GROUP 00

GENERAL

CONTENTS

HOW TO USE THIS MANUAL

M2000029001698

MODEL INDICATIONS

The following abbreviations are used in this manual for identification of model types.
2000:Indicates models equipped with the 1,998 mL <4B11> petrol engine.
2400:Indicates models equipped with the 2,360 mL <4B12> petrol engine.
2WD:Indicates the 2-wheel drive vehicles.
4WD:Indicates the 4-wheel drive vehicles.
A/C:Indicates the air conditioner.
CVT: Indicates the continuously variable transmission.
DOHC: Indicates an engine with the double overhead camshaft.
INVECS:Indicates the intelligent and innovative vehicles electronic control system.
MIVEC:Indicates the Mitsubishi innovative valve timing electronic control system.
MPI:Indicates the multipoint injection.

TARGETS OF DEVELOPMENT

M2000004002285

While the worldwide sluggish car demand is expected to increase in the future, the demand for a compact size Sport Utility Vehicle (SUV) is expanding drastically and stably. The middle size SUV has accounted for 40% of the whole SUV market. Furthermore, emerging markets are also expected to expand drastically. By considering these market trends, Mitsubishi Motors launches "NEW OUTLANDER", which leads with its innovations in the areas of fuel consumption and environmental protection (low CO_2 emission level), in all the markets (including major advanced and emerging countries).

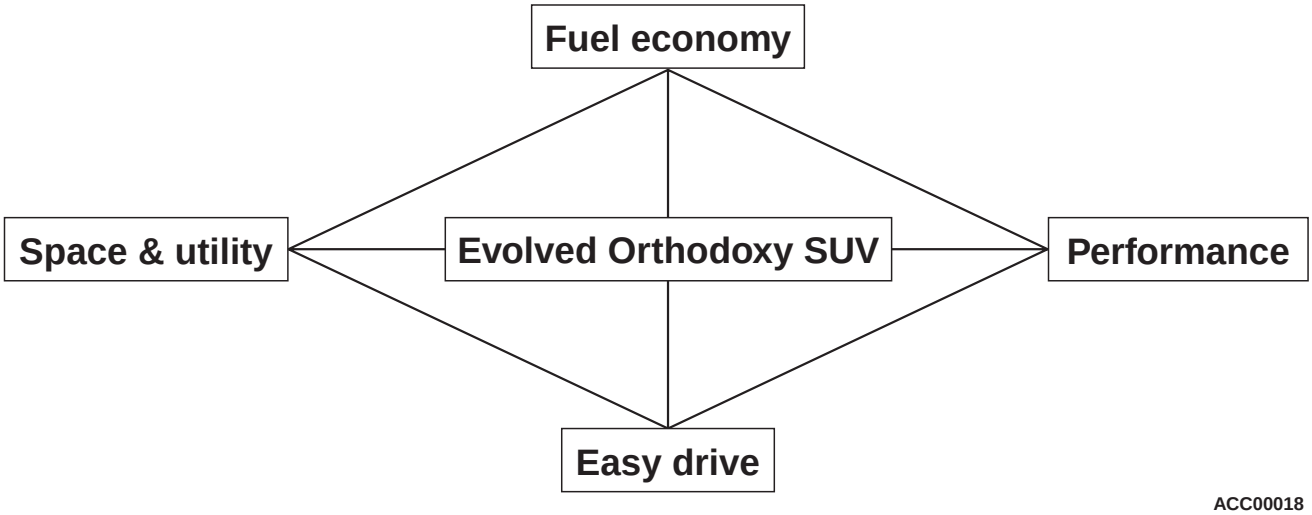
CONCEPT KEYWORD: Well balanced ECO SUV

- Best-in-class fuel consumption and eco-friendliness
- New Outlander has derived positive-rated points from the predecessor, and boasts of high-level eco-friendliness.
- Negative-rated points such as equipment (navigation system, etc.) and interior quality have been improved.
- Various advanced equipment and systems have been added.

PRODUCT FEATURES

M2000005001199

EVOLVED ORTHODOXY SUV



ACC00018

FUEL ECONOMY

Improved fuel consumption
Best-in-class fuel consumption

- Low aerodynamic drag coefficient (7% reduction compared to the predecessor)
- Light weight (85 kg reduction on average compared to the predecessor)
- Newly-developed engine adopted for all models

PERFORMANCE

Advanced electronic-controlled 4WD

- Manual 2WD/4WD changeover has been abolished. A brand-new system switches the drive train mode from "4WD ECO" (2WD) to "4WD AUTO" (and vice versa) automatically, depending on road condition.
- The mode switch has been changed from rotary type to push type.

EASY DRIVE

Vehicle silhouette has been derived from the predecessor.

Vehicle dimensions are roughly the same as the predecessor.
Improved front vision

Improved front vision

- Reduced cross-section of A pillar
- Clearance around the outside rear view mirror V-shaped area widened
- Lowered wiper blade rest position

SPACE AND UTILITY

Wide luggage compartment space

- The rear seat folding mechanism has been modified in order to widen the luggage compartment space (239 mm longer than the predecessor).
- Stowed tonneau cover

TECHNICAL FEATURES

EXTERIOR

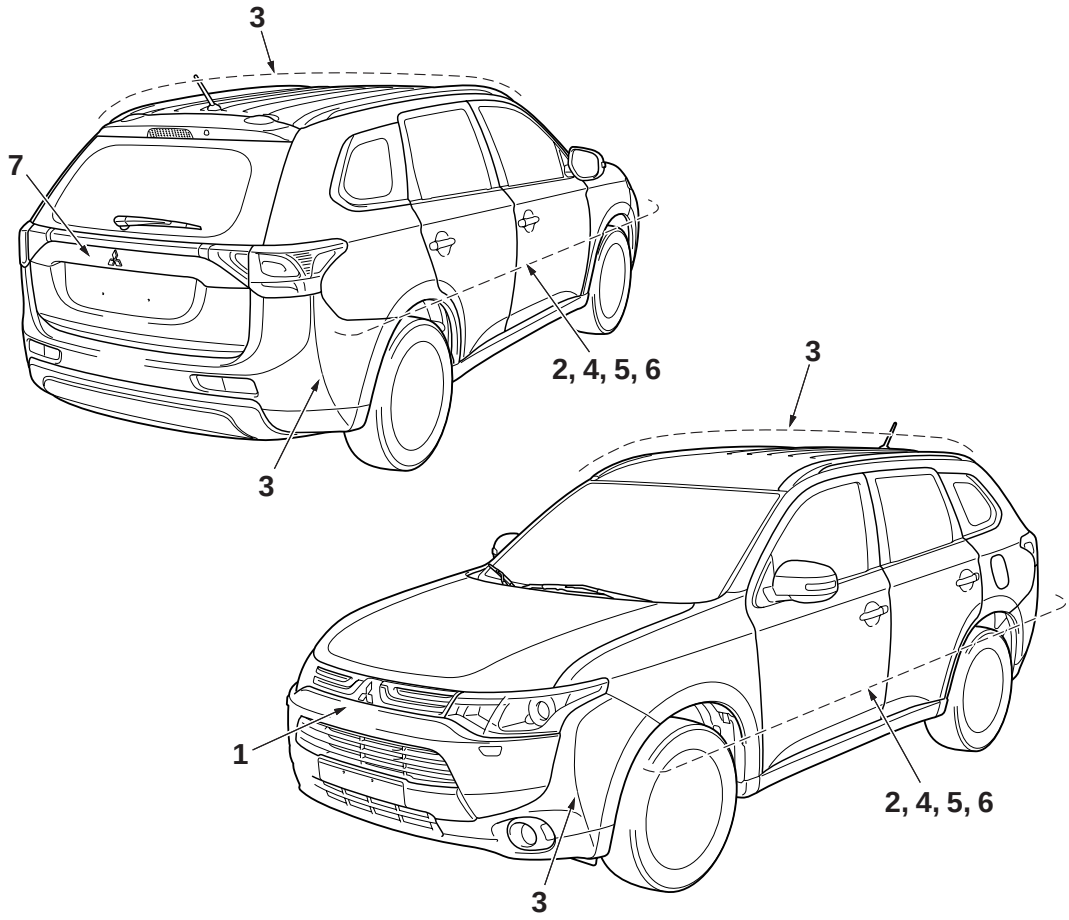
M2000017001862

DESIGN FEATURES

"Eco-friendliness appealing design" as the world leading car

- Unique form satisfying aerodynamic requirements
- Excellent quality in surface treatment as well as weight reduction in sheet metal

MAIN FEATURES



ACC00047AB

1. A wide and stable SUV-face boasting of an emblem and a trapezoid grille, which are used to echo Mitsubishi Sport Utility Vehicle (SUV) heritage.
2. Boxy silhouette conveying excellent practicality and the exclusivity of a premium-class SUV.
3. Fine-tuned roof silhouette, rearward narrowed-down cabin form, aerodynamic form offered by front and rear edge treatments.
4. Body form realising weight saving without any compromise to rigidity by adopting optimum cross-sectional area.
5. Longitudinal streamlined body silhouette enhances this car's main characteristics, thus offering grand image
6. A practical as well as dynamic body form adopting a wedged shape in belt line and side character line.
7. Grand, wide and vivid image by locating an emblem in higher position

INTERIOR

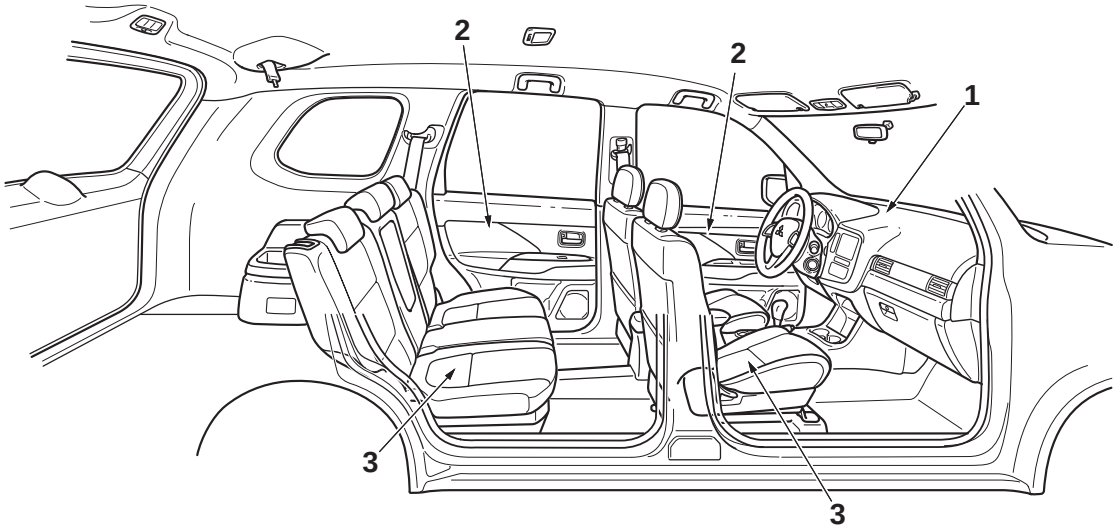
M2000018002095

DESIGN FEATURES

"Quality design" enhancing grand presence

- Grand presence enhancing premium image and reliability
- Surface quality offering generous and wrap-around feeling
- Effectively and clearly assigned decorations and accents

MAIN FEATURES



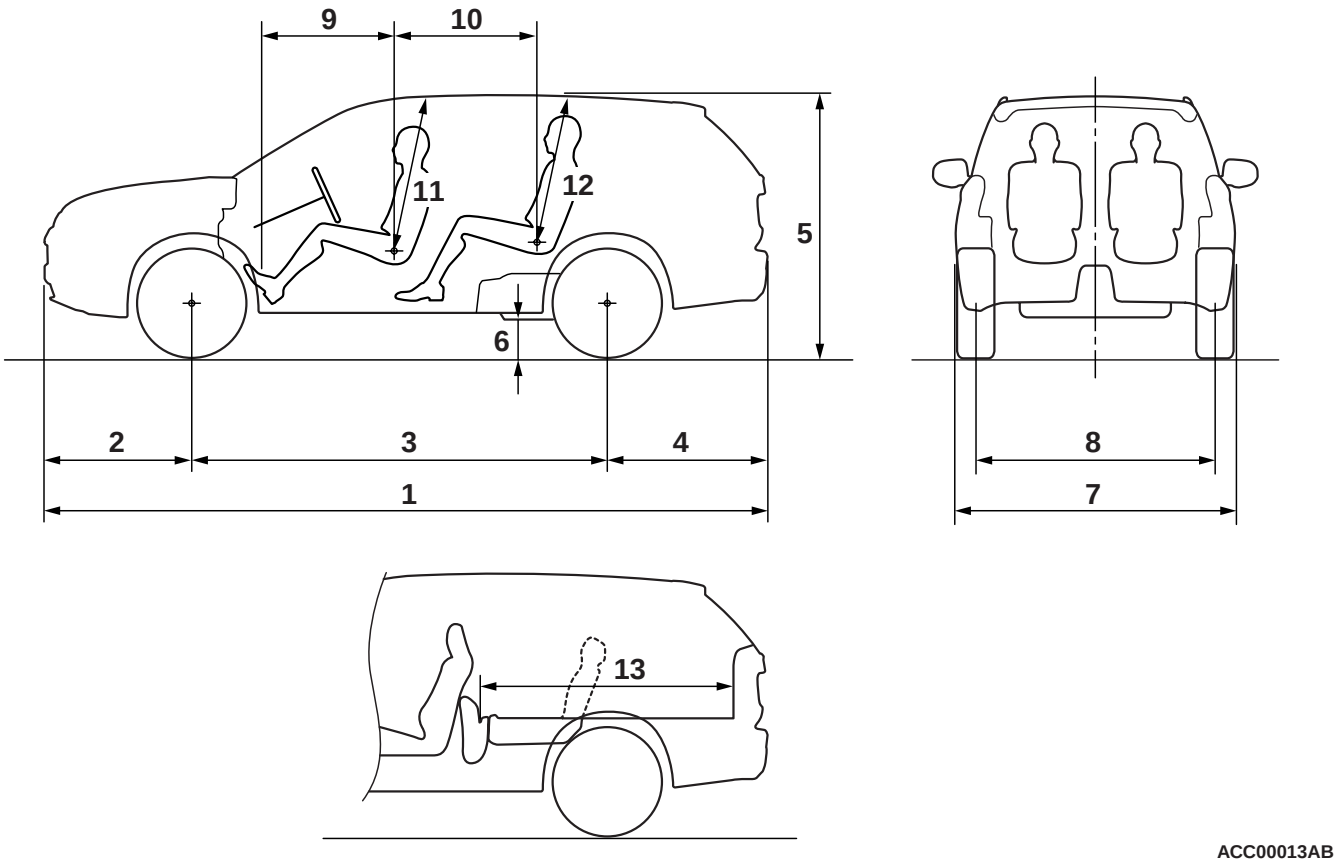
ACC00045AB

1. Instrument panel
   - Clear and simple form due to reduced separations
   - Luxurious soft pads attached around the upper part, thus improving the sense of touch
   - Ergonomic layout where controls are arranged at the centre of the dash board and face towards the driver
   - Glazed black finish on the centre panel offering advanced image
   - Large premium-class decorations, which feature sporty silver carbon or eucalyptus wood (optional), are arranged optimally in the vicinity of front passenger.
2. Door trim
   - Soft pad attached on the front door trim, thus improving the sense of touch
   - Large decorations are arranged at the front, which underline spaciousness and horizontal contours, thus improving appearance.
   - Dynamic-shaped fabric insert adhered on horizontal-contoured trim
3. Front seat and rear seat
   - Simple and premium form featuring moderate character
   - Double-stitch seam on leather seat (optional) underling premium image

BODY DIMENSIONS

M2000000400445

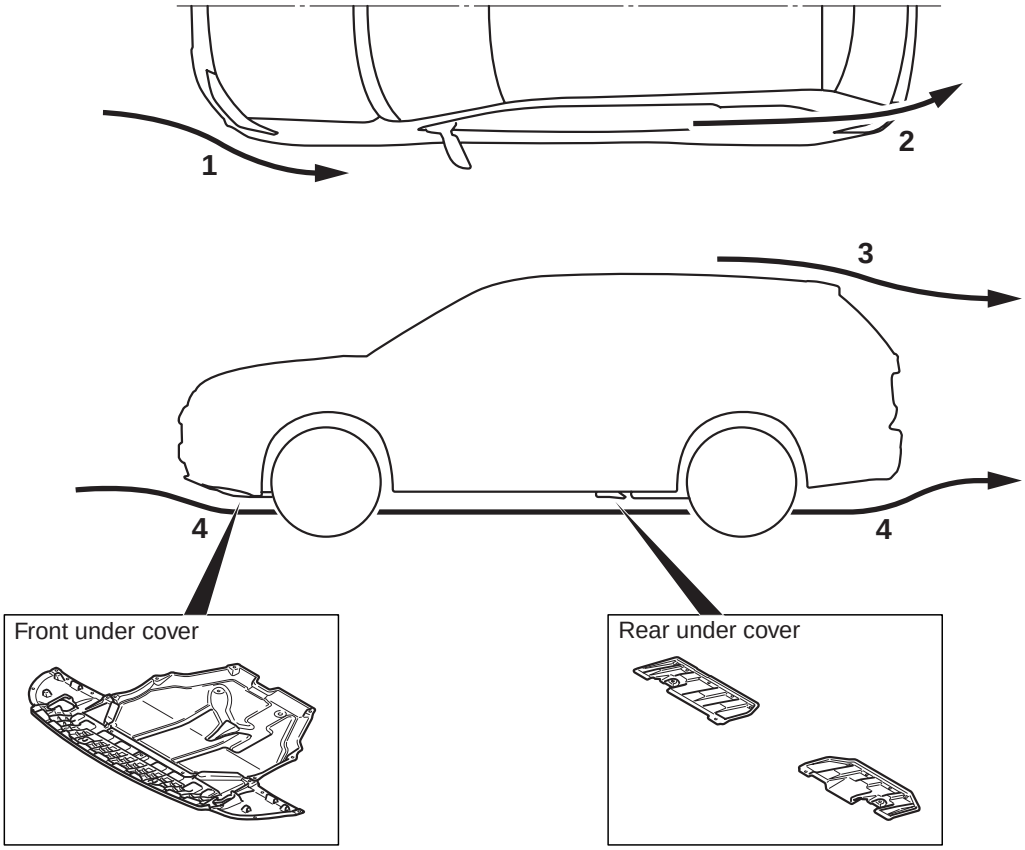
COMFORT



ACC00013AB

No.	Item		Dimension mm
1	Overall length		4,655
2	Front overhang		955
3	Wheelbase		2,670
4	Rear overhang		1,030
5	Overall height (unladen)		1,680
6	Ground clearance (unladen)		215
7	Overall width		1,800
8	Front track		1,540
	Rear track		1,540
9	Front leg space		870
10	Rear leg space		875
11	Head room	Front seat	928
12		Rear seat	872
13	Cargo room length		1,685

AERODYNAMICS



ACC00050 AB

New OUTLANDER achieved a drag coefficient of C_D (Coefficient of drag), 7% reduction as compared to the current model, by using the cutting-edge computer simulation technology and with the numerous wind tunnel experiments. Optimized body form of bumper side, roof, C-pillar and effective aerodynamic items such as air dams, under covers, rear spoiler also reduce aerodynamic drag and lift force.

1. Optimized bumper makes the side flow very smooth.
2. Tapered body shape makes the wake stable and small.
3. Stream-lined roof shape is even more optimized.
4. Air resistance is reduced by optimally arranged aerodynamic items such as air dams, under covers.

These items reduce front and rear lift force, too.

ACTIVE SAFETY

M2000031001598

The following safety equipment/systems are used:

- ABS (Anti-skid Braking System) with EBD (Electronic Brake-force Distribution)
- ASC (Active Stability Control system)
- Hill start assist system
- ESS (Emergency Stop signal System)
- S-HID headlamp (Super wide High Intensity Discharge headlamp)
- Security alarm

PASSIVE SAFETY

M2000032001654

The following safety equipment/systems are used:

- RISE Body (Reinforced Impact Safety Evolution body)
- Driver's and front passenger's SRS (Supplemental Restraint System) air bag
- Curtain air bag and Side-airbag
- Driver's knee air bags
- Front seat belt retractor with pre-tensioner and force-limiter function.
- Three-point rear seat belt with ELR/ALR (child seat fixing mechanism)
- Immobilizer function

COMFORTABLE EQUIPMENTS

M2000026000953

STEERING SYSTEM WITH TILT AND TELESCOPIC MECHANISMS

The tilt and telescopic mechanisms allow the driver to adjust the steering wheel position precisely depending on his/her wish and body size.

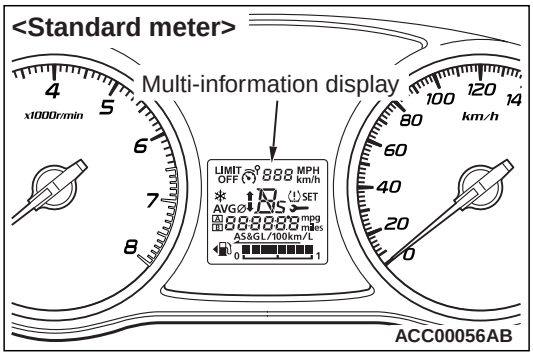
KEYLESS OPERATION SYSTEM (KOS)

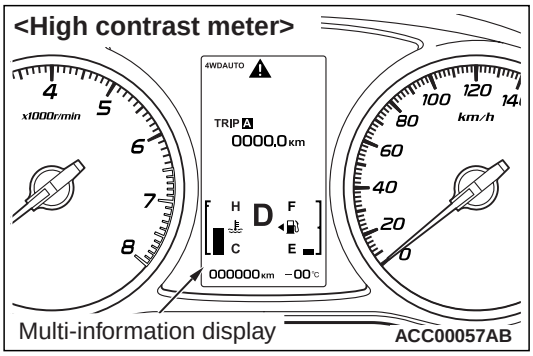
The door entry function has been employed, that enables the driver to lock or unlock all the doors (including tailgate) without taking the key out from his/her pocket or bag by operating the lock/unlock switches on the front door <Driver's side> or tailgate whenever the driver carries the keyless operation key with him/her. [Refer to GROUP 42B – Keyless Operation System (KOS)]

ONE-TOUCH START SYSTEM (OSS)

For vehicles equipped with the keyless operation system (KOS), the push-type engine start switch has been employed. [Refer to GROUP 42B – One-touch Start System (OSS)]

MULTI-INFORMATION DISPLAY





The multi-information display can display the following items: various warnings, odometer and trip meter, illumination control, service reminder information, engine coolant temperature, remaining fuel amount, selector lever position, average and instantaneous fuel consumption, possible cruising distance, average vehicle speed, and others. Displayed contents can be switched by operating the multi-information meter switch. Also, the displayed language or unit on the multi-information display can be changed from the function setting screen. (Refer to GROUP 54A – Combination Meter)

AUDIO AND NAVIGATION SYSTEM

A NEW GENERATION WIDE 2-DIN CD OUDIO

- A "Wide 2-DIN" size system has been adopted.
- Piano black paint and chrome decorations offer premium image.
- Supports USB/iPod control functions

Newly developed DISPLAY AUDIO

- Piano black paint and chrome decorations offer premium image.
- Features 6.1 inch QVGA (Quarter Video Graphics Array) full-colour display and touch screen.
- Supports USB/iPod control functions
- Rear view camera image with reference lines

Newly-developed NAVIGATION – Mitsubishi Multi Communication System (MMCS)

- SD card is used as data storage instead of HDD.
- High-definition display [VGA (Video Graphics Array) instead of QVGA (Quarter Video Graphics Array)]
- Dual display function such as navigation and AV (Audio Visual)/Vehicle information, etc.
- Supports USB/iPod control functions and SD audio files

A/C SYSTEM

There are two modes for the air conditioner system (same as the predecessor); full auto A/C and dual zone A/C.

The "dual zone A/C" mode allows separate stratification control selections for the right and left outlets, depending on individual passenger's wishes (Refer to GROUP 55 – Heater, Air Conditioner and Ventilation).

ENVIRONMENTAL PROTECTION

M2000027000945

Mitsubishi Motors Corporation has given careful consideration to protection of natural resources and the environment. Environmentally friendly features are shown below.

Classification	Parts Name	Features
Adoption of easy recycling material	Bumper, Radiator grille, Instrument panel, Interior door trims	Adoption of thermoplastic resin

Classification	Parts Name	Features
Expansion of recycled material	Bumper, Radiator grille, Instrument panel, Interior door trims	Re-use of material discarded in plant
	Sound absorbing materials in dash panel and headlining, Oil level gauge	Re-use of discarded material in other industry
Reduction of hazardous substances	Fuel tank, Radiator, Heater core, Balance weight for wheel, Glass ceramics print, Electrode position paint, bearing metal, valve sheet	Adoption of lead free material
	Discharge headlight, combination meter, Navigation system	Adoption of mercury free material

VEHICLE IDENTIFICATION

MODELS

M2000001101495

VEHICLES FOR RUSSIA (EASTERN EUROPE COUNTRIES)

<2000>

Model code		Seating capacity	Engine model	Transmission model	Fuel supply system
GF2W	XTSHL6Z	5-persons	4B11 (1,998 mL) DOHC MIVEC petrol engine	F1CJA (Front wheel drive 2WD, INVECS-III CVT with sport mode)	MPI
	XTSHZL6Z			W1CJA (Electronic control 4WD, INVECS-III CVT with sport mode)	

<2400>

Model code		Seating capacity	Engine model	Transmission model	Fuel supply system
GF3W	XTHHZL6Z	5-persons	4B12 (2,360 mL) DOHC MIVEC petrol engine	W1CJA (Electronic control 4WD, INVECS-III CVT with sport mode)	MPI

MODEL CODE

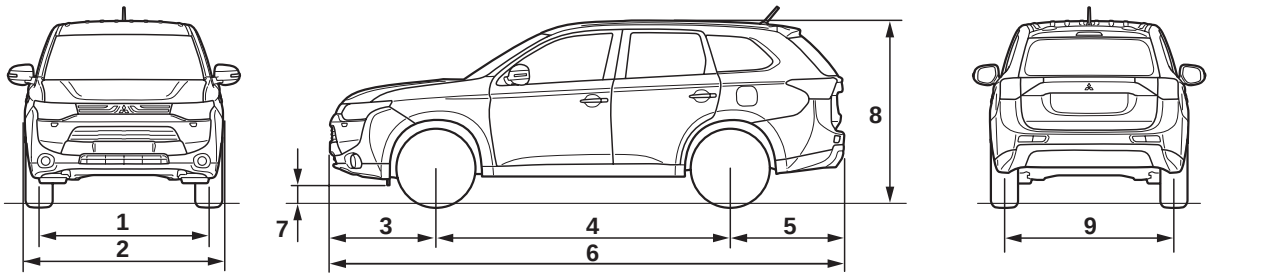
ACB04331AB

No.	Item	Content	
1	Development	GF	OUTLANDER
2	Engine type	2	2.0L MPI (4B11)
		3	2.4L MPI (4B12)
3	Vehicle type	W	Station wagon
4	Body style	X	4-door with tailgate
5	Transmission type	T	CVT

No.	Item	Content	
6	Trim level (Price class)	S	INFORM <2000 – 2WD>
		H	INVITE <2000 – 4WD>, INSTYLE <2400>
7	Engine specification	H	MIVEC (DOHC)
8	Special feature	None	2WD
		Z	4WD
9	Steering wheel location	L	Left hand
10	Destination	6Z	Vehicles for Russia

MAJOR SPECIFICATIONS

M2000030003256



ACB04339AB

<2000>

Item				INTENSE	
				GF2W	
				XTSHL6Z	XTSHZL6Z
Vehicle dimension mm	Front track		1	1,540	1,540
	Overall width		2	1,800	1,800
	Front overhang		3	955	955
	Wheelbase		4	2,670	2,670
	Rear overhang		5	1,030	1,030
	Overall length		6	4,655	4,655
	Ground clearance (unladen)		7	215	215
	Overall height (unladen)		8	1,680	1,680
	Rear track		9	1,540	1,540
Vehicle weight kg	Kerb weight	Without full optional parts		1,415	1,480
		With full optional parts		1,484	1,559
	Gross vehicle weight			1,985	1,985
	Gross axle weight rating-front			1,150	1,150
	Gross axle weight rating-rear			1,250	1,250
	Gross combination weight			3,665	3,665
Seating capacity				5	5

Item		INTENSE	
		GF2W	
		XTSHL6Z	XTSHZL6Z
Engine	Model No.	4B11	4B11
	Type	DOHC MIVEC	DOHC MIVEC
	Total displacement mL	1,998	1,998
	Max. output <EEC> kW/rpm	107/6,000	107/6,000
	Max. torque <EEC> N·m/rpm	196/4,200	196/4,200
Fuel system	Fuel supply system	MPI	MPI
Transmission	Model code	F1CJA	W1CJA
	Type	Front wheel drive 2WD, INVECS-III CVT with sport mode	Electronic control 4WD, INVECS-III CVT with sport mode
Turning radius m	Body	5.73	5.73
	Wheel	5.3	5.3

<2400>

Item				INSTYLE
				GF3W
				XTHHZL6Z
Vehicle dimension mm	Front track		1	1,540
	Overall width		2	1,800
	Front overhang		3	955
	Wheelbase		4	2,670
	Rear overhang		5	1,030
	Overall length		6	4,655
	Ground clearance (unladen)		7	215
	Overall height (unladen)		8	1,680
	Rear track		9	1,680
Vehicle weight kg	Kerb weight	Without full optional parts		1,495
		With full optional parts		1,569
	Gross vehicle weight			2,210
	Gross axle weight rating-front			1,150
	Gross axle weight rating-rear			1,250
	Gross combination weight			3,890
Seating capacity				5
Engine	Model No.			4B12
	Type			DOHC MIVEC
	Total displacement mL			2,360
	Max. output <EEC> kW/rpm			123/6,000
	Max. torque <EEC> N·m/rpm			222/4,100
Fuel system	Fuel supply system			MPI

Item		**INSTYLE**
		GF3W
		XTHHZL6Z
Transmission	Model code	W1CJA
	Type	Electronic control 4WD, INVECS-III CVT with sport mode
Turning radius m	Body	5.73
	Wheel	5.3

GROUP 11

ENGINE MECHANICAL

CONTENTS

GENERAL INFORMATION

M2112000102444

Two types of engines are available; 4B11 (1,998 cc) and 4B12 (2,360 cc).
These engines have adopted the following features:

- MIVEC (Mitsubishi Innovative Valve timing Electronic Control system) for the intake valves
- Cylinder block made of an aluminium alloy
- Valve train with direct-acting valve tappets
- Silent timing chain
- Unit type balancer<4B12>

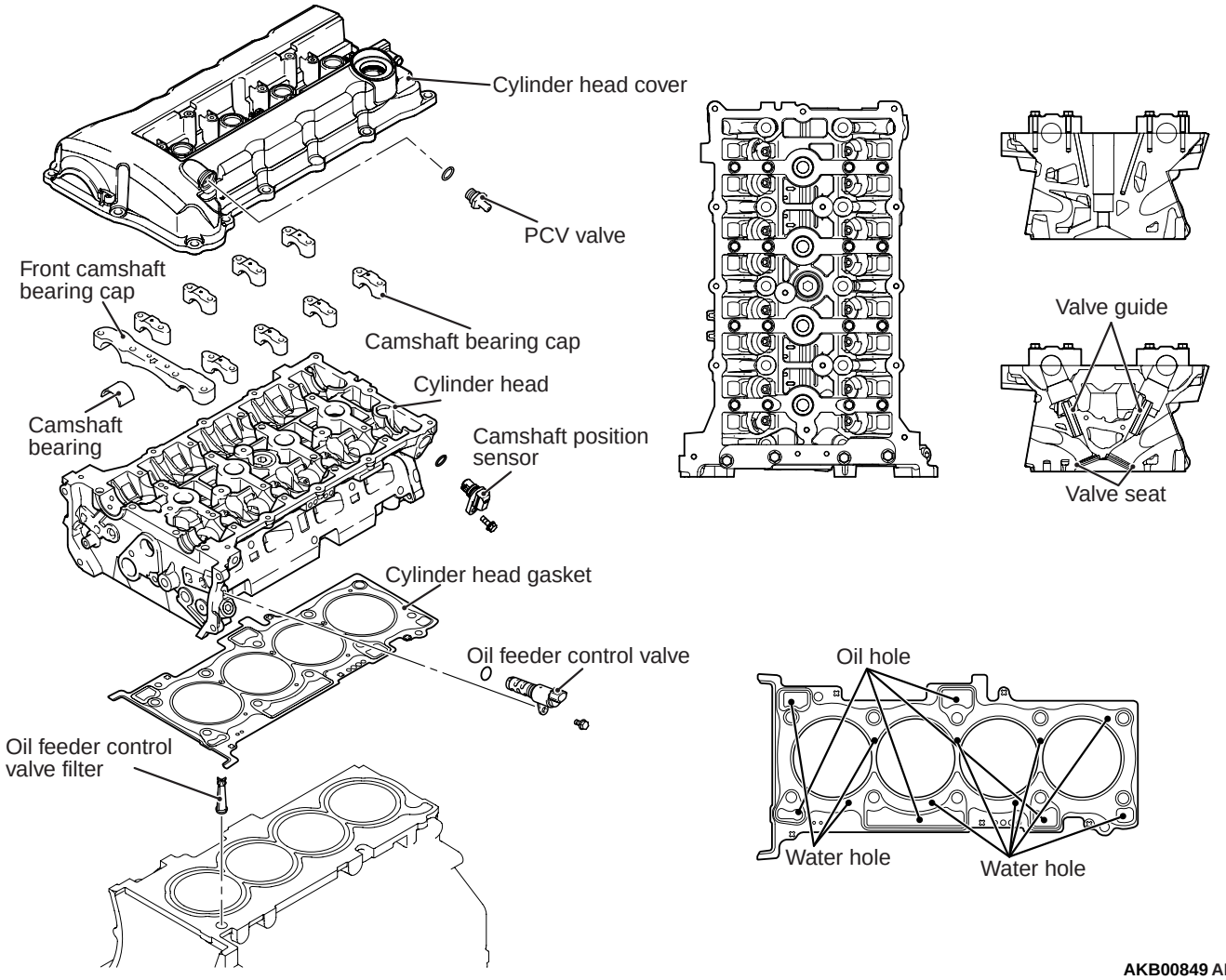
MAIN SPECIFICATIONS

Item		Specification	
Engine model		4B11	4B12
Total displacement cc		1,998	2,360
Bore × stroke mm		86 × 86	88 × 97
Compression ratio		10.0	10.5
Combustion chamber		Pentroof type	
Valve timing	Intake opening	28° BTDC – 3° BTDC	40° BTDC – 0° BTDC
	Intake closing	45° ABDC – 20° ABDC	64° ABDC – 24° ABDC
	Exhaust opening	BBDC 39°	BBDC 39°
	Exhaust closing	ATDC 5°	ATDC 5°
Maximum output (EEC net) kW / r/min		107 / 6,000	123 / 6,000
Maximum torque (EEC net) N·m / r/min		196 / 4,200	222 / 4,100
Fuel injection system		Electronically controlled multipoint fuel injection	
Ignition system		Electronically controlled 4-coil	

BASE ENGINE

M2112001002194

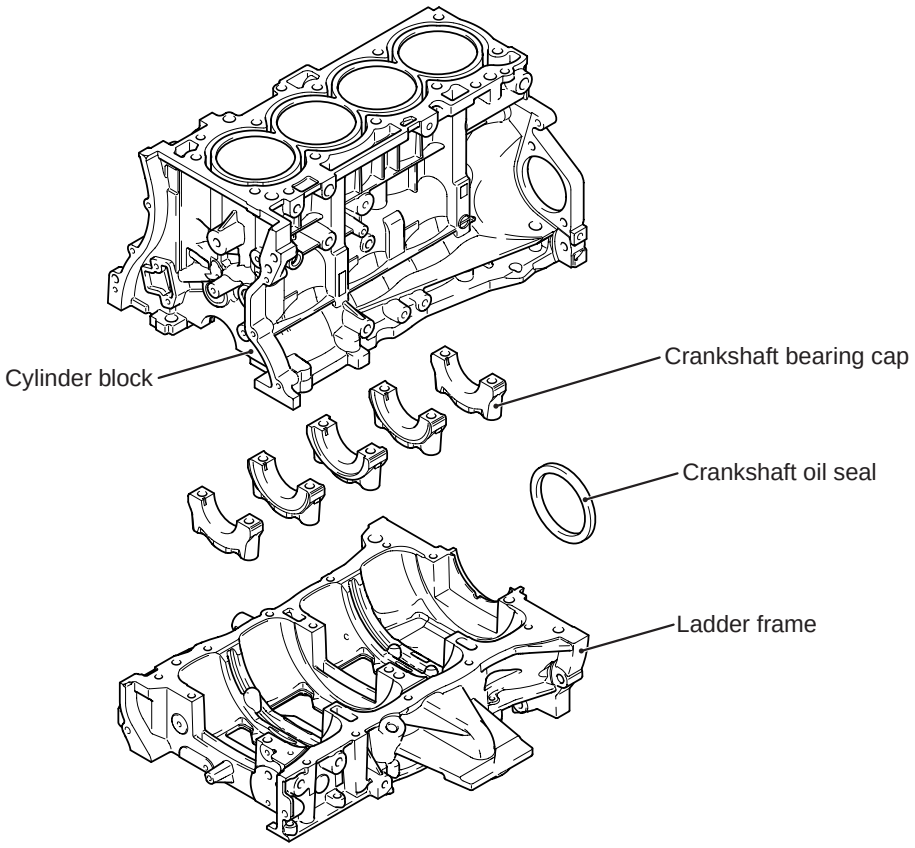
CYLINDER HEAD RELATION



AKB00849 AB

1. CYLINDER HEAD COVER
   - A Plastic cylinder head cover has been adopted.
2. PCV VALVE
3. FRONT CAMSHAFT BEARING CAP
   - On each camshaft, the thrust load is supported by No. 4 bearing. The No. 1 bearings for the intake and exhaust camshafts have a common bearing cap.
4. CAMSHAFT BEARING CAP
   - Each of the intake and exhaust camshafts is supported by five bearings.
5. CAMSHAFT BEARING
6. OIL FEEDER CONTROL VALVE
7. OIL FEEDER CONTROL VALVE FILTER
8. CYLINDER HEAD
   - The cylinder head is made of aluminium alloy, which is lightweight and has an excellent cooling efficiency. The intake and exhaust ports are arranged in a cross-flow construction. Each cylinder has a pair of intake ports on one side and a pair of exhaust ports on the other side.
9. CYLINDER HEAD GASKET
   - A dual-layer, metal type cylinder head gasket that excels in heat resistance and sealing performance has been adopted.
10. VALVE GUIDE
    - Valve guides that are common to both the inlet and exhaust have been adopted.
11. VALVE SEAT
    - Sintered alloy valve seats have been adopted.
12. CAMSHAFT POSITION SENSOR

CYLINDER BLOCK



AKB00850AB

A cylinder block made of an aluminium alloy has been adopted for weight reduction.
Five bearings are provided for the crankshaft journals and the No. 3 bearing sustains the thrust load of the crankshaft.
The water jacket is the full Siamese type.

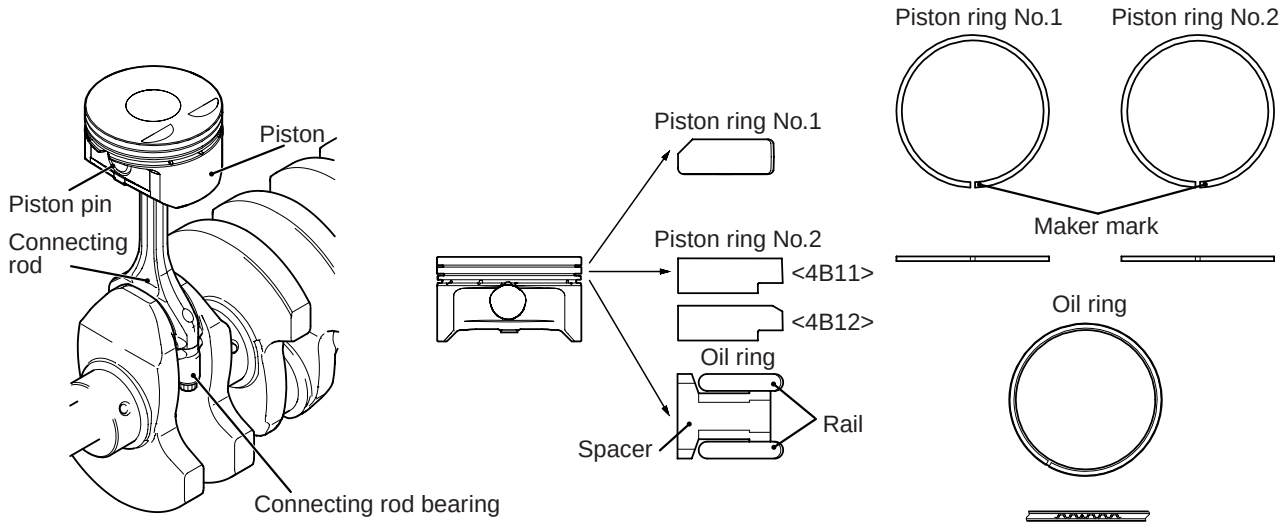
1. CYLINDER BLOCK
   - The cylinder block is made of lightweight aluminium alloy.

The water jacket is of a full-seamless design.

Item	4B11	4B12
Overall height mm	230.1	240.1
Bore mm	86	88
Bore pitch mm	96	96
Stroke mm	86	97

2. CRANKSHAFT BEARING CAP
   - The crankshaft journal is supported by four bearings. The crankshaft thrust load is supported by No. 3 bearing.
3. LADDERFRAME

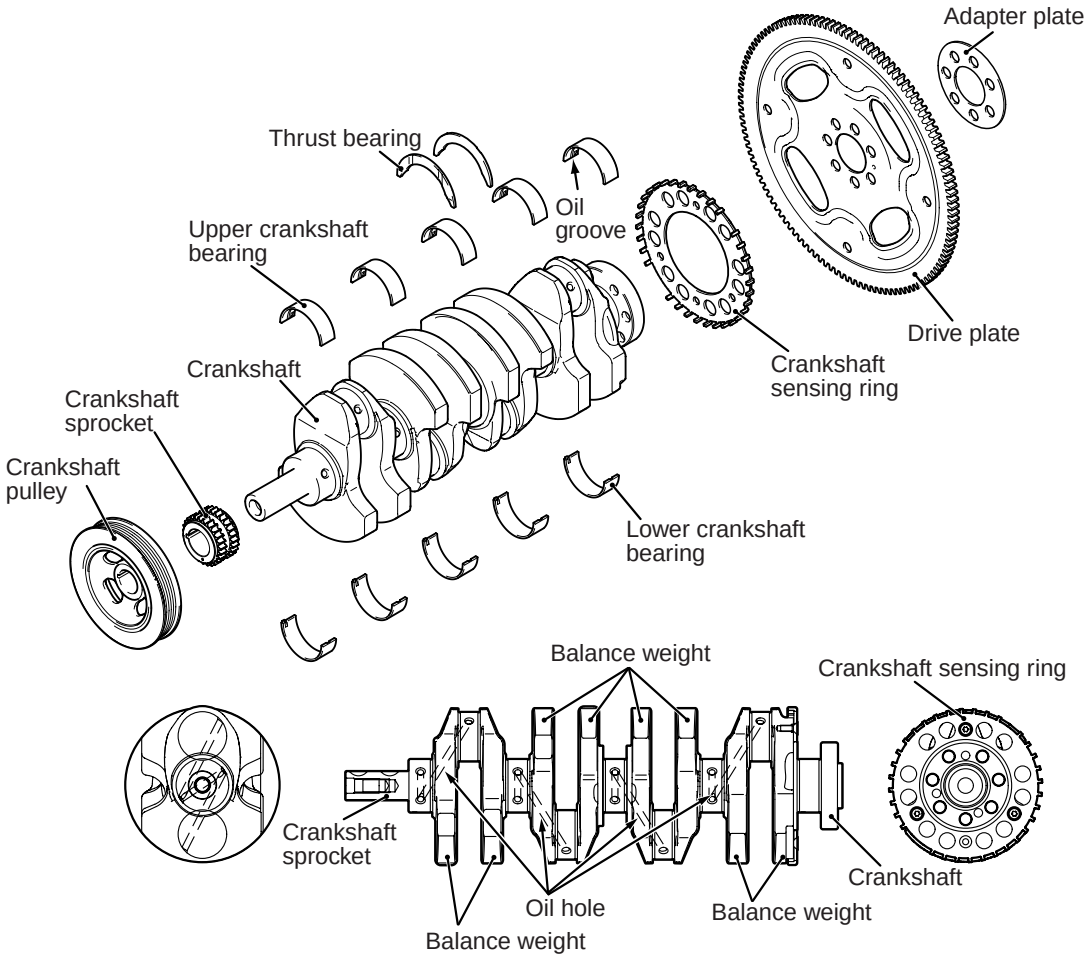
PISTON RELATION



AKB00851AB

1. PISTON
   - The pistons are made of a special aluminium alloy. Their weight has been reduced by lowering their overall height and increasing the depression at each end of the piston pin. The piston pin hole centre is offset 0.8 mm towards the thrust side of the piston centre. The skirt portion along the perimeter of the piston is finished with streaks that excel in oil retention and seizure resistance.
2. PISTON PIN
   - The piston pin is of a semi-floating type, press-fitted into the connecting rod small end while capable of floating relative to the piston.
3. CONNECTING ROD
   - The connecting rod is made of highly rigid, forged carbon steel. The rod portion has an H-shaped cross section. The connecting rod big end bearing is lubricated through an oil passage running from the main journal to the crankshaft pin.
4. PISTON RING
   - Each piston is provided with No. 1 and No. 2 compression rings and an oil ring.
5. CONNECTING ROD BEARING
   - The upper and lower connecting rod bearing halves are identical. The connecting rod bearing is equipped with back metal. While the bearing itself is made of aluminium alloy, the back metal is normally made of steel sheet. The connecting rod bearing is narrower than the bearing cap, this is to minimize wear.

CRANKSHAFT RELATION

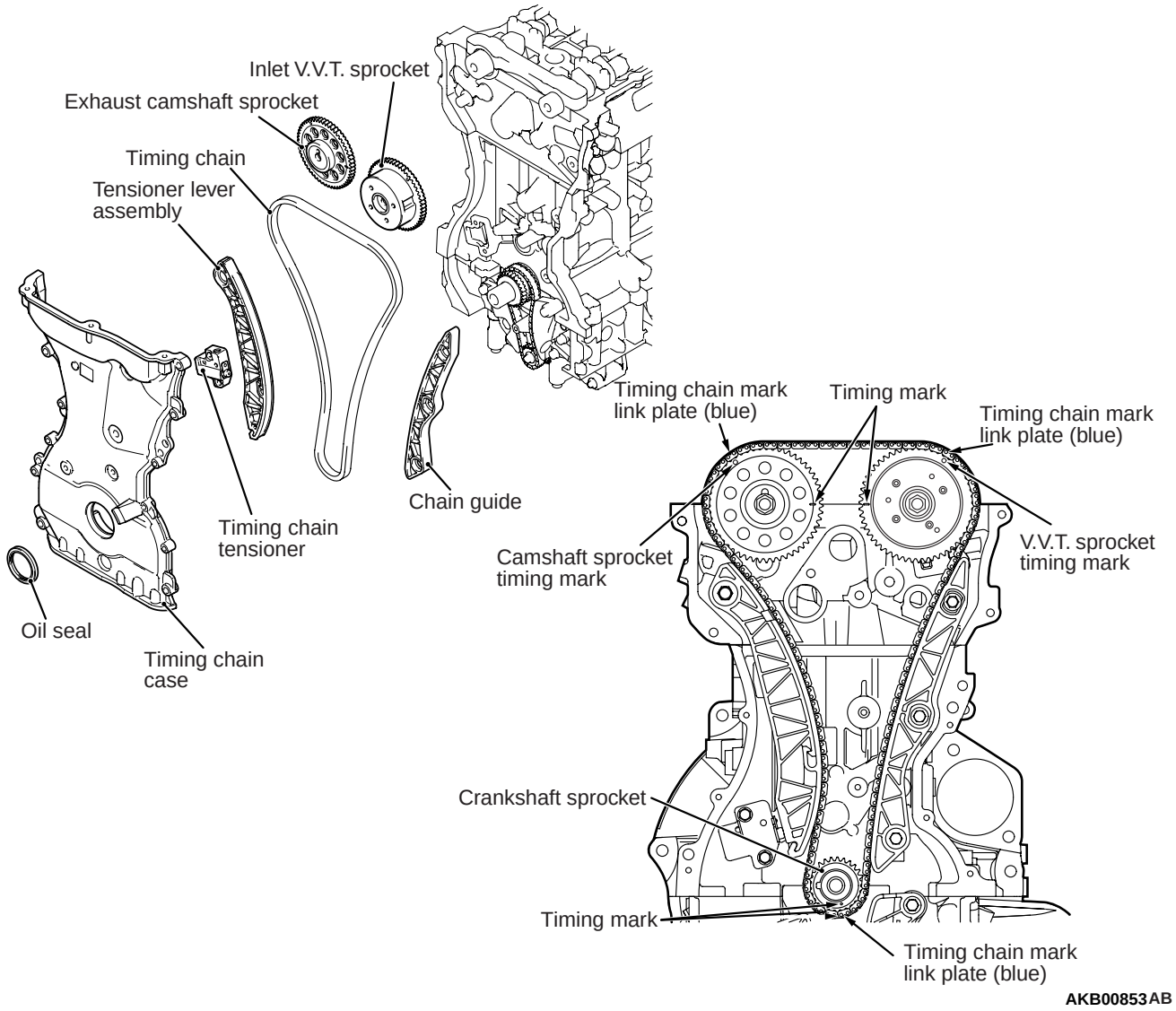


AKB00852AB

1. CRANK SHAFT
   - A casted crankshaft is used for the crankshaft. The crankshaft consists of five main bearings and eight balance weights. The crankshaft pins are arranged at 180° intervals. The oil hole supplies lubrication oil from the journal to the crank pin. A crankshaft sprocket and an oil pump drive gear shaft are shrink-fitted onto the front of the crankshaft.
2. CRANKSHAFT BEARING
   - The upper crankshaft bearing (with oil groove) is located on the cylinder block side while the lower bearing (without oil groove) is held by the bearing cap.The crankshaft bearing is equipped with back metal. While the bearing itself is made of aluminium alloy, the back metal is made of steel sheet.
3. THRUST BEARING
   - A thrust bearing is installed on both sides of the No. 3 crankshaft bearing.
4. CRANKSHAFT PULLEY
   - The crankshaft pulley is made of cast-iron and rubber. The pulley has grooves to engage with a V-ribbed belt (six ribs), which drives an alternator and a water pump and an A/C compressor. An ignition timing mark (notch) is stamped on the flange of the pulley. The crankshaft pulley is equipped with a torsional damper to minimize the torsional vibration of the crankshaft as well as substantially reduce noise and vibration at the high speed range.
5. CRANKSHAFT SENSING RING

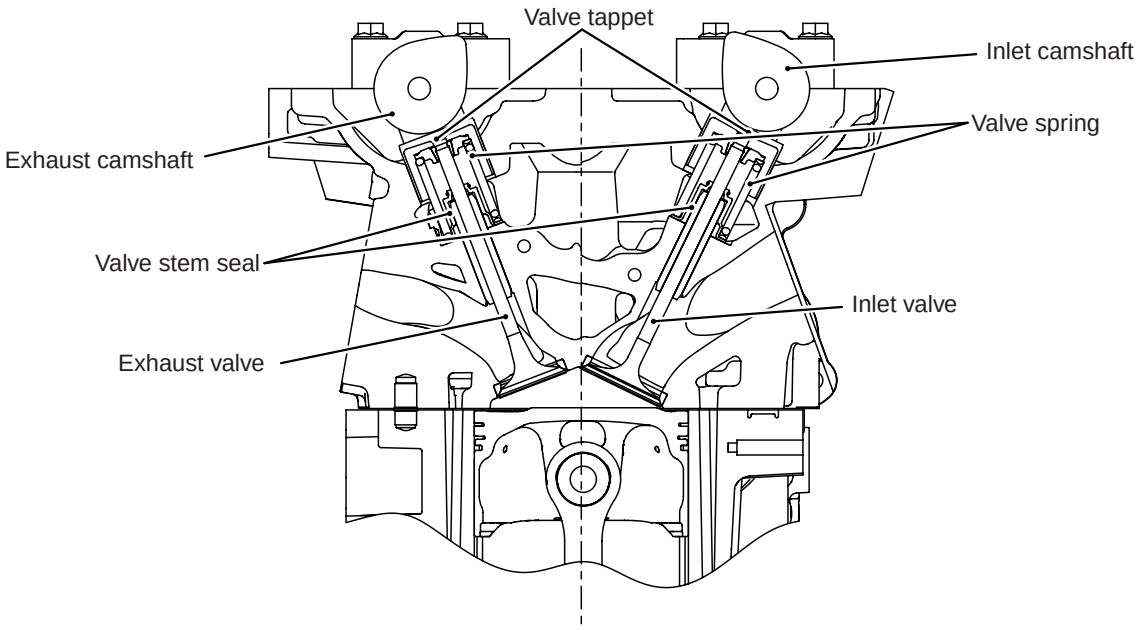
   The crankshaft is also fitted with a crankshaft sensing ring.
6. DRIVE PLATE
   - A cast iron ring gear is a shrink fit in the steel plate of the drive plate. The drive plate is installed by tightening six bolts.

TIMING CHAIN RELATION



1. OIL SEAL
   - A front crankshaft oil seal is press-fit into the case.
2. TIMING CHAIN CASE
   - The engine support bracket, the oil pump and the relief valve are integrated as well as water chamber of the water pump.
3. TIMING CHAIN
   - The two camshafts are driven by the timing chain via the respective sprockets. The timing chain, consisting of 180 links, is an endless chain, connecting the crankshaft sprocket with the camshaft and V.V.T. sprockets. The timing chain is equipped with three mark link plates (blue) to correctly time the two sprockets with each other. The timing chain is tensioned by the timing chain tensioner, which has a built-in plunger with plunger springs.
4. TIMING CHAIN TENSIONER
   - The plunger in the timing chain tensioner directly pushes the tension lever, and the pressure automatically adjusts the timing chain tension. A cam is provided to lock the plunger in place after the engine stops. This helps prevent the timing chain from wobbling just after the engine starts. With the timing chain tensioner installed, do not crank the engine in the reverse direction. This will force the plunger to overcome the cam, or even cause other problems.
5. TENSIOR LEVER ASSEMBLY
6. CHAIN GUIDE ASSEMBLY
7. CAMSHAFT SPROCKET EXHAUST
8. V.V.T. CAMSHAFT SPROCKET

VALVE RELATION



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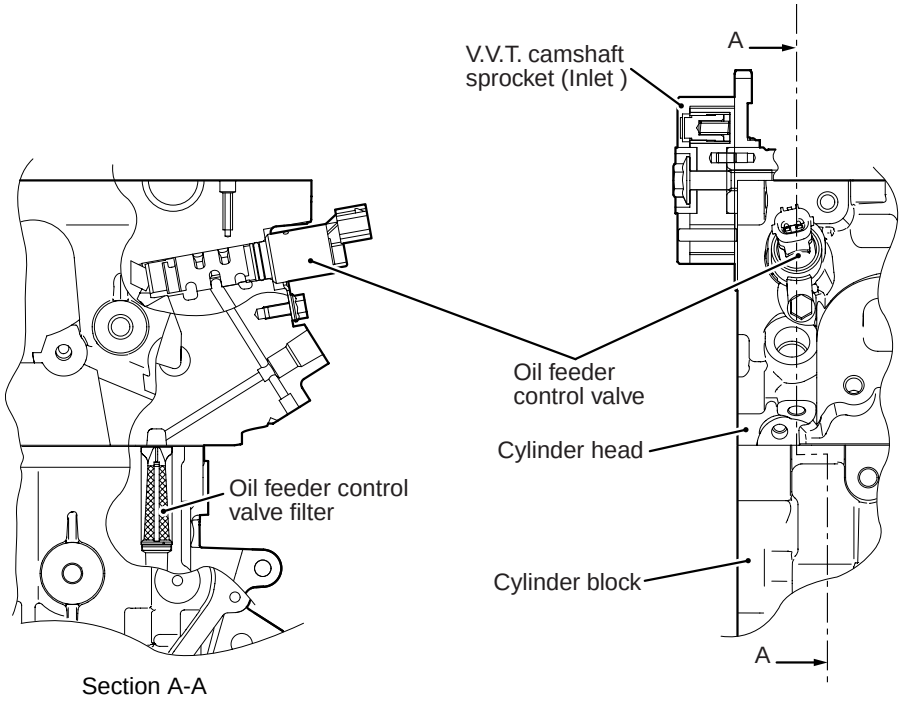
The valve mechanism is based on a 4-valve DOHC (Double Over Head Camshaft) design having the camshaft on the upper valve. Each cylinder has two intake valves and two exhaust valves, arranged in a V-shape pattern.
Camshaft rotation is transmitted via valve tappets to the respective valves which open and close accordingly.

1. CAMSHAFT
2. VALVE TAPPET
   - Valve tappets are available in 47 thicknesses, at 0.015 mm intervals between 3.000 mm and 3.690 mm, to ensure correct valve clearance.
3. VALVE
   - The valves have heat-resistance. The entire valve surface is treated with nitriding.
4. VALVE STEM SEAL
   - The valve stem seals are integrated with the valve spring seats.
   - The valve stem seal portion excels in sealing performance and is equipped with a spring to prevent oil from descending.
5. VALVE SPRING
   - The valve spring has a dual pitch spring to prevent surging in the high speed range.

MIVEC (MITSUBISHI INNOVATIVE VALVE TIMING ELECTRONIC CONTROL SYSTEM) RELATION



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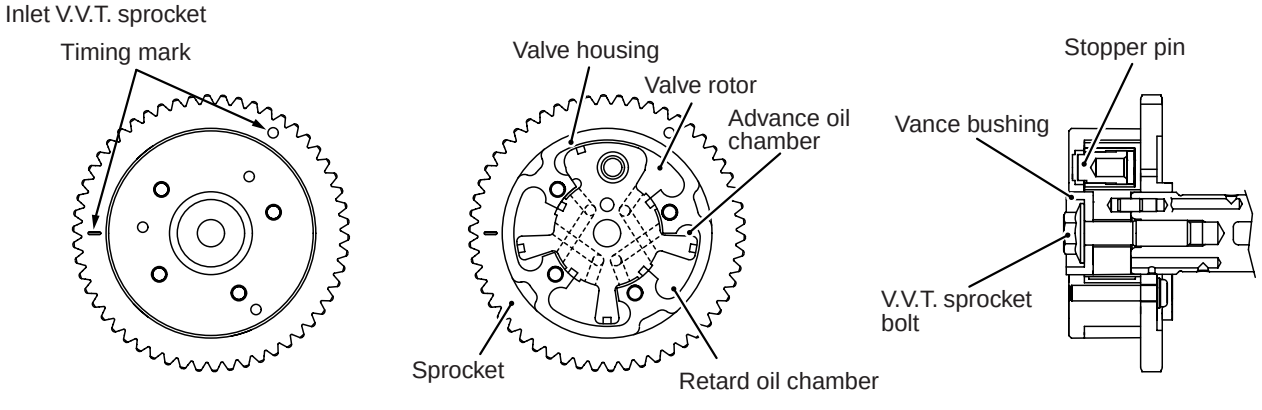
MIVEC (Mitsubishi Innovative Valve timing Electronic Control system) consists of the components illustrated above.

The intake valve timing is optimally controlled (continuously variable) under the changing driving conditions to improve performance in the entire speed range.

V.V.T. SPROCKET (VARIABLE VALVE TIMING SPROCKET)



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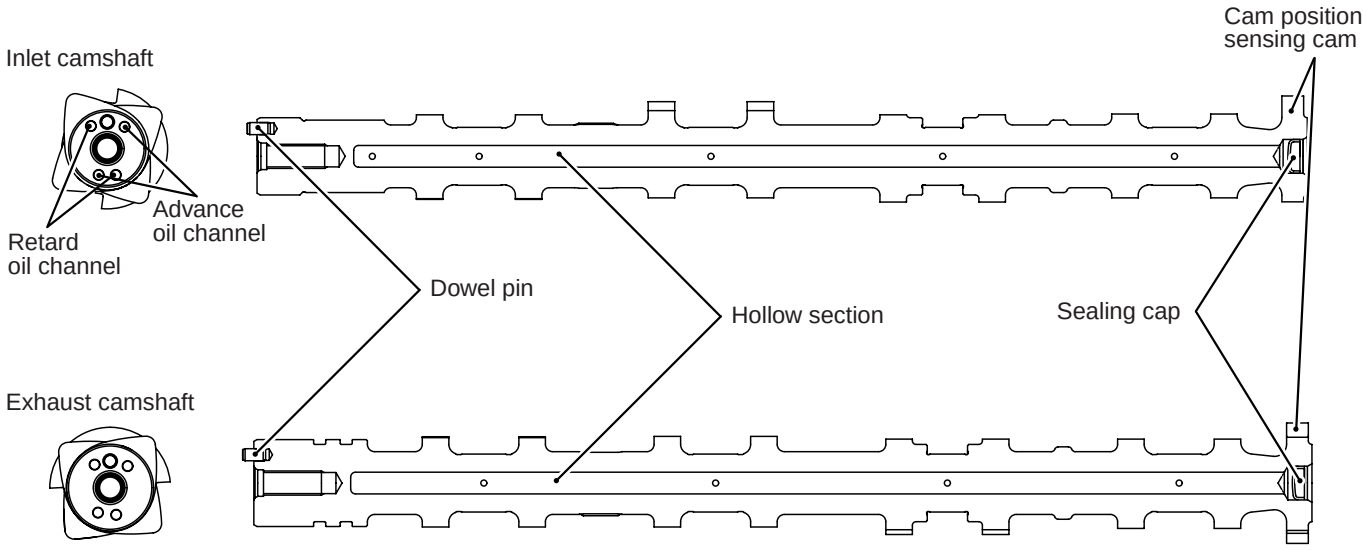
Oil from the oil feeder control valve is sent to the V.V.T. sprocket, moving the vane rotor and thus regulating the valve timing.

CAMSHAFT

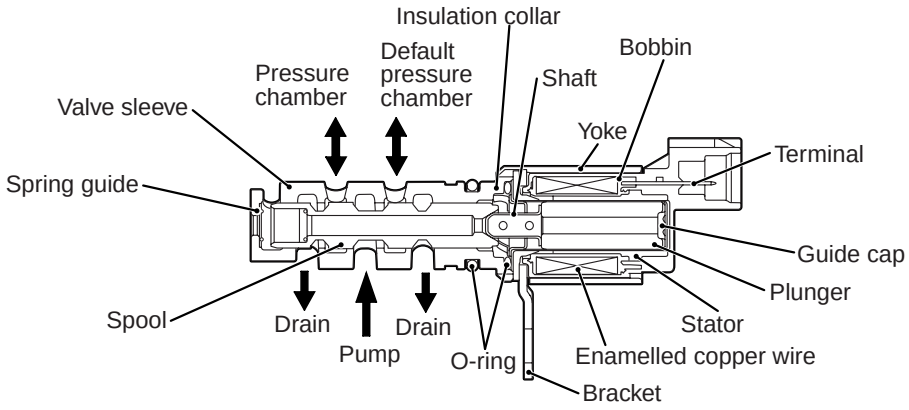


AK502506AH

The lightweight camshaft is achieved by the hollow design.
Oil channels run through the intake camshaft, through which oil is sent from the oil feeder control valve to the V.V.T. sprocket.

A cam position sensing ring is press-fitted onto the rear portion of the intake camshaft.

OIL FEEDER CONTROL VALVE (OCV)



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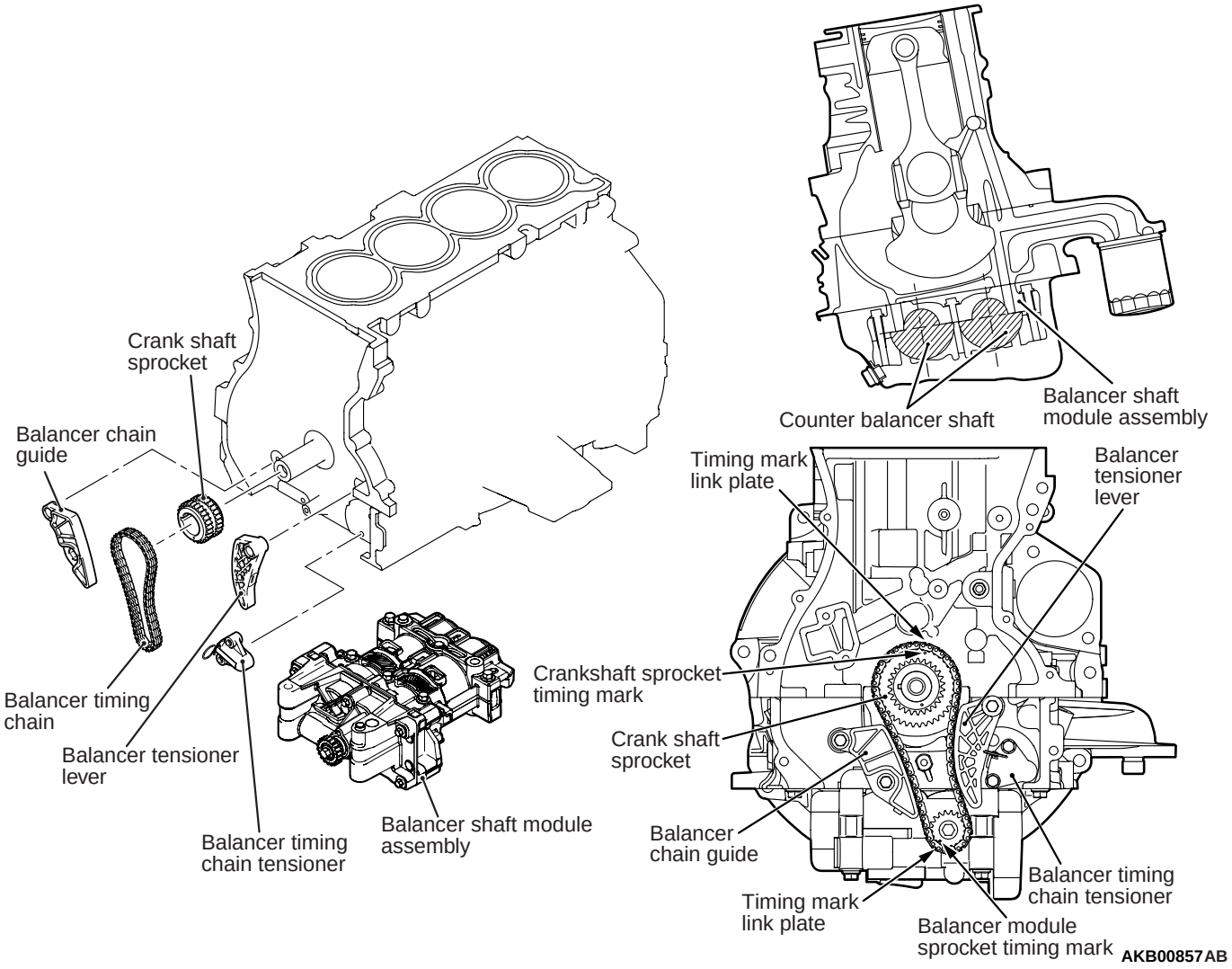
The oil feeder control valve is essentially a solenoid valve, regulated by the engine-ECU signals to feed oil to the V.V.T. sprocket assembly to move the vane rotor.

BALANCER RELATION<4B12>



1. BALANCER TIMING CHAIN
   - The balancer chain is a silent, endless type, consisting of 72 links. It is installed around the balancer module sprocket and the crankshaft sprocket. Two mark link plates (orange and blue) are installed on the balancer chain to locate the sprockets. When the balancer chain drives the balancer module sprocket, the balancer gear causes the right and left balancer shafts to rotate.
2. CRANKSHAFT SPROCKET
3. BALANCER TIMING CHAIN TENSIONER
4. BALANCER CHAIN GUIDE
5. BALANCER TENSIONER LEVER
6. BALANCER SHAFT MODULE ASSEMBLY
   - The counter balancer shaft is located inside the oil pan to achieve a compact engine. The balancer shaft module assembly integrates an oil pump and a balancer unit to realise a compact and lightweight package. The balancer shaft module assembly cannot be disassembled.

GROUP 12

ENGINE LUBRICATION

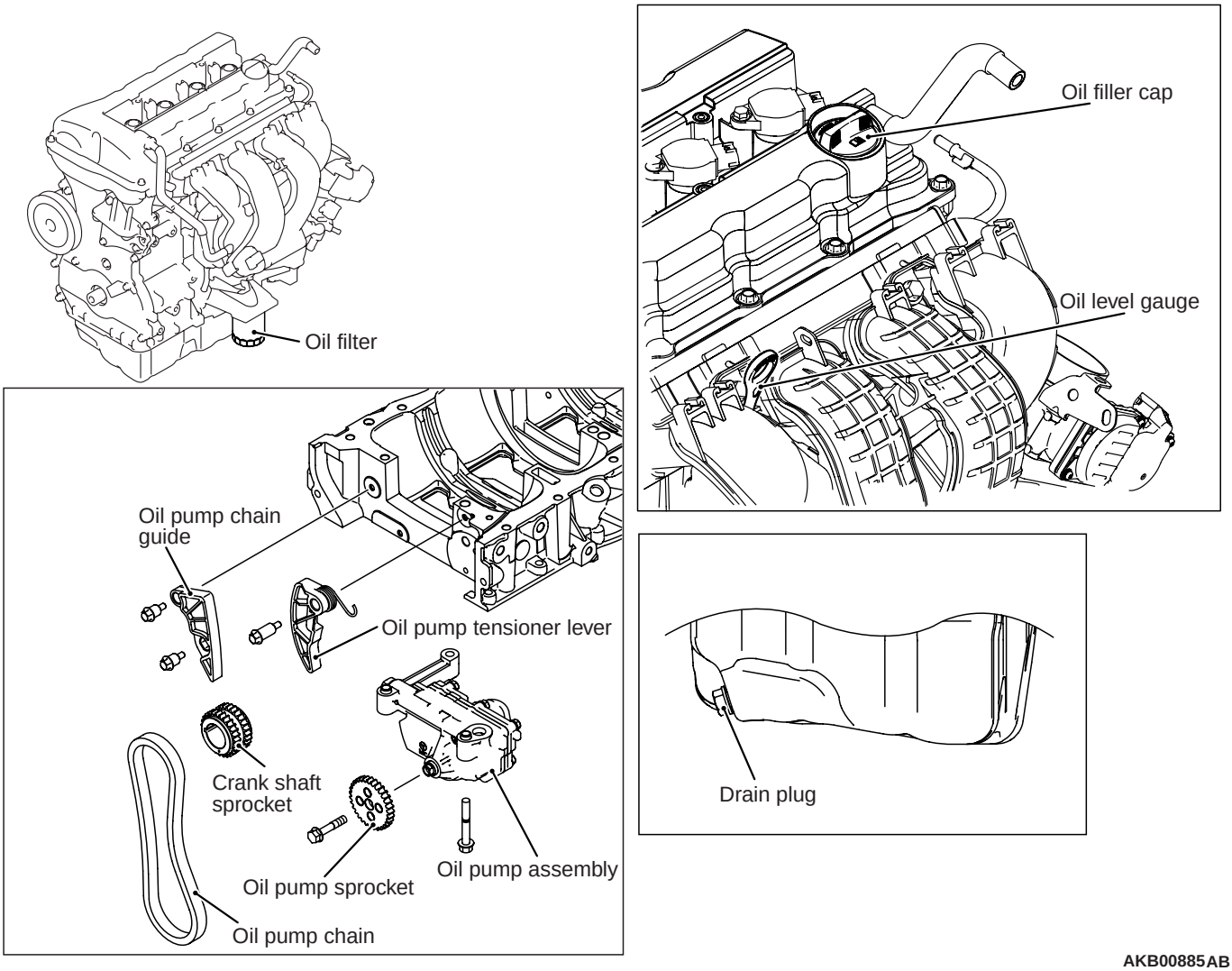
CONTENTS

GENERAL INFORMATION

M2120000100465

The lubrication system is the full-flow, filter pumping system.
The engine oil that accumulates in the oil pan is drawn and discharged by the oil pump. After its pressure is regulated by the relief valve, the oil passes through the oil filter. Then, it flows from the oil passage in the cylinder block to the individual crankshaft journals and the cylinder head.
After the oil is pumped to the individual crankshaft journals, it passes through a passage in the crankshaft and is fed to the pins. After the oil is pumped to the cylinder head, it flows to the camshaft journals and the oil feeder control valves.

LUBRICATION RELATION



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1. OIL FILLER CAP
2. OIL LEVEL GAUGE
3. DRAIN PLUG
4. OIL PAN
   - The oil pan is made of sheet metal and contains an oil sump in the forward area of the engine.

FIPG (Formed-In-Place Gasket) is used to seal between the oil pan and the ladder frame.

NOTE: FIPG is the abbreviation for Formed-In-Place Gasket.

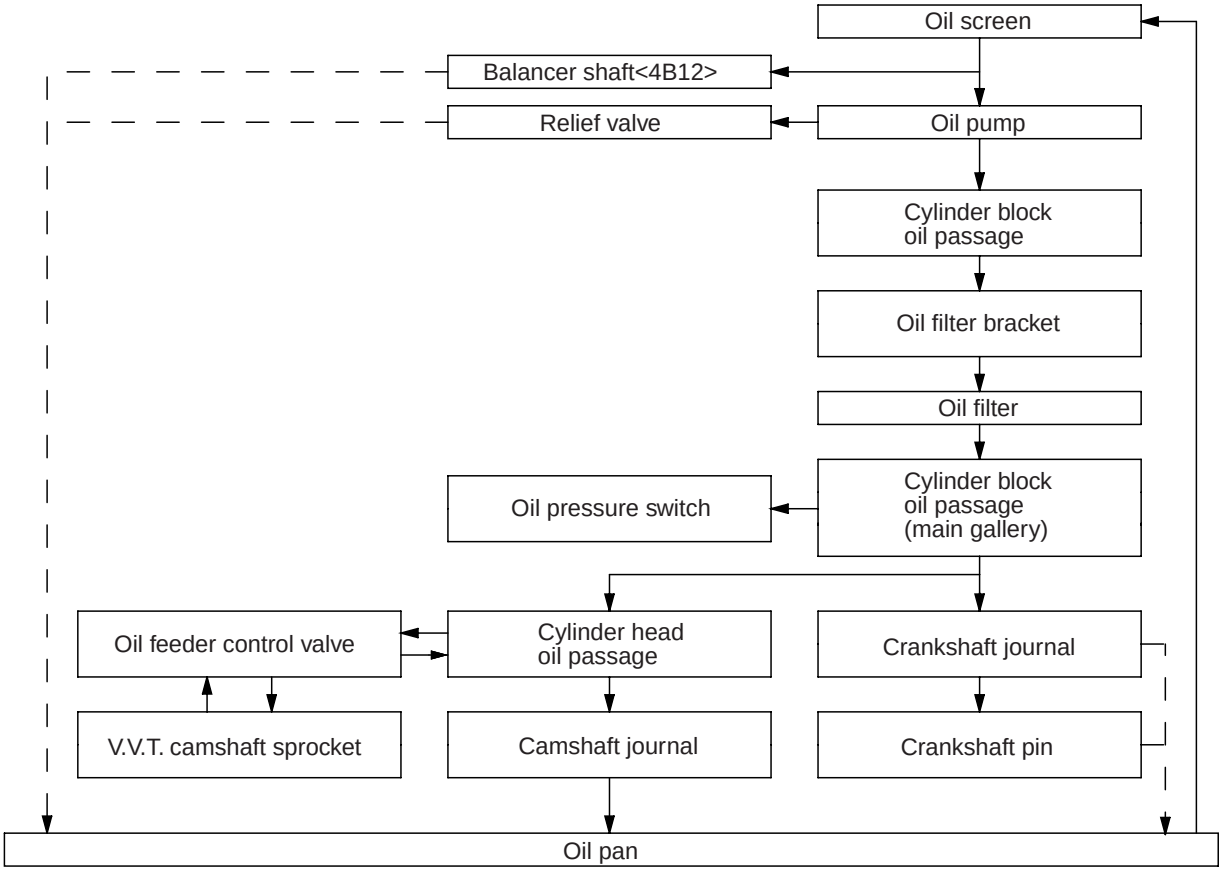
5. OIL FILTER
   - The oil filter is installed on the left side of the cylinder block.
6. OIL PUMP<4B11>
   - The oil screen is integrated into the oil pump case to be compact and lightweight.

The oil pump case, which is installed to the bottom of the ladder flame, is driven by the oil pump chain through the oil pump sprocket installed to the front of the oil pump case.

Item	Specification
Displacement L/min(6,000 r/min.)	70

OIL PASSAGE

M2120000200741



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GROUP 13

FUEL

CONTENTS

GROUP 13A

MULTIPOINT FUEL INJECTION (MPI)

CONTENTS

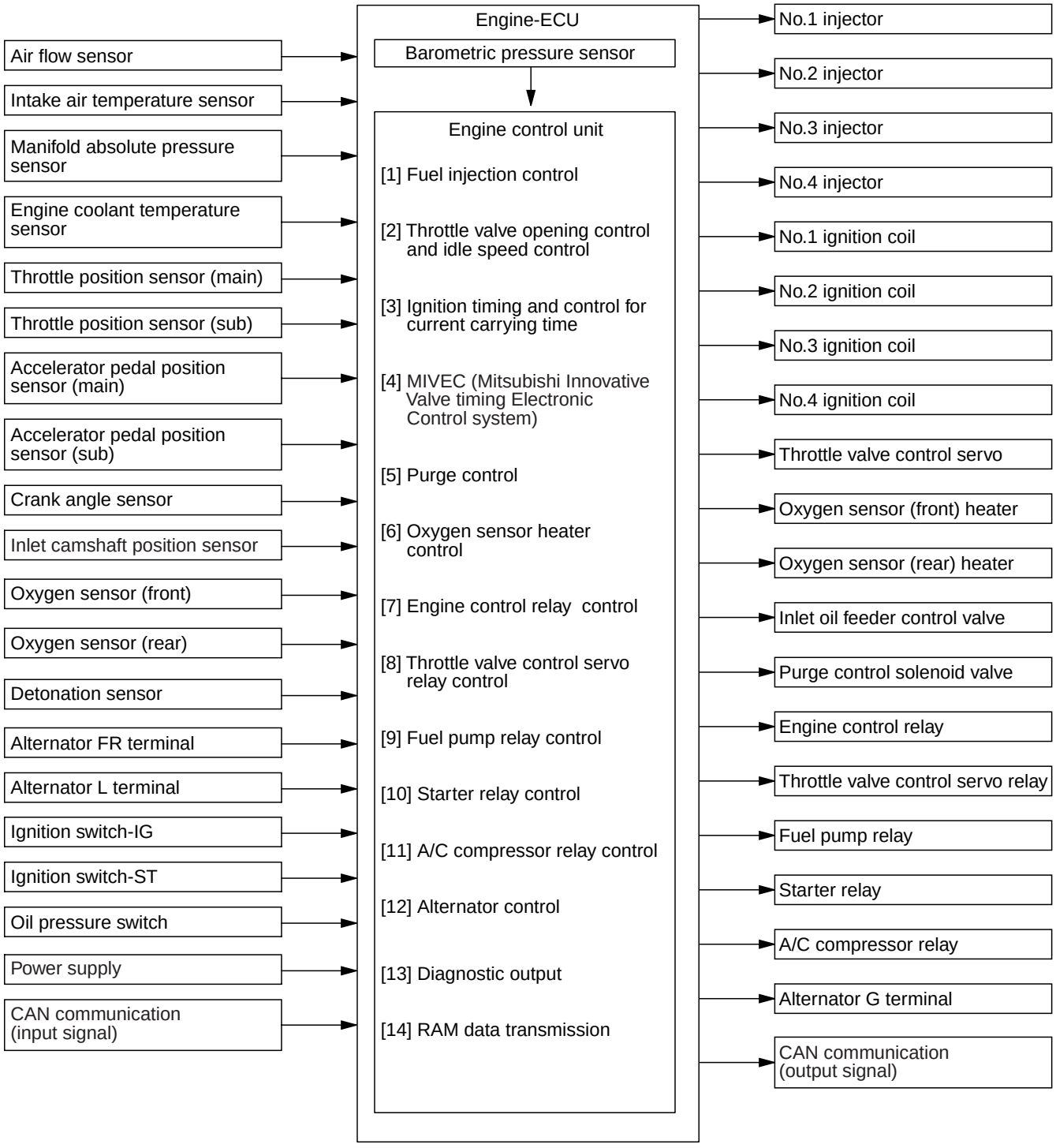
GENERAL INFORMATION

M2132000102640

The following points of the 4B1 engine introduced to the previous OUTLANDER have been changed:

Improvement / Additions	Remark
The variable valve timing control (V.V.T.) system has been discontinued at the engine exhaust side.	Due to this, the exhaust oil control valve and the exhaust camshaft position sensor have been discontinued.
An electric power steering has been adopted.	Due to this, the power steering fluid pressure switch terminal has been deleted from the engine-ECU.
The air flow sensor has been changed.	The engine-ECU delivers a sensor reference voltage to the air flow sensor.
The exhaust gas recirculation (EGR) valve has been discontinued.	Weight saving due to simpler structure

System Block Diagram



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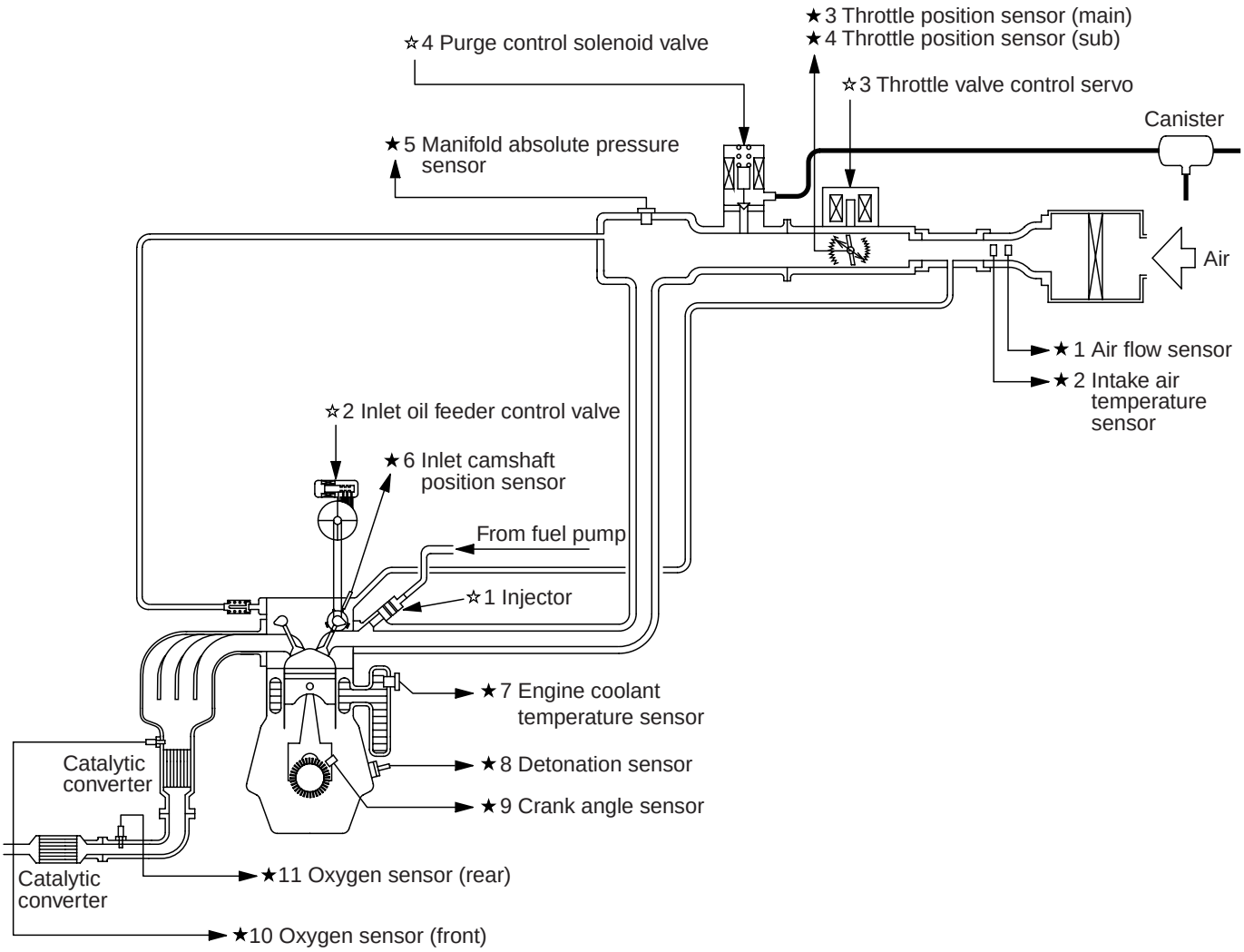
Control System Diagram

★ 1 Air flow sensor ★ 2 Intake air temperature sensor ★ 3 Throttle position sensor (main) ★ 4 Throttle position sensor (sub) ★ 5 Manifold absolute pressure sensor ★ 6 Inlet camshaft position sensor ★ 7 Engine coolant temperature sensor ★ 8 Detonation sensor ★ 9 Crank angle sensor ★10 Oxygen sensor (front) ★11 Oxygen sensor (rear)	● Power supply ● Ignition switch-IG ● Ignition switch-ST ● Accelerator pedal position sensor (main) ● Accelerator pedal position sensor (sub) ● Engine oil pressure switch ● Alternator FR terminal ● Alternator L terminal ● CAN communication (input signal)	⇨	Engine-ECU ● Barometric pressure sensor	⇨	☆1 Injector ☆2 Inlet oil feeder control valve ☆3 Throttle valve control servo ☆4 Purge control solenoid valve	● Ignition coil ● Engine control relay ● Fuel pump relay ● Starter relay ● Throttle valve control servo relay ● A/C compressor relay ● Alternator G terminal ● Oxygen sensor (front) heater ● Oxygen sensor (rear) heater ● CAN communication (input signal)



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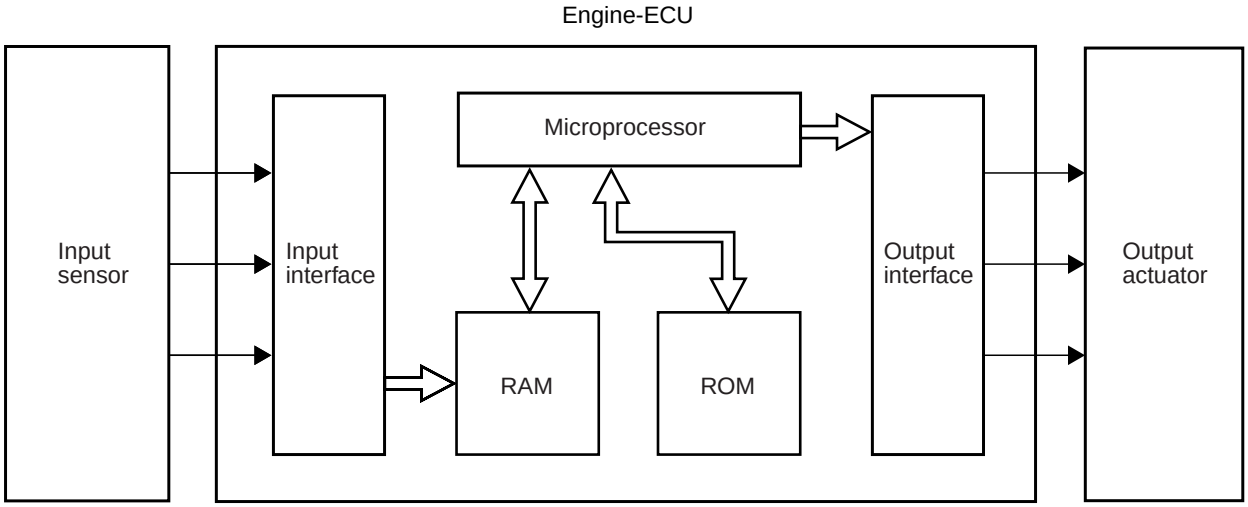
CONTROL UNIT

M2132021500960

ENGINE-ECU



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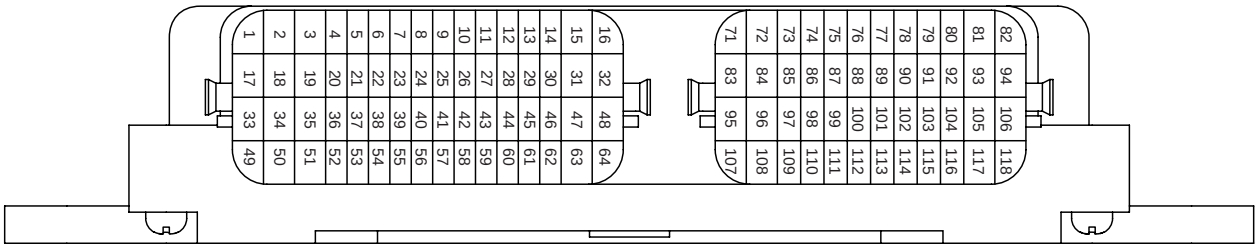
Engine-ECU is installed in the engine room. Engine-ECU judges (calculates) the optimum control to deal with the constant minute changes in driving conditions based on information input from the sensors and drives the actuator. Engine-ECU is composed of 32-bit microprocessor and Random Access Memory (RAM), Read Only Memory (ROM) and Input /Output interface. Engine-ECU uses flash-memory ROM that allows re-writing of data so that change and correction of control data is possible using special tools. It also uses Electrically Erasable Programmable Read Only Memory (EEPROM) so that studied compensation data is not deleted even if battery terminals are disconnected.

ENGINE-ECU CONNECTOR INPUT/OUTPUT PIN ARRANGEMENT



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Terminal No.	Terminal code	Terminal name	Terminal No.	Terminal code	Terminal name
1	OCVI	Inlet oil feeder control valve	2	INJ1	No. 1 injector
3	INJ2	No. 2 injector	4	CIL1	No. 1 ignition coil
5	CIL2	No. 2 ignition coil	6	NTSW	Starter active signal
8	SGT	Crank angle sensor	9	5V	Sensor supplied voltage
10	TPSM	Throttle position sensor (main)	11	TPSS	Throttle position sensor (sub)

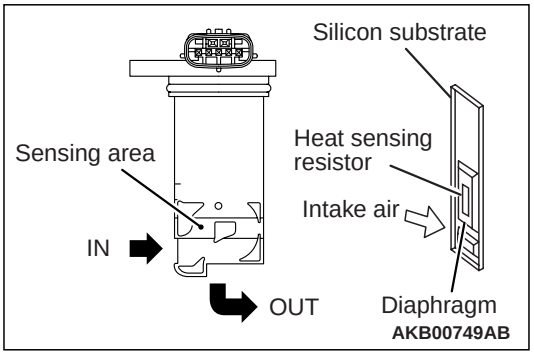
Terminal No.	Terminal code	Terminal name	Terminal No.	Terminal code	Terminal name
12	TPS5	Power supply voltage applied to throttle position sensor	13	TPSE	Throttle position sensor earth
14	CPI	Inlet camshaft position sensor	15	ETV+	Throttle valve control servo (+)
16	ETV−	Throttle valve control servo (−)	18	INJ3	No. 3 injector
19	INJ4	No. 4 injector	20	CIL3	No. 3 ignition coil
21	CIL4	No. 4 ignition coil	24	SGTE	Crank angle sensor earth
25	K/S	Detonation sensor (+)	26	WTS	Engine coolant temperature sensor
27	WTSE	Engine coolant temperature sensor earth	30	CPIE	Inlet camshaft position sensor earth
34	OHFL	Oxygen sensor (front) heater	35	OHRL	Oxygen sensor (rear) heater
36	OPSW	Oil pressure switch	37	PURG	Purge control solenoid valve
38	O2FL	Oxygen sensor (front)	39	OFLE	Oxygen sensor (front) offset voltage
40	O2RL	Oxygen sensor (rear)	41	ORLE	Oxygen sensor (rear) offset voltage
42	K/SE	Detonation sensor (−)	44	MAP5	Power supply voltage applied to manifold absolute pressure sensor
45	MAP	Manifold absolute pressure sensor	46	MAPE	Manifold absolute pressure sensor earth
60	ALTG	Alternator G terminal	61	ALTF	Alternator FR terminal
62	ALTL	Alternator L terminal	71	RSG	Throttle valve control servo earth
72	RSB	Power supply voltage applied to throttle valve control servo	73	C/R	Engine control relay
74	APSM	Accelerator pedal position sensor (main)	75	APS5	Power supply voltage applied to accelerator pedal position sensor (main)
76	APSE	Accelerator pedal position sensor (main) earth	77	APSS	Accelerator pedal position sensor (sub)
78	5VV	Power supply voltage applied to accelerator pedal position sensor (sub)	79	EV	Accelerator pedal position sensor (sub) earth
81	GNDE	Engine-ECU earth	82	BAT1	Power source
83	RSH	Throttle valve control servo earth	84	C/RL	Throttle valve control servo relay
87	AFS	Air flow sensor	88	AFSE	Air flow sensor earth
89	ATS	Intake air temperature sensor	90	CANH	CAN interface (high)

Terminal No.	Terminal code	Terminal name	Terminal No.	Terminal code	Terminal name
91	CANL	CAN interface (low)	92	IGN	Ignition switch-IG
93	GNDE	Engine-ECU earth	96	FP/R	Fuel pump relay
97	AFS5	Air flow sensor reference voltage	102	AC/R	A/C compressor relay
103	FMB	Flash EP-ROM data rewriting power source	104	BACK	Backup power source
105	ST	Ignition switch-ST	106	STRL	Starter relay
108	BRK	Brake switch			

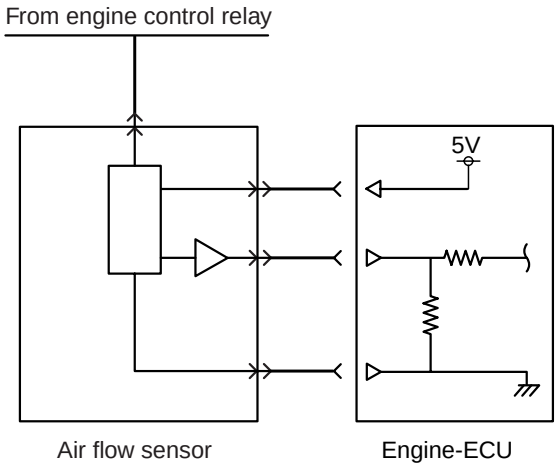
SENSOR

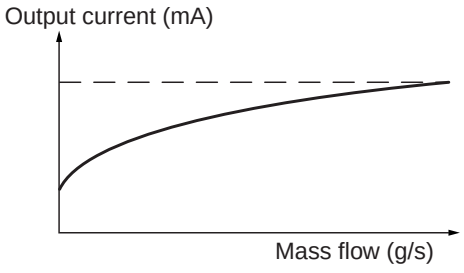
M2132001001472

AIR FLOW SENSOR



Air flow sensor is installed in the air intake hose. Air flow sensor is composed of an extremely small heat-sensing resistor. The air flow sensor controls the amount of electric current flowing into the heat sensing resistor to keep the heat sensing resistor at a constant temperature to the intake air temperature. When the air mass flow rate increases, the air flow speed is higher and also the amount of heat transfer from the heat sensing resistor to the air increased. Therefore, the air flow sensor increases the amount of electric current to the heat sensing resistor. Thus, the amount of electric current increases in accordance with the air mass flow rate. The air flow sensor measures the air mass flow rate by detecting the amount of electric current. The air flow sensor amplifies the detected electric current amount and outputs it into the engine-ECU. Engine-ECU uses this output current and engine speed to calculate and decide basic fuel injection time. Sensor properties are as shown in the figure.





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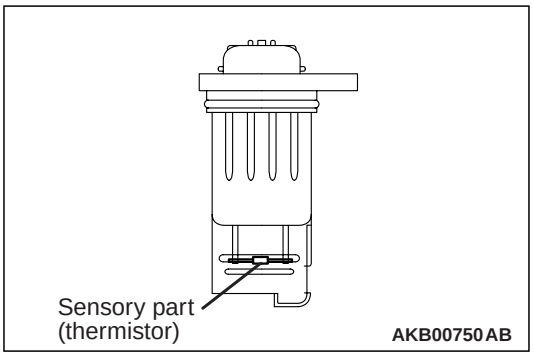
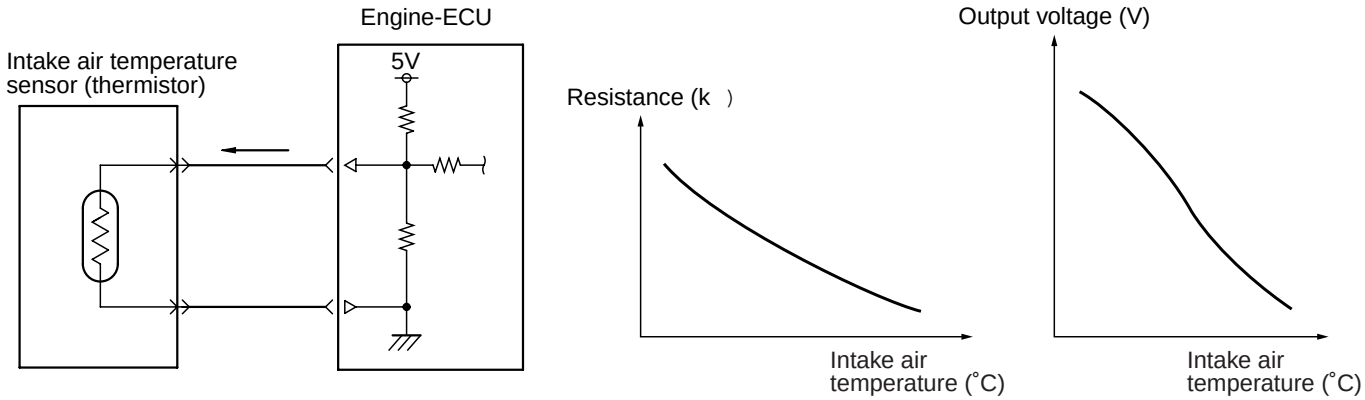
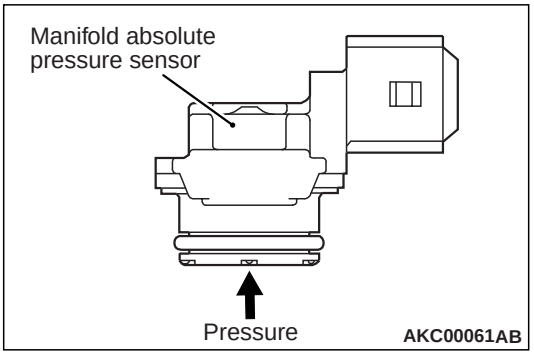
INTAKE AIR TEMPERATURE SENSOR



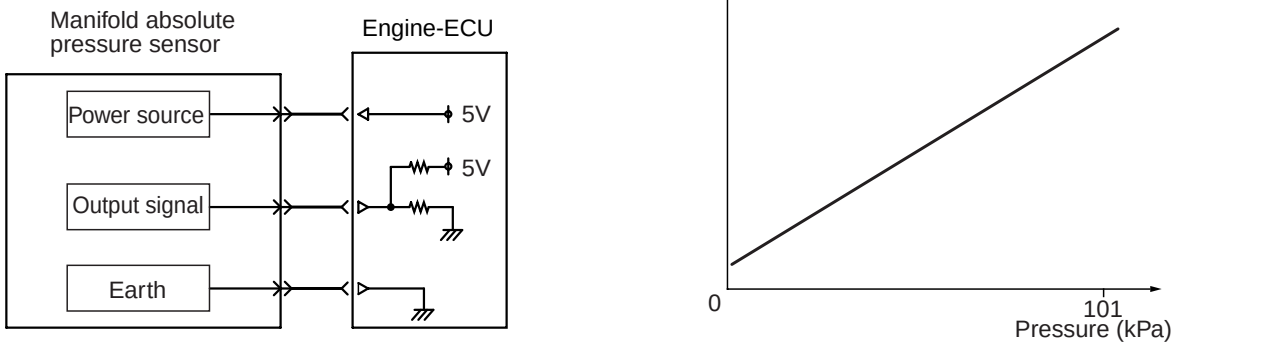
Intake air temperature sensor is built in to the air flow sensor. Intake air temperature sensor detects intake air temperature through thermistor's resistance change and outputs the voltage according to intake air temperature to engine-ECU. Engine-ECU uses this output voltage to compensate fuel injection control and ignition timing control. Sensor properties are as shown in the figure.



MANIFOLD ABSOLUTE PRESSURE SENSOR



The manifold absolute pressure sensor is installed in the inlet manifold. Manifold absolute pressure sensor uses a piezo resistive semiconductor to output the voltage according to manifold absolute pressure to engine-ECU. Engine-ECU uses this output voltage to compensate fuel injection volume according to manifold absolute pressure. Sensor properties are as shown in the figure.



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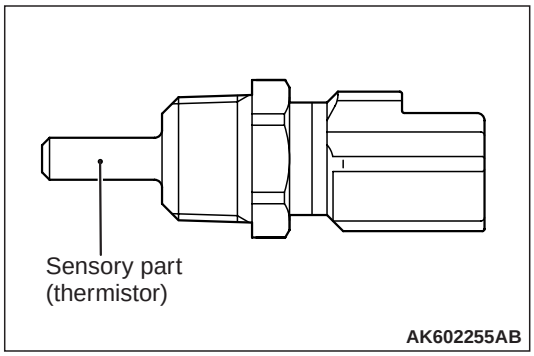
ENGINE COOLANT TEMPERATURE SENSOR



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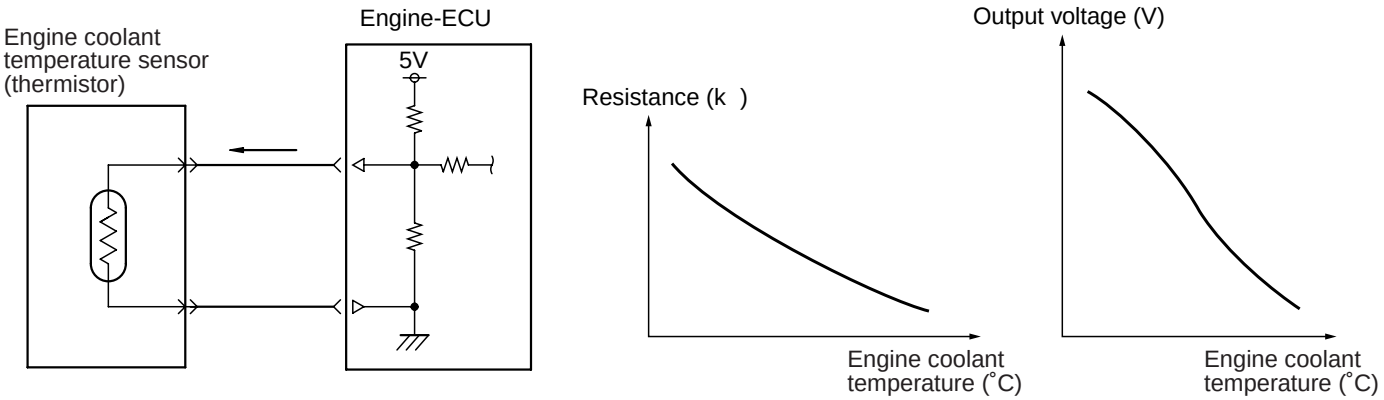
The engine coolant temperature sensor is installed in the thermostat housing. Engine coolant temperature sensor uses thermistor's resistance change to detect coolant temperature and output the voltage according to coolant temperature to engine-ECU.
Engine-ECU uses this output voltage to appropriately control fuel injection volume, idle speed and ignition timing when the engine is cold. Sensor properties are as shown in the figure.



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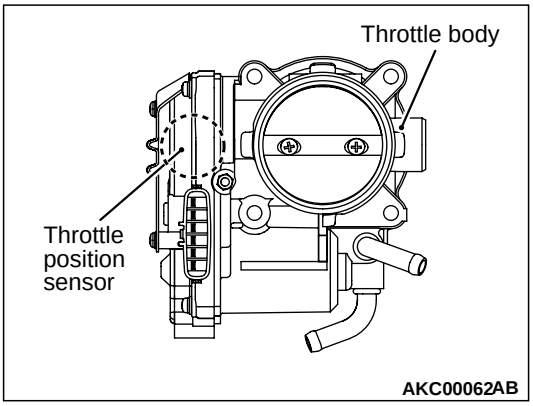
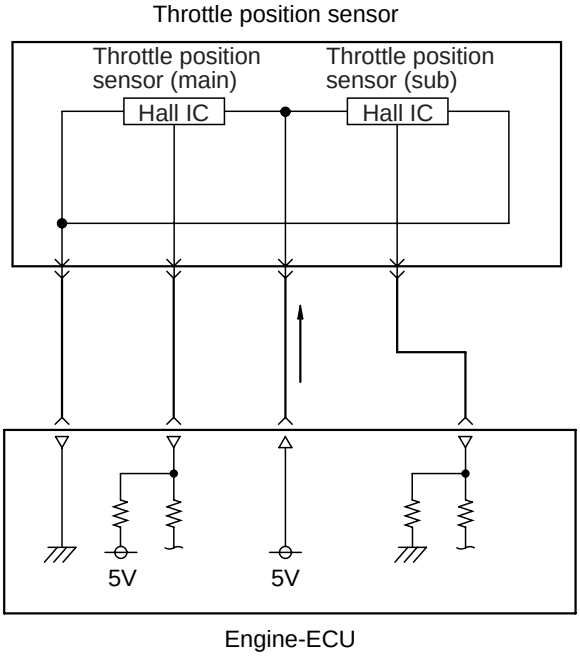
THROTTLE POSITION SENSOR

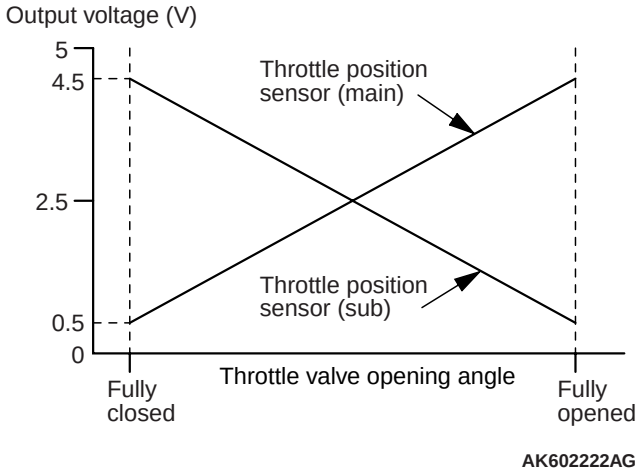


The throttle position sensor is installed in the throttle body. Throttle position sensor outputs voltage to engine-ECU based on the throttle shaft rotation angle. Engine-ECU uses this signal to detect the throttle valve opening angle to perform throttle valve control servo feedback control. This throttle position sensor uses Hall IC and is a non-contact type.

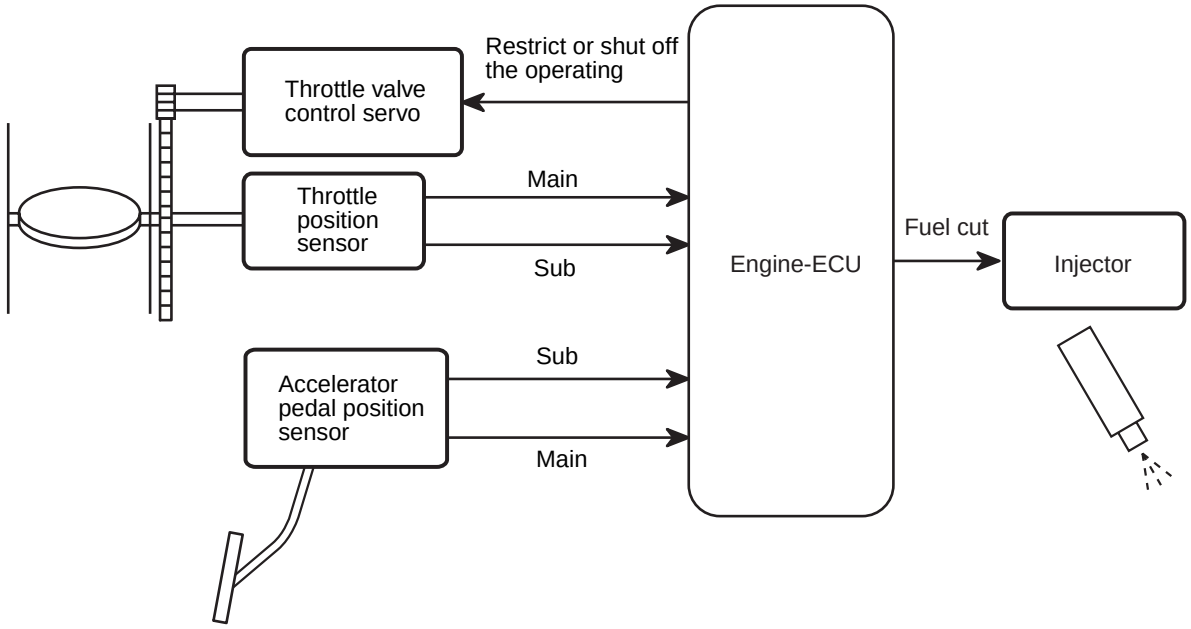
STRUCTURE AND SYSTEM

Throttle position sensor is composed of a permanent magnet fixed on the throttle shaft, Hall IC that outputs voltage according to magnetic flux density and a stator that efficiently introduces magnetic flux from the permanent magnet to Hall IC.
Magnetic flux density at Hall IC is proportional to the output voltage.
Throttle position sensor has 2 output systems – throttle position sensor (main) and throttle position sensor (sub), and the output voltage is output to engine-ECU. When throttle valve turns, output voltage of throttle position sensor (main) and throttle position sensor (sub) changes. This allows engine-ECU to detect actual throttle opening angle. Engine-ECU uses this output voltage for throttle valve control servo feedback control. The relationship between throttle opening angle and output voltage of the throttle position sensor (main) and throttle position sensor (sub) is as shown in the figure below.





When abnormality is detected



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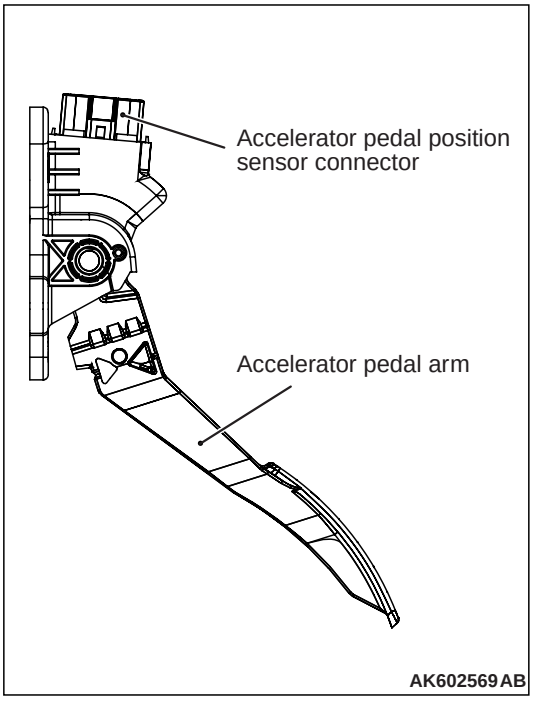
Engine-ECU compares output voltage of the throttle position sensor (main) and throttle position sensor (sub) to check for abnormality in the throttle position sensor. If the engine-ECU detects the abnormality, the emergency should be prevented by performing the fuel-safe control.

- When 1-system malfunctions
  The engine ECU should perform the throttle valve position control by only using the signal having no malfunctions. Depressing the accelerator pedal half way can perform the control. Performing the fuel cut can increase the engine rotation speed.
- When 2-system malfunctions
  The engine ECU should cut the energization of the throttle valve control servo. At that time, the spring built in the throttle valve can slightly open the throttle valve. This allows the engine ECU to control the engine output.

ACCELERATOR PEDAL POSITION SENSOR



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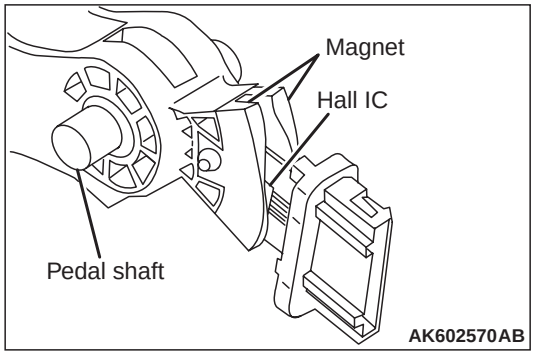
Accelerator pedal position sensor is integrated with accelerator pedal, and detects accelerator opening angle. Engine-ECU uses the output voltage of this sensor to control appropriate throttle valve opening angle and fuel injection volume. This accelerator pedal position sensor uses Hall IC and is a non-contact type.

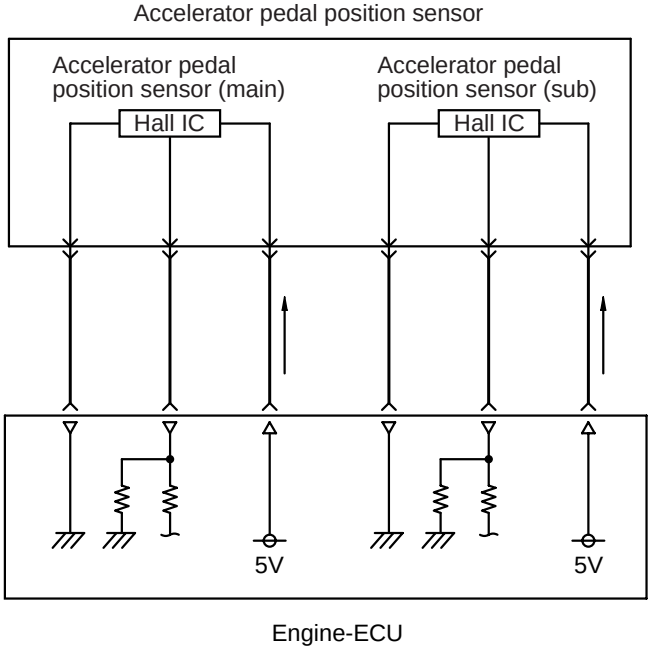
STRUCTURE AND SYSTEM

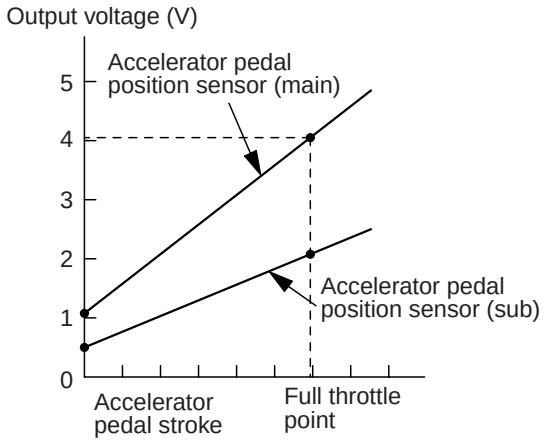


Accelerator pedal position sensor is composed of a permanent magnet fixed on the magnet carrier of the pedal shaft, Hall IC outputs voltage according to magnetic flux density and a stator that efficiently introduces magnetic flux from the permanent magnet to Hall IC.

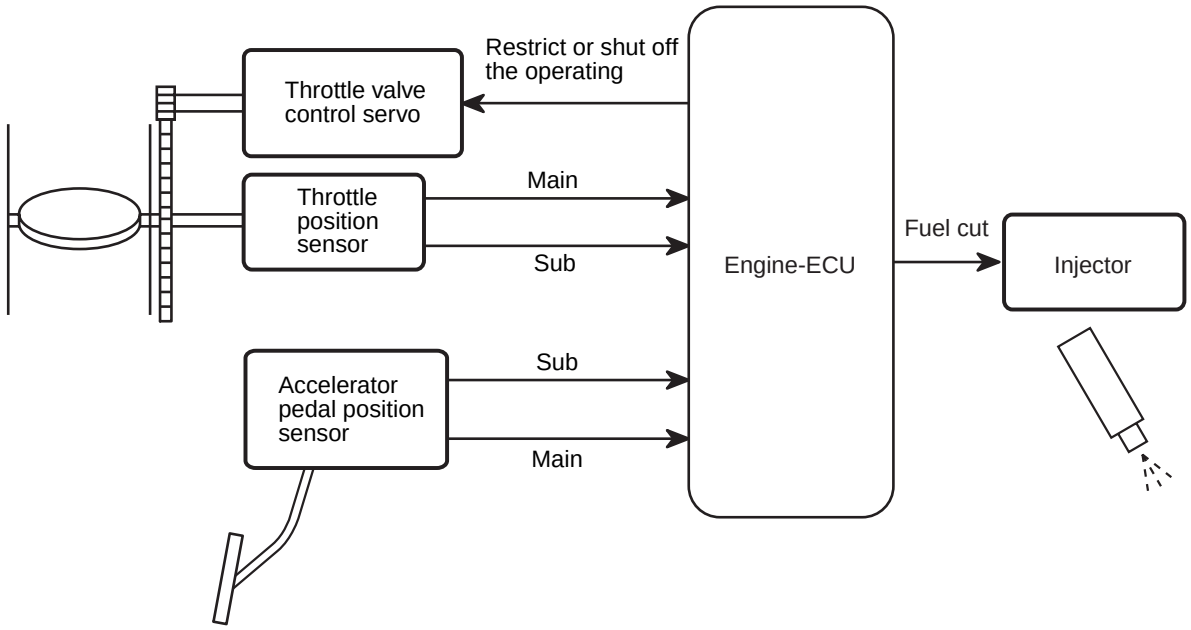
Magnetic flux density at Hall IC is proportional to the output voltage.

The accelerator pedal position sensor has 2 output systems – accelerator pedal position sensor (main) and accelerator pedal position sensor (sub), and the output voltage is output to engine-ECU. According to depression of the accelerator pedal, output voltage of the accelerator pedal position sensor (main) and accelerator pedal position sensor (sub) changes. This allows engine-ECU to detect the actual accelerator pedal depression amount. Engine-ECU uses accelerator pedal position sensor (main) output voltage for appropriate throttle valve opening angle control and fuel injection volume control. Also, engine-ECU compares output voltage of the accelerator pedal position sensor (main) and accelerator pedal position sensor (sub) to check for abnormality in sensor. The relationship between accelerator opening angle and output voltage of the accelerator pedal position sensor (main) and accelerator pedal position sensor (sub) is as shown in the figure below.





When abnormality is detected



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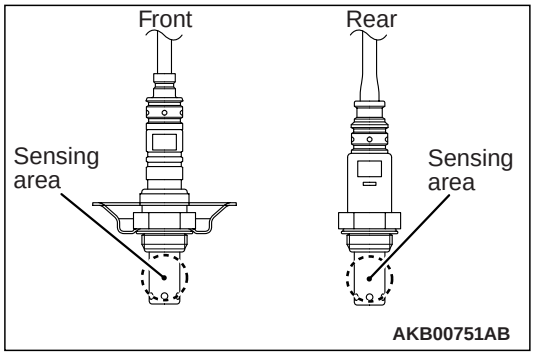
Engine-ECU compares output voltage of the accelerator pedal position sensor (main) and accelerator pedal position sensor (sub) to check for abnormality in sensor. If the engine-ECU detects the abnormality, the emergency should be prevented by performing the fuel-safe control.

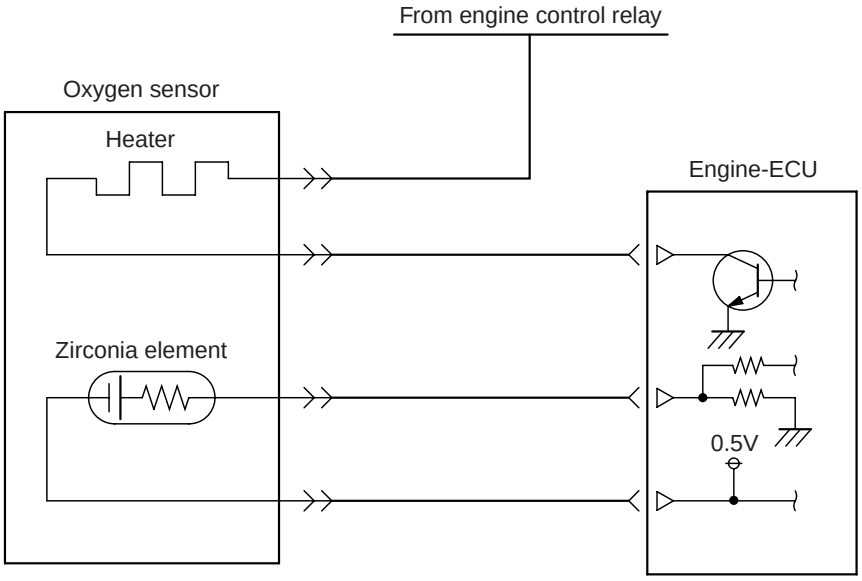
- When 1-system malfunctions
  The engine-ECU should detect the amount of accelerator pedal depressed by only using the signal having no malfunctions. Depressing the accelerator pedal half way can perform the control. Performing the fuel cut can increase the engine rotation speed.
- When 2-system malfunctions
  The engine-ECU should cut the energization of the throttle valve control servo. At that time, the spring built in the throttle valve can slightly open the throttle valve. This allows the engine-ECU to control the engine output.

OXYGEN SENSOR



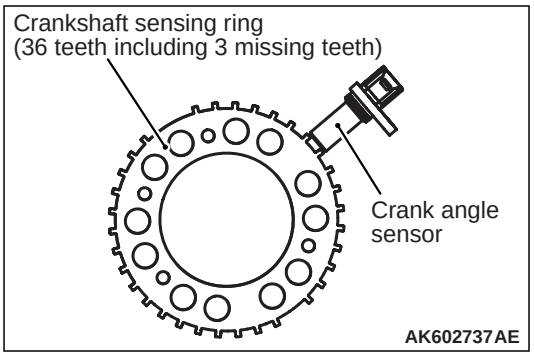
The oxygen sensor (front) is installed in the exhaust manifold. The oxygen sensor (rear) is installed in the exhaust front pipe.
Oxygen sensor has a built-in heater to help early activation of the sensor. This allows feedback control of air-fuel ratio soon after engine start.

This sensor uses the oxygen concentration cell principle of solid electrolyte (zirconia) and displays the property of sudden change in output voltage near theoretical air-fuel ratio. This property is used to detect oxygen density in exhaust gas. Feedback to engine-ECU allows it to judge whether air-fuel ratio is rich or lean compared to theoretical air-fuel ratio. This allows engine-ECU precise feedback control to get theoretical air-fuel ratio with best cleaning efficiency of 3-way catalytic converter.



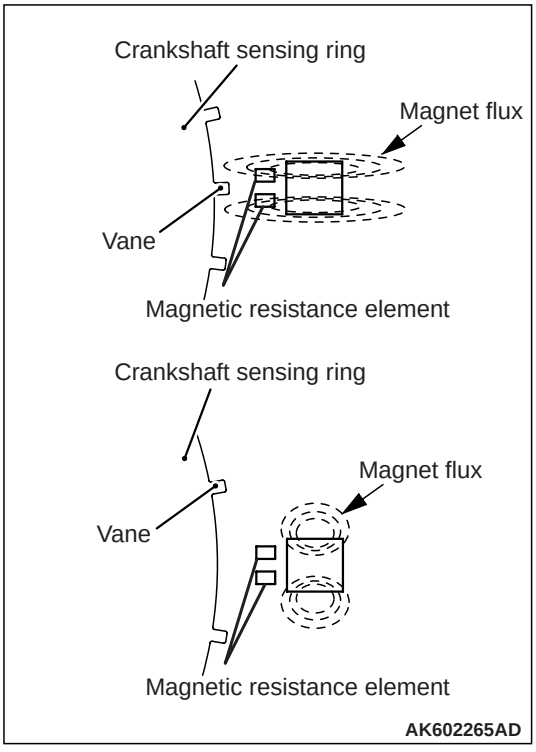
AK602576AB

CRANK ANGLE SENSOR



AK602737AE

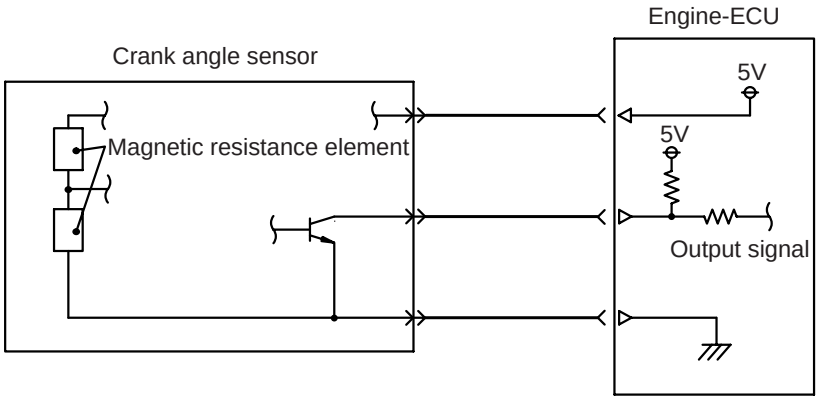
A crank angle sensor is installed on the exhaust side of the cylinder block. The crank angle sensor monitors rotation of crankshaft sensing ring (36 teeth including 3 missing teeth) installed on the crankshaft and converts to voltage (pulse signal) that is output to engine-ECU. Engine-ECU uses crank angle sensor's output pulse to detect crankshaft position.



AK602265AD

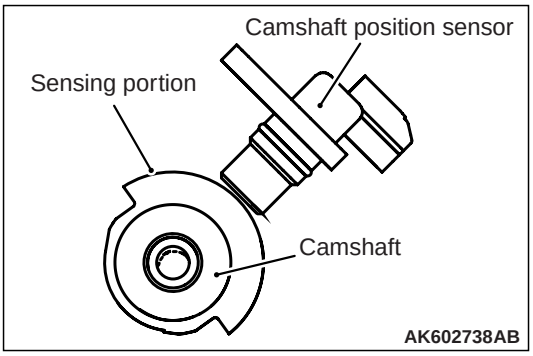
The crank angle sensor uses a magnetic resistance element. When the vane of the crankshaft-sensing ring passes the front surface of the magnetic resistance element, the flux from the magnet passes the magnetic resistance element. Thus, resistance of the magnetic resistance element increases. When the vane of the crankshaft-sensing ring does not pass the front surface of the magnetic resistance element,

the flux from the magnet does not pass the magnetic resistance element and the resistance decreases. The crank angle sensor converts this change in resistance of the magnetic resistance element to a 5 V pulse signal and outputs it to engine-ECU.

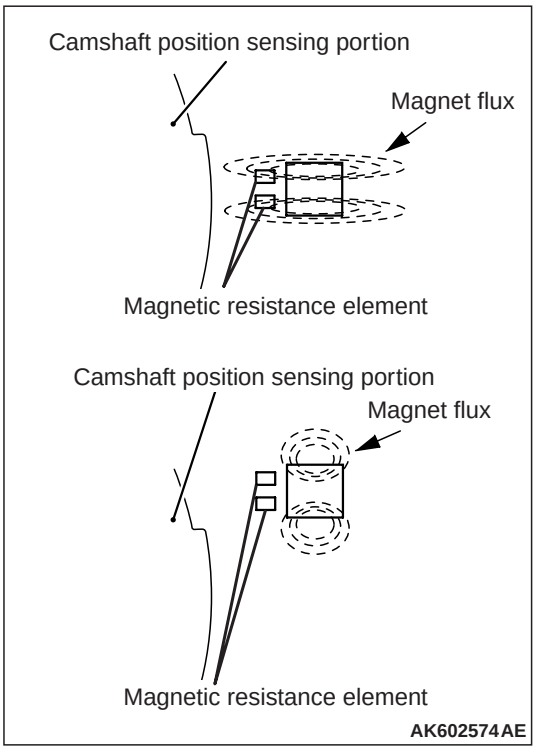


AK602285AB

INLET CAMSHAFT POSITION SENSOR

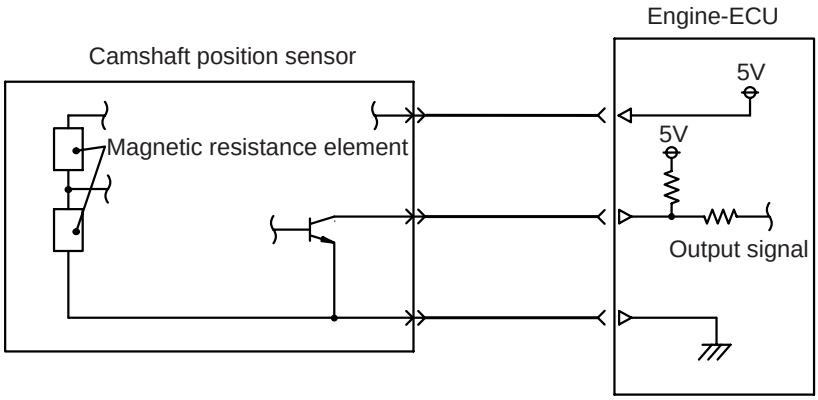


The inlet camshaft position sensor is installed on the inlet side of the cylinder head. The inlet camshaft position sensor monitors shape of the half-moon sensing portion and converts to voltage (pulse signal) that is output to engine-ECU. Upon receiving this output voltage, the engine-ECU effects feedback control to optimize the phase of the inlet camshaft. Also, engine-ECU uses a combination of the camshaft position sensor output pulse signal and crankshaft position sensor output pulse signal to identify cylinders in the compression process.



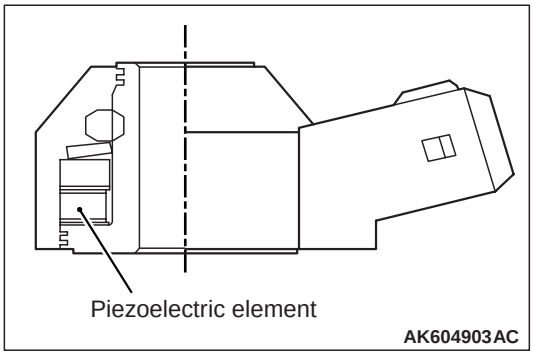
The inlet camshaft position sensor uses a magnetic resistance element. When the camshaft position sensing portion passes the front surface of the magnetic resistance element, the flux from the magnet passes the magnetic resistance element. Thus, resistance of the magnetic resistance element increases. When the camshaft position sensing portion does not pass the front surface of the magnetic resistance element, the flux from the magnet does

not pass the magnetic resistance element and the resistance decreases. The inlet camshaft position sensor converts this change in resistance of the magnetic resistance element to a 5 V pulse signal and outputs it to engine-ECU.

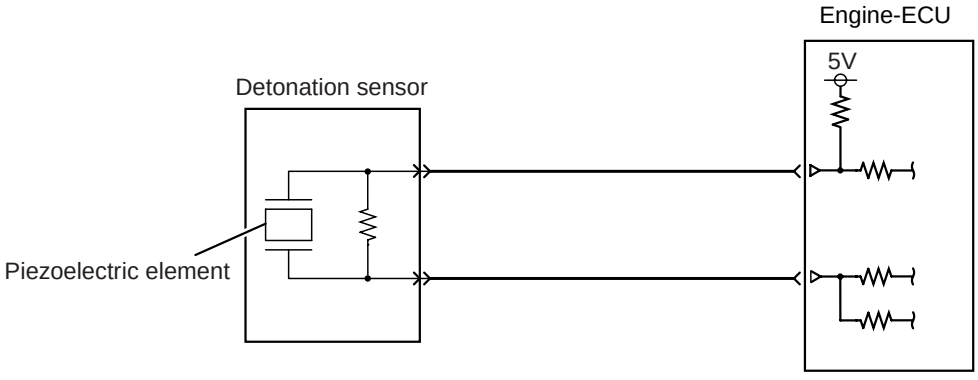


AK602287AB

DETONATION SENSOR



A detonation sensor is installed on the inlet side of the cylinder block. Detonation sensor uses the piezoelectric element to convert the vibration of the cylinder block generated when engine is in operation to minute voltage that is output to engine-ECU. Engine-ECU uses the minute output voltage from the detonation sensor filtered through the cylinder block's natural frequency to detect knocking, and compensates the ignition timing lag according to the strength of the knocking.



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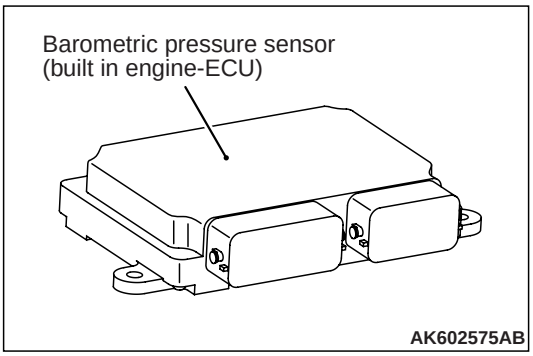
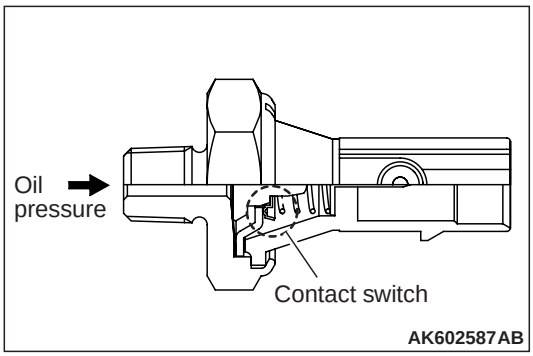
BAROMETRIC PRESSURE SENSOR

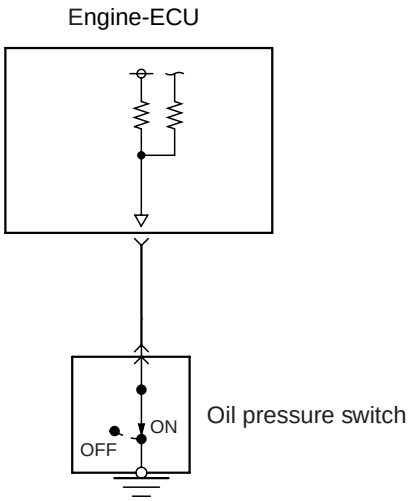


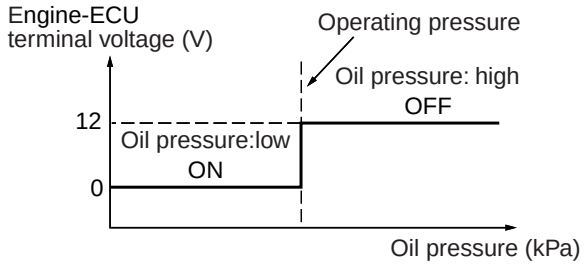
A barometric pressure sensor is built into engine-ECU. The barometric pressure sensor is a semiconductor diffused pressure element which outputs voltage to engine-ECU according to atmospheric pressure. Engine-ECU uses this output voltage to sense the altitude of the vehicle and compensates fuel injection volume to achieve the appropriate air-fuel ratio for that altitude.

OIL PRESSURE SWITCH



The oil pressure switch is installed on the inlet side of the cylinder block. The oil pressure switch detects whether the oil pressure is high or low using the contact switch. When the oil pressure becomes higher than the specified value after the engine starts, the contact point of the oil pressure switch opens. This allows the engine-ECU to detect the oil pressure is higher than the specified value. The engine-ECU outputs the OFF signal to the combination meter through the CAN and then turns off the oil pressure warning lamp.

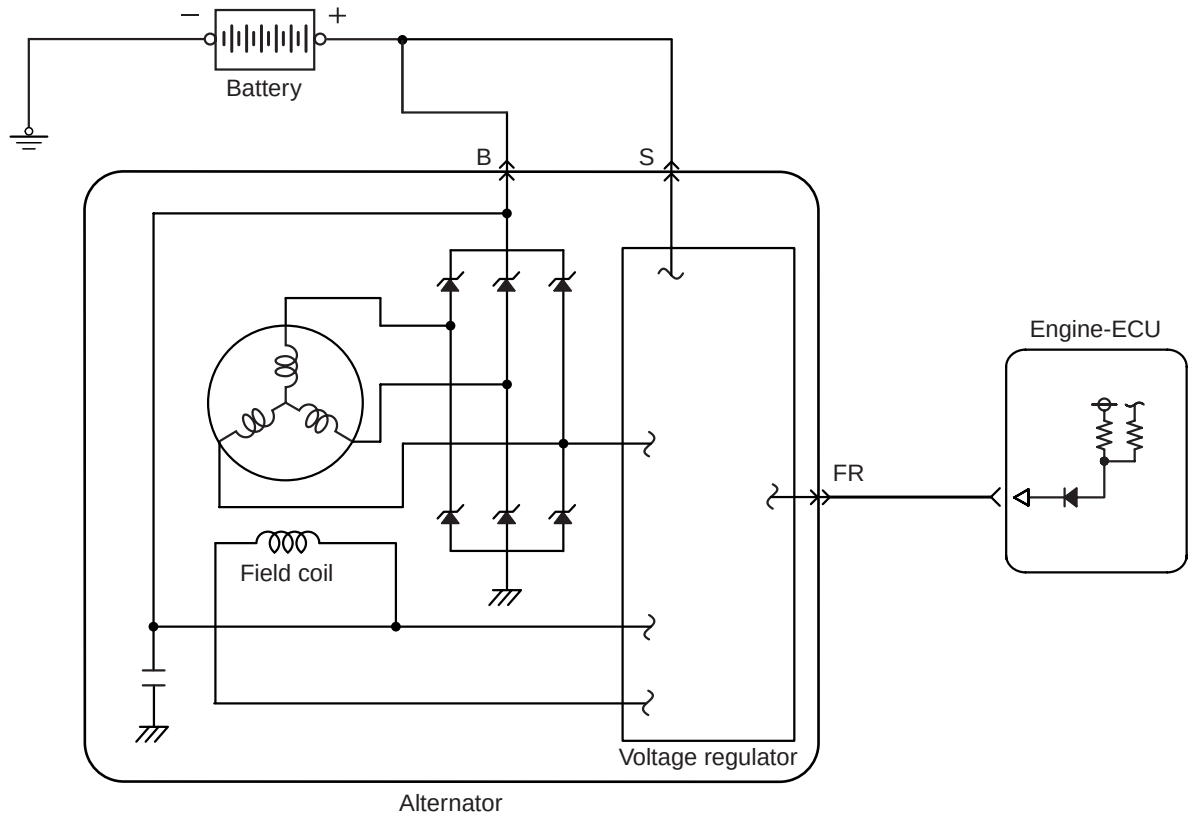




AK602228AF

ALTERNATOR FR TERMINAL

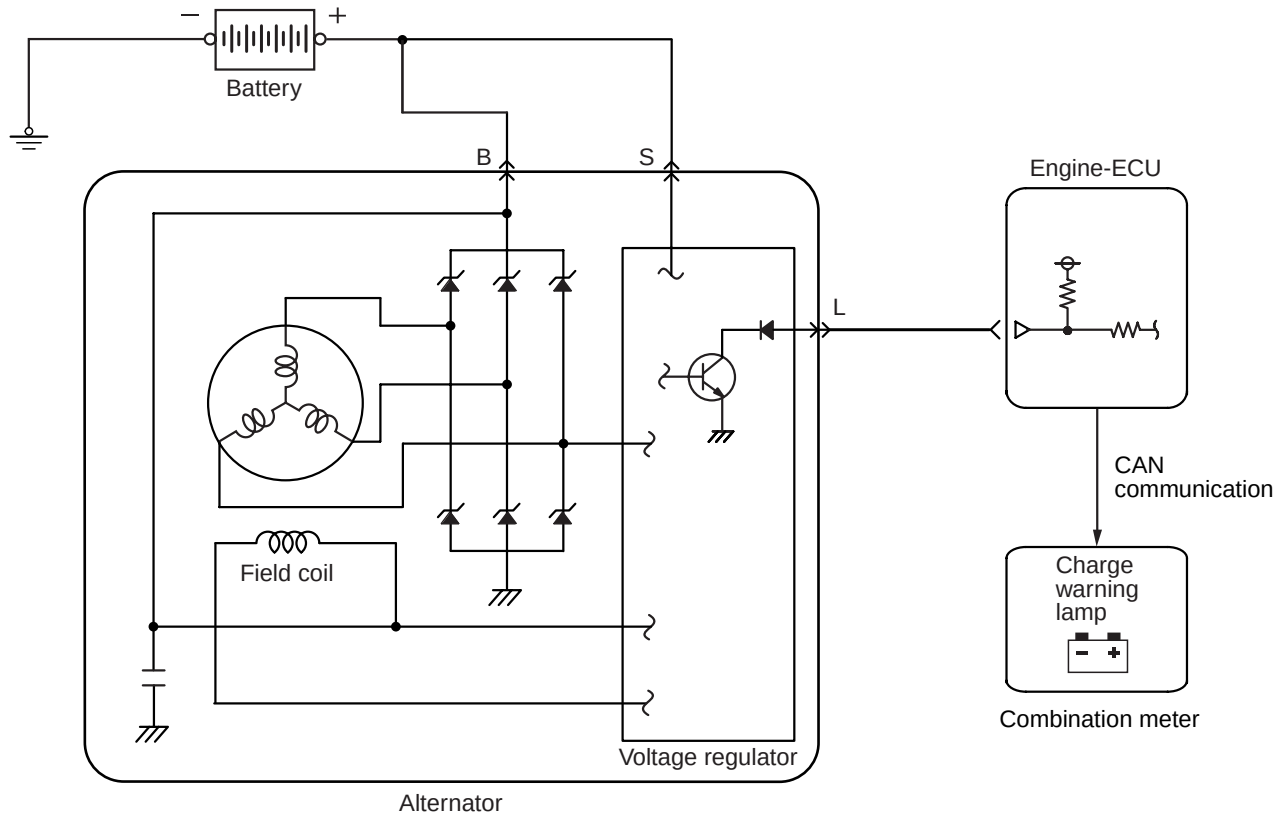
Alternator turns ON/OFF the power transistor in the voltage regulator to adjust current flow in the field coil according to alternator output current. In this way alternator output voltage is kept adjusted (to about 14.4 V). The ratio of power transistor ON time (ON duty) is output from alternator FR terminal to engine-ECU. Engine-ECU uses this signal to detect alternator output current and drives throttle valve control servo according to output current (electric load). This prevents change in idle speed due to electric load and helps maintain stable idle speed.



AK604998AB

ALTERNATOR L TERMINAL

After turning on the ignition switch, the current is input by the engine-ECU to the alternator L terminal. This allows the voltage regulator to be on and the field coil to be excited. When the alternator rotates in this situation, the voltage is excited in the stator coil and the current is output from B-terminal through the commutation diode. Also the generated voltage is input to the voltage regulator through the commutation diode. After the electric generation begins, the current is supplied to the field coil from this circuit. In addition, the generated voltage is output from the alternator L terminal to the engine-ECU. This allows the engine-ECU to detect that the electric generation begins. The engine-ECU outputs the ON signal to the combination meter through the CAN and then turns off the charge lamp.

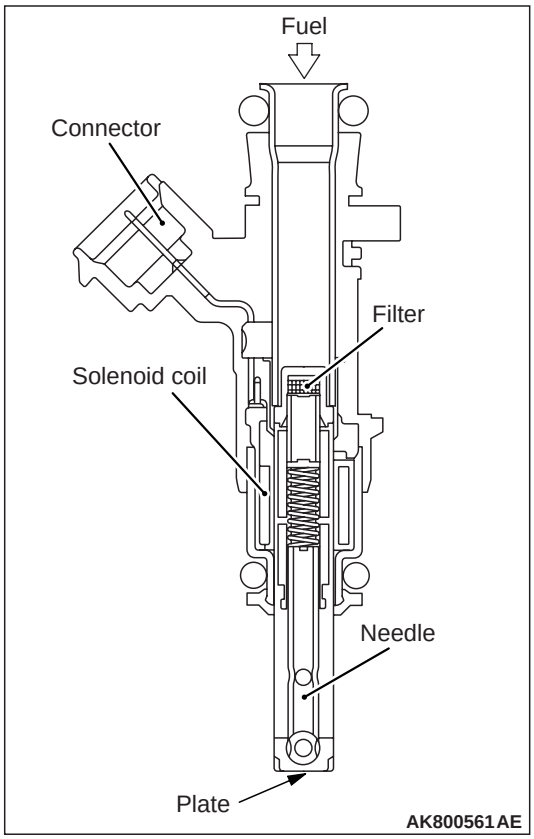

−
+
Battery
B
S
Engine-ECU
L
CAN
communication
Charge
warning
lamp
Field coil
Voltage regulator
Combination meter
Alternator

AK604999 AB

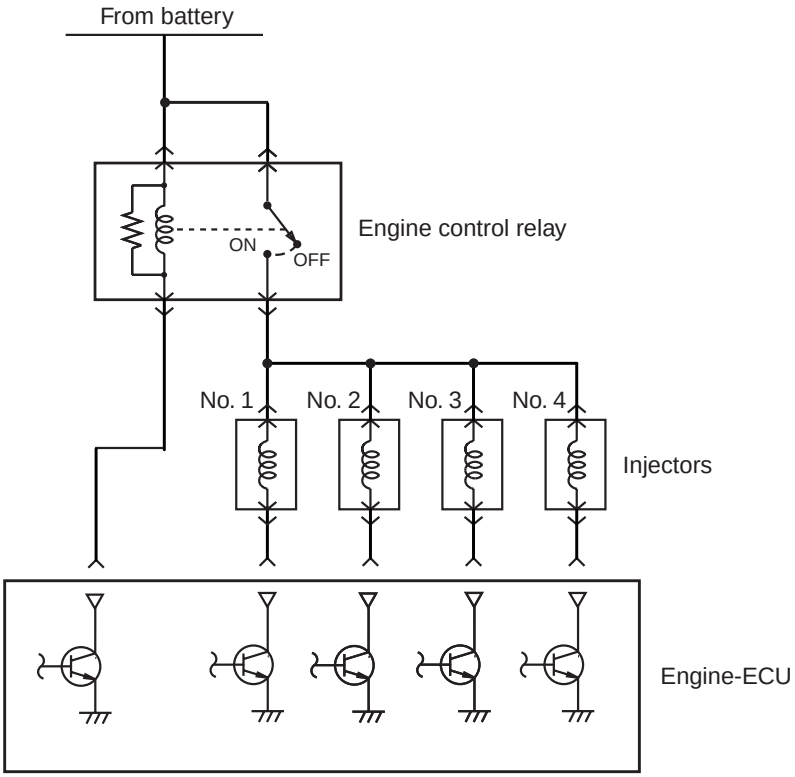
ACTUATOR

M2132002001129

INJECTOR



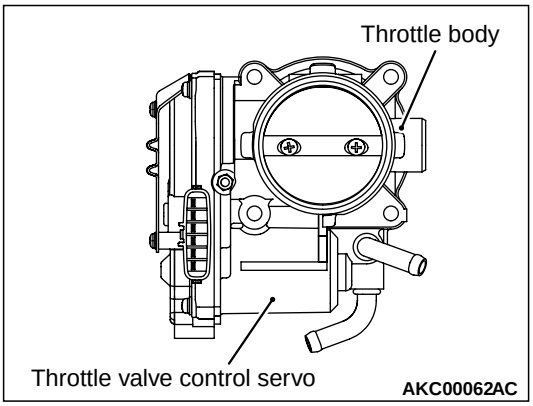
An injector is an injection nozzle with the electromagnetic valve that injects fuel based on the injection signal sent by engine-ECU. 1 injector is installed in the inlet manifold of each cylinder and fixed to the delivery pipe. When electricity flows through the solenoid coil, the needle gets sucked in. The needle gets pulled till the fully open position so that the injection hole is fully open and the fuel gets injected.



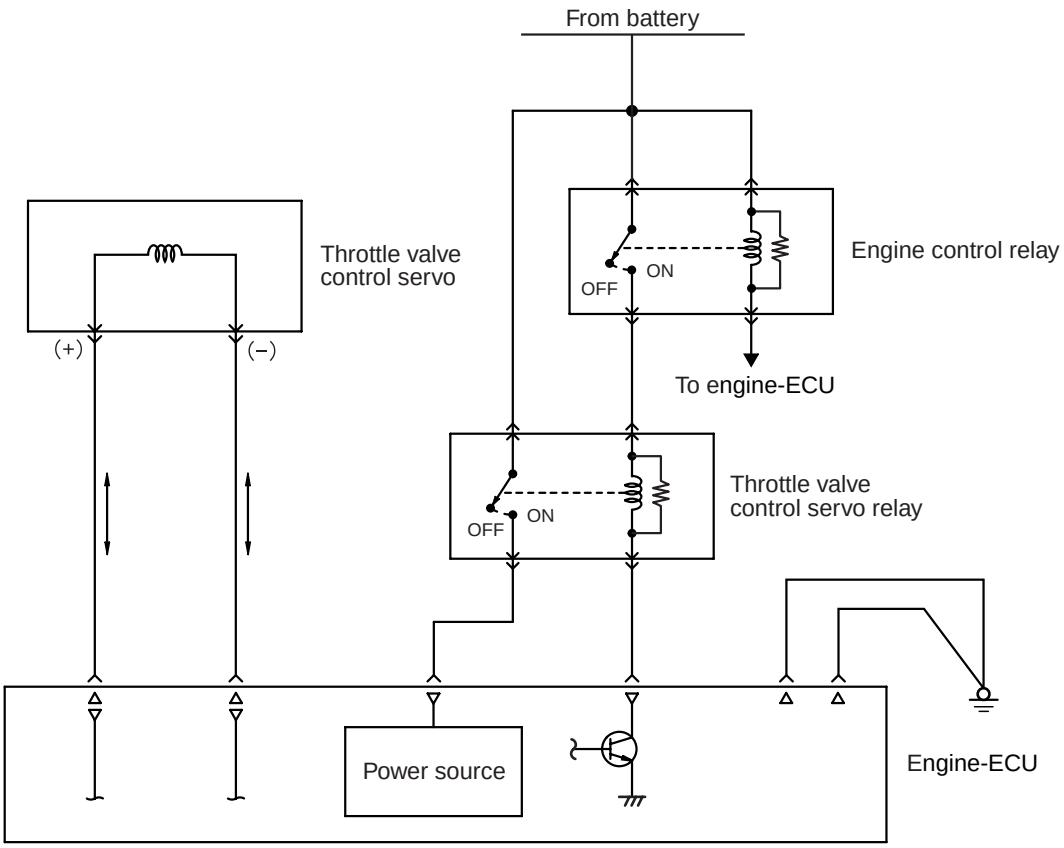
AKB00844AB

Voltage from the battery gets applied from the injector relay to the injector and up to the engine-ECU. Engine-ECU turns ON its power transistor and prepares the injector's earth circuit. Thus, current flows through the injector while power transistor is ON and the injector injects fuel.

THROTTLE VALVE CONTROL SERVO



A throttle valve control servo is installed in throttle body. The throttle valve control servo performs the Open/Close of the throttle valve through the reduction gear. Engine-ECU changes current direction according to the Open/Close direction and also changes current to the motor coil to control the throttle valve control servo.
Throttle valve control servo is composed of a good response, low energy, and small DC motor with brush and can generate rotation force corresponding to the current applied on the coil. When there is no current passing through the throttle valve control servo, the throttle valve remains at a prescribed opening angle. So, even if current stops because of a fault in the system, a minimum level of running remains possible.



AK602231AF

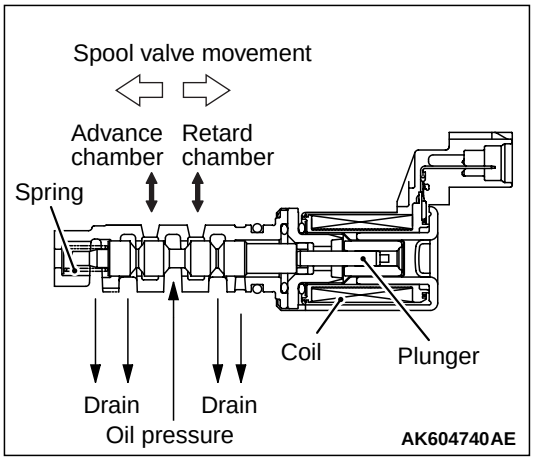
IGNITION COIL

Refer to GROUP 16 – Ignition System – Ignition Coil .

PURGE CONTROL SOLENOID VALVE

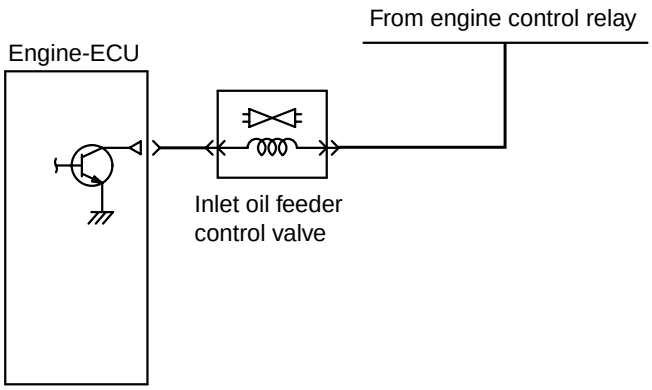
Refer to GROUP 17 – Emission Control <MPI> – Evaporative Emission Control System .

INLET OIL FEEDER CONTROL VALVE



AK604740AE

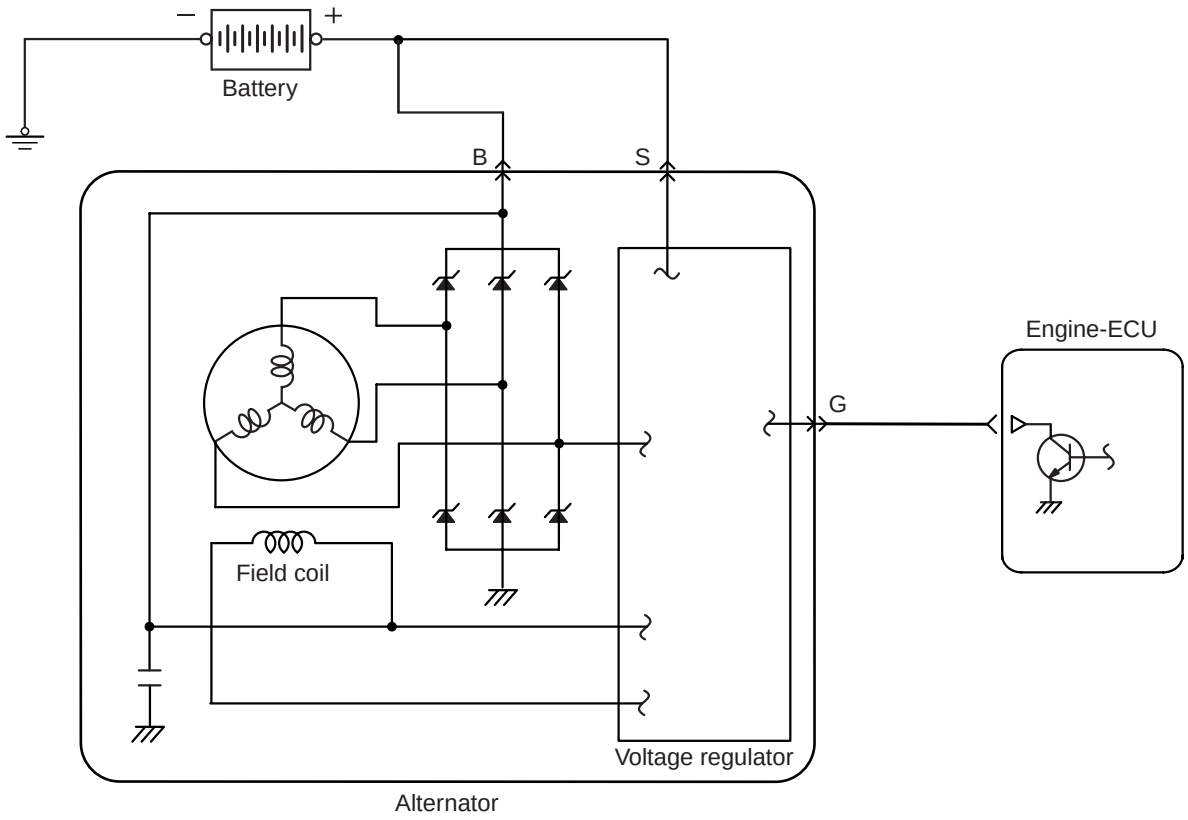
The inlet oil feeder control valve is installed on the inlet side of the cylinder head. Receiving the duty signal from the engine-ECU, the inlet oil feeder control valve operates the spool valve position and divides the oil pressure from the cylinder block into the advanced chamber and the retarded chamber of the V.V.T. sprocket as well as continually changes the inlet camshaft phase. The spring makes spool valve stop at the position where the inlet camshaft is at the most retarded angle when the engine is stopped. The engine-ECU operates the spool valve position by increasing and decreasing ON duty ratio of the inlet oil feeder control valve and allows the inlet camshaft to be at the target phase angle. When the duty ratio increases, the V.V.T. sprocket makes phase of inlet camshaft advanced angle side. When the duty ratio degreases, the V.V.T. sprocket makes phase of inlet camshaft retarded angle side. When the medium duty ratio, at which the spool valve is at the medium position, is achieved, all the oil passages are closed. This allows the phase angle to be kept constant. The engine-ECU changes and controls the duty ratio in accordance with the engine operation to get the optimum phase angle.



AK700721 AB

ALTERNATOR G TERMINAL

Engine-ECU uses ON/OFF of alternator G terminal to control alternator output voltage. When the power transistor in the engine-ECU turns ON, output voltage gets adjusted to about 12.8 V. When alternator output voltage drops to 12.8 V it becomes lower than voltage of the charged battery and almost no current is output from the alternator. When the power transistor in the engine-ECU turns OFF, output voltage gets adjusted to about 14.4 V. When alternator output voltage is about 14.4 V, alternator outputs current to produce electricity. In case electric load is generated suddenly, engine-ECU controls alternator G terminal's On-duty to limit the sudden increase in alternator load due to generation and thus prevents change in idle speed.



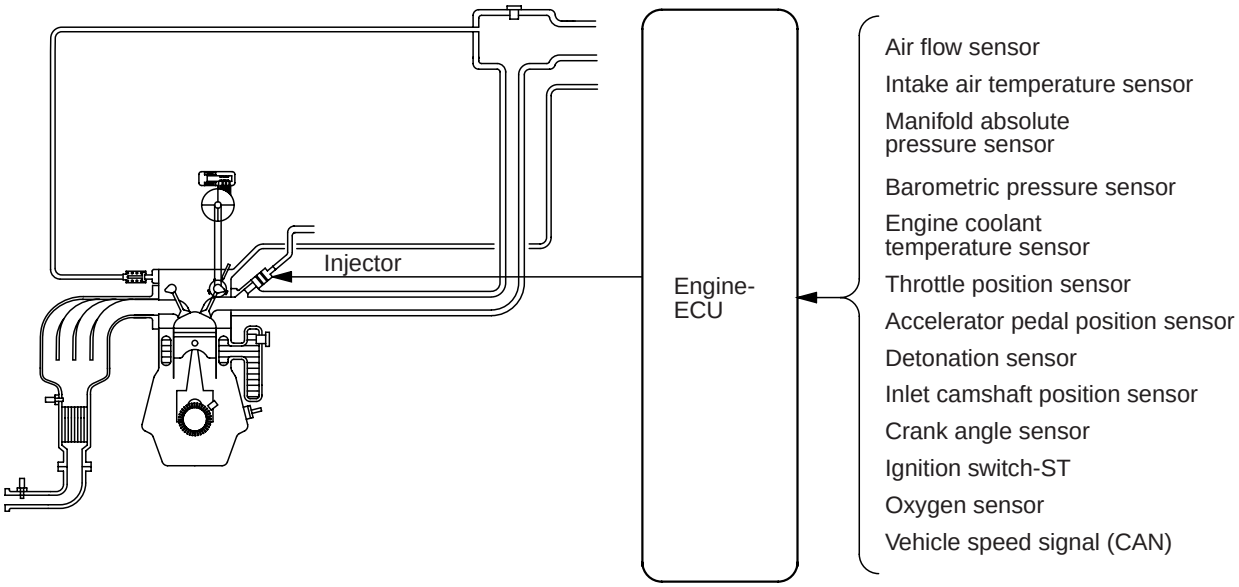
AK605000 AB

FUEL INJECTION CONTROL

M2132003001876

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

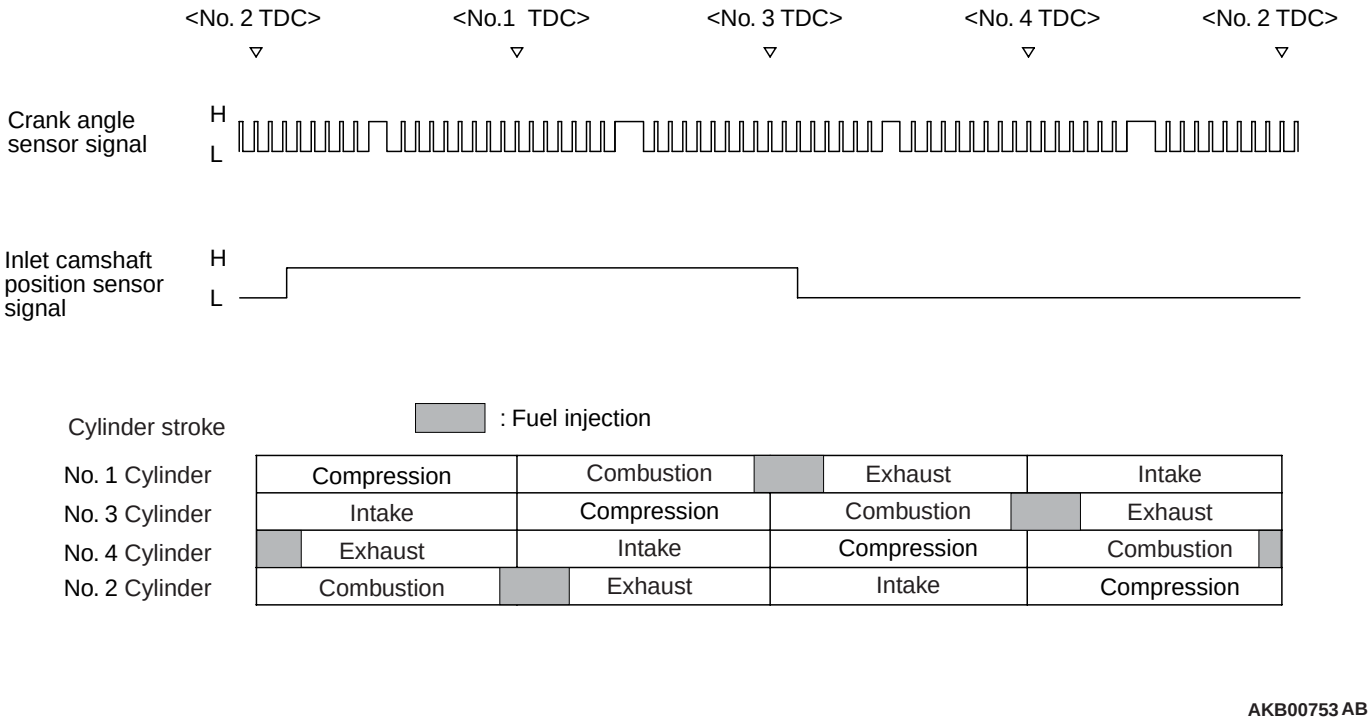


AKB00752AB

1. INJECTOR ACTUATION (FUEL INJECTION) TIMING

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

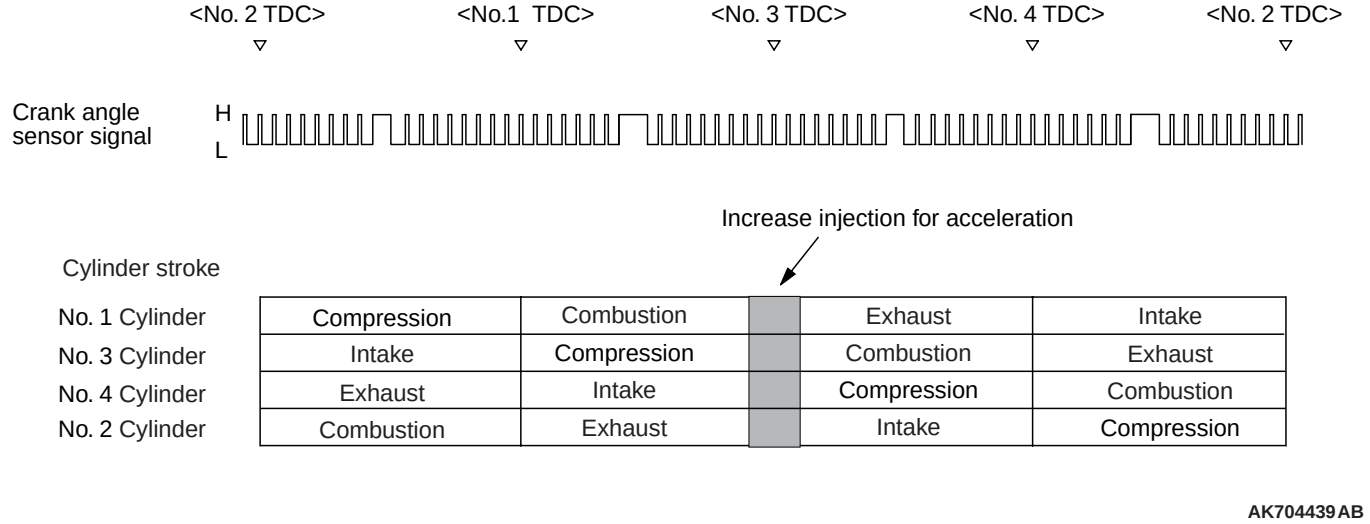
Fuel Injection During Cranking and Normal Operation



AKB00753 AB

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 inlet 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



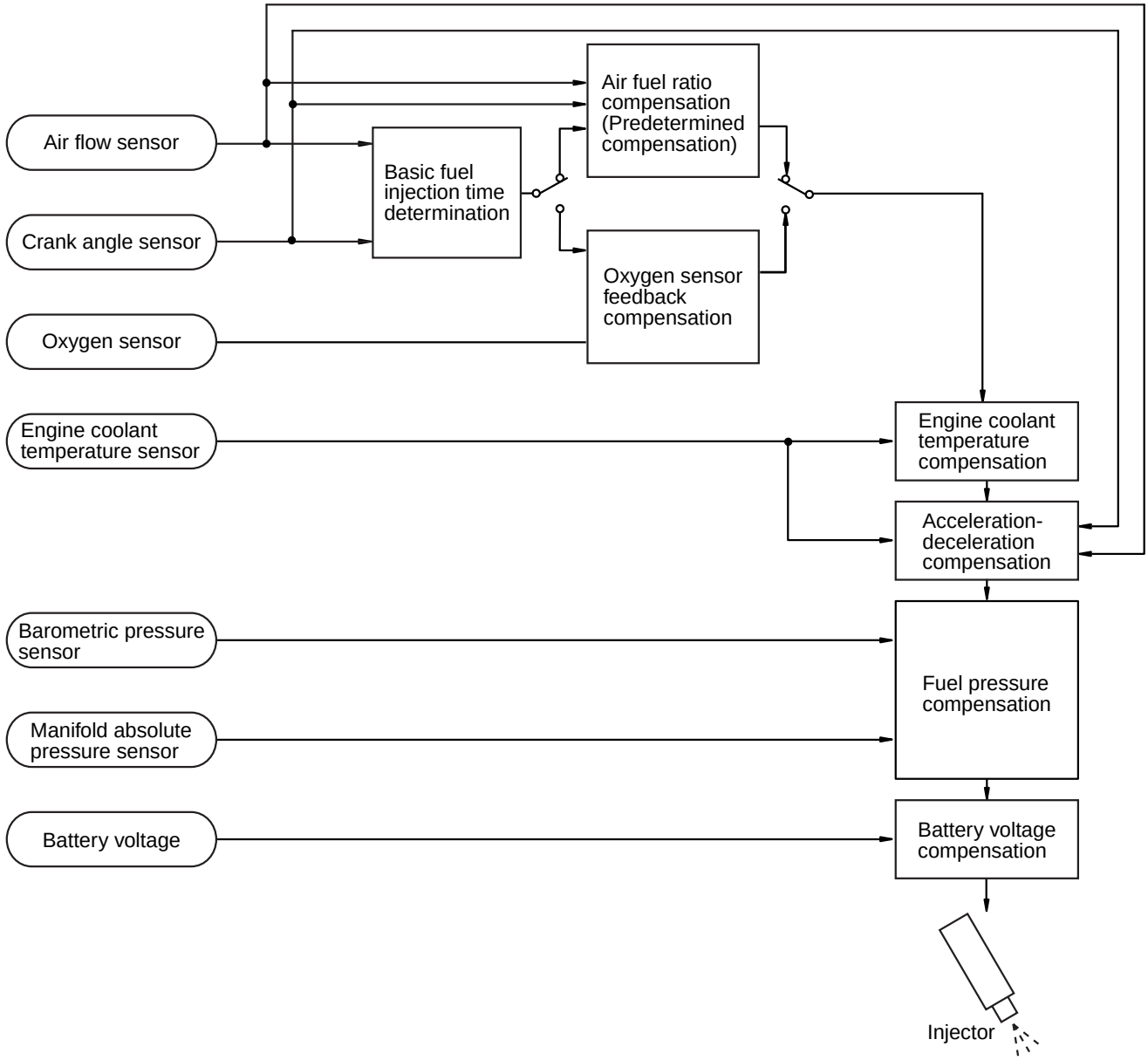
AK704439 AB

In addition to the synchronizing 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)



AK602278AB

[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
Oxygen sensor feedback compensation	The Oxygen 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 oxygen sensor (front) using the output signal of the oxygen sensor (rear). This allows the deviation of the output signal, caused by the deterioration of the oxygen sensor (front), to be solved, then the highly accurate exhaust gas control is performed.
Air-fuel ratio compensation	Under driving conditions where oxygen 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 atmospheric pressure and manifold absolute pressure. The greater the difference in pressure, the shorter 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 oxygen sensor. This allows system to compensate in accordance with engine characteristics.

[Fuel limit control during deceleration]

Engine-ECU limits fuel when decelerating downhill to prevent excessive rise of catalytic converter temperature and to improve fuel efficiency.

[Fuel-cut control when over-run]

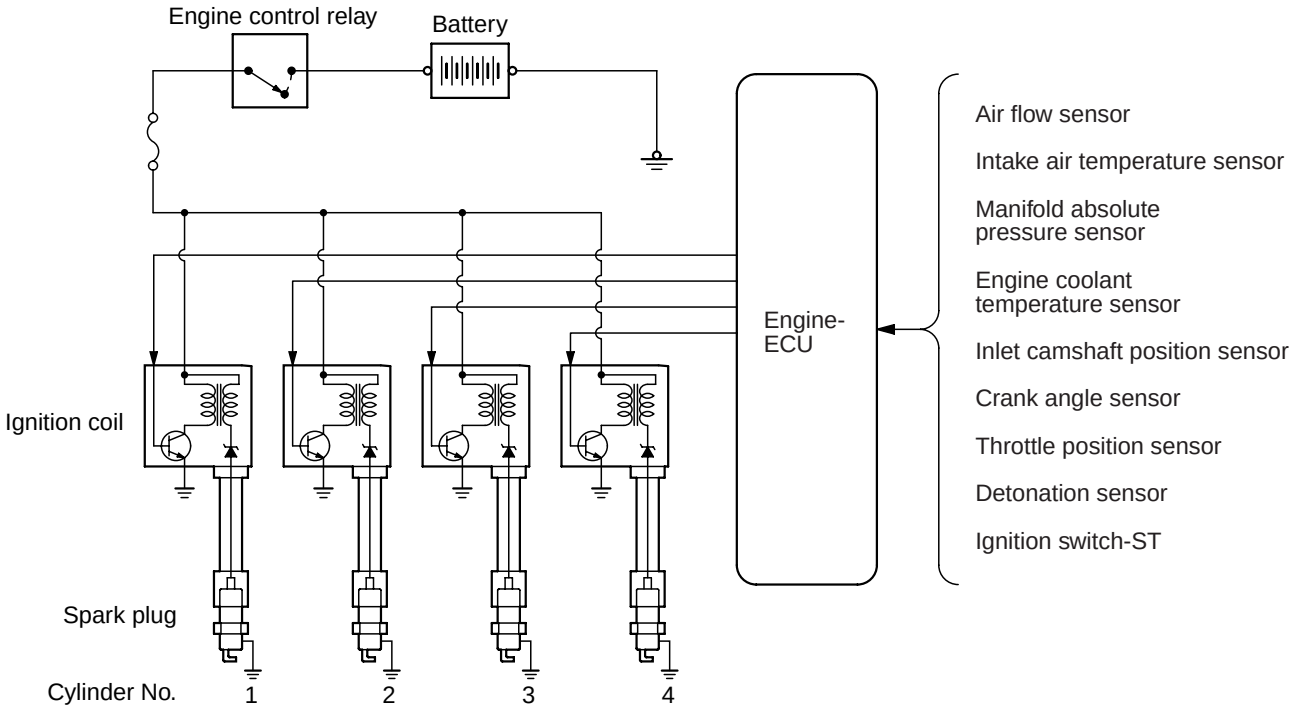
When engine speed exceeds a prescribed limit (6,600 r/min), engine-ECU cuts fuel supply to prevent overrunning and thus protect the engine.

IGNITION TIMING AND CONTROL FOR CURRENT CARRYING TIME

M2132027100573

Ignition timing is pre-set according to engine driving conditions. Compensations are made according to pre-set values depending on conditions such as engine coolant temperature, battery voltage etc. to decide optimum ignition timing. Primary current connect/disconnect signal is sent to the power transistor to control ignition timing. Ignition is done in sequence of cylinders 1, 3, 4, 2.

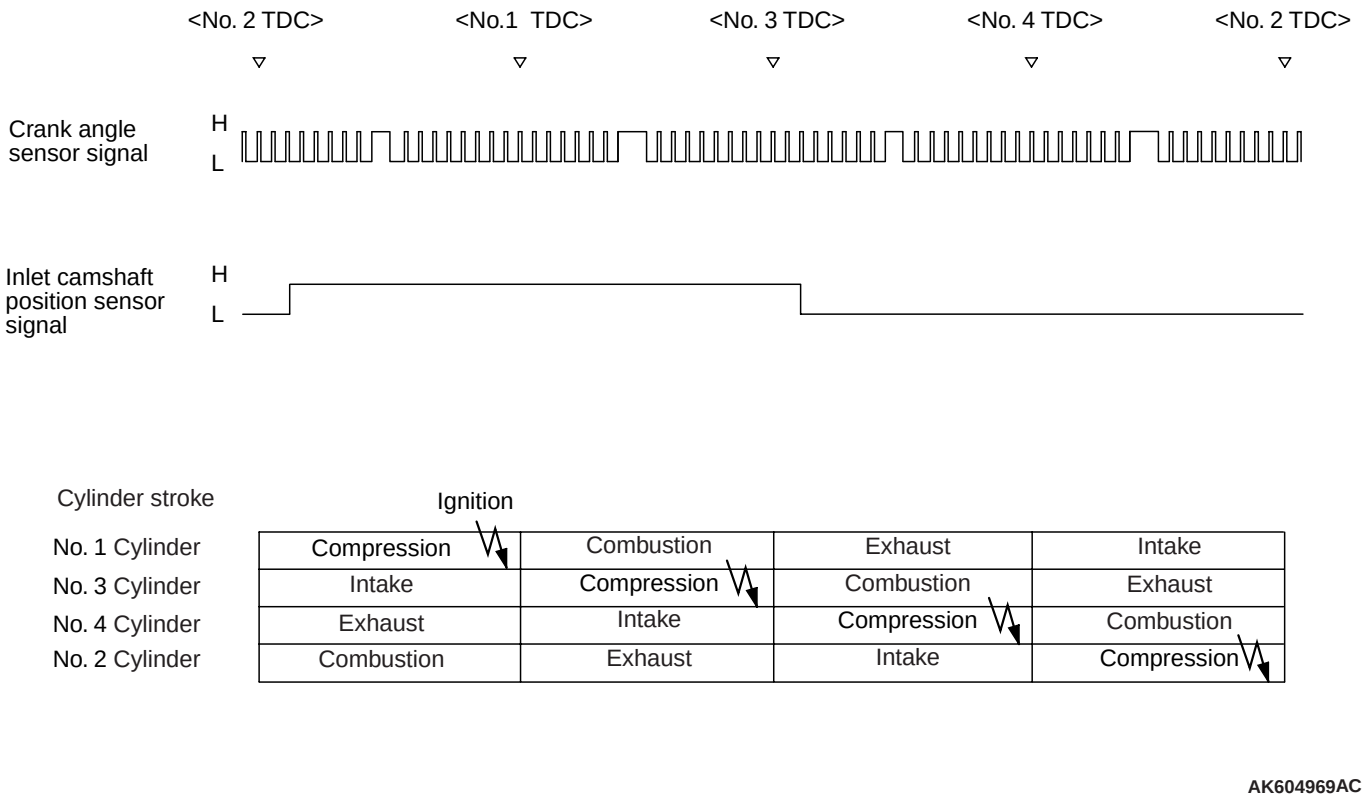
System Configuration Diagram



AK502722AN

1. Ignition power control

Based on the crankshaft position sensor signal and camshaft position sensor signal, engine-ECU decides the ignition cylinder, calculates the ignition timing and sends the ignition coil primary current connect/disconnect signal to the power transistor of each cylinder in the ignition sequence.



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2. Spark-advance control and current carrying time control

[During start]

Engine-ECU initiates ignition at fixed ignition timing (5° BTDC) synchronized with the crankshaft position sensor signal.

[During normal operation]

After determining the basic spark-advance based on the intake air volume and engine speed, engine-ECU makes compensations based on input from various sensors to control the optimum spark-advance and current carrying time.

List of main compensations for spark-advance control and current carrying time control

Compensations	Content
Intake air temperature compensation	Compensation is made according to intake air temperature. The higher the intake air temperature the greater the delay in ignition timing.
Engine coolant temperature compensation	Compensation is made according to engine coolant temperature. The lower the engine coolant temperature the greater the advance in ignition timing.
Knocking compensation	Compensation is made according to generation of knocking. The greater the knocking the greater the delay in ignition timing.
Stable idle compensation	Compensation is made according to change in idle speed. In case engine speed becomes lower than target speed, ignition timing is advanced.
Delay compensation when changing shift	During change of shift, sparking is delayed compared to normal ignition timing to reduce engine output torque and absorb the shock of the shift change.

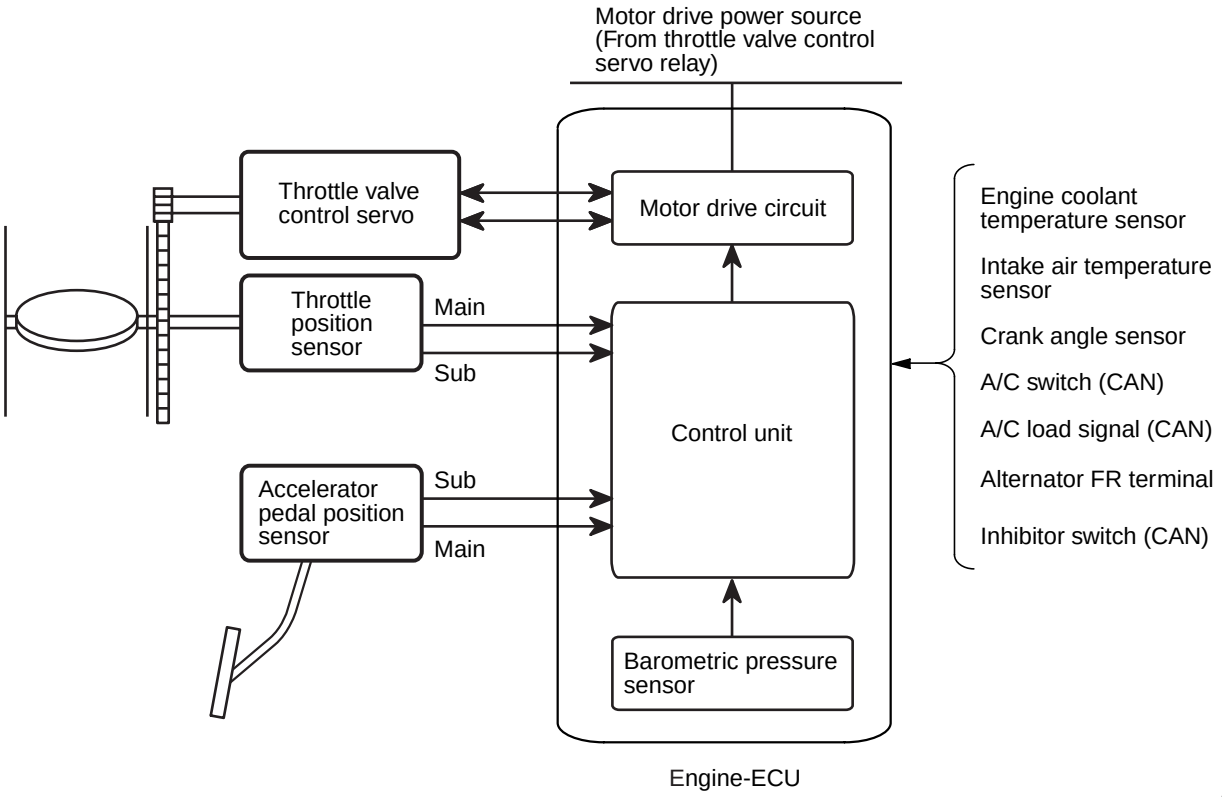
Compensations	Content
Battery voltage compensation	Compensation is made depending on battery voltage. The lower the battery voltage the greater the current carrying time and when battery voltage is high current carrying time is shortened.

[Control for checking ignition timing]
During basic ignition timing set mode for M.U.T.-III actuator test function, sparking is done with fixed ignition timing (5° BTDC) synchronized with crankshaft position sensor signal.

THROTTLE VALVE OPENING ANGLE CONTROL AND IDLE SPEED CONTROL

M2132003501053

Engine-ECU detects the amount of accelerator pedal depression (as per operator's intention) through the accelerator pedal position sensor. Based on pre-set basic target opening angles it adds various compensations and controls the throttle valve opening angle according to the target opening angle.



AK602236AQ

While starting
Engine-ECU adds various compensations to the target opening angle that are set based on the engine coolant temperature, so that the air volume is optimum for starting.

While idling

Engine-ECU controls the throttle valve to achieve the target opening angle that are set based on the engine coolant temperature. In this way best idle operation is achieved when engine is cold and when it is hot. Also, the following compensations ensure optimum control.

While driving

Compensations are made to the target opening angle set according to the accelerator pedal opening angle and engine speed to control the throttle valve opening angle.

List of main compensations for throttle valve opening angle and idle speed control

Compensations	Content
Stable idle compensation (immediately after start)	In order to stabilize idle speed immediately after start, target opening angle is kept big and then gradually reduced. Compensation values are set based on the engine coolant temperature.
Rotation speed feedback compensation (while idling)	In case there is a difference between the target idle speed and actual engine speed, engine-ECU compensates the throttle valve opening angle based on that difference.
Atmospheric pressure compensation	At high altitudes atmospheric pressure is less and the intake air density is low. So, the target opening angle is compensated based on atmospheric pressure.
Engine coolant temperature compensation	Compensation is made according to the engine coolant temperature. The lower the engine coolant temperature the greater the throttle valve opening angle.
Electric load compensation	Throttle opening angle is compensated according to electric load. The greater the electric load, the greater the throttle valve opening angle.
Compensation when shift is in D range	When transmission is changed from P or N range to some other range, throttle valve opening angle is increased to prevent reduction in engine speed.
Compensation when A/C is functioning	Throttle opening angle is compensated according to functioning of A/C compressor. While A/C compressor is being driven, the throttle valve opening angle is increased.

Initialize control

After ignition switch turns OFF, engine-ECU drives the throttle valve from fully closed position to fully open position and records the fully closed/open studied value of the throttle position sensor (main and sub) output signals. The recorded studied values are used as studied value compensation for compensating basic target opening angle when the engine is started next.

Engine protection control

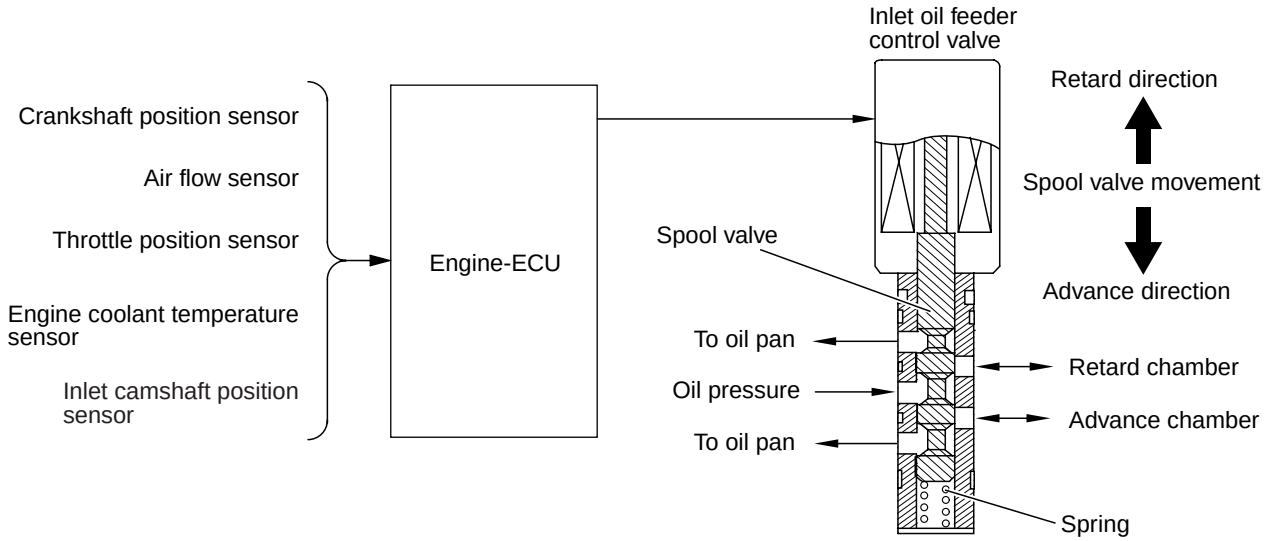
When the racing is continued during the vehicle stopped period (no-load period) for more than the specified time, the engine-ECU closes the throttle valve and restricts the engine speed to protect the engine.

MIVEC (Mitsubishi Innovative Valve Timing Electronic Control System)

M2132023500911

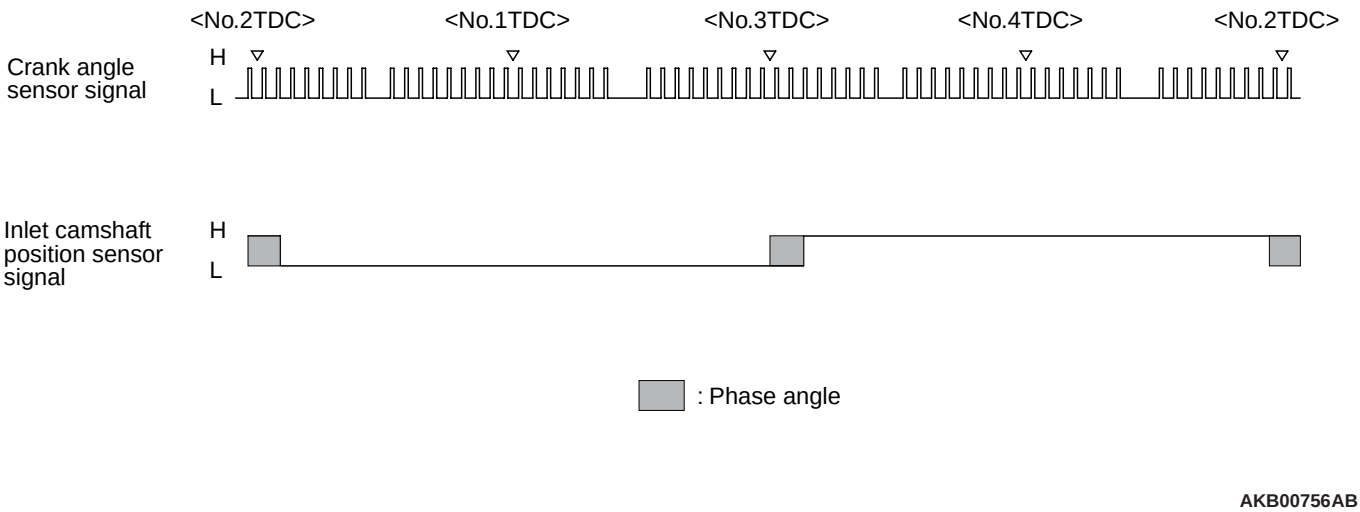
The MIVEC system effects a continuously variable control on the inlet valve timing. The valve operating angle is not change. MIVEC enables valve timing control that is optimal for the operating conditions of the engine. Thus, it stabilizes the idle and improves power output and torque in all driving ranges.

System Configuration Diagram



AKB00755AB

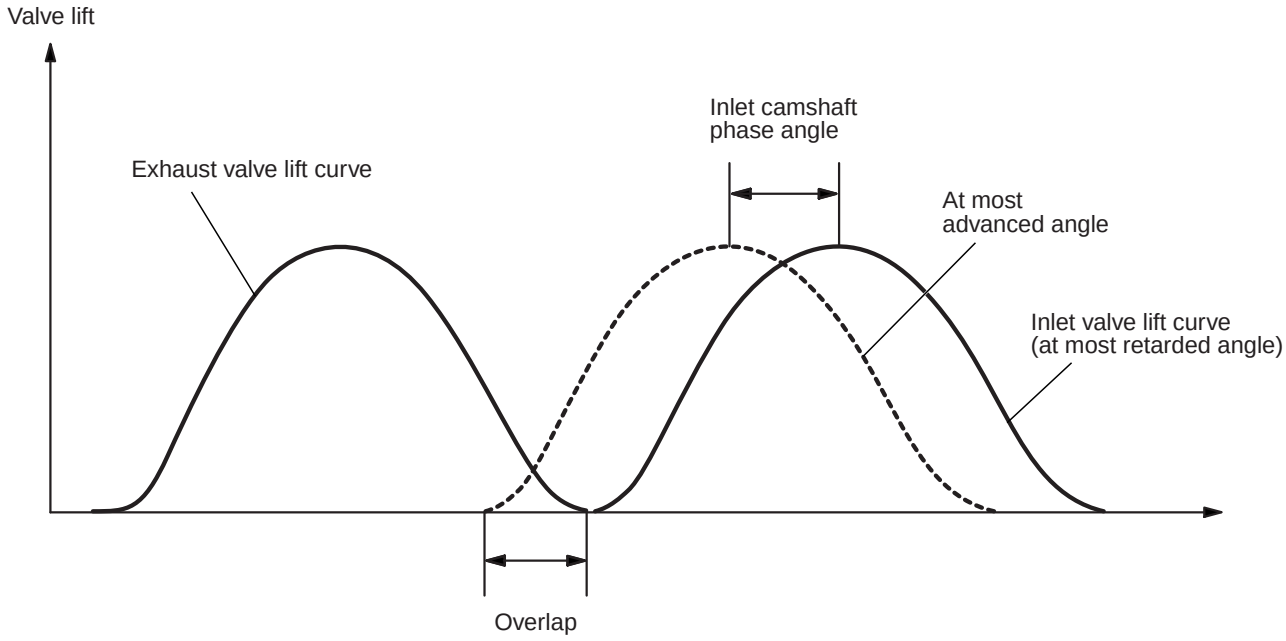
- The engine-ECU assesses the driving conditions of the engine by way of the signals input by sensors.
- Based on the assessed information, the engine-ECU outputs duty cycle signals to the inlet oil feeder control valve in order to control the position of the spool valve.
- By varying the position of the spool valve, the oil pressure can be applied either to the retard or advance chamber, thus continuously changing the phases of the inlet camshaft.



AKB00756AB

The engine-ECU calculates the detected phase angle by using the signal from the inlet camshaft position sensor and the crank angle sensor.

Operation Conceptual Diagram



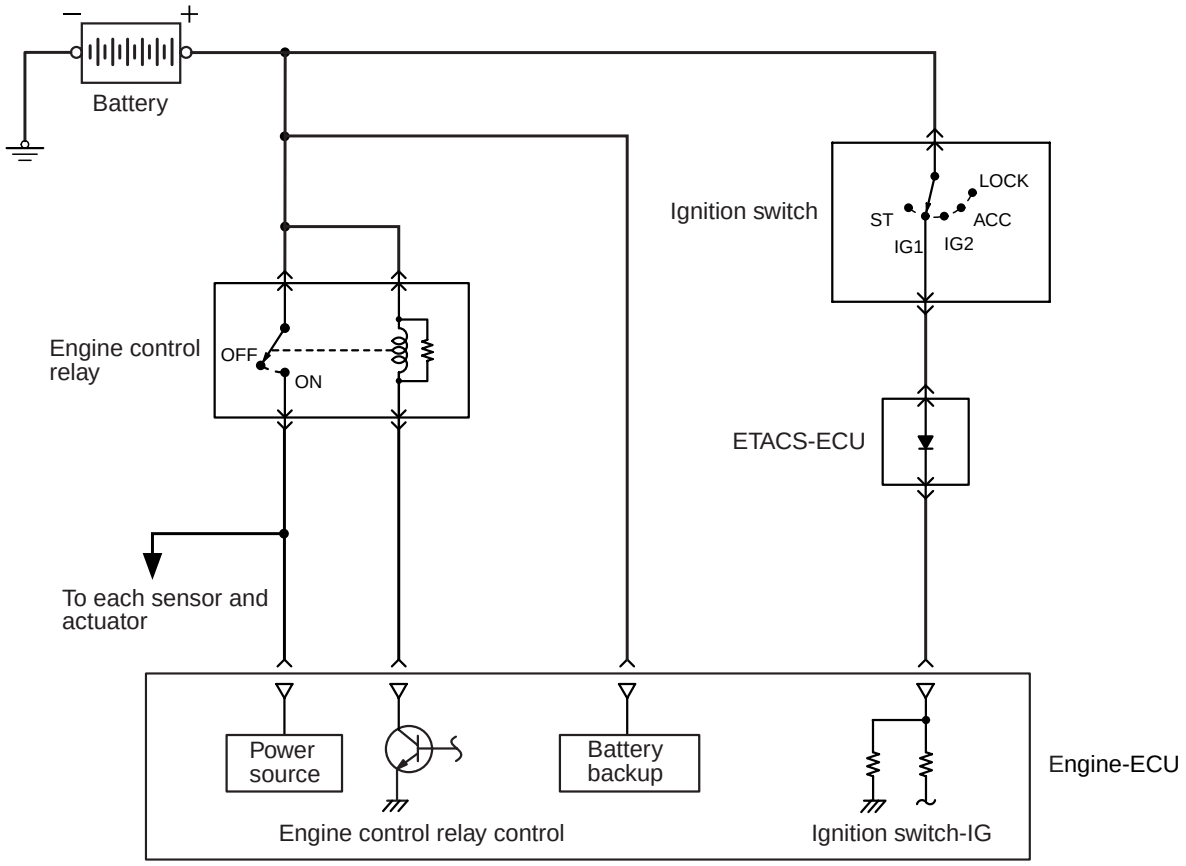
AK800138AB

The engine-ECU controls the camshaft phase angle in order to attain optimal valve timing that suits the engine load and engine speed.

	Initial Phase	Control Direction
Inlet valve	Most retarded angle	Advance direction

ENGINE CONTROL RELAY CONTROL

M2132006000720



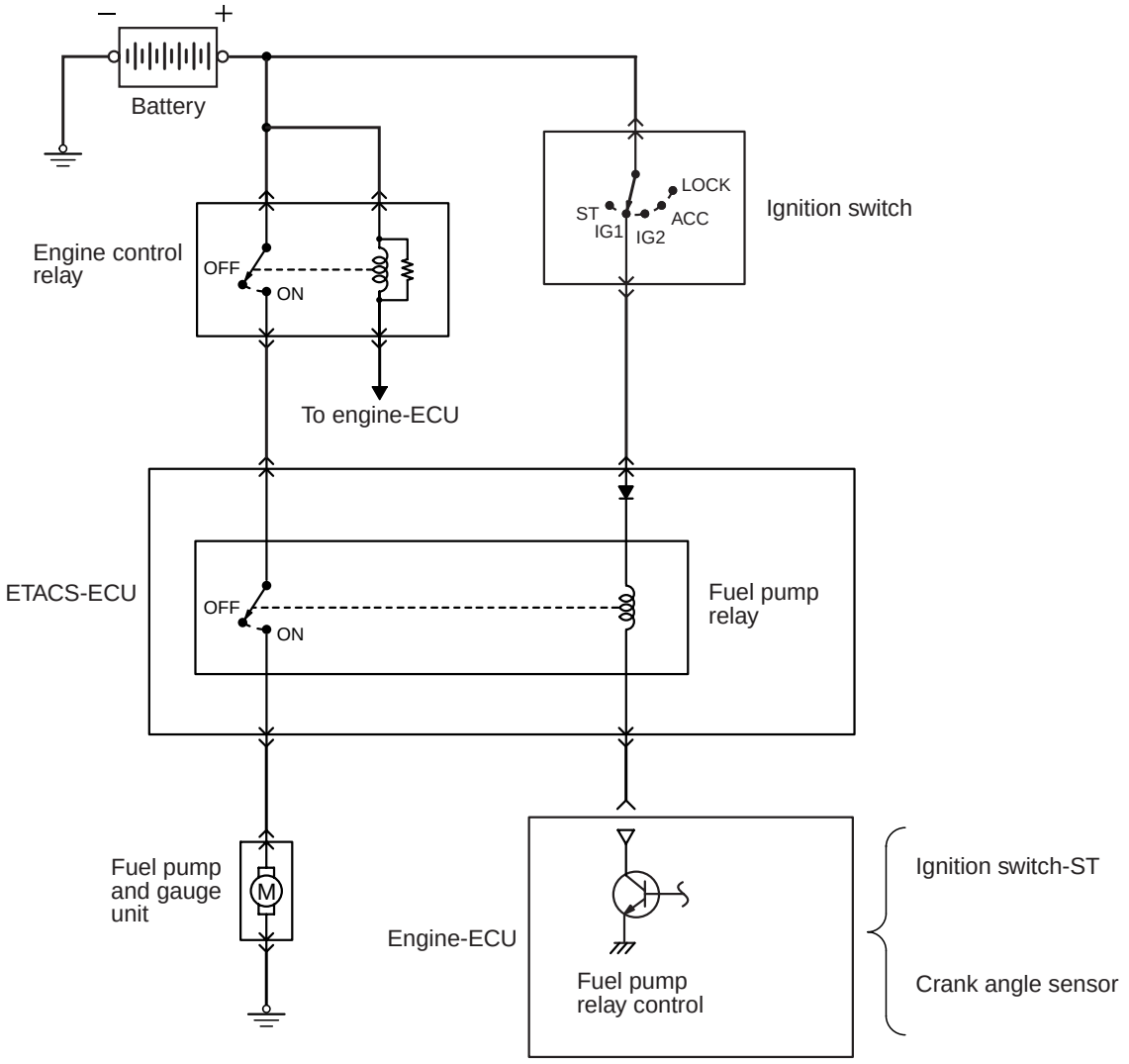
AK604134AD

When the ignition switch-IG "ON" signal is input, engine-ECU turns ON the power transistor for control of the engine control relay. As a result, current flows through the engine control relay's coil, the relay switch turns ON and power is supplied to each sensor and actuator. Also, when ignition switch-IG "OFF" signal is input, engine-ECU performs the following controls and then turns OFF the power transistor for control of engine control relay.

- Throttle valve initializing control

FUEL PUMP RELAY CONTROL

M2132006500769

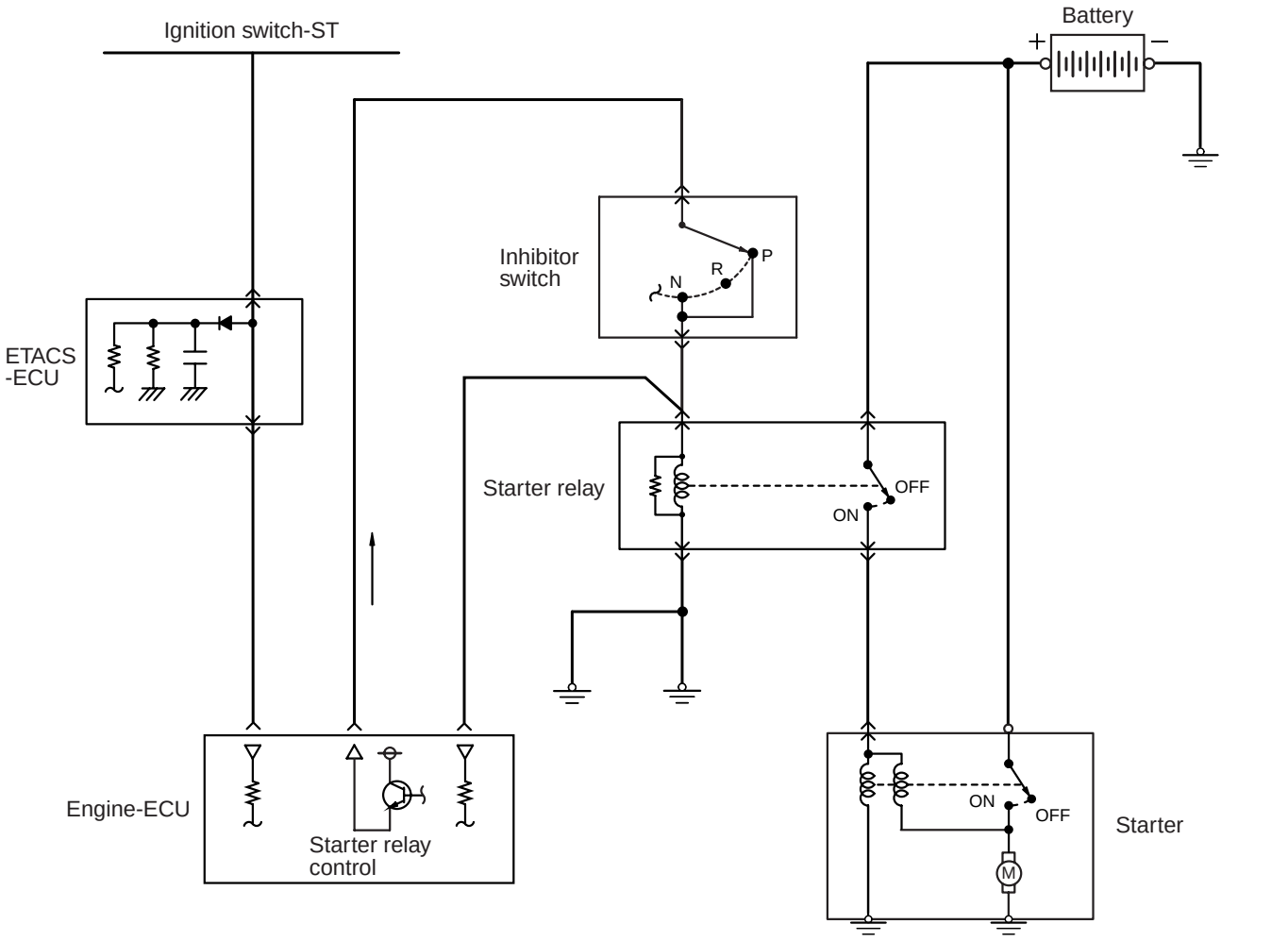


AK700635 AB

When current flows through the fuel pump relay, the relay turns ON and the fuel pump is driven. The fuel pump relay is built into the ETACS-ECU. When the ignition switch-ST signal is input, engine-ECU turns ON the power transistor for control of the fuel pump relay. As a result, power is supplied to the fuel pump. Also, if engine speed falls below a set value, the fuel pump relay is turned OFF. Thus, it deals with sudden stoppages such as engine stalling etc. by stopping the pump.

STARTER RELAY CONTROL

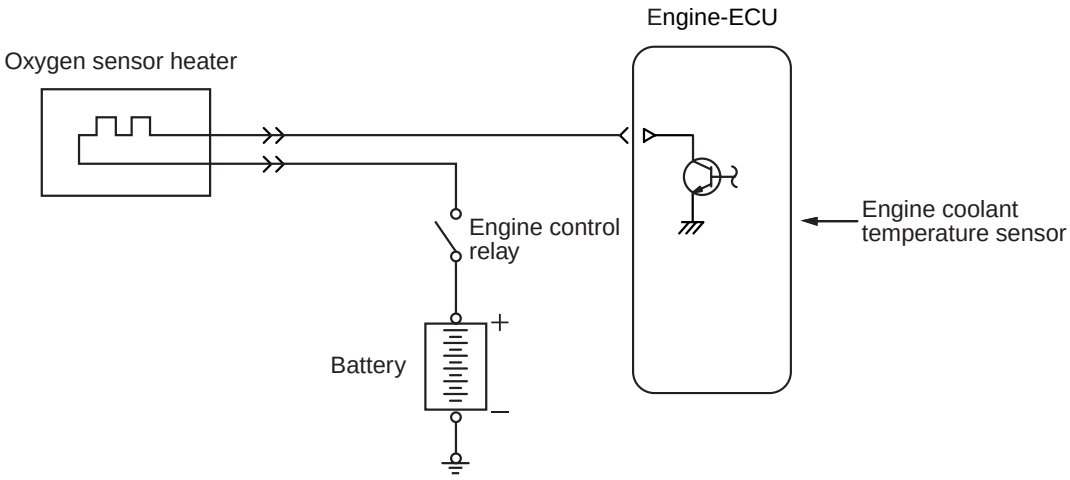
M2132025500672



When the ignition switch-ST signal is input, engine-ECU turns ON the power transistor for control of the starter relay.

OXYGEN SENSOR HEATER CONTROL

M2132007000734

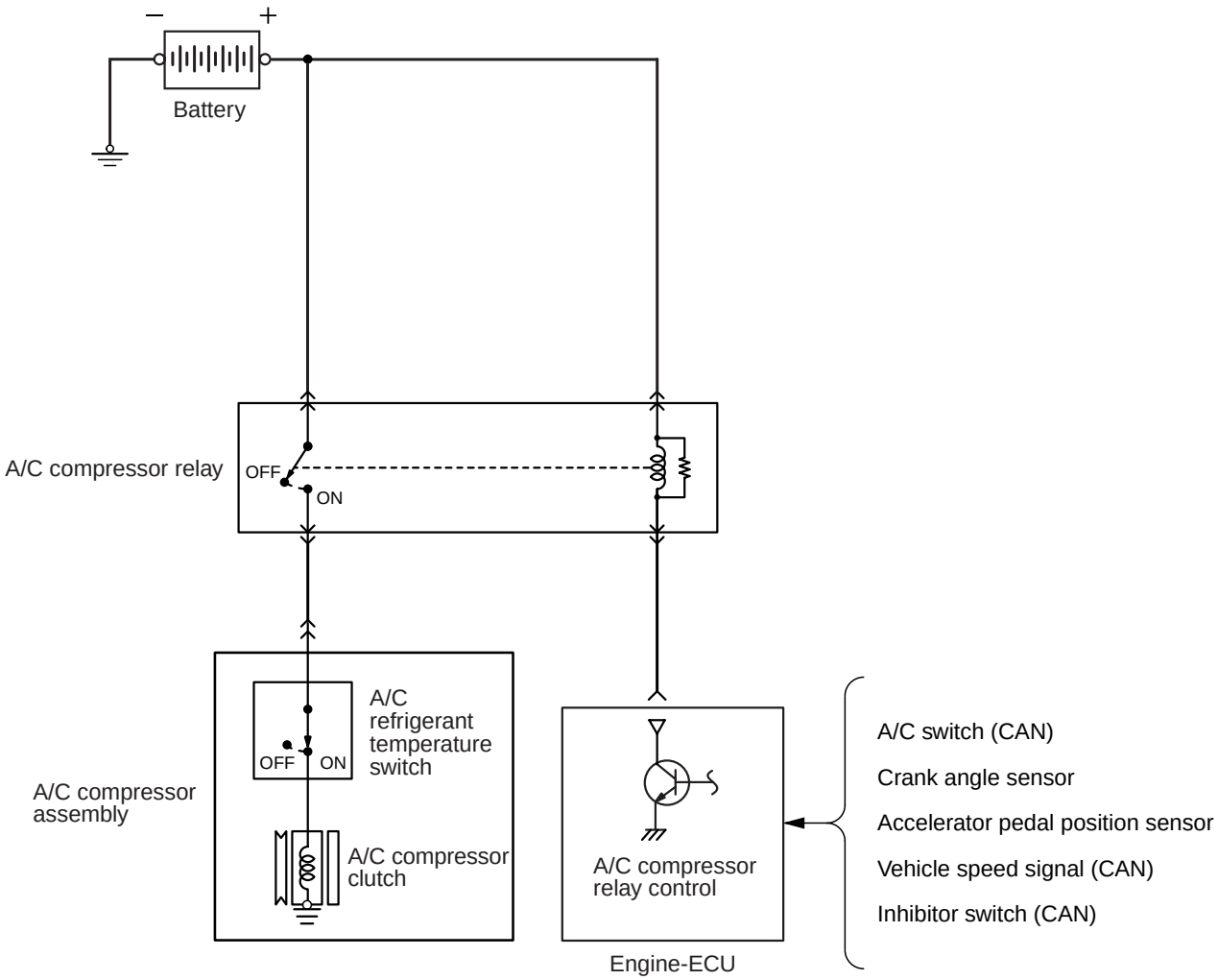


AK602241AE

When exhaust gas temperature is low, the oxygen sensor response is dull. So, response is improved by raising the sensor temperature by passing current through the heater at a low exhaust gas temperature, such as in the immediate aftermath of the engine start, or during the warm up operation and in cutting the fuel during deceleration. Based on driving conditions and the oxygen sensor activation state, engine-ECU changes the amount of current (duty ratio) to the heater to quicken the activation of the oxygen sensor.

A/C COMPRESSOR RELAY CONTROL

M2132034500722

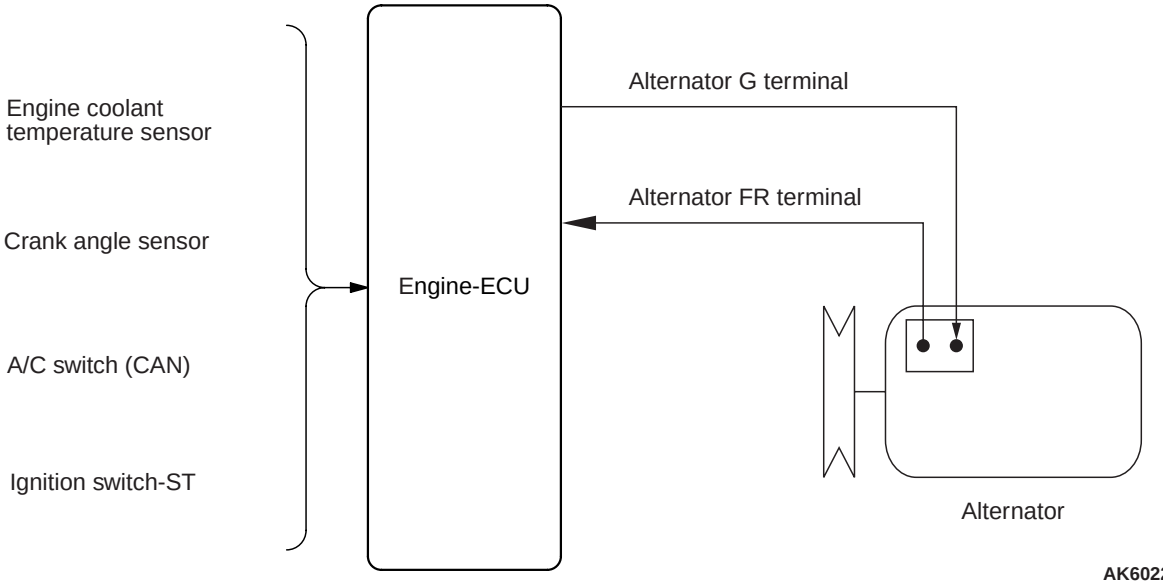


AK800141 AH

After the A/C switch is turned ON and A/C compressor relay reaches a state where it can turn ON, engine-ECU turns ON the A/C compressor relay and drives the A/C compressor. In order to prevent change in engine speed due to increased load of driving the compressor, it controls the A/C compressor relay to drive the A/C compressor after idle-up is complete. Also, in order to secure acceleration performance, it turns OFF the A/C compressor relay for a fixed amount of time, if the throttle opening angle increases beyond a prescribed limit.

ALTERNATOR CONTROL

M2132025000785



AK602242AL

During engine idle operation, engine-ECU controls duty of conduction between alternator G terminal and earth. (G terminal duty is controlled to be the same as ON duty of the power transistor inside the voltage regulator). If headlights etc. are turned on while engine is idling, the consumed current increases suddenly, but by gradually increasing the alternator G terminal OFF duty, engine-ECU restricts sudden increase in alternator output current and output current is increased only gradually. (Battery current is supplied to the headlamp etc. till alternator produces sufficient current.) Thus, engine-ECU prevents change in idle speed due to sudden increase of engine load.

PURGE CONTROL

M2132027500106

Refer to GROUP 17 – Emission Control – Evaporative Emission Control System .

CONTROLLER AREA NETWORK (CAN)

M2132019000957

CAN communication is established to ensure the reliable transmission of information. Refer to GROUP 54C – General Information .

DIAGNOSIS SYSTEM

M2132009002093

Engine-ECU has been provided with the following functions for easier system inspection. Refer to the workshop manual for the details about each item.

- Freeze-frame data function
- Diagnosis code function
- Data list function
- Actuator test function

GROUP 13B

FUEL SUPPLY

CONTENTS

GENERAL INFORMATION

M2134000101676

The fuel system consists of the following components:

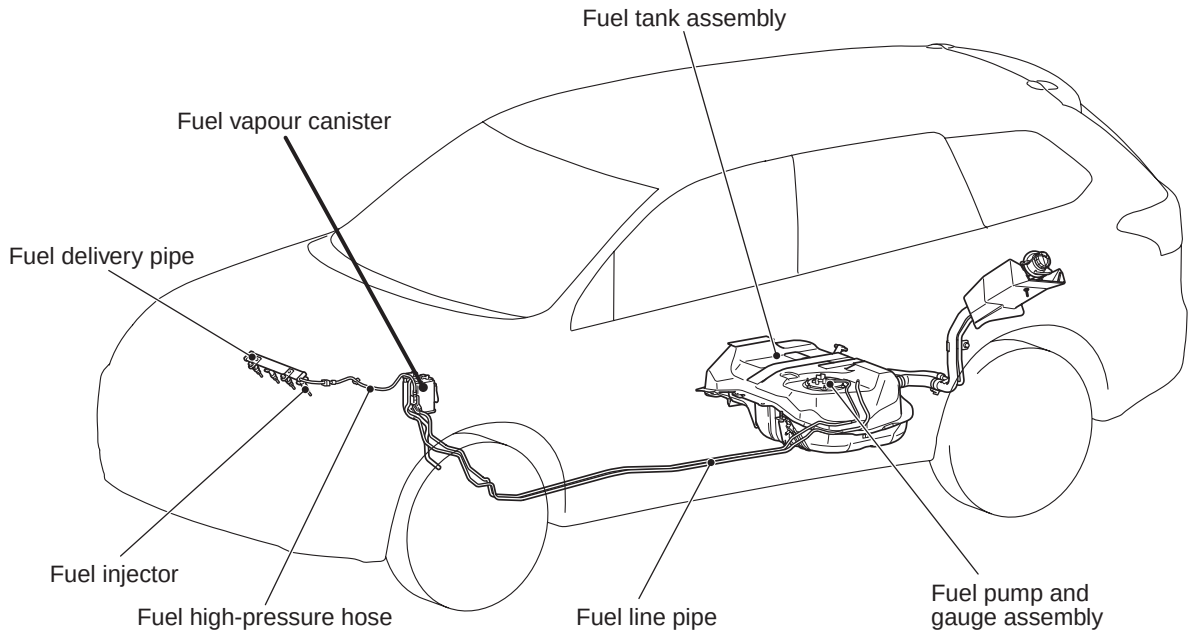
- Fuel injector
- Fuel delivery pipe
- Fuel vapour canister
- Fuel high-pressure hose
- Fuel line pipe
- Fuel tank assembly
- Fuel pump and gauge assembly
- Fuel gauge unit <4WD>

SPECIFICATIONS

Item		Specification
Fuel tank capacity L	2WD	63
	4WD	60
Fuel pump type		Electric (incorporates tank pump and gauge assembly)
Fuel filter type		Cartridge (incorporates tank pump and gauge assembly)
Fuel return system		Return less
Fuel pressure regulator control pressure kPa		324
Fuel injector	Type	Elector-magnetic
	Quantity	4
Evaporative emission control system		Fuel vapour canister

CONSTRUCTION DIAGRAM

<2WD>



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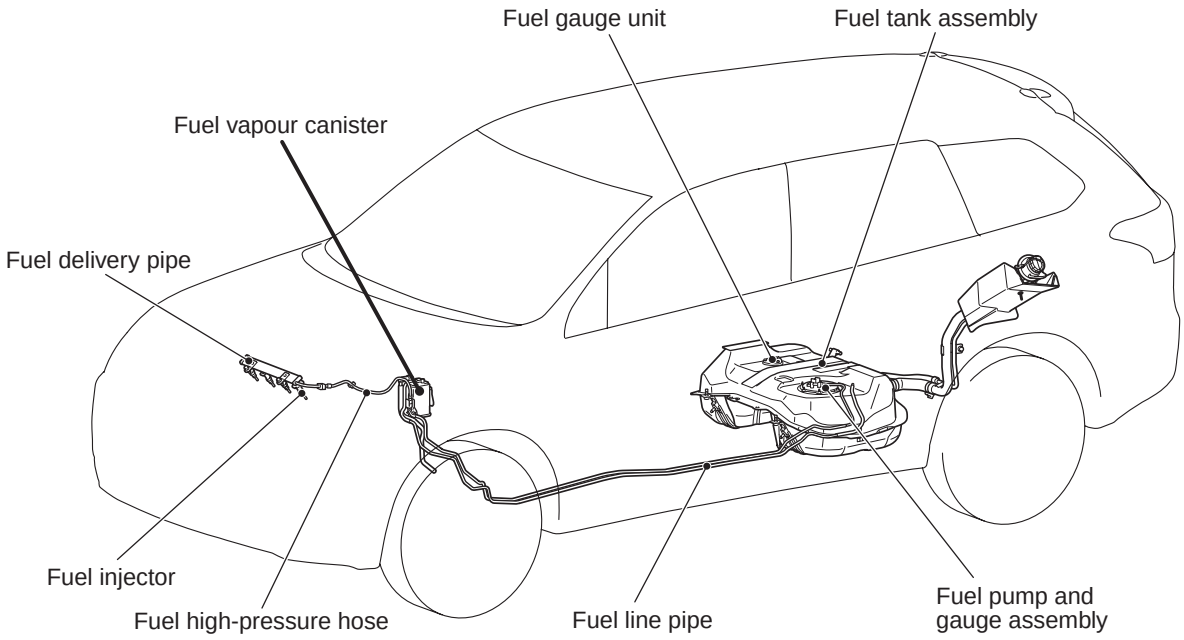
<4WD>



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This fuel system is designed with consideration for global environment protection to ensure safety at a collision, reduce weight, and improve reliability and quality. This system has the following features:

- A quick-joint connector of a plastic tube is used for the fuel high-pressure hose in the engine compartment to reduce the permeation of fuel evaporative emission.
- The surface of under floor fuel line pipes is coated with 1-mm thickness of resin to improve resistance to corrosion and chipping.
- A return less fuel system eliminates returned fuel from the engine. The heat that fuel receives from the engine is reduced, minimising fuel temperature in the fuel tank and controlling the amount of evaporated gas.
- The activated charcoal of fuel vapour canister is modified for downsizing, weight saving and better performance.

FUEL TANK

M2134001001672

The fuel tank assembly consists of components such as a fuel pump and gauge assembly, a fuel gauge unit, and a fuel tank, and has the following features:

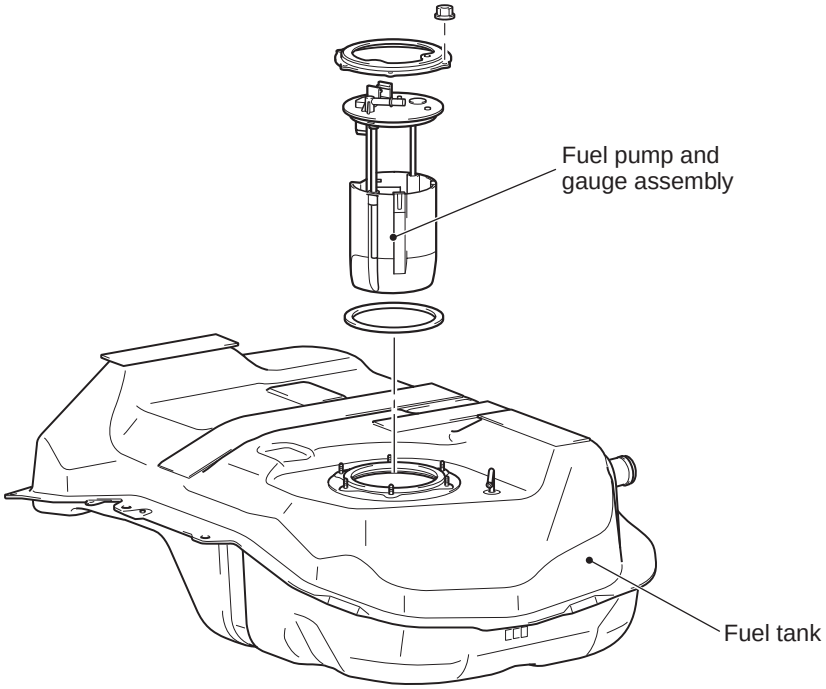
- The fuel tank is mounted underneath the second seat to improve safety at a collision.
- The fuel tank itself is made of a pre-coat galvanized steel sheet that contains no lead.
- The capacity of the fuel tank is 63 litres <2WD> or 60 litres <4WD> to meet long-distance drives.
- A fuel tank safety valve, which prevents fuel leakage when the vehicle banks or rolls over, is located inside the fuel tank for fewer openings and hose bonding points on the fuel tank top surface.
- A built-in fuel filter and a fuel tank suction hose have been adopted to meet the fuel tank of a saddleback shape. <4WD>

The fuel pump and gauge assembly consist of the following components:

- Fuel pump
- Fuel gauge unit
- Fuel filter
- Fuel pressure regulator

CONSTRUCTION DIAGRAM

<2WD>



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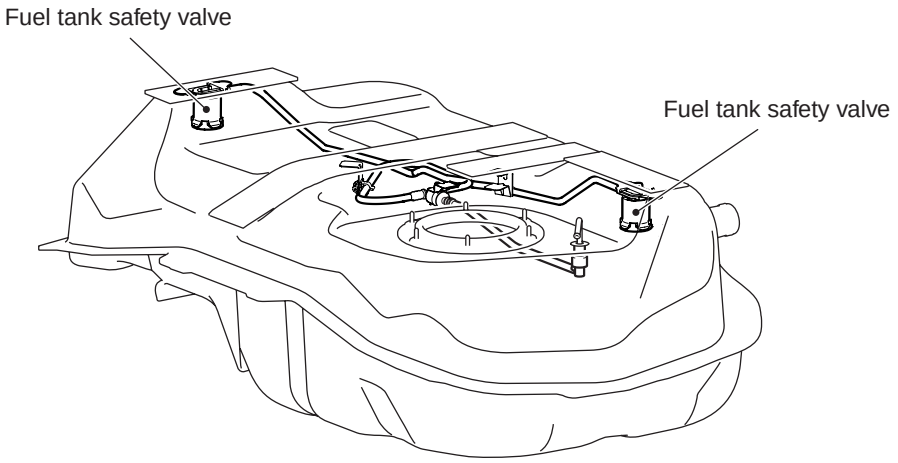

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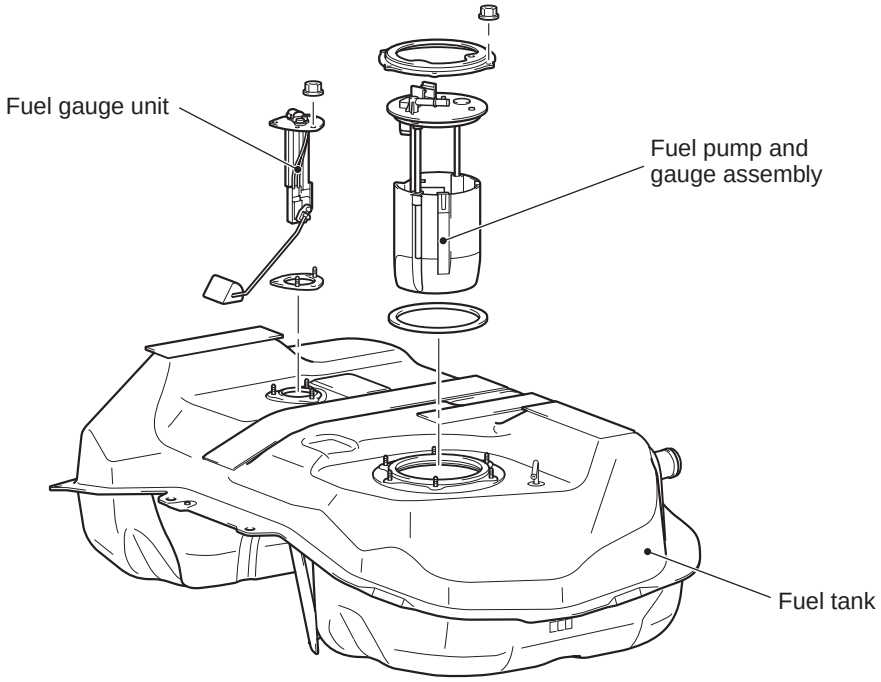

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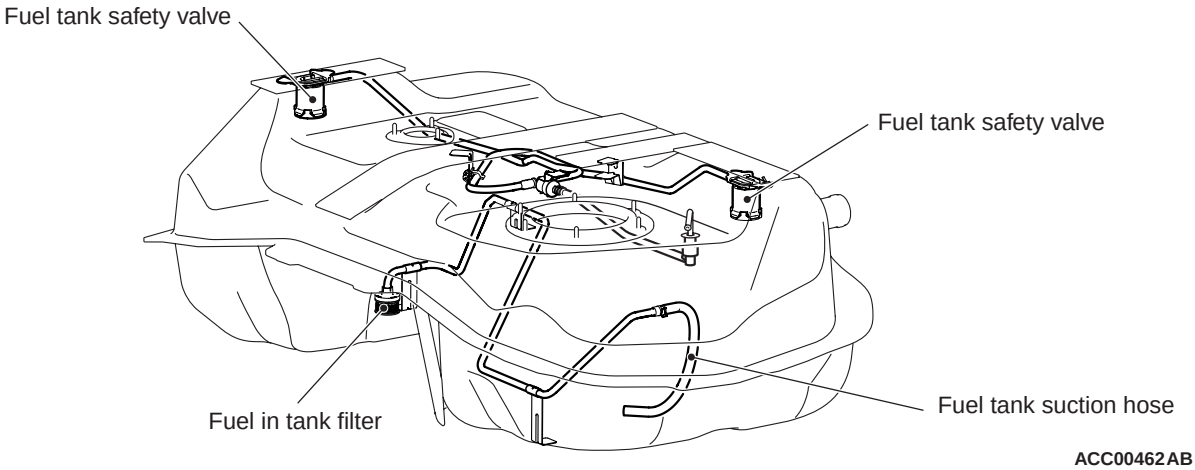

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GROUP 14

ENGINE COOLING

CONTENTS

GENERAL INFORMATION

M2140000101567

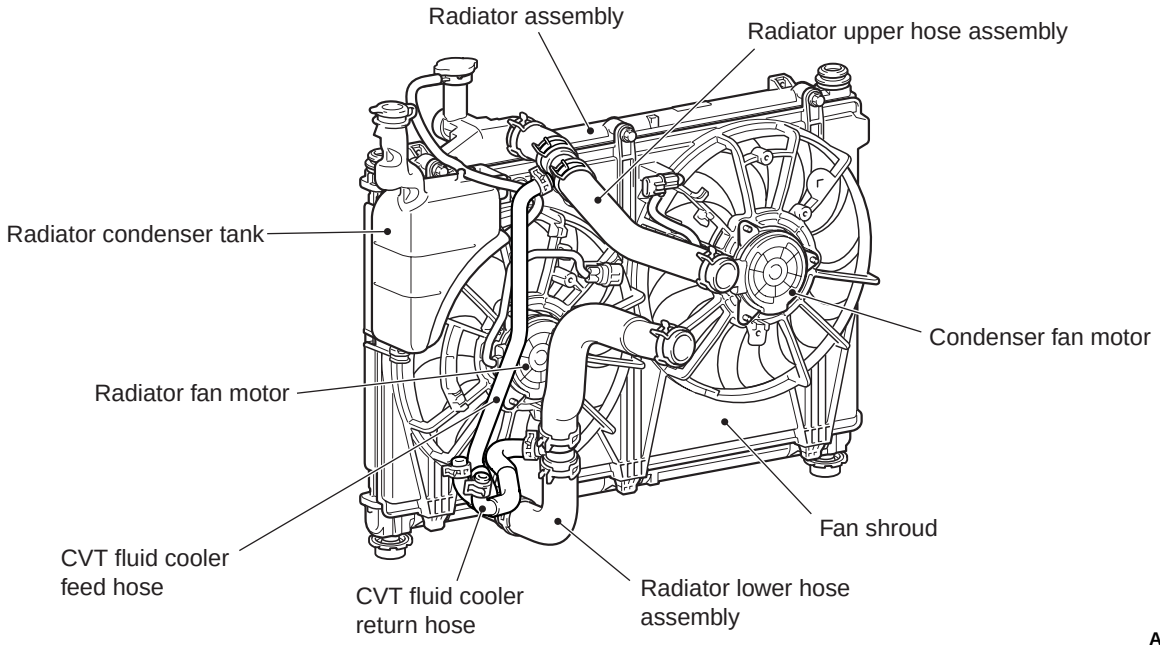
For the cooling method, a forced water-cooling circulation system is adopted and it has the following characteristics:

- To reduce the coolant temperature variation, the inlet control system which arranges the thermostat at the inlet side of the coolant flowing from the radiator to the engine is adopted.
- A down-flow radiator has been adopted in order to reduce the number of parts and improve serviceability.
- A ring fan has been adopted in order to reduce noise.
- A radiator condenser tank is assembled into the fan shroud in order to reduce the number of parts and improve serviceability.

SPECIFICATIONS

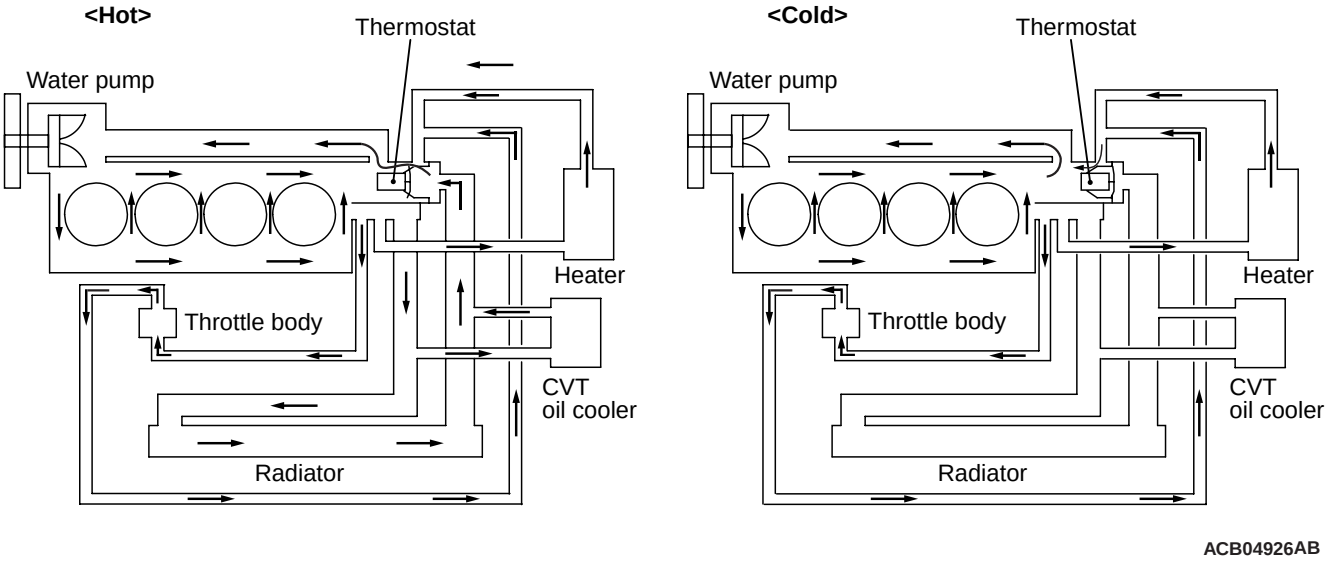
Item		**4B1**
Cooling method		Water-cooled pressurised, forced circulation with electrical fan
Water pump	Type	Centrifugal impeller
	Drive method	Drive belt
Thermostat	Type	Wax pellet with jiggle valve
	Valve open temperature °C	82 ± 1.5
Radiator	Type	Pressurised corrugate type
	Core size (width × height × thickness) mm	687.4 × 400 × 16
	Performance kJ/h	201,800
Engine coolant	Specified coolant	DIA QUEEN SUPER LONG LIFE COOLANT or equivalent
	Quantity (including 0.65 L in the radiator condenser tank) L	Approximately 7.5

CONSTRUCTION DIAGRAM



WATER PASSAGE

M2140004000718



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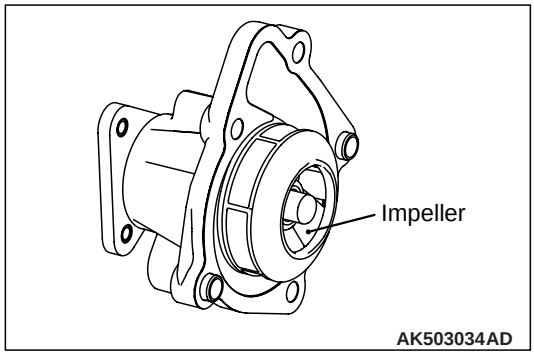
WATER PUMP

M2140003000492



AK503034AD

The water pump is the centrifugal, impeller type that is installed in front of the cylinder block. It is driven by the drive belt.

Item	Specifications
Discharge volume L/rpm	185/6 500
Impeller diameter mm	62

GROUP 15

INTAKE AND EXHAUST

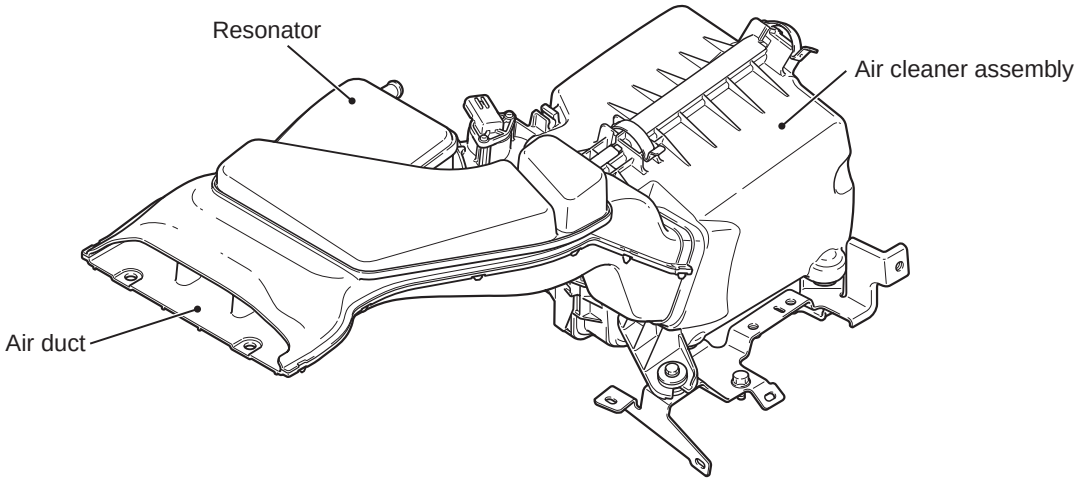
CONTENTS

AIR INTAKE SYSTEM

AIR DUCT AND AIR CLEANER

M2150004001381

CONSTRUCTION DIAGRAM



ACB05021AB

In order to save weight, an air cleaner element without plastics is used and the panel thicknesses of the cover and the housing are optimised.

INLET MANIFOLD

M2150010000666

The inlet manifold is made of plastic for weight reduction, and the surface roughness of the inner walls of the ports has been improved to reduce intake resistance.

EXHAUST SYSTEM

EXHAUST MANIFOLD

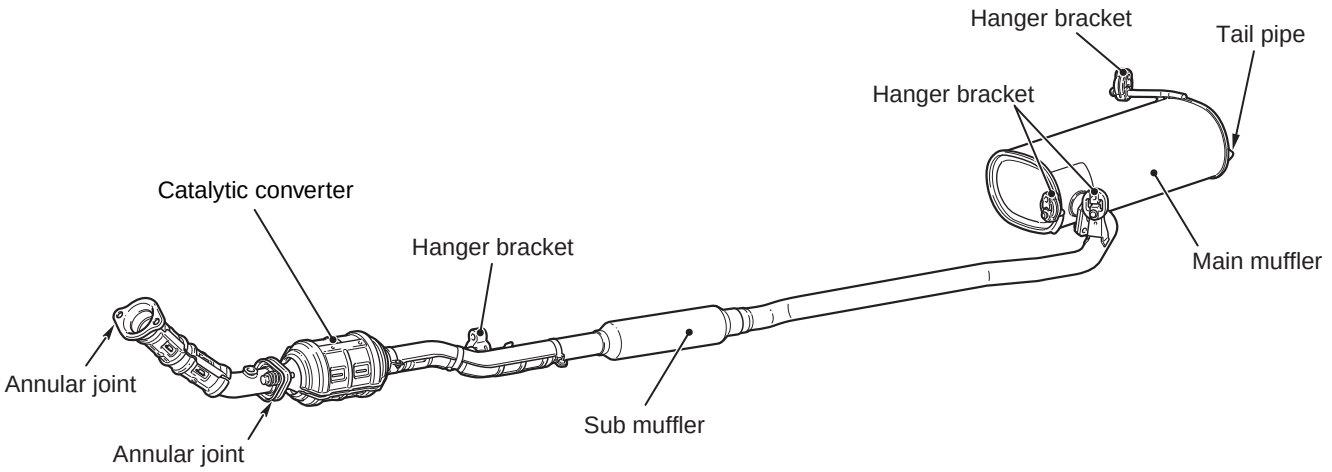
M2150006001105

The exhaust manifold incorporates a catalytic converter. In order to reduce vibration, a spherical joint is used at the front pipe connection.

EXHAUST PIPE AND MUFFLER

M2150003001775

CONSTRUCTION DIAGRAM



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Exhaust pipe and muffler consisting of two 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 optimisation of position, which reduces vibration to the vehicle.
- The spherical joint has been adopted for connection between the front exhaust pipe and the exhaust manifold, and between the exhaust pipe and the centre exhaust pipe, which reduces vibration to the vehicle.

GROUP 16

ENGINE ELECTRICAL

CONTENTS

STARTER MOTOR

M2161002000728

The starter motor is a reduction drive type with planetary gear.

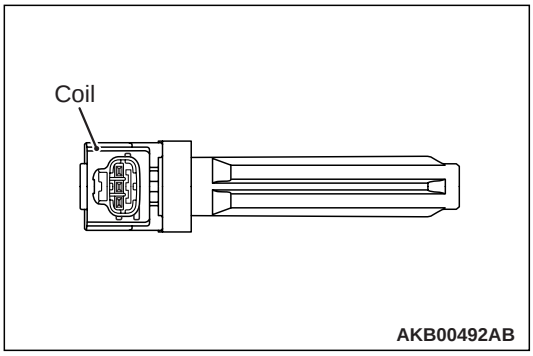
ALTERNATOR

M2162001000687

The alternator is the battery detection type.

IGNITION COIL

M2163001000561



The ignition coil is the plug-top type.
This plug-top type ignition coil has the following features:

- A durable low-tension distribution system is adopted.
- A separate igniting system is adopted. Due to this, high voltage generated in the ignition coils can be delivered into the spark plugs effectively.
- Low fuel consumption due to combustion stabilisation
- Compact and light weight

SPARK PLUG

M2163005000499

Iridium-tipped spark plugs are used.

GROUP 17

ENGINE AND EMISSION CONTROL

CONTENTS

ENGINE CONTROL

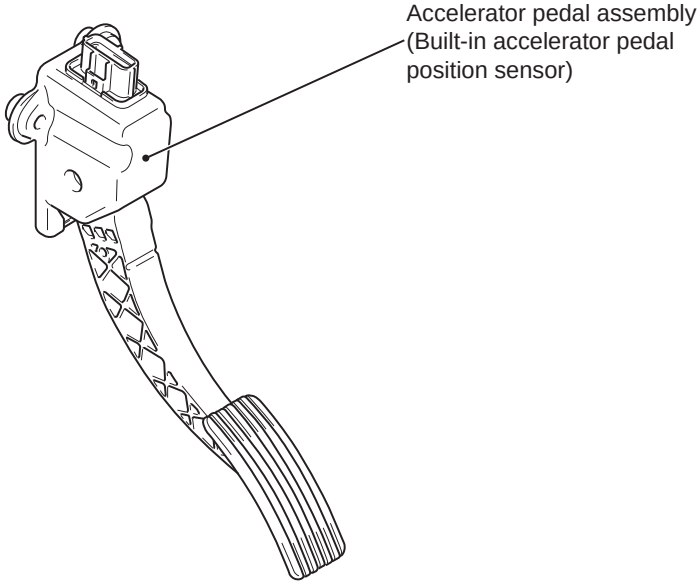
GENERAL INFORMATION

M2170001001522

For the accelerator system, an electronic throttle valve control system has been adopted, eliminating of an accelerator cable.

This system detects the amount of the accelerator pedal movement by using an accelerator pedal position sensor in the accelerator pedal assembly for electronically controls the throttle valve.

CONSTRUCTION DIAGRAM



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CRUISE CONTROL SYSTEM

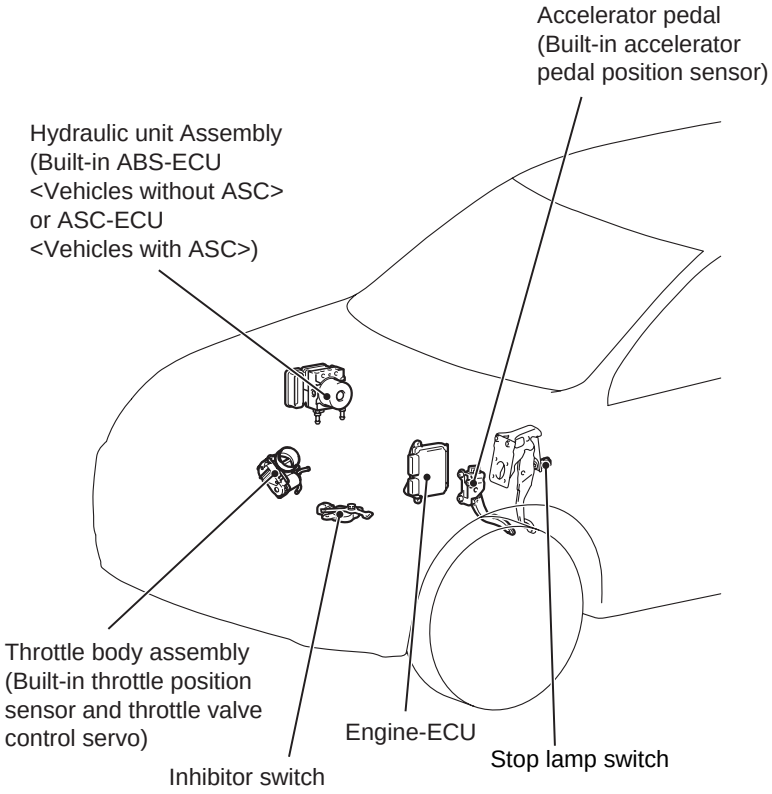
GENERAL INFORMATION

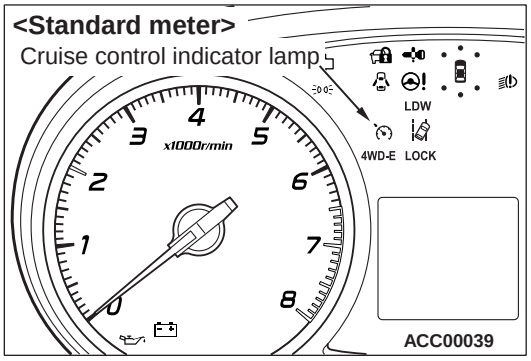
M2170001001533

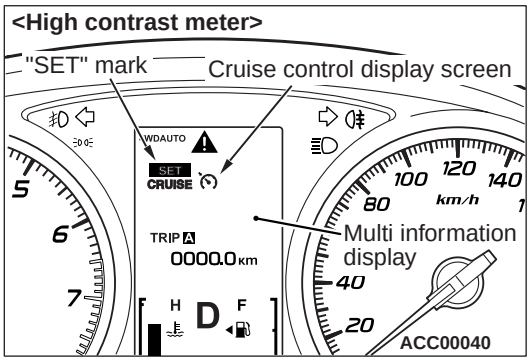
The cruise control system, which provides the constant speed driving without depressing the accelerator pedal at a vehicle speed determined by the driver (within the range from approx. 40 to 200 km/h).

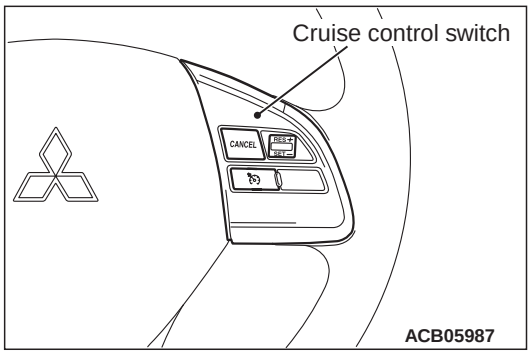
For this cruise control system, in conjunction with the electronic throttle valve control system, the engine-ECU electronically controls the throttle valve.

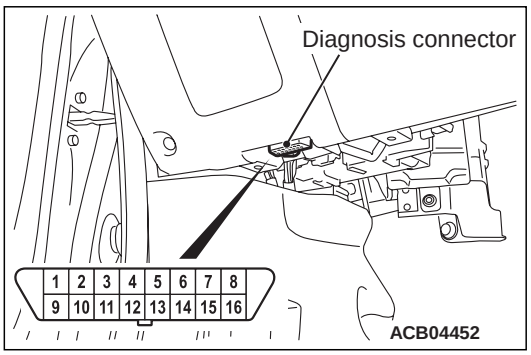
CONSTRUCTION DIAGRAM

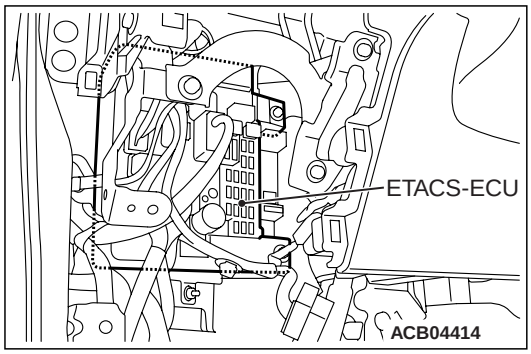


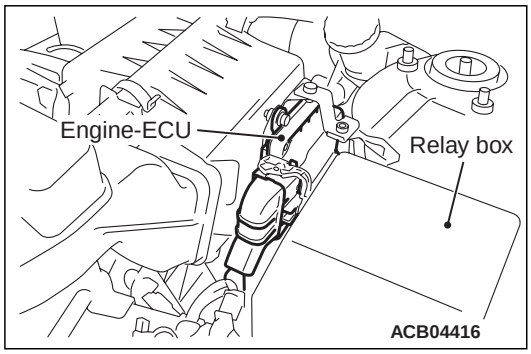












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COMPONENTS AND FUNCTIONS

Component		Function
ABS-ECU <Vehicles without ASC> or ASC-ECU <Vehicles with ASC>		Outputs the cruise control cancel signal to the engine-ECU.
Accelerator pedal position sensor		Informs the engine-ECU of the accelerator pedal depression.
Cruise control indicator lamp <standard meter> or cruise control display screen <high contrast meter>		When the ON/OFF switch is pressed, a lamp will illuminate or a screen will be displayed to inform the driver that the cruise control system is active.
Cruise control switch	Cruise control ON/OFF switch	Power switch for cruise control system.
	RES + switch	Vehicle speed is set with the RES + switch and SET − switch.
	SET − switch	
	CANCEL switch	Cancels the constant speed driving.
CVT-ECU		• Controls the CVT based on the CVT control signal from the engine-ECU. • The selector lever "N" position signal from the inhibitor switch is sent to the engine-ECU. • Outputs the signal from the secondary pulley speed sensor to the engine-ECU.
Diagnosis connector		If the M.U.T.-III is connected, the diagnosis code and data list from the engine-ECU can be read.
Engine-ECU		• Based on the input signal from each sensors and switches, the throttle opening angle indication signal is sent. • Based on the input signal from each sensors and switches, the CVT control signal is sent to the CVT-ECU. • Based on the secondary pulley speed sensor signal from the CVT-ECU, it calculates the vehicle speed. • Based on the selector lever "N" position signal from the CVT-ECU, it cancels constant speed driving. • To the cruise control indicator lamp, the cruise control system ON/OFF signal is sent. • The diagnosis codes of the cruise control system are sent to the cruise control indicator lamp. • The data list of the cruise control system is sent to the diagnosis connector.
Inhibitor switch		The constant speed driving is cancelled by the selector lever operation, the "N" position is detected.
Stop lamp switch		• The constant speed driving is cancelled by the brake operation, the brake pedal operation is detected. • As for the stop lamp switch, two built-in switches, the stop lamp switch which is also used for the stop lamp illumination and the brake switch which is used exclusively for the cruise control, are integrated, and thus the reliability is enhanced.
Throttle valve control servo		The throttle valve opens and closes in response to the throttle angle control signal from the engine-ECU.
Throttle position sensor		Informs the engine-ECU of the throttle valve opening angle.

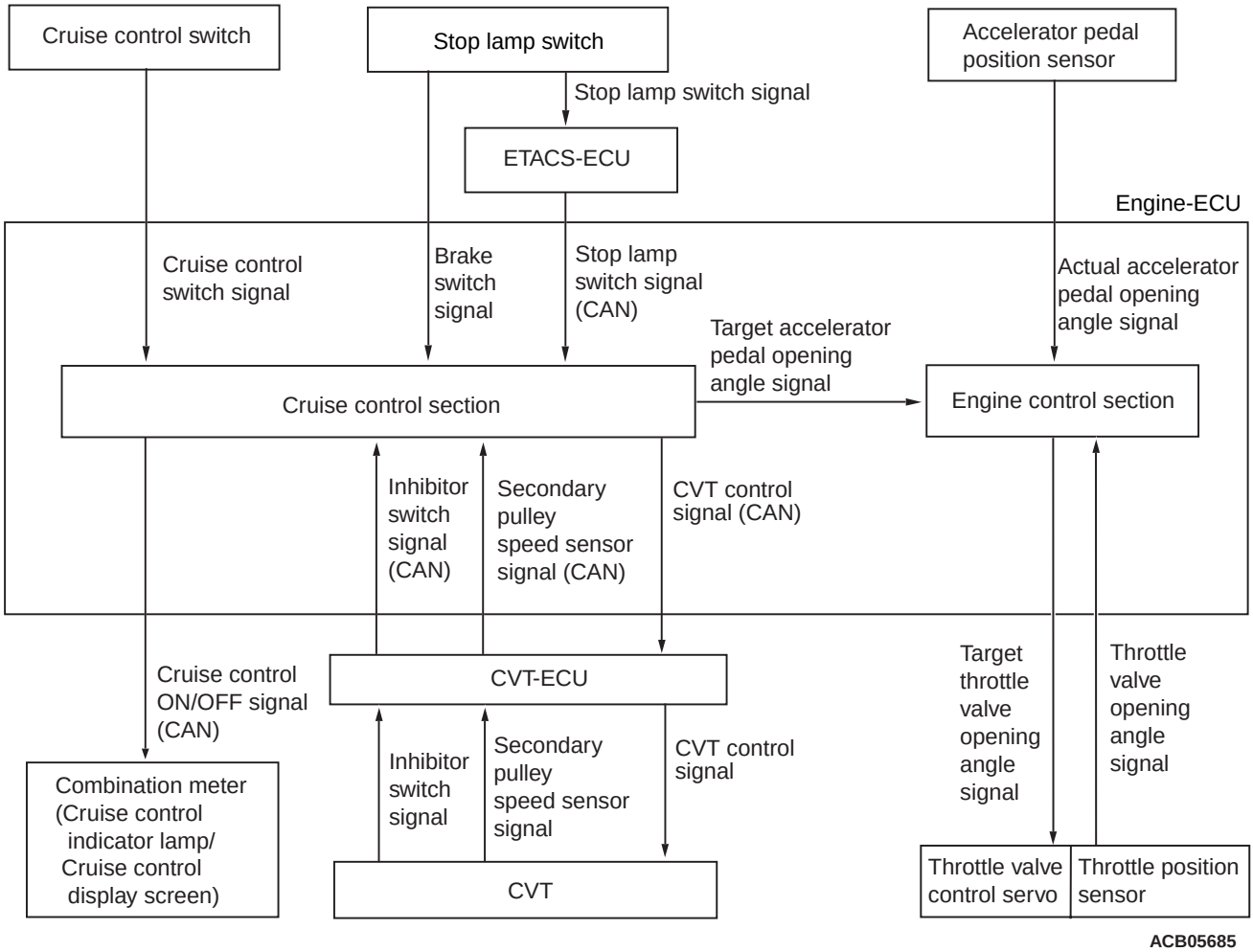
CONSTRUCTION AND OPERATION

M2170002000890

The cruise control section in engine-ECU calculates the cruise control system operation condition based on the signals sent from switches and sensors. Based on the calculation, the cruise control section outputs the target accelerator pedal opening angle signal to the engine control section, and CVT control signal to CVT-ECU, and cruise control status (ON/OFF, etc.) to the combination meter, respectively.

In the engine control section, the target throttle valve opening angle is calculated based on the target accelerator pedal opening angle signal from the cruise control section and the actual accelerator pedal opening angle signal from the accelerator pedal position sensor, and the vehicle speed is controlled by operating the throttle valve control servo. The combination meter will turn on the cruise control indicator lamp <Standard meter> or the cruise control display screen <High contrast meter> when the cruise control system is active. On the high contrast meter, "SET" symbol will also appear in the screen during constant speed driving.

BLOCK DIAGRAM



SYSTEM FUNCTIONS

SET FUNCTION

1. While driving in the vehicle speed range of approximately 40 to 200 km/h, press the SET – switch.
2. The cruise control system stores the vehicle speed when the SET – switch is released, and then performs a constant speed driving at the stored vehicle speed.
3. When the SET – switch is operated while driving at the vehicle speed of high speed limit (approximately 200 km/h) or faster, the constant speed driving is not performed.

4. When the SET – switch is operated while driving at the vehicle speed of low speed limit (approximately 40 km/h) or slower, the constant speed driving is not performed.

DECELERATION FUNCTION

1. When the SET – switch is pressed and held for approximately 0.5 second or longer during the constant speed driving, the vehicle is decelerated by using engine braking while the switch is pressed.
2. After that the SET – switch is released, the vehicle speed of that time is newly stored, and then the constant speed driving is performed at that speed.
3. In addition, when the SET – switch is pressed for less than approximately 0.5 second, the vehicle speed is decreased by approximately 1.6 km/h from the constant speed driving speed. The decelerated speed is newly stored, and then the constant speed driving is performed at that speed.
4. When the SET – switch is pressed and held, and the vehicle speed is decelerated to low speed limit (approximately 40 km/h) , the low speed limit will be maintained.

RESUME FUNCTION

1. During the constant speed driving, press the CANCEL switch, or depress the brake pedal to cancel the constant speed driving.
2. Afterward, when the RES + switch is pressed while driving at a vehicle speed of low speed limit (approximately 40 km/h) or more, a constant speed driving is performed at the vehicle speed stored when the constant speed driving was cancelled.

ACCELERATION FUNCTION

1. During the constant speed driving, when the RES + switch is pressed and held for approximately 0.5 seconds or longer, the vehicle is accelerated with the specified acceleration while the switch is pressed.
2. After that the RES + switch is released, the vehicle speed of that time is newly stored, and then the constant speed driving is performed at that speed.
3. In addition when the RES + switch is pressed for less than approximately 0.5 second, the vehicle speed is increased by approximately 1.6 km/h from the constant speed driving speed. The accelerated vehicle speed is newly stored, and then the constant speed driving is performed at that speed.

CANCEL FUNCTION

When any of the following conditions are satisfied, the constant speed driving will be cancelled.

- The cruise control system is stopped by the pressing the cruise control ON/OFF switch.
- The CANCEL switch is pressed.
- The brake pedal is depressed.
- The selector lever is shifted to the "N" position.
- The vehicle speed becomes low speed limit (approximately 40 km/h) or less.
- The vehicle speed is decreased by 15 km/h or more from the setting vehicle speed.
- An abnormality occurs in the vehicle speed signal.
- The ASC is operated.
- An abnormality occurs in CVT-ECU.
- An abnormality occurs in the CAN communication.

LAST STATUS MEMORY FUNCTION

The system stores cruise control ON/OFF status of the cruise control when the ignition switch is turned off. Then, when the ignition switch is turned on the next time, the system will resume the stored status.

FAIL-SAFE FUNCTION

When one of the following conditions is met, the cruise control system function will be suspended until the system returns to normal condition. Also, when one of the following conditions is met, a constant speed driving is cancelled immediately.

- An abnormality occurs in the cruise control switch.
- An abnormality occurs in the stop lamp signal.

When one of the following conditions is met, unless the vehicle is stopped to turn the ignition switch to the "LOCK" (OFF) position, the cruise control system function will be suspended even if the system returns to the normal state. Also, one of the following conditions is met, a constant speed driving is cancelled immediately.

- Engine-ECU abnormality.
- An abnormality occurs in the vehicle speed signal.
- Throttle position sensor abnormality.
- Accelerator pedal position sensor abnormality.

DIAGNOSIS FUNCTION

To ease the system inspection, the diagnosis code inspection, data list inspection is available by M.U.T.-III.

NOTE: For the diagnosis code items and input check code items, refer to the Workshop Manual.

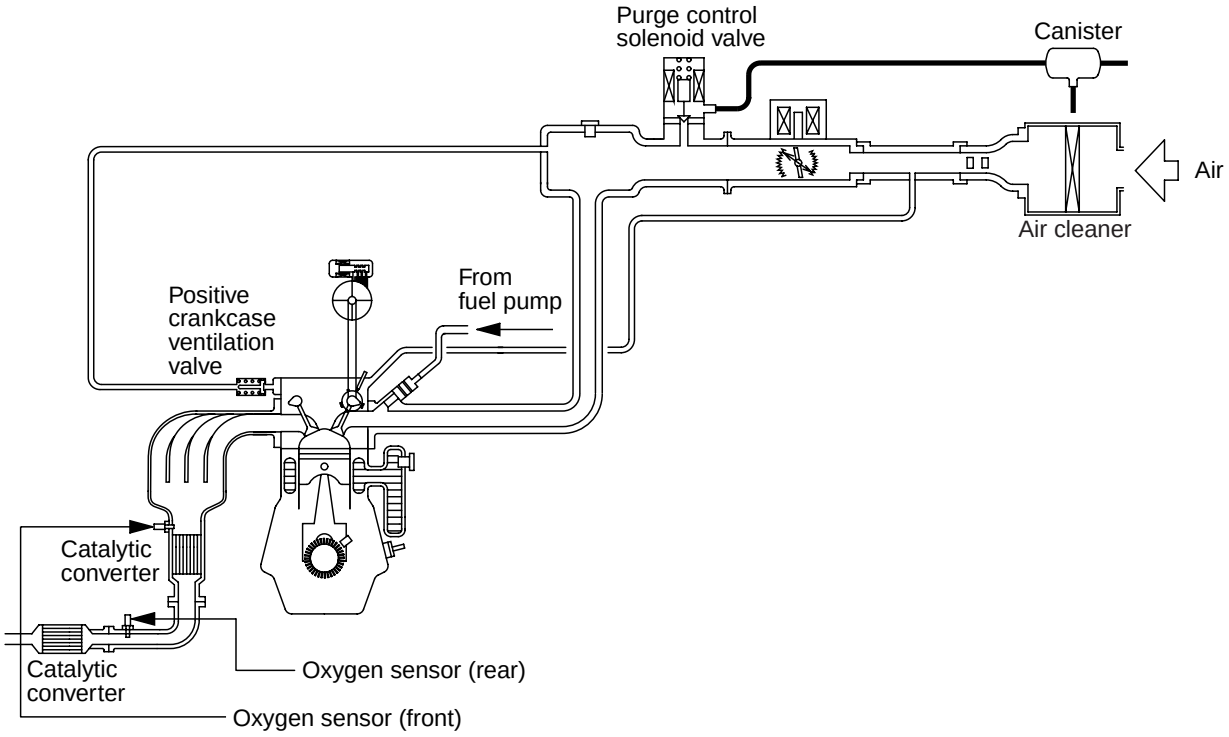
EMISSION CONTROL<MPI>

GENERAL INFORMATION

M2171000101756

The emission control is basically the same as the 4B1 engine mounted on the ASX.

SYSTEM CONFIGURATION DIAGRAM



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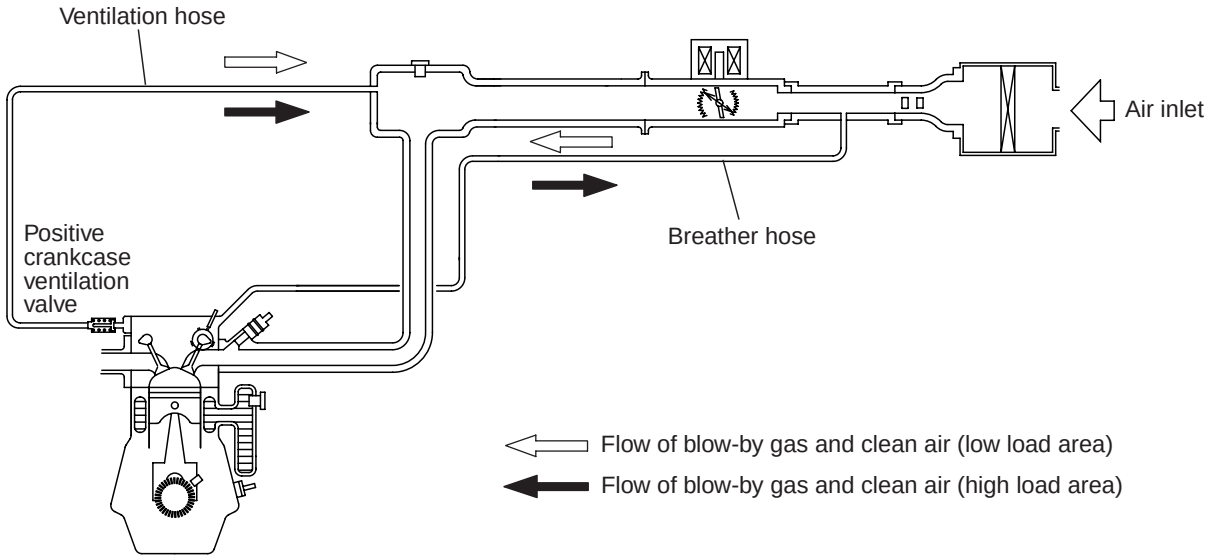
Exhaust gas cleaning devices list

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

System		Objective / Function	Composition parts
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 • Oxygen sensor • 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

CRANKCASE VENTILATION SYSTEM

M2171000400583



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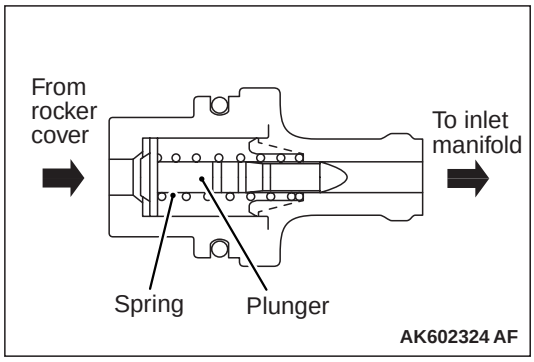
A blow-by gas reduction device prevents blow-by gas from being expelled into the atmosphere and is of closed type. A positive crankcase ventilation (PCV) valve is provided in the ventilation hose from the rocker cover to the inlet manifold. During low load driving, clean air is supplied to the crankcase 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.

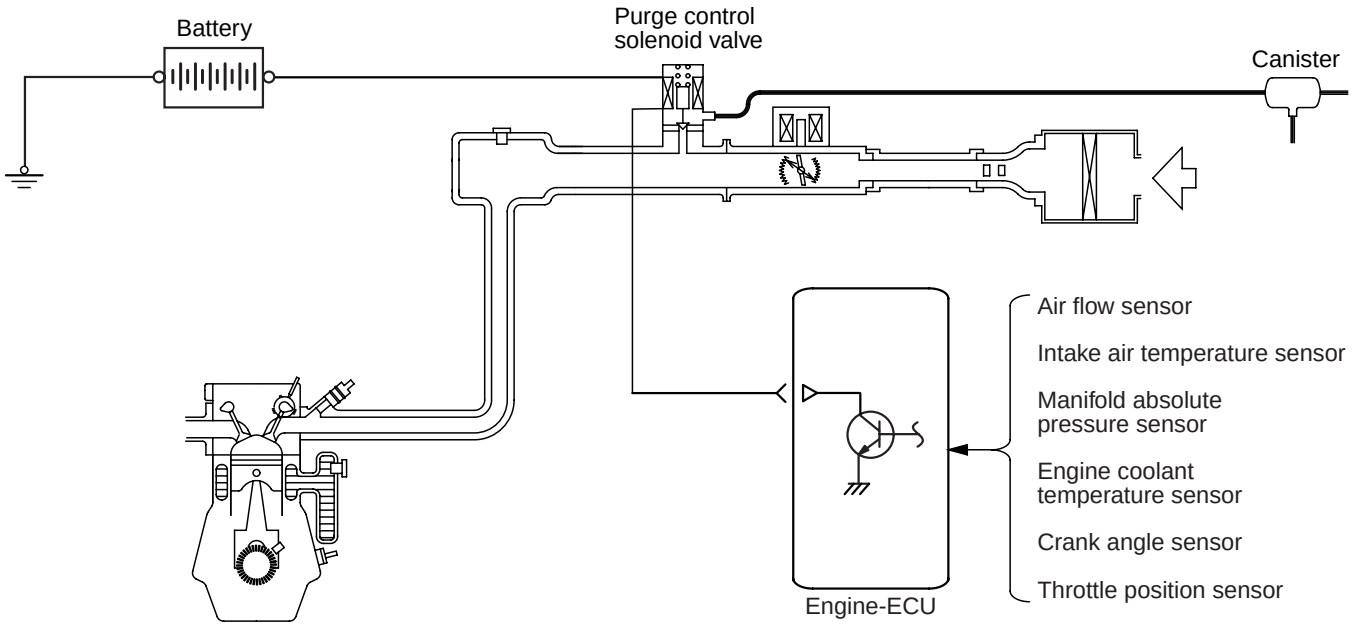
POSITIVE CRANKCASE VENTILATION (PCV) VALVE



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

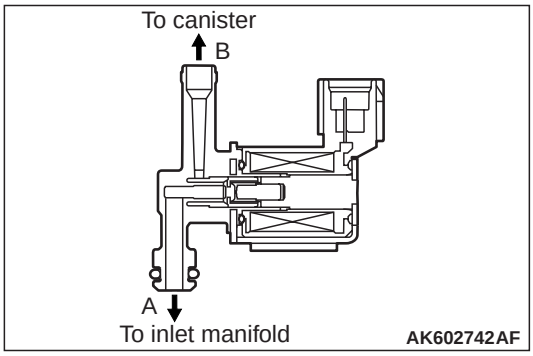
EVAPORATIVE EMISSION CONTROL SYSTEM

M2171000200590

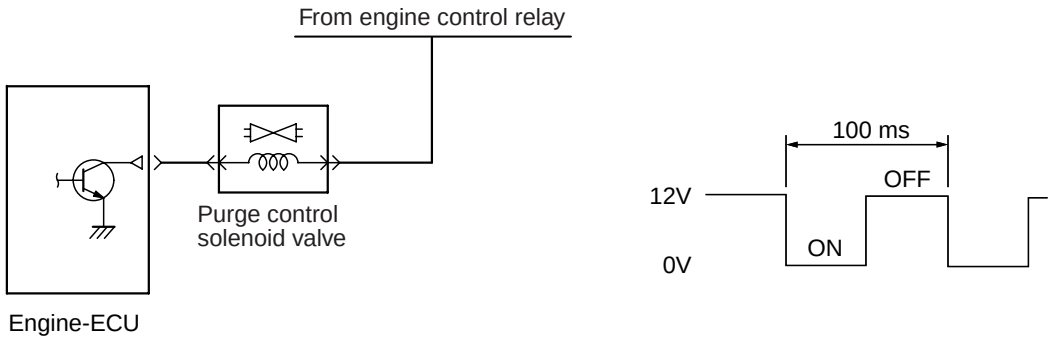


HC (hydrocarbon) generated in the fuel tank are adsorbed by the active carbon in the canister and stored. HC stored in the canister is introduced to the inlet manifold when engine is in operation where it is mixed with intake air and combusted. Engine-ECU introduces optimum HC amount according to driving 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.

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.



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EMISSION REDUCTION SYSTEMS

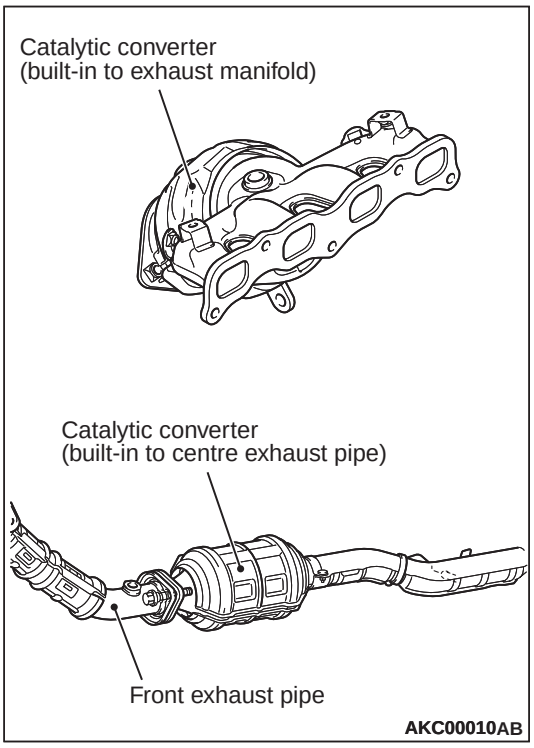
M2171000800439

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

Refer to GROUP 13A – Fuel Injection Control .

2. CATALYTIC CONVERTER



The exhaust manifold and the centre exhaust pipe include a catalytic converter.
Based on appropriate air-fuel ratio feedback from oxygen sensor, CO and HC are oxidized and NOx is reduced. Catalytic converter 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.

GROUP 23

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

CONTENTS

CVT

GENERAL INFORMATION

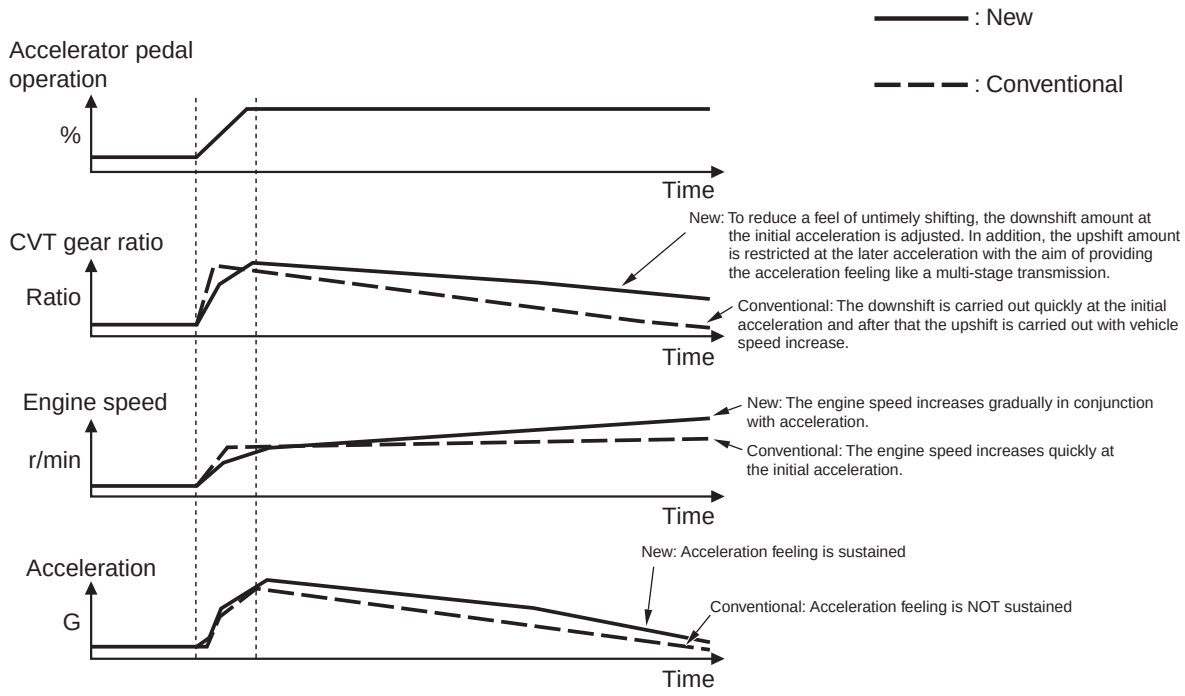
M2231000100585

The CVT is basically the same as for the predecessor. However, note that a new gear ratio control is adopted in order to reduce slip unique to the CVT.

SPECIFICATIONS

Transmission model		F1CJA-2-A5W	W1CJA-2-A5WA	W1CJA-1-14YA
Engine model		4B11		4B12
Drive system		2WD	4WD	
Torque converter	Model	3-element, 1-stage, 2-phase		
	Stall torque ratio	1.99		1.83
	Lock-up	Present		
Transmission type		Forward automatic CVT (steel belt-driven), reverse 1 speed		
Gear ratio	Forward	2.349 – 0.394		
	Reverse	1.750		
Final reduction gear ratio		6.466		
Control type		Electronically-controlled		
Function	Shift control	Present		
	Line pressure control	Present		
	Select control	Present		
	Lock-up control	Present		
	Self-diagnosis function	Present		
	Fail-safe function	Present		
Number of speedometer gears (drive/driven)		– (detected by the ABS sensor)		
Oil pump	Model	Vane-type pump		
	Drive type	Driven by the engine, sprocket, and chain		
CVT fluid	Brand name	MITSUBISHI MOTORS GENUINE CVTF-J4		
	Capacity (L)	Approximately 7.1		

NEW ACCELERATION CONTROL



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A new acceleration control has been employed, in which the engine speed and vehicle speed respond linearly to an accelerator pedal operation to reduce the CVT-specific slippage feel.

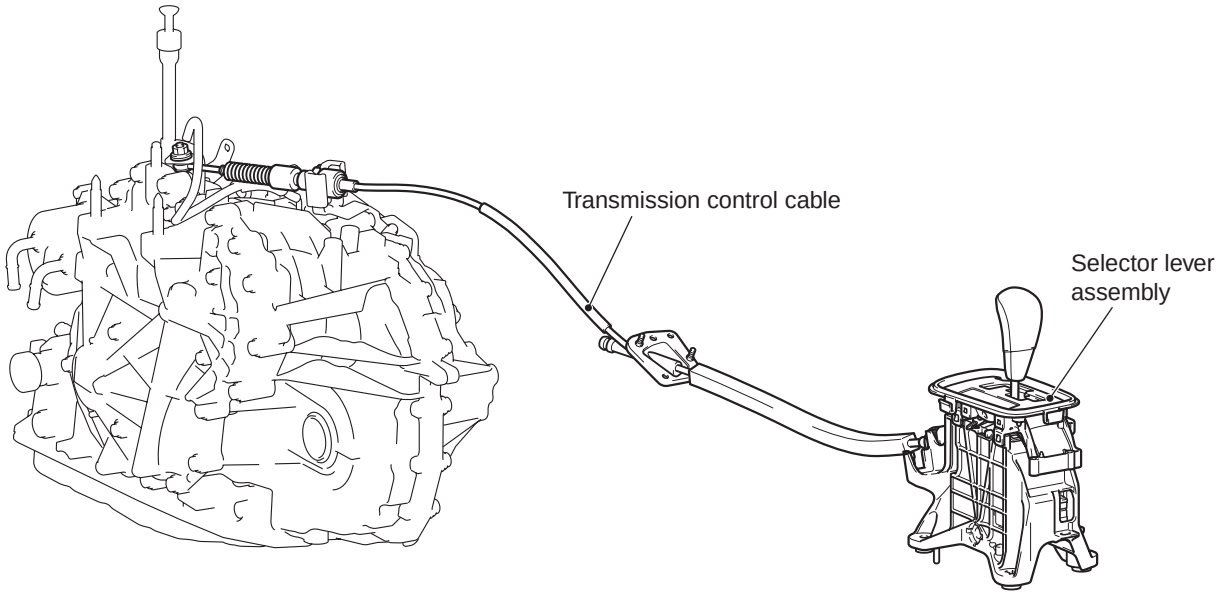
Moreover, both comfortable acceleration and power output performance have been achieved at the same time by increasing the acceleration G with increase of the engine speed.

TRANSMISSION CONTROL

GENERAL INFORMATION

M2232000100823

- The gate-type selector lever with excellent operability has been employed to provide an appropriate control force and a crisp operation feel.
- Shift lock and key interlock mechanisms of reliable electric type have been adopted.
- The weight reduction of the selector lever assembly has been realised by structural rationalisation.
- There are two types of the selector lever knob; sporty black and luxurious leather.
- The black shift indicator panel enhances the sporty image.
- Paddle shift is available on certain models.



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GROUP 25

PROPELLER SHAFT

CONTENTS

GENERAL INFORMATION

M2250000100829

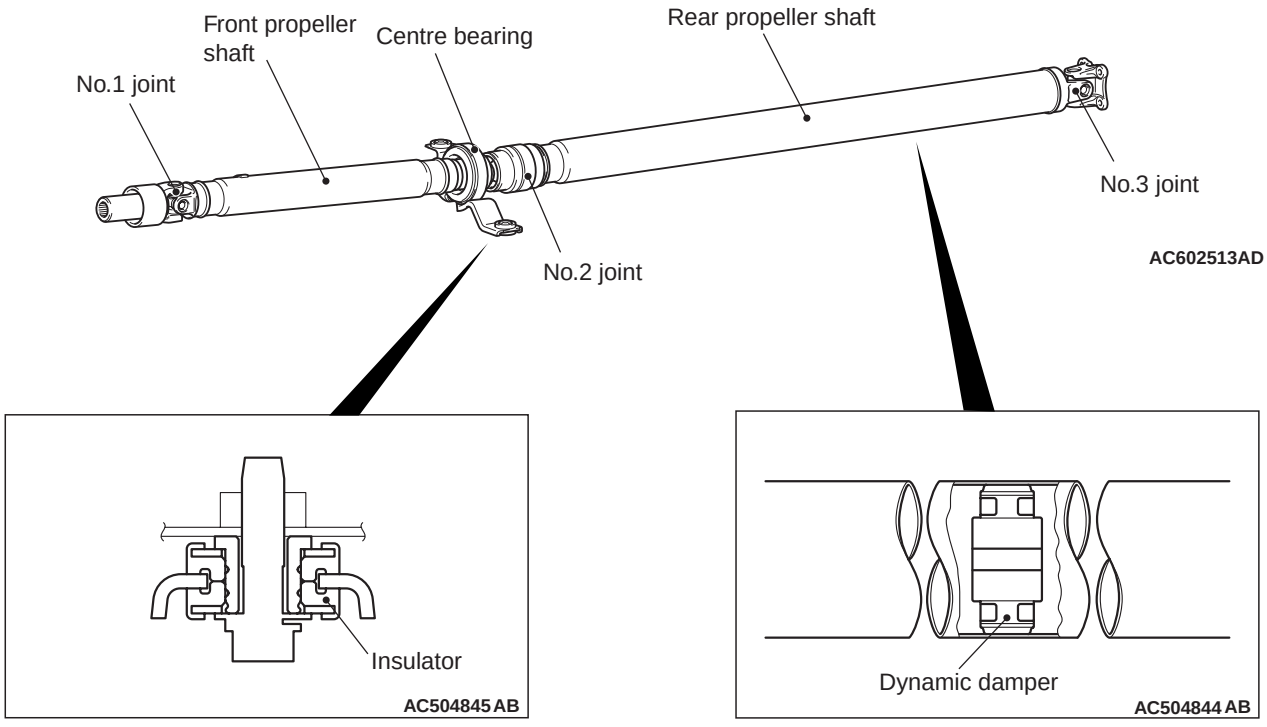
The 2-piece, 3-joint type propeller shaft with a centre bearing is adopted.
It has the following features:

- An insulator is installed to the vehicle body joint of the centre bearing to reduce vibration.
- Inside the rear propeller shaft, the dynamic damper is integrated to reduce a booming noise cased by the resonance at the high engine speed.
- Adopting the friction welding method, the installation structure is streamlined to reduce the weight.
- Lead-free grease is adopted for the universal joint.

SPECIFICATIONS

Item			Specifications
Propeller shaft	Type		2-piece, 3-joint type propeller shaft
Universal joint	Type	No.1	Cross type (caulking method)
		No.2	Constant velocity type
		No.3	Cross type (caulking method)
	Bearing		Needle roller bearing (maintenance-free type)

CONSTRUCTION DIAGRAM



GROUP 26

FRONT AXLE

CONTENTS

GENERAL INFORMATION

M2260000101533

For the front axle, the multi-line angular contact ball bearing with an integral oil seal is adopted as a wheel bearing, and EBJ-PTJ type constant velocity joint as a driveshaft.
It has the following features:

- The lightweight and compact EBJ-type constant velocity joint is installed on the wheel side of the driveshaft, and the vibration reduced PTJ-type constant velocity joint is installed on the differential side.
- For the driveshaft (RH), instead of the conventional output shaft, the long stem integrated with the differential side constant velocity joint is adopted to streamline the structure. <4WD>
- Dynamic damper is mounted on driveshaft (RH) to reduce differential booming noise. <2000>
- Lead-free grease for the constant velocity joint is adopted.
- Hexavalent chromium is eliminated from the dust cover material.
- The number of parts is reduced by integrating the magnetic encoder for ABS wheel speed detection into the wheel bearing.

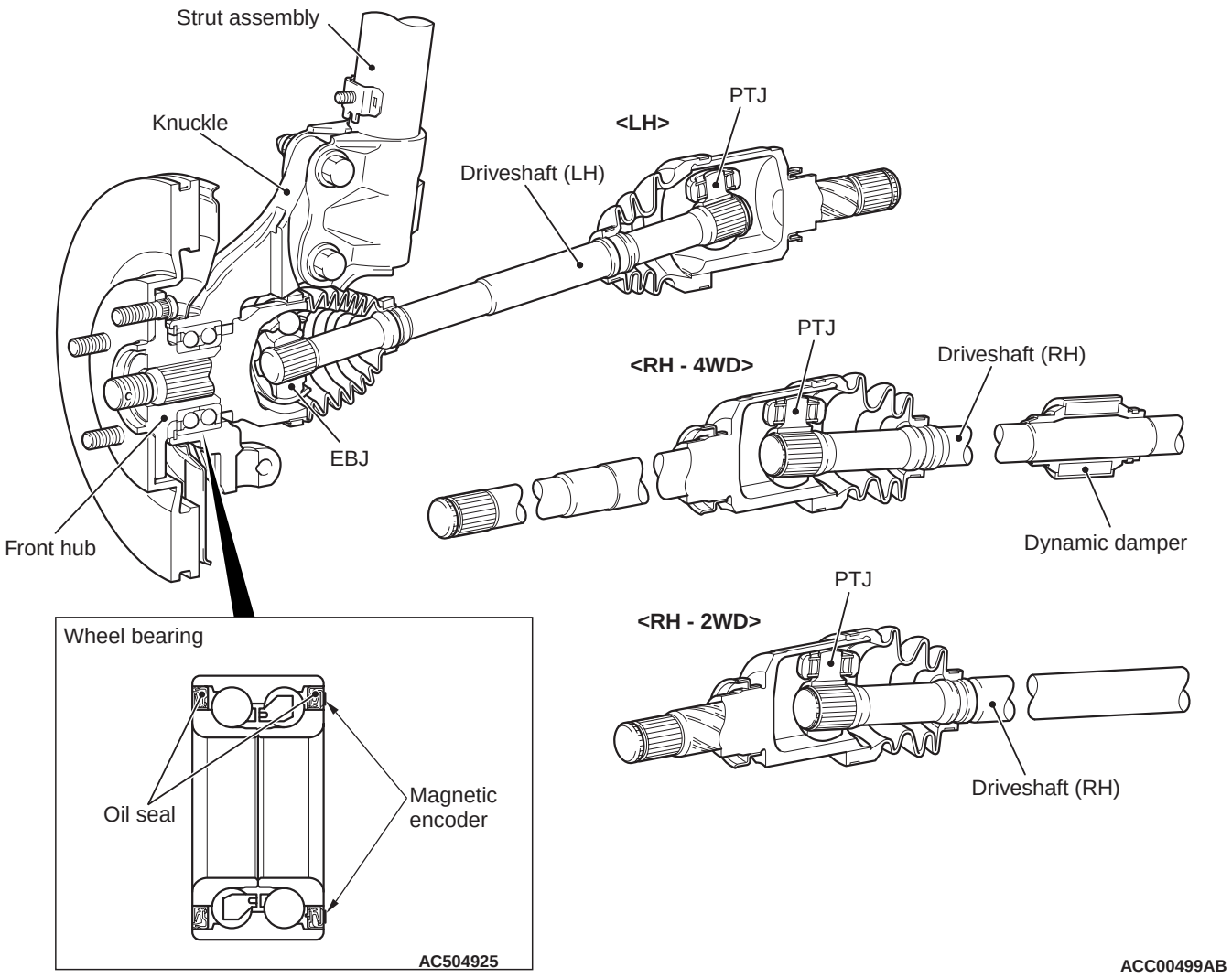
NOTE:
EBJ (High Efficiency Compact Undercut Joint): the lighter and smaller constant velocity joint compared with the conventional BJ has been achieved by adopting the eight small balls.
PTJ (Pillow Tripod Joint)

SPECIFICATIONS

Item			**Specifications**
Wheel bearing	Bearing type		Unit bearing (Double-row angular contact ball bearing)
	Bearing (Outer diameter × inside diameter) (mm)		80 × 43
Drive shaft	Joint type	Outside	EBJ
		Inside	PTJ
	Shaft length* × shaft diameter (mm)	LH	392.5 × 25.4
		RH	708.0 × 34.0 <2WD>, 509.0 × 29.0 <4WD>

*NOTE: *: Indicates the distance between each joint centre.*

CONSTRUCTION DIAGRAM



GROUP 27

REAR AXLE

CONTENTS

REAR AXLE <2WD>

M2270002000325

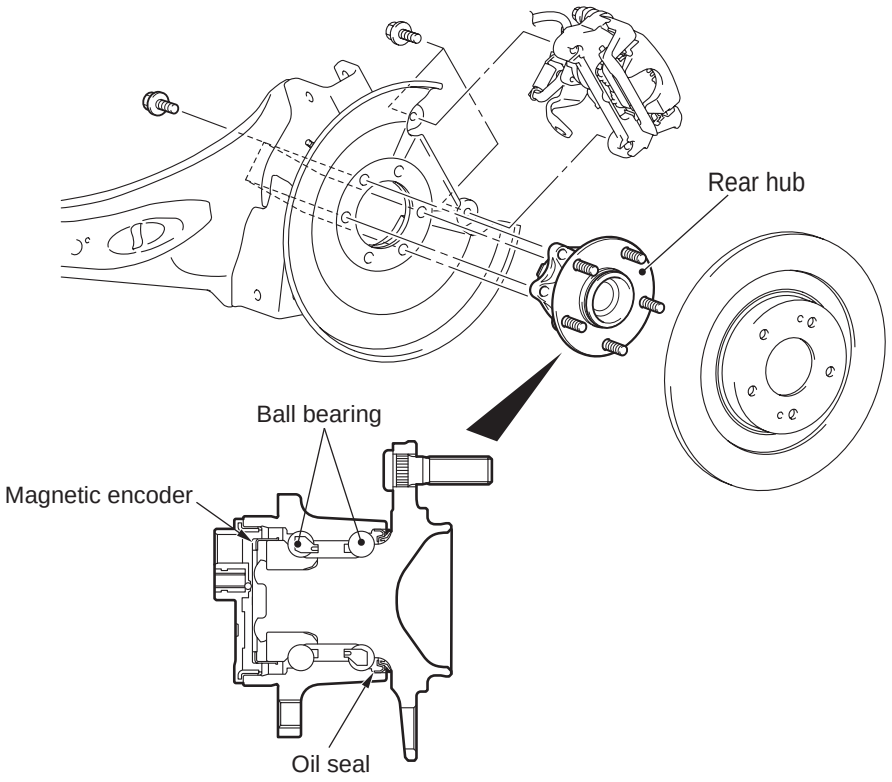
The rear axle has the following features:

- The wheel bearing is a unit ball bearing (double-row angular contact ball bearing) which incorporates the oil seals and is highly resistant to thrust loads.
- The number of parts has been reduced by integrating the magnetic encoder for ABS wheel speed detection into the wheel bearing.

SPECIFICATIONS

Item		Specification
Wheel bearing	Bearing type	Unit ball bearing (double-row angular contact ball bearing)

CONSTRUCTION DIAGRAM



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REAR AXLE <4WD>

M2270003000436

For the rear axle, the unit ball bearing (double-row angular contact ball bearing) in which the hub and ball bearing are incorporated has been adopted for the wheel bearing, and the EUJ–ETJ type constant velocity joint for the driveshaft.
The following features are also available.

- The lightweight and compact EUJ type constant velocity joint has been installed on the wheel side of the driveshaft, and the lightweight compact ETJ type constant velocity joint has been installed on the differential side.
- Adoption of the electronic control 4WD optimizes the size of the driveshaft constant velocity joint and achieves the weight saving.

- Lead-free grease for the constant velocity joint has been adopted.
- Hexavalent chromium has been eliminated from the dust cover material.
- The number of parts has been reduced by integrating the magnetic encoder for ABS wheel speed detection into the wheel bearing.

EUJ (High Efficiency Compact Undercut Joint):The lighter and smaller constant velocity joint compared with the conventional UJ has been achieved by adopting the eight small balls.

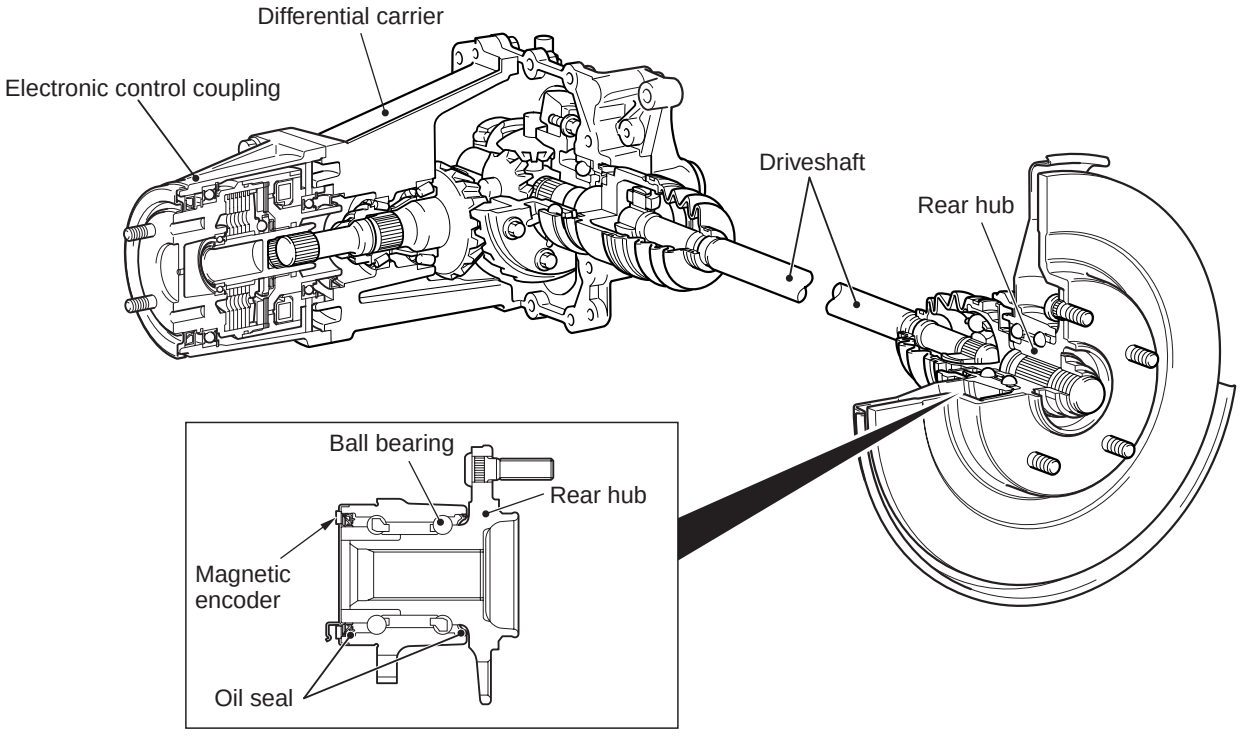
ETJ (High Efficiency Compact Tripod Joint):The lighter and smaller constant velocity joint compared with the conventional TJ has been installed.

SPECIFICATIONS

Item			Specification
Wheel bearing	Bearing type		Unit ball bearing (double-row angular contact ball bearing)
Driveshaft	Joint type	Outer	EUJ
		Inner	ETJ
	Shaft length* × Shaft diameter mm	LH	496.0 × 24
		RH	576.4 × 24

*NOTE: *: Indicates the distance between the centre of each joint.*

CONSTRUCTION DIAGRAM



DIFFERENTIAL

M2270001000786

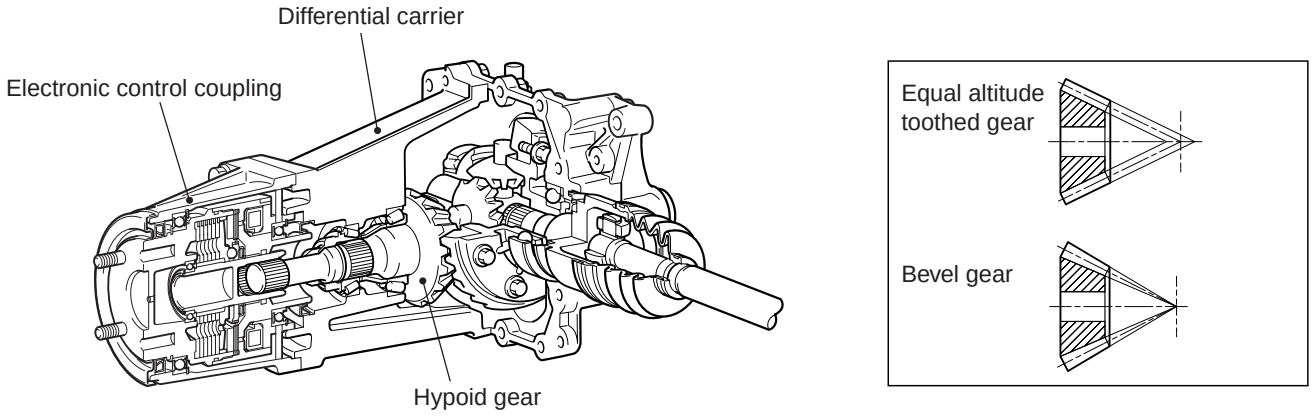
With the introduction of the electronic control 4WD, the electronic control coupling has been installed in front of the differential.

The electronic control coupling transfers the drive force to the rear wheels by pushing the clutch in according to the strength of the magnetic attraction generated by the magnetic coil (For more details, refer to Electronic Control 4WD P.27-5).
The following features are also available.

- Aluminium differential carrier has been adopted for weight saving.
- Optimization of the hypoid gear ratio reduces the torque loss.
- Adoption of the hypoid gear with the same teeth height realizes the downsizing and increases the strength of the coupling.

SPECIFICATIONS

Item		Specification
Reduction gear type		Hypoid gear
Reduction ratio		2.352
Differential gear type (Type × Quantity)	Side gear	Straight bevel gear × 2
	Pinion gear	Straight bevel gear × 2
Number of teeth	Drive gear	40
	Drive pinion	17
	Side gear	14
	Pinion gear	10
Gear oil	Hypoid gear oil API classification GL-5, SAE 80W	Approx. 0.4 L



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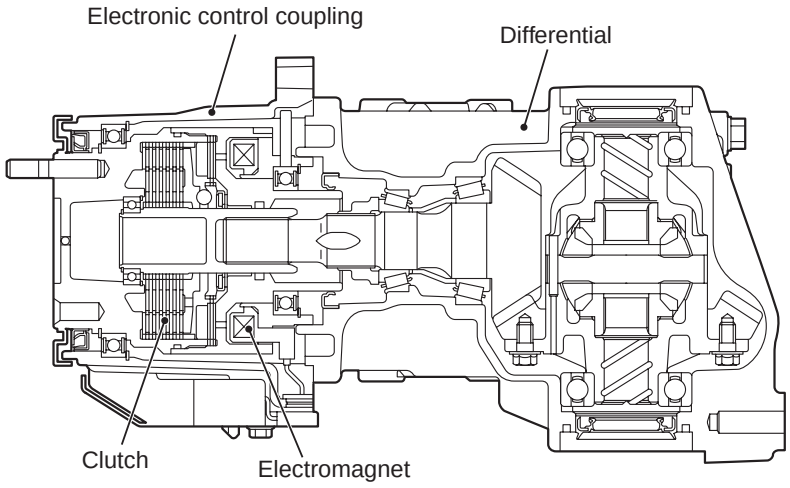

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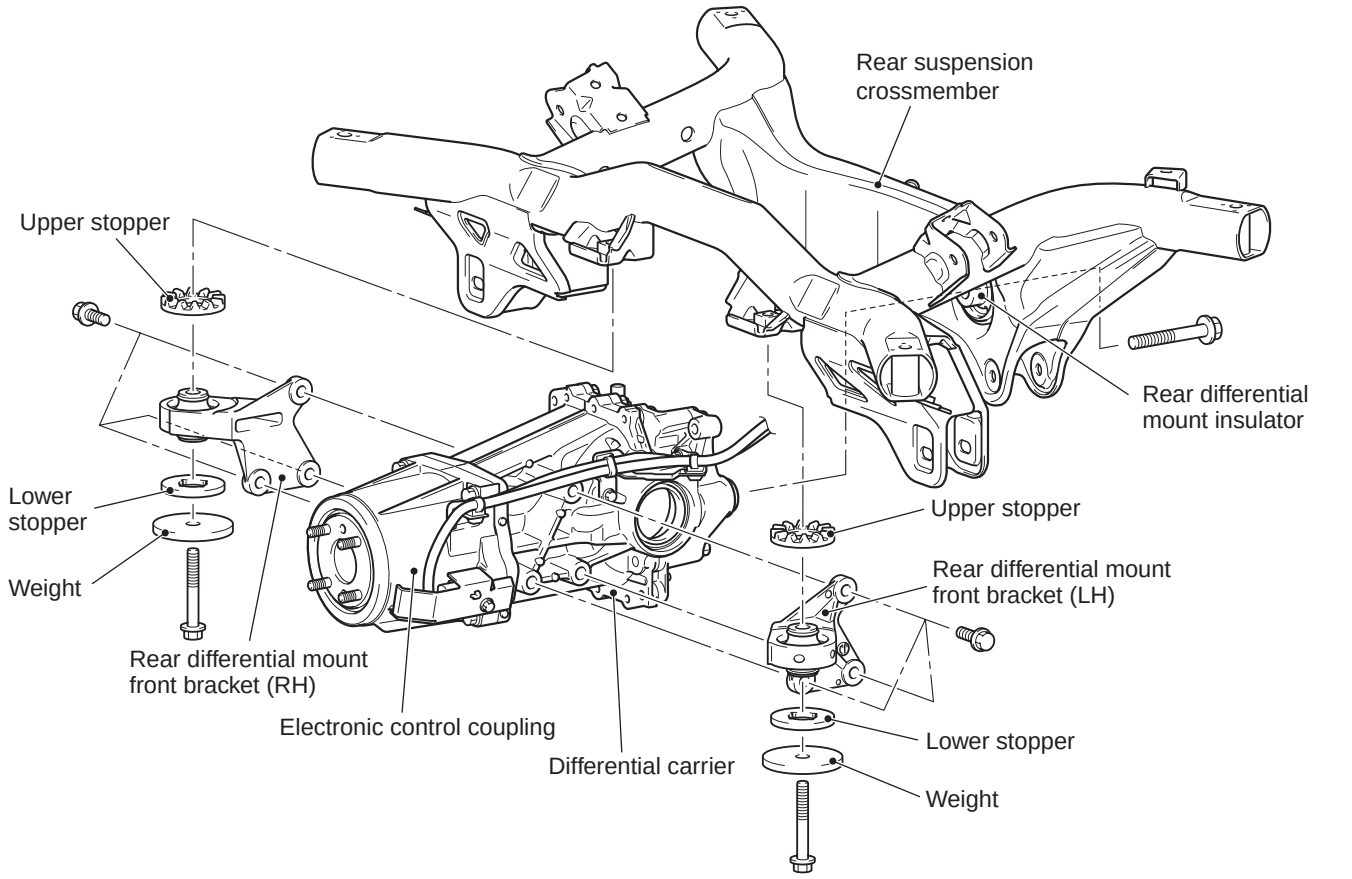
DIFFERENTIAL MOUNT



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The front side of the differential carrier is installed to the rear suspension crossmember via rear differential mount front bracket (LH/RH). The rear side of the differential carrier is installed to the rear suspension crossmember via rear differential mount insulator. In this way, the adoption of the three-point support type differential mount and the optimization of the layout reduce the vibration and noise.

ELECTRONICALLY CONTROLLED 4WD

GENERAL INFORMATION

M2270000101125

- Electronically controlled 4WD has been adopted to ensure the on-road performance, achieve lighter and smaller body, and realize better fuel economy.
- The electronically controlled 4WD controls the torque of the electronic control coupling located between the propeller shaft and rear differential. This strategy is enabled by varying the torque distribution to the front and rear wheels from the status closer to the front wheel drive to the status closer to the direct coupling 4WD and realizes the optimal drive force according to the various driving conditions.

AIMS OF DEVELOPMENT

Lightweight and simple construction of the electronically controlled 4WD achieves good fuel efficiency and provides enjoyment of selecting the drive mode.

FUNCTION

- The adoption of the electronic control coupling prevents the tight corner braking phenomenon* and satisfies the traction performance.

*NOTE: *Tight corner braking indicates the following condition. When the 4WD vehicle turns sharply on a pavement at low speed (ex. parallel parking), the rotational radius of the front and rear wheels differs, and this difference can no longer be compensated by the tyre slippage. At this time, the driver feels as if the brake was applied.*

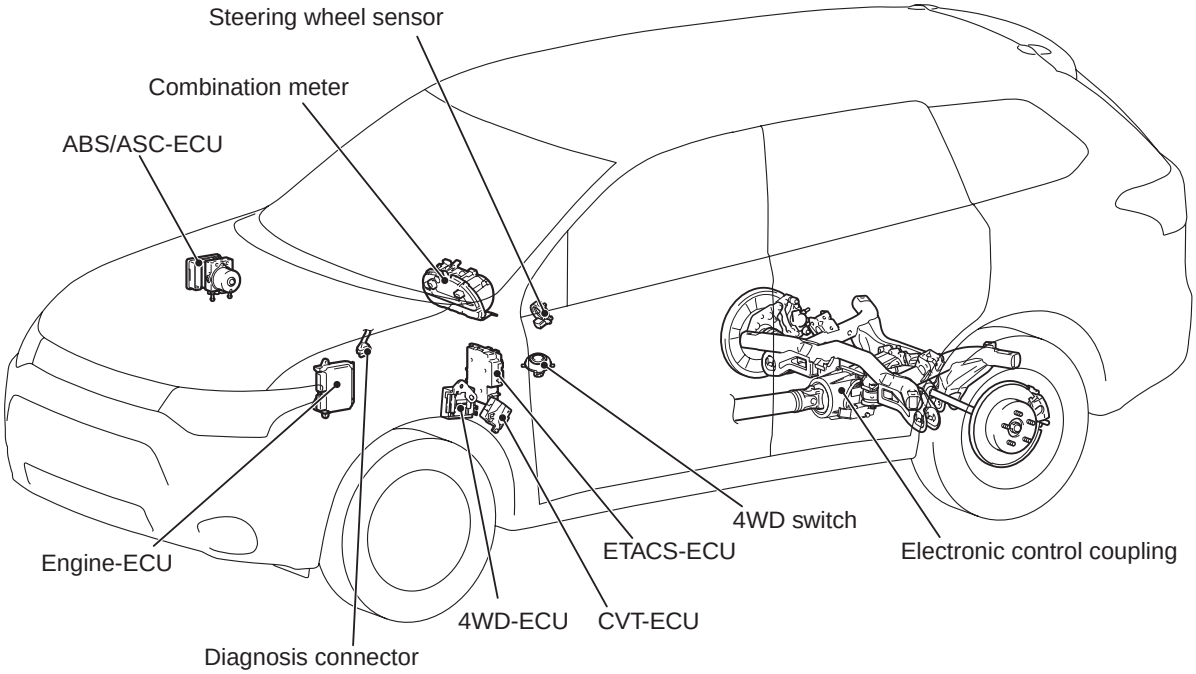
- The electronically controlled 4WD receives the signals of the throttle position and vehicle speed via CAN* communication protocol, detects the vehicle driving condition and operation of the driver, and distributes the proper torque to the rear wheels.

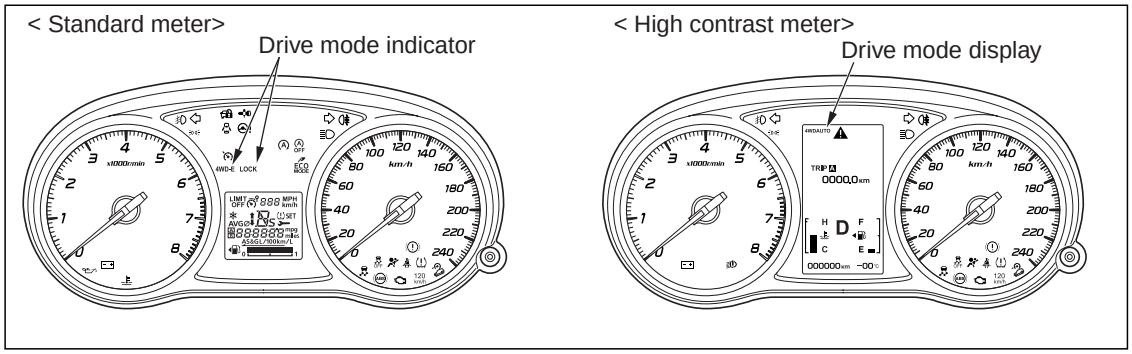
*NOTE: *: For more information about CAN (Controller Area Network), refer to GROUP 54C .*

- Under severe driving condition, the system is protected by minimizing the limitation force of the differential.
- During high-speed driving, the fuel efficiency is improved by reducing the limitation force of the differential.
- The following drive modes are available according to the drivers' preference to provide the enjoyment of selecting functions.

Drive mode	Control content	Appeal point
4WD ECO	Minimizes the limitation force of the differential.	High fuel efficiency mode. This mode is ordinary driven on efficient 2WD and provides 4WD performance on wheel slipping conditions.
4WD AUTO	Increases the limitation force of the differential according to the different rotation speed of the front and rear wheels and the throttle position.	Normal mode. This mode achieves adequate 4WD performance on various conditions, dried pavement, wet road, snow road, etc.
4WD LOCK	Further increases the limitation force of the differential compared to the 4WD AUTO.	High traction mode. This mode excels at rough road driving and escape from stuck conditions, in addition, realizes strong 4WD driving from low speed to high speed on ordinary road.

CONSTRUCTION DIAGRAM





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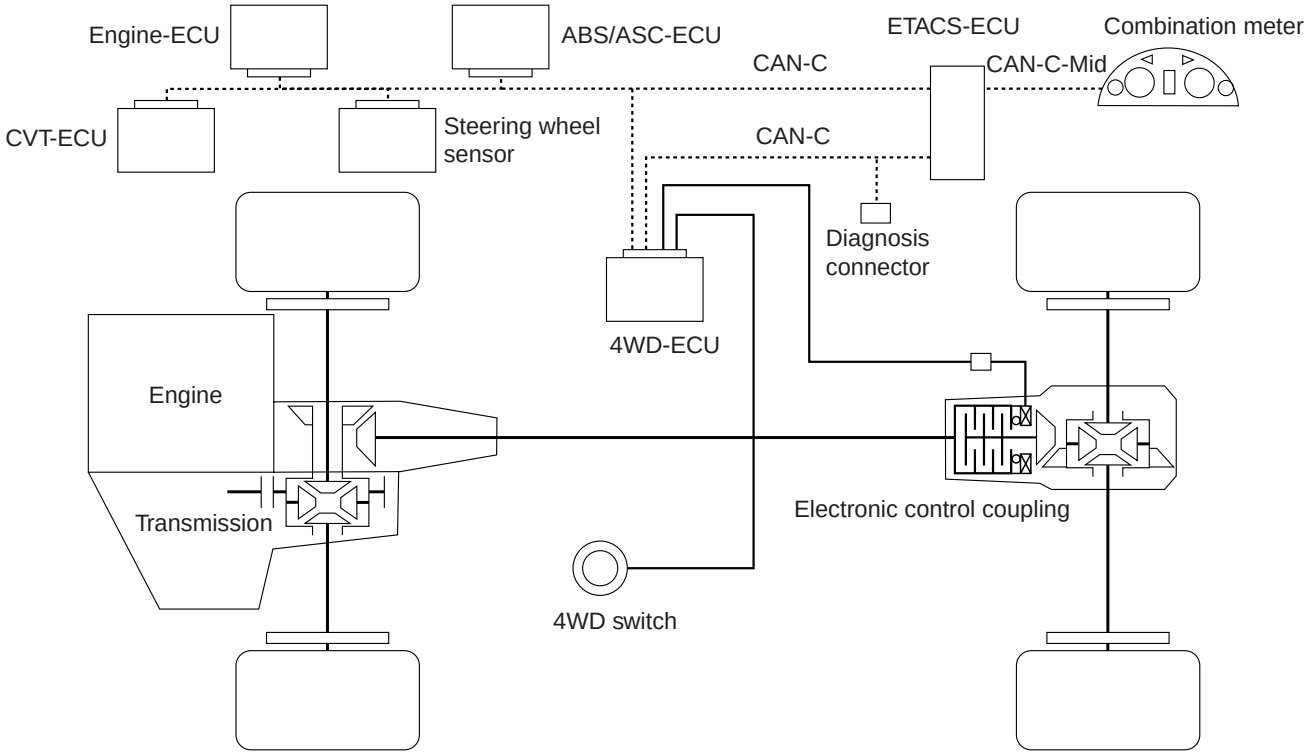
System component and function

Parts name	Functional description
Engine ECU	Sends the following signals required by 4WD-ECU via CAN communication. • Engine torque signal • Throttle position signal • Engine speed signal
CVT-ECU	Sends the following signals required by 4WD-ECU via CAN communication. • Gear position signal
ABS/ASC-ECU	Sends the following signals required by 4WD-ECU via CAN communication. • ABS sensor signal (4 wheels speed signal) • ABS/ASC operation signal • 4WD limitation torque signal

Parts name	Functional description
Steering wheel sensor	Sends the following signals required by 4WD-ECU via CAN communication. • Steering angle signal
4WD switch	Sends the drive mode switch signal (4WD) to 4WD-ECU.
ETACS-ECU	Receives drive mode-related information (4WD ECO, 4WD AUTO, 4WD LOCK), failure information and protection information from the 4WD-ECU, and then sends them to the combination meter.
4WD-ECU	Calculates the optimum differential limitation force judging from the vehicle condition and present drive mode based on the signals from each ECU and switch, and controls the current value flown to the electronic control coupling.
	Controls the indicators (4WD ECO, 4WD AUTO, 4WD LOCK) in the combination meter.
	Controls the self-diagnostic function and fail-safe function.
	Controls diagnostic function (Compatible with M.U.T.-III).
Electronic control coupling	Transmits the torque corresponding to the current value controlled by 4WD-ECU to the rear wheels.
Drive mode indicator	Integrated in the combination meter, and indicates the selected drive mode. • When the 4WD system fails or is protected, the "4WD-E" or"LOCK" indicator will flash simultaneously or alternately, and the system automatically will enter the front wheel drive mode to protect the drive system components, and the drive mode changeover with the 4WD switch will become unavailable. <Standard meter> • When the 4WD system fails or is protected, a message will be displayed, and the system automatically will enter the front wheel drive mode to protect the drive system components, and the drive mode changeover with the 4WD switch will become unavailable. <High contrast meter> • The drive mode signal from 4WD-ECU is sent to the combination meter via ETACS-ECU using CAN communication.
Diagnosis connector	Outputs the diagnosis code and establishes the communication with M.U.T.-III.

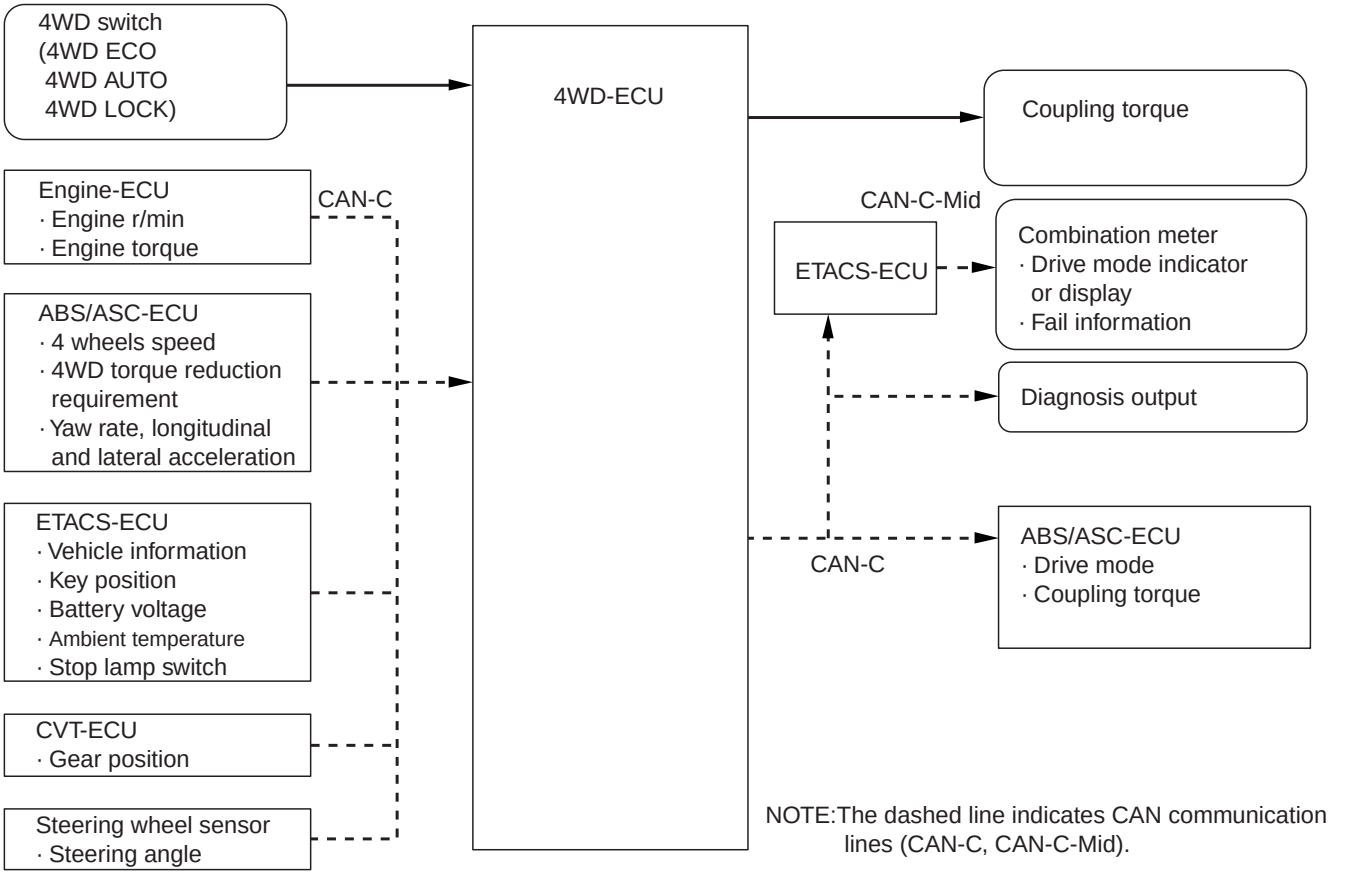
System configuration



NOTE:The dashed line indicates CAN communication lines (CAN-C, CAN-C-Mid).

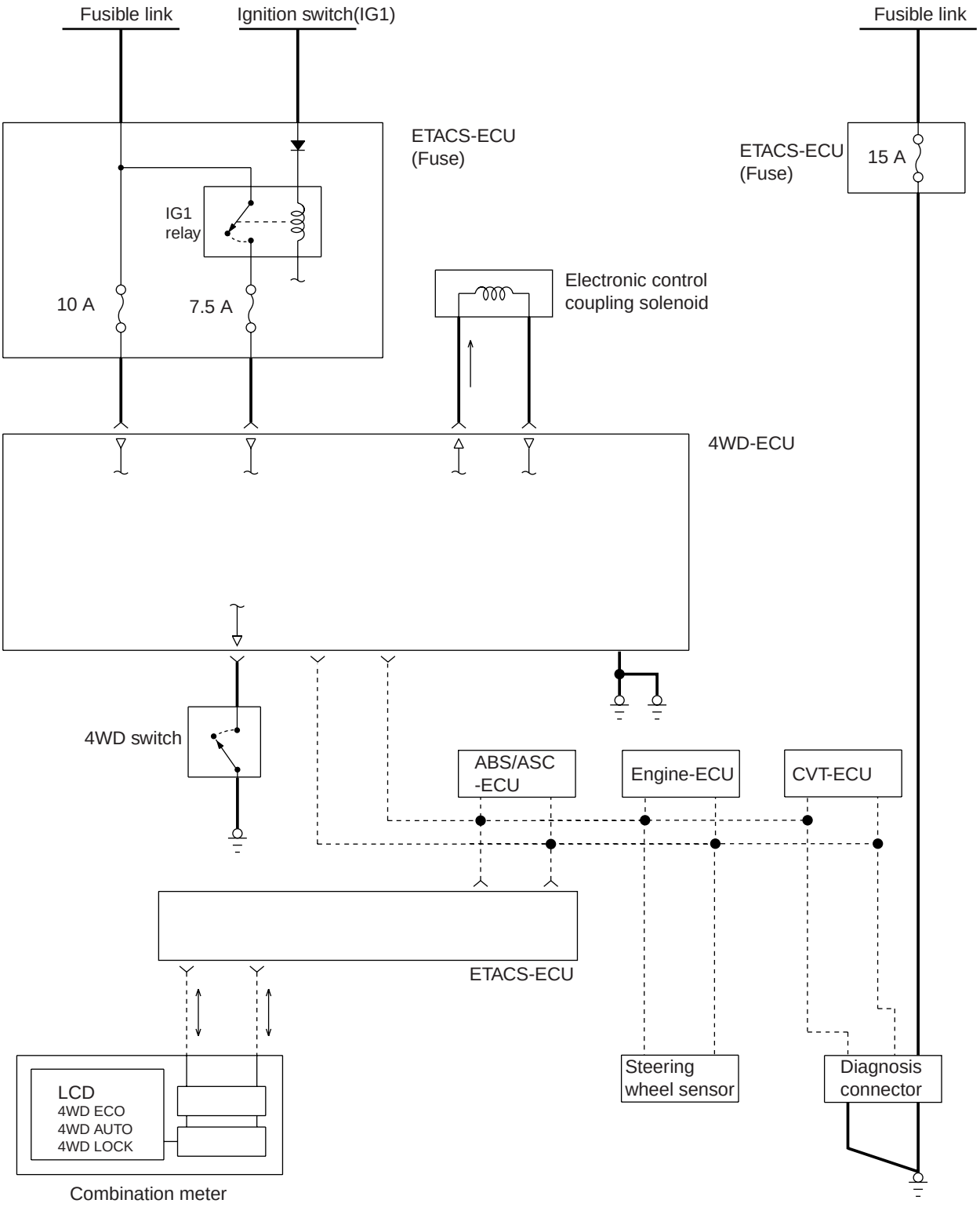
ACC00455 AB

Control schematic diagram



ACC00456 AB

Electronically controlled 4WD electric circuit diagram



NOTE:The dashed line indicates CAN communication lines.

ACB05564 AC

4WD-ECU

M2270000500078

FUNCTION

The main functions of 4WD-ECU are as follows:

1. Communication function
   - CAN communication with other ECUs (Engine ECU, CVT-ECU, ABS/ASC-ECU, steering wheel sensor, ETACS)

- Communication with drive mode switch: The signal from the drive mode switch changes the drive mode.
- Combination meter display: Drive mode is displayed.

2. Coupling control function
   - Current output: Differential control function of the electronic control coupling according to the vehicle conditions
3. ECU self-diagnosis function
   - Initial check: ROM check, relay check, etc.
   - Recording function of diagnosis codes and freeze frame data in case of failure
   - System shutdown function after failure detection, "4WD-E" and "LOCK" indicator warning and message indication on display
   - Normal control: Malfunction of CPU power supply, relay check, open or short circuit of the I/O signal, abnormal CAN communication

FAIL-SAFE FUNCTION

FAILURE DETECTION

4WD-ECU performs the following checks at a timing shown in the chart below. 4WD-ECU determines the malfunction occurred when the failure detection conditions are met, and it sets the diagnosis code and executes the countermeasures for trouble. When the failure resume conditions are met, ECU determines the status is normal, and resumes the system.

Start-up (Initial check just after the ignition switch is turned ON.)

1. CPU check
   - Performs the ROM and RAM check.
2. Actuator check
   - After CPU check has been completed, check the driving voltage with the actuator relay OFF.

Always (During ignition ON status other than initial check operation)

1. CPU check
   - Performs CAN communication and interactive check between CPUs.
2. Power supply check
   - Monitors the CPU supply voltage and checks if the voltage is within specifications.
3. Actuator check
   - Checks if the actuator relay turns ON according to the control.
   - Compares the command current value from CPU with the monitored current and checks if they agree.
4. External wire connection check
   - Checks if the input and output of each external wire connection is open, shorted, or stuck.

NOTE: For the fail-safe specification, refer to Workshop Manual.

DIAGNOSTIC FUNCTION

4WD-ECU has the following functions for easier system checks. All of the following items can be diagnosed using the M.U.T.-III.

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

DIAGNOSIS CODE SET

Using M.U.T.-III, the diagnosis code (information of failures generated in the electronically controlled 4WD system) can be read. When a failure occurs, 4WD-ECU sets the diagnosis code for that failure in the nonvolatile memory (EEPROM*), so the recorded information will not be erased even if the battery is disconnected.

NOTE:

- **EEPROM (Electrical Erasable & Programmable ROM): Special type of memory that can be programmed or erased electrically*
- *For the diagnosis code output items of the electronically controlled 4WD, refer to Workshop Manual.*

SERVICE DATA OUTPUT

Using M.U.T.-III, the data (input data from each ECU and switch) used for control by the electronically controlled 4WD system can be read.

NOTE: For each service data item, refer to Workshop Manual.

ACTUATOR TEST

M.U.T.-III can forcibly drive the actuators (electronic control coupling solenoid and drive mode indicator) controlled by the electronically controlled 4WD system.

NOTE: For the actuator test specification, refer to Workshop Manual.

FREEZE FRAME DATA OUTPUT

M.U.T.-III can read the freeze frame data (driving conditions when the failure occurs) set when the diagnosis code is detected.

NOTE: For freeze frame data items, refer to Workshop Manual.

4WD SWITCH

M2270001300011

The 4WD switch has been installed on the floor console. When the 4WD switch is operated with the ignition switch ON, the drive mode can alternate 4WD ECO, 4WD AUTO or 4WD LOCK.

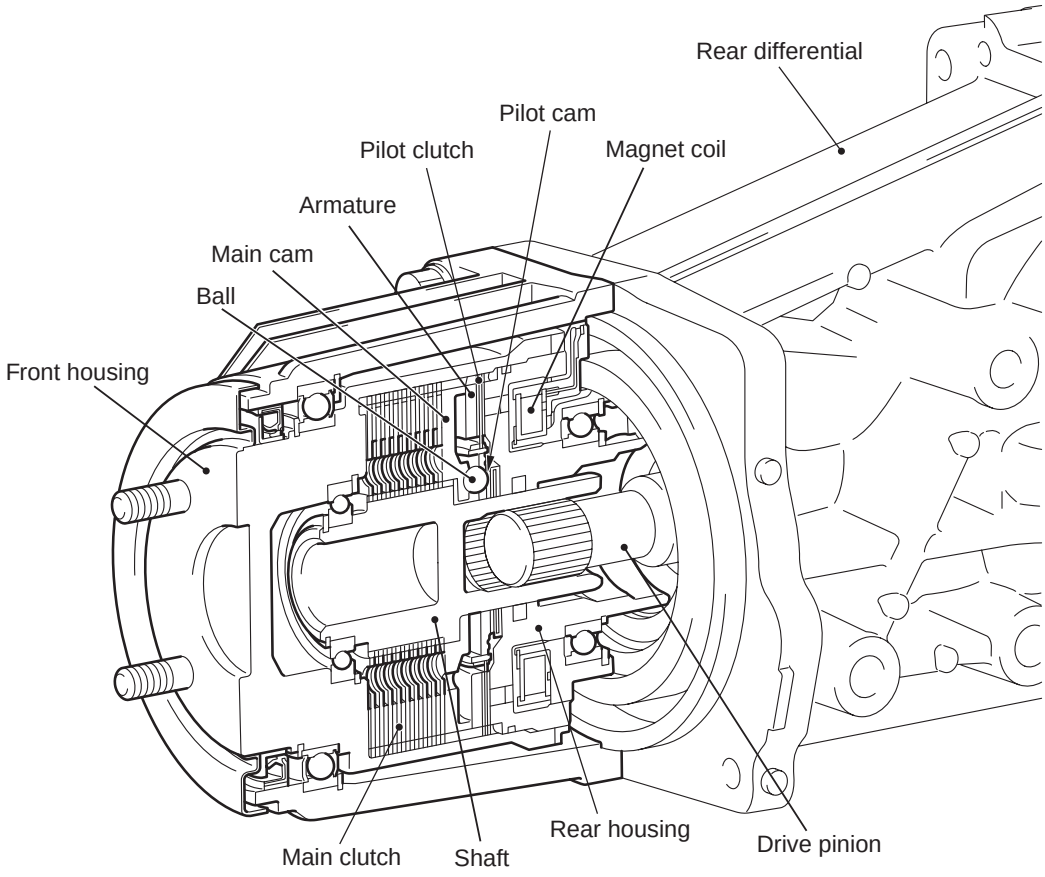
ELECTRONIC CONTROL COUPLING

M2270000700072

FEATURES

The electronic control coupling realizes the highly reliable 4WD system with lighter weight and simpler construction.

CONSTRUCTION



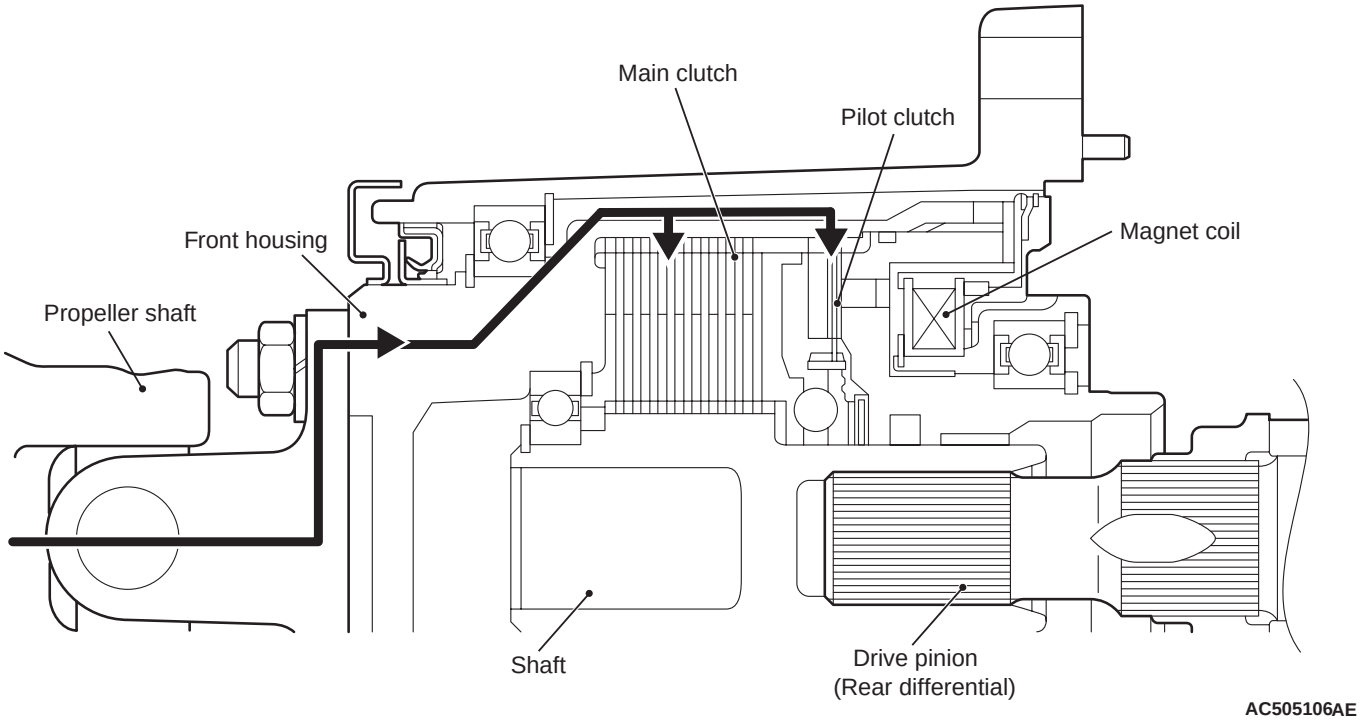
AC505099AC

The electronic control coupling is comprised of the front housing, main clutch, main cam, ball, pilot cam, armature, pilot clutch, rear housing, magnetic coil, and shaft.

- The front housing is joined to the propeller shaft and rotates along with the shaft.
- The main clutch and pilot clutch are assembled to the front housing on the outer side and to the shaft on the inner side (The pilot clutch is installed via the pilot cam).
- The shaft is engaged via serrations with the drive pinion of the rear differential.

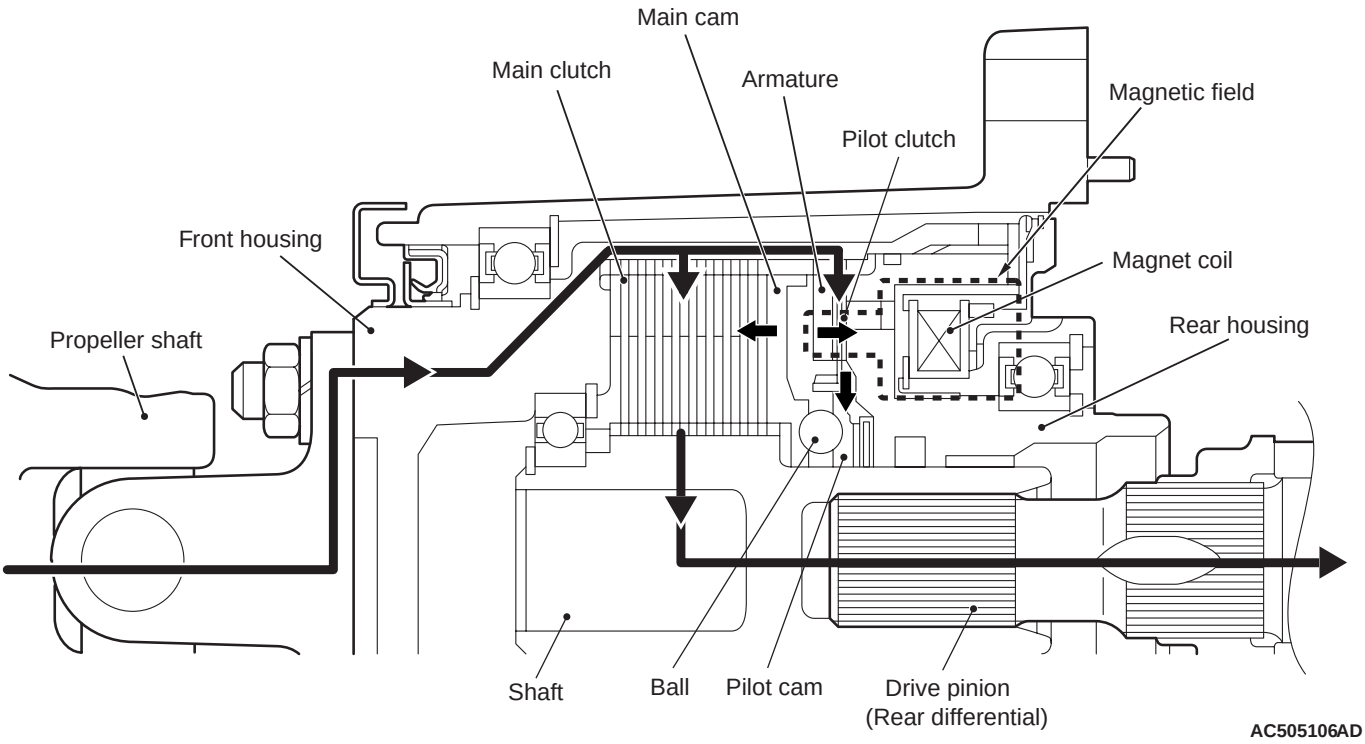
OPERATION

Coupling stops (2WD: Magnetic coil de-energized.)

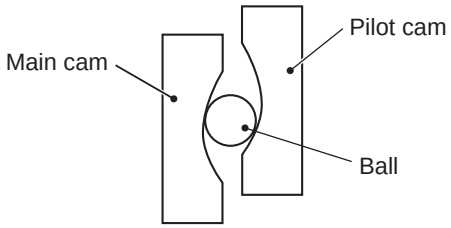


The drive force from the transfer is transmitted to the front housing connected to the propeller shaft. The drive force is also transferred to the pilot clutch and the outer side of the main clutch assembled to the front housing. Because the pilot clutch and the main clutch are not engaged with the magnetic coil de-energized, the drive force is not transferred to the shaft and the drive pinion of the rear differential.

Coupling operates (4WD: Magnetic coil energized.)



AC505106AD



AC507947AD

- The drive force from the transfer is transmitted to the front housing connected to the propeller shaft. The drive force is also transferred to the pilot clutch and the outer side of the main clutch assembled to the front housing. When the magnetic coil is energized, the magnetic field is generated among the rear housing, pilot clutch, and armature. The magnetic field induces the pilot clutch and armature to engage the pilot clutch. When the pilot clutch is engaged, the drive force is transferred to the pilot cam. When there is a difference in rotation speed between the front and rear wheels (i.e. rotation speed of the propeller shaft is different from that of the drive pinion), the rotation speed of the pilot cam applied with the drive force and that of the main cam not applied with the drive force become different. The ball slides along the curved space between the pilot cam and main cam by the rotational speed difference and pushes the pilot cam and main cam. Then, the main clutch is pushed toward the main cam to engage. When the main clutch is engaged, the drive force is transferred to the rear wheels via the shaft and the drive pinion of the rear differential.
- By controlling the current applied to the magnetic coil, the amount of the drive force transferred to the rear wheels can be controlled within the range of 0 to 100%.

GROUP 31

WHEEL AND TYRE

CONTENTS

GENERAL INFORMATION

M2310000102022

The wheels and tyres of the following specifications have been established.

SPECIFICATIONS

Road wheel and tyre

<2000>

Item		Standard	Option <4WD>	
Wheel	Type	Steel type	Aluminium type	Aluminium type
	Size	16 × 6.5JJ	16 × 6.5J	18 × 7J
	Amount of wheel offset mm	38	38	38
	PCD mm	114.3	114.3	114.3
Tyre	Size	215/70R16 100H	215/70R16 100H	225/55R18 98H

<2400>

Item		Standard	Option
Wheel	Type	Aluminium type	Aluminium type
	Size	16 × 6.5J	18 × 7J
	Amount of wheel offset mm	38	38
	PCD mm	114.3	114.3
Tyre	Size	215/70R16 100H	225/55R18 98H

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

Spare wheel and tyre

Item		Standard	Option
Wheel	Type	Steel type	Aluminium type
	Size	16 × 6.5JJ	18 × 7J
	Amount of wheel offset mm	38	38
	PCD mm	114.3	114.3
Tyre	Size	215/70R16 100H	225/55R18 98H

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

GROUP 32

POWER PLANT MOUNT

CONTENTS

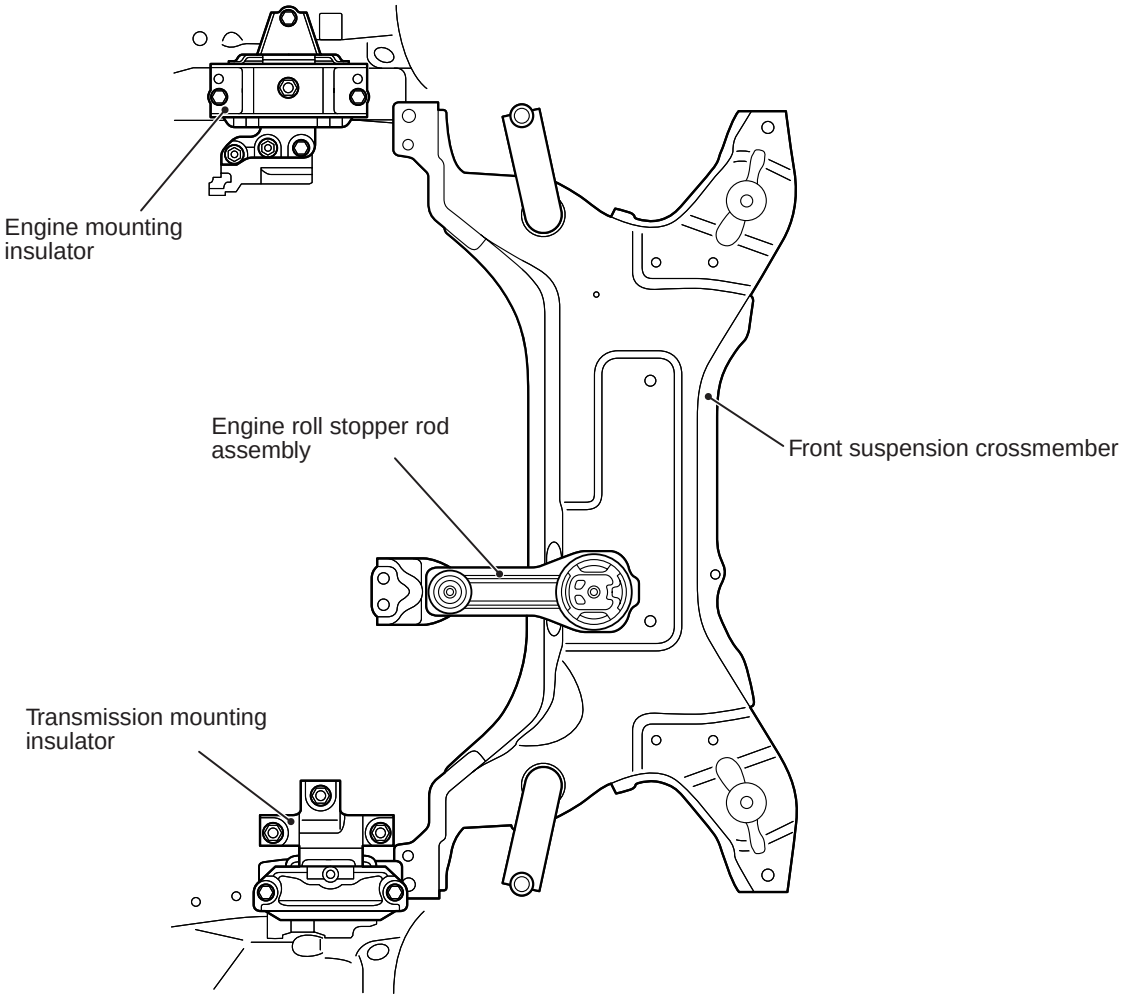
GENERAL INFORMATION

M2320000101503

New pendulum engine mounting system reduces noise and vibration, which has the following features.

- The power train mass is supported in line with the axis of inertia and torque reaction is controlled by roll-rod stopper with longitudinal force in stead of vertical force, sensitive to noise and vibration.
- Roll-rod stopper has two rubber-to-metal bushings including large voided bushing and reduces vibration and noise doubly.
- Enlarged right-hand engine mount, incorporating a hydraulic chamber, reduces transmission of noise and vibration in common use and enhances ride quality on rough roads.

CONSTRUCTION DIAGRAM



ACB05015AB

GROUP 33

FRONT SUSPENSION

CONTENTS

GENERAL INFORMATION

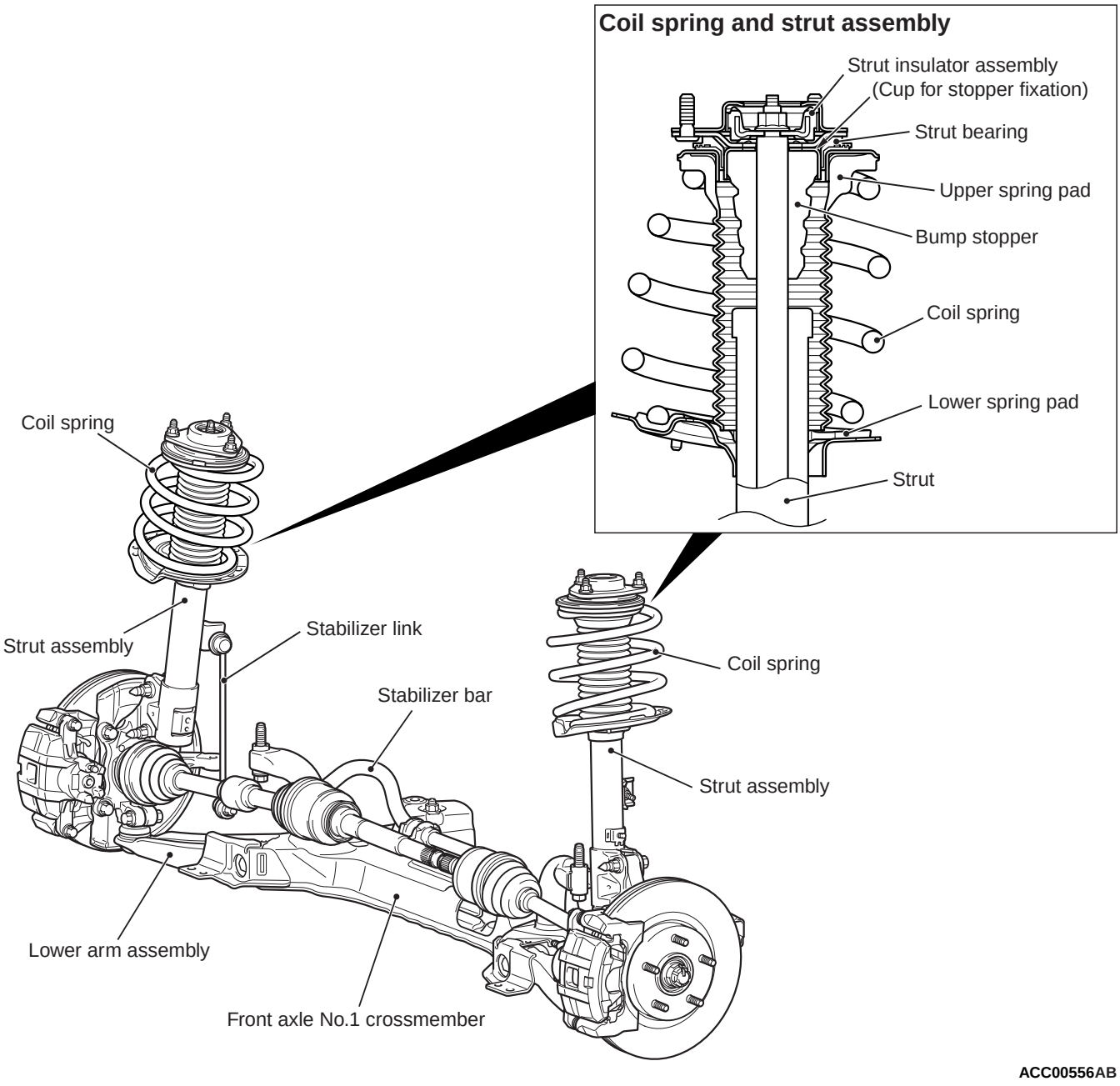
M2330000101979

The well-proven MacPherson strut type suspension has been adopted. Various components such as the strut assembly and the coil spring have been modified or fine-tuned in order to enhance driving comfort, compared with the previous model.

MAIN FEATURES

- The thicker upper spring pad and lower spring pad reduce high-frequency vibration and road noise.
- The newly adopted polyurethane bump stopper absorbs high load without transmitting sharp vibrations to the bodyshell.
- The newly added cup does not rotate together with the strut. As this stationary cup holds the bump stopper, Therefore, the friction on the top surface of the bump stopper can be suppressed, thus eliminating sources of noise.
- The extended dust cover bellows suppresses dust intrusion through absorber oil seal.
- The newly designed barrel-shaped springs reduce weight.

CONSTRUCTION DIAGRAM



SPECIFICATIONS

SUSPENSION SYSTEM

Item	Specification
Suspension type	MacPherson strut with coil spring

WHEEL ALIGNMENT

Item	Specification
Camber	0°20'
Caster	2°35'
Kingpin inclination	12°45'

Item		Specification
Toe-in	At the centre of tyre tread mm	1
Toe-in angle (per wheel)		0°02'

GROUP 34

REAR SUSPENSION

CONTENTS

GENERAL INFORMATION

M2340000101657

New blade multi-link rear suspension is an evolution of the current rear suspension to enhance stability and save unsprung weight. Springs and shock absorbers are optimised and fine-tuned for well- balanced handling, stability and ride comfort.

MAIN FEATURES

- Newly designed stamping arms reduce unsprung weight which offer greater handling and ride comfort.
- New designed blade suspension has a slight passive toe-steer effect and provides safer handling.
- Extended toe control links provide smooth suspension stroke feeling and enhance ride comfort.
- The fine-tuned voided bushes pressed in the blade trailing arm reduce harshness and absorb vibration.

SPECIFICATIONS

SUSPENSION SYSTEM

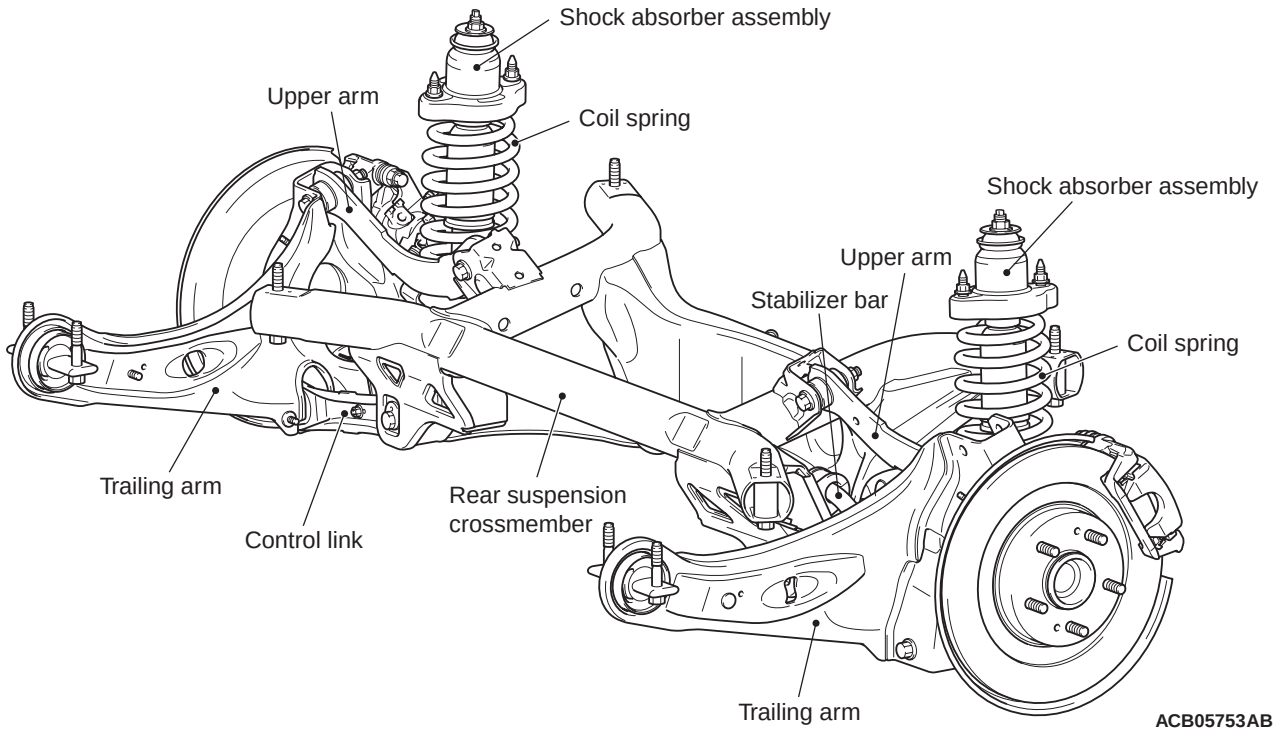
Item	Specification
Suspension type	Trailing arm type multi-link

WHEEL ALIGNMENT

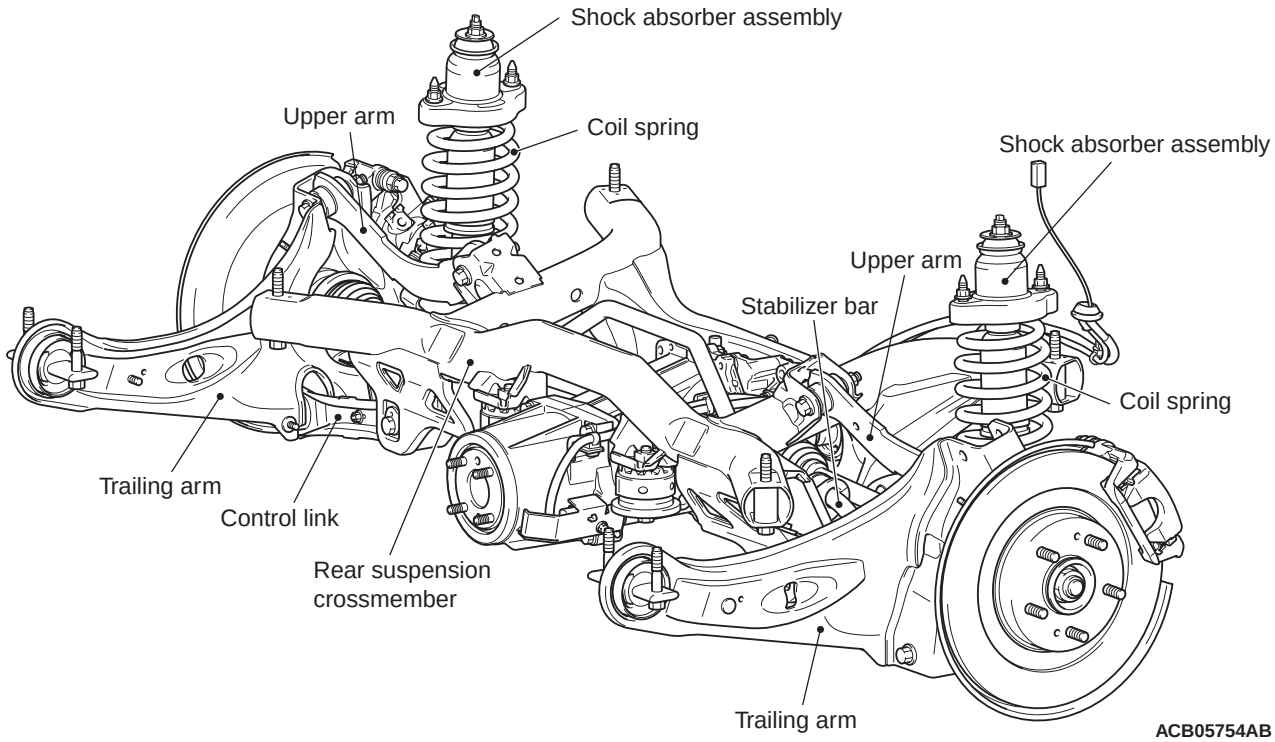
Item	Specification
Camber	–0°30'
Toe-in mm	3

CONSTRUCTION DIAGRAM

<2WD>



<4WD>



GROUP 35

SERVICE BRAKE

CONTENTS

GROUP 35A

BASIC BRAKE SYSTEM

CONTENTS

GENERAL INFORMATION

M2350000101755

Brake systems with higher reliability and durability have achieved distinguished braking performance.

FEATURES

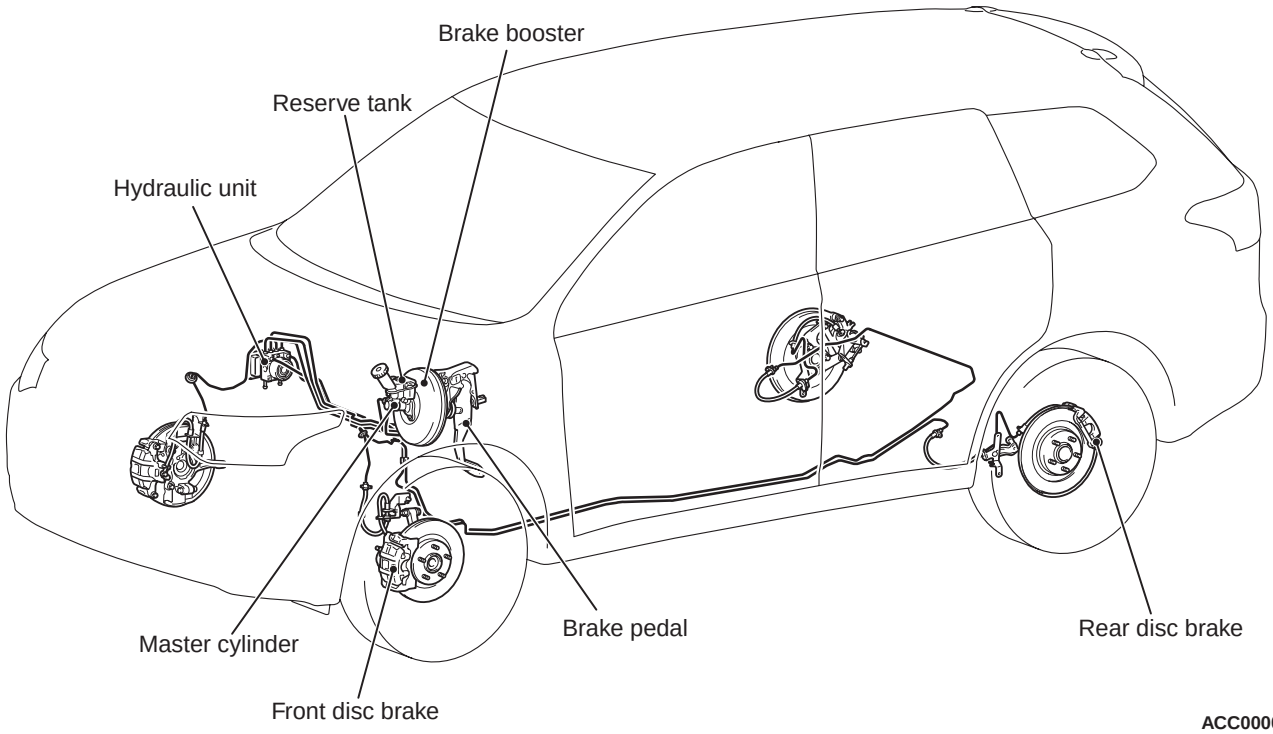
IMPROVEMENT OF BRAKING PERFORMANCE

- In addition to the 10-inch single brake booster, the small and long stroke-type master cylinder has been adopted to achieve the downsizing and secure the assist force.
- The installation of 16-inch ventilated disc brake on the front axle and 16-inch solid disc brake on the rear axle achieves the secure braking force and direct braking feeling.

IMPROVEMENT IN SAFETY

- Diagonal split (X-type) brake lines is adopted.
- Audible wear indicators are used on the front and rear brake pads to warn the driver of wear limit.

CONSTRUCTION DIAGRAM



ACC00001AB

SPECIFICATIONS

Item		Specification
Master cylinder	Type	Tandem type
	I.D. (Inner diameter) mm	20.6
Brake booster	Type	Vacuum type, single
	Size inch	10
	Boost ratio	8.5
Rear wheel hydraulic control method		EBD (Electronic control braking force distribution)

Item		Specification
Front disc brake	Type	Floating caliper, 1-piston, ventilated disc
	Brake disc effective dia. × thickness mm	241.6 × 26
	Cylinder I.D. mm	57.1
	Brake pad thickness mm	10.0
	Clearance adjustment	Automatic adjustment
Rear disc brake	Type	Floating caliper with parking brake mechanism integrated, 1-piston, solid disc
	Brake disc effective dia. × thickness mm	259.8 × 10
	Cylinder I.D. mm	41.3
	Brake pad thickness mm	9.0
	Clearance adjustment	Automatic adjustment
Brake fluid		DOT3 or DOT4

CONSTRUCTION DESCRIPTION

MASTER CYLINDER

M2350001000673

The master cylinder is a tandem-type, with a structure that emphasizes safety.

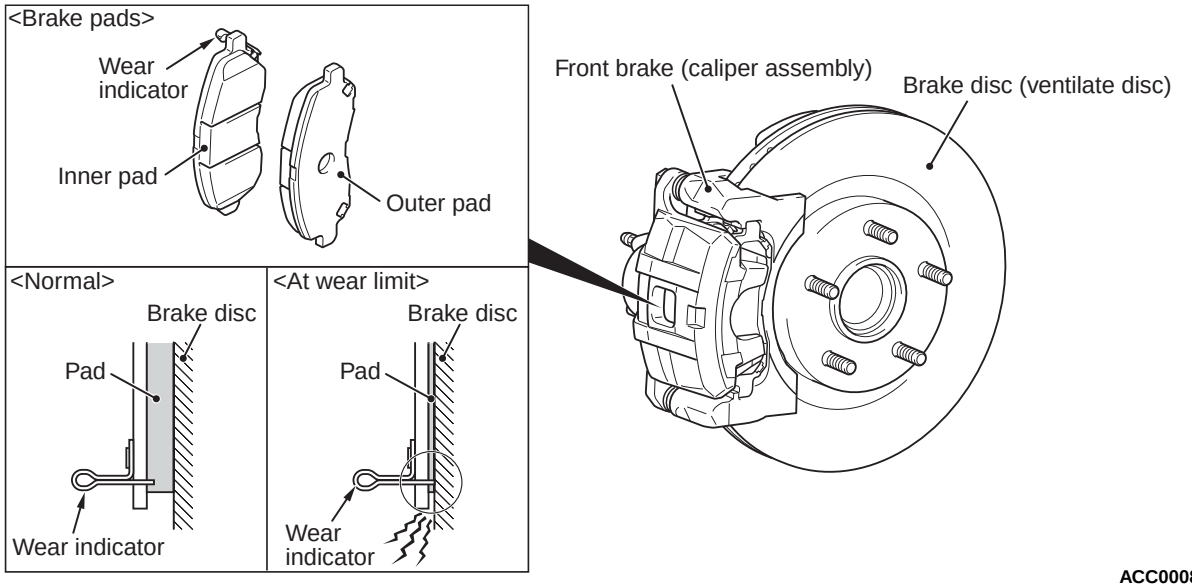
BRAKE BOOSTER

M2350002000988

10-inch brake booster has been installed.

FRONT BRAKE

M2350003000947

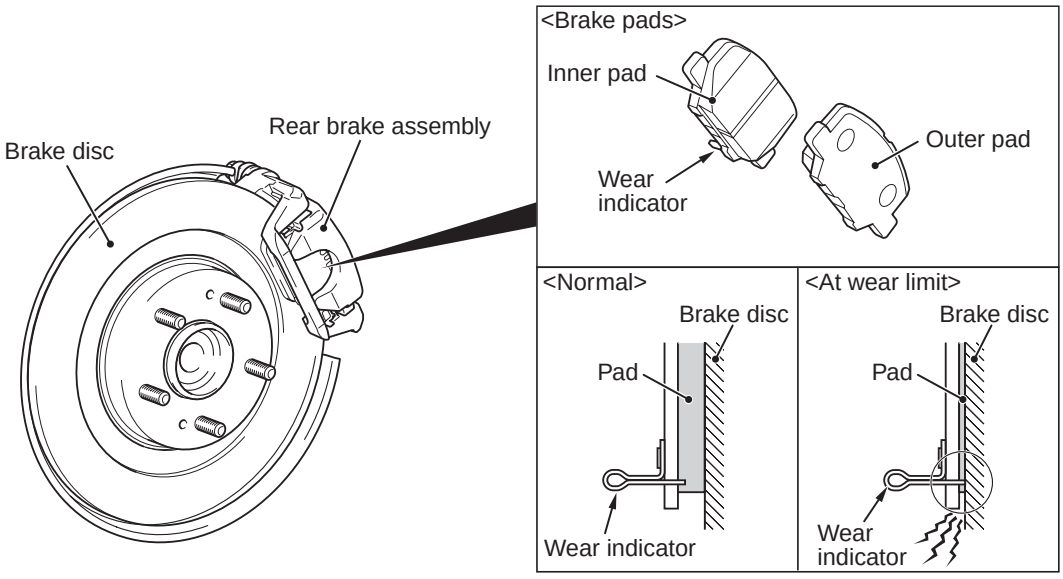


ACC00085AB

- The outer disc type brake disc which can be tightened together with the wheel has been introduced for better serviceability.
- The 1-piston ventilate disc brake has been adopted.
- The inner brake pads with audible wear indicator are adopted which warn the driver of the wear limit.

REAR BRAKE

M2350004000917



ACC00071AB

- The outer disc type brake disc which can be tightened together with the wheel has been introduced for better serviceability.
- The 1-piston solid disc brake with parking brake mechanism integrated has been adopted.
- The inner brake pads with audible wear indicator are adopted which warn the driver of the wear limit.

GROUP 35B

ANTI-SKID BRAKING SYSTEM (ABS)

CONTENTS

GENERAL INFORMATION

M2351000101554

The 4ABS ensures directional stability and control during hard braking.
This ABS uses a 4-sensor system that controls all four wheels independently of each other.

- EBD [*1]control can obtain ideal rear wheel brake force.
- The magnetic encoder for wheel speed detection has been installed instead of the rotor as the wheel speed sensor.
- For wiring harness saving and secure data communication, CAN [*2] bus has been adopted as a tool of communication with another ECU.
- Fail-safe function which ensures that safety is maintained.
- Diagnostic function which provides improved serviceability.

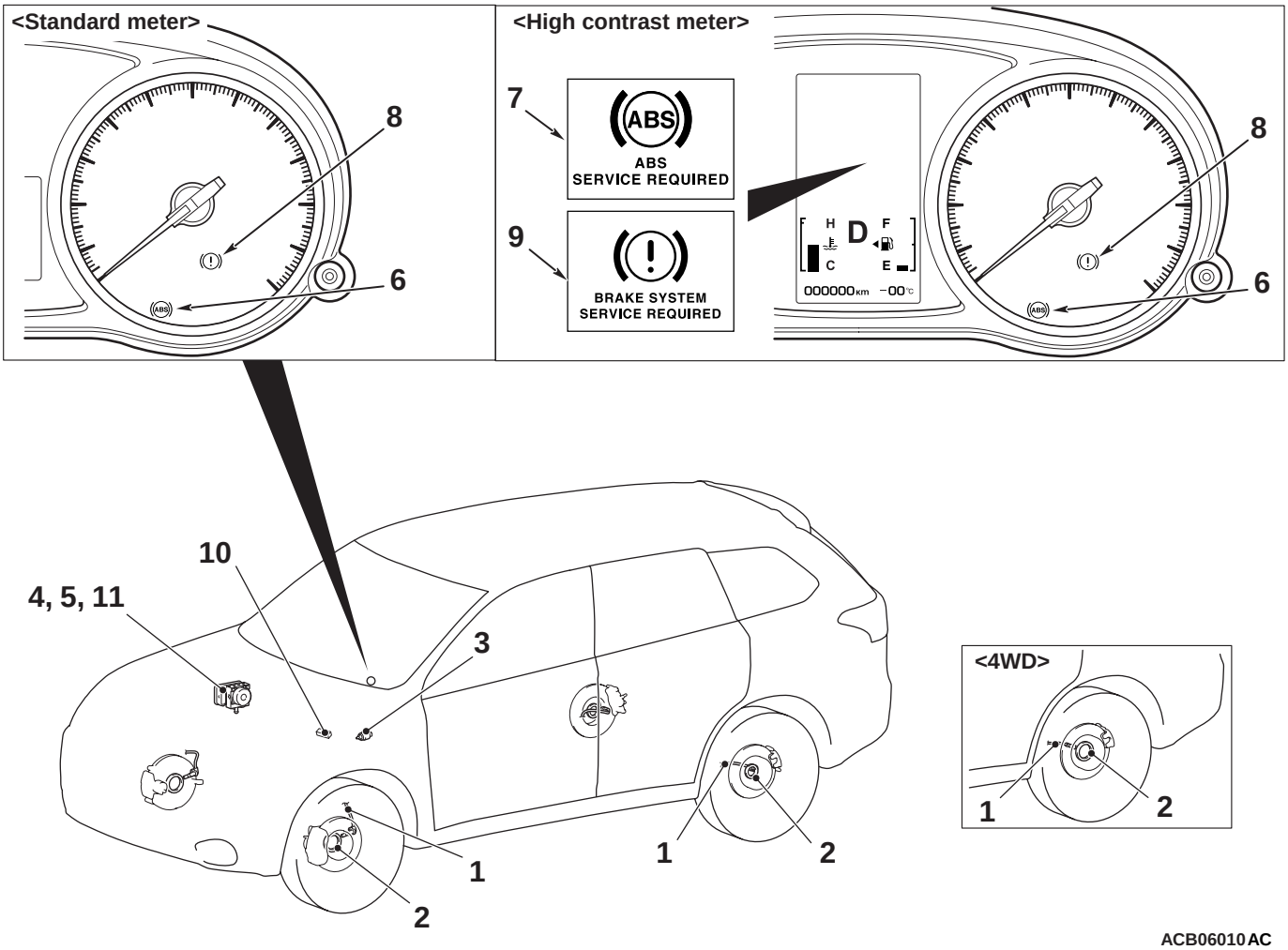
NOTE:

- *[*1]: EBD (Electronic Brake-force Distribution)*
- *[*2]: For more details about CAN (Controller Area Network), refer to GROUP 54C .*

Specifications

Item			**Specifications**
ABS control type			4 sensors
Wheel speed sensor	Magnetic encoder	Front	86 (N pole: 43, S pole: 43)
		Rear	96 (N pole: 48, S pole: 48)
	Type		Semiconductor

CONSTRUCTION DIAGRAM

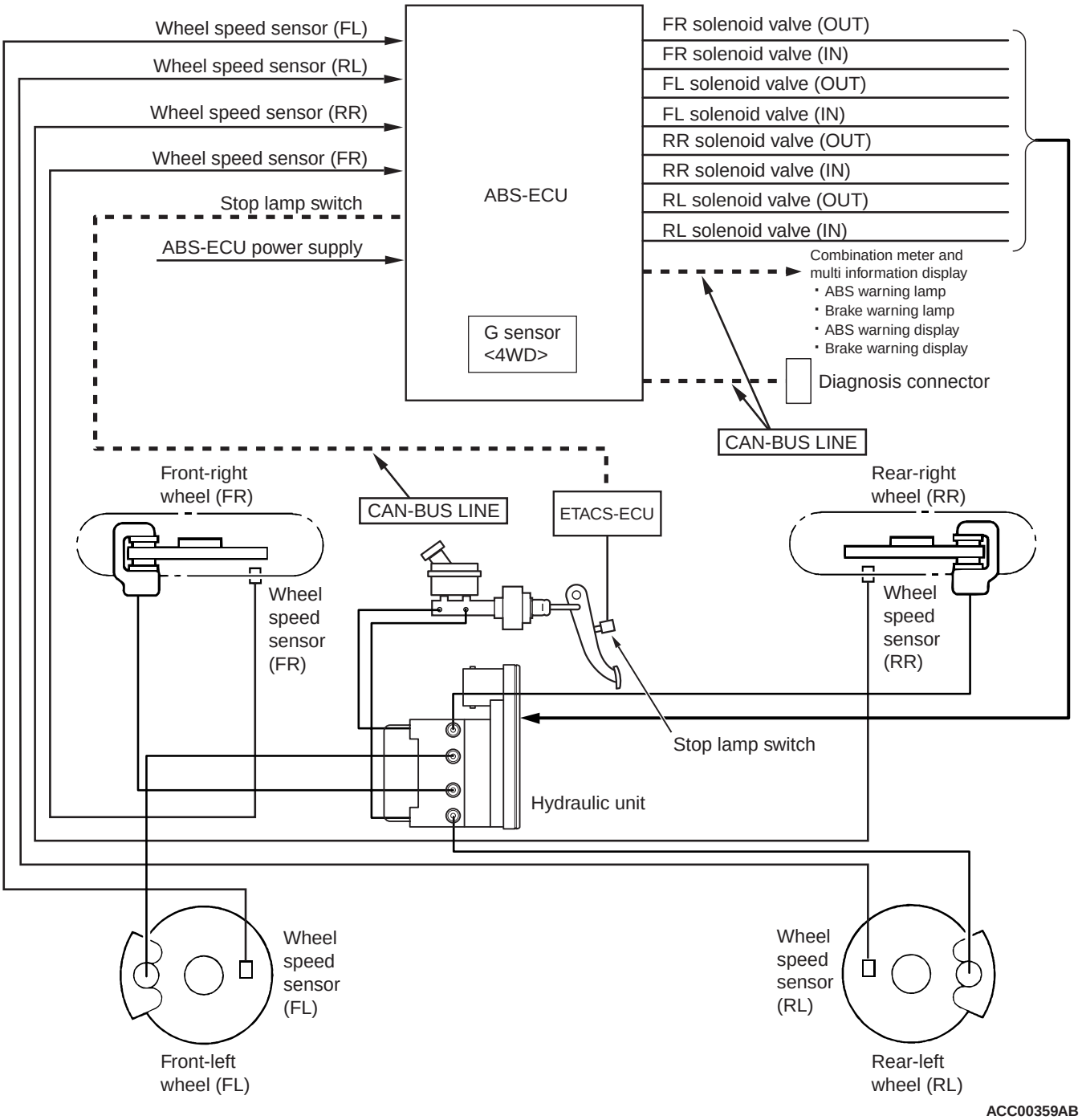


MAIN COMPONENTS AND FUNCTIONS

Name of part		Number	Outline of function
Sensor	Wheel speed sensor	1	Outputs the frequency signal in proportion to the rotation speed of each wheel to ABS-ECU.
	Magnetic encoder for wheel speed detection	2	When the magnetic encoder for wheel speed detection (a plate on which north and south pole sides of the magnets are arranged alternately) rotates, the wheel speed sensor outputs frequency pulse signal in proportion to each wheel speed.
	Stop lamp switch	3	Outputs the signal indicating whether the brake pedal is depressed or not to ABS-ECU.
	G sensor <4WD>	4	Incorporated in ABS-ECU, and detects the longitudinal acceleration of the vehicle.

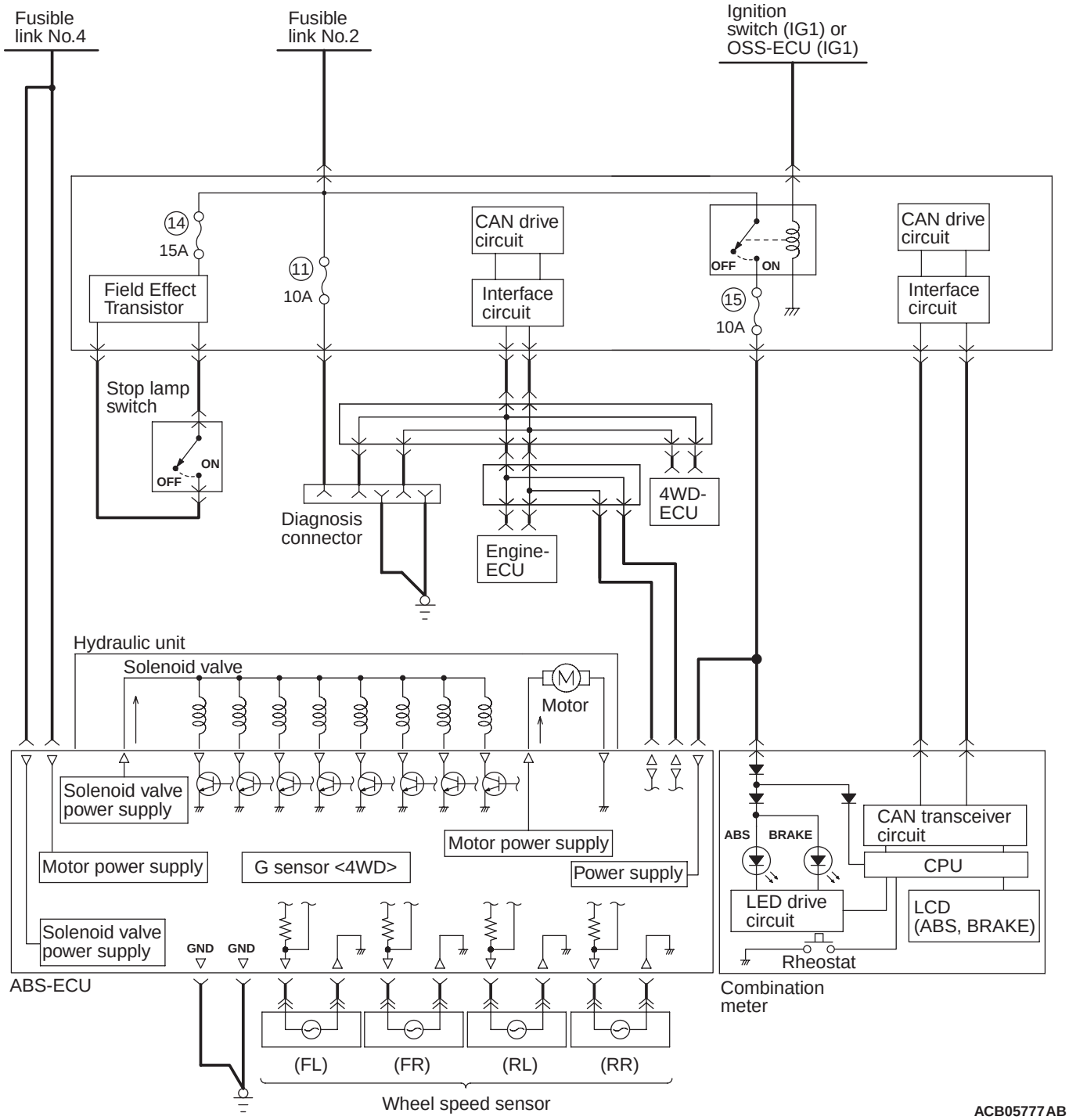
Name of part		Number	Outline of function
Actuator	Hydraulic unit	5	Drives the solenoid valve using the signal from ABS-ECU, and controls the brake fluid pressure for each wheel.
	ABS warning lamp	6	Informs the driver of the system status by illuminating, flashing, or turning off the warning lamp according to the signal from ABS-ECU.
	ABS warning display	7	Informs the driver of the system status by illuminating or turning off the warning display according to the signal from ABS-ECU.
	Brake warning lamp	8	Used as the warning lamp for the parking brake, brake fluid level, and EBD control. Informs the driver of the system status by illuminating or turning off the warning lamp according to the signal from ABS-ECU.
	Brake warning display	9	Used as the warning display for brake fluid level, and EBD control. Informs the driver of the system status by illuminating or turning off the warning display according to the signal from ABS-ECU.
Diagnosis connector		10	Outputs the diagnosis code and establishes the communication with M.U.T.-III.
ABS-ECU		11	Controls actuators (described above) based on the signals coming from each sensor.
			Controls the self-diagnosis and fail-safe functions.
			Controls the diagnosis function (M.U.T.-III compatible).

SCHEMATIC DIAGRAM



NOTE: Dashed lines indicate the CAN bus communication lines.

ABS ELECTRICAL DIAGRAM

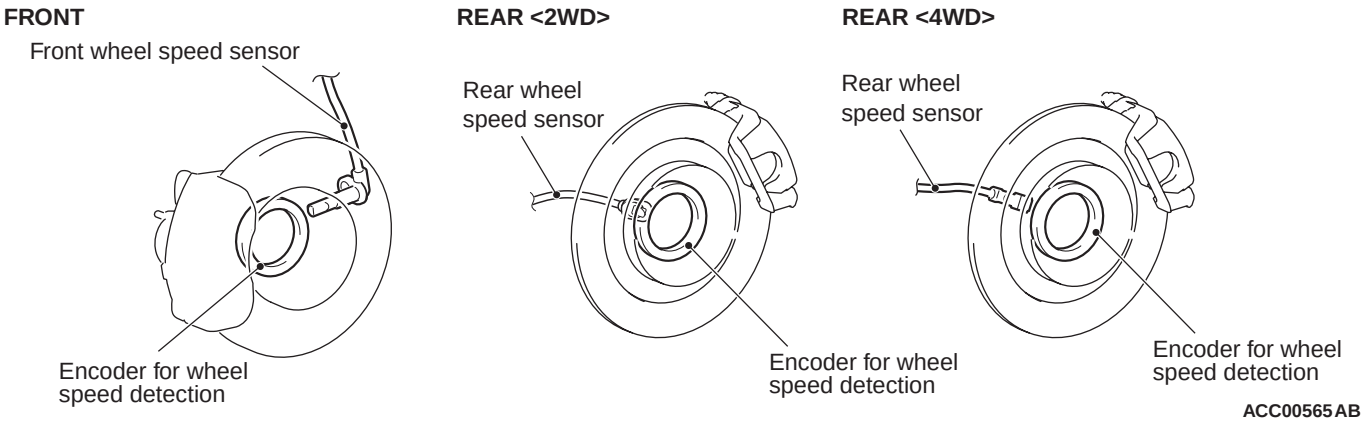


CONSTRUCTION DESCRIPTION

SENSOR

M2351001001000

WHEEL SPEED SENSOR



ACC00565AB

The wheel speed detecting section is a kind of a pulse generator. It consists of the magnetic encoder for wheel speed detection (a plate on which north and south pole sides of the magnets are arranged alternately) which rotates at the same speed of the wheel and the wheel speed sensor (semiconductor sensor). This sensor outputs frequency pulse signals in proportion to the wheel speed.

The front wheel speed detecting section consists of the front wheel speed sensor mounted on the knuckle and the magnetic encoder for wheel speed detection which is press-fitted together with the oil seal to the front wheel bearing. The rear wheel speed sensor consists of the rear wheel speed sensor mounted on the trailing arm assembly and the magnetic encoder for wheel speed detection which is press-fitted together with the oil seal to the rear wheel bearing.

G SENSOR <4WD>

The G-sensor is incorporated in ABS-ECU, and detects longitudinal acceleration of a vehicle.

ACTUATORS

M2351002000486

ABS WARNING LAMP, BRAKE WARNING LAMP

The ABS system informs the driver to the ABS system status by illuminating, extinguishing, or flashing the ABS warning lamp and brake warning lamp as follows.

ABS warning lamp and brake warning lamp illumination or flashing pattern

State		ABS warning lamp	Brake warning lamp
Normal	Correct	–	–
Faulty	ABS failure	Illuminates	–
	EBD failure	Illuminates	Illuminates
When M.U.T.-III is connected	Actuator not operated	–	–
	Actuator operated	Flash (2Hz)	–
	After the actuator is activated forcibly *	Illuminates*	Illuminates*

NOTE:

- **: The ABS warning lamp and the brake warning lamp stay on until the ignition switch is turned to the LOCK (OFF) position.*
- *When the brake fluid level in the brake fluid reservoir tank is lower than the specified value, or when the parking brake lever is pulled, the brake warning lamp turns ON.*

ABS-ECU

M2351003001028

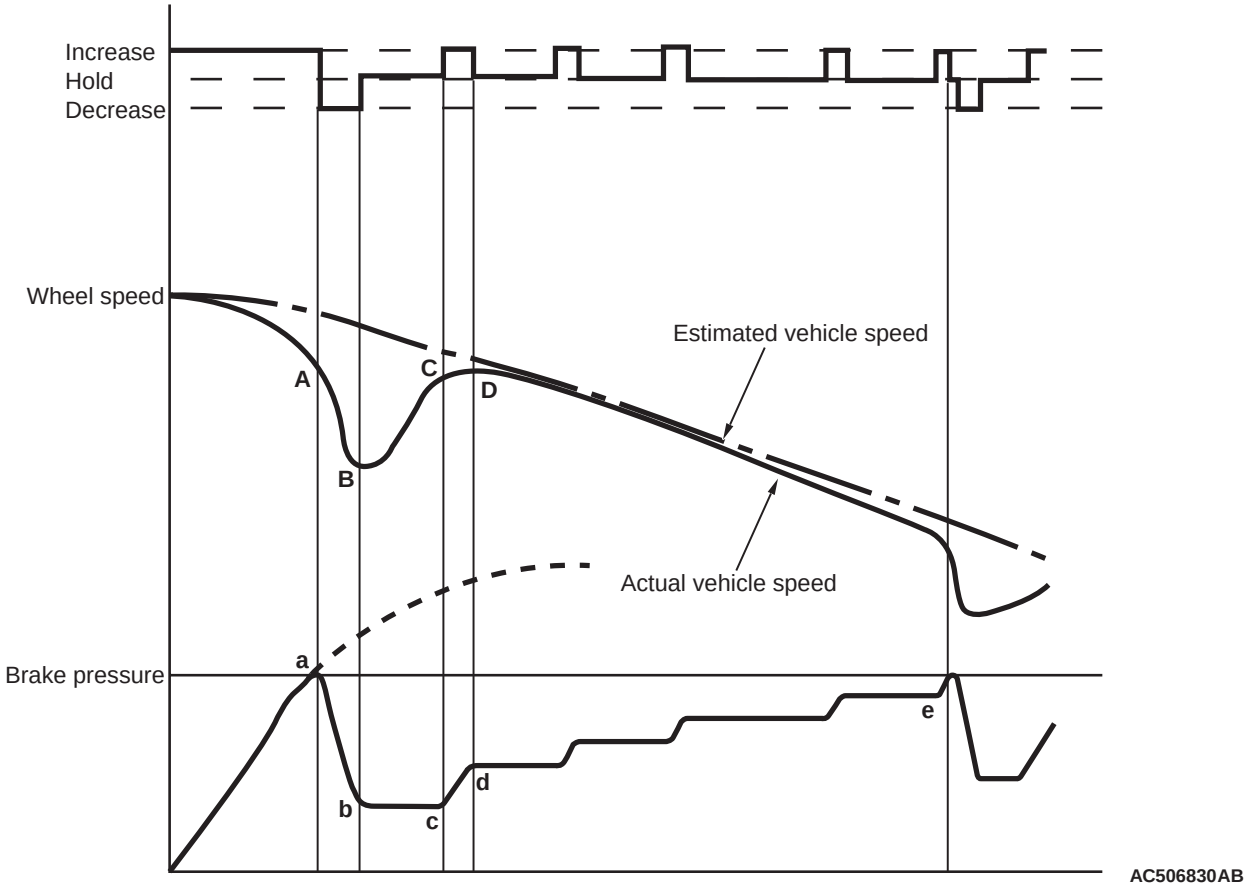
- By integrating ABS-ECU into the hydraulic unit, no wiring harness for sending drive signal of the solenoid valve and pump motor is required, assuring higher reliability.
- By incorporating the G-sensor <4WD>, no sensor harness is required, enhancing the reliability.
- Self-diagnostic and memory functions are integrated into ABS-ECU. If any malfunction is detected by the self-diagnostic function, ABS-ECU activates a fail-safe function and illuminates the ABS warning lamp and brake warning lamp*.

*NOTE: *: The brake warning lamp is used as the EBD control warning lamp.*

- ABS-ECU detects vehicle speed from the signals of the wheel speed sensor and its incorporated G sensor <4WD>, recognizes the wheel rotation status, estimates the wheel slip condition based on the preprogrammed algorithm, and then controls the solenoid valve in the hydraulic unit so that the wheels do not lock.

ABS fluid pressure control

ABS control cycle

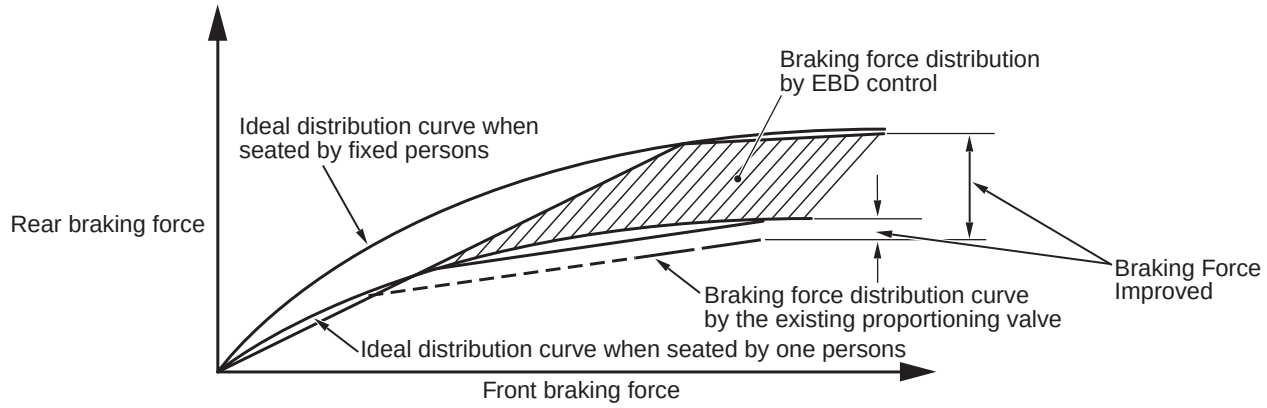


1. The ABS-ECU calculates the speed and deceleration of each wheel based on the signals from the four wheel speed sensors and the G sensor <4WD> incorporated in the ABS-ECU, and estimates the vehicle speed at that time.
2. When the brake pedal is depressed, the brake fluid pressure applied to the wheel cylinder increases, and the wheel speed decreases. When the difference between the wheel speed and vehicle speed increases, and the vehicle deceleration goes below the specified value (Point A), ECU determines that the wheels are about to be locked. At this time, ECU reduces the brake fluid pressure by outputting the pressure decrease signal to the solenoid valves (IN, OUT). (between a and b)
3. When the vehicle deceleration and wheel speed begin recovery, and the vehicle speed reaches the point B, ECU outputs the pressure hold signal to maintain the wheel cylinder fluid pressure. (between b and c)
4. When the wheel speed deceleration is further recovered and overpasses the point C, ECU determines that the wheel lock possibility has been eliminated and increases the brake fluid pressure by outputting the pressure increase signal again. (between c and d)
5. Brake fluid pressure is controlled by repeating the increase and hold of the pressure. (between d and e)
6. When the wheel deceleration goes below the threshold again, ABS-ECU controls the brake fluid pressure by repeating the cycle (Step 2 to 5).

EBD fluid pressure control

EBD control is activated in a range with lower slip ratio where ABS is disabled. EBD calculates vehicle deceleration and slip amount of the four wheels based on the wheel speed sensor signal. If the rear wheel speed differs from the vehicle speed by a certain level or more, EBD increases, holds, and decreases the pressure at the rear wheel control solenoid valve in the hydraulic unit, and then adjusts rear wheel brake fluid pressure fairly close to an ideal distribution curve.

EBD operating conceptual design



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INITIAL CHECK

ABS-ECU performs the following initial checks using the diagnostic functions. ABS-ECU illuminates the ABS warning lamp for 3 seconds (including the initial check) * after the ignition switch is turned ON. If any malfunction is detected, ABS-ECU continues illuminating the ABS warning lamp and disables ABS control.

*NOTE: *: The ABS warning lamp may stay on after the ignition switch is turned ON until the startup vehicle speed reaches approximately 10 km/h. As far as ABS-ECU memorizes any diagnosis code related to the wheel speed sensor malfunction recorded during the previous ignition ON status, ABS-ECU continues illuminating the ABS warning lamp until it verifies that the malfunction for that code is resolved (startup check).*

STARTUP CHECK

When the startup vehicle speed reaches approximately 10 km/h, ABS-ECU performs the following checks.

1. Motor, solenoid valve check (Initial startup* only)

   Turns ON the motor relay in ECU, and checks the pump motor operation. At the same time, ABS-ECU sequentially energizes each solenoid valve in a very short period and checks the valve operation.

   *NOTE: *: Initial startup indicates a first startup after the system has started.*
2. Wheel speed sensor check

   ABS-ECU checks for any wheels that have not received wheel speed sensor signal from the startup.

CONSTANT CHECK

ABS-ECU constantly checks the following items.

1. ABS-ECU
   (1) Performs self-diagnosis in ECU.
   (2) Checks for abnormal output voltage of G sensor, and detects open or short circuit in the G sensor <4WD>.
   (3) Checks the output voltage for G sensor, and determines that the G sensor is stuck when the output voltage exceeding the specification continues for a certain period or more <4WD>.
2. ECU power supply

   Checks if ECU power supply voltage stays within the operational range.
3. Wheel speed sensor
   (1) Monitors the output voltage of the sensor signal wiring harness and checks for abnormal output voltage (open/short circuit).
   (2) Checks for any wheels that do not send pulse signal while the vehicle is in motion.

(3) Checks if wheel speed which is abnormally higher or lower than the vehicle speed is input.

4. Pump motor, solenoid valve

Checks that the ABS-ECU output signal and the operating conditions of the pump motor and solenoid valve agree with each other.

FAIL-SAFE FUNCTION

If any malfunction is detected by the self-diagnostic function, ABS-ECU illuminates the ABS warning lamp and brake warning lamp*, and it disables ABS and EBD control.

*NOTE: *: The brake warning lamp is used as EBD control warning lamp.*

DIAGNOSTIC FUNCTION

ABS-ECU has the following functions for easier system checks. The following items can be diagnosed using M.U.T.-III.

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

GROUP 35C

ACTIVE STABILITY CONTROL SYSTEM (ASC)

CONTENTS

GENERAL INFORMATION

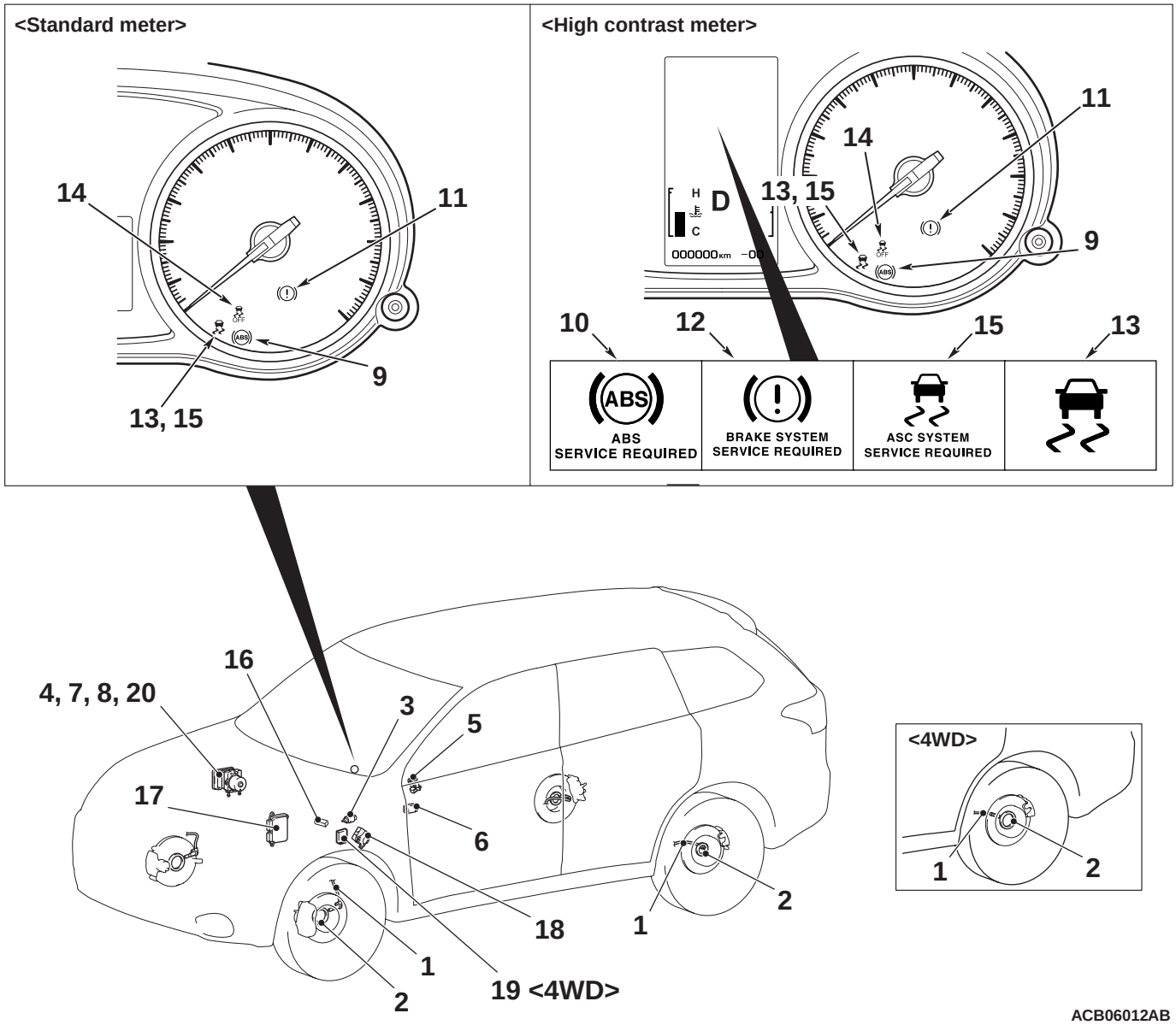
M2355000100683

Active Stability Control System (ASC) has been installed.

- The ASC system integrates the traction control (TCL) function and stability control function.
- When TCL detects the slip of the driving wheel (ex. during startup on low μ road), it automatically applies the brakes to the slipping driving wheel. At the same time, TCL reduces the engine output and prevents the wheel spin when it determines that the engine torque is too high for the road surface μ.
- When the ASC-ECU determines that the vehicle is in a dangerous condition, it reduces the engine output and applies brake force to four wheels independently to control the vehicle behaviour, avoiding the critical state.
- Hill Start Assist (HSA) function has been adopted to hold and prevent the roll back of the vehicle when the vehicle is on a slope and the foot is transferred from the brake pedal to the accelerator pedal <Vehicles with HSA>.
- The brake assist (BA) control determines an emergency braking and increases the braking force for the drivers who cannot depress the brake sufficiently when the emergency brake is applied. This shortens the distance to stop or reduces the collision speed.

NOTE: By the integrated control with the anti-skid brake system (ABS), the system stabilises the vehicle attitude and at the same time secures the driving force.

CONSTRUCTION DIAGRAM



MAIN COMPONENTS AND FUNCTIONS

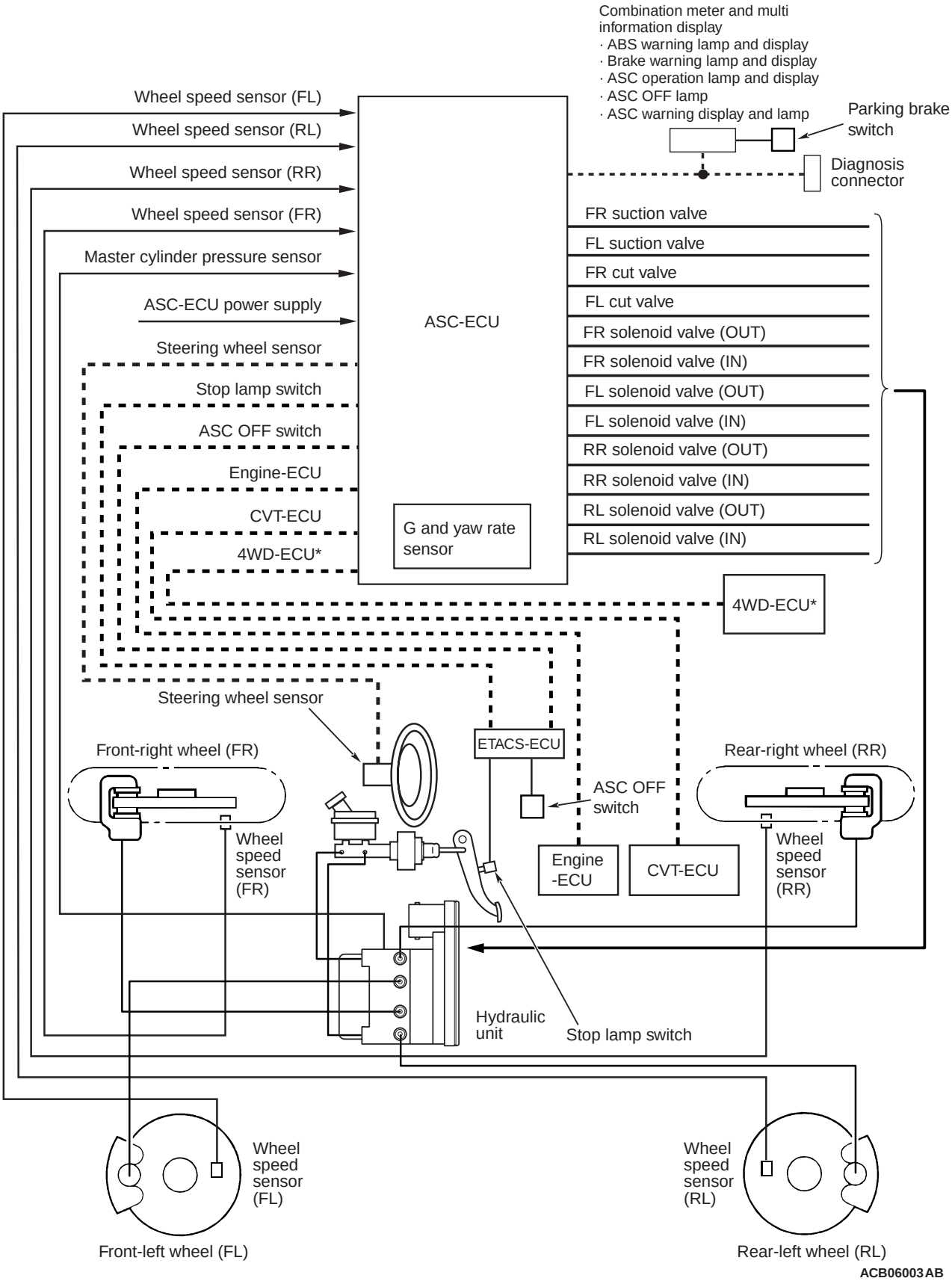
Name of part		Number	Functional description
Sensor	Wheel speed sensor	1	Outputs the frequency signal in proportion to the rotation speed of each wheel to ASC-ECU.
	Magnetic encoder for wheel speed detection	2	The wheel speed sensor is a pulse generator. When the magnetic encoder for wheel speed detection (a plate on which north and south pole sides of the magnets are arranged alternately) rotates, it outputs frequency pulse signal in proportion to each wheel speed.
	Stop lamp switch	3	Outputs the signal indicating whether the brake pedal is depressed or not to ASC-ECU.
	G & yaw rate sensor	4	Is integrated in the ASC-ECU, detects the yaw rate and longitudinal and lateral acceleration of a vehicle, and sends a signal to the ASC-ECU.
	Steering wheel sensor	5	Detects the steering angle of the steering wheel, and outputs signal to ASC-ECU via the CAN bus line.
	ASC OFF switch	6	Outputs the ON/OFF signal for ASC to ASC-ECU.
	Brake fluid pressure sensor	7	Integrated into the hydraulic unit, and outputs the signal for the brake fluid pressure in the master cylinder to ASC-ECU.
Actuator	Hydraulic unit	8	Drives the solenoid valve using the signal from ASC-ECU, and controls the brake fluid pressure for each wheel.
	ABS warning lamp	9	Informs the driver of the system status by illuminating, flashing, or turning off the ABS warning lamp according to the signal from ASC-ECU.
	ABS warning display	10	Informs the driver of the system status by illuminating or turning off the ABS warning display according to the signal from ASC-ECU.
	Brake warning lamp	11	Used as the brake warning lamp for the parking brake, brake fluid level, and EBD control. Informs the driver of the system status by illuminating or turning off the brake warning lamp according to the signal from ASC-ECU.
	Brake warning display	12	Used as the brake warning display for the brake fluid level, and EBD control. Informs the driver of the system status by illuminating or turning off the brake warning display according to the signal from ASC-ECU.
	ASC operation display and lamp[*1]	13	Informs the driver of the system status by flashing when the system operates according to the signal from ASC-ECU.
	ASC OFF lamp	14	Informs the driver of the system shutdown by illuminating by the signal from ASC-ECU. Informs the driver that the brake system overheats and the brake TCL stops by flashing the ASC OFF lamp for the duration of approximately 2 Hz.
	ASC warning display and lamp[*1]	15	TCL function and stability control function, HSA function use the same display and lamp[*1]. Depending on the signal from ASC-ECU, the ASC warning display and lamp[*1] informs the driver of the system status by illuminating when the system has malfunction (When the ASC warning display and lamp[*1] is illuminated, the HSA function does not operate).

Name of part	Number	Functional description
Diagnosis connector	16	Sets the diagnosis code and establishes the communication with M.U.T.-III.
Engine-ECU	17	Controls the engine output based on the signal from ASC-ECU.
CVT-ECU	18	CVT-ECU performs integrated control with ASC-ECU. Output the gear position to ASC-ECU.
4WD-ECU*2	19*2	Outputs the drive status to ASC-ECU. 4WD-ECU performs integrated control with ASC-ECU.
ASC control unit (ASC-ECU)	20	Controls the actuators (hydraulic unit) based on the signals sent from sensors.
		Controls the self-diagnostic function and fail-safe function.
		Controls diagnostic function (Compatible with M.U.T.-III).

NOTE:

- **1: Colour liquid crystal display*
- **2: 4WD*

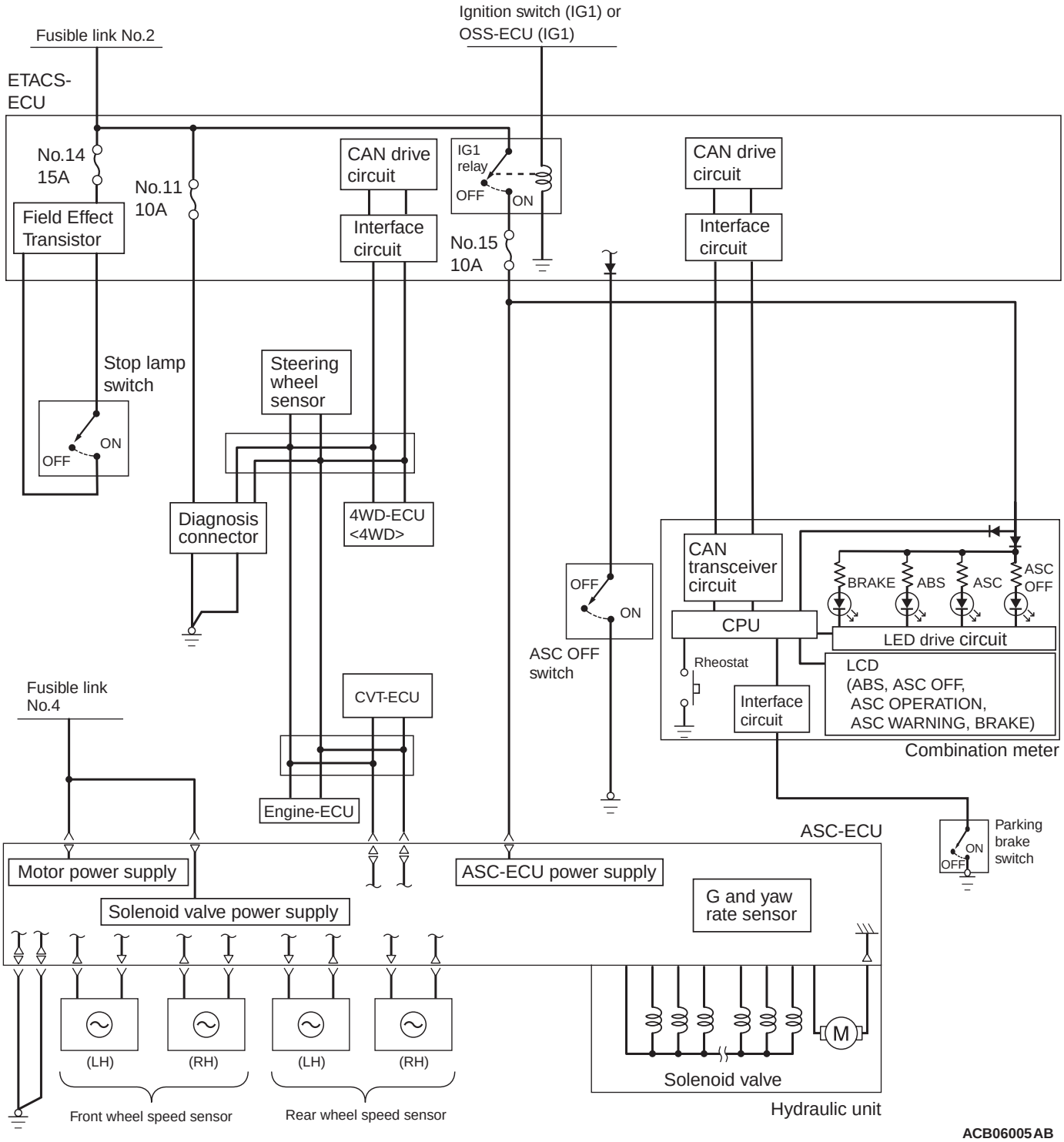
SCHEMATIC DIAGRAM



NOTE:

- *Dashed lines indicate the CAN bus line.*
- **: 4WD*

ASC ELECTRICAL DIAGRAM



CONSTRUCTION DIAGRAM

SENSOR

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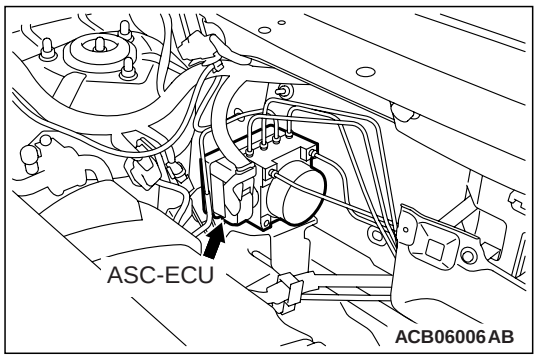
WHEEL SPEED SENSOR

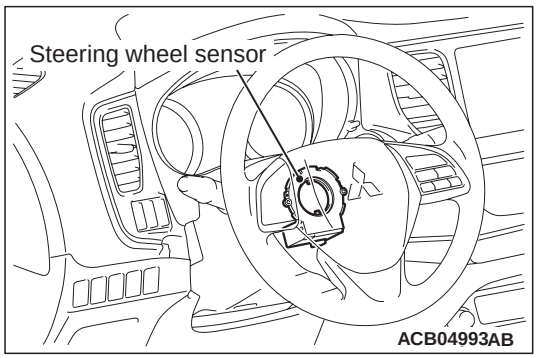
Refer to GROUP 35B – Sensor .

G & YAW RATE SENSOR



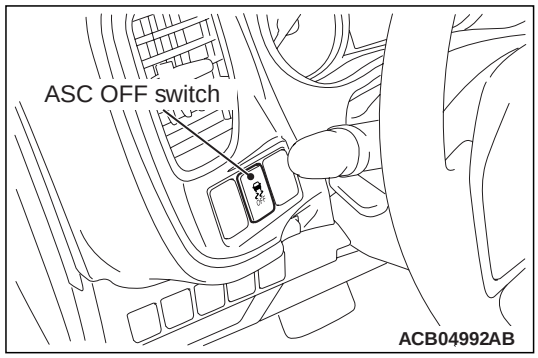
The G & yaw rate sensor is integrated in the ASC-ECU, and detects the yaw rate and longitudinal and lateral acceleration of a vehicle.

STEERING WHEEL SENSOR



The steering wheel sensor is attached to the column switch, and detects the rotational angle of the steering wheel.

ASC OFF SWITCH



The ASC OFF switch is installed on the side air outlet (driver's side). ASC functions can be disabled by pressing this switch for 3 seconds (The HSA and BA function operates even when the ASC system is turned OFF with the ASC OFF switch). Pressing this switch again resumes the ON status. As a countermeasure for the stuck of the ASC OFF switch, pressing the ASC OFF switch for 15 seconds resumes the system to the ON status.
When the ignition switch is turned from "LOCK" (OFF) to ON position, ASC functions are constantly in the ON status.

ASC OFF SWITCH OPERATION AND SYSTEM OPERATION

ASC OFF switch operation	TCL		Stability control	HSA	BA
	Brake control	Engine control			
Not operated	Enabled	Enabled	Enabled	Enabled	Enabled
Operated (Press and hold for 3 seconds)	Prohibited	Prohibited	Prohibited	Enabled	Enabled

NOTE: The stability control is available when the vehicle speed is 15 km/h or more.

ACTUATOR

M2355001200445

HYDRAULIC UNIT

The hydraulic unit incorporates the ABS control and ASC control. The cut valve, pressure relief valve, suction valve, suction damper, G & yaw rate sensor and pressure sensor have been added to the unit for the ASC control.

NOTE: For the internal hydraulic circuit of the hydraulic unit, refer to P.35C-15.

ASC OPERATION DISPLAY AND LAMP, ASC WARNING DISPLAY AND LAMP, ASC OFF lamp

The ASC system illuminates or flashes the ASC operation display and lamp, ASC warning display and lamp or ASC OFF lamp in the following operation patterns, and informs the driver of the ASC system status.

ASC operation display and lamp

- Flashes in 2 Hz (display)/4 Hz (lamp) during the ASC control.

ASC warning display and lamp

- Turns ON when the system malfunction occurs.

ASC OFF lamp

- ASC-ECU detects the overheat of the brake pads. When the brake TCL control is prohibited, the ASC OFF lamp flashes in approximately 2 Hz.

ASC operation display and lamp, ASC warning display and lamp, ASC OFF lamp illumination and flashing patterns

State		ASC operation display and lamp	ASC warning display and lamp	ASC OFF lamp
Normal	Normal	–	–	–
	Stability control operated	Flashing (display: 2 Hz, lamp: 4 Hz)	–	–
	TCL operated	Flashing (display: 2 Hz, lamp: 4 Hz)	–	–
	HSA operated	–	–	–
ASC is disabled by ASC OFF switch	ASC disabled	–	–	Illuminates
When the brake pad temperature is high	ASC-ECU informs the driver that the brake TCL does not function.	–	–	Flashing (2 Hz)
Abnormal	Stability control malfunction	–	Illuminates	Illuminates
	TCL malfunction	–	Illuminates	Illuminates
	HSA malfunction	–	Illuminates	–*
M.U.T.-III connection	Actuator not operated	–	–	–
	Actuator operated	–	Illuminates	Illuminates

*NOTE: * Illuminates if the TCL function or stability control function is defective when the HSA function is defective. (HSA control prohibited)*

ASC-ECU

M2357000100515

This ECU incorporates the ABS function, EBD function, HSA function, stability control function and TCL function, brake assist control.

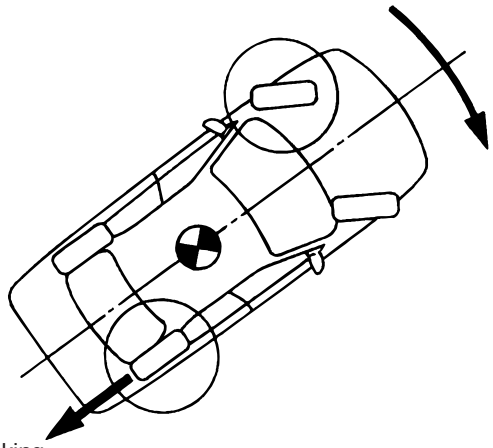
The hydraulic units of the ASC and TCL systems employ the automatic pressurisation function. These systems also incorporates G and yaw rate sensor (integrated with ASC-ECU), steering wheel sensor, and master cylinder pressure sensor (integrated with hydraulic unit).

STABILITY CONTROL DESCRIPTION

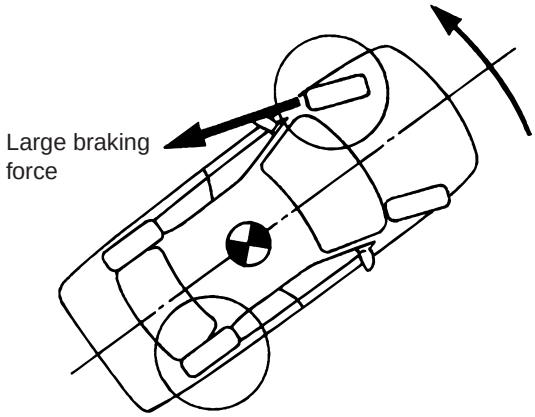
ASC-ECU detects vehicle movement based on information from various sensors and calculates a model of ideal vehicle movement. ASC-ECU compares the actual vehicle movement with the ideal vehicle model, and manages the brake of the specific wheel so that the actual vehicle movement gets close to the ideal vehicle mode. It also controls the understeer or oversteer condition by creating the yaw moment in the vehicle.

Example of Stability Control function

<Generation of rotating force>



<Generation of counter-rotating force>



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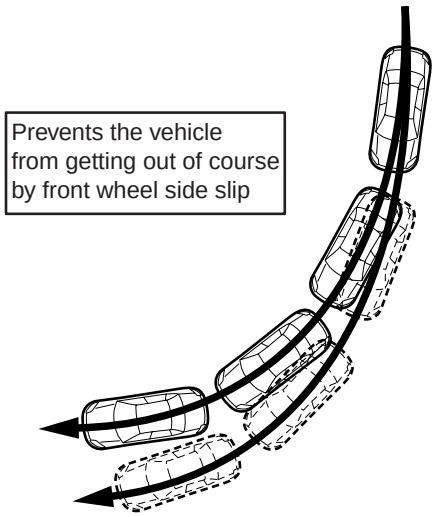
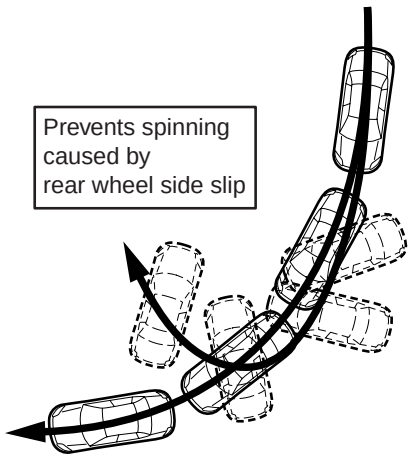
The Stability Control manages the vehicle attitude by creating a yaw moment from altering the balance between the cornering force and each wheel's braking mechanism.

Example of the effect of control

Suppression of front wheel side slip



Suppression of rear wheel side slip



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For example, on a slippery surface, if the vehicle tends to be under-steered contrary to the driver's intention, a yaw moment (a rotational moment) is created to restrain the under-steering by increasing the rear-inside braking force. On the other hand, when the vehicle tends to be oversteered, a yaw moment (a restorative moment) is created to restrain the oversteering by increasing the front-outside wheel braking force. Furthermore, when it is determined that the vehicle is over-speeding, safe and stable cornering is enabled by deceleration from reducing the engine output.

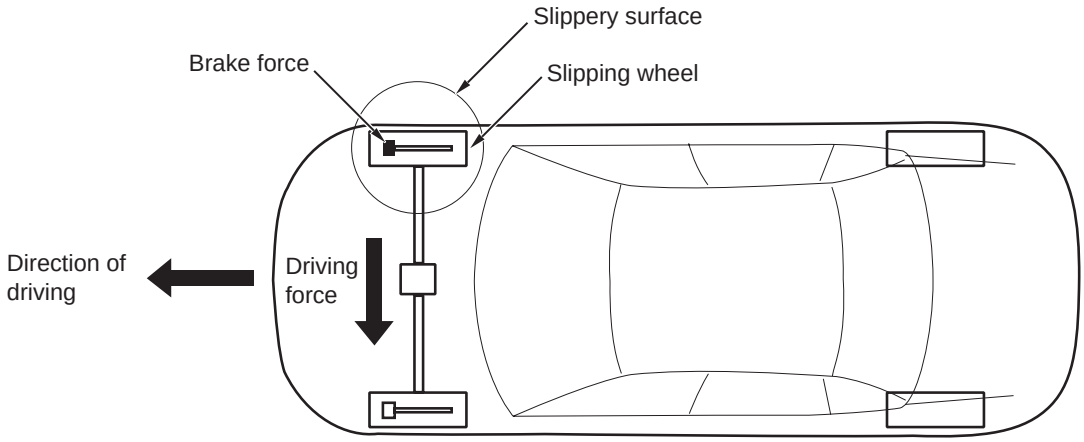
Joint control

ASC-ECU transmits data necessary for control of ABS and TCL, performing joint control.

Control system	Control content
ABS	Even during ABS operation, ABS performance is improved from the joint operation of the stability control.
TCL	During acceleration, engine output is governed through joint operation with stability control.

Example of TCL function

2WD



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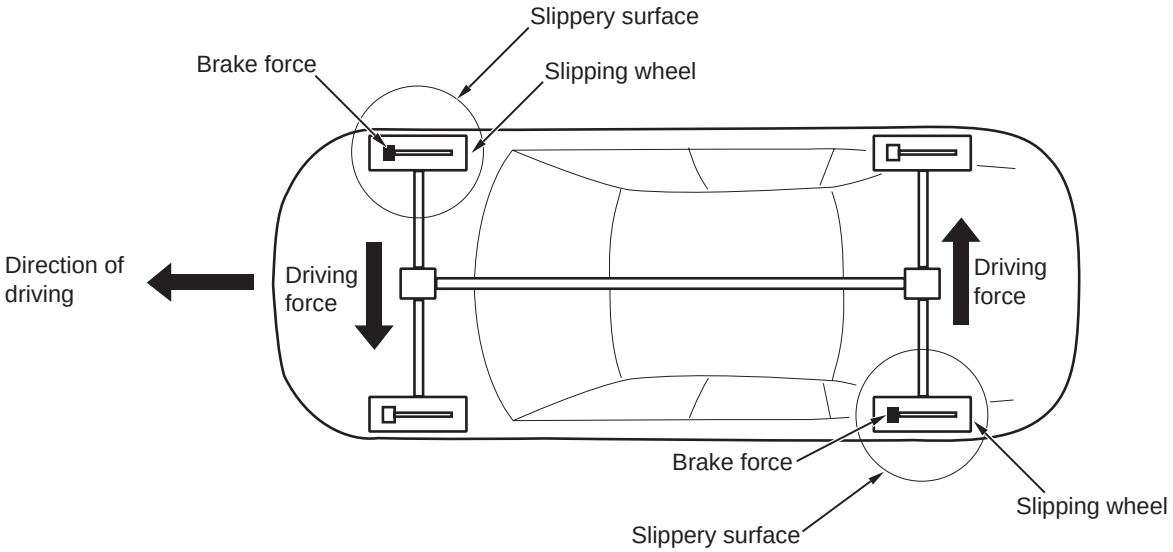
4WD



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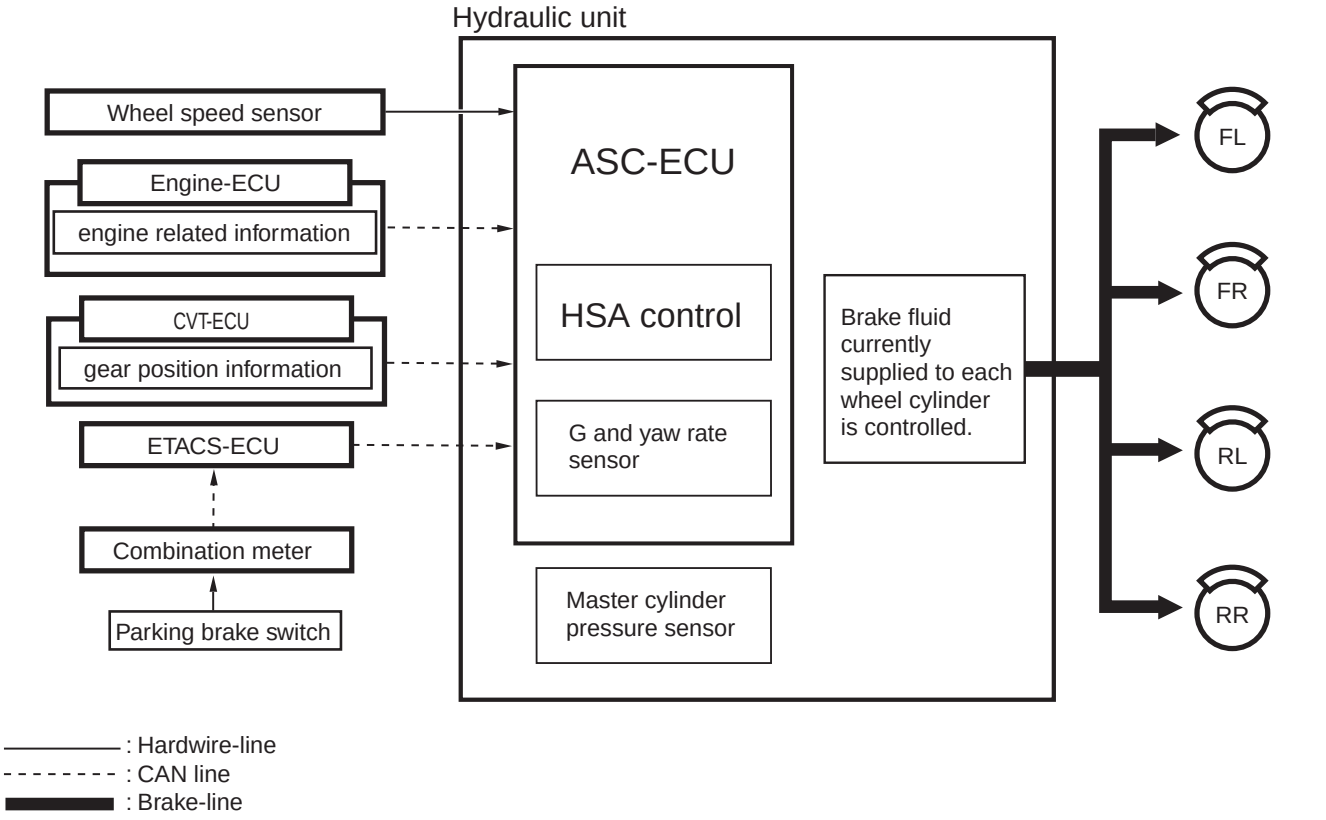
When the driving wheels slip on the slippery road surface, TCL applies the brake automatically, sends the signal requesting engine speed reduction to the engine-ECU, and prevents the loss of the driving force resulting from the slippage of the driving wheel.

Hill START ASSIST (HSA) FUNCTION

System configuration



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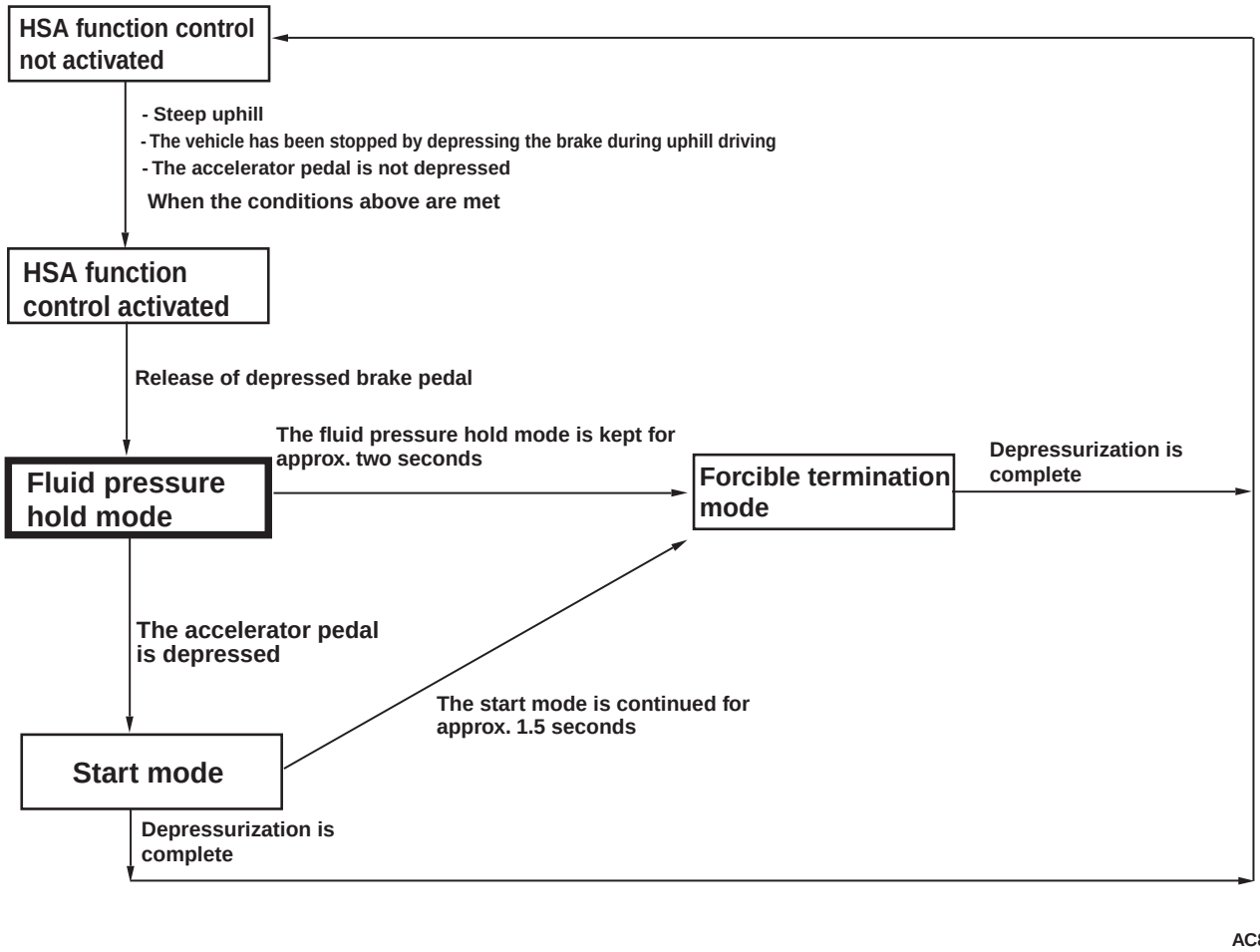
When the vehicle has completely stopped on a steep uphill by the service brake, ASC-ECU judges whether or not start the HSA function control in accordance with the signals (ETACS-ECU, CVT-ECU, G & yaw rate sensor, brake fluid pressure sensor, engine-ECU, wheel speed sensor).

HSA function state transition diagram (Overview)



NOTE:

- *ASC-ECU judges the inclination angle of the slope according to the G and yaw rate sensor output.*
- *When either of the following conditions is satisfied, the mode is shifted to the forcible termination mode, and HSA function control is terminated.*
  - *The parking brake operation is detected.*
  - *The shift lever operation to the shift or selector position other than the uphill direction driving is detected (Forward uphill driving: shift or selector position other than "D"*, Reverse uphill driving: shift or selector position other than "R").*
  - *The accelerator pedal and brake pedal are depressed at the same time.*
  - *The wheel speed sensor pulse is generated (When the vehicle moved)*
  - *The engine is stopped by engine stall, etc.*

**:When uphill driving, if shift position is "N" position, HSA function is operated*

HSA function control activated

ASC-ECU judges that the HSA operation condition is satisfied. When the driver releases the brake pedal, ASC-ECU maintains the brake wheel cylinder pressure and waits.

FLUID PRESSURE HOLD MODE

By closing the cut valve, ASC-ECU maintains the brake wheel cylinder pressure of the time when the brake pedal is depressed, to prevent the vehicle from moving backward.

START MODE

ASC-ECU releases the brake wheel cylinder pressure maintained by the cut valve, depending on the engine torque generated by depressing the accelerator pedal.

FORCIBLE TERMINATION MODE

ASC-ECU immediately releases the brake wheel cylinder pressure maintained by the cut valve and terminates HSA function control.

BRAKE ASSIST (BA) CONTROL

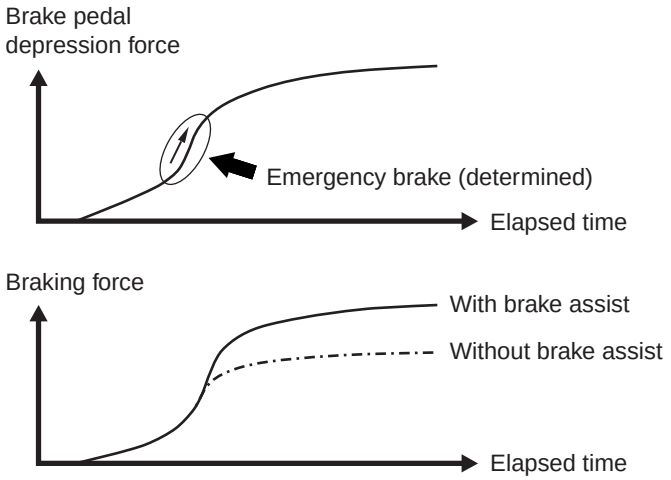
Operation description

- If an emergency brake is determined by the brake pedal depression speed and force, the brake assist works to increase the braking force the drivers produce. [The braking force is not increased more than the brake performance (the friction force between the road surface and the tyres) .]
- The brake assist is completed when the brake pedal is released or the vehicle is stopped.

fail-safe function

The brake assist mechanism does not work when the ABS warning lamp illuminates.

Brake assist operation



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FAIL-SAFE AND DIAGNOSTIC FUNCTIONS

ASC-ECU constantly monitors the input and output signals. If an error is detected in the system, ASC-ECU sends a fail signal and the corresponding indicator lamp is illuminated or blinks. Various controls are processed depending on the cause of malfunction as shown below.
ASC-ECU has the following functions for easier system checks.

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

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

CALIBRATION

After the steering wheel sensor and hydraulic unit (integrated with ASC-ECU and G & yaw rate sensor) have been replaced with new ones, calibration must be performed using M.U.T.-III*.

NOTE:

- *M.U.T.-III uses the ABS data list.*
- **: For calibration, refer to Workshop Manual.*

DESCRIPTION OF CONSTRUCTION AND OPERATION

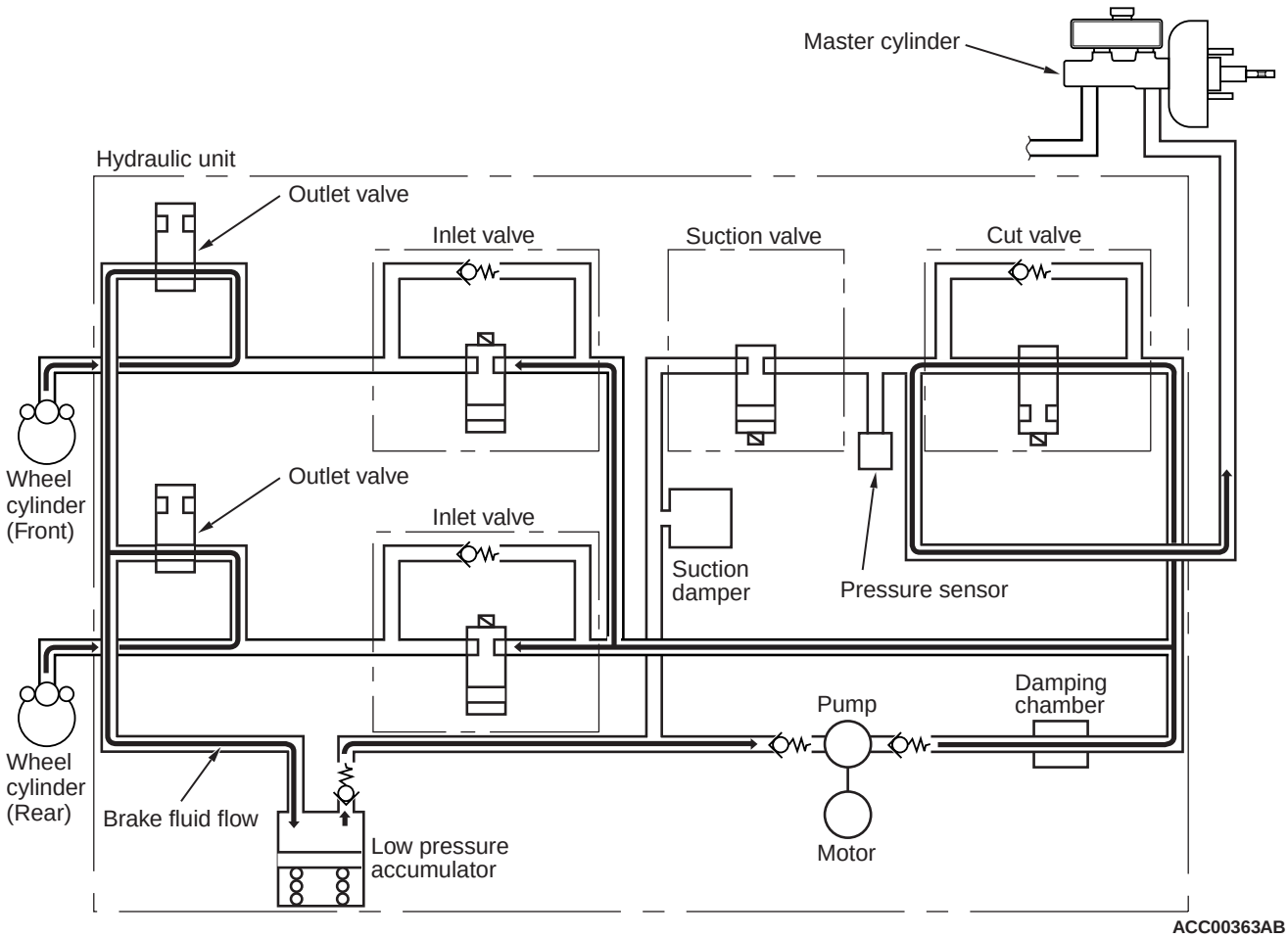
M2355002000563

STABILITY CONTROL OPERATION

ASC-ECU receives various kinds of information from the engine-ECU, 4WD-ECU, ETACS-ECU, CVT-ECU, steering wheel sensor, G & yaw rate sensor, and wheel speed sensor. When ECU determines the vehicle runs in the oversteer or understeer direction based on the signal sent from these sensors, ASC-ECU drives each valve and pump motor and controls the braking force to be applied to the wheels.

When the system increases the fluid pressure automatically, it closes the cut valve to shut off the pressure line to the suction valve, and drives the pump motor. For example, when the vehicle runs in the oversteer direction while turning to the right, ASC-ECU supplies the brake fluid from the pump to the front left wheel to apply the braking force on it. ASC-ECU, the engine ECU, and 4WD-ECU communicate with each other via CAN. When the accelerator pedal is depressed too far, the signal requesting the engine output reduction is sent to the engine ECU. Depending on the situation, 4WD control amount limitation signal is sent to the ASC-ECU to secure the ASC controllability.

When brake fluid pressure decreases during ABS operation

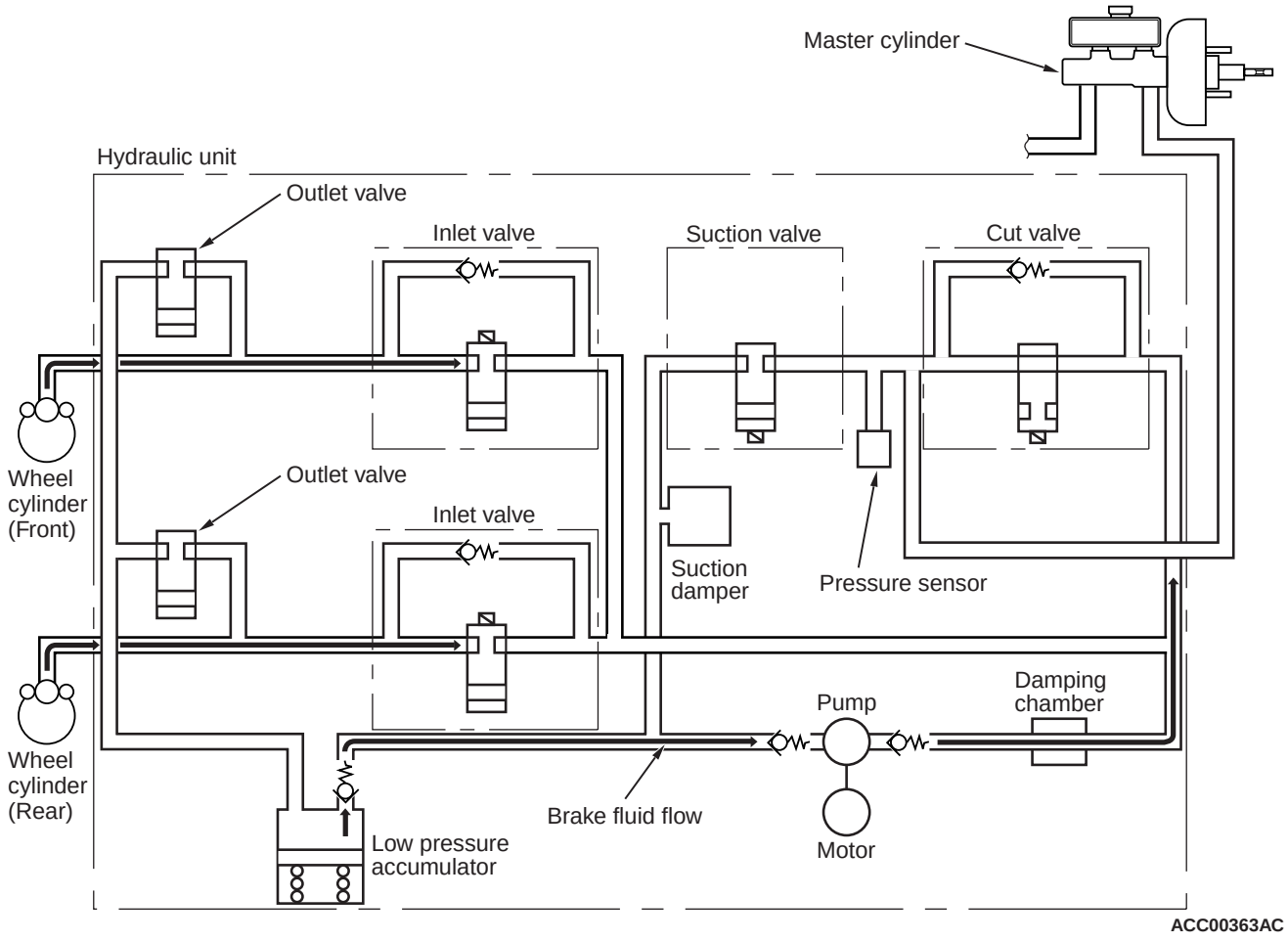


The brake fluid supplied from the wheel cylinder is stored in the low pressure accumulator. Then, the stored brake fluid is returned to the master cylinder by driving the pump using the motor.

VALVE CONDITION

Item	Power status	Open/Close
Cut valve	OFF	Open
Suction valve	OFF	Closed
Inlet valve	ON	Closed
Outlet valve	ON	Open

When brake fluid pressure is held by ABS

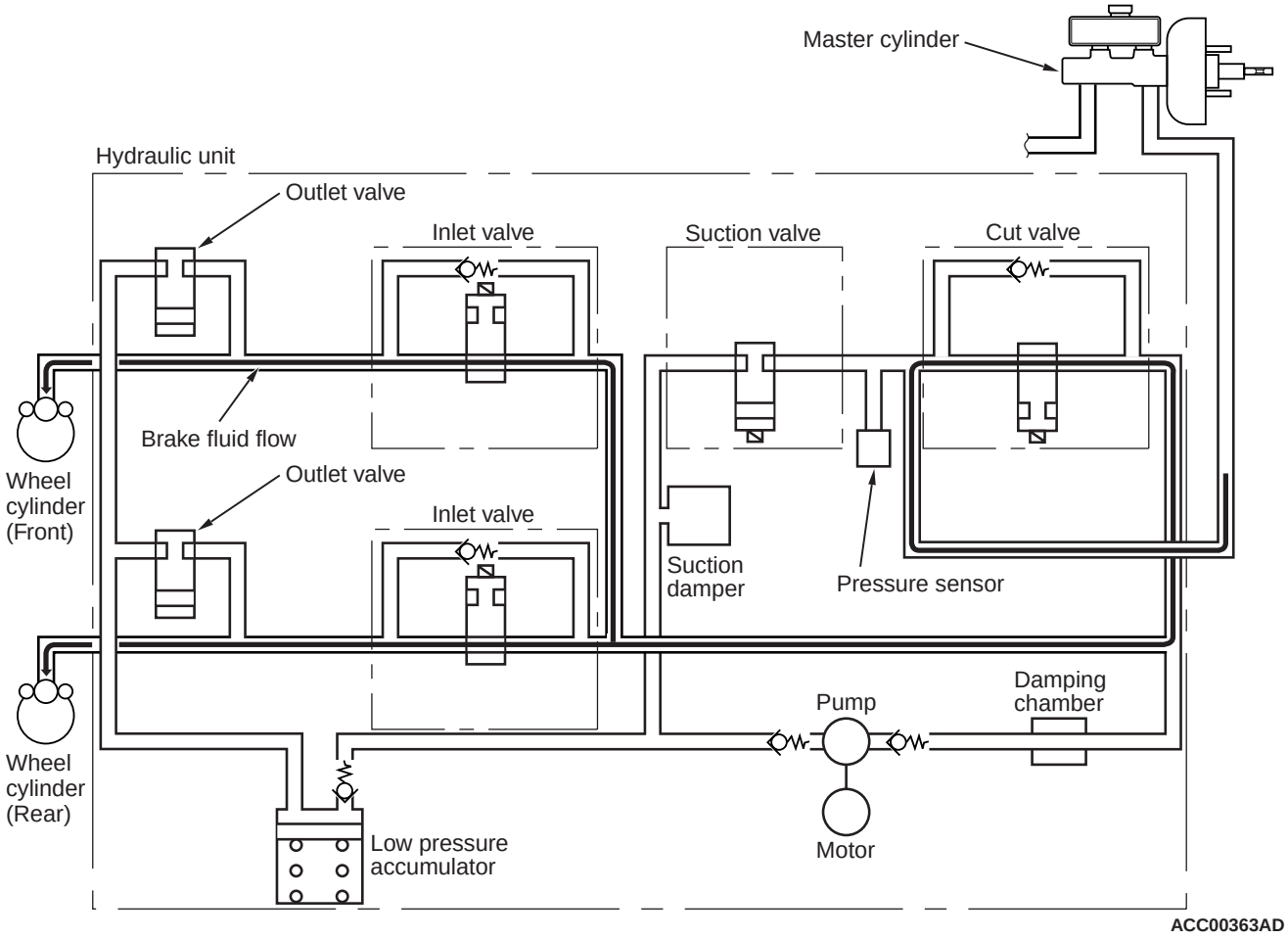


The system closes the inlet valve and outlet valve to hold the brake fluid pressure in the wheel cylinder. If the brake fluid is stored in the low pressure accumulator, the brake fluid is returned to the master cylinder by driving the pump using the motor.

VALVE CONDITION

Item	Power status	Open/Close
Cut valve	OFF	Open
Suction valve	OFF	Closed
Inlet valve	ON	Closed
Outlet valve	OFF	Closed

When brake fluid pressure is increased by normal braking or ABS

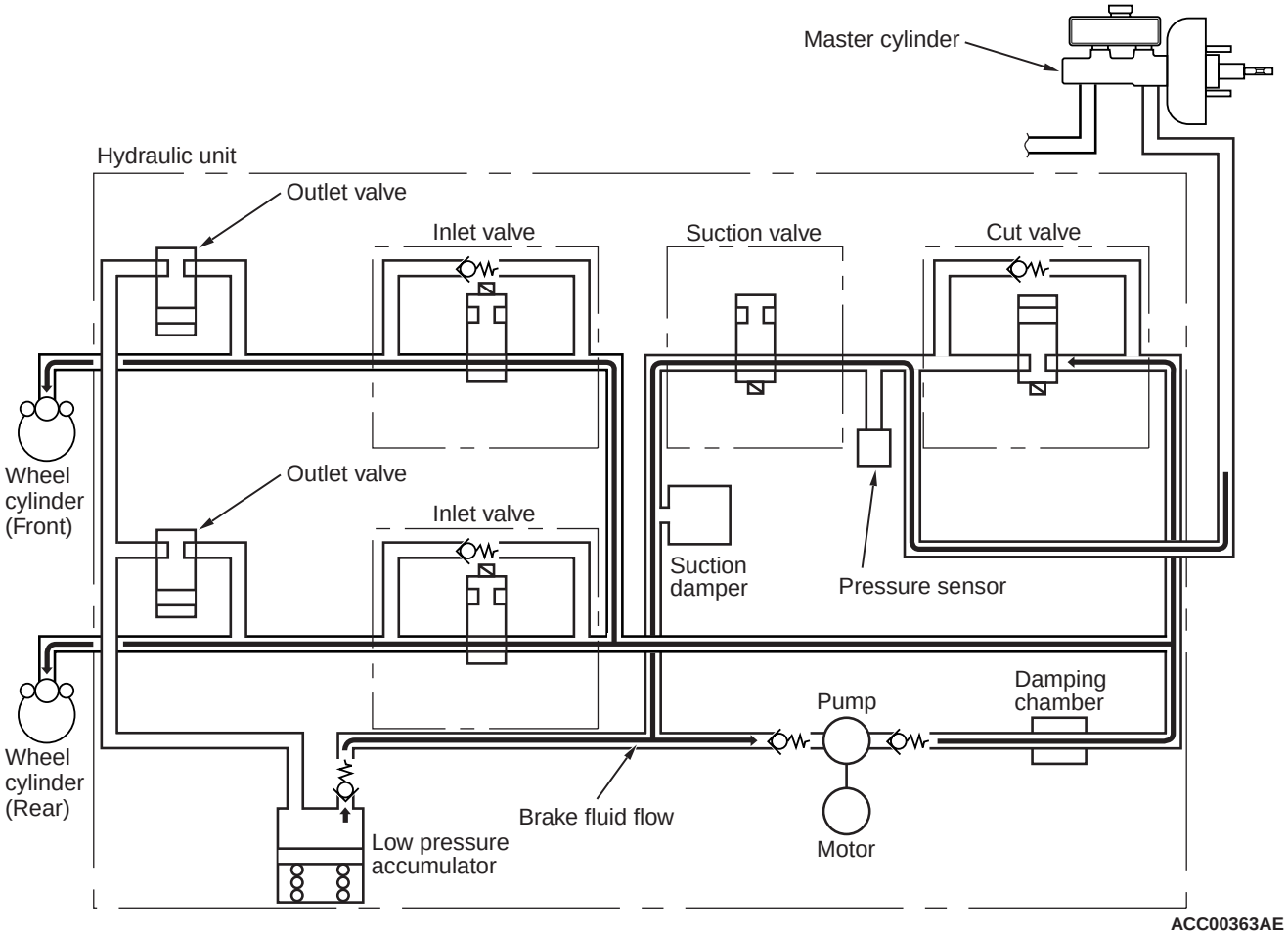


The system opens the inlet valve while closing the outlet valve to increase the brake fluid pressure in the wheel cylinder.

VALVE CONDITION

Item	Power status	Open/Close
Cut valve	OFF	Open
Suction valve	OFF	Closed
Inlet valve	OFF	Open
Outlet valve	OFF	Closed

When brake fluid pressure is increased by stability control (or increased by TCL)



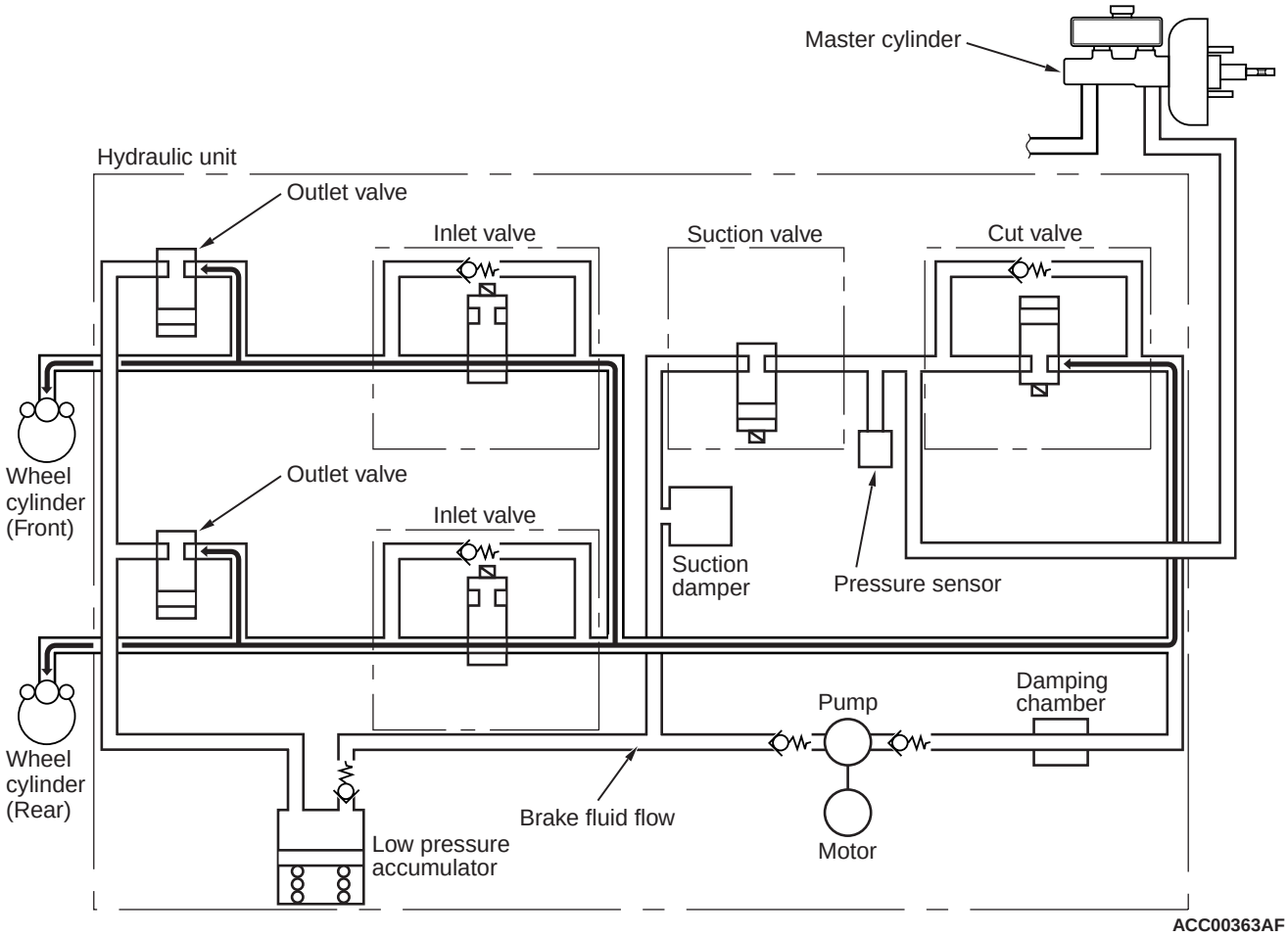
The system closes the cut valve to block the passage from the pump outlet to the master cylinder, and opens the suction valve, connecting the passage from the master cylinder to the pump inlet. The brake fluid from the master cylinder is supplied to the wheel cylinder.

VALVE CONDITION

Item	Power status	Open/Close
Cut valve	ON	Closed
Suction valve	ON	Open
Inlet valve*	OFF	Open
Outlet valve*	OFF	Closed

*NOTE: * The inlet valve and the outlet valve close or open depending on driving conditions to control the brake fluid pressure at each wheel.*

When brake fluid pressure is held by stability control, TCL or HSA (Hill Start Assist) function



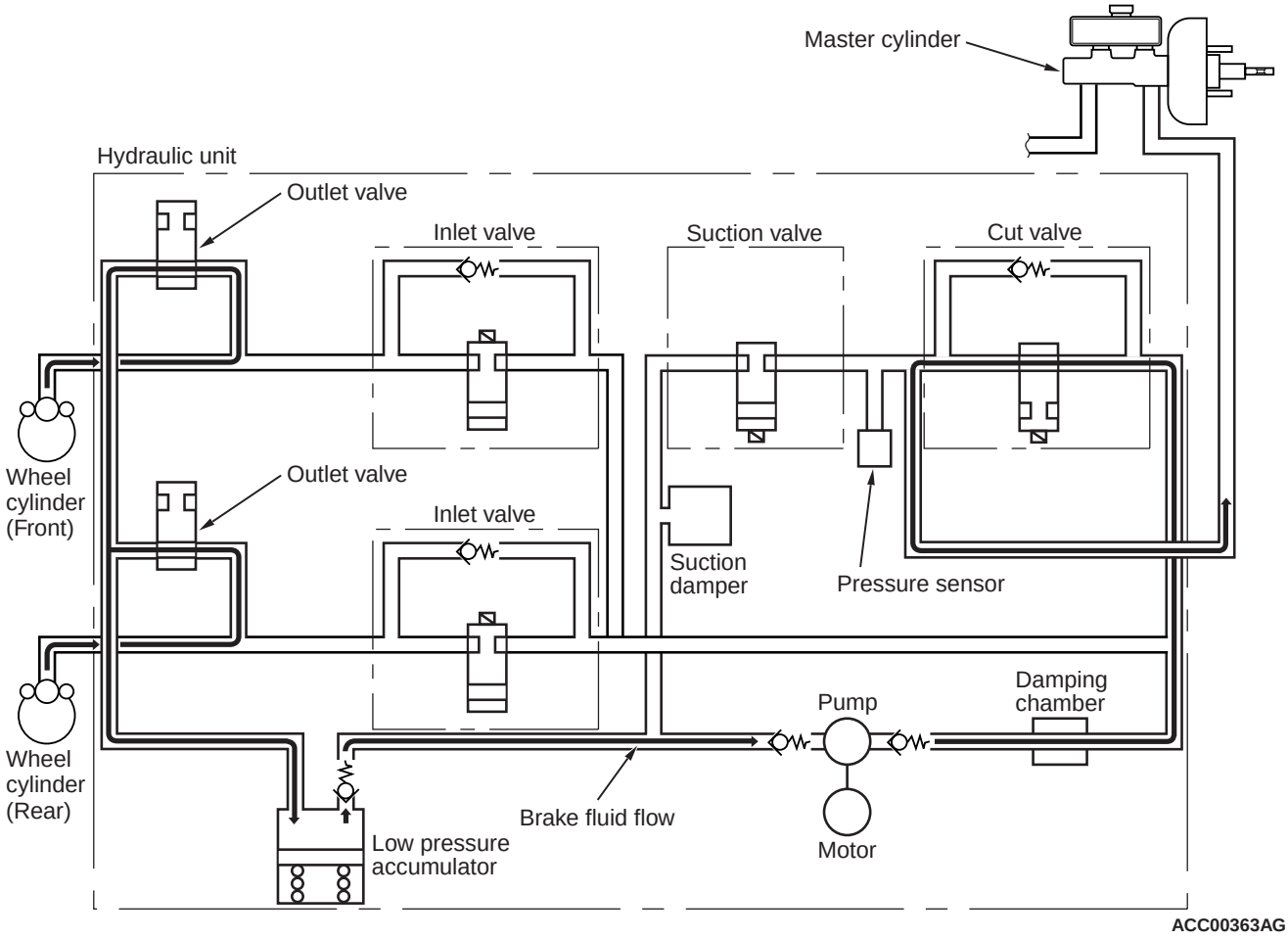
The system closes the cut valve, suction valve and outlet valve to hold the brake fluid pressure in the wheel cylinder.

VALVE CONDITION

Item	Power status	Open/Close
Cut valve	ON	Closed
Suction valve	OFF	Closed
Inlet valve*	OFF	Open
Outlet valve*	OFF	Closed

*NOTE: * The inlet valve and the outlet valve close or open depending on driving conditions to control the brake fluid pressure at each wheel.*

When brake fluid pressure is decreased by stability control (or decreased by TCL)



The system opens the outlet valve while closing the inlet valve to store the brake fluid filled in the wheel cylinder in the low pressure accumulator. The brake fluid stored in the low pressure accumulator returns to the master cylinder through the suction valve.

VALVE CONDITION

Item	Power status	Open/Close
Cut valve	OFF	Open
Suction valve	OFF	Closed
Inlet valve*	ON	Closed
Outlet valve*	ON	Open

*NOTE: * The inlet valve and the outlet valve close or open depending on driving conditions to control the brake fluid pressure at each wheel.*

TCL OPERATION

ASC-ECU receives various kinds of information from the engine-ECU, 4WD-ECU, steering wheel sensor, G & yaw rate sensor, CVT-ECU, and wheel speed sensor. When ASC-ECU determines that the driving wheel is slipping, it suppresses the wheel slippage. At this time, ASC-ECU controls the brake fluid pressure of the driving wheel determined to be slipping so that the torque is transferred to another driving wheel. Basically, the operations of ABS solenoid valve and ASC valve are the same. ASC-ECU, the engine-ECU, and CVT-ECU communicate with each

other via the CAN bus line. When the accelerator pedal is depressed too far, the signal requesting the engine speed reduction is sent to the engine-ECU. The ASC-ECU performs joint control with CVT-ECU and secures the TCL controllability.

HSA OPERATION

ASC-ECU receives various kinds of information from the engine ECU, G & yaw rate sensor, CVT-ECU, ETACS-ECU and wheel speed sensor. When the vehicle has been completely stopped on a slope by the service brake, the ASC-ECU activates the HSA. The HSA maintains the brake wheel cylinder pressure by closing the cut valve to prevent the vehicle from sliding down the slope when the brake pedal is released at startup. It also adjusts the brake wheel cylinder pressure depending on the engine torque to prevent the vehicle from moving backward during startup.

GROUP 36

PARKING BRAKES

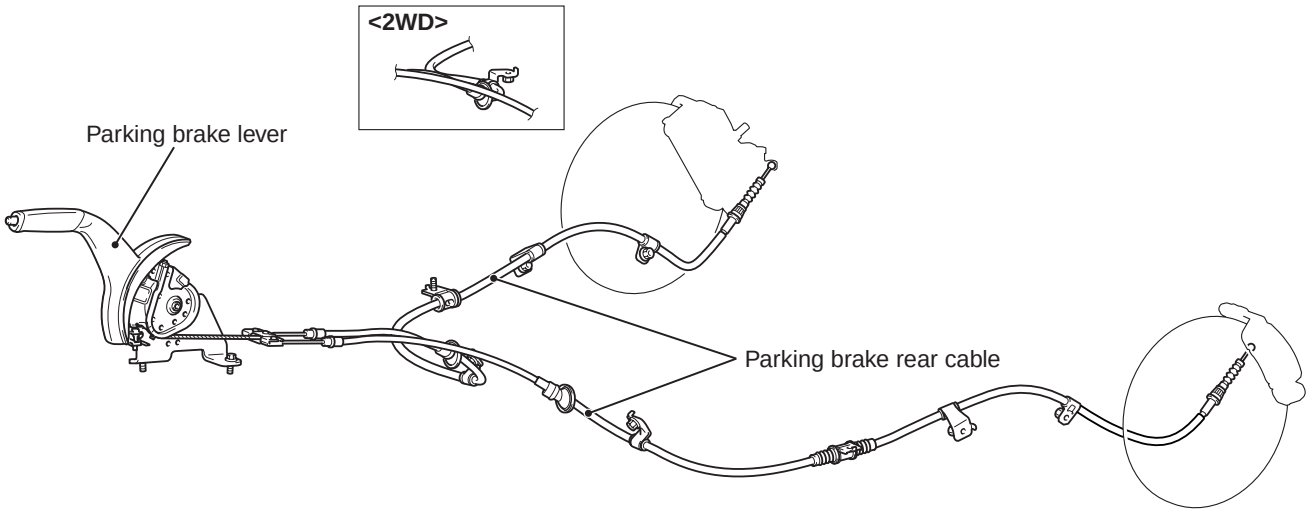
CONTENTS

GENERAL INFORMATION

M2360000101165

A parking brake lever is used to operate the mechanical rear-wheel acting type parking brake.

CONSTRUCTION DIAGRAM



ACB04927AB

GROUP 37

ELECTRIC POWER STEERING (EPS)

CONTENTS

GENERAL INFORMATION

M2370000102158

An electrical power steering system has been adopted.

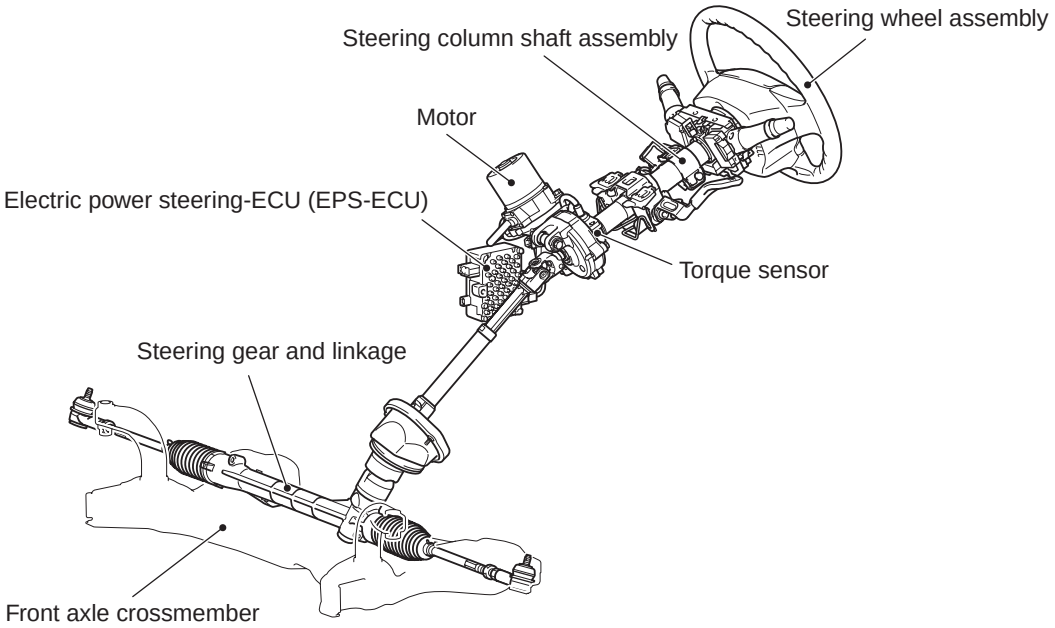
FEATURES

- Improved fuel consumption by reduction of engine load, and weight saving by decrease of the number of parts have been achieved with the introduction of the electric power steering system.
- 3-spoke type steering wheel integrated with an SRS air bag has been adopted.
- Shock absorbing mechanism has been adopted with the steering column shaft assembly.

SPECIFICATIONS

Item		Specification
Steering wheel	Type	3-spoke type
	Outside diameter mm	370
	Maximum number of turns	3.3
Power steering type		Electrical powered type
Steering gear	Type	Rack and pinion type
	Stroke ratio (Rack stroke/Steering wheel maximum number of turns) mm/rev	43.69
	Rack stroke mm	144
Steering angle	Inner wheel	38° 50'
	Outer wheel (reference value)	32° 20'

CONSTRUCTION DIAGRAM



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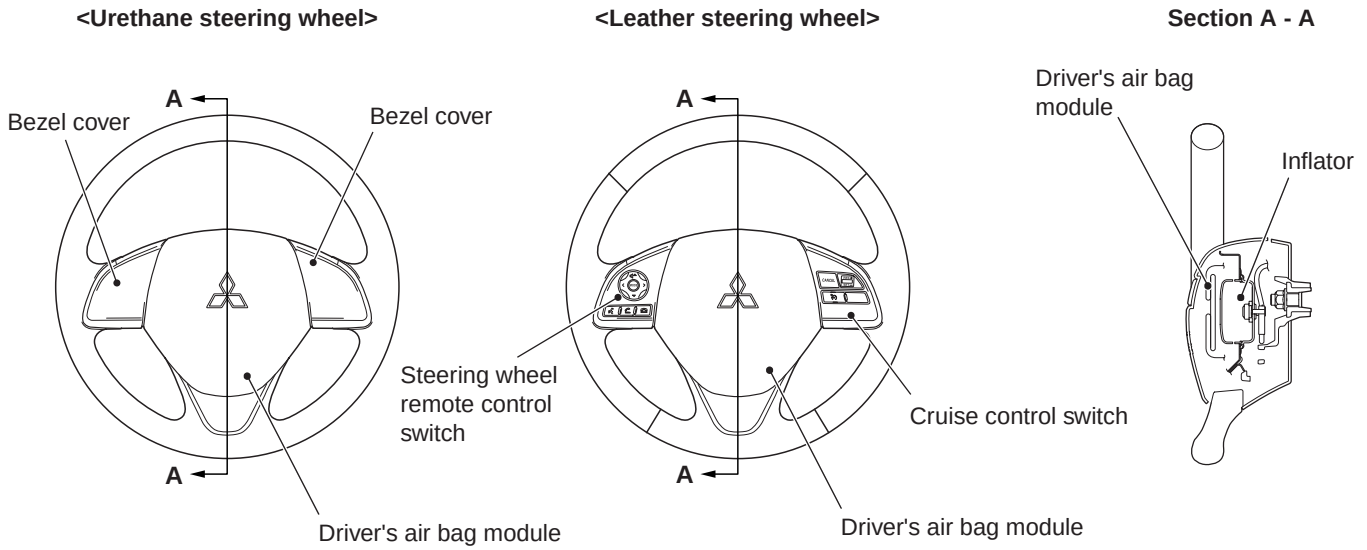
STEERING WHEEL

M2370001001474



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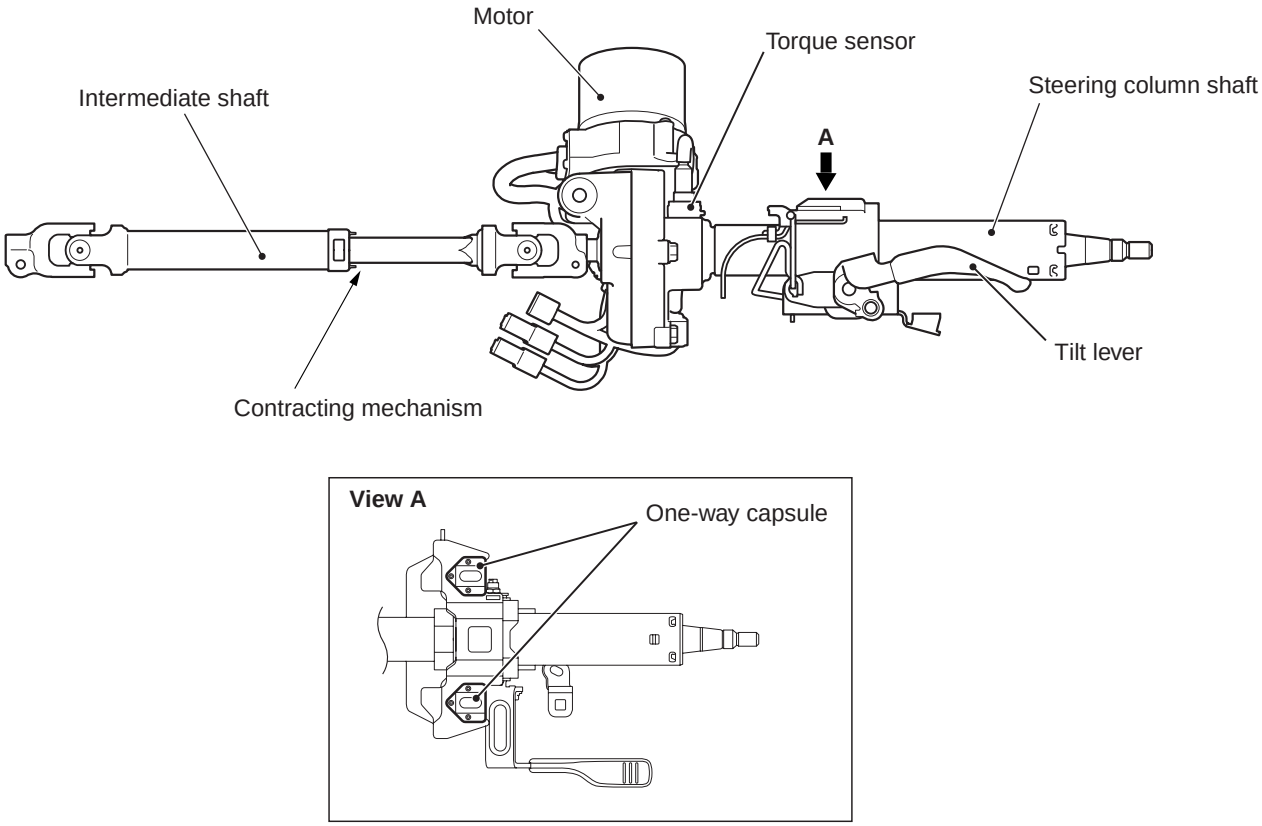
The steering wheel is designed to improve operability, safety and maintainability and has the following features:

- The 3-spoke type has been adopted. The steering wheel made of urethane or leather has been adopted.
- Steering wheel remote control switch (steering wheel audio remote control switch, steering wheel voice control switch) and cruise control switch are available on some models.
- It incorporates an SRS airbag to protect the driver in the event of a frontal collision (single inflator).

STEERING SHAFT AND COLUMN

M2370002001046



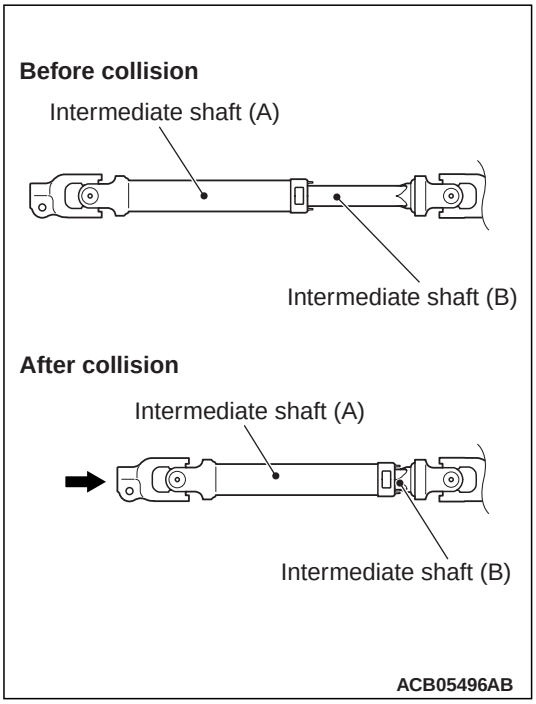
ACB05495AB

The steering shaft and column, which informs the EPS-ECU of steering effort on the steering wheel, consist of a torque sensor and motors, etc. They are designed to improve safety, and has the following features:

- Shock absorbing mechanism has been adopted to the steering column which absorbs the impact energy at collision and provides safety to the driver.
- Collapsible steering column has been employed. During a collision, the steering wheel moves forward.
- The adoption of the collapsible steering column construction prevents the fallaway sections from being affected by the impact at primary collision, and stabilises the shock absorbing capability. Also, the secondary collision impact is partially absorbed by the collapsible steering column construction, enhancing the collapse performance.

IMPACT-ABSORBING MECHANISM

PRIMARY COLLISION



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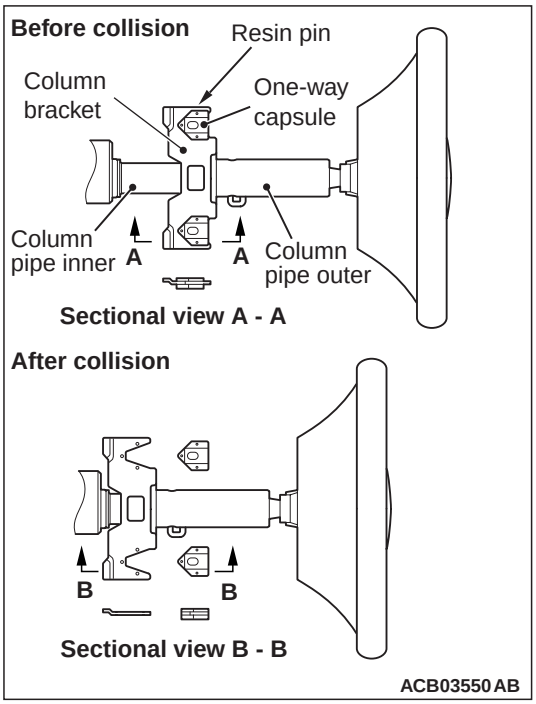
When a vehicle crash occurs and the intermediate shaft is loaded from the gearbox side, the intermediate shaft (A) is forced into the intermediate shaft (B) to absorb an impact load. By this, a rearward outthrusting of steering column is prevented.

SECONDARY COLLISION



When the driver's body falls against the steering wheel via the deployed air bag, the column bracket moves forwards by deforming the rivet pin of the one-way capsule.

ELECTRIC POWER STEERING

GENERAL INFORMATION

M2370000102169

Vehicle-speed sensitive electric power steering (whole range type) has been adopted. This system allows a light steering force during stationary steering manoeuvre or low speed driving, and a moderate steering force during medium or high speed driving. For vehicles with this system, the EPS-ECU controls the motor current according to the vehicle speed and steering force of the steering wheel.

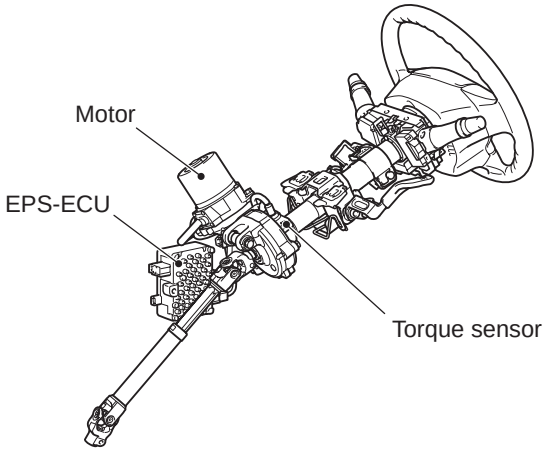
CAN* communication has been adopted in order to communicate with another ECUs for obtaining necessary information related to this control, achieving wiring harness saving and secure data communication.

*NOTE: *: For more information about CAN (Controller Area Network), refer to GROUP 54C, General Information .*

SPECIFICATIONS

Item		Specification
Motor	Type	Permanent magnetic field type
	Rated voltage V	DC 12
	Rated current Arms	82
Torque sensor	Type	Noncontact type hole IC type
EPS-ECU	Control type	Microcomputer control (32 bit)
	Rated voltage V	DC 12

GENERAL DESCRIPTION ON SYSTEM



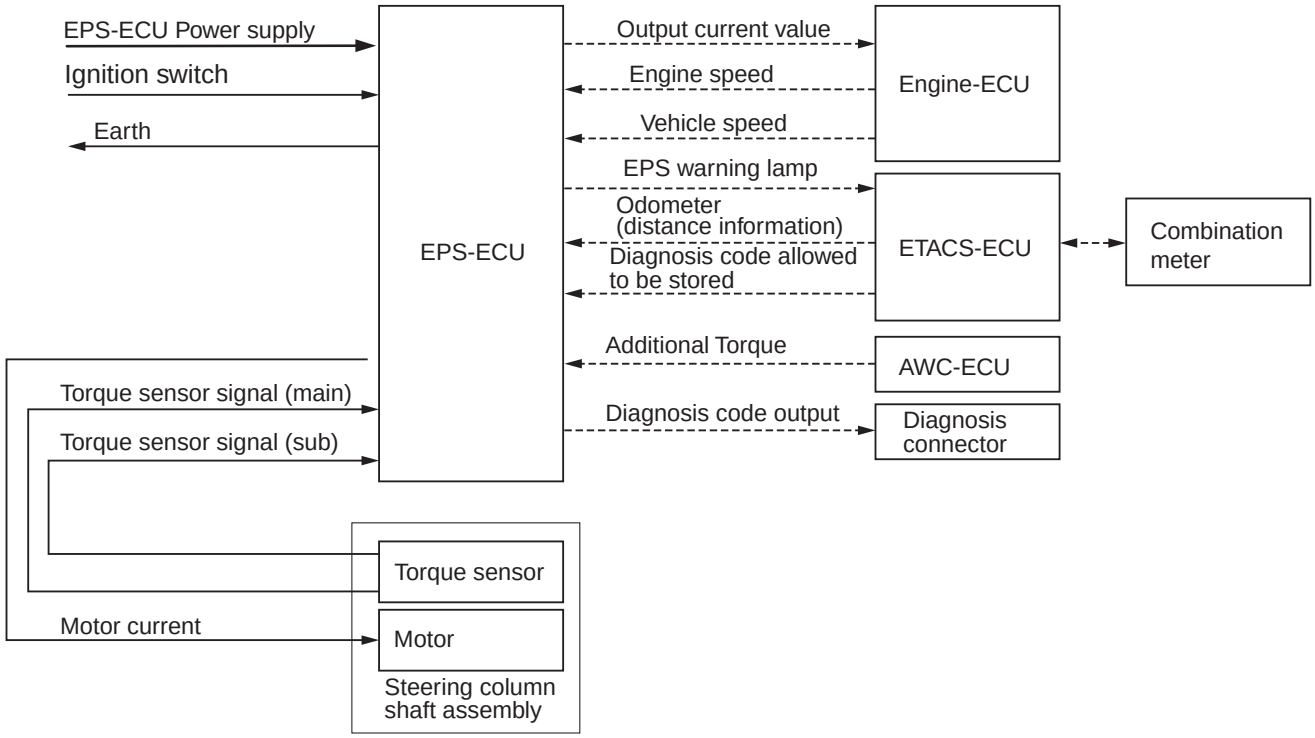
ACB05501AB

To improve operational reliability, the dual-circuit system has been adopted for the torque sensor. If any malfunction occurs in the electric power steering system, the fail-safe function of the EPS-ECU is activated, and the output current of the EPS-ECU applied to the motor is turned off. At the same time, the steering system enters manual mode, and informs a driver of the system malfunction by illuminating the warning lamp on the combination meter. The warning lamp illuminates when the following malfunctions occur: open circuit in the electric power steering system wiring harness, poor connection, malfunctions in the EPS-ECU, motor, or sensors.

ELECTRICAL PARTS AND FUNCTIONS

Parts name		**Description about function**
Sensor	Wheel speed sensor (ABS-ECU or ASC-ECU)	The vehicle speed signal is sent from the ABS-ECU or ASC-ECU to the EPS-ECU via the engine-ECU.
	Torque sensor	Detects a steering force, converts it into the voltage signal, and then sends the signal to the EPS-ECU.
Actuator	Motor	Generates assist torque by the steering operation to the column shaft using the signals sent from the EPS-ECU.
	Electric power steering warning lamp (in combination meter)	Warns a driver of the system malfunction using the signal sent from the EPS-ECU.
EPS-ECU		Control the actuator (motor) based on the signal sent from sensor.
		Controls the self-diagnostic function and fail-safe function.
		Controls diagnostic function (Compatible with M.U.T.-III).

SYSTEM CONFIGURATION

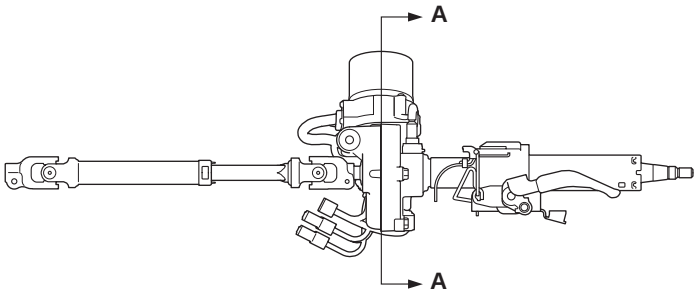


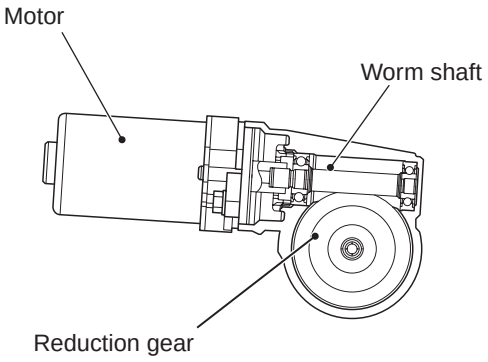
NOTE: – – – – – – line indicates the CAN communication.

ACB05502AB

MOTOR

M2370001100122





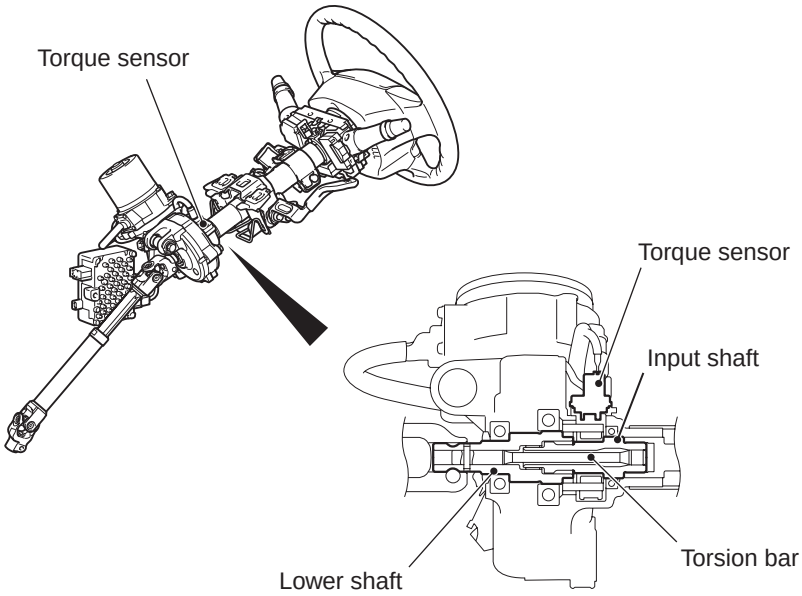
Sectional view A - A

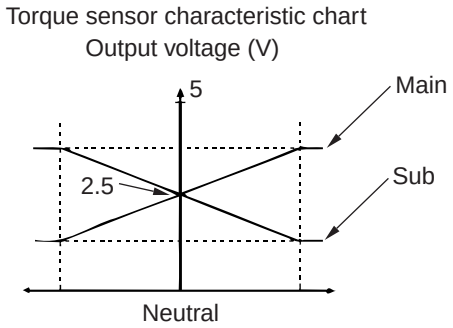
ACB05503AB

The EPS motor receives the control current from the EPS-ECU, and rotates in accordance with steering operation. The rotational force generated by the EPS motor is transmitted via the worm shaft and the reduction gear to the column shaft.

TORQUE SENSOR

M2370001600020





ACB05508

The torque sensor is mounted on the column shaft, and detects the steering force. When the steering wheel is turned, the phase relationship between the input shaft and the lower shaft will be changed due to distortion of the torsion bar. The torque sensor will detect the distortion angle and send two voltage signals (main and sub) to the EPS-ECU in accordance with it.

ELECTRIC POWER STEERING-ECU (EPS-ECU)

M2370000800195

The EPS-ECU includes an input interface circuit, a microprocessor, an output drive circuit, a power relay and a motor line relay. It also integrates a self-diagnostic function, and illuminates the warning lamp on the combination meter when a trouble occurs. At the same time, it sends diagnosis code(s) to the diagnosis connector.

CAN communication

The EPS-ECU communicates with the other ECUs and other units through CAN communication to control the steering system.

Input signals	**Sent to**			
	Engine-ECU	**AWC-ECU**	**Combination meter (via the ETACS-ECU)**	**ETACS-ECU**
Engine speed	●	–	–	–
Vehicle speed	●	–	–	–
Additional torque		●		
Distance information (diagnosis additional information)	–	–	●	–
Vehicle information (diagnosis control)	–	–	–	●

NOTE: Indicates items which send and receive data through CAN communication.

Output signal name	Received by		
	Engine-ECU	Combination meter (via the ETACS-ECU)	Diagnosis connector
Motor current signal	•	–	–
EPS warning lamp illumination request signal	–	•	–
Diagnosis code signal	–	–	•
Service data output signal	–	–	•

NOTE: Indicates items which send and receive data through CAN communication.

Fail-safe function

If the EPS-ECU detects any malfunction, it illuminates the EPS warning lamp, deactivates the EPS functions, and then switches the steering system into manual mode.

DIAGNOSIS FUNCTION

The EPS-ECU has the following functions to make system checks easier.

- Diagnosis code set
- Service data output

All the above items can be diagnosed using MUT-III.

Diagnosis code set

There are 29 diagnostic items. Since all the diagnostic results are recorded in volatile memory (EEPROM*), they are stored in the memory even though the battery terminals are disconnected.

NOTE:

- **EEPROM (Electrical Erasable & Programmable ROM): Special type of memory that can be programmed or erased electrically.*
- *For diagnosis items, refer to Workshop Manual.*

Service data output

Using M.U.T.-III, the input data sent from the sensors and motors can be read.

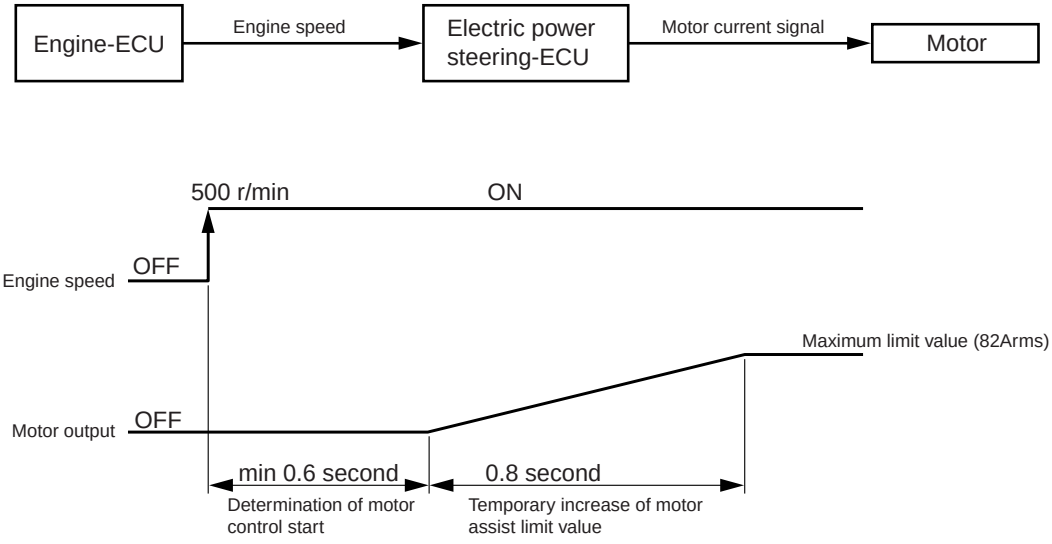
NOTE: For service data items, refer to Workshop Manual.

OPERATION

M2370000700217

IGNITION SWITCH ON

Ignition supply voltage is applied to the EPS-ECU, and the ECU enters standby mode.



AC611649AJ

1. When the engine is started, the engine speed signal sent from the engine-ECU is input to the EPS-ECU.
2. After starting the engine, the EPS-ECU judges the engine status "ENGINE SPEED ON" when the engine speed reaches 500 r/min, then the power assist function is ready.

STEERING WHEEL OPERATION

ACB05506AB

1. When the steering wheel is operated, the torque sensor integrated into the column shaft detects the steering torque and outputs the torque sensor signal (main and sub), which varies with the steering force, to the EPS-ECU.
2. The EPS-ECU outputs the current in proportion to the torque sensor signal to the motor.
3. The motor outputs the rotational torque (assist torque) in proportion to the current intensity and assists the power steering gear.

FAIL-SAFE FUNCTION OPERATION

During the fail-safe mode, the electric power steering operates as a manual steering system.

GROUP 42

BODY

CONTENTS

GROUP 42A

BODY

CONTENTS

GENERAL INFORMATION

M2420000102064

FEATURES

LIGHT WEIGHT, HIGH RIGIDITY, ANTI-CORROSIVE

- High-tensile steel plates and anti-corrosion steel plates have been adopted.
- The ring structure for the side structure reinforcement has been adopted.
- A front floor side member has been adopted.

REDUCTION IN VIBRATION AND NOISE

- Sound dampening foam material and urethane foam have been adopted.

IMPROVEMENTS IN SAFETY

- The one-touch power window (operative after ignition switch is turned OFF) with safety mechanism has been installed.
- The direct combination key cylinder and inside lock cables for the front doors have been adopted to improve door opening operation upon impact.
- RISE (Reinforced Impact Safety Evolution) has been adopted for the main body.
- The side door beam has been adopted.
- The crush box structure has been adopted to the front end of front sidemember .
- The front end side panel under the engine compartment absorbs impact energy during frontal collision more effectively than the predecessor.
- The impact-absorbing structure has been utilised on the fender, and the cowl top to improve the pedestrian protection capability.
- The fender bracket padding structure has been adopted.

IMPROVEMENTS IN OPERATION PERFORMANCE

- The central door locking system which can lock/unlock all the doors and tailgate has been adopted.
- The override function which allows to open the driver's door by pulling the driver's inside handle when all the doors are locked has been adopted.
- Electric tailgate lock release handle that requires only the slightest operating force has been adopted.
- The electric tailgate with safety mechanism has been installed as an option.

IMPROVEMENTS IN MARKETABILITY AND APPEARANCE

- By improving an audible clicking sound when the door latch and striker are engaged, the door locking sound quality has been enhanced.
- The high rigidity pressed door has been adopted to improve the rigidity of the door sash bottom section.
- The wiper deicer has been added to the windshield as an option <Optional>
- The privacy glasses for the rear door window glass, quarter window glass and tailgate window glass have been adopted as an option.
- The latch cover has been installed to the hood latch front section to deter thieves.
- The sunroof with safety mechanism has been installed as an option.

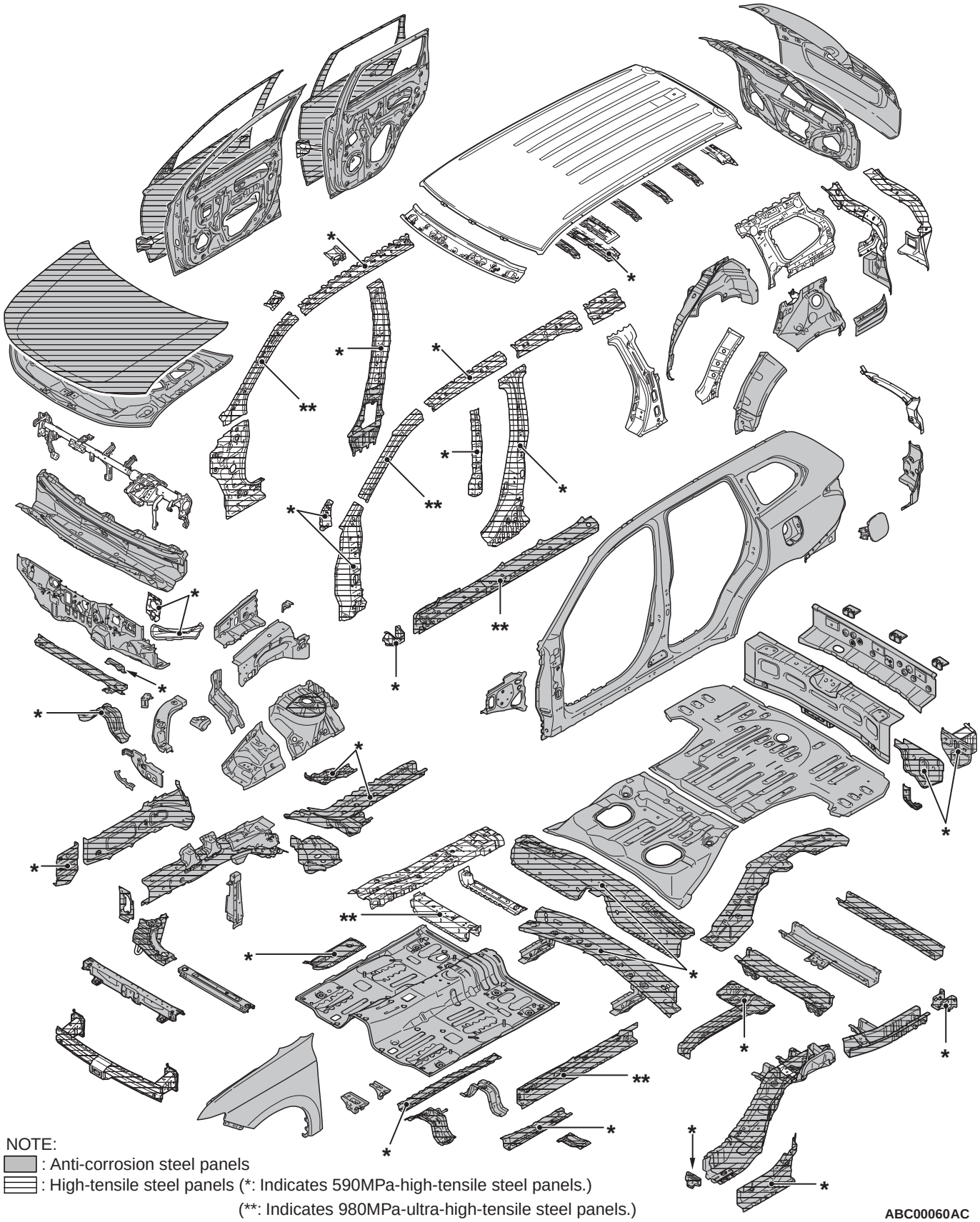
IMPROVEMENTS IN FUNCTIONALITY

- The fuel filler cap holder has been installed to the fuel lid in order to prevent the fuel cap from being left open.

MAIN BODY

BODY PANELLING

M2420002001554



NOTE:
: Anti-corrosion steel panels
: High-tensile steel panels (*: Indicates 590MPa-high-tensile steel panels.)
(**: Indicates 980MPa-ultra-high-tensile steel panels.)

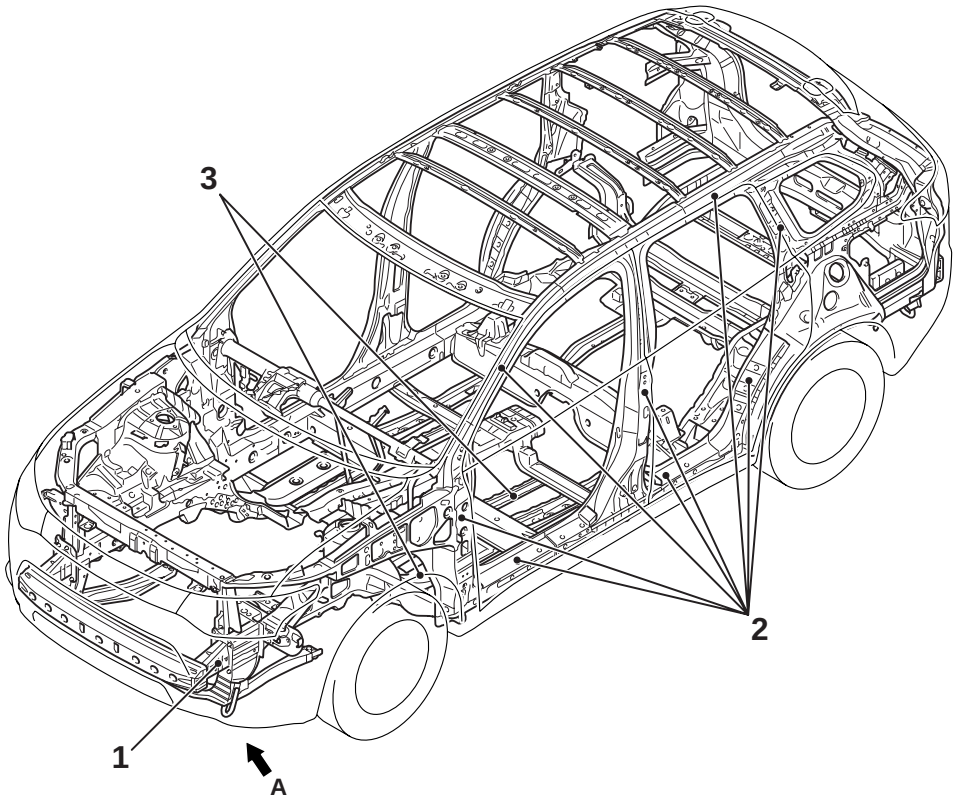
ABC00060AC

- RISE (Reinforced Impact Safety Evolution) has been adopted for the main body in order to improve all-round impact safety at high level.
- The applications of anti-corrosion steel plates have been expanded to the hood, doors, inner panel of the tailgate and reinforcements to improve the anti-corrosive properties of the main body.
- Some high-tensile steel panels in 590 MPa-class and 980 MPa-class have been adopted to improve the rigidity and weight reduction of the panel.
- The sealer application area has been extended to the entire flange folded edge of the doors, hood, and tailgate, and the panel joints at the bottom of the front floor and the rear floor, in order to improve rust resistance.

BODY SHELL

M2420003001320

IMPACT SAFETY BODY RISE (REINFORCED IMPACT SAFETY EVOLUTION)



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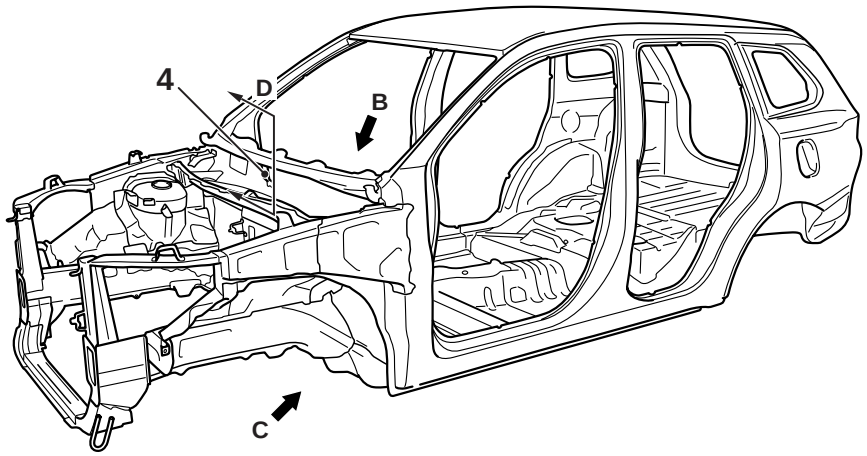

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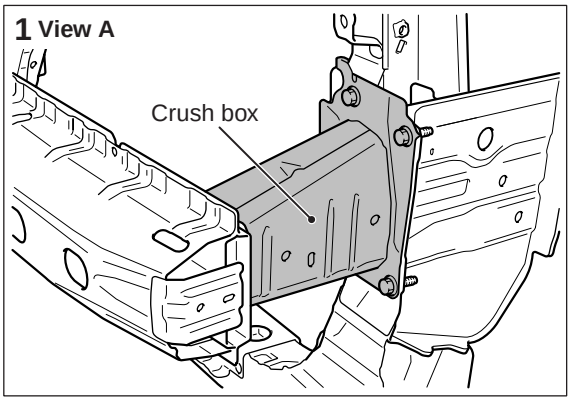
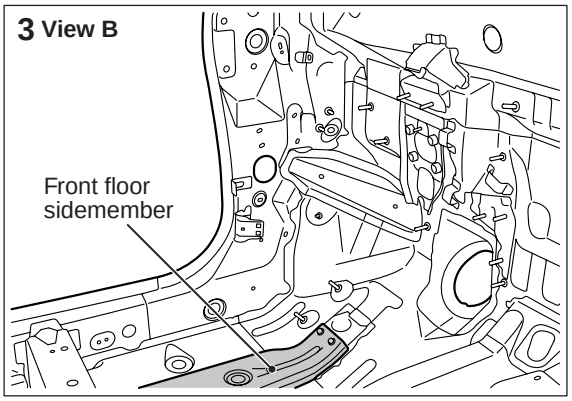
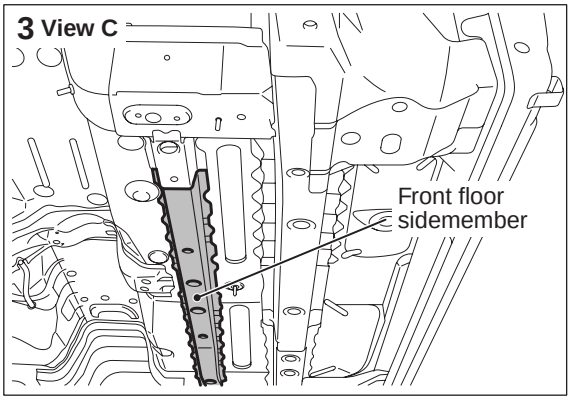
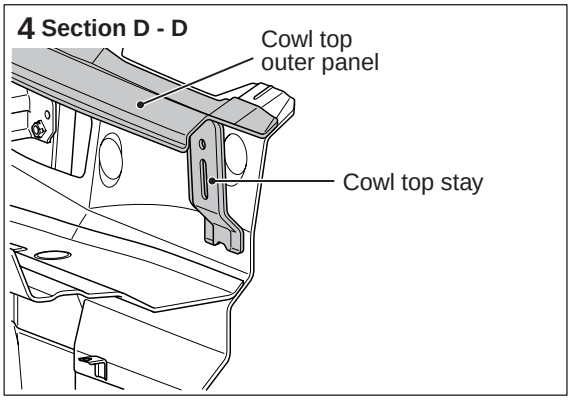






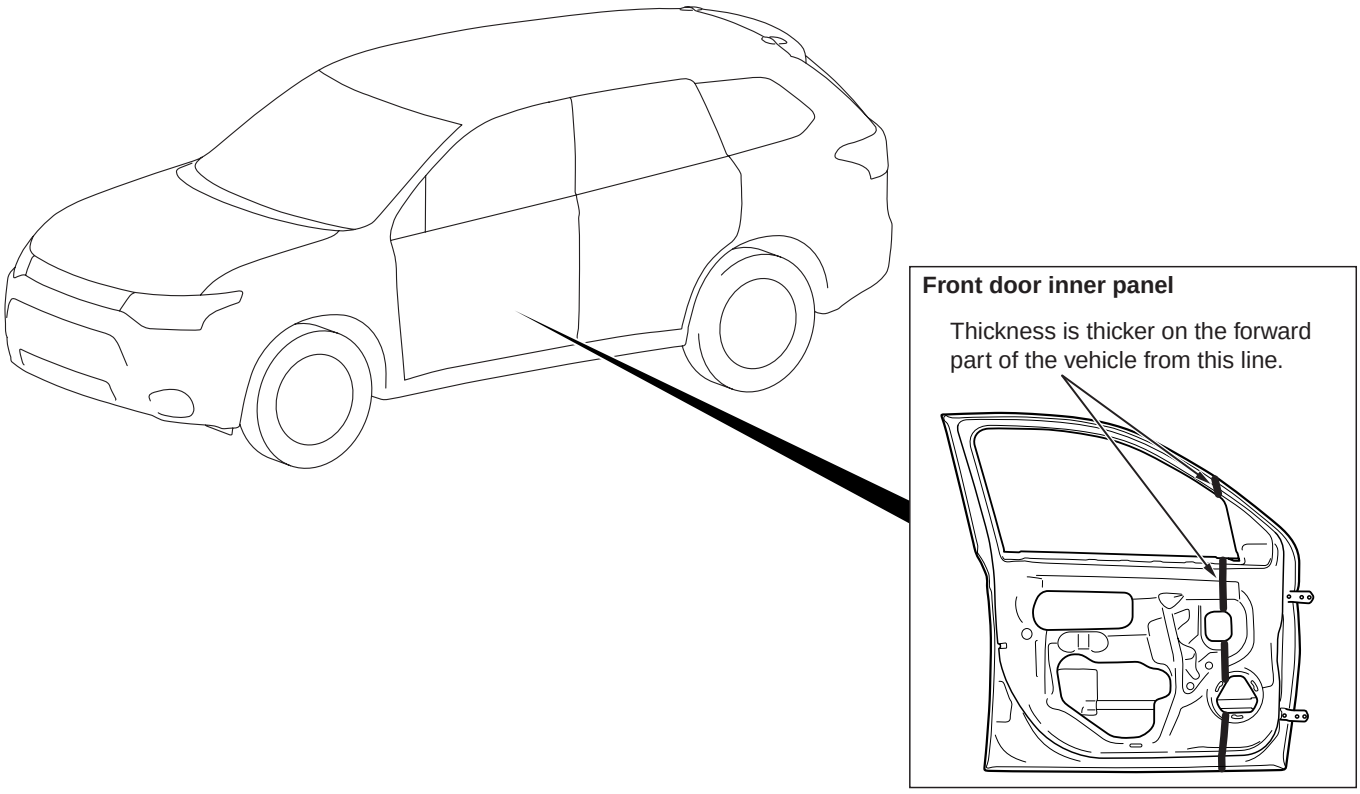


ABC00043AB

The front and rear structures to absorb high energy, and the highly tough cabin structure are adopted to reduce the risk of passenger injuries at front-, rear-, and side-impact collisions, secure the space for life protection, and facilitate rescuing passengers. These structures also have the following features:

1. The crush box structure has been adopted to the front end of the front sidemember to improve the characteristics at a minor frontal collision.
2. The ring structure of the side structure reinforcement has been adopted to improve the collision characteristics and the rigidity of the whole vehicle.
3. A front floor sidemember is located in and under the front floor to improve frontal collision safety.
4. The padding structure of the cowl top is designed to have a crushable structure in order to efficiently absorb energy upon impact, thus improving the pedestrian protection capability.

STEEL PLATE WITH UNEVEN THICKNESS



The uneven thickness steel panels* (in uneven thickness integrated structure) have been adopted for the parts shown in the figure to improve safety upon impact and reduce weight.

*NOTE: *: A steel sheet of varying thickness that is welded into one steel sheet.*

QUIETNESS

M2420004000911

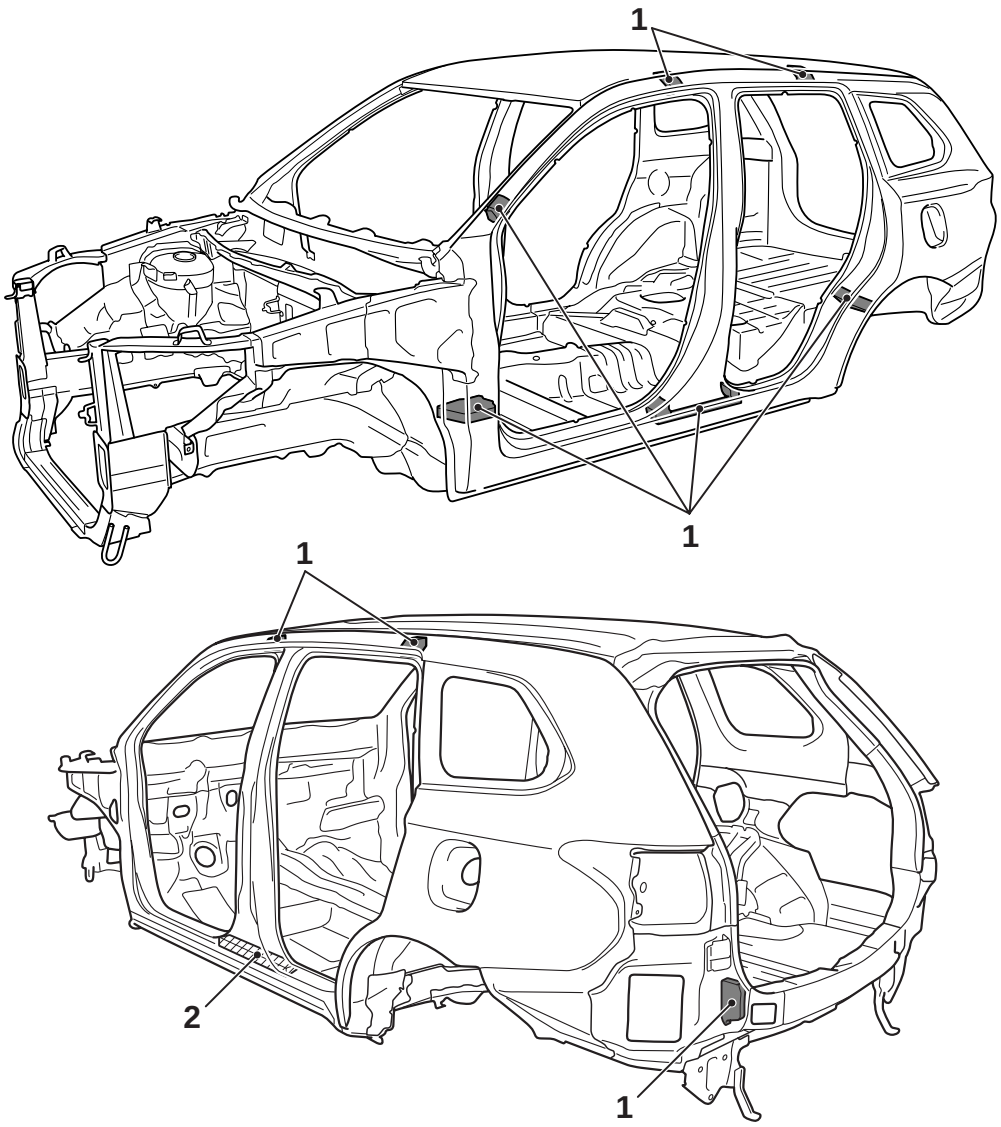


ABB00855AB

1. The sound dampening foam material has been adopted to the upper and lower sections of the front pillar, roof side rail section, centre pillar lower section, wheel house arch, and rear end inside to shield from external noise.
2. Urethane foam has been inserted into the centre pillar lower section to shield from external noise.

BODY COLOUR CHARTS

M2420005002891

Two types of colour variation have been introduced; the colour suggesting the great nature or the colour providing the sporty and tough impression. Colour names have been modified for easy recognition. The colour recipe is the same as the conventional one.

BODY COLOUR TABLE

Colour	Colour code	Colour number	Colour name	Coating film structure	Composition of film
SILVER	A31	CMA10031	Cool Silver Metallic	2M	Metallic
REDDISH BROWN	C07	CMC10007	Copper Metallic	2M	Metallic
DARK BLUE	D14	CMD10014	Cosmic Blue Mica	2P	Interferenced Pearl
GREY	U17	CMU10017	Titanium Grey Metallic	2M	Metallic
BLUISH SILVER	U21	CMU10021	Technical Silver Metallic	2M	Metallic

Colour	Colour code	Colour number	Colour name	Coating film structure	Composition of film
WHITE	W13	CMW10013	White Pearl	3P	Pearl
WHITE	W37	CMW10037	White Solid	2S	Solid
BLACK	X42	AC11342	Black Mica	2P	Interferenced Pearl

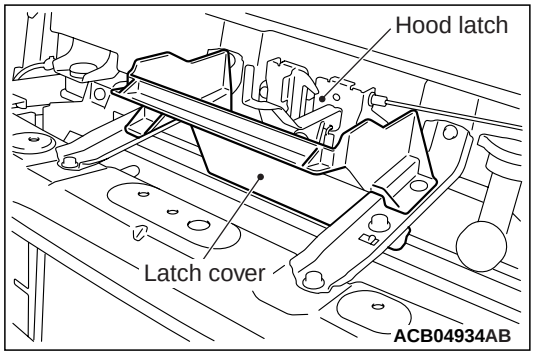
NOTE:

- *The coating film structure indicates top coating only (2S: 2 coat solid, 2M: 2 coat metallic, 2P: 2 coat pearl, 3P: 3 coat pearl).*
- *For painting, inner panel colours should be similar to the outer panel colours.*

HOOD

M2420023000738

HOOD LATCH



The latch cover has been installed to the front of the hood latch to deter thieves.

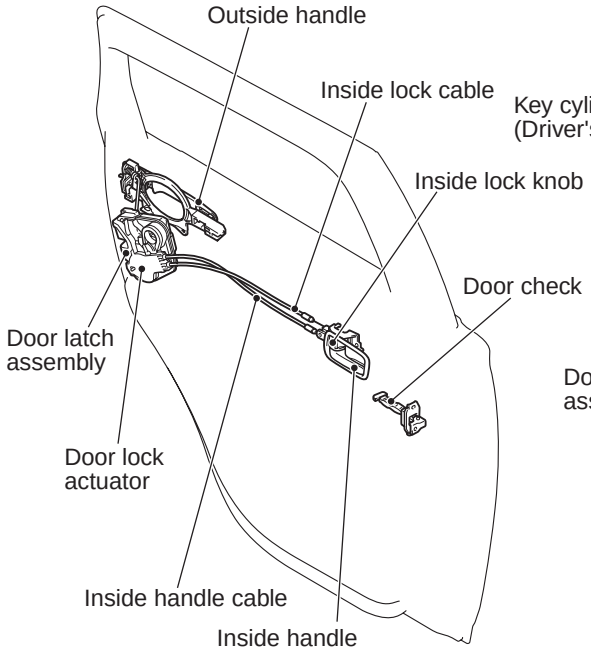
DOOR AND TAILGATE

DOOR AND TAILGATE LOCK

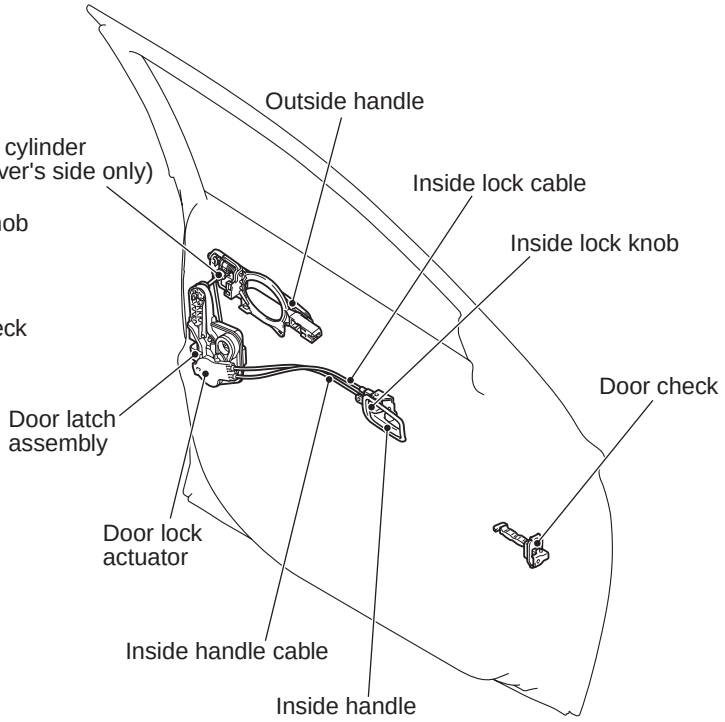
M2420001100317

CENTRAL DOOR LOCKING

<Rear door>

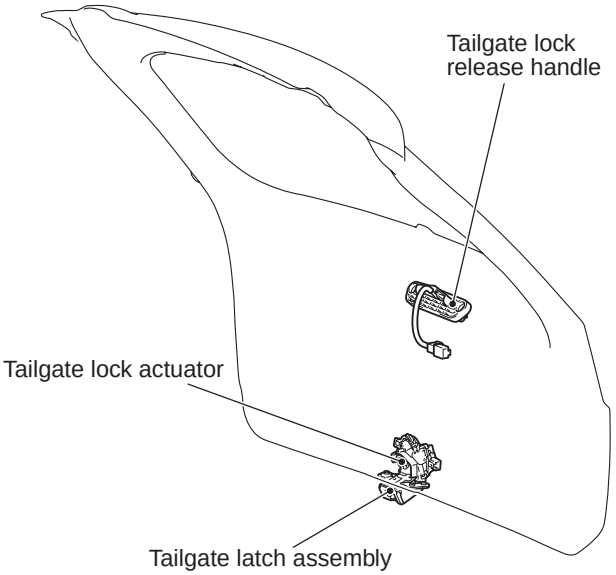


<Front door>



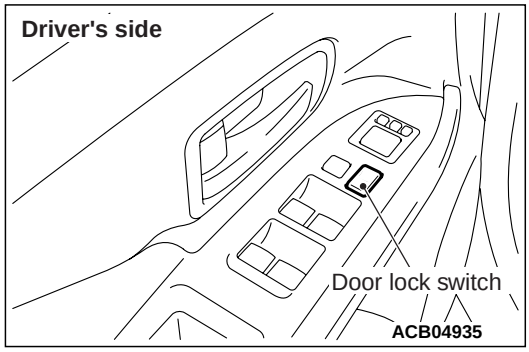
ACB05642AB

<Tailgate upper (Except vehicles with electric tailgate)>



ACB05432

Location of the door lock switch



ACB04935

ACC00210AB

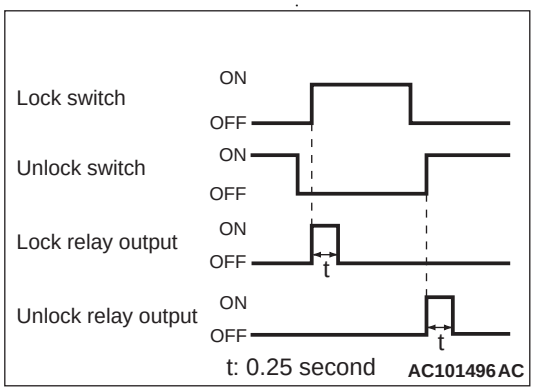
- The central door locking system that locks/unlocks all the doors and tailgate using the driver's side door lock switch has been installed.
- The child protection function has been introduced to prevent the rear doors from being opened accidentally during driving.
- The key-in prevention function has been introduced.

- The selector "P" position-linked door unlocking function has been introduced.
- The ignition switch "LOCK (OFF)" position-linked door unlocking function has been introduced.
- The direct combination key cylinder mechanism has been adopted.

DESCRIPTION OF CONSTRUCTION AND OPERATION

CENTRAL DOOR LOCKING

- When the driver's door lock switch is pushed to the lock position with all doors closed, all the doors and tailgate will be locked. With the driver's door opened, the driver's door lock switch cannot be operated (blocking mechanism).<Driver's side only>
- The function that allows the driver's door to be opened by pulling the driver's door inside handle even when the driver's door inside lock knob is in the lock position is called "override function". All the doors and tailgate can be unlocked at the same time.



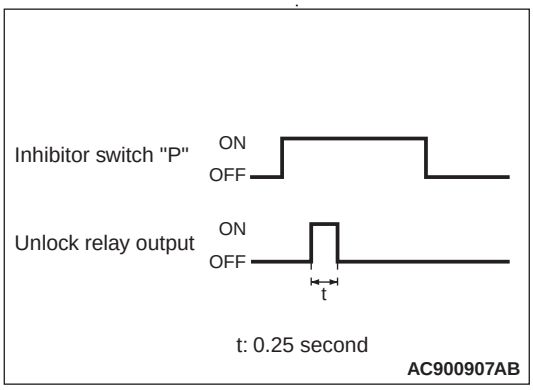
When the driver's door is locked, ETACS-ECU turns the lock relay output ON for 0.25 second to lock all the doors (including the tailgate). When the driver's door is unlocked, ETACS-ECU turns the unlock relay output ON for 0.25 second to unlock all the doors (including the tailgate).

KEY-IN PREVENTION FUNCTION

When the driver's door inside lock knob is operated to the lock position with the driver's door opened, the driver's door cannot be locked, preventing it from being locked with the key inside the vehicle.

SELECTOR "P" POSITION-LINKED DOOR UNLOCKING FUNCTION

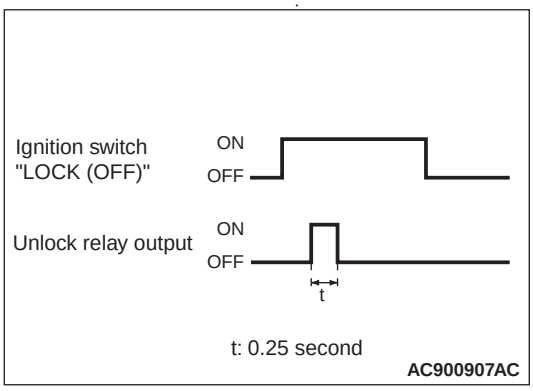
- When the selector lever is shifted to the "P" (parking) position with the ignition switch turned ON, all the doors will be unlocked automatically, improving passengers' convenience for getting out. Using a customise feature, the selector "P" position-linked door unlocking function can be changed (Refer to P.42A-37).



When the selector lever is shifted to the P position with the ignition switch turned ON, the inhibitor switch "P" turns ON, ETACS-ECU turns the unlock relay output ON for 0.25 second to unlock all the doors.

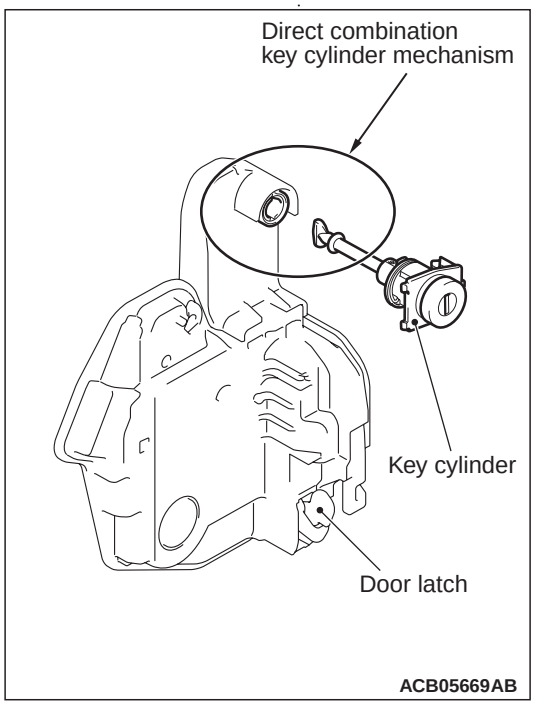
IGNITION SWITCH "LOCK (OFF)" POSITION-LINKED DOOR UNLOCKING FUNCTION

- When the ignition switch is turned to the " LOCK (OFF)" position, all the doors will be unlocked automatically, improving passengers' convenience for getting out. Using a customise function, the ignition switch " LOCK (OFF)" position-linked door unlocking function can be changed (Refer to P.42A-37).



When the ignition switch is turned to the " LOCK (OFF)" position, ETACS-ECU turns the unlock relay output ON for 0.25 second to unlock all the doors.

DIRECT COMBINATION KEY CYLINDER MECHANISM

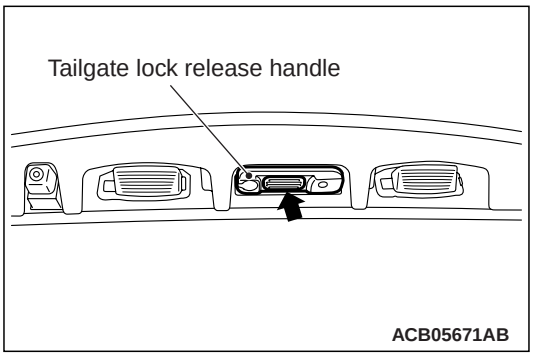


The structure in which an impact of a side collision is not easily transferred to the door latch with the doors unlocked has been established to facilitate the door opening operation. (To prevent passengers from falling out of the vehicle)

- Even if any door key cylinder is attempted to be tampered with the doors locked, the tampering force is not easily transferred to the door latch to deter thieves.

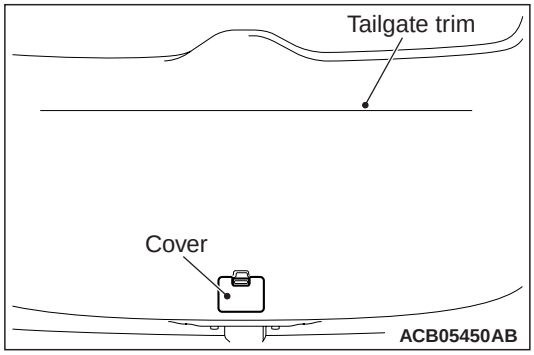
TAILGATE

TAILGATE LOCK RELEASE HANDLE

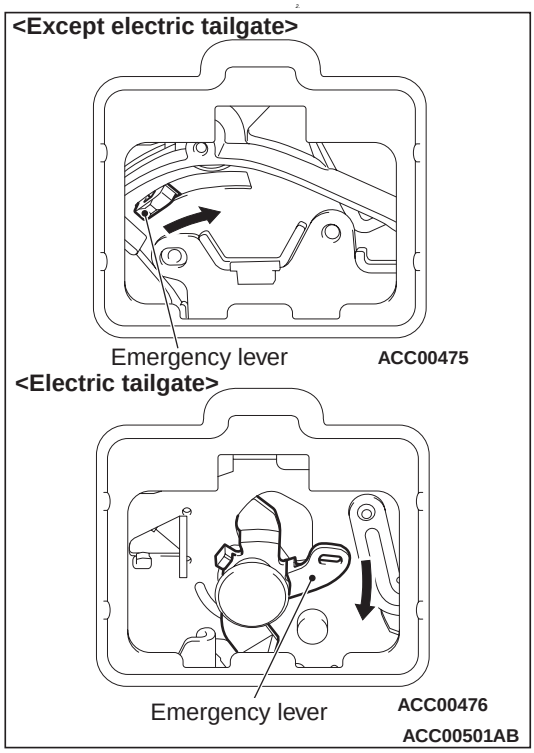


The electric tailgate lock release handle which requires a small operating force and has no temperature dependency has been adopted to improve the opening operation. The switch will be turned on by pressing the arrow mark on tailgate lock release handle.

NOTE: If the tailgate cannot be opened from the outside of the vehicle due to any malfunction such as discharged battery, it can be opened from the inside of the vehicle using the following procedures:



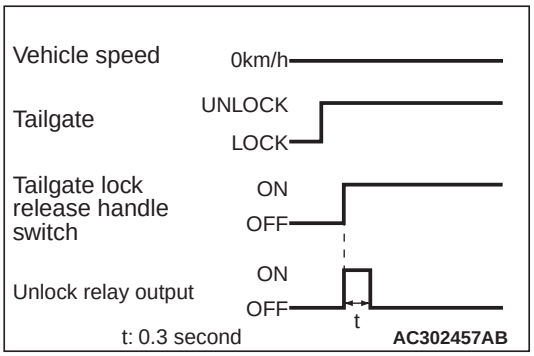
From the inside of the vehicle, remove the emergency lever cover installed to the tailgate trim.



Operate the emergency lever to the direction of the arrow.

3. *Open the tailgate while pushing it up.*

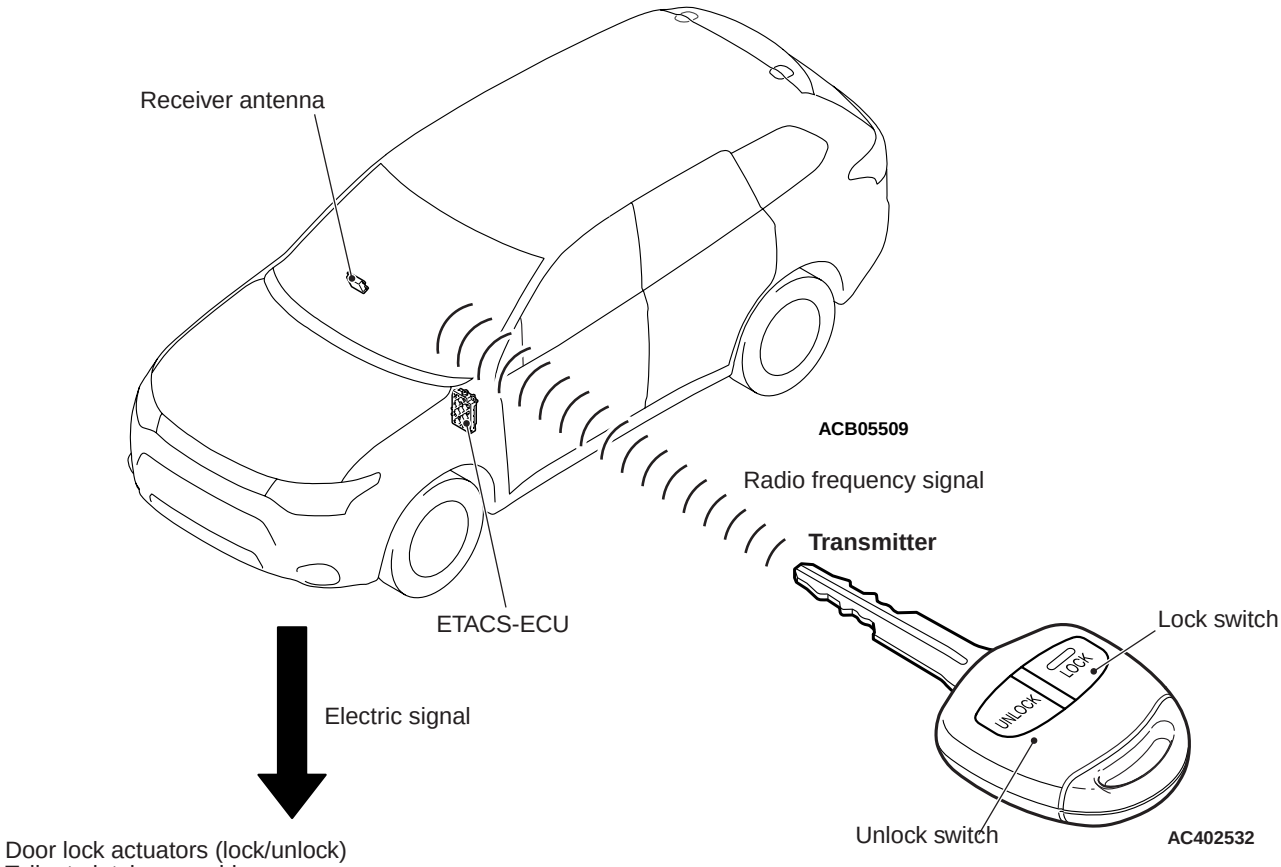
TAILGATE OPENER CONTROL FUNCTION



When the tailgate lock release handle is operated to open the tailgate (the tailgate lock release handle switch turns ON) while the vehicle is parked and the tailgate is unlocked, ETACS-ECU turns the unlock relay output ON for 0.3 seconds, thus the tailgate can be opened by the tailgate lock release handle.

KEYLESS ENTRY SYSTEM <Vehicles without keyless operation system>

M2420010001117



Door lock actuators (lock/unlock)
Tailgate latch assembly
Door mirror assembly (unfolding/folding)
The signal causes the hazard warning lamp to flash once when the doors are locked, or flash twice when unlocked (Initial setting).
The signal causes the room lamp to extinguish when the doors are locked, or come on for 15 seconds when unlocked.

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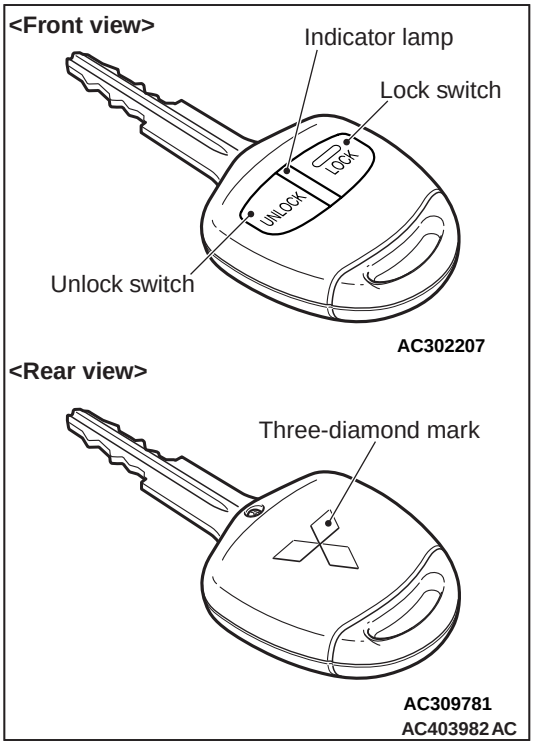
The keyless entry system is installed. There are the following features.

- Transmitter has two switches (LOCK/UNLOCK).
- The power door locks with selective unlocking has been adopted.
- The receiver antenna is equipped with the integral receiver and receiving antenna.
- Up to 8 encrypted codes (8 transmitters) can be registered using M.U.T.-III.
- Answer-back function has been adopted.
- Using the LOCK/UNLOCK switches, all doors (including tailgate) can be locked or unlocked.

- By using the lock/unlock switches, the driver can lock/unlock all the doors (including tailgate), fold/unfold the door mirrors.
- *NOTE: Using a customisation function, the operation of the door mirrors can be enabled or disabled (Refer to P.42A-37).*

DESCRIPTION OF STRUCTURE AND OPERATION

TRANSMITTER



The transmitter is integrated into the master key.

- When either switch is pressed, the transmitter emits a radio signal representing a specific ID code.
- There are two switches on the transmitter; the lock switch and the unlock switch.
- An indicator lamp, which illuminates when signals are transmitted, is added on the key grip. This indicator lamp informs you of the signal transmission status and warns you of flat battery.
- A brilliant silver Three-diamond mark is stamped on the back side of the key grip to improve appearance.
- A signal transmission circuit (printed circuit) and a battery are housed in one case. The case is housed in the key grip, thus improving resistance to water ingress.
- A coin type battery, CR1616 is used in the transmitter.
- The transmitter switch operation allows the system to operate as follows:

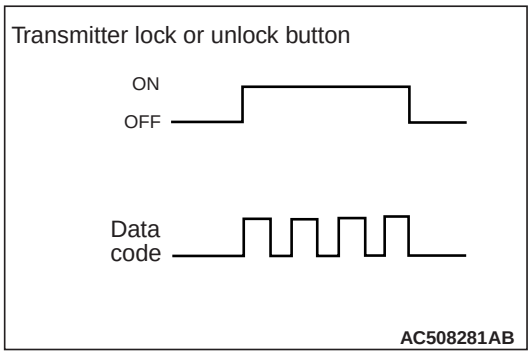
Function	Transmitter operation	System operation
Standard function (lock/unlock)	Press the lock switch once.	All doors (including the tailgate) are locked. *NOTE: If the retracting function of the electric folding mirrors is added using a customisation function, it can be retracted in synchronisation with a lock operation.*
	Press the unlock switch once.	All doors (including the tailgate) are unlocked. *NOTE: If the opening function of the electrical folding mirrors is added as an adjustment function, it can be opened in synchronisation with an unlock operation.*

Function	Transmitter operation	System operation
Multi mode function	Press the lock switch once to lock all doors (including the tailgate), and within 30 seconds press the lock switch twice consecutively.	The door mirrors are retracted.
	Press the unlock switch once to unlock all doors (including the tailgate), and within 30 seconds press the unlock switch twice consecutively.	The door mirrors return to the original position.
Power door locks with selective unlocking	Press the unlock switch once to unlock the driver's door, and within 2 seconds, press the unlock switch again to unlock the front passenger's door, rear doors and tailgate.	Power door locks with selective unlocking. *NOTE: Using a customisation function, the power door locks with selective unlocking can be enabled or disabled.*

POWER DOOR LOCKS WITH SELECTIVE UNLOCKING

- Responding to the adoption of power door locks with selective unlocking, the anti-theft feature has been improved.
- When the lock/unlock switch of front door (driver's side) is pressed once, only the driver's door is unlocked. When the lock/unlock switch of front door (driver's side) is pressed once again within 2 seconds after the driver's door is unlocked, the front passenger's door, rear doors, and the tailgate are unlocked.
- When the unlock switch on the transmitter is pressed once, only the driver's door is unlocked. When the transmitter unlock switch is pressed once again within 2 seconds after the driver's door is unlocked, the front passenger's door, rear doors, and the tailgate are unlocked.
- Using a customisation function, the power door locks with selective unlocking can be enabled or disabled (Refer to).

ENCRYPTED CODE



The figure shows the codes transmitted from the transmitter. Every time the switch is pressed, the data code is transmitted twice. The encrypted code for user identification is a combination of 0 and 1, and more than 1 million different combinations are available. In addition to the encrypted code, the data code contains a rolling code that changes at each transmission, protecting transmission codes from theft by coping.

RECEIVER ANTENNA

The receiver antenna receives the signal from the transmitter and sends the signal to the ETACS.

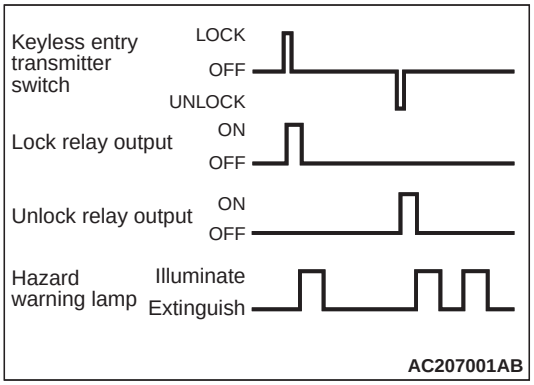
ETACS-ECU

ETACS-ECU compares the signal the receiver antenna received from the transmitter with the encrypted code registered in it, and when they coincided, operates keyless entry function (door lock, unlock, etc.). By connecting M.U.T.-III to the diagnosis connector, encrypted codes of up to eight transmitters can be registered.

FUNCTION FOR CONFIRMING ETACS-ECU OUTPUT AND OPERATION

The ETACS-ECU outputs LOCK/UNLOCK signal and informs the driver of the keyless entry system operation by flashing the lamp (Answer-back). Using a customisation feature, the flashing patterns for the answer-back function can be changed according to the table below. The initial setting at factory for the answer-back function is as follows: "Hazard warning lamp: LOCK, Flash once, UNLOCK, Flash twice / Room lamp: LOCK, Flash once, UNLOCK, Stay on for 15 seconds." Using a customisation feature, the hazard answer-back function can be changed (Refer to P.42A-37).

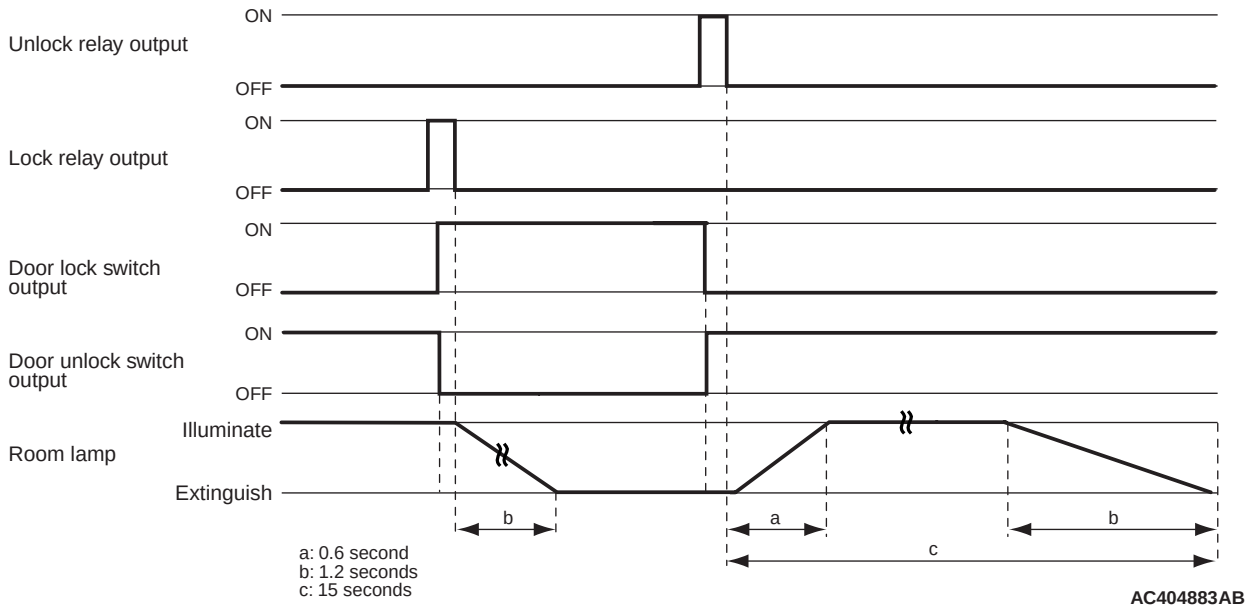
KEYLESS ENTRY HAZARD LAMP ANSWERBACK FUNCTION



When the LOCK signal from the transmitter is input to ETACS-ECU via the receiver antenna, all doors (including tailgate) are locked, and the room lamp is turned off in synchronisation with hazard lamp answerback (when the room lamp is illuminated, the lamp is turned off). Also, when the UNLOCK signal from the transmitter is input to ETACS-ECU via the receiver antenna, all doors (including tailgate) are unlocked, and the room lamp is illuminated for 15 seconds in synchronisation with hazard lamp answerback.

When LOCK signal from the keyless entry transmitter is input to the ETACS-ECU, all doors (including tailgate) are locked and the hazard warning lamp flashes once. When UNLOCK signal is input, all doors (including tailgate) are unlocked and the hazard warning lamp flashes twice.

KEYLESS ENTRY ROOM LAMP ANSWER-BACK FUNCTION



KEYLESS ENTRY TIMER LOCK TIME

If any door is not opened or closed within 30 seconds after the doors (including tailgate) are unlocked by the keyless entry system, ETACS-ECU automatically outputs the door lock signal to lock the doors (including tailgate). This function prevents the doors (including tailgate) from being unlocked unexpectedly by operation errors. Using a customisation feature, the keyless entry timer lock time can be changed (Refer to P.42A-37).

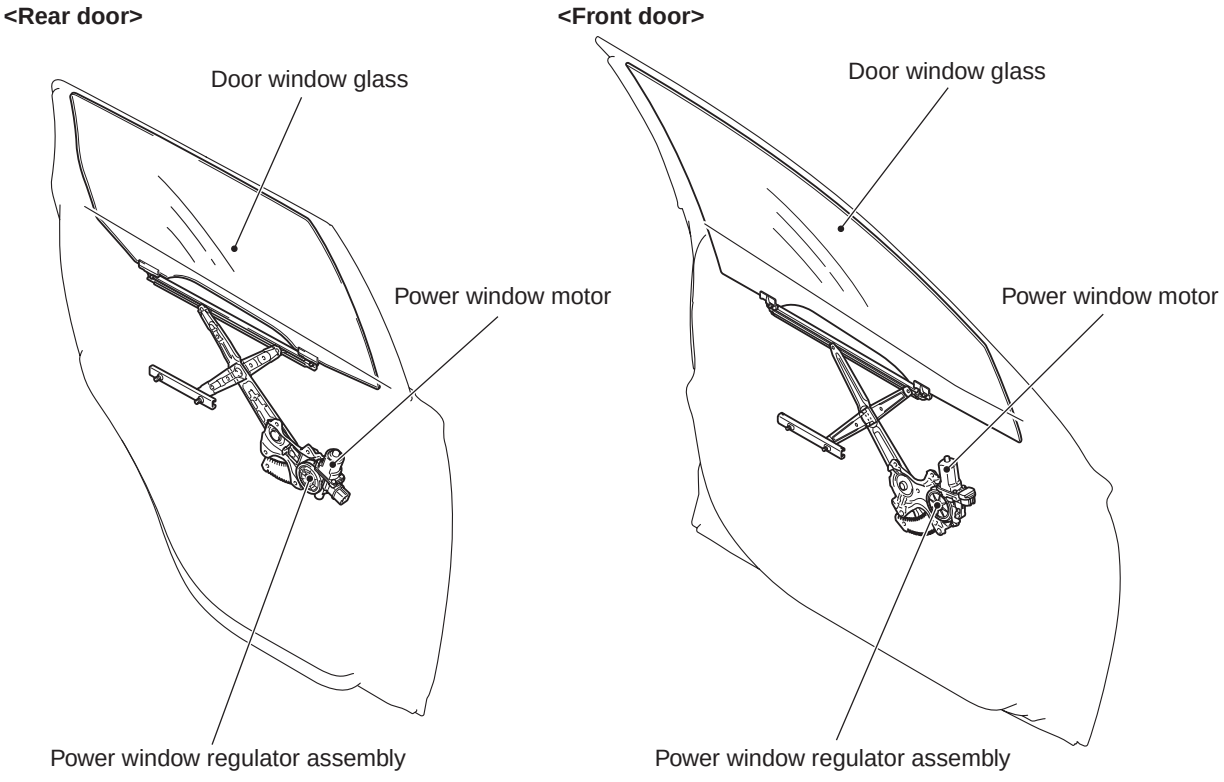
OPERATION INHIBITION CONDITIONS

The operation of the keyless entry system is inhibited in the following conditions.

- When the ignition key is inserted into the ignition switch.
- When either door (including tailgate) is open (the door switch: ON). (including door ajar)

POWER WINDOW

M2420022000735



ACC00214AB

The power window has the following features:

- The safety mechanism has been adopted.
- The power window timer function has been adopted.
- The power window lock switch has been adopted.

DESCRIPTION OF CONSTRUCTION AND OPERATION

POWER WINDOW SYSTEM

The power window switch has a waterproofing structure which prevents water (such as rain drops) entering from above. Should water enters, it is drained through the hole located on the lower area of the switch, and no water may be accumulated.

SAFETY MECHANISM

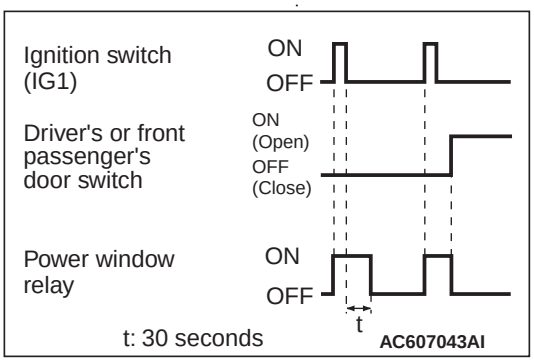
The power window with the safety mechanism has been adopted. To enhance safety, if any obstacle such as a hand or a head is detected to be pinched during a window glass closing operation, the window glass is opened by approximately 150 mm.

POWER WINDOW SWITCH

The power window switch has employed the push-pull operation method to enhance safety. To open a door window glass, press in the switch knob, and to close, pull it up. The one-touch opening/closing mechanism has been adopted to the driver's power window switch to fully open or close any door window glass in a single operation.

POWER WINDOW TIMER FUNCTION

- The power window can be opened or closed after the ignition switch is turned OFF by the timer function. Using a customise feature, the timer period can be changed. (Refer to P.42A-37.)



Even after the ignition is switched off, the ETACS-ECU keeps the power window relay activated for approximately 30 seconds, enabling raising or lowering of the power windows by using the power window switches (timer function). After approximately 30 seconds, the power window relay is deactivated.

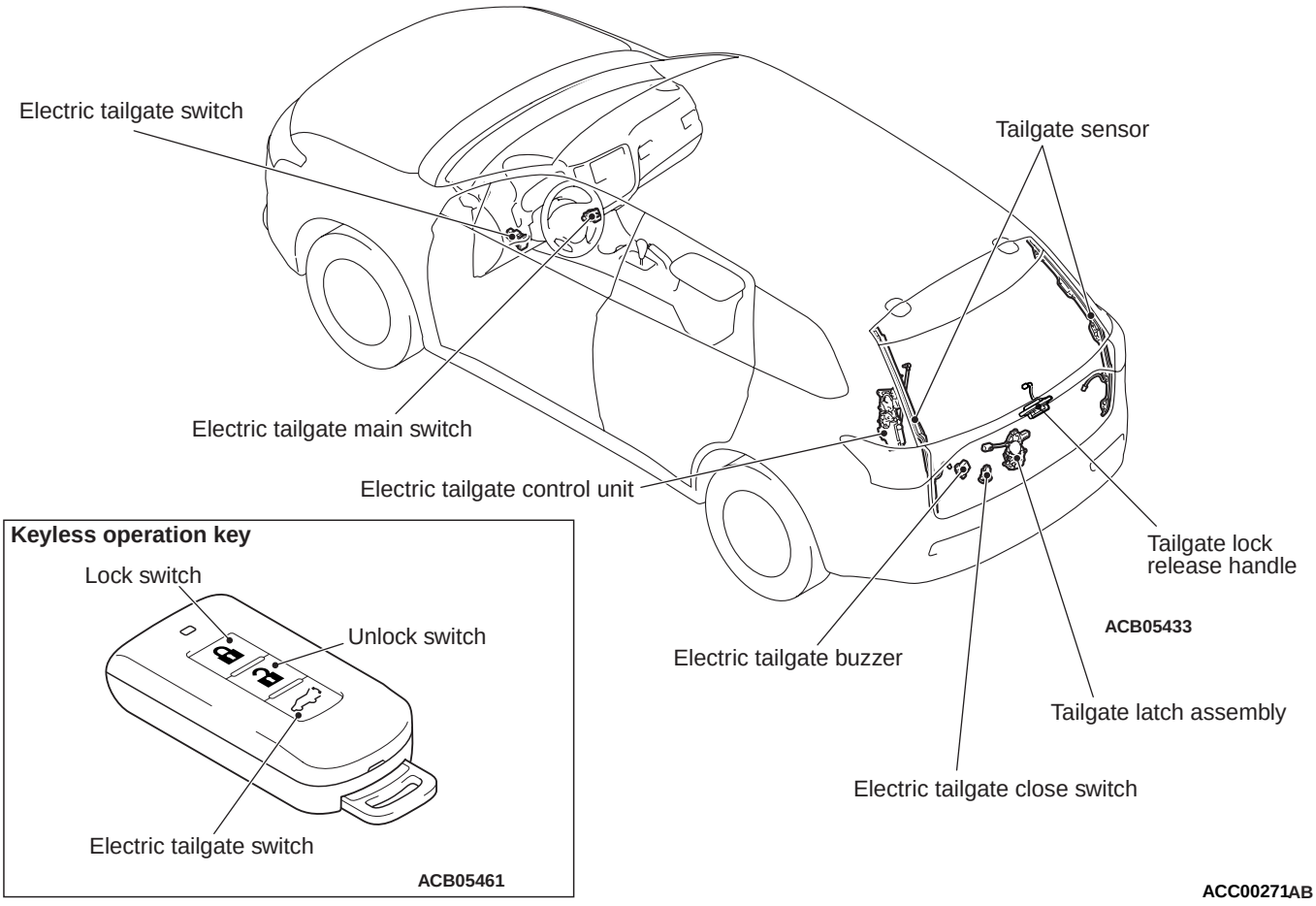
During this timer operation, if the driver's or front passenger's door is opened, the power window relay is deactivated from that moment.

POWER WINDOW LOCK SWITCH

The driver power window switch is equipped with the lock switch. This switch disables the opening/closing operation of the door window glass using each passenger's power window switch. Using a customise feature, the lock switch operation can be changed (Refer to P.42A-37).

ELECTRIC TAILGATE

M2420001900078



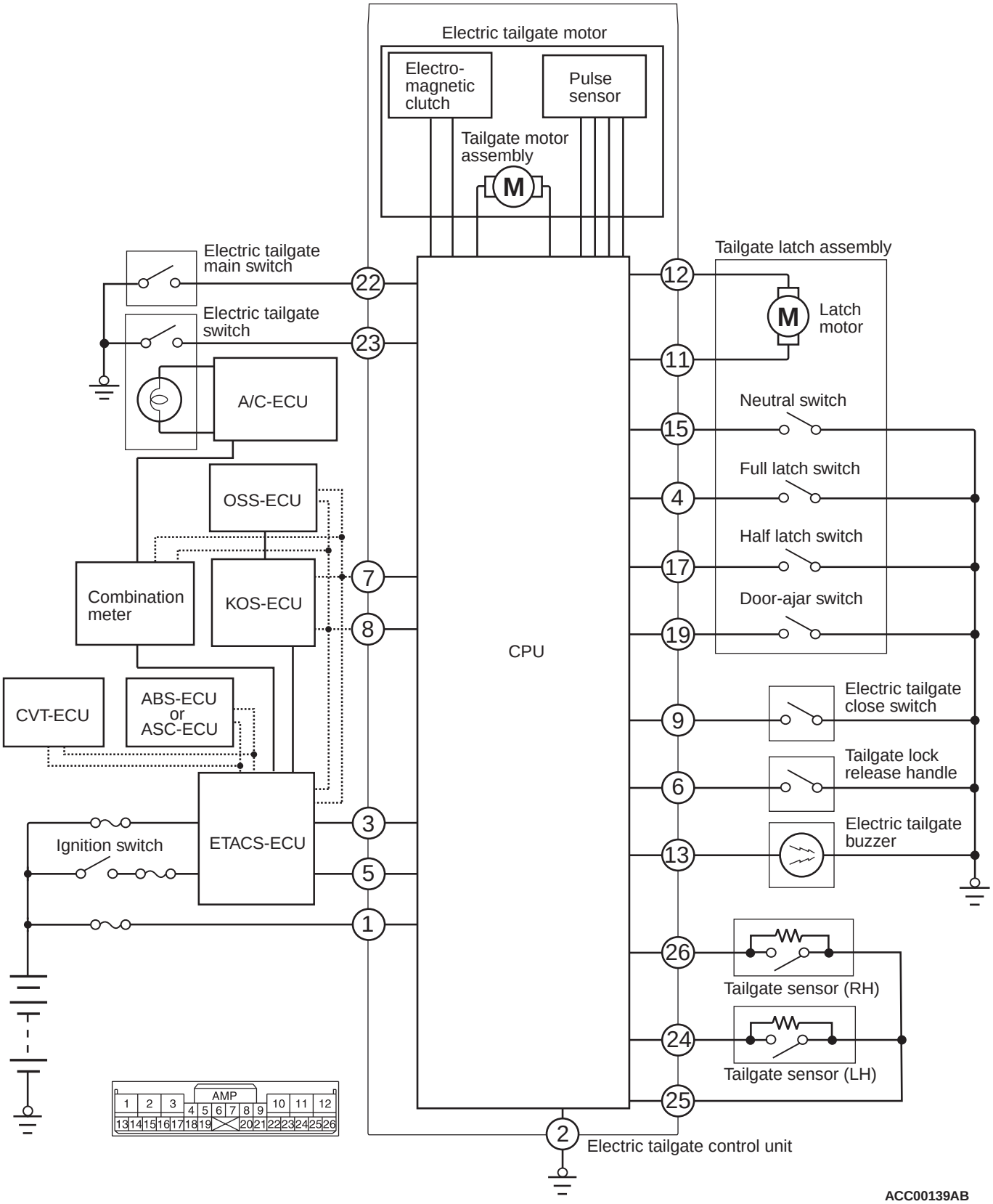
The electric tailgate has been adopted as an option. There are the following features.

- The electric tailgate can be opened and closed automatically by using the electric tailgate switch of the keyless operation key. (Refer to GROUP 42B – Keyless Entry Function .)

- The electric tailgate can be automatically opened and closed using the electric tailgate switch.
- The electric tailgate can be closed fully by using its close switch.
- The electric tailgate can be opened fully by using its tailgate lock release handle.
- The safety mechanism has been adopted.
- A safety mechanism prevents the electric tailgate from lowering.
- A mechanism, which prevents a sudden opening and closing, has been adopted.
- The easy closer system has been adopted.

DESCRIPTION OF CONSTRUCTION AND OPERATION

Electric tailgate control unit system circuit



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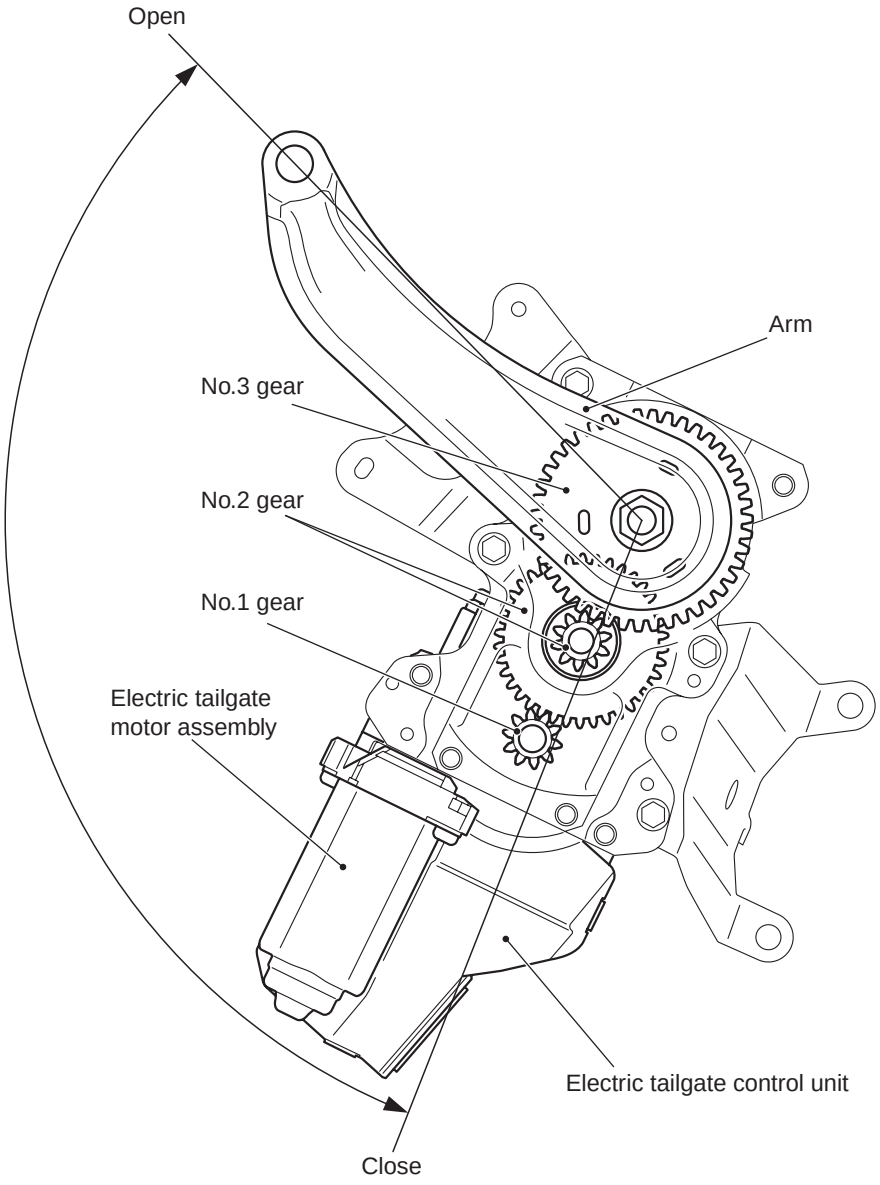
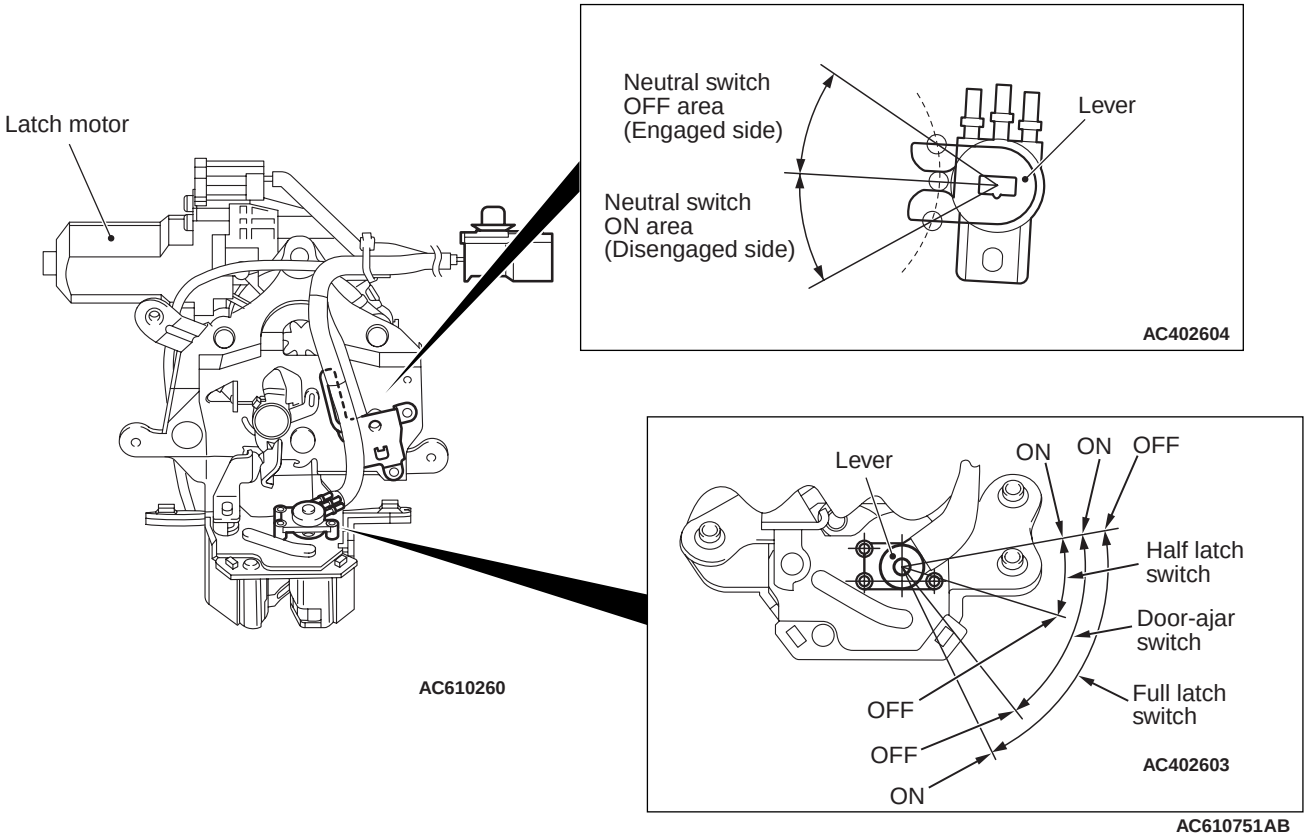
The electric tailgate control unit uses input signals from switches to control the electric tailgate motor.

ELECTRIC TAILGATE CONTROL UNIT



The electric tailgate motor consists of an electric motor assembly (incorporating an electromagnetic clutch and gears), gears and arms. It is integrated in the electric tailgate control unit. As the motor runs to the open or close direction, the gears (No.1, No.2, and No.3) will rotate in that order, thus turning the arm.

TAILGATE LATCH



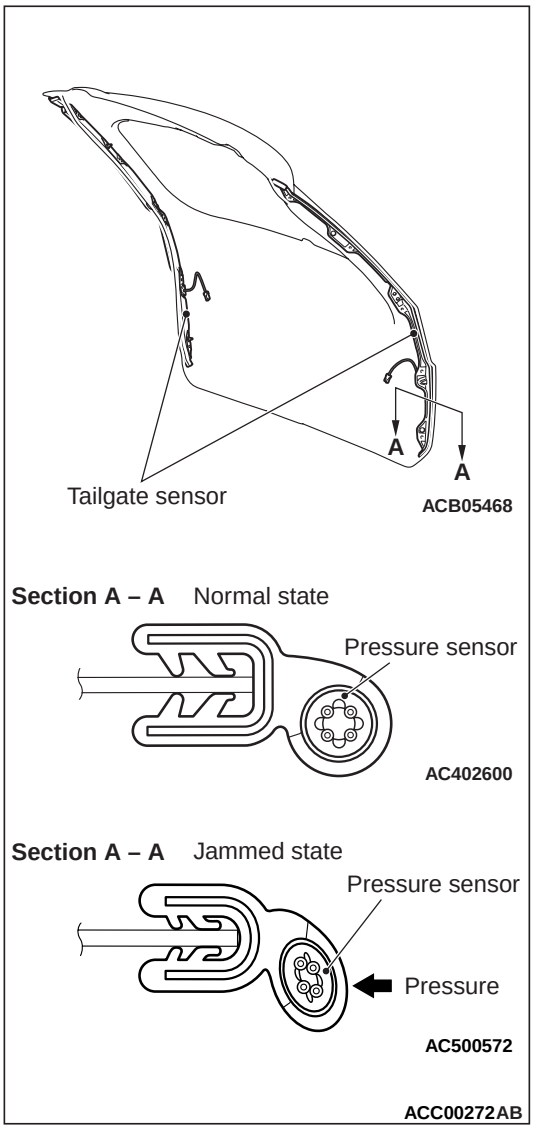
The tailgate latch includes the latch motor and switches. With each switch, ON and OFF is switched by the lever movement.

- A half latch switch detects that the latch remains ajar (not engaged fully). This prevents the electric tailgate from opening unintentionally.
- A full latch switch detects that the electric tailgate remains closed fully (overrun*).

*NOTE: *: Overrun indicates that the striker is pulled further to close side by the tailgate latch in order to fully close the electric tailgate securely.*

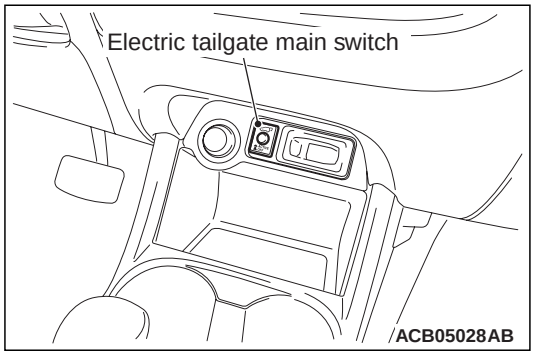
- A door-ajar switch detects the doors are closed fully. In addition, the switch detects that the electric tailgate can be opened.
- A neutral switch detects the neutral position of the latch motor.

TAILGATE SENSOR



While the electric tailgate is being closed automatically, if pressure is applied to the tailgate sensors located at the both sides of electric tailgate, the system determines that something is caught by the compression of pressure detection sensor.

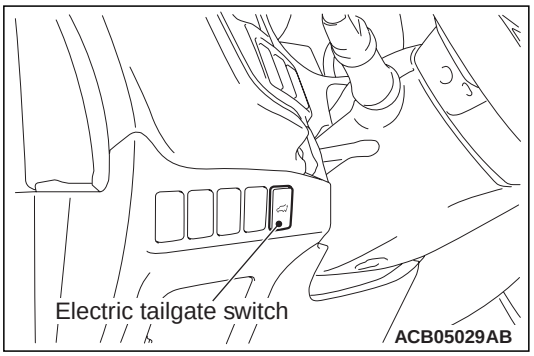
ELECTRIC TAILGATE MAIN SWITCH



When the electric tailgate main switch in the instrument panel is OFF, the electric tailgate cannot be opened or closed automatically. This prevents the electric tailgate from an unintentional operation caused by the accidental pressing of electric tailgate switch or electric tailgate close switch of the keyless operation key.

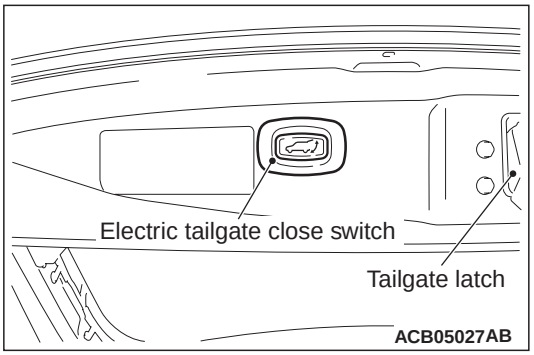
NOTE: If you attempt to open or close the tailgate automatically while the electric tailgate main switch is off, the warning buzzer will sound four times to warn that the electric tailgate cannot be operated.

ELECTRIC TAILGATE SWITCH



When you press and hold the electric tailgate switch on the instrument panel, the electric tailgate is automatically opened or closed to its full position.

ELECTRIC TAILGATE CLOSE SWITCH



If you turn on the electric tailgate close switch inside the tailgate while the tailgate is fully opened, it will be closed automatically to its full position.

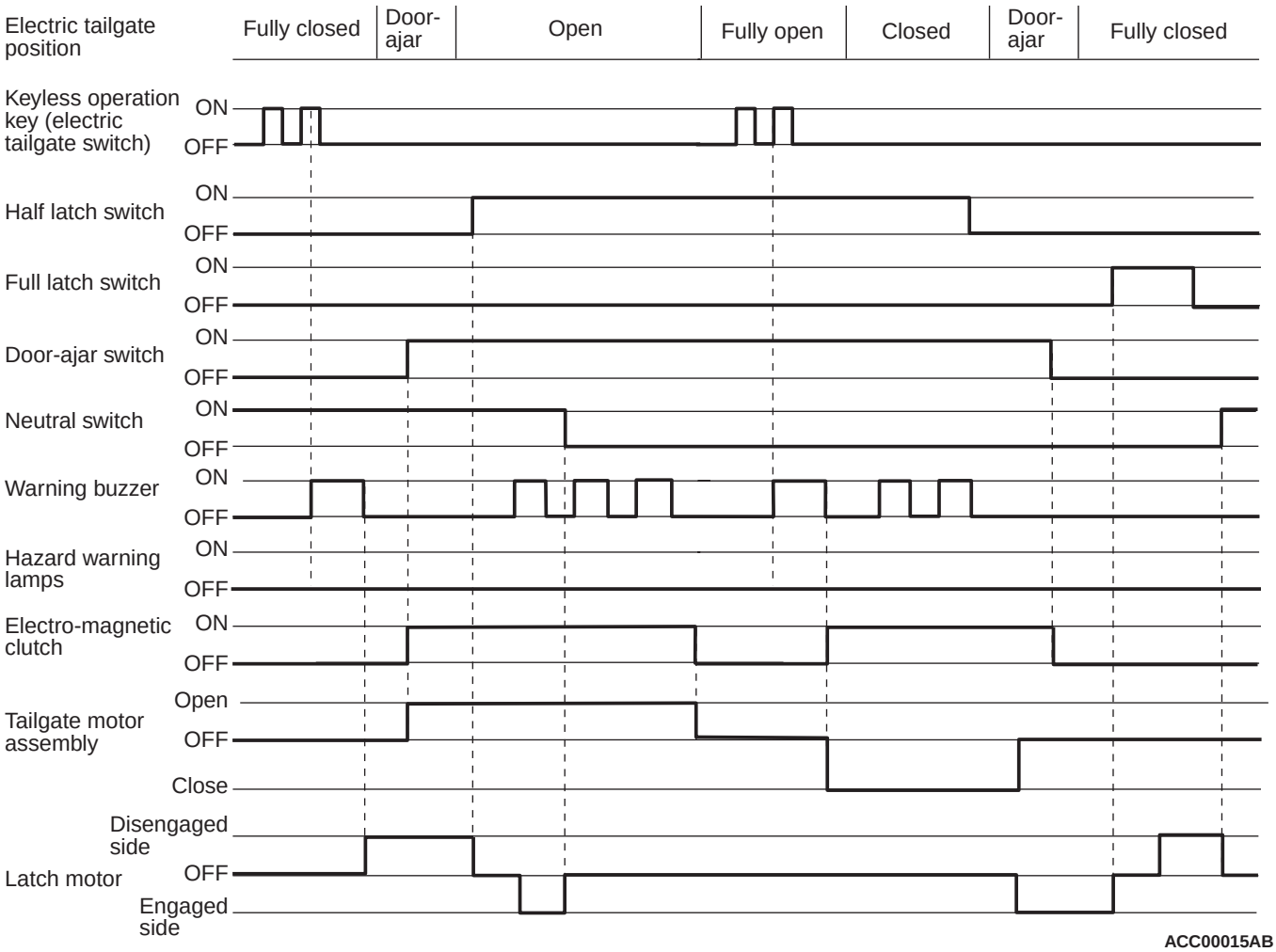
TAILGATE LOCK RELEASE HANDLE

The electric tailgate lock release handle which requires a small operating force and has no temperature dependency has been adopted to improve the opening operation. When the handle is operated, the switch is turned ON or OFF. Refer to P.42A-9.

CONDITIONS FOR AUTOMATIC OPERATION BY USING THE KEYLESS OPERATION KEY, ELECTRIC TAILGATE SWITCH, TAILGATE LOCK RELEASE HANDLE, AND ELECTRIC TAILGATE CLOSE SWITCH

- When the electric tailgate main switch is ON.
- When the tailgate is unlocked by using the central door locking or keyless operation key.
- When the vehicle is stationary with the selector lever at "P" (parking) position.
- When the electric tailgate is opened or closed fully.
- When the system voltage is 11V or more
- When the ignition switch is in the LOCK (OFF) or ACC position
- When the ignition switch is on and the vehicle is stationary with the selector lever at park position.
- When the tailgate sensor is OFF

Opening and closing the electric tailgate by using the keyless operation key



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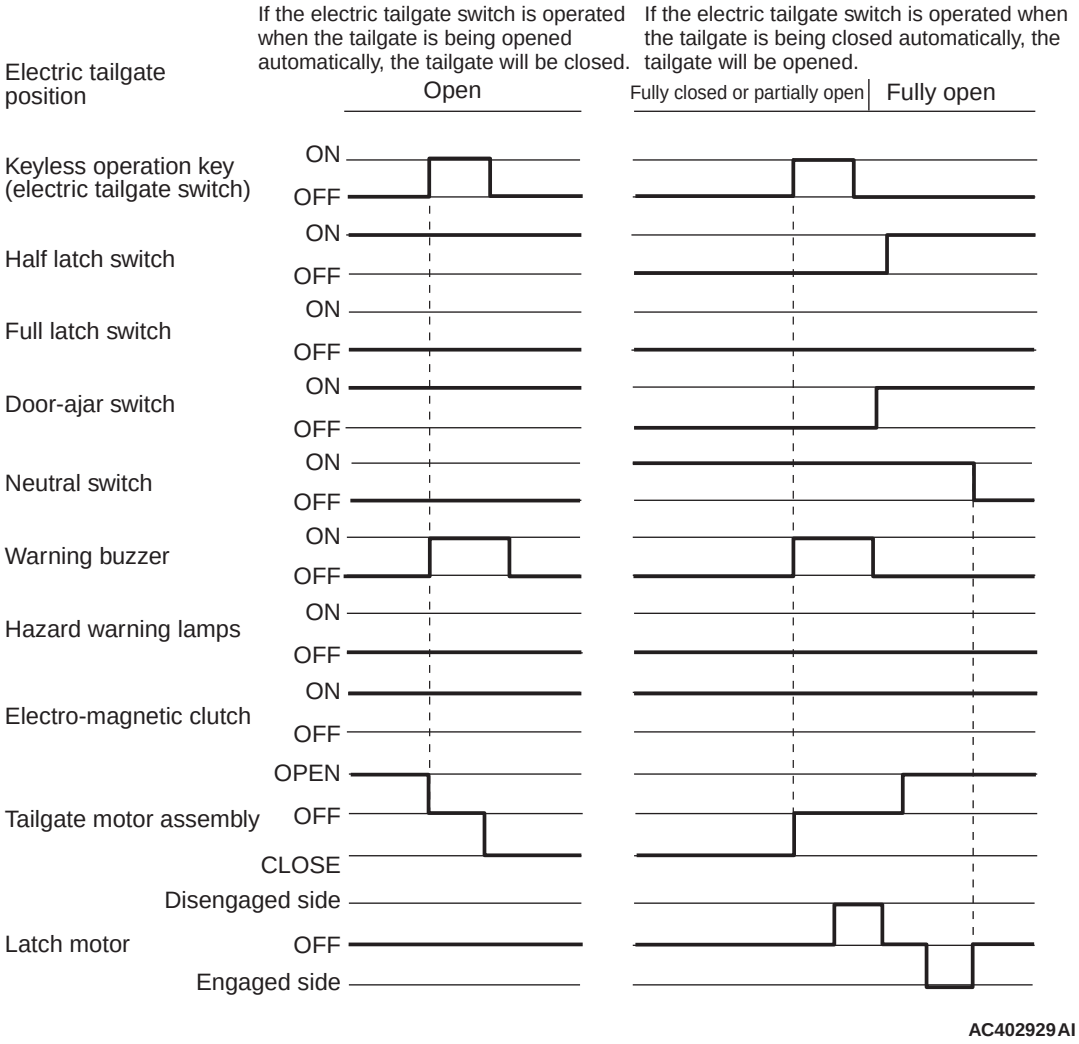
If the electric tailgate switch of the keyless operation key is pushed twice, the warning buzzer will sound, and then the electric tailgate will open or close. When the electric tailgate is operated, the warning buzzer operates as follows:

- When you are opening the electric tailgate, the warning buzzer will sound four times to open it fully.
- When you are closing the electric tailgate, the warning buzzer will sound three times to close it fully.



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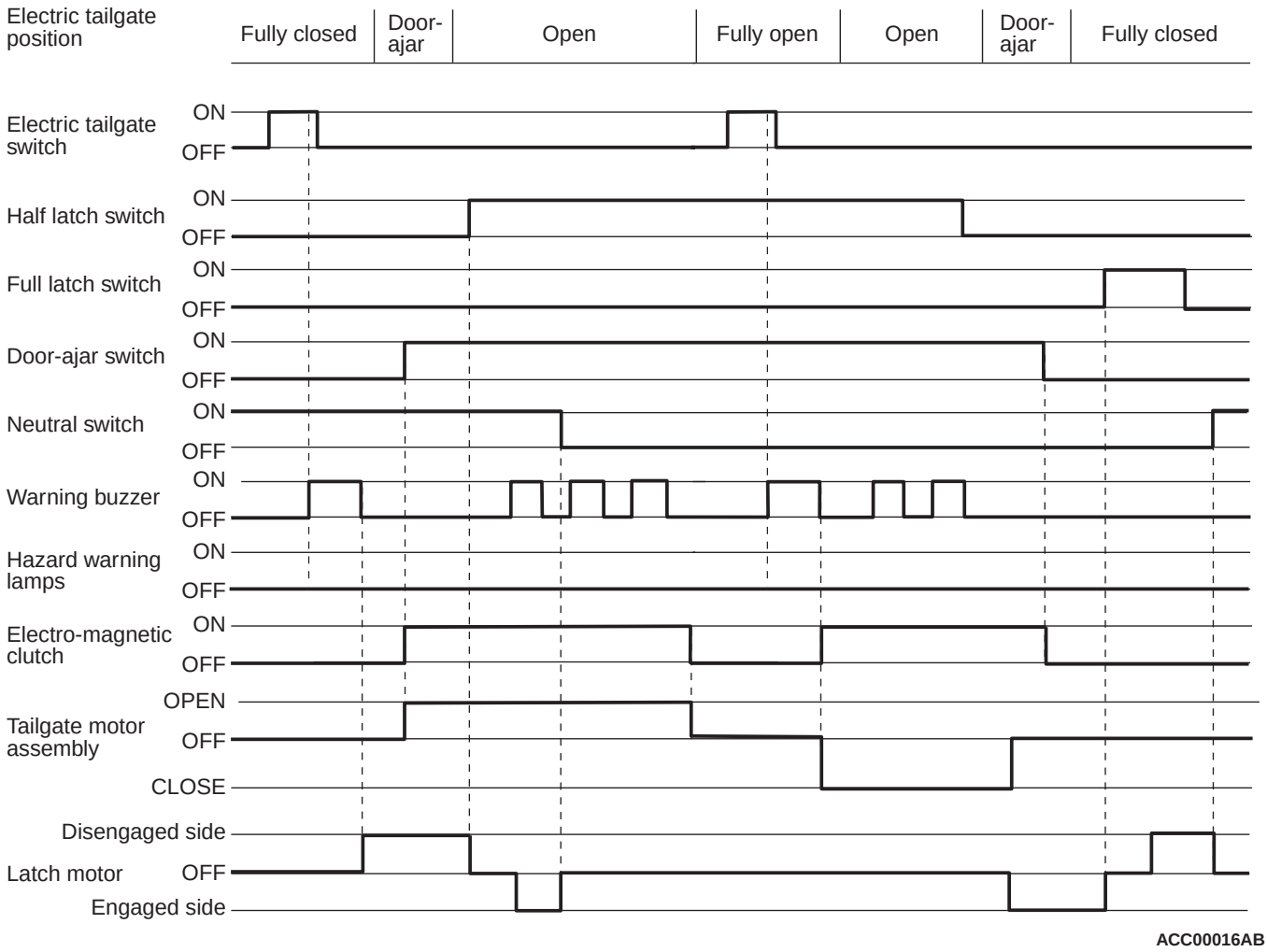
When the electric tailgate switch of the keyless operation key is pushed once while the electric tailgate is being closed or opened, the warning buzzer will sound once, and then the electric tailgate will operate in the opposite direction.

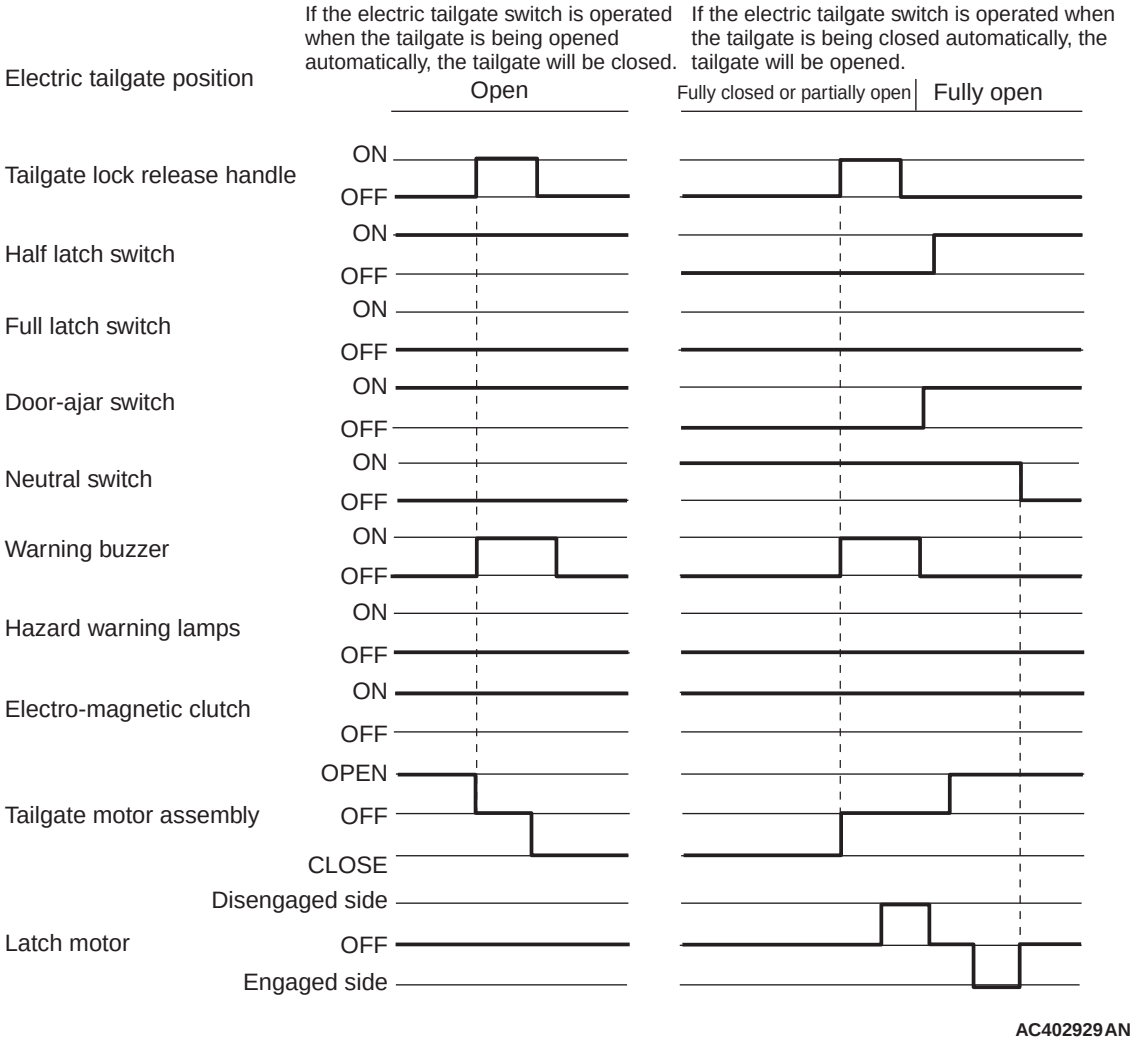
Opening and closing of electric tailgate using electric tailgate switch



ACC00016AB

When the electric tailgate switch is pressed and held, the warning buzzer will sound, and then the electric tailgate will open or close. When the electric tailgate is operated, the warning buzzer operates as follows:

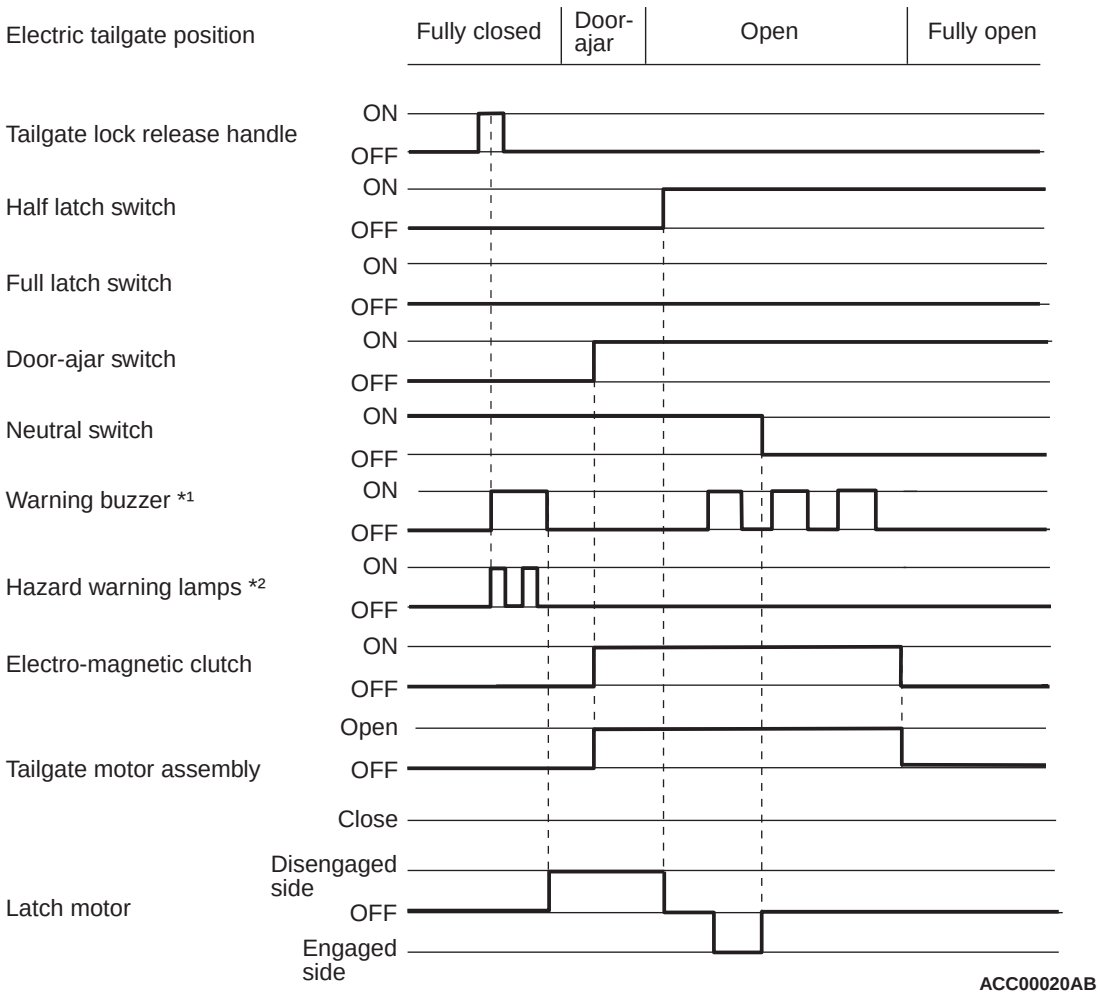
- When you are opening the electric tailgate, the warning buzzer will sound four times to open it fully.
- When you are closing the electric tailgate, the warning buzzer will sound three times to close it fully.



AC402929AN

When the electric tailgate switch is pushed once while the electric tailgate is being closed or opened, the warning buzzer will sound once, and then the tailgate will operate in the opposite direction.

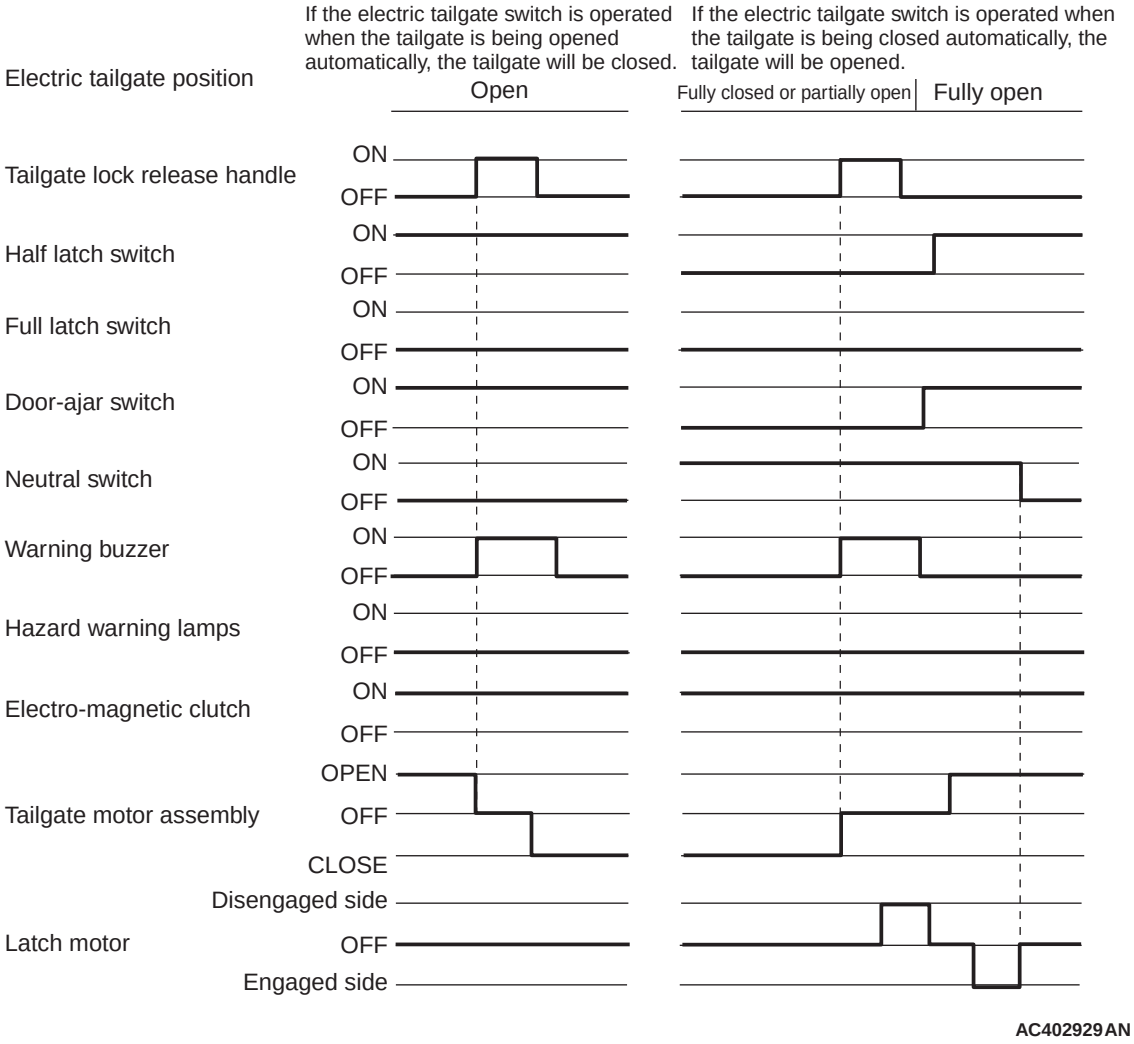
Opening the electric tailgate fully by using its tailgate lock release handle



If the tailgate lock release handle is pushed once, the warning buzzer will sound four times, the hazard warning lamps will flash twice, and then the tailgate will open.

NOTE:

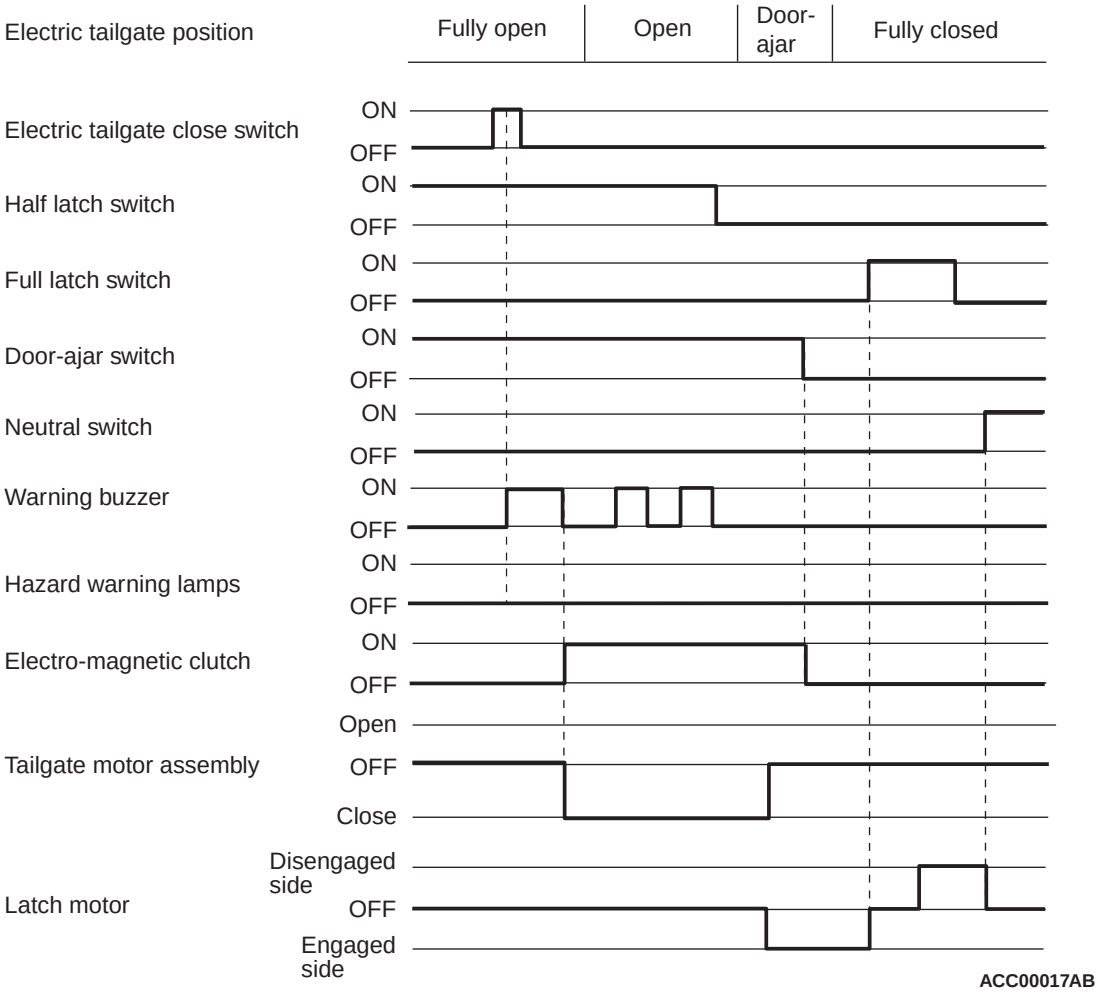
- **1: The warning buzzer sounds only when the tailgate lock release handle is operated with all the doors unlocked.*
- **2: The hazard warning lamps flash only when the tailgate lock release handle is operated with all the doors locked.*



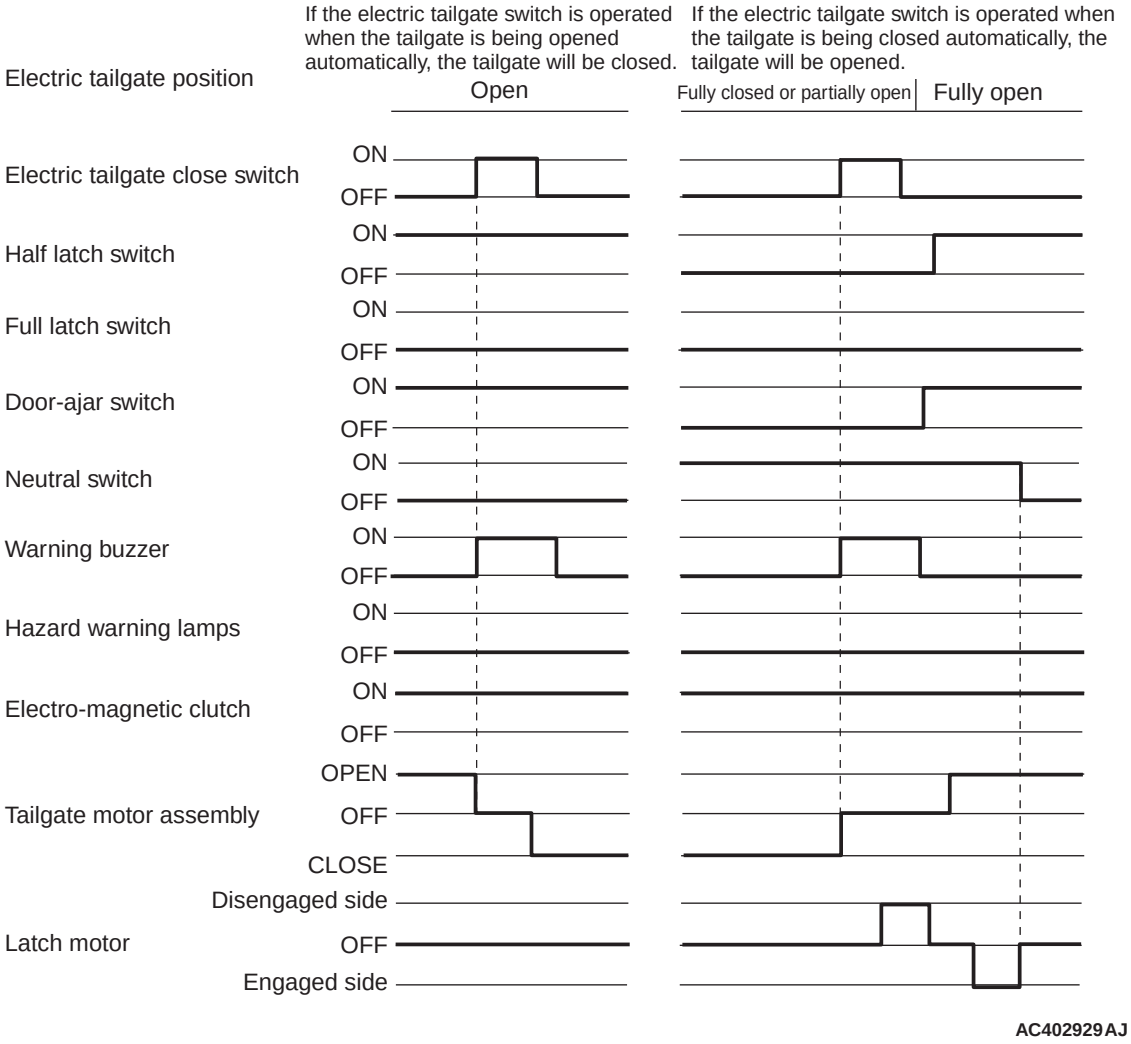
AC402929AN

If the tailgate lock release handle is pushed once while the tailgate is being opened fully, the warning buzzer will sound once, and then the tailgate will close.

Closing the electric tailgate fully by using its close switch



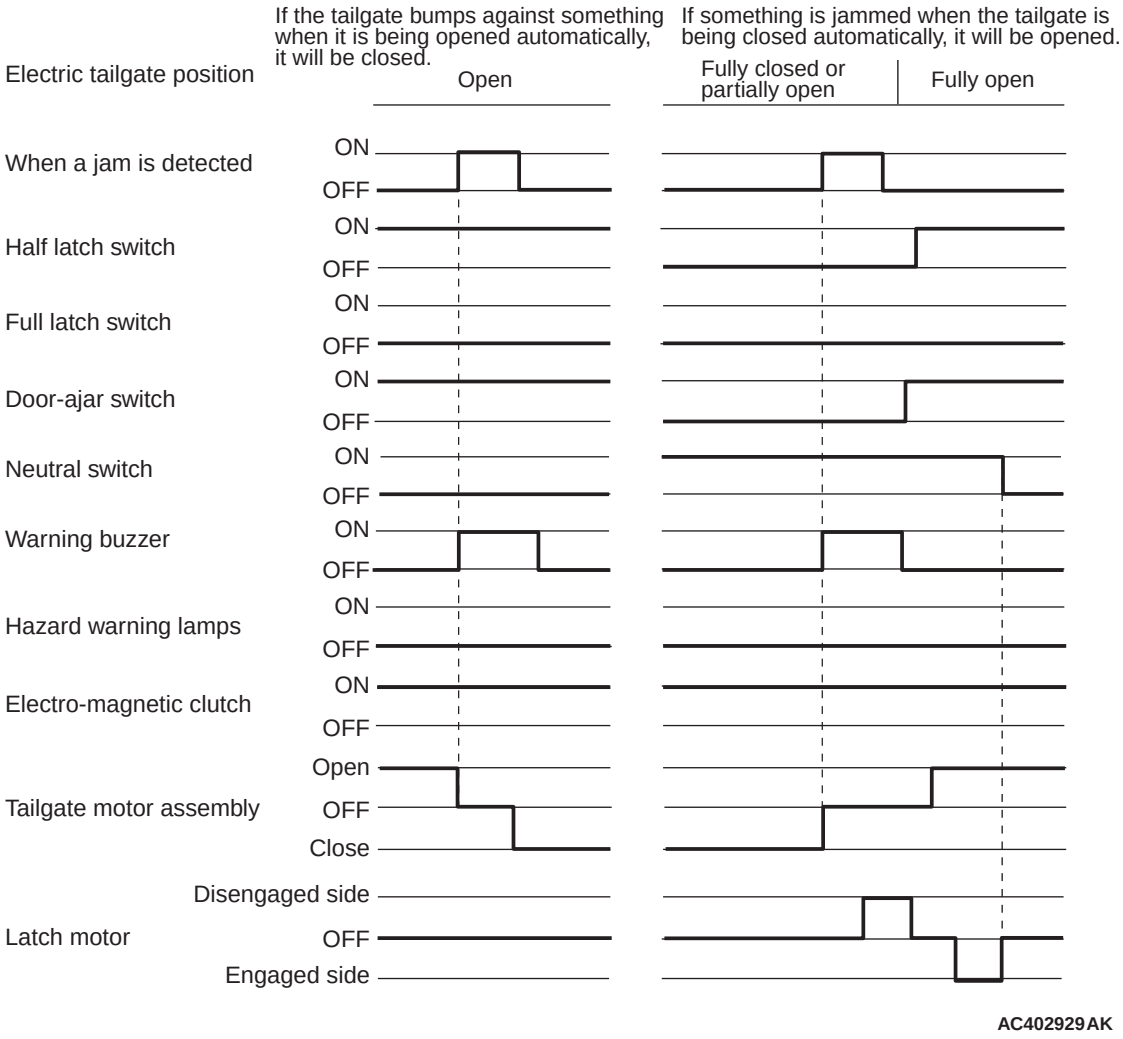
If the electric tailgate close switch is pushed once, the warning buzzer will sound three times, and then the tailgate will close.



AC402929AJ

If the electric tailgate close switch is pushed once while the tailgate is being closed fully, the warning buzzer will sound once, and then the tailgate will open.

SAFETY MECHANISM



AC402929AK

If a person or luggage is caught while the electric tailgate is being closed automatically, or your finger is caught at one of the tailgate sensors located at both sides of electric tailgate, the warning buzzer will sound once and then the tailgate will operate to the opposite direction.

NOTE: When the safety mechanism is activated consecutively for twice, the operation is changed to the manual operation. If the operation is changed to the manual operation, fully opening or closing the electric tailgate once enables the automatic operation.

MECHANISM PREVENTING ELECTRIC TAILGATE FROM LOWERING

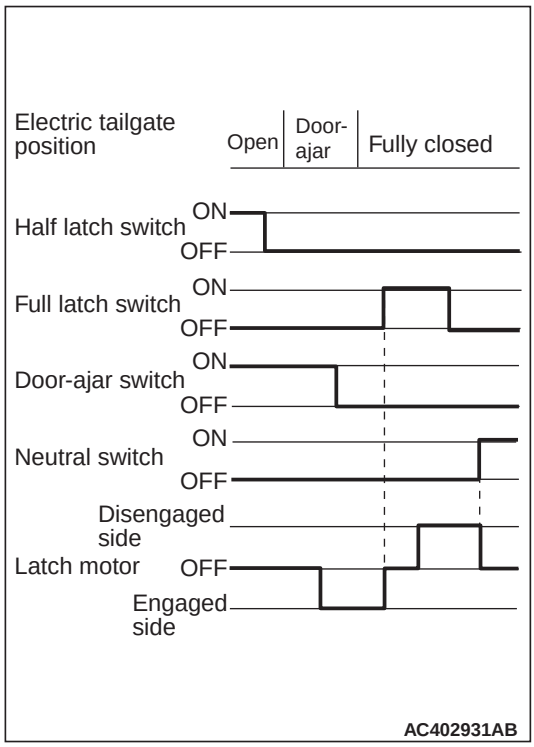
If the electric tailgate is opened automatically to the full position and then the electric tailgate control unit detects that the tailgate is being lowered due to additional equipment on the tailgate or other reasons, the warning buzzer will sound to warn the driver and then the system will close the tailgate automatically.

NOTE: The mechanism, which prevents electric tailgate from lowering, may also operate if the tailgate gas spring is too deteriorated to support the tailgate.

A MECHANISM PREVENTING A SUDDEN OPENING AND CLOSING

If a poor system voltage occurs while the electric tailgate is being opened or closed automatically, the system will inhibit the automatic operation. This may cause the electric tailgate to stop or move intermittently. With this feature, the mechanism will prevent the electric tailgate from closing or opening suddenly.

EASY CLOSER SYSTEM



If the electric tailgate is closed to its ajar position, the system will close the tailgate automatically to its full position. This ensures safety by closing the tailgate fully, and improves comfort by eliminating unpleasant noise during slamming.

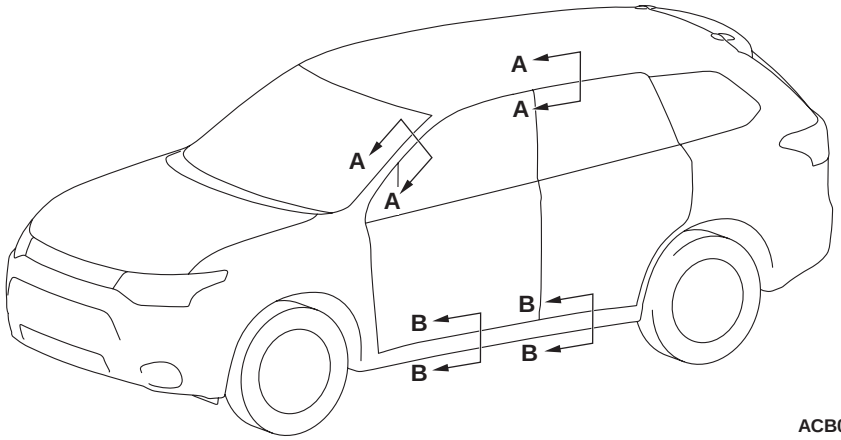
NOTE: The easy closer system can operate even if the slide door power switch is OFF.

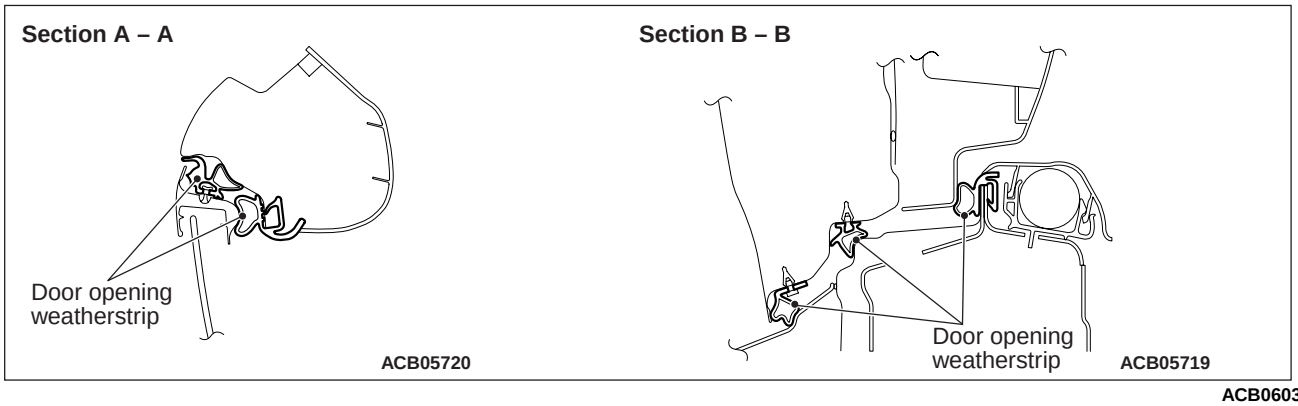
DATA LIST REFERENCE TABLE

Using M.U.T.-III, the input data sent from the sensors and switches can be read. For service data items, refer to Workshop Manual.

WEATHERSTRIP

M2420020000513



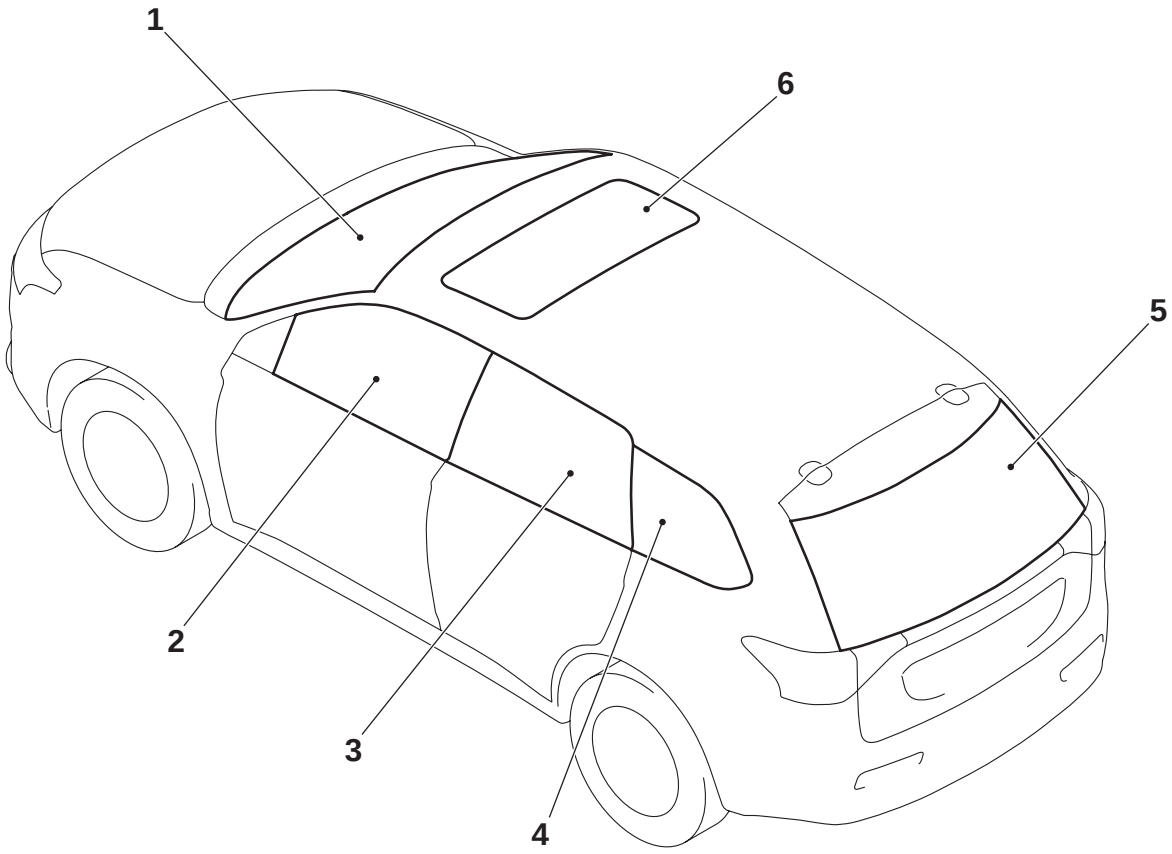


The double weather strips have been installed along the perimeter of the door window to improve the sound-proof and water-proof performances.

WINDOW GLASS

M2420015001640

VISIBLE RAY TRANSMISSIVITY RATE FOR WINDOW GLASS



ACB05026AB

Number	Name	Type	Thickness (mm)	Colour	Visible ray transmissivity rate (%)
1	Windshield	Laminated glass	4.76	Green	79
2	Front door window glass	Tempered glass	4.0	Green	80

Number	Name	Type	Thickness (mm)	Colour	Visible ray transmissivity rate (%)
3	Rear door window glass	Tempered glass	3.1	Green	82
				Dark grey (privacy glass)	25
4	Quarter window glass			Green	82
				Dark grey (privacy glass)	25
5	Tailgate window glass			Green	82
				Dark grey (privacy glass)	25
6	Sunroof lid glass		3.5	Dark grey	20

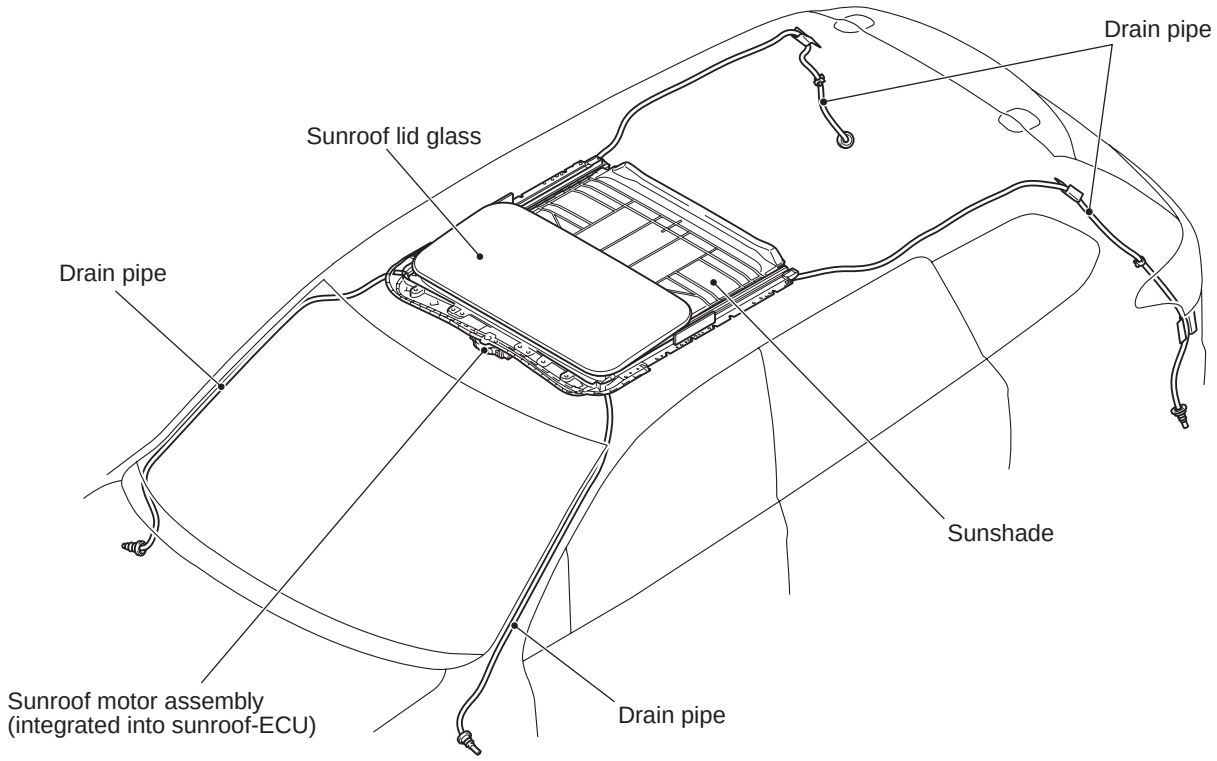
NOTE: The visible ray transmissivity rate (%) is a reference value.

The laminated glass has been adopted for the windshield, and the tempered glass has been adopted for other windows. The window glass has the following features.

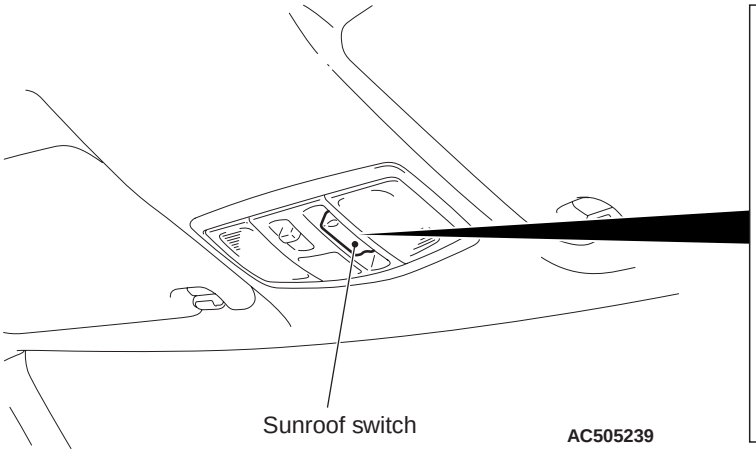
- The privacy glasses for the rear door window glass, quarter window glass, and tailgate window glass have been adopted <Optional>.

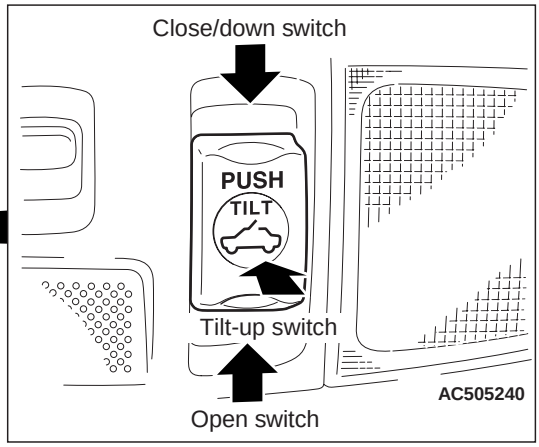
SUNROOF

M2420016000877



ACB05472AB





AC506511AB

The electric sliding glass sunroof with tilt-up mechanism has been adopted as an option. This sunroof has the following characteristics:

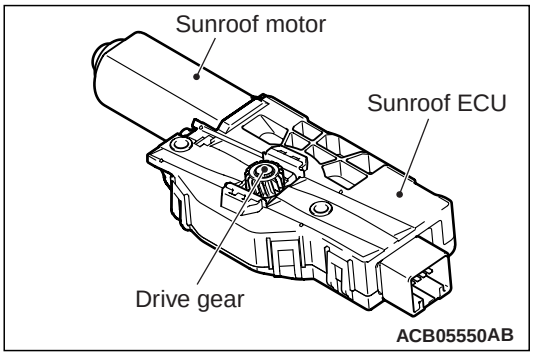
- A lightweight sunroofs has been adopted.
- The sunroof tilts up for approximately 30 mm to improve ventilation performance.
- The integrated switch allows for all slide opening/closing, tilt up/down, and stop operations. All operations are available at one touch.
- If external force is applied during slide closing or tilt down operations that obstructs operations, the sunroof lid glass will move in the reverse direction.

DESCRIPTION OF CONSTRUCTION AND OPERATION

SAFETY MECHANISM

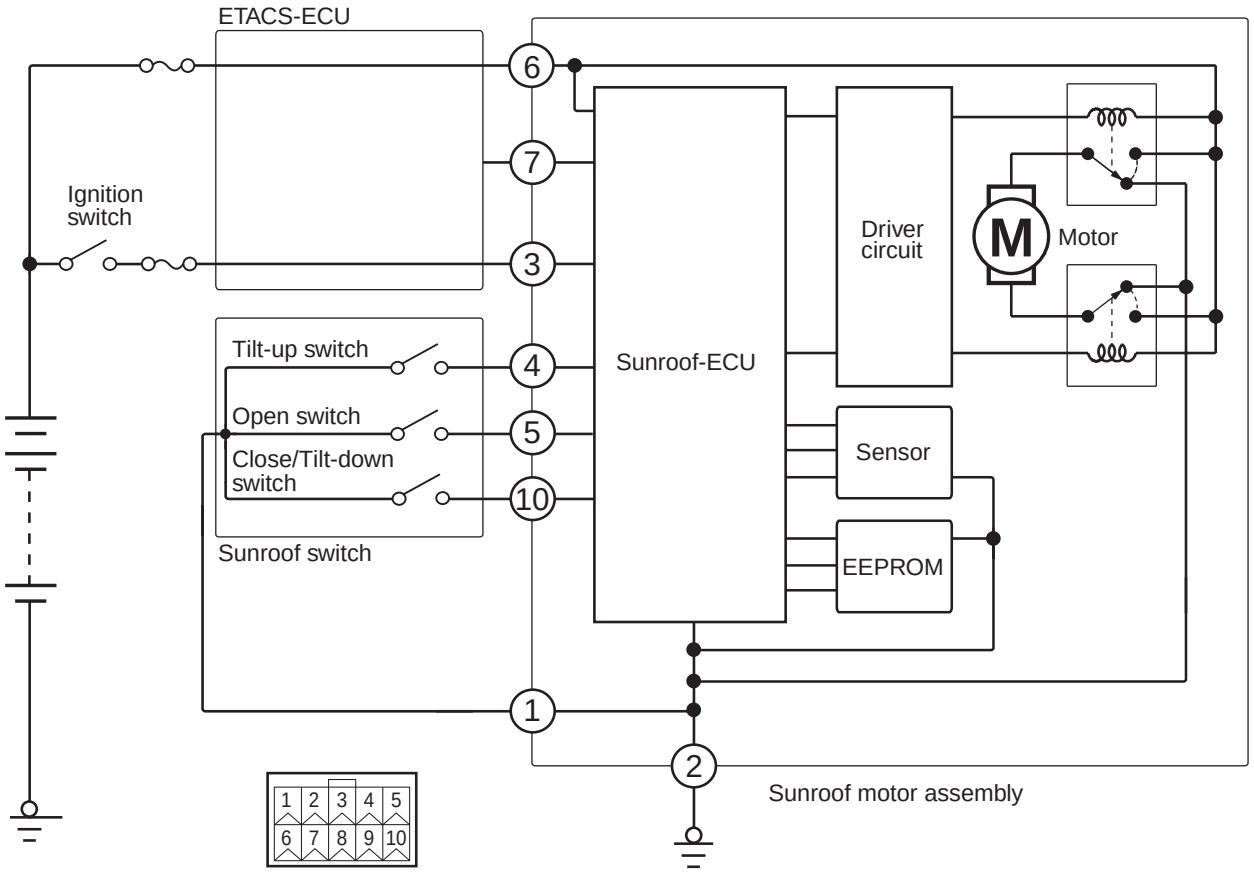
- If any obstacle such as a hand or a head is detected to be pinched during a sunroof lid glass closing operation, the sunroof lid glass is opened by approximately 200 mm or more.
- During the sunroof lid glass closing operation, by continuing the sunroof close switch operation, the sunroof can be forcibly closed without activating the safety mechanism even when the obstacle is detected to be pinched.
- During the safety mechanism activation, when the sunroof close switch is operated, the sunroof lid glass stops. By continuing the close switch operation, the sunroof lid glass can be forcibly closed without activating the safety mechanism even when the obstacle is detected to be pinched.

SUNROOF MOTOR ASSEMBLY



The sunroof motor assembly, which consists of the motor main body, drive gear, and sunroof ECU, is installed in front of the housing.

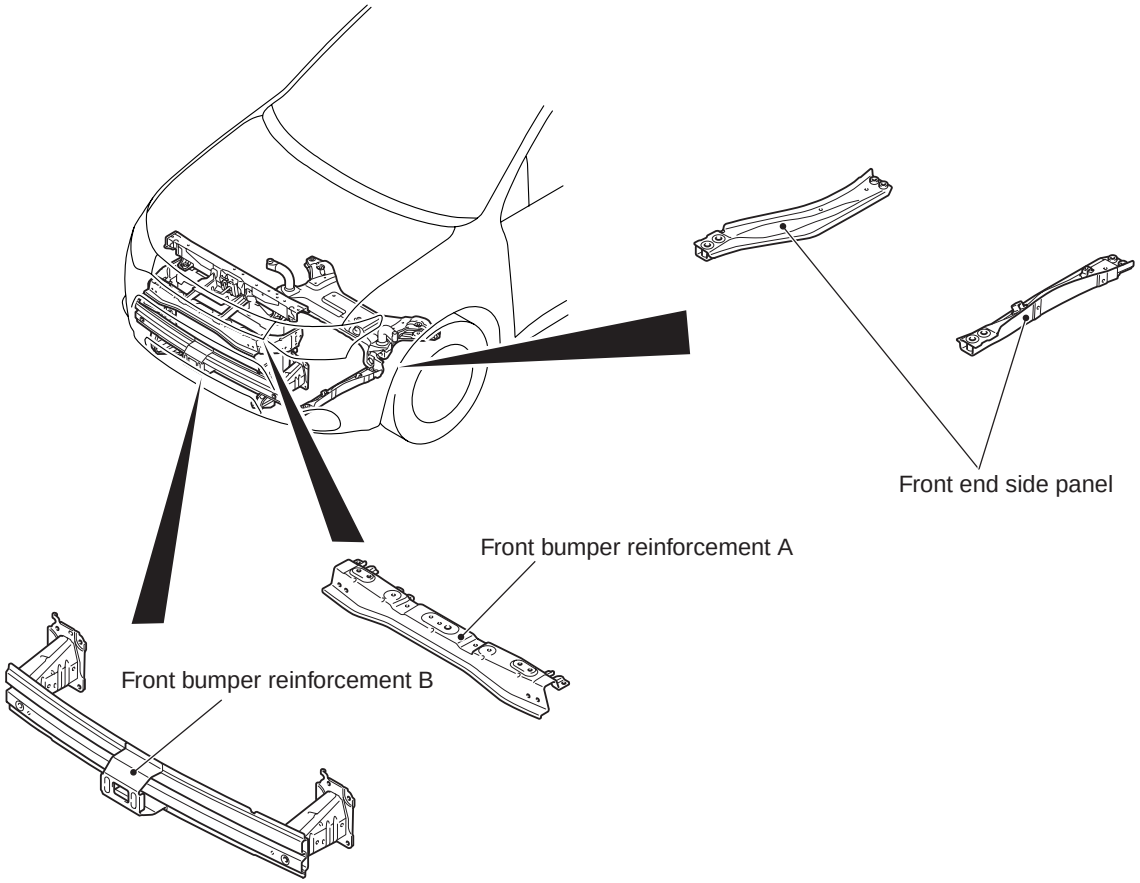
SUNROOF-ECU



The sunroof-ECU incorporates a microcomputer and controls motor operations with the sunroof switch signals, depending on various conditions.

LOOSE PANELS

M2420000200418



ACC00273AB

The front end side panel under the engine compartment absorbs impact energy during frontal collision more effectively than the predecessor. In addition, an impact-absorbing bumper minimises the risk of injury to pedestrians, in particular to legs and head.

CUSTOMISE FUNCTION

M2420002500880

By operating the M.U.T.-III ETACS system or MMCS, the following functions can be customised. The programmed information is held even when the battery is disconnected.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Hazard answer back	Adjustment of the number of keyless hazard warning lamp answer back flashes	Lock:1, Unlock:2	LOCK: Flashes once, UNLOCK: Flashes twice (initial condition)
		Lock:1, Unlock:0	LOCK: Flashes once, UNLOCK: No flash
		Lock:0, Unlock:2	LOCK: No flash, UNLOCK: Flash twice
		Lock:2, Unlock:1	LOCK: Flash twice, UNLOCK: Flash once
		Lock:2, Unlock:0	LOCK: Flash twice, UNLOCK: No flash
		Lock:0, Unlock:1	LOCK: No flash, UNLOCK: Flash once
		Lock:0, Unlock:0	No function
Auto door unlock	Adjustment of the auto door unlock function	Disabled	Without function (initial condition)
		Always (P pos)	With function: Operates when the shift lever or the selector lever is moved to the P position.
		Always(Lock pos)	With function: Operates when the ignition switch is moved to the LOCK (OFF) position.
Door unlock mode	Adjustment of power door locks with selective unlocking	All Doors Unlock	Without function: The first operation of keyless entry system or unlock operation by KOS unlocks all doors (initial condition).
		Dr Door Unlock	With function: The first operation of keyless entry system or unlock operation by KOS unlocks the driver's door only, and the second unlock operation within 2 seconds after that unlocks all doors.
Timer lock timer	Timer lock period adjustment	30 sec.	30 seconds (initial condition)
		60 sec.	60 seconds
		120 sec.	120 seconds
		180 sec.	180 seconds
Multi mode	Multi-mode keyless entry function customisation <Vehicles with electric retractable remote controlled door mirrors>	Disable	No function
		D/M: O&C	Door mirror fold/unfold operation only (initial condition)

GROUP 42B

KEYLESS OPERATION SYSTEM (KOS)

CONTENTS

GENERAL INFORMATION

M2421000100630

The keyless operation system (KOS) enables the driver to lock or unlock all the doors (including the tailgate) by just operating the lock/unlock switch on the front door outside handles or operating the tailgate lock release handle (tailgate open switch, tailgate lock switch), without taking the keyless operation key out from his/her pocket or bag when he/she is carrying a keyless operation key which has been registered in the vehicle's KOS-ECU (Door entry function). The KOS also allows the driver to start the engine without using the conventional mechanical key (engine start function). Moreover, the KOS incorporates the keyless entry function with which, like the conventional keyless entry system, a driver can perform the remote operation (opening/closing of all the doors and the tailgate) by using the lock/unlock switch of the keyless operation key and the immobilizer function that prohibits the starting of engine by using an unauthorised key. The KOS has the following features:

- Each vehicle is provided with two keyless operation keys, and up to four keyless operation keys can be registered in the vehicle's KOS-ECU.
- The keyless operation key also incorporates an indicator lamp that enables the driver to check if the signal is transmitted correctly or if the battery in the key is discharged (Refer to P.42B-14).
- The keyless operation key incorporates an emergency key to lock/unlock the front doors in case the battery in the keyless operation key is discharged or the keyless operation system is not working normally.

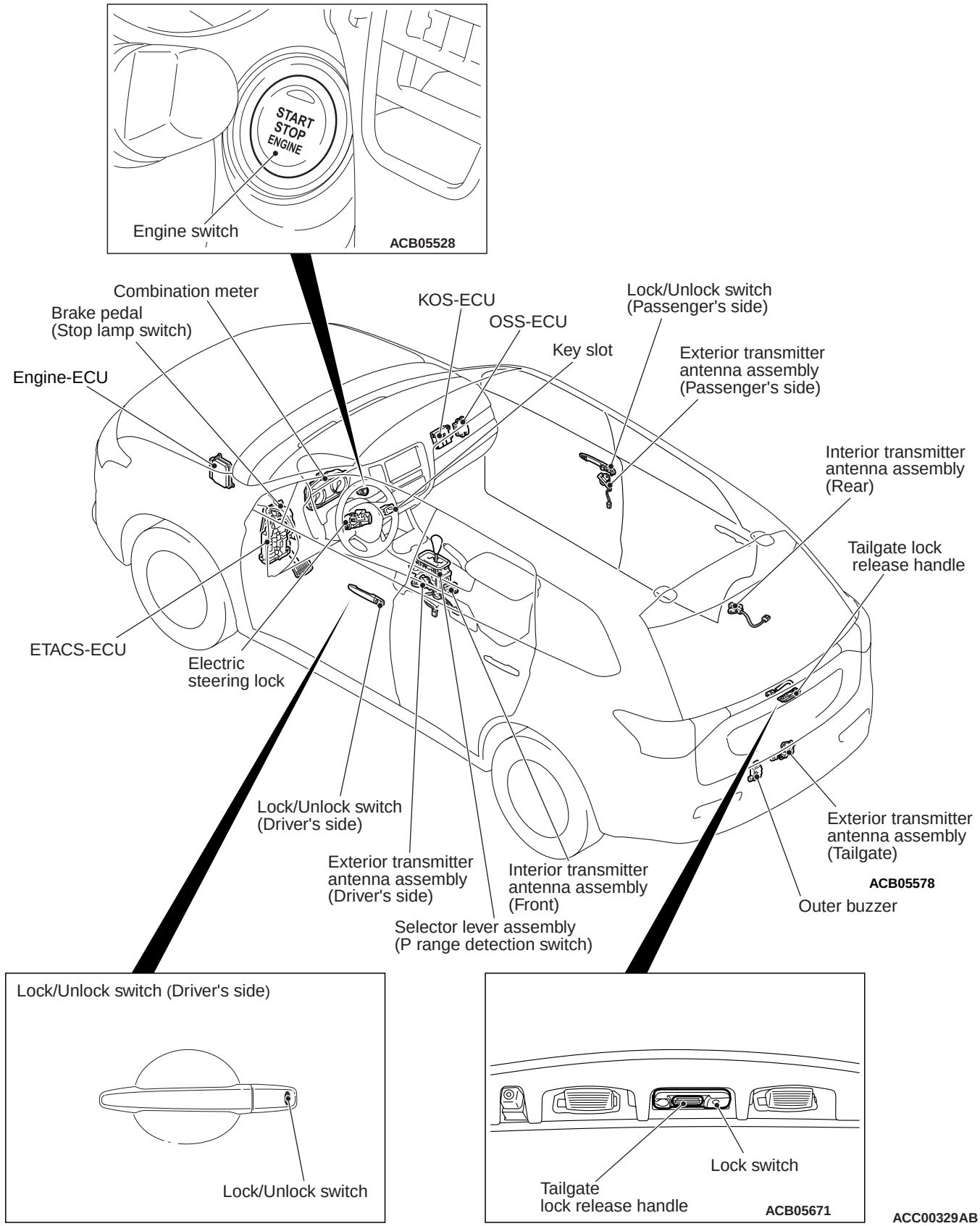
NOTE: If the immobilizer related system failure occurs, the engine may not start.

- The driver can customise KOS; enabling/disabling all the system functions, enabling the door locking/unlocking function only, or enabling the engine starting function only (Refer to P.42B-31).
- Engine start function: The system has been changed to the engine start system that supports OSS (one-touch start system).

NOTE: OSS (one-touch start system): System that has the electrically actuated steering lock, and that allows the engine to be started and the vehicle power to be switched via the operation of engine switch.

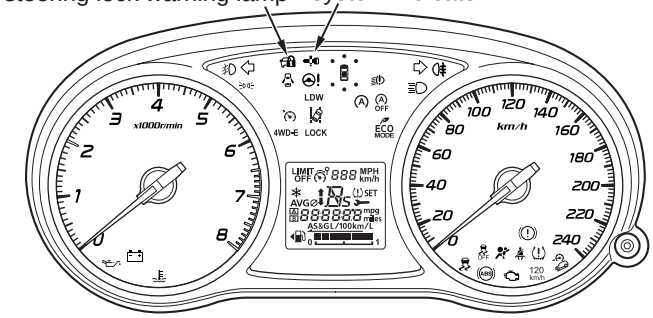
- Engine starting method when keyless operation key battery is discharged: A change has been made to the control that does not use the emergency key and performs the control with the discharged keyless operation key inserted in the key slot.

CONSTRUCTION DIAGRAM



Combination meter

<Standard meter>



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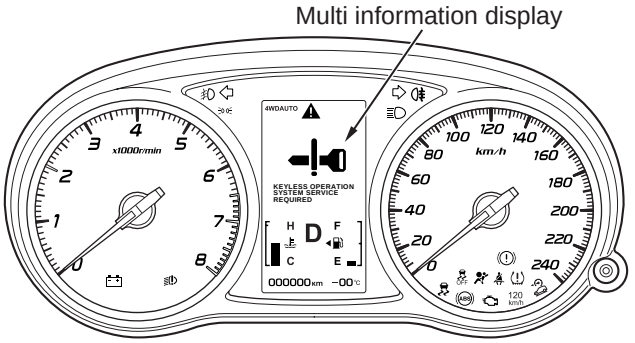

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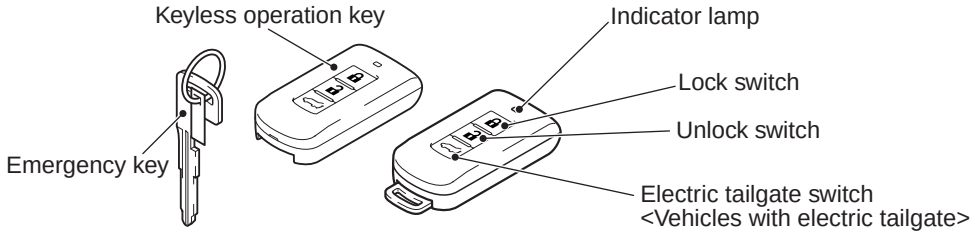
ACC00331AB



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Main components and functions

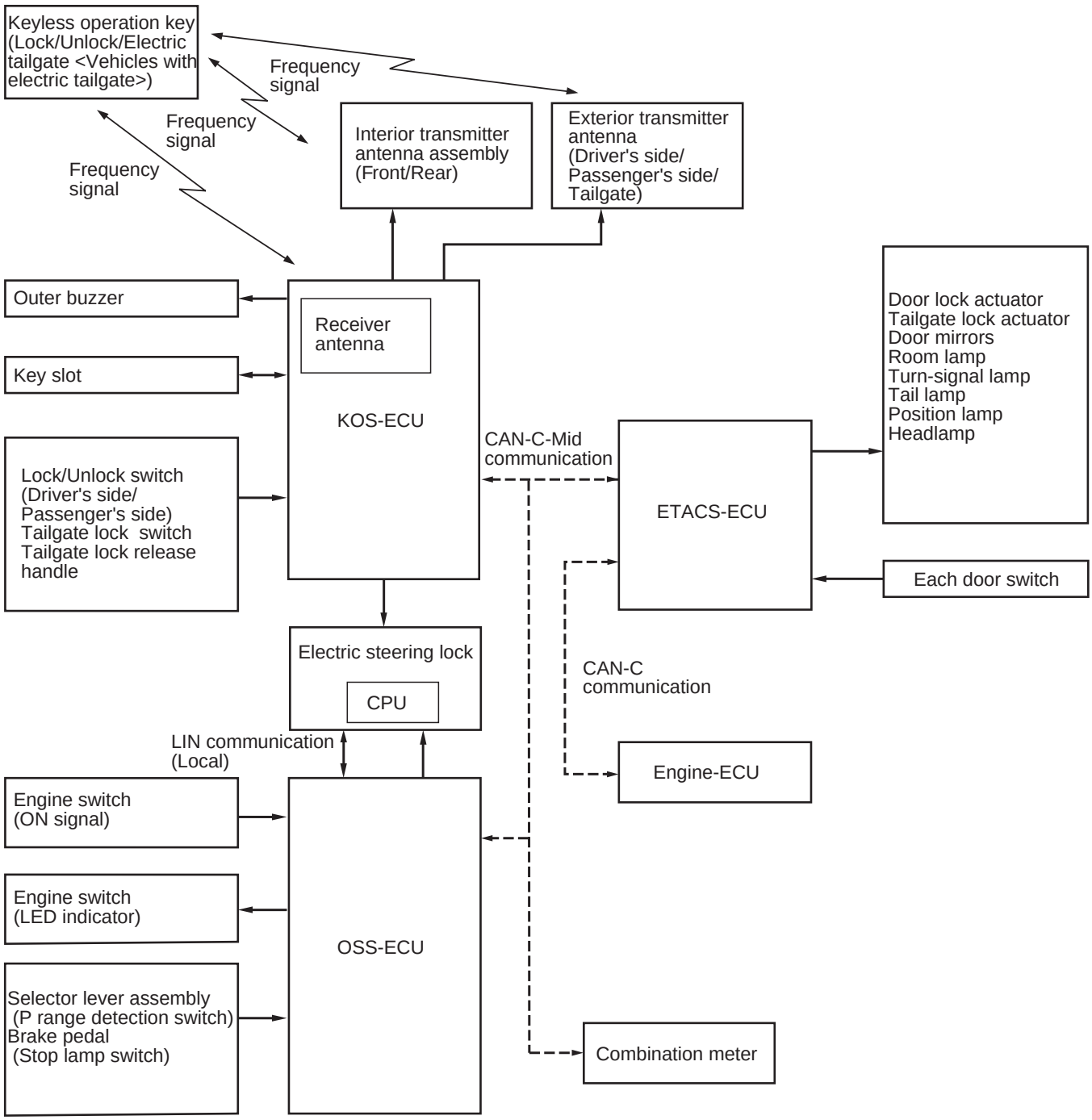
Parts name	Functional description
KOS-ECU	Controls KOS by using the following inputs/outputs and communications. • Input of front door lock/unlock switch, input of tailgate lock release handle, and input of tailgate lock switch • Communications with ETACS-ECU, OSS-ECU and combination meter via CAN • Wireless communication of keyless operation key via the interior and exterior transmitter antennas as well as via the key slot integrated antenna • Output to the outer buzzer • Output of actuator driving permission signal to electric steering lock
Electric steering lock (incorporates electric steering lock unit)	The steering lock mechanism incorporates a mechanism that can electrically unlock the lock. When the lock is unlocked electrically, the steering lock is unlocked approximately for 30 seconds by the certification communication with OSS-ECU via LIN communication, the power supply permission signal obtained via wire communication, and the actuator driving permission signal received via wire communication from KOS-ECU.

Parts name		Functional description
Keyless operation key (incorporates emergency key)		• The keyless operation key receives signals sent from each interior/exterior transmitter antenna, certifies the key ID code, calculates the encrypted code, and sends the reply data signal to KOS-ECU. If the integrated battery is discharged, the keyless operation key receives signals sent from the key slot when it is inserted in the key slot. Then, it certifies the key ID code, calculates the encrypted code, and sends the reply data signal to KOS-ECU via the key slot. Also, when the lock/unlock switch on the keyless operation key is pressed, the corresponding signal is sent to KOS-ECU. • If two or more keyless operation keys registered in KOS-ECU respond at the same time, their signals would interfere. To avoid this interference, each signal from KOS-ECU is given the priority* data, and the keyless operation keys respond in accordance with this priority.
Lock/Unlock switch	Driver's side Passenger's side	Locks/unlocks all the doors and tailgate when the driver carrying the keyless operation key presses the lock/unlock switch on the front door outside handle.
Tailgate lock release handle		Unlocks all the doors and the tailgate when a driver carrying the keyless operation key presses the tailgate lock release handle.
Tailgate lock switch		Locks all the doors and tailgate when the driver carrying the keyless operation key presses the lock switch on the tailgate lock release handle.
Exterior transmitter antenna assembly	Driver's side Passenger's side Tailgate	Converts the data output from KOS-ECU via wire into a signal, and sends it to the keyless operation key (For more information on the transmission/reception area, refer to the door entry function valid area P.42B-8).
Interior transmitter antenna assembly	Front Rear	Converts the data output from KOS-ECU via wire into a signal, and sends it to the keyless operation key (For more information on the transmission/reception area, refer to the one-touch start system valid area P.42B-18).
Outer buzzer		The outer buzzer sounds when: • The doors are locked or unlocked by the door entry function. • The keyless operation key is carried out of the vehicle when the power supply mode is other than OFF, and the door is closed. • The lock/unlock switch on the front door outside handle is pressed when the power supply mode is other than OFF. • The lock/unlock switch on the front door outside handle is pressed when the keyless operation key is still located inside the car. • The lock/unlock switch on the front door outside handle is pressed when the door is ajar. • With the driver's door kept open, the keyless operation key is not removed from the key slot located in the glove box.
Key slot		Converts the data output from KOS-ECU via wire into a signal, sends it to the keyless operation key, and then sends the reply data signal from keyless operation key to KOS-ECU.

Parts name	Functional description
OSS-ECU	Controls OSS by using the following inputs/outputs and communications. • Input from the engine switch • Input from stop lamp switch • Input from P range detection switch • Input of monitoring signal for actuator driving permission of electric steering lock via wire communication with KOS-ECU • Output of KOS back-up power supply via wire communication with KOS-ECU • Power supply output to electric steering lock unit • CAN communication with KOS-ECU, ETACS-ECU, engine ECU, and combination meter • LIN communication with electric steering lock
Engine switch	• Output of engine switch ON/OFF signal to OSS-ECU • Input of LED signal from OSS-ECU
Combination meter (keyless operation alarm display)	Communicates with KOS-ECU and OSS-ECU via CAN. Receives the warning request or warning information from KOS-ECU and OSS-ECU, and displays the warning.
ETACS-ECU	• Communicates with KOS-ECU via CAN. By the door lock/unlock request or tailgate lock/unlock request from KOS-ECU, ETACS-ECU outputs the lock/unlock signal. When the door lock/unlock signal is output, the ETACS-ECU flashes or illuminates the turn-signal lamps and the room lamp to notify the driver that the doors are locked/unlocked. Furthermore, by the multi-mode function of keyless entry, the folding/unfolding of door mirrors is performed depending on the pattern of door lock/unlock request from KOS-ECU. • Communicates with OSS-ECU via CAN, and outputs the door switch ON/OFF signal. • Receives the ACC output signal or IG1 output signal sent from OSS-ECU via wire communication, and drives the ACC relay or supplies electrical current to the IG1 relay to drive the IG1 relay. • Using the welcome light function, the headlamps and tail lamps are illuminated by the door unlock request from KOS-ECU.
Engine-ECU	Communicates with OSS-ECU through ETACS-ECU via CAN. Permits/inhibits the engine starting and controls the engine operation.

*NOTE: *: When registering the keyless operation keys, KOS-ECU numbers each key (1 to 4) in the order they are registered (initial priority). This priority is renewed each time the doors are locked/unlocked and the engine switch is pressed. For example, when only keys 1 and 3 have responded to the signal sent from KOS-ECU, the new priority of the keys would be 1-3-2-4. When keys 3 and 4 have responded, then the priority of the keys becomes 3-4-1-2.*

System configuration



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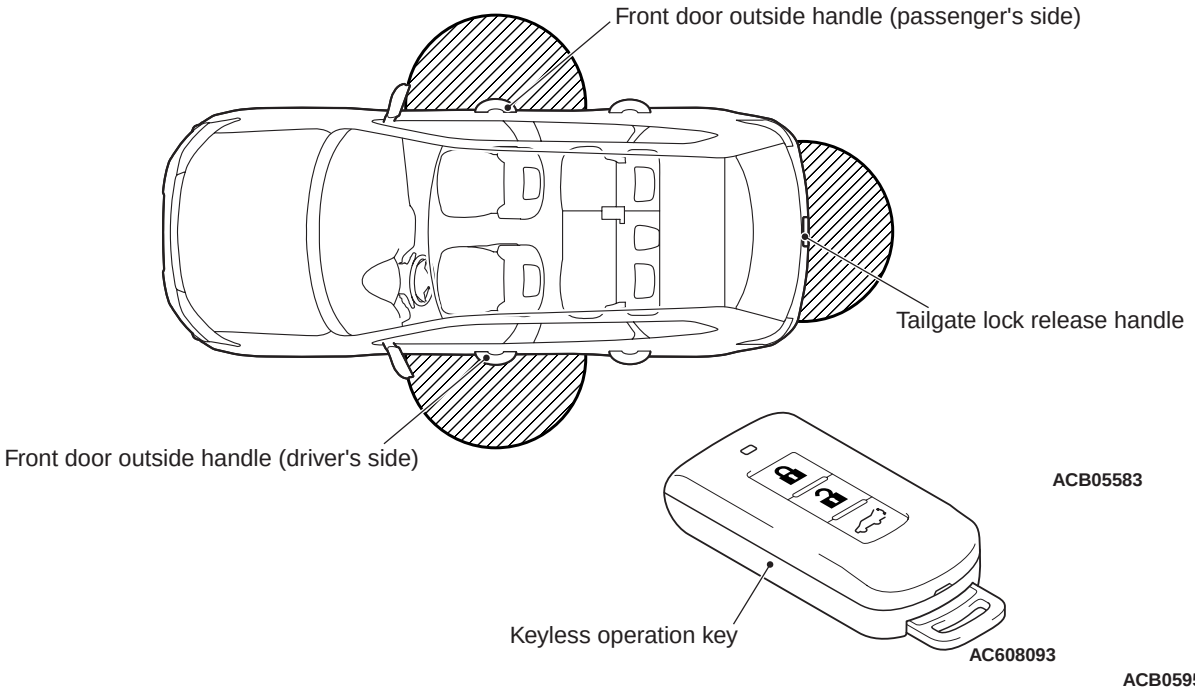
SYSTEM OPERATION

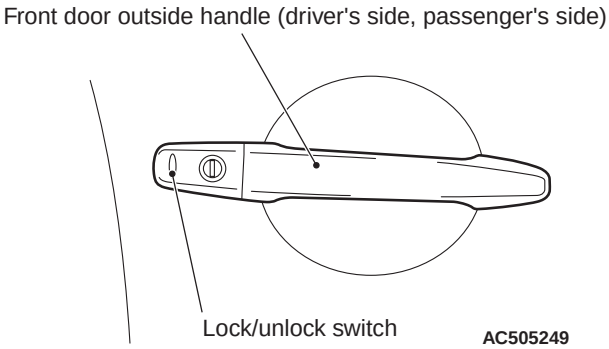
DOOR ENTRY FUNCTION

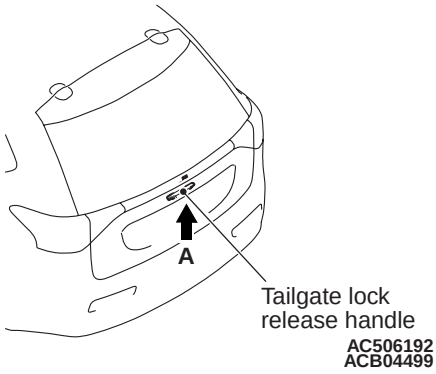
M2421009100411

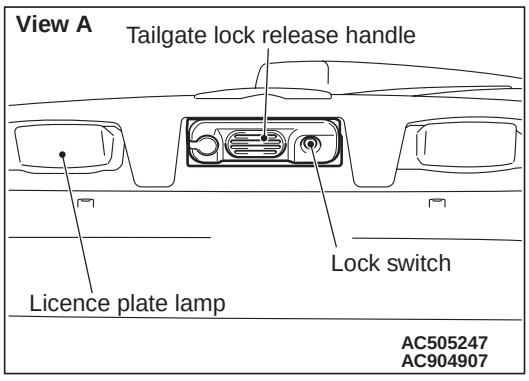
DESCRIPTION OF CONSTRUCTION AND OPERATION

<Vehicles outside area>









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When a driver carrying a keyless operation key presses the lock/unlock switch on the front door out side handle (driver's side, front passenger's side) or the lock switch of tailgate lock release handle, the KOS-ECU communicates with the keyless operation key to authorise* the keyless operation key. When the KOS-ECU senses the registered keyless operation key within 70 cm in radius from the periphery of the vehicle, it requests the ETACS-ECU to lock/unlock the doors (If the keyless operation key is too high/low or too close to the vehicle, the door entry function may not function).

*NOTE: *: In the communication for certification of the keyless operation key, KOS-ECU judges if the keyless operation key ID (specified to keyless operation key) contained in the response data from the keyless operation key coincides with the ID that has been stored in ECU by registration operation. The keyless operation key sends the response to KOS-ECU only when the KOS ID (specific to KOS-ECU) contained in the received data coincided with the stored ID. In the beginning of the communication for certification, KOS-ECU creates an encrypted code calculation factor in random number, and sends it to the keyless operation key together with the transmit data. The keyless operation key calculates the code by using the received factor, and sends the result to KOS-ECU together with the response data. KOS-ECU determines that the communication is established only when the code calculation results of both parties coincided.*

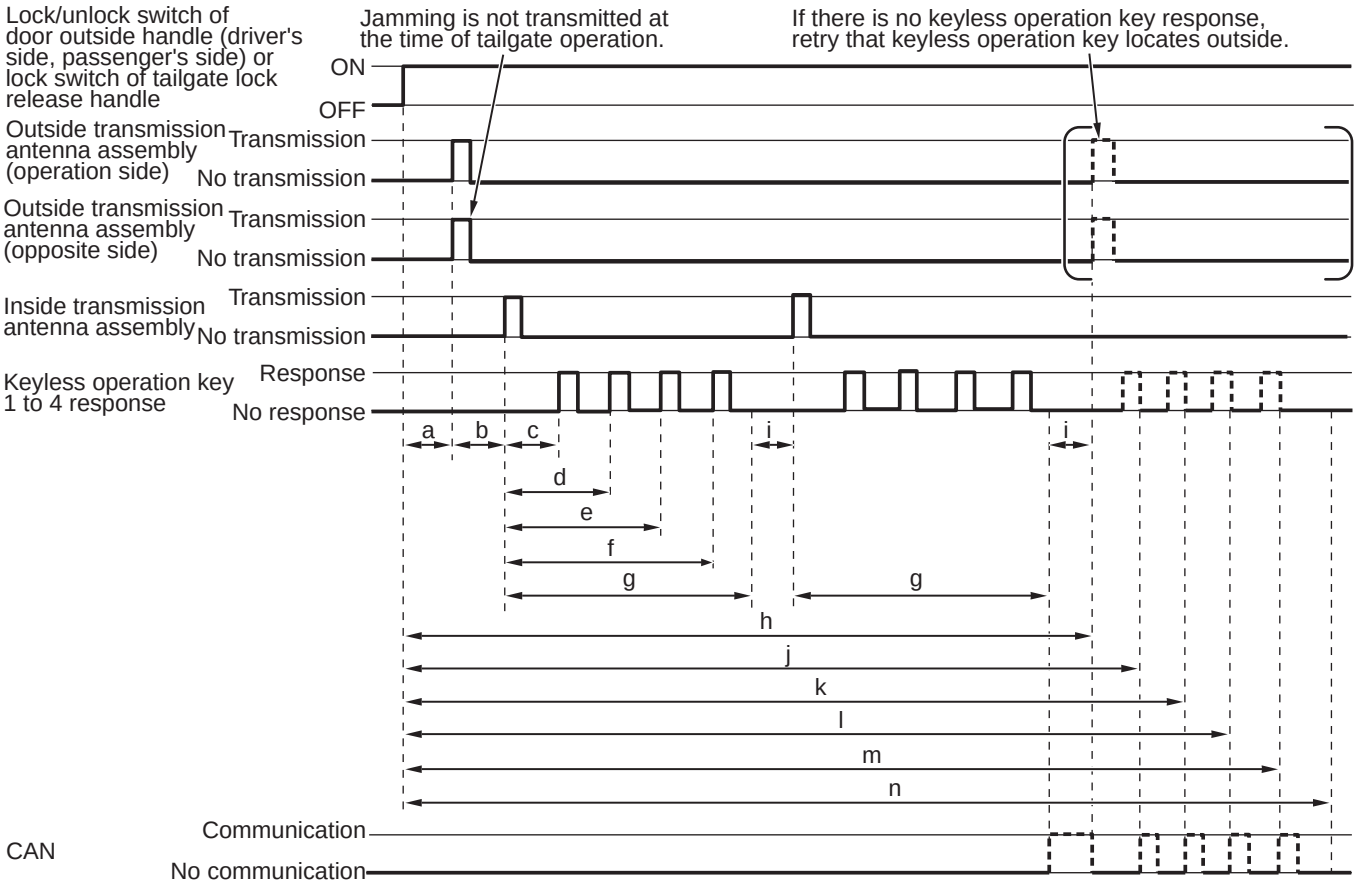
LOCKING OPERATION OF DOOR ENTRY FUNCTION

The keyless operation key certification communication is performed when the lock/unlock switch of front door outside handle (driver's side, front passenger's side) or the lock switch of tailgate lock release handle is turned ON. When KOS-ECU can certify the registered keyless operation key outside the vehicle only, it requests ETACS-ECU to lock all the doors (including tailgate).

NOTE:

- *When a keyless operation key is located inside the vehicle, KOS-ECU does not output a request for locking all the doors.*
- *When a keyless operation key with discharged battery is inserted in the keyless operation key slot, the keyless operation key is not certified to be located inside the vehicle.*

CONTROL OF LOCKING OPERATION



a: Exterior data transmitting start: 0.03 to 0.04 sec
b: Interior data transmitting start: 0.03 to 0.05 sec
c: Keyless operation key 1 response onset time: 0.035 to 0.06 sec
d: Keyless operation key 2 response onset time: 0.08 to 0.115 sec
e: Keyless operation key 3 response onset time: 0.135 to 0.18 sec
f: Keyless operation key 4 response onset time: 0.2 to 0.26 sec
g: Reception-waiting time: It is variable by the registration number (4 registration: 0.3 sec)
h: CAN communication onset time: It is variable by the registration key number (4-key registration: 0.68 to 0.73 sec)*
i: Retry transference time (retry completed): 0.01 sec
Function completed time (retry failed): 0.02 to 0.03 sec
j: CAN communication onset time: keyless operation key 1 priority order response time (4-key registration: 0.76 to 0.87 sec)*
k: CAN communication onset time: keyless operation key 2 priority order response time (4-key registration: 0.81 to 0.92 sec)*
l: CAN communication onset time: keyless operation key 3 priority order response time (4-key registration: 0.86 to 0.99 sec)*
m: CAN communication onset time: keyless operation key 4 priority order response time (4-key registration: 0.93 to 1.07 sec)*
n: Operation completed time: keyless operation key 4 priority order response time (4-key registration: 0.69 to 1.09 sec)*
Note:*: Including CAN communication onset time: to 0.03 sec

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1. KOS-ECU detects the lock/unlock switch ON signal of door outside handle (driver's side, front passenger's side) or the lock switch ON signal of tailgate lock release handle.

   NOTE: When KOS-ECU detects the lock/unlock switch ON signal of door outside handle (driver's side, front passenger's side) or the lock switch ON signal of tailgate lock release handle, KOS-ECU judges the lock prohibition condition. When the lock prohibition condition is met, the locking operation is terminated.
2. KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly on the operation side.
3. After the exterior data are transmitted from the exterior transmitter antenna assembly, the interior data are transmitted from the interior transmitter antenna assembly (front, rear).
4. After the specified time (varies with the number of keyless operation keys registered in KOS-ECU) has elapsed, a confirmation is made that there is no keyless operation key located inside the vehicle.
   - When KOS-ECU receives the response from the keyless operation key that received the interior data, KOS-ECU terminates the process without performing the locking operation.
5. KOS-ECU transmits the interior data from the interior transmitter antenna assembly (front, rear).

6. After the specified time (varies with the number of keyless operation keys registered in KOS-ECU) has elapsed, a confirmation is made if the lock conditions are met.
   - When KOS-ECU receives the response from the keyless operation key that received the interior data, KOS-ECU terminates the process without performing the locking operation.
   - When all the responses from the registered keyless operation key are the exterior data only, KOS-ECU transmits the lock request to ETACS-ECU. Also, KOS-ECU transmits the keyless operation key number to ETACS-ECU.

NOTE: When multiple keyless operation keys responded, KOS-ECU transmits ETACS-ECU the key number of keyless operation key that responded first. As for the transmission sequence to ETACS-ECU, the keyless operation key number is transmitted first, and then the lock request is output.

   - If there is no response from the keyless operation key, Step 6 is performed once.
7. KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly on the operation side.
8. If the specified time (varies with the number of keyless operation keys registered in KOS-ECU) has not elapsed, a confirmation is made if the lock conditions are met.
   - After retry, when the responses from the registered keyless operation key are the exterior data only, KOS-ECU transmits the lock request (request to lock the applicable position) to ETACS-ECU. Also, KOS-ECU transmits the keyless operation key number to ETACS-ECU.

NOTE: When multiple keyless operation keys responded, KOS-ECU transmits ETACS-ECU the key number of keyless operation key that responded first. As for the transmission sequence to ETACS-ECU, the keyless operation key number is transmitted first, and then the lock request is output.

   - When the locking operation is performed on the driver's side, the priority order of keyless operation key is updated.

LOCKING OPERATION INHIBITION CONDITIONS

In the following cases, the door locking operation is inhibited.

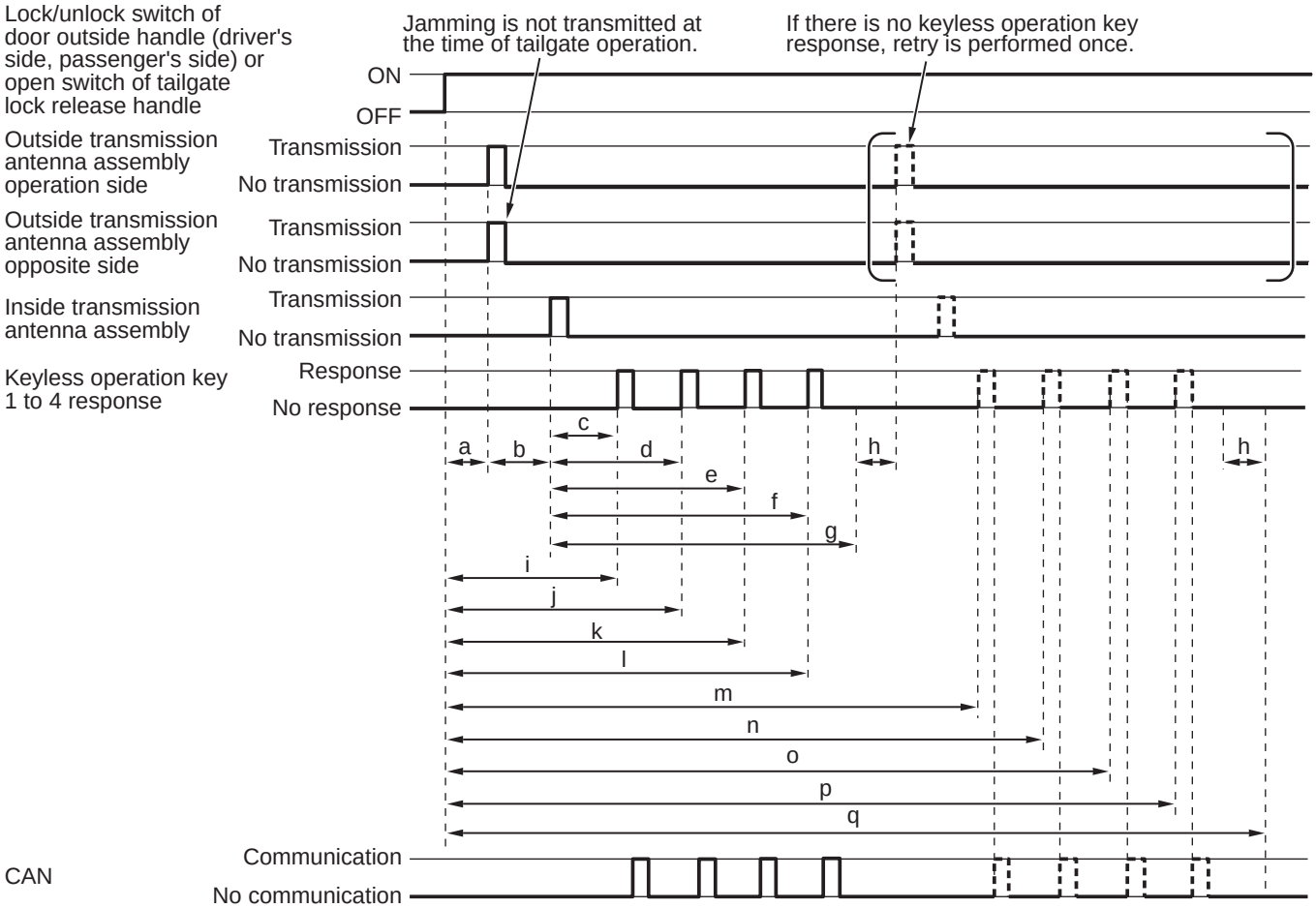
- Any door or the tailgate is open (door switch is ON). (including door ajar)
- Either of the exterior/interior transmitter antenna assembly is being detected to be open, or it is actually open.
- The wiring of exterior/interior transmitter antenna assembly is contacting against the power supply line.
- The engine switch is other than OFF.
- The lock and unlock signals are input at the same time. (When the tailgate is operated)
- The door entry function is prohibited by the customisation function.

UNLOCKING OPERATION OF DOOR ENTRY FUNCTION

The keyless operation key and KOS-ECU communicate to certify the keyless operation key when the lock/unlock switch of front door outside handle (driver’s side, front passenger's side) or the tailgate lock release handle (open switch) is turned ON. When KOS-ECU can certify the registered keyless operation key outside the vehicle, it requests ETACS-ECU to unlock all the doors (when a registered keyless operation key is certified outside the vehicle, KOS-ECU requests ETACS-ECU to unlock even when other registered keyless operation keys are located inside the vehicle).

NOTE: When the driver's door limited unlocking function is set to active using the customisation function, the operation can be performed using the lock/unlock switch of front door outside handle (driver's side). Within 2 seconds after the driver's door is unlocked by pressing the lock/unlock switch of front door outside handle (driver's side) once, pressing the lock/unlock switch of front door outside handle (driver's side) unlocks all the doors (including tailgate).

CONTROL OF UNLOCKING OPERATION



a: Exterior data transmitting start: 0.015 to 0.04 sec
b: Interior data transmitting start: 0.03 to 0.05 sec
c: Keyless operation key 1 response onset time: 0.035 to 0.06 sec
d: Keyless operation key 2 response onset time: 0.08 to 0.115 sec
e: Keyless operation key 3 response onset time: 0.135 to 0.18 sec
f: Keyless operation key 4 response onset time: 0.2 to 0.26 sec
g: Reception-waiting time: It is variable by the registration number (4 registration: 0.3 sec)
h: Retry transference time (retry completed): 0.01 sec
Function completed time (retry failed): 0.02 to 0.03 sec
i: CAN communication onset time: keyless operation key 1 priority order response time (4-key registration: 0.1 to 0.2 sec)*
j: CAN communication onset time: keyless operation key 2 priority order response time (4-key registration: 0.14 to 0.25 sec)*
k: CAN communication onset time: keyless operation key 3 priority order response time (4-key registration: 0.2 to 0.32 sec)*
l: CAN communication onset time: keyless operation key 4 priority order response time (4-key registration: 0.26 to 0.4 sec)*
m: CAN communication onset time: keyless operation key 1 priority order response time (4-key registration: 0.44 to 0.56 sec)*
n: CAN communication onset time: keyless operation key 2 priority order response time (4-key registration: 0.48 to 0.61 sec)*
o: CAN communication onset time: keyless operation key 3 priority order response time (4-key registration: 0.54 to 0.68 sec)*
p: CAN communication onset time: keyless operation key 4 priority order response time (4-key registration: 0.6 to 0.76 sec)*
q: Operation completed time: keyless operation key 4 priority order response time (4-key registration: 0.28 to 0.78 sec)*
Note:*: Including CAN communication onset time: to 0.03 sec

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1. KOS-ECU detects the lock/unlock switch ON signal of door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (open switch) ON signal.

   NOTE: When KOS-ECU detects the lock/unlock switch ON signal of door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (open switch) ON signal, KOS-ECU judges the unlock prohibition condition. When the unlock prohibition condition is met, the unlocking operation is terminated.
4. For the specified time (varies with the number of keyless operation keys registered in KOS-ECU),
2. When KOS-ECU detects the lock/unlock switch ON signal of front door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (open switch) ON signal, KOS-ECU transmits the exterior data from the exterior transmitter antenna assembly on the operation side.
3. After the exterior data are transmitted from the exterior transmitter antenna assembly, the interior data are transmitted from the interior transmitter antenna assembly (front, rear).

   the response from the keyless operation key meeting the unlock condition is monitored.

- When the registered keyless operation key receives the exterior data only, KOS-ECU transmits the unlock request (request to unlock the applicable position) to ETACS-ECU.
- Even after the specified time has elapsed, if KOS-ECU receives no response that satisfies the unlock, it performs a retry once. (When no response after the retry, KOS-ECU terminates the unlocking operation.)
- When the unlocking operation is performed on the driver's side, the priority order of keyless operation key is updated.

UNLOCKING OPERATION INHIBITION TIME (WHEN THE TAILGATE IS OPERATED)

Considering that the customer operates the lock switch of tailgate lock release handle to make sure the doors are locked, the unlocking operation is prohibited for 3 seconds after the locking operation is performed by the lock switch of tailgate lock release handle. Using the customisation function, the unlock prohibition time can be changed.

UNLOCKING OPERATION INHIBITION CONDITIONS

In the following cases, the unlocking operation is prohibited.

- Any door or the tailgate is open (door switch is ON). (including door ajar)
- Inside lock knob position of driver's side and front passenger's side is set to Unlock.
- The engine switch is other than OFF.
- The lock and unlock signals are input at the same time. (When the tailgate is operated)
- The exterior/interior transmitter antenna assembly is being detected to be open, or it is open.
- The wiring of exterior/interior transmitter antenna assembly is contacting against the power supply line.
- During the unlocking operation inhibition time (When the tailgate is operated)
- The door entry function is prohibited by the customisation function.

ANSWERBACK FUNCTIONS

When KOS-ECU sends a signal to ETACS-ECU, ETACS-ECU outputs the lock/unlock signal and activates the hazard warning lamp to notify the driver the doors are locked/unlocked.

	Lock signal received	**Unlock signal received**
ETACS-ECU	Lock signal output	Unlock signal output
Hazard warning lamp	Flashes once (initial setting)	Flashes twice (initial setting)

KOS TIMER LOCK FUNCTION

When none of the doors are opened within 30 seconds after the doors are unlocked by KOS, ETACS-ECU automatically outputs the door lock signal to lock the doors. This function prevents the doors from being unlocked accidentally.

KEYLESS ENTRY FUNCTION

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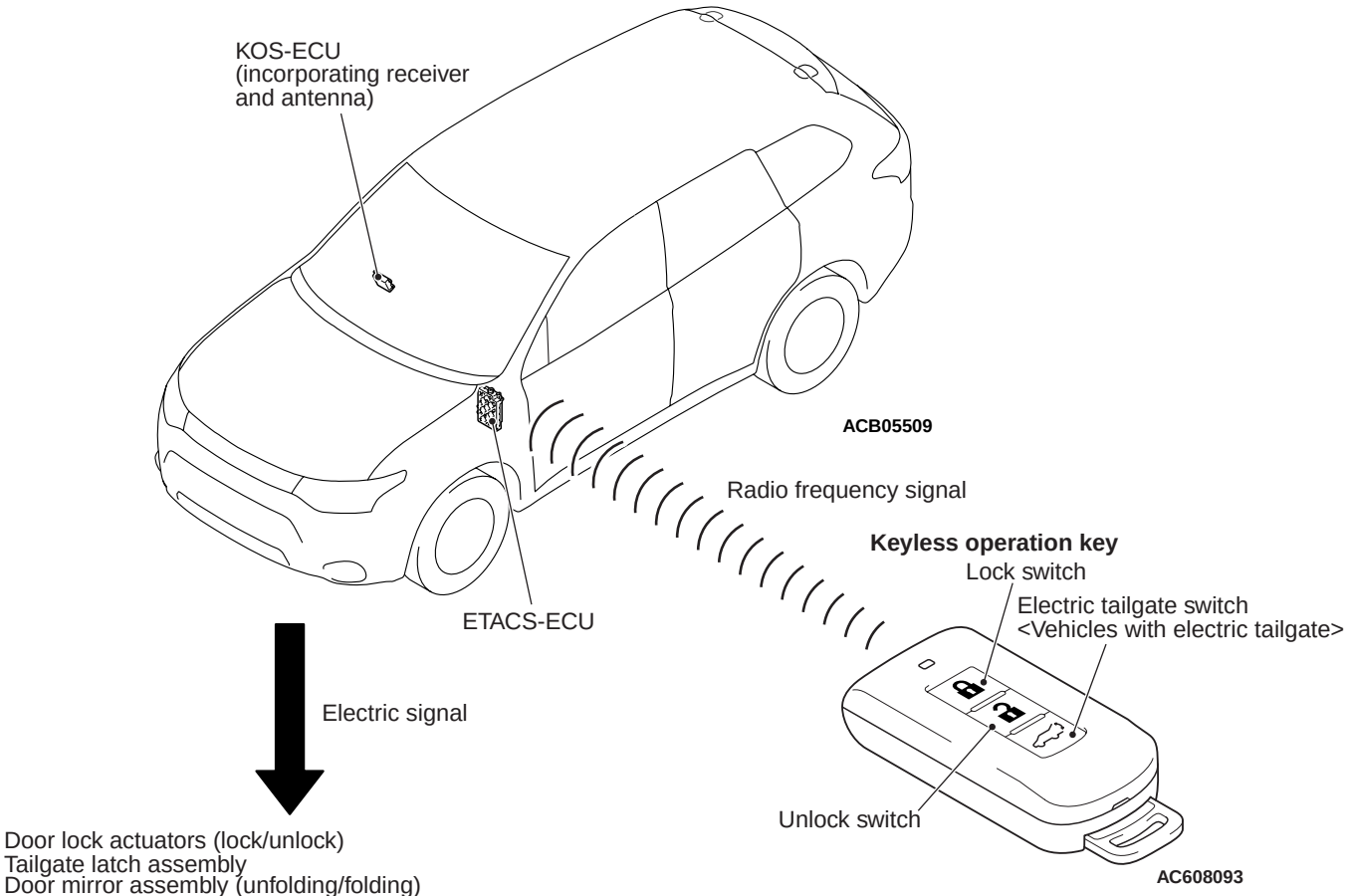


This keyless entry function has the following features:

- A two switches keyless operation key with lock and unlock switches is adopted <Vehicles without electric tailgate>.
- A three switches keyless operation key with lock, unlock and electric tailgate switches is adopted <Vehicles with electric tailgate>.
- The power door locks with selective unlocking has been adopted.
- The KOS-ECU incorporates a receiver and a receiving antenna.
- Up to 4 security codes can be registered using M.U.T.-III.
- Answerback functions

NOTE: The answerback function can be enabled/disabled using a customisation function (Refer to P.42B-31).

- Using the lock/unlock switches, all doors (including tailgate) can be locked or unlocked, door mirrors can be retracted or opened <Vehicles with electric-folding door mirrors>.

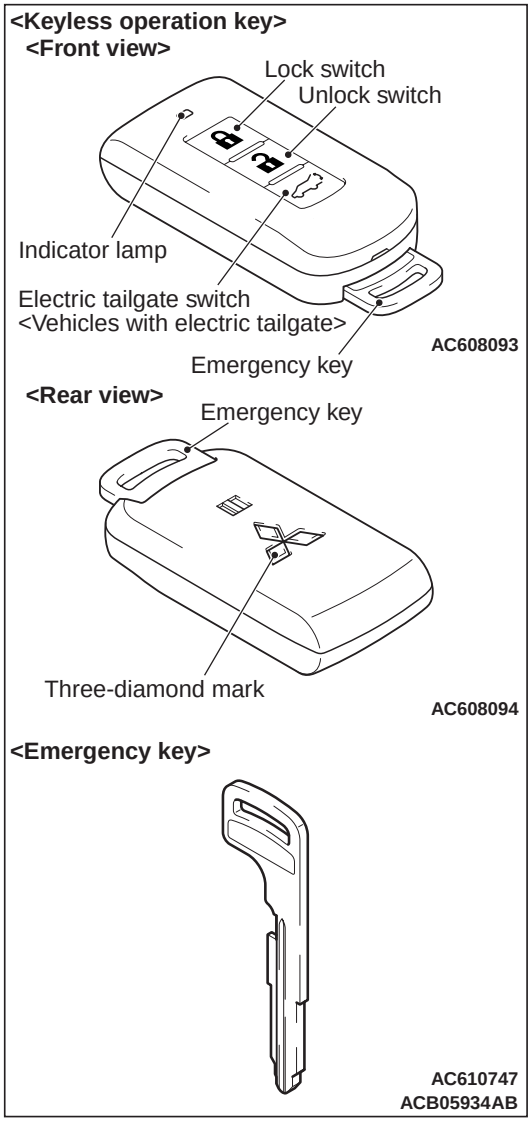
NOTE: Using the customisation function, a change for multi-mode function (door mirrors) can be set. (Refer to P.42B-31.)

- Keyless entry timer lock

NOTE: Timer of the keyless entry timer lock can be enabled/disabled using a customisation function (Refer to P.42B-31).

DESCRIPTION OF CONSTRUCTION AND OPERATION

KEYLESS OPERATION KEY



- The two switches <vehicles without electric tailgate> and three switches <vehicles with electric tailgate> have been adopted for keyless operation key, and the specific encrypted code is transmitted as radio wave signal.
- A shining three-diamond mark on the back of the keyless operation key gives it a classy look.
- Matt-plating is adopted for switches to improve appearance.
- An indicator lamp, which illuminates when signals are received, is added on the keyless operation key. This indicator lamp informs you of the signal transmission status and warns you of flat battery.
- The switch operation of the keyless operation key allows the system to operate as follows:

Function	Keyless operation key operation	System operation
Standard function (lock/unlock/electric tailgate <vehicles with electric tailgate>)	Press the lock switch once.	All doors (including the tailgate) are locked. *NOTE: If the retracting function of the electric folding mirrors is added using a customisation function, it can be retracted in synchronisation with a lock operation.*
	Press the unlock switch once.	All doors (including the tailgate) are unlocked. *NOTE: If the opening function of the electrical folding mirrors is added as an adjustment function, it can be opened in synchronisation with an unlock operation.*
	While the tailgate is unlocked, press the electric tailgate switch twice within two seconds.	The electric tailgate is opened or closed. (Refer to GROUP 42A – Electric Tailgate .)
Multi mode function <Vehicles with electric-folding door mirrors>	Press the lock switch once to lock all doors (including the tailgate), and within 30 seconds press the lock switch twice consecutively.	The door mirrors are retracted.
	Press the unlock switch once to unlock all doors (including the tailgate), and within 30 seconds press the unlock switch twice consecutively.	The door mirrors return from the retracted position.
Power door locks with selective unlocking	Press the unlock switch once to unlock the driver's door, and within 2 seconds, press the unlock switch again to unlock the front passenger's door, rear doors and tailgate.	Power door locks with selective unlocking. *NOTE: Using a customisation function, the power door locks with selective unlocking can be enabled or disabled.*

POWER DOOR LOCKS WITH SELECTIVE UNLOCKING

- Responding to the adoption of power door locks with selective unlocking, the anti-theft feature has been improved.
- When the lock/unlock switch of front door (driver's side) is pressed once, only the driver's door is unlocked. When the lock/unlock switch of front door (driver's side) is pressed once again within 2 seconds after the driver's door is unlocked, the front passenger's door, rear doors, and the tailgate are unlocked.

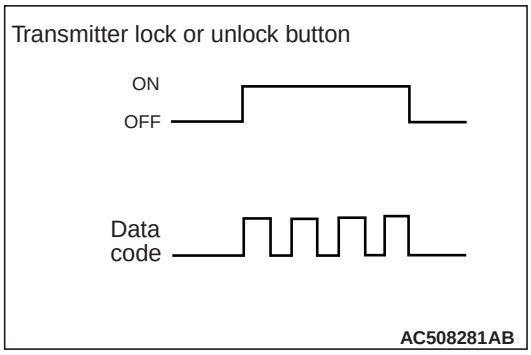
NOTE: When the lock/unlock switch of front door (driver's side) is pressed once, only the driver's door is unlocked. When the lock/unlock switch of front door (driver's side) is pressed once again more than 2 seconds after the driver's door is unlocked, the driver's door only is unlocked.

- When the unlock switch on the keyless operation key is pressed once, only the driver's door is unlocked. When the keyless operation key unlock switch is pressed once again within 2 seconds after the driver's door is unlocked, the front passenger's door, rear doors, and the tailgate are unlocked.

NOTE: When the keyless operation key unlock switch is pressed once, only the driver's door is unlocked. When the keyless operation key unlock switch is pressed once again more than 2 seconds after the driver's door is unlocked, the driver's door only is unlocked.

- Using a customisation function, the power door locks with selective unlocking can be enabled or disabled (Refer to P.42B-31).

ENCRYPTED CODE

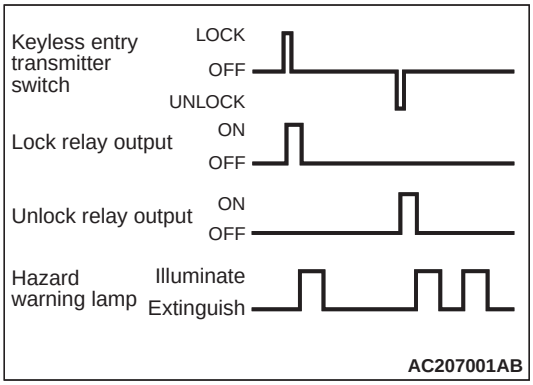


Four data codes are transmitted when a switch is operated once. The encrypted code for user identification is a combination of 0 and 1, and more than 1 million different combinations are available. To prevent theft by copying signal codes, the data code includes a rolling code with the encrypted code. The rolling code changes each time a signal is sent.

RECEIVER

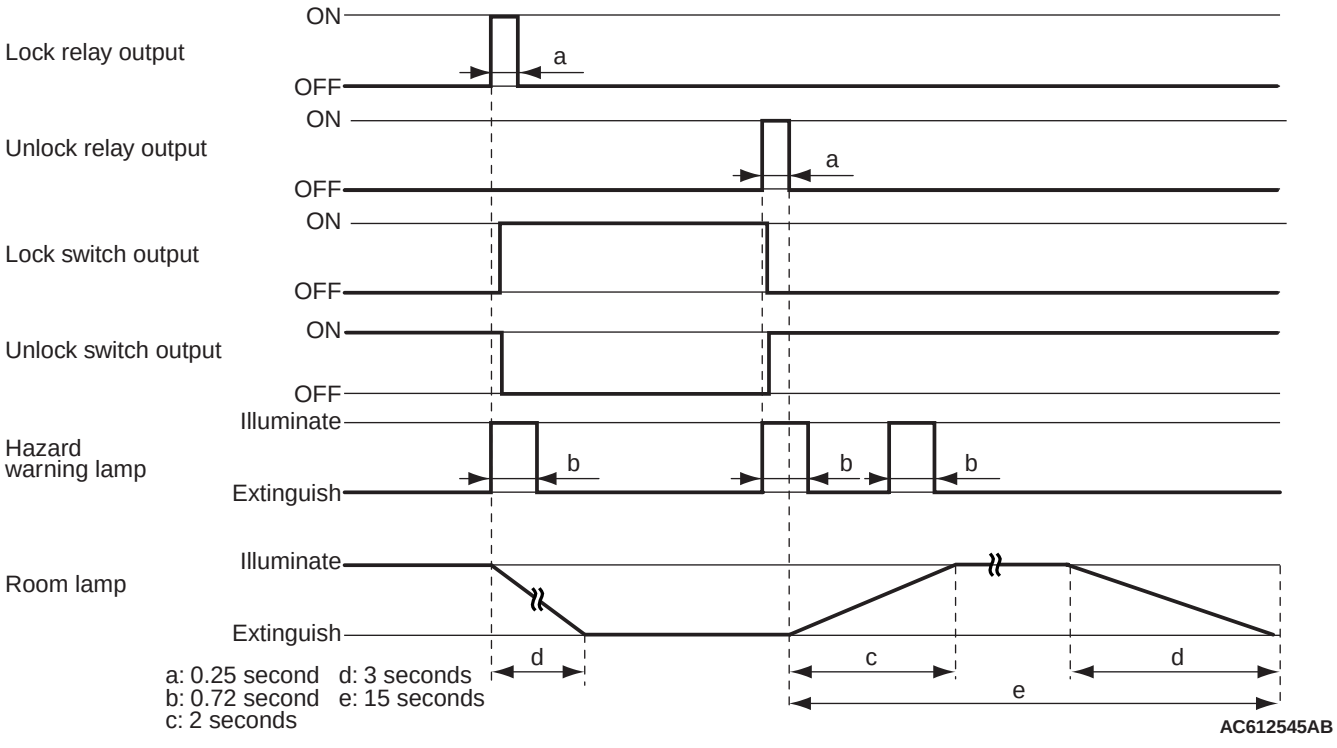
The receiver is incorporated into the KOS-ECU together with the receiving antenna. The receiver compares the signal which the antenna received from the keyless operation key with the registered encrypted code and the stored code of the receiver, and when they coincided, outputs a signal from the KOS-ECU. By connecting M.U.T.-III to the diagnosis connector, up to four encrypted codes of keyless operation keys can be registered.

KEYLESS ENTRY HAZARD LAMP ANSWERBACK FUNCTION



The hazard answerback function that allows checking the lock/unlock state of the door easily even in the daytime is installed. When the LOCK signal from the keyless operation key is input to ETACS-ECU, all doors (including tailgate) are locked and the hazard warning lamp flashes once. When UNLOCK signal is input, all doors (including tailgate) are unlocked and the hazard warning lamp flashes twice. Using a customisation function, the hazard answerback can be enabled/disabled (Refer to P.42B-31).

KEYLESS ENTRY ROOM LAMP ANSWER-BACK FUNCTION



When the LOCK signal from the keyless operation key is input to ETACS-ECU, all doors (including tailgate) are locked, and the room lamp is turned off in synchronisation with hazard lamp answerback (when the room lamp is illuminated, the lamp is turned off). Also, when the UNLOCK signal from the keyless operation key is input to ETACS-ECU, all doors (including tailgate) are unlocked, and the room lamp is illuminated for 15 seconds in synchronisation with hazard lamp answerback.

KEYLESS ENTRY TIMER LOCK TIME

When none of the doors is opened within 30 seconds after the doors are unlocked by the keyless entry system, ETACS-ECU automatically outputs the door lock signal to lock the doors. This function prevents the doors (including the tailgate) from being unlocked unexpectedly by operation errors. Using a customisation function, the timer lock period can be changed (Refer to P.42B-31).

OPERATION INHIBITION CONDITIONS

The operation of the system is inhibited when:

- Any door or the tailgate is open (door switch is ON). (including door ajar) <Lock function only>

OSS (ONE-TOUCH START SYSTEM)

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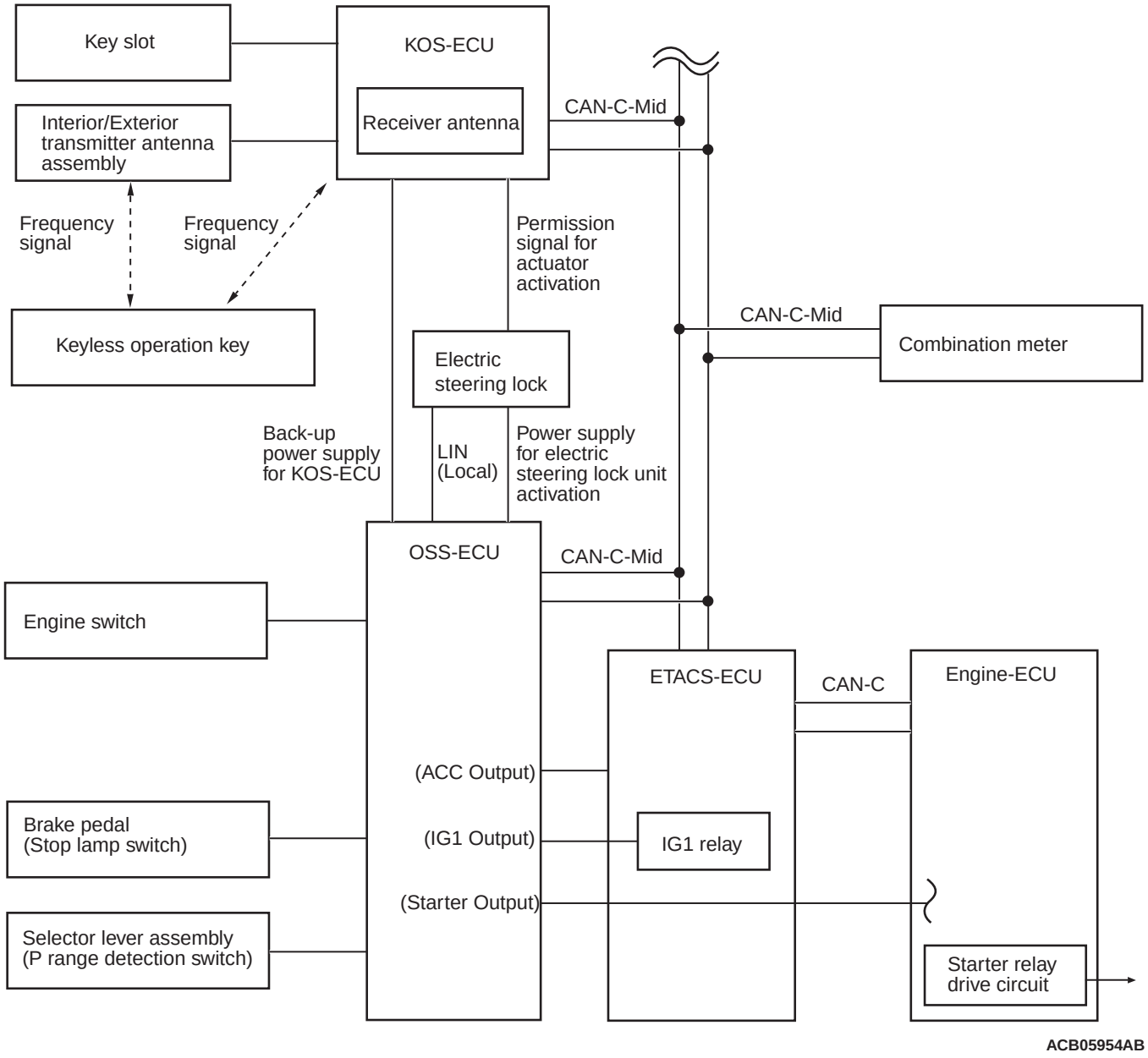
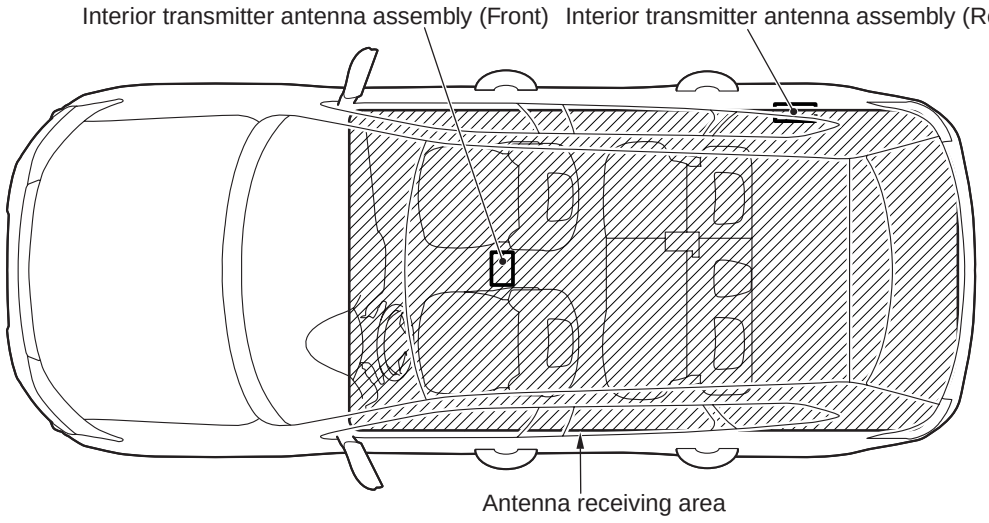
With the one-touch start system, when the engine switch mounted inside the vehicle is operated, OSS-ECU receives the stop lamp switch input signal from the brake pedal, the P range detection switch input signal from the selector lever assembly, and performs the certification communication with keyless operation key using KOS-ECU, the certification communication with electric steering lock, and the engine start certification communication with engine-ECU. Only when the input signals and certification communications are valid, the one-touch start system performs the power supply changeover control, the electric steering lock locking/unlocking control, and the engine start control.

ONE-TOUCH START SYSTEM CONFIGURATION



ONE-TOUCH START SYSTEM VALID AREA

The one-touch start system can be activated by the pressing of engine switch only when the keyless operation key is located within the interior antenna receiving area.



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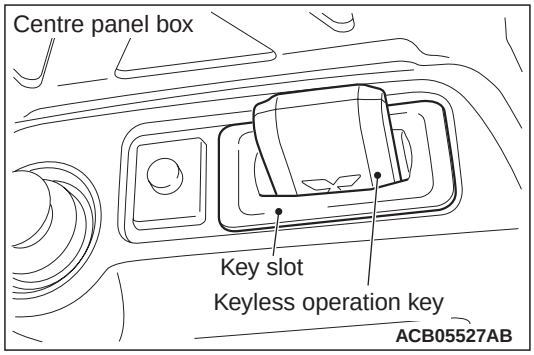
NOTE:



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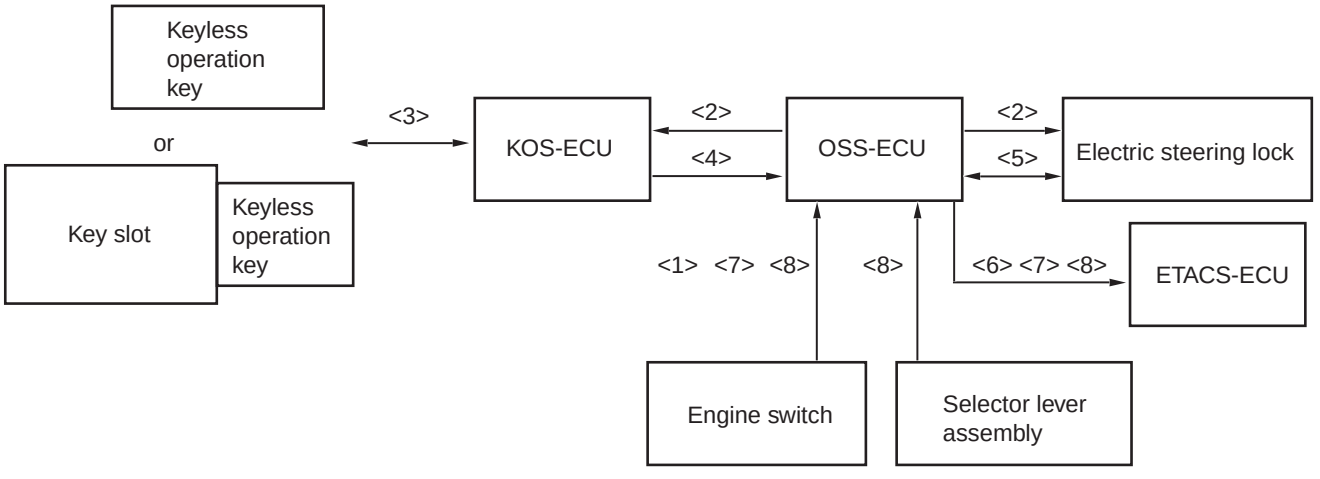
If the keyless operation key battery is discharged, the one-touch start system (power supply changeover, engine start/stop) becomes available when the keyless operation key is inserted into the key slot located in the floor console. When inserting the keyless operation key to the key slot, easy locking of the key can be performed by inserting the key from the emergency key side.

Power supply changeover control (Operation description)



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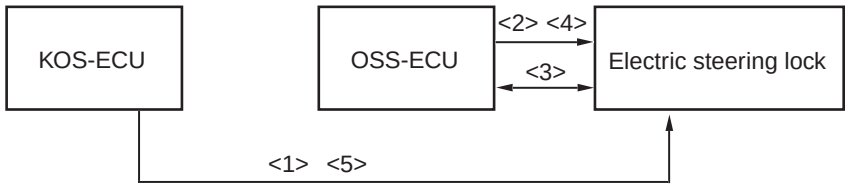
Flow of power supply changeover control	
<1>	Under the power OFF status, operate the engine switch without depressing the brake pedal.
<2>	By the operation of engine switch, OSS-ECU sends KOS-ECU the certification request via CAN, and at the same time, supplies the electric steering lock unit power to the electric steering lock.
<3>	In accordance with the certification request from OSS-ECU, KOS-ECU performs the certification communication with the keyless operation key.
<4>	KOS-ECU sends the key certification result to OSS-ECU via CAN. OSS-ECU compares its certification result with the KOS-ECU certification result, and goes to <5> when the results agree with each other.
<5>	OSS-ECU performs the certification communication with the electric steering lock via LIN (local LIN). The electric steering lock compares the certification result with that of OSS-ECU, and unlocks the steering lock when the results agree with each other.
<6>	After the certification communication with the electric steering lock, OSS-ECU sends the ACC output to ETACS-ECU. Then, ETACS-ECU drives the internal ACC relay to turn the power to ACC.
<7>	With the power supply set to ACC, when the engine switch is operated again without depressing the brake pedal <CVT vehicle>, OSS-ECU sends the IG1 output. Then, the current is supplied to the IG1 relay in ETACS-ECU, thus driving the IG1 relay and turning the power ON. (At this time, OSS-ECU also communicates with engine-ECU to certify the engine start.)
<8>	With the power supply set to ON, when the engine switch is operated again without depressing the brake pedal, the power of the CVT vehicle is turned OFF when the selector lever is in the P position, or the power is turned to ACC when in other than the P position. When the vehicle speed information, which is received via CAN, cannot be received or when the vehicle speed is 3 km/h or more, any standard engine switch operations will not be accepted. However, the power can be turned to ACC by the emergency stop operation*. *NOTE: *: The emergency stop operation refers to the operation to press and hold the engine switch for 3 seconds or longer, or to repeatedly press the engine switch 3 times or more within 1 second. After the emergency stop operation, OSS-ECU will not accept the engine switch operation for 2 seconds.*

Electric steering lock locking/unlocking control (Operation description)



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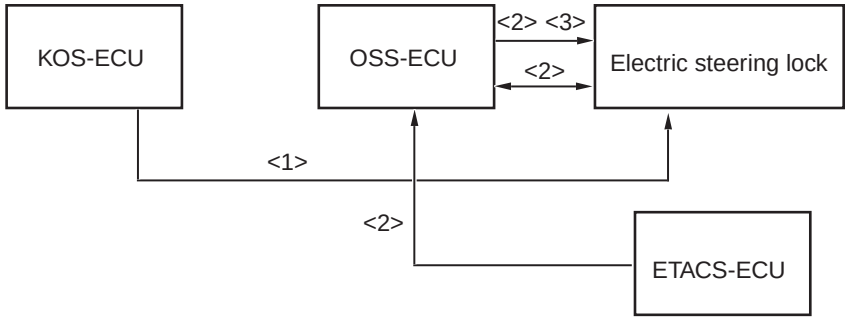
Flow of electric steering lock unlocking control	
•	Lock status of electric steering lock
<1>	KOS-ECU outputs the actuator driving permission signal to the electric steering lock.

Flow of electric steering lock unlocking control	
<2>	By the operation of engine switch, OSS-ECU sends KOS-ECU the certification request via CAN, and at the same time, supplies the electric steering lock unit power to the electric steering lock.
•	Matching of certification results with KOS-ECU (Refer to Step <1> to <4> of power supply changeover control.)
<3>	OSS-ECU performs the certification communication with the electric steering lock via LIN (local LIN). The electric steering lock compares the certification result with that of OSS-ECU, and unlocks the electric steering lock by driving the internal actuator when the results agree with each other.
<4>	After the electric steering lock is unlocked, OSS-ECU stops the supplying of electric steering lock unit power to the electric steering lock. (Subsequently, OSS-ECU sends the ACC output to ETACS-ECU. Then, ETACS-ECU drives the internal ACC relay to turn the power to ACC.)
<5>	After the engine is started, KOS-ECU stops the actuator driving permission signal for the electric steering lock.



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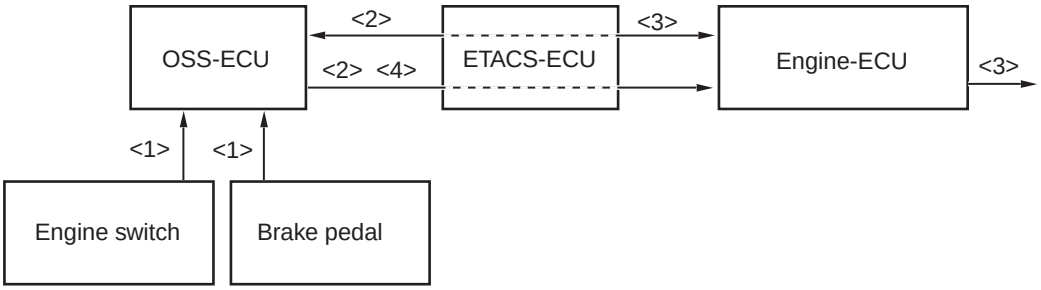
Flow of electric steering lock locking control	
•	Unlock status of electric steering lock
<1>	KOS-ECU supplies the actuator driving power to the electric steering lock.
<2>	With the power supply set to OFF, OSS-ECU receives the door status change (excluding tailgate) from ETACS-ECU via CAN. Using the door status change from "Open to Close to Open" as a trigger*, OSS-ECU supplies the electric steering lock unit power to the electric steering lock, and then performs the certification communication via LIN (local LIN). The electric steering lock compares the certification result with that of OSS-ECU, and locks the steering lock by driving the internal actuator when the results agree with each other. *NOTE: *: The trigger also includes the operation of lock/unlock button on keyless operation key as well as the door locking/unlocking by the operation of keyless operation switch.*
<3>	After the electric steering lock is locked, OSS-ECU stops the supplying of electric steering lock unit power to the electric steering lock.

Engine start control (Operation description.)



AC905173AD

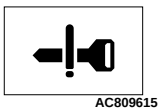
Flow of engine start control	
<1>	With the power supply set to OFF, operate the engine switch while depressing the brake pedal.
•	Matching of certification results with KOS-ECU and electric steering lock (Refer to Step <2> to <5> of power supply changeover control.)
<2>	At the same time with the transmission of certification request to engine-ECU via CAN, OSS-ECU also sends the starter output to engine-ECU.
<3>	Engine-ECU supplies current to the starter relay to perform cranking. Also, engine-ECU compares its own certification result with the OSS-ECU certification result, and starts the engine when the results agree with each other. (If the certification results do not agree with each other, engine-ECU stops the supplying of current to the starter relay and injector. Also, OSS-ECU stops the starter output.)
<4>	After the engine start is complete, OSS-ECU stops the starter output.

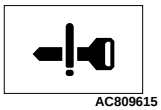
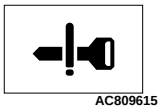
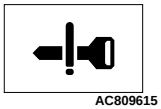
WARNINGS/ALARMS <Standard meter>

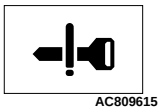
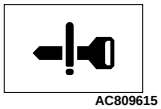
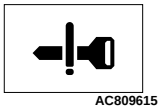
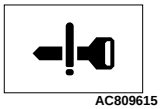
M2421009300426

KOS WARNING AND WARNING INDICATOR LIST

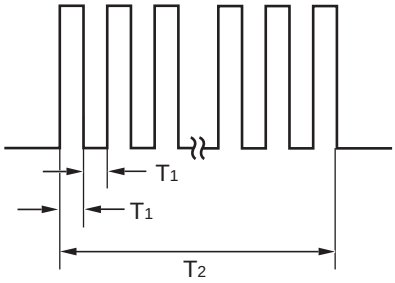
When the KOS fails or operates improperly, the KOS-ECU warns the driver of this by setting off the outer buzzer and by displaying the keyless operation warning by the indicator lamp in the combination meter.

Item	Indicator	State	Warning operation	Warning cancellation condition (when any of the condition met)
Keyless operation key battery low voltage warning	 AC809615	The keyless operation key with low battery voltage is detected when the engine switch is pressed.	Warning indicator flashes for 30 seconds.	• Power supply mode OFF is detected. • 30 seconds have passed after the warning output started.

Item	Indicator	State	Warning operation	Warning cancellation condition (when any of the condition met)
Keyless operation key take out warning	 AC809615	The keyless operation key is carried out of the vehicle when the power supply mode is in other than OFF, and the door is closed.	• The warning indicator flashes for 5 minutes. • Outer buzzer sounds for 5.69 seconds in pattern 2.	• Power supply mode OFF is detected. • KOS-ECU has detected a keyless operation key inside the vehicle. • 5 minutes have passed when the power supply mode is in ACC.
Door lock does not operate (keyless operation key is located inside the vehicle).	 AC809615	The lock/unlock switch on the front door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (tailgate open switch, tailgate lock switch) are pressed when the keyless operation key is still located inside the car.	• Warning indicator flashes for 5 seconds. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• The lock/unlock switch on the front door outside handle (driver's side, front passenger's side) or tailgate lock release handle (tailgate open switch, tailgate lock switch) are pressed again. • 5 seconds have passed after the warning output started.
Door lock does not operate (door open).	 AC809615	The lock/unlock switch on the front door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (tailgate open switch, tailgate lock switch) are pressed when the door is ajar.	• Warning indicator flashes for 5 seconds. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• All doors are closed. • 5 seconds have passed after the warning output started.

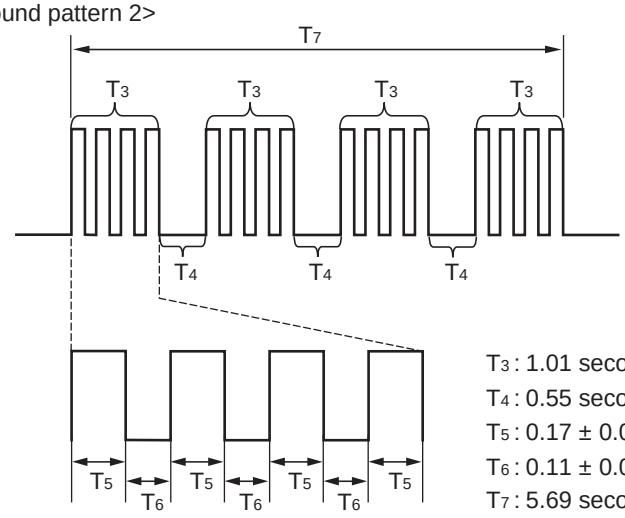
Item	Indicator	State	Warning operation	Warning cancellation condition (when any of the condition met)
System error	 AC809615	Engine switch is pressed when an error has been detected in EEPROM of KOS-ECU.	The warning indicator illuminates for 5 minutes.	5 minutes have passed after the alarm is output, also the power supply mode is OFF
		Engine switch is pressed when a transmission antenna has an open circuit or short to power supply.		
		Open circuit or short to earth is detected in the key slot.		
		An error is detected, and the power supply mode is other than OFF.		
No keyless operation key detected inside the car	 AC809615	No keyless operation key is detected inside the car when the engine switch is pressed.	The warning indicator flashes for 5 seconds.	• Power supply mode OFF is detected. • 5 seconds have passed after the warning output started.
Key reminder	 AC809615	With the driver's door kept open, the keyless operation key is not removed from the key slot located in the floor console.	• The warning indicator flashes for 1 minute. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• Key is removed from the key slot in the floor console. • 1 minutes have passed after the warning output started.
Engine switch reminder	 AC809615	The lock/unlock switch on the front door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (tailgate open switch, tailgate lock switch) are pressed when the power supply mode is other than OFF.	• Warning indicator flashes for 5 seconds. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• Power supply mode OFF is detected. • 5 seconds have passed after the warning output started.

<Sound pattern 1>



T1 : 0.08 ± 0.01 second
T2 : 2.96 seconds

<Sound pattern 2>



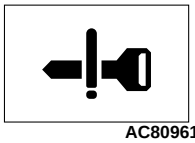
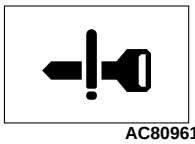
T3 : 1.01 seconds
T4 : 0.55 second
T5 : 0.17 ± 0.01 second
T6 : 0.11 ± 0.01 second
T7 : 5.69 seconds

AC501053AE

OSS WARNING AND WARNING INDICATOR LIST

When the OSS fails or operates improperly, the OSS-ECU warns the driver of this by displaying the one-touch start system warning by the indicator lamp in the combination meter.

Item	Indicator	Factor	Warning operation
Immobilizer error	 AC904253	• Displayed when the certification communication fails with KOS, electrical steering lock, or engine-ECU. • Displayed when the power supply mode is turned ON while the keyless operation key is judged to be brought outside the vehicle with the power supply mode in ACC, or when the engine starting operation is performed after such a status. • Displayed when the electrical steering lock cannot be locked because there is a P detection switch malfunction.	• The warning indicator illuminates.
Steering turn indication	 AC904253	Displayed when the steering lock is not unlocked because the steering force is applied.	• The warning indicator flashes. • Buzzer sounds.

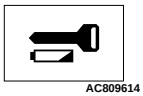
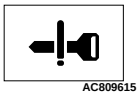
Item	Indicator	Factor	Warning operation
Electrical steering lock malfunction	 AC809615	Displayed when a malfunction occurs to the steering lock system.	• The warning indicator illuminates. • Buzzer sounds.
Steering lock not locked	–	The door is open with the steering lock not locked.	Buzzer sounds.
Power supply system error	 AC809615	Displayed when an error occurs to the power supply system.	• The warning indicator illuminates. • Buzzer sounds.
Power OFF indication	–	The door is open with the power supply mode in ON or in ACC.	Buzzer sounds.

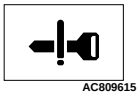
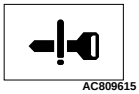
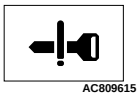
WARNINGS/ALARMS <High contrast meter>

M2421009300415

KOS WARNING AND WARNING INDICATOR LIST

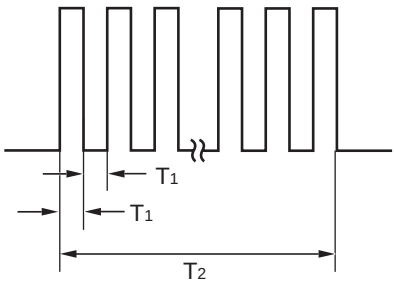
When KOS failed or operated improperly, KOS-ECU warns the driver of this by setting off the outer buzzer and the keyless operation warning indicator on the multi information display in the combination meter.

Item	Display content		State	Warning operation	Warning cancellation condition (when any of the condition met)
Keyless operation key battery low voltage warning	 AC809614	KEY BATTERY LOW	The keyless operation key with low battery voltage is detected when the engine switch is pressed.	Warning indicator display for 30 seconds.	• Power supply mode OFF is detected. • 30 seconds have passed after the warning output started.
Keyless operation key take out warning	 AC809615	KEY NOT DETECTED	The keyless operation key is carried out of the vehicle when the power supply mode is in other than OFF, and the door is closed.	• The warning indicator display for 5 minutes. • Outer buzzer sounds for 5.69 seconds in pattern 2.	• Power supply mode OFF is detected. • KOS-ECU has detected a keyless operation key inside the vehicle. • 5 minutes have passed when the power supply mode is in ACC.

Item	Display content		State	Warning operation	Warning cancellation condition (when any of the condition met)
Door lock does not operate (keyless operation key is located inside the vehicle).	 AC809615	KEY STILL IN VEHICLE	The lock/unlock switch of the front door outside handle is pressed when the keyless operation key is still located inside the car.	• Warning indicator display for 5 seconds. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• Lock/unlock switch of the front door outside handle is pressed again. • 5 seconds have passed after the warning output started.
Door lock does not operate (door open).	 AC809615	CHECK DOORS	The lock/unlock switch on the front door outside handle is pressed when the door is ajar.	• Warning indicator display for 5 seconds. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• All doors are closed. • 5 seconds have passed after the warning output started.
System error	 AC809615	KEYLESS OPERATION SYSTEM SERVICE REQUIRED	Engine switch is pressed when an error has been detected in EEPROM of KOS-ECU.	The warning indicator display for 5 minutes.	5 minutes have passed after the engine switch is pressed, also the power supply mode is OFF.
			Engine switch is pressed when a transmission antenna has an open circuit or short to power supply.		
			Open circuit or short to earth is detected in the key slot.		
			An error is detected, and the power supply mode is other than OFF.		
No keyless operation key detected inside the car	 AC904250	KEY NOT DETECTED INSERT KEY INTO KEY SLOT	No keyless operation key is detected inside the car when the engine switch is pressed.	The warning indicator display for 5 seconds.	• Power supply mode OFF is detected. • 5 seconds have passed after the warning output started.

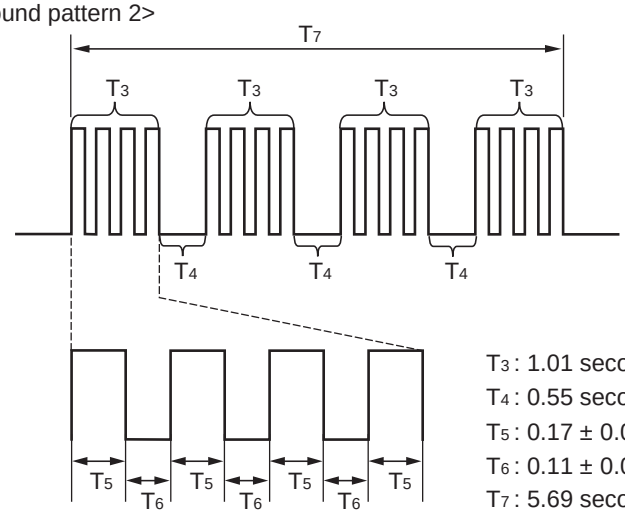
Item	Display content		State	Warning operation	Warning cancellation condition (when any of the condition met)
Key reminder	 AC904251	REMOVE KEY FROM KEY SLOT	With the driver's door kept open, the keyless operation key is not removed from the key slot.	• The warning indicator display for 1 minute. • Outer buzzer sounds for 2.96 seconds in pattern 1.	• Key is removed from the key slot. • 1 minutes have passed after the warning output started.
Engine switch reminder	 AC904252	–	The lock/unlock switch on the front door outside handle (driver's side, front passenger's side) or the tailgate lock release handle (tailgate open switch, tailgate lock switch) are pressed when the power supply mode is other than OFF.	• Warning indicator display for 5 seconds. • Outer buzzer sounds for 2.96 seconds in pattern 1.	5 minutes have passed after the engine switch is pressed, also the power supply mode is OFF.

<Sound pattern 1>



T1 : 0.08 ± 0.01 seconds
T2 : 2.96 seconds

<Sound pattern 2>



T3 : 1.01 seconds
T4 : 0.55 seconds
T5 : 0.17 ± 0.01 seconds
T6 : 0.11 ± 0.01 seconds
T7 : 5.69 seconds

AC501053AC

OSS WARNING AND WARNING INDICATOR LIST

When OSS failed or operated improperly, KOS-ECU warns the driver to that effect by displaying the one-touch start system warning on the multi information display in the combination meter.

Item	Display contents		Factor
Immobilizer error	 AC904253	IMMOBILIZER SYSTEM SERVICE REQUIRED	• Displayed when the certification communication fails with KOS, electrical steering lock, or engine-ECU. • Displayed when the power supply mode is turned ON while the keyless operation key is judged to be brought outside the vehicle with the power supply mode in ACC, or when the engine starting operation is performed after such a status. • Displayed when the electrical steering lock cannot be locked because there is a P detection switch malfunction.
Steering turn indication	 AC904254	PUSH ENGINE SWITCH WHILE TURNING STEERING WHEEL	Displayed when the steering lock is not unlocked because the steering force is applied.
Electrical steering lock malfunction	 AC904255	STEERING LOCK SERVICE REQUIRED	Displayed when a malfunction occurs to the steering lock system.
Shift P indication	 AC904256	SHIFT TO P POSITION	Displayed if the shift lever is in other than "P" range when the engine is not running.
Steering lock not locked	 AC904257	STEERING WHEEL UNLOCKED	Displayed when the door is open with the steering lock not locked.
Power supply system error	 AC904260	ELECTRICAL SYSTEM SERVICE REQUIRED	Displayed when an error occurs to the power supply system.

Item	Display contents		Factor
Engine starting method	 AC904258	PRESS BRAKE PEDAL TO START ENGINE	Displayed when the shift lever is in other than "P" range or "N" range at the engine start, or when the engine switch is pressed without the brake pedal depressed.
Power OFF indication	 AC904252	–	Displayed when the door is open with the power supply mode in ON or in ACC.

CUSTOMISATION FUNCTION

M2421000300548

By operating the M.U.T.-III ETACS system, the following functions can be customised. The programmed information is held even when the battery is disconnected.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Hazard answer back	Adjustment of the number of keyless hazard warning lamp answer back flashes	Lock:1, Unlock:2	LOCK: Flashes once, UNLOCK: Flashes twice (initial condition)
		Lock:1, Unlock:0	LOCK: Flashes once, UNLOCK: No flash
		Lock:0, Unlock:2	LOCK: No flash, UNLOCK: Flash twice
		Lock:2, Unlock:1	LOCK: Flash twice, UNLOCK: Flash once
		Lock:2, Unlock:0	LOCK: Flash twice, UNLOCK: No flash
		Lock:0, Unlock:1	LOCK: No flash, UNLOCK: Flash once
		Lock:0, Unlock:0	No function
Auto fold mirror	Electric folding door mirror automatic unfolding function <vehicles with electric retractable remote controlled door mirrors>	Not Auto	No synchronised operation
		Open Vehicle SPD	Vehicle speed-dependent operation
		Open/Close by IG	Ignition switch linked operation
		OPN/CLS Keyles	Keyless entry linked operation (initial condition)
Auto door unlock	Adjustment of the auto door unlock function	Disabled	Without function (initial condition)
		Always (P pos)	With function: Operates when the shift lever or the selector lever is moved to the P position.
		Always(Lock pos)	With function: Operates when the ignition switch is moved to the LOCK (OFF) position.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Door unlock mode	Adjustment of power door locks with selective unlocking	All Doors Unlock	Without function: The first operation of keyless entry system or unlock operation by KOS unlocks all doors (initial condition).
		Dr Door Unlock	With function: The first operation of keyless entry system or unlock operation by KOS unlocks the driver's door only, and the second unlock operation within 2 seconds after that unlocks all doors.
Timer lock timer	Timer lock period adjustment	30 sec.	30 seconds (initial condition)
		60 sec.	60 seconds
		120 sec.	120 seconds
		180 sec.	180 seconds
Multi mode	Multi-mode keyless entry function customisation <Vehicles with electric retractable remote controlled door mirrors>	Disable	No function
		D/M: O&C	Door mirror fold/unfold operation only (initial condition)
KOS key detect out from window	With/without KOS key exterior detection function <Vehicles with KOS>	Enable	No function
		Disable	With function (initial condition)
KOS feature	KOS function adjustment <Vehicles with KOS>	Both enable	All KOS functions are enabled (initial condition).
		Door Entry enable	Only door entry function is enabled.
		ENG strt enable	Only engine starting function is enabled.
		Both disabled	All KOS functions are disabled.
KOS unlock disable time	Adjusts the door unlock inhibition period after door lock is activated. <Vehicles with KOS>	0 sec.	0 second
		3 sec.	3 seconds (Initial condition)
		5 sec.	5 seconds
Outer buzzer volume	Volume adjustment for the KOS outer buzzer	Volume 1	Quieter than the standard
		Volume 2	Standard volume (Initial condition)
		Volume 3	Louder than the standard
Gate auto open by Handle SW	Opening operation by using the gate handle switch	Disable	No function
		Enable	With function (Initial condition)

GROUP 51

EXTERIOR

CONTENTS

GENERAL INFORMATION

M2510000103148

FEATURES

BETTER APPEARANCE

1. Newly designed front bumper and radiator grille
2. The windshield washer nozzles are located at the rear end under the hood.

BETTER AERODYNAMIC CHARACTERISTICS

3. Aerodynamic front bumper
4. Front side air dam (Refer to)
5. Overfender
6. Roof drip moulding (Refer to)

BETTER USER-FRIENDLINESS

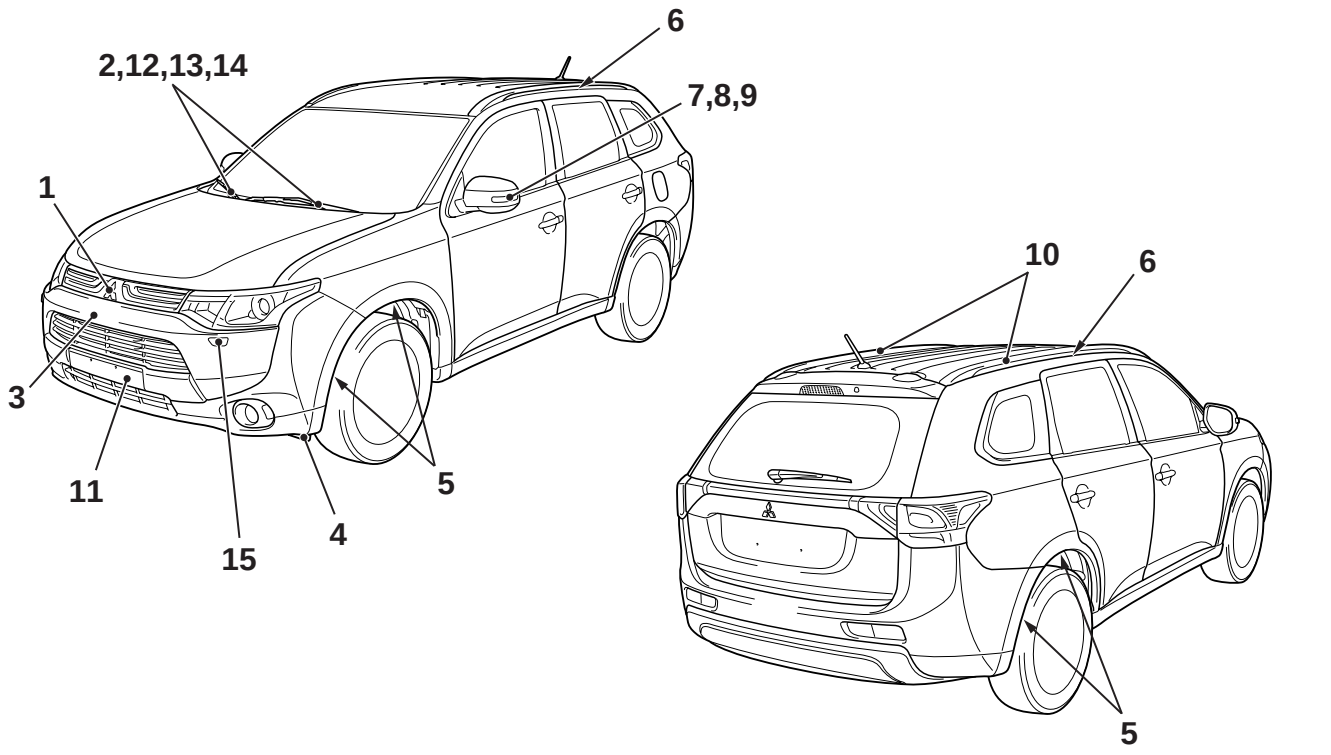
7. Electric folding remote-controlled door mirrors <Some models>
8. Heated door mirrors
9. Door mirrors with built-in side turn-signal lamps <Some models>
10 Roof rails <Optional>

BETTER PRODUCT PACKAGE

11. Front bumper to reduce the severity of an injury in an accident with pedestrians. (Refer to)
12. Vehicle speed sensitive intermittent windshield wiper system
13. Rain sensitive AUTO wiper <Optional >
14. Wiper deicer <Optional >
15.Headlamp washer <Optional>

SUPPORT RECYCLING OF RESOURCES

Aggressively uses PP (polypropylene) materials that are easy to recycle and easy to stamp material symbols on the plastic (resin) parts.



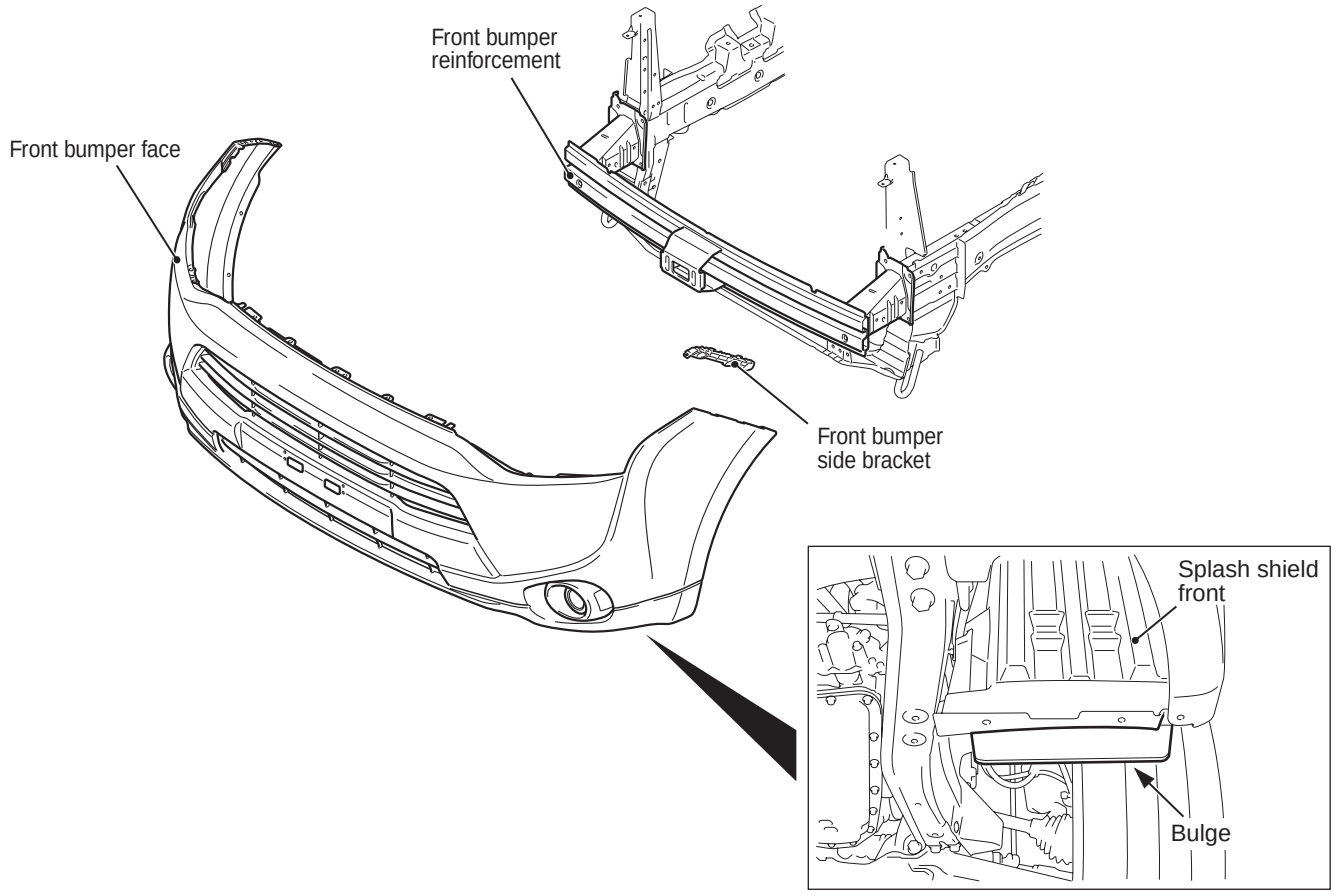
ACB05806AB

BUMPER

M2510001300566

FRONT BUMPER

CONSTRUCTION DIAGRAM



ACC00353AB

- Impact-absorbing structure

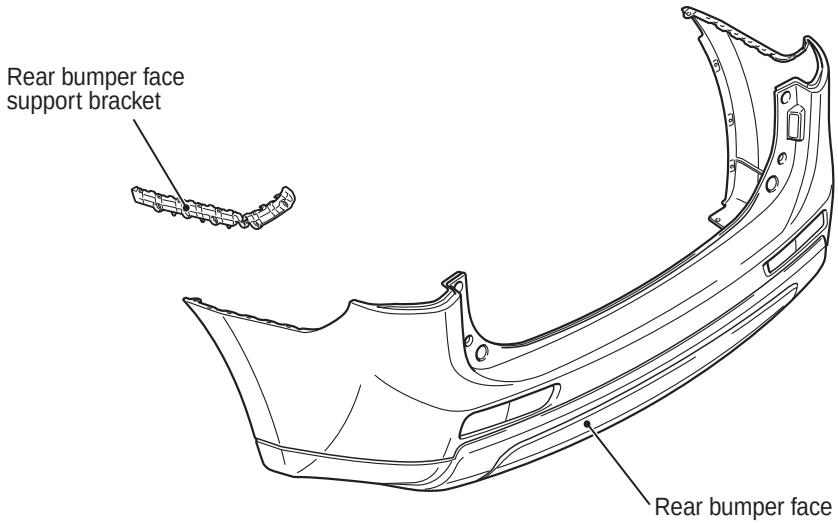
The front bumper reinforcement has been installed behind the front bumper assembly and energy-absorbing material has been adopted to reduce a risk of injury to pedestrian's legs upon a collision.

- With the front bumper reinforcement remaining on the body, the front bumper can be removed as a unit.
- front side air dam

The front side air dams have been adopted in front of the left and right tyres to suppress the airflow against the tyres.

- Resin-made front bumper side brackets have been adopted to improve the alignment with the body.

REAR BUMPER
CONSTRUCTION DIAGRAM



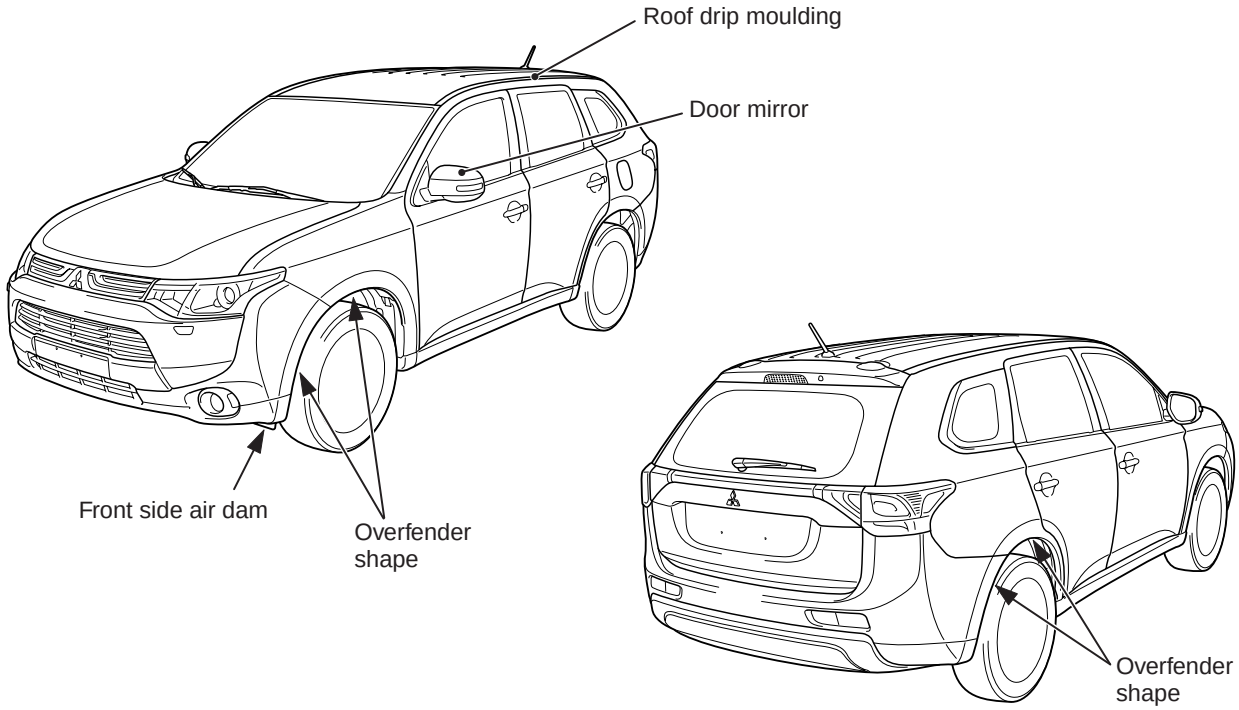
ACB05705AB

- Resin-made rear bumper face support brackets have been adopted to improve the alignment with the body.

AERO PARTS

M2510003001348

CONSTRUCTION DIAGRAM



ACC00450 AB

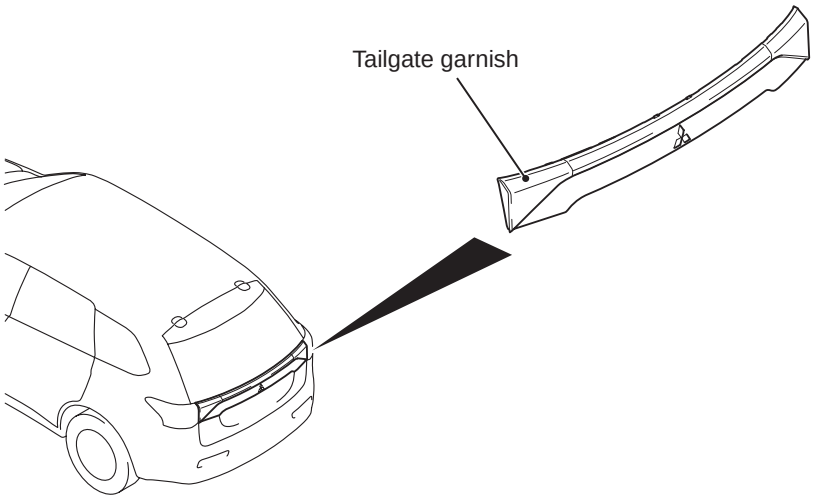
Aerodynamic performance has been improved by the optimised shape of the following parts.

- Front side air dam: Refer to .
- Overfender shape: Overfender shape from the front bumper to the fender and from the quarter panel to the rear bumper keeps the off-road vehicle image as an SUV, at the same time the optimised shape of the related parts improves aerodynamic performance.
- Roof drip moulding: Groove in the roof moulding is eliminated in order to reduce wind noise and aerodynamic drag.
- Door mirror

GARNISHES

M2510008300675

CONSTRUCTION DIAGRAM



ACB05464AB

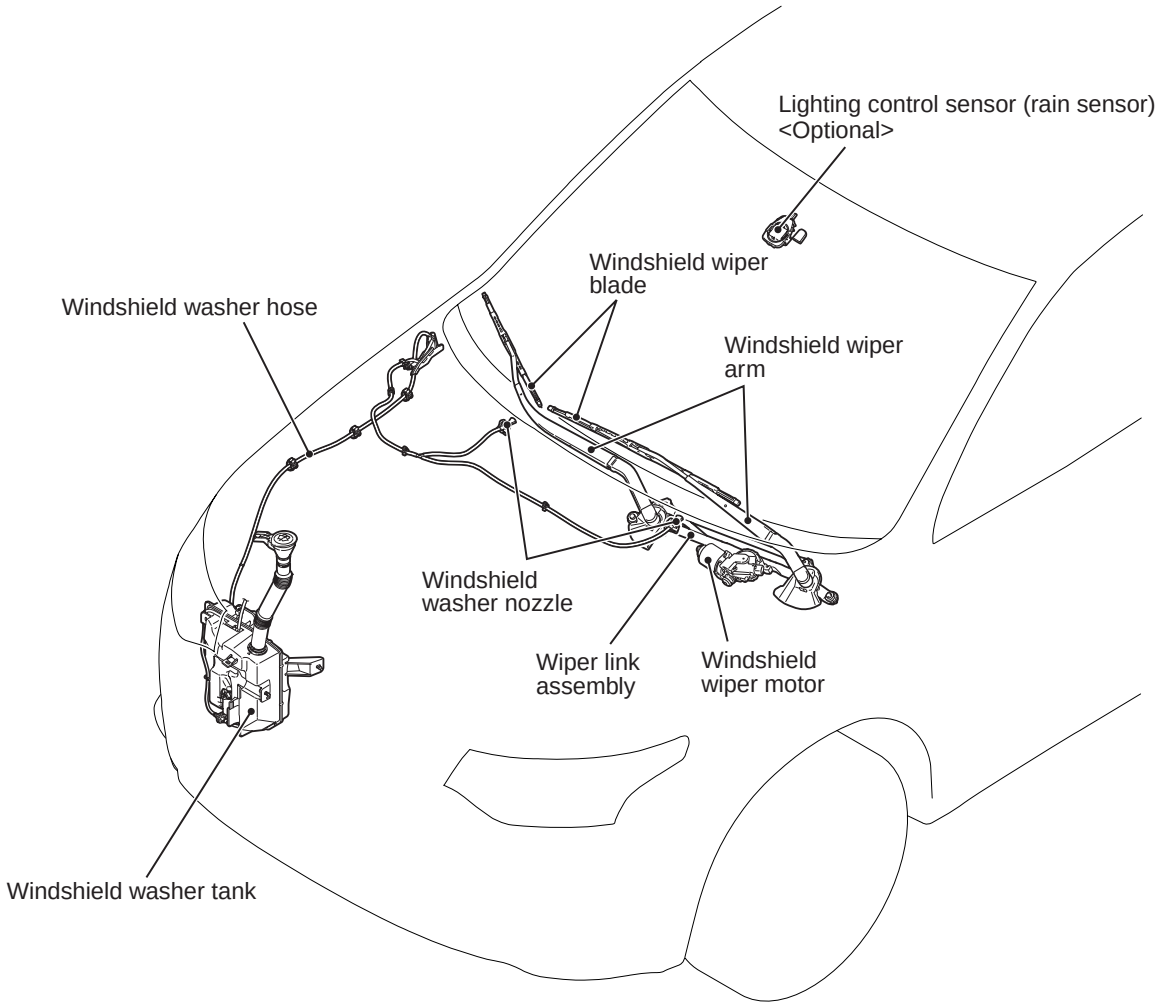
The following tailgate garnish have been installed on the body to improve the appearance and marketability.

WIPER AND WASHER

WINDSHIELD WIPER AND WASHER

M2510007001458

CONSTRUCTION DIAGRAM



ACC00345AB

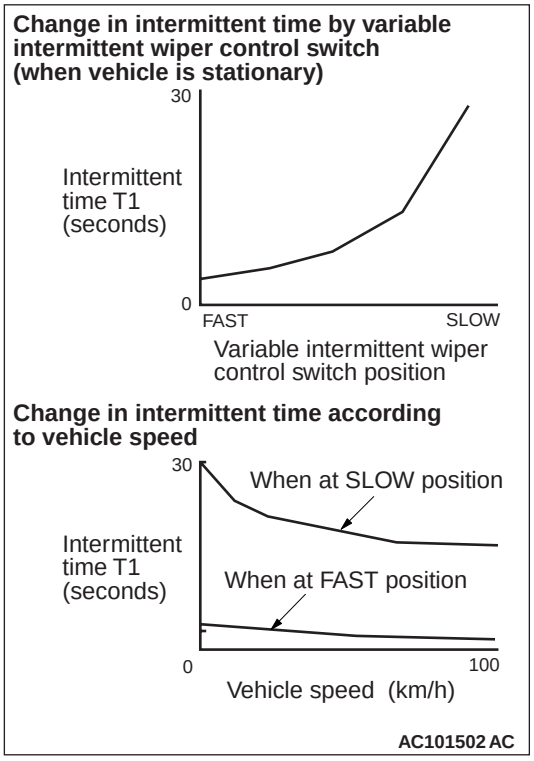
- 2-speed (low/high speed) windshield wiper has been adopted.
- The intermittent wiper features a vehicle speed-dependent variable intermittent time function*.
- For the windshield auto wiper, the rain sensitive AUTO wiper function* has been adopted.<Optional>
- Wiper motor torque has been increased to improve kinetic performance of the wiper in the snowfall. Wiper blade pressure has been increased to improve the wiping performance while driving at high speed.
- The mist wiper is turned ON by operating the mist switch in the opposite direction of the wiper switch for easy operation. The mist wiper is equipped with the function that quickly wipes raindrops away at high speed when the mist switch is ON, and when the mist switch is OFF, at low speed until the stop position is reached. When the mist switch is briefly turned ON, the wiper operates once at low speed.
- The windshield washer nozzles are located at the rear end under the hood in order to improve appearance.
- The windshield washer is a 2-nozzle and 6-jet type.
- The windshield washer nozzle with the integral check valve has been adopted to prevent the washer fluid from running down, and to improve the response to switch operation.

- The washer motor for both of a windshield washer motor and a rear washer motor has been installed to reduce the weight.
- Washer-linked wiper function* has been adopted. The washer fluid can be injected without operating the wiper. When the ignition switch is turned ON while the washer switch is ON, the washer motor operates but the wiper does not.
- The delayed finishing wipe function* has been adopted to the windshield wiper. When the wiper operation is stopped after spraying the washer fluid, the wiper operates once to wipe out the washer fluid ran down.

*NOTE: *: Using the customise function, the vehicle speed-dependent variable intermittent time function, rain sensitive AUTO wiper function, washer-linked wiper function and the delayed finishing wipe function can be selected (Refer to).*

DESCRIPTION OF CONSTRUCTION AND OPERATION

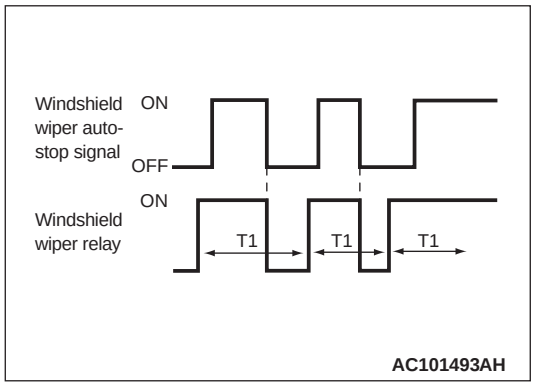
Intermittent control (Vehicle speed-dependent variable type) <Initial condition: with function>



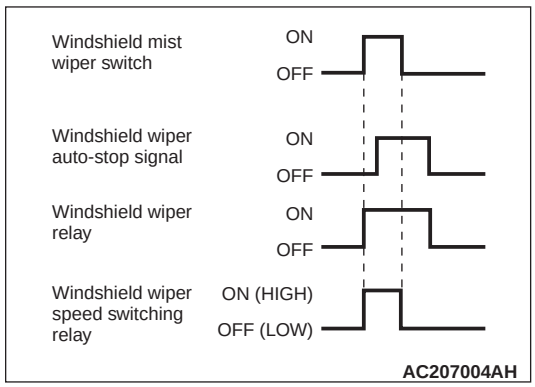
1. ETACS calculates the windshield intermittent wiper interval T1 from the position of the windshield intermittent wiper switch on the column switch and the vehicle speed signal (sent from the combination meter to ETACS via CAN communication).

NOTE: Using the customise function, the vehicle speed-dependent variable intermittent time function can be invalidated (Refer to).

2. When ETACS receives the ON signal of the windshield intermittent wiper switch, it turns the windshield wiper relay ON. When the wiper reaches the stop position, the windshield wiper auto-stop signal turns OFF, and the windshield wiper relay turns OFF. When the intermittent time T1 calculated by step 1 has elapsed after the windshield wiper relay ON, the windshield wiper relay turns ON again, and the above-mentioned operation is repeated.

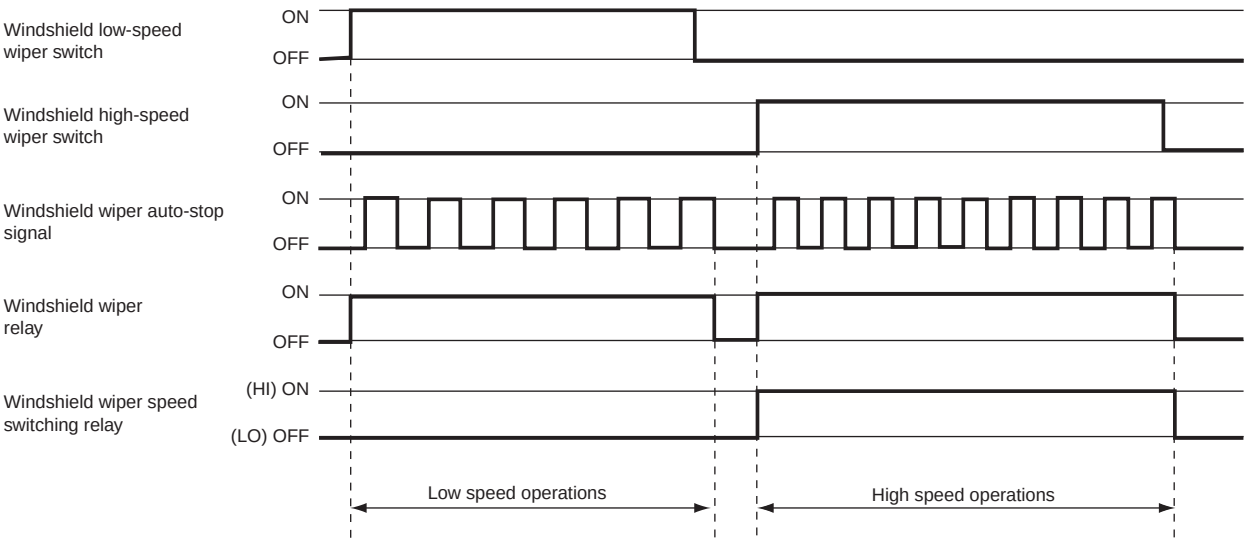


Mist wiper control



When the windshield wiper mist switch on the column switch is turned ON while the ignition switch is in ACC or ON position, the column switch turns the windshield wiper relay ON. At the same time, the wiper speed switching relay turns ON (HI). When the windshield mist wiper switch is ON, the windshield wiper operates at high speed.

Low speed wiper and high speed wiper control

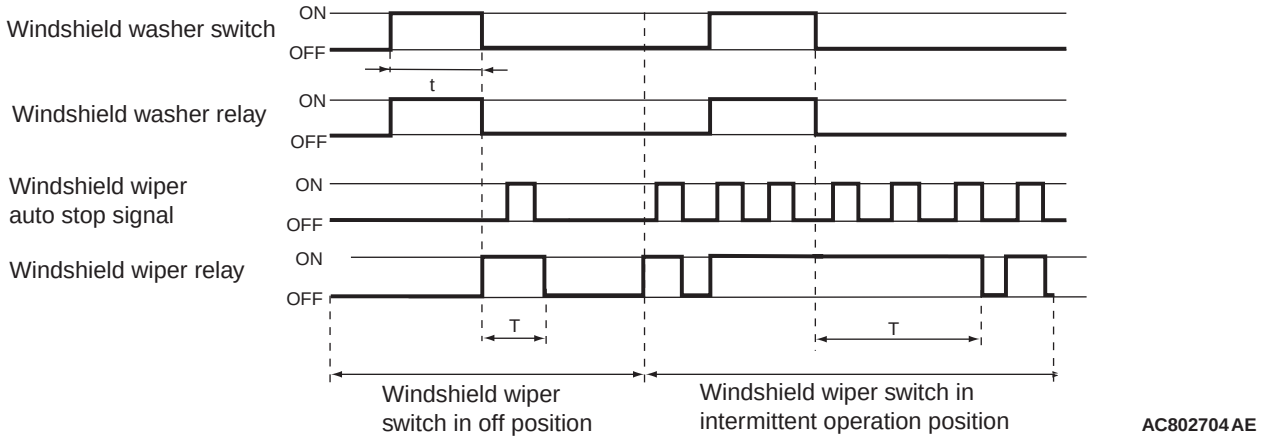


AC506610AF

When the windshield low speed wiper switch on the column switch is turned ON while the ignition switch is in ACC or ON position, the column switch turns the windshield wiper relay ON. Also, the wiper speed switching relay turns OFF (LO), and the windshield wiper operates at low speed.

When the windshield high speed wiper switch is turned ON, the windshield wiper relay turns ON. Also, the wiper speed switching relay turns ON (HI), and the windshield wiper operates at high speed.

Windshield wiper linked with washer function <Initial condition: with function>



AC802704AE

t: Less than 0.35 seconds
T: Windshield wiper operation time

Wiper switch	Washer switch ON time (t)	Windshield wiper operation time (T)
OFF position	Less than 0.35 second	0 second
	0.35 second to less than 0.5 second	1 second
	0.5 second or more	3 seconds
INT position	Less than 0.35 second	1 second
	0.35 second to less than 0.5 second	1 second
	0.5 second or more	3 seconds
AUTO position	Less than 0.35 second	1 second
	0.35 second to less than 0.5 second	0 second
	0.5 second to less than 0.75 second	1 second
	0.75 second or more	3 seconds
LO, HI, MIST position	-	3 seconds

When the windshield washer switch on the column switch is turned ON while the ignition switch is in ACC or ON position, ETACS turns the windshield washer relay ON.
When the windshield washer switch is kept ON for 0.35 second or longer, the windshield wiper relay (the wiper relay output time varies depending on the conditions. For details, see the table.) is turned ON, and the windshield wiper operates at high speed.
The windshield wiper is turned OFF with 3 seconds delay after the windshield washer switch is turned OFF.
Even when the windshield washer switch is turned ON while the windshield wiper is operating intermittently, the intermittent action starts again after the linked operation is finished.
If the ignition switch is turned to ACC position while the windshield washer switch is ON, the windshield washer relay turns ON, but the windshield wiper does not perform the linked operation. When the windshield washer switch is turned OFF and then ON, the windshield wiper starts the linked operation.

NOTE:

- *Using the customise function, the washer linked windshield wiper function can be invalidated (Refer to).*
- *Using the customise function, when the washer linked windshield wiper function is invalidated, only the washer operates. It is useful to melt ice from the frozen windshield.*

Comfort washer function <Initial condition: without function>

The table below shows the switch operations of the comfort washer.

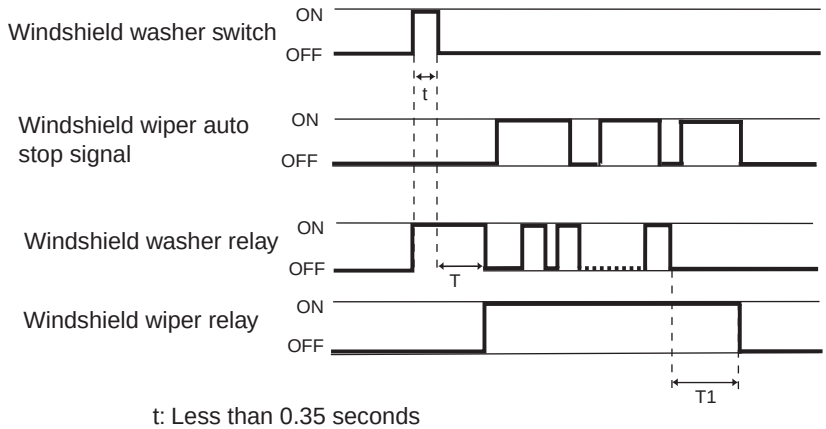
Wiper switch	Washer-linked wiper: Enable		Washer-linked wiper: Disable	
	Vehicle speed less than 130km/h	Vehicle speed 130km/h or more	Vehicle speed less than 130km/h	Vehicle speed 130km/h or more
OFF	Intermittent washer and wiping	1-second washer and wiping	1-second washer	1-second washer
INT	Intermittent washer and wiping	1-second washer and wiping	1-second washer	1-second washer
AUTO	Intermittent washer and wiping	1-second washer and wiping	Intermittent washer and wiping	1-second washer and wiping

Wiper switch	Washer-linked wiper: Enable		Washer-linked wiper: Disable	
LO	Intermittent washer and wiping	0.5-second washer	Intermittent washer and wiping	0.5-second washer
HI or MIST	1-second washer	1-second washer	1-second washer	1-second washer

NOTE:

- *The comfort washer function can be enable by the customise function.(Refer to .)*
- *When the windshield wiper switch is operated while the comfort washer function is activated, the comfort washer function will be suspended.*

Intermittent washer and wiping



t: Less than 0.35 seconds
T: 1.0 second
T1: 3.0 second

AC802531AC

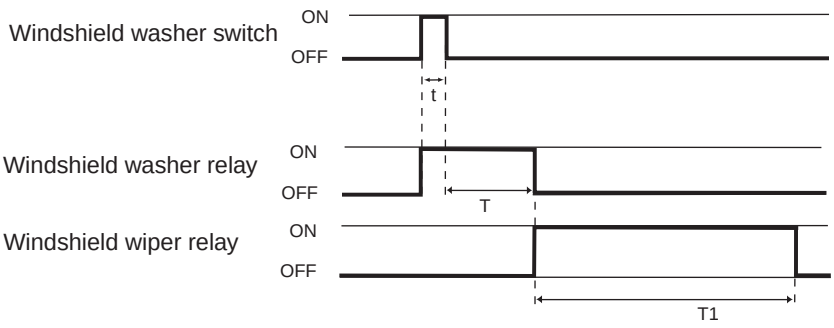
The intermittent washer and wiping operate as follows:

1. Turn on the windshield washer switch for less than 0.35 second.
2. The windshield washer operates for 0.5 seconds.
3. The windshield washer operates intermittently 4 to 6 times, and the windshield wipers operate, linked with the windshield washer operation.
4. The windshield wipers operate for 3 seconds.

NOTE:

- *If the windshield washer switch is turned ON for less than 0.35 second when the windshield washer is injecting washer fluid for 0.5 seconds and when the windshield washer is injecting washer fluid intermittently 4 to 6 times, the intermittent washer and wiping will stop.*
- *If the windshield washer switch is turned ON for less than 0.35 second when the windshield wipers are operating for 3 seconds, the windshield washer operates intermittently 4 to 6 times again.*

1-second washer and wiping



t: Less than 0.35 seconds
T: 1.0 second
T1: 3.0 second

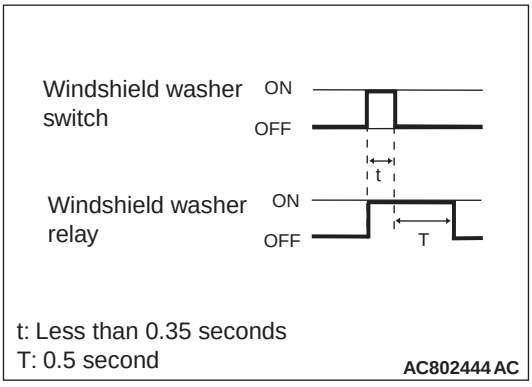
AC802442 AC

When the windshield washer switch is turned ON for less than 0.35 second, the windshield washer operates for 1 second. The windshield washer operates for 1 second, and then the windshield wipers operate for 3 seconds.

NOTE:

- *If the windshield washer switch is turned ON for less than 0.35 second when the windshield wipers are operating for 3 seconds, the windshield washer operates for 1 second again.*

0.5-second washer

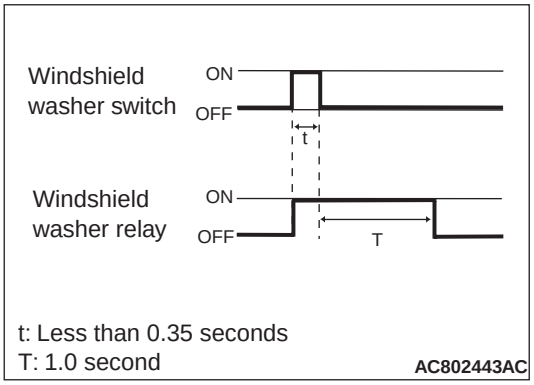


t: Less than 0.35 seconds
T: 0.5 second

AC802444 AC

When the windshield washer switch is turned ON for less than 0.35 second, the windshield washer operates for 0.5 second.

1-second washer

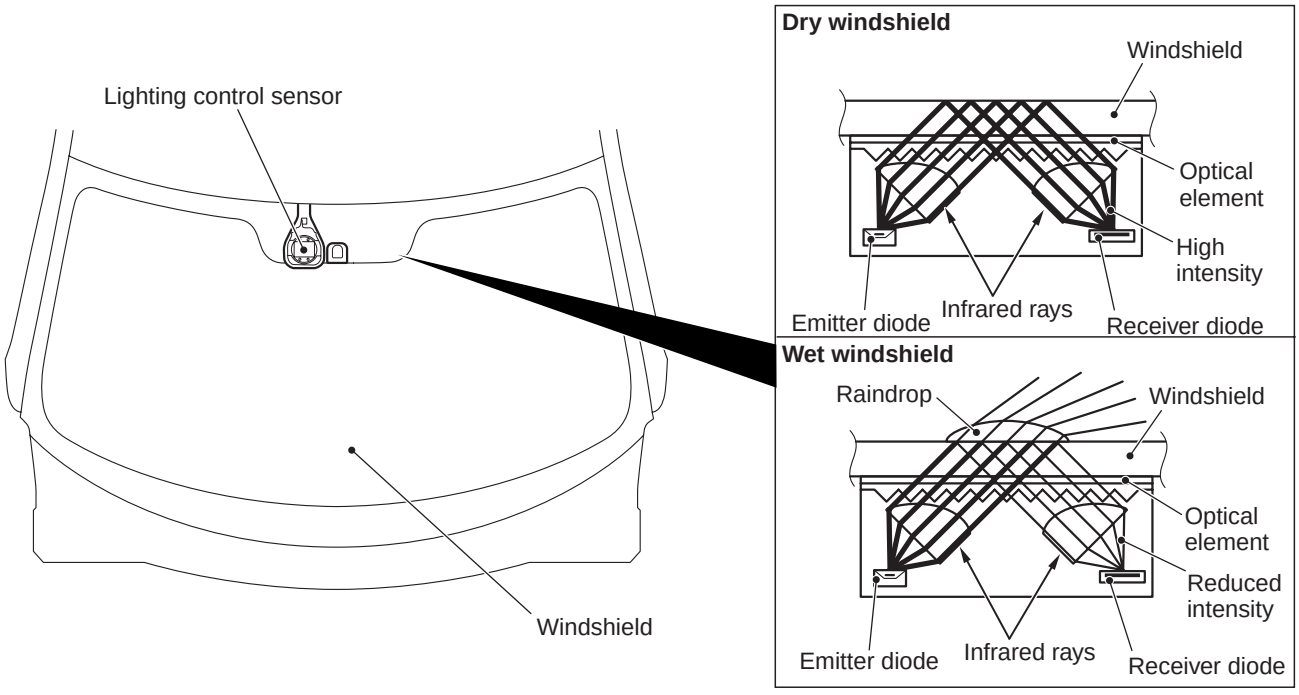


t: Less than 0.35 seconds
T: 1.0 second

AC802443AC

When the windshield washer switch is turned ON for less than 0.35 second, the windshield washer operates for 1 second.

Rain sensitive AUTO wiper function <Optional>



- Lighting control sensor (rain sensor) has been installed in the upper part of the windshield to sense the raindrops and windshield wiper can be operated when the ignition switch is at ON and wiper switch is at AUTO position.
- The lighting control sensor detects the raindrops on the windshield surface using the optical element, and it automatically switches the windshield wiper operation, depending on the amount of rainfall, to the intermittent or LO/HI operation.
- The lighting control sensor detects the raindrops using the reflections of infrared rays, and depending on the amount of rainfall, it automatically adjusts the wiping speed.
- Dry windshield: All infrared rays emitted from the emitter diode are reflected by the windshield and directed to the receiver diode as they are.
- Wet windshield: Part of the infrared rays emitted from the emitter diode are transmitted to outside of the windshield through the raindrops, and the infrared rays with reduced intensity are directed to the receiver diode.

NOTE: Using the customise function, the rain sensitive AUTO wiper function can be invalidated (Refer to).

Delayed finishing wipe function <Initial condition: with function>

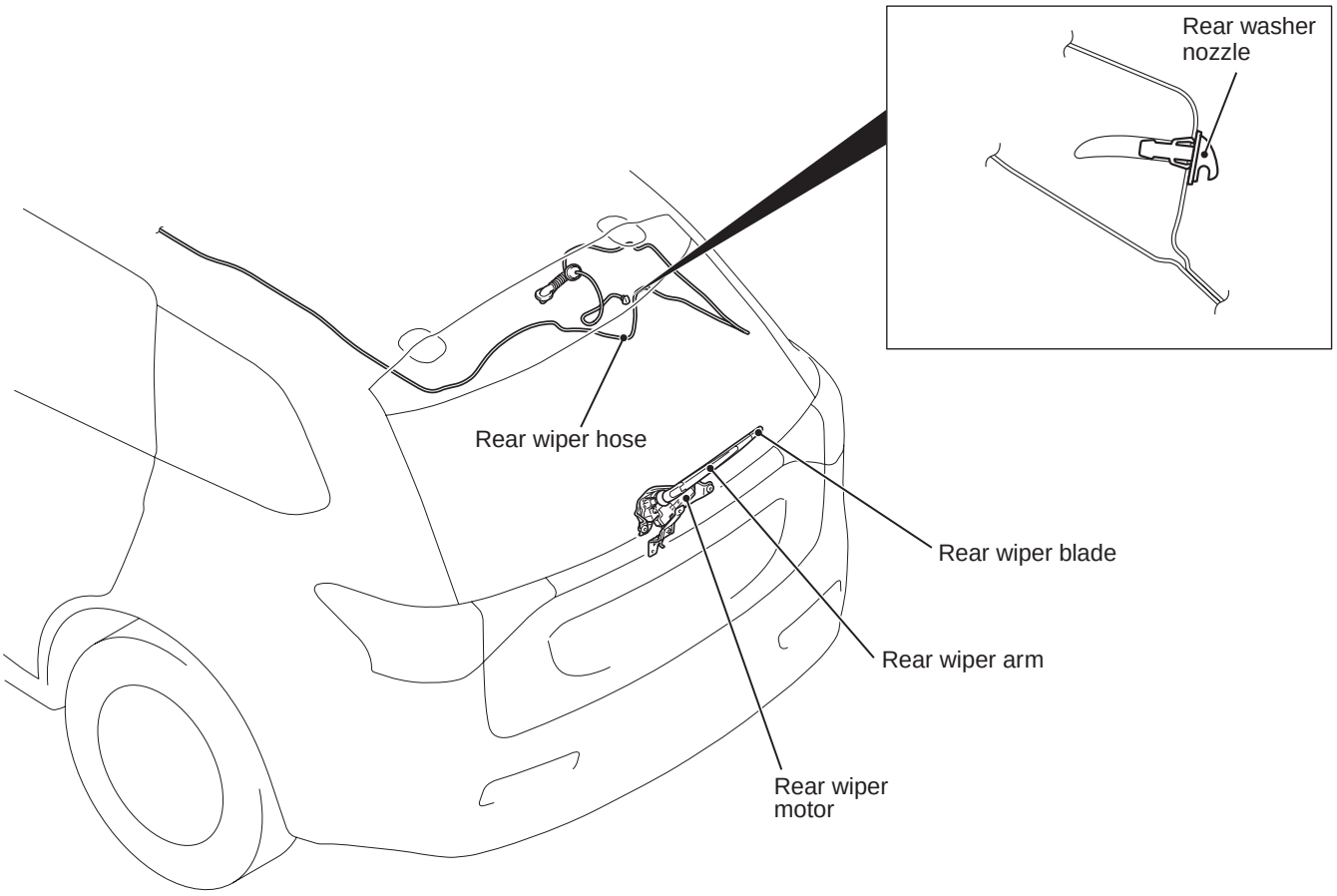
1. When the washer lever of the column switch is operated for 0.5 seconds or longer with the ignition switch in the ACC or ON position, or when the comfort washer function is enable, the washer fluid is sprayed and the wiper is operated. 6 seconds after stopping the wiper operation, the wiper operates once to wipe out the washer fluid ran down.

NOTE: Using the customise function, the delayed finishing wipe function can be invalidated (Refer to).

REAR WIPER AND WASHER

M2510008000748

CONSTRUCTION DIAGRAM



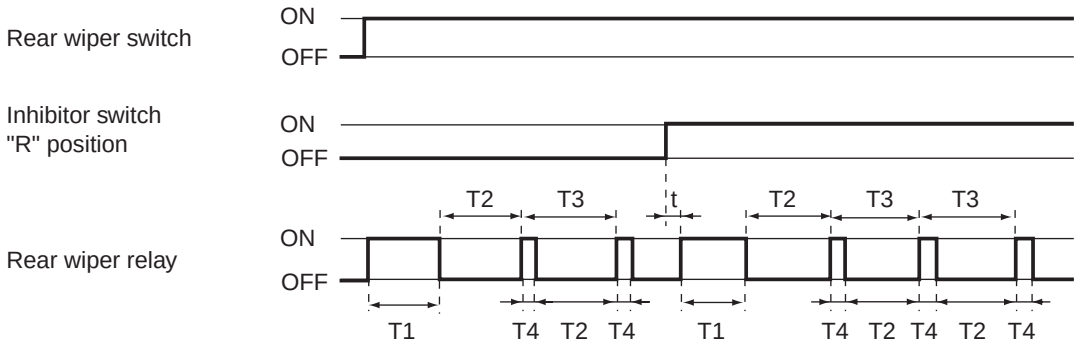
ACC00126AB

- Resin wiper arm has been adopted to achieve weight reduction and integration of the arm and blade.
- Fixed interval type intermittent wiper* has been adopted to provide a clear rear view in rainy weather.
- The washer tank is shared with the windshield washer.
- Washer-linked wiper function* has been adopted. Washer fluid can be optionally injected without operating the wiper optionally. When the ignition switch is turned ON while the washer switch is ON, the washer motor operates but the wiper does not.
- Reverse gear-linked rear wiper function (automatic rear window wiper operation with reverse gear engaged)* has been adopted. In this function, the rear wiper performs continuous low-speed operation for 3 cycles approximately 1 second after the selector lever is shifted to "R" position while the front or rear wiper switch is in the intermittent position, and then proceed with the intermittent operation.

*NOTE: *: Using the customise function, the fixed interval type intermittent wiper, reverse gear-linked rear wiper function and the washer-linked wiper function can be adjusted (Refer to).*

DESCRIPTION OF CONSTRUCTION AND OPERATION

Rear wiper control <Initial condition: Front or rear wiper switch ON>



AC207474AO

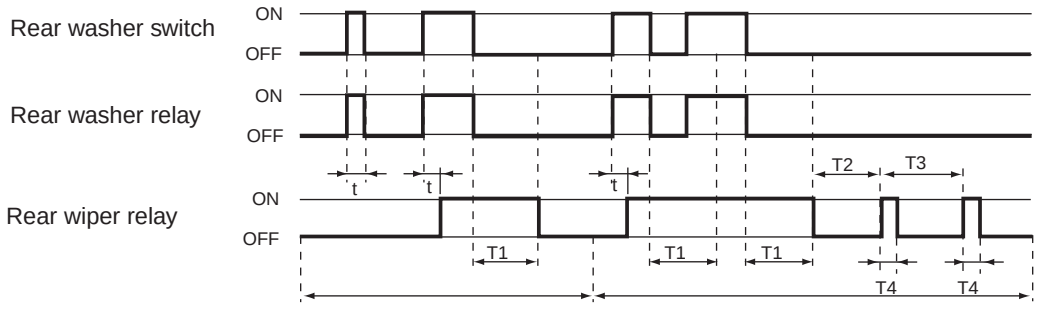
t: 1.0 second
T1: 3.0 seconds
T2: 7.4 seconds
T3: 8.0 seconds
T4: 0.6 second

When the rear wiper switch on the column switch is turned ON while the ignition switch is in ACC or ON position, ETACS turns the rear wiper relay ON for 3 seconds (for approximately 2 cycles) and operates the intermittent action in 8 seconds interval.

When the selector lever is moved to R (reverse) position during the front or rear wiper operation, the inhibitor switch R (reverse) turns ON, and 1 second after that, ETACS turns the rear wiper relay ON for 3 seconds (for approximately 3 cycles), and operates the intermittent action in 8 seconds interval again.

NOTE: Using the customise function, the operation with front/rear wiper ON can be switched to the operation with the rear wiper only ON. (Refer to .)

Washer-linked rear wiper function <Initial condition: with function>



AC507498AE

t : 0.3 second
T1 : 3 seconds
T2 : 7.4 seconds
T3 : 8 seconds
T4 : 0.6 second

When the rear washer switch on the column switch is turned ON while the ignition switch is in ACC or ON position, ETACS turns the rear washer relay ON. The rear washer relay turns ON after the rear washer switch has been ON for 0.3 seconds, then turns the rear wiper relay ON to operate the rear wiper simultaneously. When the rear washer switch is turned OFF, after 3 seconds the rear wiper is turned OFF.

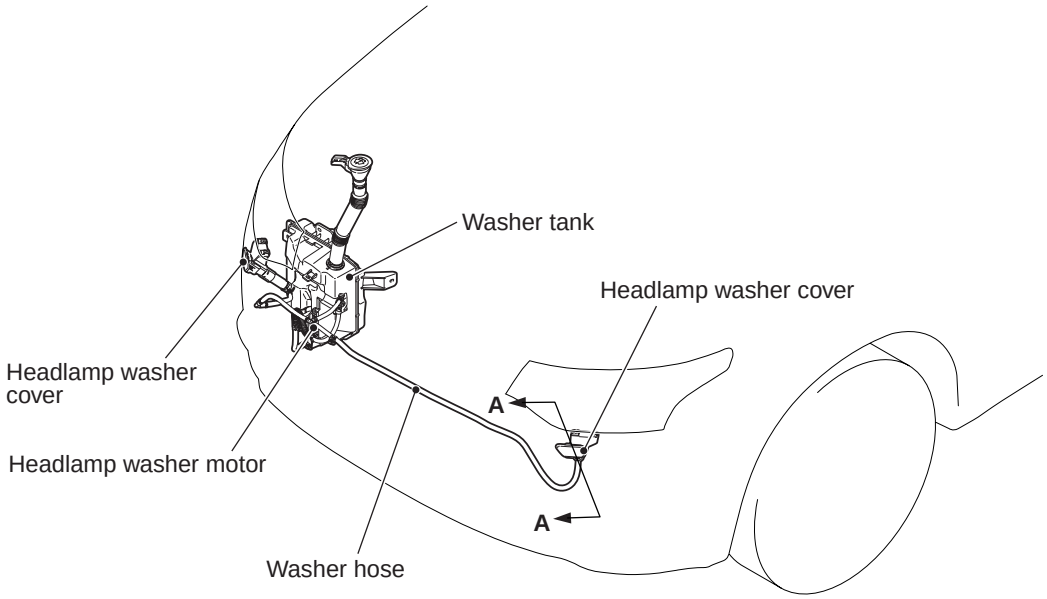
If the rear washer switch is turned ON during the rear wiper operation, 7.4 seconds after turning OFF the rear wiper relay turns OFF, the intermittent action is resumed in 8 seconds interval.

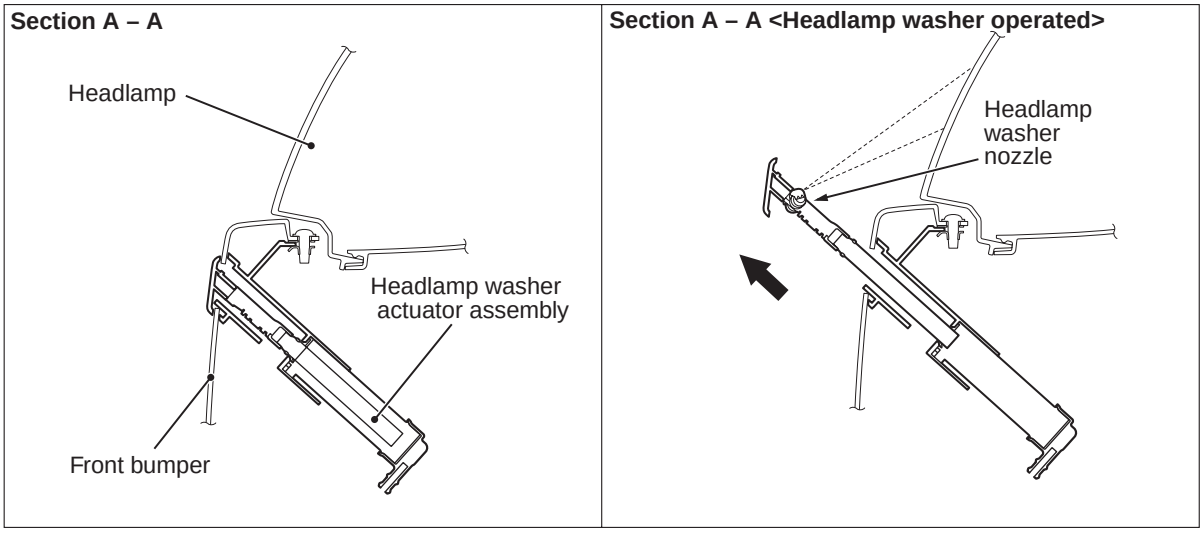
NOTE: Using the customise function, the washer linked rear wiper function can be invalidated (Refer to).

HEADLAMP WASHER <OPTIONAL>

M2510000500437

CONSTRUCTION DIAGRAM





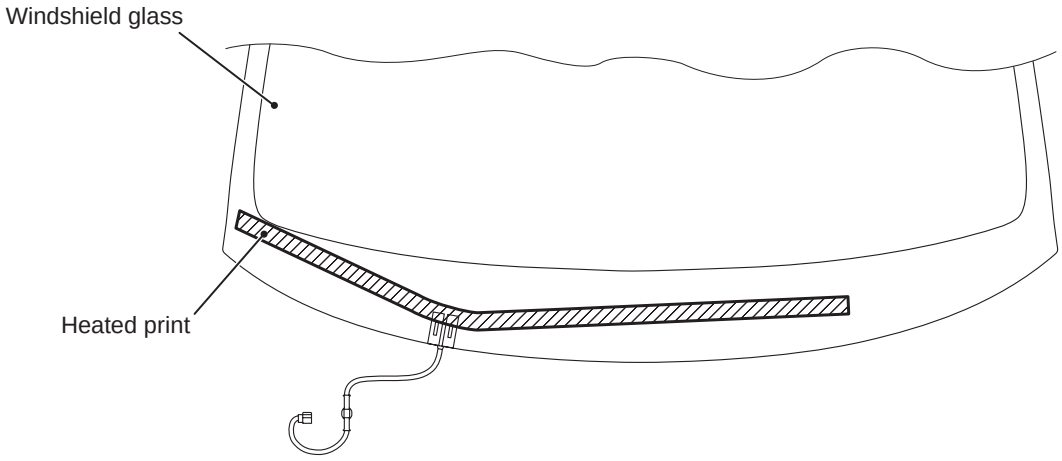
ACC00343AB

- The headlamp washer can be operated with the ignition 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 lighting 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.

WIPER DEICER <OPTIONAL>

M2510008200184

CONSTRUCTION DIAGRAM



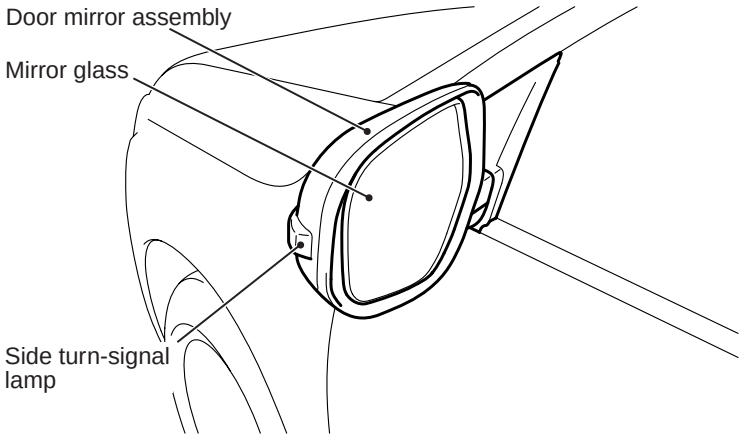
ACB05706AB

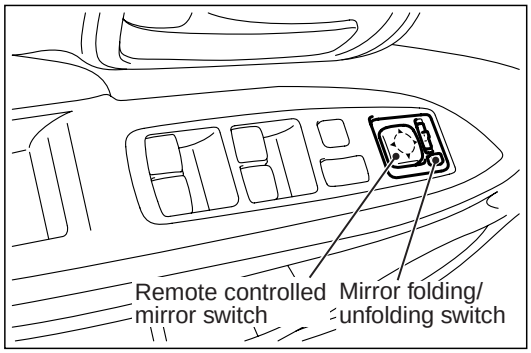
For the prevention measures for the wiper freeze-up at the stop position, the wiper deicer has been installed. The wiper is deiced by the heater element integrated in the windshield to perform its operation. In addition, the wiper deicer is linked with the rear window defogger.

OUTSIDE MIRROR

M2510008101005

CONSTRUCTION DIAGRAM





ACC00012AB

Door mirrors have the following features:

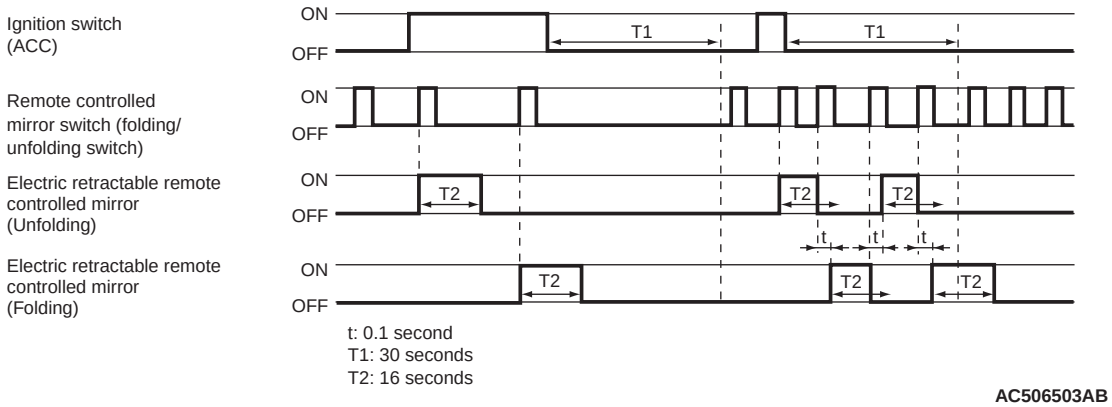
- Electric folding remote-controlled door mirrors have been adopted <Some models>.
- Heated mirrors have been adopted.
- Door mirrors with built-in side turn-signal lamps have been adopted <Some models>.
- Low air resistance door mirror shape has been introduced.

- One of the optional functions, such as the vehicle speed-dependent automatic unfolding function*, ignition switch-linked function* or keyless entry-linked function*, can be selected.

*NOTE: *: Using the customise function, the vehicle speed-dependent automatic unfolding function, ignition switch-linked function or the keyless entry-linked function can be selected (Refer to).*

DESCRIPTION OF CONSTRUCTION AND OPERATION

Electric retractable remote controlled door mirror



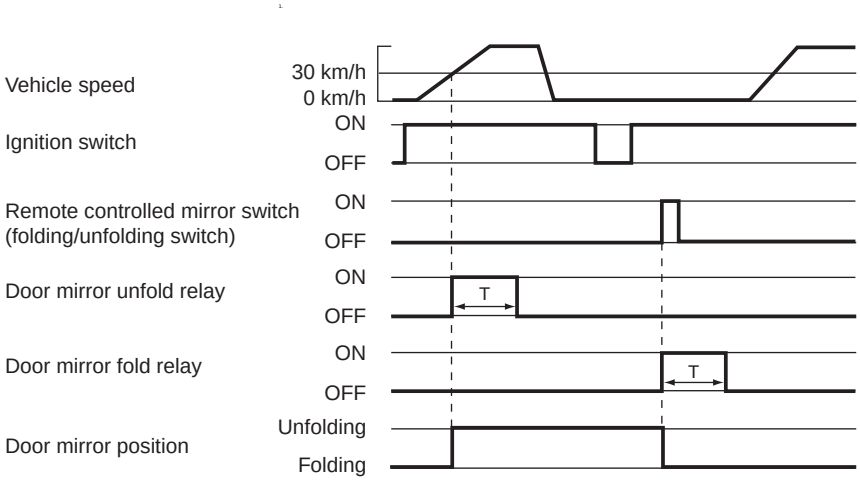
AC506503AB

When the folding/unfolding switch on the electric remote control mirror switch is turned ON while the ignition switch is in ACC or ON position, ETACS turns either of the door mirror fold relay or unfold relay ON for 16 seconds to fold or unfold the door mirrors. Even after the ignition switch is turned OFF, the door mirrors remain operable for 30 seconds.
If the folding/unfolding switch on the remote control mirror switch is turned ON while one of the door mirror relays (fold/unfold) is in operation, the other operating relay is turned ON after 0.1 second.

NOTE: Whether the door mirrors are at the folding or unfolding position is determined by ETACS according to the memory of the door mirror relay position (fold/unfold) operated previously. For this reason, if the mirrors are manually folded, they may not move when the folding/unfolding switch is pressed next time.

Automatic unfolding function <Initial condition: Keyless entry-linked folding/unfolding function)

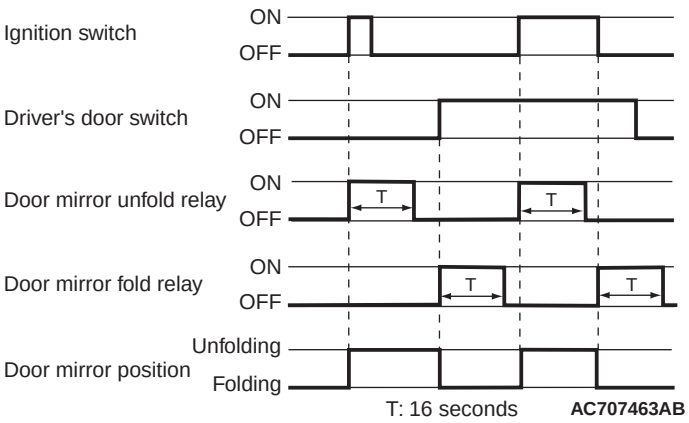
1. Vehicle speed-dependent unfolding



AC207002AB

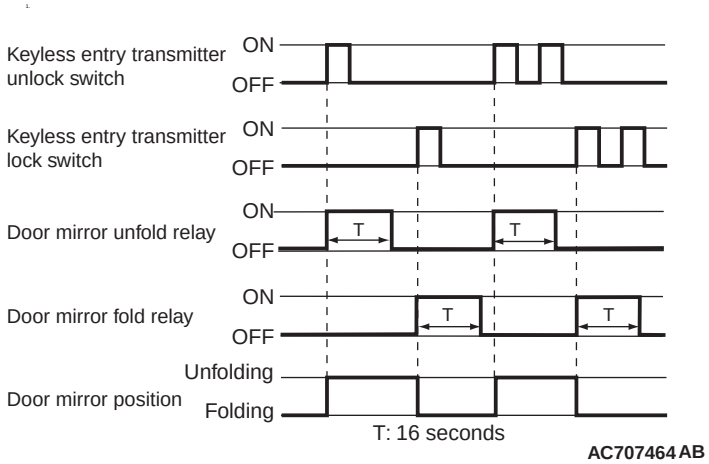
When the vehicle speed reaches 30 km/h with the ignition switch ON and the mirrors folded, ETACS turns the door mirror unfold relay (ON) for 16 seconds to unfold the door mirrors. However, the door mirrors do not return to their unfolded positions automatically if the ignition switch is turned from OFF to ON, and then the folding/unfolding switch on the remote control mirror switch is operated.

2. Ignition switch-linked folding/unfolding function



When the ignition switch is turned ON with the mirrors folded, ETACS turns the door mirror unfold relay (ON) to unfold the door mirrors. When the door is opened with the ignition switch OFF (LOCK), ETACS turns the door mirror fold relay (ON) to fold the door mirrors.

3. Keyless entry-linked folding/unfolding function



Linked with the keyless entry transmitter locking operation,* ETACS turns the door mirror fold relay ON to fold the door mirrors, and linked with the keyless entry transmitter unlocking operation, ETACS turns the door mirror unfold relay ON to unfold the door mirrors.

NOTE:

- **: For vehicles with KOS, the door mirrors are folded linked with lock operation of KOS, and unfolded linked with unlock operation.*
- *Using the customise, the functions 1, 2, and 3 can be selected or disabled (Refer to).*
- *Whether the door mirrors are at the folding or unfolding position is memorised and determined by the previously operated door mirror relay (fold/unfold). For this reason, if the mirrors are manually folded, they are not unfolded automatically.*

CUSTOMISATION FUNCTION

M2510001400820

By operating the M.U.T.-III ETACS system, the following functions can be customised. The programmed information is held even when the battery is disconnected.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Front wiper operation	Adjustment of the intermittent windshield wiper operation <vehicles without lighting control sensor>	Normal INT	Intermittent wiper interval is fixed to 4 seconds.
		Variable INT	Intermittent wiper interval is calculated only by the wiper volume control.
		Speed Sensitive	Intermittent wiper interval is calculated according to the intermittent wiper volume control and vehicle speed (initial condition).
	Adjustment of the intermittent windshield wiper operation <vehicles with lighting control sensor>	Normal INT	Intermittent wiper interval is fixed to 4 seconds.
		Variable INT	Intermittent wiper interval is calculated only by the wiper volume control.
		Speed Sensitive	Intermittent wiper interval is calculated according to the intermittent wiper volume control and vehicle speed.
		Rain Sensitive	Intermittent wiper interval is calculated according to the intermittent wiper volume control and lighting control sensor (initial condition).
Front /rear wiper washer	Disabling or enabling washer-linked wiper function	Only Washer	No function
		Washer & Wiper	With function: Without delayed finishing wipe function <Initial condition>
		With after wipe	With function: With delayed finishing wipe function

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Intelligent/Comfort washer	With/without Comfort washer function	Disable	No function (Initial condition)
		Enable	With function
Intermittent time of rear wiper	Adjustment of rear wiper interval	0 sec	No wiper interval
		4 sec	4 seconds
		8 sec	8 seconds (initial condition)
		16 sec	16 seconds
Rear wiper Low speed mode	Disabling or enabling rear wiper continuous operation	Disable	No function
		Enable	With function (initial condition)
Rear wiper (linked reverse gear)	Adjustment of automatic rear window wiper operation with reverse gear engaged	Enable(R wip.ON)	Operates only when the rear wiper switch is ON.
		Enable(R/F wip.)	Operates only when the front or rear wiper switch is ON (initial condition).
Auto fold mirror	Electric folding door mirror automatic unfolding function <vehicles with electric retractable remote controlled door mirrors>	Not Auto	No synchronised operation
		Open Vehicle SPD	Vehicle speed-dependent operation
		Open/Close by IG	Ignition switch linked operation
		OPN/CLS Keyless	Keyless entry linked operation (initial condition)

GROUP 52

INTERIOR AND SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

GROUP 52A

INTERIOR

CONTENTS

GENERAL INFORMATION

M2520000101745

Functionality, interior comfort, and safety have been emphasized, giving interior design for elegance and relaxation space. Various measures have been taken actively to protect the environment and recycle resources.

FEATURES

Quality improvement

1. Full interior trim
2. The dual-action folding mechanism of the second seat allows the driver to flip up the seat cushion and then fold the seatback with easy operation. Due to this, a lowered flat cargo space can be achieved without any compromise to seating comfort.

Usability improvement

1. Armrest (rear floor console, second seat, front door trim, rear door trim)
2. Cup holder (front floor console, second seat armrest)
3. Bottle holder
4. Tonneau cover <Vehicles with tonneau cover>
5. Luggage hook

Convenient boxes

1. Glove box
2. Card holder (glove box)
3. Seatback pocket (front seat)
4. Centre lower tray
5. Rear console tray
6. Rear floor console box
7. Rear side box (lower quarter trim RH)
8. Door pocket (front door trim, rear door trim)

Safety enhancement

1. Front and rear collision protection seat mechanism (front seat)
2. ISO-FIX child seat fixing bar (second seat outside)
3. Tether anchorage (second seat outside)
4. ELR 3-point seat belt
5. Seat belt retractor with a driver's side pre-tensioner and force limiter
6. Seat belt retractor with a passenger’s side pre-tensioner and force limiter

Consideration for the optimum driving position

1. Seat height adjustment (driver’s seat)
2. Headrestraint with height adjustment (front seat)
3. Seat slide adjustment (front seat)

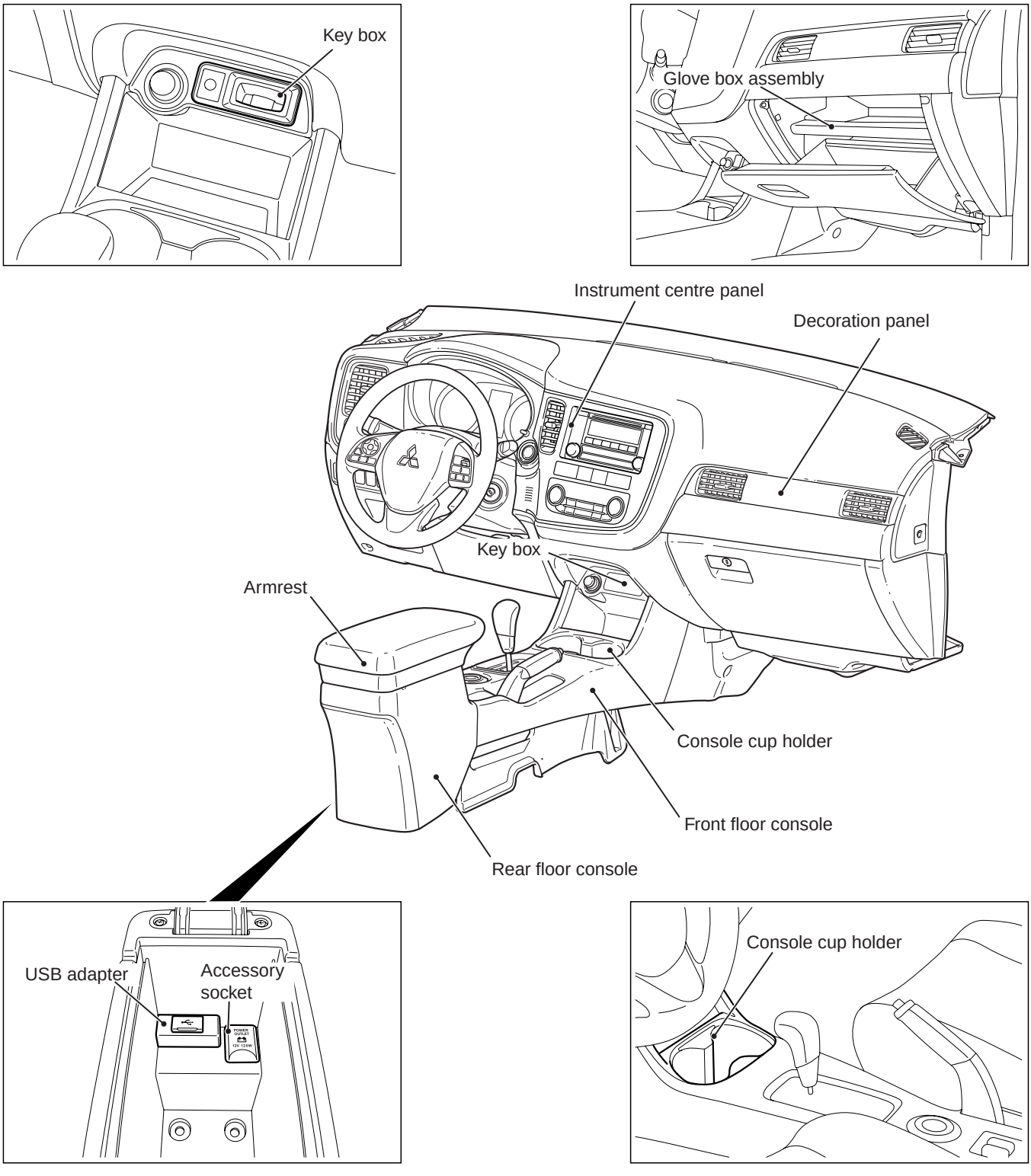
Measures for resource recycling

1. Aggressively use PP materials that are easy to recycle and easy to stamp material symbols on the plastic (resin) parts.
2. Reduction of chemical material (formaldehyde*, organic solvent)

*NOTE: *: Clear and colourless, toxic, irritating odour*

INSTRUMENT PANEL AND FLOOR CONSOLE

M2520001001462



ACC00465AB

The instrument panel offers the following features:

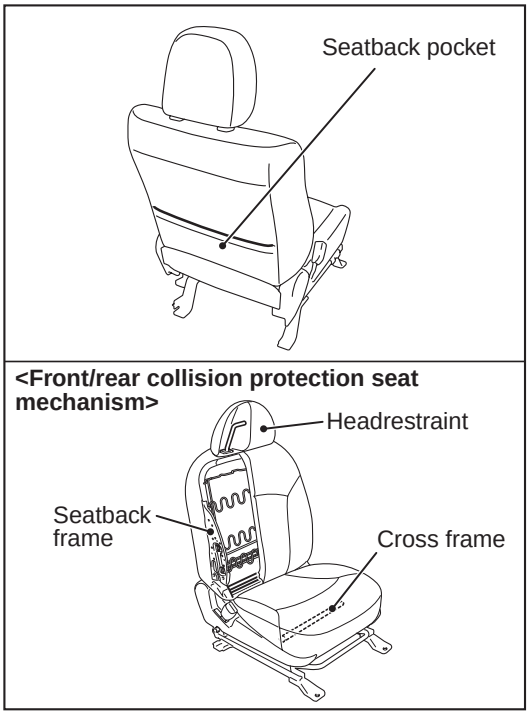
- The division unit of each part has been enlarged, also the gap and level difference between the instrument panel has been minimised to achieve the delicate quality.

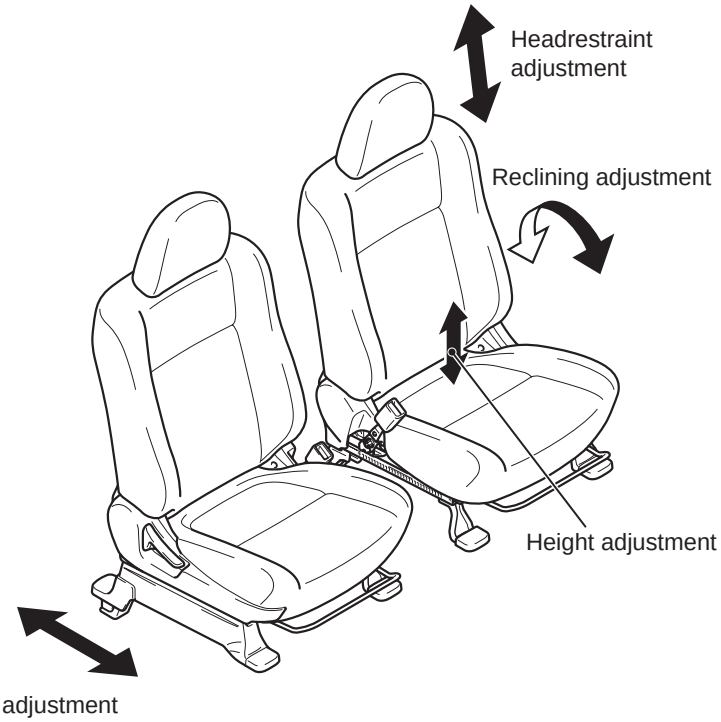
- A lamp has been added to the large-sized glove box with card holder have been installed for the improved convenience.
- To the lower part of centre panel, a centre lower tray that can store up to 6 CDs has been installed with which jumping out or dropping of stored items during abrupt start is prevented.
- A console cup holder that can store two plastic bottles or brick packs has been installed in the front floor console.
- Rear console tray that can store a mobile phone, cards, pens, and others has been installed to the rear floor console, and additionally, rear floor console box that can store 10 CDs or 7 DVDs has been installed to under the rear floor console.
- Simple and clear form by reducing separations on the instrument panel.
- Soft pads attached around the upper part, thus improving the sense of touch.
- Ergonomic layout where controls are arranged at the centre of the dash board and face towards the driver.
- High grossed black finish on the instrument centre panel.
- Decoration panels, which underline sportiness (silver carbon) or luxury (wood grain tone), are arranged optimally in the vicinity of front passenger. <wood grain tone: optional equipment>
- The engine can be started and power supply to accessories can be turned on and off in the conventional manner by inserting a keyless operation key into the key slot on the instrument panel centre lower (upper part of the front floor console).

SEAT

FRONT SEAT

M2520004001494





ACB05051AB

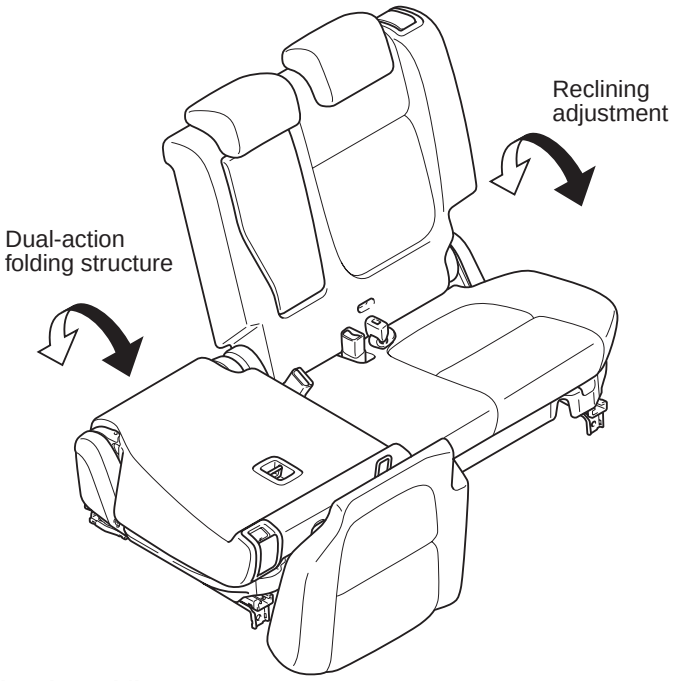
The front seat offers the following advantages:

- The seats are designed to be adjustable in the reclining and sliding directions.
- Headrestraints with a vertical adjustment mechanism have been adopted.
- The seat height adjustment function has been introduced to the driver's seat. This function raises and lowers the seat cushion together with the seatback, thus the driver's waist position in relation to the seatback is always kept constant,

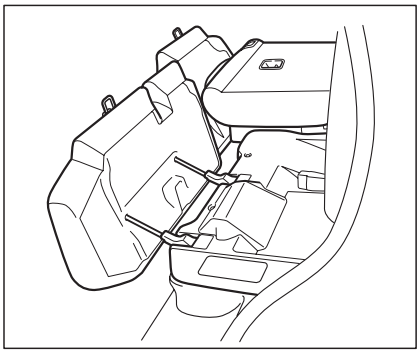
resulting in the improved riding comfort. By the height adjustment amount up to 45 mm, the more optimised driving position can be adjusted. The pump type seat height adjustment lever has been adopted for convenient use.
- For the driver's seat, 4 WAY power seat has been adopted for better convenience. <Vehicles with power seat>
- The driver's seat and passenger's seat have seatback pockets for better convenience.
- The frontal and rear-end collision protection seat structure (backward layout of seatback frame and optimisation of headrestraint position) has been adopted to enhance safety during a collision at lower vehicle speed. The cross frame has been installed below the seat cushion to reduce the forward travel distance of the passengers during a frontal collision and has enhance safety.
- Glared fabric has been newly developed based on fine and high-quality fabric has been adopted, thus offering tailor-made smoothness.
- Lateral holding of the seatback has been improved.
- The head restraints is in height than the predecessor, thus enhancing safety.
- The heated seat switch is relocated from the seat to the front floor console, thus improving ease of operation. <Vehicles with heated seats>

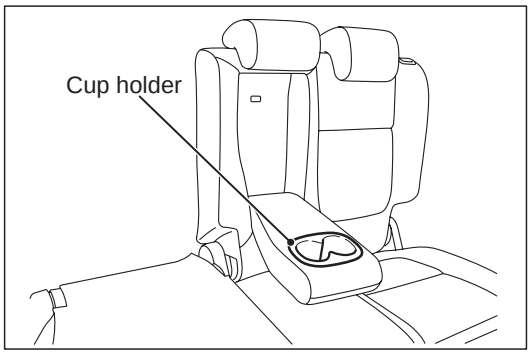
SECOND SEAT

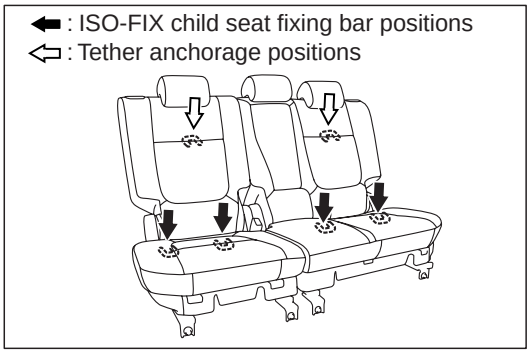
M2520005000353



<Dual-action folding structure>







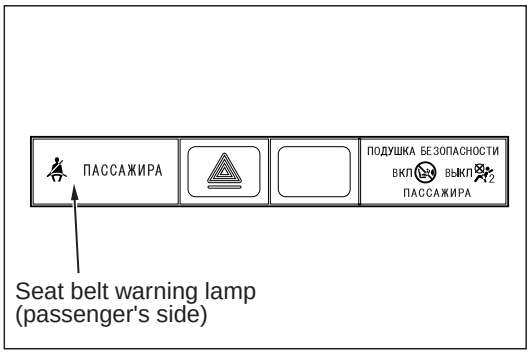
ACC00464AB

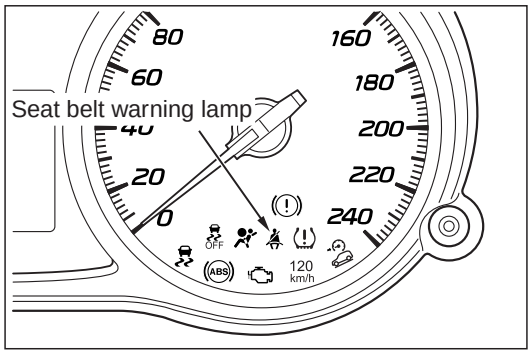
The second seats offer the following features.

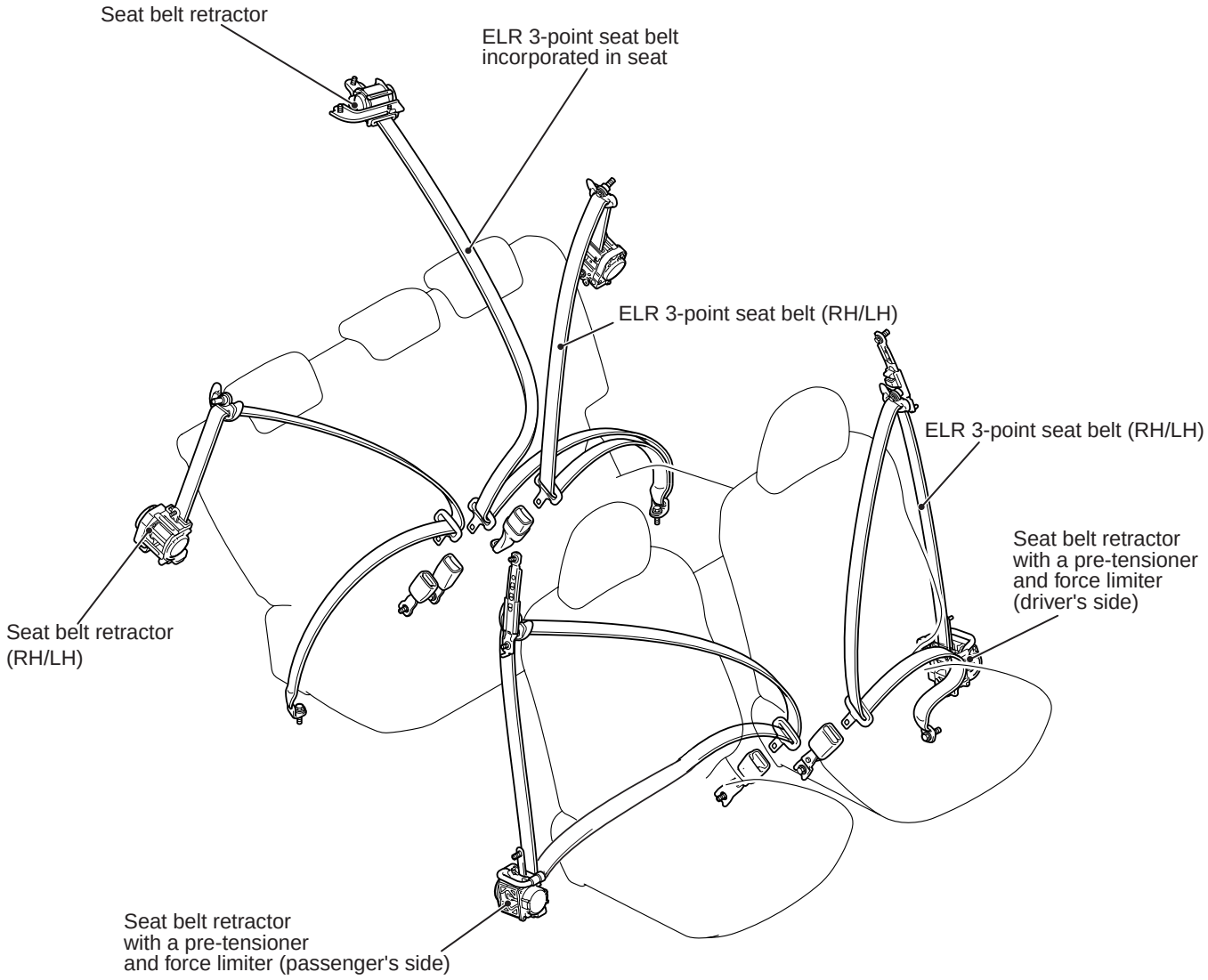
- The dual-action folding mechanism of the second seat allows to flip up the seat cushion and then fold the seatback with easy operation. Due to this, a lowered flat cargo space can be achieved without any compromise to seating comfort.
- Reclining adjustment mechanisms have been adopted to improve comfort.
- Armrests with a cup holder have been installed to improve convenience.
- Headrestraints have been installed to the second seats.
- The ISO-FIX child seat fixing bar is installed as standard on the outer seats, and the tether anchorage on outer seats, improving the versatility of child seat installation.
- The structure of the second seat frame has been optimised and the centre seat belt retractor is mounted on the roof, thus reducing its weight.

SEAT BELT

M2520010001277







ACB05996AD

The seat belts offer the following features:

<Front seat belt>

- The 3-point seat belt with ELR has been adopted together with a pre-tensioner and force limiter.

- A seat belt warning lamp has been included on the combination meter to encourage the driver to fasten the seat belt when the belt is not connected.
- A seat belt warning light has been included on the centre panel to encourage the passenger to fasten the seat belt when the belt is not connected.

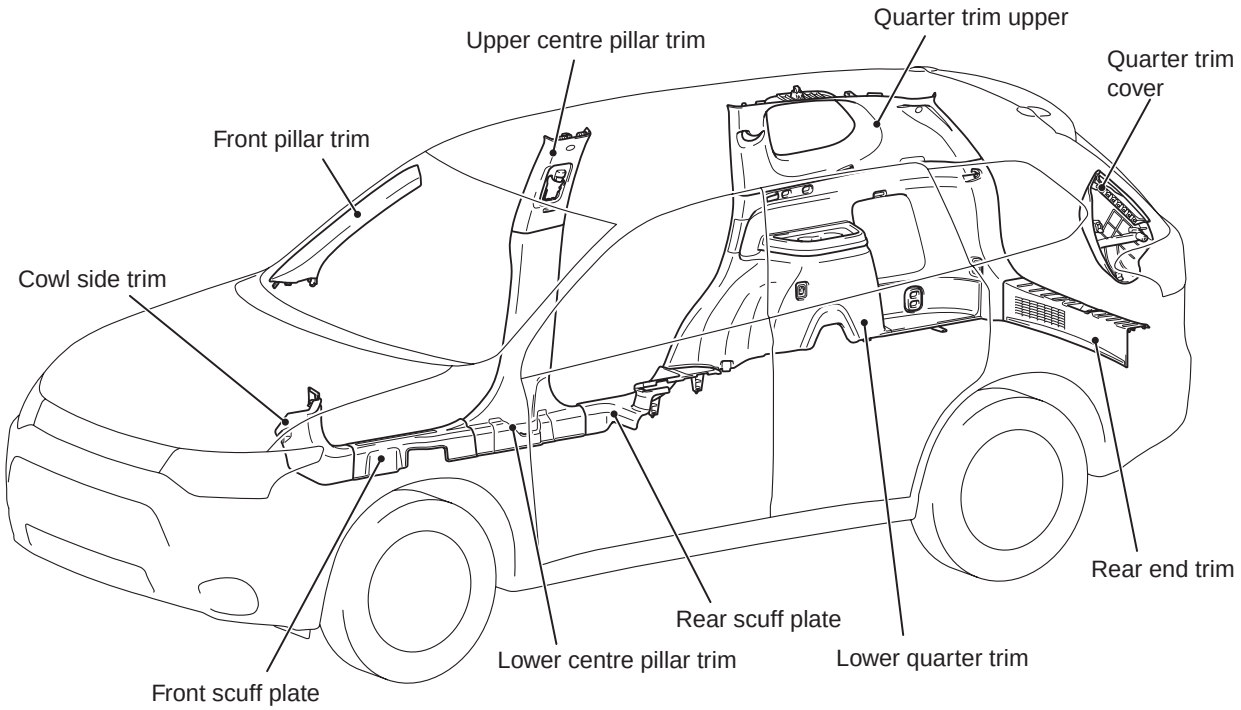
<Second seat belt>

- 3-point seat belt with ELR has been installed.
- The seat belt tongue can be inserted into the buckle easily as the self-standing buckles are used for all seating positions.

TRIMS

INTERIOR TRIM

M2520012000883



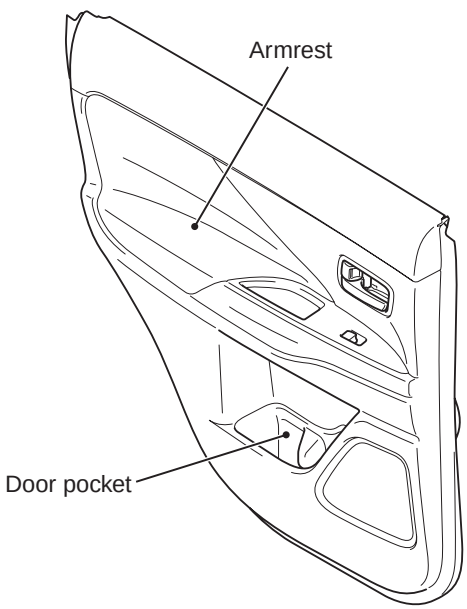
ACB05046AB

- The interior trim is a full trim to improve quality.
- The collision energy absorbing structure that is integrated with a trim has been adopted to the pillar trim. With the structure that reduces head injuries upon the secondary impact against the cabin during a collision, the safety has been improved.
- Material codes are shown on trim to facilitate recycling.

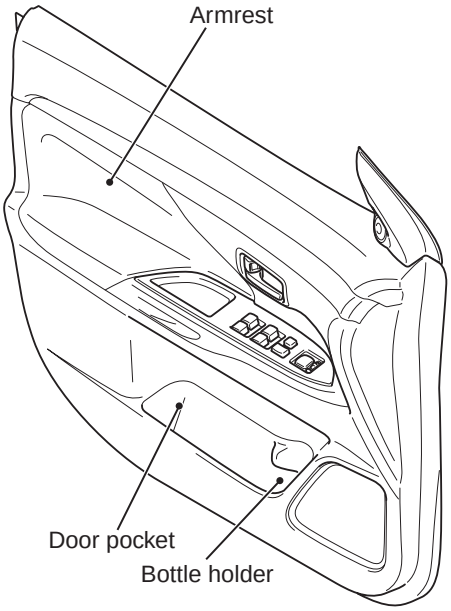
DOOR TRIM

M2520012300828

<Rear door trim>



<Front door trim>



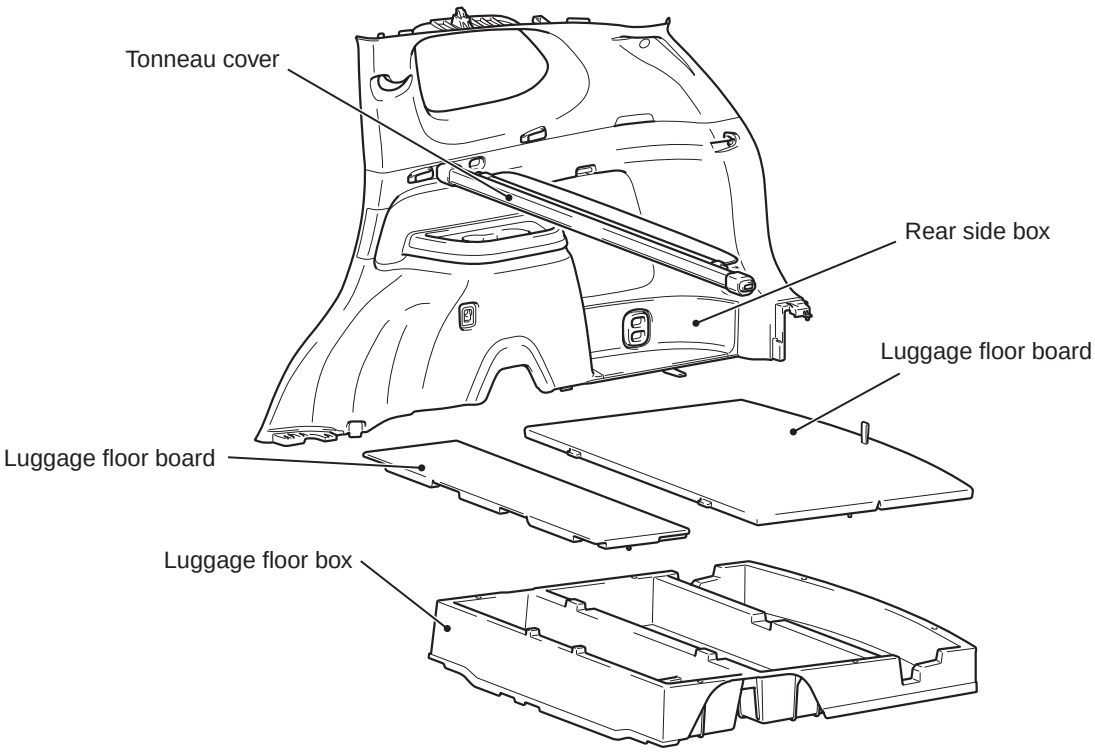
ACB05049AB

The door trims offer the following features.

- Break-proof resin material has been used for trim panels, improving safety.
- Bottle holders which can store a 500-ml plastic bottle have been installed to the front door trim and rear door trim to improve convenience. Also, the bottle holding capability has been improved to accommodate bottles with shapes that are difficult to keep upright.
- Door pockets have been installed to the front and rear door trim panels. The front door pockets have a large capacity that can hold A4-size maps.
- For the armrests, the energy absorbing structure has been adopted which reduces the mid section injuries to passengers by collapsing. Also, with one-piece forming of the cloth with a soft layer added, the quality has been improved.
- Soft pads are attached to the front door trim upper panels.
- Two types of decoration panels on the instrument panel passenger side and the front door trim provide a continuous appearance. A luxurious but moderate wood decoration panel is available for high grade models. Carbon silver decoration panel underlining sporty appearance quality
- To prevent your fingers from being slipped off during door closing, the pull handle recess has been modified.
- To accommodate various types of bottles, the bottle holders are larger but clear in design.

LUGGAGE ROOM

M2520013000422

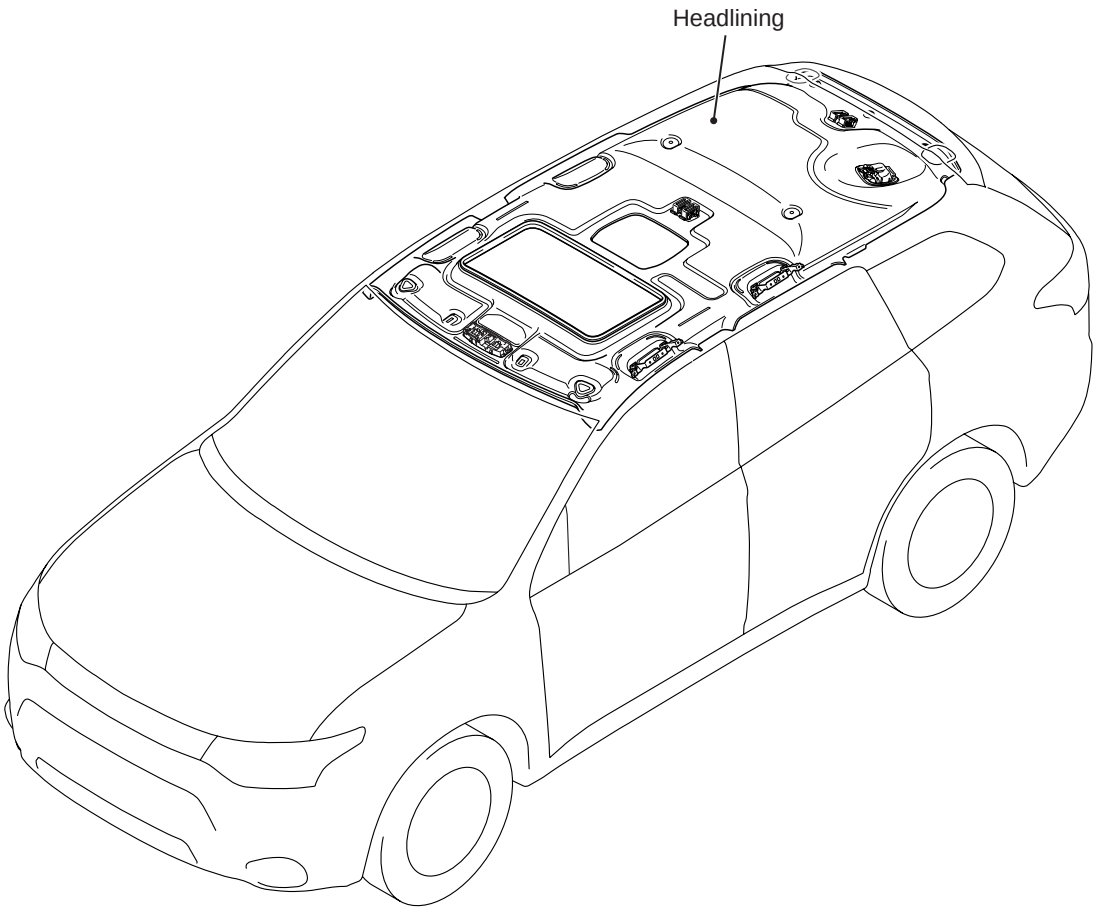


ACC00099AB

- The rear side box has been equipped to improve usability.
- Luggage floor box has been equipped to the luggage room floor to improve usability.
- Adding a luggage floor box allows virtually flat flooring from the second seat to the rear end. The customer can load and unload even long object much easier.
- The luggage floor box is approx. 100 cm long, approx. 100 cm wide and approx. 15 cm deep (total capacity: approx. 68 litre). It can accommodate the tonneau cover or a flat tyre repair kit tidily by partitions.
- The luggage floor board is divided into two pieces via hinges. This structure allows the driver to gain access to the luggage floor box by opening a respective separate lid only even when large object is being stowed.
- The rear side box between the quarter trim and the luggage floor box is useful for stowing a small object. The customer can accommodate soft objects such as plastic bags in the rear side box. Furthermore, the customer can take out them easily as the box has no lid.

HEADLINING

M2520014000663



ACB05042 AB

Interior design with safe material has been adopted, achieving more safe and comfortable interior.

- Headlining which absorbs and dissolves chemical substances has been adopted. This headlining efficiently absorbs and dissolves a smoking smell, a life-smell, and formaldehyde*.
- Chemical substances such as formaldehyde and organic solvent generated from the interior parts have been minimised by the refined material and method, improving amenity.

*NOTE: *: Clear and colourless, toxic, irritating odour*

GROUP 52B

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

GENERAL INFORMATION

M2521000102031

- 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 SRS knee airbag, the SRS side airbags or the SRS curtain airbags have been installed as standard or optional 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 SRS 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 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.
- The seat belt pre-tensioner is activated simultaneously with the deployment of driver's and passenger's (front) air bags in 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 driver'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.

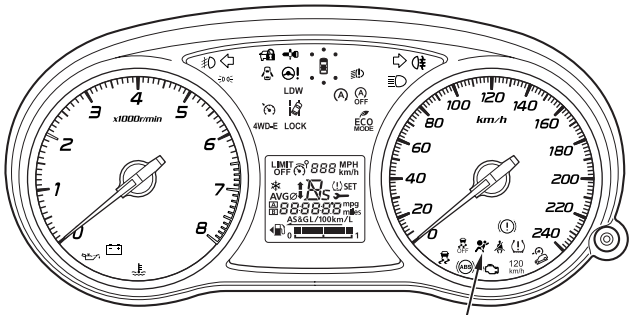
⚠ CAUTION

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)*

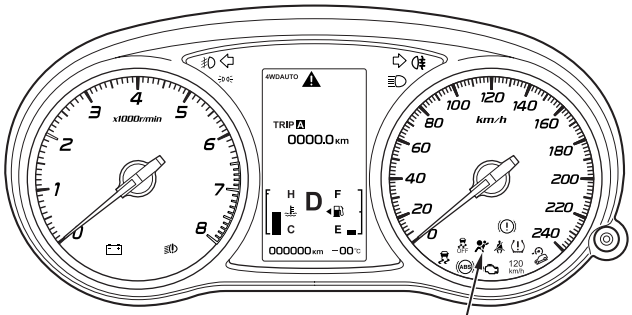
CONSTRUCTION DIAGRAM

<Standard meter>

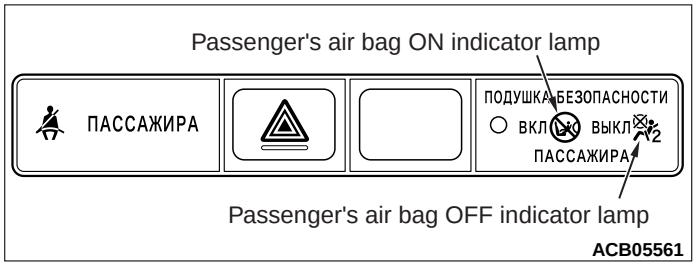


ACB05440

<High contrast meter>



ACB05441



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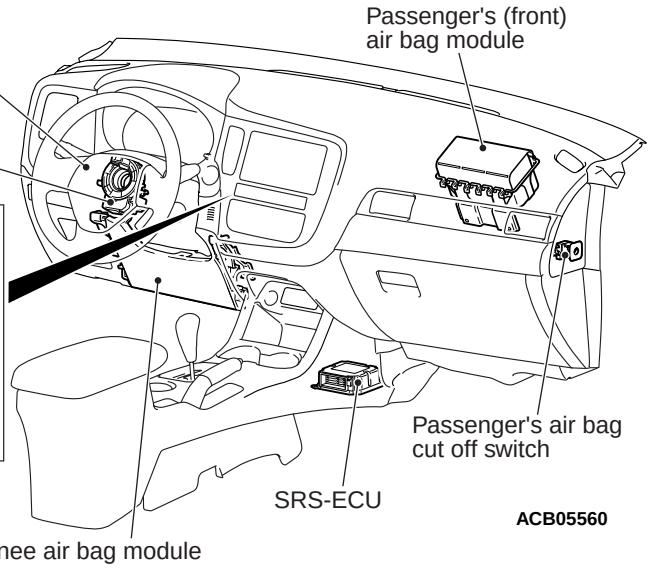

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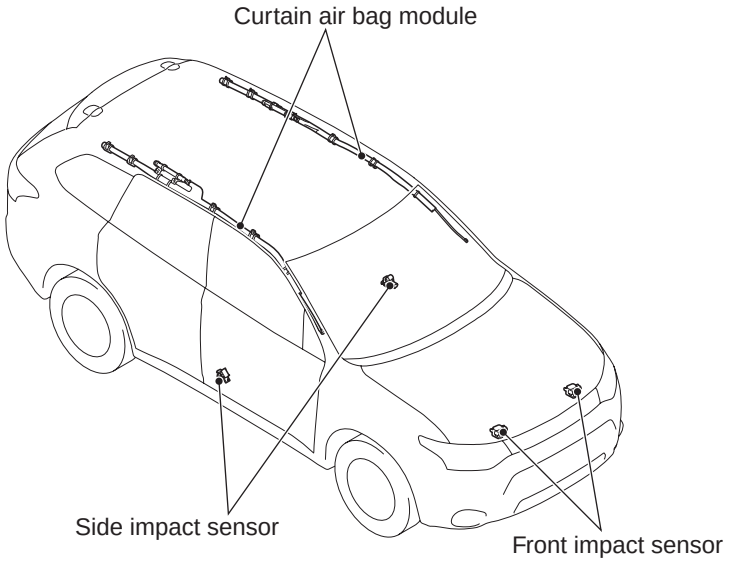

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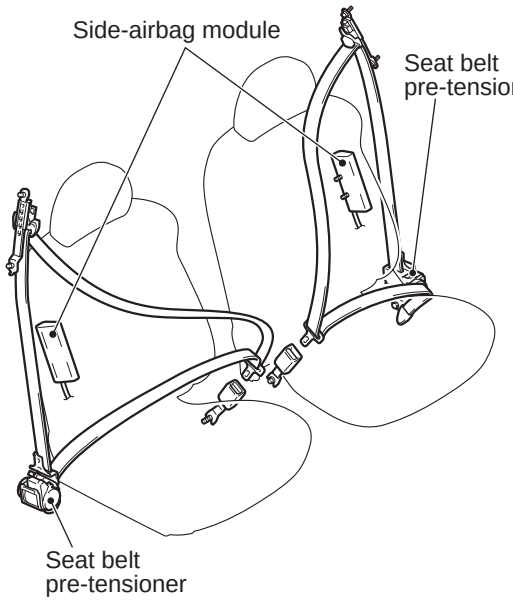
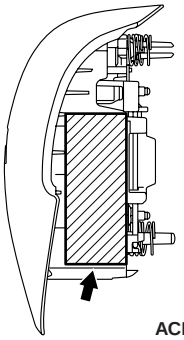


ACC00250AB

CAUTION LABELS

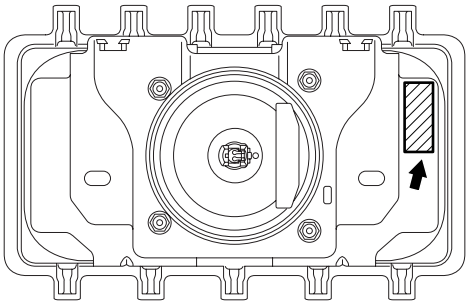
The labels indicating the precautions for handling and maintenance of SRS air bags and seat belt with pre-tensioner are attached to the locations shown in the figure. If the label is damaged or is dirty, replace with the new label.

Driver's air bag module



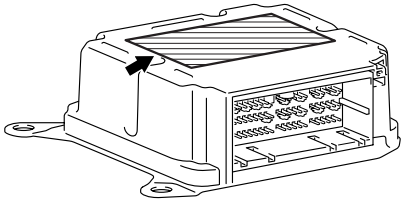
ACB03681

Passenger's (front) air bag module



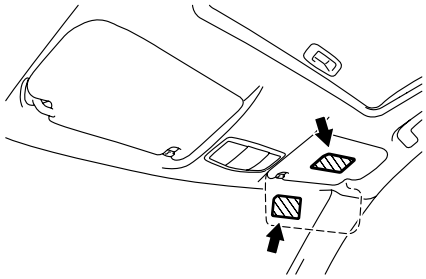
ACB05535

SRS-ECU

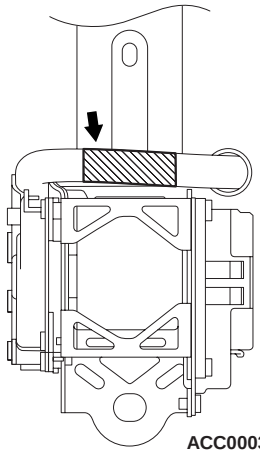


ACB05614

Sunvisor ⁎



Seat belt pre-tensioner (right and left)

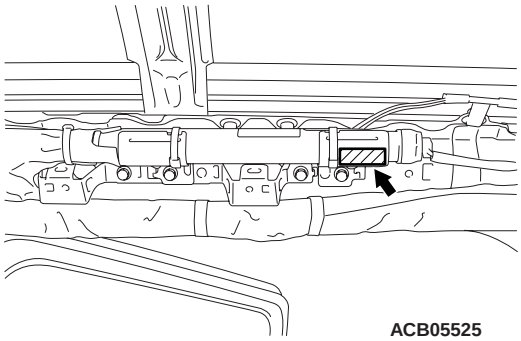


ACC00035

Side-airbag module (right and left)

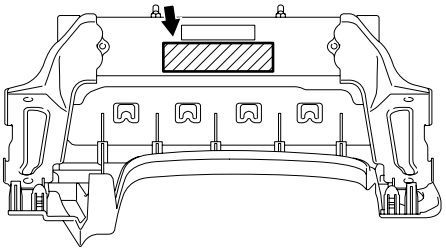
AC506241

Curtain air bag module (right and left)



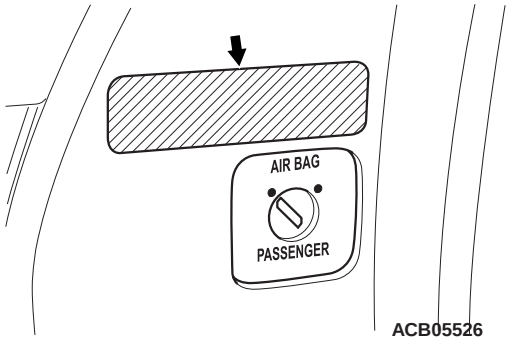
ACB05525

Knee air bag module



ACB05536

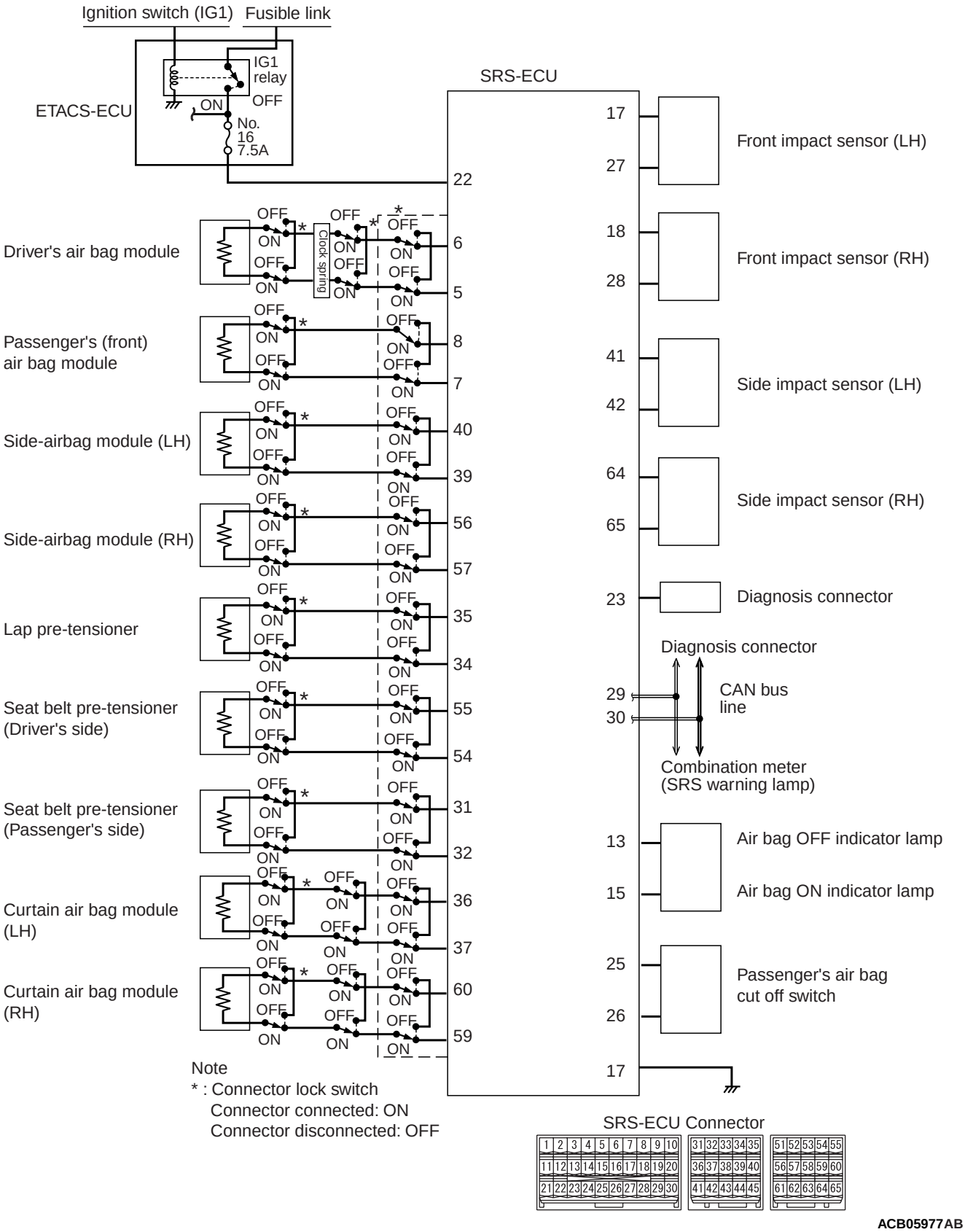
Passenger's air bag cut off switch



ACB05526

ACC00073AB

SRS SYSTEM CIRCUIT DIAGRAM



ACB05977AB

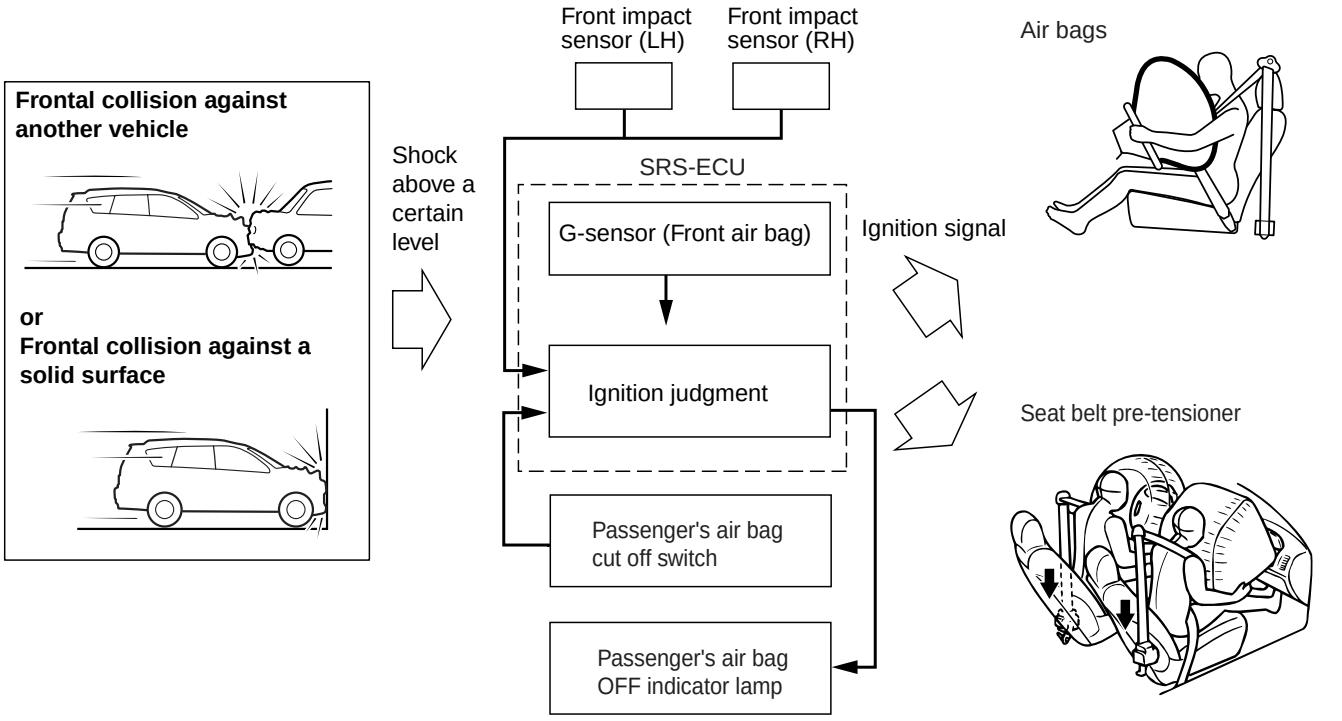
Number in system circuit diagram	Circuit name	Universal harness Wire size and colour
1	Driver’s knee air bag (squib) (-)	L
2	Driver’s knee air bag (squib) (+)	R
5	Driver's air bag squib (-)	GR
6	Driver's air bag squib (+)	W-B
7	Passenger's (front) air bag squib (+)	P
8	Passenger's (front) air bag squib (-)	LG
13	Passenger’s air bag OFF indicator lamp	V
15	Passenger's air bag ON indicator lamp	BR
17	Left-side front impact sensor (+)	W
18	Right-side front impact sensor (+)	G
22	Ignition switch (IG1) power supply (fuse No. 16)	Y
23	Diagnosis connector	B-W
24	Earth	B
25	Passenger's air bag cut off switch (-)	B-L
26	Passenger's air bag cut off switch (+)	GR-G
27	Left-side front impact sensor (-)	R
28	Right-side front impact sensor (-)	Y
29	CAN-C_L	L
30	CAN-C_H	G
31	Passenger's seat belt pre-tensioner squib (+)	W-B
32	Passenger's seat belt pre-tensioner squib (-)	B-W
34	Passenger's seat belt lap pre-tensioner squib (-)	G
35	Passenger's seat belt lap pre-tensioner squib (+)	R
36	Left-side curtain air bag squib (+)	Y
37	Left-side curtain air bag squib (-)	BR
39	Left-side side-airbag squib (-)	P
40	Left-side side-airbag squib (+)	V
41	Left-side side impact sensor (+)	W
42	Left-side side impact sensor (-)	B
54	Driver's seat belt pre-tensioner squib (-)	Y
55	Driver's seat belt pre-tensioner squib (+)	BR
56	Right-side side-airbag squib (+)	L
57	Right-side side-airbag squib (-)	GR
59	Right-side curtain air bag squib (-)	G
60	Right-side curtain air bag squib (+)	R
64	Right-side side impact sensor (-)	P
65	Right-side side impact sensor (+)	V

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

SYSTEM OPERATION

DUAL STAGE AIR BAGS AND SEAT BELT PRE-TENSIONER

M2521000700781

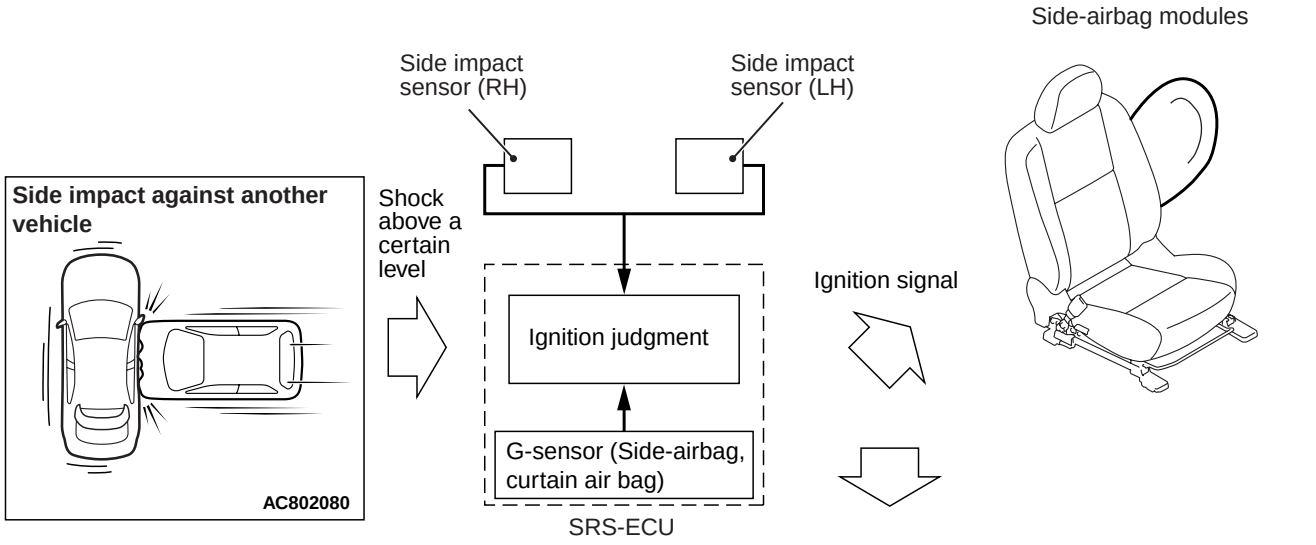


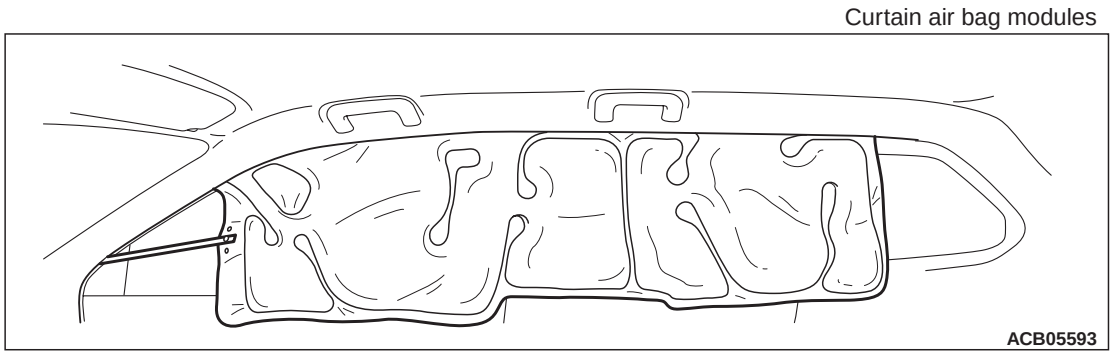
ACC00043AB

SRS-ECU uses data of the front impact sensor (in engine compartment) and G-sensor (in SRS-ECU) to calculate collision severity during frontal collision. SRS-ECU judges necessity of air bag based on the calculated collision severity. In addition, the SRS-ECU also judges the operation of seat belt pre-tensioner after calculating collision severity. Alternatively, when the passenger's air bag cut off switch is set to the air bag off position, the SRS-ECU illuminates the passenger's air bag OFF indicator lamp by disabling the deployment of passenger's (front) air bag.

SIDE AND CURTAIN AIR BAGS

M2521000800573





ACC00075AB

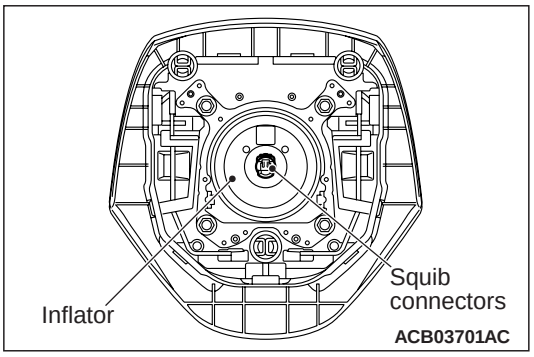
SRS-ECU uses data of the side impact sensor and G-sensor (in SRS-ECU) to calculate collision severity, during side collision. SRS-ECU judges necessity of side-airbag and curtain air bag based on the calculated collision severity.

SYSTEM CONSTRUCTION

DRIVER'S AIR BAG MODULE

M2521002000766

For items other than below, refer to GROUP 37 - Steering Wheel .



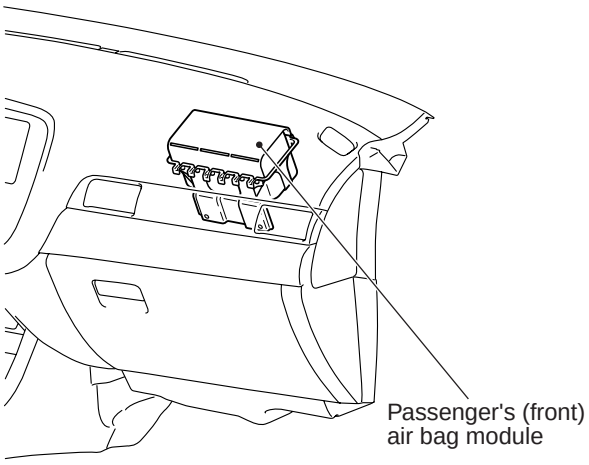
It incorporates an SRS airbag to protect the driver in the event of a frontal collision.

The airbag module is equipped with an inflator that does not contain sodium azide.

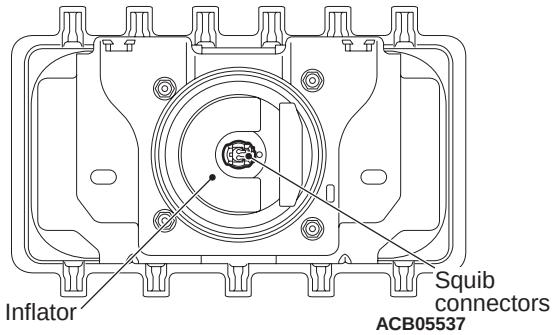
The air bag is made of nylon and is inflated by the gas from the inflator. Then, as the air bag contacts the passenger, the gas is discharged through two openings of backside of air bag, thus deflating the air bag to reduce the impact on the passenger.

PASSENGER'S (FRONT) AIR BAG MODULE

M2521003000628



ACB05622



ACB05537

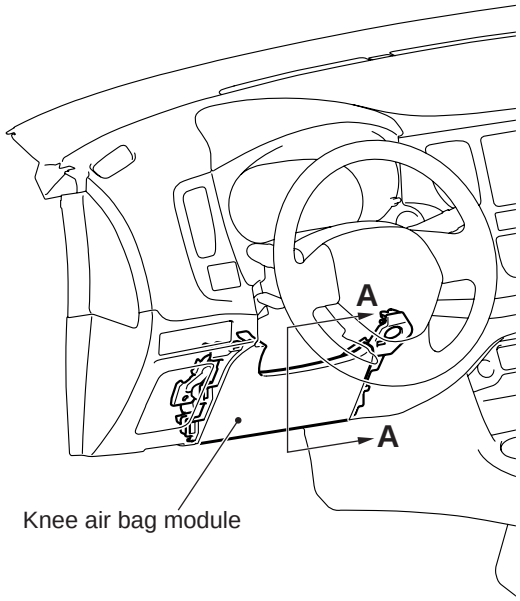
ACC00265 AB

The passenger's (front) air bag module consists of an air bag, and their fasteners.
The air bag is made from nylon and inflates by the gas from the inflator. As a passenger is being pressed to the air bag, it deflates, discharging gas from two vents at the side of the air bag to reduce the shock from the impact.

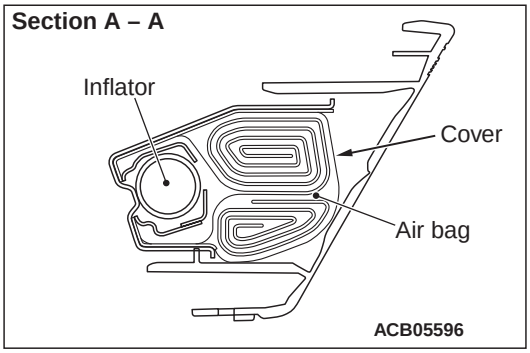
For the inflator, the gas which is harmless to the human body has been used.

KNEE AIR BAG MODULE

M2521002600177



ACB05623



ACB05596

ACC00159AB

The knee air bag module consists of a cover, an air bag, an inflator, and the fixing gear relating to those parts, and is installed under the steering column.

Like the driver's and front passenger's air bags, the knee air bag is inflated upon a frontal collision for better protection of the driver.

For the inflator, the gas which is harmless to the human body has been used.

SIDE-AIRBAG MODULE

M2521004000557

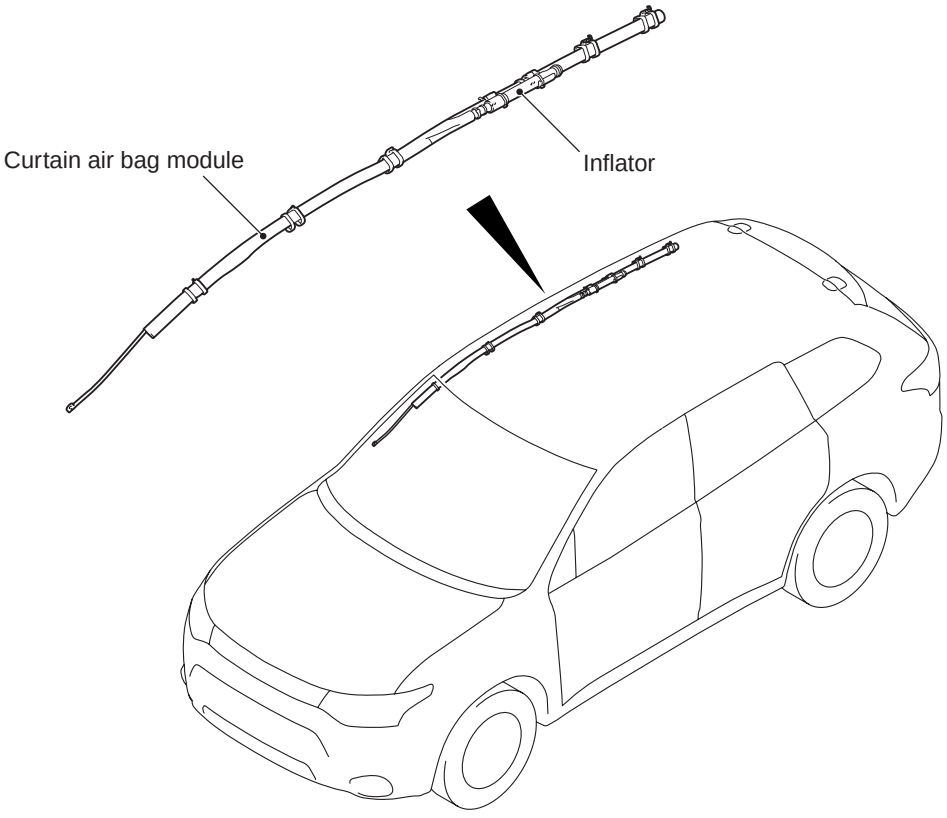
AC801674
ACC00074AB

The side-airbag module consists of an air bag, air bag cover, inflator and their fasteners. The modules are installed in the outer side supports of the driver's and front passenger's seatbacks. The side-airbags help protect the occupants regardless of the seat position and seatback angle.

The air bags are compactly folded and stored under the cover. On the side of the air bag, there are holes through which gas is partially released to alleviate shock to the occupant when the air bag is deployed. For the inflator, the gas which is harmless to the human body has been used.

CURTAIN AIR BAG MODULE

M2521000500431

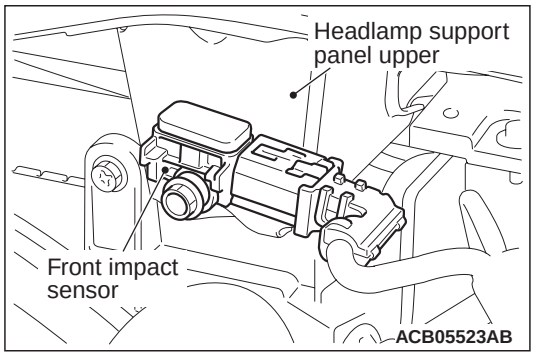


ACB05422
ACC00251AB

The curtain air bag module consists of an air bag, an inflator, and the fixing gear relating to those parts, and is installed in the roof side sections (from the driver's and the passenger's front pillars to the rear pillars).
An inflator that does not contain sodium azide is used.

FRONT IMPACT SENSOR

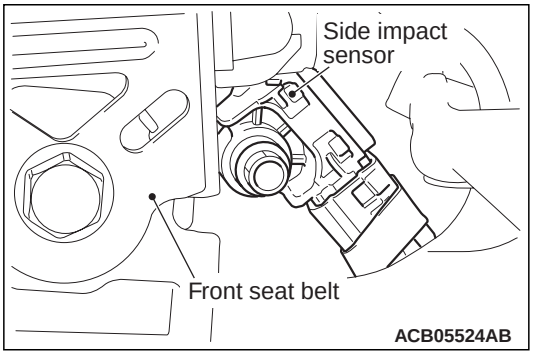
M2521005000646



- The front impact sensor is installed on the headlamp support panel upper in the engine room, and the analogue G-sensor is housed in the front impact sensor.
- The front impact sensor transmits the coded acceleration data to SRS-ECU. Based on the data, SRS-ECU determines the deployment stage of the front air bag, then energises appropriate squib.
- SRS-ECU performs the diagnostics of the front impact sensor internal components. If a malfunction occurs, it sets the diagnosis code.

SIDE IMPACT SENSOR

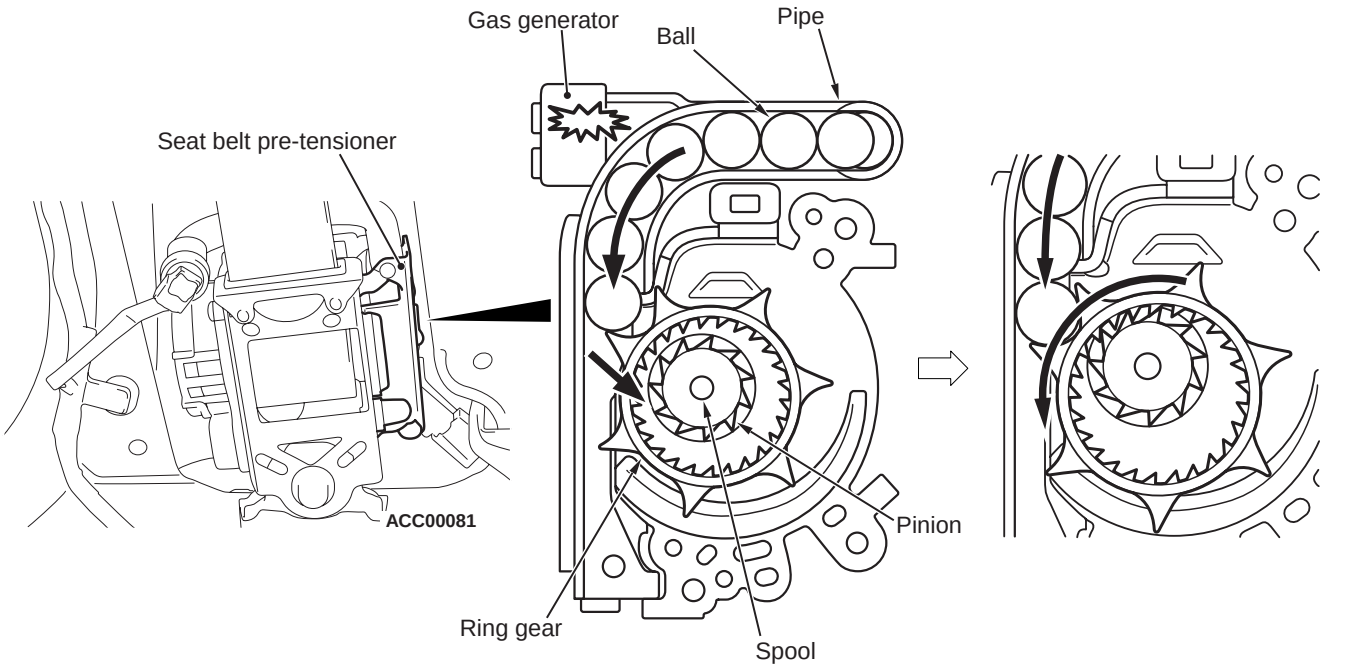
M2521006000575



- The side impact sensors are installed to the lower part of the centre pillars on both sides, and the analogue G-sensor is housed in the side impact sensor.
- The front impact sensor transmits the coded acceleration data to SRS-ECU. Based on the data, SRS-ECU determines the deployment of the side-airbags and curtain air bags, then energises appropriate squib(s).
- SRS-ECU performs the diagnostics of the side impact sensor internal components. If a malfunction occurs, it sets the diagnosis code.

SEAT BELT WITH PRE-TENSIONER

M2521008000786

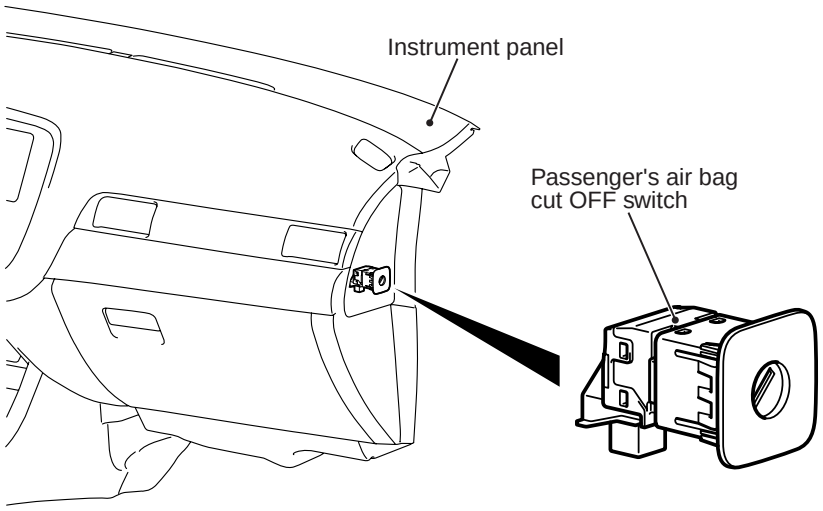


The seat belt incorporating the pretensioner automatically winds the seatbelt upon front impact to reduce forward shifting of the passenger.

The seat belt pre-tensioner ignites the gas generator and emits gas with the electric current supplied from SRS-ECU. The gas pressure shifts the ball in the pipe and the balls comes in contact with the protrusion of the ring gear, which is inserted in the ring gear and then interlocked with the pinion is inserted in the ring gear The ring gear rotation forces the pinion to turn the spool toward the belt wind direction to wind the belt.

PASSENGER'S AIR BAG CUT OFF SWITCH

M2521001700278



ACB05631

ACB05632

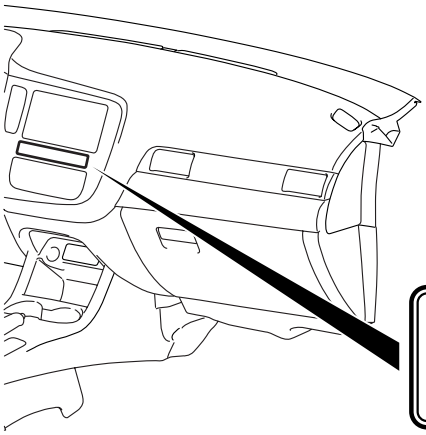
ACC00118AB

Passenger’s air bag cut off switch is located in the instrument panel passenger’s side. The passenger’s air bag cut off switch can be used to disable the passenger's (front) air bag.

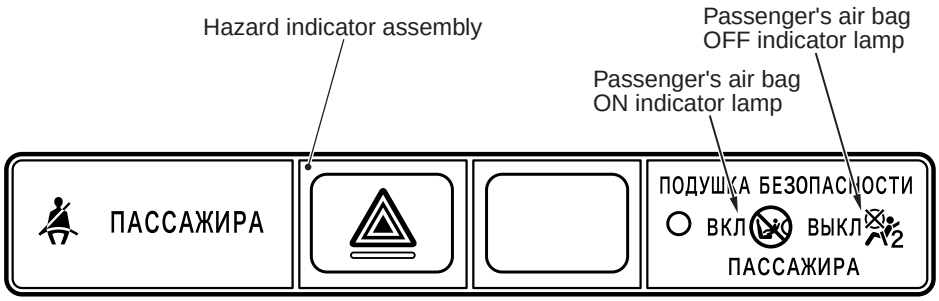
- To turn an air bag off, follow these steps:
  1. Insert the ignition key into the key opening of the appropriate air bag cut off switch, and turn that air bag cut off switch to the "OFF" position.
  2. Remove the key from the key opening of that air bag cut off switch.
  3. Insert the key into the ignition switch, and turn the ignition to "ON" position.
- To turn an air bag on, follow these steps:
  1. Insert the key into the key opening of the appropriate air bag cut off switch, and turn that air bag cut off switch to "ON" position.
  2. Remove the key from the key opening of that air bag cut off switch.
  3. Insert the key into the ignition switch, and turn the ignition to "ON" position.

PASSENGER'S AIR BAG ON/OFF INDICATOR LAMP

M2521001600196



ACB05034



ACB05561

ACC00116AB

The passenger's air bag ON/OFF indicator lamp is installed in centre air outlet.
When passenger's air bag cut off switch is turned OFF, the indicator will stay on to show that the passenger's (front) air bag is not operational.
When passenger's air bag cut off switch is turned ON, the indicator goes off to show that the passenger's (front) air bag is operational.

SRS-ECU

M2521007001054

In addition to the analogue G-sensor and safing G-sensor for the frontal collision, the SRS-ECU incorporates the analogue G-sensor and safing G-sensor for the side collision. Upon a frontal collision, when the impact G is simultaneously detected by the front impact sensor in the engine room, analogue G-sensor, and safing G-sensor for the frontal collision in SRS-ECU, SRS-ECU outputs the ignition signal to the driver's and passenger's (front) air bag modules (squibs).
Upon a side collision, when the lateral impact G is simultaneously detected by the analogue G-sensor of side impact sensor and the safing G-sensor for side collision in SRS-ECU, the SRS-ECU outputs the ignition signal to the side-airbag module (squib) and the curtain air bag module (squib) of the relevant side that is subjected to the impact.
Also, SRS-ECU has the following functions that improve the system reliability.

- Power supply back-up function (back-up condenser) in preparation for the power supply malfunction upon a collision
- Booster function (DC-DC converter) in preparation for the battery voltage drop
- Diagnosis function that performs a system check

DIAGNOSIS FUNCTION

To improve the system reliability, SRS-ECU performs the diagnostics of each part. If a malfunction is detected, it lights up the SRS warning lamp, and stores the contents as the corresponding diagnosis code. Also, to facilitate the system check, it has the following functions, and the check can be performed using M.U.T.-III.

- Diagnosis code set
- Service data output
- Actuator test

DIAGNOSIS CODE SET

SRS-ECU performs a self-diagnosis on the following items. If a malfunction is detected, its content (diagnosis code) is stored in the involatile memory (EEPROM*). Therefore, the diagnosis code will not be erased even when the battery terminal is disconnected. The diagnosis code can be erased using M.U.T.-III.

NOTE:

- **: EEPROM (Electrical Erasable & Programmable Read Only Memory): ROM that can be programmed or erased electrically*
- *For each diagnosis item, refer to Workshop Manual.*

DATA LIST OUTPUT

Using M.U.T.-III, the service data can be read.

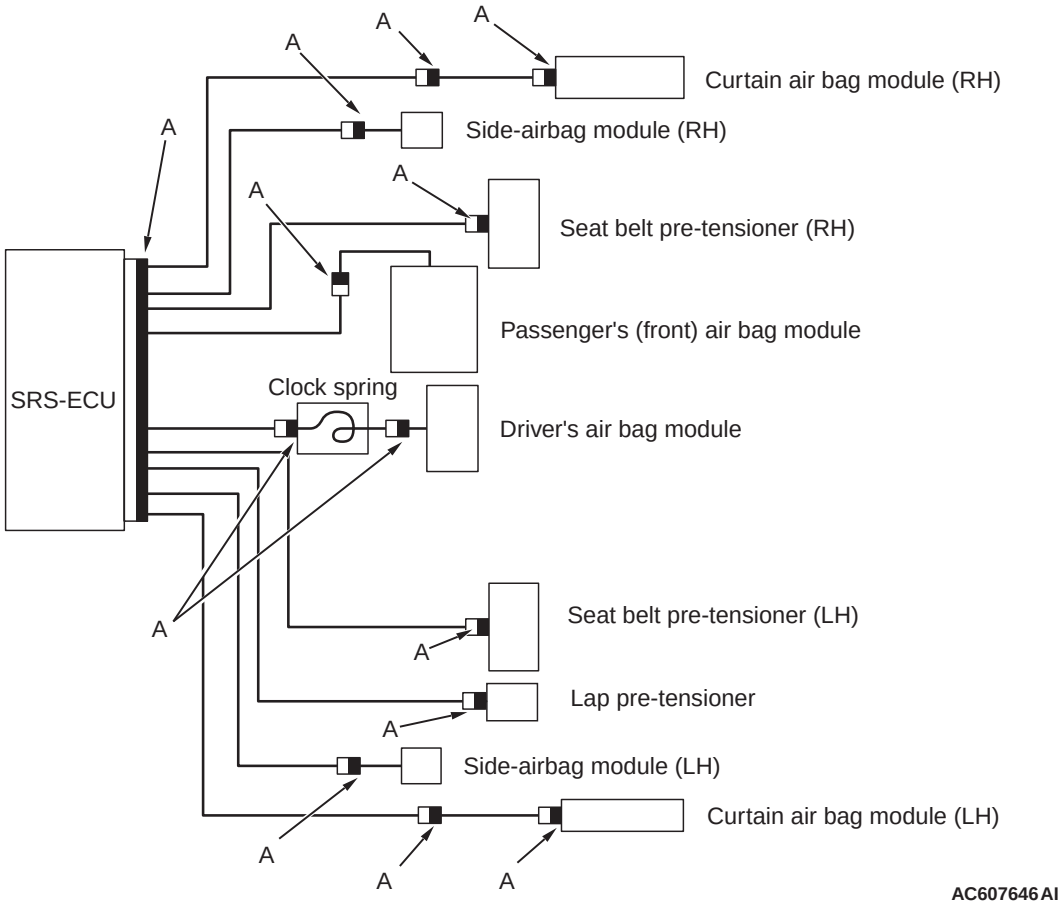
NOTE: For service data items, refer to Workshop Manual.

ACTUATOR TEST

Using M.U.T.-III, the actuator can be forcibly operated. For the actuator test specification, refer to Workshop Manual.

SRS AIR BAG SPECIAL CONNECTOR

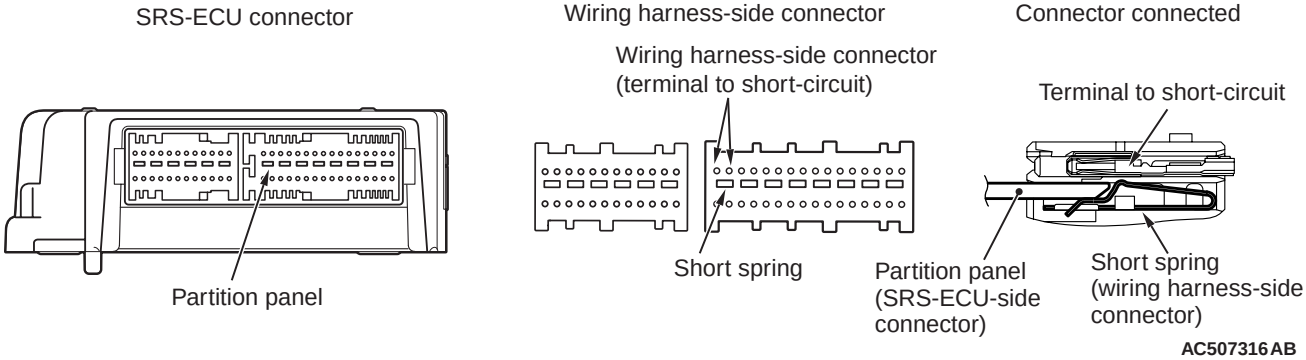
M2521009001027



AC607646 AI

To enhance the system reliability, a connector short circuiting mechanism is integrated in the SRS-ECU connector, air bag module connectors, clock spring connector, and pre-tensioner connectors (black connector "A" shown in the figure).

CONNECTOR SHORT-CIRCUIT MECHANISM



AC507316 AB

This mechanism prevents the improper deployment of air bag module because of the current application to the squib due to the static electricity when connectors between SRS-ECU and air bag modules (squibs) are disconnected. When the connector is disconnected, the short spring short circuits the (+) and (-) of squibs, and prevents the static electricity from generating the potential difference. This connector mechanism is adopted for the following connectors.

- SRS-ECU connector
- Connector between the clock spring and body-side wiring harness
- Each air bag module connector
- Intermediate connector between curtain air bag module and SRS-ECU

GROUP 54

CHASSIS ELECTRICAL

CONTENTS

GROUP 54A

CHASSIS ELECTRICAL

CONTENTS

DIAGNOSIS SYSTEM

GENERAL INFORMATION

M2544100200739

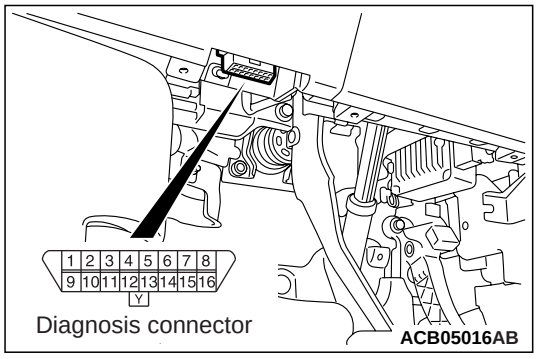
For improved serviceability, a diagnosis connecter for inspection of M.U.T.-III is built into the instrument panel, near the position of the driver's left foot.

System name	Diagnosis code set	Output of service data	Actuator test	Erasure of diagnosis code by the M.U.T.-III	Freeze frame data	Special function	Coding
MPI	•	•	•	•	•	•	•
CVT	•	•	–	•	•	•	–
Electric power steering (EPS)	•	•	•	•	•	•	–
ABS, ASC	•	•	•	•	•	•	–
SRS air bag	•	•	•	•	•	•	•
Air conditioner	•	•	•	•	•	•	–
ETACS ECU	•	•	•	•	•	•	•
KOS	•	•	•	•	•	•	•
IMMO/Keyless	•	•	–	•	•	•	•
Combination meter	•	•	•	•	•	•	–
Steering angle sensor	–	–	–	–	–	•	–
ETG	•	•	•	•	•	•	•
4WD	•	•	–	•	•	•	–
OSS	•	•	•	•	•	•	•

NOTE:

1. *•: Indicates that the diagnosis function is set.*
2. *–: Indicates that the diagnosis function is not set.*

DIAGNOSIS CONNECTOR



Diagnosis connector	
Terminal No.	**Connecting contents**
1	Diagnosis control
2, 3	–
4	Earth
5	Earth
6	CAN communication line (CAN_H)
7, 8	MPI
9 to 13	–
14	CAN communication line (CAN_L)
15	–
16	Battery power supply

BATTERY

GENERAL INFORMATION

M2544200200833

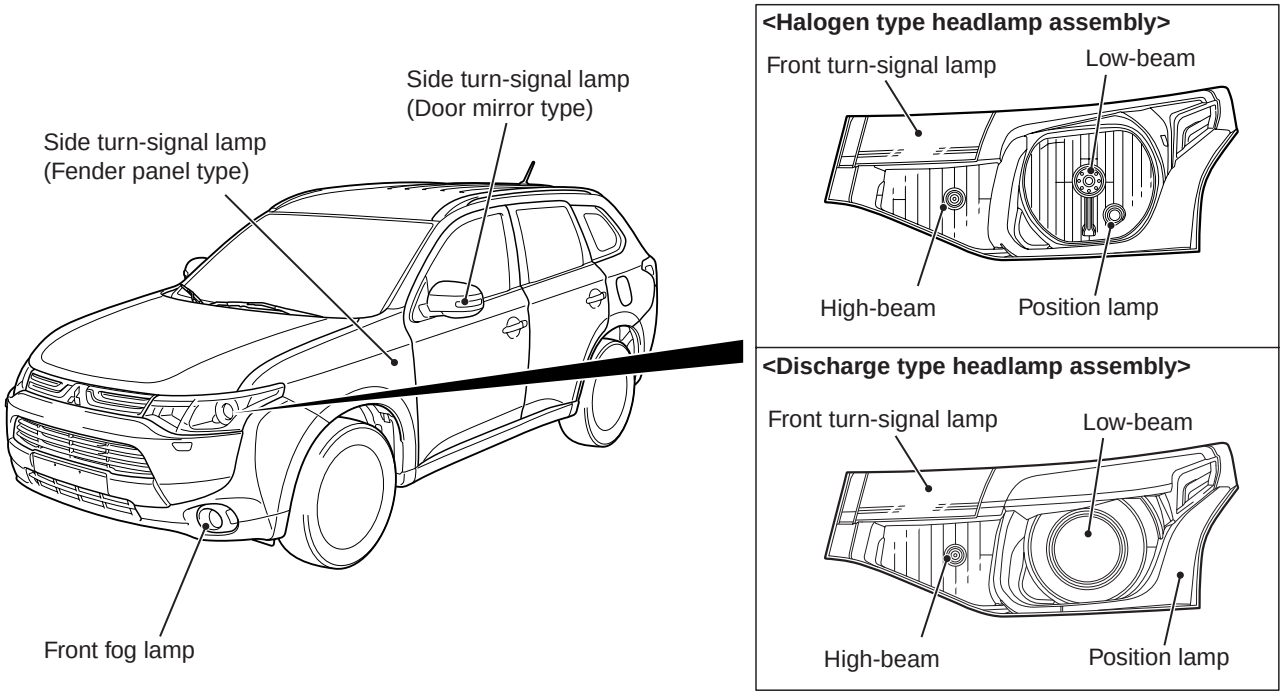
Item	75D23L
Voltage V	12
Capacity (5-hour rate) Ah	52
Electrolytic fluid specific gravity (fully charged state at 20°C)	1.220 to 1.290

LIGHTING

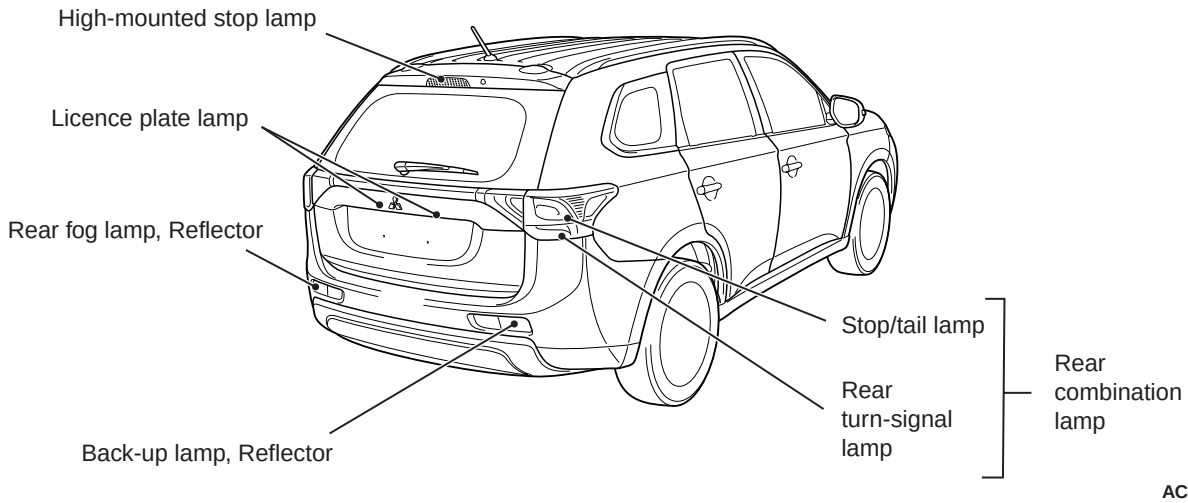
EXTERIOR LAMPS

M2544300301119

Construction diagram



ACC00151AB



- There are two types of headlamp assemblies: halogen type and discharge type (optional for 2.4L model).
- The headlamp assembly employs the four-lamp integrated with the headlamp (low-beam), headlamp (high-beam), front turn-signal lamp, and position lamp.
- The newly adopted discharge headlamp for low beam provides a much better view than ordinary halogen lamps. <Vehicles with discharge type headlamp>
- Switching of the high-beam and low-beam illumination of the discharge type headlamp is controlled by moving the lightproof board in the projector unit according to the signal from the column switch (lighting switch).
- For the low-beam of the headlamp, the headlamp manual levelling system <Vehicles with halogen type headlamp> (Refer to P.54A-5.) and the headlamp automatic levelling system <Vehicles with discharge type headlamp> (Refer to P.54A-6.) have been adopted so that the height adjustment of the optical axis can be performed depending on the vehicle load status.
- The fog lamp have been installed to above the front bumper.
- The rear fog lamp and back-up lamp have been installed to the rear bumper.
- Two types of the side turn-signal lamp have been established: the one attached to the fender panel and the one integrated into the door mirror.
- The rear combination lamp are integrated with the stop/tail lamp and rear turn-signal lamp.
- The LED-type high-mounted stop lamp have been integrated into the tailgate.
- The licence plate lamp have been installed to above the licence plate.
- The lighting system is provided with headlamp automatic-shutdown function, auto lamp function, welcome light function and coming home light function (Refer to P.54A-10).
- For the flasher timer function of turn-signal lamp, the comfort flasher function has been adopted to improve the operability when changing the lane. When the turn-signal lamp switch (lighting switch) is operated for a short time, this function flashes the turn-signal lamp of the operated direction three times (Refer to P.54A-10).

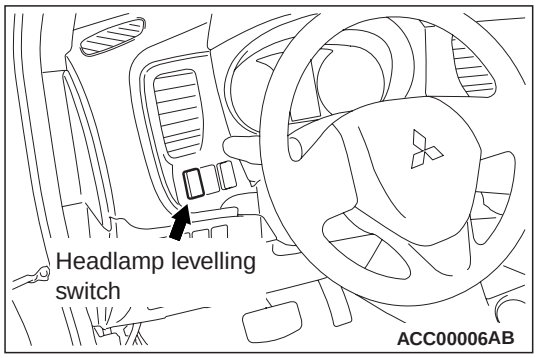
Specifications

Item		
Headlamp assembly <Vehicles with halogen type headlamp>	High-beam W	60 (HB3)
	Low-beam W	55 (H7)
	Position lamp W	5 (W5W)
	Front turn-signal lamp W	21 (PY21W)

Item		
Headlamp assembly <Vehicles with discharge type headlamp>	High-beam W	60 (HB3)
	Low-beam W	35 (D4S)
	Position lamp W	5 (W5W)
	Front turn-signal lamp W	21 (PY21W)
Front fog lamp	Front fog lamp W	55 (H11)
Rear fog lamp W		21 (W21W)
Back-up lamp W		21 (W21W)
Side turn-signal lamp	Fender panel type W	5
	Door mirror type	LED type
Rear combination lamp	Stop/tail W	21 (P21/5W)
	Rear turn-signal W	21 (PY21W)
High-mounted stop lamp	Integrated in tailgate spoiler	LED type
Licence plate lamp W		5 (W5W)

NOTE: The brackets ( ) show the bulb type.

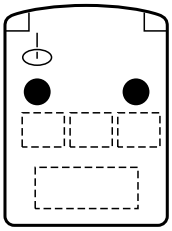
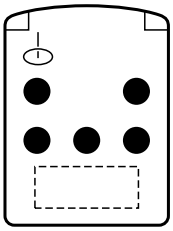
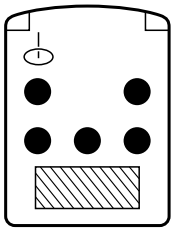
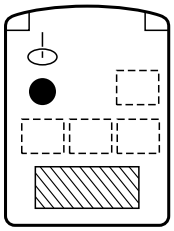
Headlamp manual levelling system



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.

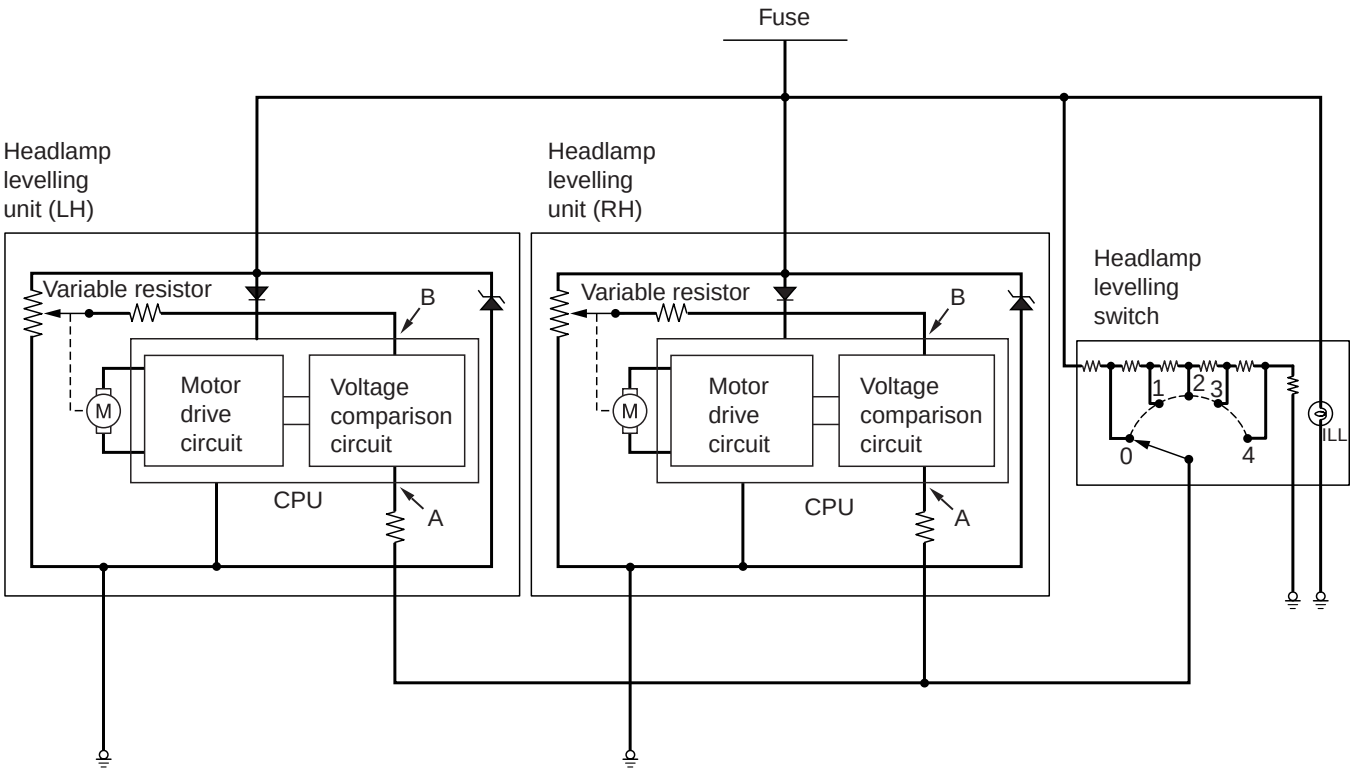
Relationship between the switch positions and the number of passengers/loads

5-seating

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 or 3	4

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.

Headlamp automatic levelling system

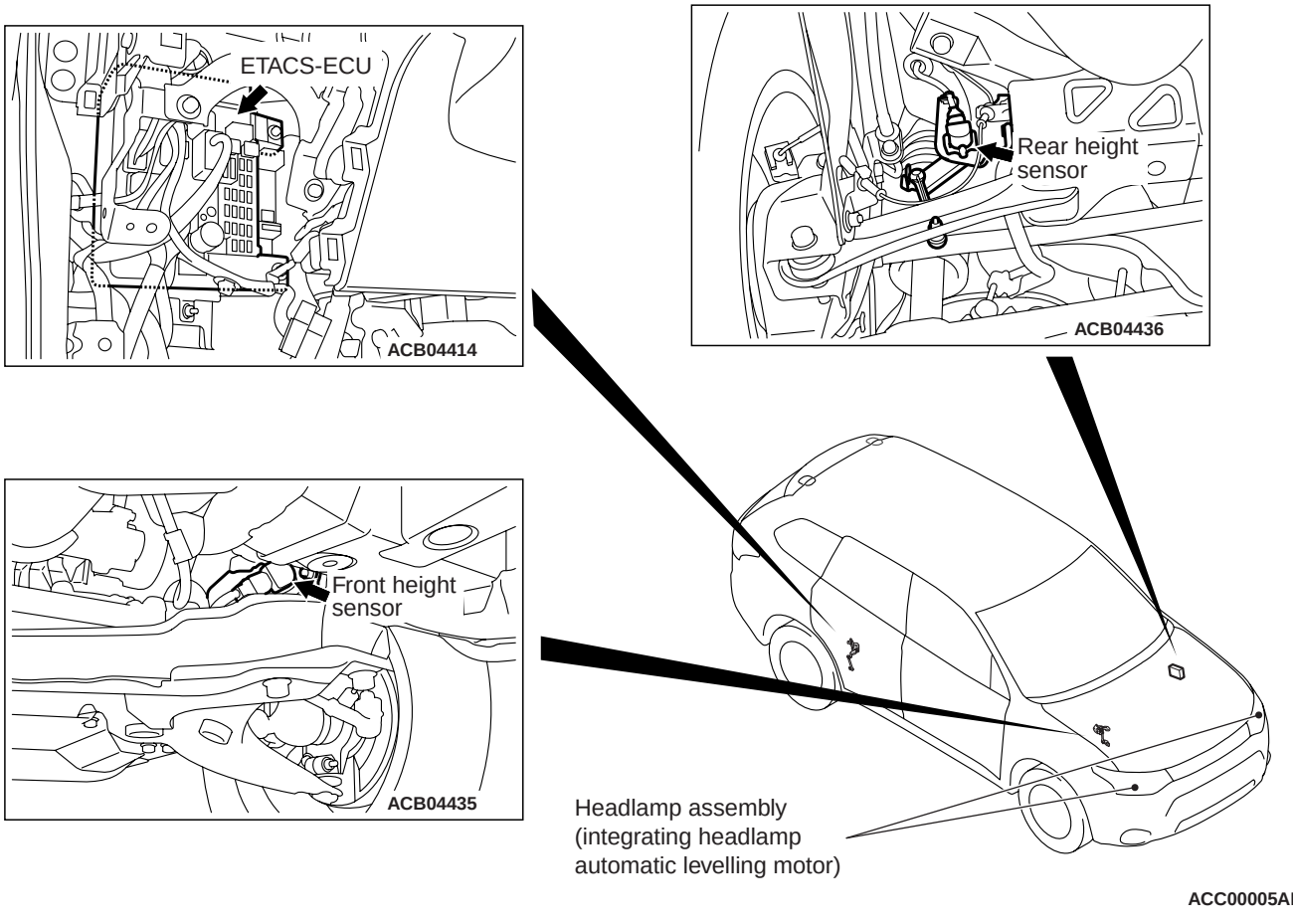
The beam direction of the headlamps (vertical angle) changes according to the number of passengers and the amount of load. The headlamp automatic levelling system is a system that automatically controls the beam direction of headlamps (up and down angle) when parking or travelling with stable vehicle attitude so that the drivers of oncoming cars and of cars driving in front are not dazzled by the headlamp beam that is directed upwards.

Operational Description

The beam direction of headlamps is automatically controlled according to driving conditions as described in the table below.

Vehicle condition	Control content
When parking	When the engine is stopped with the headlamp (low-beam) ON or when the vehicle is stopped with the headlamp (low-beam) ON and the accelerator pedal is released, the ETACS-ECU controls the beam direction according to the height sensor values of the change in load resulting from getting on/off of passengers or loading/unloading of loads.
When driving at a constant speed	When a vehicle starts on curb, the travelling vehicle posture changes from the posture during parking, so that the beam direction changes. To control the improper beam direction caused by such vehicle attitude change, the ETACS-ECU controls the beam direction while travelling with stable vehicle attitude. This beam direction control while travelling with stable vehicle attitude is performed only once between a vehicle stop and the next stop. When driving is started on a gravel or rough road, the beam direction control is activated after the vehicle attitude becomes stable on a paved road.

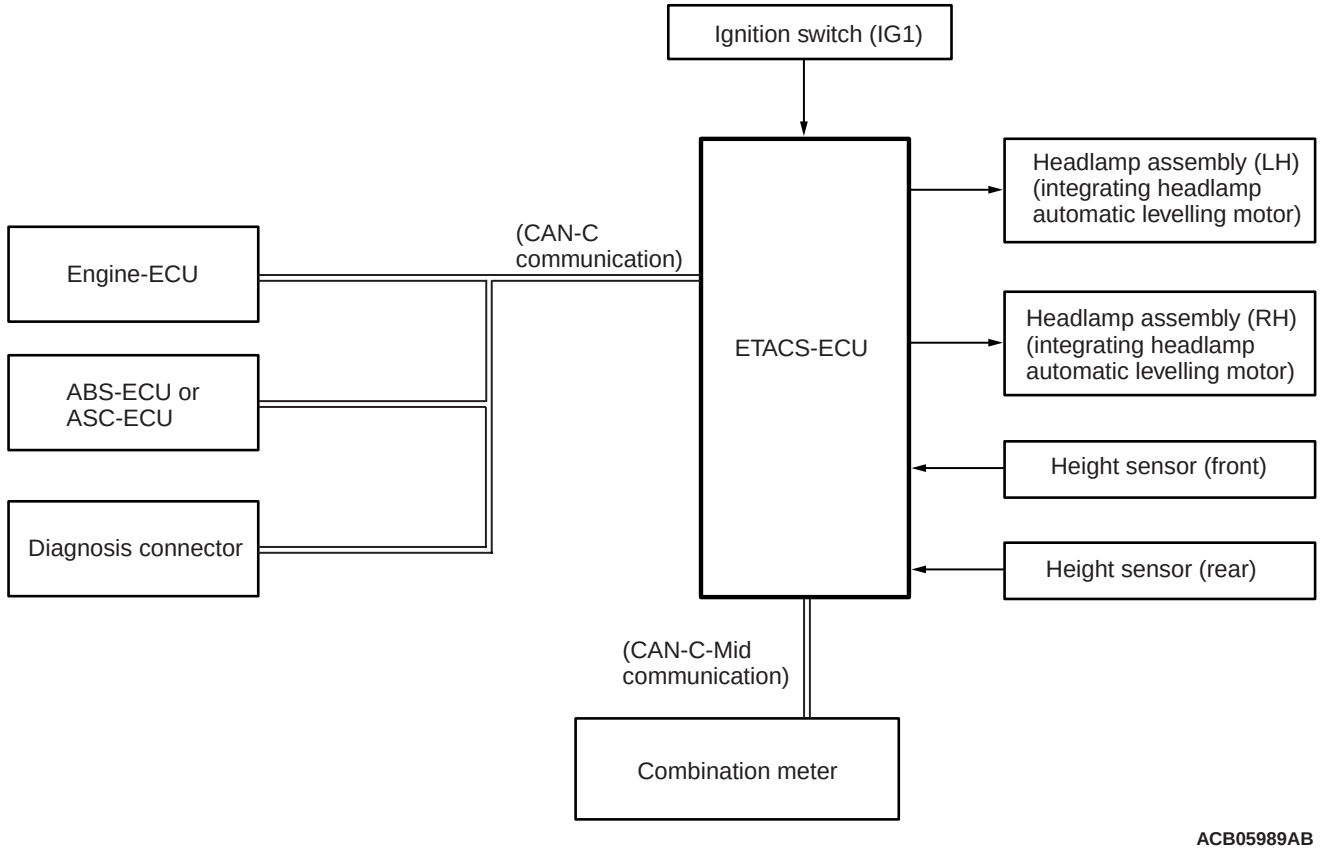
System component and function



Parts name	Functional description
Ignition switch	Supplies power to the ETACS-ECU when the ignition switch is in the ON position.
Height sensor (front)	Detects the elongation/contraction of the front suspension and transmits the signal to the ETACS-ECU.

Parts name	Functional description
Height sensor (rear)	Detects the elongation/contraction of the rear suspension and transmits the signal to the ETACS-ECU.
Headlamp assembly (integrating headlamp automatic levelling motor)	Drives the headlamp reflector by receiving signals from the ETACS-ECU.
Combination meter	Send an odometer indication value to the ETACS-ECU.
ABS-ECU or ASC-ECU	Transfers the vehicle travel distance information to the ETACS-ECU.
Engine-ECU	Transfers engine speed signals and accelerator pedal position signals to the ETACS-ECU.
ETACS-ECU	• Transfers lighting switch position signals, all door switch ON/OFF signals, tailgate latch switch ON/OFF signals, hazard warning lamp switch ON/OFF signals, headlamp (low-beam) ON/OFF status signals. • Controls the headlamp automatic levelling motor integrated in the headlamp assembly based on the signals form switches and sensors to control the beam direction according to the vehicle posture.
Diagnosis connector	Outputs diagnosis codes.

System block diagram



INTERIOR LAMP

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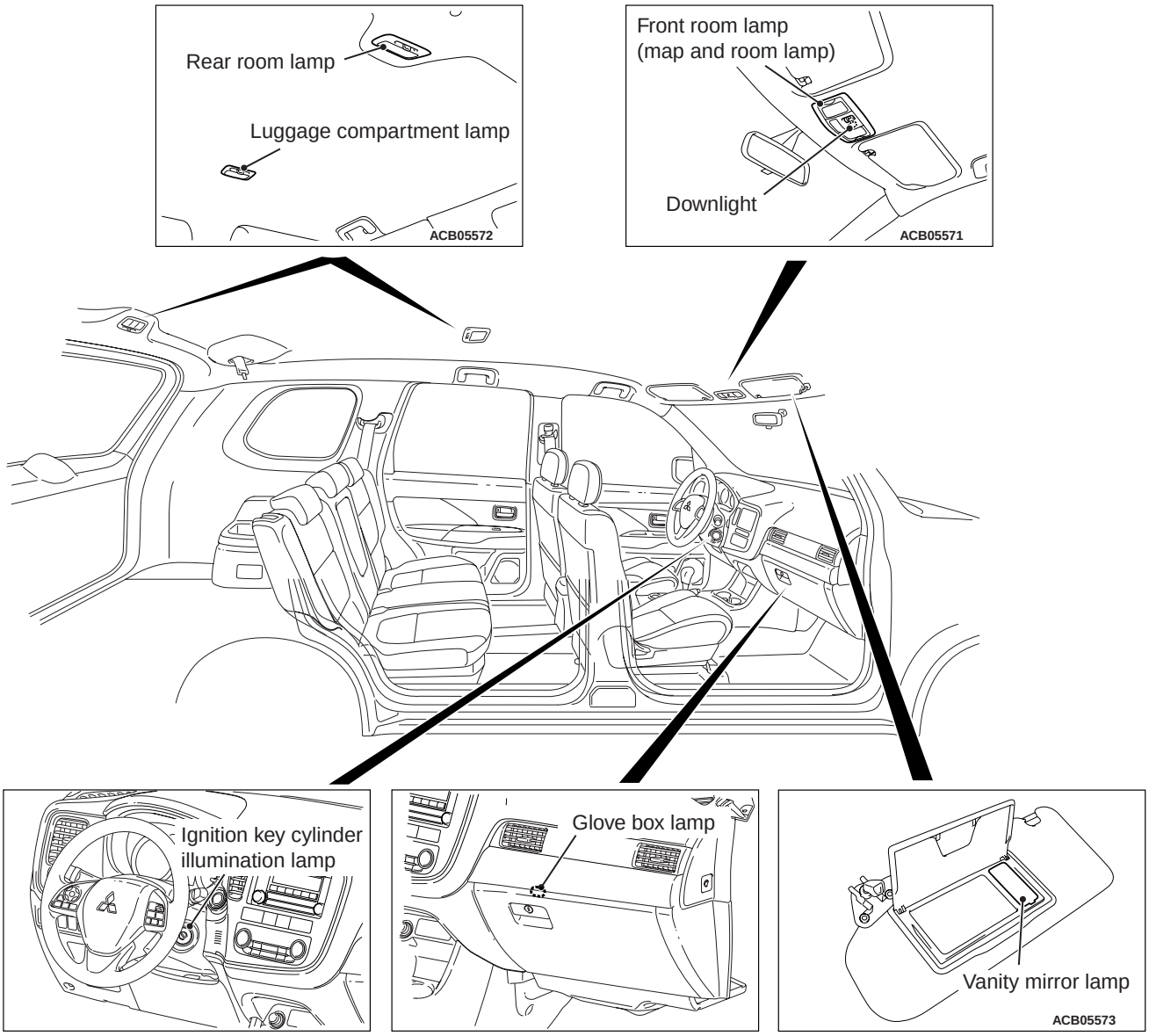
CONSTRUCTION DIAGRAM



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- A front room lamp, installed to the front part of the roof, has been equipped with the lens-push type map & room lamp which can be operated easily from the driver's and front passenger's seat, offering an excellent operability for turning on and off the lamp.
- The front room lamp incorporates a downlight.
- The rear room lamp which illuminates the rear passenger's seat is installed to above the second seat.
- The luggage room lamp which illuminates the luggage room is installed to the upper part of the luggage room.
- A glove box lamp has been added to the glove box.
- A ignition key cylinder illumination lamp has been added to the ignition key cylinder. <Vehicles without KOS>
- The vanity mirror lamps have been installed on the sun visors of driver's and front passenger's seats.
- The interior lamp dimmer control function, interior lamp automatic-shutoff function and ignition key cylinder illumination lamp control function have been adopted for the interior lamp (Refer to Function and Control by ETACS-ECU P.54A-10).

Specifications

Item	Specification
Front room lamp (map and room lamp) W × quantity	8 × 2
Downlight	LED type
rear room lamp W	8
Luggage compartment lamp W	8
Glove box lamp W	1.4
Ignition key cylinder illumination lamp W <Vehicles without KOS>	1.4
Vanity mirror lamp W	2

FUNCTION AND CONTROL BY ETACS-ECU.

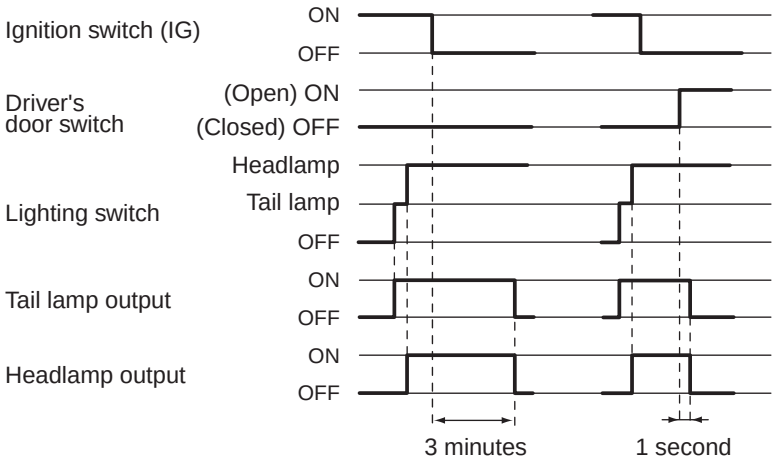
M2544300600979

Following functions are controlled by ETACS-ECU.

Function		Function description
Headlamp	Headlamp automatic-shutdown function	P.54A-11
	Auto lamp function <vehicles with lighting control sensor>	P.54A-11
	Welcome light function	P.54A-12
	Coming home light function	P.54A-12
Flasher timer function	Turn-signal lamp	P.54A-12
	Comfort flasher function	P.54A-12
	Hazard warning lamp	P.54A-12
Fog lamp	Front fog lamp function	
	Rear fog lamp function	
Interior lamp	Interior lamp dimmer control function	P.54A-14
	Interior lamp automatic-shutoff function	P.54A-15
	Ignition key cylinder illumination lamp control function	P.54A-15

HEADLAMP

HEADLAMP AUTOMATIC-SHUTDOWN FUNCTION (INITIAL CONDITION: WITH FUNCTION)

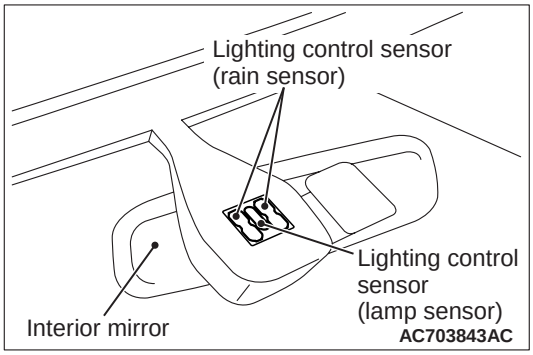


Even when the lighting switch (tail lamp switch or headlamp switch) is ON, the headlamp (including the tail lamps) turns off automatically with any of the following conditions to prevent the battery discharge caused by unattended operation.

- If the ignition switch is turned OFF with the lighting switch ON, the lamp turns off automatically after 3 minutes. If the driver's door is opened during the 3 minutes, the lamp turns off after 1 second.
- If the lighting switch is turned to the tail lamp position or headlamp position from OFF with the ignition switch OFF, the lamps do not turn off automatically.

NOTE: This function can be cancelled through customisation (Refer to Customisation Function P.54A-16).

AUTO LAMP FUNCTION (INITIAL CONDITION: ILLUMINATES IN STANDARD AMBIENT BRIGHTNESS) <vehicles with lighting control sensor>



- Auto lamp function automatically turns ON/OFF the headlamp and tail lamp according to the signal from the lighting control sensor (lamp sensor) attached to the windshield when the lighting switch is in the AUTO position.
- The lamp sensor and the rain sensor are incorporated into the lighting control sensor. The lamp sensor is used for the auto lamp function, and the rain sensor for the rain sensitive wiper function *.

*NOTE: *: For the rain sensitive wiper function, refer to GROUP 51, Windshield Wiper and Washer .*

- The lighting control sensor (lamp sensor) detects the front and surrounding brightness of the vehicle. With this detection, it is judged that the vehicle enters a tunnel or just drives under a bridge. When it is judged that the vehicle drives through a tunnel, the headlamp and tail lamp are automatically turned ON. When it is judged that the vehicle drives under a bridge, the headlamp and tail lamp are not turned ON automatically. When the vehicle surroundings get dark in case such as evening, the headlamp and tail lamp are automatically turned ON.
- The timing that the headlamp and tail lamp are automatically turned ON when the vehicle surroundings get dark in case such as evening can be adjusted by the customisation function. (Refer to Customisation Function P.54A-16.)

WELCOME LIGHT FUNCTION (INITIAL CONDITION: TAIL LAMP ILLUMINATES)

When the lighting switch is in the OFF or AUTO position, unlock operation by the keyless entry system lights up the tail lamp or headlamp. The lighting control sensor operates at nighttimes only.

NOTE: Using the customisation function, it is possible to adjust that either the tail lamp or headlamp lights up. For more information about the customisation function feature, refer to P.54A-16.

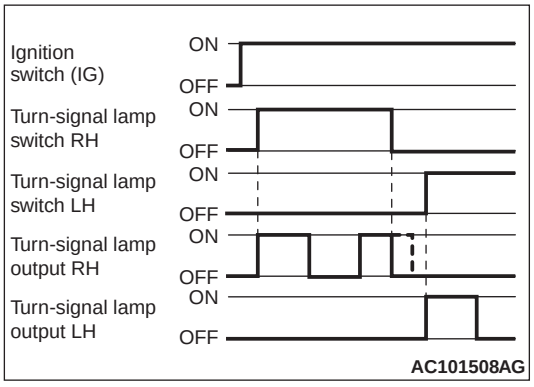
COMING HOME LIGHT FUNCTION (INITIAL CONDITION: 30 SECONDS)

When the ignition switch is in the LOCK (OFF) position, passing operation lights up the headlamp for a certain period.

NOTE: Using the customisation function, the illumination time can be adjusted to 15 seconds, 30 seconds, 60 seconds, or 180 seconds. For more information about the customisation function feature, refer to P.54A-16.

FLASHER TIMER FUNCTION

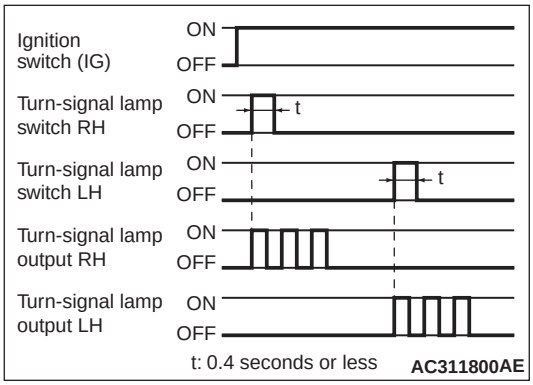
TURN-SIGNAL LAMP (INITIAL CONDITION: TURN SIGNAL LAMP CAN BE OPERATED WHEN THE IGNITION SWITCH IS IN THE ON POSITION)



When the turn-signal lamp switch is ON (LH or RH) with the ignition switch is ON, the turn-signal lamp output (flash signal) is turned ON.
If the lamp bulb of the front or rear turn-signal lamp has burned out, the flashing speed becomes faster to alert the driver that the lamp bulb has burned out.

NOTE: Using a customisation function, this function becomes available even when the ignition switch is in the ACC position. For more information about the customisation feature. (Refer to Customisation Function P.54A-16).

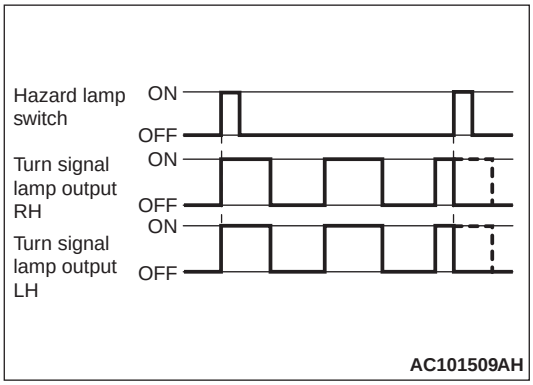
COMFORT FLASHER FUNCTION (INITIAL CONDITION: WITH FUNCTION)



With the ignition switch in the ON position, when the turn signal switch is turned ON momentarily (0.4 second or less), ETACS-ECU turns ON the turn signal lamp output, and flashes the turn signal lamp three times.

NOTE: Using the customisation function, "with function/without function" of the comfort flasher function and the switch acceptance time can be set. For more information about the customisation function. (Refer to Customisation Function P.54A-16).

HAZARD WARNING LAMP



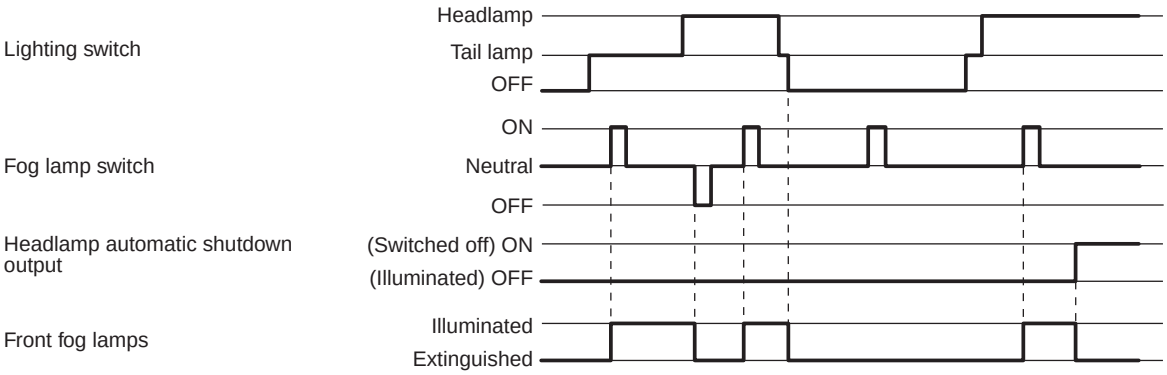
ETACS-ECU detects the signal that changes the hazard lamp switch from OFF to ON, and reverses the flashing state by the signal (to the flashing state when the hazard lamp is not flashing, and to the turned OFF state when flashing).

NOTE:

1. *The push-return switch has been adopted for the hazard lamp switch.*
2. *Even if the lamp bulb has burned out, the flashing speed of the hazard lamp is not changed.*

FOG LAMP

FRONT FOG LAMP FUNCTION



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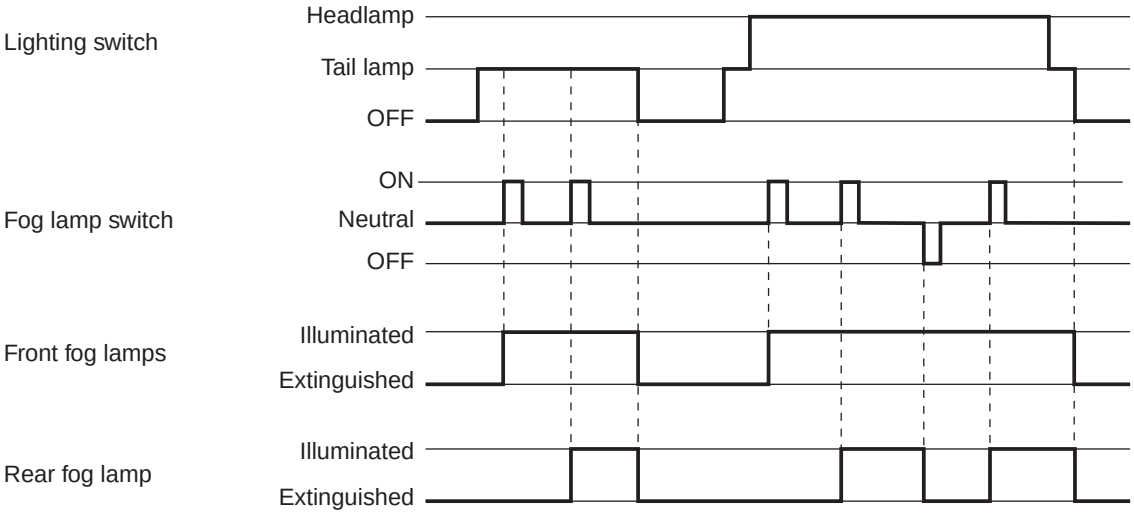
When the fog lamp switch is turned to ON with the tail lamp or the headlamp lit (the tail lamp switch or the headlamp switch is ON), the front fog lamp relay turns ON, and the front fog lamps turn on.
If the tail lamp or the headlamp is turned off with the lighting switch OFF while the front fog lamps lit, the front fog lamps turn off the same time to prevent unattended operation.

If the tail lamp is turned off by the headlamp automatic-shutdown function, the front fog lamps turn off at the same time. However, if the tail lamps turn on again, the front fog lamps do not.

REAR FOG LAMP FUNCTION



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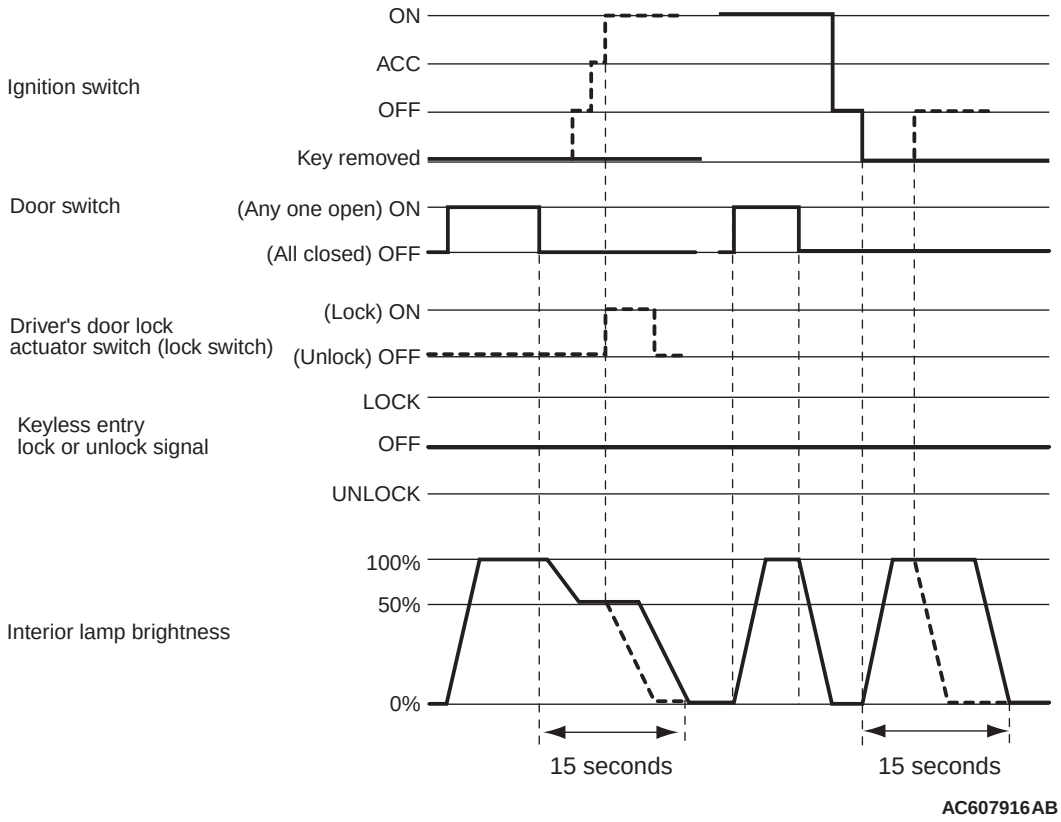
If the fog lamp switch is turned ON while the front fog lamp is ON, the rear fog lamp illuminates. The rear fog lamp is switched ON or OFF by turning on or off the fog lamp switch.

If the tail lamp is turned OFF, the front fog lamp and the rear fog lamp are turned OFF at the same time.

INTERIOR LAMP

INTERIOR LAMP DIMMER CONTROL FUNCTION (INITIAL CONDITION: 15 SECONDS)



When the interior lamp switch is on the door position, ETACS-ECU controls the interior lamp as follows.

1. When the ignition switch is OFF:

By opening any door or tailgate, the lamp turns ON (100%), and dims (50%) when the door or tailgate is closed, then and turns off after 15 seconds.

However, when the ignition switch is turned ON or the door lock is operated, the lamps turn off at that time.

2. When the ignition switch is ON:

By opening any door or tailgate, the lamp (100%) turns ON and OFF when the door or tailgate is closed.

3. When all doors and the tailgate are closed, and the ignition key is removed*:

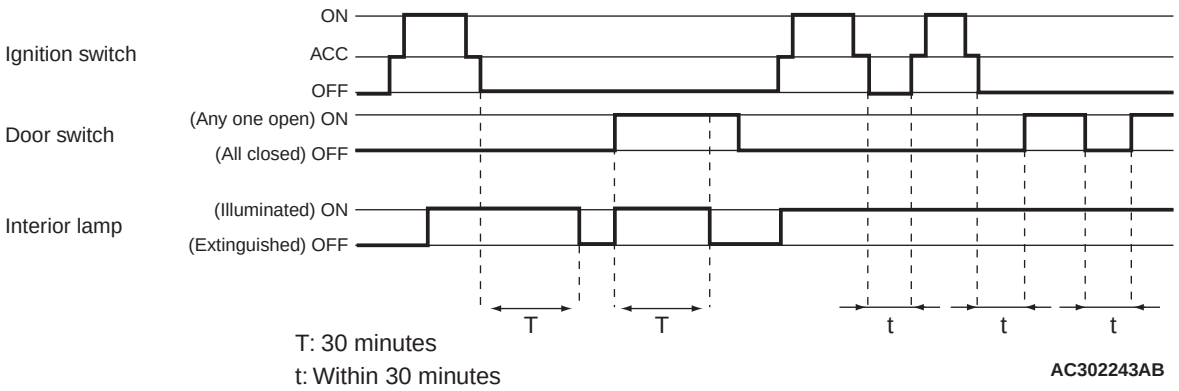
With all the doors closed, when the ignition key is removed, the lamp turns ON (100%) after approximately 1 second (after the engine is stopped), and then gradually dims down to OFF after 15 seconds.

By inserting the ignition key again or operating the door lock with the lamp lit, the lamps turns off.

NOTE:

- **: For the vehicles with KOS, it is operated the same way when the steering lock is locked or when the emergency key is removed from the key cylinder.*
- *For the vehicles with the keyless entry system, the delayed lamp-off time and the operation times of the keyless entry interior lamp answer back can be changed by the customisation function. (Refer to Customisation Function P.54A-16)..*

INTERIOR LAMP AUTOMATIC-SHUTOFF FUNCTION (INITIAL CONDITION: 30 MINUTES)

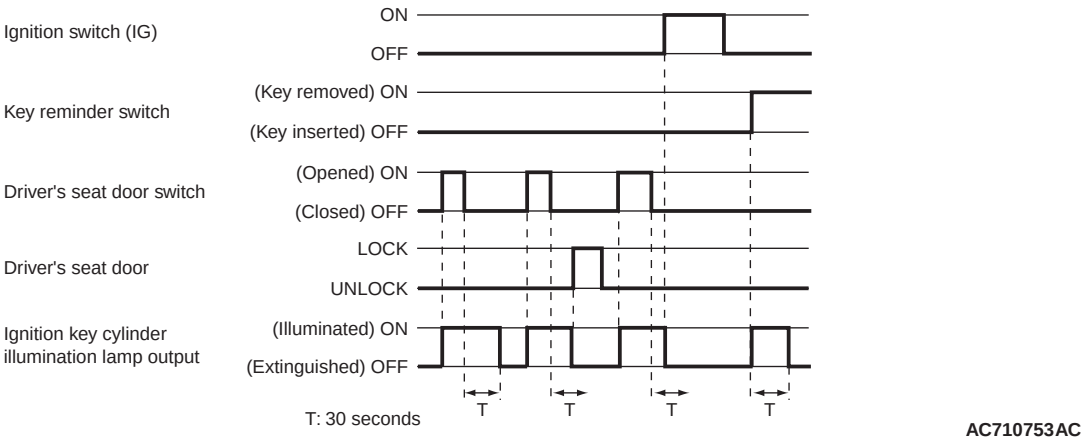


When the interior lamp such as the room lamp [all interior lamps connecting to the room lamp fuse (the front room lamp, the rear room lamp, the luggage compartment lamp, and the ignition key cylinder illumination lamps)] is lit, but either one of the conditions is met, the interior lamp is turned off automatically for preventing the battery discharge caused by the unattended operation or the door-ajar.

- After 30 minutes with the interior lamp lit while the ignition switch is OFF, the lamp turns off automatically.
- After 30 minutes with any door opened while the ignition switch is OFF, the lamp turns off automatically.
- After the auto-turn OFF, the interior lamp returns to the illumination state when the doors are opened/closed, keyless entry transmitter switch is operated, or ignition switch is turned to ACC position. After returning, the lamp turns OFF after 30 minutes, when the interior lamp auto turn off condition is met.

NOTE: The interior lamp automatic shut-off time can be adjusted by the customisation function. (Refer to Customisation Function P.54A-16).

IGNITION KEY CYLINDER ILLUMINATION LAMP CONTROL FUNCTION



The ETACS-ECU controls the ignition key cylinder illumination lamp as described below.

- With the ignition switch OFF, the lamp is illuminated when the driver's door is opened, and it is turned off 30 seconds after the driver's door is closed. However, the lamp is turned off if the ignition switch is turned ON or doors are locked within 30 seconds.
- When the ignition key is removed from the ignition key cylinder, the lamp illuminates for 30 seconds after approximately 1 second (after the engine is stopped).*

*NOTE: *: For the vehicles with KOS, it is operated the same way when the steering lock is locked or when the emergency key is removed from the key cylinder.*

CUSTOMISATION FUNCTION

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By operating the M.U.T.-III ETACS system, the following functions can be customised. The programmed information is held even when the battery is disconnected.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Turn power source	Adjustment of turn-signal lamp operation condition	ACC or IG1	Operable with ACC or ON position
		IG1	Operable with ON position (initial condition)
Comfort flasher	With/without comfort flasher function	Disable	No function
		Enable	With function (initial condition)
Comfort flasher switch time	Switch operation time to activate the comfort flasher function	Normal	0.4 second (initial condition)
		Long	0.8 second
Hazard answer back	Adjustment of the number of keyless hazard warning lamp answer back flashes	Lock:1, Unlock:2	LOCK: Flashes once, UNLOCK: Flashes twice (initial condition)
		Lock:1, Unlock:0	LOCK: Flashes once, UNLOCK: No flash
		Lock:0, Unlock:2	LOCK: No flash, UNLOCK: Flash twice
		Lock:2, Unlock:1	LOCK: Flash twice, UNLOCK: Flash once
		Lock:2, Unlock:0	LOCK: Flash twice, UNLOCK: No flash
		Lock:0, Unlock:1	LOCK: No flash, UNLOCK: Flash once
		Lock:0, Unlock:0	No function
Sensitivity for auto lamp	Lighting control sensor sensitivity (illumination intensity) <vehicles with lighting control sensor>	Level 1 bright	High ambient brightness
		Level 2 bright	Standard ambient brightness (initial condition)
		Level 3	Low ambient brightness
		Level 4 dark	Low-low ambient brightness
Room lamp delay timer with door	Adjustment of interior lamp delay shutdown time	0 sec	0 second (no delay shutdown time)
		7.5 sec	7.5 seconds
		15 sec	15 seconds (initial condition)
		30 sec	30 seconds
		60 sec	60 seconds
		120 sec	120 seconds
		180 sec	180 seconds
Head lamp auto cut customise	Adjustment of headlamp automatic shutdown function	Disable	No function
		Enable (B-spec.)	With function (initial condition)

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Interior lamp auto cut timer	Adjustment of interior lamp automatic shutdown function operation time	Disable	No function
		3 min	3 minutes
		30 min	30 minutes (initial condition)
		60 min	60 minutes
Coming home light	Disabling or enabling coming home light function	Disabled	No function
		15 sec	The headlamps illuminate for 15 seconds.
		30sec	The headlamps illuminate for 30 seconds. (initial condition)
		60 sec	The headlamps illuminate for 60 seconds.
		180 sec	The headlamps illuminate for 180 seconds.
Welcome light	Disabling or enabling welcome light function	Disabled	No function
		Small lamp	The tail lamps illuminate. <initial condition>
		Head lamp	The headlamps illuminate.

COMBINATION METER

GENERAL INFORMATION

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There are two types of the combination meter; standard meter and high contrast meter. A speedometer is located at the right, a liquid crystal display at the centre lower part, a tachometer at the left, and a meter information switch <Standard meter> or rheostat illumination switch <High contrast meter> at the right lower part. The combination meter has the following features:

Standard meter

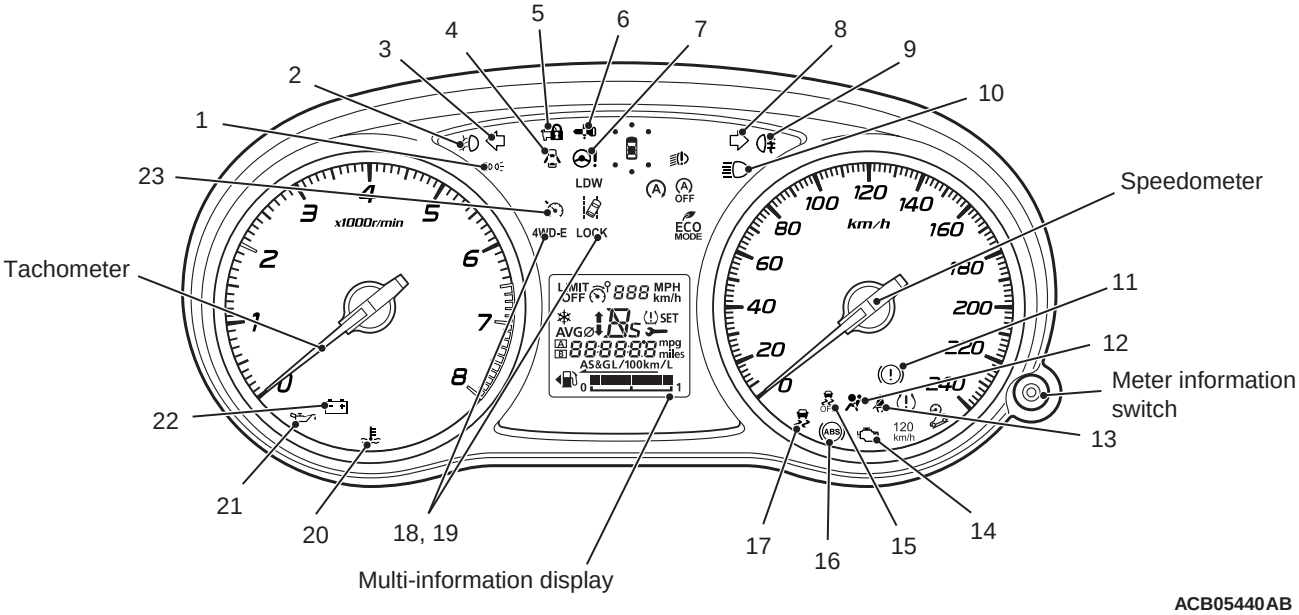
- A segment-type LCD is adopted. For details refer to P.54A-19.

High contrast meter

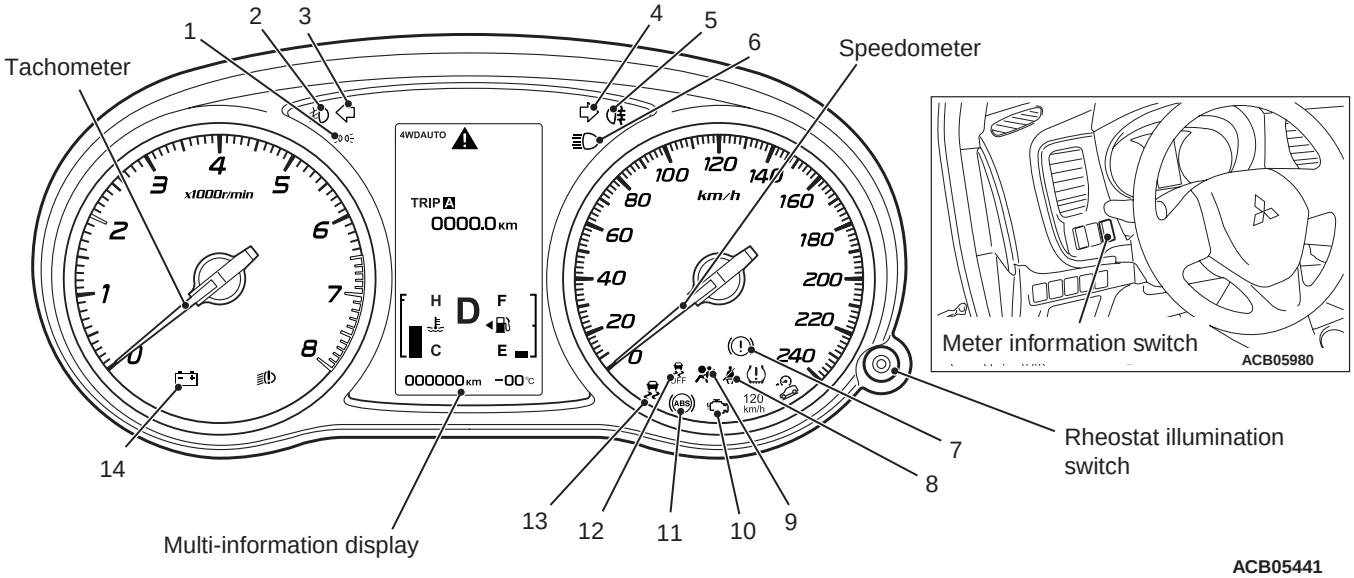
- A colour liquid crystal display has been adopted. For details refer to P.54A-21.
- A navigation indicator has been adopted. <Vehicles with MMCS>
- A meter information switch is located in the instrument panel.

CONSTRUCTION DIAGRAM

<Standard meter>



<High contrast meter>



Standard meter

1. Position lamp indicator lamp
2. Front fog lamp indicator lamp
3. Turn-signal lamp indicator/hazard warning indicator lamp (LH side)
4. Door-ajar warning lamp
5. Immobilizer/electric steering lock warning lamp
6. Keyless operation system indicator lamp
7. Electric power steering system warning lamp
8. Turn-signal lamp indicator/hazard warning indicator lamp (RH side)
9. Rear fog lamp indicator lamp
10. High-beam indicator lamp
11. Brake warning lamp
12. Supplemental restraint system warning lamp
13. Driver's seat belt warning lamp
14. Check engine warning lamp
15. Active stability control system OFF indicator lamp
16. Anti-skid braking system warning lamp
17. Active stability control system ON indicator lamp
18. 4WD-ECO indicator lamp

19. 4WD-lock indicator lamp
20. Coolant temperature warning lamp
21. Oil pressure warning lamp
22. Charging warning lamp
23. Cruise control system indicator lamp

High contrast meter

1. Position lamp indicator lamp
2. Front fog lamp indicator lamp
3. Turn-signal lamp indicator/hazard warning indicator lamp (LH side)
4. Turn-signal lamp indicator/hazard warning indicator lamp (RH side)
5. Rear fog lamp indicator lamp
6. High-beam indicator lamp
7. Brake warning lamp
8. Driver's seat belt warning lamp
9. Supplemental restraint system warning lamp
10. Check engine warning lamp
11. Anti-skid braking system warning lamp
12. Active stability control system OFF indicator lamp
13. Active stability control system ON indicator lamp
14. Charging warning lamp

MULTI-INFORMATION DISPLAY <STANDARD METER>

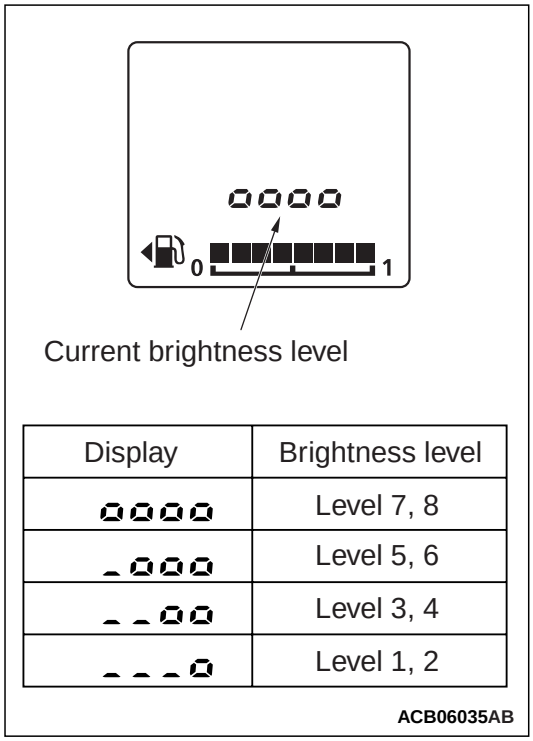
M2545500500515

In the multi-information display, the followings are displayed; "Odometer", "TRIP A", "TRIP B", "Meter illumination control", "Driving range", "Average fuel consumption", "Outside temperature and frost warning", "Service reminder*".

NOTE:

- **: Is not displayed during driving.*

METER ILLUMINATION CONTROL



Display	Brightness level
0000	Level 7, 8
_000	Level 5, 6
__00	Level 3, 4
___0	Level 1, 2

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The brightness of the combination meter can be adjusted in eight stages (LEVEL 1 to LEVEL 8) by pushing the meter information switch when the meter is illuminated. Current illumination level will be displayed each time the meter information switch is pushed. The illumination level can be changed by operating the meter information switch according to specified procedure *. The brightness of each brightness level is as described in the table below.

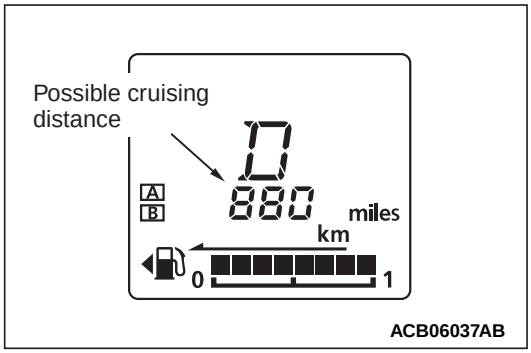
NOTE: The brightness can be set separately for the daytime and nighttime. The configured information is stored in the RAM. In the initial setting of brightness, the daytime is set at LEVEL 8 and the nighttime is set at LEVEL 7.

BRIGHTNESS LEVEL TABLE

Brightness level	Dial brightness		Pointer brightness		LCD display brightness	
	Day	Night	Day	Night	Day	Night
LEVEL 8	100%	100%	100%	100%	100%	35%
LEVEL 7	90%	58.8%	90%	58.8%	90%	19%
LEVEL 6	81%	34.3%	81%	34.3%	81%	10.4%
LEVEL 5	71%	20.3%	71%	20.3%	71%	5.5%
LEVEL 4	61%	11.8%	61%	11.8%	61%	3.1%

Brightness level	Dial brightness		Pointer brightness		LCD display brightness	
	Day	Night	Day	Night	Day	Night
LEVEL 3	51%	6.8%	51%	6.8%	51%	1.6%
LEVEL 2	42%	3.8%	42%	3.8%	42%	0.7%
LEVEL 1	32%	2.3%	32%	2.3%	32%	0.3%

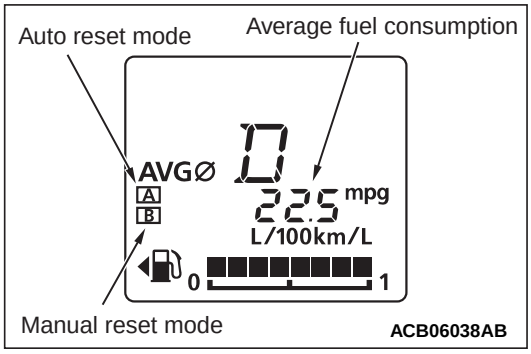
DRIVING RANGE DISPLAY



Calculates current driving range possible on the remaining fuel and displays it on the multi-information display.

NOTE: Possible driving range displayed is only for guide.

AVERAGE FUEL CONSUMPTION DISPLAY

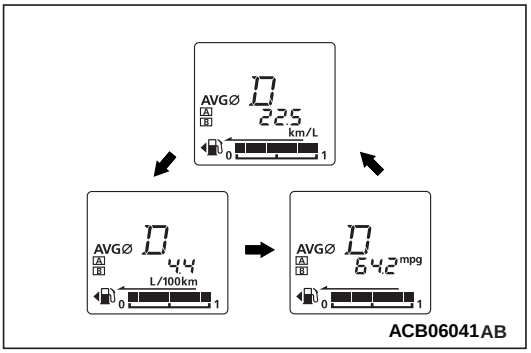


Calculates average fuel consumption since the last reset and displays it on the multi-information display.

RESET MODE

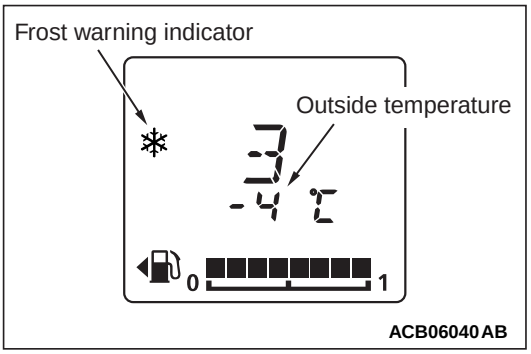
There are two reset modes; manual reset mode and auto reset mode. In the manual reset mode, the driver can reset it at any time by operating the meter information switch. In the auto reset mode, the calculation will be reset without operating the meter information switch when four hours elapse since the last ignition switch turning off.

Change unit for trip computer



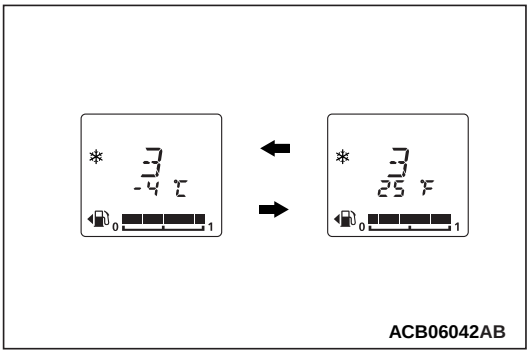
A long press of the meter information switch will change unit displayed while the average fuel consumption is displayed.

OUTSIDE TEMPERATURE AND FROST WARNING



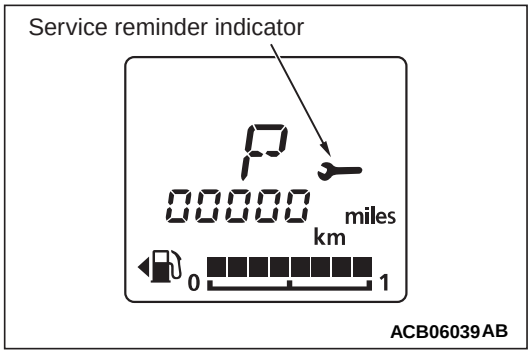
Informs the driver how the road condition is. While the frost warning is being triggered, the buzzer will sound and the indicator will illuminate or flash to alert the driver.

Change unit for outside temperature



Displayed unit (Celsius and Fahrenheit) can be switched over by pressing and holding the meter information switch while the outside temperature and frost warning screen is being displayed.

SERVICE REMINDER



When the inspection interval (alert start point in table below) is due in accordance with the predetermined schedule (see table below), the service reminder indicator will be displayed when the ignition switch is turned to the ON position. However, even if the warning condition is met, the indicator does not display immediately. It illuminates next time when the ignition switch is turned ON. The impending inspection interval can be displayed by changing the LCD section by the meter information switch. The service reminder indicator will go off when it is reset by operating the meter information switch according to the specified procedure *, or the warning criteria (end point) shown in the table below is satisfied.

NOTE:

- **: For details about the meter information switch special operation, refer to the Workshop Manual.*

SCHEDULE TABLE

Schedule	Warning type	Warning criteria
Normal	Elapsed time (month)	Every 12 elapsed months
	Driving distance (miles)	Every 12,500 miles of driving distance
	Driving distance (km)	Every 20,000 km of driving distance

WARNING CRITERIA (WARNING START AND END POINTS)

Elapsed time		Driving distance (km)		Driving distance (miles)	
Warning start point	**Warning end point**	**Warning start point**	**Warning end point**	**Warning start point**	**Warning end point**
–15 days	+15 days	– 500 km	+500 km	– 300 miles	+300 miles

MULTI INFORMATION DISPLAY <HIGH CONTRAST METER>

M2545500500496

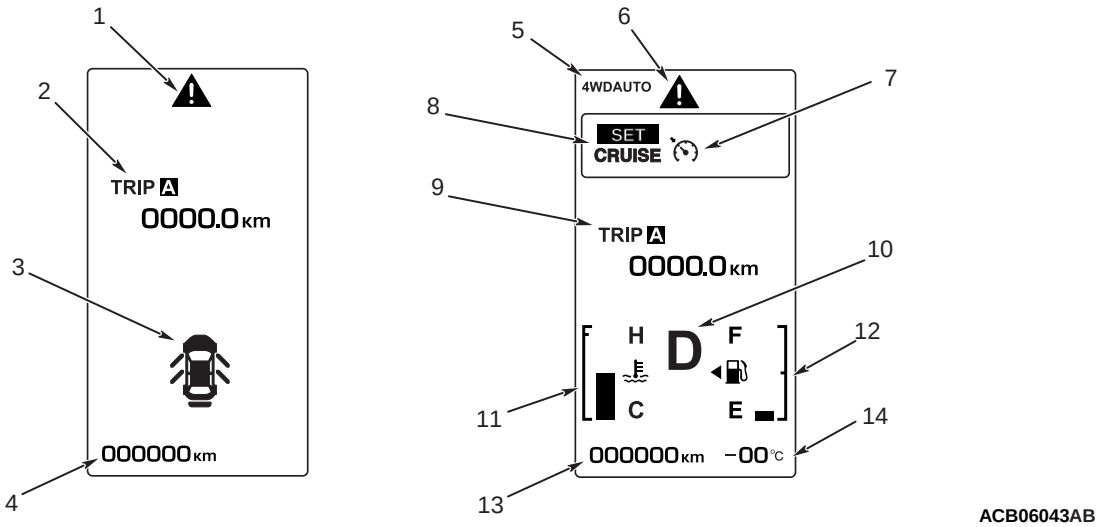
In the multi-information display, followings are displayed; "Drive mode indicator", "Caution mark", "Cruise control", "TRIP A", "TRIP B", "Meter illumination control", "Driving range", "Average fuel consumption", "Average speed/Instant fuel consumption", "Service reminder*", "Function setting*", "Selector lever position", "Engine coolant temperature", "Fuel remaining", "Odometer", "Outside temperature". Displayed contents can be switched by operating the meter information switch.

NOTE:

- **: Is not displayed during driving.*

When the ignition switch is LOCK (OFF), ACC position

When the ignition switch is ON position



ACB06043AB

WHEN THE IGNITION SWITCH IS IN THE LOCK (OFF) POSITION (DISPLAYED WHEN A DOOR IS OPEN OR THE MULTI INFORMATION METER SWITCH IS OPERATED.)

Item		Content
1	Caution mark display screen	It indicates when some warnings have occurred or existence of warning on background. Except for frost warning and service interval indication.
2	Information screen/interrupt display screen	• When the meter information switch is operated, the displayed information contents are changed in the following order. 1. TRIP A (To reset the trip meter, press and hold the switch.) 2. TRIP B (To reset the trip meter, press and hold the switch.) 3. Service reminder (When service reminder function is enabled.) 4. Warning screen display (When a warning is present.) • An interrupt display of appropriate contents is performed when a warning is issued.
3	Door-ajar warning display screen	Displays the door or tailgate that is open.
4	Odometer display screen	Displays the odometer.

WHEN THE IGNITION SWITCH IS ON POSITION

Item		Content
5	Drive mode indicator display screen	Displays which driving mode is selected.
6	Caution mark display screen	It indicates when some warnings have occurred or existence of warning on background. Except for frost warning and service interval indication.
7	Cruise control symbol display screen	Displayed when the cruise control system is on.
8	Cruise control status display screen	Displays a cruise control system status.

Item		Content
9	Information screen/interrupt display screen	• When the meter information switch is operated, the displayed information contents are changed in the following order. 1. Trip meter (A) (To reset the trip meter, press and hold the switch.) 2. Trip meter (B) (To reset the trip meter, press and hold the switch.) 3. Driving range 4. Average fuel consumption (To reset the average fuel consumption, press and hold the switch.) 5. Average speed/Instant fuel consumption (To reset the average speed/Instant fuel consumption, press and hold the switch.) 6. Service reminder (When service reminder function is enabled.) 7. Function setting screen (Appears when the vehicle is stopped, the selector lever is in the "P" position, and the parking brake is ON) (To display the setting screen, press and hold the switch.) 8. Warning screen display (When a warning is present.) • An interrupt display of appropriate contents is performed when a warning is issued.
10	Selector lever position display screen	Displays the selector lever position.
11	Engine coolant temperature display screen	Displays the engine coolant temperature.
12	Fuel remaining display screen	Displays the remaining fuel amount.
13	Odometer display screen	Displays the odometer.
14	Outside temperature display screen	Displays the ambient temperature.

METER ILLUMINATION CONTROL

The brightness of the combination meter can be adjusted in eight stages (LEVEL 1 to LEVEL 8) by pushing the rheostat illumination switch when the meter is illuminated. Current illumination level will be displayed each time the rheostat illumination switch is pushed. The illumination level can be changed by operating the rheostat illumination switch according to specified procedure *. The brightness of each brightness level is as described in the table below.

NOTE: The brightness can be set separately for the daytime and nighttime. The configured information is stored in the RAM. In the initial setting of brightness, the daytime is set at LEVEL 8 and the nighttime is set at LEVEL 7.

BRIGHTNESS LEVEL TABLE

Brightness level	Dial brightness		Pointer brightness		LCD display brightness	
	Day	Night	Day	Night	Day	Night
LEVEL 8	100%	100%	100%	100%	100%	100%
LEVEL 7	90%	22.3%	90%	22.3%	90%	19%
LEVEL 6	81%	10.9%	81%	10.9%	81%	9.3%
LEVEL 5	71%	5.3%	71%	5.3%	71%	4.6%
LEVEL 4	61%	2.5%	61%	2.5%	61%	2.3%
LEVEL 3	51%	1.2%	51%	1.2%	51%	1.1%
LEVEL 2	42%	0.5%	42%	0.5%	42%	0.6%

Brightness level	Dial brightness		Pointer brightness		LCD display brightness	
	Day	Night	Day	Night	Day	Night
LEVEL 1	32%	0.2%	32%	0.2%	32%	0.3%

SERVICE REMINDER FUNCTION

When the inspection interval (alert start point in table below) is due in accordance with the predetermined schedule (see table below), the service reminder indicator will be displayed when the ignition switch is turned to the ON position. However, even if the warning condition is met, the indicator does not display immediately. It illuminates next time when the ignition switch is turned ON. The impending inspection interval can be displayed by changing the LCD section by the meter information switch. The service reminder indicator will go off when it is reset by operating the meter information switch according to the specified procedure *, or the warning criteria (end point) shown in the table below is satisfied.

*NOTE: *: For details about the meter information switch special operation, refer to the Workshop Manual.*

SCHEDULE TABLE

Schedule	Warning type	Warning criteria
Normal	Elapsed time (month)	Every 12 elapsed months
	Driving distance (miles)	Every 12,500 miles of driving distance
	Driving distance (km)	Every 20,000 km of driving distance

WARNING CRITERIA (WARNING START AND END POINTS)

Elapsed time		Driving distance (km)		Driving distance (miles)	
Warning start point	Warning end point	Warning start point	Warning end point	Warning start point	Warning end point
–30 days	+30 days	– 500 km	+500 km	– 300 miles	+300 miles

BUZZER

M2545500600396

Using its own signal or signal sent via CAN communication, the combination meter sounds the integrated buzzer.

Item	Relating ECU
Seat belt reminder function	Combination meter
Electric steering wheel lock malfunction warning buzzer (vehicles with OSS)	OSS
OSS-related malfunction warning buzzer (vehicles with OSS)	OSS
Engine switch reminder buzzer (vehicles with OSS)	OSS
A/T shift cancel buzzer	CVT-ECU
Paddle shift cancel prohibition buzzer <Vehicles with paddle shift>	
Lamp reminder buzzer function	ETACS-ECU
Keyless operation key reminder buzzer (vehicles with KOS)	KOS
Door-ajar warning buzzer function	ETACS-ECU
Freeze warning buzzer	Combination meter
Parking brake reminder buzzer function	Combination meter
Multi-information display interrupt display buzzer	Combination meter

Item	Relating ECU
ETACS-ECU function customisation buzzer	ETACS-ECU
A/C operation buzzer	A/C-ECU
Audio operation buzzer	Radio and CD player, Multivision display
Meter information switch or rheostat illumination switch <High contrast meter> operation buzzer	Combination meter
Turn-signal lamp buzzer function	ETACS-ECU
Rest reminder buzzer	Combination meter

SEAT BELT REMINDER FUNCTION

When the driver's seat belt is released

1. When the ignition switch is turned ON, the driver's seat belt indicator illuminates and the buzzer sounds for 6 seconds.
2. 60 seconds after the ignition switch is turned ON, if the vehicle speed exceeds 8 km/h, the driver's seat belt indicator illuminates and blinks for 90 seconds. The buzzer sounds simultaneously with the blinks of the indicator.
3. On Step 2 completion, if the seat belt is not fastened when the vehicle speed changes from 3 km/h to 8 km/h, the indicator illuminates and blinks again and the buzzer sounds again.

When the front passenger's seat belt is released

- Control is the same as when the driver's seat belt is not fastened.

ELECTRIC STEERING WHEEL LOCK WARNING BUZZER (VEHICLES WITH OSS)

A buzzer will sound when the steering wheel lock is not activated/deactivated normally.

OSS-RELATED MALFUNCTION WARNING BUZZER (VEHICLES WITH OSS)

A buzzer will sound when an error occurs in the OSS-ECU power supply system.

ENGINE SWITCH REMINDER BUZZER (VEHICLES WITH OSS)

With the engine switch in the ON position, when the driver's door is opened, the buzzer sounds.

A/T SHIFT CANCEL BUZZER/PADDLE SHIFT CANCEL PROHIBITION BUZZER <VEHICLES WITH PADDLE SHIFT>

The buzzer sounds when the shift change on the transmission side is not made although the downshift operation is performed with the selector lever or paddle shift.

LAMP REMINDER BUZZER FUNCTION

With the ignition switch in the LOCK (OFF) position, when the driver's door is opened with the tail lamp switch remaining ON, the buzzer sounds.

KEYLESS OPERATION KEY REMINDER BUZZER (VEHICLES WITH KOS)

With the ignition switch in the LOCK (OFF) position, when the driver's door is opened with the keyless operation key left in the vehicle, the buzzer sounds.

DOOR-AJAR WARNING BUZZER FUNCTION

With the ignition switch in the ON position, when any of the doors (including the tailgate) is open and the vehicle speed information sent via the CAN communication is 8 km/h or more, the buzzer sounds.

FREEZE WARNING BUZZER

When the ignition switch is in the ON position, if the ambient temperature is at 3°C or below, the buzzer sounds.

PARKING BRAKE REMINDER BUZZER FUNCTION

With the ignition switch in the ON position, if the parking brake has not been reset (parking brake switch: ON), and when the vehicle speed information transmitted via CAN communication is 8 km/h or more, the buzzer sounds.

MULTI-INFORMATION DISPLAY INTERRUPT DISPLAY BUZZER

When the interrupt display is displayed on the multi-information display because of alarms, the buzzer sounds.

ETACS-ECU FUNCTION CUSTOMIZATION BUZZER

When entering into the customize mode of ETACS-ECU functions or when the customisation is executed, the buzzer sounds in each case.

A/C OPERATION BUZZER, AUDIO OPERATION BUZZER

According to the buzzer sounding request signal which is received when the A/C, radio and CD player, CD changer or audio visual navigation unit is operated, the buzzer sounds.

METER INFORMATION SWITCH OR RHEOSTAT ILLUMINATION SWITCH <HIGH CONTRAST METER> OPERATION BUZZER

When the meter information switch or rheostat illumination switch <High contrast meter> is operated, the buzzer sounds.

TURN-SIGNAL LAMP BUZZER FUNCTION

The buzzer sounds in synchronisation with the turn signal lamp operation.

REST REMINDER BUZZER

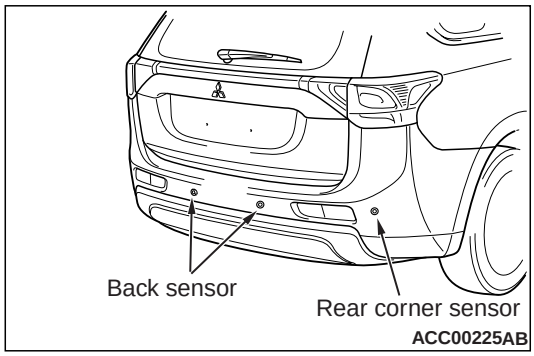
When the time to take a rest which was set on the multi-information display is reached, the buzzer sounds.

REVERSING SENSOR (CORNER SENSOR AND BACK SENSOR)

GENERAL INFORMATION

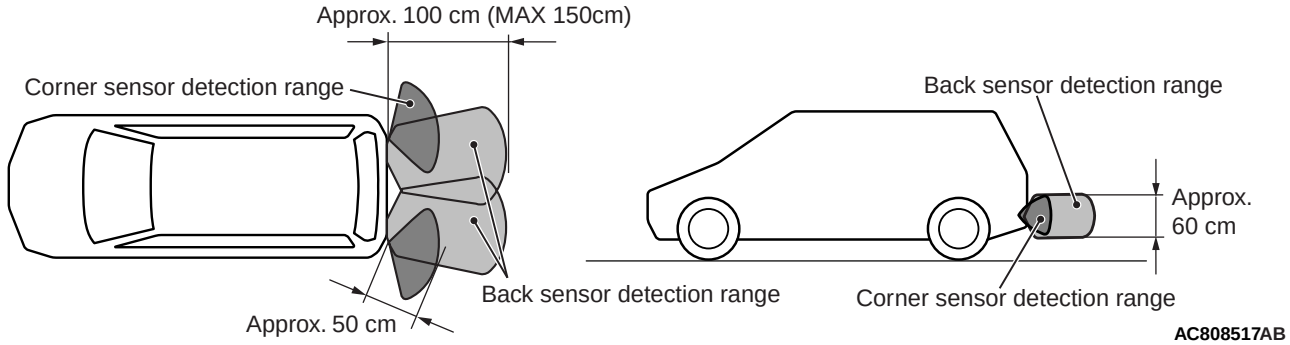
M2545200200353

The ultrasonic sensors installed on the rear corner bumper and rear bumper detect obstacles at the vehicle corners. These sensors have been adopted to inform the driver of the obstacle distance from the vehicle using the buzzer in corner sensor/back sensor-ECU, and to improve the safety and vehicle drivability during driving the vehicle into a garage and parking in a narrow space.



⚠ CAUTION

When the illuminated licence plate is installed, the sensors may not operate because of noise from the plate.Refer to FAIL-SAFE FUNCTION (1)



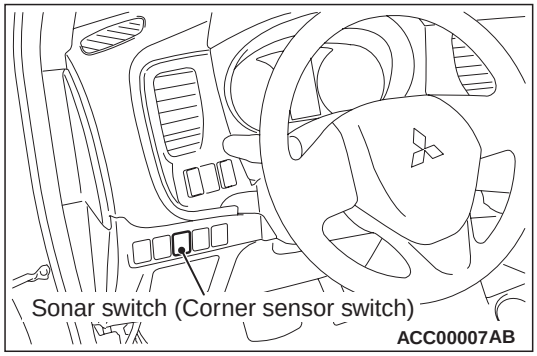
- Automatically active system by select reverse position

- Depending on whether the vehicle is equipped with a towing bar, you can change sensors between the standard mode and the towing bar mode. The towing bar mode changes the system to exclude in the area in which the towing bar is mounted from the detection areas.

NOTE: The detection range of the sensor varies with temperature and humidity. Obstacles below the bumpers or a curbstone not taller than the sensor position may be hard to be detected.

OPERATION

ACTIVATION/DEACTIVATION OF REVERSING SENSOR SYSTEM



By shifting the gear to the reverse position and operating the sonar switch (corner sensor switch), the system can be turned ON (reversing sensor indicator: ON) and OFF (reversing sensor indicator: OFF).

THE TOWING BAR MODE SWITCHING

By operating the sonar switch (corner sensor switch), "TOWING BAR MODE" and "STANDARD MODE" can be changed.

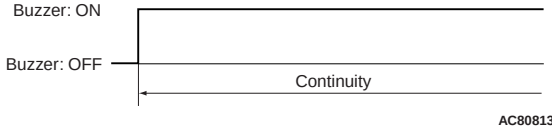
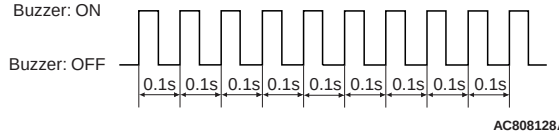
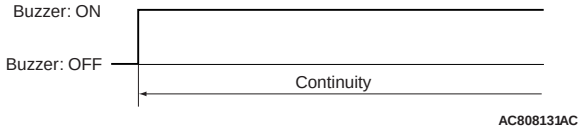
1. Turn the ignition switch to the ON position.
2. Move the shift lever or selector lever to the "R" (reverse) position.
3. Turn off the reversing sensor system by operating the sonar switch (corner sensor switch).(Reversing sensor indicator: OFF)
4. Press and hold the sonar switch (corner sensor switch) for approximately 5 seconds.
5. The buzzer* sounds and the mode is switched between "TOWING BAR MODE" and "STANDARD MODE".

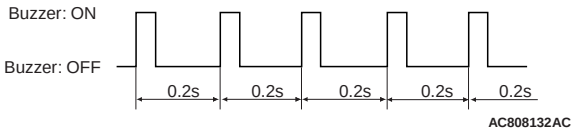
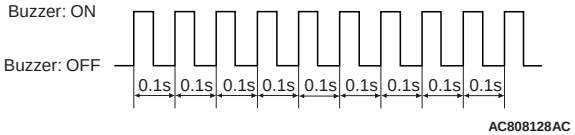
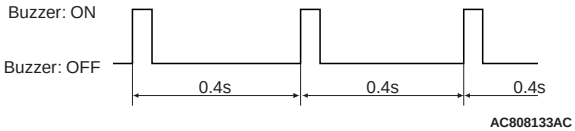
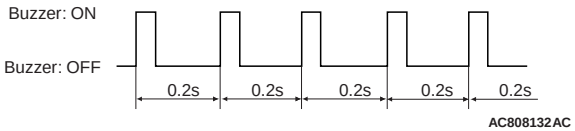
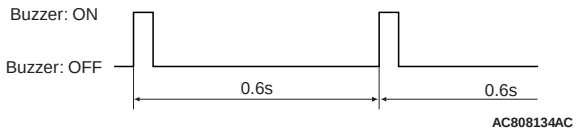
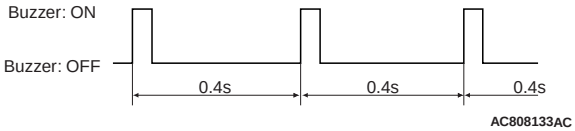
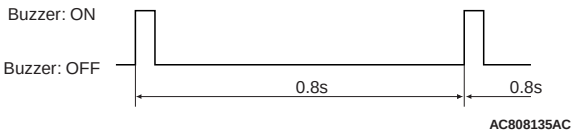
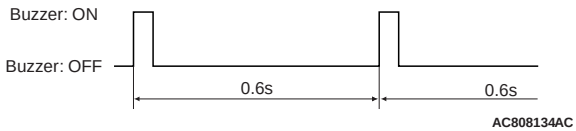
*NOTE: *: Sounds twice when the mode is switched to "TOWING BAR MODE". Sounds once when the mode is switched to "STANDARD MODE".*

BUZZER DURATION

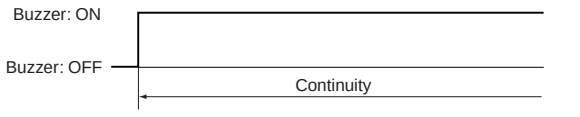
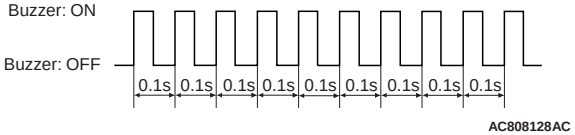
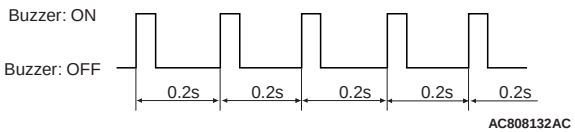
The buzzer sound of the corner sensor/back sensors is the same. The buzzer in the corner sensor/back sensor-ECU sounds based on the closer alarm cycle having a higher priority.

BACK SENSOR

Distance between back sensor and obstacles	Buzzer duration	
	The standard mode	The towing bar mode
Less than approximately 40 cm		Buzzer: OFF
Approximately 40 to 60 cm		

Distance between back sensor and obstacles	Buzzer duration	
	The standard mode	The towing bar mode
Approximately 60 to 80 cm		
Approximately 80 to 100 cm		
Approximately 100 to 120 cm		
Approximately 120 to 150 cm		

CORNER SENSOR

Distance between corner sensor and obstacles	Buzzer duration
Less than approximately 25 cm	
Approximately 25 to 40 cm	
Approximately 40 to 50 cm	

FAIL-SAFE FUNCTION

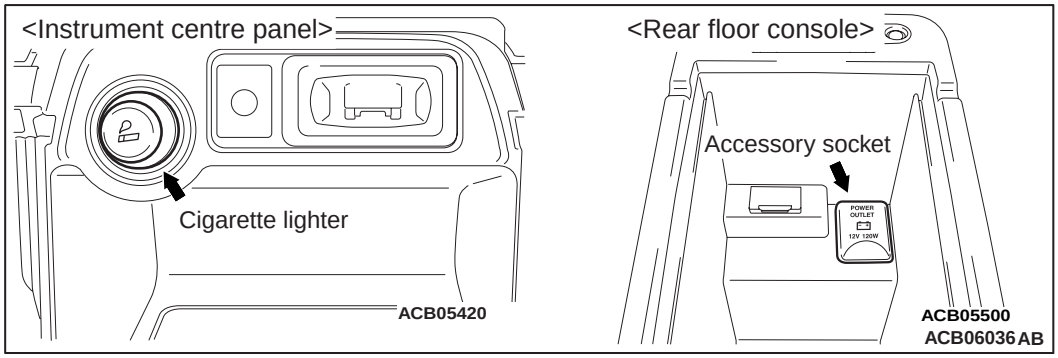
1. When the ultrasonic noise is received, the bass toned buzzer sound continuously. When the ultrasonic noise stops, the normal operation will be resumed immediately.
2. When the abnormality such as the open circuit of a sensor occurs, the sensor turns OFF and the high toned buzzer sounds for 5 seconds. When the normal signal is received, the normal state will be resumed.

3. When an abnormality occurs in the system, the reversing sensor indicator keeps flashing with 0.8-second interval until the system returns to the normal condition. However, if the system is turned OFF by using the switch, the indicator stops its flashing.

ACCESSORY SOCKET

GENERAL INFORMATION

M2544400200785



- The instrument centre panel is equipped with a cigarette lighter as standard.
- The rear console contains a plug-in type accessory socket, which is useful when using a accessory device
- The maximum load is 120 W when a single accessory socket is used.

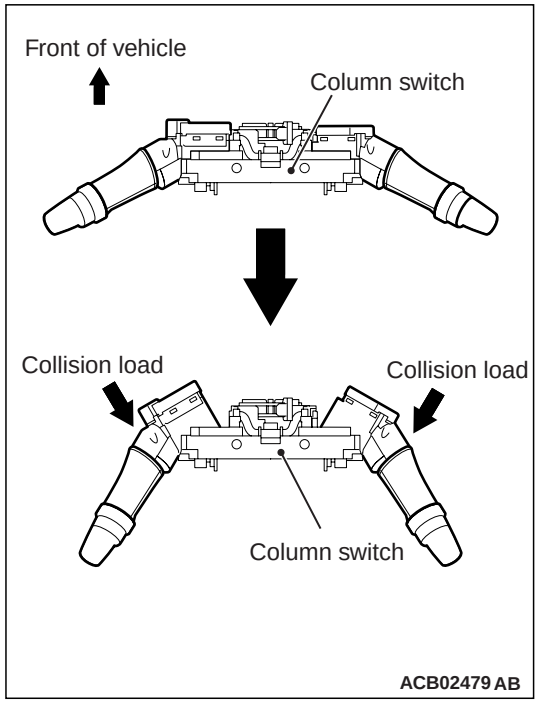
COLUMN SWITCH

GENERAL INFORMATION

M2546100200166

Column switch has a function to ensure the driver's safety upon an impact of frontal collision.

FUNCTION



If the column switch moves to the front of the vehicle and hits the instrument panel or meter bezel due to the impact of frontal collision, the steering wheel moves to the front of the vehicle because the right and left levers fall down, ensuring the driver's safety. In addition, the column switch is ensured of the rigidity that the levers do not fall down by the normal operation, but it cannot be reused after deformation occurrence.

AUDIO AND NAVIGATION SYSTEM

GENERAL INFORMATION

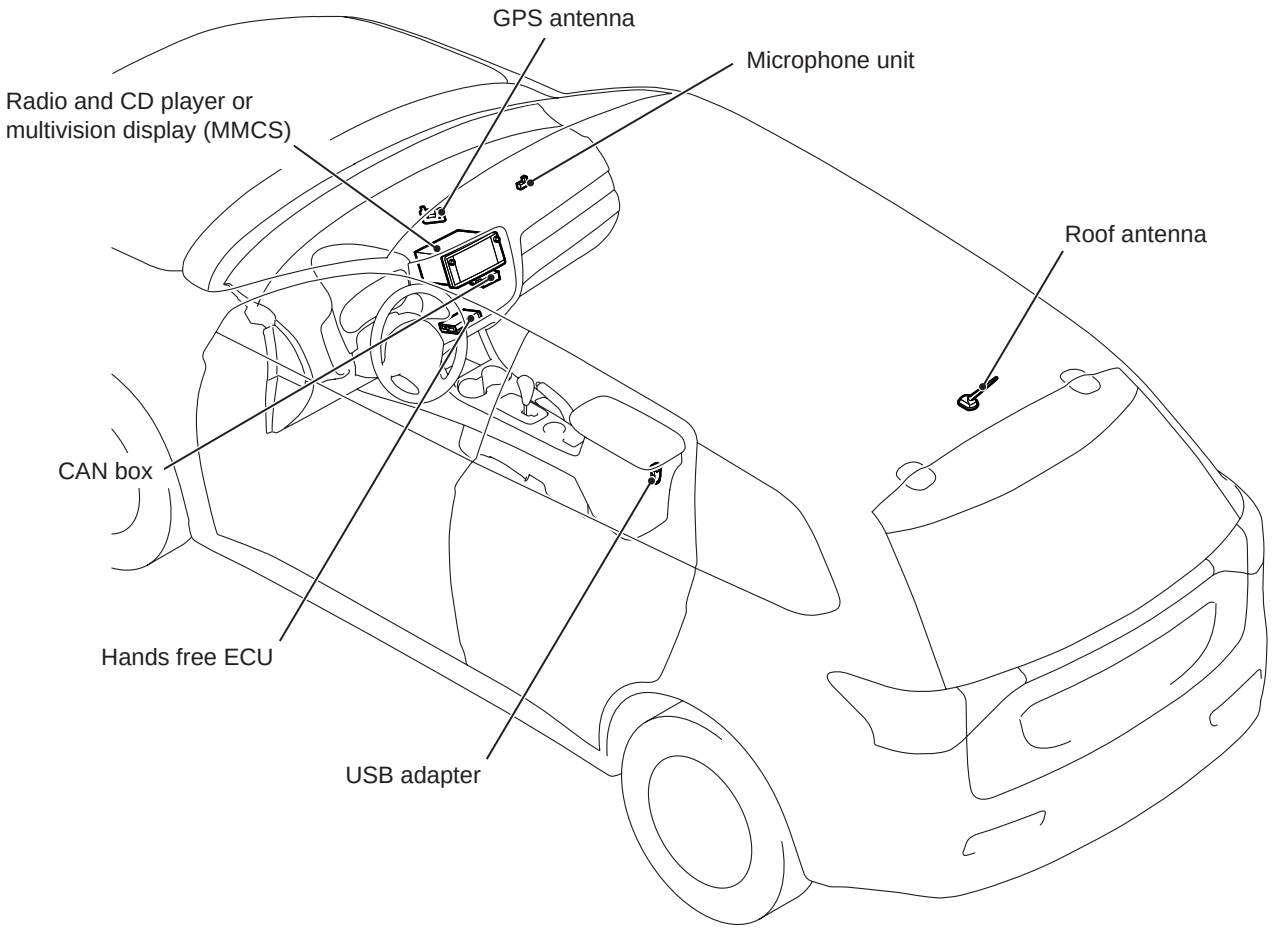
M2547000100563

- For the audio unit (radio and CD player), the following two types have been established: the 1CD audio as well as the display audio.
- For Mitsubishi Multi Communication System (MMCS), the multivision display with CD drive and SD memory card drive is established.
- A rear view camera has been established to the tailgate.
- On the spoke of steering wheel, the steering wheel remote control switch has been installed.
- An USB adapter is equipped in the rear console.
- The hands-free interface system has been established.
- For the speaker system, the following two types have been established: the 6 speakers as well as the 9 speakers at 7 positions*.

*NOTE: *Vehicles with Rockford Fosgate® premium sound system.*

- A roof antenna has been mounted for receiving radio broadcast.
- The Rockford Fosgate® premium sound system (audio amplifier and 9 speakers at 7 positions) has been established.

CONSTRUCTION DIAGRAM



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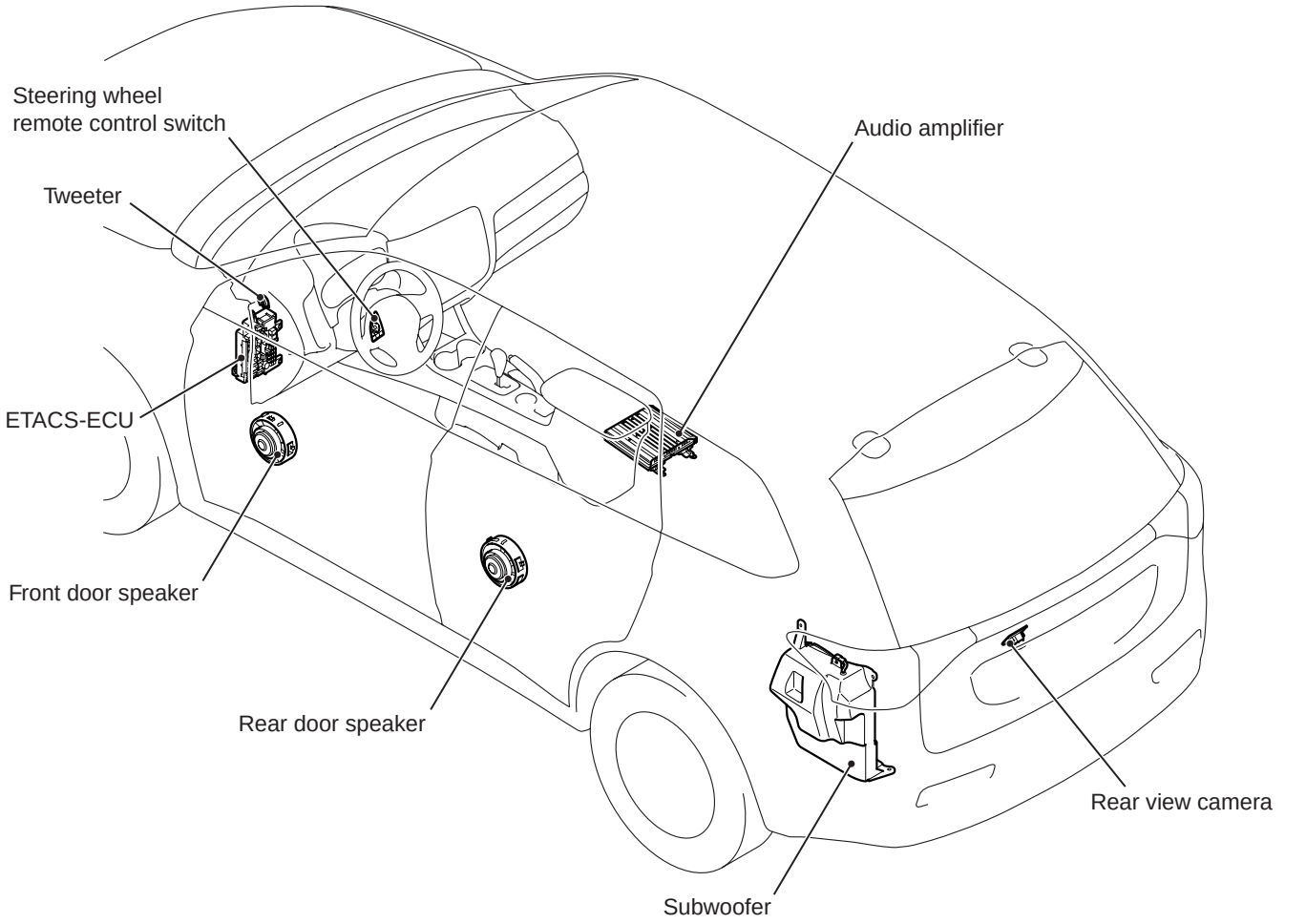


RADIO AND CD PLAYER

M2544900400610

For the audio unit, the following two types have been established: the 1CD audio as well as the display audio. To have best acoustical characteristics, integrated amplifier is tuned to the acoustic.

1CD audio

- Harmonized face panel design and colour with around trim parts.
- 2 line bright white letters on VFD (Vacuum Fluorescent Display), umber illumination.

Display audio

- Harmonized face panel design and colour with around trim parts.
- 6.1 inch QVGA full colour display, with touch panel, umber illumination.
- Compatible with rear view camera interface.

SPECIFICATIONS

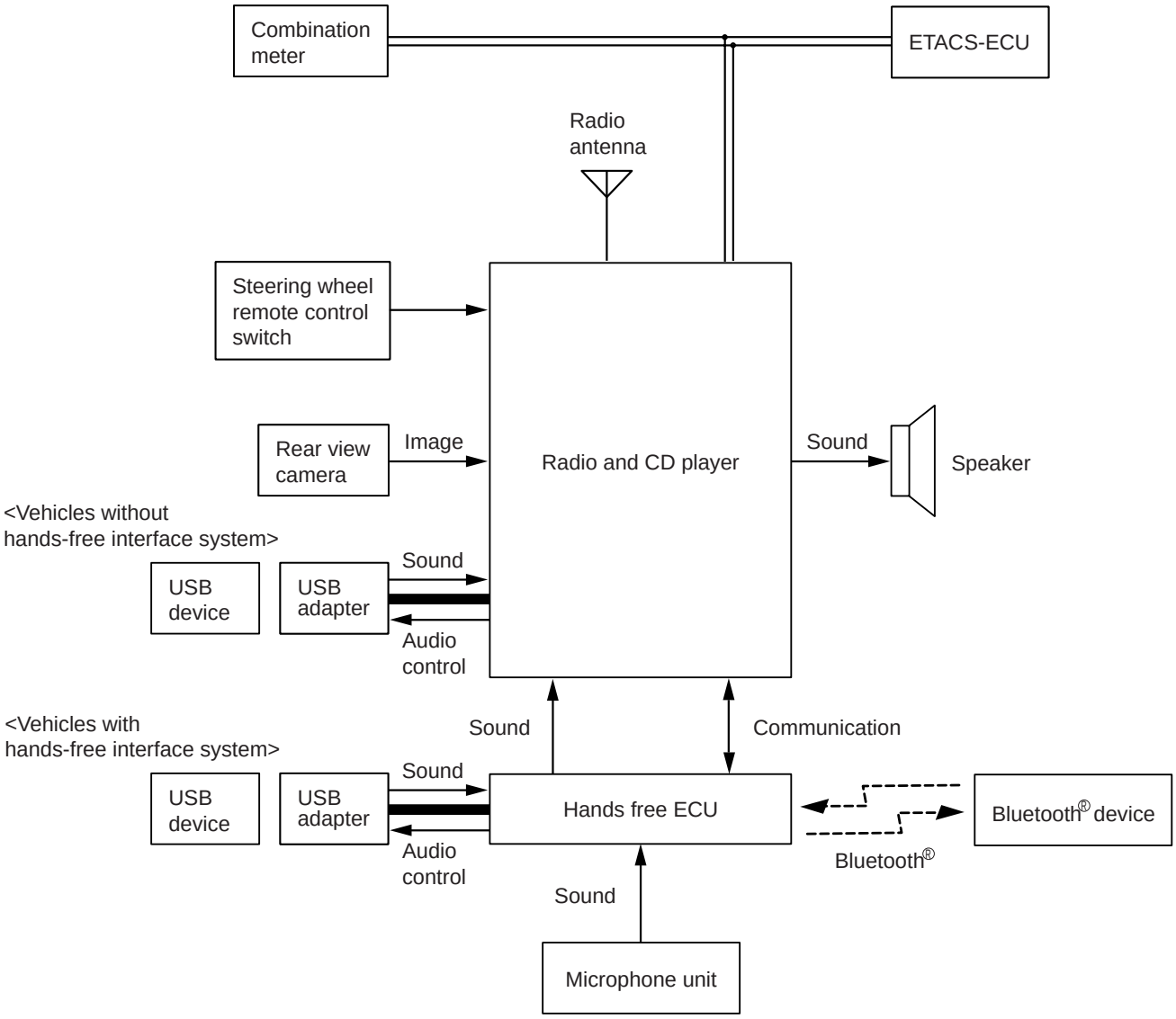
Item	1CD audio	Display audio
FM/MW/LW electronic tuning radio	Equipped	Equipped
RDS function	Equipped	Equipped
CD player, compatible with MP3 format (CD-R/CD-RW supported)*1	Equipped	–

Item	1CD audio	Display audio
CD player, compatible with MP3/WMA/AAC format (CD-R/CD-RW supported)*1	–	Equipped
Audio integrated 4 channel power amplifier	General 140 W	General 140 W
Supports iPod®/portable music player/USB memory device (MP3/WMA/AAC compatible) connection*2	Equipped	Equipped

NOTE:

- **1: Some MP3/WMA/AAC format and CD-R/CD-RW may not be played.*
- **2: A iPod®/portable music player/USB memory device (MP3/WMA/AAC compatible) can be connected through the USB connection to play its stored audio file or charge its battery. Some devices may not be compatible with the hands free ECU.*

SYSTEM BLOCK DIAGRAM



ACC00427

MITSUBISHI MULTI COMMUNICATION SYSTEM (MMCS)

M2544800100560

For Mitsubishi Multi Communication System (MMCS), the multivision display (7 inch WVGA display of wide 2 DIN size) with CD drive and SD memory card drive is established.
Two slots of SD memory card available. One uses map data and software program etc., the other uses music data (MP3, WMA, etc.) playback.
Lift customer satisfaction point to improve following items from current model.

Refresh Design

Adopt high-definition screen

- Change WQVGA (480 x 234 dot) display into WVGA (800 x 480 dot) in the same size. So, supply sharper image.

Change panel and screen design

- Change the name of panel buttons easy to understand.
- Adopt rotary switches to change volume intuitively.

- Group each menu easy to understand (Left side: AV, Right side: Navigation, Under: Setting).
- Create expensive-looking high gross black and plating on the panel.

Improve Functions

Improve the base feature of MMCS

- Add 3D map view and 3D landmarks
- Add highway (motorway) map
- Add junction view
- Display speed limit

Display guidance point in the combination meter

- Displaying guidance information displayed in MMCS in combination meter, confirm guidance point safety.

Improve Usability

Add map of new countries

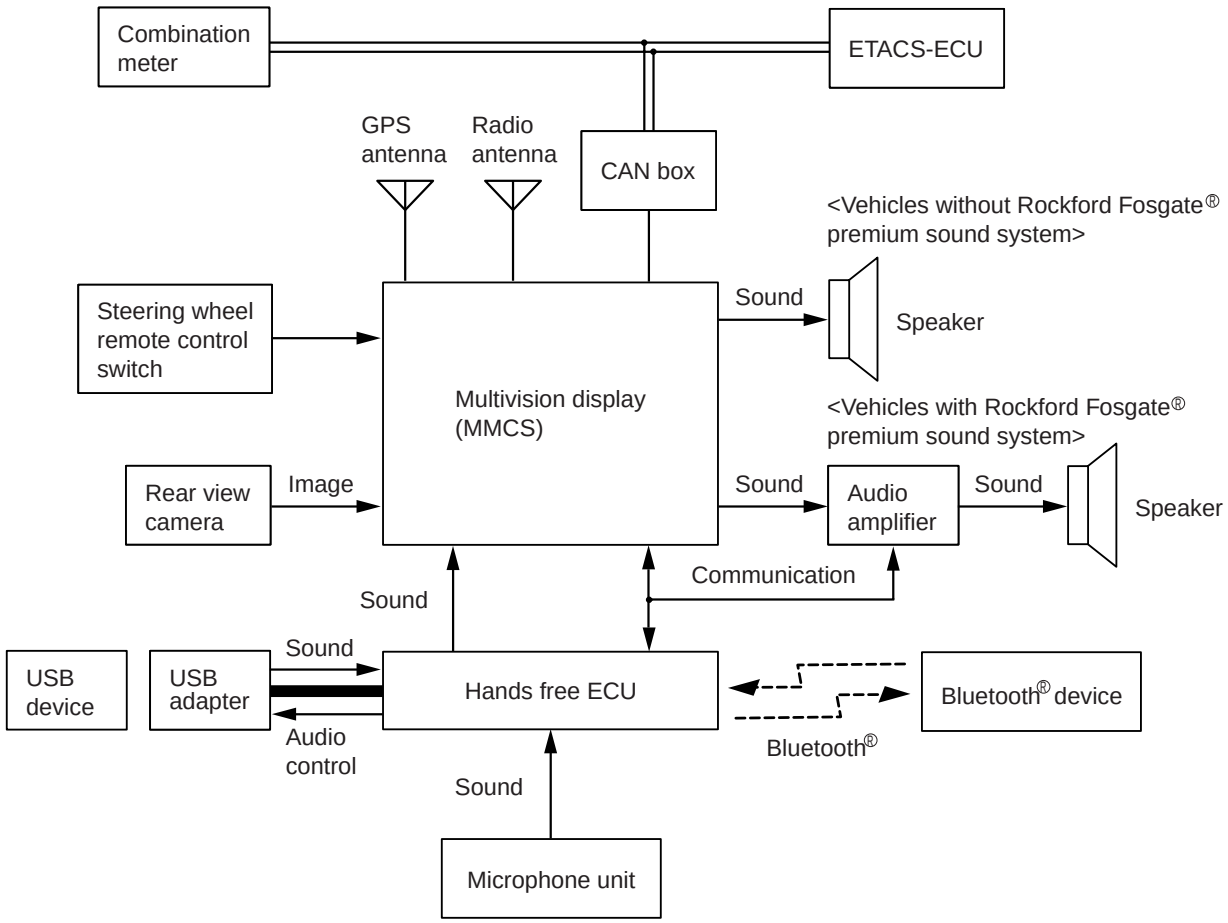
- Add new countries as below.
  - Finland
  - Baltic States (Latvia, Lithuania, Estonia)
  - Belarus
  - Moldova

Enhance AV Functions

Display two screen at a time

- Display map screen and other screen (AV, Information etc.) at a time

SYSTEM BLOCK DIAGRAM



ACB05488

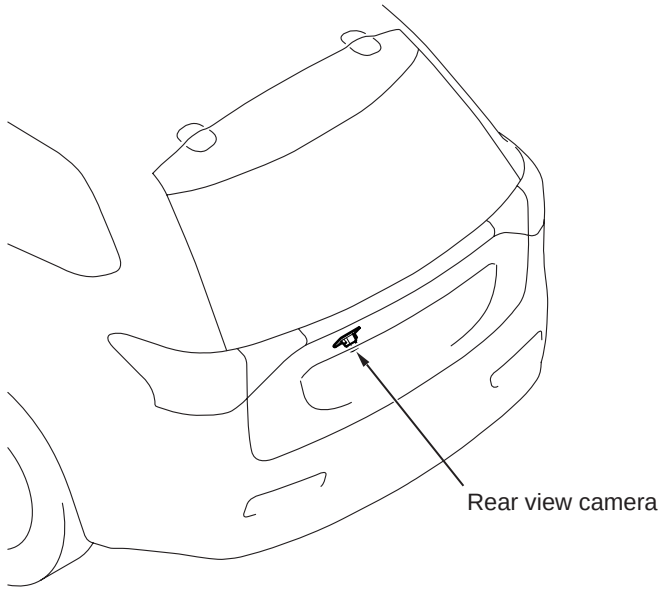
ETACS FUNCTION CUSTOMISATION FUNCTION

The ETACS functions can be customised by selecting of the multivision display.

REAR VIEW CAMERA

M2544700100187

A rear view camera has been established to the tailgate. The rear view camera displays the rear view image of the vehicle on the display audio or multivision display for easy confirmation of safety when driving backward.



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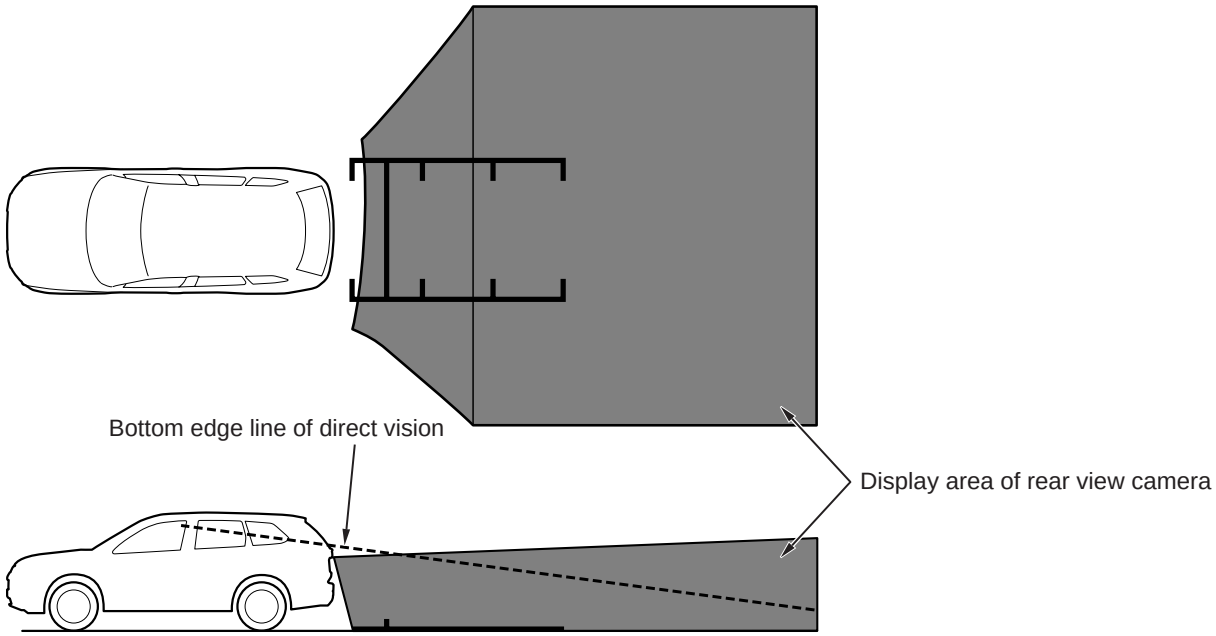

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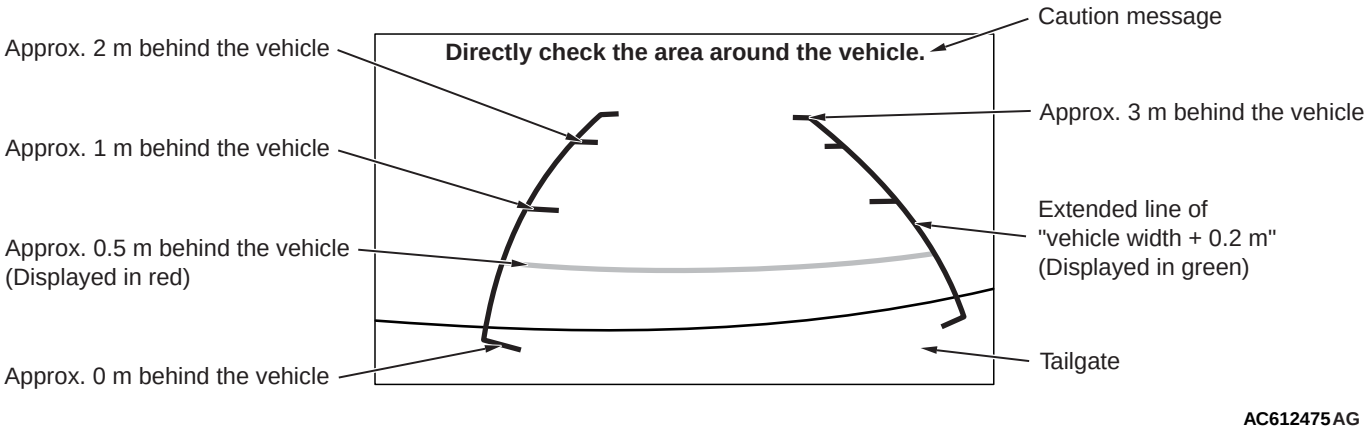
OPERATION

When the selector lever is moved to the R (reverse) position with the ignition switch "ON", the image of the rear view camera is displayed on the display audio screen or multivision display screen.

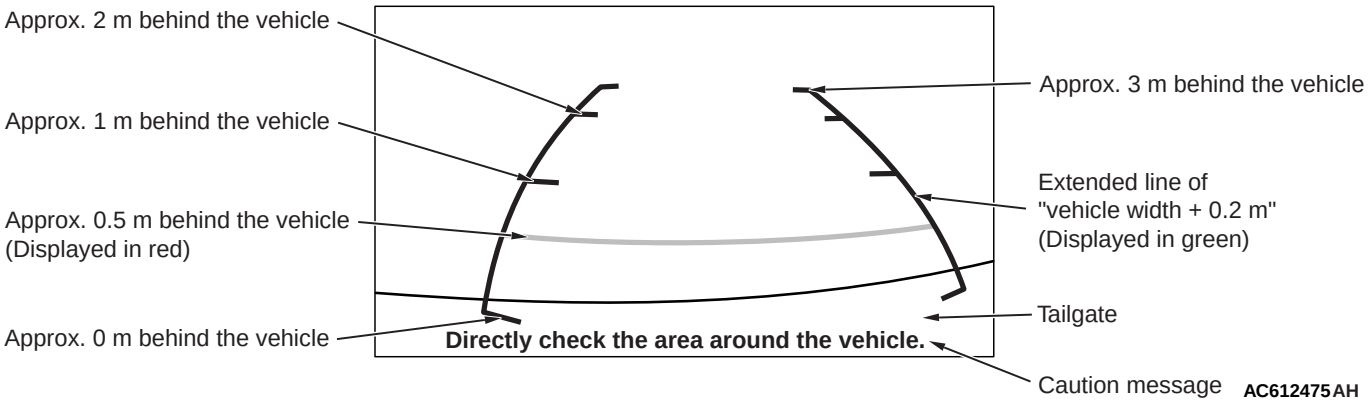
Screen display

Displays rear view camera.

<Vehicles with display audio>

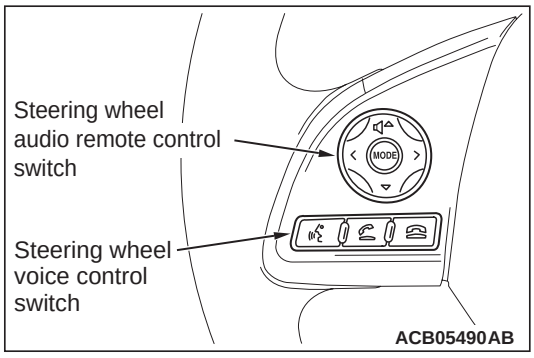


<Vehicles with multivision display>



STEERING WHEEL REMOTE CONTROL SWITCH

M2546500000320



On the spoke of steering wheel, the steering wheel audio remote control switch and steering wheel voice control switch have been installed.

STEERING WHEEL AUDIO REMOTE CONTROL SWITCH

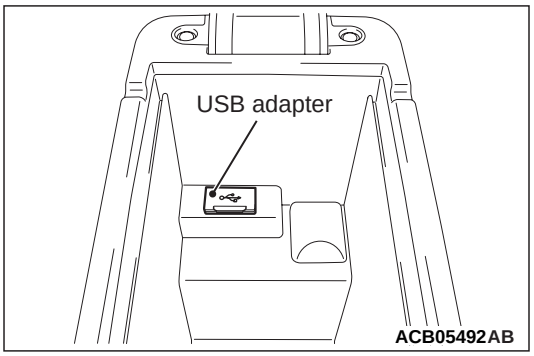
Using the steering wheel audio remote control switch, the volume adjustment of the radio and CD player and the multivision display, mode changeover, CD track up/down, and others can be performed.

STEERING WHEEL VOICE CONTROL SWITCH <VEHICLES WITH HANDS-FREE INTERFACE SYSTEM>

Using the steering wheel voice control switch, hands-free interface system.

USB ADAPTER

M2547100100021



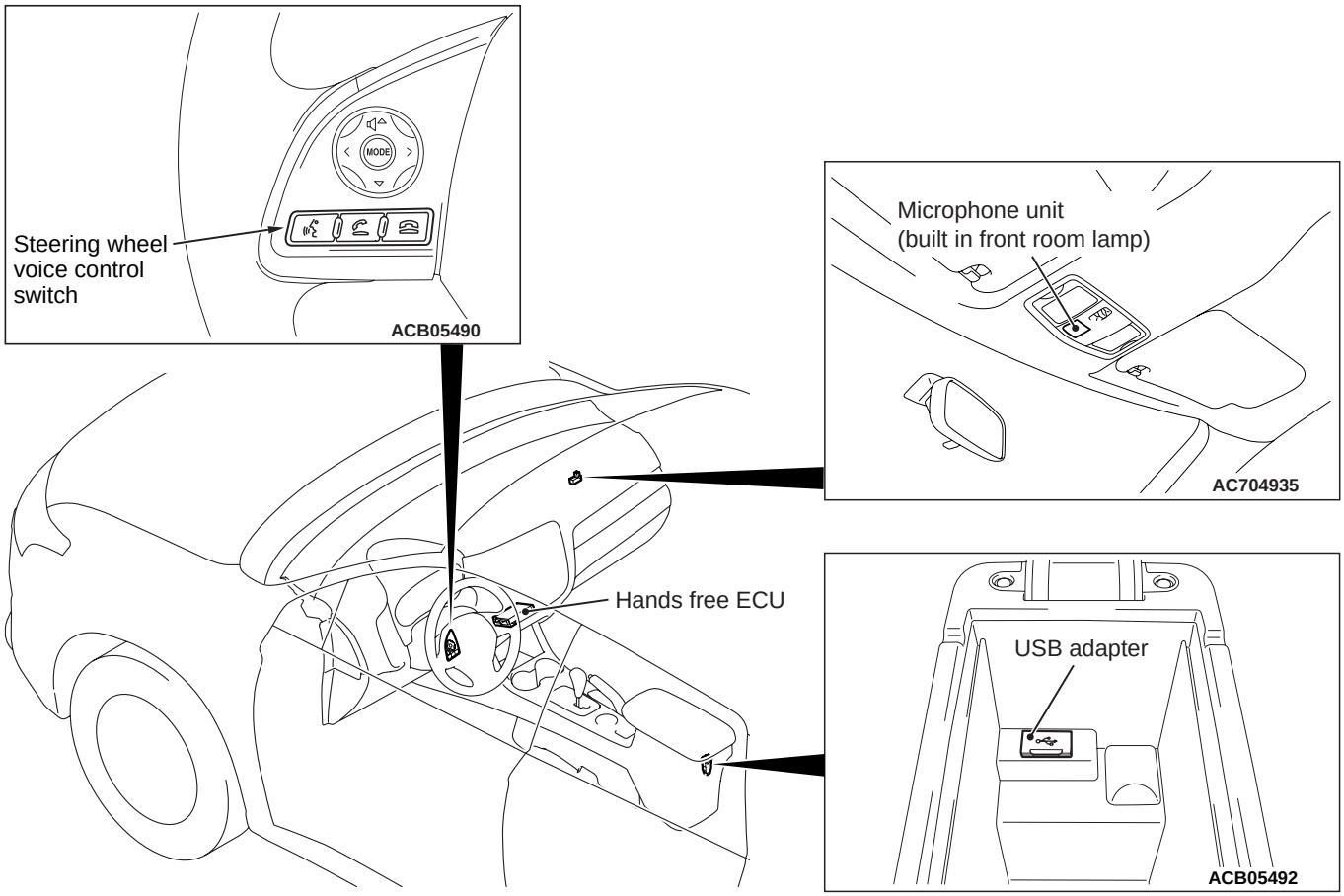
An USB adapter is equipped in the rear console. A iPod®/portable music player can be connected through the USB connection to play its stored audio file on the radio and CD player or the multivision display, or charge its battery.

HANDS-FREE INTERFACE SYSTEM

M2546400300023

The hands-free interface system enables handsfree talking and playing music by Bluetooth® connection with Bluetooth® device (mobile phone or music player). In addition, music can be played by connecting the USB-compatible device to the USB adapter.

CONSTRUCTION DIAGRAM



SPEAKER

M2545000100426

6 speakers (tweeter, front door, rear door) are provided.

NOTE: For Rockford Fosgate® premium sound system, refer to P.54A-41.

SPECIFICATIONS

Item	Allowable input power W	Rated input power W
Tweeter	25	3
Front door speaker	35	15
Rear door speaker	35	15

TWEETER

The 3.5 cm balance dome tweeters are incorporated in the front door sash trim.

DOOR SPEAKER

The 16 cm paper cone speakers are incorporated in the front door and rear door.

ANTENNA

M2545100100371

At the centre of the roof rear, the roof antenna has been mounted for receiving radio broadcast.

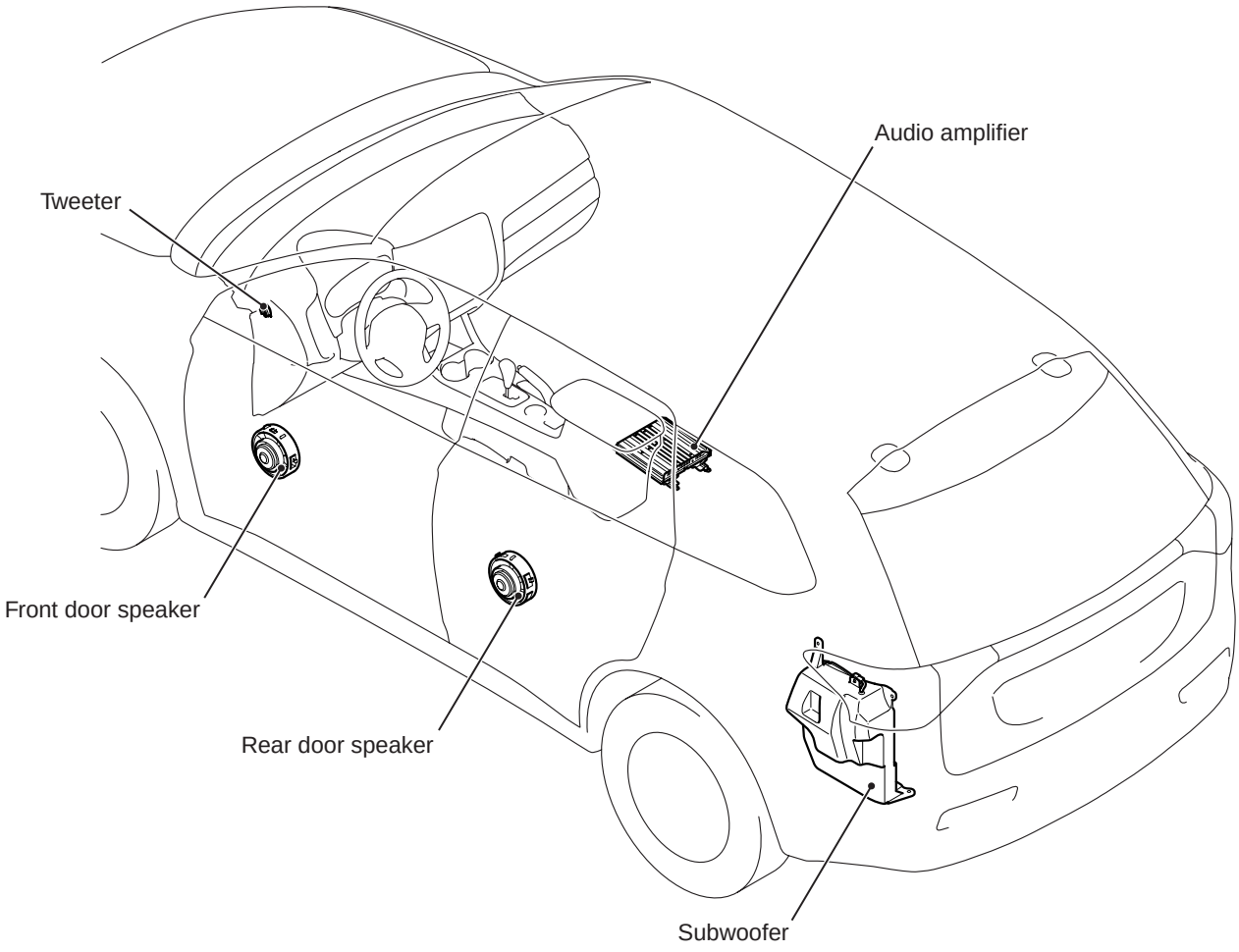
ROCKFORD FOSGATE PREMIUM SOUND SYSTEM

GENERAL INFORMATION

M2547000100574

The premium sound system applies "Rockford Fosgate®", American top car audio brand, as same as current model. All the electronics devices, circuits, like audio unit and premium amplifier, and sound structures, such as door speakers and subwoofer are newly developed. And the sound system is tuned thoroughly by professional Mitsubishi and Rockford engineers, the Rockford Fosgate® premium sound system accomplished higher sound quality than the current model having high reputation at world wide markets.

CONSTRUCTION DIAGRAM



ACC00014 AB

FUNCTION

Various attractive new sound adjusting functions are added, to select sound setting precisely, according to various user preferences.

Surround technology: DTS Neural Surround

Multi-channel surround enhancement technology developed by DTS, surround sound from the rear speakers, even 2-channel music source.

Media expander: PremiDIA-HD

Compensate sound quality of the compressed digital music source.

Automatic volume control technology: Dolby Volume

Auto volume level adjusting technology developed by Dolby, reduce volume changes between different volume level source.

Wide stereo technology: PremiDIA-WIDE

Emphasize stereo image more expanded, beyond cabin space.

Listening Position selector

Sound quality optimization according to the location of the listeners.

3 levels speed compensated volume (SCV)

Select from 3 levels of SCV effect (+OFF) accordingly from driving noise (current model: fixed value, SCV ON or OFF).

AUDIO AMPLIFIER

M2547000200258

As a separate amplifier, 8-ch audio amplifier incorporating digital signal processor (total maximum output of 710 W) has been introduced.

By using AUREUS® 32 bit digital signal processor and BURR-BROWN® 24 bit D/A converter, system has higher accretion of digital sound processing, and it makes predominantly clear sound.

SPEAKER

M2545000100437

9 speakers [tweeter, front door, rear door (2-way), subwoofer] are provided.

SPECIFICATIONS

Item	Allowable input power W	Rated input power W
Tweeter	50	25
Front door speaker	80	40
Rear door speaker	80	40
Subwoofer	150/150	75/75

TWEETER

The 3.5 cm soft dome tweeters are incorporated in the front door sash trim.
By using light weight CCAW (Copper-Clad Aluminium Wire) voice coil and Tetoron® diaphragm, making much clear and comfortable high frequency sound.

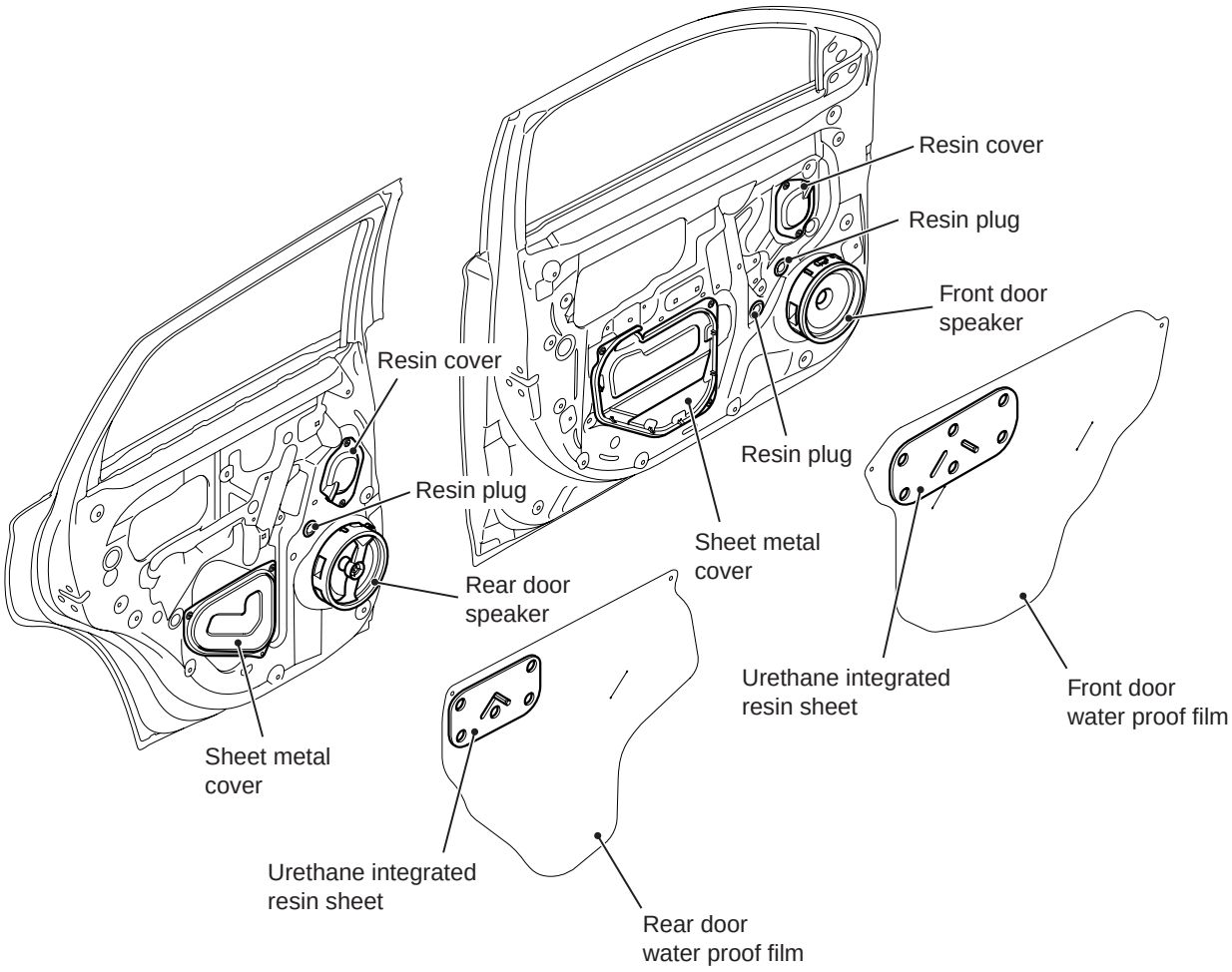
DOOR SPEAKER

The 16 cm polypropylene cone speakers (woofer) are incorporated in the front door. The 16 cm + 3.5 cm polypropylene cone 2-way coaxial speakers (woofer + tweeter) are incorporated in the rear door.
Vacuum moulded 3D shape cone woofer has advantages for lighter weight and higher stiffness. By making horn shaped surrounding of the tweeter, makes sound connection smoothly from low to high frequency.

SUBWOOFER

The 25 cm dual voice coil subwoofer has been installed to the quarter trim in the luggage room, enabling the playback of dynamic deep bass.
Gain more power than current model although subwoofer unit size is same. Position and direction of it are decided enthusiastically for excellent sound.

DOOR AS A SPEAKER BOX



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The openings of doors is blocked by using the sheet metal cover, resin cover, resin plug and urethane integrated resin sheet to make the door into a speaker box, thus improving the sound quality. As an advantage of the sheet metal cover, the rigidity of the areas around the speaker has been increased, and the higher sound pressure, suppression of high harmonic, and suppression of dumping are achieved to improve sound quality.

IMMOBILIZER SYSTEM <Vehicles without keyless operation system>

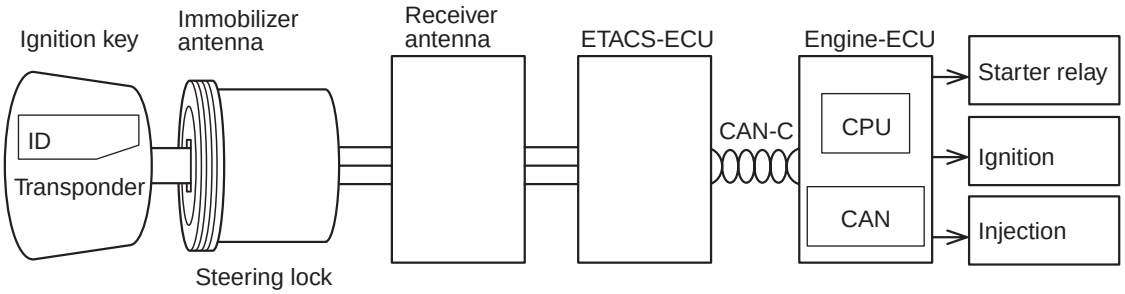
GENERAL INFORMATION

M2544600200251

- The immobilizer system consists of the receiver antenna, the ETACS-ECU, the steering lock (immobiliser antenna) and the ignition key.
- The receiver antenna communicates with the transponder via the steering lock to receive keyless entry signal, and then sends the signal to the ETACS.
- ID codes (transmitter and transponder) is registered into ETACS-ECU.

- The ETACS-ECU compares the ID code, which it receives from the receiver antenna, with the one stored in its memory. If the ID codes correspond, the ETACS-ECU will permit the keyless operation and the engine starting.
- The ignition key (transmitter and transponder) incorporates an indicator lamp that enables the driver to check if the signal is transmitted correctly or if the battery in the key is discharged.
- Each vehicle is provided with two ignition keys as standard, and up to eight ignition keys can be registered.
- Settings of the keyless entry function can be adjusted using a customisation function.

CONSTRUCTION DIAGRAM



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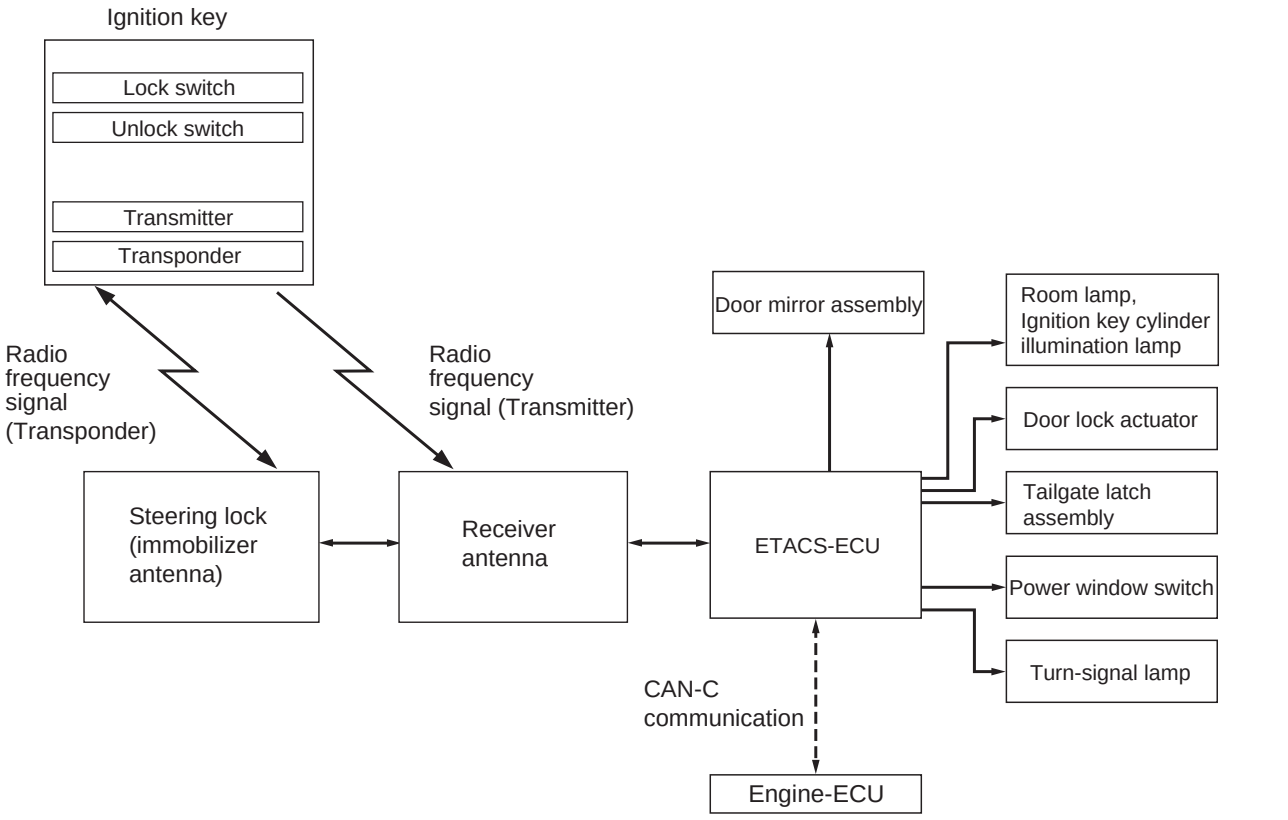
MAIN COMPONENTS

Component name	Outline of function
Receiver antenna	Receives the operation signals from the lock/unlock switches on the ignition key (transmitter and transponder), sends them to ETACS-ECU Sends signal to the transponder in the ignition key and receives the reply data from the transponder via the steering lock (immobilizer antenna), sends the reply data to ETACS-ECU. Communication with transponder is operated by ETACS, Receiver antenna is a driver module for transponder communication.
Steering lock (immobilizer antenna)	Wireless communication with ignition key (transponder) receives the ID code (key ID) of the ignition key (transponder) needed for starting the engine, transponder communication is conducted via this antenna and receiver antenna drives this antenna.
Ignition key (transmitter and transponder)	The ignition key (transponder) receives signals for certification sent from ETACS-ECU via receiver antenna and immobilizer antenna, and sends the reply data signal to ETACS-ECU via receiver antenna and immobilizer antenna. The ignition key (transmitter) also sends signals to receiver antenna when the lock/unlock switches on it are operated.
ETACS-ECU	Conduct certification communication with the engine by using the CAN communications. Operate the receiver antenna for the transponder communication, and store the IDs using the immobilizer communication.
Engine-ECU	Communicates with ETACS-ECU via CAN. Permits/inhibits the engine starting and controls the engine operation.

System configuration



ACC00115AB

OPERATION

1. When the ignition key is inserted to the ignition switch or the ignition switch is turned to the ON position, ETACS-ECU starts operation of receiver antenna, and starts communication with ignition key (transponder) by radio frequency.
2. When the ignition key receives the request signal to start the communication from receiver antenna via immobilizer antenna, then transponder starts the communication and send the signal for communication to receiver antenna via immobilizer antenna.
3. Receiver antenna sends the codes (key ID, etc) sent from the ignition key to the ETACS-ECU.
4. ETACS-ECU compares the codes (key ID, etc) sent from receiver antenna with the already-registered ID code and self calculated value, and then reflect the result of transponder communication to the certification communication with engine ECU.

NOTE:

- *The transponder integrated in the ignition key uses the power supplied from receiver antenna via immobilizer antenna. Therefore, it can be used regardless of the battery in ignition key (for transmitter).*
- *Two ignition keys (transmitter and transponder) are provided, and up to eight keys can be registered to one vehicle as needed.*
- *When ETACS-ECU is replaced or when the key is lost or added, the ID codes for all the keys (key ID) must be registered using M.U.T.-III.*

ETACS

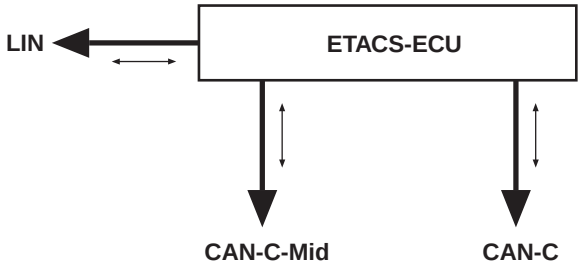
GENERAL INFORMATION

M2545400200722

ETACS*-ECU has three main functions (gateway function, coding function, body electrical equipment control function).

*NOTE: *: ETACS (Electronic Time and Alarm Control System)*

GATEWAY FUNCTION



ACC00079AB

As a central ECU for the on-vehicle communication network system established in the vehicle, the gateway function is integrated into ETACS-ECU. The gateway function offers the following functions:

- Data transfer among three networks*1

Transfers the data flowing in a network to another network in real time.

*NOTE: *1: CAN*2*-C (power train network), CAN*2*-C-Mid (middle-speed body network), LIN *3(low-speed body network)*

*NOTE: *2: For details of CAN, refer to GROUP 54C, Controller Area Network (CAN) .*

*NOTE: *3: For details of LIN, refer to GROUP 54B, Local Interconnect Network (LIN) .*

- Diagnosis of each network communication line

Detects and stores an open circuit and short circuit of communication line.

- Communication error diagnosis of network ECUs

Detects and stores the ECU that is not properly transmitting data.

CODING FUNCTION

By writing the coding data such as vehicle model, destination, and equipment level to ECUs, the functions of ECUs can be changed. There are two types of coding method, the local coding and global coding.

BODY ELECTRICAL EQUIPMENT CONTROL FUNCTION

This function controls the following electrical equipment.

- Exterior lamps
- Wiper, washer
- Central door locking system
- Interior lamp
- Electric-folding door mirror <vehicles with electric retractable remote controlled door mirrors>
- Keyless entry, keyless operation system <vehicles with KOS>
- Power supply control
- Immobilizer system <vehicles without electric retractable remote controlled door mirrors>
- Headlamp automatic levelling system <vehicles with headlamp automatic levelling system>

FUNCTION AND CONTROL BY ETACS-ECU.

M2545400300547

POWER SUPPLY CONTROL

ACC POWER CUT-OFF FUNCTION <INITIAL CONDITION: 30 MINUTES>

The function has been added that the ACC power supply is cut-off when 30 or 60 minutes has elapsed with the ignition switch in the ACC position.

NOTE: Using a customise function, the availability of ACC power cut-off function and its time to ACC power cut-off can be set. (Refer to Customise Function P.54A-45).

CUSTOMISATION FUNCTION

M2545400400942

By operating the M.U.T.-III ETACS system, the following functions can be customised. The programmed information is held even when the battery is disconnected.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Turn power source	Adjustment of turn-signal lamp operation condition	ACC or IG1	Operable with ACC or ON position
		IG1	Operable with ON position (initial condition)
Comfort flasher	With/without comfort flasher function	Disable	No function
		Enable	With function (initial condition)
Hazard answer back	Adjustment of the number of keyless hazard warning lamp answer back flashes	Lock:1, Unlock:2	LOCK: Flashes once, UNLOCK: Flashes twice (initial condition)
		Lock:1, Unlock:0	LOCK: Flashes once, UNLOCK: No flash
		Lock:0, Unlock:2	LOCK: No flash, UNLOCK: Flash twice
		Lock:2, Unlock:1	LOCK: Flash twice, UNLOCK: Flash once
		Lock:2, Unlock:0	LOCK: Flash twice, UNLOCK: No flash
		Lock:0, Unlock:1	LOCK: No flash, UNLOCK: Flash once
		Lock:0, Unlock:0	No function
Front wiper operation	Adjustment of the intermittent windshield wiper operation <vehicles without lighting control sensor>	Normal INT	Intermittent wiper interval is fixed to 4 seconds.
		Variable INT	Intermittent wiper interval is calculated only by the wiper volume control.
		Speed Sensitive	Intermittent wiper interval is calculated according to the intermittent wiper volume control and vehicle speed (initial condition).
	Adjustment of the intermittent windshield wiper operation <vehicles with lighting control sensor>	Normal INT	Intermittent wiper interval is fixed to 4 seconds.
		Variable INT	Intermittent wiper interval is calculated only by the wiper volume control.
		Speed Sensitive	Intermittent wiper interval is calculated according to the intermittent wiper volume control and vehicle speed.
		Rain Sensitive	Intermittent wiper interval is calculated according to the intermittent wiper volume control and lighting control sensor (initial condition).
Front/rear wiper washer	Disabling or enabling washer-linked wiper function	Only Washer	No function
		Washer & Wiper	With function: Without delayed finishing wipe function <Initial condition>
		With after wipe	With function: With delayed finishing wipe function
Intermittent time of rear wiper	Adjustment of rear wiper interval	0 sec.	No wiper interval
		4 sec.	4 seconds
		8 sec.	8 seconds (initial condition)
		16 sec.	16 seconds

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Rear wiper Low speed mode	Disabling or enabling rear wiper continuous operation	Disable	No function
		Enable	With function (initial condition)
Auto fold mirror	Electric folding door mirror automatic unfolding function <vehicles with electric retractable remote controlled door mirrors>	Not Auto	No synchronised operation
		Open Vehicle SPD	Vehicle speed-dependent operation
		Open/Close by IG	Ignition switch linked operation
		OPN/CLS Keyless	Keyless entry linked operation (initial condition)
Sensitivity for auto lamp	Lighting control sensor sensitivity (illumination intensity) <vehicles with lighting control sensor>	Level 1 bright	High ambient brightness
		Level 2 bright	Standard ambient brightness (initial condition)
		Level 3	Low ambient brightness
		Level 4 dark	Low-low ambient brightness
Room lamp delay timer with door	Adjustment of interior lamp delay shutdown time	0 sec.	0 second (no delay shutdown time)
		7.5 sec.	7.5 seconds
		15 sec.	15 seconds (initial condition)
		30 sec.	30 seconds
		60 sec.	60 seconds
		120 sec.	120 seconds
		180 sec.	180 seconds
Head lamp auto cut customise	Adjustment of headlamp automatic shutdown function	Disable	No function
		Enable (B-spec.)	With function (initial condition)
Interior lamp auto cut timer	Adjustment of interior lamp automatic shutdown function operation time	Disable	No function
		3 min	3 minutes
		30 min	30 minutes (initial condition)
		60 min	60 minutes
Comfort flasher switch time	Switch operation time to activate the comfort flasher function	Normal	0.4 second (initial condition)
		Long	0.8 second
Intelligent/Comfort washer	With/without Comfort washer function	Disable	No function (Initial condition)
		Enable	With function

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
Auto door unlock	Adjustment of the auto door unlock function	Disable	Without function (initial condition)
		Always (P pos)	With function: Operates when the shift lever or the selector lever is moved to the P position.
		Always(Lock pos)	With function: Operates when the ignition switch is moved to the LOCK (OFF) position.
Door unlock mode	Adjustment of power door locks with selective unlocking	All Doors Unlock	Without function: The first operation of keyless entry system or unlock operation by KOS unlocks all doors (initial condition).
		Dr Door Unlock	With function: The first operation of keyless entry system or unlock operation by KOS unlocks the driver's door only, and the second unlock operation within 2 seconds after that unlocks all doors.
Timer lock timer	Timer lock period adjustment	30 sec.	30 seconds (initial condition)
		60 sec.	60 seconds
		120 sec.	120 seconds
		180 sec.	180 seconds
Multi mode	Multi-mode keyless entry function customisation <Vehicles with electric retractable remote controlled door mirrors>	Disable	No function
		D/M: O&C	Door mirror fold/unfold operation only (initial condition)
Duration of horn chirp	Horn sounding time during horn answer back	Short	0.01 second (initial condition)
		Long	0.02 second
Rear wiper(linked reverse gear)	Adjustment of automatic rear window wiper operation with reverse gear engaged	Enable(R wip.ON)	Operates only when the rear wiper switch is ON.
		Enable(R/F wip.)	Operates only when the front or rear wiper switch is ON (initial condition).
KOS key detect out from window	With/without KOS key exterior detection function <Vehicles with KOS>	Enable	No function
		Disable	With function (initial condition)
KOS feature	KOS function adjustment <Vehicles with KOS>	Both enable	All KOS functions are enabled (initial condition).
		Door Entry enable	Only door entry function is enabled.
		ENG start enable	Only engine starting function is enabled.
		Both disable	All KOS functions are disabled.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
KOS unlock disable time	Adjusts the door unlock inhibition period after door lock is activated. <Vehicles with KOS>	0 sec.	0 second
		3 sec.	3 seconds (Initial condition)
		5 sec.	5 seconds
Remote ENG starter answer back	Remote engine starter answer back function adjustment	Disable	No function (Initial condition)
		Enable	With function
ACC power auto cut	Time to ACC power cut-off when the ignition switch is in the ACC position	Disable	No function
		30 min	30 minutes (initial condition)
		60 min	60 minutes
Coming home light	Disabling or enabling coming home light function	Disable	No function
		15 sec.	The headlamps illuminate for 15 seconds.
		30 sec.	The headlamps illuminate for 30 seconds. (initial condition)
		60 sec.	The headlamps illuminate for 60 seconds.
		180 sec.	The headlamps illuminate for 180 seconds.
Welcome light	Disabling or enabling welcome light function	Disable	No function
		Small lamp	The tail lamps illuminate. <initial condition>
		Head lamp	The headlamps illuminate.
Outer buzzer volume	KOS outer buzzer volume adjustment <Vehicles with KOS>	Volume 1	Quieter than the standard
		Volume 2	Standard volume (Initial condition)
		Volume 3	Louder than the standard
A/C Recirculation Control	With/without inside/outside air automatic control function	Disable	No function
		Enable	With function (Initial condition)
A/C Switch Control	With/without A/C automatic control function	Disable	No function
		Enable	With function (Initial condition)

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
A/C Sensible temp. customize	Adjusting mean value for temperature setting	-2	Decreases the control temperature two degrees than the temperature displayed on the LCD.
		-1	Decreases the control temperature one degree than the temperature displayed on the LCD.
		0	No change (Initial condition)
		1	Increases the control temperature one degree than the temperature displayed on the LCD.
		2	Increases the control temperature two degrees than the temperature displayed on the LCD.
FOOT / DEF Air outlet ratio	Changes air distribution rate for DEF/FOOT vents during manual operation.	Normal	D/F2 (Initial condition)
		FOOT > DEF	D/F1(more to FOOT vent): More air flows through FOOT vents.
		FOOT < DEF	D/F3(more to DEF vent): More air flows through DEF vents.
FACE / FOOT Air outlet ratio	Changes air distribution rate for FACE/FOOT vents during manual operation.	Normal	B/L2 (Initial condition)
		FACE > FOOT	B/L1(more to FACE vent): More air flows through FACE vents.
		FACE < FOOT	B/L3(more to FOOT vent): More air flows through FOOT vents.
Auto Rear Defogger(Engine Start)	When ambient temperature is 3 degree or less, the rear defogger will be turned on automatically. (The rear window defogger has never been activated since the ignition switch was turned on last time)	Disable	No function (Initial condition)
		Enable	With function

GROUP 54B

LOCAL INTERCONNECT NETWORK (LIN)

CONTENTS

GENERAL INFORMATION

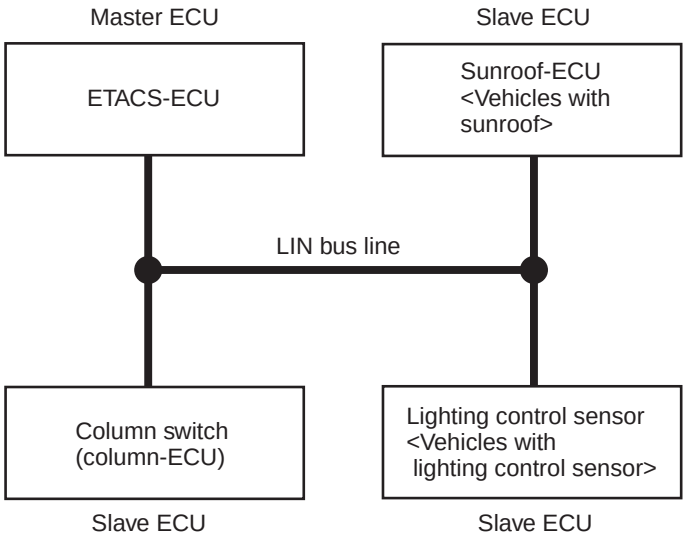
M2545600100019

LIN refers to "Local Interconnect Network," which is a serial multiplex communication protocol* administrated by LIN consortium. A communication circuit employing the LIN protocol connects each ECU, and switch and sensor data can be shared among ECUs, which enables more reduction in wiring.

*NOTE: *: The regulations that have been decided in detail, from software matters such as the necessary transmission rate for communication, the system, data format, and communication timing control method to hardware matters such as the harness type and length and the resistance values.*

STRUCTURE

M2545600200395



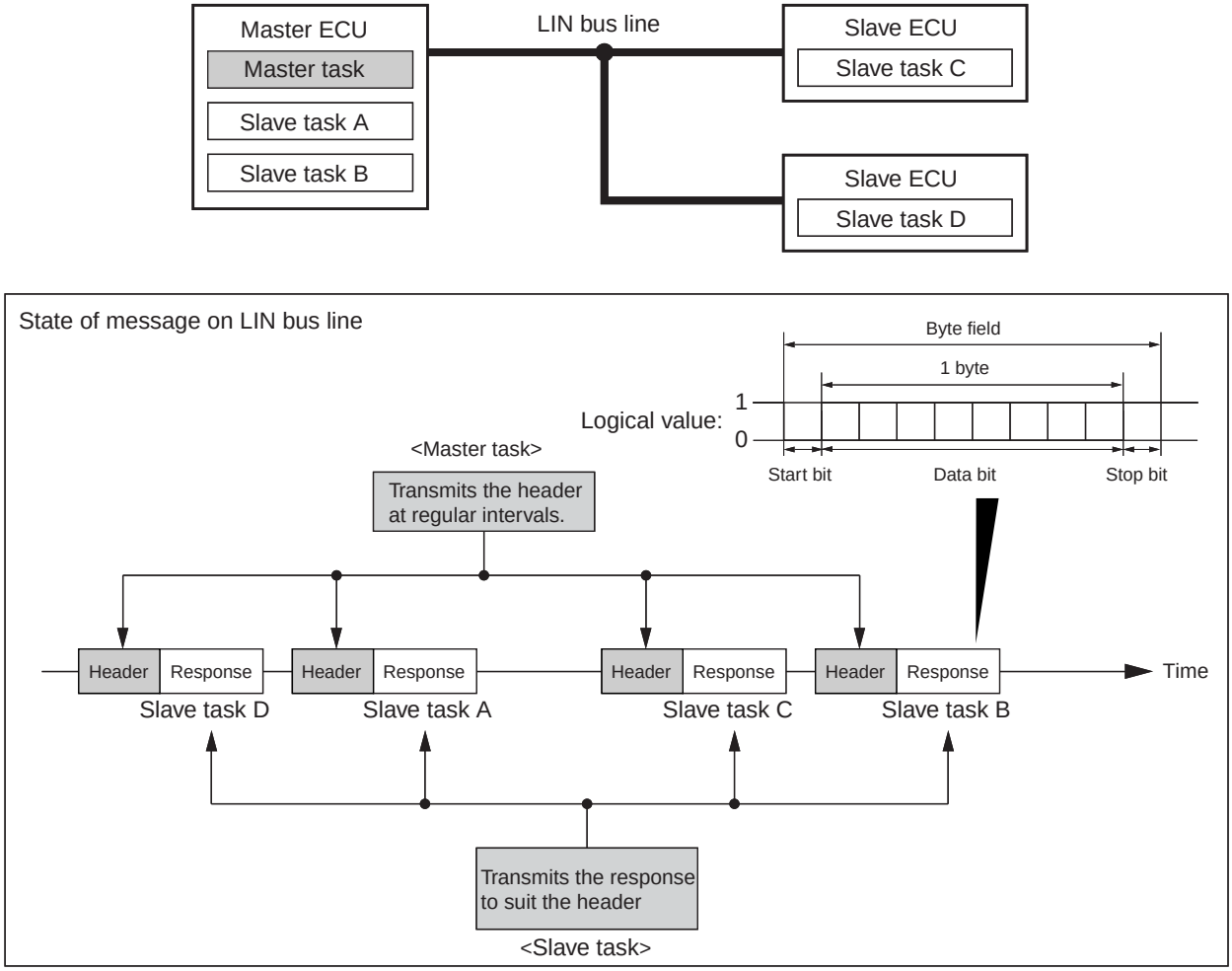
AC608956AD

Master and slave ECUs are connected to the LIN bus lines. The master ECU is the ETACS*-ECU, and the slave ECUs are the column switch (column-ECU), the sunroof-ECU <vehicles with sunroof> and the lighting control sensor <vehicles with lighting control sensor>. The master ECU requests these slave ECUs to communicate each other via communication lines.

*NOTE: *: ETACS (Electronic Time and Alarm Control System)*

SYSTEM OPERATION

M2545600300132

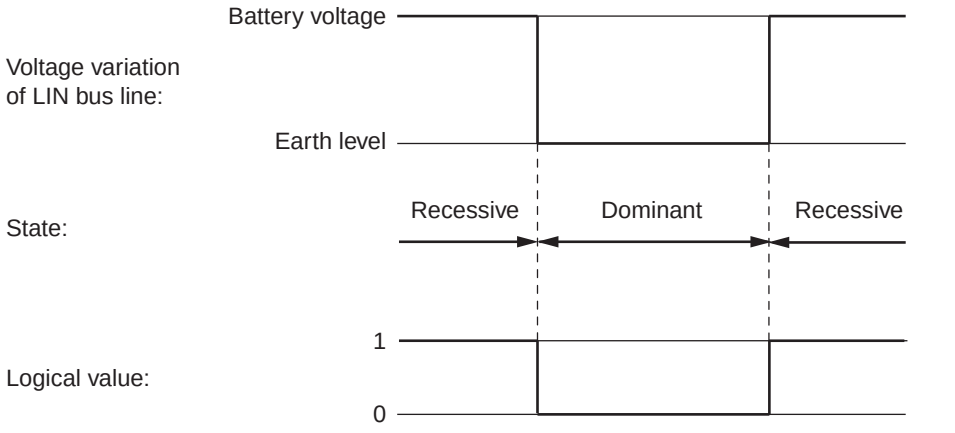


AC506324AE

LIN communication system is described below:

- The master ECU performs the master tasks and slave tasks, and the slave ECUs perform the slave tasks.
- When the master ECU performs a master task, the header frame which stores information to call certain slave tasks (ECU) is transmitted at regular intervals.
- When the master ECU and slave ECU perform a slave task, the ECU called by the header frame transmits the response frame which stores data used for control.
- A header and response collectively are called as a message frame, and the communication method that uses the message frame is called as the frame communication.
- Basically, the communication data is used with some blocks of 10-bit data group which includes one start bit and one stop bit (byte field) arranged in order.

VOLTAGE VARIATION OF LIN BUS LINE

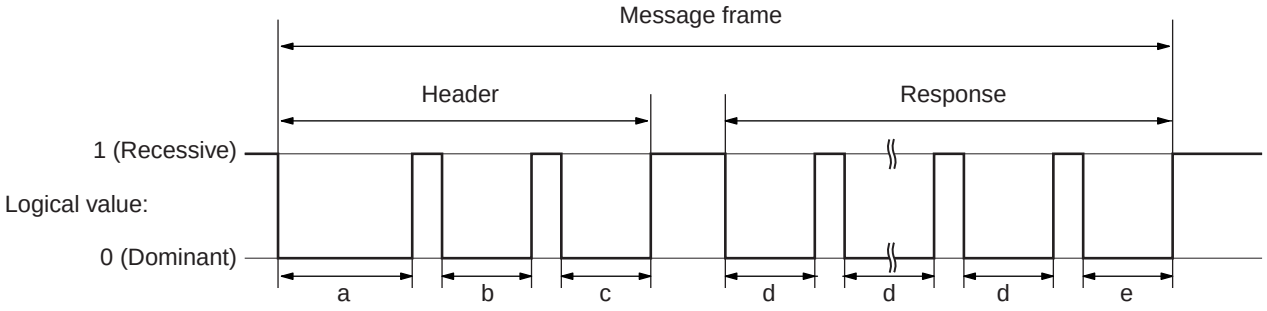


AC309813AF

When each ECU sends or receives signals, LIN bus line voltage varies as follows:

- The voltage variation of LIN bus line (0 and 1 combination as a logical value) ranging between battery voltage (recessive) and 0 V (dominant) is output (transmitted) as a control signal.
- When no communication is established, the LIN bus line remains recessive (battery voltage).

MESSAGE FRAME



a: Synchronisation start region c: Identifier region e: Checksum region
b: Synchronisation region d: Data region

AC506907AD

A message frame consists of regions that include a synchronisation start region, identifier region, data region, and checksum region. A few bits of recessive data is used to separate the frame from each region.

Frame	Region name	Description
Header	Synchronisation start region	A region that informs each ECU of the starting of header transmission by sending dominant signals for a given period of time.
	Synchronisation region	A region that synchronises the transmission cycle of each ECU connected to the LIN bus line (the slave ECU matches its communication speed to that of the master ECU).
	Identifier region	A region that stores an ID to call the slave ECU defined by the LIN protocol. The number of bytes for the data region is also defined in this region.

Frame	Region name	Description
Response	Data region	A region to store the control data used by ECU that is called by the header
	Checksum region	A region for checking errors in data content The sending-end ECU calculates data region value according to the specified computing equation, and the result is stored in this filed. The receiving-end ECU detects the transmission error based on the checksum filed value.

GROUP 54C

CONTROLLER AREA NETWORK (CAN)

CONTENTS

GENERAL INFORMATION

M2542000100386

CAN, an abbreviation for Controller Area Network, is an ISO-certified international standard for a serial multiplex communication protocol[*1]. A communication circuit employing the CAN protocol connects each ECU, and sensor data can be shared among, which enables more reduction in wiring.

CAN offers the following advantages.

- Transmission rates are much faster than those in conventional communication (up to 1 Mbps[*2]), allowing much more data to be sent.
- It is exceptionally immune to noise, and the data obtained from each error detection device is more reliable.
- Each ECU connected via the CAN communicates independently, therefore if the ECU enters damaged mode, communications can be continued in some cases.

NOTE:

- *[*1]: The regulations have been decided in detail, from software matters such as the necessary transmission rate for communication, the system, data format, and communication timing control method to hardware matters such as the harness type and length and the resistance values.*
- *[*2]: bps=bit per second*

STRUCTURE

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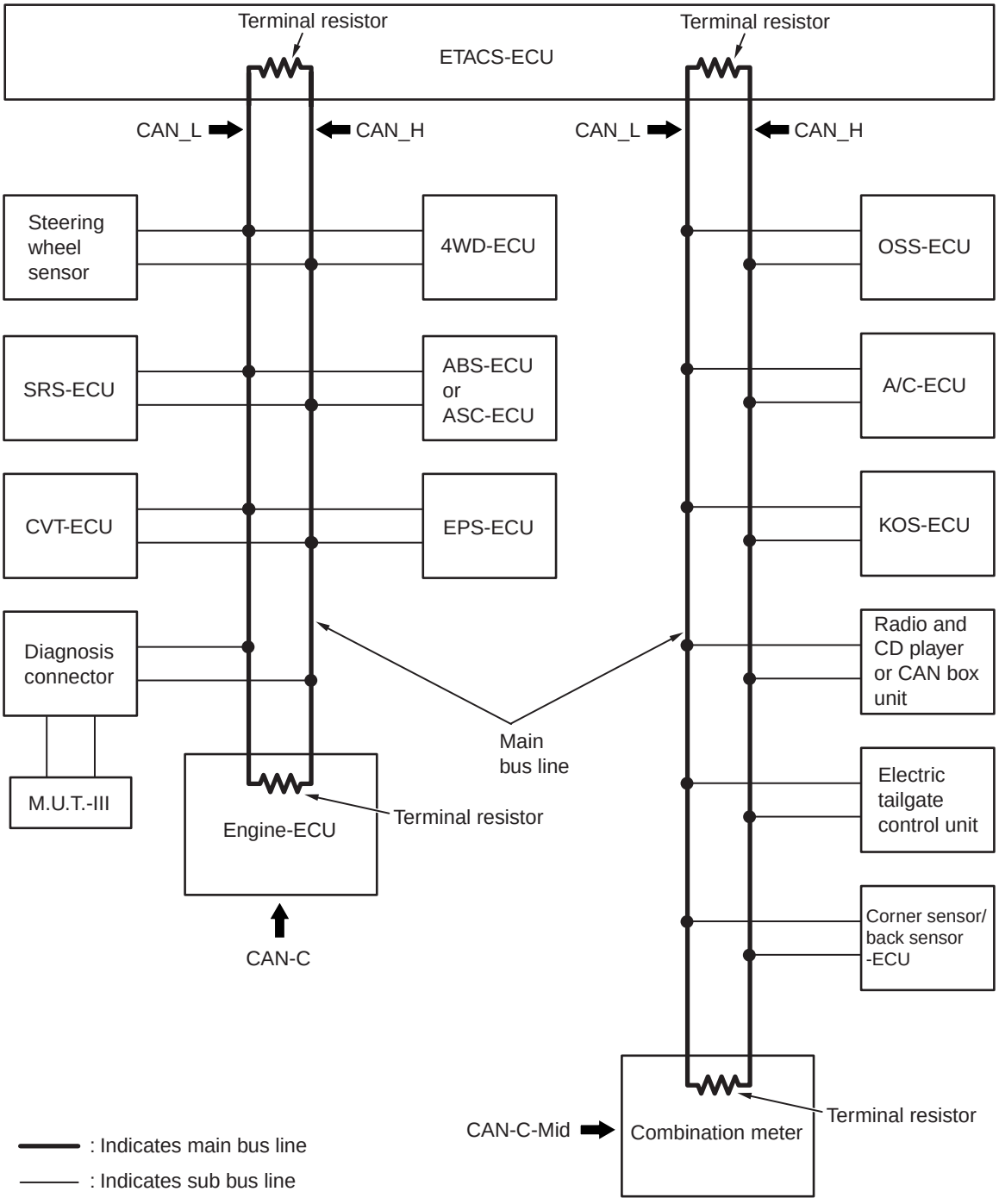


ACB05902AC

- A gateway function has been integrated to ETACS-ECU as the network central ECU (Refer to GROUP 54A – ETACS-ECU).
- The CAN system consists of the following two networks: CAN-C (high-speed power train network) and CAN-C-Mid (middle-speed body network). Each ECU is connected to one of the networks depending on its functions.
- The CAN bus line consists of two lines, CAN_L and CAN_H (CAN Low and CAN High, respectively), as well as two terminal resistors (A twisted-pair cable, highly resistant to noise, is used for the communications line).
- The CAN bus line connecting two dominant ECUs is the main bus line, and the CAN bus line connecting each ECU is the sub-bus line.

- With CAN bus, the terminal resistors are incorporated in ECU. Resistors with approximately 120 Ω is used for the dominant ECU.

NOTE:
- *Dominant ECU: ETACS-ECU, engine ECU and Combination meter.*
- *Non-dominant ECU: ECU and sensor on CAN network, excluding ETACS-ECU, engine ECU and Combination meter.*

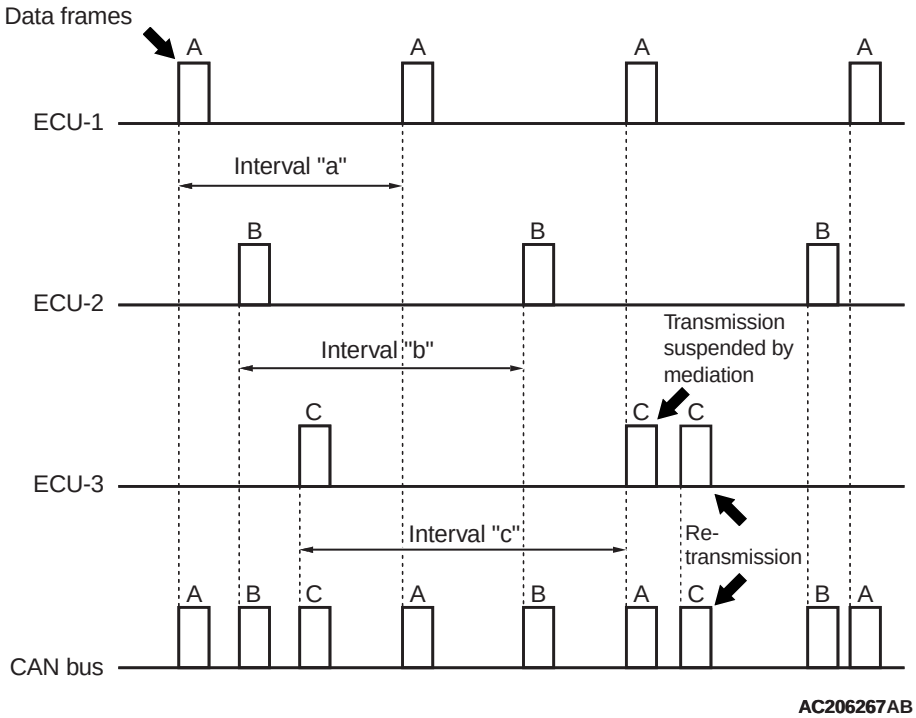
- To the CAN bus line, ECU, sensor, and diagnosis connector are connected as follows for each network.

CAN-C
- ETACS-ECU
- Steering wheel sensor
- 4WD-ECU <4WD>
- SRS-ECU
- ABS-ECU <vehicles without ASC> or ASC-ECU <vehicles with ASC>
- CVT-ECU
- EPS-ECU
- Diagnosis connector
- Engine-ECU

CAN-C-Mid
- ETACS-ECU
- OSS-ECU <vehicles with OSS>
- A/C-ECU
- KOS-ECU <vehicles with KOS>
- Radio and CD player <vehicles with radio and CD player>
- Electric tailgate control unit <vehicles with electric tailgate>
- CAN box unit <vehicles with MMCS>
- Corner sensor/back sensor-ECU <vehicles with reversing sensor system>
- Combination meter

SYSTEM OPERATION

M2542000300506



AC206267AB

The CAN communication system is described below.
- Each ECU communicating with CAN periodically sends several sensors' information on CAN bus as data frame (called periodical sending data). For further details, consult the data frame section.
- ECUs requiring data on CAN bus can receive data frames sent from each ECU simultaneously.
- The data sent from each ECU conducting CAN communication is transmitted at 0.01 – 1 sec interval depending on necessity of data.

NOTE: In the figure above, the data frame A is transmitted in "a" intervals, while the data frames B and C are transmitted at intervals "b" and "c," respectively.
- A single ECU transmits multiple data frames.

- When data frames conflict with one another (when plural ECUs transmit signals simultaneously), data is prioritised for transmission by mediation, therefore, plural data frames are not sent simultaneously. For further details, consult the mediation section.
- Data is transmitted not by the conventional voltage-using method but by voltage potential difference. For further details, consult the section on CAN bus voltage transformation .
- Reliability of each ECU transmitting signals via CAN communication is secured by several error detection and recovery processes. For further details, consult the sections on error detection and system recovery.
- For major communication signals (transmitting signals) among ECUs.

MEDIATION

Because each ECU transmits data independently on the CAN bus, there are cases of data collision when multiple data frames that ECUs attempt to transmit simultaneously (if multiple ECUs transmit at nearly the same moment). At this moment, processing of the ECUs attempting transmission is performed in the following way.

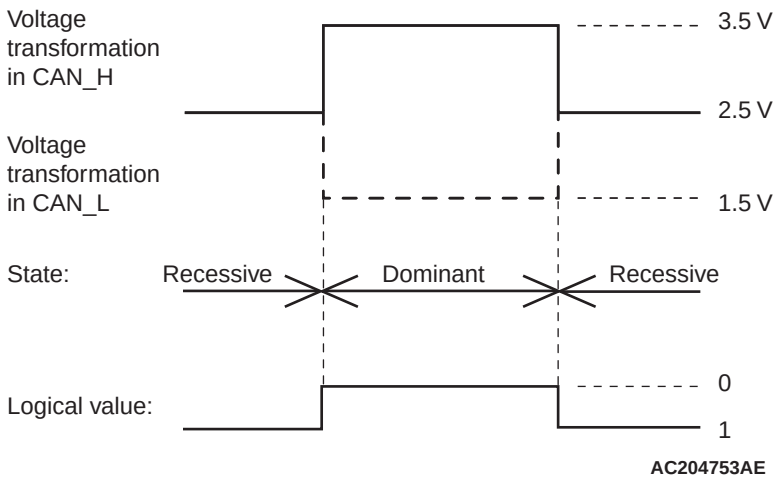
1. Data frame with high priority is transmitted first according to ID codes memorized in data frames.
2. Transmission of low-priority data (data frames) is suspended by the issuing ECUs until the bus clears (when no transmission data exists on the CAN bus).

NOTE: If the suspended state continues for a specific time, new data (data frame content) is created and sent.

3. ECU containing suspended data frames transmits the data when the bus becomes available.

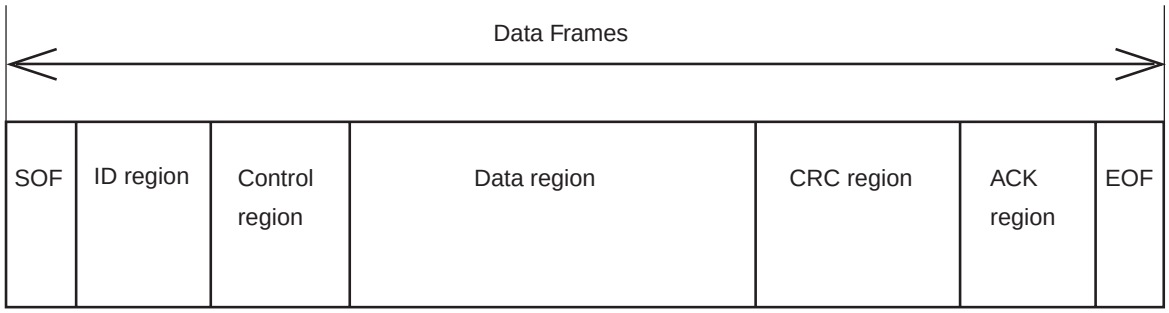
NOTE: There is enough capacity on the CAN bus, which never prevents data frames from being sent.

VOLTAGE TRANSFORMATION ON THE CAN BUS



Data frame transmission through the CAN bus line involves voltage transformation (for output signals) in the distinctive CAN profile as follows. The ECU transmitting through the CAN_H and CAN_L bus lines sends 2.5 – 3.5 V signals to the CAN_H side and 2.5 – 1.5 V signals to the CAN_L side. The receiving ECU reads the data from the CAN_H and CAN_L potential difference. "Recessive" refers to the state where both CAN_H and CAN_L are under the 2.5 V state, and "Dominant" refers to the state where CAN_H is under the 3.5 V state and CAN_L is under the 1.5 V state. By transformation mainly to 2.5 V, even in cases when voltage is rendered 0 from faulty earthing or the like (causing a problem of an approximate 0.5 voltage increase on the communications line), communication can be continued uninterrupted. Employing dual communications lines improves reliability to prevent the presence of noise, compared to the conventional communication method.

DATA FRAMES



AC404606AB

The data frame, which is sent from each ECU (or sensor) to the CAN bus line, consists of the fields bellow.

SOF (Start of Frame)
- Indicates the start of the frame

ID (Identifier) region
- Identifies the data content while specifying priority rank in case of mediation

Control region
- Specifies the frame type, data length, etc.

Data region
- Values used for data control, etc.

CRC (Cyclic Redundancy Check) region
- Region where to check for errors in sent data. The transmitting ECU calculates data regions by applying prescribed operations and stores the results. The receiving ECU detects erroneous communication by comparing the CRC region with the data region.

ACK (Acknowledge) region
- Region where to conform the reception of sent data

EOF (End of Frame)
- Indicates the end of the frame

ERROR DETECTION AND RECOVERY

CAN protocol secures its reliability of communication by providing several error detection function such as CRC shown in data frame, and the recovery function (recovery is performed by resending, from abnormal state such as transmission errors). If an error is detected but it is not resolved even after recovery, communication is stopped. This state is called "Bus Off."

SELF-DIAGNOSIS

M2542000400428

- CAN self-diagnosis is performed by each ECU connected to the CAN bus.
- Diagnosis codes related to communication are named with the capital letter U, and are called "U-codes."
- A summary of the CAN self-diagnosis system is presented below.

TIME-OUT

Each ECU transmits data frames periodically. If the data frame is not received within the specified period, the intended receiving ECU transmits a diagnosis code indicating communication time-out for the ECU that failed to transmit.

FAILURE DATA

When the transmitting ECU detects failure of a sensor directly connected to it, this is the pertinent data used to inform the ECU.

CAN BUS DIAGNOSTICS

M2542000500339

As ECUs are connected via CAN bus (including M.U.T.-III), always diagnose CAN bus to confirm its normality when inspecting. When the CAN bus diagnosis is carried out, the M.U.T.-III will monitor the mutual communication status of the ECUs and then display a current status of the CAN bus on its screen.

GROUP 55

HEATER, AIR CONDITIONER AND VENTILATION

CONTENTS

GENERAL INFORMATION

M2551000101826

The new heater unit integrates blower, and evaporator, it increases the air flow but reduces air flow resistance and air flow noise.

FEATURES

ENHANCEMENTS IN COMFORT

- With the adoption of automatic A/C system, the inlets (fresh air/recirculation air), the vents, temperature at the vents and fan speed are automatically the controlled according to the outside temperature and cabin temperature so that the optimum air conditioner is achieved.
- By the adoption of clean air filter, the air quality in the cabin has been kept.
- Improves the cooling performance by optimal refrigerant line routing and prevents potential refrigerant leaks by reducing refrigerant line connections.
- Independent air conditioner control function allows individual temperature adjustment at the right and left depending on which the customer prefers.<Vehicles with DUAL-ZONE AUTO A/C>

ENHANCEMENTS IN OPERATION PERFORMANCE

- To enhance luxurious appearance and convenience, a liquid crystal display panel has been adopted.
- Customize function has been added for the enhanced convenience.

ENHANCEMENTS IN FUEL ECONOMY

- The 3D-profile high efficiency compressor has been installed, thus improving the fuel economy.
- The idle-up speed is controlled in two steps to secure the air cooling performance during summer and to enhance the fuel economy in the moderate seasons.
- The cooling fan control depending on the refrigerant pressure and on the vehicle speed reduce alternator load, thus enhancing the fuel economy.

ENHANCEMENT IN SAFETY

- A/C system will shut down automatically if the air bags are open.
- Crushable space has been adopted into heater unit to reduce the risk of passenger injuries if a collision occurred.

GLOBAL ENVIRONMENT PROTECTION

- Refrigerant system (HFC134a) has been adopted.
- Clean air filter media and its cover are separated to reduce waste materials, when replacing the filter.

ENHANCEMENTS IN SERVICE QUALITY

- Reduction of refrigerant gas leakage and enhancement in serviceability by incorporating condenser and receiver
- Clean air filter is installed to the backside of glove box to facilitate the filter replacement.

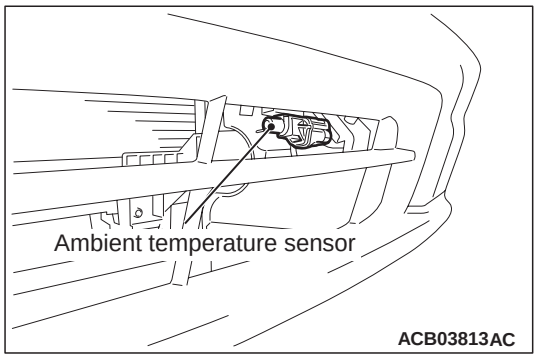
ENHANCEMENTS IN RESPONSIBILITY

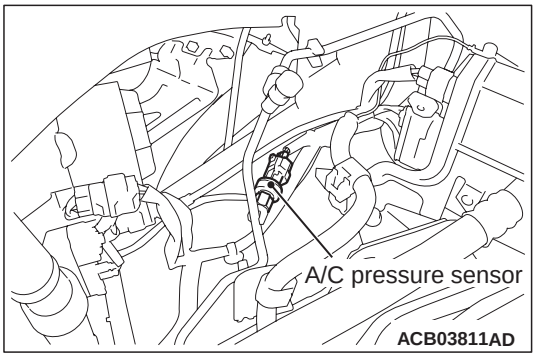
Reliable information transmission is achieved by connecting A/C-ECU and each ECU via CAN communication.

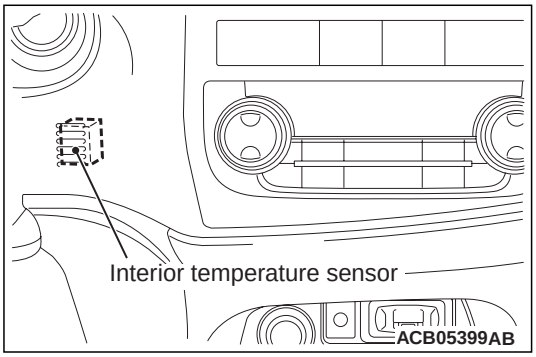
SPECIFICATIONS

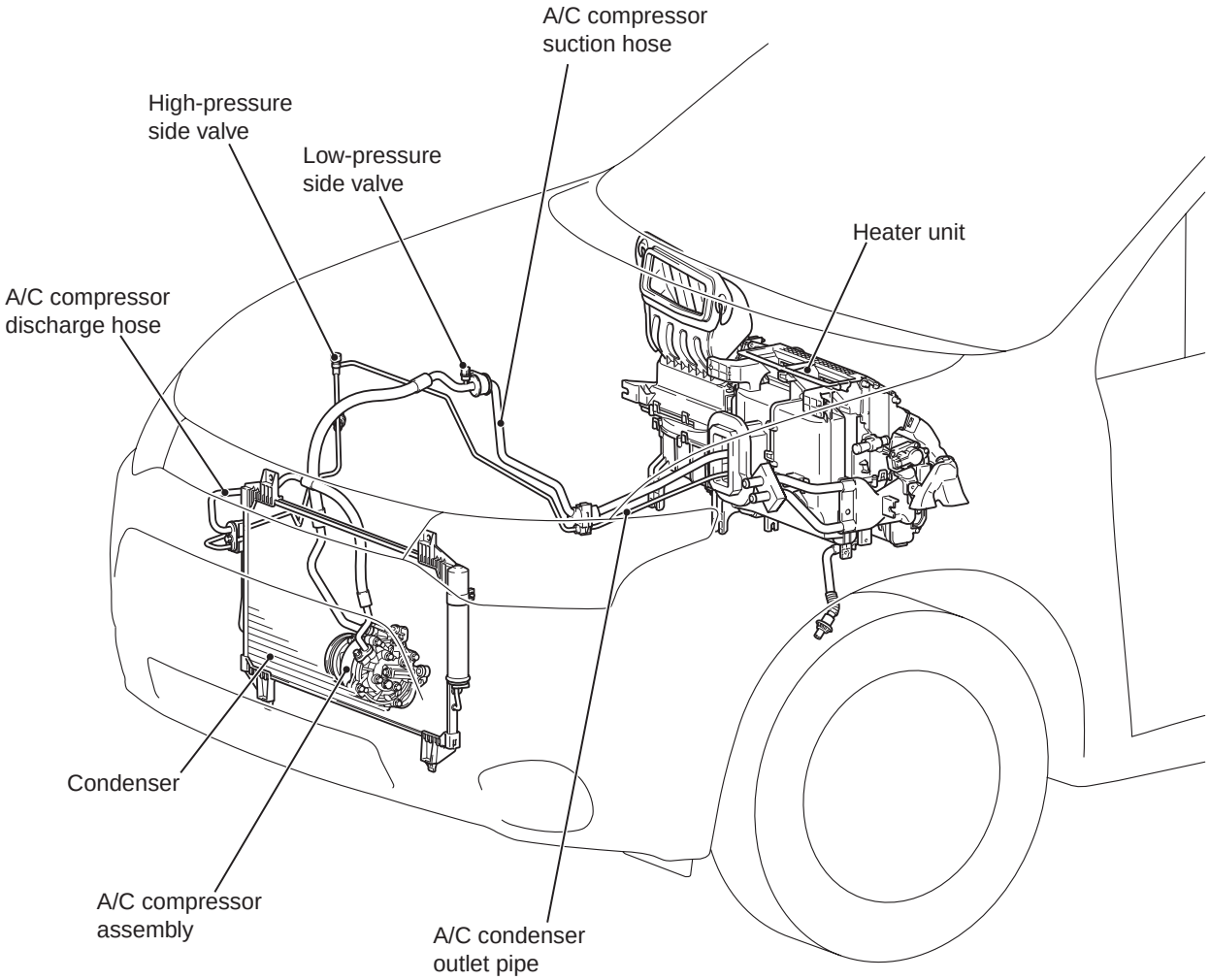
Item		Specification
Air conditioner switch type		LCD push button
Compressor type		QS90
Cooling output kW		5.5
Heating output kW		5.7
Refrigerant	Type	HFC-134a
	Charge quantity g	480 - 520

CONSTRUCTION DIAGRAM

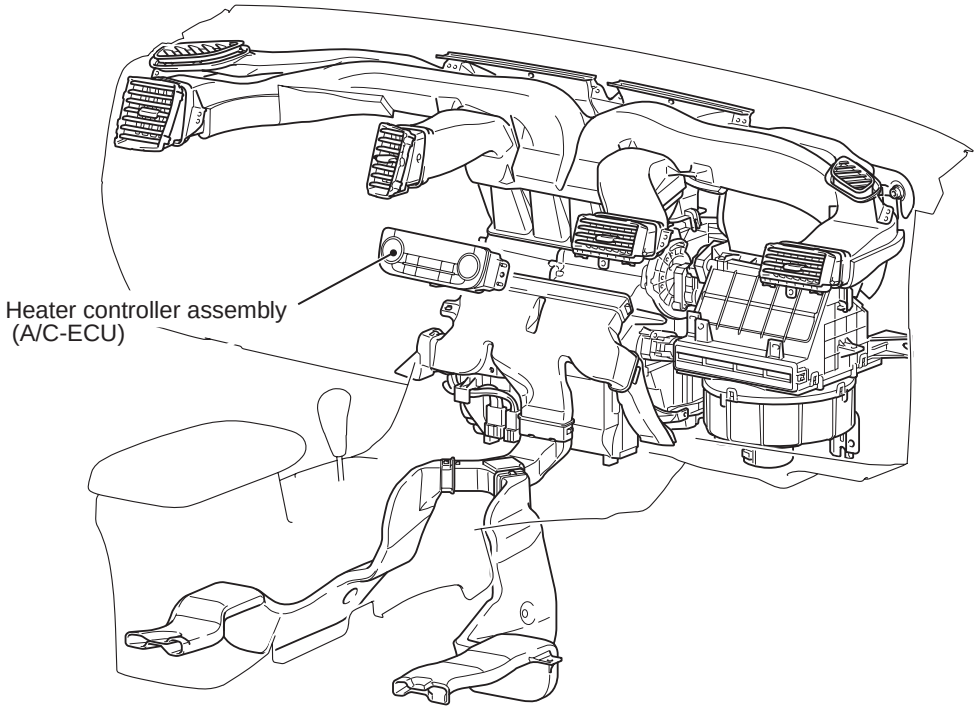







A/C compressor suction hose
High-pressure side valve
Low-pressure side valve
Heater unit
A/C compressor discharge hose
Condenser
A/C compressor assembly
A/C condenser outlet pipe

ACB05002AB



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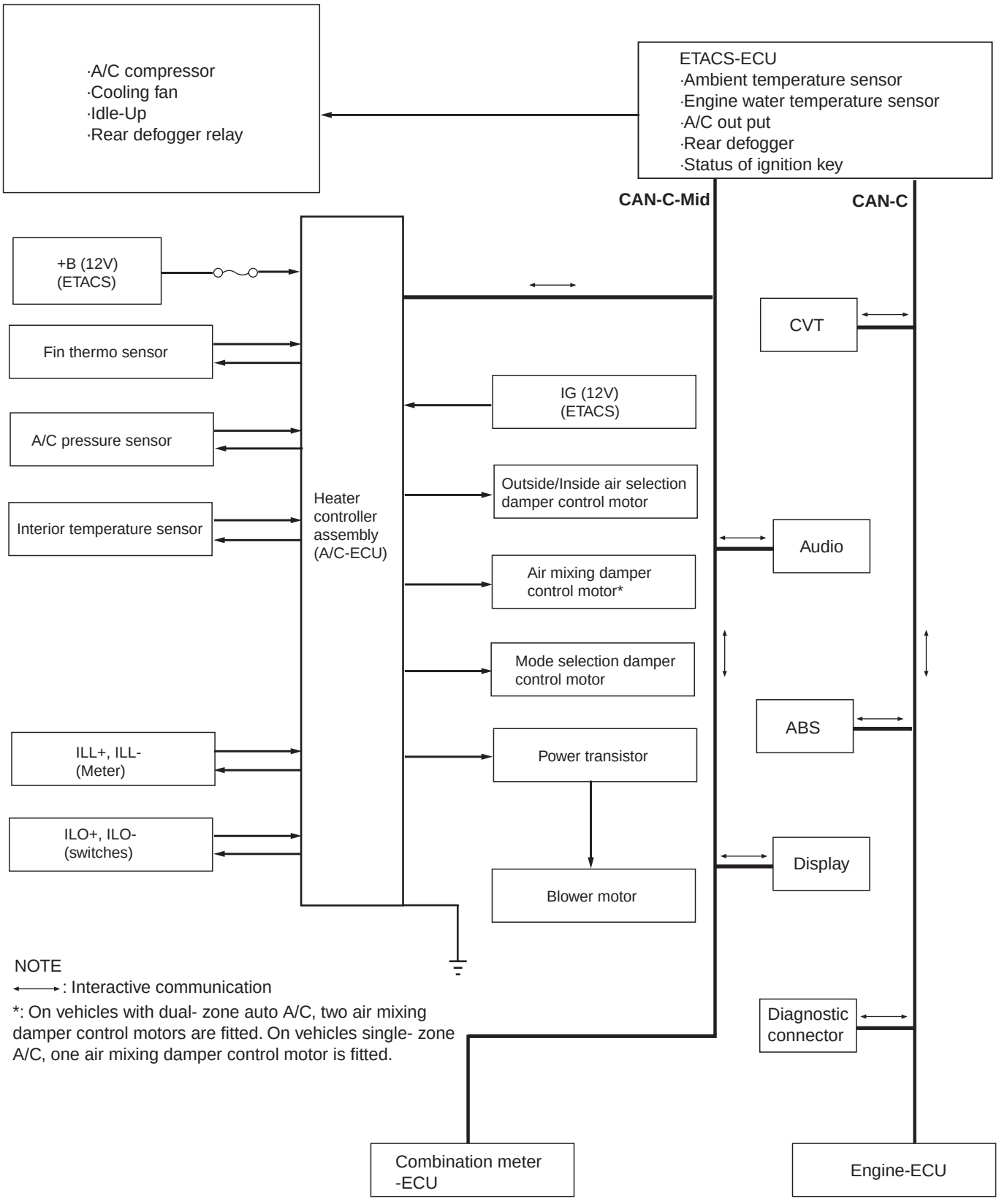
COMMUNICATION

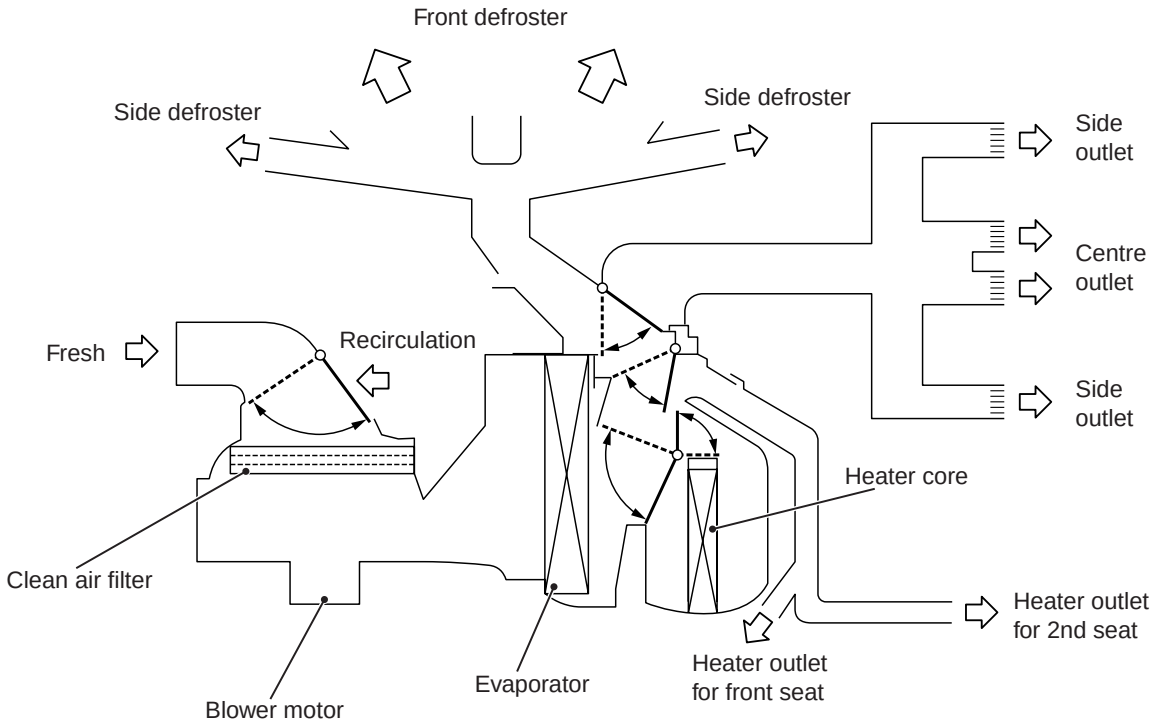


NOTE
←→: Interactive communication
*: On vehicles with dual- zone auto A/C, two air mixing damper control motors are fitted. On vehicles single- zone A/C, one air mixing damper control motor is fitted.

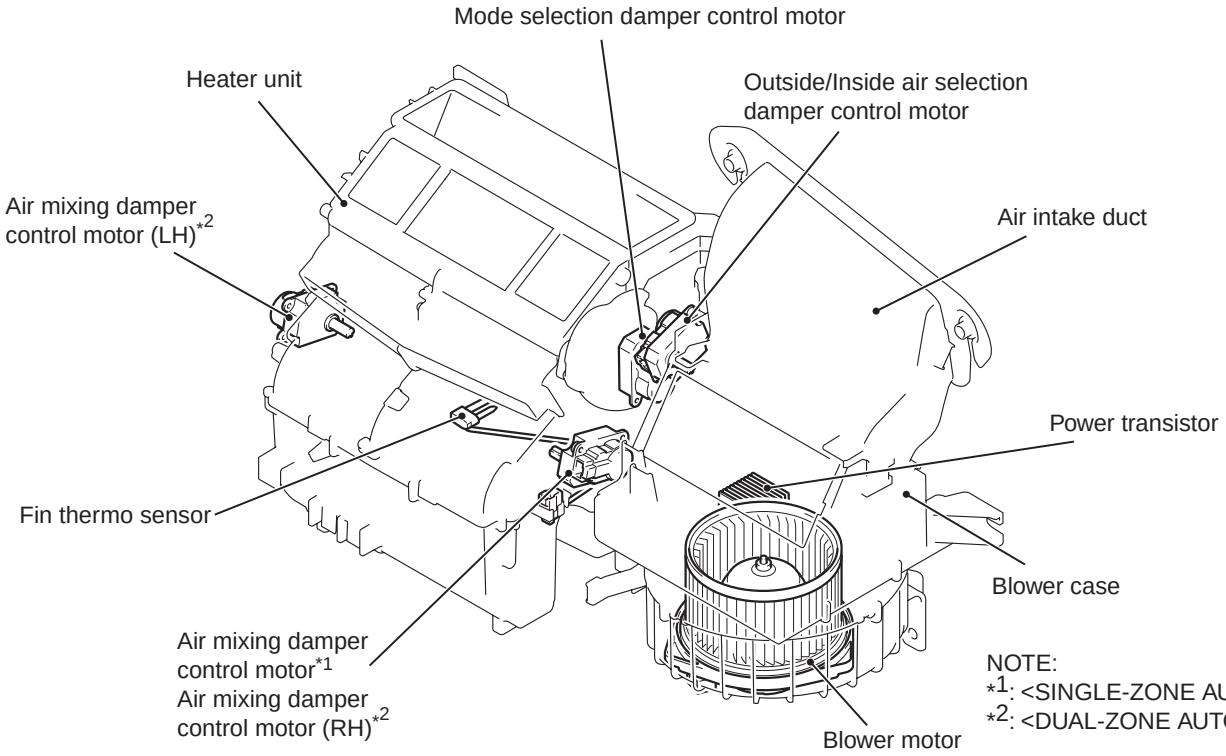
ACC00036AB

HEATER AND AIR CONDITIONER SYSTEM

M2551001000896

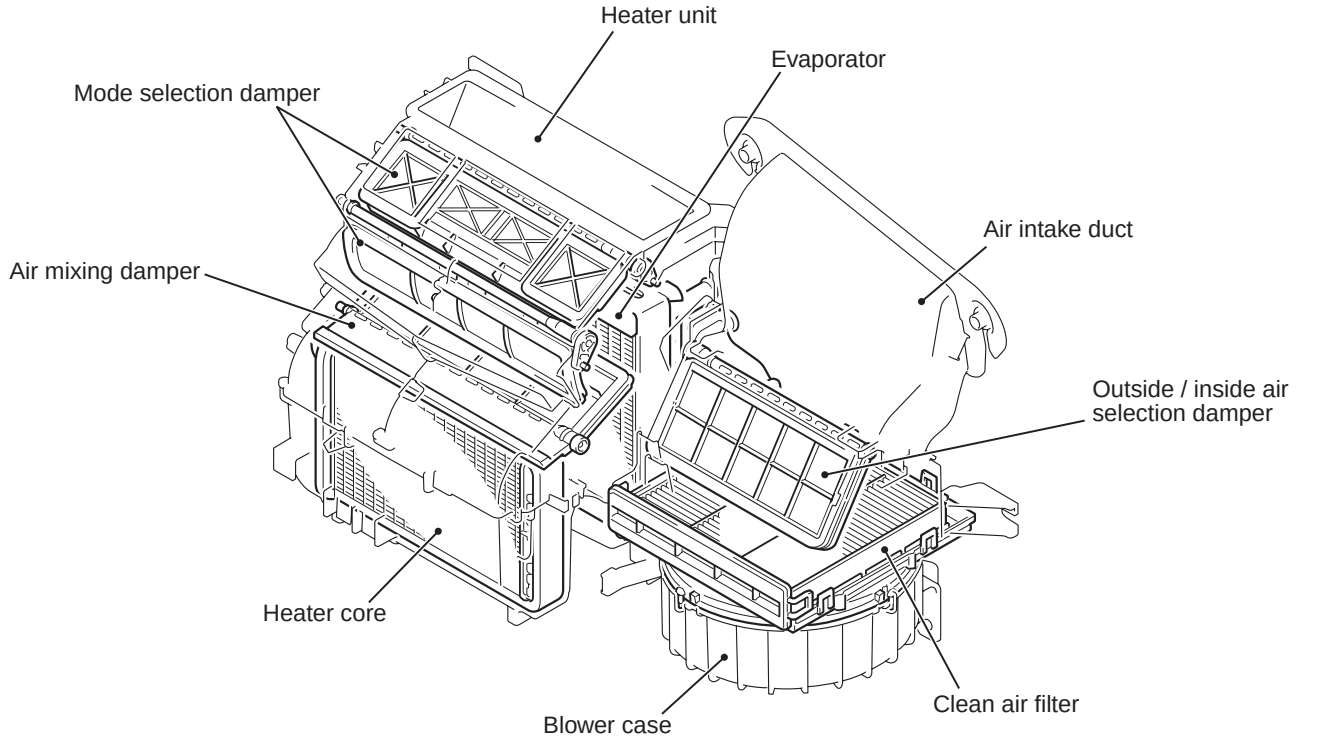


AC612039AO



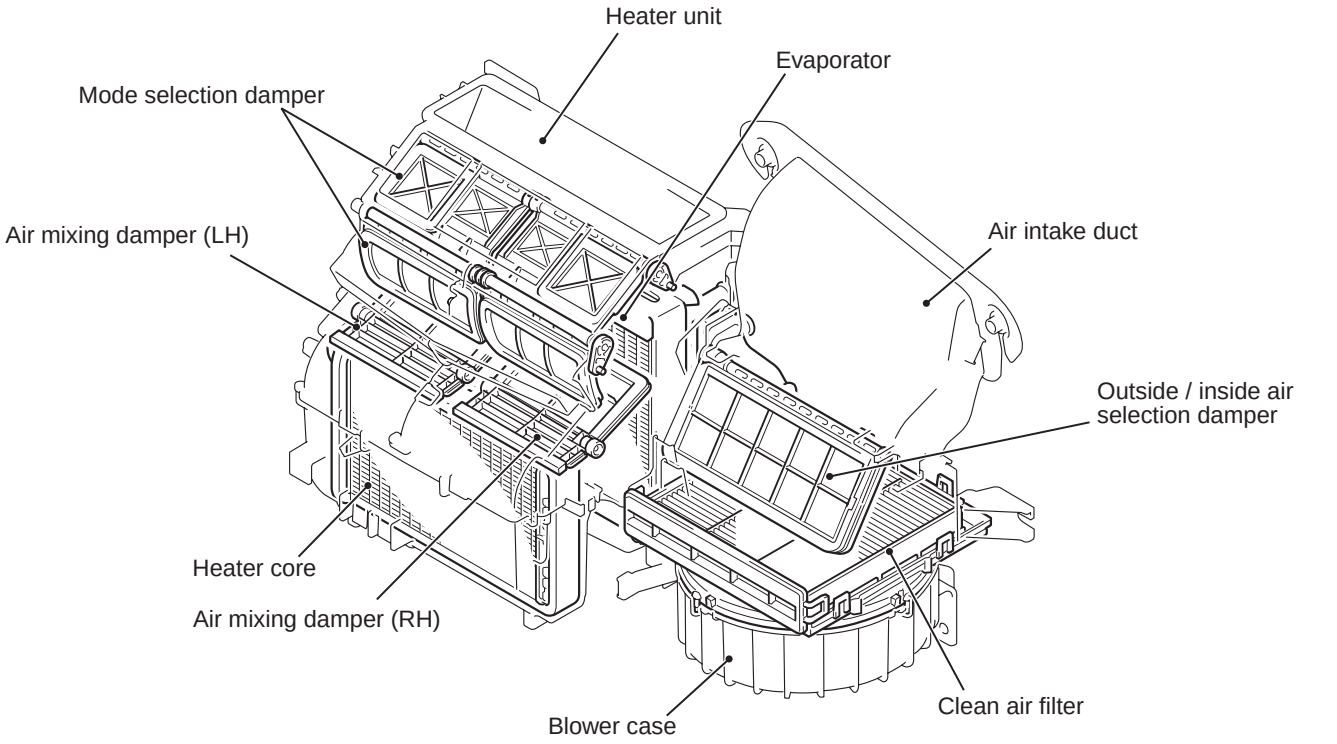
ACB05541AB

<SINGLE-ZONE AUTO A/C>

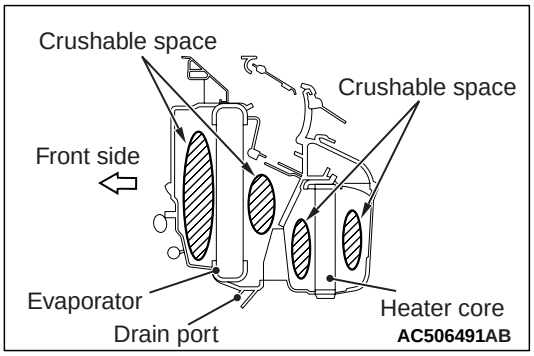


ACB05542 AB

<DUAL- ZONE AUTO A/C>



ACC00509AB



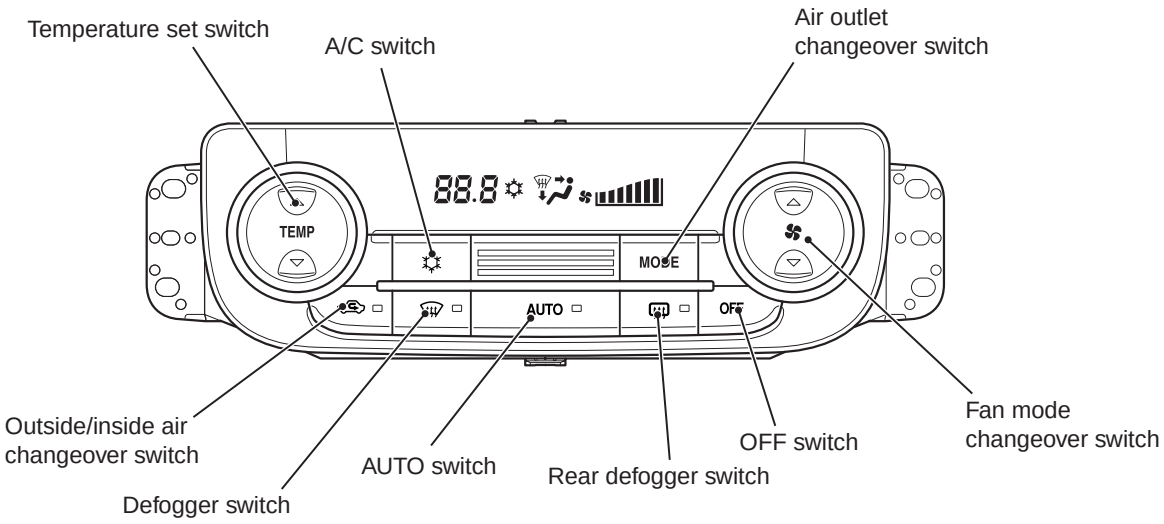
The following front heater unit has been adopted.

- A case of thinner panel thickness, a narrower evaporator and condenser, a smaller expansion valve, a lighter power transistor are used to save weight.
- Higher density in the core enhances the cooling performance. Internal temperature in the evaporator are equalised due to an optimum multi-flow structure and refrigerant circuit, thus improving comfort.
- Openings on the dash panel are sealed securely by adding a cover, etc. to the expansion valve. Insulation pads are adhered to the HVAC case and the duct, thus improving sound absorption and insulation against external noise.
- A heater/cooling assembly unit is adopted for greater fan power and reduced noise.
- The evaporator and heater core has been longitudinally installed in the vehicle length, and a crushable space has been ensured so that it absorbs the impact in case of a collision and reduces the risk of passenger injuries.
- Inside air recirculation is controlled by driving the inside/outside damper, thus improving the heating performance in winter.
- The air temperature of the defroster outlets has been set lower than at the foot outlets to prevent the red glow on face in winter. In order to avoid too cool temperature around the torso, the air distribution at the side face and foot outlets is optimised.
- Clean air filter has been introduced as standard to prevent the intrusion of foreign materials including pollen, dust and cigarette smoke to improve the air quality inside the passenger compartment.
- The installation position of clean air filter has been set to the backside of glove box to facilitate the filter replacement operation. At the same time, the one-touch tab structure has been adopted for the cover installation to enable the replacement operation without tools.
- The air mixing damper control motors and the air mixing dampers are installed as shown. The air mixing dampers can be operated independently to allow passengers to set temperature each for the driver and the front passenger. <Vehicles with DUAL-ZONE AUTO A/C>

HEATER CONTROL

M2551000900904

WITHOUT DUAL A/C



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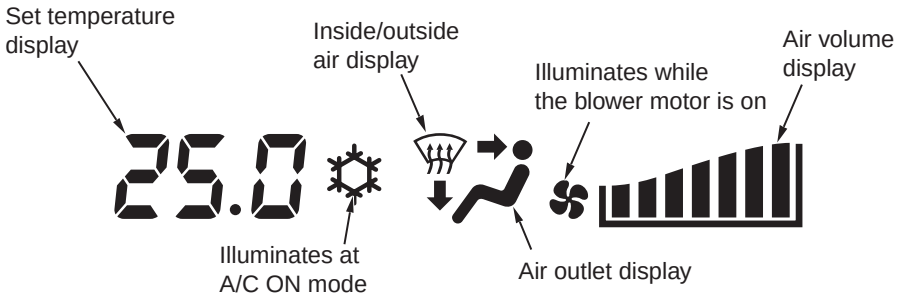
LCD panel <WITHOUT DUAL A/C>



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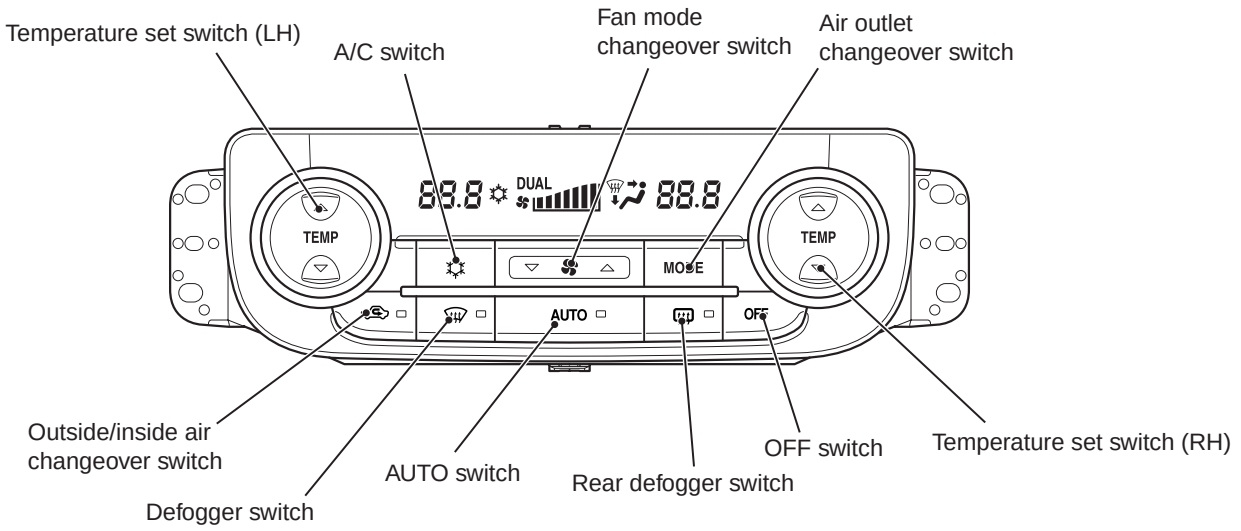
DUAL A/C



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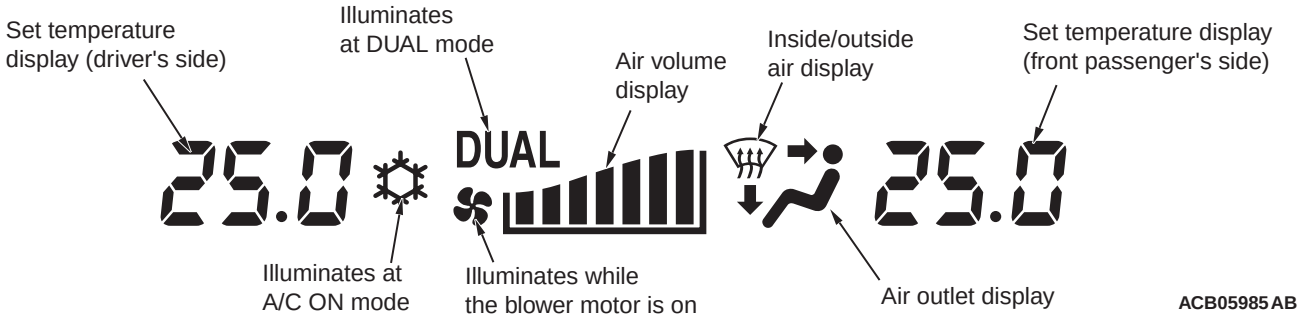
LCD panel <DUAL A/C>



ACB05985AB

The following heater controller has been adopted.

- To enhance luxurious appearance and convenience, a liquid crystal display panel has been adopted.
- A white character LCD is adopted in order to provide a better visibility.
- Ergonomic layout of the control panel allows the driver to check the current status without less eye movement.
- The smoke-shaded LCD screen provides a luxury image.

AIR CONDITIONER CONTROL SYSTEM

M2551002800033

General

The air conditioner system with following features has been adopted.

- If the heater fan runs at higher stage, the recirculation ratio of heated air will be increased, thus improving heating performance.
- The heating performance is enhanced by increasing air volume.
- The heating performance is enhanced by restricting minimum air volume at low ambient temperature (-5°C or less).
- The interior temperature sensor can measure temperature more precisely due to better sealing around it. This improves the response and comfort of the automatic air conditioner.

CONTROL

FORCED DEF CONTROL

When air outlet position is switched to DEF, A/C is automatically turned ON, and outside/inside air selection damper is set to the fresh air position to quickly defrost the windshield screen.

MAX COOL, MAX HOT CONTROL

When the set temperature is at MAX COOL (15°C) or at MAX HOT (29°C) with the air outlet and air volume at the AUTO positions, the following controls are made automatically by the A/C-ECU.

Subject to control	MAX COOL	MAX HOT
Air mix damper	MAX COOL position	MAX HOT position
Air outlet mode	FACE position	FOOT position
Air volume	Maximum	Maximum
Outside/inside air selection damper	Air recirculation position*	Fresh air position*
Air conditioner switch	ON*	OFF*

NOTE: "" indicates that when the automatic control is not cancelled using the customise function, the manual operation is disabled.*

IDLE-UP CONTROL

A/C-ECU and the engine-ECU communicate with each other through the CAN communication. The idle-up speed of the engine is controlled in two steps depending on the A/C load to secure the air cooling performance during summer and to enhance fuel economy in seasons with moderate temperature.

DETECTION CONTROL FOR REFRIGERANT LEAKS

A/C-ECU determines if the refrigerant amount is less than specified or refrigerant pressure is abnormal by using the ambient temperature (ambient temperature sensor to measure refrigerant inflation rate) and refrigerant pressure (measured by the A/C pressure sensor). When refrigerant amount or refrigerant pressure is judged abnormal, the compressor is cut-off to protect the A/C system.

PROTECTION CONTROL AT AIR BAG DEPLOYMENT (DURING COLLISION)

When the air bag deployment is detected, the A/C system is stopped.

COMMUNICATION

A/C-ECU performs the signal transmission and reception with each ECU via CAN (Controller Area Network)*.

*NOTE: *: For details of CAN communication, refer to GROUP 54C − Controller Area Network .*

DIAGNOSTIC FUNCTION

A/C-ECU has the following functions for easier system checks.

- DIAGNOSTIC FUNCTION
- Service data output
- Actuator test

NOTE: For each item, refer to the Workshop Manual.

CUSTOMIZATION FUNCTION

M2551003000018

By operating the M.U.T.-III ETACS system, the following functions can be customised. The programmed information is held even when the battery is disconnected.

Adjustment item (M.U.T.-III display)	Adjustment item	Adjusting content (M.U.T.-III display)	Adjusting content
A/C Recirculation Control	With/without inside/outside air automatic control function	Disable	No function
		Enable	With function (Initial condition)
A/C Switch Control	With/without A/C automatic control function	Disable	No function
		Enable	With function (Initial condition)
A/C Sensible temp. customize	Adjusting mean value for temperature setting	-2	Decreases the control temperature two degrees than the temperature displayed on the LCD.
		-1	Decreases the control temperature one degree than the temperature displayed on the LCD.
		0	No change (Initial condition)
		1	Increases the control temperature one degree than the temperature displayed on the LCD.
		2	Increases the control temperature two degrees than the temperature displayed on the LCD.
FOOT / DEF Air outlet ratio	Changes air distribution rate for DEF/FOOT vents during manual operation.	Normal	D/F2 (Initial condition)
		FOOT > DEF	D/F1(more to FOOT vent): More air flows through FOOT vents.
		FOOT < DEF	D/F3(more to DEF vent): More air flows through DEF vents.
FACE / FOOT Air outlet ratio	Changes air distribution rate for FACE/FOOT vents during manual operation.	Normal	B/L2 (Initial condition)
		FACE > FOOT	B/L1(more to FACE vent): More air flows through FACE vents.
		FACE < FOOT	B/L3(more to FOOT vent): More air flows through FOOT vents.
Auto Rear Defogger(Engine Start)	When ambient temperature is 3 degree or less, the rear defogger will be turned on automatically. (The rear window defogger has never been activated since the ignition switch was turned on last time)	Disable	No function (Initial condition)
		Enable	With function

A/C COMPRESSOR

M2551001100837

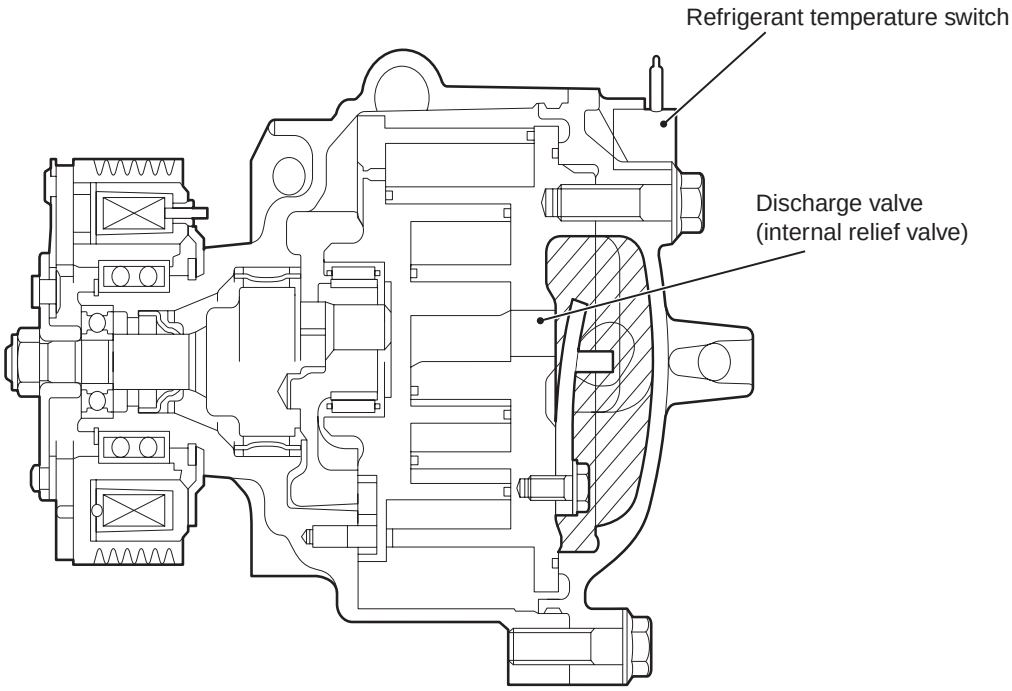
HIGH EFFICIENCY COMPRESSOR WITH INTEGRATED OIL SEPARATOR

High efficiency compressor with integrated oil separator has been adopted to enhance fuel economy by reducing the A/C operating rate.

MAGNETIC CLUTCH WITH THERMAL FUSE

At the compressor lock, the thermal fuse integrated in the magnet clutch is blown due to the frictional heat against the compressor in order to reduce risk of the drive belt breakage. The thermal fuse, together with the coil, is coated with resin to enhance resistance to corrosion.

3D-PROFILE COMPRESSOR

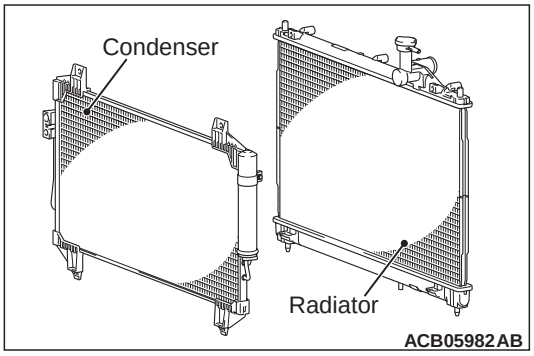


AC708240AC

- The 3D profile improves durability and efficiency, and shortens the total length.
- An internal relief valve allows compressed refrigerant to escape into the outlet side, thus improving the reliability of the compressor.
- The refrigerant temperature switch can measure temperature without any openings on the case. This reduces the risk of refrigerant leaks.

CONDENSER

M2551001400333

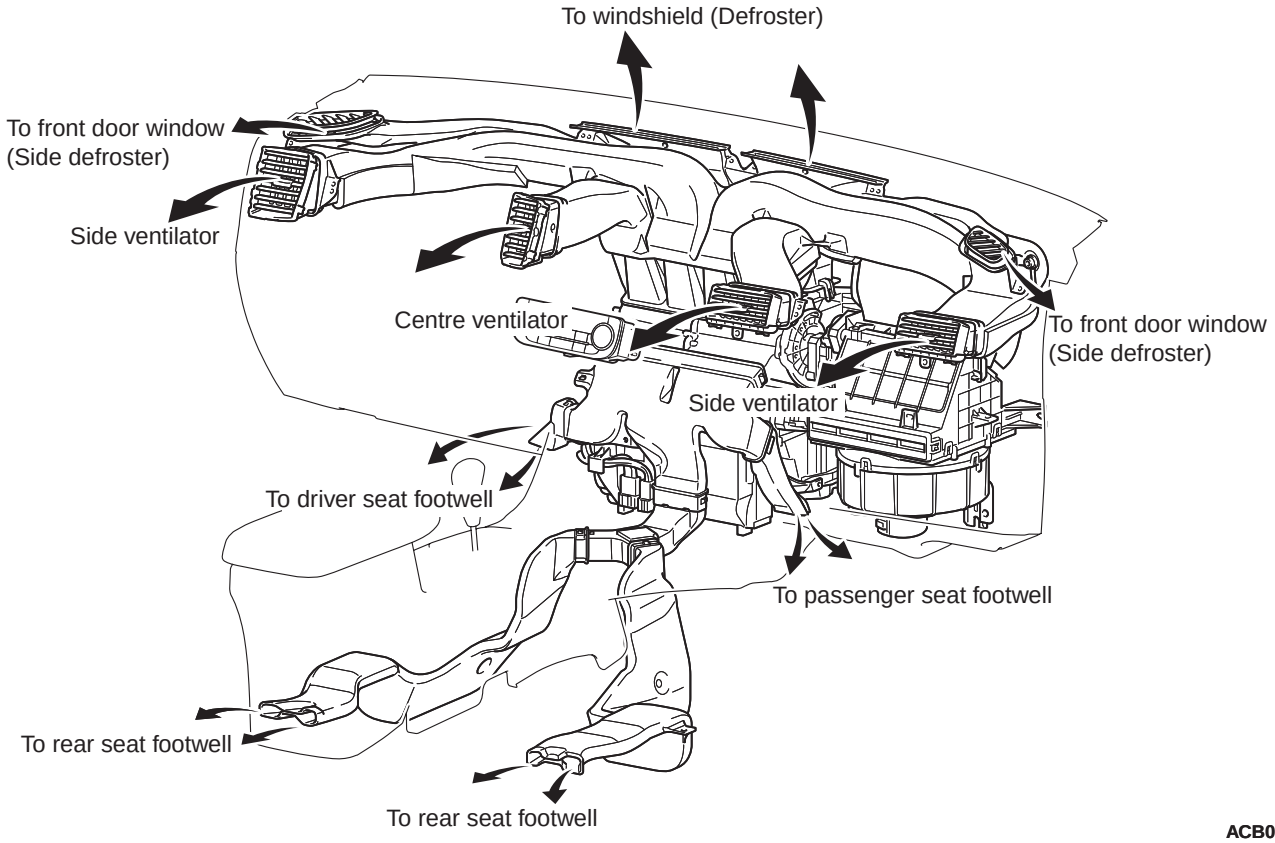


The air conditioner compressor with following features has been adopted..

- A sub-cool type is adopted in order to enhance performance.
- A narrower high-efficiency core and plastic brackets are adopted in order to save weight.
- A condenser is assembled into the radiator as one module, thus simplifying the structure.

DUCT

M2551001300842

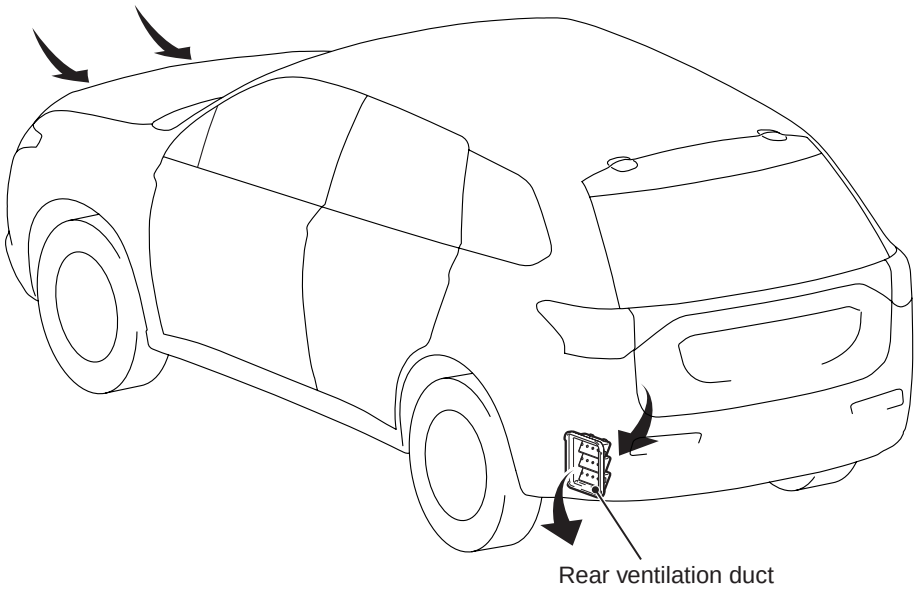


The following air outlet system has been adopted to improve comfort.

- The FACE vents at the driver's side is located so that air is directed to the driver's face rather than hands. This improves comfort.
- A rear heater duct is fitted in order to improve comfort.

VENTILATION SYSTEM

M2551002001096



ACB05000AB

Fresh air is sucked from the front deck and exhausted through the air outlet behind the rear bumper. Optimising areas of the outside air induction hole and the air outlet enhances ventilated air amount, reducing noise.