0008

"Not Applicable"

6.1.5. Spare wheel carrier (if fitted)

M90601050A0008

"Not Applicable"

6.1.6. Mechanical coupling and towing device

M90601060A0008

"Not Applicable"

6.1.7. Transmission

M90601070A0008

"Not Applicable"

6.1.8. Engine mountings

M90601080A0008

"Not Applicable"

6.1.9. Engine performance (X) 2

M90601090A0018

"Query raised for this content"

6.2. CAB AND BODYWORK

6.2.1. Condition

M90602010A0008

"Not Applicable"

6.2.2. Mounting

M90602020A0008

"Not Applicable"

6.2.3. Doors and door catches

M90602030A0008

"Not Applicable"

6.2.4. Floor

M90602040A0008

"Not Applicable"

6.2.5. Driver's seat

M90602050A0008

"Not Applicable"

6.2.6. Other seats

M90602060A0014

- Max Number of seats total (excluding driver's seat) - 4
- Number of rear-facing seats - 0

6.2.7. Driving controls

M90602070A0008

"Not Applicable"

6.2.8. Cab steps

M90602080A0008

"Not Applicable"

6.2.9. Other interior and exterior fittings and equipment

M90602090A0008

"Not Applicable"

6.2.10. Mudguards (wings), spray suppression devices

M90602100A0008

"Not Applicable"

6.2.11. Stand

M90602110A0008

"Not Applicable"

6.2.12. Handgrips and footrests

M90602120A0008

"Not Applicable"

GROUP 7

OTHER EQUIPMENT

CONTENTS

7.1. SAFETY-BELTS/BUCKLES AND RESTRAINT SYSTEMS (AS REGARDS L CATEGORY: L6/L7) . . 7-2

7.1.1. Security of safety-belts/buckles mounting 7-2
7.1.2. Condition of safety-belts/buckles. . . . 7-3
7.1.3. Safety belt load limiter. 7-3
7.1.4. Safety belt Pre-tensioners. 7-4
7.1.5. Airbag 7-8
7.1.6. SRS Systems 7-8

7.2. FIRE EXTINGUISHER (X)2. 7-8

7.3. LOCKS AND ANTI-THEFT DEVICE 7-8

7.4. WARNING TRIANGLE (IF REQUIRED) (X)2 7-8

7.5. FIRST AID KIT. (IF REQUIRED) (X)2 7-8

7.6. WHEEL CHOCKS (WEDGES) (IF REQUIRED) (X)2 7-8

7.7. AUDIBLE WARNING DEVICE. . . 7-8

7.8. SPEEDOMETER 7-9

7.9. TACHOGRAPH (IF FITTED/REQUIRED) 7-9

7.10. SPEED LIMITATION DEVICE (IF FITTED/REQUIRED) 7-9

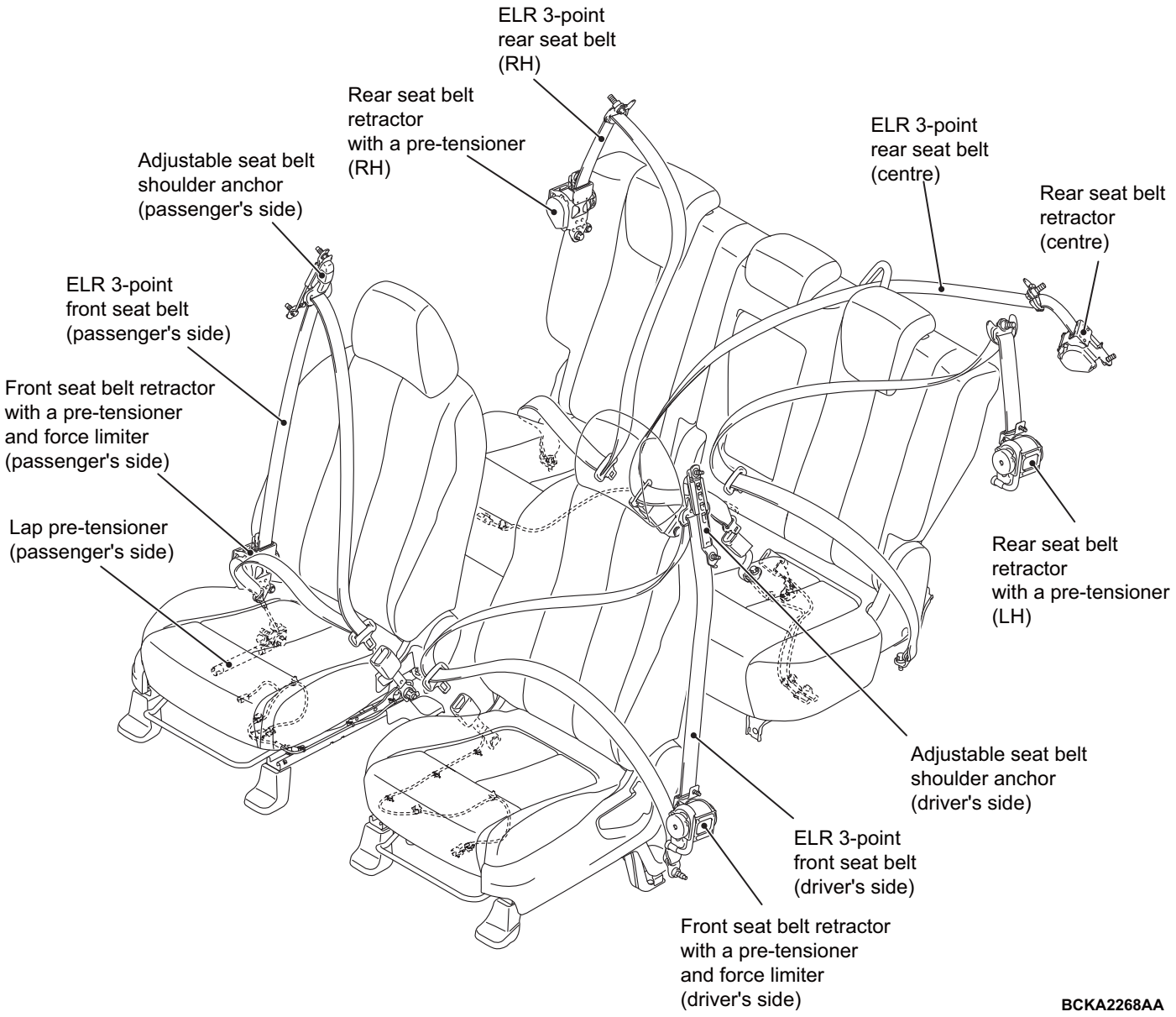
7.11. ODOMETER IF AVAILABLE (X)2 7-9

7.12. ELECTRONIC STABILITY CONTROL (ESC) IF FITTED/REQUIRED 7-9

7.1. SAFETY-BELTS/BUCKLES AND RESTRAINT SYSTEMS (AS REGARDS L CATEGORY: L6/L7)

7.1.1. Security of safety-belts/buckles mounting

M90701010A0014



BCKA2268AA

- By making the buckles of all the seats free-standing, you can wear the seat belts more comfortably.

Front seat belt

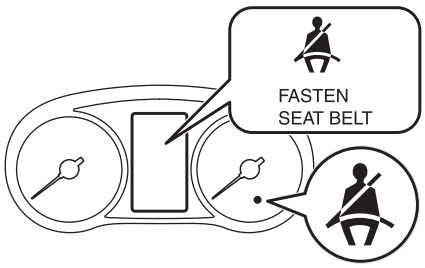
- The 3-point seat belt with ELR has been adopted together with a retractor pre-tensioner and force limiter.
- In addition, the lap pre-tensioner is adopted on the front passenger's seat side to improve safety.
- Adjustable seat belt shoulder anchor provide the most suitable belt fitting.

Rear seat belt

- The 3-point seat belt with ELR has been adopted.
- In addition, the retractor pre-tensioner is adopted for the left and right seats to improve safety.

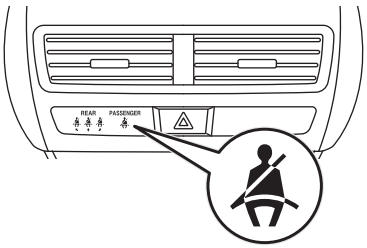
Seat belt warning lamp

<Driver's seat>



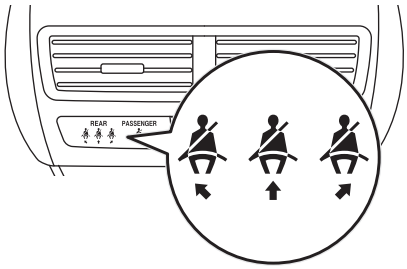
BCH03092AB

<Front passenger's seat>



BCKA2259AA

<Rear passenger's seat>



BCKA2260AA

A warning lamp is set to all seats or front seats to encourage passenger's to wear seatbelts.For further details on seat belt warning lamp.

7.1.2. Condition of safety-belts/buckles.

M90701020A0008

Refer to 7.1.1. Security of safety-belts/buckles mounting P.7-2.

7.1.3. Safety belt load limiter

M90701030A0008

Refer to 7.1.1. Security of safety-belts/buckles mounting P.7-2.

7.1.4. Safety belt Pre-tensioners

M90701040A0014

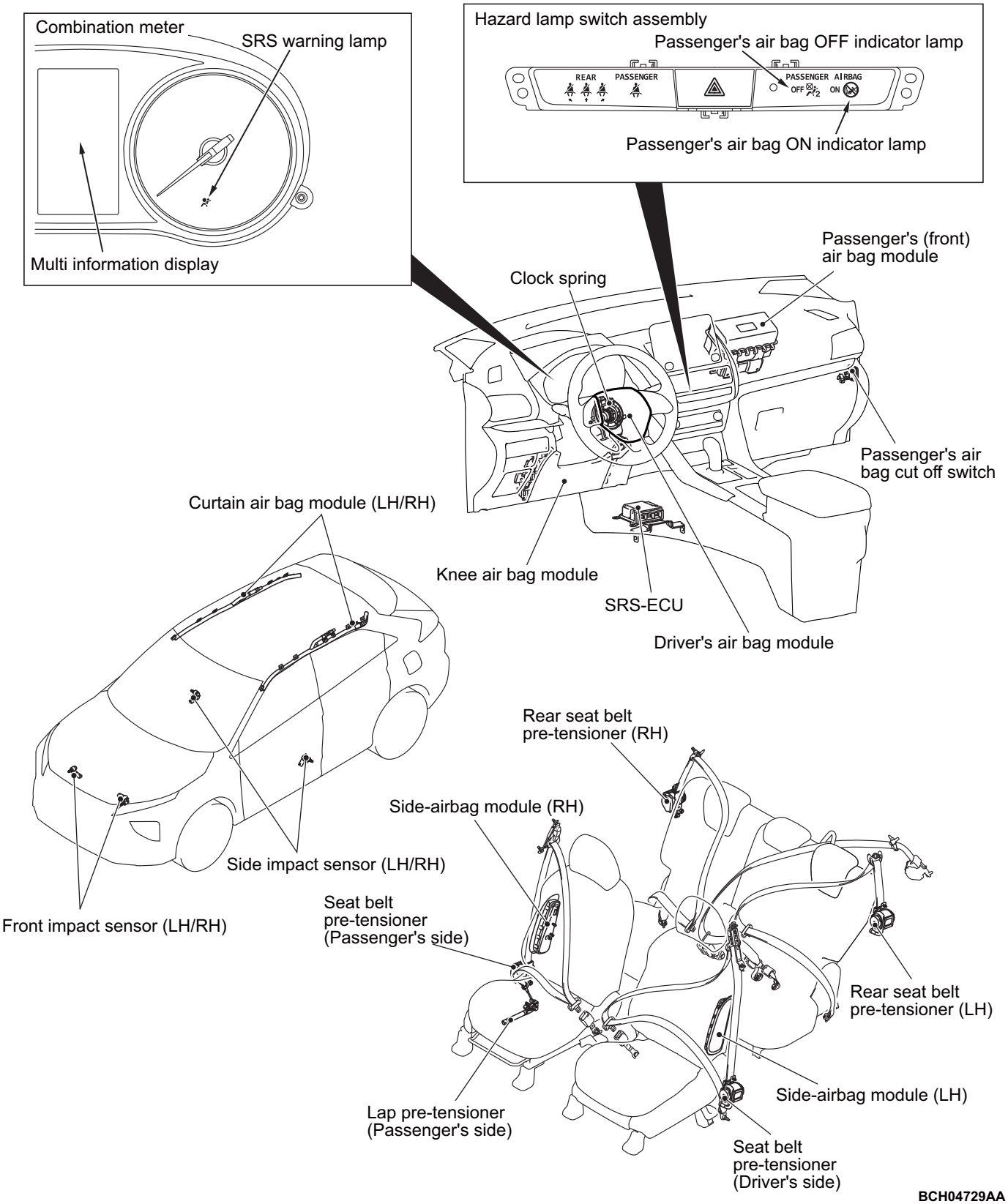
- To provide a better safety upon impact, the driver's and front passenger's air bags have been installed to all vehicles as standard. Furthermore, the driver's knee airbag, the side-airbags or the curtain airbags have been installed as standard equipment depending on model type.
- The SRS* air bag is a system that is effective with the seat belt fastened, and it is designed as a supplemental system of the seat belt.
- The driver's and front passenger's air bag are activated when an impact exceeding the threshold is applied upon a frontal collision, and the cushion air bag is instantaneously inflated to protect the head and chest areas of the front seat passengers.
- The passenger's air bag cut off switch which can enable and disable the passenger's (front) air bag has been equipped in the instrument panel of passenger's side.
- The driver's knee air bag is activated when an impact exceeds the threshold upon a frontal collision, and the cushion air bag is instantaneously inflated for better protection of the driver.
- The side-airbag is activated when an impact exceeds the threshold upon a side collision, and the cushion air bag is instantaneously inflated to protect the chest area of the front seat passengers.
- The curtain air bag is activated simultaneously with the side-airbag upon a side collision to protect the heads of the front seat and second seat passengers.
- For the inflator, the gas which is harmless to the human body has been adopted.
- High voltage shutdown function shuts off the high voltage as needed upon a frontal collision, side collision and rear-end collision in order to reduce the risk for the occupants, rescuer, and rescue team of the electrical hazard caused by high voltage electric leakage.
- The seat belt pre-tensioner is installed as a standard in the front and rear seats. The pre-tensioner is activated simultaneously with the deployment of the driver's and front passenger's air bags and the driver's knee air bag in the case of a frontal collision. Seat belts are pulled in to eliminate the slack upon a collision, thus improving the initial occupant restraint, and reducing the travel distance of the occupants. For the passenger's seat, in addition to the seat belt pre-tensioner for the shoulder side, the lap pre-tensioner has been installed on the outer seat belt lower anchor side in order to improve the restraining performance around the waist in addition to the chest area.

⚠ CAUTION

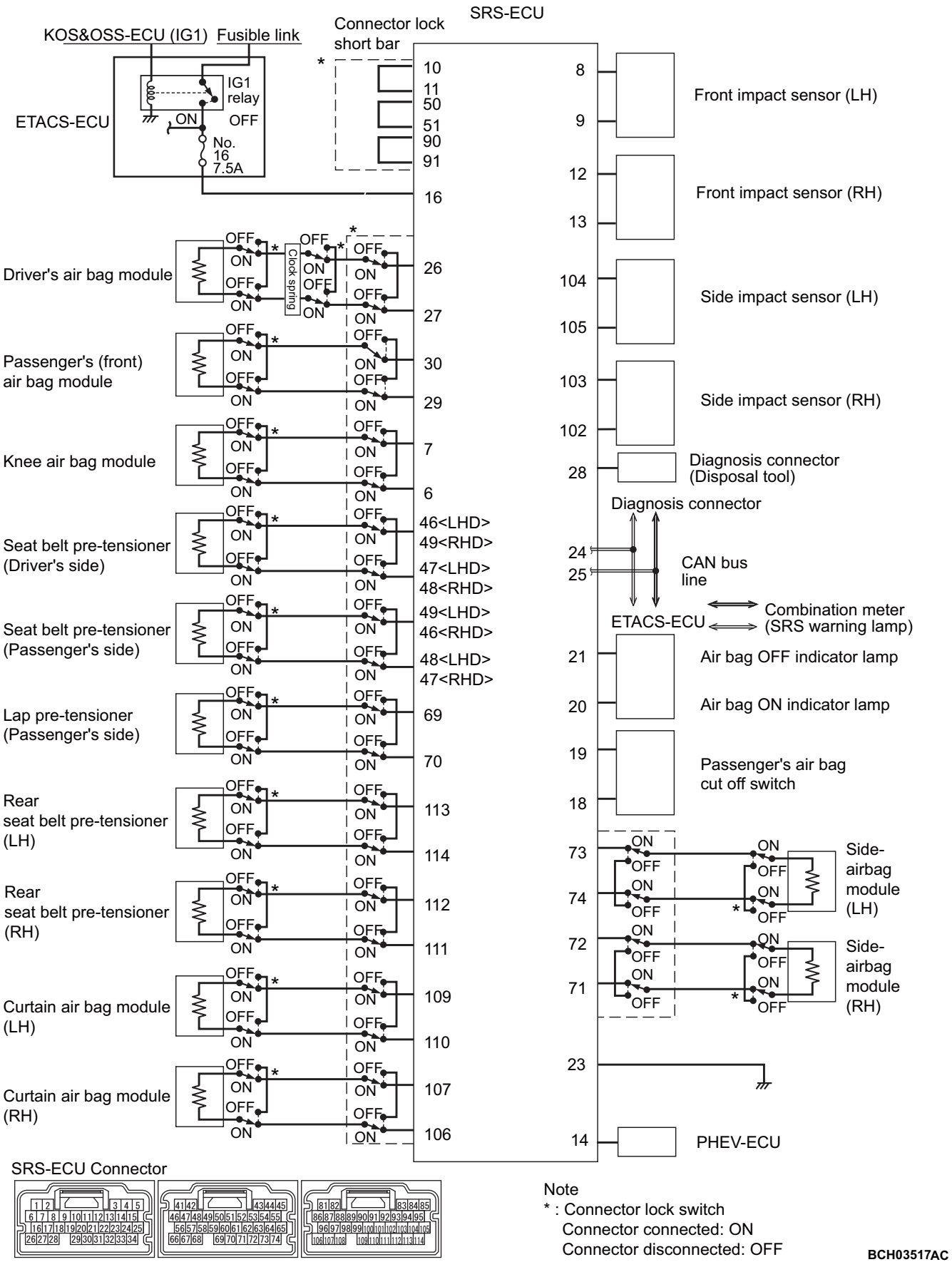
- **The SRS (Supplemental Restraint System) air bag is a system that is effective with the seat belt fastened, and it is designed as a supplemental system of the seat belt.**
- **Do not disassemble the SRS air bag components or seat belt with pre-tensioner. Also, do not apply an impact.**

NOTE: *: SRS (Supplemental Restraint System)

CONSTRUCTION DIAGRAM



SRS SYSTEM CIRCUIT DIAGRAM



Note
* : Connector lock switch
Connector connected: ON
Connector disconnected: OFF

BCH03517AC

Number in system circuit diagram	Circuit name	Universal harness Wire size and colour
6	Knee air bag squib (-)	L
7	Knee air bag squib (+)	R
8	Front impact sensor (LH) (+)	L
9	Front impact sensor (LH) (-)	R
12	Front impact sensor (RH) (+)	G
13	Front impact sensor (RH) (-)	LG
14	PHEV-ECU	Y
16	KOS&OSS-ECU (IG1) power supply (fuse No. 16)	Y
18	Passenger's air bag cut off switch (+)	G
19	Passenger's air bag cut off switch (-)	L
20	Passenger's air bag ON indicator lamp	V
21	Passenger's air bag OFF indicator lamp	BR
23	Earth	B
24	CAN-C_L	G
25	CAN-C_H	L
26	Driver's air bag squib (+)	G
27	Driver's air bag squib (-)	GR
28	Diagnosis connector (Disposal tool)	LG
29	Passenger's (front) air bag squib (+)	P
30	Passenger's (front) air bag squib (-)	LG
46	Seat belt pre-tensioner squib (Driver's side) (+) <LHD>	BR
	Seat belt pre-tensioner squib (Passenger's side) (+) <RHD>	
47	Seat belt pre-tensioner squib (Driver's side) (-) <LHD>	Y
	Seat belt pre-tensioner squib (Passenger's side) (-) <RHD>	
48	Seat belt pre-tensioner squib (Passenger's side) (-) <LHD>	B
	Seat belt pre-tensioner squib (Driver's side) (-) <RHD>	
49	Seat belt pre-tensioner squib (Passenger's side) (+) <LHD>	W
	Seat belt pre-tensioner squib (Driver's side) (+) <RHD>	
69	Lap pre-tensioner squib (Passenger's side) (+)	R
70	Lap pre-tensioner squib (Passenger's side) (-)	G
71	Side-airbag squib (RH) (-)	GR
72	Side-airbag squib (RH) (+)	L
73	Side-airbag squib (LH) (+)	V
74	Side-airbag squib (LH) (-)	P
102	Side impact sensor (RH) (+)	G-W
103	Side impact sensor (RH) (-)	R-G
104	Side impact sensor (LH) (+)	W-B
105	Side impact sensor (LH) (-)	B-W
106	Curtain air bag squib (RH) (-)	V
107	Curtain air bag squib (RH) (+)	LG
109	Curtain air bag squib (LH) (+)	BR
110	Curtain air bag squib (LH) (-)	L
111	Rear seat belt pre-tensioner squib (RH) (-)	Y

Number in system circuit diagram	Circuit name	Universal harness Wire size and colour
112	Rear seat belt pre-tensioner squib (RH) (+)	G
113	Rear seat belt pre-tensioner squib (LH) (+)	R
114	Rear seat belt pre-tensioner squib (LH) (-)	W

NOTE: For how to read the harness wire diameter and wire colour, refer to the Electrical Wiring Diagram.

7.1.5. Airbag

M90701050A0008

Refer to 7.1.4. Safety belt Pre-tensioners P.7-4.

7.1.6. SRS Systems

M90701060A0008

Refer to 7.1.4. Safety belt Pre-tensioners P.7-4.

7.2. FIRE EXTINGUISHER (X)2

M90702000A0008

"Not Applicable"

7.3. LOCKS AND ANTI-THEFT DEVICE

M90703000A0008

"Not Applicable"

7.4. WARNING TRIANGLE (IF REQUIRED) (X)2

M90704000A0008

"Not Applicable"

7.5. FIRST AID KIT. (IF REQUIRED) (X)2

M90705000A0008

"Not Applicable"

7.6. WHEEL CHOCKS (WEDGES) (IF REQUIRED) (X)2

M90706000A0008

"Not Applicable"

7.7. AUDIBLE WARNING DEVICE

M90707000A0008

"Not Applicable"

7.8. SPEEDOMETER

M90708000A0008

"Not Applicable"

7.9. TACHOGRAPH (IF FITTED/REQUIRED)

M90709000A0008

"Not Applicable"

7.10. SPEED LIMITATION DEVICE (IF FITTED/REQUIRED)

M90710000A0008

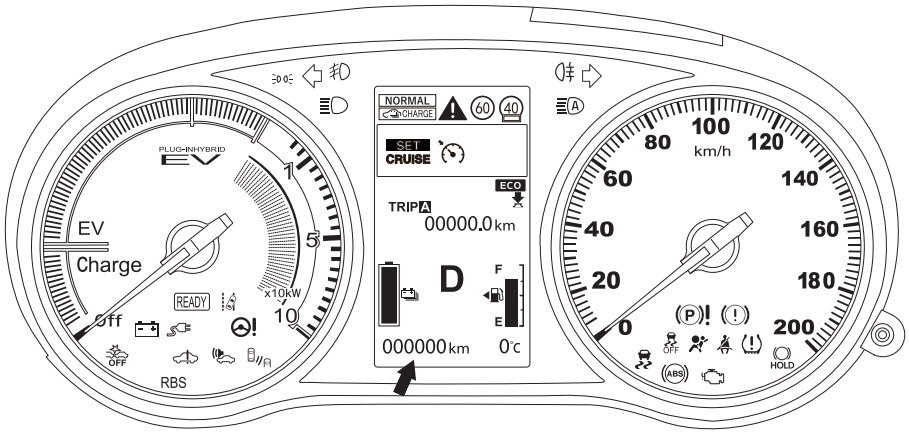
"Not Applicable"

7.11. ODOMETER IF AVAILABLE (X)2

M90711000A0016

Visual Inspection

Check the odometer for displaying the total traveling distance of vehicle.



BCKA3985AA

7.12. ELECTRONIC STABILITY CONTROL (ESC) IF FITTED/REQUIRED

M90712000A0016

Refer to 1.6. ANTI-LOCK BRAKING SYSTEM (ABS) P.1-12.

GROUP 8

NUISANCE

CONTENTS

8.1. NOISE 8-2
8.1.1. Noise suppression system 8-2

8.2. EXHAUST EMISSIONS. 8-2
8.2.1. Positive ignition engine emissions . . 8-2
8.2.2. Compression ignition engine emissions 8-24

8.3. ELECTROMAGNETIC INTERFERENCE SUPPRESSION . . . 8-25

8.4. OTHER ITEMS RELATED TO THE ENVIRONMENT 8-25
8.4.1. Fluid leaks 8-25

8.1. NOISE

8.1.1. Noise suppression system

M90801010A0046

"Query raised for this content"

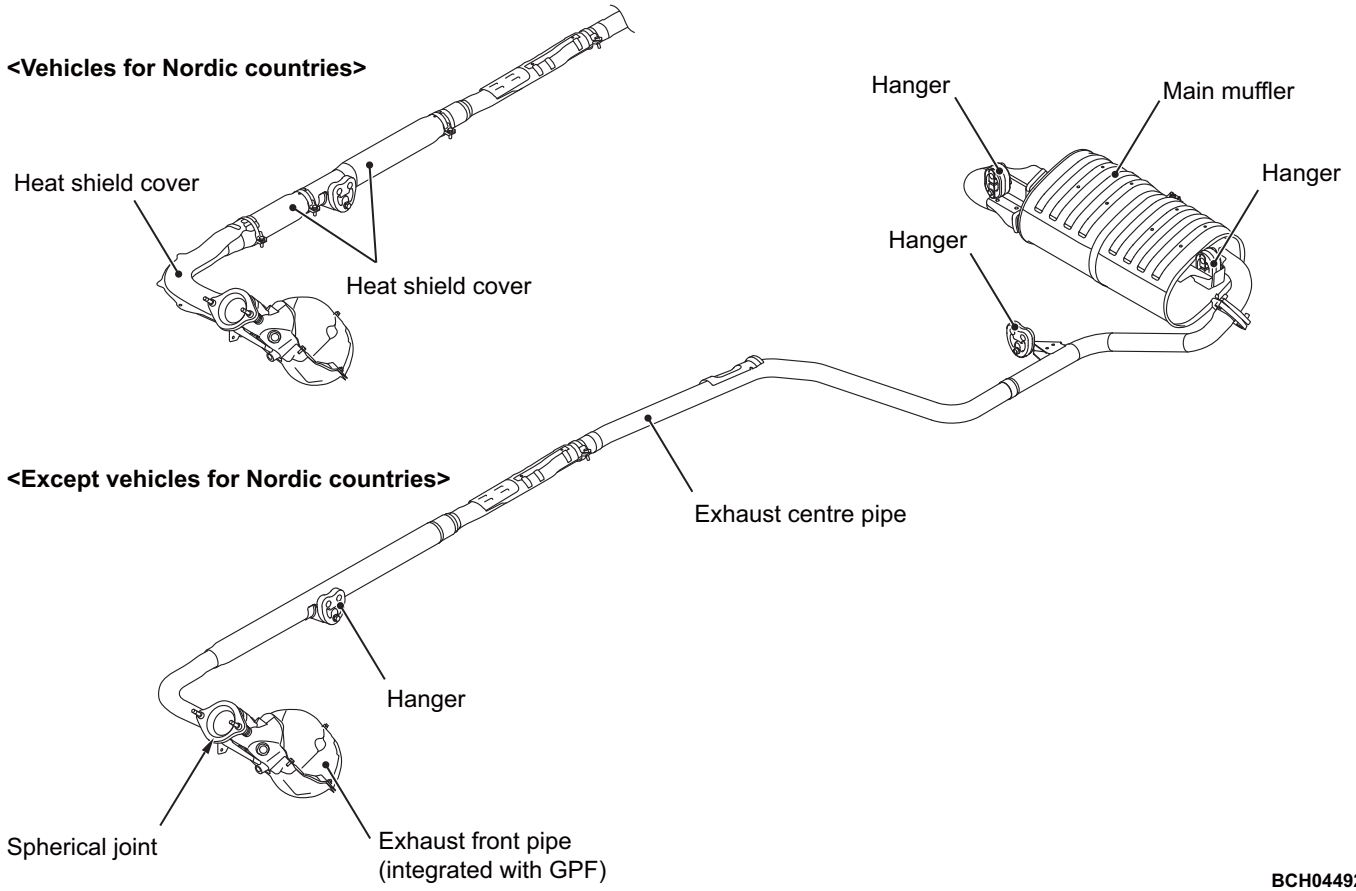
8.2. EXHAUST EMISSIONS

8.2.1. Positive ignition engine emissions

8.2.1.1. Exhaust emissions control equipment

M90802011A0041

CONSTRUCTION DIAGRAM



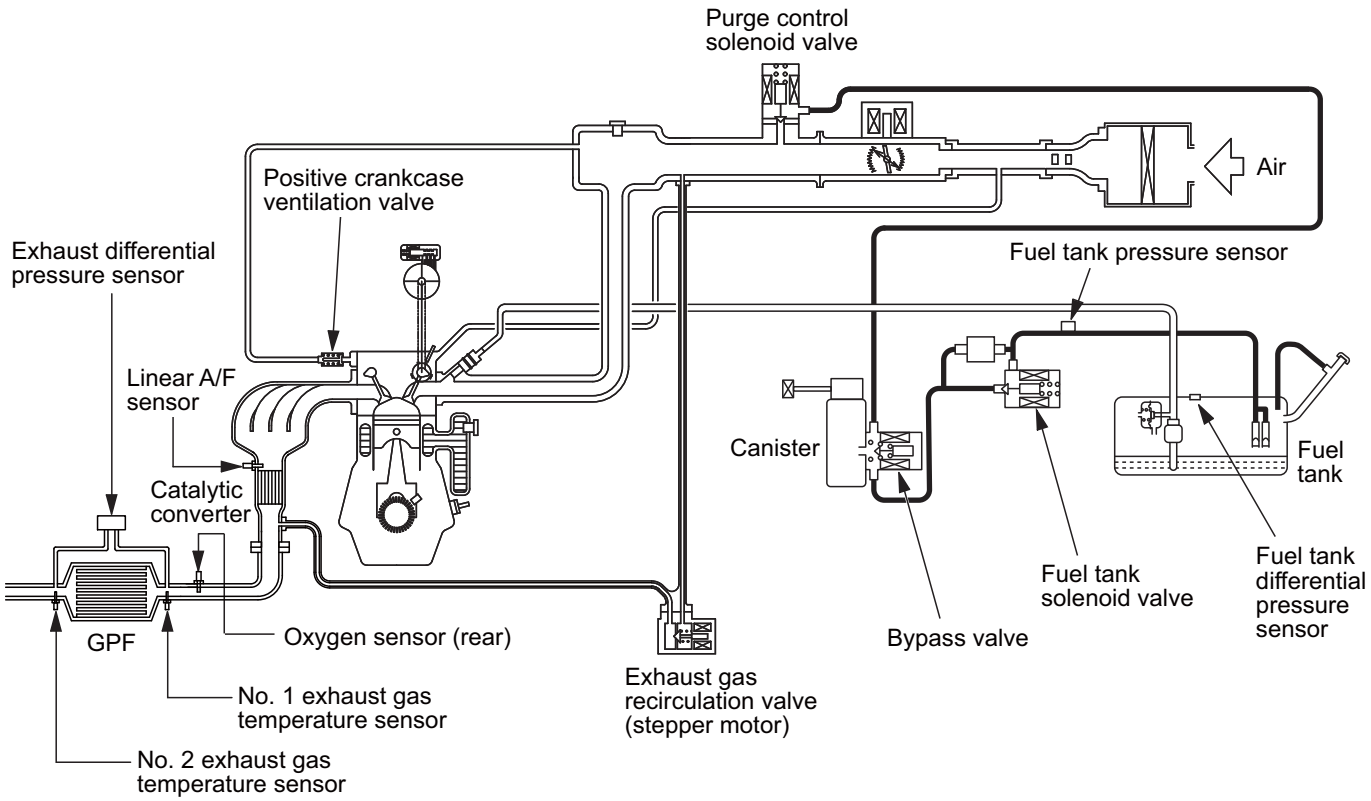
BCH04492AA

Exhaust pipe and muffler consisting of three separation system has the following features:

- Improve emission gas cleaning ability by adopting rear exhaust system and placing front catalytic converter by engine as close as possible.
- A 4-point exhaust muffler hanger has been adopted for optimization of position, which reduces vibration to the vehicle.
- The spherical joint has been adopted for connection between the exhaust front pipe and the exhaust manifold, and between the exhaust front pipe and the exhaust centre pipe, which reduces vibration to the vehicle.

The emission control system is shown as follows:

SYSTEM CONFIGURATION DIAGRAM

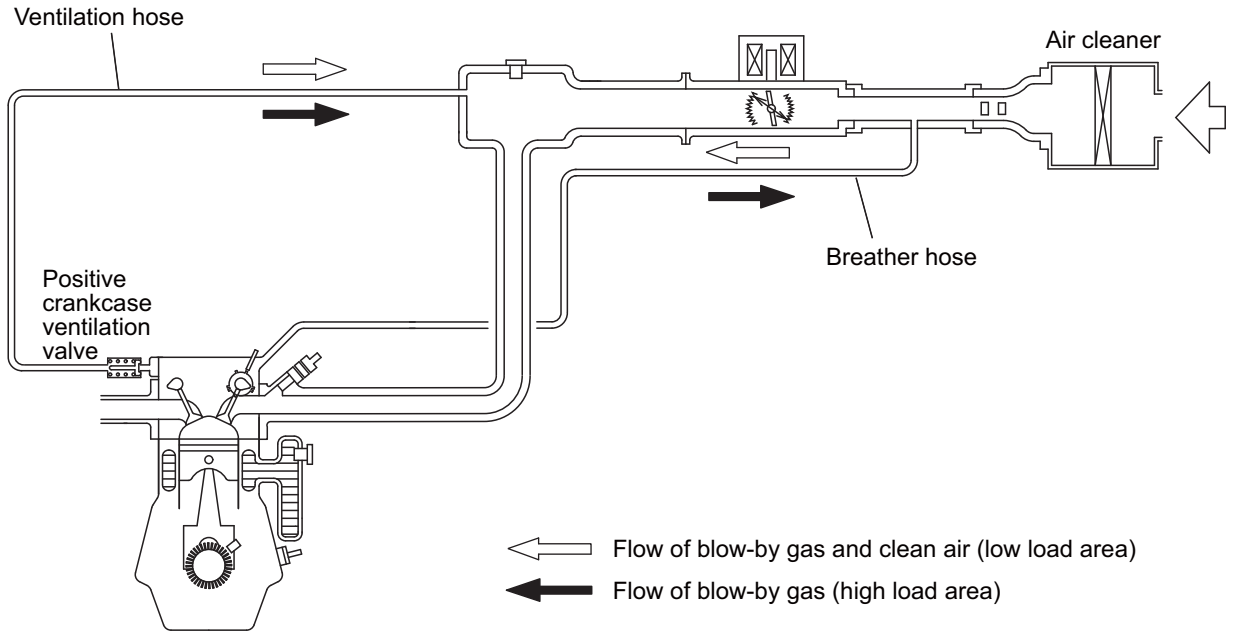


BCKA0724AA

Exhaust gas cleaning devices list

System		Objective / Function	Composition parts
Crankcase ventilation system		HC decrease Re-combustion of blow-by gas.	Positive crankcase ventilation (PCV) valve
Evaporative emission control system		HC decrease Re-combustion of blow-by gas.	• Canister • Purge control solenoid valve
Exhaust gas recirculation system		NOx decrease Reduce NOx generation by controlling EGR volume according to engine warm-up condition and driving conditions.	Exhaust gas recirculation valve
GPF system		Particulate matter (PM) is removed. PM accumulated in the GPF is removed.	• GPF • No. 1 exhaust gas temperature sensor • No. 2 exhaust gas temperature sensor • Exhaust differential pressure sensor
Emission reduction systems	Air-fuel ratio feedback control	Decrease of CO, HC and NOx Controls air-fuel ratio of air-fuel mixture to become theoretical air-fuel ratio (about 14.7), which is when the 3-way catalytic converter's cleaning performance is best. It also controls optimum fuel supply based on coolant temperature, driving conditions etc.	• Engine-ECU • Air flow sensor • Injector • Linear air-fuel ratio sensor • Oxygen sensor (rear) • Crank angle sensor etc.
	Catalytic converter	Decrease of CO, HC and NOx It facilitates oxidation of CO and HC and reduction of NOx so that all 3 component gases are cleaned simultaneously.	• Monolith catalyst • Closed type catalyst (GPF)

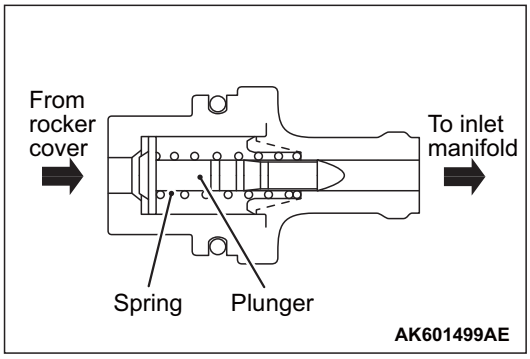
CRANKCASE VENTILATION SYSTEM



BCKA0725AA

A blow-by gas reduction device prevents blow-by gas from being expelled into the atmosphere and is of closed type. A positive crankcase ventilation (PCV) valve is provided in the ventilation hose from the rocker cover to the inlet manifold. During low load driving, clean air is supplied to the crankcase by the air intake hose via the breather hose and rocker cover, and it mixes with the blow-by gas in the crankcase. The blow-by gas in the crankcase is induced to the inlet manifold through the rocker cover and PCV valve. During high load driving, blow-by gas in the crankcase is induced to the inlet manifold through the rocker cover and PCV valve and at the same time also via the air intake hose and throttle body due to negative pressure in the air cleaner.

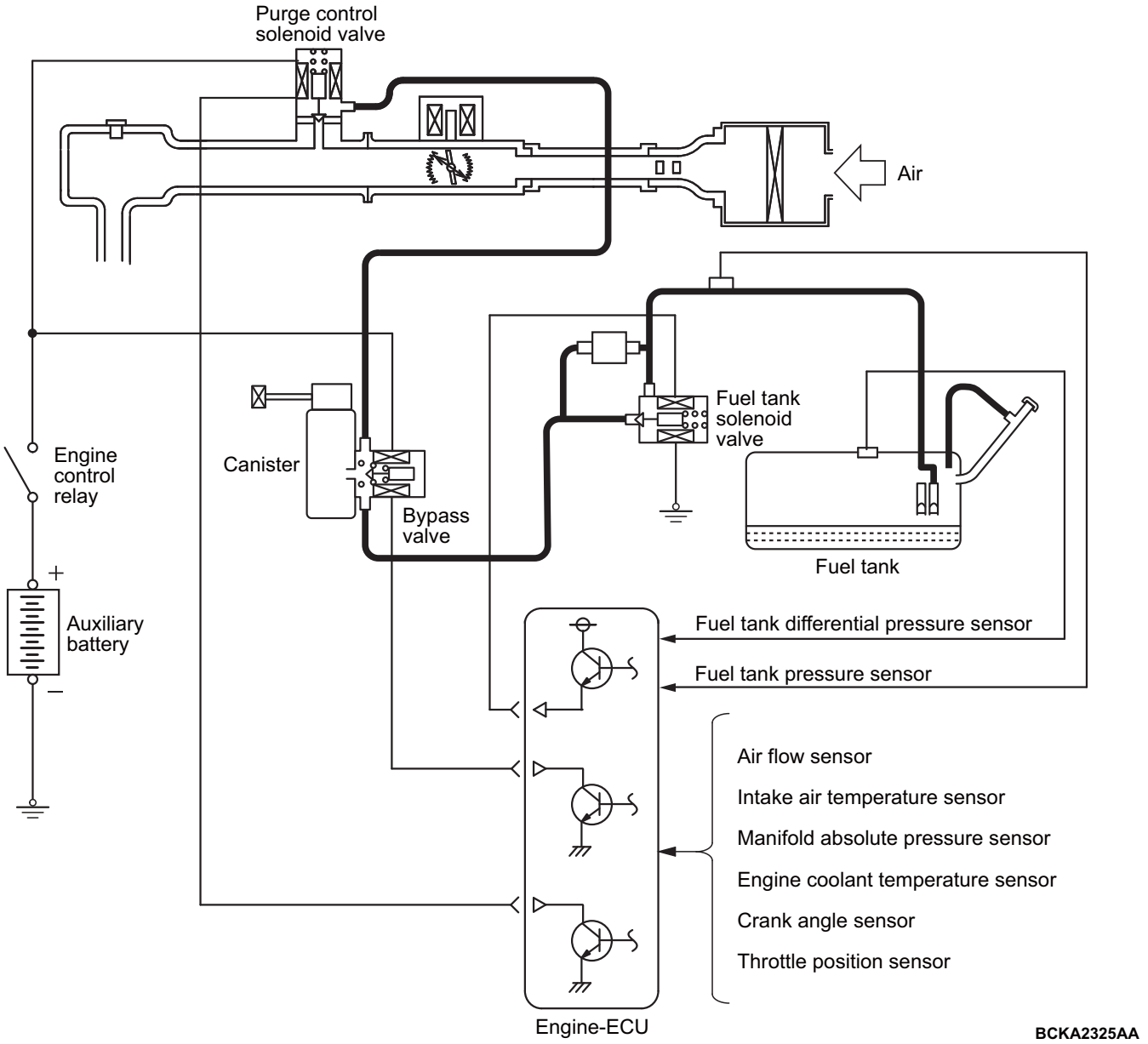
POSITIVE CRANKCASE VENTILATION (PCV) VALVE



AK601499AE

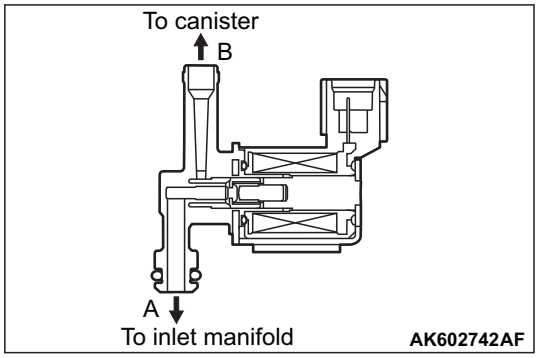
PCV valve lifts the plunger according to negative pressure at the inlet manifold to create appropriate ventilation for the crankcase.

EVAPORATIVE EMISSION CONTROL SYSTEM

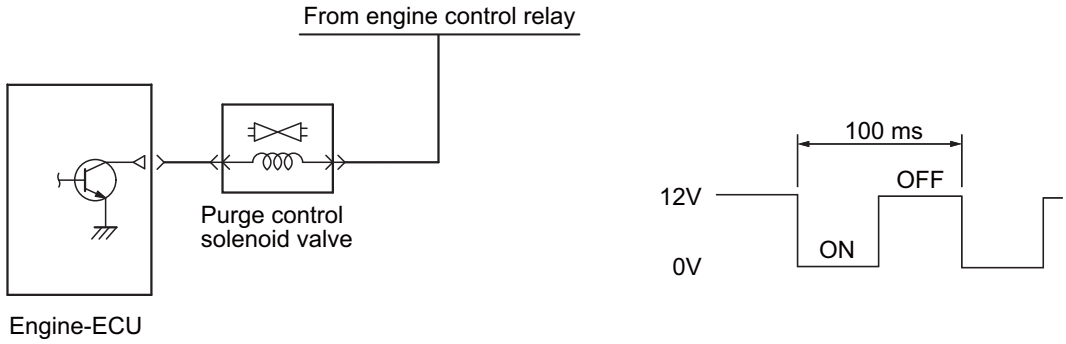


HC (hydrocarbon) generated in the fuel tank are adsorbed by the active carbon in the canister and stored. HC stored in the canister is introduced to the inlet manifold when engine is in operation where it is mixed with intake air and combusted. Engine-ECU introduces optimum HC amount according to driving conditions and so performs duty control on the purge control solenoid valve. Also, the purge control solenoid valve is closed during deceleration or immediately after engine start to restrict change in air-fuel ratio and prevent engine from stalling. When suction is performed from the canister, the engine-ECU sets the fuel tank solenoid valve to the OFF (close) state and the bypass valve to the OFF (open) state. For this reason, gas suction is not performed from the fuel tank. Also, when the pressure inside the fuel tank becomes equal to or higher than the predetermined value, the engine-ECU sets the fuel tank solenoid valve to the ON (open) state to open the gas passage of the fuel tank, and the bypass valve to the ON (close) state to shut off the gas passage of the canister, and after starting the engine, purges evaporated gas in the fuel tank by duty controlling the purge control solenoid valve to depressurise it.

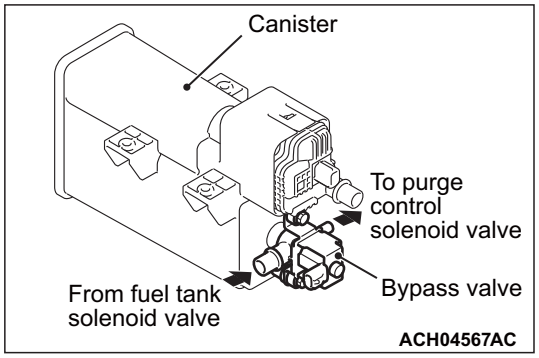
PURGE CONTROL SOLENOID VALVE



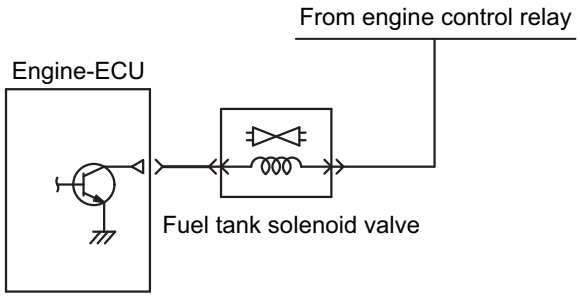
A purge control solenoid valve is installed in the inlet manifold. The purge control solenoid valve controls the intake volume of fuel vapour gas from the canister. The purge control solenoid valve is a duty control type solenoid valve. When current is not passing through the coil, nipple A is kept airtight and fuel vapour gas cannot be sucked in. When current passes through the coil, air can pass between nipple A and B and fuel vapour gas is sucked in.
Engine-ECU changes the ON duty ratio according to engine's operating condition to control the intake volume of fuel vapour gas.

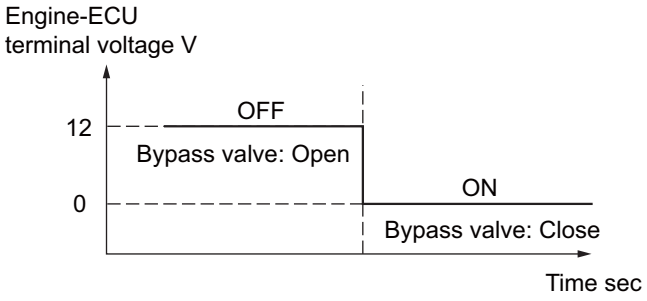


BYPASS VALVE



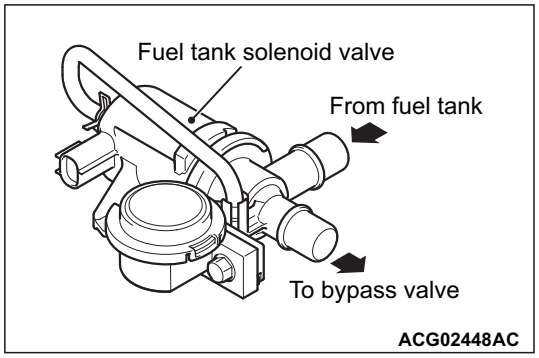
The bypass valve, an ON/OFF type solenoid valve, is installed on the canister. The bypass valve is installed between the canister and the fuel tank solenoid valve, and shuts off or opens the purge piping. The engine-ECU turns the bypass valve OFF at refuelling to introduce fuel vapour gas into the canister, and turns the bypass valve ON during the fuel tank internal high pressure purge control to shut off the inflow of fuel vapour gas to the canister. The engine-ECU also controls whether the fuel tank solenoid valve is ON/OFF for the purge flow monitor and evaporative emission control system leak monitor.



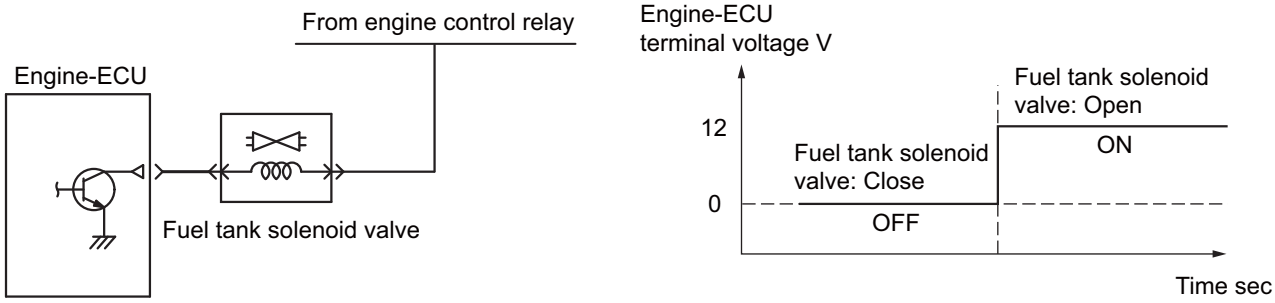


ACH04572AE

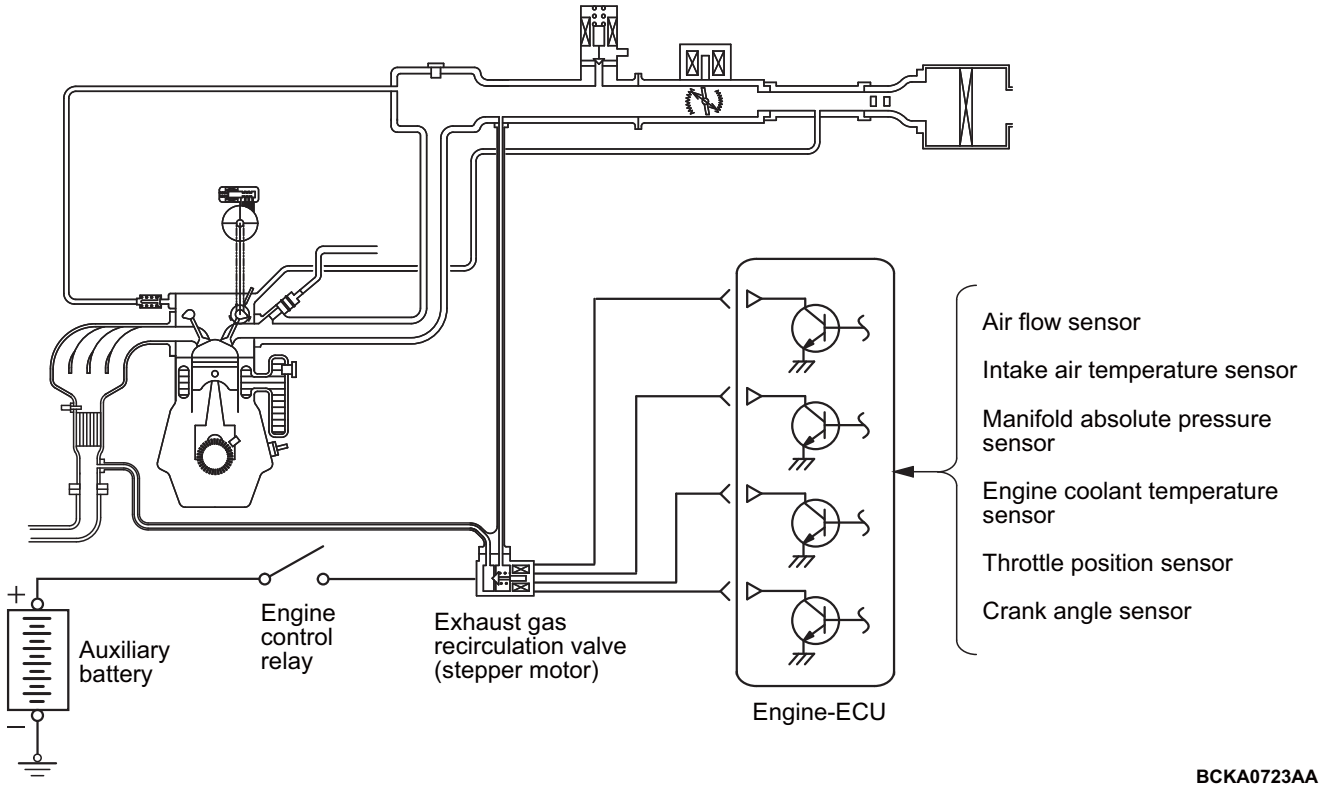
FUEL TANK SOLENOID VALVE



The fuel tank solenoid valve, an ON/OFF type solenoid valve, is mounted near the fuel tank on the floor bottom side. The fuel tank solenoid valve is installed between the bypass valve and the fuel tank attached to the canister, and opens/closes the fuel vapour gas passage. The engine-ECU turns the fuel tank solenoid valve ON to open the fuel vapour gas passage at the time of refuelling and fuel tank internal high pressure purge control. The ECM also controls whether the fuel tank solenoid valve is ON/OFF for the purge flow monitor and evaporative emission control system leak monitor.



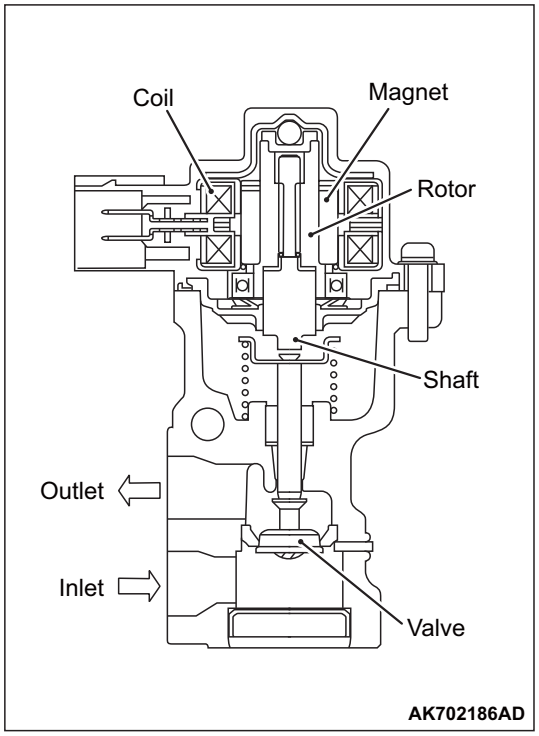
EXHAUST GAS RECIRCULATION SYSTEM



BCKA0723AA

When the combustion gas temperature becomes high, generation of the environment polluting NOx (nitrogen oxides) increases rapidly. Exhaust gas recirculation system is used to decrease the volume of NOx generated. Exhaust gas recirculation system re-circulates exhaust gas inside the inlet manifold. It increases specific heat of the combustion gases and reduces combustion speed to lower the combustion temperature and reduce the volume of NOx generated. Engine-ECU calculates the exhaust gas recirculation introduction volume according to engine operating conditions and controls the exhaust gas recirculation valve opening angle at optimum. Also, immediately after the ignition switch ON signal is input, it drives fully closed stepper motor and performs initialisation.

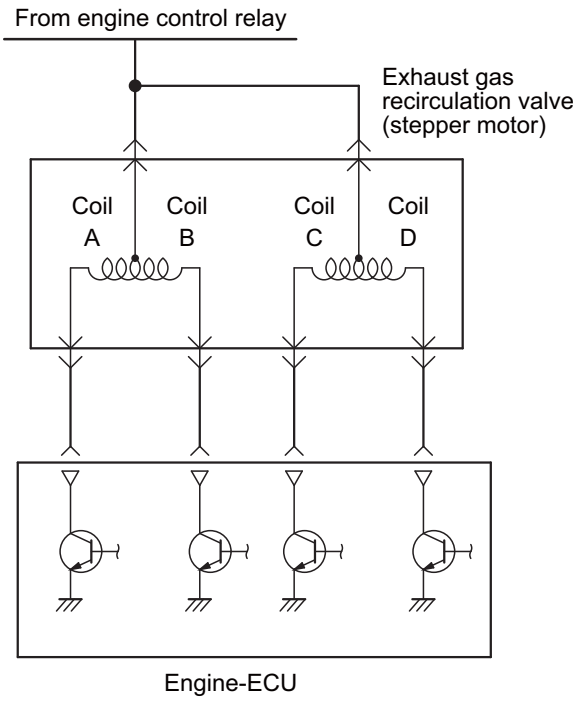
EXHAUST GAS RECIRCULATION VALVE

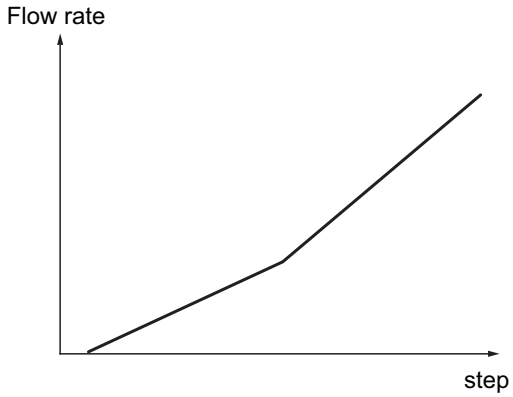


Depending on the vehicle, the installation location of the exhaust gas recirculation valve is as follows.
Exhaust gas recirculation valve is installed in EGR valve support.

The exhaust gas recirculation valve controls exhaust gas recirculation flow volume using the stepper motor method and reduces exhaust gas (NOx) and fuel consumption. The exhaust gas recirculation valve drives the stepper motor based on the signal from engine-ECU. When stepper motor rotor turns in clockwise or anti-clockwise direction, the shaft fitted with a rotor and a screw expands and contracts and the movement of the shaft causes the valve to go up and down. Thus, exhaust gas recirculation path gap is controlled minutely. The stepper motor turns 15° per step. The stepper motor turns forward or back only up to the angle dictated by the number of pulse signals (number of steps) from the engine-ECU. In other words, increase and decrease of the exhaust gas recirculation flow volume depends on the number of signals (number of steps) from engine-ECU. Engine-ECU changes current flow to the 4 coils (A, B, C, D) in the stepper motor in sequence according to the phase pattern in the following chart in order to turn the stepper motor rotor. Open valve changes phase in order of $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 0$. Close valve changes phase in order of $3 \rightarrow 2 \rightarrow 1 \rightarrow 0 \rightarrow 3$.

Phase number	Stepper motor coil			
	Coil A	Coil B	Coil C	Coil D
0	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON



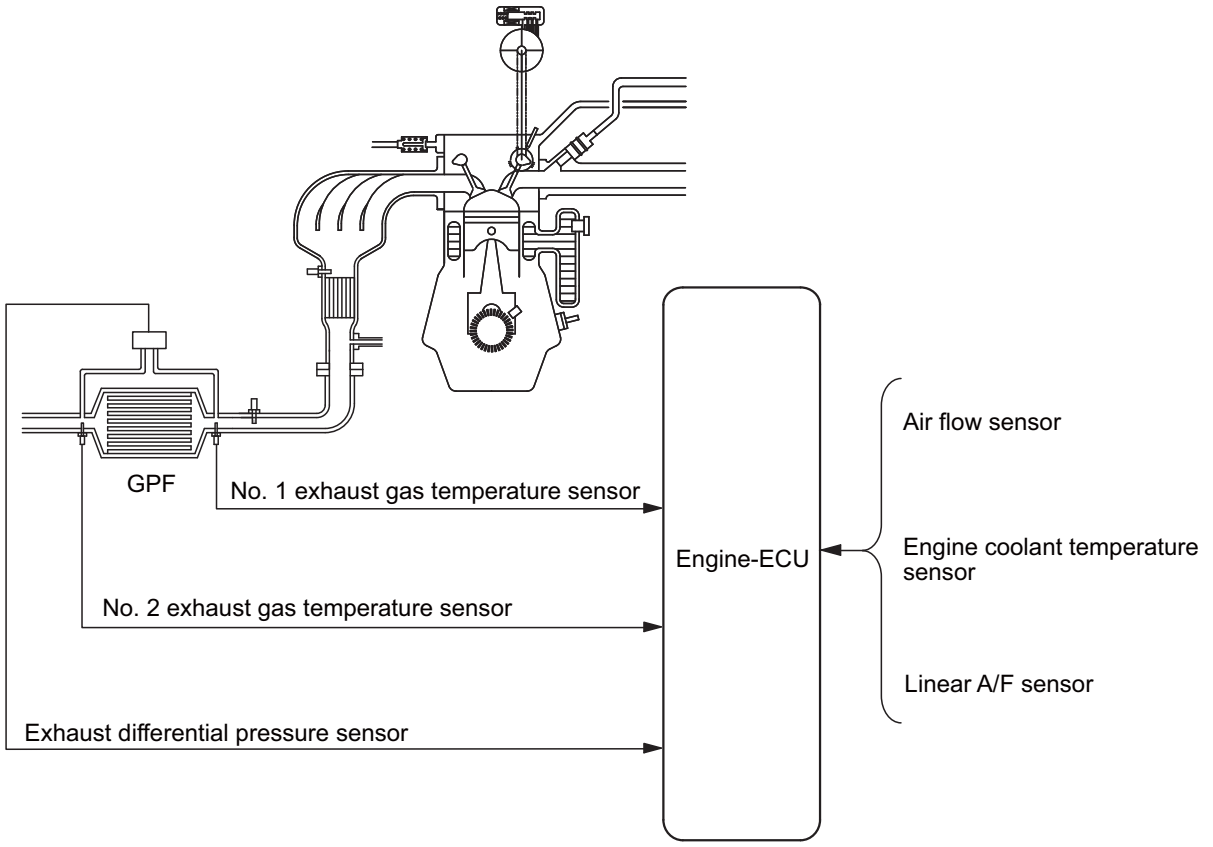


AK602586AB

GPF SYSTEM

Through the input signal sent from each sensor, the engine-ECU anticipates the amount of particulate matter (PM) accumulated in the GPF. Taking control of automatically regenerating the GPF under the certain condition, the engine-ECU removes the PM when the PM accumulates more than the standard. At the GPF regeneration, the GPF temperature is higher and the high temperature exhaust gas discharges.

GPF CONTROL

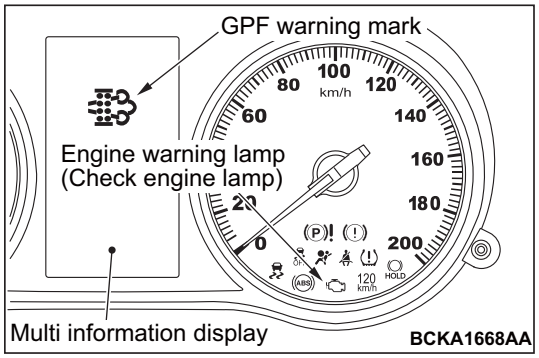


BCKA0729AA

The engine-ECU is carried out the following control related to GPF.

Main control items of the GPF

Control items	Outline
PM particle number (PN) emissions calculation	The PN emissions are calculated from engine operating conditions.
Soot combustion calculation	The combustion condition of soot is calculated from the temperature and the oxygen concentration of GPF.
Accumulated soot calculation	The accumulated amount of soot is estimated from the PN emissions calculation, the soot combustion calculation, the accumulated ash calculation, the measured value of the exhaust differential pressure sensor and the filtering efficiency of GPF.
Accumulated ash calculation	The accumulated amount of ash in GPF is calculated from the accumulated soot calculation and measured value of the exhaust differential pressure sensor.
GPF protection	To prevent excessive temperature rising due to the soot combustion, fuel cut time is limited from the exhaust gas temperature and the accumulated amount of soot.
GPF temperature rising	If the exhaust gas temperature is not reached the soot combustion temperature, the ignition retard will be done to raise the exhaust gas temperature.



When detecting that the PM accumulates more than the standard in the GPF, the engine-ECU shows the GPF warning mark (red) on the multi information display in the combination meter. This encourages the driver to drive the vehicle under the conditions that are adequate to accomplish the GPF regeneration. If the driver does not drive the vehicle under the conditions that are adequate to accomplish the GPF regeneration although the GPF warning mark (red) is shown on the multi information display, the PM accumulation in the GPF gets higher, and then the GPF can possibly reach its clogged or damaged level. Thus, the engine-ECU shows the GPF warning mark (yellow), and illuminates the engine warning lamp to warn the driver that the vehicle must be brought to the workshop.

GPF REGENERATION CONTROL

The GPF regeneration is performed under the following conditions:

- Engine: after warm-up
- Vehicle speed: 60 km/h or more
- Amount of accumulated PM exceeds specified value.

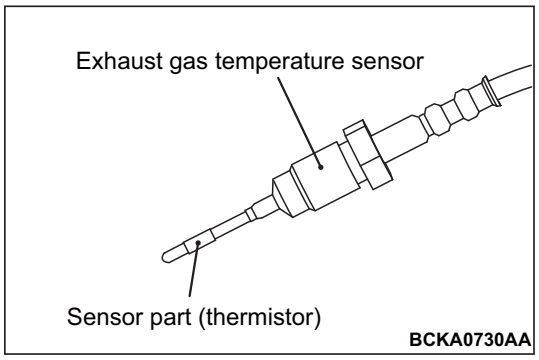
The engine-ECU raises the GPF temperature which it can regenerate during driving, and burns the PM using oxygen supplied to the GPF due to the fuel cut at the time of releasing the accelerator pedal.
When GPF regeneration is executed from M.U.T.-IIISE, the following contents become effective.

- Releasing of the torque restriction at GPF Clogging failure and cancellation of the fuel cut limit.
- Display of soot load level, exhaust gas temperature etc. on the M.U.T.-IIISE display screen.

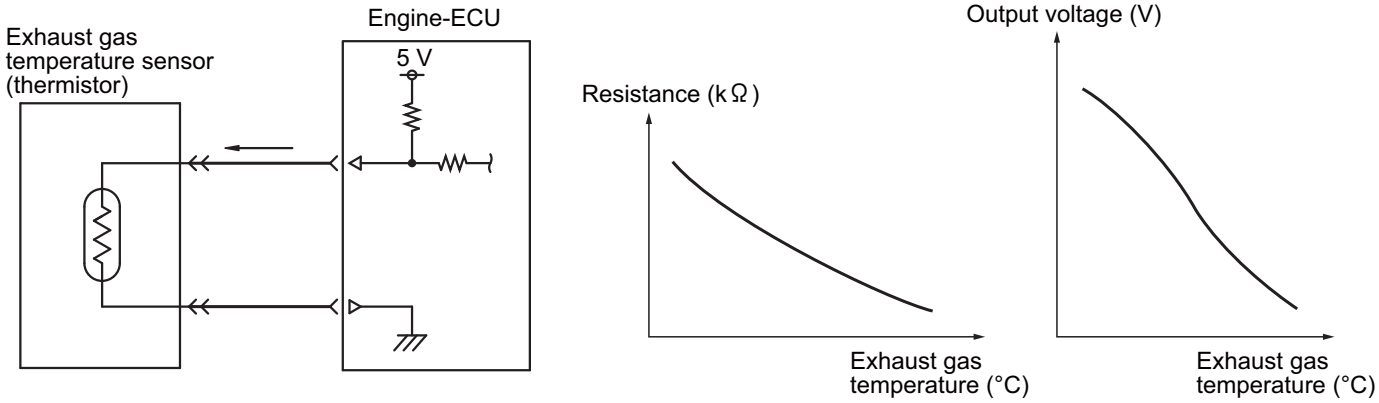
RISING TEMPERATURE CONTROL

The engine-ECU raises the exhaust gas temperature upstream of the GPF to about 650°C. This will raise the temperature of PM and react with oxygen supplied at the time of fuel cut and it can burn PM.

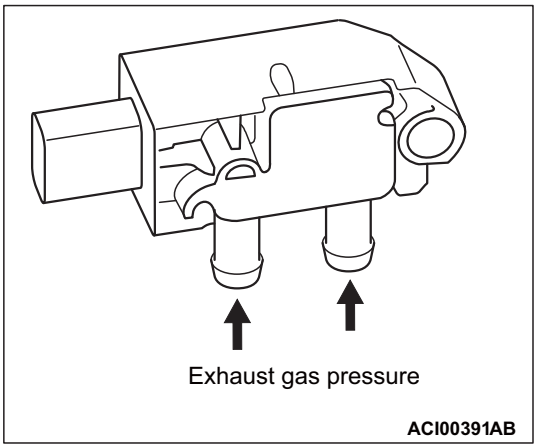
No. 1 EXHAUST GAS TEMPERATURE SENSOR, No. 2 EXHAUST GAS TEMPERATURE SENSOR



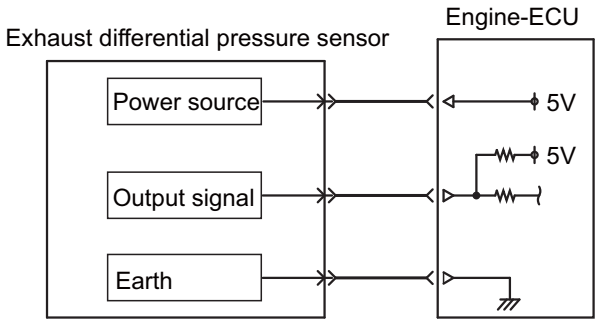
The No. 1 exhaust gas temperature sensor is installed to the upstream area of the GPF, the No. 2 exhaust gas temperature sensor is installed to the downstream area of the GPF. Each sensor detects the temperature in the each area through the change in the thermistor resistance and outputs the voltage to the engine-ECU in accordance with the temperature. The engine-ECU performs the soot combustion calculation, the GPF protection control and the GPF temperature rise control through this output voltage. The sensor characteristics are as shown in the charts.

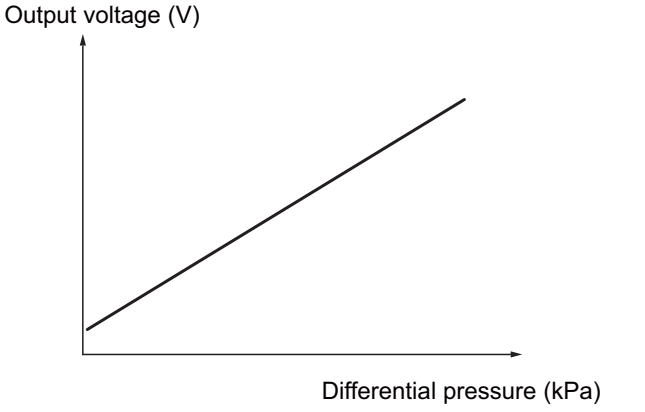


EXHAUST DIFFERENTIAL PRESSURE SENSOR



The exhaust differential pressure sensor is installed near the catalytic converter. Using the piezo resistive semiconductor, the exhaust differential pressure sensor outputs the voltage to the engine-ECU in accordance with the difference in the voltage between the GPF upstream area and the GPF downstream area. The engine-ECU performs the soot combustion calculation, the accumulated soot calculation and the accumulated amount of ash calculation through this output voltage. The sensor characteristics are as shown in the charts.





EMISSION REDUCTION SYSTEMS

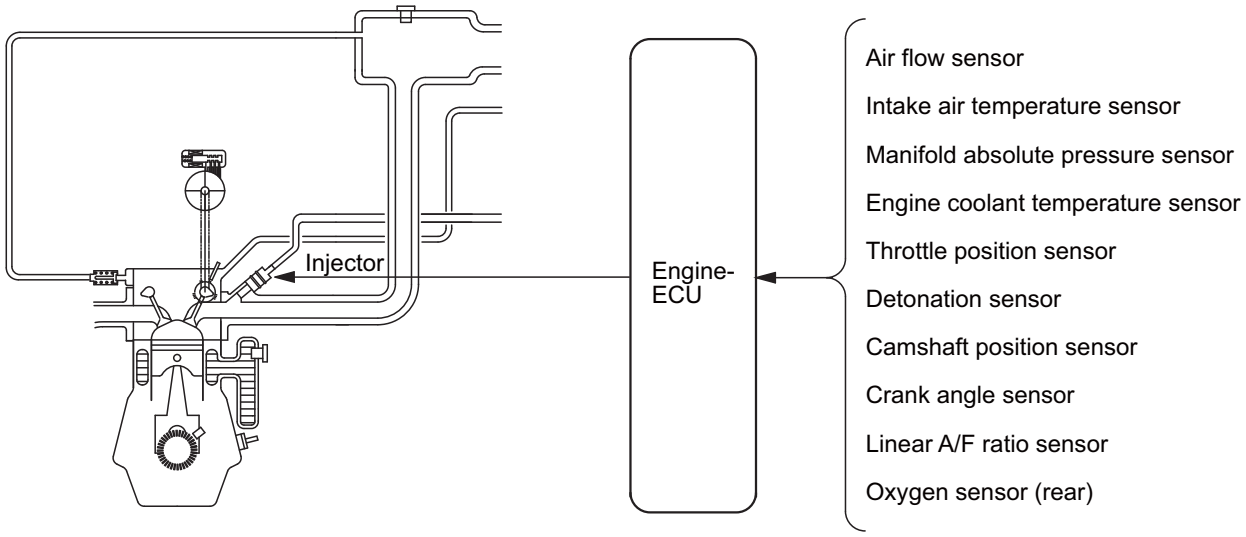
These decrease CO, HC and NOx in the exhaust gases and consist of air-fuel ratio feedback control and catalytic converter.

1. AIR-FUEL RATIO FEEDBACK CONTROL

FUEL INJECTION CONTROL

Fuel injection volume is regulated to obtain the optimum air-fuel ratio in accordance with the constant minute changes in engine driving conditions. Fuel injection volume is controlled by injector drive time (injection time). There is a prescribed basic drive time that varies according to the engine speed and intake air volume. Engine-ECU adds prescribed compensations to this basic drive time according to conditions such as the intake air temperature and engine coolant temperature to decide injection time. Fuel injection is done separately for each cylinder and is done once in two engine rotations.

System Configuration Diagram

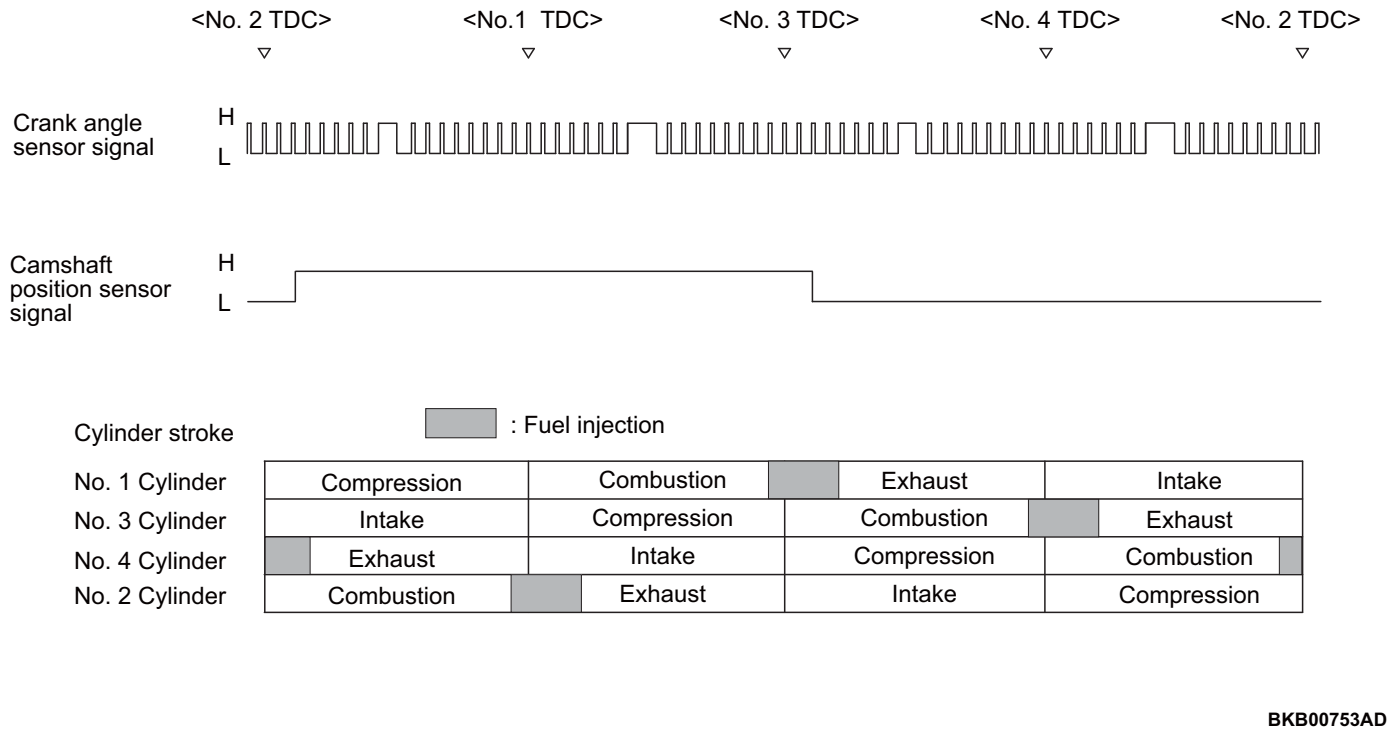


BCKA0945AA

1. INJECTOR ACTUATION (FUEL INJECTION) TIMING

Injector drive time in case of multipoint fuel injection (MPI) is controlled as follows according to driving conditions.

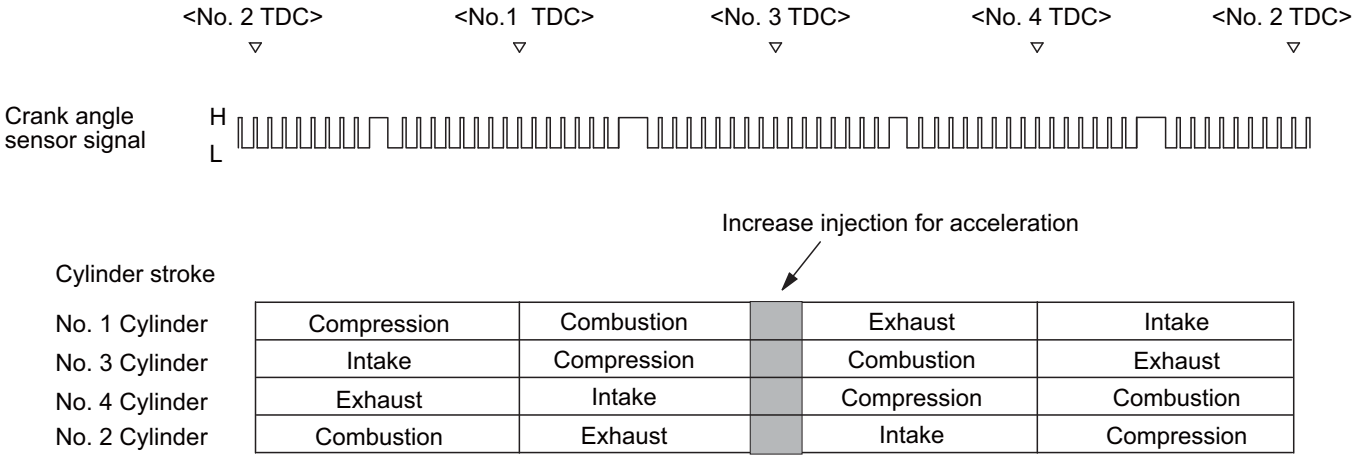
Fuel Injection During Cranking and Normal Operation



BKB00753AD

Fuel injection to each cylinder is done by driving the injector at optimum timing while it is in exhaust process based on the crankshaft position sensor signal. Engine-ECU compares the crankshaft position sensor output pulse signal and camshaft position sensor output pulse signal to identify the cylinder. Using this as a base, it performs sequential injection in the sequence of cylinders 1, 3, 4, 2.

Additional Fuel Injection During Acceleration



No. 1 Cylinder	Compression	Combustion	Exhaust	Intake
No. 3 Cylinder	Intake	Compression	Combustion	Exhaust
No. 4 Cylinder	Exhaust	Intake	Compression	Combustion
No. 2 Cylinder	Combustion	Exhaust	Intake	Compression

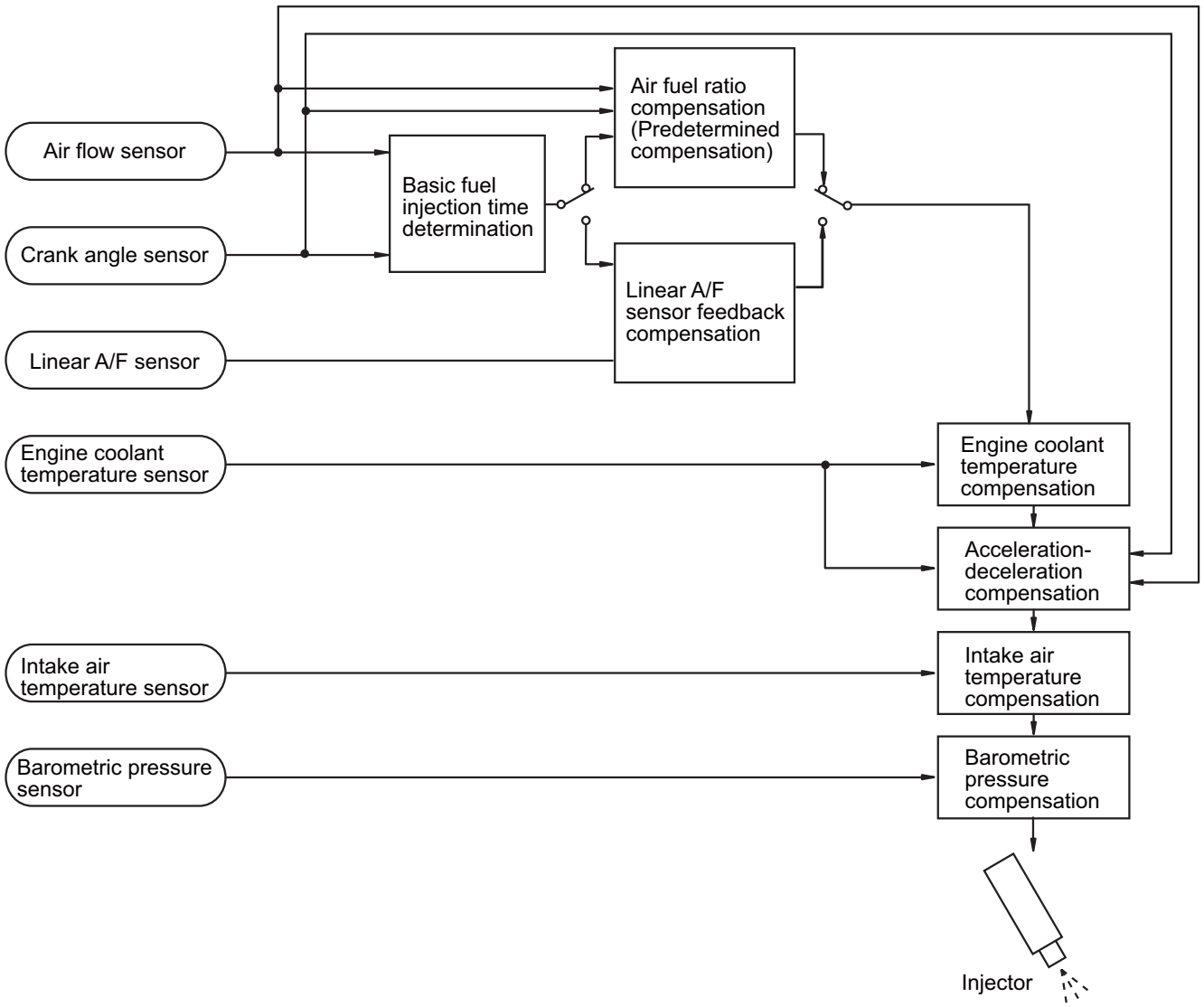
BK704439AC

In addition to the synchronising fuel injection with crankshaft position sensor signal during acceleration, the volume of fuel is injected according to the extent of the acceleration.

2. Fuel injection volume (injector drive time) control

Under normal operating conditions, the figure shows the flow chart of calculating the injection amount during the injector driving time. Basic drive time is decided based on the air flow sensor signal (intake air volume signal) and crankshaft position sensor signal (engine rotation signal). This basic drive time is compensated according to signals from various sensors and optimum injector drive time (fuel injection volume) is calculated according to driving conditions.

Fuel Injection Volume Control Block Diagram (Normal Operation)



BKC00367AA

[Injector basic drive time]

Fuel injection is performed once per cycle for each cylinder. Basic drive time refers to fuel injection volume (injector drive time) to achieve theoretical air-fuel ratio for the intake air volume of 1 cycle of 1 cylinder. Fuel injection volume changes according to the pressure difference (injected fuel pressure) between manifold pressure and fuel pressure (constant). So, injected fuel pressure compensation is made to injector drive time for theoretical air-fuel ratio to arrive at basic drive time.

$$\text{Basic fuel injection time} \propto \frac{\text{Intake air amount per cycle per cylinder}}{\text{Theoretical air-fuel ratio}} \times \text{Fuel injection pressure compensation}$$

AK602279AB

Intake air volume of each cycle of 1 cylinder is calculated by engine-ECU based on the airflow sensor signal and crank angle sensor signal. Also, during engine start, the map value prescribed by the coolant temperature sensor signal is used as basic drive time.

[Injector drive time compensation]

After calculating the injector basic drive time, the engine-ECU makes the following compensations to control the optimum fuel injection volume according to driving conditions.

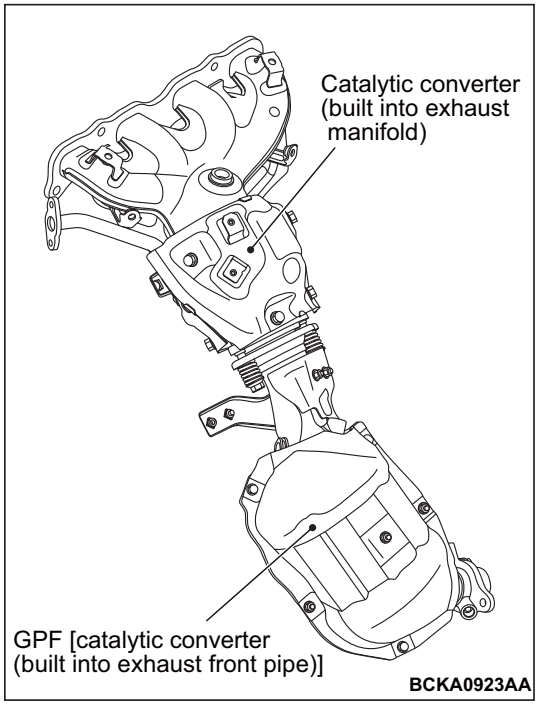
List of main compensations for fuel injection control

Compensations	Content
Linear A/F sensor feedback compensation	The linear A/F sensor signal is used for making the compensation to get air-fuel ratio with best cleaning efficiency of the 3-way catalytic converter. This compensation might not be made sometimes in order to improve drivability, depending on driving conditions. (Air-fuel ratio compensation is made.) The engine-ECU compensates the output signal of the linear A/F sensor using the output signal of the oxygen sensor (rear). This allows the deviation of the output signal, caused by the deterioration of the linear A/F sensor, to be solved, then the highly accurate exhaust gas control is performed.
Air-fuel ratio compensation	Under driving conditions where linear A/F sensor feedback compensation is not performed, compensation is made based on pre-set map values that vary according to engine speed and intake air volume.
Engine coolant temperature compensation	Compensation is made according to the engine coolant temperature. The lower the engine coolant temperature, the greater the fuel injection volume.
Acceleration/ Deceleration compensation	Compensation is made according to change in intake air volume. During acceleration, fuel injection volume is increased. Also, during deceleration, fuel injection volume is decreased.
Fuel injection compensation	Compensation is made according to the pressure difference between fuel tank pressure and manifold absolute pressure. The greater the difference in pressure, the shorter or longer the injector drive time.
Battery voltage compensation	Compensation is made depending on battery voltage. The lower the battery voltage, the greater the injector drive signal time.
Learning value for fuel compensation	Compensation amount is learned to compensate feedback of linear A/F sensor. This allows system to compensate in accordance with engine characteristics.

[Fuel-cut control when over-run]

When engine speed exceeds a prescribed limit (4,800 r/min), engine-ECU cuts fuel supply to prevent overrunning and thus protect the engine.

2. CATALYTIC CONVERTER



The exhaust manifold and exhaust front pipe include a catalytic converter.
Based on appropriate air-fuel ratio feedback from linear air-fuel ratio sensor and oxygen sensor (rear), CO and HC are oxidized and NOx is reduced. Catalytic converter (built into exhaust manifold) is a monolith with beehive design with catalysts on the unit surface. It is protected by a thermally insulating mat and enclosed in a shell.
The catalytic converter (built into exhaust front pipe) is a closed type GPF that has a catalytic function.

8.2.1.2. Gaseous emissions

M90802012A0040

PRE-INSPECTION CONDITION

"Pre-inspection condition" refers to the condition that the vehicle must be in before proper engine inspection can be carried out. If you see the words "Set the vehicle to the pre-inspection condition". in this manual, it means to set the vehicle to the following condition.

- Engine coolant temperature 80 to 90°C
- Lamps, electric cooling fan and all accessories: OFF
- Selector lever: N position

M.U.T.-IIISE

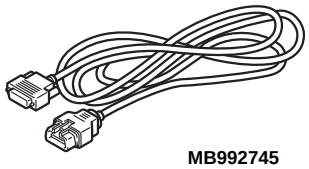
M.U.T.-III SE

Vehicle communication interface-Lite (V.C.I.-Lite)



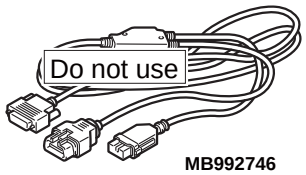
MB992744

V.C.I.-Lite main harness A



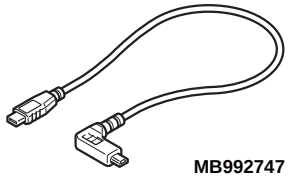
MB992745

V.C.I.-Lite main harness B



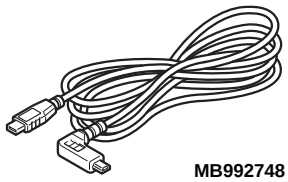
MB992746

V.C.I.-Lite USB cable short



MB992747

V.C.I.-Lite USB cable long



MB992748

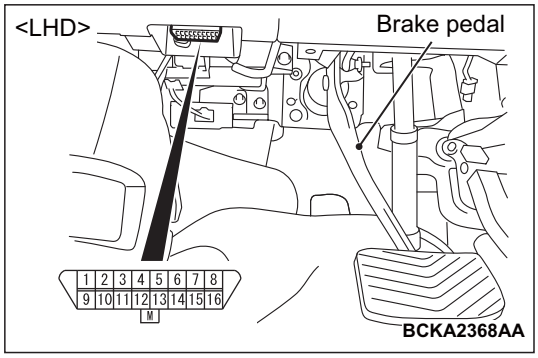
ACB05419AE

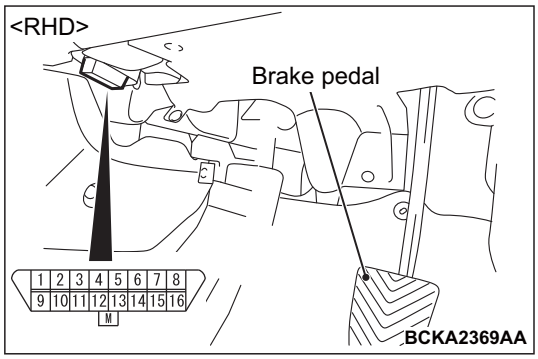
⚠ CAUTION

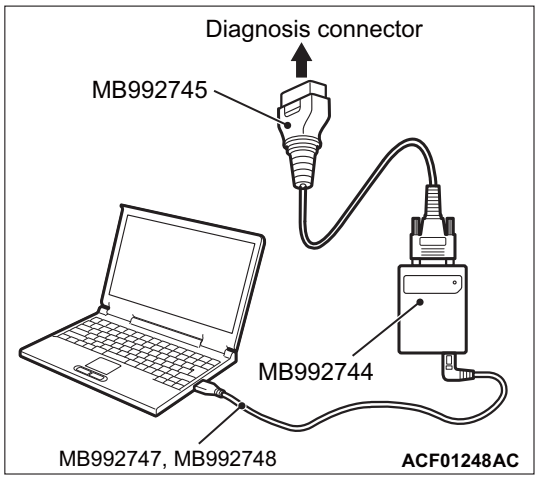
For the V.C.I.-Lite, use MB992745, MB992747 and MB992748.

Refer to the "M.U.T.-IIISE User's Manual" for instructions on handling the M.U.T.-IIISE.

⚠ CAUTION
Turn the power supply mode of the electric motor switch to OFF before connecting or disconnecting the M.U.T.-IIISE.







Connect the M.U.T.-IIISE to the diagnosis connector as shown in the illustration.

8.2.2. Compression ignition engine emissions

8.2.2.1. Exhaust emission control equipment

M90802021A0024

"Not Applicable"

8.2.2.2. Opacity

M90802022A0024

"Not Applicable"

8.3. ELECTROMAGNETIC INTERFERENCE SUPPRESSION

M90803000A0008

"Not Applicable"

8.4. OTHER ITEMS RELATED TO THE ENVIRONMENT

8.4.1. Fluid leaks

M90804010A0008

"Not Applicable"

GROUP 9

SUPPLEMENTARY TESTS FOR PASSENGER-CARRYING VEHICLES CATEGORIES M2, M3

CONTENTS

9.1. DOORS 9-2
9.1.1. Entrance and exit doors 9-2
9.1.2. Emergency exits 9-2

9.2. DEMISTING AND DEFROSTING SYSTEM (X)2 9-2

9.3. VENTILATION & HEATING SYSTEM (X)2 9-2

9.4. SEATS. 9-2
9.4.1. Passenger seats (including seats for accompanying personnel) 9-2
9.4.2. Driver's seat (additional requirements) 9-2

9.5. INTERIOR LIGHTING AND DESTINATION DEVICES (X)2. 9-2

9.6. GANGWAYS, STANDING AREAS 9-2

9.7. STAIRS AND STEPS 9-2

9.8. PASSENGER COMMUNICATION SYSTEM (X)2 9-2

9.9. NOTICES (X)2 9-3

9.10. REQUIREMENTS REGARDING THE TRANSPORTATION OF CHILDREN. (X)2 9-3
9.10.1. Doors 9-3
9.10.2. Signalling and special equipment . . 9-3

9.11. REQUIREMENTS REGARDING THE TRANSPORTATION OF PERSONS WITH REDUCED MOBILITY (X)2 9-3
9.11.1. Doors, ramps and lifts 9-3
9.11.2. Wheelchair restraint system 9-3
9.11.3. Signalling and special equipment . . 9-3

9.12. OTHER SPECIAL EQUIPMENT (X)2 9-3
9.12.1. Installations for food preparation . . . 9-3
9.12.2. Sanitary installation 9-3
9.12.3. Other devices (e.g. audio-visual systems) 9-3

9.1. DOORS

9.1.1. Entrance and exit doors

M90901010A0008

"Not Applicable"

9.1.2. Emergency exits

M90901020A0008

"Not Applicable"

9.2. DEMISTING AND DEFROSTING SYSTEM (X)2

M90902000A0008

"Not Applicable"

9.3. VENTILATION & HEATING SYSTEM (X)2

M90903000A0008

"Not Applicable"

9.4. SEATS

9.4.1. Passenger seats (including seats for accompanying personnel)

M90904010A0008

"Not Applicable"

9.4.2. Driver's seat (additional requirements)

M90904020A0008

"Not Applicable"

9.5. INTERIOR LIGHTING AND DESTINATION DEVICES (X)2

M90905000A0008

"Not Applicable"

9.6. GANGWAYS, STANDING AREAS

M90906000A0008

"Not Applicable"

9.7. STAIRS AND STEPS

M90907000A0009

"Not Applicable"

9.8. PASSENGER COMMUNICATION SYSTEM (X)2

M90908000A0008

"Not Applicable"

9.9. NOTICES (X)2

M90909000A0008

"Not Applicable"

9.10. REQUIREMENTS REGARDING THE TRANSPORTATION OF CHILDREN. (X)2

9.10.1. Doors

M90910010A0008

"Not Applicable"

9.10.2. Signalling and special equipment

M90910020A0008

"Not Applicable"

9.11. REQUIREMENTS REGARDING THE TRANSPORTATION OF PERSONS WITH REDUCED MOBILITY (X)2

9.11.1. Doors, ramps and lifts

M90911010A0008

"Not Applicable"

9.11.2. Wheelchair restraint system

M90911020A0008

"Not Applicable"

9.11.3. Signalling and special equipment

M90911030A0008

"Not Applicable"

9.12. OTHER SPECIAL EQUIPMENT (X)2

9.12.1. Installations for food preparation

M90912010A0008

"Not Applicable"

9.12.2. Sanitary installation

M90912020A0008

"Not Applicable"

9.12.3. Other devices (e.g. audio-visual systems)

M90912030A0008

"Not Applicable"