Mazda6 Training Manual

FOREWORD

This manual explains each component or system operation and function for the Mazda6.

For proper repair and maintenance, a thorough familiarization with this manual is important, and it should always be kept in a handy place for quick and easy reference.

All the contents of this manual, including drawings and specifications, are the latest available at the time of printing. As modifications affecting repair or maintenance occur, relevant information supplementary to this volume will be made available at Mazda dealers. This manual should be kept up-to-date.

Mazda Motor Corporation reserves the right to alter the specifications and contents of this manual without obligation or advance notice.

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Mazda Motor Corporation
HIROSHIMA, JAPAN

APPLICATION:
This manual is applicable to vehicles beginning with the Vehicle Identification Numbers (VIN) shown on the following page.

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PRINTED IN The Netherlands, MARCH 2002
3359–1E–02C

VEHICLE IDENTIFICATION NUMBERS (VIN)

U.K. specs.

JMZ GG12820#	100001—
JMZ GG14320#	100001—
JMZ GG14820#	100001—
JMZ GG12F20#	100001—
JMZ GG12F50#	100001—
JMZ GG14F20#	100001—
JMZ GG14F50#	100001—

European (L.H.D.) specs.

JMZ GG1232*#	100001—
JMZ GG1282*#	100001—
JMZ GG1432*#	100001—
JMZ GG1482*#	100001—
JMZ GG12F2*#	100001—
JMZ GG12F5*#	100001—
JMZ GG14F2*#	100001—
JMZ GG14F5*#	100001—

GCC specs.

JM7 GG32F**#	100001—
JM7 GG34F**#	100001—
JM7 GG42F**#	100001—
JM7 GG44F**#	100001—

RELATED MATERIALS

Engine Workshop Manual L8, LF, L3 . . . . . 1731–1*–02C
Manual Transaxle Workshop Manual
G35M–R 1732–1*–02C
Automatic Transaxle Workshop Manual
FN4A–EL 1623–10–98E
Automatic Transaxle Workshop Manual
Supplement FN4A–EL 1746–1*–02C
Mazda6 Wiring Diagram
(European (L.H.D.), GCC specs.) 5539–1*–02C
Mazda6 Wirinig Diagram
(U.K. specs.) 5540–1*–02C
Mazda6 Bodyshop Manual
(European (L.H.D. U.K.), GCC specs.) 3360–1*–02C

* : Indicates the printing location
E: Europe
0: Japan

GENERAL INFORMATION

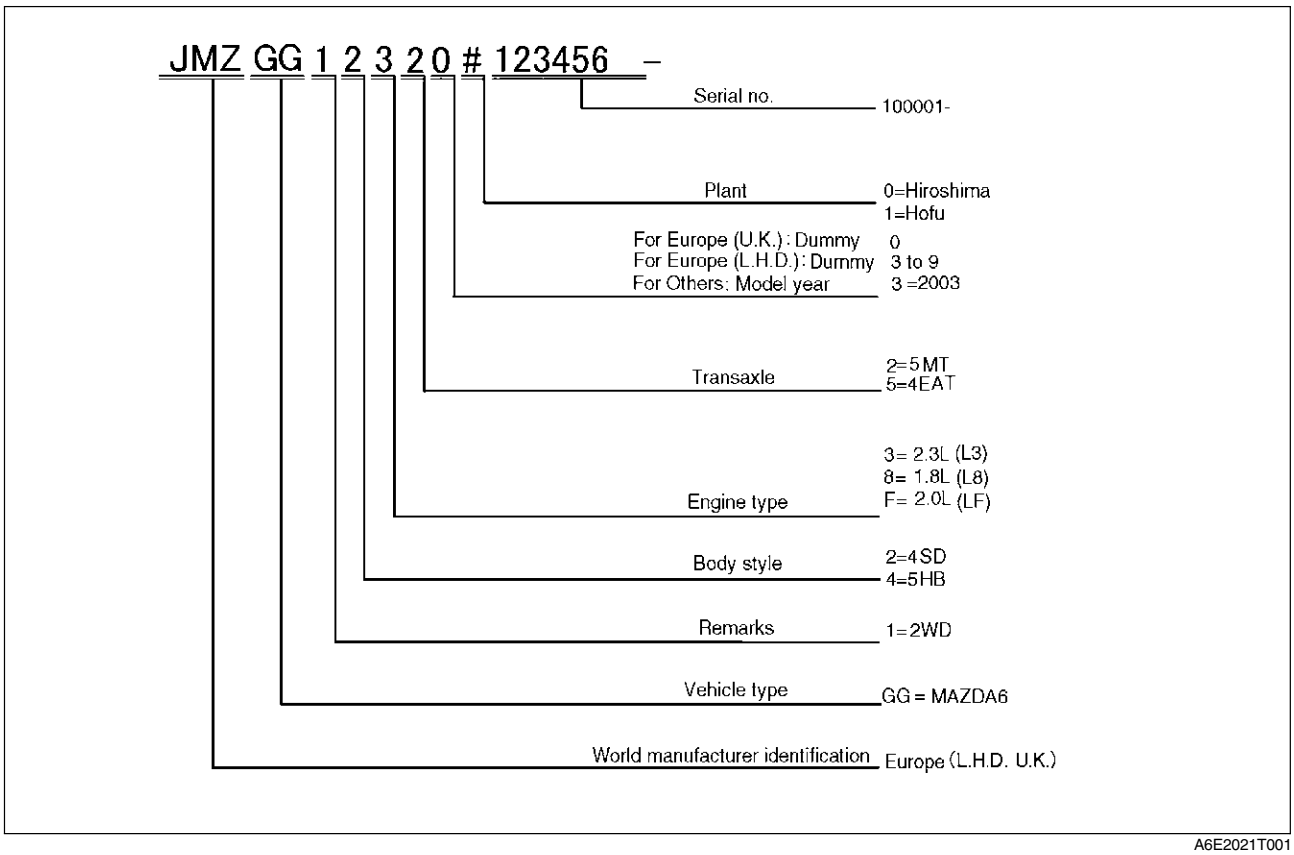
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HOW TO USE THIS MANUAL

VIN CODE

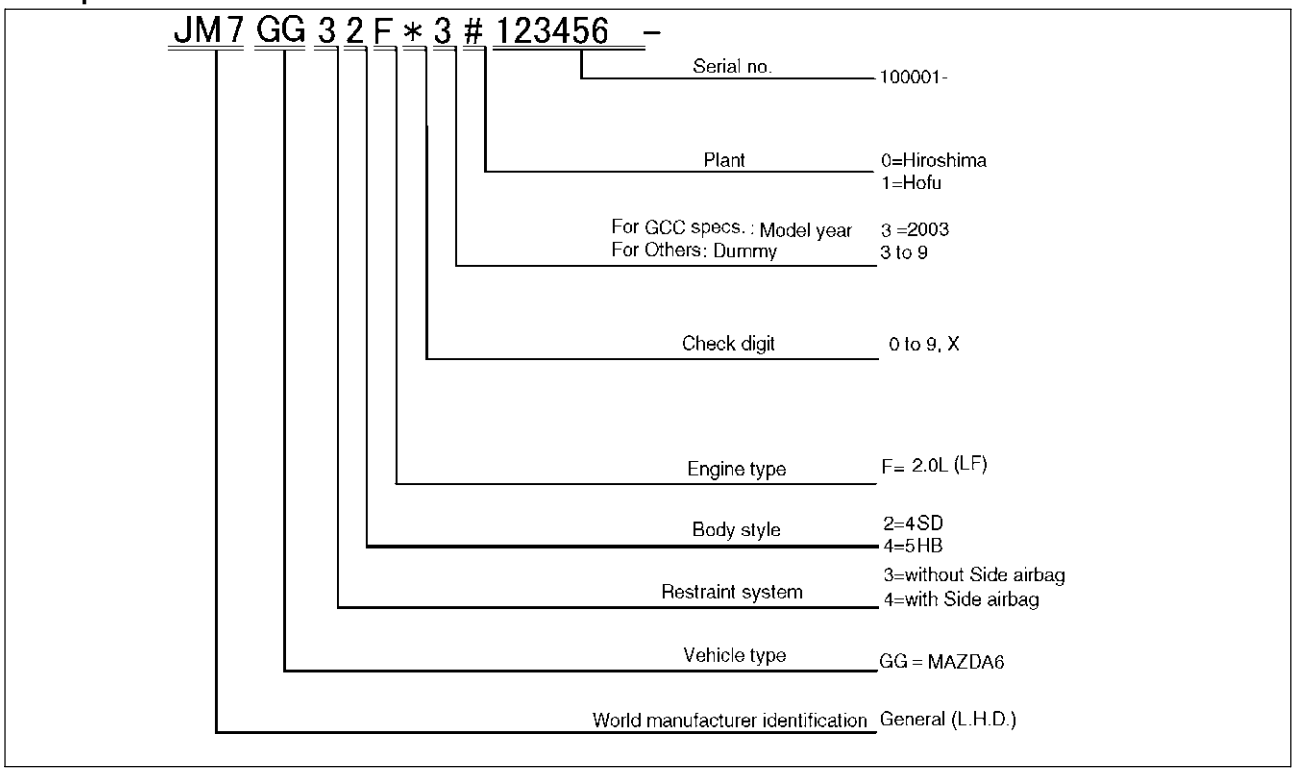
A6E201000001T01

European (L.H.D. U.K.) specs.



A6E2021T001

GCC specs.



A6E2021T002

UNITS

UNITS TABLE

A6E201200002T01

Electrical current	A (ampere)
Electric power	W (watt)
Electric resistance	ohm
Electric voltage	V (volt)
Length	mm (millimeter)
	in (inch)
Negative pressure	kPa (kilo pascal)
	mmHg (millimeters of mercury)
	inHg (inches of mercury)
Positive pressure	kPa (kilo pascal)
	kgf/cm^2 (kilogram force per square centimeter)
	psi (pounds per square inch)
Torque	N·m (Newton meter)
	kgf·m (kilogram force meter)
	kgf·cm (kilogram force centimeter)
	ft·lbf (foot pound force)
	in·lbf (inch pound force)
Volume	L (liter)
	US qt (U.S. quart)
	Imp qt (Imperial quart)
	ml (milliliter)
	cc (cubic centimeter)
	cu in (cubic inch)
	fl oz (fluid ounce)
Weight	g (gram)
	oz (ounce)

Conversion to SI Units (Système International d'Unités)

- All numerical values in this manual are based on SI units. Numbers shown in conventional units are converted from these values.

Rounding Off

- Converted values are rounded off to the same number of places as the SI unit value. For example, if the SI unit value is 17.2 and the value after conversion is 37.84, the converted value will be rounded off to 37.8.

Upper and Lower Limits

- When the data indicates upper and lower limits, the converted values are rounded down if the SI unit value is an upper limit and rounded up if the SI unit value is a lower limit. Therefore, converted values for the same SI unit value may differ after conversion. For example, consider 2.7 kgf/cm^2 in the following specifications:

  210—260 kPa {2.1—2.7 kgf/cm^2, 30—38 psi}
  270—310 kPa {2.7—3.2 kgf/cm^2, 39—45 psi}

- The actual converted values for 2.7 kgf/cm^2 are 265 kPa and 38.4 psi. In the first specification, 2.7 is used as an upper limit, so the converted values are rounded down to 260 and 38. In the second specification, 2.7 is used as a lower limit, so the converted values are rounded up to 270 and 39.

NEW STANDARDS

NEW STANDARDS TABLE

A6E202800020T01

- Following is a comparison of the previous standard and the new standard.

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
AP	Accelerator Pedal	—	Accelerator Pedal	
ACL	Air Cleaner	—	Air Cleaner	
A/C	Air Conditioning	—	Air Conditioning	
BARO	Barometric Pressure	—	Atmospheric Pressure	
B+	Battery Positive Voltage	Vb	Battery Voltage	
—	Brake Switch	—	Stoplight Switch	
—	Calibration Resistor	—	Corrected Resistance	#6
CMP sensor	Camshaft Position Sensor	—	Crank Angle Sensor	
CAC	Charge Air Cooler	—	Intercooler	
CLS	Closed Loop System	—	Feedback System	
CTP	Closed Throttle Position	—	Fully Closed	
CPP	Clutch Pedal Position	—	Clutch Position	
CIS	Continuous Fuel Injection System	EGI	Electronic Gasoline Injection System	
CS sensor	Control Sleeve Sensor	CSP sensor	Control Sleeve Position Sensor	#6
CKP sensor	Crankshaft Position Sensor	—	Crank Angle Sensor 2	
DLC	Data Link Connector	—	Diagnosis Connector	
DTM	Diagnostic Test Mode	—	Test Mode	#1
DTC	Diagnostic Trouble Code(s)	—	Service Code(s)	
DI	Distributor Ignition	—	Spark Ignition	
DLI	Distributorless Ignition	—	Direct Ignition	
EI	Electronic Ignition	—	Electronic Spark Ignition	#2
ECT	Engine Coolant Temperature	—	Water Thermo	
EM	Engine Modification	—	Engine Modification	
—	Engine Speed Input Signal	—	Engine RPM Signal	
EVAP	Evaporative Emission	—	Evaporative Emission	
EGR	Exhaust Gas Recirculation	—	Exhaust Gas Recirculation	
FC	Fan Control	—	Fan Control	
FF	Flexible Fuel	—	Flexible Fuel	
4GR	Fourth Gear	—	Overdrive	
—	Fuel Pump Relay	—	Circuit Opening Relay	#3
FSO solenoid	Fuel Shut Off Solenoid	FCV	Fuel Cut Valve	#6
GEN	Generator	—	Alternator	
GND	Ground	—	Ground/Earth	
HO2S	Heated Oxygen Sensor	—	Oxygen Sensor	With heater
IAC	Idle Air Control	—	Idle Speed Control	
—	IDM Relay	—	Spill Valve Relay	#6
—	Incorrect Gear Ratio	—	—	
—	Injection Pump	FIP	Fuel Injection Pump	#6
—	Input/Turbine Speed Sensor	—	Pulse Generator	
IAT	Intake Air Temperature	—	Intake Air Thermo	
KS	Knock Sensor	—	Knock Sensor	
MIL	Malfunction Indicator Lamp	—	Malfunction Indicator Light	
MAP	Manifold Absolute Pressure	—	Intake Air Pressure	
MAF sensor	Mass Air Flow Sensor	—	Airflow Sensor	
MFL	Multiport Fuel Injection	—	Multiport Fuel Injection	
OBD	On-Board Diagnostic	—	Diagnosis/SelfDiagnosis	
OL	Open Loop	—	Open Loop	

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
—	Output Speed Sensor	—	Vehicle Speed Sensor 1	
OC	Oxidation Catalytic Converter	—	Catalytic Converter	
O2S	Oxygen Sensor	—	Oxygen Sensor	
PNP	Park/Neutral Position	—	Park/Neutral Range	
—	PCM Control Relay	—	Main Relay	#6
PSP	Power Steering Pressure	—	Power Steering Pressure	
PCM	Powertrain Control Module	ECU	Engine Control Unit	#4
—	Pressure Control Solenoid	—	Line Pressure Solenoid Valve	
PAIR	Pulsed Secondary Air Injection	—	Secondary Air Injection System	Pulsed injection
—	Pump Speed Sensor	—	NE Sensor	#6
AIR	Secondary Air Injection	—	Secondary Air Injection System	Injection with air pump
SAPV	Secondary Air Pulse Valve	—	Reed Valve	
SFI	Sequential Multipoint Fuel Injection	—	Sequential Fuel Injection	
—	Shift Solenoid A	—	1-2 Shift Solenoid Valve	
		—	Shift A Solenoid Valve	
—	Shift Solenoid B	—	2-3 Shift Solenoid Valve	
		—	Shift B Solenoid Valve	
—	Shift Solenoid C	—	3-4 Shift Solenoid Valve	
3GR	Third Gear	—	3rd Gear	
TWC	Three Way Catalytic Converter	—	Catalytic Converter	
TB	Throttle Body	—	Throttle Body	
TP sensor	Throttle Position Sensor	—	Throttle Sensor	
TCV	Timer Control Valve	TCV	Timing Control Valve	#6
TCC	Torque Converter Clutch	—	Lockup Position	
TCM	Transmission (Transaxle) Control Module	—	ECAT Control Unit	
—	Transmission (Transaxle) Fluid Temperature Sensor	—	ATF Thermosensor	
TR	Transmission (Transaxle) Range	—	Inhibitor Position	
TC	Turbocharger	—	Turbocharger	
VSS	Vehicle Speed Sensor	—	Vehicle Speed Sensor	
VR	Voltage Regulator	—	IC Regulator	
VAF sensor	Volume Air Flow Sensor	—	Air flow Sensor	
WUTWC	Warm Up Three Way Catalytic Converter	—	Catalytic Converter	#5
WOT	Wide Open Throttle	—	Fully Open	

#1 : Diagnostic trouble codes depend on the diagnostic test mode
#2 : Controlled by the PCM
#3 : In some models, there is a fuel pump relay that controls pump speed. That relay is now called the fuel pump relay (speed).
#4 : Device that controls engine and powertrain
#5 : Directly connected to exhaust manifold
#6 : Part name of diesel engine

ENGINE

B

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ABBREVIATIONS

ABBREVIATIONS

A6E220102000T01

A/C	Air conditioner
ABDC	After bottom dead center
ATDC	After top dead center
BBDC	Before bottom dead center
BTDC	Before bottom dead center
DOHC	Double overhead camshaft
EX	Exhaust
IN	Intake
OCV	Oil control valve
P/S	Power steering
PCV	Positive crankcase ventilation
SST	Special service tool
TDC	Top dead center

OUTLINE

OUTLINE OF CONSTRUCTION

A6E220202000T01

- The new L8 engine models (1.8L) has been adopted for European specs.
- The new LF engine models (2.0L) has been adopted.
- The new L3 (with variable valve timing mechanism) engine models (2.3L) has been adopted for European specs.

FEATURES

A6E220202000T02

Improved engine performance

- The variable valve timing mechanism has been adopted for L3 engine models (2.3L).

Reduced engine weight

- Main parts (cylinder head and cylinder block) made of aluminum alloy.

Reduced engine noise and vibration

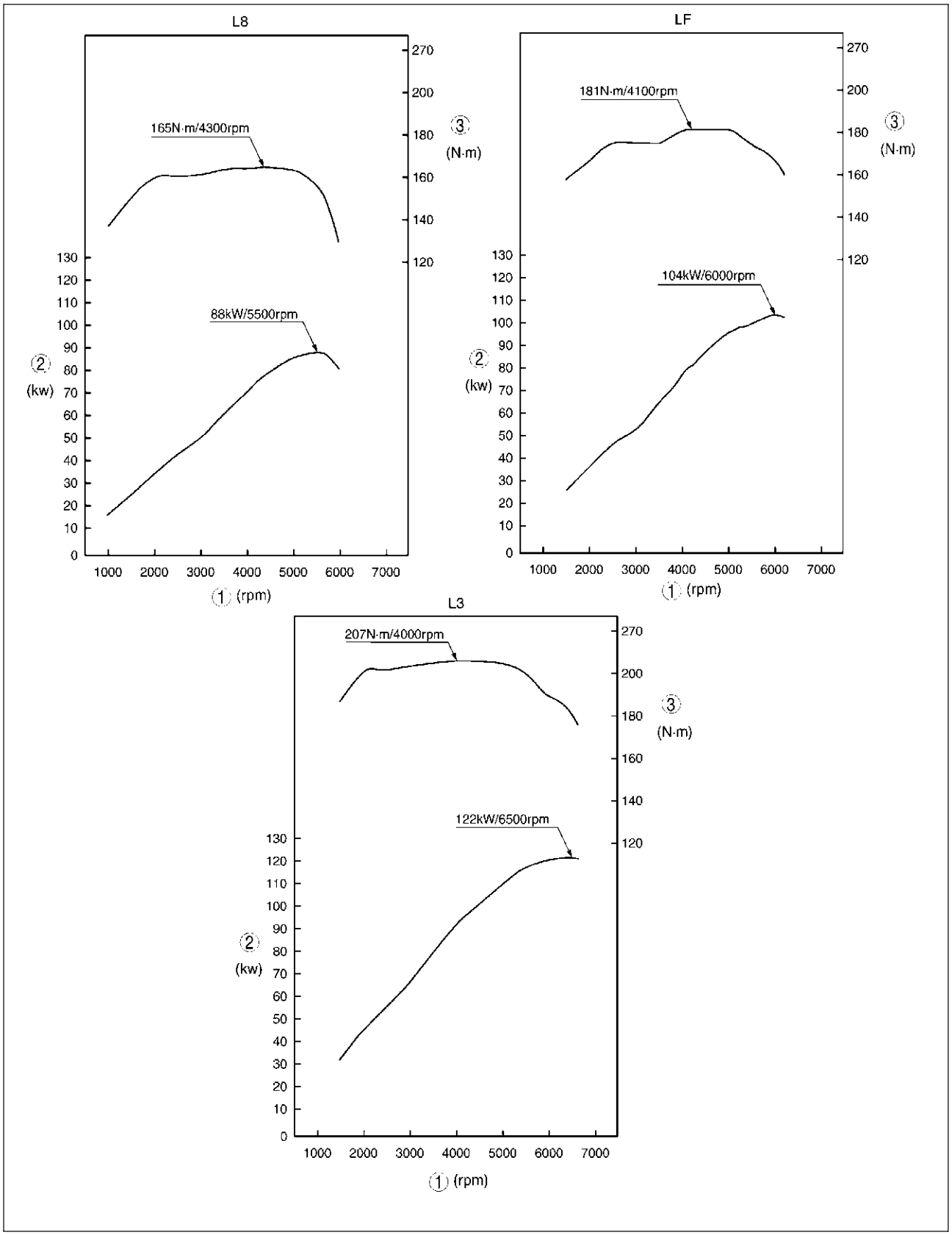
- The cylinder head is made of aluminum alloy.
- The cassette type balancer unit has been adopted for the L3 engine models (2.3L).
- Silent timing chain has been adopted.
- A deep skirt type and forms the ladder frame structure with the integrated main bearing cap has been adopted for the cylinder block.
- The crankshaft pulley with torsional damper has been adopted.
- The engine mount of pendulum type has been adopted.

Improved serviceability

- The drive belt of serpentine type has been adopted.
- Tension of the drive belt is adjusted automatically with an auto-tensioner.
- Timing chains have been adopted to eliminate the need for replacement.
- The engine front cover with service hole has been adopted. (for unlocking the chain adjust ratchet, and securing the tensioner arm).

ENGINE PERFORMANCE CURVE

A6E220202000T04



AME2202N001

1	Engine speed

2	Output
3	Torque

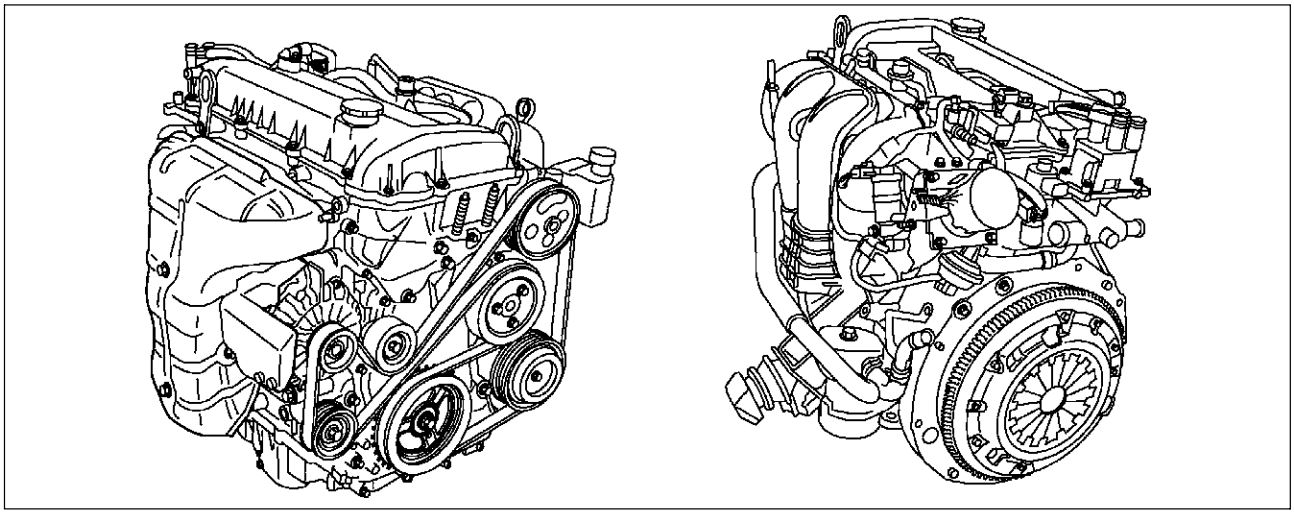
SPECIFICATIONS

A6E220202000T03

Item				Specification		
				L8	LF	L3
Type				Gasoline, 4-cycle		
Cylinder arrangement and number				In-line, 4-cylinder		
Combustion chamber				Pentroof		
Valve system				DOHC, timing chain driven, 16 valves		
Displacement			(ml {cc, cu in})	1,798 {1,798, 109.7}	1,999 {1,999, 121.9}	2,261 {2,261, 137.9}
Bore × stroke			(mm {in})	83.0 × 83.1 {3.27 ×3.27}	87.5 × 83.1 {3.44 ×3.27}	87.5 × 94.0 {3.44 × 3.70}
Compression ratio				10.8:1	10.8:1	10.6:1
Compression pressure			(kPa {kgf/cm^2, psi} [rpm])	1,750 {17.85, 253.8} [300]	1,720 {17.54, 249.5} [300]	1,430 {14.58, 207.4} [290]
Valve timing	IN	Open	BTDC (°)	4	4	0—25
		Close	ABDC (°)	33	52	0—37
	EX	Open	BBDC (°)	37	37	42
		Close	ATDC (°)	4	4	5
Valve clearance (mm {in})		IN		0.22 {0.0087}— 0.28 {0.011} [Engine cold]		
		EX		0.27 {0.011}— 0.33 {0.012} [Engine cold]		

STRUCTURAL VIEW

A6E220202000T05



AME2202N002

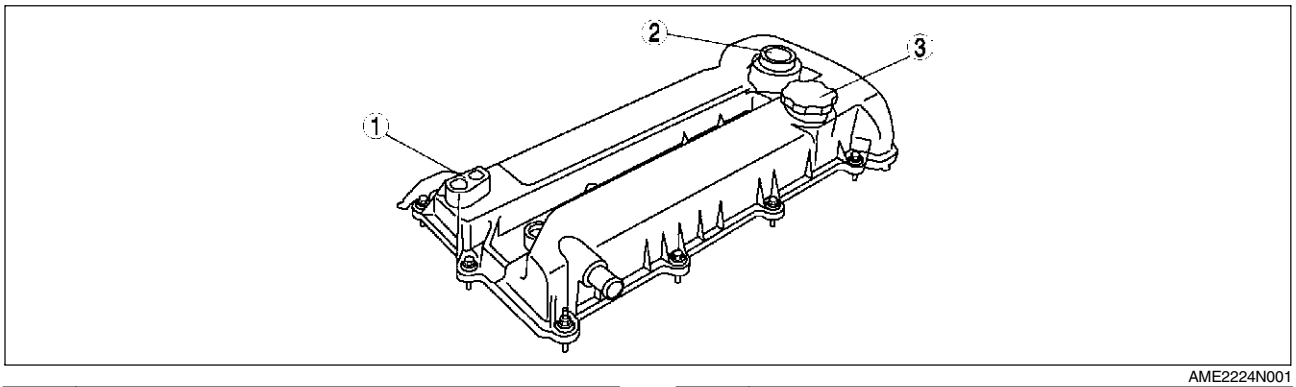
ENGINE

CYLINDER HEAD COVER

A6E222410100T01

Structure

- The cylinder head cover is made of integrated aluminum alloy, which is lightweight and sound absorbent.
- The oil filler cap is a screw-in type. The boss for installing the camshaft position (CMP) sensor is provided at the rear of the cylinder head cover.
- L3 engine models has a hole for installing the oil control (OCV) valve.



AME2224N001

1	Camshaft position (CMP) sensor
2	Oil control (OCV) valve attachment hole (L3)

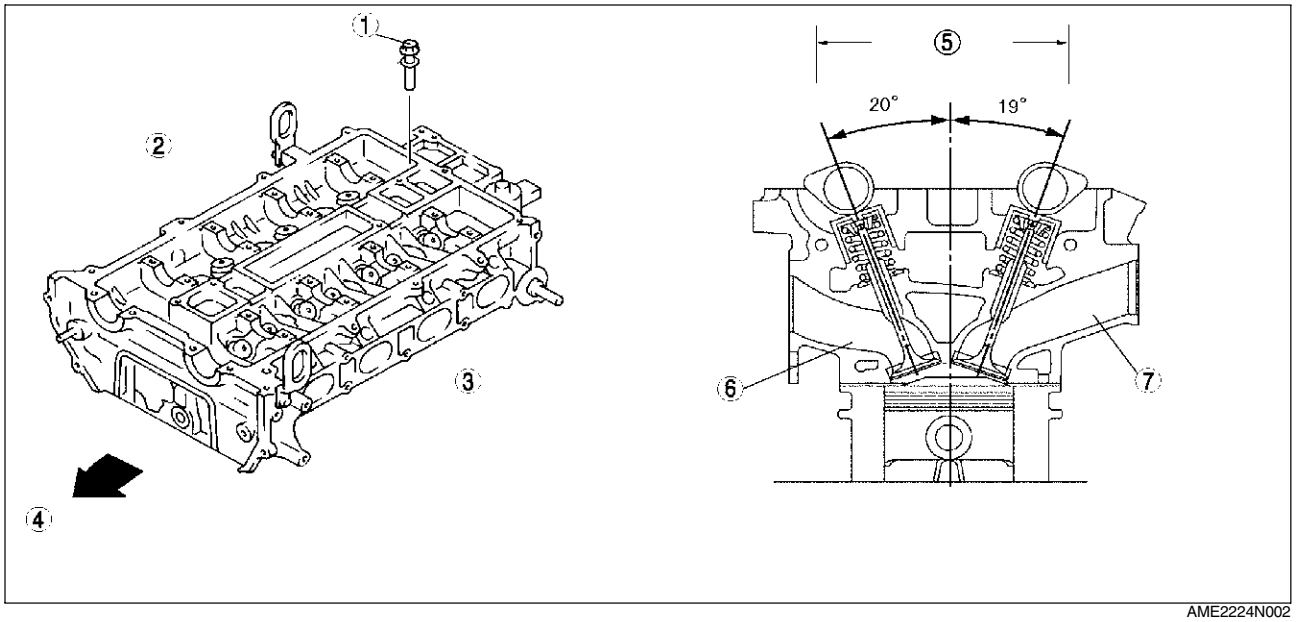
3	Oil filler cap

CYLINDER HEAD

A6E222410100T02

Structure

- The cylinder head is made of a high heat conductive, lightweight aluminum alloy, which has been quenched.
- Compact, pentroof-type combustion chambers have been adopted. The spark plugs are mounted at the top of the combustion chambers to improve combustion efficiency.
- The intake/exhaust port layout is a cross flow type, (the angle between two valves is 39°, the two intake valves and the two exhaust valves per cylinder) which improves air intake/exhaust efficiency.
- The cylinder head bolt is a plastic region tightening bolt, which is tightened in five motions. It insures a stable axis during tightening.



AME2224N002

1	Cylinder head bolt
2	Exhaust side
3	Intake side
4	Engine front side

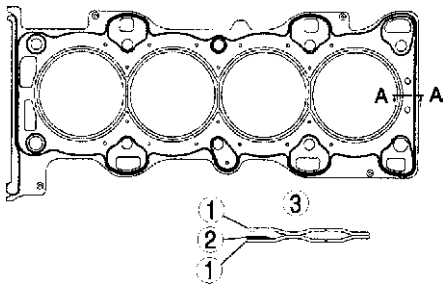
5	The angle between two valves
6	Intake port
7	Exhaust port

CYLINDER HEAD GASKET

A6E222410271T01

Structure

- Cylinder head gaskets are 2 layer-metal gaskets.



AME2224N400

1	Beat plate
2	Shim

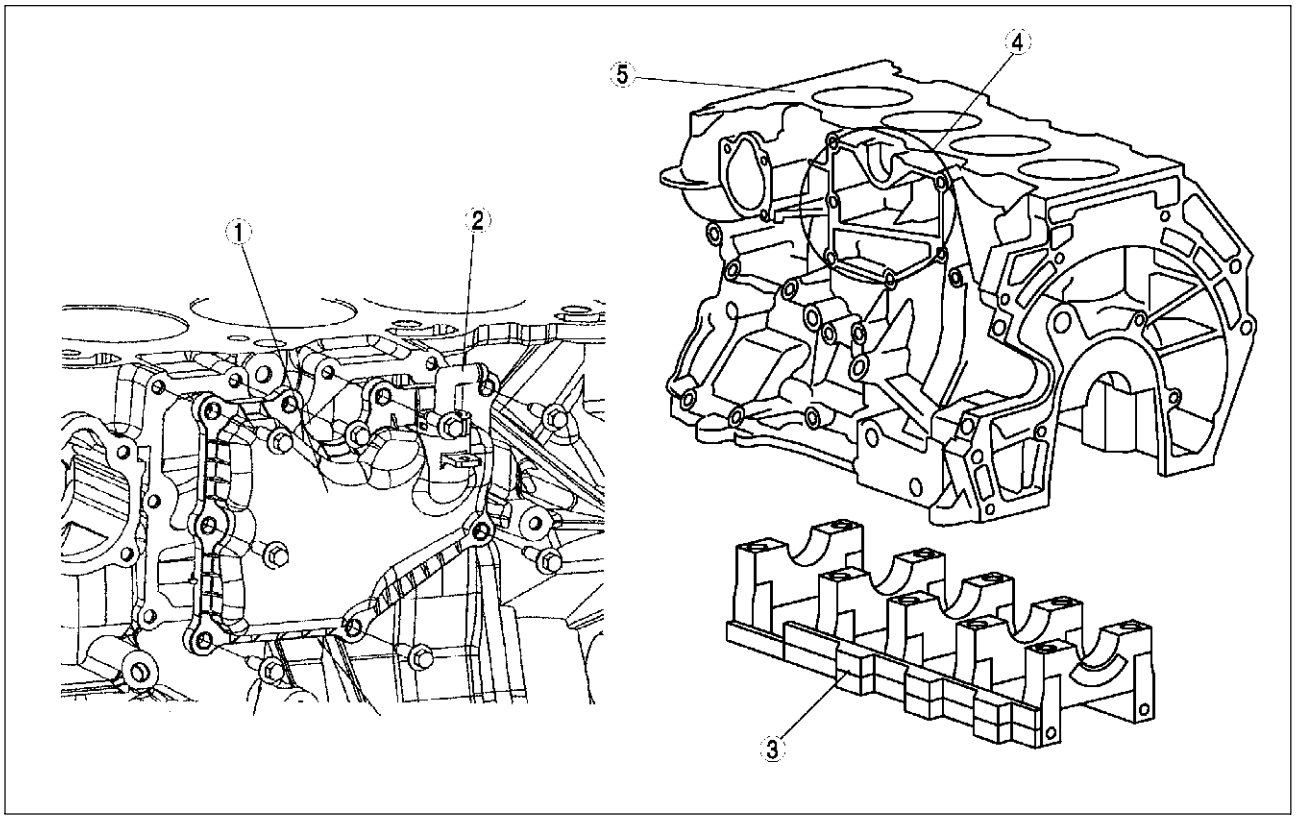
3	A-A sectional view

CYLINDER BLOCK

A6E222410300T01

Structure

- The cylinder block is made of aluminum alloy, which is cast with the cast iron liner, improving heat radiation and decreasing weight.
- The cylinder block is a deep skirt type and forms the ladder frame structure with the integrated main bearing cap. The water jacket of the cylinder block is a closed deck type. Its higher rigidity reduces vibration and noise.
- The cylinder block has the oil separator cover on the opposite side of the fresh air intake, the PCV (positive crankcase ventilation) valve and the oil separator function with an part for installing the PCV valve, to improve blow-by gas ventilation efficiency.
- The tab for alignment, used to install the upper main journal and the lower main bearing, has been decommissioned.
- The main bearing cap bolt is a plastic region tightening bolt, which is to be tightened in two motions. It insures a stable axis during tightening.



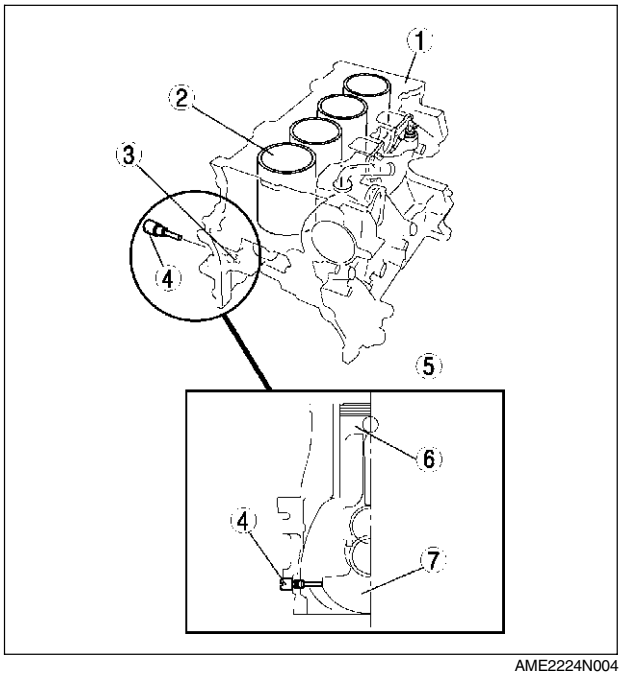
AME2224N003

1	Oil separator cover
2	PCV valve
3	Main bearing cap

4	Oil separator cover attachment part
5	Cylinder block

- The service hole for installing the SST, which is used for detect the No.1 cylinder's TDC position, is located at the right side of the cylinder block. The TDC position can be detected when the SST edge touches the cutting surface of the No.1 counter weight.

1	Cylinder block
2	No.1 cylinder
3	Service hole
4	SST
5	No.1 cylinder TDC position
6	No.1 piston
7	Crankshaft counter



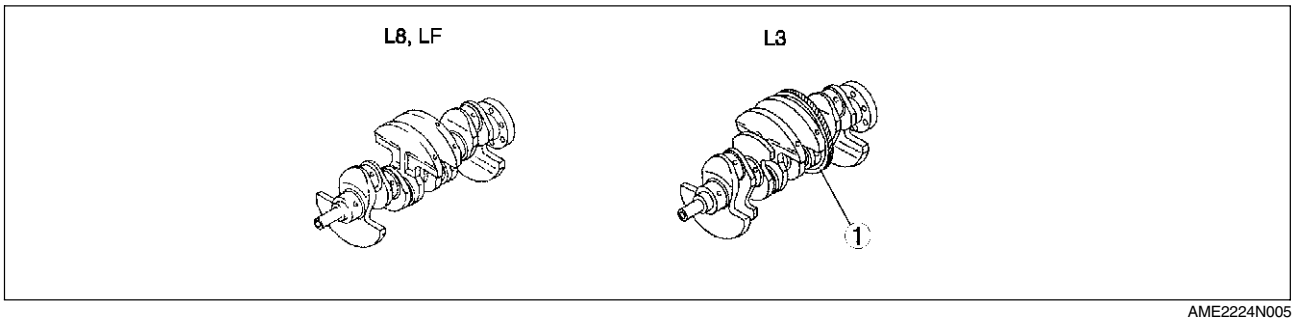
AME2224N004

CRANKSHAFT, MAIN BEARING

A6E222411301T01

Structure

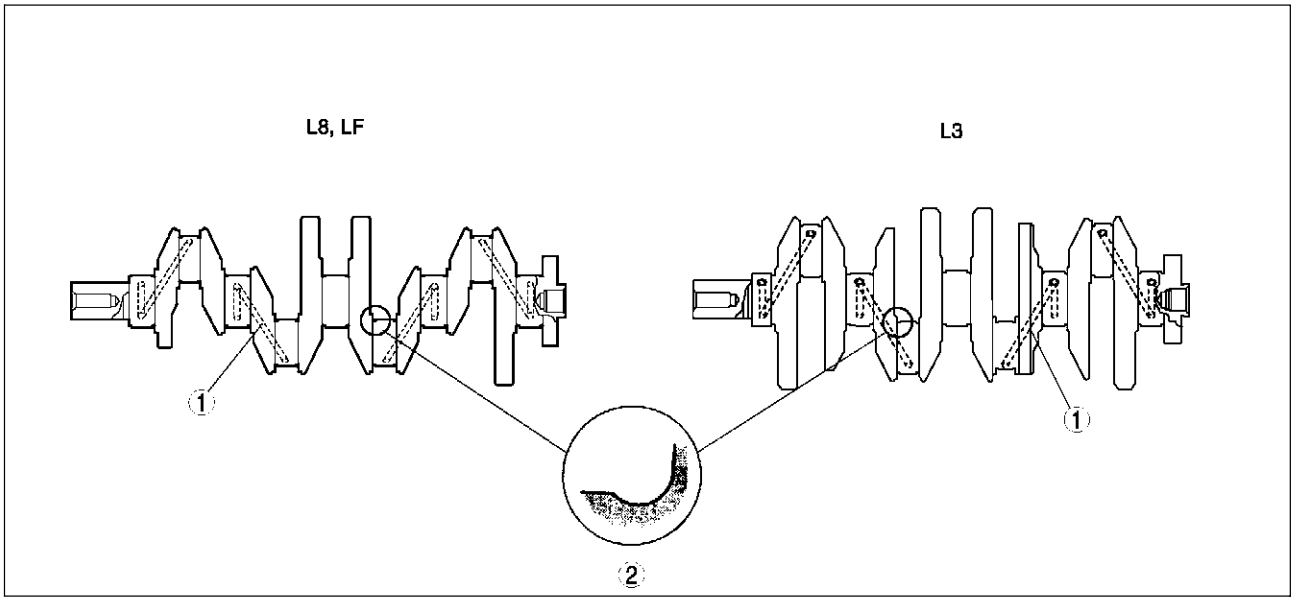
- Cast iron 5 axle-hole 4 counter weight has been adopted for the L8 engine models and LF engine models crankshafts.
- Cast iron 5 axle-hole 8 counter weight has been adopted for the L3 engine models crankshaft. The shrinkage fitted drive gear is attached to the crankshaft and the crankshaft drives the balance shaft.
- The conventional positioning key has been decommissioned and the tightening pressure of the crankshaft pulley tightening bolt secures the installation part of the crankshaft sprocket. When installing the crankshaft sprocket, always use the SST and align the No.1 cylinder to TDC.



AME2224N005

1	Drive gear

- The oil line for supplying oil to each journal is provided in the crankshaft. And the crank pin and the fillets on both sides of journal are rolled so that they bear the heavy loads.

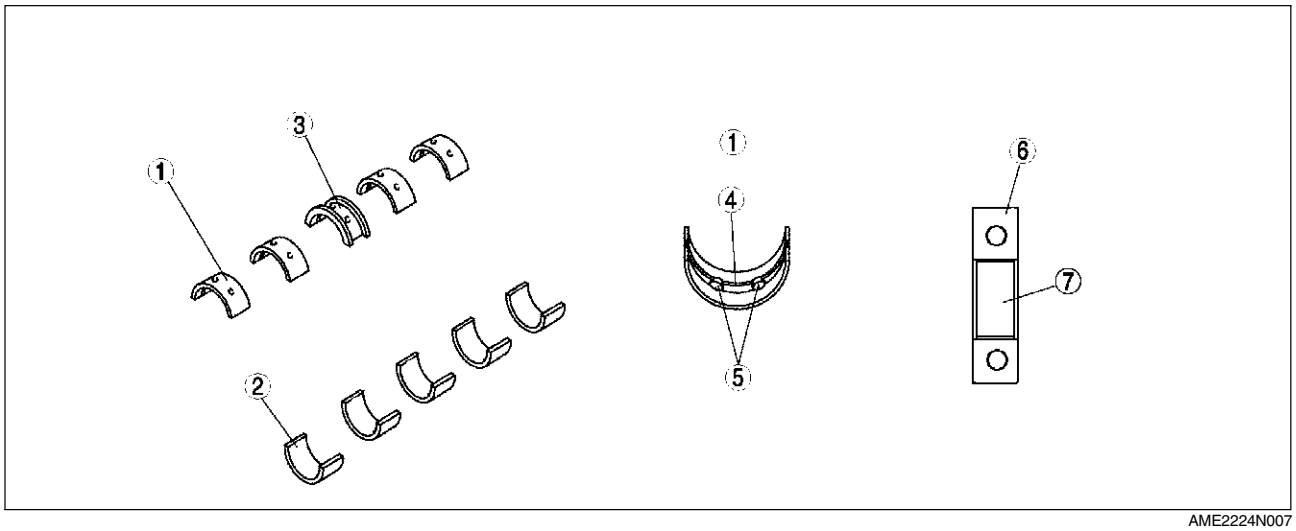


AME2224N006

1	Oil passage

2	Fillet roll area

- The upper and lower main bearings are made of aluminum alloy and the upper side No.3 journal bearing is integrated with the thrust bearing. The upper main bearing has the oil grooves and the oil holes.
- The upper and lower bearings' positioning tabs for installing the main journal have been decommissioned.
- Measure and attach the main bearings (upper and lower) so that they are positioned at the center the main bearing cap.



AME2224N007

1	Upper main bearing
2	Lower main bearing
3	Thrust bearing
4	Supplying engine oil

5	2 holes Supplying engine oil
6	Main bearing cap
7	Main bearing

- Three kinds of main bearings are available depending on the oil clearance.

(mm {in})

Bearing size	Color	Bearing thickness
Standard	Green	2.506—2.509 {0.0987—0.0988}
0.25 {0.01} Oversize		2.628—2.634 {0.1035—0.1037}
0.50 {0.02} Oversize		2.753—2.759 {0.1084—0.1086}

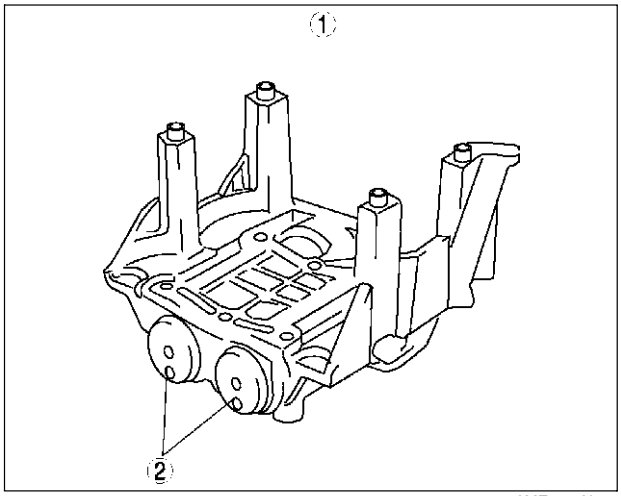
BALANCER UNIT

A6E222411301T02

Outline

- The cassette type balancer, which is separated from the engine, has been adopted for the L3 engine models to reduce vibration from the engine.

1	Cassette type balancer unit
2	balance shaft



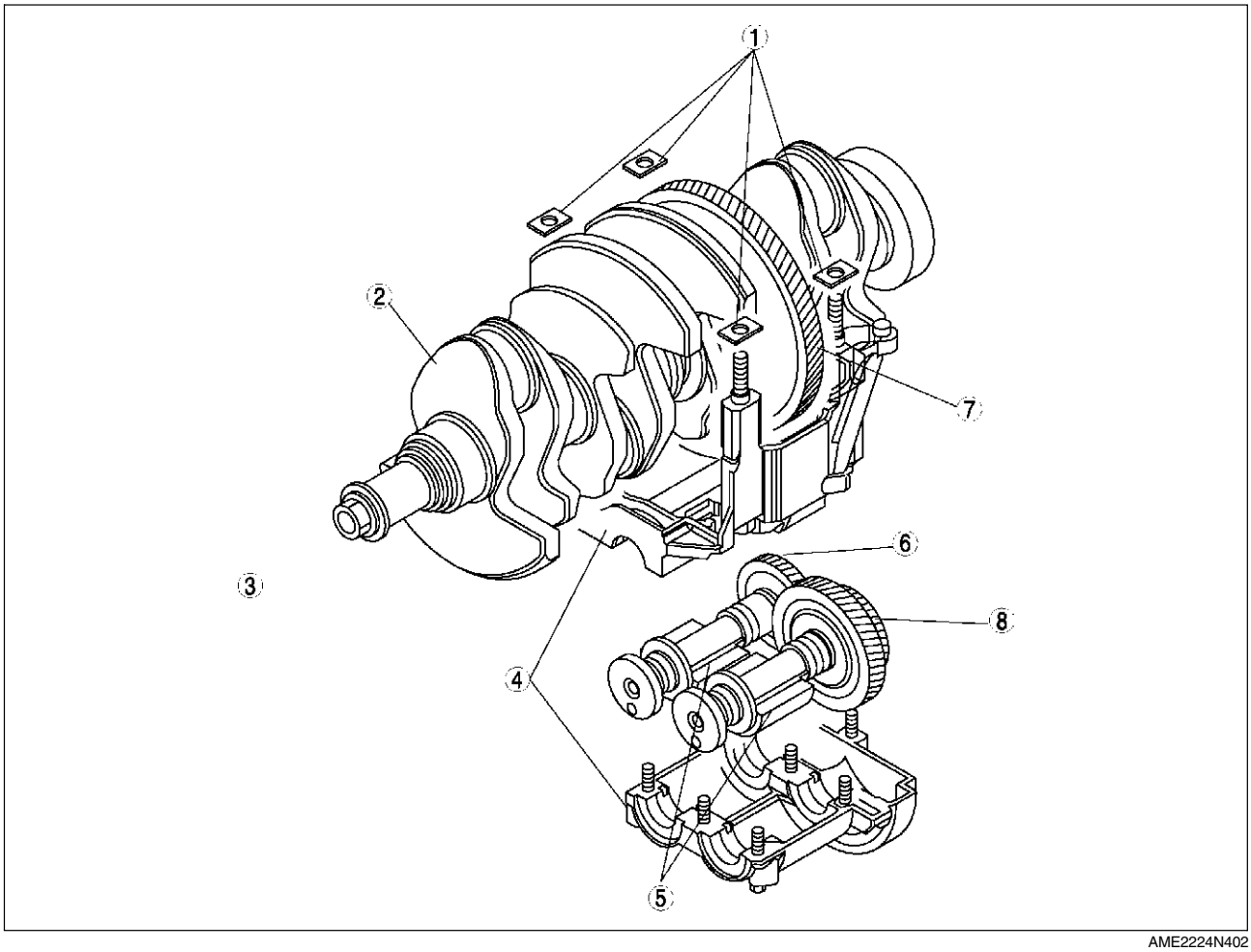
AME2224N401

Structure

- The balancer unit is configured with two balancer shafts (No.1 and No.2) with weights, the balancer unit case and the adjust shim which adjusts the amount of backlash in the crankshaft.
- The two balancer shafts (No.1 and No.2) are driven by the drive gear which is attached to the crankshaft.
- The balancer unit cannot be disassembled because it is a precision unit.

Operation

- The rotary motion is transmitted from the drive gear, which is between the back of the No.3 cylinder and the No.4 main journal, directly to the No.1 balance shaft with driven gear. Then the balance unit transmits the rotation motion to the No.2 balance shaft. The ratio of gears, which are attached to No.1 and No. 2 balancer shafts, has been set so that the gear rotates at twice the velocity of the crankshaft. The balancer shaft's rotation velocity counterbalances (generate the force in the opposite direction) the rotation inertial force (secondary inertial rotation force) from the crankshaft.

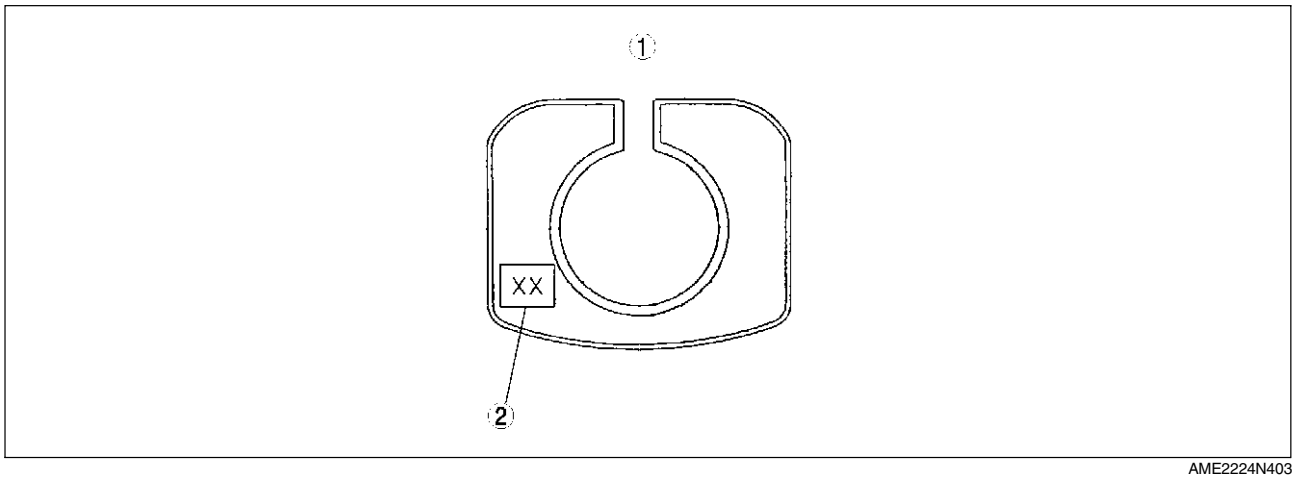


AME2224N402

1	Adjust shim
2	Crankshaft
3	Engine front
4	Balancer unit case

5	Weights
6	No.2 balance shaft
7	Drive gear
8	No.1 balance shaft with driven gear

- Replace the adjust shim to adjust backlash. There are 40 kinds of adjuster shim depending on the thickness. To determine the kind, check the engraved identification mark (2 digits) on the adjust shim.



AME2224N403

1	Cylinder block

2	Engraved identification mark (2 digits)

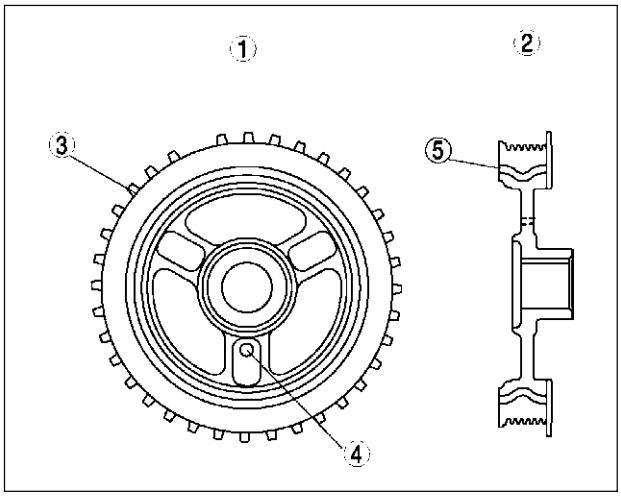
CRANKSHAFT PULLEY

A6E222411371T01

Structure

- The crankshaft position (CKP) signal detecting blade has been adopted for the crankshaft pulley. And the torsional damper, which prevents the crankshaft from wobbling, has also been adopted for the crankshaft.
- The positioning key slot, which is used for attaching the pulley to the crankshaft, has been decommissioned. For aligning the crankshaft pulley to the crankshaft, use the positioning hole on the engine front cover and the crankshaft pulley.
- Crankshaft pulley rock bolt is the plastic region tightening bolt, which can be tightened in 2 motions. It insures a stable axis during tightening.

1	Elevation view
2	Sectional view
3	Braid for CKP sensor signal detection
4	Hole for pulley positioning
5	Torsional damper



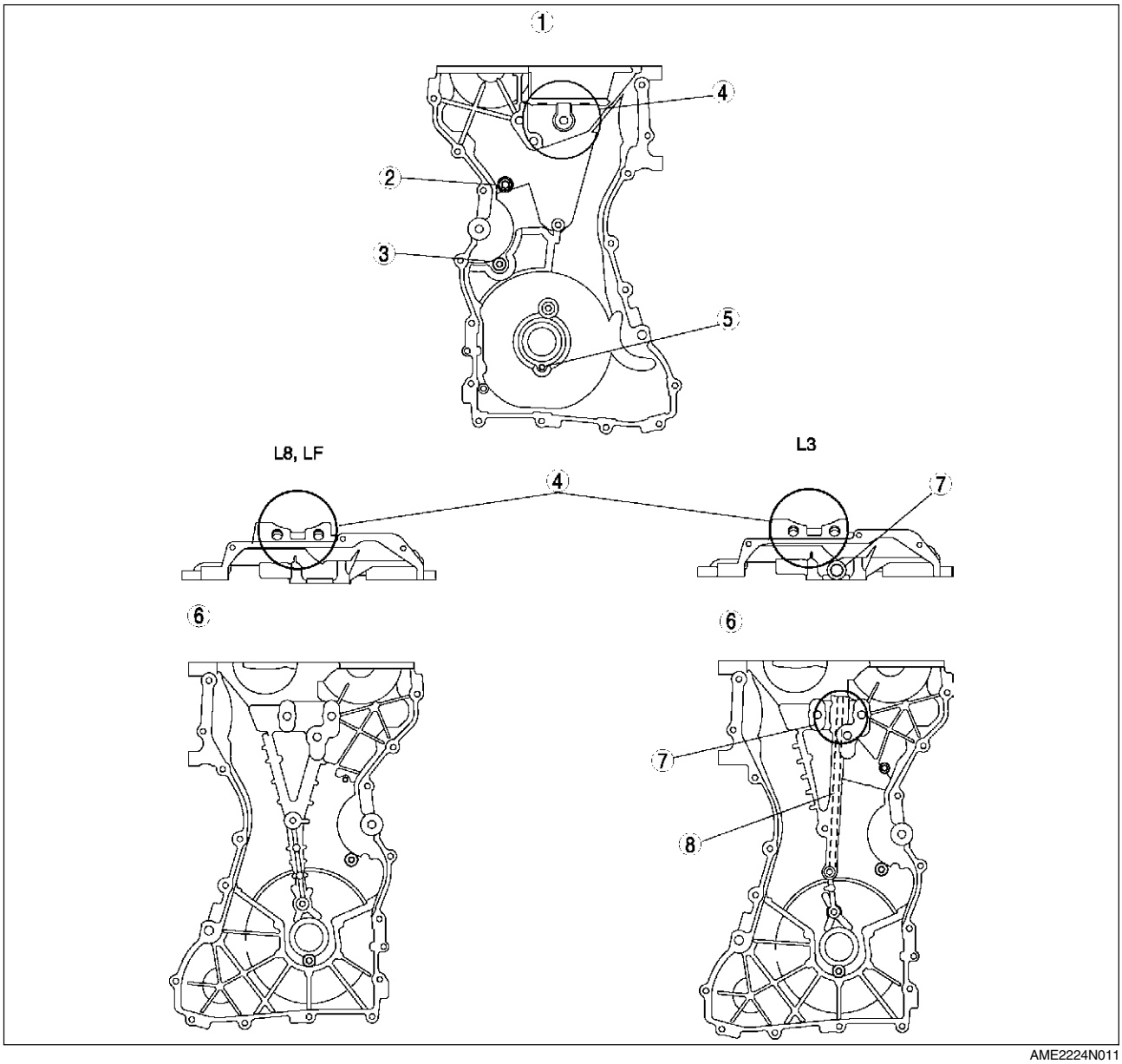
AME2224N012

ENGINE FRONT COVER

A6E222401001T01

Structure

- The engine front cover is made of aluminum alloy, and is integrated with the No.3 engine-mounting bracket, to improve noise absorption and decrease weight.
- The hole for crankshaft pulley positioning bolt, the service hole for unlocking the chain adjuster ratchet, and the service hole for securing the tensioner arm when loosening the timing chain, are on the engine front cover.
- The oil line and the integrated oil filter are on the L3 engine front cover.



AME2224N011

1	Elevational view
2	Service hole for tensioner arm fixation
3	Service hole for chain tensioner lock release
4	No.3 engine mount bracket

5	Bolt hole crankshaft pulley positioning
6	Back view
7	Oil filter
8	Oil passage to OCV

PISTON, PISTON RING, PISTON PIN

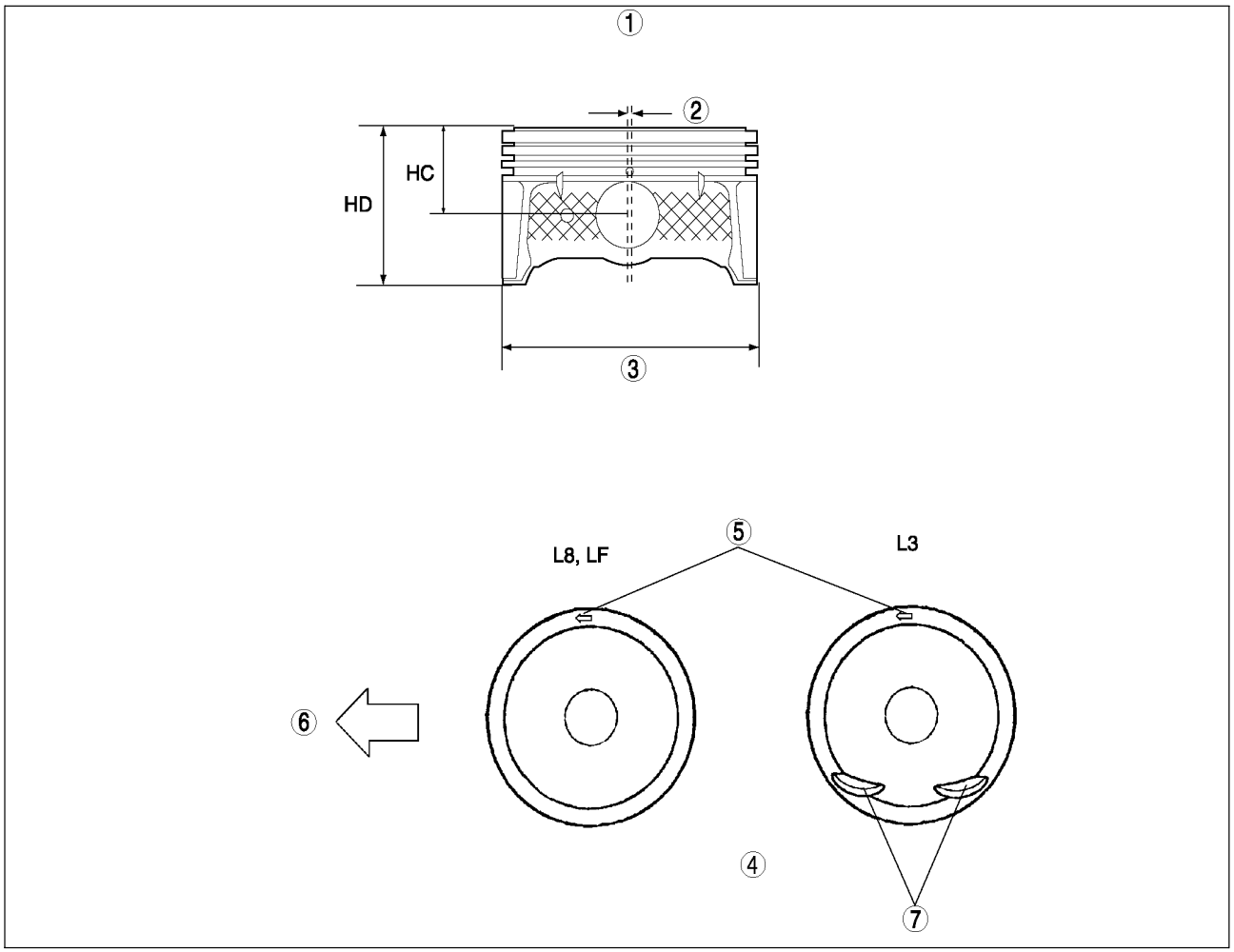
A6E222411010T01

Structure

- The pistons are made of aluminium alloy, which withstands heat and is highly conductive.
- The piston skirt is coated with graphite to reduce friction.
- The offset pistons are used to reduce piston-slapping noise.
- To prevent the piston from being reassembled in the wrong direction, the front mark (←) is on the piston.
- Pistons and connecting rods cannot be disassembled because they are shrinkage fit.
- L3 engine models piston has a valve recess.

Piston Specification.

ITEM		L8	LF	L3
Outer diameter	mm {in}	82.965—82.995 {3.2664—3.2675}	87.465—87.495 {3.4435—3.4435}	87.465—87.495 {3.4435—3.4435}
Offset quantity	mm {in}	0.8 {0.04}	0.8 {0.04}	0.8 {0.04}
Compression height:HC	mm {in}	28.5 {1.122}	28.5 {1.122}	28.5 {1.122}
Piston height: HD	mm {in}	51.0 {2.0078}	51.0 {2.0078}	51.0 {2.0078}

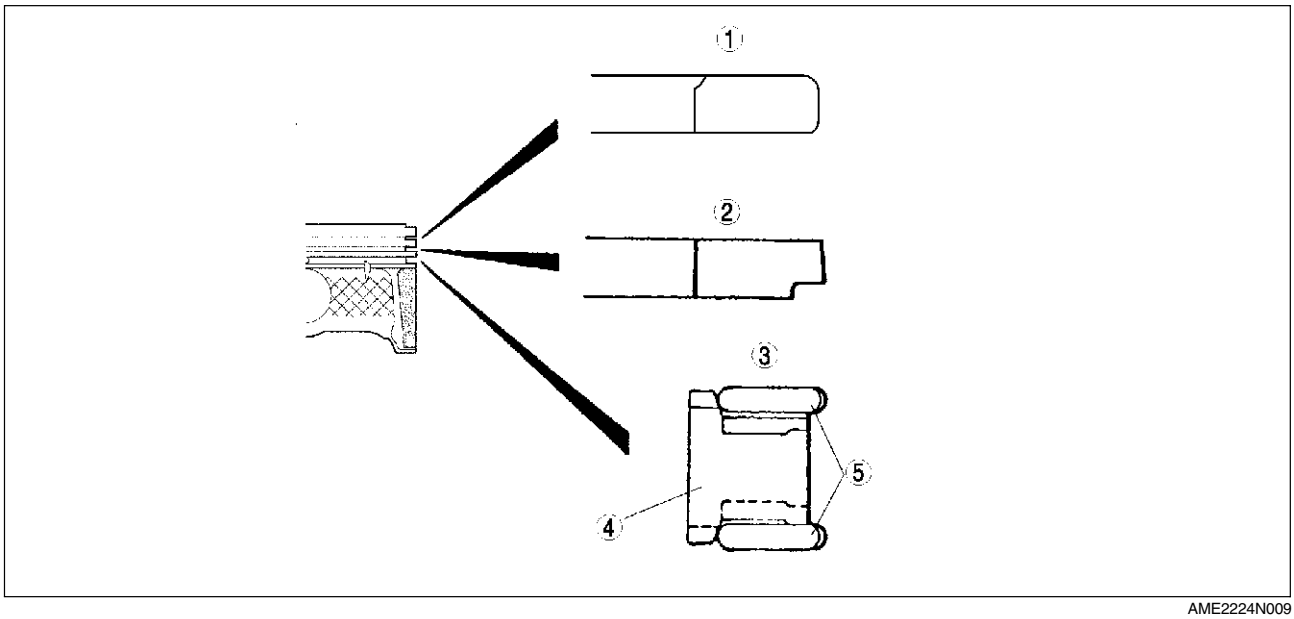


AME2224N008

1	Piston side view
2	Offset
3	Outer diameter
4	Piston upper surface view

5	Install arrow facing engine front
6	Engine front side
7	Valve rises

- The following piston rings are used. Top ring: barrel face ring, Second ring: taper under cut ring, Oil ring: two scuff rings and an expander.
- The piston pin is made of chrome steel alloy, which has superior rigidity.
- The connecting rod and the piston pin are shrinkage fit, and cannot be disassembled.



AME2224N009

1	Top ring sectional view
2	Second ring sectional view
3	Oil ring sectional view

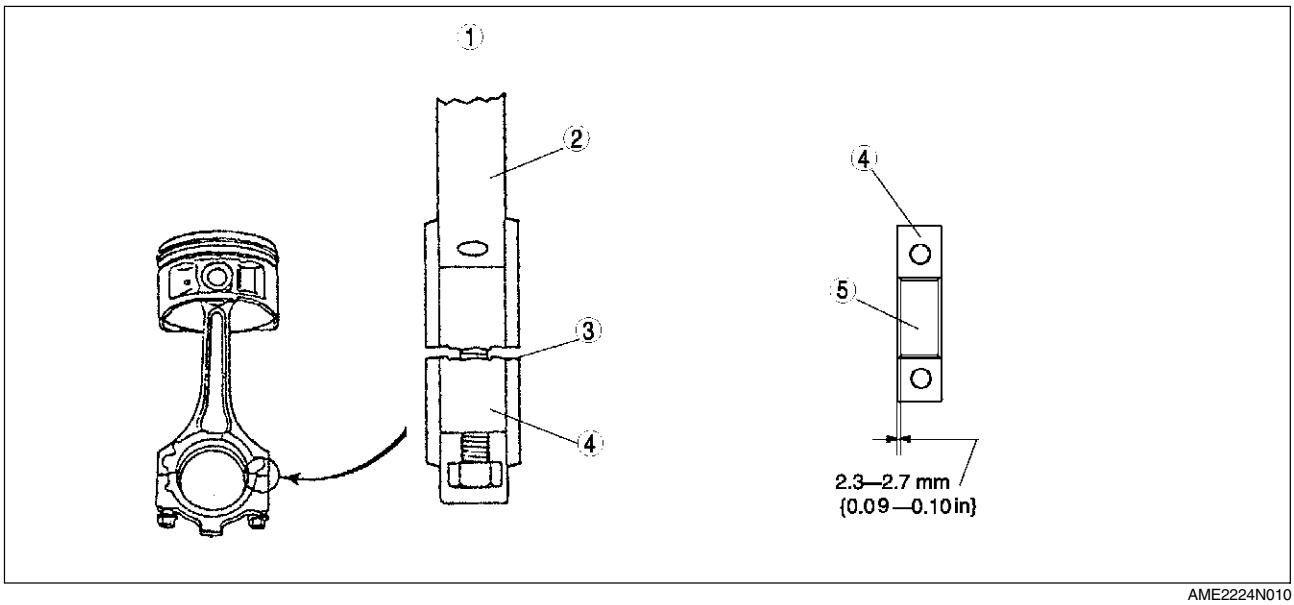
4	Side rail
5	Expander

CONNECTING ROD, CONNECTING ROD BEARING

A6E222411211T01

Structure

- Connecting rod is made of structural sintered alloy to improve rigidity.
- The connecting rod, the piston, and the piston pin are shrinkage fit, and cannot be disassembled.
- The connecting rod bolt is the plastic region tightening bolt, which is tightened in two steps to insure a stable axis during tightening.
- The conventional positioning tab has been decommissioned for the connecting rod bearing. When installing the bearing, measure the position of the bearing so that the position gets to the center of the connecting rod and the bearing cap, and install it.
- The big end of the connecting rod and the connecting rod cap were originally formed as a single unit and then it was cut into the connecting rod and the cap. Using the form of the cutting surface, align the connecting rod and the cap.



AME2224N010

1	Enlargement

2	Connecting rod

3	Fracture side
4	Connecting rod bearing cap

5	Connecting rod bearing

- The upper lower bearing of the connecting rod bearing is made of aluminum alloy.
- There are three kinds of connecting rod bearings depending on the oil clearance.

Bearing size	Color	Bearing thickness (mm {in})
Standard	Green	1.496—1.502 {0.0589—0.0591}
0.50 {0.02} Oversize	1.748—1.754 {0.0688—0.0690}	
0.25 {0.01} Oversize	1.623—1.629 {0.0639—0.0641}	

DRIVE BELT

A6E222415800T01

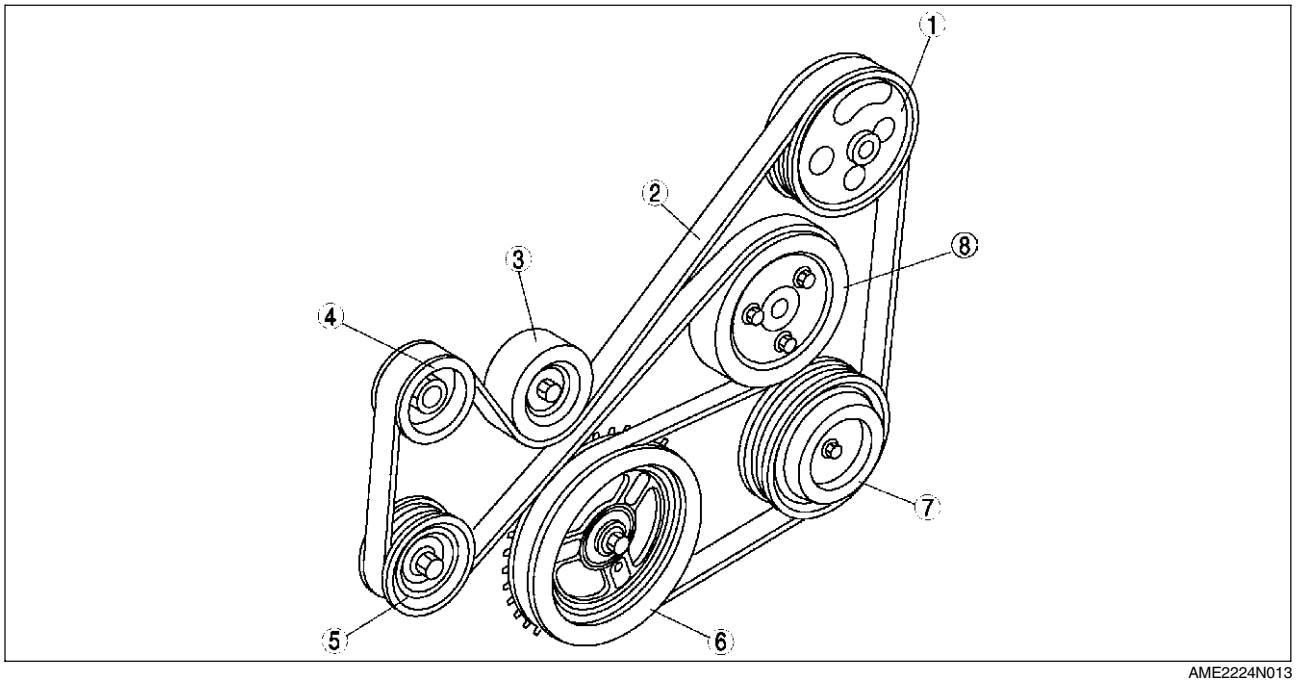
Structure

- The drive belt is a serpentine type, which uses a V-ribbed belt to drive the supplemental units. This shortens the length of engine and makes it easier to service.
- The front drive belt's auto tensioner, in which the coil spring is embedded, has been adopted for the drive belt's tension. The tensioner pulley automatically maintains the drive belt's tension.

Drive Belt Specification.

ITEM		L8	LF	L3
Belt length size	mm {in}	About 2,255 {88.78} (About 2,160 {85.04})		About 2,305 {90.75} (About 2,210 {87.01})
Belt width size	mm {in}	About 20.5 {0.81}		

( ) is A/C non-equipping vehicle specification.



AME2224N013

1	P/S oil pump pulley
2	Drive belt
3	Idler pulley
4	Generator pulley

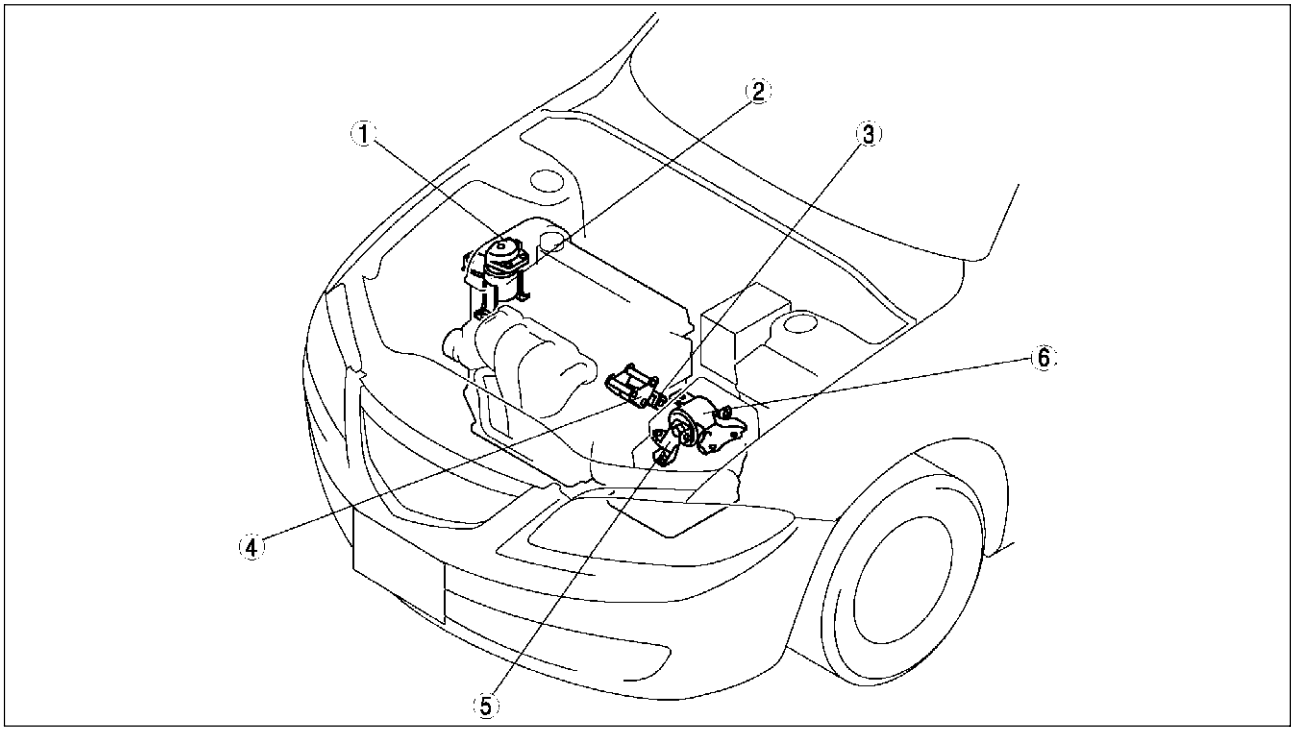
5	Front drive belt auto tensioner
6	Crankshaft pulley
7	A/C compressor pulley
8	Water pump pulley

ENGINE MOUNT

A6E222439000T03

Outline

- The layout of the engine mounting is pendulum type, which reduces the noise in the cabin.
- The engine supported at three points, and simplification of engine mount composition parts is attained.
- The No.3 engine mounting rubber, which is an oil-filled type, has been adopted to reduce the noise in the cabin.
- The surface of No.3 engine joint bracket and the No.1 engine-mounting rubber is made of aluminum alloy to decrease weight.



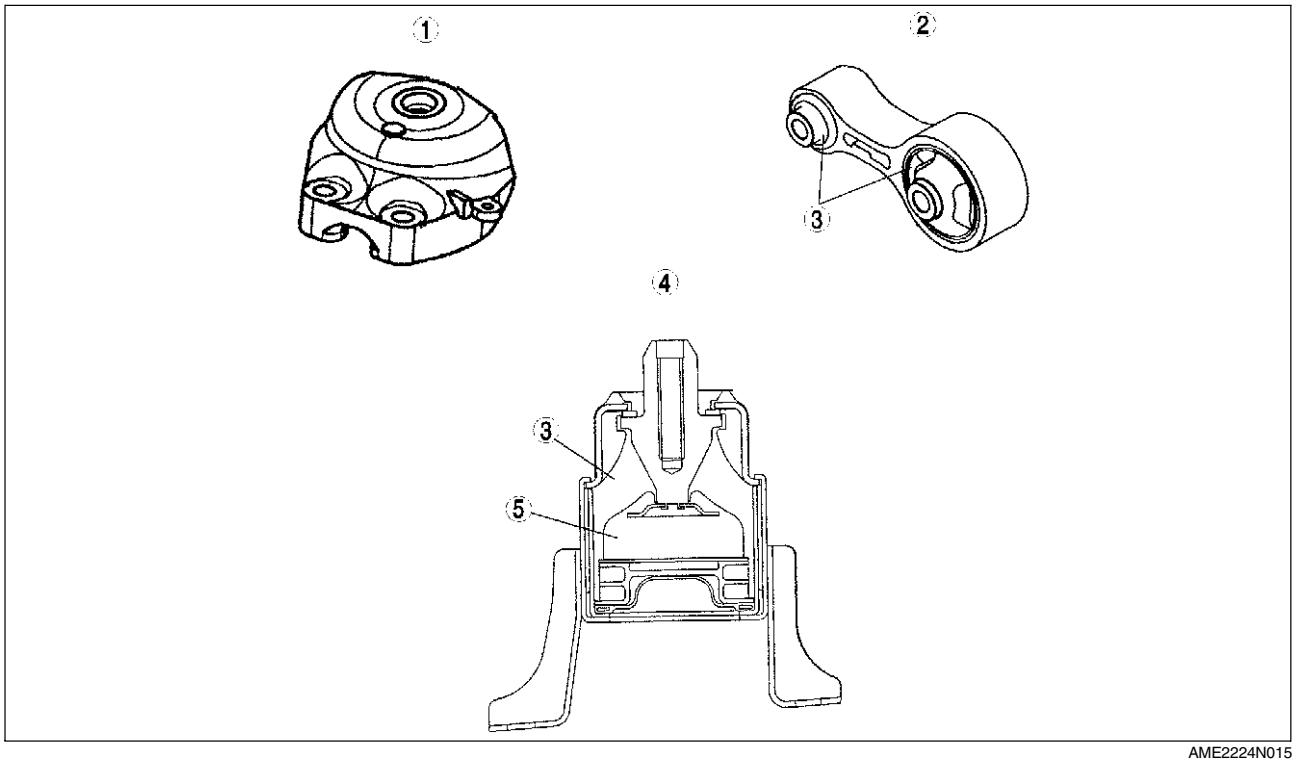
AME2224N014

1	No.3 engine joint bracket
2	No.3 engine mount rubber
3	No.1 engine mount rubber

4	No.1 engine mount bracket
5	No.4 engine mount bracket
6	No.4 engine mount rubber

Structure

- The surface of No.1 engine mounting rubber is made of aluminum alloy. The form is torque rod structure, which regulates the conventional rubber function and the rotation from the power train, and it has a vibration isolator.
- The No.3 engine mounting rubber is oil-filled for noise reduction and vibration isolation.
- The No.3 engine-mounting bracket is integrated with the aluminum alloy engine front cover.

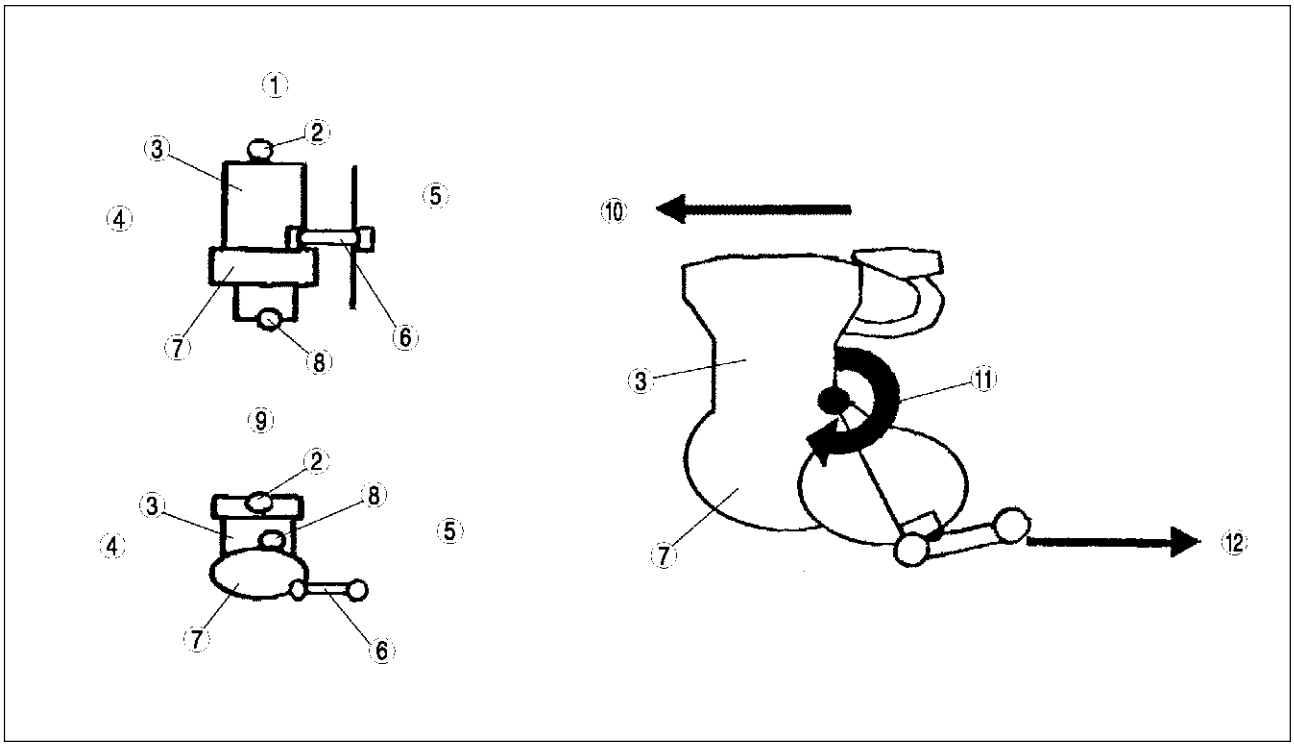


AME2224N015

1	No.3 engine joint bracket
2	No.1 engine mount rubber
3	Rubber part

4	No.3 engine mount rubber sectional view
5	Oil

- The engine is supported at the following three points: front part of the engine (No.3 engine mounting), one side of the transaxle (No.1 engine mounting), and rear upper part of the transaxle (No.4 engine mounting). The supporting point at the side of the tranaxle (No.1 engine mounting) has been set at the transaxle's lowest edge. With this layout, the No.1 engine mounting absorbs the rotation force, generated under the engine torque's fluctuation and transmitted to the power train, and distributes the rotation force to the front and rear part of the engine (pendulum).



AME2224N016

1	Power train system upper surface
2	No.3 engine mount
3	Engine
4	Vehicle front
5	Vehicle rear
6	No.1 engine mount

7	Transaxle
8	No.4 engine mount
9	Power train system back
10	Engine front
11	Torque
12	Engine back

VALVE MECHANISM

VALVE MECHANISM

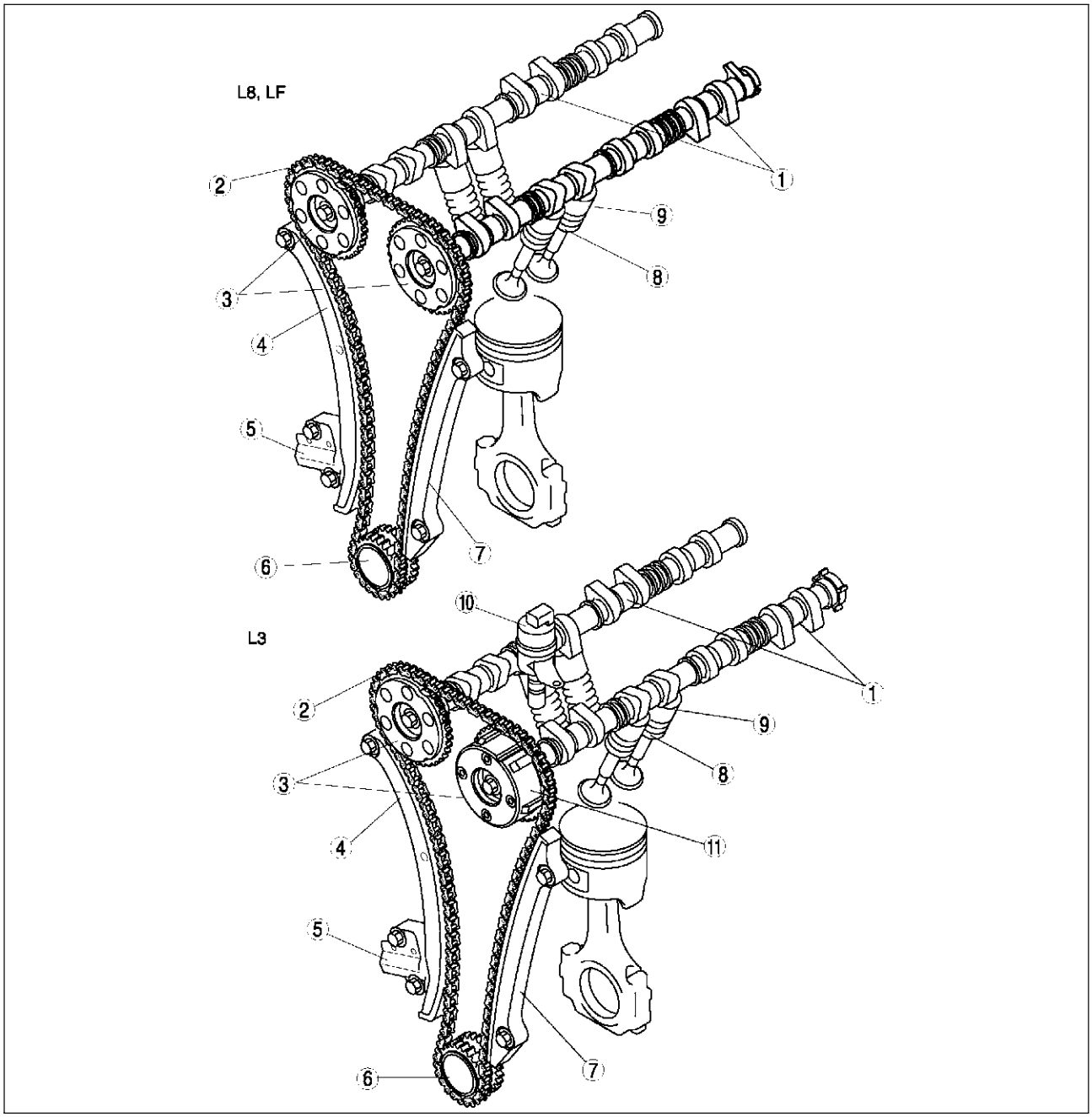
A6E221112111T08

B

Outline

- There are two intake ports and two exhaust ports per No. 1 cylinder. Totally 16 valves are directly driven by two camshafts.
- The variable valve timing mechanism, which insures the best valve timing depending on the drive condition by constantly changing the phase of the intake port side camshaft, has been adopted for the L3 engine models.

Structural view



AME2211N001

1	Camshaft
2	Timing chain
3	Camshaft sprocket
4	Tensioner arm
5	Chain tensioner
6	Crankshaft sprocket

7	Chain guide
8	Valve assembly
9	Tappet
10	Oil control valve (OCV)
11	Variable valve timing actuator

CAMSHAFT

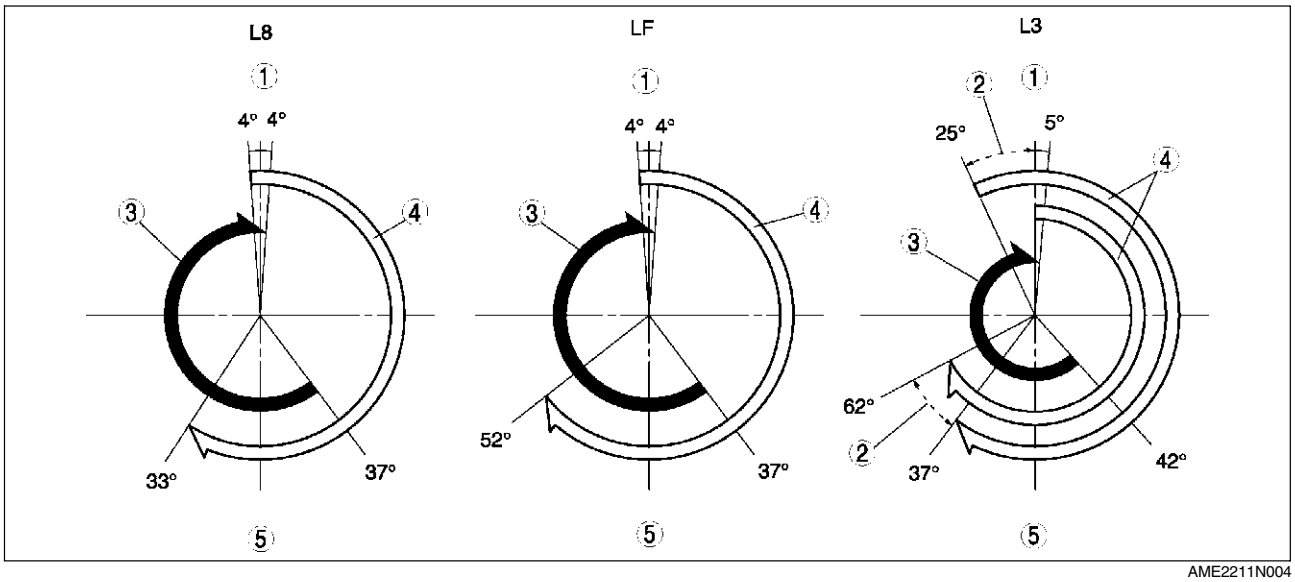
A6E221112420T01

Structure

- The cast iron 5 axis-hole, which has great rigidity, has been adopted for the camshaft to insure higher reliability.
- The endplay of the camshaft is regulated at the rear of the No. 1 journal.
- The lubricating oil is supplied through the oil supply hole at each journal. Additionally the cam nose part has been chilled to improve the abrasion resistance and to make the cam hill part lightweight by shortening the width.
- The positioning pin or key slot, which was used when installing the camshaft sprocket to the edge of the camshaft, has been decommissioned. And the lubrication process has been adopted for the camshaft sprocket tightening bolt to prevent instability in the axis during tightening.
- There is an oil line, by which the oil is supplied to the variable valve timing actuator, located at the L3 engine models intake port side camshaft (front of camshaft).

Camshaft Specification.

ITEM		L8		LF		L3	
		IN	EX	IN	EX	IN	EX
LIFT	(mm{in})	7.5 {0.29}	7.7 {0.30}	8.8 {0.34}	7.7 {0.30}	9.1 {0.35}	7.8 {0.31}
Overlap	(°)	8		8		30	

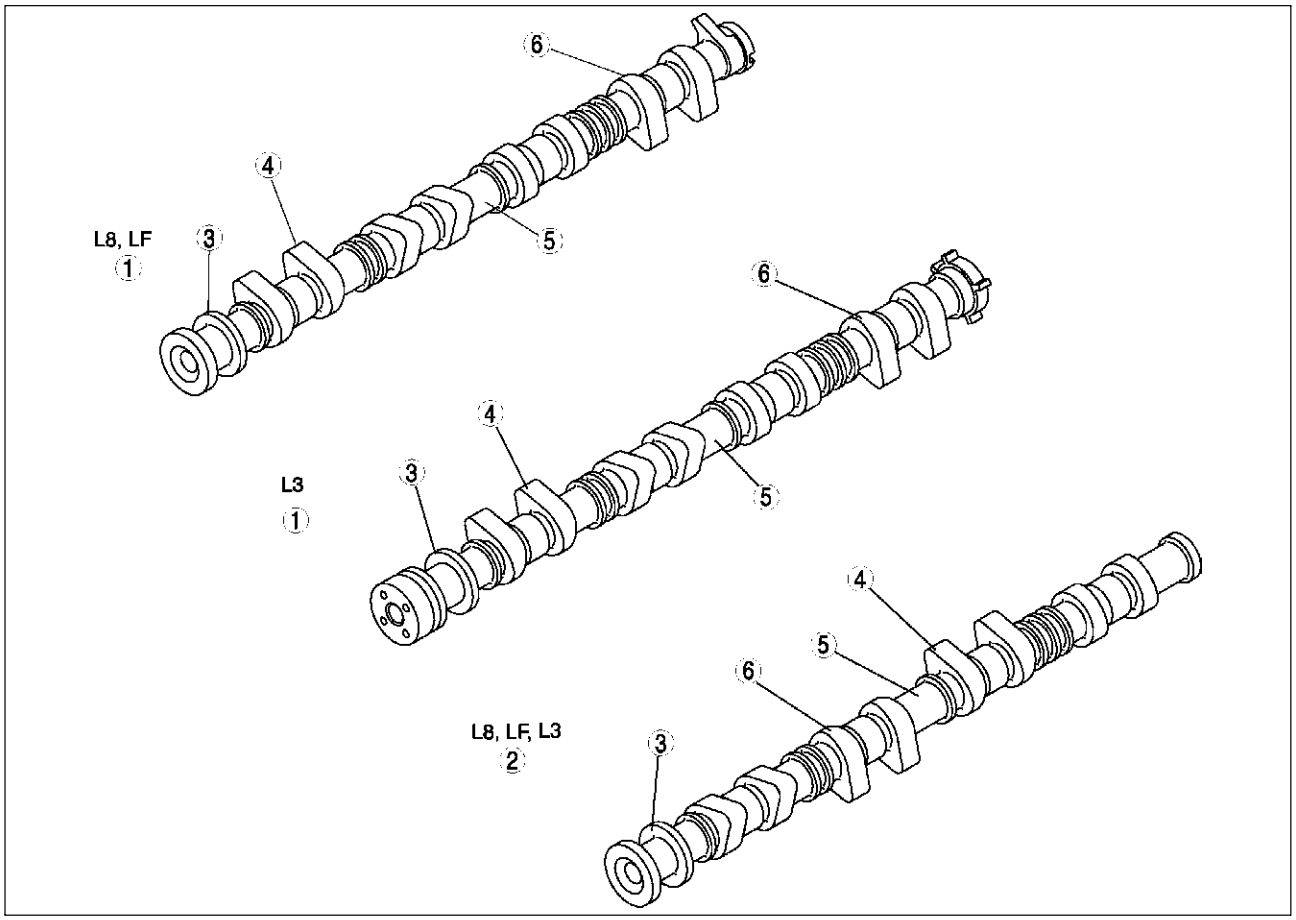


AME2211N004

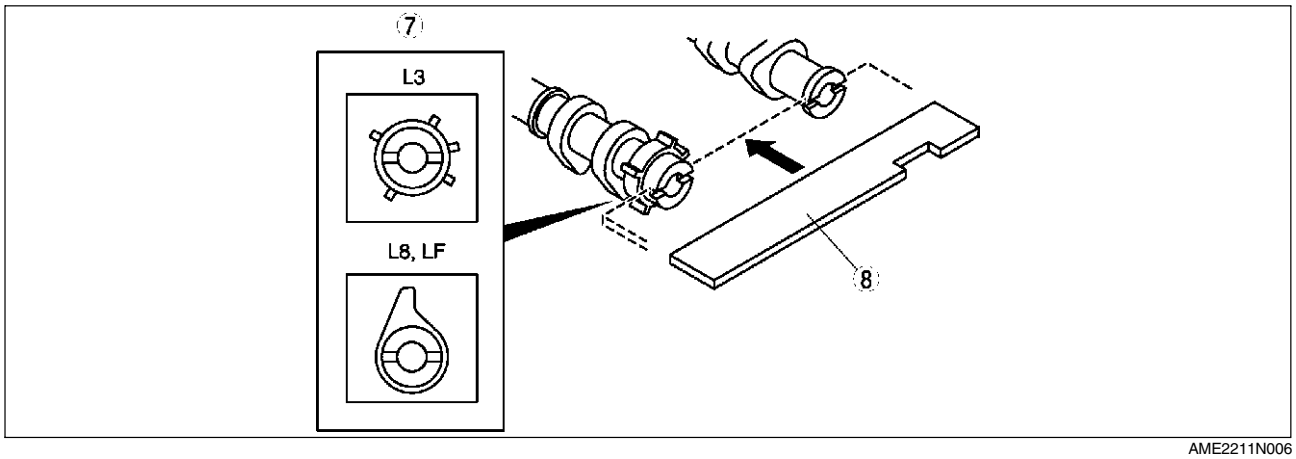
1	TDC
2	Variable domain
3	EX

4	IN
5	BDC

- The detection unit or the camshaft position (CMP) sensor, which is integrated with the camshaft, is at the intake port side camshaft for L8 engine models and LF engine models.
- The detection unit (trigger plate) for the camshaft position (CMP) sensor is at the intake port side camshaft for L3 (with variable valve timing mechanism) engine models.
- The groove for securing the No.1 TDC for the camshaft, is provided at the rear of the intake and exhaust camshaft.



AME2211N005



AME2211N006

1	Intake camshaft
2	Exhaust camshaft
3	Thrust
4	Cam nose

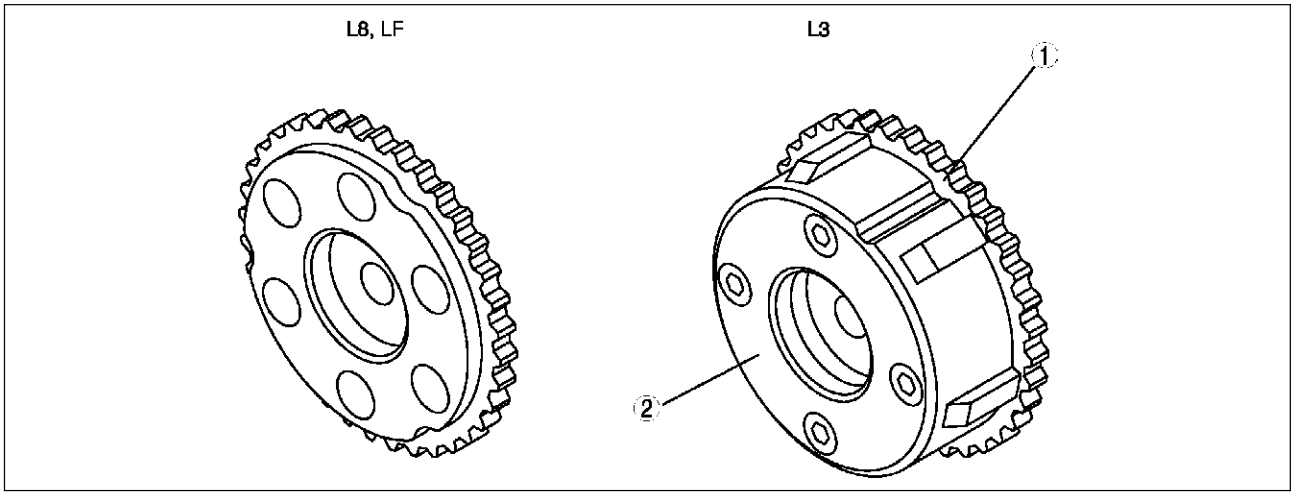
5	Cam journal
6	Cam heel
7	Detection part for CKP sensors
8	SST

CAMSHAFT SPROCKET

A6E221112420T02

Structure

- The sintered alloy, which has high rigidity, has been adopted for the camshaft sprocket and has been quenched to improve the abrasion resistance at the contact point with the timing chain.
- L3 engine models intake port side camshaft sprocket is integrated (cannot be disassembled) with the variable valve timing actuator.



AME2211N009

1	Camshaft sprocket
2	Variable valve timing actuator

CRANKSHAFT SPROCKET

A6E221112420T03

Structure

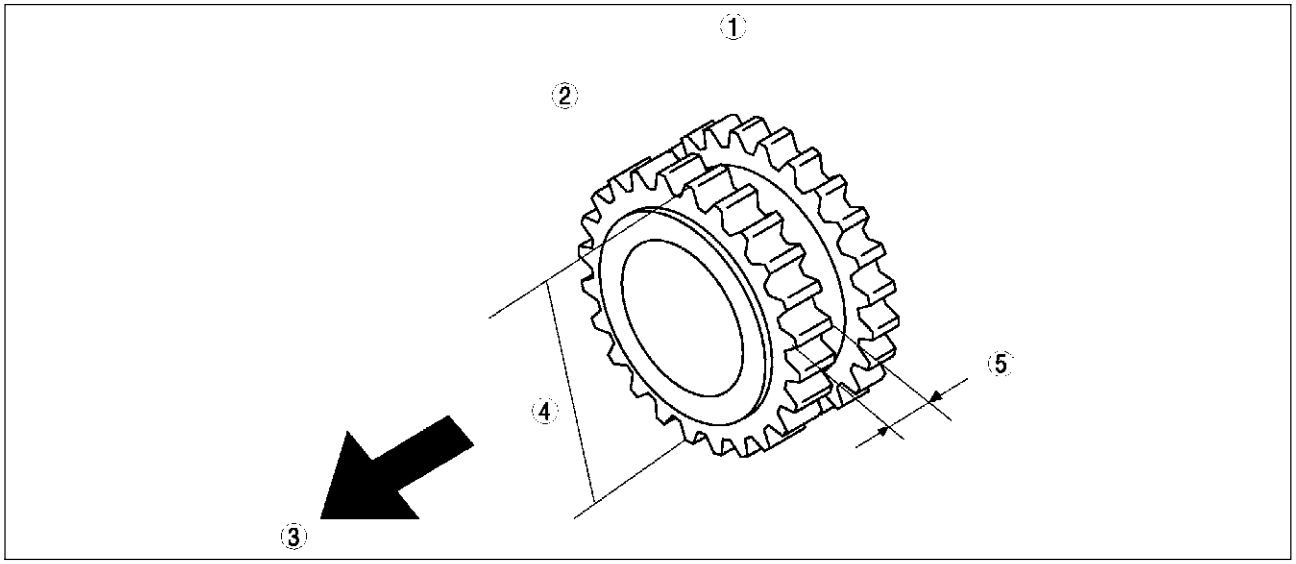
- High-strength chromium steel has been adopted for the crankshaft sprocket. Due to carburizing protection, abrasion resistance at all chain contact points is increased.
- The crankshaft sprocket consists of the timing chain sprocket and oil pump sprocket, which have been integrated into a single unit.
- The keyway on the crankshaft sprocket, used to position the crankshaft during installation, has been eliminated.

Timing Drive Sprocket Specification.

ITEM	L8	LF	L3
Outer diameter (mm {in})	About 47.955 {1.8880}		About 48.495 {1.9093}
Tooth width (mm {in})	About 7.35 {0.289}		About 8.03 {0.316}

Oil Pump Drive Sprocket Specification.

ITEM	L8	LF	L3
Outer diameter (mm {in})	About 47.955 {1.8880}		About 48.495 {1.9093}
Tooth width (mm {in})	About 6.15 {0.242}		About 5.93 {0.242}



AME2211N010

1	Oil pump drive sprocket
2	Timing chain drive sprocket
3	Engine front

4	Outer diameter
5	Tooth width

TIMING CHAIN, CHAIN TENSIONER

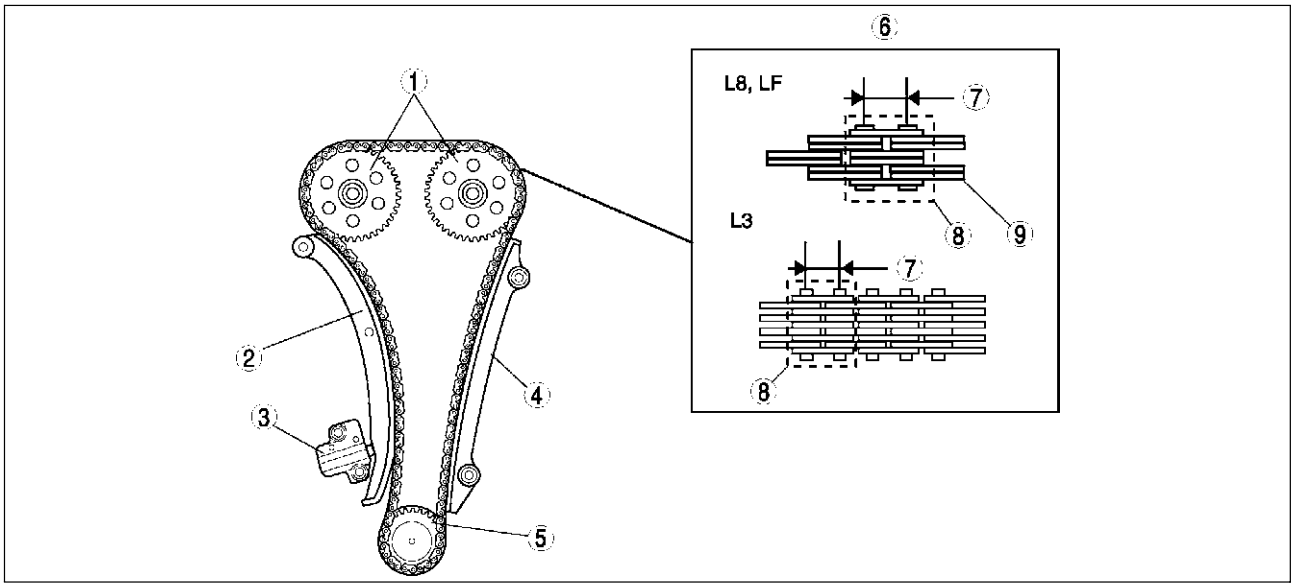
A6E221112040T01

Structure

- The timing chain is the silent chain (link grounding type), by which the tapping noise caused by matching each sprocket is reduced.
- Engine oil inside the engine front cover lubricates the timing chain and each sprocket. The pin part of the timing chain is nitrite-treated to improve abrasion resistance.

Timing Chain Specification.

ITEM	L8	LF	L3
Pitch size (mm {in})	8 {0.32}		6.35 {0.25}
Pitch number	134		174

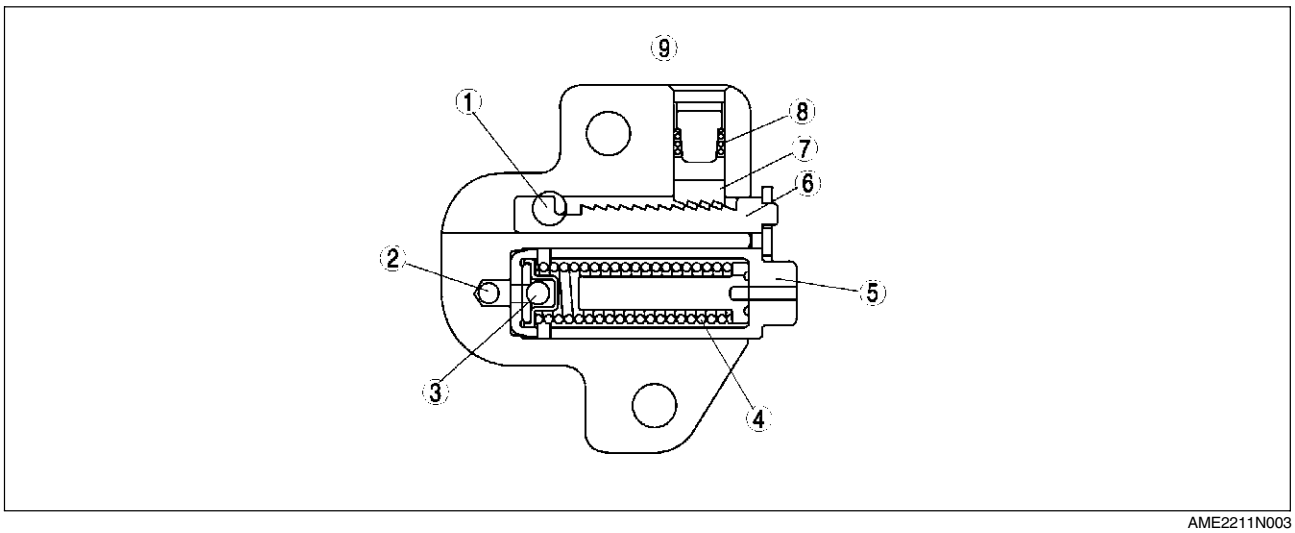


AME2211N002

1	Camshaft sprocket
2	Tensioner arm
3	Chain tensioner
4	Chain guide
5	Crankshaft sprocket

6	Timing chain
7	Pitch size
8	Pitch
9	Link

- The timing chain tensioner is the oil pressure type chain tensioner. The tension of the timing chain is kept constant, using the oil pressure and the spring force in the chain tensioner.
- The tension of the timing chain is kept constant by the oil pressure and the piston spring force.
- The oil pressure type chain tensioner is configured with the following parts: Piston spring, which depresses the tensioner arm, Check ball which maintains pressing in the tensioner arm.



AME2211N003

1	Hole for a rachet lock
2	Oil supply hole
3	Check ball
4	Piston spring
5	Piston

6	Rack
7	Ratchet
8	Ratchet spring
9	Cross-section

VALVE, VALVE SPRING, VALVE SEAL, VALVE GUIDE

A6E221112111T02

Structure

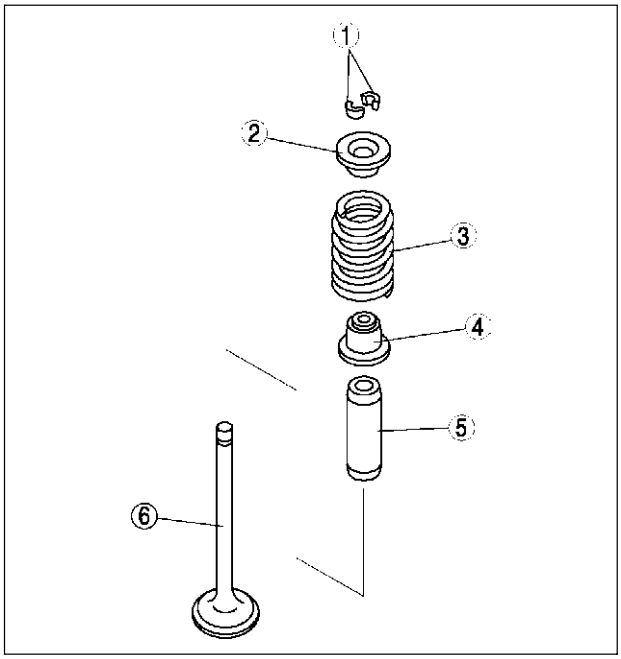
- The valves are heat-resistant steel. There are two intake valves, two exhaust valves per No.1 cylinder.

VALVE SPEC.

ITEM		L8	LF	L3
Valve full length	(mm {in})	Intake valve: About 101.6 {4.000} Exhaust valve: About102.6 {4.039}		
Intake valve umbrella diameter	(mm {in})	About 32.5 {1.28}	About 35 {1.38}	
Exhaust valve umbrella diameter	(mm {in})	About 28 {1.10}	About 30 {1.18}	
Stem diameter	(mm {in})	Intake valve: About 5.5 {0.22} Exhaust valve: About 5.5 {0.22}		

- The intake valve and the exhaust valve are treated with the tufftride process to improve abrasion resistance.
- The valve spring is an uneven outer dimension type. It has been improved by reducing the size of the upper seat.
- The valve guide is made of the sintered alloy to improve abrasion resistance.
- The valve seat is integrated with the lower valve spring seat to simplify the unit and improve its serviceability.

1	Valve keeper
2	Upper valve spring seat
3	Valve spring
4	Valve seal
5	Valve guide
6	Valve



AME2211N008

TAPPET

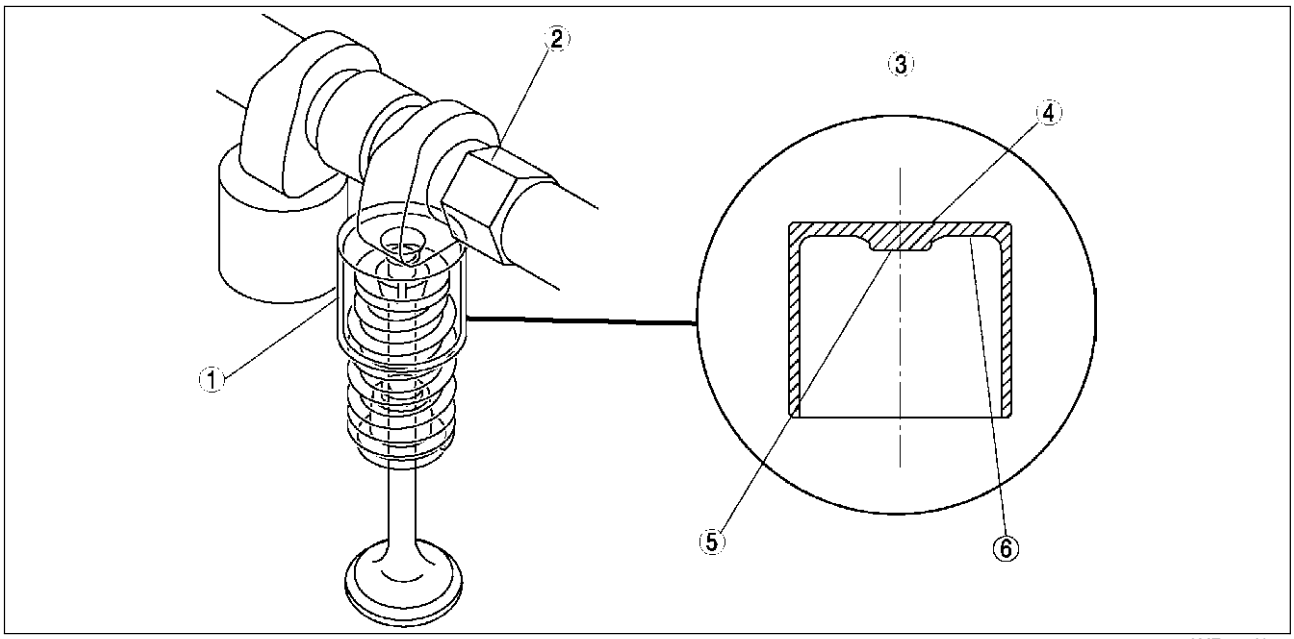
A6E221112111T03

Structure

- The tappet is a shimless tappet which is integrated with the shim.
- Besides the tappet, the grounding surface of the cam is phosphate-coated to smooth the surface and improve abrasion resistance.
- To adjust the valve clearance, replace the tappet. There are 35 kinds of tappets depending on the thickness. To distinguish the difference, check the engraved identification mark (3 digits).

Tappet Specification.

Discernment mark	Tappet thickness (mm {in})	The number of jumps (mm {in})
725—625	3.725—3.625 {0.1467—0.1427}	0.025 {0.00098}
602—122	3.602—3.122 {0.1418—0.1229}	0.02 {0.00078}
100—000	3.100—3.000 {0.1220—0.1181}	0.025 {0.00098}



AME2211N007

1	Tappet
2	Camshaft
3	Tappet sectional view

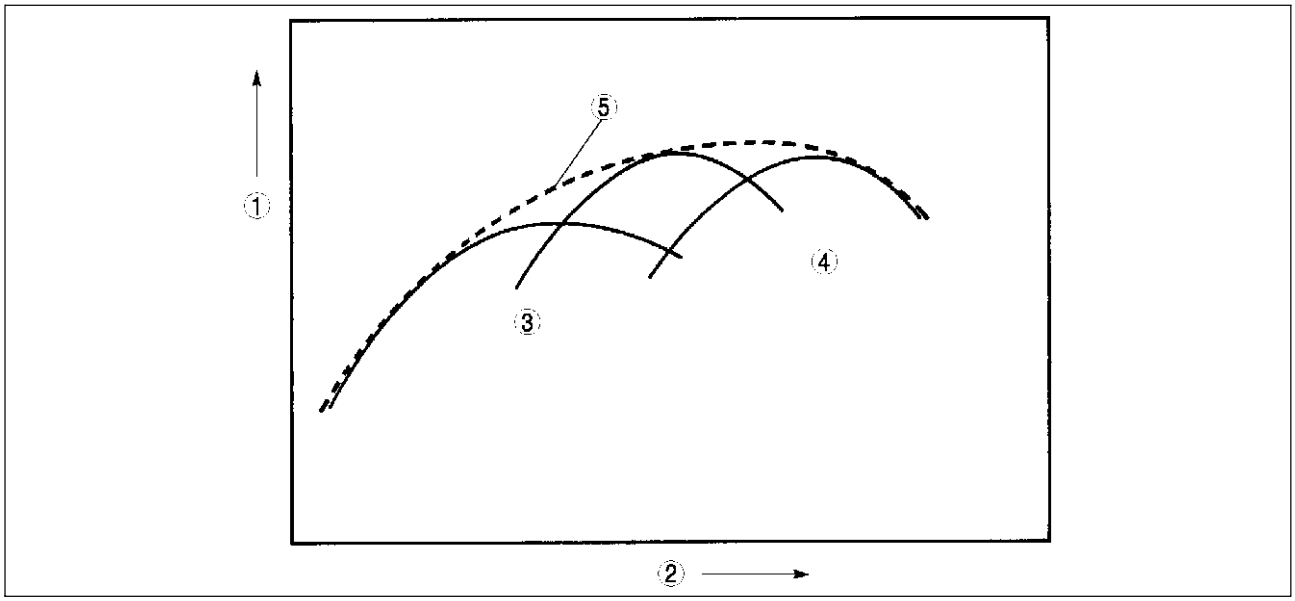
4	Cam lob contact surface
5	Valve stem contact surface
6	Identification mark position

VALVE MECHANISM

A6E221112111T07

Outline

- A variable timing mechanism, which realizes optimum valve timing according to engine operation conditions by continuously modifying the phases of the intake camshaft and crankshaft, has been adopted.



AME2211N013

1	Torque
2	Engine speed
3	Low-middle speed engine

4	High speed engine
5	Engine with variable valve timing mechanism

Variable Valve Timing Mechanism

Function

- The variable valve timing mechanism continuously modifies the phases of the variable valve timing actuator and the intake camshaft using hydraulic pressure controlled by the oil control valve (OCV) so that optimal valve timing is obtained according to engine operation conditions.
- The oil control valve (OCV) operation is based on signals from the PCM according to engine operation conditions and it controls hydraulic pressure to the variable valve timing actuator.

Operation and purpose according to driving condition

Idling range, light load range

- Due to a reduction in the amount of overlap, less combusted gas is returned to the intake port. This stabilizes idle speed in the idling range, improving fuel economy, and also ensures engine stability in the light load range.

Medium load range

- Overlap amount has been increased and the EGR ratio inside the cylinder is higher. This reduces engine friction loss (pumping loss), lowering the combustion temperature and reducing the amount of NOx the in exhaust gas. The amount of hydrocarbon emission has also been reduced through reignition of non-combusted gas.

Heavy load, low-middle speed range

- The intake valve is closed early, and high volumetric efficiency is obtained to improve low-middle speed torque.

Heavy load, high speed range

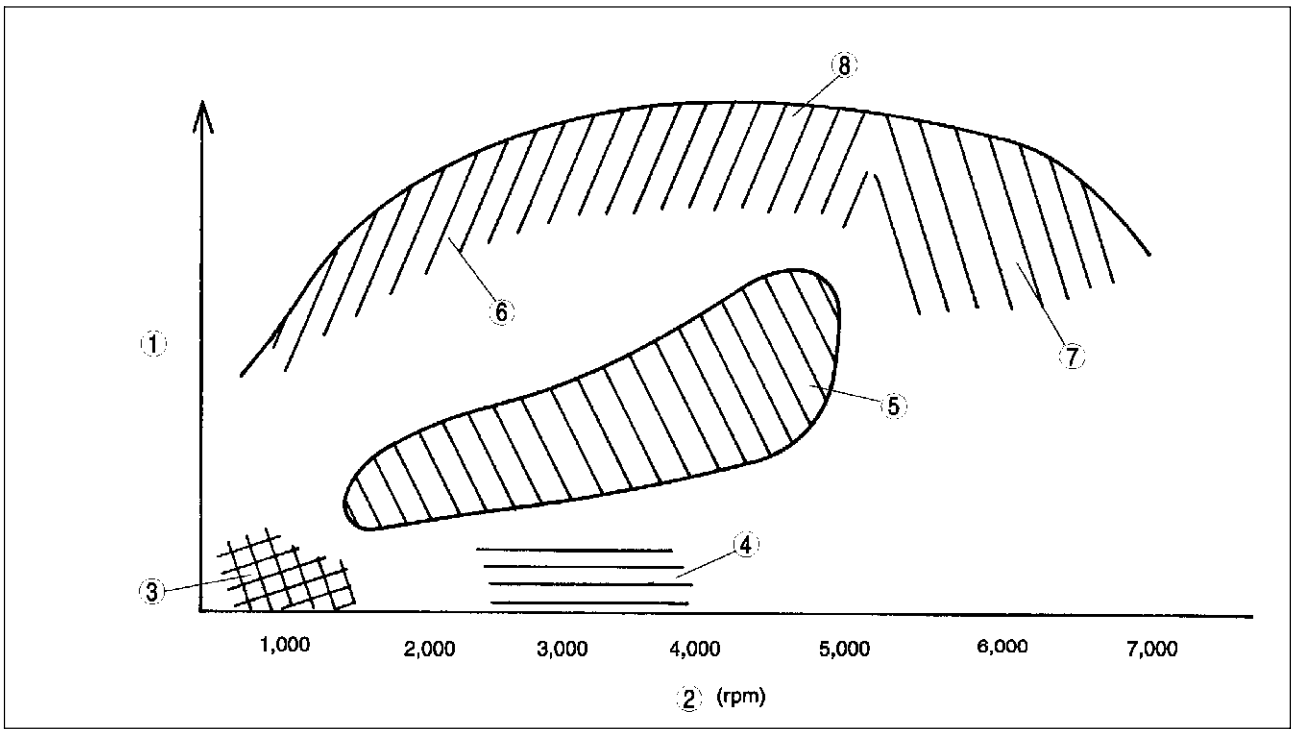
- Timing for intake valve closure is delayed and high volumetric efficiency is obtained to improve maximum output.

When temperature is low

- The overlap amount has been minimized to prevent combusted gas from returning to the intake port and to reduce the additional fuel injection amount. This improves fuel economy and stabilizes fast idle speed.

When engine is started or stopped

- Startability has been improved because the overlap amount has been minimized to prevent combusted gas from returning to the intake port.



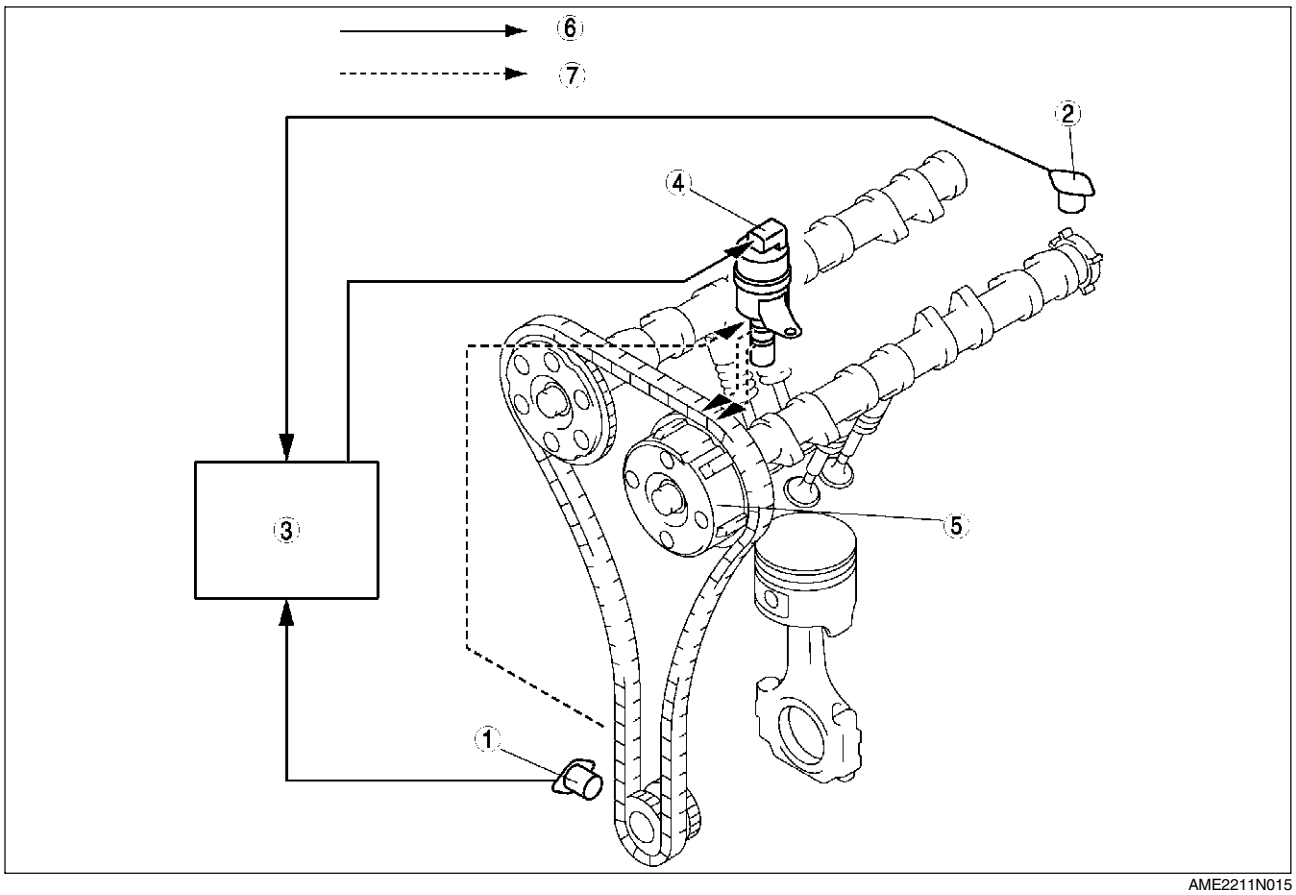
AME2211N014

1	Load
2	Engine speed
3	Idling range
4	Light load range

5	Medium load range
6	Heavy load, low-middle speed range
7	Heavy load, high speed range
8	Full load performance

Construction

- The variable valve timing mechanism consists of a variable valve timing actuator, oil control valve (OCV), CKP sensor, CMP sensor, and the PCM.

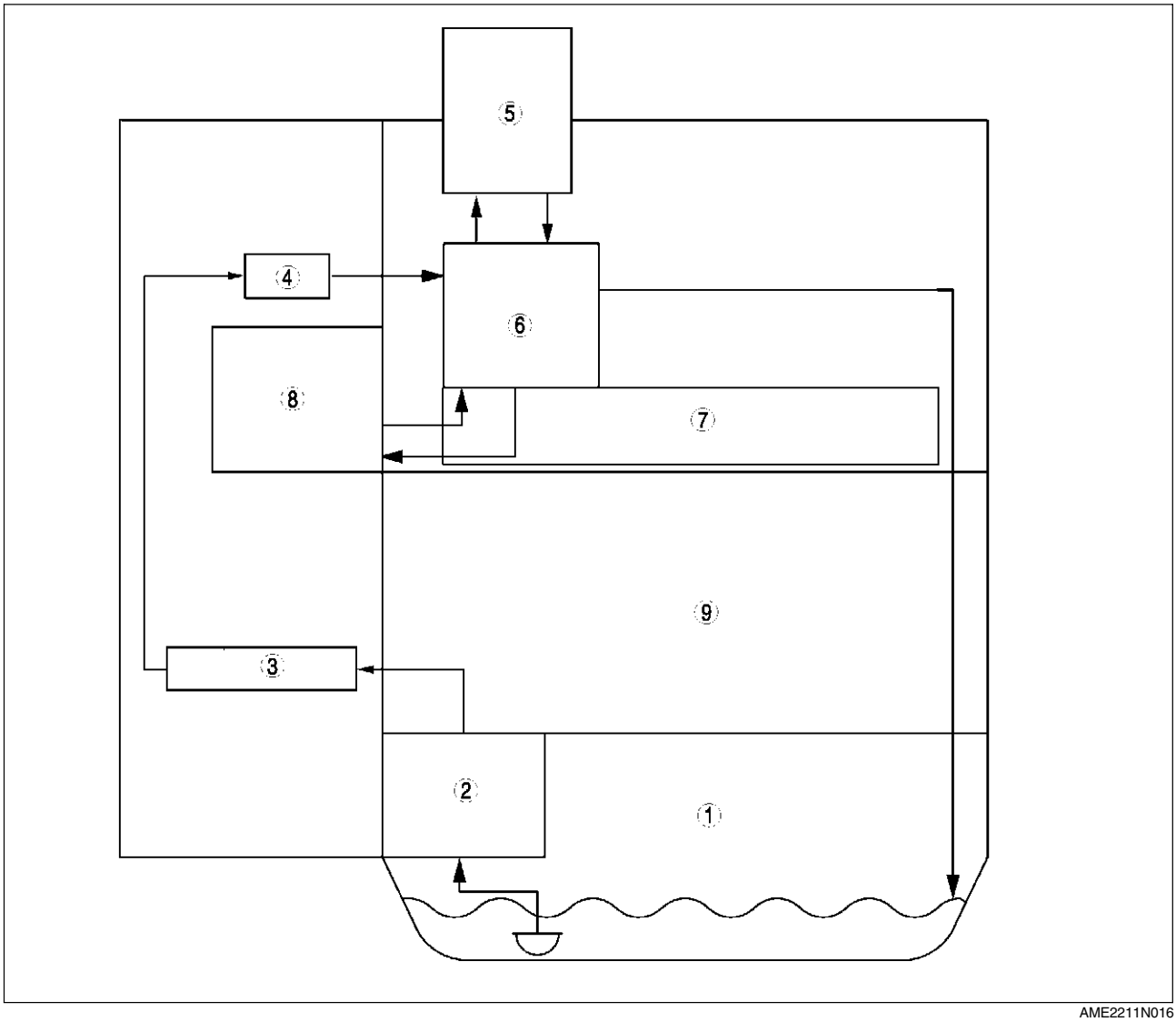


AME2211N015

1	CKP sensor
2	CMP sensor
3	PCM
4	Oil control valve (OCV)

5	Variable valve timing actuator
6	Electric signal
7	Hydraulic pressure

Hydraulic Pressure Flow Diagram



AME2211N016

1	Oil pan
2	Oil pump
3	Oil pipe
4	Oil filter
5	Oil control valve (OCV)

6	Oil control valve (OCV) adapter
7	Camshaft
8	Variable valve timing actuator
9	Cylinder block

Component and function

Variable valve timing actuator	• Continuously modifies the phases of the intake camshaft and crankshaft at the forward end of the intake camshaft using hydraulic pressure from the oil control valve (OCV).
Oil control valve (OCV)	• Operated by current (duty signal) from the PCM. Switches the hydraulic oil passages to the variable valve timing actuator.
CKP sensor	• Inputs engine revolution signal to the PCM.
CMP sensor	• Inputs cylinder identification signal to the PCM.
PCM	• Controls the oil control valve (OCV) so that optimum valve timing is obtained according to engine operation conditions.

Operation outline

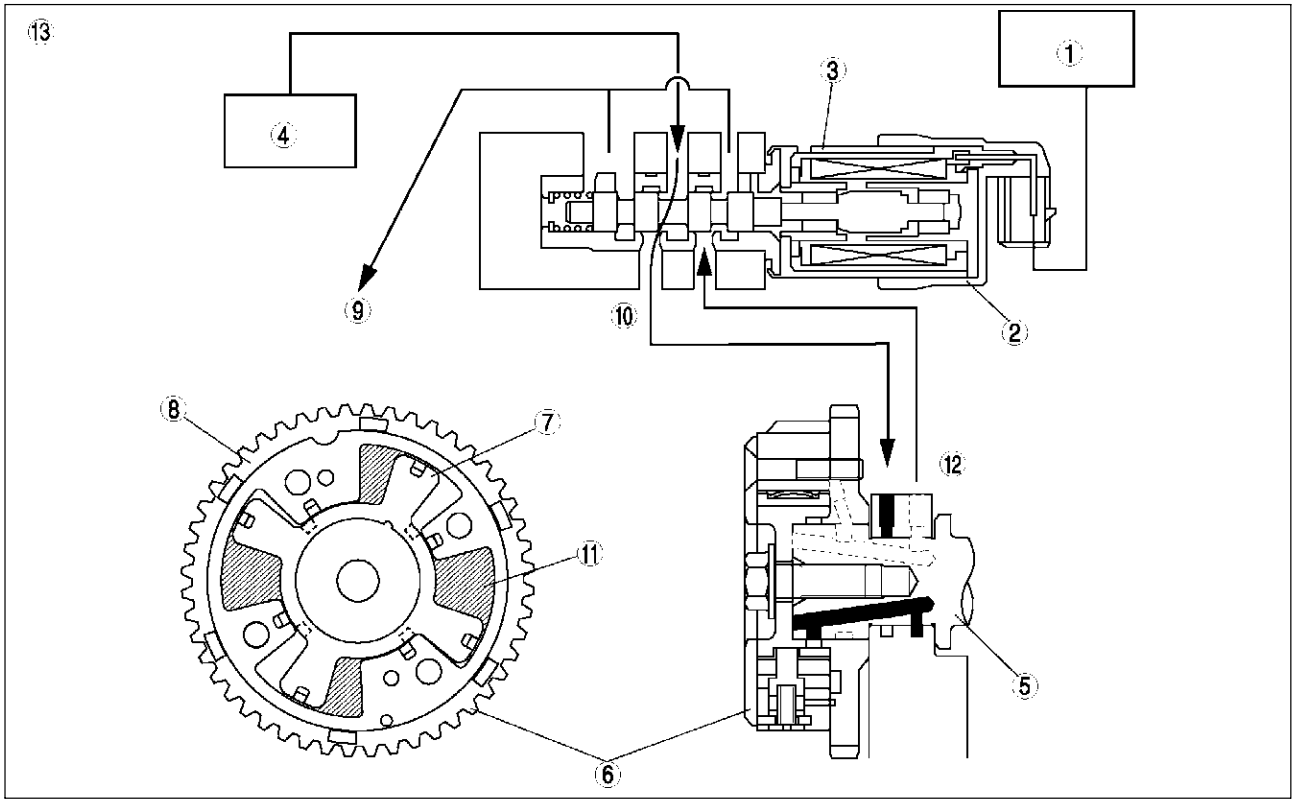
- The variable valve timing actuator has two hydraulic chambers: a valve timing advance chamber and a valve timing retard chamber. They are located between the integrated housing of the camshaft sprocket and the camshaft integrated rotor. The oil pump supplies engine oil. to each chamber. Hydraulic pressure applied to each chamber is controlled by the oil control valve (OCV) and the relative phases of the camshaft sprocket and the camshaft are modified to obtain optimum valve timing according to engine operation conditions.

At engine start

- When the stopper pin in the variable valve timing actuator engages with the rotor, which is at the position of maximum valve timing retard due to spring force, the camshaft sprocket and the camshaft rotate as one unit. When the oil pump pressure rises and the stopper pin is disengaged, it becomes possible to modify the relative angles of the camshaft sprocket and the camshaft.

Advancing valve timing

- When the spool valve in the oil control valve (OCV) moves to the left according to the PCM signal, hydraulic pressure, from the oil pump, feeds into the valve timing advance passage and finally to the valve timing advance chamber in the variable valve timing actuator. Then, the rotor integrated with the camshaft rotates in the valve timing advance direction, against the housing driven by the crankshaft, and the valve timing is advanced.



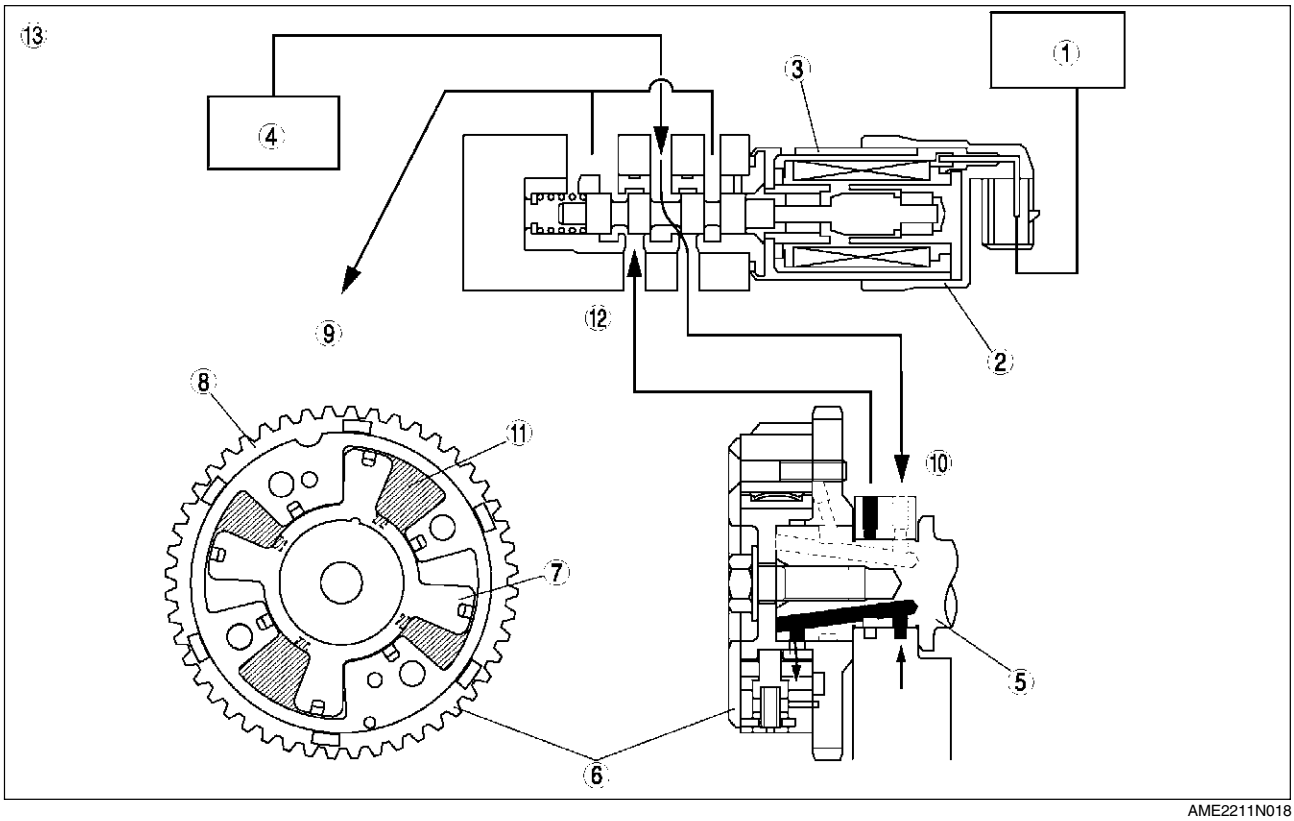
AME2211N017

1	PCM
2	Oil control valve (OCV)
3	Spool valve
4	Oil pump
5	Camshaft
6	Variable valve timing actuator
7	Rotor

8	Housing
9	Oil pan
10	To valve timing advance chamber
11	Valve timing advance chamber
12	From valve timing retard chamber
13	Hydraulic pressure flow

Retarding valve timing

- When the spool valve in the oil control valve (OCV) moves to the right according to the PCM signal, hydraulic pressure, from the oil pump, feeds into the valve timing retard passage and finally to the valve timing retard chamber in the variable valve timing actuator. Then, the rotor integrated with the camshaft rotates in the valve timing retard direction, against the housing driven by the crankshaft, and valve timing is retarded.



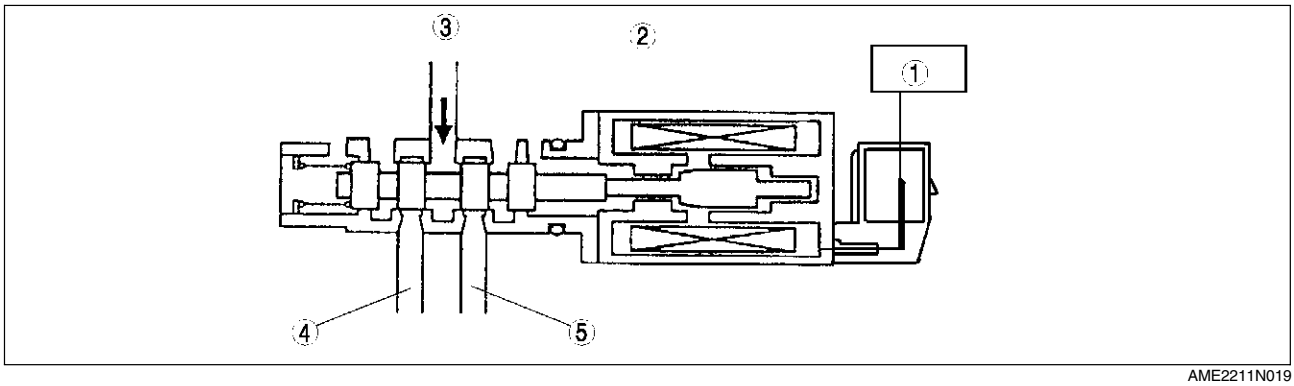
AME2211N018

1	PCM
2	Oil control valve (OCV)
3	Spool valve
4	Oil pump
5	Camshaft
6	Variable valve timing actuator
7	Rotor

8	Housing
9	Oil pan
10	To valve timing retard chamber
11	Valve timing retard chamber
12	From valve timing advance chamber
13	Hydraulic pressure flow

Maintaining intermediate valve timing

- The spool valve in the oil control valve (OCV) is located near the middle of the valve timing advance and retard positions. Because of this, hydraulic pressures are maintained in both valve timing advance and retard chambers of the variable valve timing actuator. At the same time, relative angles of the rotor and the housing are fixed and maintained, resulting in fixed valve timing.



AME2211N019

1	PCM
2	Oil control valve (OCV)
3	Oil pump

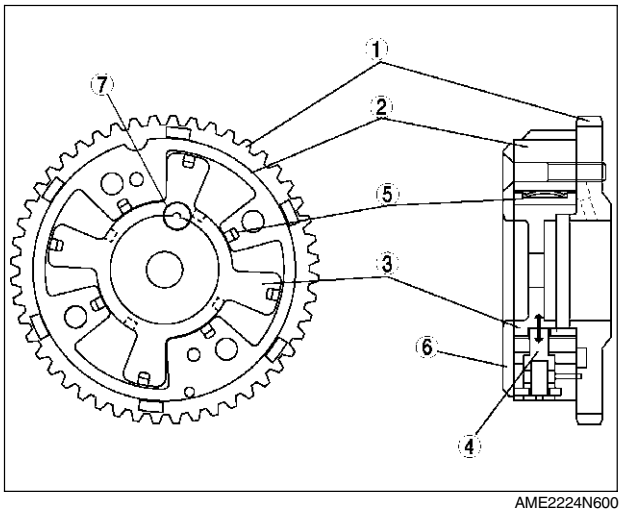
4	To valve timing advance chamber
5	To valve timing retard chamber
6	Hydraulic pressure flow

VARIABLE VALVE TIMING ACTUATOR

A6E221112111T05

- The variable valve timing actuator consists of the following: a housing case integrated to the camshaft sprocket, a cover, a camshaft integrated rotor, and a stopper pin that retains the rotor and case when the engine stops. Also, the rotor has a chip seal that seals the valve timing advance chamber and the valve timing retard chamber.
- The cover and rotor of the variable valve timing actuator are notched, and are used as alignment marks when inspecting the variable valve timing actuator.

1	Camshaft sprocket
2	Case
3	Rotor
4	Stopper pin
5	Tip seal
6	Cover
7	Notch

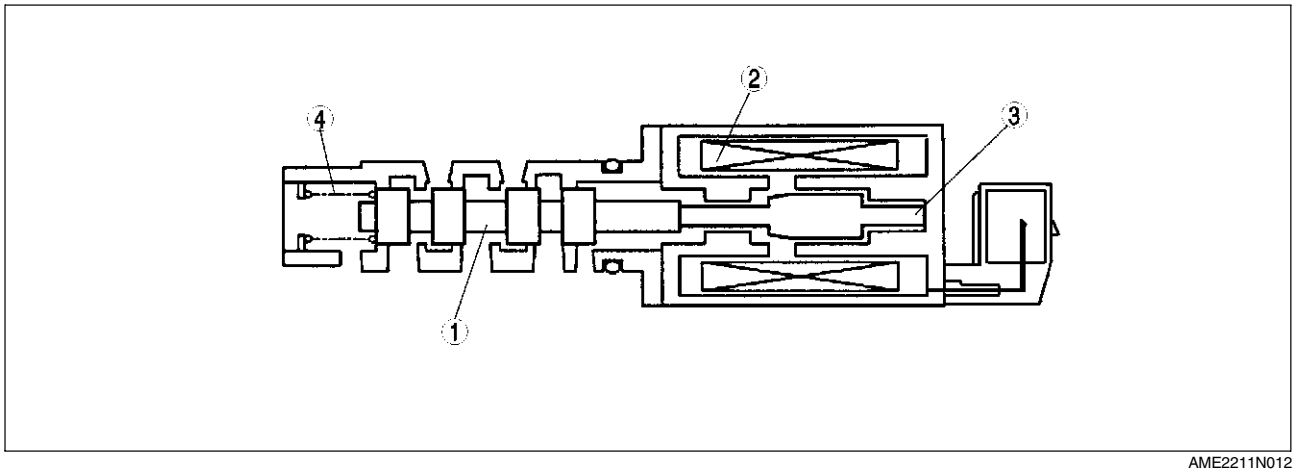


AME2224N600

OIL CONTROL VALVE (OCV)

A6E221112111T06

- The oil control valve (OCV) consists of a spool valve that switches the passages for engine oil, a coil that moves the spool valve, a plunger, and a return spring.



AME2211N012

1	Spool valve
2	Coil

3	Plunger
4	Return spring

LUBRICATION SYSTEM

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ABBREVIATIONS D-2
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OIL JET VALVE D-12

ABBREVIATIONS

ABBREVIATIONS

A6E330102000T01

OCV	Oil control valve

OUTLINE

OUTLINE OF CONSTRUCTION

A6E330201003T01

- The lubrication system is a forced-fed type that uses a full-flow filter.
- An environment-friendly oil filter, designed so that only the internal oil filter (rather than entire assemly) need to be replaced, has been adopted.

FEATURES

A6E330201003T02

Reduced weight
- Aluminum alloy oil pan has been adopted.
- Plastic oil strainer has been adopted.
- Resin oil filter cover has been adopted.

Reduced vibration and noise
- An oil pan made from laminated damping steel has been adopted.
- The oil pan upper block is tightened with main bearing cap.

Improved lubrication and reliability
- The following have been adopted.
  - — Trochoid gear type oil pump
  - — Water-cooled type oil cooler (LF and L3 engine models)
  - — Oil jet valve

SPECIFICATIONS

A6E330201003T03

Item		Engine		
		L8	LF	L3
Lubrication system		Force-fed type		
Oil cooler		—	Water-cooled	
Oil pressure	(kPa {kgf/cm^2, psi} [rpm])	234—521 {2.39—5.31, 33.9—75.5} [3,000]		395—649 {4.03—6.61, 57.3—94.1} [3,000]
Oil pump	Type	Trochoid gear type		
	Relief pressure (kPa {kgf/cm^2, psi})	500—600 {5.09—6.11, 72.6—87.0}		
Oil filter	Type	Full-flow, paper element		
	Bypass pressure (kPa {kgf/cm^2, psi})	80—120 {0.9—1.2, 12.8—17.0}		
Oil capacity (Approximate quantity)	Total (Dry engine) (L {US qt, Imp qt})	4.6 {4.8, 4.0}		4.2 {4.4, 3.6}
	Oil replacement (L {US qt, Imp qt})	3.9 {4.0, 3.4}		3.1 {3.3, 2.7}
	Oil and oil filter replacement (L {US qt, Imp qt})	4.3 {4.5, 3.8}		3.5 {3.7 ,3.1}

Recommended Engine oil

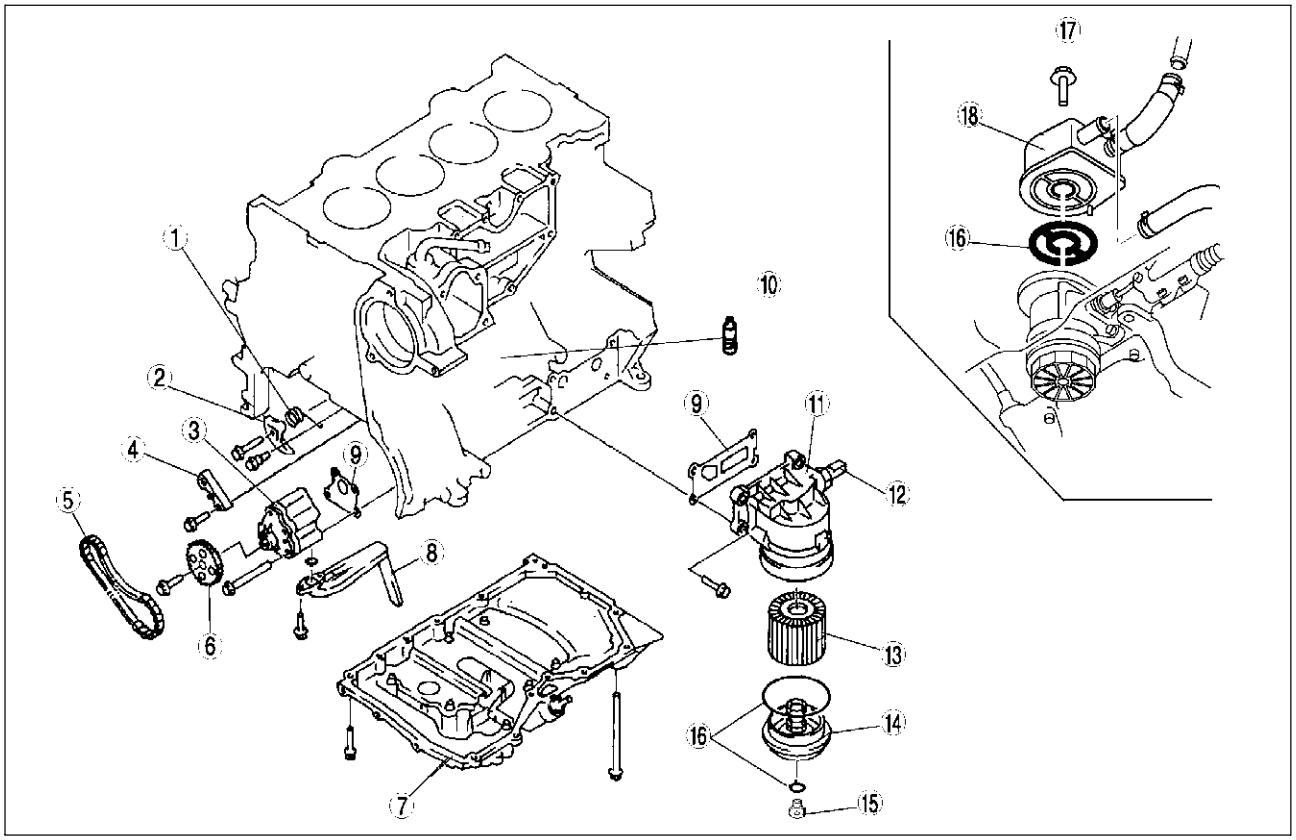
Item		Market		
		European countries		Except European countries
Engine oil	Grade	API SJ ACEA A1 or A3	API SL ILSAC GF-3	API SG, SH, SJ, SL ILSAC GF-2, GF-3
	Viscosity (SAE)	5W-30	5W-20	40, 30, 20, 20W-20, 10W-30, 10W-40, 10W-50, 20W-40, 15W-40, 20W-50, 15W-50, 5W-20, 5W-30
	Remarks	Mazda genuine DEXELIA oil	—	—

D

LUBRICATION SYSTEM

STRUCTURAL VIEW

A6E333001003T01



AME3300N001

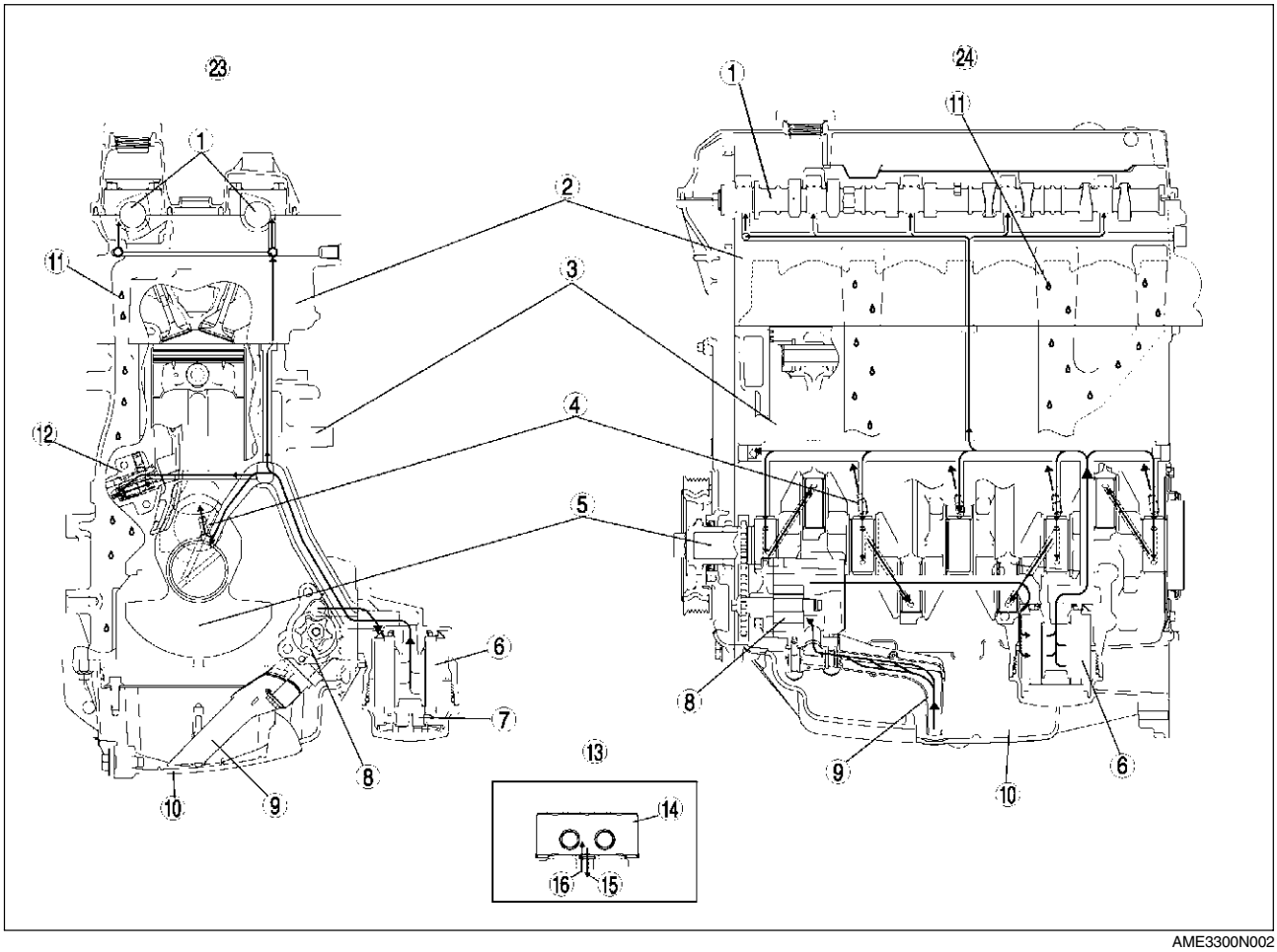
1	Chain tensioner spring
2	Chain tensioner
3	Oil pump
4	Chain guide
5	Oil pump driven chain
6	Oil pump sprocket
7	Oil pan
8	Oil strainer
9	Gasket

10	Oil jet valve
11	Oil filter adapter
12	Oil pressure switch
13	Oil filter
14	Oil filter cover
15	Oil filter drain plug
16	O ring
17	LF and L3 engine models
18	Oil cooler

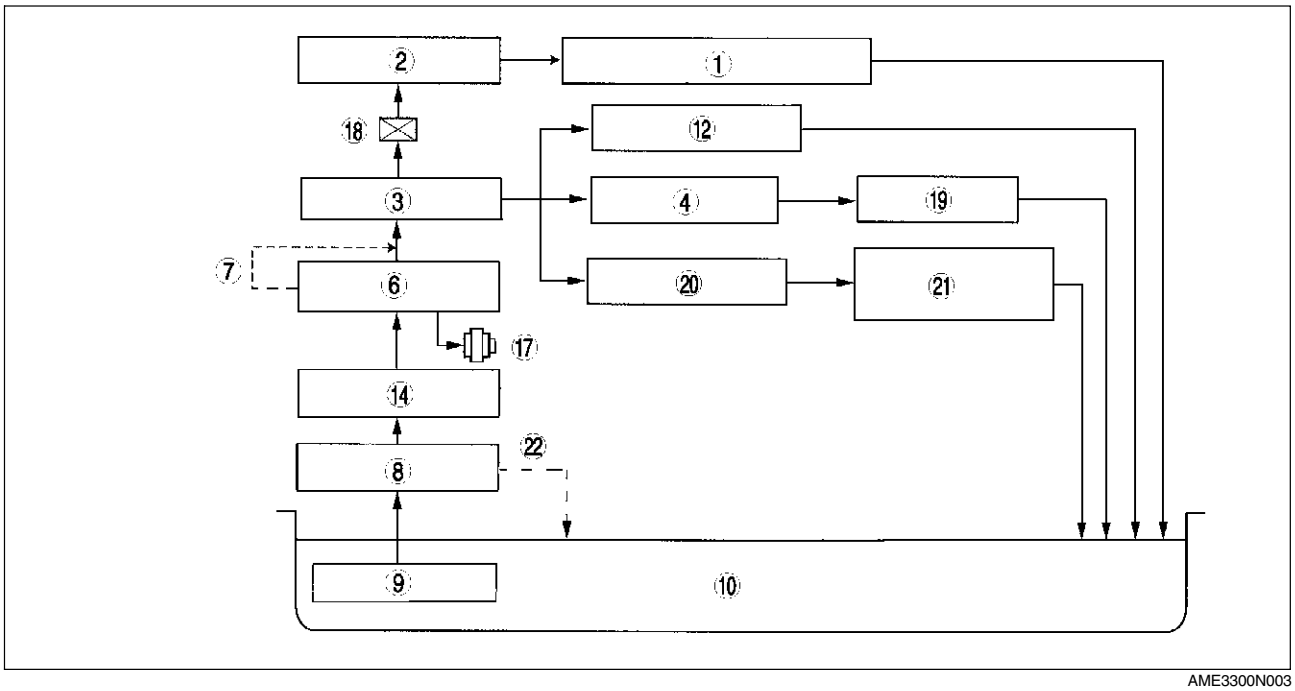
LUBRICATION FLOW DIAGRAM

A6E333001003T02

L8, LF



AME3300N002



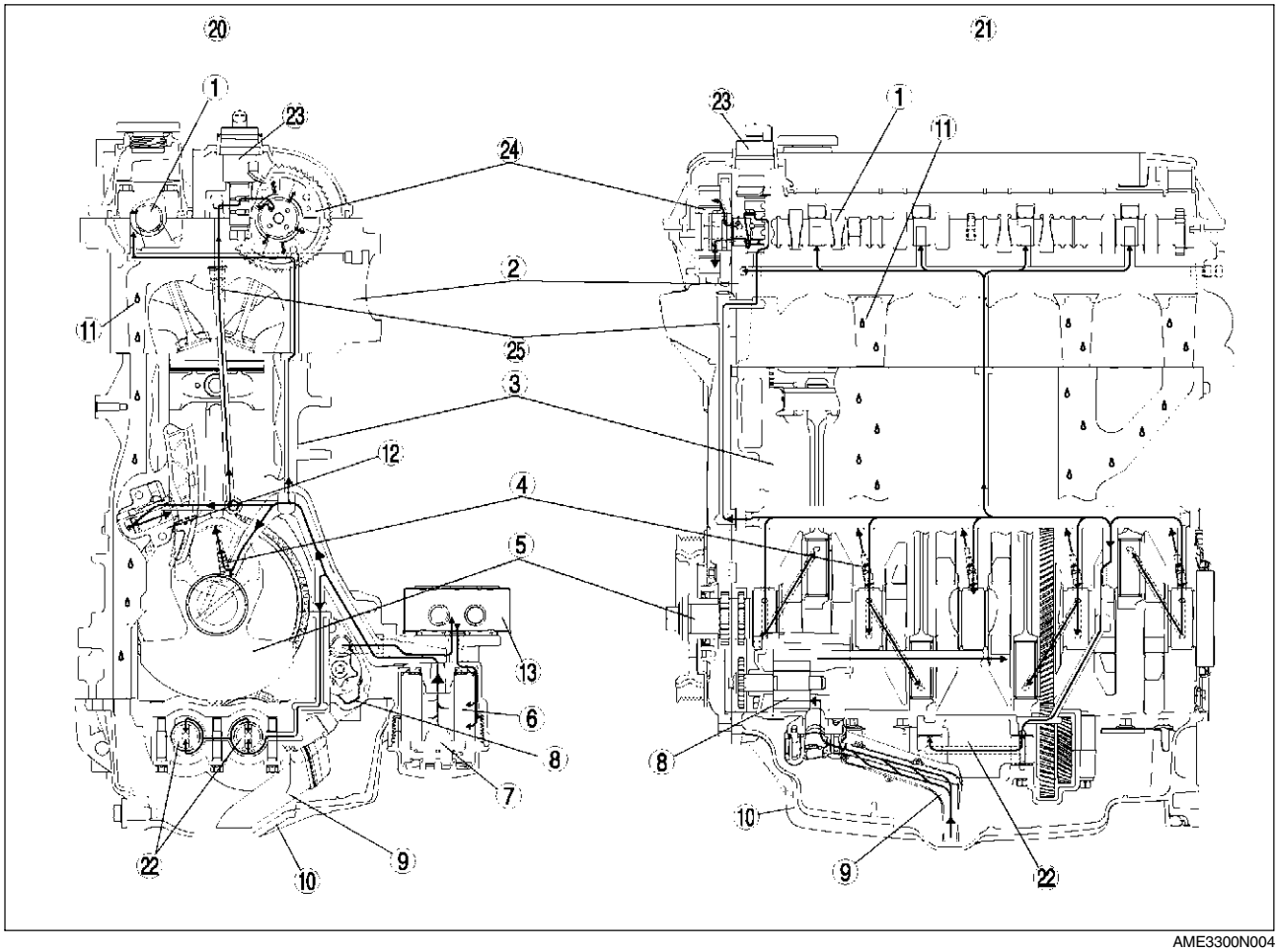
AME3300N003

1	Camshaft
2	Cylinder head
3	Cylinder block
4	Oil jet valve
5	Crankshaft
6	Oil filter
7	Oil filter bypass valve
8	Oil pump
9	Oil strainer
10	Oil pan
11	Return oil
12	Chain tensioner
13	LF engine model

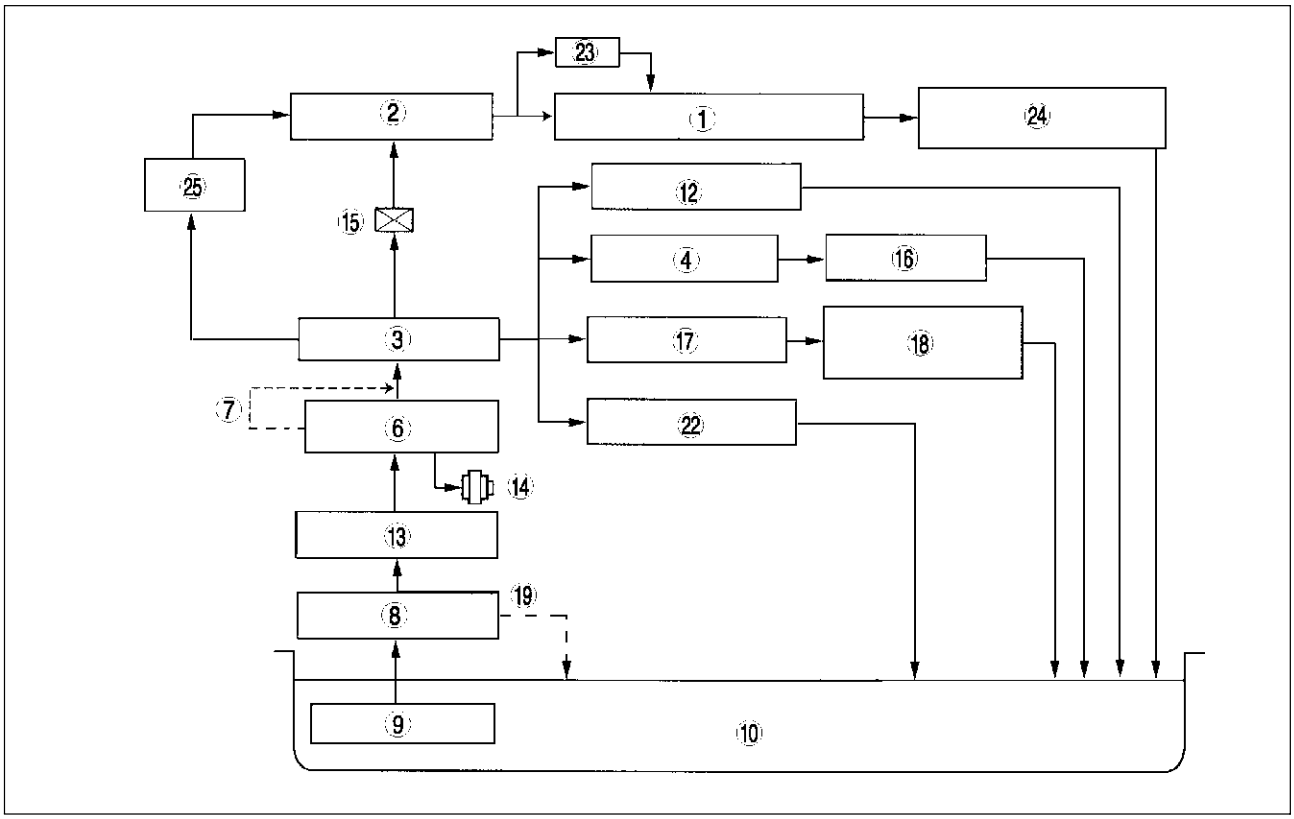
14	Oil cooler
15	To oil filter
16	From oil pump
17	Oil pressure switch
18	Orifice
19	Piston
20	Main bearing
21	Crankshaft bearing, Connecting rod bearing
22	Oil pressure relief valve
23	Elevational view
24	Side view

D

L3



AME3300N004



AME3300N005

1	Camshaft
2	Cylinder head
3	Cylinder block
4	Oil jet valve
5	Crankshaft
6	Oil filter
7	Oil filter bypass valve
8	Oil pump
9	Oil strainer
10	Oil pan
11	Return oil
12	Chain tensioner
13	Oil cooler

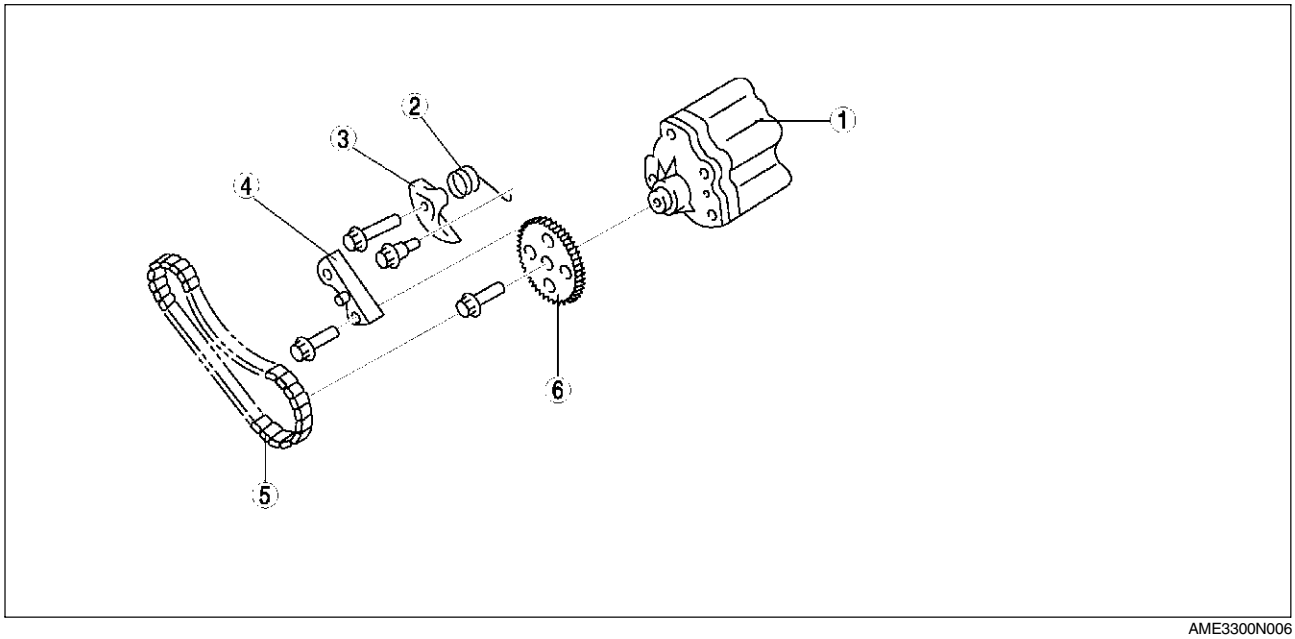
14	Oil pressure switch
15	Orifice
16	Piston
17	Main bearing
18	Crankshaft bearing, Connecting rod bearing
19	Oil pressure relief valve
20	Elevational view
21	Side view
22	Balance shaft
23	Oil control valve (OCV)
24	Variable valve timing actuator
25	Oil filter (Inner engine front cover)

OIL PUMP

A6E333014100T01

Structure

- The oil pump is installed inside the engine front cover. The crankshaft drives the inner rotor via the oil pump chain and oil pump sprocket.
- The oil pump consists of the oil pump sprocket, oil pump chain, oil pump chain guide, oil pump chain tensioner, and oil pump chain tensioner spring.



AME3300N006

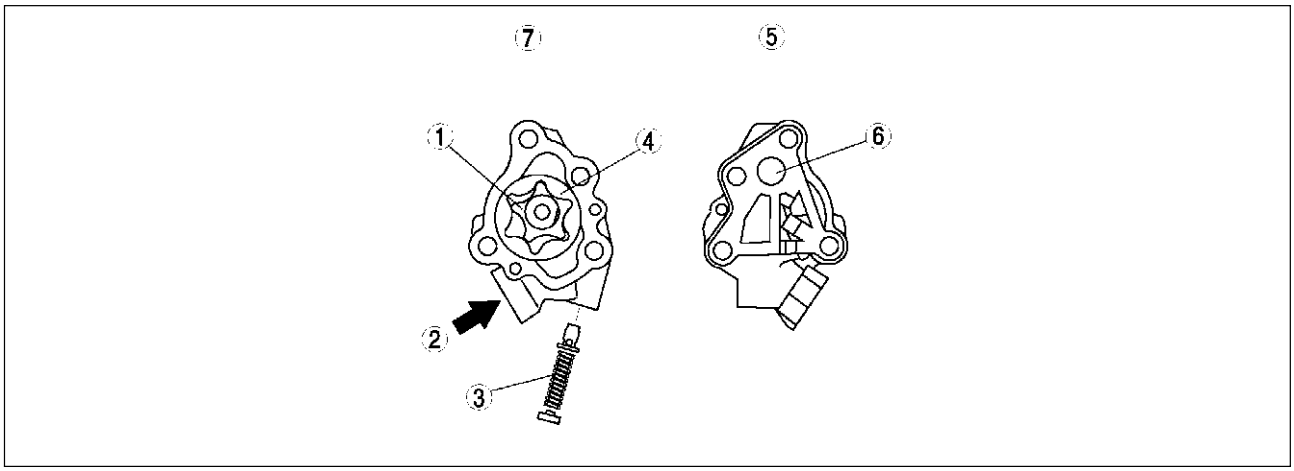
1	Oil pump body (with a built-in relief valve)
2	Oil pump chain tensioner spring
3	Oil pump chain tensioner

4	Oil pump chain guide
5	Oil pump chain
6	Oil pump sprocket

- An efficient and compact 5-lobe epitrochoid and 6-flank inner envelop type gear has been adopted on the oil pump.
- The oil pump consists of the inner and outer rotors, relief valve and oil pump body.
- The oil pump cannot be disassembled. If there is an oil pump malfunction, replace it as a unit.

OIL PUMP SPEC.

ITEM	ENGINE SPEED [rpm]	ENGINE		
		L8	LF	L3
Oil discharge pressure [Oil temperature: 100°C {212°F}] (kPa {kgf/cm^2, psi})	1,500	129— 269 {1.32—2.74, 18.7—39.0}		193—400 {1.97—4.07, 27.9—58.0}
	3,000	234—521 {2.39—5.31, 33.9—75.5}		395— 649 {4.03—6.61, 57.3—94.1}
Relief valve opening pressure (kPa {kgf/cm^2, psi})		500—600 {5.09—6.11, 72.6—87.0}		



AME3300N007

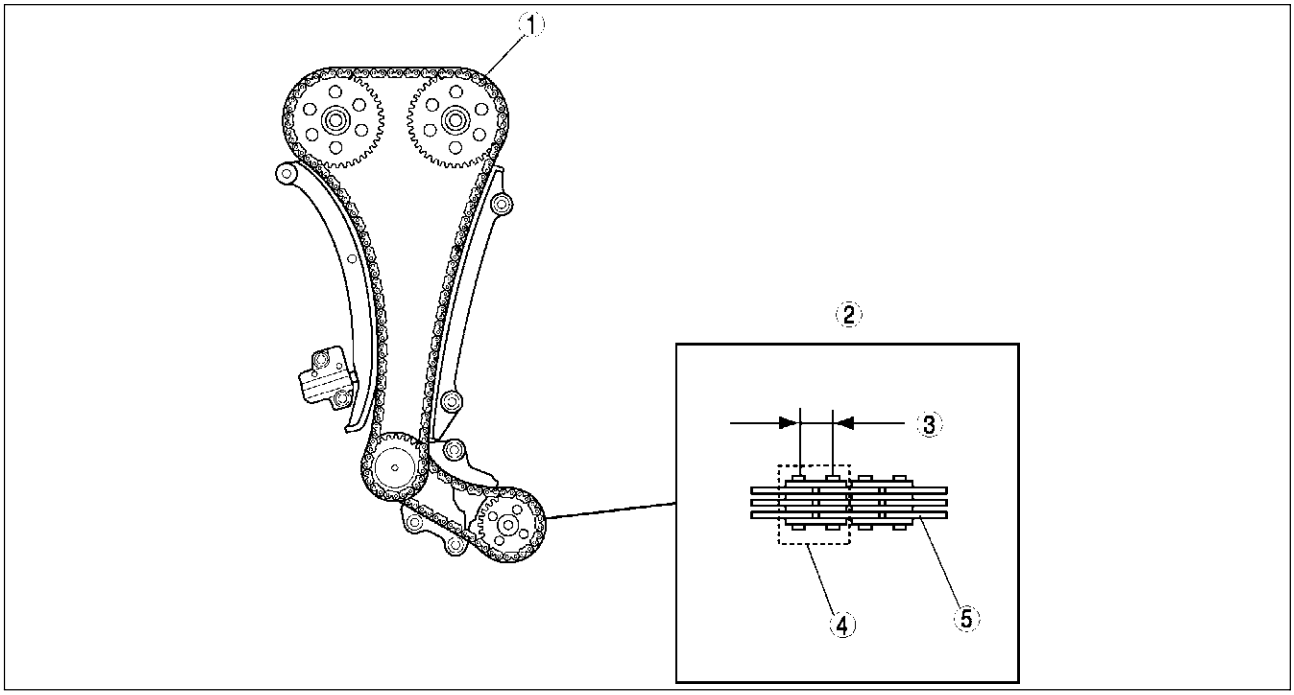
1	Inner rotor
2	Oil in
3	Relief valve assembly
4	Outer rotor

5	Back
6	Oil out
7	Front

- A silent chain (link connecting type) has been adopted to the oil pump chain to reduce chain operation noise when the chain and the sprocket engage.
- The engine oil in the engine front cover lubricates the oil pump chain. The wear resistance has been improved by the nitriding processing of the pin constructing the oil pump chain.
- The durability has been improved by heating the sintering material on the oil pump sprocket inside of a furnace.

OIL PUMP DRIVEN CHAIN SPEC.

ITEM	ENGINE		
	L8	LF	L3
Pitch size (mm {in})	8 {0.4}		6.35 {0.25}
Number of pitches	54		66



AME3300N008

1	Timing chain
2	Oil pump driven chain
3	Pitch size

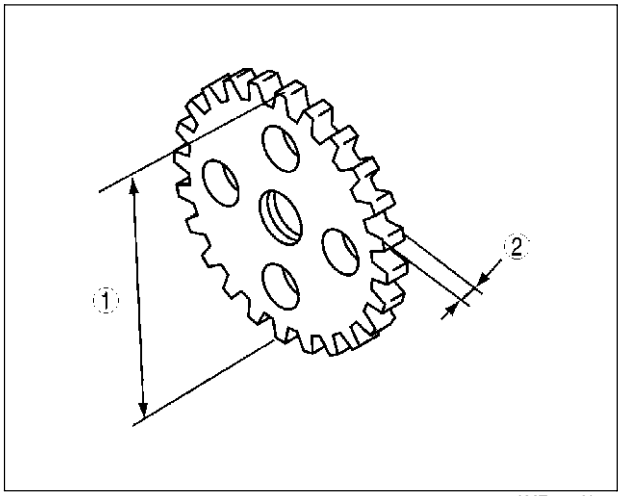
4	Pitch
5	Link

- The oil pump sprocket is heat forged from sintered metals to improve durability.

OIL PUMP SPROCKET SPEC.

ITEM		ENGINE		
		L8	LF	L3
Outer diameter	(mm {in})	60.78 {2.394}		46.46 {1.829}
Drive tooth width	(mm {in})	6.15 {0.242}		5.7 {0.23}

1	Outer diameter
2	Drive tooth width



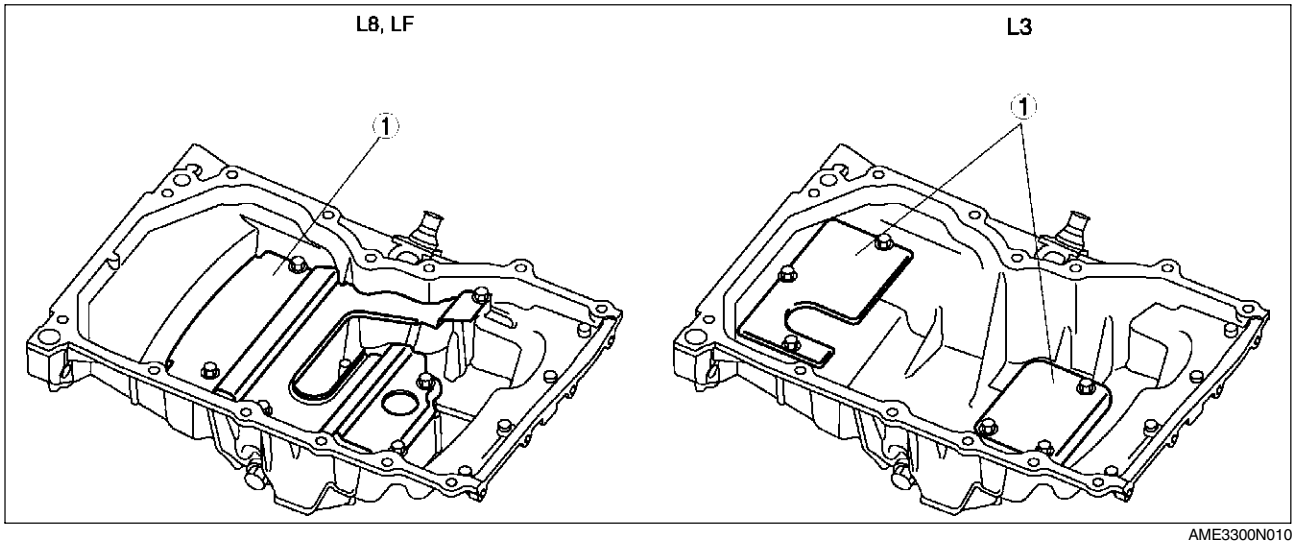
AME3300N009

OIL PAN

A6E333010040T01

Structure

- An aluminum alloy oil pan has been adopted for weight reduction. A silicon sealant with excellent sealing qualities has been also adopted.
- Oil pan baffle plates have been adopted inside the oil pan to stabilize engine oil diffusion by crankshaft rotation and oil level when the vehicle rolls.



AME3300N010

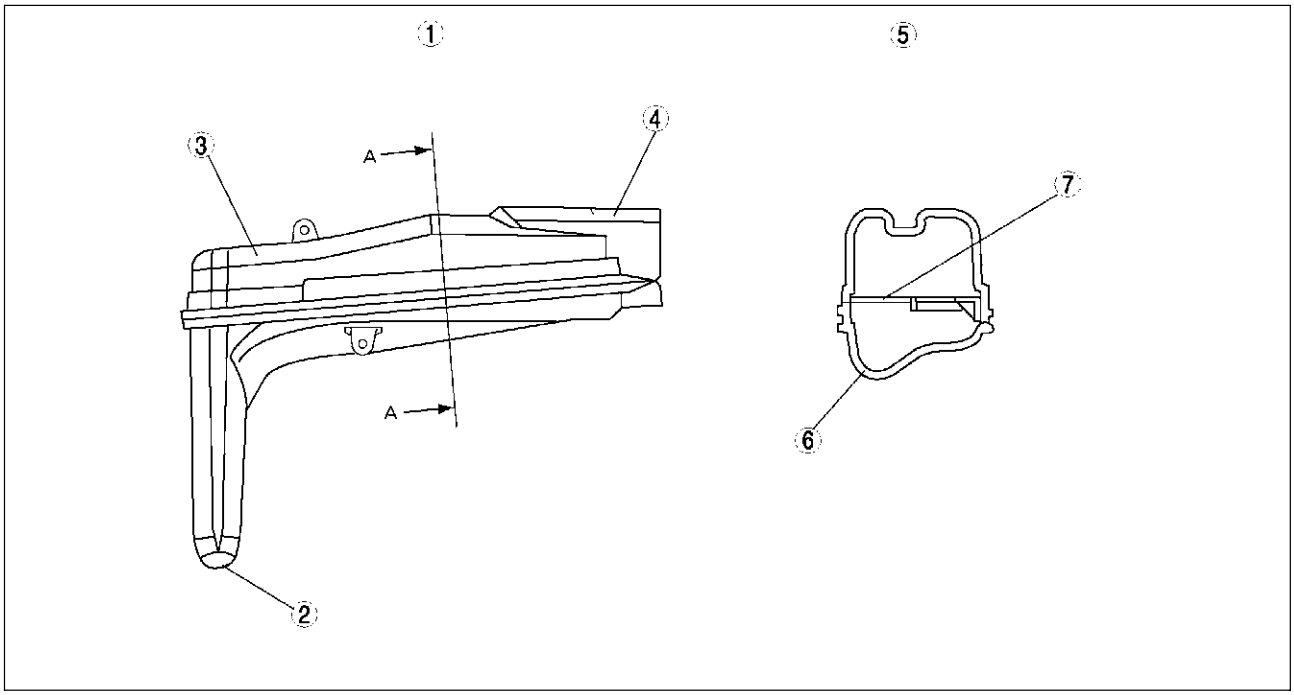
1	Oil pan baffle plate

OIL STRAINER

A6E333014700T01

Structure

- A plastic oil strainer with a resin filter in the middle of the strainer has been adopted for weight reduction.



AME3300N011

1	Appearance figure
2	Oil supply mouth
3	Oil strainer
4	Oil pump attachment side

5	A - A sectional view
6	Oil strainer
7	Filter

OIL FILTER

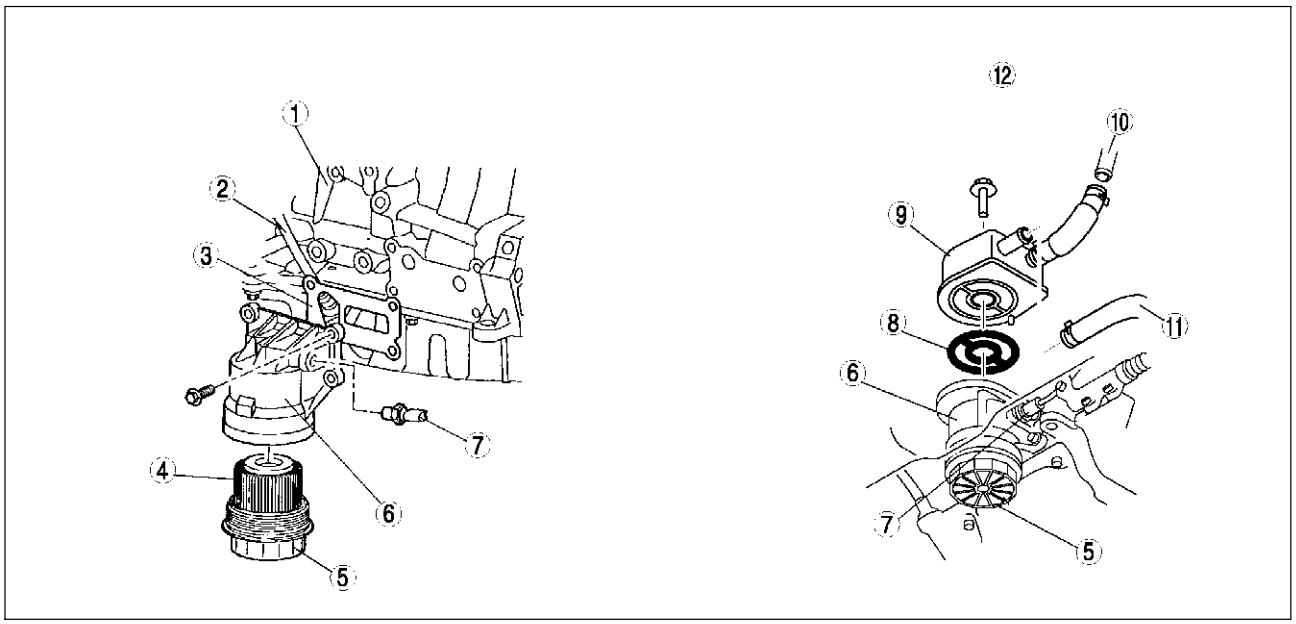
A6E333014300T01

Structure

- The oil filter is attached to the right side of the oil level gage (oil pan side) on cylinder block.
- The oil filter adapter has been adopted for weight reduction. The oil pressure switch is installed on the oil filter adapter.
- A resin oil filter has been adopted for weight reduction. A drain has been installed on the bottom of the oil filter replacement service ability.
- An environment-friendly oil filter, designed so that only the internal oil filter (rather than entire assembly) need to be replaced, has been adopted. The replaceable oil filter is made of a material that can be completely incinerated.
- A water-cooled oil cooler has been adopted to reduce the engine oil degradation. Also, the exclusive use oil filter adapter has been adapted for the oil cooler. (LF and L3 engine models)

OIL FILTER SPEC.

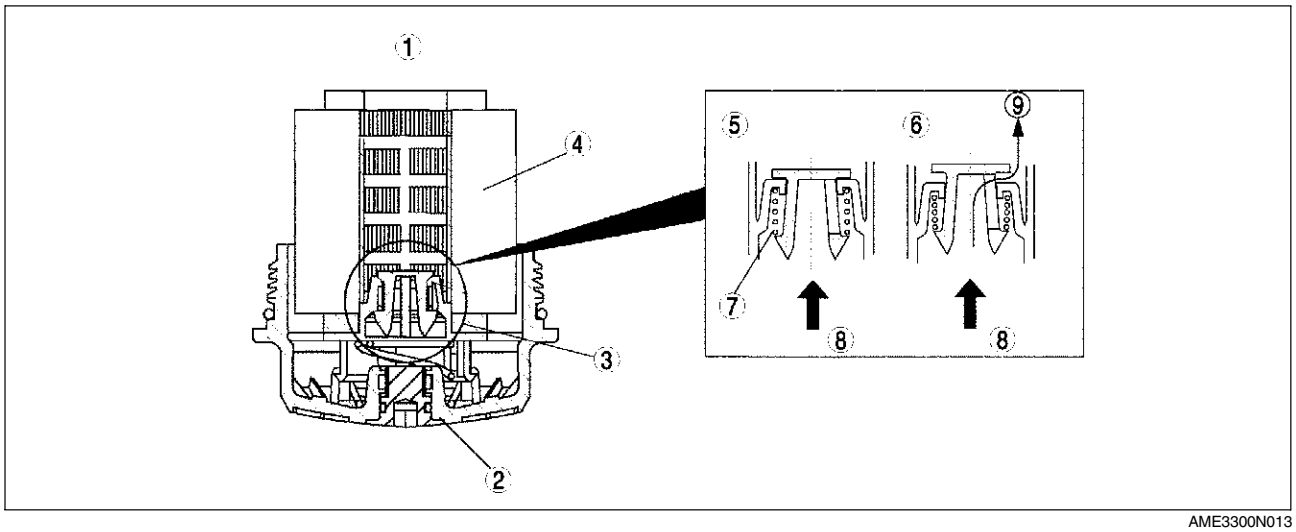
ITEM		ENGINE		
		L8	LF	L3
Outer diameter	(mm {in})	67—69 {2.4—2.7}		65.2—65.8 {2.57—2.59}
Height	(mm {in})	73.5—75.5 {2.89—2.97}		72.6—74.4 {2.86—2.92}



AME3300N012

1	Cylinder block
2	Oil level gage
3	Gasket
4	Oil filter
5	Oil filter cover
6	Oil filter adapter

7	Oil pressure switch
8	O-ring
9	Oil cooler
10	To water outlet case
11	To thermostat
12	LF and L3 engine models



AME3300N013

1	Oil filter
2	Oil filter cover
3	Relief valve
4	Oil filter
5	Normal

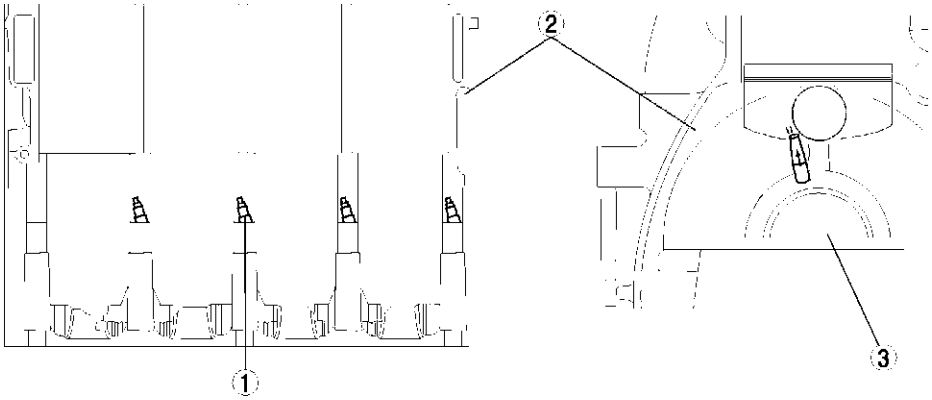
6	Relief
7	Spring
8	Oil pressure
9	Oil passage

OIL JET VALVE

A6E333010730T01

Structure

- The oil jet valves are installed in the cylinder block (in the main journal). The piston cooling efficiency by oil injected from the nozzles has been improved by the attachment direction of the oil jet valves which are pointed toward the back surface of each piston.
- The oil jet valves have been designed to maintain optimum oil pressure in the engine by controlling the oil injection of the oil according to the oil pressure on the oil jet valve.



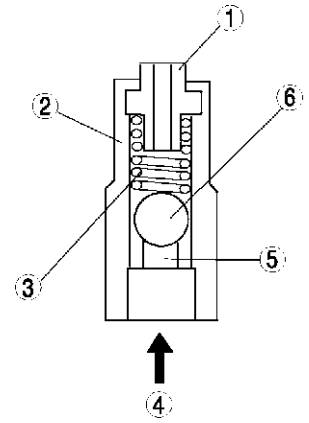
AME3300N014

1	Oil jet valve
2	Cylinder block

3	Crankshaft

Operation

- Oil pressure applied to the check-ball in the oil jet valve opens and closes the oil passage way to the nozzle and controls oil injection start and stop.
- Oil pressure greater than the specified value applied to the check-ball in the oil jet valve opens the oil passage to the spring-pressed nozzle, starting injection. Conversely, oil pressure less than the specified value applied to the check-ball blocks the jet valve by spring force, stopping injection.



AME3300N015

1	Nozzle
2	Oil jet valve body
3	Spring

4	Oil
5	Oil passage
6	Check ball

COOLING SYSTEM

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ABBREVIATIONS E-2
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COOLING FAN E-5
RADIATOR COWLING, COOLANT RESERVOIR TANK E-6
THERMOSTAT E-6
WATER PUMP E-7

ABBREVIATIONS

ABBREVIATIONS

A6E360102000T01

ATF	Automatic transaxle fluid
ATX	Automatic transaxle

OUTLINE

OUTLINE OF CONSTRUCTION

A6E360201004T01

- L8, LF and L3 engine models are water cooled by forced circulation cooling systems.

FEATURES

A6E360201004T02

Reduced weight and size
- Cross-flow type radiator with radiator tanks made of plastic and the core made of aluminum.
- Stainless steel thermostat body is built in the plastic thermostat case
- Built-in type water pump

Reduce engine noise and vibration
- The cooling fan is a thermo modulator system type.
- Electric cooling fan has been adopted.

Improved reliability
- The following have been adopted.
  — Thermostat of highly durable wax type.
  — Water pump that is built into cylinder block

SPECIFICATIONS

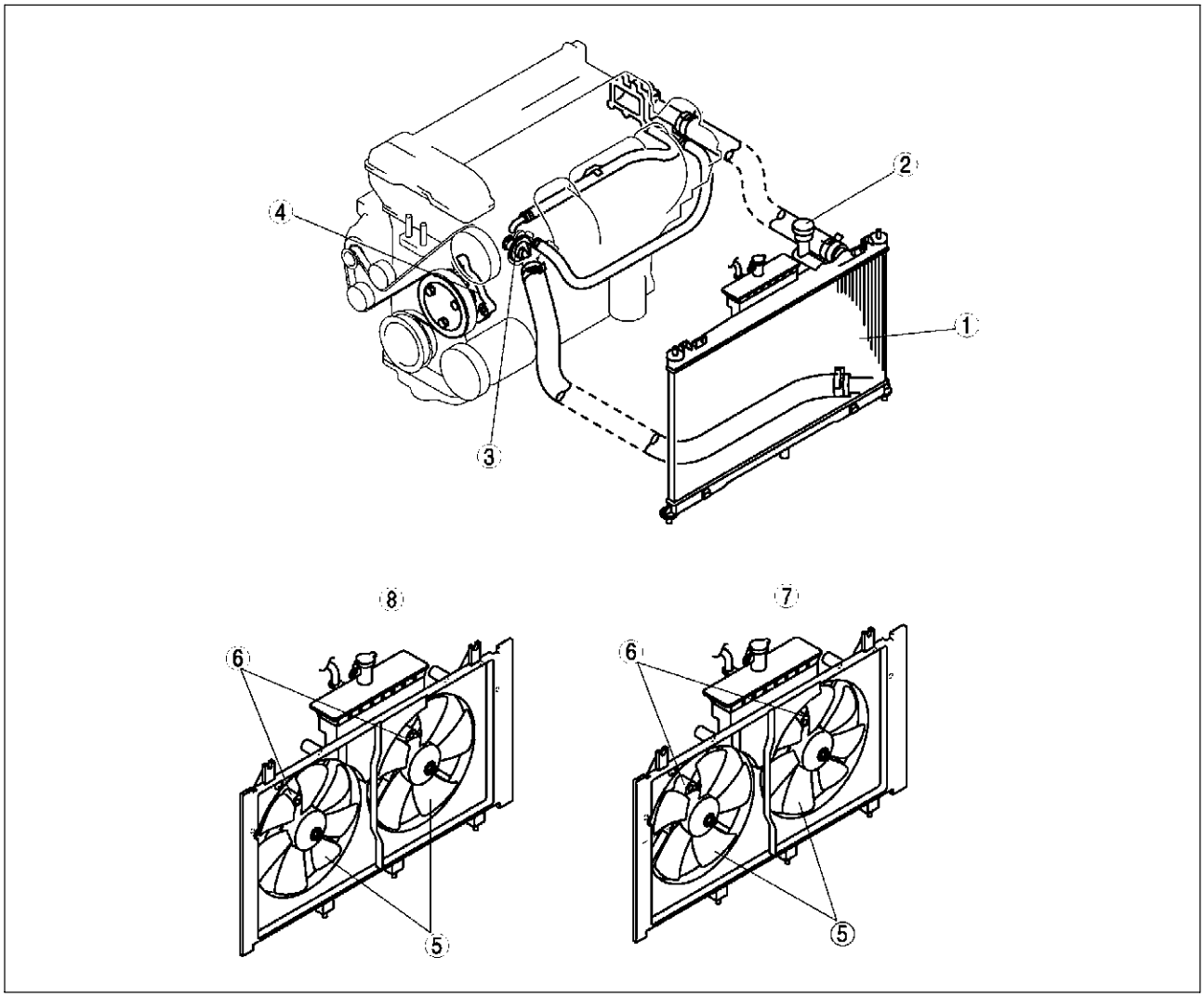
A6E360201004T03

<table>
<tr><th colspan="4" rowspan="2">Item</th><th colspan="4">Engine type</th></tr>
<tr><th>L8</th><th colspan="2">LF</th><th>L3</th></tr>
<tr><td colspan="4">Cooling system</td><td colspan="4">Water-cooled, Electromotive</td></tr>
<tr><td colspan="4">Coolant capacity (Approximate quantity) (L {US qt, Imp qt})</td><td colspan="4">7.5 {7.9, 6.6}</td></tr>
<tr><td>Water pump</td><td colspan="3">Type</td><td colspan="4">Centrifugal, V-ribbed belt-driven</td></tr>
<tr><td rowspan="4">Thermostat</td><td colspan="3">Type</td><td colspan="4">Wax</td></tr>
<tr><td colspan="2">Opening temperature</td><td>(°C {°F})</td><td colspan="4">80.0—84.0 {176—183.2}</td></tr>
<tr><td colspan="2">Full-open temperature</td><td>(°C {°F})</td><td colspan="4">97 {206.6}</td></tr>
<tr><td colspan="2">Full-open lift</td><td>(mm {in})</td><td colspan="4">More then 8.0 {0.31} min.</td></tr>
<tr><td>Radiator</td><td colspan="3">Type</td><td colspan="4">Corrugated fin</td></tr>
<tr><td colspan="4">Cap valve opening pressure (kPa {kgf/cm^2, psi})</td><td colspan="4">112.8—142.2 {1.15—1.45, 16.4—20.6}</td></tr>
<tr><td rowspan="3">Cooling fan</td><td colspan="3">Type</td><td colspan="4">Thermo-modulated, Electromotive</td></tr>
<tr><td rowspan="2">Blade</td><td>Outer diameter</td><td>(mm {in})</td><td>300 {11.8}</td><td colspan="2">300 {11.8}</td><td>320 {12.6}</td></tr>
<tr><td>Quantity</td><td></td><td>Cooling fan No.1: 5
Cooling fan No.2: 7</td><td>(Except for Israel)
Cooling fan No.1: 5
Cooling fan No.2: 7</td><td>(For Israel)
Cooling fan No.1: 7
Cooling fan No.2: 5</td><td>Cooling fan No.1: 7
Cooling fan No.2: 5</td></tr>
</table>

COOLING SYSTEM

STRUCTURAL VIEW

A6E363001004T02



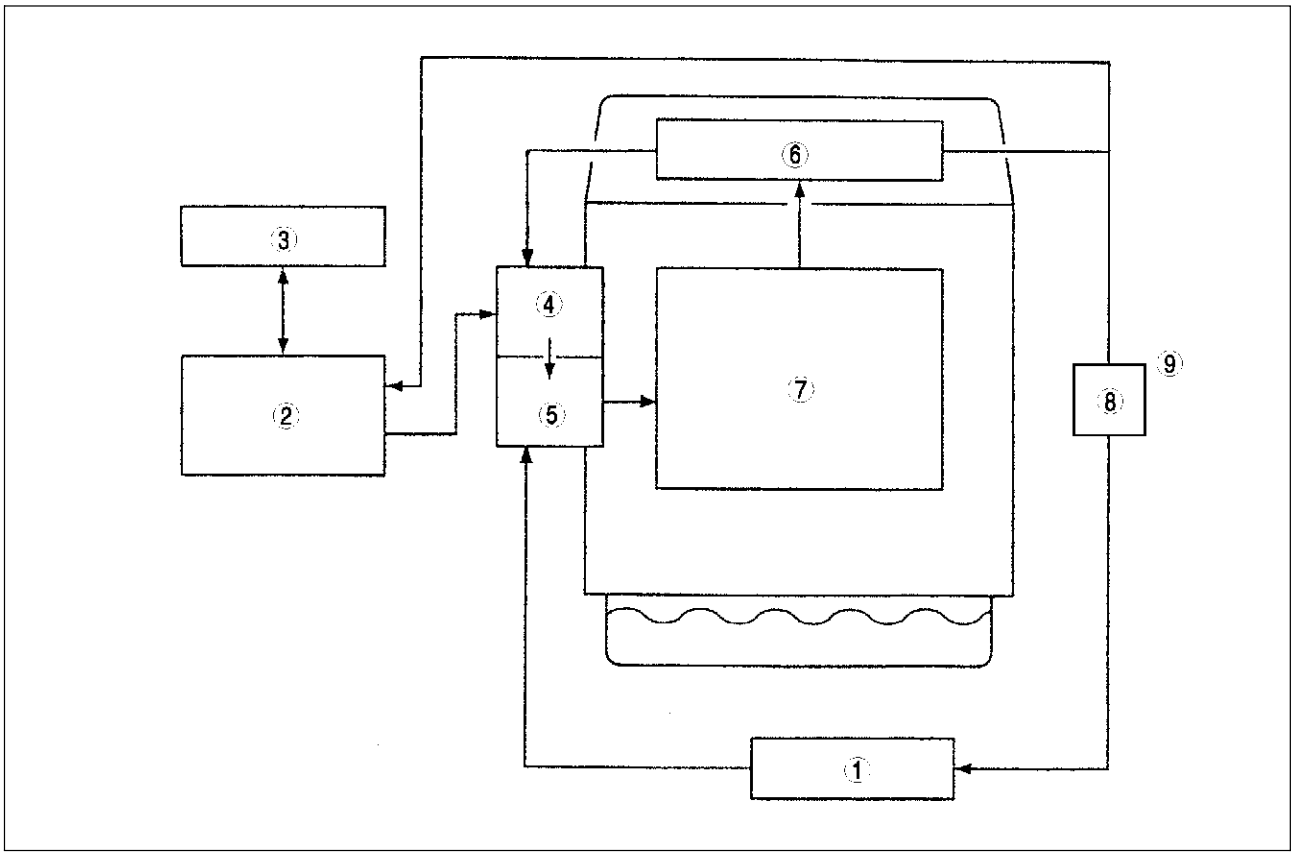
AME3602N001

1	Radiator
2	Radiator cap
3	Thermostat
4	Water pump

5	Cooling fan blade
6	Cooling fan motor No.1,Cooling fan motor No.2
7	For Israel and L3 engine model
8	LF engine model except for Israel and L8 engine model

COOLING FLOW DIAGRAM

A6E363001004T03



AME3602N002

1	Heater
2	Radiator
3	Coolant reservoir tank
4	Thermostat
5	Water pump

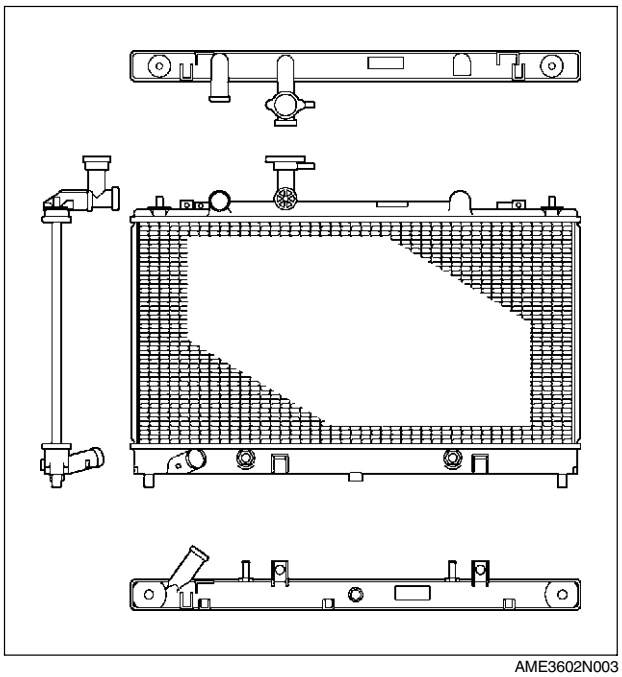
6	Cylinder head
7	Cylinder block
8	Oil cooler
9	LF and L3 engine models

RADIATOR

A6E363015200T01

Structure

- A cross-flow radiator with corrugated fins is used for improved cooling.
- The radiator tanks are made of plastic and the core is made of aluminum.
- Four rubber-insulated mounting brackets are utilized to decrease vibration.
- The radiator has an ATF cooler in the radiator tank. (ATX)
- A small pressuring type cap has been adopted for the radiator cap.



AME3602N003

COOLING FAN

A6E363015140T01

Structure

- Electric cooling fans No.1 and No.2, operated according to a fan control signal from the PCM, have been adopted. Due to this, engine noise is reduced and rapid warming-up is possible.
- A cooling fan No.1 and No.2 is attached to the radiator cowling.

Cooling fan, fan motor specs:

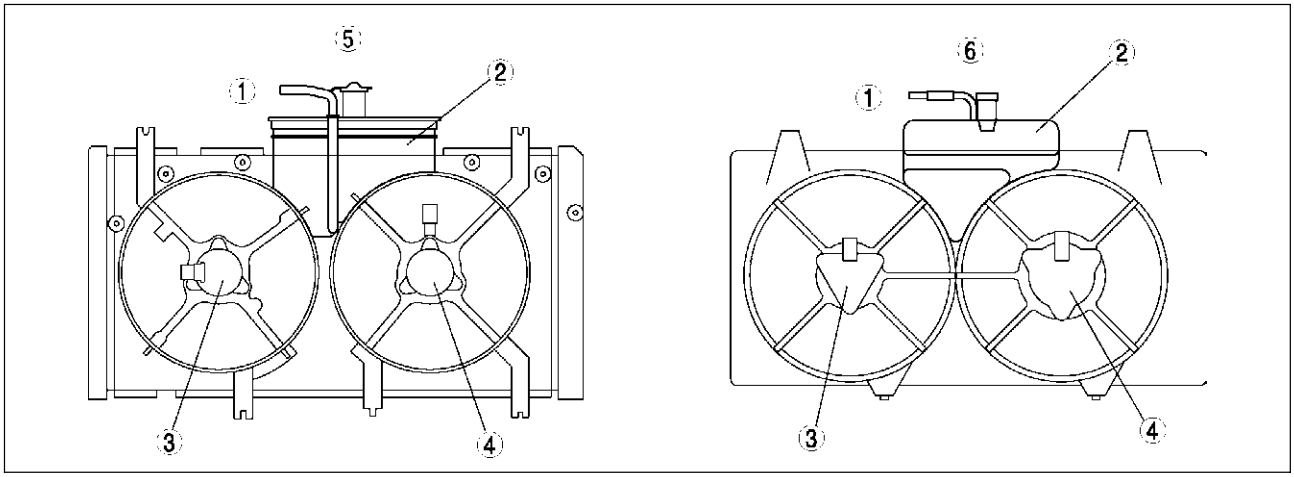
ITEM			ENGINE		
			L8	LF	L3
Cooling fan No.1	Number of Blade	(sheet)	5	For Israel: 7 Except for Israel: 5	7
	Motor output	(W)	80	80-120	70
Cooling fan No.2	Number of Blade	(sheet)	7	For Israel: 5 Except for Israel: 7	5
	Motor output	(W)	80	80-120	120

RADIATOR COWLING, COOLANT RESERVOIR TANK

A6E363015140T02

Structure

- A radiator cowling is made of plastic for the weight reduction.
- A coolant reservoir tank can be removed from the radiator cowling. (For Israel and L3 engine models)
- A coolant reservoir tank can not be removed from the radiator cowling. (LF engine models except for Israel and L8 engine models)



AME3602N004

1	To radiator
2	Coolant reservoir tank
3	Cooling fan motor No.1

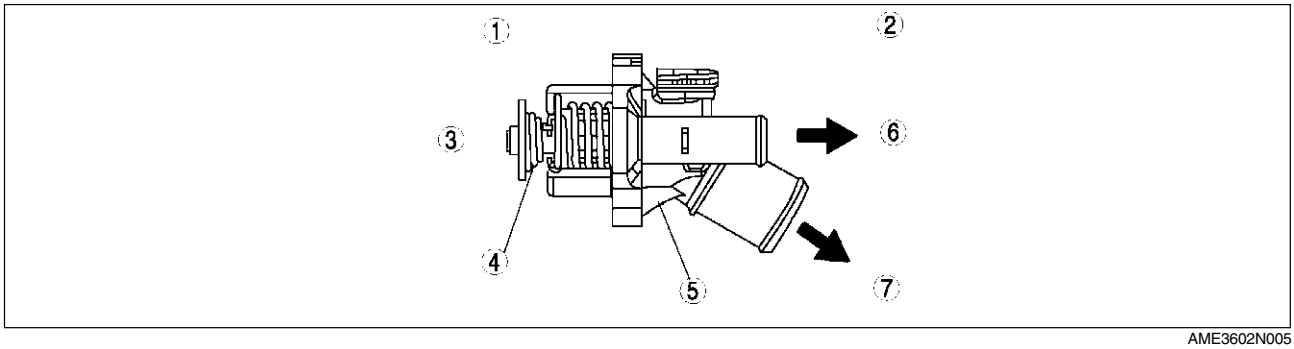
4	Cooling fan motor No.2
5	LF engine model except for Israel and L8 engine models
6	For Israel and L3 engine models

THERMOSTAT

A6E363015171T01

Structure

- A wax-type thermostat with a jiggle-pin has been adopted.
- The plastic thermostat case has a built-in stainless steel thermostat body with excellent corrosion resistance.
- When the engine coolant temperature is below 75.0°C {167°F}, the thermostat stops the circulation of radiator coolant from the radiator for improved engine warming. When the engine coolant temperature is between 80.0°C {176°F} to 84.0 °C {183.2°F}, the thermostat begins opening the valve and engine coolant flows from the radiator to stabilize engine coolant temperature.



AME3602N005

1	Engine side
2	Radiator side
3	Water pump
4	Thermostat body

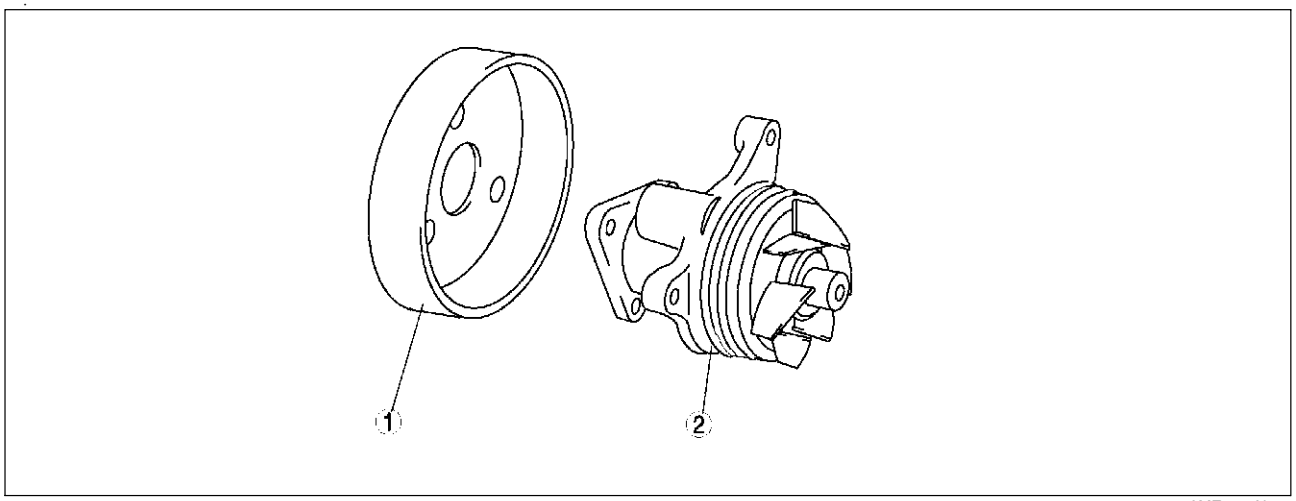
5	Thermostat case
6	Oil cooler (LF and L3 engine models) Heater hose (L8 engine model)
7	Lower radiator hose

WATER PUMP

A6E363015010T01

Structure

- The water pump body is made of aluminum alloy for weight reduction.
- The impeller is built into the cylinder block and the water pump is not seviceable and must be replaced as a unit if faulty.
- The water pump is driven by the front drive belt. (sirpentain type)



AME3602N006

1	Water pump pulley
2	Water pump body

FUEL AND EMISSION CONTROL SYSTEMS

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F

ABBREVIATIONS

ABBREVIATIONS

A6E390118881T01

AAS	Air adjust screw
CAN	Controller area network
DC	Drive cycle
FFD	Freeze frame data
KOEO	Key on, engine off
KOER	Key on, engine running
OCV	Oil control valve
PC	Pending code
PID	Parameter identification
TCS	Traction control system
VAD	Variable air duct
VIS	Variable intake-air system
VLIM	Variable length intake manifold
VTCS	Variable tumble control system

OUTLINE

OUTLINE OF CONSTRUCTION

A6E390218881T01

- The Mazda6 (GG) has been equipped with the new engine (L series). The features of the L series engines are as follows.

FEATURES

A6E390218881T02

System simplification

- Controller area network has been adopted.
- Mechanical returnless fuel system has been adopted.

Improved engine performance

- Variable air duct (VAD) control system has been adopted to improve engine performance at high engine speed. (L3 engine)
- Variable valve timing control system has been adopted to improve engine performance. (L3 engine)
- Variable intake-air system (VIS) has been adopted to improve engine torque characteristics and combustion efficiency. (L3 engine)

Improved emission performance

- Variable valve timing control system has been adopted. (L3 engine)
- Variable tumble control system (VTCS) has been adopted.
- New fuel injection timing control has been adopted.
- Manifold absolute pressure correction has been adopted to IAC control and fuel injection control.

Weight reduction

- Resin fuel tank has been adopted.

Improved serviceability

- Nonadjustable ignition timing has been adopted.
- Nonadjustable IAC has been adopted.
- Quick release connectors have been adopted on all joints of fuel lines.
- KOEO/KOER self-test function has been adopted.
- Pending code storage process has been changed.
- MIL illumination conditions for the second drive cycle type have been changed.

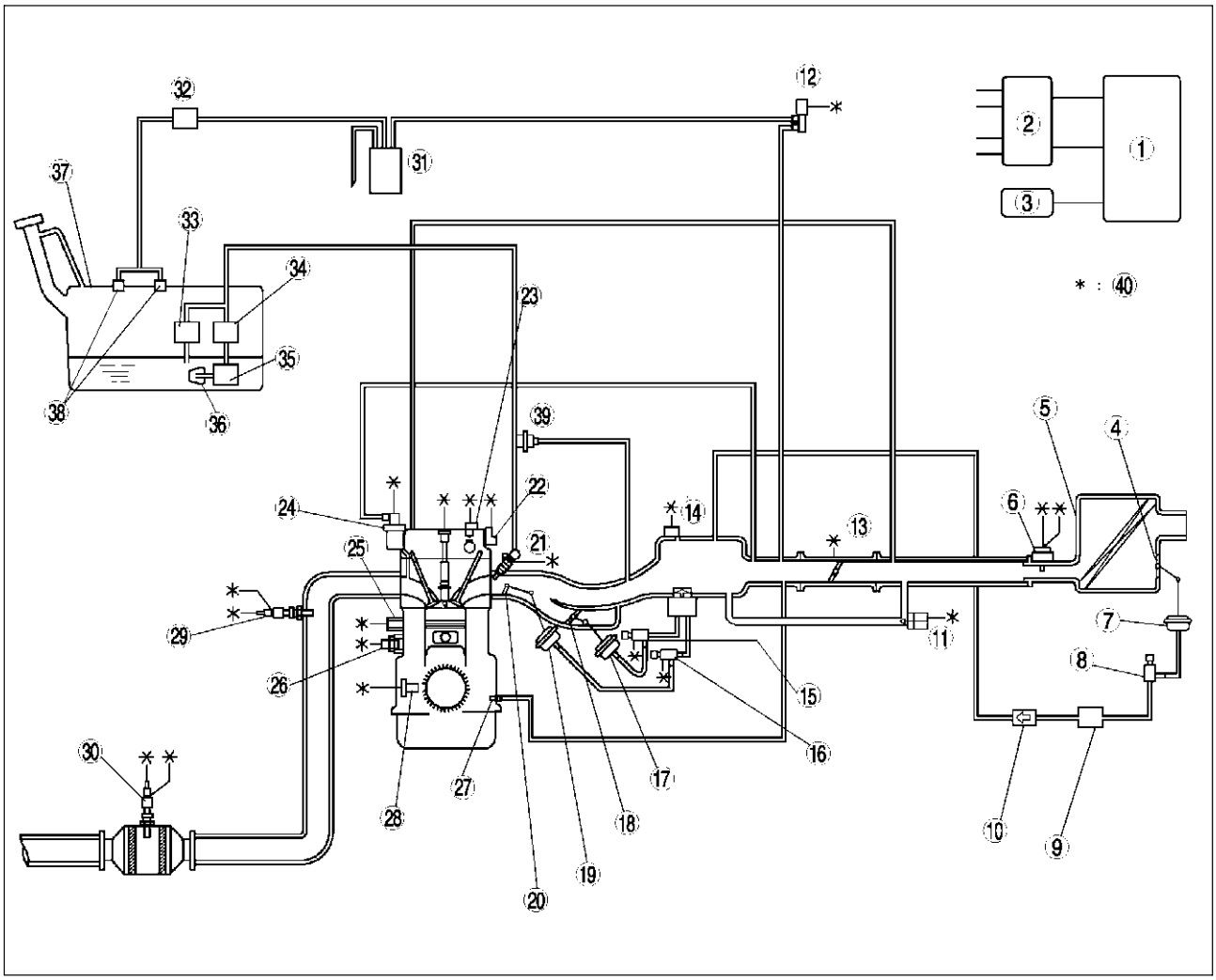
SPECIFICATIONS

A6E390218881T03

Item		L8, LF, L3
Air cleaner element	Type	Paper element (oil permeated)
IAC valve	Type	Duty control
Fuel injector	Type	Hi-ohmic
	Type of fuel delivery	Top-feed
	Type of drive	Voltage
Pressure regulator	Regulating pressure (kPa {kgf/cm^2, psi})	440 {4.5, 64}
Fuel tank	Capacity (L {US qt, Imp qt})	64 {68, 56}
Fuel	Specification	Unleaded (RON 95 or above)
Catalyst	Type	TWC (monolithic)
EGR control	Type	Stepping motor type
Evaporative emission control system	Type	Canister type
PCV system	Type	Closed type

CONTROL SYSTEM DIAGRAM

A6E390218881T04



A6E3902T000

1	PCM
2	Ignition coil
3	Generator
4*	VAD shutter valve
5	Air cleaner
6	MAF sensor
7*	VAD shutter valve actuator
8*	VAD control solenoid valve
9*	Vacuum chamber
10*	VAD check valve (one-way)
11	IAC
12	Purge solenoid valve
13	TP sensor
14	MAP sensor
15*	VIS control solenoid valve
16	Variable tumble control solenoid valve
17*	VIS shutter valve actuator
18*	VIS shutter valve
19	VTCS shutter valve actuator
20	VTCS shutter valve

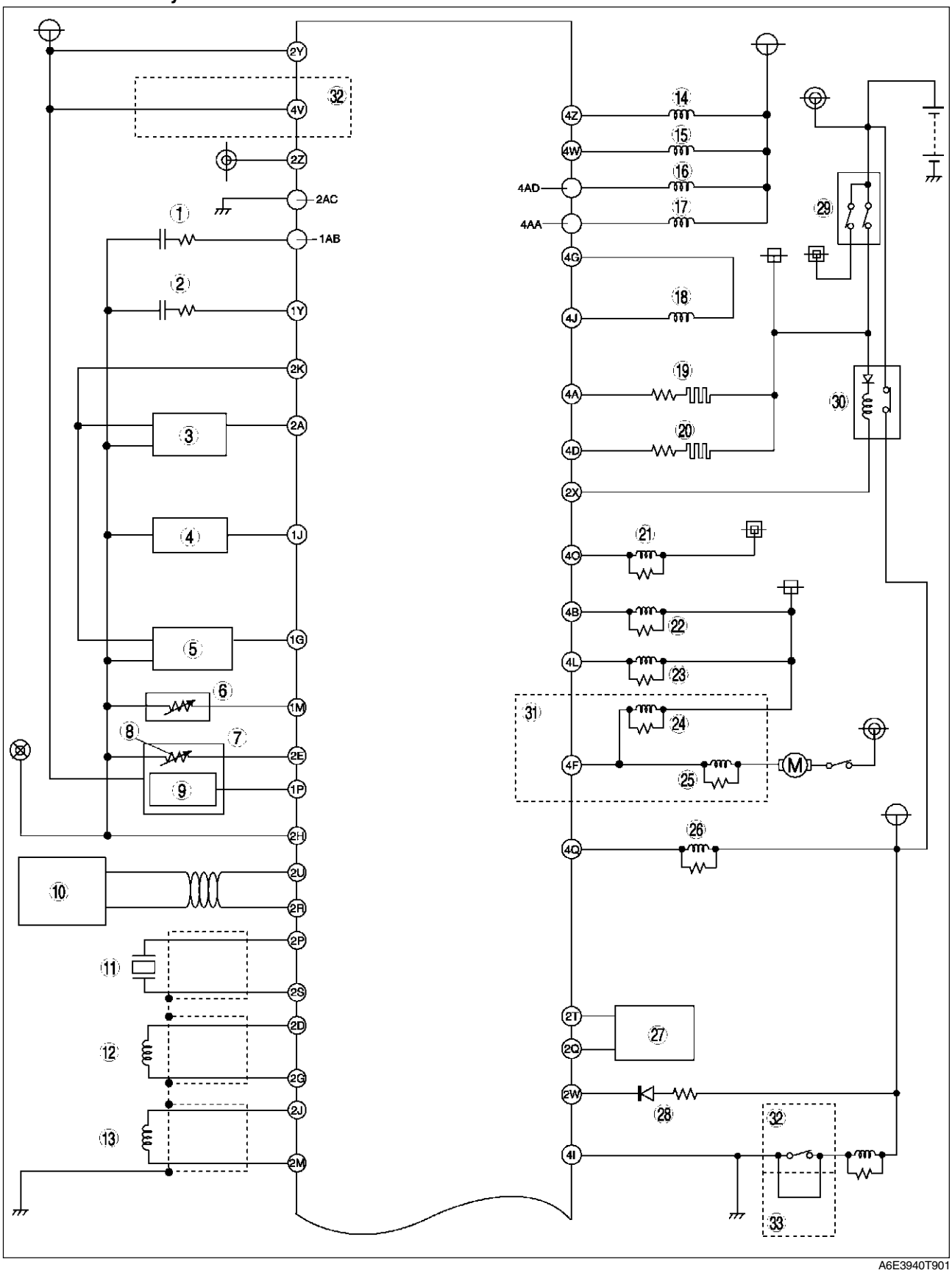
21	Fuel injector
22*	OCV
23	CMP sensor
24	EGR valve
25	Knock sensor
26	ECT sensor
27	PCV valve
28	CKP sensor
29	Heated oxygen sensor (front)
30	Heated oxygen sensor (rear)
31	Charcoal canister
32	Check valve (two-way)
33	Pressure regulator
34	Fuel filter (high pressure)
35	Fuel pump
36	Fuel filter (low pressure)
37	Fuel tank
38	Rollover valve
39	Pulsation damper
40	To PCM

* : Equipped for L3 engine model

CONTROL SYSTEM WIRING DIAGRAM

A6E390218881T05

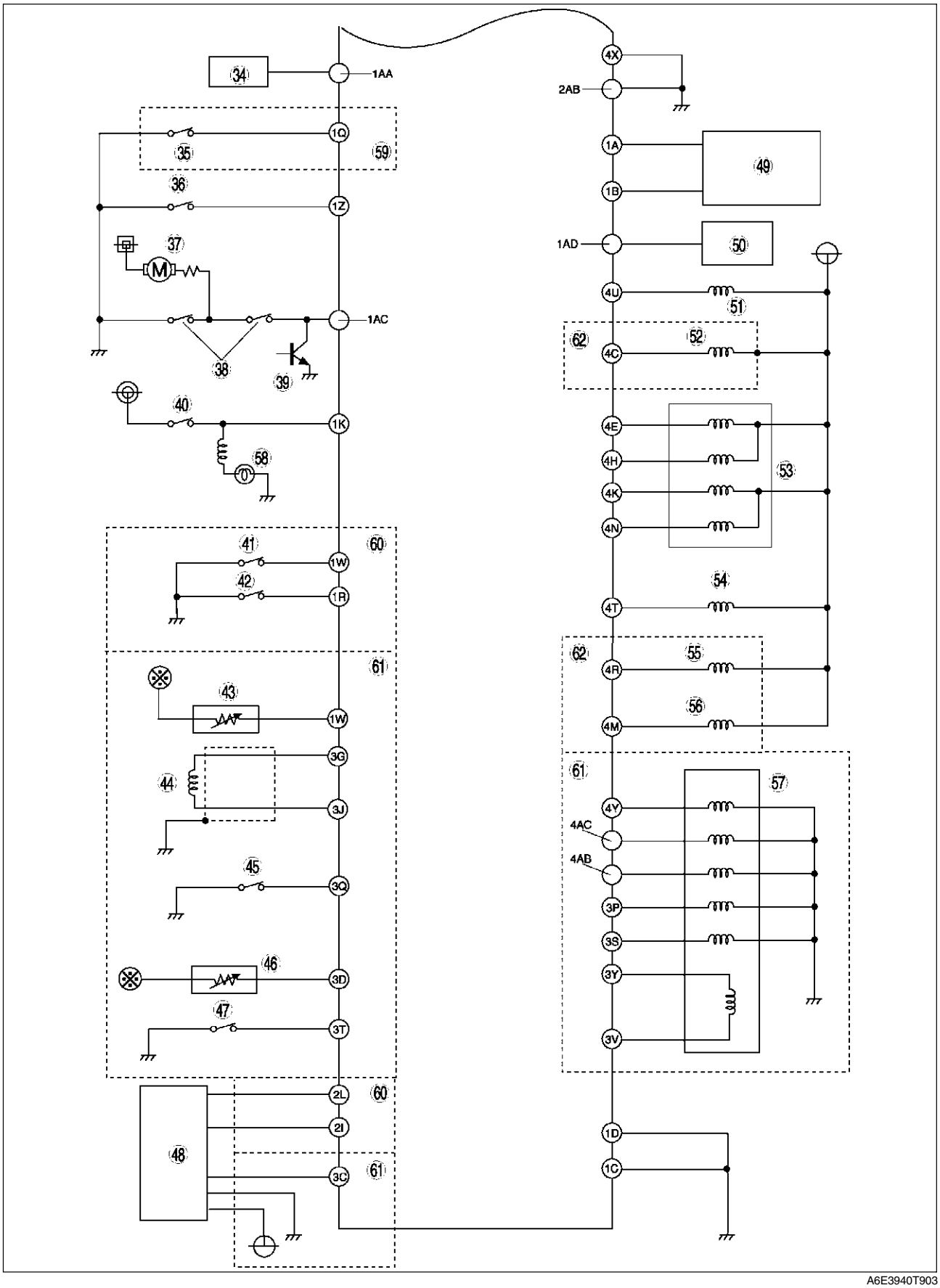
With Immobilizer System



A6E3940T901

1	Heated oxygen sensor (front)
2	Heated oxygen sensor (rear)
3	TP sensor
4	MAP sensor
5	BARO sensor
6	ECT sensor
7	MAF/IAT sensor
8	IAT sensor
9	MAF sensor
10	Controller area network (CAN)
11	Knock sensor
12	CKP sensor
13	CMP sensor
14	Fuel injector No.1
15	Fuel injector No.2
16	Fuel injector No.3
17	Fuel injector No.4

18	IAC
19	Oxygen sensor heater (front)
20	Oxygen sensor heater (rear)
21	A/C relay
22	Cooling fan relay
23	Cooling fan relay
24	Cooling fan relay
25	Cooling fan relay
26	Fuel pump relay
27	Coil
28	Security light
29	Ignition switch
30	Main relay
31	L8, LF (Intensely hot area) and L3 engine models
32	ATX model
33	MTX model

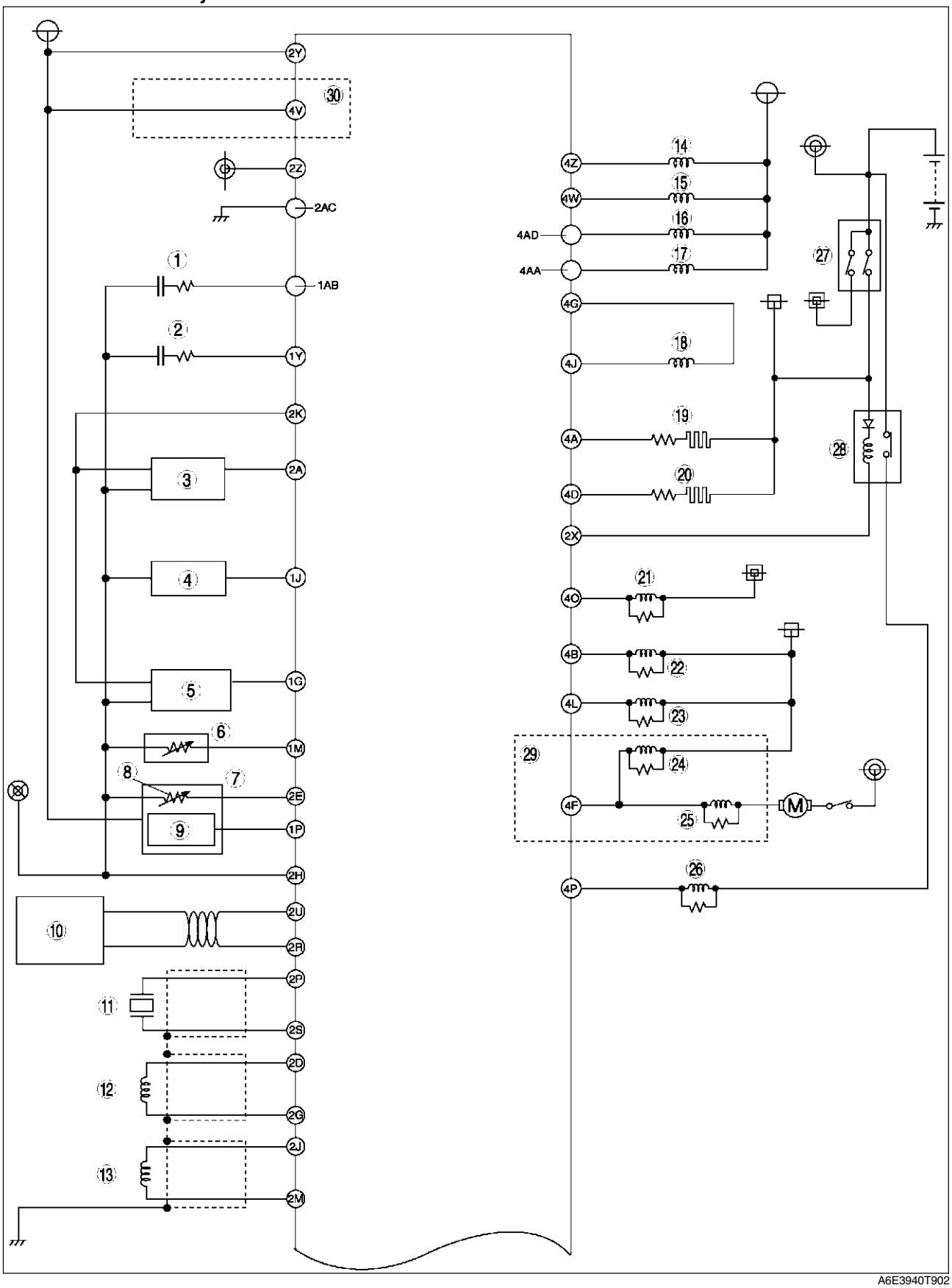


A6E3940T903

34	Generator
35	Refrigerant pressure switch (middle)
36	PSP switch
37	Blower motor
38	Refrigerant pressure switch (high and low)
39	A/C switch
40	Brake switch
41	Neutral switch
42	Clutch switch
43	TR switch
44	Turbine speed sensor
45	HOLD switch
46	TFT sensor
47	Oil pressure switch
48	VSS

49	Ignition coil
50	Generator
51	Purge solenoid valve
52	VAD control solenoid valve
53	EGR valve
54	Variable tumble control solenoid valve
55	VIS control solenoid valve
56	OCV
57	Valve body
58	Brake light
59	L8, LF (Intensely hot area) and L3 engine models
60	MTX model
61	ATX model
62	L3 engine model

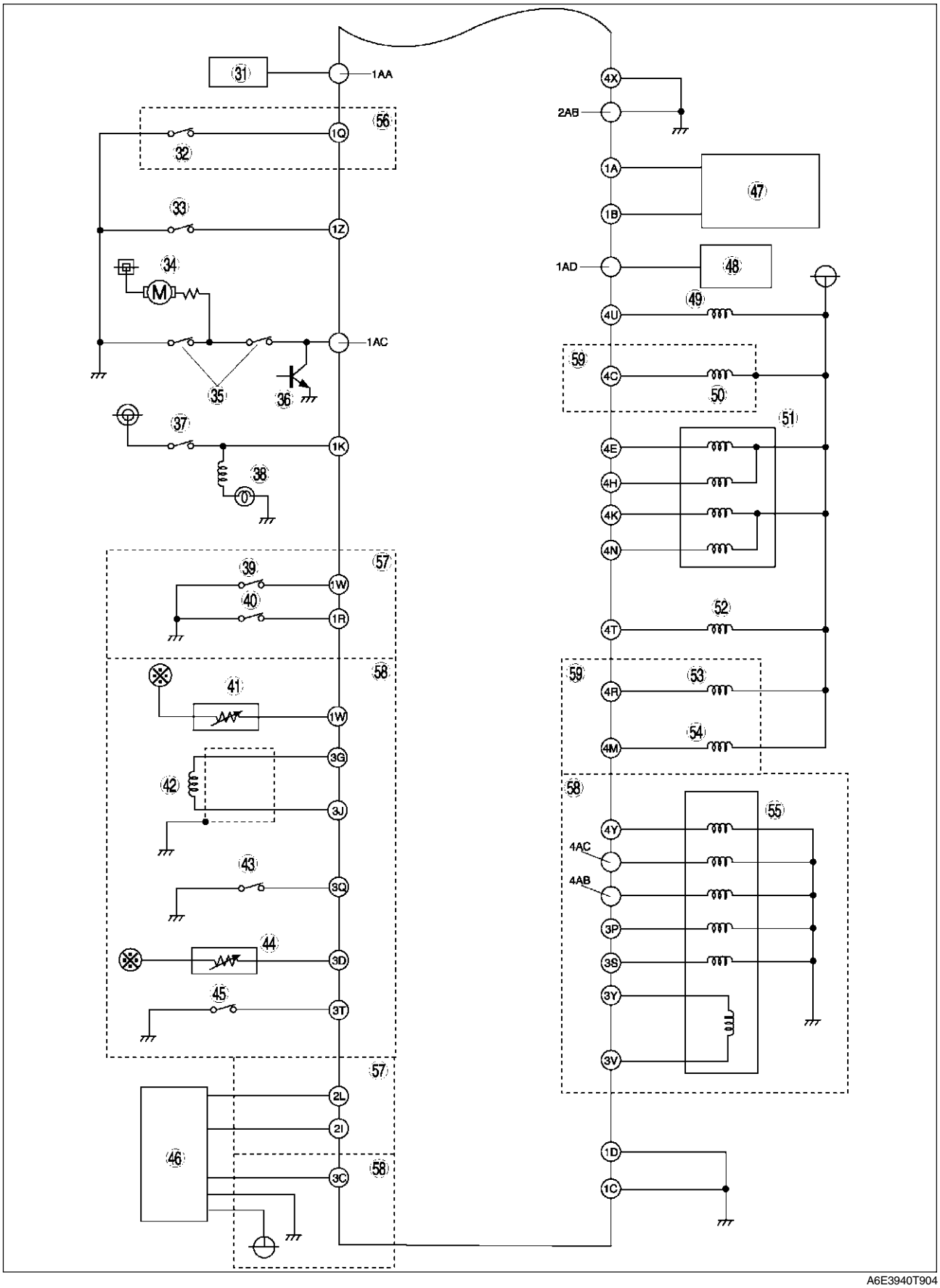
Without Immobilizer System



A6E3940T902

1	Heated oxygen sensor (front)
2	Heated oxygen sensor (rear)
3	TP sensor
4	MAP sensor
5	BARO sensor
6	ECT sensor
7	MAF/IAT sensor
8	IAT sensor
9	MAF sensor
10	Controller area network (CAN)
11	Knock sensor
12	CKP sensor
13	CMP sensor
14	Fuel injector No.1
15	Fuel injector No.2

16	Fuel injector No.3
17	Fuel injector No.4
18	IAC
19	Oxygen sensor heater (front)
20	Oxygen sensor heater (rear)
21	A/C relay
22	Cooling fan relay
23	Cooling fan relay
24	Cooling fan relay
25	Cooling fan relay
26	Fuel pump relay
27	Ignition switch
28	Main relay
29	L8, LF (Intensely hot area) and L3 engine models
30	ATX model



A6E3940T904

31	Generator
32	Refrigerant pressure switch (middle)
33	PSP switch
34	Blower motor
35	Refrigerant pressure switch (high and low)
36	A/C switch
37	Brake switch
38	Brake light
39	Neutral switch
40	Clutch switch
41	TR switch
42	Input/turbine speed sensor
43	HOLD switch
44	TFT sensor
45	Oil pressure switch

46	VSS
47	Ignition coil
48	Generator
49	Purge solenoid valve
50	VAD control solenoid valve
51	EGR valve
52	Variable tumble control solenoid valve
53	VIS control solenoid valve
54	OCV
55	Valve body
56	L8, LF (Intensely hot area) and L3 engine models
57	MTX model
58	ATX model
59	L3 engine model

F

INTAKE-AIR SYSTEM

INTAKE-AIR SYSTEM OUTLINE

A6E391013000T01

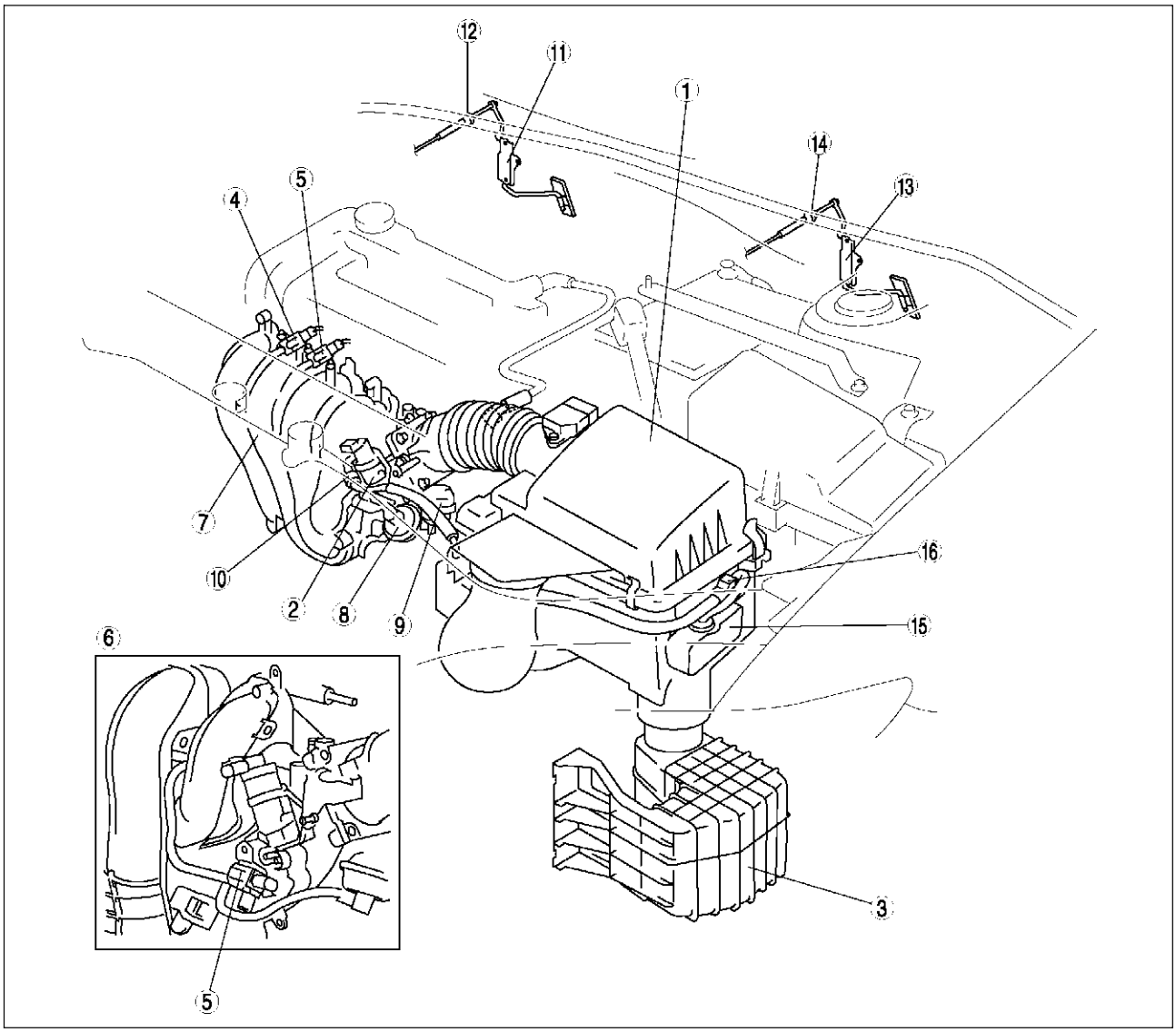
- The function, structure and operation of each part in the intake-air system of the Mazda6 (GG) L3, LF, and L8 engine models are essentially carried over from the current 323 (BJ) FS engine models, except for the following:
  - — A non AAS type throttle body has been adopted to improved serviceability.
  - — A resin intake manifold has been adopted to reduce weight.
  - — The variable air duct (VAD) system has been adopted to improved the engine performance.
  - — Variable intake-air system (VIS) has been adopted. Same function as VICS of current 323 (BJ) FS engine models.

×: Applied
–: Not applied

Item	Mazda6 (GG)			Current 323 (BJ) FS	Remark for new model
	L3	LF	L8		
Resonance chamber	×				Same function as current 323 (BJ) FS engine models
Air cleaner	×				Same function as current 323 (BJ) FS engine models
Throttle body	×				Same function as current 323 (BJ) FS engine models AAS has been eliminated due to automatic adjustment of idle speed
IAC valve	×				Same function as current 323 (BJ) FS engine models
Intake manifold	×				Same function as current 323 (BJ) FS engine models
Dynamic chamber	×				Same function as current 323 (BJ) FS engine models
VIS	×	–		×	Same function as VICS of current 323 (BJ) FS engine models
VTCS	×			–	Same function as current MX-5 (NB) BP engine models
VAD system	×	–			Newly adopted

INTAKE-AIR SYSTEM STRUCTURAL VIEW

A6E391013000T02



A6E3910W036

1	Air cleaner
2	IAC valve
3	Resonance chamber
4	VIS control solenoid valve (L3)
5	Variable tumble control solenoid valve
6	L8, LF engine models
7	Intake manifold
8	VIS shutter valve actuator (L3)

9	VTCS shutter valve actuator
10	VAD check valve (one-way) (L3)
11	Accelerator pedal (R.H.D.)
12	Accelerator cable (R.H.D.)
13	Accelerator pedal (L.H.D.)
14	Accelerator cable (L.H.D.)
15	VAD shutter valve (L3)
16	VAD control solenoid valve (L3)

VARIABLE AIR DUCT (VAD) SYSTEM OUTLINE (L3)

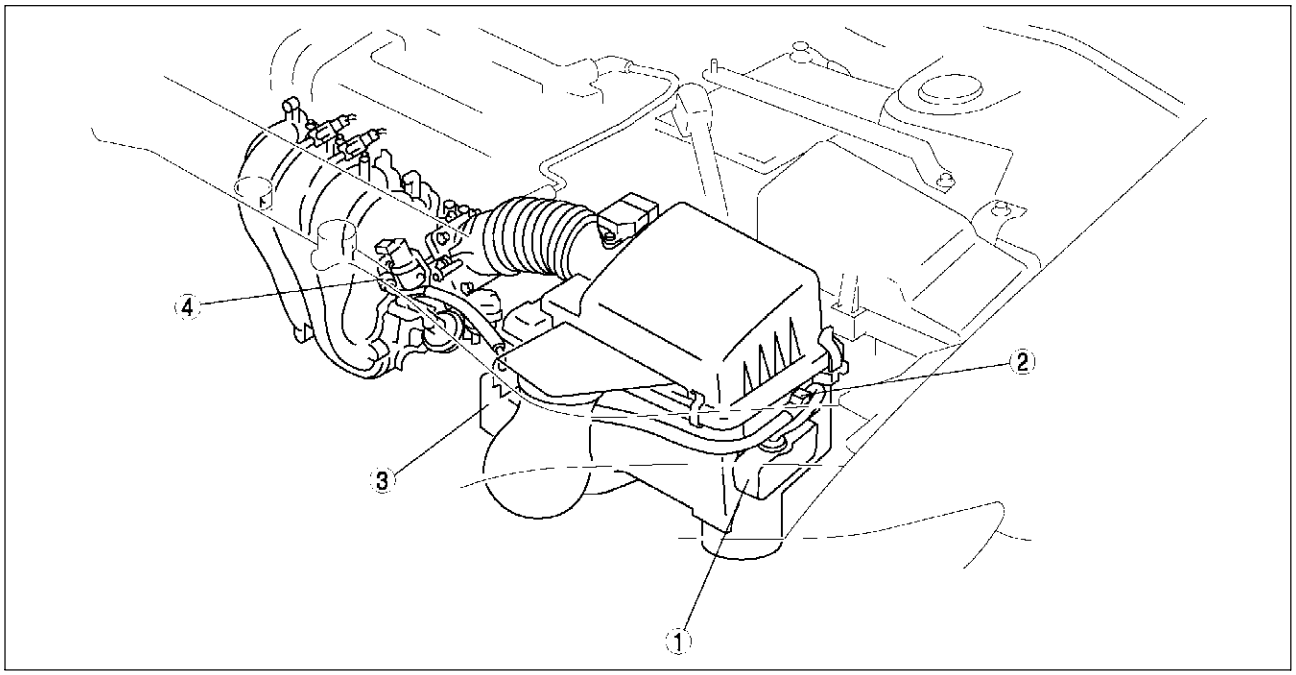
A6E391013000T03

Outline

- The VAD control system opens the VAD shutter valve in the air cleaner only at high engine speeds not decrease at high engine speeds due to insufficient mass airflow amount.

Structure

- The VAD system is composed of VAD shutter valve, VAD control solenoid valve, VAD vacuum chamber, VAD check valve (one-way).



A6E3910W029

1	VAD shutter valve	3	VAD vacuum chamber
2	VAD control solenoid valve	4	VAD check valve (one-way)

VARIABLE AIR DUCT (VAD) SHUTTER VALVE DESCRIPTION (L3)

A6E391013000T04

Function

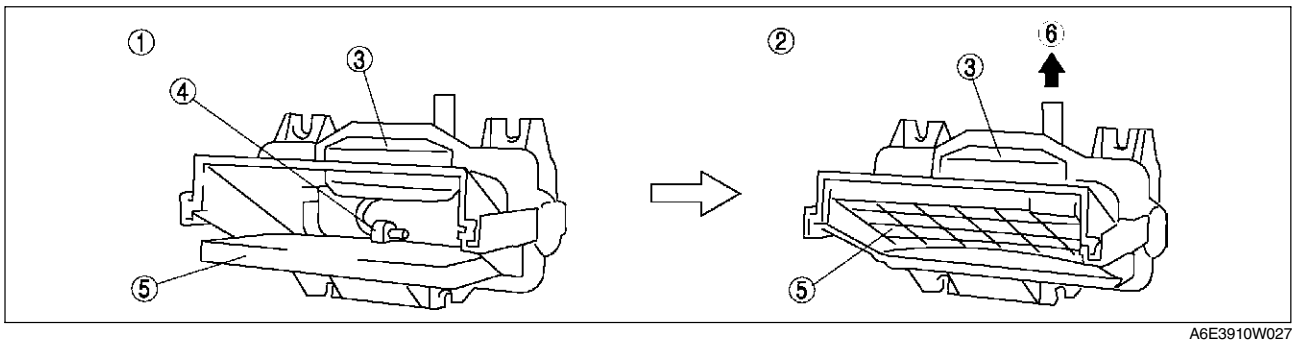
- Opens and closes the shutter valves.

Structure

- The VAD shutter valve actuator is composed of a rod, diaphragm chamber, and spring.

Operation

- Normally, the rod is pushed by the force of the spring, opening the shutter valve. When intake manifold vacuum is applied to the diaphragm chamber, the rod is pulled, closing the shutter valve.



A6E3910W027

1	Shutter valve open	4	Rod
2	Shutter valve close	5	VAD shutter valve
3	VAD shutter valve actuator	6	Intake manifold vacuum

VARIABLE AIR DUCT (VAD) SOLENOID VALVE DESCRIPTION (L3)

A6E391013000T05

Function

- Switches the intake manifold vacuum passage between the intake manifold and the actuator.

Structure

- Composed of a solenoid coil, spring, plunger, and filter.

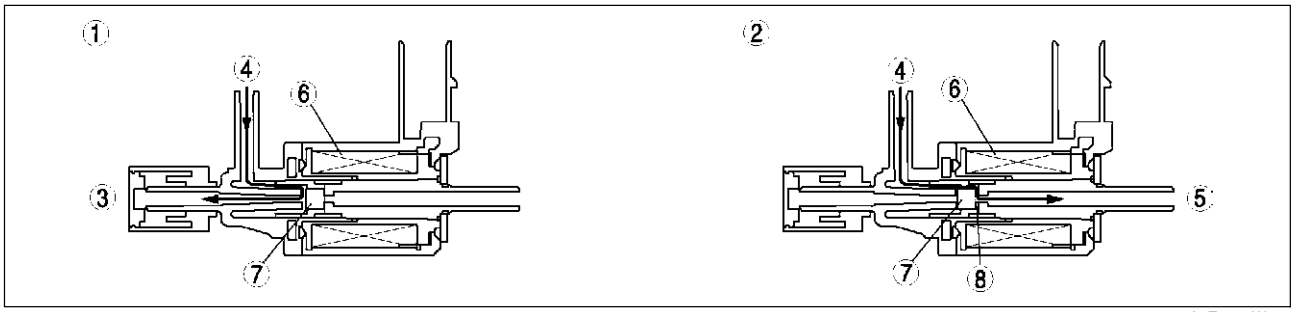
Operation

Energized

- The plunger is pulled back to open the air passage between the A and B ports, which applies the atmosphere to the VAD shutter valve actuator.

De-energized

- The plunger is returned forward to open the air passage between the B and C ports, which applies the intake manifold vacuum VAD shutter valve actuator.



A6E3910W026

1	Energized
2	De-energized
3	Port A (to atmosphere)
4	Port B (to actuator)

5	Port C (to intake manifold)
6	Coil
7	Plunger
8	Spring

VARIABLE AIR DUCT (VAD) CHECK VALVE (ONE-WAY) DESCRIPTION (L3)

A6E391013000T06

Function

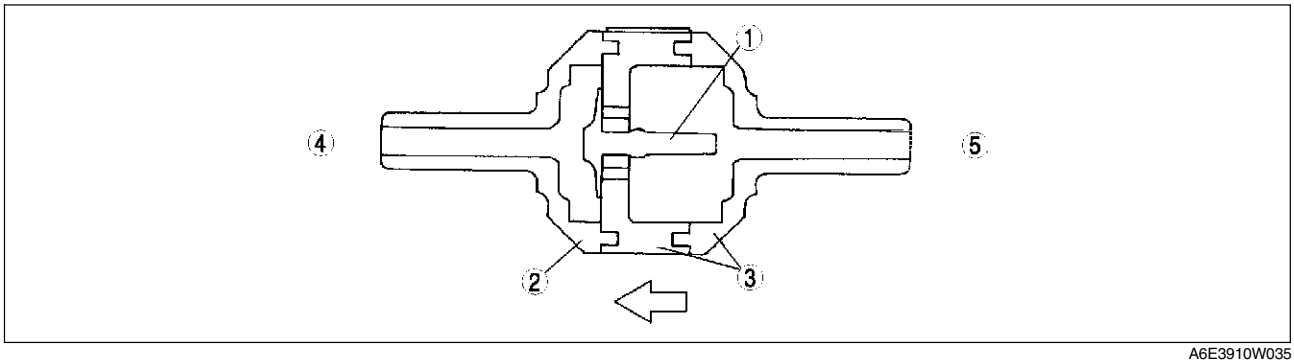
- The VAD check valve (one-way) maintain the vacuum in the VAD vacuum chamber.

Structure

- The VAD check valve (one-way) is composed of a valve.

Operation

- The VAD check valve (one-way) allows air flow only from VAD vacuum chamber to intake manifold.



A6E3910W035

1	Check valve
2	Green
3	White

4	Intake manifold
5	VAD vacuum chamber

FUEL SYSTEM

FUEL SYSTEM OUTLINE

A6E391201006T01

- The function, structure and operation of each part in the fuel system of the Mazda6 (GG) L3 engine model are the same as those of the 323 (BJ) FS engine models except for the following:
  — Mechanical returnless fuel system has been adopted.

× : Applied

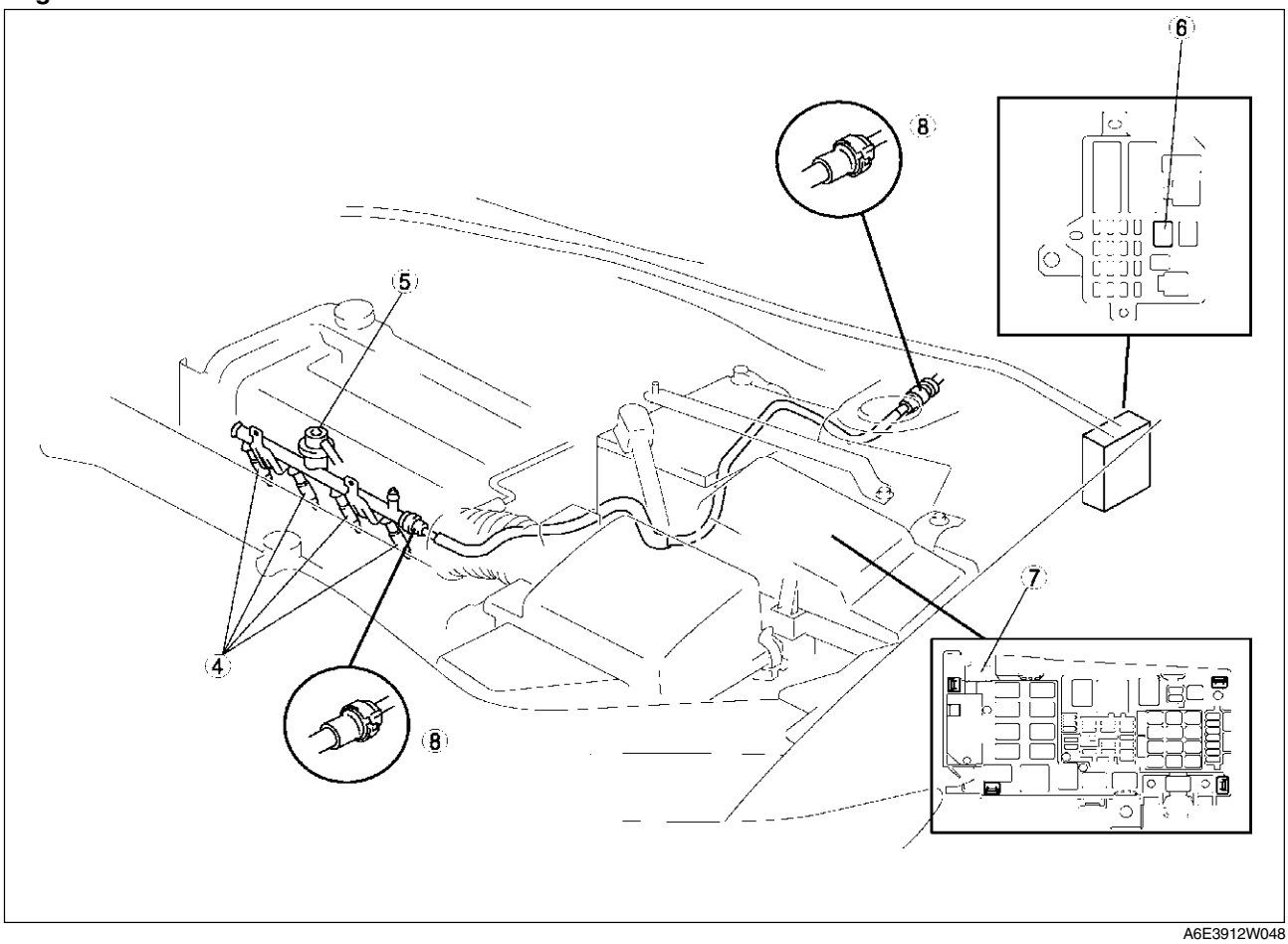
Item	Mazda6 (GG)			323 (BJ) FS	Remark for new model
	L3	LF	L8		
Fuel tank	×				Same as current 323 (BJ) FS engine models
Fuel pump unit (Built-in fuel filter (high-and low-pressure))	×				New part adopted
Quick release connector (fuel distributor side)	×				Same as current 323 (BJ) FS engine models (fuel distributor side)
Quick release connector (fuel tank side)	×				
Quick release connector (engine room side)	×				
Pulsation dumper	×				Same as current 323 (BJ) FS engine models
Pressure regulator	×				Integrated pressure regulator with the fuel pump unit
Fuel injector	×				Same as current 323 (BJ) FS engine models
Nonreturn valve	×				Same as current 323 (BJ) FS engine models

F

FUEL SYSTEM STRUCTURAL VEW

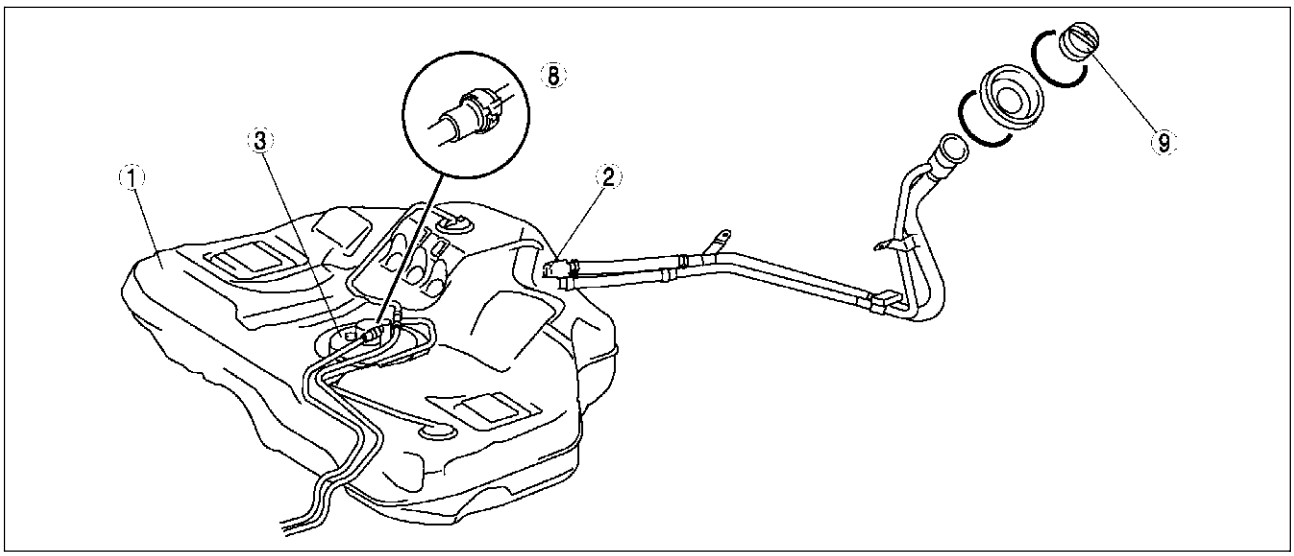
A6E391201006T02

Engine Room Side



A6E3912W048

Fuel tank side



A6E3912W049

1	Fuel tank
2	Nonreturn valve
3	Fuel pump unit
4	Fuel injector
5	Pulsation damper

6	Fuel pump relay
7	Check connector
8	Quick release connector
9	Fuel filler cap

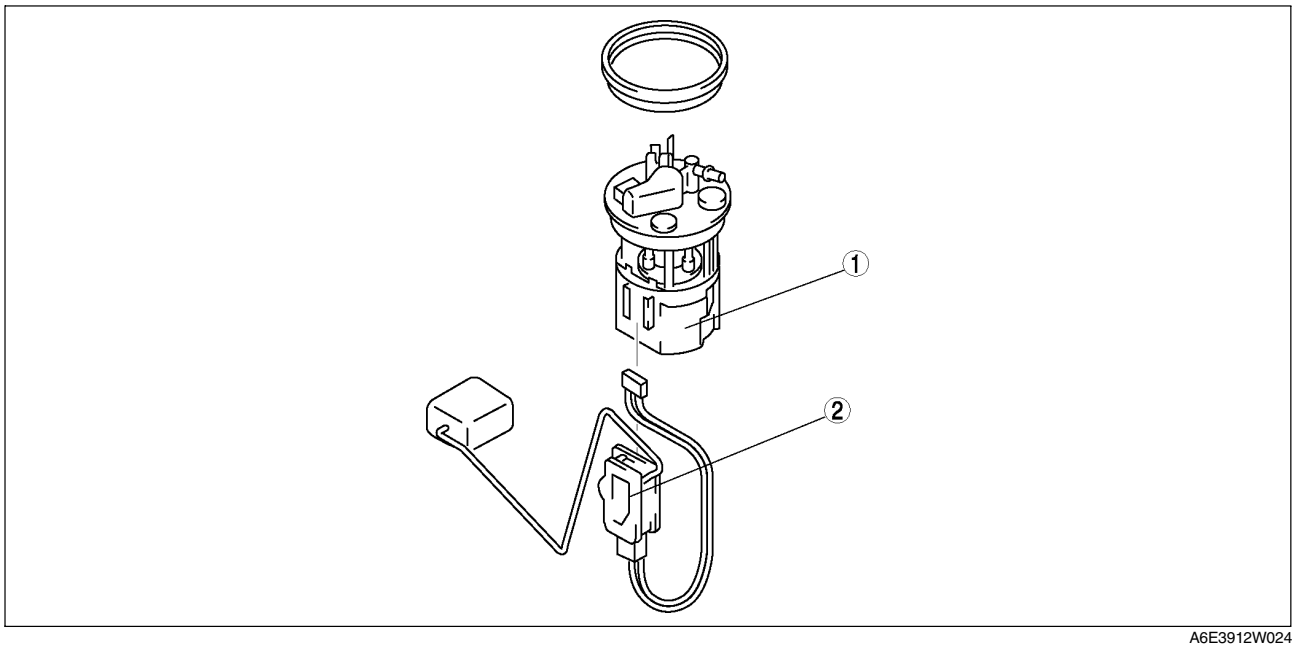
FUEL PUMP UNIT DESCRIPTION

A6E391213350T01

Note
- It is normal to hear the fuel pump operating when the ignition switch is turned to the ON position.

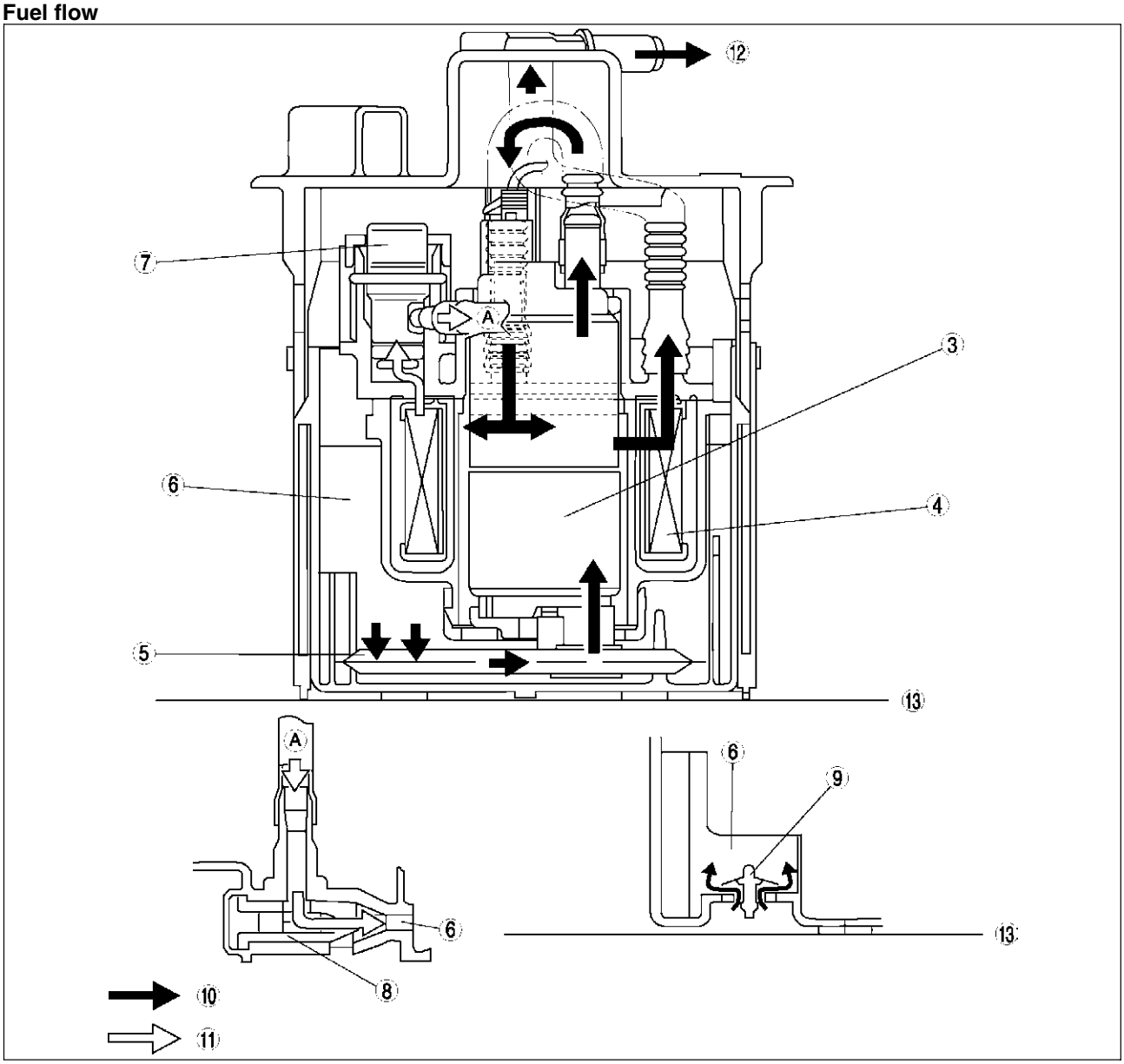
Function
- Due to the adoption of the mechanical returnless fuel system.
- The fuel pump unit, except for the fuel gauge sender unit, is integrated for confidentiality protection.
- To prevent decreased engine output from a lack of fuel supply when the vehicle is turning, the fuel pump has been designed so the fuel supply always remains constant in the fuel reservoir cup.
- Fuel stored in the fuel reservoir cup is supplied from two lines: the check valve (one-way) and the jet pump.

Structure



A6E3912W024

Fuel flow



A6E3912W035

1	Fuel pump unit
2	Fuel gauge sender unit
3	Fuel pump
4	Fuel filter (high-pressure)
5	Fuel filter (low-pressure)
6	Fuel reservoir cup
7	Pressure regulator

8	Fuel jet pump
9	One-way valve
10	Main fuel flow
11	Return fuel flow
12	To fuel distributor
13	Fuel tank

EXHAUST SYSTEM

EXHAUST SYSTEM OUTLINE

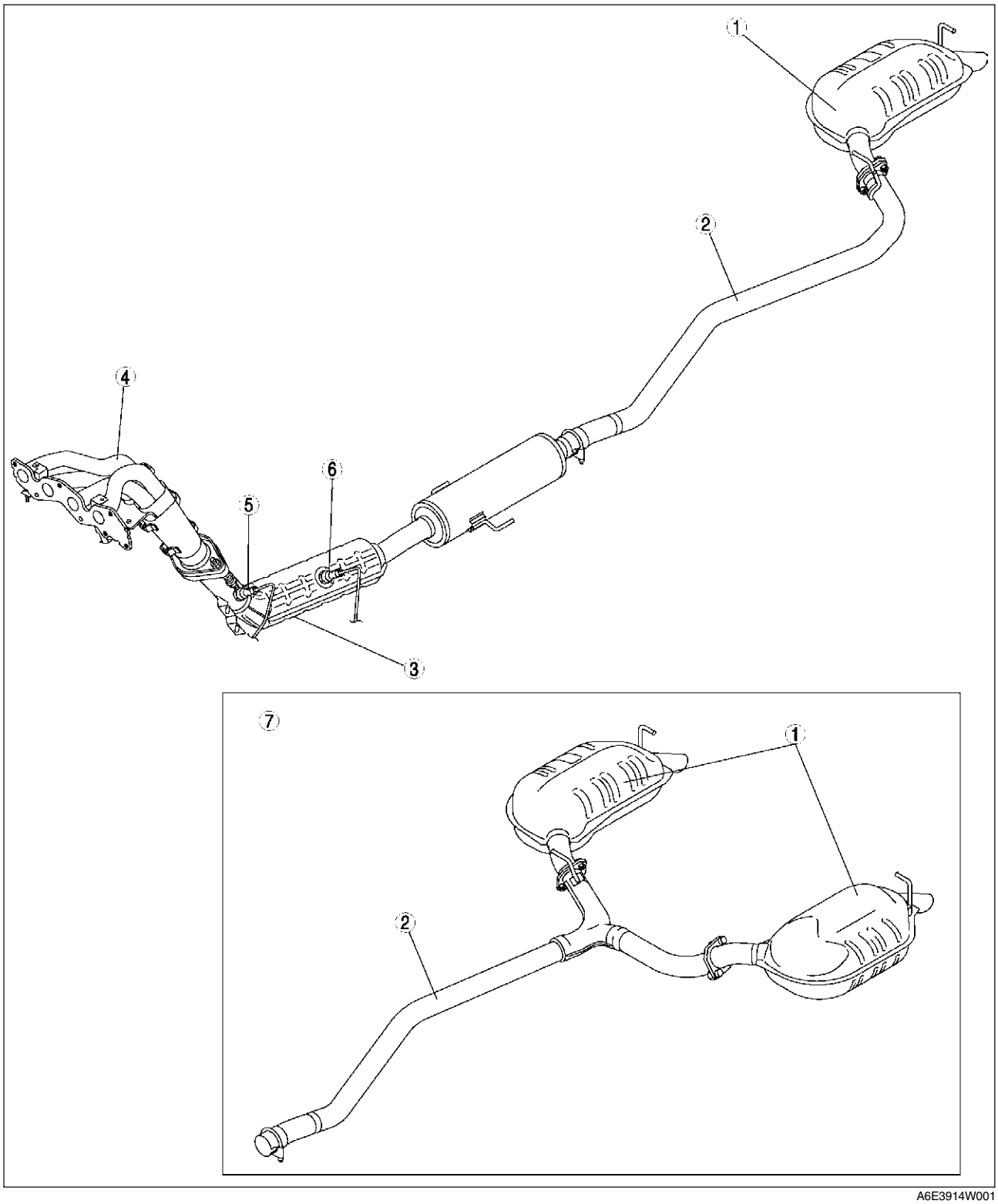
A6E391440000T01

Features

- The exhaust manifold is located behind the engine.
- This layout allows for shorter exhaust pipes and improved exhaust efficiency. Moreover, due to the shorter distance to the catalytic converter, temperature decrease of exhaust emission is prevented and catalyst is more efficient.
- Temperature decrease of exhaust emission is further prevented with double layer exhaust manifold pipes.

EXHAUST SYSTEM STRUCTURAL VIEW

A6E391440000T02



A6E3914W001

1	Main silencer
2	Middle pipe
3	TWC
4	Exhaust manifold

5	HO2S (front)
6	HO2S (rear)
7	L3 engine model

EMISSION SYSTEM

OUTLINE

A6E391601007T01

- The function, structure and operation of each part in the emission system of the Mazda6 (GG) L3, LF, and L8 engine models are the same as those of the MPV (LW) FS engine models, except for the following:
  — Charcoal canister has been changed.
  — The pulsation reduce chamber has been adopted. (R.H.D.)

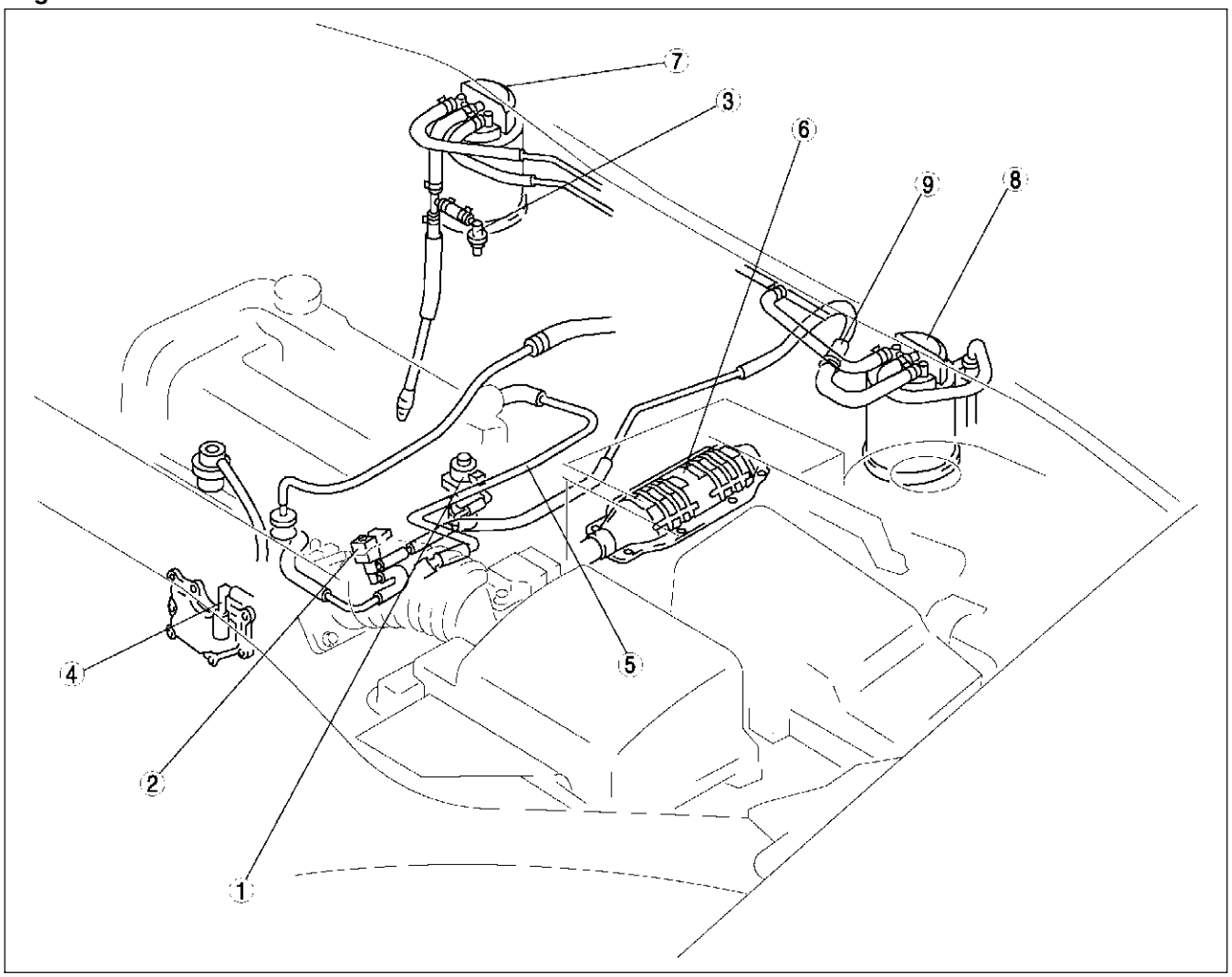
×: Applied
–: Not applied

Item	Mazda6 (GG)			Current MPV (LW) FS	Remark for new model
	L3	LF	L8		
Rollover valve	×				Same as current MPV (LW) FS engine models
Charcoal canister	×				Same as current MPV (LW) FS engine models
Evaporative gas check valve (one-way)	×				Same as current MPV (LW) FS engine models
Purge solenoid valve	×				Same as current MPV (LW) FS engine models
PCV valve	×				Same function and operation as current MPV (LW) FS engine models
TWC	×				Same function as current MPV (LW) FS engine models
EGR valve	×				Same function and operation as current MPV (LW) FS engine models
Pulsation reduce chamber (R.H.D.)	×			–	Newly adopted

EMISSION SYSTEM STRUCTURAL VIEW

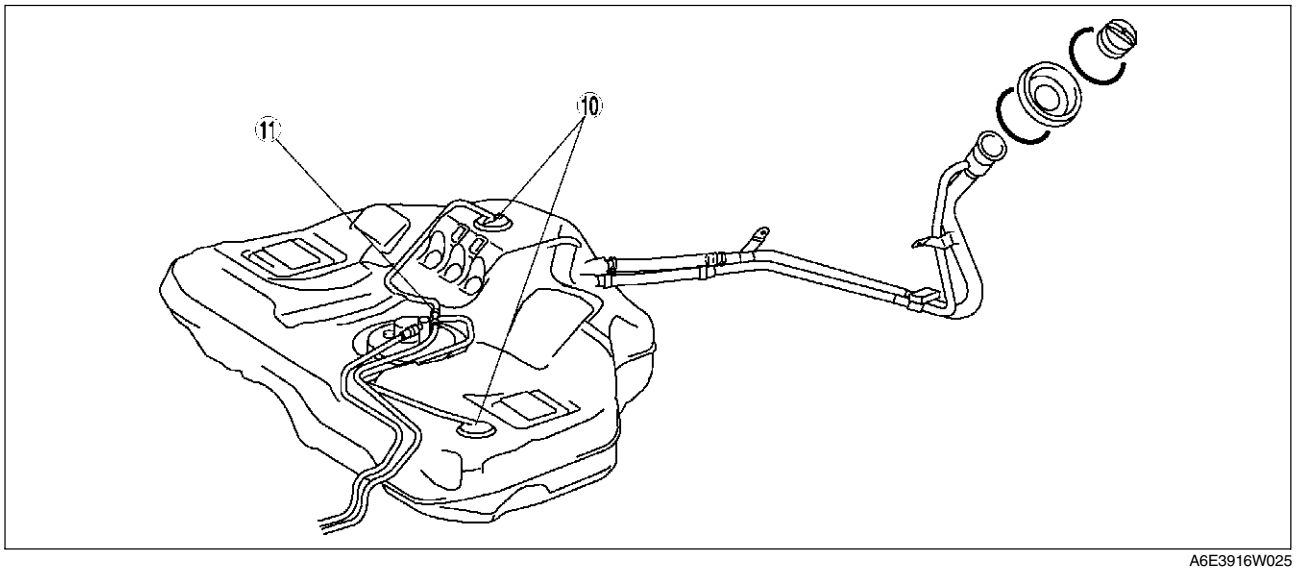
A6E391601007T02

Engine room side



A6E3916W024

Fuel tank side



A6E3916W025

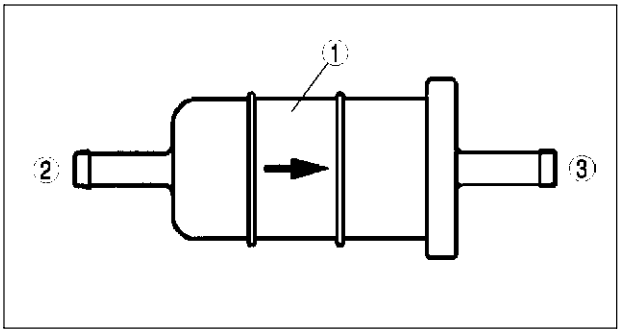
1	EGR valve
2	Purge solenoid valve
3	Evaporative gas check valve (one-way) (L.H.D.)
4	PCV valve
5	Ventilation hose
6	TWC
7	Charcoal canister (L.H.D.)
8	Charcoal canister (R.H.D.)
9	Pulsation reduce chamber (R.H.D.)
10	Rollover valve
11	Check valve (two-way)

PULSATION REDUCE CHAMBER DESCRIPTION

- A pulsation reduce chamber has been adopted between the purge solenoid valve and the charcoal canister to eliminate pulsation that occurs during the purge solenoid valve operation, preventing the pulsation from being transmitted to the charcoal canister.

1	Pulsation reduce chamber
2	To purge solenoid valve
3	To charcoal canister

A6E391601007T03



A6E3916W022

THREE-WAY CATALYTIC CONVERTER (TWC) DESCRIPTION

A6E391620500T01

Features

- Due to the shorter distance to the catalytic converter, temperature decrease of exhaust emission is prevented and catalyst is more efficient.
- Temperature decrease of exhaust emission is further prevented with double layered exhaust manifold pipes.

CONTROL SYSTEM

OUTLINE

A6E394018881T01

- The construction and operation of the Mazda6 (GG) is essentially carried over from that of the current MPV (LW) FS engine model, except for the following.

New Devices
- MAP sensor which monitoring the intake manifold absolute pressure is the same function as BARO sensor.

Similar Devices
CKP sensor
- Output wave form is different.

CMP sensor
- Output wave form is different.

New Systems
Variable air duct control
- To improve the engine performance at high engine speed.

Controller area network (CAN)
- To simplify the system.

Similar Systems
Idle air control (IAC)
- Same function as MPV (LW) FS engine model except for the followings.
  - — Adopt the MAP factor to the feedback correction to improve the precise control.
  - — Idle speed is different to match the vehicle characteristics.

Variable intake-air system (VIS)
- Same function as VICS but operation condition is different to match the vehicle characteristics.

Variable tumble control system (VTCS)
- Same function as MX-5 (NB) but operation condition is different to match the vehicle characteristics.

Variable valve timing control system
- Same function as MX-5 (NB) but operation condition is different to match the vehicle characteristics.

Fuel injection control
- Same function as MPV (LW) FS engine model except for the following.
  - — Adopt the BARO correction to improve the precise control.
  - — Adopt the Rear HO2S feedback correction to improve the emission performance.

Electronic spark advance (ESA) control
- Same control as 626 (GF) FS engine model

Purge control
- Adopt the BARO correction to improve the emission performance

Heated oxygen sensor heater control
- Same control as 323 (BJ) FS engine model

A/C cut-off control
- Operation condition is different to match the vehicle characteristics.

Immobilizer system
- Same function as MPV (LW) FS engine model however it equipped into PCM to simplify the system.

Input Device

×:Applied
—: Not applied

Item	Signal	Mazda6 (GG)	Current MPV (LW) FS	Remark for new model
MAF/IAT sensor	MAF and IAT	×		Same as 323 (BJ) ZM engine model
TP sensor	TP	×		Same function as MPV (LW) FS engine model
MAP sensor	MAP	×	—	Same function as BARO sensor of MPV (LW) FS engine model
ECT sensor	ECT	×		Same function as MPV (LW) FS engine model
CMP sensor	Cylinder identification	×		Same function as MPV (LW) FS engine model Output wave form is different.
CKP sensor	Engine revolution	×		Same function as MPV (LW) FS engine model Output wave form is different.
Knock sensor	Knocking	×		Same function as MPV (LW) FS engine model
HO2S (Front, Rear)	Oxygen concentration	×		Same function as MPV (LW) FS engine model
BARO sensor	BARO	×		Same as MPV (LW) FS engine model
Neutral switch	Load/no load distinction	×		Same as MPV (LW) FS engine model
Clutch switch	Load/no load distinction	×		Same as MPV (LW) FS engine model
Brake switch	Brake pedal condition	×		Same as MPV (LW) FS engine model
PSP switch	P/S oil pump load condition	×		Same function as MPV (LW) FS engine model
VSS	Vehicle speed	×		Same as MPV (LW) FS engine model
A/C switch, refrigerant pressure switch (high, low pressure)	A/C operational	×		Same as MPV (LW) FS engine model
Refrigerant pressure switch (middle pressure)	A/C compressor load	×		Same as MPV (LW) FS engine model
Battery	Battery voltage	×		Same as MPV (LW) FS engine model
Generation voltage (Generator terminal P)	Generation voltage	×		Same as MPV (LW) FS engine model
Immobilizer unit	Immobilizer system communication	×		Same function as MPV (LW) FS engine model

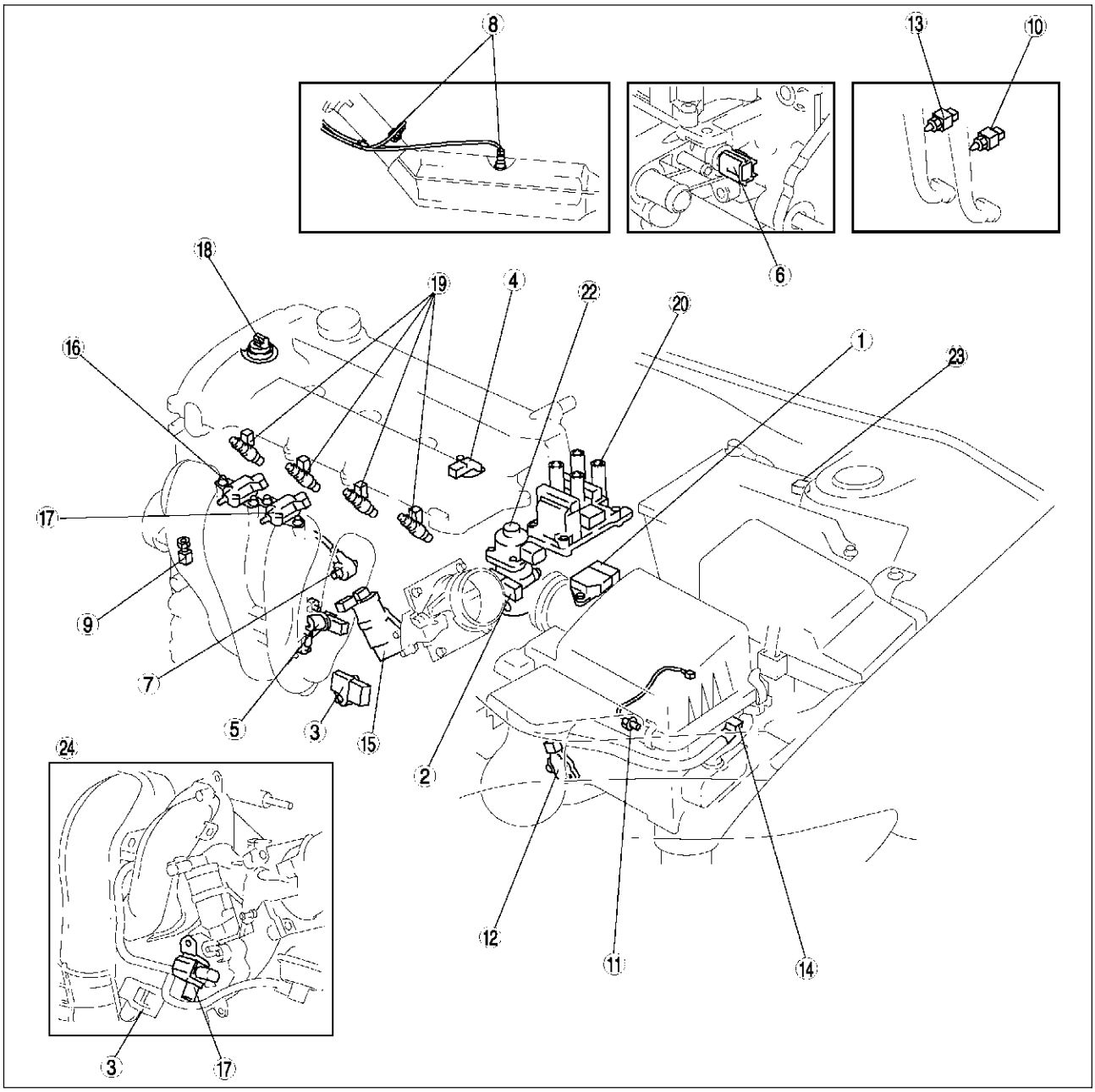
Output Device

×:Applied
—: Not applied

Item	Signal	Mazda6 (GG)	Current MPV (LW) FS	Remark for new model
IAC valve	IAC	×		Same function as MPV (LW) FS engine model Idle speed is different to match vehicle characteristics.
VIS solenoid valve	VIS	×		Same function as VICS of MPV (LW) FS engine model Operation condition is different.
VTCS solenoid valve	VTCS	×	—	Same function as MX-5 (NB) Operation condition is different.
Oil control valve (OCV)	Variable valve timing control	×	—	Same function as MX-5 (NB) Operation condition is different.
Fuel injector	Fuel injection control	×		Same function as MPV (LW) FS engine model Fuel injection timing is different. Add BARO correction Add Rear HO2S feedback correction
Fuel pump relay	Fuel pump control	×		Same as MPV (LW) FS engine model
Ignition coil	ESA control	×		Same as 626 (GF) FS engine model
EGR valve	EGR control	×		Same as MPV (LW) FS engine model
Purge solenoid valve	Purge control	×		Same function as MPV (LW) FS engine model Add BARO correction
Heated oxygen sensor heater (Front, rear)	O2S heater control	×		Same as 323 (BJ) FS engine model
Field coil (Generator terminal D)	Generator control	×		Same as MPV (LW) FS engine model
Cooling fan relay	Electric fan control	×	—	New system adopted
A/C relay	A/C cut-off control	×		Same function as MPV (LW) FS engine model Operation condition is different.
Controller area network (CAN)	Information function	×	—	New system adopted

STRUCTURAL VIEW

A6E394018881T02



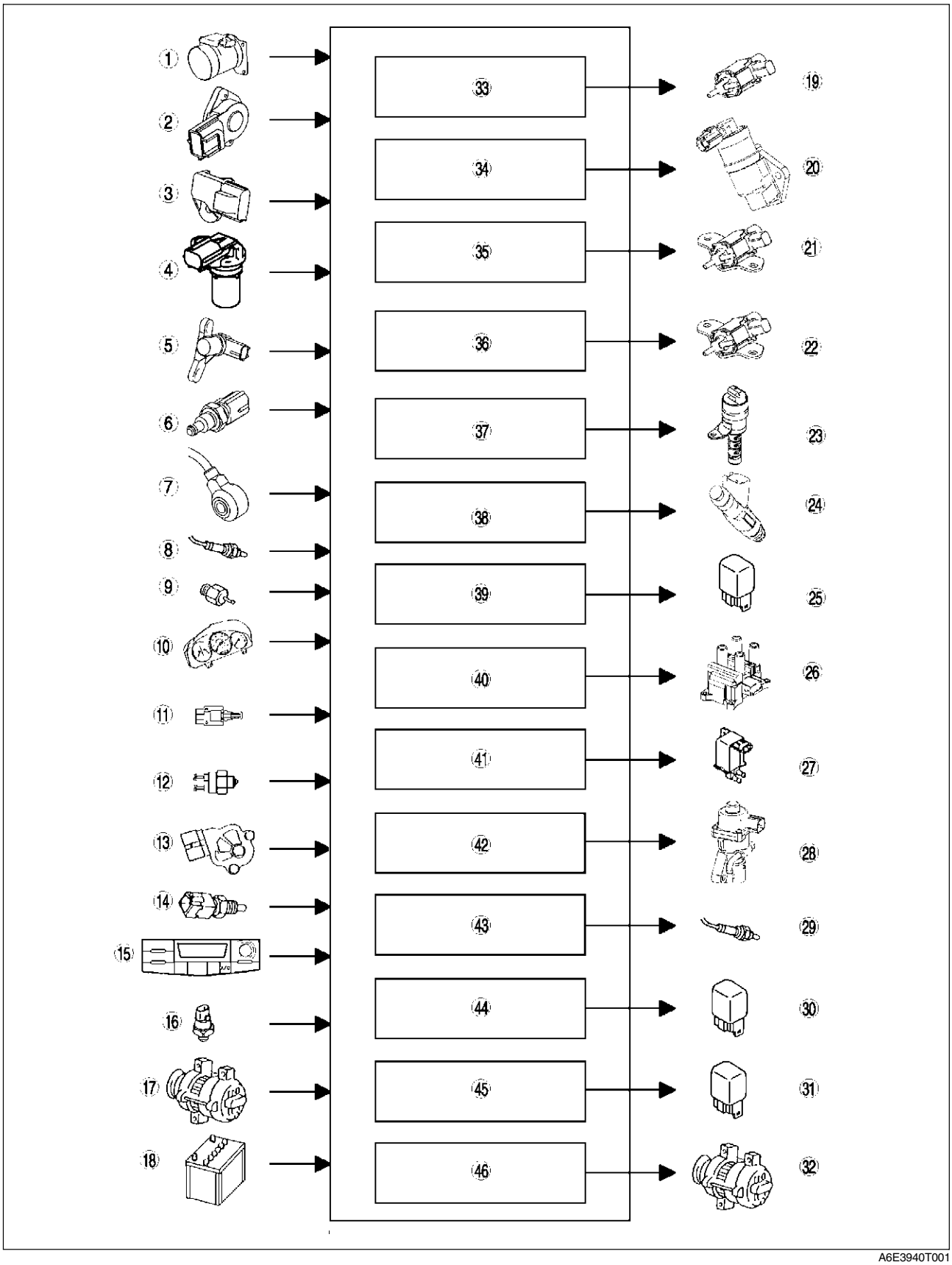
A6E3940T000

1	MAF/IAT sensor
2	TP sensor
3	MAP sensor
4	CMP sensor
5	CKP sensor
6	ECT sensor
7	Knock sensor
8	HO2S (front, rear)
9	P/S pressure switch
10	Clutch switch
11	Neutral switch
12	TR switch

13	Brake switch
14	VAD control solenoid valve
15	IAC valve
16	VIC solenoid valve
17	VTCS solenoid valve
18	OCV
19	Fuel injector
20	Ignition coil
21	Purge valve
22	EGR valve
23	BARO sensor
24	LF and L8 engine models

BLOCK DIAGRAM

A6E394018881T03



A6E3940T001

1	MAF/IAT sensor
2	TP sensor
3	MAP sensor
4	CMP sensor
5	CKP sensor
6	ECT sensor
7	Knock sensor
8	HO2S (front, rear)
9	P/S pressure switch
10	Vehicle speedometer sensor
11	Clutch switch
12	Neutral switch
13	TR switch
14	Brake switch
15	A/C switch
16	Refrigerant pressure switch
17	Generator (terminal P: generation voltage)
18	Battery
19	VAD control solenoid valve
20	IAC valve
21	VIC solenoid valve
22	VTCS solenoid valve
23	OCV

24	Fuel injector
25	Fuel pump relay
26	Ignition coil
27	Purge valve
28	EGR valve
29	Oxygen sensor heater (front, rear)
30	A/C relay
31	Cooling fan relay
32	Generator (terminal D: field coil)
33	VAD control
34	IAC
35	VIC
36	VTCS
37	Variable valve timing control
38	Fuel injection control
39	Fuel pump control
40	Electronic spark advance (ESA) control
41	Purge control
42	EGR control
43	Oxygen sensor heater control
44	A/C cut-off control
45	Electrical fan control
46	Generator control

CONTROL DEVICES AND CONTROL RELATIONSHIP CHART

A6E394018881T04

Engine Control System
Input devices

x: Applicable

Component	Idle air control (IAC)	Variable air duct (VAD) control	Variable intake-air control	Variable tumble control system (VTCS)	Variable valve timing control	Fuel injection control	Fuel pump control	Electronic spark advance (ESA) control	Purge control	EGR control	Front HO2S heater control	Rear HO2S heater control	A/C cut-off control	Electrical fan control	Generator control	Traction control	Immobilizer system
IAT sensor	x					x		x		x	x	x	x		×		
MAF sensor	x				x	x		x	x	x	x	x					
TP sensor	x	x		x	x	x		x		x	x						
MAP sensor	x					x											
ECT sensor	x	x		x	x	x		x	x	x	x	x		x			
CMP sensor					x	x											
CKP sensor	x	x	x	x	x	x	x	x	x	x	x	x	x				
Knock sensor								x									
Front HO2S						x			x								
Rear HO2S						x											
BARO sensor									x								
Neutral switch	x					x		x	x								
Clutch switch	x					x		x	x				x				
TR switch	x					x		x	x				x				
Brake switch																	
PSP switch	x					x		x									
VSS										×							
A/C switch, refrigerant pressure switch (high, low pressure)	x					x		x					×	×			
Refrigerant pressure switch (middle pressure)														×			
Battery voltage						x		x	x						×		
Generator terminal P (Generation voltage)	x					x		x							×		
ABS/TCS HU/CM																×	
Coil																	×

Output devices

×: Applicable

Component	Idle air control (IAC)	Variable air duct (VAD) control	Variable intake-air control	Variable tumble control system (VTCS)	Variable valve timing control	Fuel injection control	Fuel pump control	Electronic spark advance (ESA) control	Purge control	EGR control	Front HO2S heater control	Rear HO2S heater control	A/C cut-off control	Electrical fan control	Generator control	Traction control	Immobilizer system
IAC valve	×																
VAD control solenoid valve		×															
VIC solenoid valve			×														
VTCS solenoid valve				×													
Oil control valve (OCV)					×												
Fuel injectors						×											×
Fuel pump relay							×										
Ignition coil								×									×
Purge solenoid valve									×								
EGR valve										×							
HO2S heaters											×	×					
A/C relay													×				
Cooling fan relay														×			
Generator (terminal D: field coil)															×		
ABS/TCS HU/CM																×	

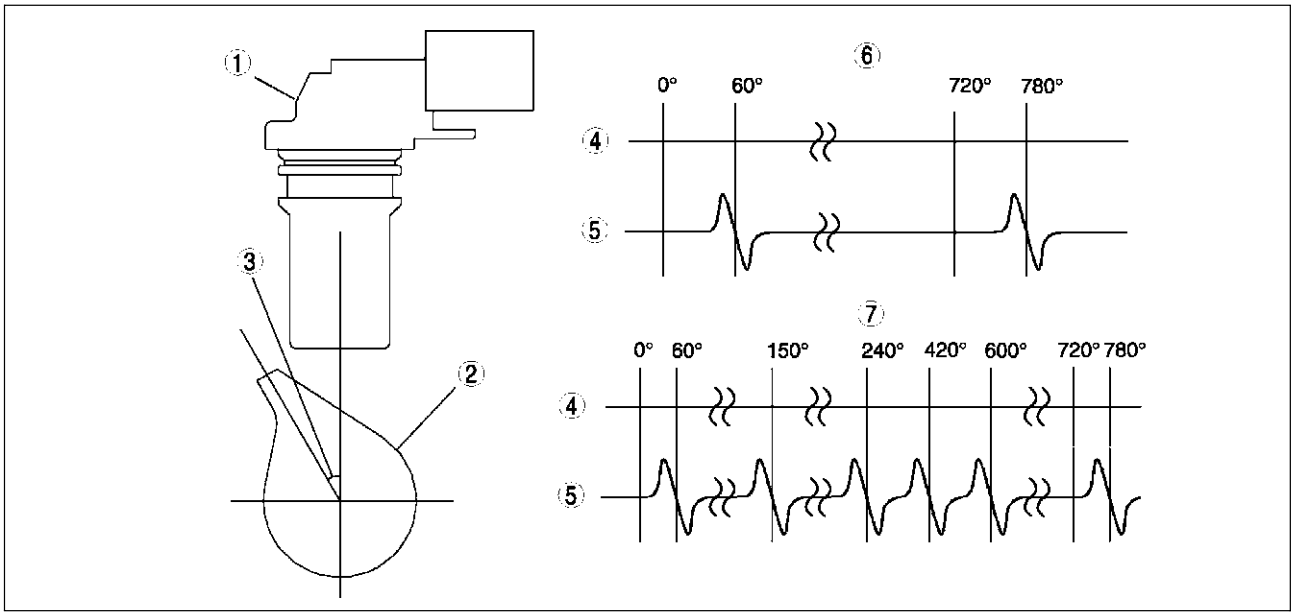
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CAMSHAFT POSITION (CMP) SENSOR

A6E394018881T05

Outline

- For cylinder identification, the CMP sensor detects a camshaft angle of **30 degree** after the top dead center in cylinder No. 1.
- The wave form of CMP sensor output is shown in the figure.



A6E3940T021

1	CMP sensor
2	Camshaft for inlet valve
3	Camshaft angle **30 degree**
4	Crankshaft angle

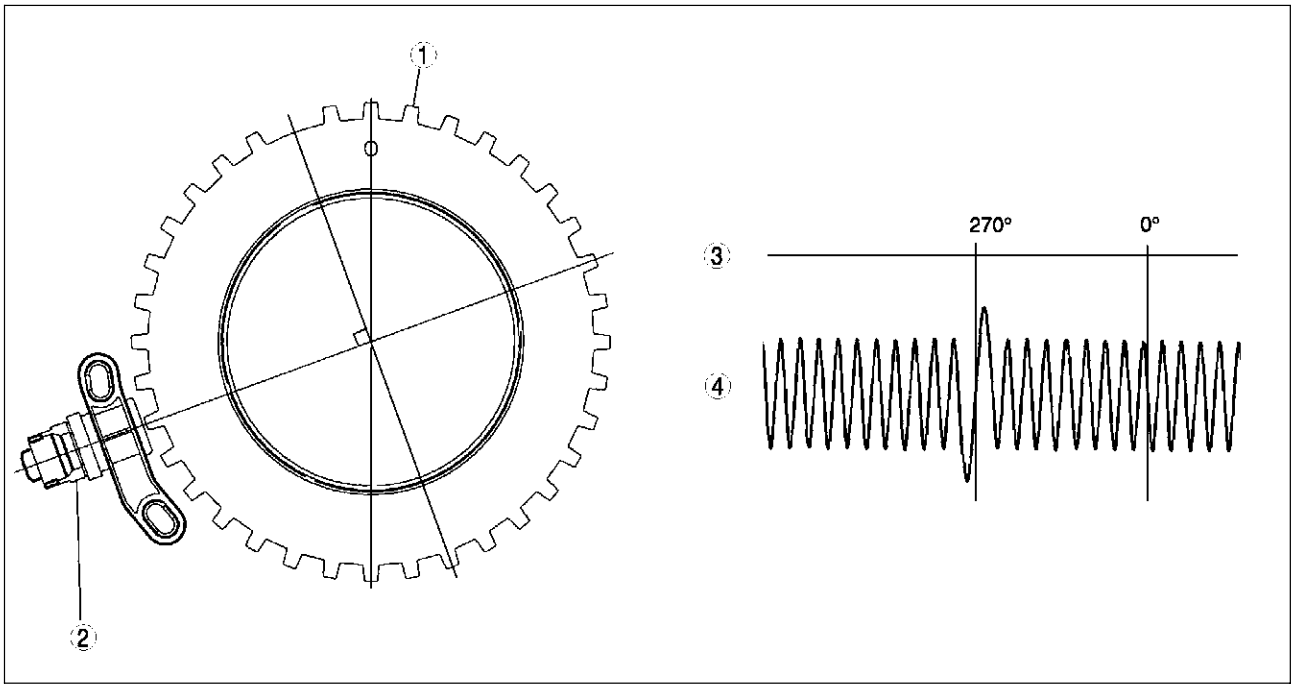
5	CMP sensor output signal
6	LF and L8 engine model
7	L3 engine model

CRANKSHAFT POSITION (CKP) SENSOR

A6E394018881T06

Outline

- For detecting the crankshaft angle, the CKP sensor detects pulsation signals from pulse wheel.
- The wave form of CKP sensor output is shown in the figure.



A6E3940T022

1	Pulse wheel
2	CKP sensor

3	Crankshaft angle
4	CKP sensor output signal

IDLE AIR CONTROL (IAC)

A6E394018881T07

Outline

- The IAC of the Mazda6 (GG) is essentially carried over from the current MPV (LW) FS engine models except for the followings.
  - — Add the MAP factor to the feedback correction
  - — Target engine speed is different caused to match the vehicle characteristics.

Target Engine Speed

Condition	Idle speed (rpm)			
	L8	LF MTX	LF ATX	L3
No load	700	650	700	650
Electrical load is on.*1	700	700	700	700
P/S is operating.	750	700	700	700
A/C is operating.*2 (Middle pressure switch OFF or Not equipped)	750	750	700	750
A/C is operating.*2 (Middle pressure switch ON if equipped)	750	750	750	750

*1 : Headlight is on, fan switch is above 1st, cooling fan is operating, and rear window defroster is on.

*2 : A/C switch and fan switch are on.

VARIABLE AIR DUCT (VAD) CONTROL

A6E394018881T08

Outline

- The VAD control system opens the VAD shutter valve in the air cleaner only at high engine speeds so that engine performance does not decrease at high engine speeds due to insufficient mass airflow amount.

Operation

- The PCM turns the VAD control solenoid valve ON to open the VAD shutter valve when all of the following conditions have been met.
  - — ECT: **above 70 °C [158 °F]**
  - — Engine speed: **above 5,800 rpm**
  - — TP angle: **above 50%**

VARIABLE INTAKE-AIR SYSTEM

A6E394018881T09

Outline

- The VIS system of the Mazda6 (GG) is essentially carried over from the VICS of the current MPV (LW) FS engine models except for operation conditions.

Operation Conditions

- The PCM energized/de-energized the VIS solenoid valve at the engine speed of **approx 4,400 rpm**.

VARIABLE TUMBLE CONTROL SYSTEM (VTCS)

A6E394018881T10

Outline

- The VTCS actuates the VTCS shutter valve in the intake manifold to increase the intake air flowing speed and create the tumbling air in the combustion chamber for better injected fuel atomization, thus reduces the HC and CO exhaust emissions at light load.

Operation Conditions
- The PCM turns the VTCS solenoid valve ON to close the VTCS shutter valve in the intake manifold when all of the following conditions are met:
  — Engine speed: **below 3,750 rpm**
  — Throttle opening angle is below as followings:
  Below 1,500 rpm: CTP
  Between 2,000 rpm and 3,000 rpm: **26—29%**
  Above 2,500 rpm: WOT
  — ECT **below 63 °C [145 °F]**
- The PCM turns the VTCS solenoid valve OFF for maintaining the startability and stability during the engine cranking and for **0.2 second** after engine started.

VARIABLE VALVE TIMING CONTROL

A6E394018881T11

Outline
- The variable valve timing control of the Mazda6 (GG) is essentially carried over from the current MX-5 (NB) except execution condition for the cleaning mode and maximum cam retard mode to match the vehicle characteristics.

Execution condition
Cleaning mode
- When all of the following conditions are met.
  — Decrease the engine speed with CTP
  — Engine speed: **between 2,250 rpm and 3,500 rpm**
  — ECT: **above 80 °C [176 °F]**

Maximum cam retard mode
- When any of the following conditions are met.
  — Cranking
  — Engine speed: **below 970 rpm**
  — ECT: **below 18 °C [64 °F]**
  — Target valve timing: **0**
  — Torque reduction is activating by TCS

FUEL INJECTION CONTROL

A6E394018881T12

Outline
- There are two types of injection timing control: “synchronized injection” and “non-synchronized injection.”
- BARO and rear oxygen sensor feedback correction has been added.

Injection Timing
Synchronized injection
- PCM determines fuel injection timing and amount synchronized with the crank angle, and based on the following signals during the intake/exhaust stroke of each cylinder.
  — CKP, MAF, ECT, IAT

Non-synchronized injection
- PCM determines fuel injection timing and amount based on the following signals (not synchronized with the crankangle).
  — TP, MAF, ECT, IAT

Correction
BARO correction
- Purpose: to maintain the engine stability
- Conditions: at all time
- Action: lower BARO, larger correction

Rear HO2S feedback correction
- Purpose: to control air/fuel ratio close to increase the performance of the catalytic converter
- Conditions: at feedback zone
- Action: Rear HO2S output voltage

A/C CUT-OFF CONTROL

A6E394018881T13

Outline
- The A/C cut-off control of the Mazda6 (GG) is essentially carried over from the current MPV (LW) FS engine model except for operation condition.

Operation Conditions

- While A/C is operating, the PCM cuts off the power supply to the A/C relay as shown below.

A/C cut-off condition	A/C cut-off time	Purpose
During cranking	For approx. 4.0 s	Startability improvement
Throttle valve is open more than 50%	For approx. 5.0 s	Acceleration performance improvement
ECT is above 113 °C {235 °F}	Alternates between on and off for 10 seconds until ECT falls to 107 °C {225 °F}	Engine reliability improvement
ECT is above 118 °C {244 °F}	Until engine ECT falls below 113 °C {235 °F}	

ELECTRIC FAN CONTROL

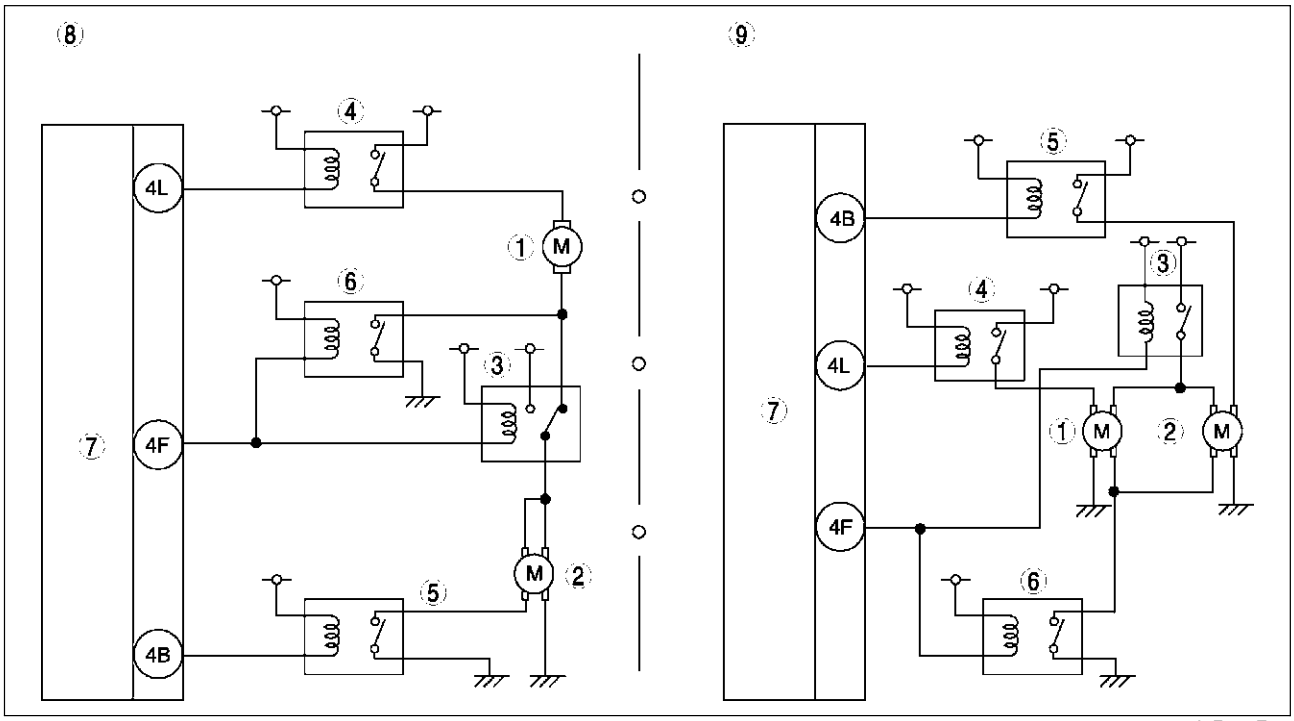
A6E394018881T14

Operation

L8, LF (Intensely hot area) and L3 engine models

ON: Energized
OFF: De-energized

Condition		PCM terminal 4L	PCM terminal 4B	PCM terminal 4F	Operation condition
Cooling fan motor No. 1	Cooling fan motor No. 2				
Stopped	Stopped	OFF	OFF	OFF	A/C: OFF ECT: below 100 °C [176 °F]
Low speed	Low speed	ON	ON	OFF	A/C: OFF ECT: 100—108 °C [212—226 °F]
High speed	High speed	ON	ON	ON	A/C: OFF ECT: above 108 °C [226 °F]
Low speed	Low speed	ON	ON	OFF	A/C: ON (middle switch OFF) ECT: below 108 °C [226 °F]
High speed	Middle speed	ON	OFF	ON	A/C: ON (middle switch ON) ECT: below 108 °C [226 °F]
High speed	High speed	ON	ON	ON	A/C: ON ECT: above 108 °C [226 °F]



A6E3940T220

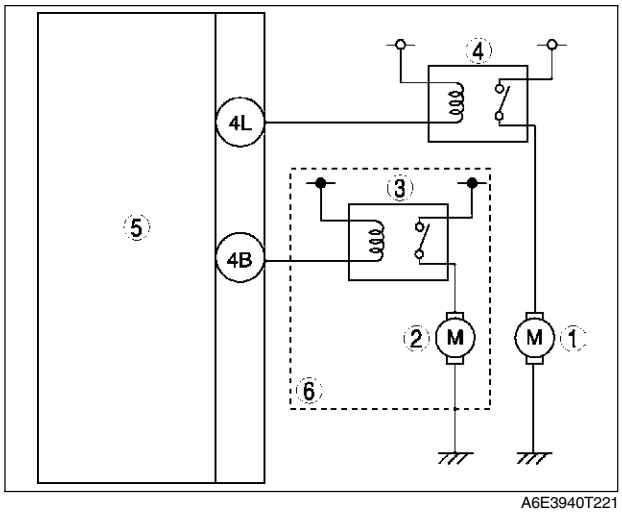
1	Cooling fan motor No. 1
2	Cooling fan motor No. 2
3	Cooling fan relay No. 1
4	Cooling fan relay No. 2
5	Cooling fan relay No. 3

6	Cooling fan relay No. 4
7	PCM
8	L3 engine models
9	LF, L8 engine models (Intensely hot area)

L8, LF (General area) engine models

1	Cooling fan motor No. 1
2	Cooling fan motor No. 2
3	Cooling fan relay No. 1
4	Cooling fan relay No. 2
5	PCM
6	With A/C system

- The PCM energized the cooling fan relay No. 1 and No. 2 (with A/C system) except all of following condition are met.
  — ECT: **below 100 °C [176 °F]**
  — A/C: OFF (with A/C system)



A6E3940T221

CONTROLLER AREA NETWORK (CAN)

A6E394018881T15

- PCM transmit/received the information in the CAN. For detail information of the CAN, see the “MULTIPLEX COMMUNICATION SYSTEM.” (See T–5 OUTLINE.)

Transmit Information
- Torque reduction inhibit
- Engine speed
- Vehicle Speed
- TP
- ECT
- Travelled distance
- Fuel injection amount
- MIL condition
- Generator warning light conditions
- Engine displacement
- Number of cylinders
- Air induction type
- Fuel type and delivery
- Country
- Transmission/axle type
- Tire circumference (front/rear)
- Desired gear/change lever position
- HOLD switch conditions

Received Information
- Wheel Speed from ABS HU/CM, ABS/TCS HU/CM, or DSC HU/CM
  - — Front Left
  - — Front right
  - — Rear left
  - — rear right
- Travelled distance from ABS HU/CM, ABS/TCS HU/CM, or DSC HU/CM
- Brake system status from ABS HU/CM, ABS/TCS HU/CM, or DSC HU/CM
- Torque reduction request from ABS/TCS HU/CM, or DSC HU/CM
- Brake system configuration from ABS HU/CM, ABS/TCS HU/CM, or DSC HU/CM

ON-BOARD DIAGNOSTIC

OUTLINE

A6E397018881T01

- The construction and operation of the on-board diagnostic system is essentially carried over from that of the current MPV (LW) GY/FS engine model, except for the following. (See MPV Workshop Manual supplement 1700-1*-00H.)
  - — DTCs, PID monitoring items, and simulation items have been changed to match the regulations. For the detail information of the regulations, refer to the “OBD Training Manual (3345-1E-00B).”
  - — KOEO/KOER self-test function has been adopted. Therefore, the present malfunction or a successful repair is readily confirmed.
  - — Pending code storage process has been changed as follows.
    1 drive cycle type
    - With the current MPV (LW) GY/FS engine model, pending codes are not available. With the new Mazda6 (GG), however, pending code is stored in the PCM during the drive cycle

    2 drive cycle type
    - With the current MPV (LW) GY/FS engine model, pending codes are deleted when a DTC is stored. With the new Mazda6 (GG), however, even if a DTC is stored, the PCM does not delete the pending code until a normal (malfunction repaired) condition judgement is made.
  - — The conditions by which the MIL for the second drive cycle type illuminates have been changed as follows.
    New Mazda6 (GG)
    - PCM determines that there is a malfunction in the first drive cycle when a DTC that has been stored in the PCM during previous drive cycles is detected.

    Current MPV (LW) GY/FS engine model
    - PCM determines that there is a malfunction in the second drive cycle.

CONTROL DEVICES AND MONITORING SYSTEM RELATIONSHIP CHART

A6E397018881T02

Monitoring System

×: Applicable

Component	Monitor item				
	Catalyst	Misfire	Fuel system	Oxygen sensor	Oxygen sensor heater
Input					
CKP sensor	×	×	×	×	×
CMP sensor	×	×	×	×	×
VSS		×	×	×	
MAF sensor	×	×	×	×	×
ECT sensor	×	×	×	×	×
IAT sensor	×	×	×	×	
TP sensor	×	×	×	×	
Rear HO2S	×			×	×
Front HO2S	×		×	×	×
Output					
DLC-2	×	×	×	×	×
MIL	×	×	×	×	×
Purge solenoid valve			×	×	
Fuel injectors			×		

DIAGNOSTIC TEST MODE

A6E397018881T03

- To match the OBD regulations, the following diagnostic test modes have been supported.

Diagnostic test mode	Item
Mode 01	Sending diagnostic data (PID data monitor/On-board system readiness test)
Mode 02	Sending freeze frame data
Mode 03	Sending emission-related malfunction code (Diagnostic trouble code: DTC)
Mode 04	Clearing/resetting emission-related malfunction information
Mode 05	Sending oxygen sensor monitor test results
Mode 06	Sending intermittent monitoring system test results (Diagnostic monitoring test result: DMTR)
Mode 07	Sending continuous monitoring system test results (pending code)

- The diagnostic test modes are as shown below.

Sending Diagnostic Data (Mode 01)

PID data monitor

- The PID monitoring items are shown in the table.

PID data monitor table

Full names	Condition/unit	
Diagnostic trouble code counter	–	
Malfunction indicator	ON/OFF	
Fuel system loop status	Refer to table below.	
Engine load calculated value	%	
Engine coolant temperature	°C	°F
Short fuel trim	%	
Long fuel trim	%	
Intake manifold absolute pressure	%	kPa
Engine speed	rpm	
Vehicle speed	km/h	mph
Spark advance	BTDC	
Intake air temperature	°C	°F
Mass air flow	g/s	
Throttle position	%	
Oxygen sensor location	–	
Front heated oxygen sensor	V	
Rear heated oxygen sensor	V	
OBD requirement to which vehicle designed	–	
Distance travelled while MI is activated	km	miles

Meaning of FUEL SYS1

Display	Meaning
-NA-	Not applicable
OPEN	Feedback stops: Engine coolant temperature is lower than the determined feedback zone.
CLOSE	Feedback operating: HO2S being used for feedback is okay.
OP DRV	Feedback stops: Open loop due to driving condition.
OP SYS	Feedback stops: Open loop due to detected system fault.
CL O2S	Feedback operating: Malfunction occurred in HO2S (rear) system.

On-board system readiness test

- The items supported by the on-board system readiness test are shown below.

Continuous monitoring system

— Misfire monitoring
— Fuel system monitoring
— Comprehensive component monitoring (CCM)

Intermittent monitoring system

— Catalyst monitoring
— O2S monitoring
— O2S heater monitoring

Sending Freeze Frame Data (FFD) (Mode 02)

- The FFDs are shown in the table.

FFD monitor table

Full names	Condition/unit	
DTC that caused required FFD storage	–	
Fuel system loop status	OPEN: NON-F/B, CLOSE: F/B	
Engine load calculated value	%	
Engine coolant temperature	°C	°F
Short fuel trim	%	
Long fuel trim	%	
Intake manifold absolute pressure	%	kPa
Engine speed	rpm	
Vehicle speed	km/h	mph
Spark advance	BTDC	
Intake air temperature	°C	°F
Mass air flow	g/s	
Throttle position	%	

Sending Emission-related Malfunction code (DTC) (Mode 03)

- The DTCs are shown in the table.

DTC table

×: Applicable
—: Not applicable

DTC No.	Condition	MIL	DC	Monitor item	Memory function
P0010	CMP actuator circuit malfunction	ON	1	CCM	×
P0011	CMP timing over-advanced	ON	1	CCM	×
P0012	CMP timing over-retarded	ON	1	CCM	×
P0031	Front HO2S heater circuit low input	ON	2	O_2 sensor heater	×
P0032	Front HO2S heater circuit high input	ON	2	O_2 sensor heater	×
P0037	Rear HO2S heater circuit low input	ON	2	O_2 sensor heater	×
P0038	Rear HO2S heater circuit high input	ON	2	O_2 sensor heater	×
P0101	MAF sensor inconsistent with TP sensor	ON	2	CCM	×
P0102	MAF circuit low input	ON	1	CCM	×
P0103	MAF circuit high input	ON	1	CCM	×
P0107	MAP sensor circuit low input	ON	1	CCM	×
P0108	MAP sensor circuit high input	ON	1	CCM	×
P0111	IAT circuit performance problem	ON	2	CCM	×
P0112	IAT circuit low input	ON	1	CCM	×
P0113	IAT circuit high input	ON	1	CCM	×
P0117	ECT circuit low input	ON	1	CCM	×
P0118	ECT circuit high input	ON	1	CCM	×
P0121	TP stuck closed	ON	2	CCM	×
P0122	TP circuit low input	ON	1	CCM	×
P0123	TP circuit high input	ON	1	CCM	×
P0125	Excessive time to enter closed loop fuel control	ON	2	CCM	×
P0131	Front HO2S no inversion (stuck low)	ON	2	CCM	×
P0132	Front HO2S no inversion (stuck high)	ON	2	CCM	×
P0133	Front HO2S circuit malfunction	ON	2	O_2 sensor	×
P0134	Front HO2S circuit no activity detected	ON	2	CCM	×
P0138	Rear HO2S circuit high input	ON	2	CCM	×
P0140	Rear HO2S circuit no activity detected	ON	2	CCM	×
P0171	Fuel trim system too lean	ON	2	Fuel	×
P0172	Fuel trim system too rich	ON	2	Fuel	×
P0300	Random misfire detected	Flash / ON	1 or 2	Misfire	×
P0301	Cylinder No.1 misfire detected	Flash / ON	1 or 2	Misfire	×
P0302	Cylinder No.2 misfire detected	Flash / ON	1 or 2	Misfire	×

DTC No.	Condition	MIL	DC	Monitor item	Memory function
P0303	Cylinder No.3 misfire detected	Flash / ON	1 or 2	Misfire	×
P0304	Cylinder No.4 misfire detected	Flash / ON	1 or 2	Misfire	×
P0327	Knock sensor circuit low input	ON	1	CCM	×
P0328	Knock sensor circuit high input	ON	1	CCM	×
P0335	CKP sensor circuit malfunction	ON	1	CCM	×
P0340	CMP sensor circuit malfunction	ON	1	CCM	×
P0403	EGR valve motor coils open or short	ON	2	CCM	×
P0420	Catalyst system efficiency below threshold	ON	2	Catalyst	×
P0443	Evaporative emission control system purge control valve circuit malfunction	ON	2	CCM	×
P0480	Fan relay control circuit malfunction	OFF	2	Other	×
P0500	Vehicle speed sensor (VSS) circuit malfunction	ON	2	CCM	×
P0505	Idle control system malfunction	OFF	—	Other	—
P0506	Idle control system RPM lower than expected	ON	2	CCM	×
P0507	Idle control system RPM higher than expected	ON	2	CCM	×
P0511	Idle control system circuit malfunction	ON	1	CCM	×
P0550	PSP switch circuit malfunction	ON	2	CCM	×
P0602	PCM programming error	ON	1	CCM	×
P0610	Control module vehicle options error	ON	1	CCM	×
P0661	VIS control circuit low input	OFF	2	Other	×
P0662	VIS control circuit high input	OFF	2	Other	×
P0703	Brake switch input malfunction	ON	2	CCM	×
P0704	Clutch switch input malfunction	ON	2	CCM	×
P0850	Neutral switch input malfunction	ON	2	CCM	×
P1410	Variable air duct valve circuit malfunction	OFF	2	Other	×
P1562	PCM +BB voltage low	ON	1	CCM	×
P2006	Variable tumble control system shutter valve stuck closed	ON	2	CCM	×
P2009	Variable tumble control solenoid valve circuit low input	ON	2	CCM	×
P2010	Variable tumble control solenoid valve circuit high input	ON	2	CCM	×
P2228	BARO sensor circuit low input	ON	1	CCM	×
P2229	BARO sensor circuit high input	ON	1	CCM	×
P2502	Generator output voltage signal no electricity	OFF	1	Other	—
P2503	Battery overcharge	OFF	1	Other	—
P2504	Generator terminal B circuit open	OFF	1	Other	—
U0073	CAN bus off	OFF	1	Other	—
U0121	PCM cannot receive any signals from ABS, ABS/TCS or DSC HU/CM	ON	1	Other	×
U0155	PCM cannot receive any signals from instrument cluster	ON	1	Other	×

Sending Intermittent Monitoring System Test Results (Mode 06)

- The items supported by the sending intermittent monitoring system are shown in the table.

TEST ID	Description	Related system
10:01:0A	Rich to lean sensor threshold voltage	HO2S
10:02:0A	Lean to rich sensor threshold voltage	
10:03:0A	Low sensor voltage for switching time calculation	
10:04:0A	High sensor voltage for switching time calculation	
10:05:10	Rich to lean sensor switching time	
10:06:10	Lean to rich sensor switching time	
10:0A:10	Sensor period	
10:80:20	Front and rear HO2S switching time ratio	TWC

Sending Continuous Monitoring System Test Results (pending code) (Mode 07)

- These appear when a problem is detected in a monitored system.

1 drive cycle type

- If any problems are detected in the first drive cycle, pending codes will be stored in the PCM memory, as well as DTCs.
- After pending codes are stored, if the PCM judges that the system is normal in any future drive cycle, the PCM deletes the pending codes.

2 drive cycle type

- The code for a failed system is stored in the PCM memory in the first drive cycle. If the problem is not found in the second drive cycle, the PCM judges that the system returned to normal or the problem was mistakenly detected, and deletes the pending code. If the problem is found in the second drive cycle too, the PCM judges that the system has failed, and stores the pending codes, and the DTCs.
- After pending codes are stored, if the PCM judges that the system is normal in any future drive cycle, the PCM deletes the pending codes.

DTC

A6E397018881T04

- Detection logics and conditions are as shown below.

CMP Timing

CMP actuator circuit malfunction (P0010)

- PCM monitors OCV voltage. If PCM detects OCV control voltage (calculated from OCV) is above or below the threshold voltage (calculated from battery positive voltage), PCM determines that OCV circuit has a malfunction.

CMP timing over-advanced (P0011)

- Actual valve timing is over-advanced by **30 deg.** from target valve timing when the OCV is controlled within the maximum valve timing retard condition.

CMP timing over-retarded (P0012)

- Actual valve timing is over-retarded by **5 deg.** from target valve timing for **5 s** when the OCV system control is within feed-back range.

Oxygen Sensor Heater

Front HO2S heater circuit low input (P0031)

- The PCM monitors the front HO2S heater control signal at the PCM terminal 4A. If the PCM turns the front HO2S heater off but front HO2S heater circuit has low voltage, the PCM determines that the front HO2S heater circuit has a malfunction.

Front HO2S heater circuit high input (P0032)

- The PCM monitors the front HO2S heater control signal at the PCM terminal 4A. If the PCM turns the front HO2S heater on but front HO2S heater circuit has high voltage, the PCM determines that the front HO2S heater circuit has a malfunction.

Rear HO2S heater circuit low (P0037)

- The PCM monitors the rear HO2S heater control signal at the PCM terminal 4D. If the PCM turns the rear HO2S heater off but rear HO2S heater circuit has low voltage, the PCM determines that the rear HO2S heater circuit has a malfunction.

Rear HO2S heater circuit high (P0038)
- The PCM monitors the rear HO2S heater control signal at the PCM terminal 4D. If the PCM turns the rear HO2S heater on but rear HO2S heater circuit has high voltage, the PCM determines that the rear HO2S heater circuit has a malfunction.

MAF Sensor
MAF sensor inconsistent with TP sensor (P0101)
- The PCM compares actual input signal from MAF sensor with expected input signal from MAF sensor (calculated by input voltage from throttle position sensor or engine speed).
  - — If mass intake air flow amount is **below 5.0 g/sec. {0.66 lb/min.}** for **5 s** and throttle opening angle is **above 50 %** with engine running, the PCM determines that detected mass intake air flow amount is too low.
  - — If mass intake air flow amount is **above 96.5 g/sec. {12.7 lb/min.}** for **5 s** and engine speed is **below 2,000 rpm** with engine running, the PCM determines that detected mass intake air flow amount is too high.

MAF sensor circuit high input (P0102)
- The PCM monitors input voltage from MAF sensor when engine running. If input voltage at the PCM terminal 1P is **below 0.21 V**, the PCM determines that MAF circuit has a malfunction.

MAF sensor circuit high input (P0103)
- The PCM monitors input voltage from MAF sensor when engine running. If input voltage at the PCM terminal 1P is **above 4.9 V**, the PCM determines that MAF circuit has a malfunction.

MAP Sensor
MAP sensor circuit low input (P0107)
- The PCM monitors input voltage from MAP sensor when intake air temperature is **above 10 °C {50 °F}**. If input voltage at the PCM terminal 1J is **below 0.1 V**, the PCM determines that MAP sensor circuit has a malfunction.

MAP sensor circuit high input (P0108)
- The PCM monitors input voltage from MAP sensor when intake air temperature is **above 10 °C {50 °F}**. If input voltage at the PCM terminal 1J is **above 4.9 V**, the PCM determines that MAP sensor circuit has a malfunction.

Intake Air Temperature (IAT) Sensor
IAT sensor circuit performance problem (P0111)
- If intake air temperature is higher than engine coolant temperature by **40 °C {104 °F}** with ignition key on, the PCM determines that there is a IAT sensor performance problem.

IAT sensor circuit low input (P0112)
- The PCM monitors input voltage from IAT sensor. If input voltage at the PCM terminal 2E is **below 0.2 V**, the PCM determines that IAT sensor circuit has a malfunction.

IAT sensor circuit high input (P0113)
- The PCM monitors input voltage from IAT sensor. If input voltage at the PCM terminal 2E is **above 4.8 V**, the PCM determines that IAT sensor circuit has a malfunction.

Engine Coolant Temperature (ECT) Sensor
ECT circuit low input (P0117)
- The PCM monitors ECT sensor signal at the PCM terminal 1M. If the PCM detects ECT sensor voltage **below 0.2 V**, the PCM determines that the ECT sensor circuit has a malfunction.

ECT circuit high input (P0118)
- The PCM monitors ECT sensor signal at the PCM terminal 1M. If the PCM detects ECT sensor voltage **above 4.6 V**, the PCM determines that the ECT sensor circuit has a malfunction.

Excessive time to enter closed loop fuel control (P0125)
- The PCM monitors ECT sensor signal at the PCM terminal 1M after engine is started while the engine is cold. If engine coolant temperature does not reach the expected temperature for specified period, the PCM determines that it has taken an excessive amount of time for the engine coolant temperature to reach the temperature necessary to start closed-loop fuel control.

Throttle Position (TP) Sensor
Throttle position stuck closed (lower than expected)/open (higher than expected) (P0121)
- If the PCM detects that throttle valve opening angle is **below 12.5%** for **5 s** after following conditions are met, the PCM determines that TP is stuck closed:
  — Engine coolant temperature **above 80 °C {176 °F}**
  — MAF sensor signal **above 32.0 g/s {4.2 lb/minutes}**
- If the PCM detects that throttle valve opening angle is **above 50%** for **5 seconds** after following conditions are met, the PCM determines that TP is stuck open:
  — Engine speed **above 500 rpm**
  — MAF sensor signal **0 g/s {0.7 lb/min.}**

TP circuit low input (P0122)
- If the PCM detects TP sensor voltage at the PCM terminal 2A is **below 0.1 V** after ignition key is turned to on, the PCM determines that TP circuit has a malfunction.

TP circuit high input (P0123)
- If the PCM detects TP sensor voltage at the PCM terminal 2A is **above 4.9 V** after ignition key is turned to on, the PCM determines that TP circuit has a malfunction.

Front Heated Oxygen Sensor (HO2S)
Front HO2S stuck low (P0131)
- The PCM monitors input voltage from the front HO2S when the following conditions are met. If input voltage from the sensor remains **below 0.45 V** for **41.2 s**, the PCM determines that there is no front HO2S inversion.
  — Engine speed is **above 1,500 rpm**.
  — Engine coolant temperature is **above 80 °C {176°F}**.

Front HO2S stuck high (P0132)
- The PCM monitors input voltage from the front HO2S when the following conditions are met. If input voltage from the sensor remains **above 0.45 V** for **41.2 s**, the PCM determines that there is no front HO2S inversion.
  — Engine speed is **above 1,500 rpm**.
  — Engine coolant temperature is **above 80 °C {178 °F}**.

Front HO2S circuit malfunction (P0133)
- The PCM monitors inversion cycle period, lean-to-rich response time and rich-to-lean response time of the sensor. The PCM calculates the average of the inversion cycle period-specified inversion cycles, average response time from lean-to-rich, and from rich-to-lean when following conditions are met. If any exceeds threshold, the PCM determines that circuit has a malfunction.
  — Drive mode 3
  — Following conditions are met:
    - Calculation load **14.8—59.4%** (at **2,000 rpm**.)
    - Engine speed **1,410—4,000 rpm** (MTX)
    - Engine speed **1,190—4,000 rpm** (ATX)
    - Vehicle speed is above **3.76 km/h**
    - Engine coolant temperature is **above -10 °C {14 °F}**
    - Front HO2S signal inversion cycle is **above 10 cycles**

Front HO2S circuit no activity detected (P0134)
- The PCM monitors input voltage from the front HO2S when the following conditions are met. If input voltage from sensor never **exceed 0.55 V** for **83.2 s**, the PCM determines that sensor circuit is not activated.
  — Engine speed is **above 1,500 rpm**.
  — Engine coolant temperature is **above 80 °C {176 °F}**.

Rear Heated Oxygen Sensor (HO2S)
Rear HO2S circuit high input (P0138)
- The PCM monitors input voltage from the rear HO2S. If input voltage from the rear HO2S sensor is **above 0.45 V** for **6.4 s** during deceleration fuel cut, the PCM determines that the circuit input is high.

Rear HO2S circuit no activity detected (P0140)
- The PCM monitors input voltage from the rear HO2S when the following conditions are met. If input voltage from sensor never **exceed 0.55 V** for **30.4 s**, the PCM determines that sensor circuit is not activated.
  — Engine speed is **above 1,500 rpm**.
  — Engine coolant temperature is **above 80 °C {176 °F}**.

Fuel System
Fuel trim system too lean (P0171)
- The PCM monitors short term fuel trim (SHRTFT) and long term fuel trim (LONGFT) values during closed loop fuel control. If fuel trim exceeds preprogrammed criteria, the PCM determines that the fuel system is too lean.

Fuel trim system too rich (P0172)
- The PCM monitors short fuel trim (SHRTFT) and long fuel trim (LONGFT) values during closed loop fuel control. If fuel trim exceeds preprogrammed criteria, the PCM determines that the fuel system is too rich.

Misfire Monitor
Random misfire detection (P0300), Cylinder misfire detection (P0301, P0302, P0303, P0304)
- The PCM monitors CKP sensor input signal interval time. The PCM calculates the change of the interval time for each cylinder. If the change of interval time exceeds the preprogrammed criteria, the PCM detects a misfire in the corresponding cylinder. While the engine is running, the PCM counts the number of misfires that occurred at **200 crankshaft revolutions** and **1,000 crankshaft revolutions** and calculates misfire ratio for each crankshaft revolution. If the ratio exceeds the preprogrammed criteria, the PCM determines that a misfire, which can damage the catalytic converter or affect emission performance, has occurred.

Knock Sensor
Knock sensor circuit low input (P0327)
- The PCM monitors input signal from the knock sensor when the engine is running. If input voltage between PCM terminals between 2P and 2S is **below 0.9 V**, the PCM determines that knock sensor circuit has a malfunction.

Knock sensor circuit high input (P0328)
- The PCM monitors input signal from the knock sensor when the engine is running. If input voltage between PCM terminals 2P and 2S is **above 4.9 V**, the PCM determines that knock sensor circuit has a malfunction.

Crankshaft Position (CKP) Sensor
CKP sensor circuit malfunction (P0335)
- If the PCM does not receive input voltage from the CKP sensor for **4.2 s** while MAF is **2.0 g/s {0.26 lb/min.} or above**, the PCM determines that the CKP sensor circuit has a malfunction.

Camshaft Position (CMP) Sensor
CMP sensor circuit malfunction (P0340)
- The PCM monitors voltage from the CMP sensor when the engine is running. If the PCM does not receive input voltage from the CMP sensor while the PCM receives input signal from the CKP sensor, the PCM determines that CMP circuit has a malfunction.

EGR Valve
EGR valve (stepper motor) circuit malfunction (P0403)
- The PCM monitors input voltage from EGR valve. If voltage at PCM terminals 4E, 4H, 4K and/or 4N remains low or high, the PCM determines that EGR valve circuit has a malfunction.

Catalyst System
Catalyst system efficiency below threshold (P0420)
- The PCM compares the number of front HO2S and rear HO2S inversions for a predetermined time. The PCM monitors the number of inversions the rear side performs while the front side inverts for a specified number of times when the following monitoring conditions are met. The PCM detects the inversion ratio. If inversion ratio is below threshold, the PCM determines that the catalyst system has deteriorated.
  - — Engine speed **1,410—3,000 rpm** (MTX)
  - — Engine speed **1,281—3,000 rpm** (ATX)
  - — Calculated load **15—50%**(*1)

  *1: Maximum calculated load value varies depending on engine speed

Purge Solenoid Valve
Evaporative emission control system purge control valve circuit malfunction (P0443)
- The PCM monitors input voltages from the purge solenoid valve. If voltage at the PCM terminal 4U remains low or high, the PCM determines that the purge solenoid valve circuit has a malfunction.

Fan Control System
Fan control circuit malfunction (P0480)
- The PCM monitors input voltages from the fan control module. If voltage at the PCM terminal 1U remains low or high, the PCM determines that the fan control circuit has a malfunction.

Vehicle Speed Sensor (VSS)
VSS circuit malfunction (P0500) (MTX vehicles without ABS)
- Vehicle speed signal does not input after the following conditions are met:
  — Gear is in other than neutral position
  — Load is above **40%**
  — Engine speed is **2,000 rpm or above**

Idle Air Control (IAC) Valve
IAC system malfunction (P0505)
- The PCM monitors idle speed. If idle speed is **1,800 rpm or below** for **3 s** during KOER self test, the PCM determines that the IAC system has a malfunction.

IAC system RPM lower than expected (P0506)
- Actual idle speed is lower than expected by **100 rpm** for **14 s**, when brake pedal is depressed (brake switch is on) and steering wheel is held straight ahead (power steering pressure switch is off).

IAC system RPM higher than expected (P0507)
- Actual idle speed is higher than expected by **200 rpm** for **14 s**, when brake pedal is depressed (brake switch is on) and steering wheel is held straight ahead (power steering pressure switch is off).

IAC valve circuit malfunction (P0511)
- If the PCM detects that the PCM terminal 4G voltage is above or below threshold when IAC control duty target is **within16—70%**, the PCM determines that the IAC valve circuit has a malfunction.

Power Steering Pressure (PSP) Switch
PSP switch circuit malfunction (P0550)
- The PCM monitors PSP switch signal at the PCM terminal 1Z. If input voltage is low (switch stays on) for **1 minute** when the VSS is **above 60 km/h {37.3 mph}** and ECT is **above 60 °C {140 °F}**, the PCM determines that the PSP switch circuit has a malfunction.

PCM Configuration
PCM programming error (P0602)
- No configuration data in PCM.

Note
- If “PCM CONFIGURATION” is successful, the PCM stored DTC P0602 and illuminates the MIL (System i s normal) Clear the DTC P0602 using WDS or equivalent after “PCM CONFIGURATION”.
- MIL goes off after three drive cycles with no failure (DTCs remain in PCM).

Control module vehicle options error (P0610)
- PCM data configuration error.

Variable Intake-air System (VIS) Control Solenoid Valve
VIS control solenoid valve circuit low input (P0661)
- The PCM monitors VIS control solenoid valve control signal at the PCM terminal 4R. If the PCM turns the VIS control solenoid valve off but voltage at the PCM terminal 4R still remains low, the PCM determines that VIS control solenoid valve circuit has a malfunction.

VIS control solenoid valve circuit high input (P0662)
- The PCM monitors VIS control solenoid valve control signal at the PCM terminal 4R. If the PCM turns the VIS control solenoid valve on but voltage at the PCM terminal 4R still remains high, the PCM determines that VIS control solenoid valve circuit has a malfunction.

Brake Switch
Brake switch input malfunction (P0703)
- The PCM monitors changes in input voltage from the brake switch. If the PCM does not detect the PCM terminal 1K voltage changes while alternately accelerating and decelerating **8 times**.

Clutch Switch
Clutch switch input malfunction (P0704)
- The PCM monitors changes in input voltage from the clutch switch. If the PCM does not detect the PCM terminal 1R voltage changes while running vehicle with vehicle speed **above 0 km/h {0 mph}** and **below 30 km/h {19 mph} 8 times** alternately, PCM determines that clutch switch circuit has a malfunction.

Neutral Switch
Neutral switch input malfunction (P0850)
- The PCM monitors changes in input voltage from the neutral switch. If the PCM does not detect the PCM terminal 1W voltage changes while running vehicle with vehicle speed **above 30 km/h {19 mph}** and the clutch pedal is depressed and released **10 times** repeatedly, PCM determines that neutral switch circuit has a malfunction.

Variable Air Duct (VAD) Solenoid Valve
VAD control system circuit malfunction (P1410)
- The PCM monitors the VAD solenoid control signal at PCM terminal 4C. If the PCM detects that the VAD solenoid control signal does not change when VAD solenoid valve is switched to ON or OFF, the PCM determines that VAD solenoid control circuit has a malfunction.

PCM
PCM +BB (back-up battery) voltage low (P1562)
- The PCM monitors back up battery positive voltage at the PCM terminal 2Z. If the PCM detects battery positive terminal voltage **below 2.5V** for **2 s**, the PCM determines that the backup voltage circuit has malfunction.

Variable Tumble Control System
Variable tumble control system shutter valve stuck closed (P2006)
- The PCM monitors mass air amount. If actual air flow amount is below estimated air flow amount when the following monitoring conditions are met, the PCM determines that variable tumble control shutter valve has been stuck closed.
  - — Engine speed is **above 3,750 rpm**
  - — Engine coolant temperature is **above 63 °C {145 °F}**
  - — Throttle valve opening angle is above threshold[*1]

  [*1]: Maximum calculated load value varies depending on engine speed

Variable tumble control solenoid valve circuit low input (P2009)
- The PCM monitors variable tumble control solenoid valve control signal at the PCM terminal 4T. If the PCM turns the variable tumble control solenoid valve off but voltage at the PCM terminal 4T still remains low, the PCM determines that variable tumble control solenoid valve circuit has a malfunction.

Variable tumble control solenoid valve circuit high input (P2010)
- The PCM monitors variable tumble control solenoid valve control signal at the PCM terminal 4T. If the PCM turns the variable tumble control solenoid valve on but voltage at the PCM terminal 4T still remains high, the PCM determines that variable tumble control solenoid valve circuit has a malfunction.

BARO Sensor
BARO sensor circuit low input (P2228)
- The PCM monitors input voltage from BARO sensor. If input voltage at the PCM terminal 1G is **below 0.35 V**, the PCM determines that BARO sensor circuit has a malfunction.

BARO sensor circuit high input (P2229)
- The PCM monitors input voltage from BARO sensor. If input voltage at the PCM terminal 1G is **above 4.92 V**, the PCM determines that BARO sensor circuit has a malfunction.

Generator
Generator terminal B circuit open (P2502)
- The PCM judges generator output voltage is **above 17 V** and battery positive voltage is **below 11 V**.

Generator output voltage signal no electricity (P2503)
- The PCM needs **above 20 A** from the generator, and judges generator output voltage to be **below 8.5 V** during engine running.

Battery overcharge (P2504)
- The PCM judges generator output voltage is **above 18.5 V** or battery positive voltage is **above 16 V** during engine running.

Controller Area Network (CAN)
Can bus off (U0073)
- CAN controller is damaged.

PCM cannot receive any signals from ABS, ABS/TCS or DSC HU/CM control module (U0121)
- PCM cannot receive any signals from ABS, ABS/TCS or DSC HU/CM control module.

PCM cannot receive any signals from instrument cluster (U0155)
- PCM cannot receive any signals from the instrument cluster.

PID/DATA MONITOR AND RECORD

A6E397018881T05

- The PID/DATA monitoring items for the fuel and emission control systems are as shown in the table below.

Monitor item table

—: Not applicable

PID item	Definition	Unit/Condition	PCM terminal
ACCS	A/C relay	ON/OFF	4O
ACSW	A/C on demand circuit, including refrigerant pressure switch, A/C amplifier, A/C switch and fan switch	ON/OFF	1AC
ALTF	Generator field coil control duty valve in PCM	%	1AD
ALTT V	Generator output voltage	V	1AA
ARPMDES	Target engine speed	rpm	—
AST	After start timer	Time	—
BARO	Barometric pressure	Pressure	1G
	Barometric pressure signal voltage	V	1G
BOO	Brake switch	ON/OFF	1K
CHRGLP	Generator warning light control signal in PCM	ON/OFF	—
COLP	Refrigerant pressure switch (middle pressure)	ON/OFF	1Q
CPP	Clutch pedal position switch	ON/OFF	1R
CPP/PNP	Clutch pedal position switch/neutral switch circuit	ON/OFF	1W
DTCCNT	DTC Count (includes those needling no action)	—	—
ECT	Engine coolant temperature	°C or °F	1M
	Engine coolant temperature voltage	V	1M
EVAPCP	Purge solenoid valve duty value in PCM	%	4U
FAN1	Fan1 control signal	ON/OFF	4L
FAN2	Fan2 control signal	ON/OFF	4F
FAN3	Fan3 control signal	ON/OFF	4B
FDPDTC*1	Pending code that caused FFD storage	—	—
FP	Fuel pump relay control signal in PCM	ON/OFF	4P*2,4Q*3
FUELPW	Fuel injection duration in PCM	Time	4W,4Z,4AA,4AD
FUELSYS	Fuel system status (Open/Closed loop)	Open loop/ Closed loop	—
GENVDSD	Generator voltage desired	V	—
HTR11	Front HO2S heater control signal in PCM	ON/OFF	4A
HTR12	Rear HO2S heater control signal in PCM	ON/OFF	4D
IAC	IAC valve duty value in PCM	%	4G,4J
IASV	Intake air shutter valve	ON/OFF	4C
IAT	IAT	°C or °F	2E
	IAT signal voltage	V	2E
IMRC	Variable tumble control solenoid control signal in PCM	ON/OFF	4T
IMTV	Variable Intake-air system (VIS) control solenoid control signal in PCM	ON/OFF	4R
INGEAR	In gear	ON/OFF	1R,1W
IVS	Idle validation switch	ON/OFF	2A
KNOCKR	Spark retard value to prevent knocking	ANGLE	2P,2S
LOAD	Calculated engine load in PCM	%	—
LONGFT1	Current long fuel trim adjustment (Learning correction value) in PCM	%	—
MAF	Mass air flow amount	g/s	1P
	MAF signal voltage	V	1P
MAP	Manifold absolute pressure sensor	Pressure	1J
	Manifold absolute pressure signal voltage	V	1J
MIL	Malfunction indicator light control signal in PCM	ON/OFF	4I
MIL_DIS	Distance travelled since the MIL was illuminated	Distance	—
O2S11	Front HO2S signal voltage	V	1AB

PID item	Definition	Unit/Condition	PCM terminal
O2S12	Rear HO2S signal voltage	V	1Y
PSP	PSP switch	ON/OFF	1Z
RFCFLAG	Adaptive memory condition	—	—
RO2FT1	Rear O2 fuel trim	—	—
RPM	Engine speed	rpm	2D,2G
SEGRP	EGR valve (stepping motor) position in PCM	No. of step	4E,4H,4K,4N
SHRTFT1	Current short fuel trim adjustment in PCM	%	—
SPARKADV	Ignition timing control signal in PCM	BTC	2J,2M
TEST	—	ON/OFF	—
TP	TP	%	2A
	TP sensor signal voltage	V	2A
TPCT	Lowest closed throttle voltage	V	2A
VPWR	Battery positive voltage	V	2Y,2Z
VSS	Vehicle speed	KPH or MPH	2L
VT DUTY1	Camshaft position commanded duty cycle	%	4M
	Camshaft position commanded signal voltage	V	4M

*1 : Freeze frame data stored when pending code is detected
*2 : With immobilizer system
*3 : Without immobilizer system

F

SIMULATION TEST

A6E397018881T06

- The simulation test items for the fuel and emission control systems are as shown in the table below.

Simulation item table

×: Applied
—: Not applied

Simulation item	Applicable component	Operation	Test condition		PCM terminal
			IG ON	Idle	
ACCS	A/C relay	ON or OFF	×	×	4O
ALTF	Generator field coil control duty value	ON or OFF	—	×	1AD
ARPMDES	Desired RPM		×	×	—
EVAPCP	Purge solenoid valve	For purge solenoid valve: Actuated by any duty value (0—100%)	×	×	4U
FAN1	Fan1 control signal	ON or OFF	×	×	4L
FAN2	Fan2 control signal	ON or OFF	×	×	4F
FAN3	Fan3 control signal	ON or OFF	×	×	4B
FP	Fuel pump relay	ON or OFF	×	×	4P[*1],4Q[*2]
FUELPW1	Fuel injection duration	Actuated +50%— -50% fuel injection time	—	×	4W,4Z, 4AA,4AD
GENVDSD	Generator voltage desired		—	×	—
HTR11	Front heated exhaust gas oxygen sensor heater	ON or OFF	×	×	4A
HTR12	Rear heated exhaust gas oxygen sensor heater	ON or OFF	×	×	4D
IAC	Idle air control	Actuated by any duty value (0—100%)	×	×	4G,4J
IMRC	Variable tumble control solenoid control signal in PCM	ON or OFF	×	×	4T
IMTV	Variable intake-air system (VIS) control solenoid control signal in PCM	ON or OFF	×	×	4R
INJ#1	Fuel injector (Cylinder No.1)	ON or OFF	—	×	4Z
INJ#2	Fuel injector (Cylinder No.2)	ON or OFF	—	×	4W
INJ#3	Fuel injector (Cylinder No.3)	ON or OFF	—	×	4AD
INJ#4	Fuel injector (Cylinder No.4)	ON or OFF	—	×	4AA
SEGRP	EGR valve (stepping motor)	Actuated by any stepping value (0—60 steps)	×	×	4E,4H, 4K,4N
TEST	—	ON or OFF	×	×	—

*1 : With immobilizer system
*2 : Without immobilizer system

KOEO/KOER SELF-TEST

A6E397018881T07

- The self-test function consists of the KOEO (Key On, Engine Off) self-test, performed when the ignition switch is at ON, and the KOER (Key On, Engine Running) self-test, performed when idling. If an abnormality is detected as either self-test is executed, a is displayed on the WDS or equivalent. Using the self-test function, the present malfunction or a successful repair is readily confirmed. Refer to the self-test function table for the corresponding DTCs.

  KOEO (Key ON, Engine Off) self-test

  — The KOEO self-test is a powertrain control system self-diagnosis, performed when the ignition switch is at ON and the engine is stopped. A KOEO self-test begins when the connected WDS or equivalent sends an execute command to the PCM.

  — As the KOEO self-test is performed, the PCM performs inspection for the set DTCs and if a malfunction is detected the DTC is displayed on the WDS or equivalent.

  KOER (Key ON, Engine Running) self-test

  — The KOER self-test is a powertrain control system self-diagnosis, performed when the ignition switch is at ON and the engine is idling. A KOER self-test begins when the connected WDS or equivalent sends an execute command to the PCM.

  — As the KOER self-test is performed, the PCM performs inspection for the set DTCs and if a malfunction is detected the DTC is displayed on the WDS or equivalent.

KOEO/KOER self-test function table

×: Applicable
—: Not applicable

DTC No.	Condition	KOEO	KOER
P0010	CMP actuator circuit malfunction	×	×
P0011	CMP timing over advanced	—	×
P0012	CMP timing over retarded	—	×
P0031	Front HO2S heater circuit low	×	×
P0032	Front HO2S heater circuit high	×	×
P0037	Rear HO2S heater circuit low	×	×
P0038	Rear HO2S heater circuit high	×	×
P0101	MAF sensor inconsistent with TP sensor	—	—
P0102	MAF circuit low input	×	×
P0103	MAF circuit high input	×	×
P0107	MAP sensor circuit low input	×	×
P0108	MAP sensor circuit high input	×	×
P0111	IAT circuit performance problem	—	—
P0112	IAT circuit low input	×	×
P0113	IAT circuit high input	×	×
P0117	ECT circuit low input	×	×
P0118	ECT circuit high input	×	×
P0121	Throttle position stuck close	—	—
P0122	TP circuit low input	×	×
P0123	TP circuit high input	×	×
P0125	Excessive time to enter closed loop fuel control	—	—
P0131	Front HO2S no inversion (low stuck)	—	—
P0132	Front HO2S no inversion (high stuck)	—	×
P0133	Front HO2S circuit malfunction	—	—
P0134	Front HO2S circuit no activity detected	—	×
P0138	Rear HO2S circuit high input	—	—
P0140	Rear HO2S circuit no activity detected	—	×
P0171	Fuel trim system too lean	—	×
P0172	Fuel trim system too rich	—	×
P0300	Random misfire detected	—	—
P0301	Cylinder No.1 misfire detected	—	—
P0302	Cylinder No.2 misfire detected	—	—
P0303	Cylinder No.3 misfire detected	—	—
P0304	Cylinder No.4 misfire detected	—	—
P0327	Knock sensor circuit low input	×	×
P0328	Knock sensor circuit high input	×	×
P0335	CKP sensor circuit malfunction	—	—
P0340	CMP sensor circuit malfunction	—	—
P0403	EGR valve motor coils open or short	×	×
P0420	Catalyst system efficiency below threshold	—	—
P0443	Evaporative emission control system purge control valve circuit malfunction	—	×
P0480	Fan relay control circuit malfunction	×	×
P0500	Vehicle speed sensor (VSS) circuit malfunction	—	—
P0505	Idle control system malfunction	—	×
P0506	Idle control system RPM lower than expected	—	—
P0507	Idle control system RPM higher than expected	—	—
P0511	IAC valve circuit malfunction	×	×
P0550	PSP switch circuit malfunction	—	—
P0602	PCM programming error	×	×
P0610	Control module vehicle options error	×	×
P0661	VIS control circuit low input	×	×
P0662	VIS control circuit high input	×	×

DTC No.	Condition	KOEO	KOER
P0703	Brake switch input malfunction	—	—
P0704	Clutch switch input malfunction	—	—
P0850	Neutral switch input malfunction	—	—
P1410	Variable air duct valve circuit malfunction	×	×
P1562	PCM +BB voltage low	×	×
P2006	Variable tumble control system shutter valve stuck close	—	—
P2009	Variable tumble control solenoid valve circuit low input	×	×
P2010	Variable tumble control solenoid valve circuit high input	×	×
P2228	BARO sensor circuit low input	×	×
P2229	BARO sensor circuit high input	×	×
P2502	Generator output voltage signal no electricity	—	×
P2503	Battery overcharge	—	×
P2504	Generator terminal B circuit open	—	×
U0073	CAN bus off	×	×
U0121	PCM cannot receive any signals from ABS, ABS/TCS or DSC HU/CM	×	×
U0155	PCM cannot receive any signals from combination meter	×	×

ENGINE ELECTRICAL SYSTEM

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ABBREVIATIONS G-2
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STARTING SYSTEM G-6
STARTER G-6

ABBREVIATIONS

ABBREVIATIONS

A6E470102000T01

B+	Battery positive voltage
DLI	Distributorless Ignition

OUTLINE

OUTLINE OF CONSTRUCTION

A6E470201008T01

- Adoption of a DLI system eliminates the distributor.

FEATURES

A6E470201008T02

Improved marketability and durability
- Iridium spark plug has been adopted.

Improved reliability
- Coaxial-reduction type starter has been adopted.

Reduced size and system simplification
- Regulatorless generator with built in power transistor has been adopted.

SPECIFICATIONS

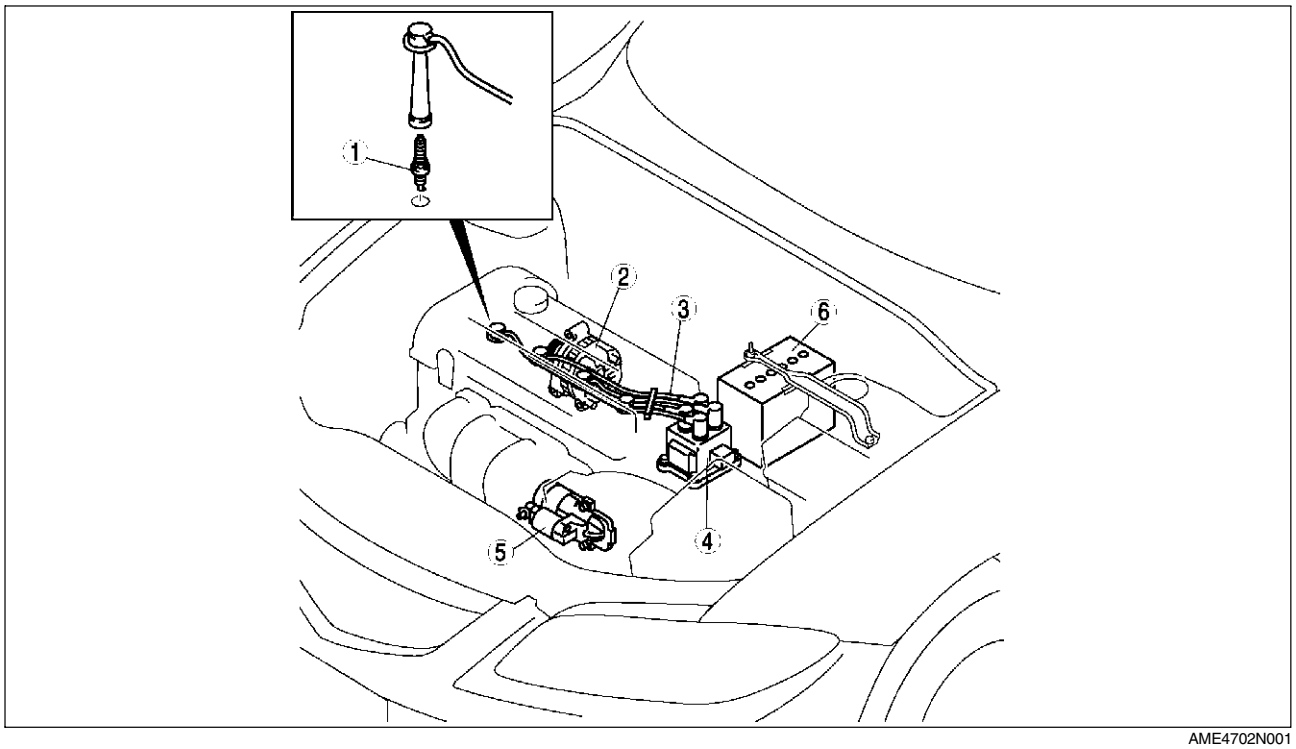
A6E470201008T03

Item				Engine type		
				L8	LF	L3
Battery	Type and capacity (5-hour rate)	European spec.		50D20L (40), 75D26L (52)		50D20L (40), 80D26L (55)
		GCC spec.		46B24LS (36)	46B24LS (36), 75D26L (52)*	46B24LS (36)
	Voltage		(V)	12		
Generator	Output		(V-A)	12-90		
	Regulated voltage			Controlled by PCM		
	Self-diagnosis function					
Ignition system	Type			DLI (Distributorless Ignition)		
	Spark advance			Electronic		
	Firing order			1—3—4—2		
Spark plug	Type	NGK		ITR6F-13		
Starter	Type			Coaxial reduction		
	Output		(kW)	1.0		1.4

*: Intensely hot area

STRUCTURAL VIEW

A6E470201008T04



AME4702N001

1	Spark plug
2	Generator
3	High-tension lead

4	Ignition coil
5	Starter
6	Battery

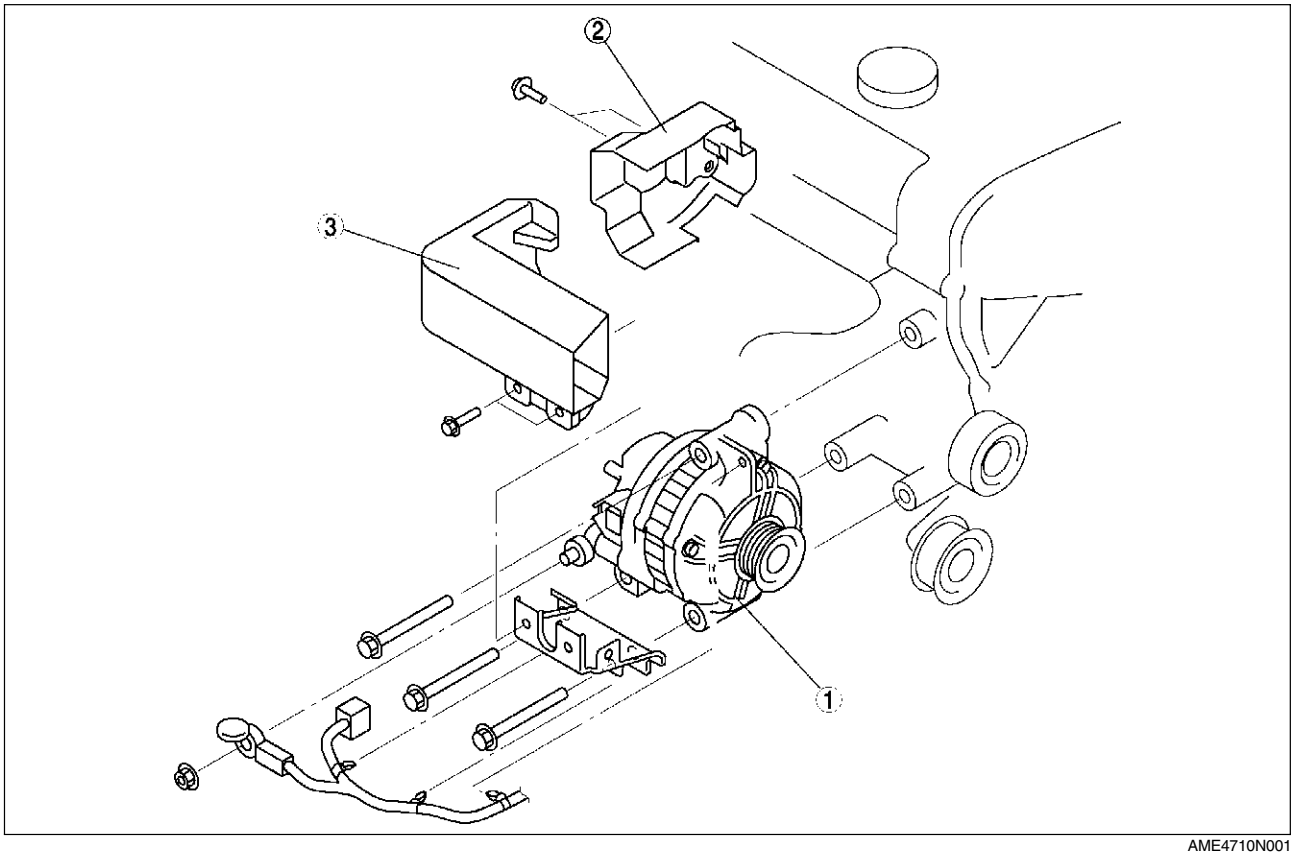
CHARGING SYSTEM

GENERATOR

A6E471001008T02

Structure

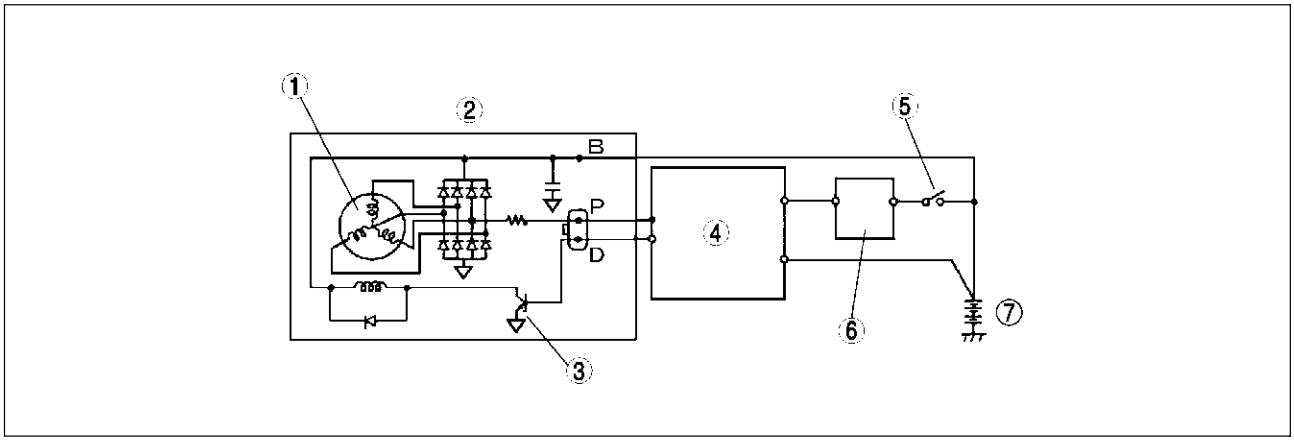
- The voltage regulator has been eliminated, and generator control is carried out by the PCM.
- A Generator duct made of plastic and generator heat insulator made of iron have been adopted to protect the generator from the exhaust manifold heat.



AME4710N001

1	Generator
2	Generator heat insulator

3	Generator duct



AME4710N002

1	Stator coil
2	Generator
3	Power transistor
4	PCM

5	Ignition switch
6	Generator warning light
7	Battery

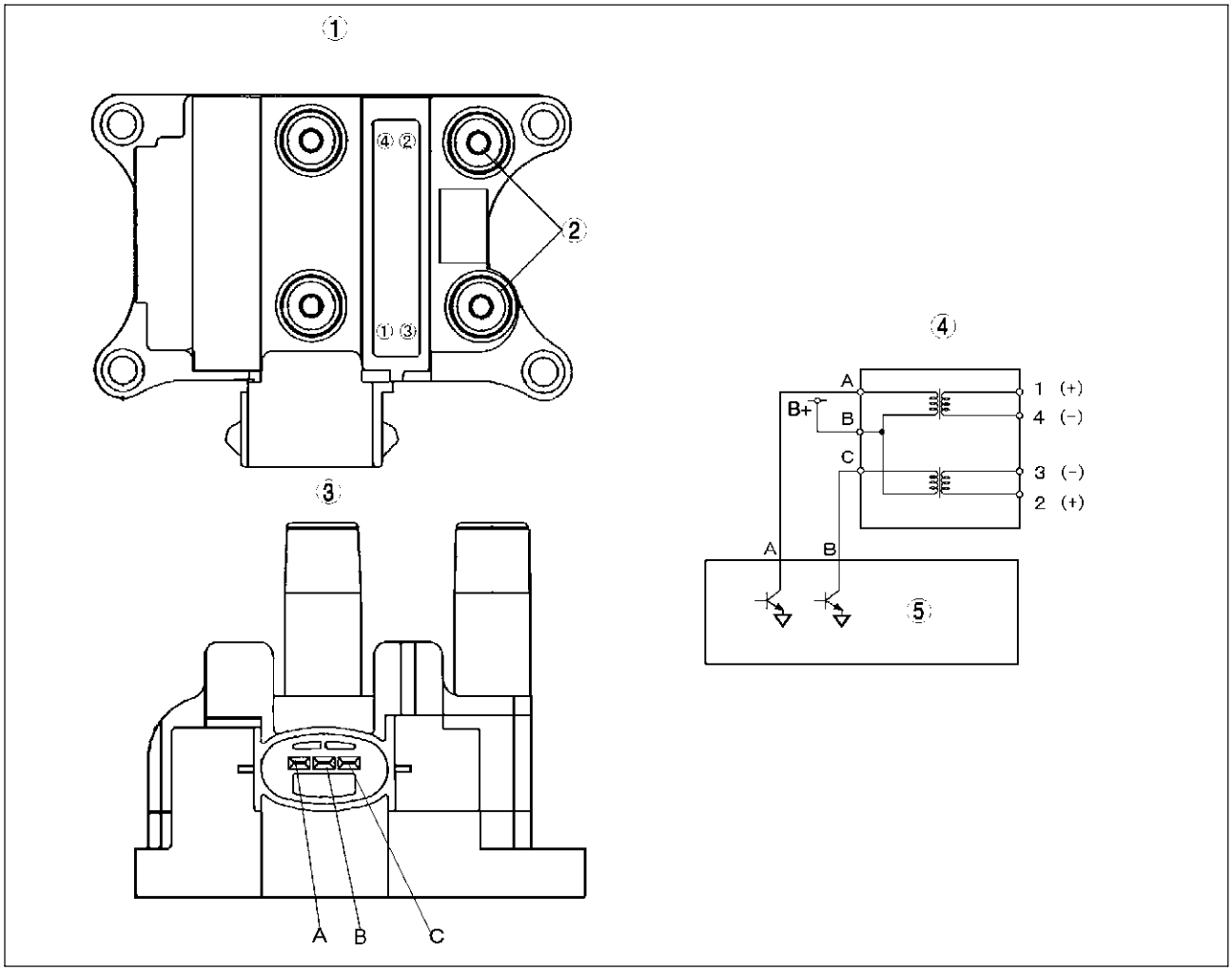
IGNITION SYSTEM

IGNITION COIL

A6E471201008T04

Structure

- The ignition coil contains two coils. They are for cylinder numbers 1 and 4, and cylinder numbers 2 and 3 respective.(Matched pairs)
- The two secondary terminals contain the secondary coils positive and negative terminals. The closed circuit of secondary coils is formed through the high-tension leads, two spark plugs and the cylinder head. Due to this, one coil ignites two cylinders simultaneously.
- The firing timing of the coil is controlled by the PCM due to built-in ignition system. (Section F)



AME4712N001

1	Ignition coil upper surface figure
2	Two secondary terminals
3	Ignition coil side view

4	Ignition coil
5	PCM

Terminal layout

Terminal		Signal
3 terminals	A	Ignition coil control signal 2 (No.1, No.4)
	B	Power supply
	C	Ignition coil control signal 1 (No.2, No.3)

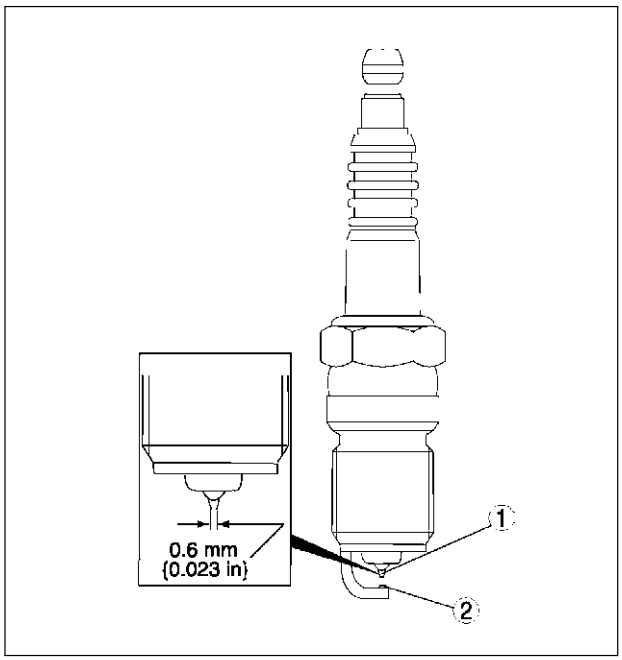
SPARK PLUG

A6E471201008T02

Structure

- The iridium spark plug with excellent durability and firing performance has been adopted.
- The extremely thin, center electrode has a diameter of 0.6 mm {0.023 in} and is made of iridium alloy. Also, durability has been improved by the use of a platinum-tipped grounding electrode.
- Based on the thinner electrode (center electrode), electric discharge has been reduced and ignition has been improved, resulting in stable ignition performance in all driving conditions and a substantial improvement in fuel economy.

1	Iridium alloy
2	Platinum-tipped



AME4712N002

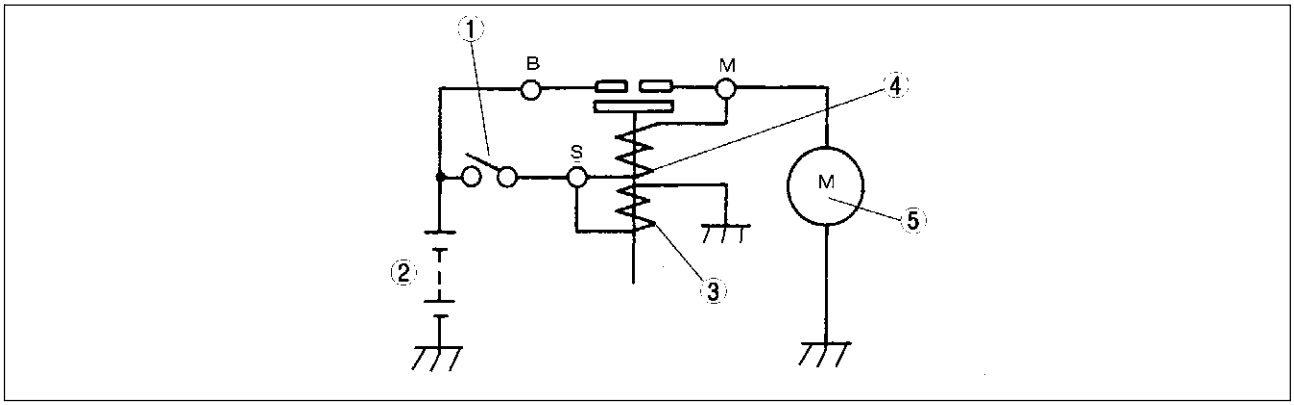
STARTING SYSTEM

STARTER

A6E471401008T02

Structure

- High torque coaxial reduction type starter has been adopted.



AME4714N001

1	Ignition switch
2	Battery
3	Holding coil

4	Pull-in coil
5	Motor

CLUTCH

OUTLINE H-2
OUTLINE OF CONSTRUCTION H-2
SPECIFICATIONS H-2

OUTLINE

OUTLINE OF CONSTRUCTION

A6E490216003T01

- The construction and operation of the clutch is essentially carried over from that of the current MPV (LW) models. (See Mazda MPV Training Manual 3340-1E-99F)

SPECIFICATIONS

A6E490216003T03

Item			Mazda6 (GG)				Current MPV (LW)
			R.H.D.		L.H.D.		
Engine			**L3, LF**	**L8**	**L3, LF**	**L8**	**FS**
Manual transaxle type			**G35M-R**				**G15M-R**
Clutch control			Hydraulic				
Clutch cover	Spring type		Diaphragm				
	Set load	(N {kgf, lbf})	6,000 {611, 1,350}	5,200 {530, 1,170}	6,000 {611, 1,350}	5,200 {530, 1,170}	
Clutch disc	Outer diameter	(mm {in})	215 {8.46}				225 {8.86}
	Inner diameter	(mm {in})	150 {5.91}				
Clutch pedal	Type		Suspended				
	Pedal ratio		6.6				6.55
	Full stroke	(mm {in})	135.6 {5.339}		140 {5.51}		135 {5.31}
Clutch master cylinder inner diameter		(mm {in})	15.87 {0.625}				
Clutch release cylinder inner diameter		(mm {in})	19.05 {0.750}				
Clutch fluid type			European (L.H.D. U.K.) specs.: SAE J1703, FMVSS116 DOT3 OR DOT4 GCC specs.: SAE J1703, FMVSS116 DOT3				SAE J1703, FMVSS116 DOT3 OR DOT4

Bold frames:New specifications

MANUAL TRANSAXLE

OUTLINE J-2
OUTLINE OF CONSTRUCTION J-2
FEATURES J-2
SPECIFICATIONS J-2
MANUAL TRANSAXLE J-3
CROSS-SECTION VIEW J-3

OUTLINE

OUTLINE OF CONSTRUCTION

A6E510201025T01

- The construction and operation of the transaxle are the same as those of the current G15M-R type manual transaxle, except for the following features. (See Mazda MPV Training Manual 3340-1E-99F) However, the following items have been changed.

FEATURES

Improved marketability

- The operation system has been changed from rod type operation system to cable type.
- The gear ratio has been changed.

SPECIFICATIONS

A6E510201025T03

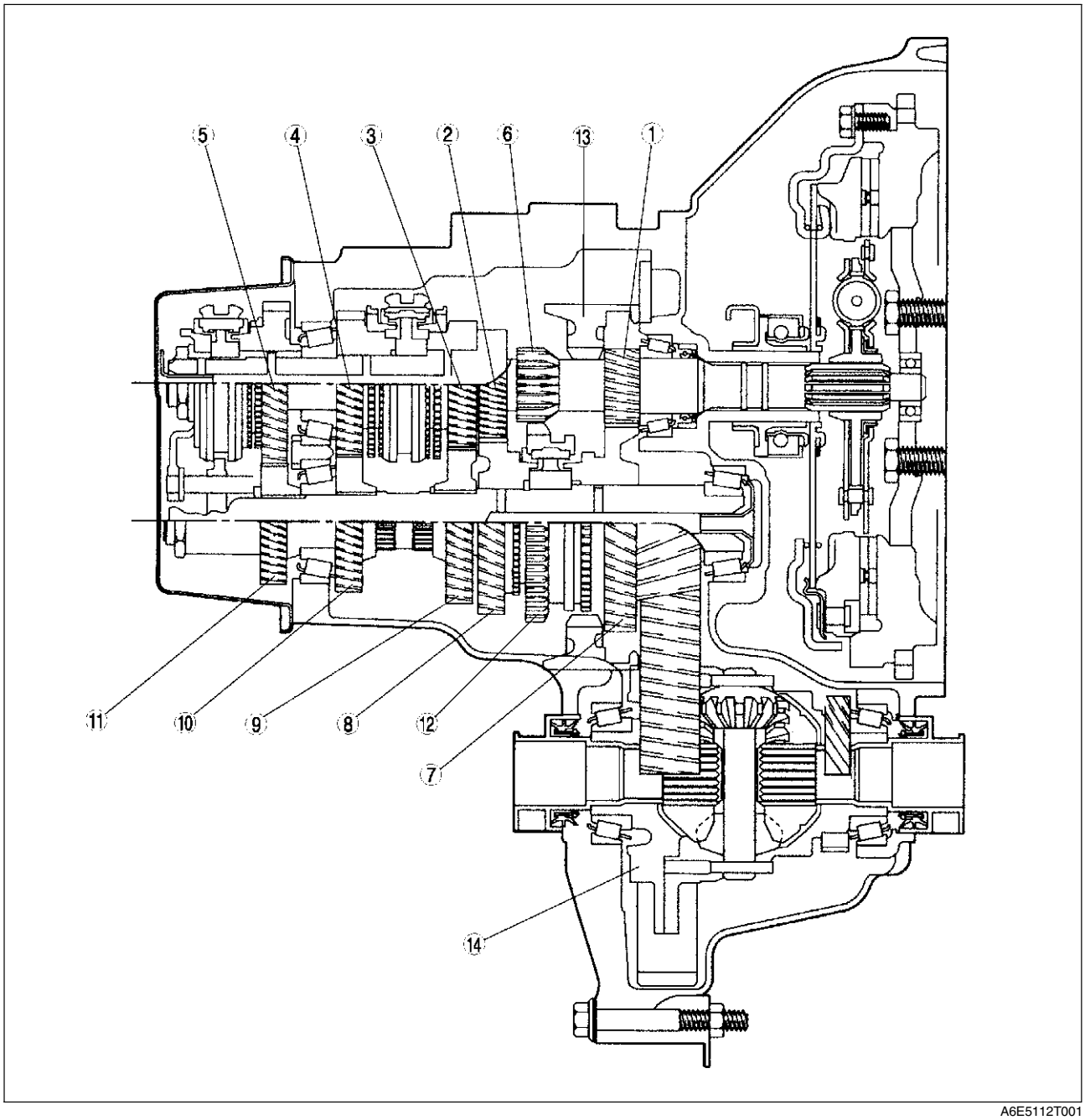
Item			Mazda6 (GG)		Current MPV (LW)
Engine			**L8, LF**	**L3**	**FS**
Transaxle type			G35M-R		G15M-R
Transaxle control			Floor-shift		
Operation system			Cable		Rod
Shift assist	Forward		Synchromesh		
	Reverse		Selective sliding and synchromesh		
Gear ratio	1st		3.666	3.307	
	2nd		2.059	1.842	
	3rd		1.392	1.233	1.310
	4th		0.970		
	5th		0.755		
	Reverse		3.166		
Final gear ratio			4.388		4.588
Oil	Grade		API service GL-4 or GL-5		
	Viscosity	All season	SAE 75W-90		
		Above 10°C {50°F}	SAE 80W-90		
	Capacity (L {US qt, Imp qt})		2.87 {3.03, 2.53}		2.70 {2.85, 2.38}

Bold frames:New specifications

MANUAL TRANSAXLE

CROSS-SECTION VIEW

A6E511201025T02



A6E5112T001

1	1st gear
2	2nd gear
3	3rd gear
4	4th gear
5	5th gear
6	Reverse gear
7	Secondary 1st gear

8	Secondary 2nd gear
9	Secondary 3rd gear
10	Secondary 4th gear
11	Secondary 5th gear
12	Clutch hub sleeve (reverse gear)
13	Reverse idler gear
14	Diffential

AUTOMATIC TRANSAXLE

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ABBREVIATIONS

ABBREVIATIONS

A6E560101030T01

ATF	Automatic transaxle fluid
EC-AT	Electronically controlled automatic transaxle
PCM	Powertrain control module
TCC	Torque converter clutch
1GR	First gear
2GR	Second gear
3GR	Third gear
4GR	Fourth gear

OUTLINE

OUTLINE OF CONSTRUCTION

A6E560201030T01

- The construction and operation of the FN4A-EL type automatic transaxle of the Mazda6 (GG) is essentially carried over from that of the current PREMACY (CP) FN4A-EL automatic transaxle models, except for the following features. (See PREMACY Training Manual 3351-1A-01A.)

FEATURES

A6E560201030T02

Improved reliability

- The conclusion type of differential ring gear has been changed from a rivet type to a bolt type.
- Adoption of a oil pressure switch.

SPECIFICATIONS

A6E560201030T03

Item			Mazda6 (GG)	Current PREMACY (CP)
Engine			**LF**	**FS**
Transaxle type			FN4A-EL	
Gear ratio		1GR	2.816	
		2GR	1.497	
		3GR	1.000	
		4GR	0.725	
		Reverse	2.648	
Final gear ratio			4.416	3.904
ATF	Type		ATF M-V	ATF M-III or equivalent (e.g. Dexron® II)
	Capacity (Approximate quantity) L {US qt, Imp qt}		7.2 {7.6, 6.3}	
Torque converter stall torque ratio			1.950	
Hydraulic system	Forward clutch (number of drive/ driven plates)		4/4	
	3-4 clutch (number of drive/driven plates)		3/3	
	Reverse clutch (number of drive/ driven plates)		2/2	
	Low and reverse brake (number of drive/driven plates)		5/5	
Band servo	Servo diameter (piston outer dia.) mm {in}		64.6 {2.54}	
Front planetary gear (number of teeth)	Front sun gear		49	
	Front pinion gear		20	
	Front internal gear		89	

Item		Mazda6 (GG)	Current PREMACY (CP)
Engine		**LF**	**FS**
Rear planetary gear (number of teeth)	Rear sun gear	37	
	Rear pinion gear	30	
	Rear internal gear	98	
Primary gear		86	
Secondary gear		82	
Output gear		19	21
Ring gear		88	86

Bold frames:New specifications

AUTOMATIC TRANSAXLE

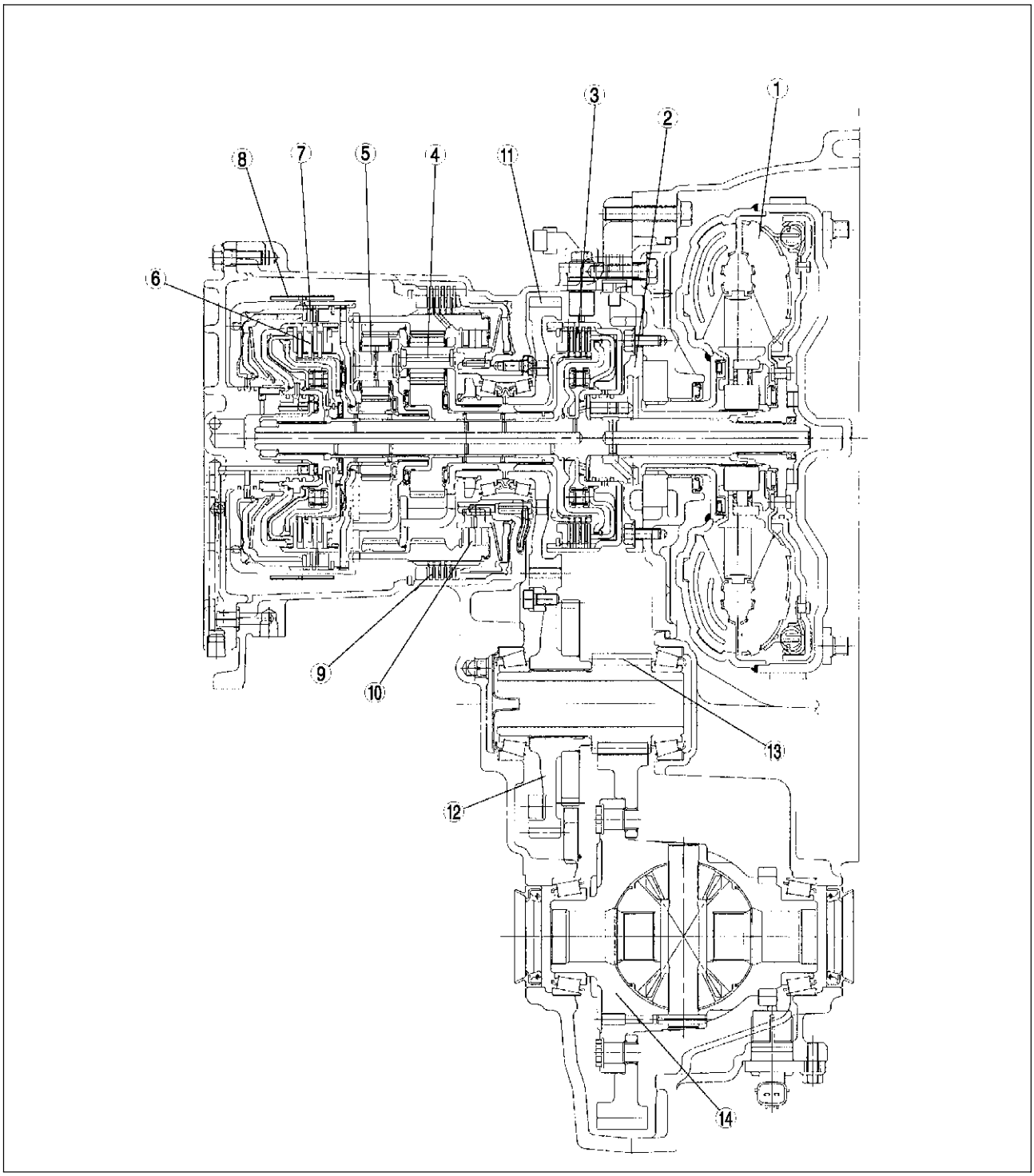
OUTLINE

A6E561401030T01

- The FN4A-EL type automatic transaxle is used.
- The construction and operation of the FN4A-EL type automatic transaxle of the New Mazda6 (GG) is essentially carried over from that of the current PREMACY (CP) .

CROSS-SECTIONAL VIEW

A6E561401030T02



A6E5614T001

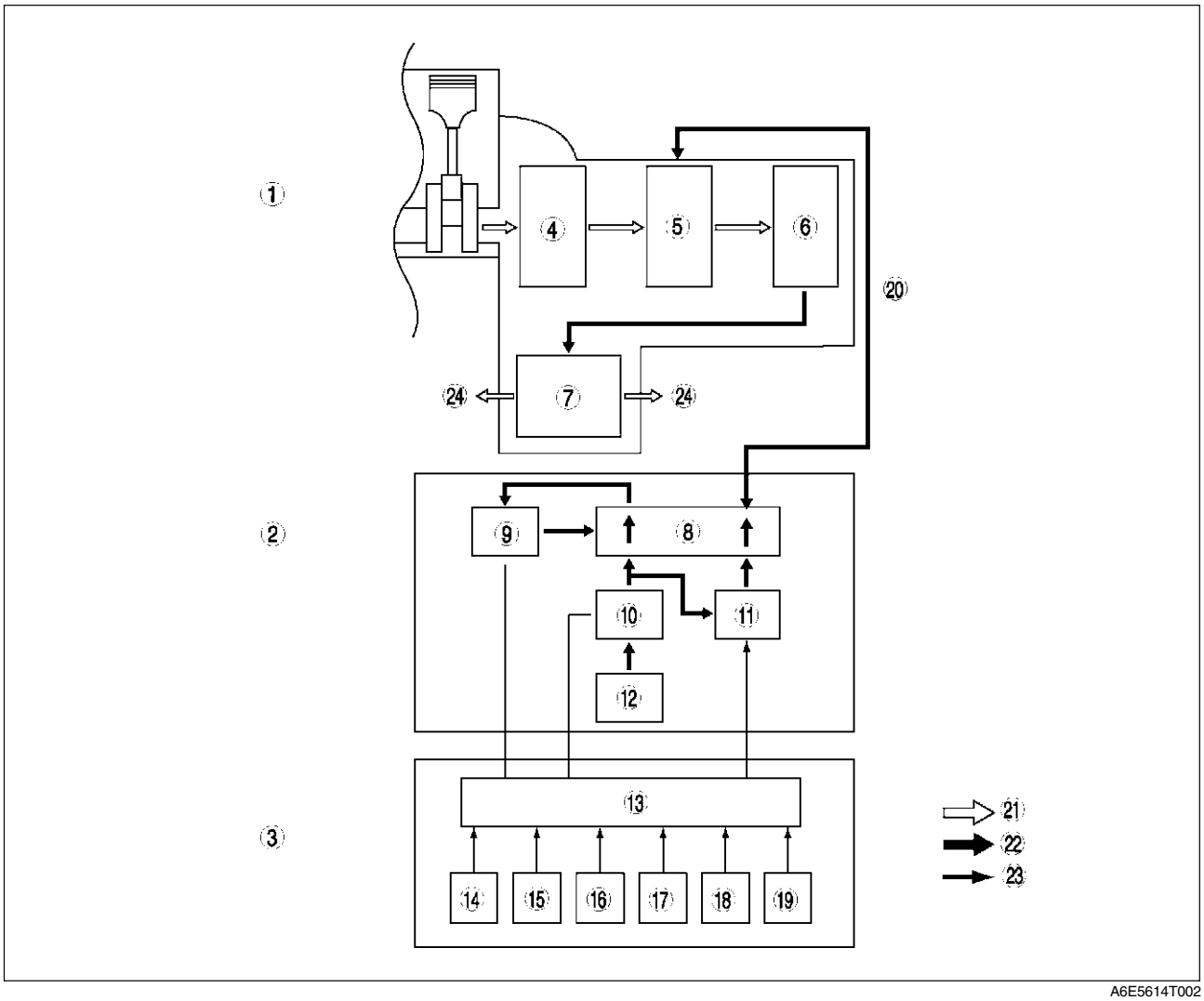
1	Torque converter
2	Oil pump
3	Forward clutch
4	Front planetary gear
5	Rear planetary gear
6	3-4 clutch
7	Reverse clutch

8	2-4 brake band
9	Low and reverse brake
10	One-way clutch
11	Primary gear
12	Secondary gear
13	Output gear
14	Differential

OUTLINE OF OPERATION

A6E561401030T03

- The operation of the electronic automatic transaxle is classified into three systems: the electronic control mechanism, the hydraulic pressure control mechanism, and the powertrain mechanism (includes the torque converter mechanism). The operation of each system is as follows:
  - — Electronic control mechanism
    - According to the signals from the switches and sensors in the input system, the PCM outputs the signal which matches the present driving condition to the linear type solenoid, ON/OFF type solenoids and the duty-cycle type solenoids in the hydraulic pressure control mechanism.
  - — Hydraulic pressure control mechanism
    - According to the signals from the PCM, each solenoid operates to switch the hydraulic passages in the control valve body and controls the clutch engagement pressure.
    - The line pressure is adjusted by the linear type pressure control solenoid. The hydraulic passages are switched by the ON/OFF type solenoids (shift solenoids D and E.) And the clutch engagement pressure is controlled by the duty-cycle type solenoids (shift solenoids A, B, and C).
  - — Powertrain mechanism
    - The driving force from the engine is transmitted through the torque converter to the transaxle.
    - The transmitted driving force operates each clutch and brake according to the clutch engagement pressure from the duty-cycle type solenoid, and the planetary gears change the gear ratio to the optimal driving force. The changed driving force is transmitted through the differential to the axle shaft and then the tires.



A6E5614T002

1	Powertrain mechanism
2	Hydraulic pressure control mechanism
3	Electronic control mechanism
4	Torque converter
5	Clutches, brakes
6	Planetary gear
7	Differential
8	Control valve body
9	Shift solenoid D, E (ON/OFF type)
10	Pressure control solenoid (linear type)
11	Shift solenoid A, B, C (duty-cycle type)
12	Oil pump

13	PCM
14	Oil pressure switch signal
15	Vehicle speed
16	ATF temprature
17	Forward clutch drum revolution speed
18	Engine revolution speed
19	Throttle position signal
20	Clutches, brakes engagement, relase pressure
21	Powerflow
22	Hydraulic pressure control signal
23	Electronic signal
24	Tire

EC-AT OPERATION CHART

A6E561401030T04

position/Range	Mode	Gear position		Shift pattern			Transaxle							Operation of shift solenoid				
										2–4 brake band				Solenoid valve (duty-cycle type)			Solenoid valve (ON / OFF type)	
				Shift	TCC	Engine brake	Forward clutch	3–4 clutch	Reverse clutch	Applied	Released	Low and reverse brake	One-way clutch	Shift solenoid A	Shift solenoid B	Shift solenoid C	Shift solenoid D	Shift solenoid E
P	–	–	–	–										–	–	–	ON	OFF
R	–	Reverse	2.648	–		×			×			×		OPEN	OPEN	OPEN	OFF	OFF
N	–	–	–	–										–	–	–	ON	OFF
D	*1 POWER/ NORMAL	1GR	2.816	↑			×						⊗	OPEN	CLOSED	CLOSED	OFF	OFF
		2GR	1.497	↑↓		×	×			×				OPEN	OPEN	CLOSED	OFF	OFF
		3GR	1.000	↑↓		×	×	×		×	×			OPEN	OPEN	OPEN	OFF	OFF
		4GR	0.725	↓		×		×		×				CLOSED	OPEN	OPEN	ON	OFF
		4GR *2 TCC ON	0.725		×	×		×		×				CLOSED	OPEN	OPEN	ON	ON
	HOLD	2GR	1.497	↑		×	×			×				OPEN	OPEN	CLOSED	OFF	OFF
		3GR	1.000	↑↓		×	×	×		×	×			OPEN	OPEN	OPEN	OFF	OFF
		4GR *3	0.725			×		×		×				CLOSED	OPEN	OPEN	ON	OFF
S	Non-HOLD	1GR	2.816	↑			×						⊗	OPEN	CLOSED	CLOSED	OFF	OFF
		2GR	1.497	↑↓		×	×			×				OPEN	OPEN	CLOSED	OFF	OFF
		3GR	1.000	↑↓		×	×	×		×	×			OPEN	OPEN	OPEN	OFF	OFF
		4GR *3	0.725			×		×		×				CLOSED	OPEN	OPEN	ON	OFF
	HOLD	2GR	1.497	↑		×	×			×				OPEN	OPEN	CLOSED	OFF	OFF
		3GR *3	1.000	↑		×	×	×		×	×			OPEN	OPEN	OPEN	OFF	OFF
		4GR *3	0.725			×		×		×				CLOSED	OPEN	OPEN	ON	OFF
L	Non-HOLD	1GR	2.816	↑		×	×					×	⊗	OPEN	OPEN	CLOSED	ON	ON
		2GR	1.497	↑↓		×	×			×				OPEN	OPEN	CLOSED	OFF	OFF
		3GR *3	1.000	↑		×	×	×		×	×			OPEN	OPEN	OPEN	OFF	OFF
		4GR *3	0.725			×		×		×				CLOSED	OPEN	OPEN	ON	OFF
	HOLD	1GR	2.816	↑		×	×					×	⊗	OPEN	OPEN	CLOSED	ON	ON
		2GR *3	1.497	↑		×	×			×				OPEN	OPEN	CLOSED	OFF	OFF
		3GR *3	1.000	↑		×	×	×		×	×			OPEN	OPEN	OPEN	OFF	OFF
		4GR *3	0.725			×		×		×				CLOSED	OPEN	OPEN	ON	OFF

*1: Automatically switches between POWER and NORMAL modes according to accelerator pedal depressing speed.
*2: Performs TCC operation in NORMAL mode.
*3: To prevent engine overspeed inhibits downshift until the engine speed is reduced to the preset speed.
×: Operating
⊗: Transmits the torque only when driving.
OPEN: Engages the line pressure to the clutch pressure.
CLOSED: Drains the clutch pressure.
ON: Engages the output port and the supply port (Solenoid reducing pressure).
OFF: Engages the output port and the drain port (Drains the output port).

A6E5614T003

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POWERFLOW

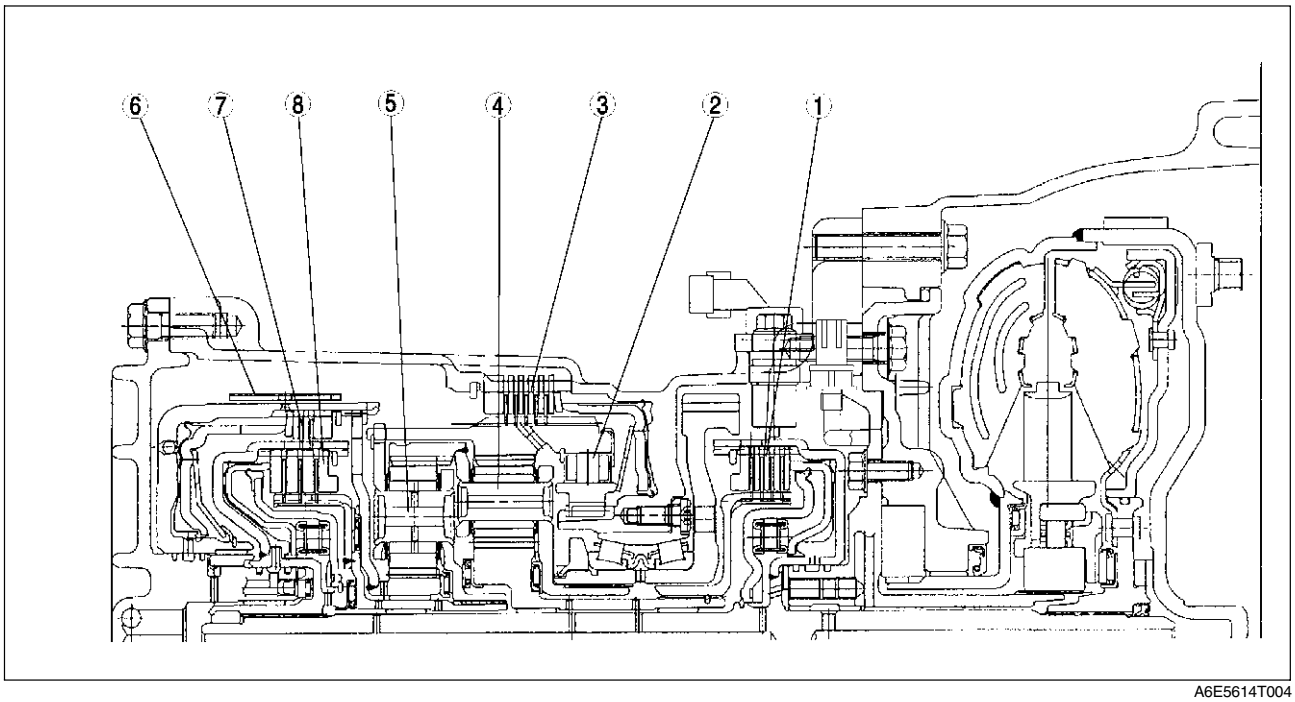
A6E561401030T05

Outline

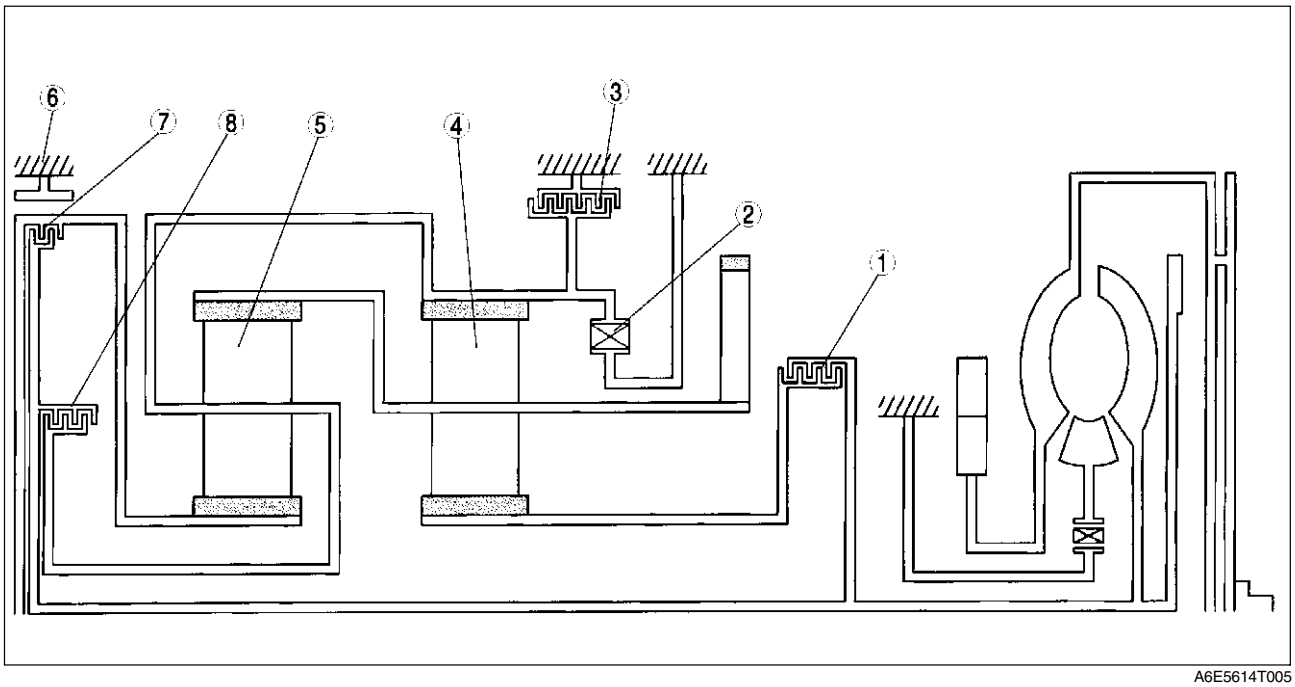
- In the powertrain mechanism, hydraulic pressure is transported from the control valves or shift solenoid A, B, or C (duty cycle type) to operate the clutches and brakes, and the planetary gear changes the gear ratio according to the vehicle driving condition.

Structure

- The powertrain mechanism of the FN4A-EL type consists of three pairs of clutches, brake, band brake, one-way clutch, and two pairs of single type planetary gears.



A6E5614T004



A6E5614T005

1	Forward clutch
2	One-way clutch
3	Low and reverse brake
4	Front planetary gear

5	Rear planetary gear
6	2-4 brake band
7	Reverse clutch
8	3-4 clutch

Operation
Component description

Component	Function
Forward clutch	• Transmits input torque from turbine shaft to front sun gear • Operates in forward range of first, second, or third gear position
3-4 clutch	• Transmits input torque from turbine shaft to rear planetary carrier • Operates in forward range of third or fourth gear position
Reverse clutch	• Transmits input torque from turbine shaft to rear sun gear • Operates when vehicle is backing
2-4 brake band	• Locks rotation of reverse drum, and fixes rear sun gear • Operates in second or fourth gear position
Low and reverse brake	• Fixes rotation of front internal gear • Operates when vehicle is backing or in first gear position (L range, HOLD)
One-way clutch	• Locks counterclockwise rotation of front internal gear in first gear position
Planetary gear	• The planetary gear functions as a transmission due to the engagement/ disengagement of clutches and/or brakes, converts the transmitted driving force of the turbine shaft and transmits it to the output gear.

Note
- All directions of rotation are viewed from the torque converter.

ELECTRONIC CONTROL SYSTEM

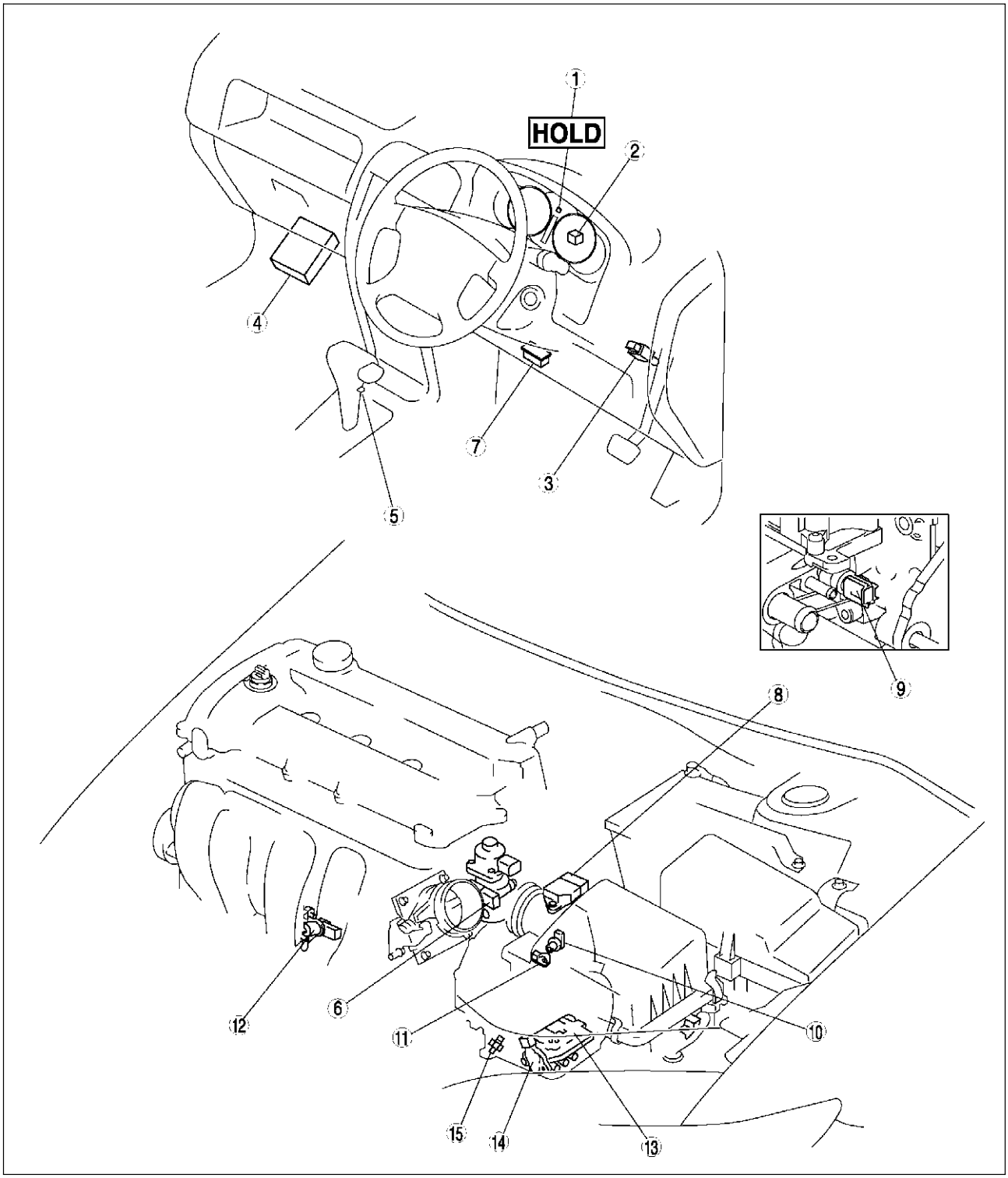
OUTLINE

A6E561501030T01

- The PCM, which is integrated with the PCM for engine control, is adopted for transaxle control. The PCM outputs the control signal to the engine and the transaxle according to the signal from each sensor and/or switch.
- Due to the adoption of the line pressure adjusting control by the linear type pressure control solenoid and the clutch engaging pressure control by duty-cycle type shift solenoids A, B, and C, excellent shift quality is obtained.

CONSTRUCTION

A6E561501030T02



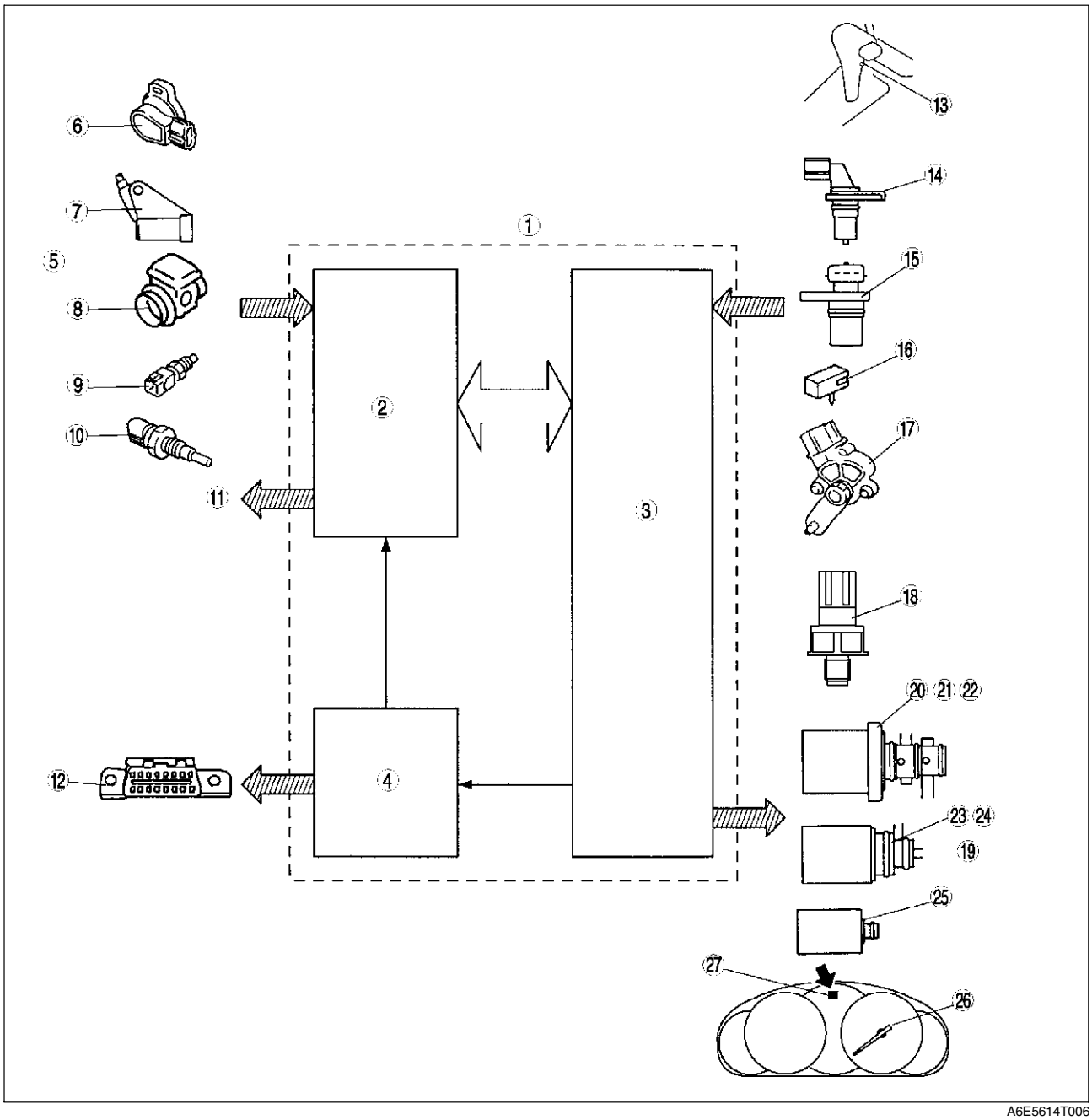
A6E5614T007

1	HOLD indicator light
2	Speedometer
3	Brake switch
4	PCM
5	HOLD switch
6	Throttle position sensor
7	DLC
8	Mass air flow sensor

9	Engine coolant temperature sensor
10	Vehicle speed sensor
11	Input /turbine speed sensor
12	Crankshaft position sensor
13	Control valve (With transaxle fluid temperature sensor and solenoid valves)
14	Transaxle range swich
15	Oil pressure switch

BLOCK DIAGRAM

A6E561501030T03



A6E5614T006

1	PCM
2	Engine control system
3	Transaxle control system
4	On-board diagnostic system
5	Input signals
6	Throttle position sensor
7	Crankshaft position sensor
8	Mass air flow sensor
9	Brake switch
10	Engine coolant templature sensor
11	Engine control output signals
12	Data link connector
13	HOLD switch
14	Input/turbine speed sensor

15	Vehicle speed sensor
16	Transaxle fluid temperature sensor
17	Transaxle range switch
18	Oil pressure switch
19	Output signals
20	Shift solenoid A
21	Shift solenoid B
22	Shift solenoid C
23	Shift solenoid D
24	Shift solenoid E
25	Pressure control solenoid
26	Speedometer signal
27	HOLD indicator light

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ELECTRONIC CONTROL ITEMS AND CONTENTS

A6E561501030T04

Item	Content
Line pressure control	• With linear type pressure control solenoid, adjusts to suitable line pressure for engine load condition and vehicle driving condition
Shift control	• Detects engine load condition and vehicle speed, and switches to the most suitable gear position according to the preset shift diagram • Selects HOLD mode by switching HOLD switch • In D range, automatically switches between POWER and NORMAL modes according to accelerator pedal depressing speed
Clutch pressure direct control (Direct electric shift control)	• With duty-cycle type shift solenoids A, B, and C, directly performs electronic control for clutch engagement pressure suitable for engine load condition and vehicle driving condition
Feedback control	• Performs real-time feedback correction for clutch engagment pressure to achieve target shifts • Performs optimal correction for clutch engagement pressure to reduce changes in engine performance and/or elapsed transaxle
Engine-transaxle total control	• Optimally controls engine output torque when shifting • Operates optimal clutch engagement pressure corresponding to engine output torque
TCC control	• According to preset TCC point, performs TCC operation via smooth TCC
Slope mode control	• Changes the shift point to prevent frequent shifting up/down when climbing hills
On-board diagnostic system	• Detects and/or memorizes failure of input/output part and transaxle condition

COMPONENT DESCRIPTIONS (ELECTRONIC CONTROL)

A6E561501030T05

Part name			Function
Input system	HOLD switch		• Selects driving modes (HOLD) and changes driving patterns
	TR switch		• Detects selector lever ranges/positions
	TP sensor		• Detects throttle valve opening angle
	Input/turbine speed sensor		• Detects forward clutch drum (input) revolution speed
	Oil pressure switch		• Detects forward clutch pressure
	VSS		• Detects differential gear case (output) revolution speed
	Brake switch		• Detects use of service brake
	TFT sensor		• Detects the ATF temperature
	ECT sensor		• Detects the engine coolant temperature
	CKP sensor		• Detects the engine revolution speed
	MAF sensor		• Detects intake air amount
Output system	Linear type	Pressure control solenoid	• Adjusts line pressure
	Duty-cycle type	Shift solenoid A	• Controls clutch engagement pressure
		Shift solenoid B	• Controls clutch engagement pressure
		Shift solenoid C	• Controls clutch engagement pressure
	ON/OFF type	Shift solenoid D	• Switches hydraulic passages for bypass valve and 3-4 shift valve
		Shift solenoid E	• Switches hydraulic passages for low and reverse shift valve, TCC, and control valve
	HOLD indicator light		• By switching HOLD switch, illuminates to indicate that it is in HOLD mode • Flashes when failure is detected by diagnosis function
	Speedometer signal		• Outputs vehicle speed signal to speedometer

INPUT/OUTPUT SIGNAL AND RELATED CONTROLS

A6E561501030T06

Component	Control item							
	Line pressure control	Shift control	Clutch pressure direct control (Direct electric shift control)	Feedback control	Engine-transaxle total control	Torque converter clutch control	Slope mode control	On-board diagnostic function
Input								
HOLD switch		X						
Transaxle range switch	X	X	X					
Throttle position sensor	X	X	X			X		X
Input/turbine speed sensor	X	O	X	X		X		X
Vehicle speed sensor	X	X	X			X	X	X
Brake switch							X	
Transaxle fluid temperature sensor	X	X	X	X		X		X
Engine coolant temperature sensor						X		X
Crankshaft position sensor	X		X		X	X		X
Mass air flow sensor	X		X	X	X		X	X
Oil pressure switch		X	X					
Output								
Pressure control solenoid	X							X
Shift solenoid A		X	X	X		X	X	X
Shift solenoid B		X	X	X				X
Shift solenoid C		X	X	X				X
Shift solenoid D		X					X	X
Shift solenoid E		X				X	X	X
HOLD indicator light		X						X
Speedometer signal								

X : Available
O : Back up

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AUTOMATIC TRANSAXLE SHIFT MECHANISM

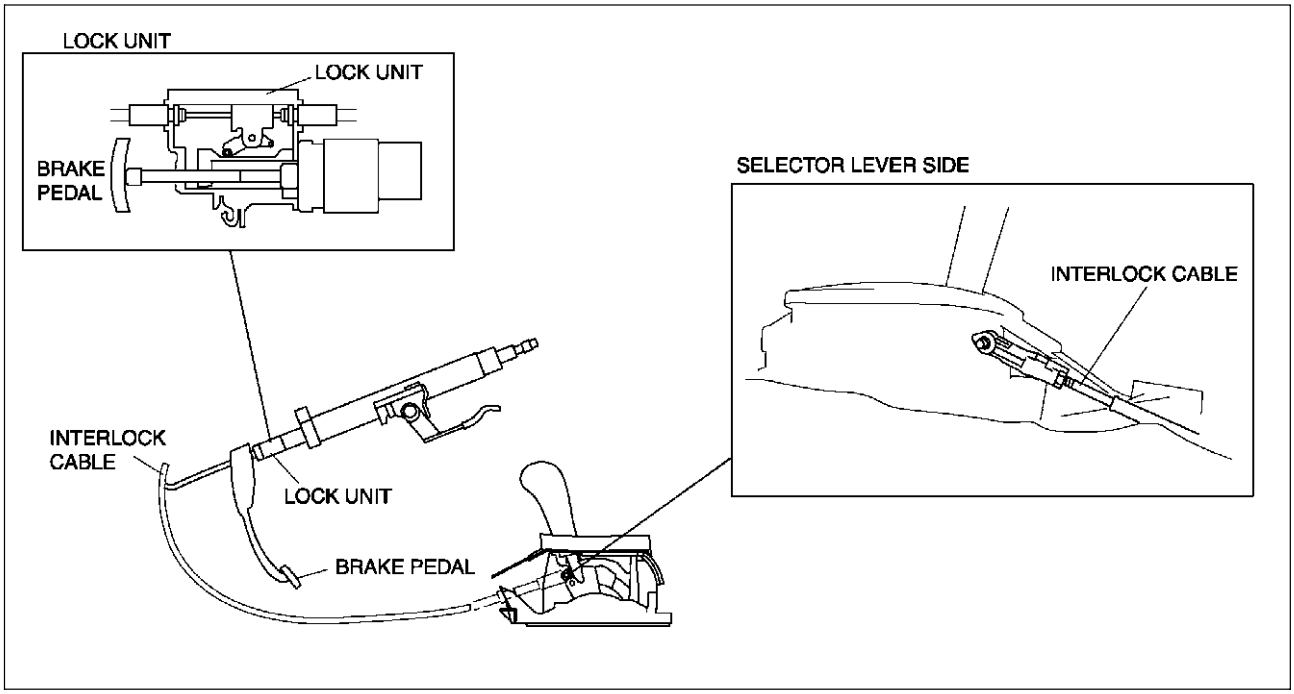
OUTLINE

A6E561646010T01

- The mechanical type shift lock system is essentially carried over from that of the current PREMACY (CP) models. (See Mazda PREMACY Training Manual 3351-1A-01A)

STRUCTURAL VIEW

A6E561646010T02



A6E5616T001

SHIFT-LOCK SYSTEM

A6E561646010T03

Outline

- To make operation smoother and to simplify internal construction, the shift lock system directly judges movement of the slider block with the slider pin.

Structure

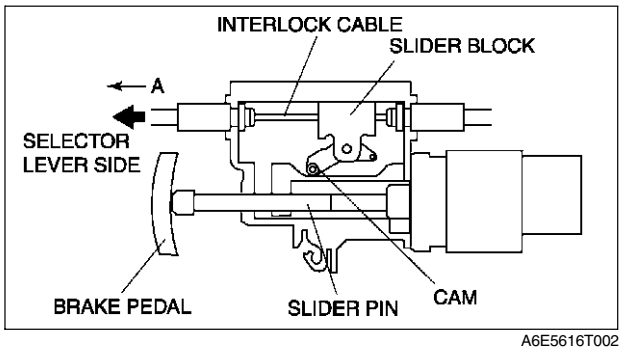
- The shift-lock unit consists of the interlock cable, interlock cam, and lock unit.

Operation

The selector lever can be shifted from P position only when the following conditions are satisfied.

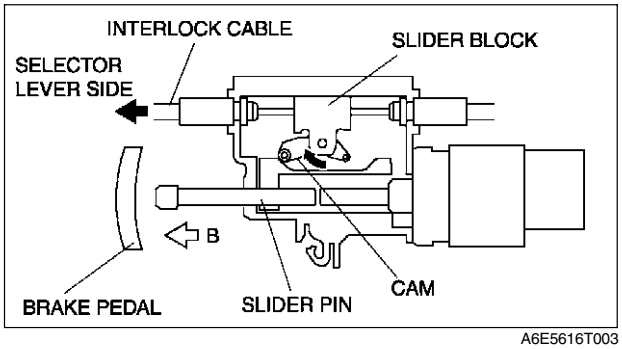
- The brake pedal is depressed.
- The selector lever push button is depressed.

When the brake pedal is not depressed, the slider pin is pressed into the position shown below by the brake pedal. Thus the slider block is inhibited from moving in direction A via the cam. In this condition, the interlock cable and interlock cam are locked, and the guide pin on the shift lever does not move out of the position. Thus the select lever cannot be shifted to other than P position.



A6E5616T002

When the brake pedal is depressed, the slider pin moves freely in direction B. The slider block also starts to move freely. The interlock cable and interlock cam are not locked, thus shifting out of P position becomes possible.



A6E5616T003

ON-BOARD DIAGNOSTIC

OUTLINE

A6E567001030T01

- The construction and operation of the on -board diagnostic system is essentially carried over from that of the previous 626 (GF) FN4A-EL models, except for the following. (See 626 626 Station Wagon Workshop Manual Supplement 1688-1*-00G).
  — DTCs, PID monitoring items, and simulation items have been changed.

DTC COMPARISON LISTS

A6E567001030T02

- The following codes are divided to improve serviceability.

Part Name	DTC	Mazda6 (GG)	Previous 626 (GF)
VSS circuit malfunction	P0500	Circuit malfunction	
TR switch	P0705	N/A	Circuit malfunction (short to ground)
	P0706	Circuit range/Performance	Circuit malfunction (open circuit)
	P0707	Circuit low input	N/A
	P0708	Circuit high input	N/A
TFT sensor	P0710	N/A	Circuit malfunction (open or short)
	P0711	Circuit range/performance (stuck)	
	P0712	Circuit malfunction (short to ground)	N/A
	P0713	Circuit malfunction (open circuit)	N/A
Input/turbine speed sensor	P0715	Circuit malfunction	
Incorrect 1GR ratio	P0731	Incorrect 1GR ratio	
Incorrect 2GR ratio	P0732	Incorrect 2GR ratio	
Incorrect 3GR ratio	P0733	Incorrect 3GR ratio	
Incorrect 4GR ratio	P0734	Incorrect 4GR ratio	
Torque converter	P0741	TCC system malfunction (stuck off)	
	P0742	TCC system malfunction (stuck on)	
Pressure control solenoid	P0745	Circuit malfunction	
Shift solenoid A	P0751	Circuit malfunction (stuck off)	
	P0752	Circuit malfunction (stuck on)	
	P0753	Circuit malfunction (electrical)	
Shift solenoid B	P0756	Circuit malfunction (stuck off)	
	P0757	Circuit malfunction (stuck on)	
	P0758	Circuit malfunction (electrical)	
Shift solenoid C	P0761	Circuit malfunction (stuck off)	
	P0762	Circuit malfunction (stuck on)	
	P0763	Circuit malfunction (electrical)	
Shift solenoid D	P0766	Circuit malfunction (stuck off)	
	P0767	Circuit malfunction (stuck on)	
	P0768	Circuit malfunction (electrical)	
Shift solenoid E	P0771	Circuit malfunction (stuck off)	
	P0772	Circuit malfunction (stuck on)	
	P0773	Circuit malfunction (electrical)	
Oil pressure switch	P0841	Circuit malfunction	N/A

ON-BOARD DIAGNOSTIC SYSTEM

A6E567001030T03

- The OBD system has the following functions:

a. Failure detection function: detects failure of the input/output devices and system components of the ATX.
b. Memory function: stores the DTC when a failure is detected.
c. Fail-safe function: fixes the output device function and input value of the sensors/switches to ensure minimum vehicle drivability when a failure is detected.
d. PID data monitoring function: monitors the input/output signals and calculated values of the PCM and sends the monitoring data to the WDS or equivalent.

DTC Table

DTC No.	Condition	MIL	HOLD indicator light flashes	DC	Monitor item	Memory function
P0500	VSS circuit malfunction (ATX)	ON	YES	2	CCM	×
P0706	Transaxle range (TR) switch circuit range/performance	ON	YES	2	CCM	×
P0707	Transaxle range (TR) switch circuit low input	ON	YES	1	CCM	×
P0708	Transaxle range (TR) switch circuit high input	ON	YES	2	CCM	×
P0711	Transaxle fluid temperature (TFT) sensor circuit range/ perfotmance	ON	NO	2	CCM	×
P0712	Transaxle fluid temperature (TFT) sensor circuit malfunction (short to ground)	ON	YES	1	CCM	×
P0713	Transaxle fluid temperature (TFT) sensor circuit malfunction (open circuit)	ON	YES	1	CCM	×
P0715	Input/turbine speed sensor circuit malfunction	ON	YES	1	CCM	×
P0731	Gear 1 incorrect (Incorrect Gear Ratio Detected)	OFF	YES	1	CCM	×
P0732	Gear 2 incorrect (Incorrect Gear Ratio Detected)	OFF	YES	1	CCM	×
P0733	Gear 3 incorrect (Incorrect Gear Ratio Detected)	OFF	YES	1	CCM	×
P0734	Gear 4 incorrect (Incorrect Gear Ratio Detected)	OFF	YES	1	CCM	×
P0741	Torque converter clutch (TCC) (stuck OFF)	OFF	YES	1	CCM	×
P0742	Torque converter clutch (TCC) (stuck ON)	OFF	YES	1	CCM	×
P0745	Pressure control solenoid malfunction	OFF	YES	1	CCM	×
P0751	Shift solenoid A stuck OFF	ON	YES	2	CCM	×
P0752	Shift solenoid A stuck ON	ON	YES	2	CCM	×
P0753	Shift solenoid A malfunction (electrical)	ON	YES	1	CCM	×
P0756	Shift solenoid B stuck OFF	ON	YES	2	CCM	×
P0757	Shift solenoid B stuck ON	ON	YES	2	CCM	×
P0758	Shift solenoid B malfunction (electrical)	ON	YES	1	CCM	×
P0761	Shift solenoid C stuck OFF	ON	YES	2	CCM	×
P0762	Shift solenoid C stuck ON	ON	YES	2	CCM	×
P0763	Shift solenoid C malfunction (electrical)	ON	YES	1	CCM	×
P0766	Shift solenoid D stuck OFF	ON	YES	2	CCM	×
P0767	Shift solenoid D stuck ON	ON	YES	2	CCM	×
P0768	Shift solenoid D malfunction (electrical)	ON	YES	1	CCM	×
P0771	Shift solenoid E stuck OFF	ON	YES	2	CCM	×
P0772	Shift solenoid E stuck ON	ON	YES	2	CCM	×
P0773	Shift solenoid E malfunction (electrical)	ON	YES	1	CCM	×
P0841	Oil pressure switch circuit malfunction	OFF	NO	2	CCM	×

Failure Detection Function

- The failure detection function compares input/output devices and system components operation to normal condition values pre-programmed in the PCM.
- If a failure is detected, the HOLD indicator light flashes to warn the driver of a malfunction in the powertrain system components or sensors/switches.
- The stored DTCs in the PCM are retrieved using the WDS or equivalent.
- The failures are detected according to the following detection concepts. Detection concepts of the TP sensor malfunction (P0122, P0123) are mentioned in the ENGINE section.

Vehicle speed sensor (VSS) circuit malfunction (P0500)

- No VSS signal is input to PCM terminal 3C when engine coolant temperature is **above 60 °C {140 °F}** and input/turbine speed sensor signal is **above 1,500 rpm** and selector lever position is at D, S or L range.

Transaxle range (TR) switch circuit range/performance (P0706)

- No TR signal (P, R, N, D, S or L range/position) Input to PCM terminal 1W when engine speed is **above 530 rpm** and vehicle speed is **above 20 km/h {12 mph}** and voltage at PCM terminal 1W is **0.5 V or above**.

Transaxle range (TR) switch circuit low input (P0707)

- Input voltage from TR switch to PCM terminal 1W **below 0.5 V** when engine speed is **above 530 rpm** and vehicle speed is **above 20 km/h {12 mph}**.

Transaxle range (TR) switch circuit high input (P0708)

- Input voltage from TR switch to PCM terminal 1W **above 4.79 V** when engine speed is **above 530 rpm** and vehicle speed is **above 20 km/h {12 mph}**.

Transaxle fluid temperature (TFT) sensor range/performance (stuck) (P0711)
- Input voltage from TFT sensor to PCM terminal 3D and 2H maintains **0.06 V** when **180 seconds** have passed after engine is started, vehicle is driven for **150 seconds or more** at vehicle speed **between 25 and 59 km/h {15 and 36 mph}**, then **60 km/h {37 mph} or more** for **100 seconds or more**.

Transaxle fluid temperature (TFT) sensor circuit malfunction (Open or short) (P0712)
- Input voltage from TFT sensor to PCM terminal 3D and 2H maintains **0.06 V** when vehicle speed is **above 20 km/h {12 mph}**.

Transaxle fluid temperature (TFT) sensor circuit malfunction (short to ground) (P0713)
- Input voltage from TFT sensor to PCM terminal 3D and 2H maintains **4.67 V** when vehicle speed is **above 20 km/h {12 mph}**.

Input/turbine speed sensor circuit malfunction (P0715)
- No input/turbine speed sensor signal to PCM terminals 3J and 3G when vehicle speed is **above 40 km/h {25 mph}** and selector lever position is at D, S, or L range.

Gear incorrect (P0731, P0732, P0733, P0734)
- If the RPM difference between the forward clutch drum revolution and differential gear case revolution exceeds or falls below the pre-programmed RPM difference in the PCM while driving in each gear, the OBD system judges “gear incorrect”.

Gear 1 incorrect (P0731)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution is below 2.157 while in 1GR.

Gear 2 incorrect (P0732)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution is below 1.249 or above 2.157 while in 2GR.

Gear 3 incorrect (P0733)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution is below 0.863 or above 1.249 while in 3GR.

Gear 4 incorrect (P0734)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution is below 0.6 or 1.249 or above while in 4GR.

Torque converter clutch (TCC) (Stuck off) (P0741)
- Difference between engine speed and turbine speed more than 100 rpm while in TCC operation.

Torque converter clutch (TCC) (Stuck on) (P0742)
- Difference between engine speed and turbine speed below 50 rpm while TCC no operation.

Pressure control solenoid valve malfunction (P0745)
- If voltage is stuck at **0V** or **B+** in pressure control solenoid control terminal 3Y of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid A malfunction (Stuck off) (P0751)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution within 0.91–1.09 and DTCs not output

Shift solenoid A malfunction (Stuck on) (P0752)
- Input/turbine speed sensor signal 188 rpm or above while vehicle stop

Shift solenoid A malfunction (electrical) (P0753)
- If voltage is stuck at **0V** or **B+** in shift solenoid A control terminal 4AB of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid B malfunction (stuck off) (P0756)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution below 2.157 and DTCs not output.

Shift solenoid B malfunction (stuck on) (P0757)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution below 1.249 or more than 2.157 in driving in D range.

Shift solenoid B malfunction (electrical) (P0758)
- If voltage is stuck at **0V** or **B+** in shift solenoid B control terminal 4AC of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid C malfunction (stuck off) (P0761)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution below 2.157 in driving in D range.

Shift solenoid C malfunction (stuck on) (P0762)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution below 0.863 or 1.249 or above in driving in D range.

Shift solenoid C malfunction (electrical) (P0763)
- If voltage is stuck at **0V** or **B+** in shift solenoid C control terminal 4Y of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid D malfunction (stuck off) (P0766)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution below 0.6 or 1.249 or above in driving in 4GR at D range.

Shift solenoid D malfunction (stuck on) (P0767)
- Revolution ratio of forward clutch drum revolution to differential gear case revolution below 0.863 or 1.249 or above in driving in D range.

Shift solenoid D malfunction (electrical) (P0768)
- If voltage is stuck at **0V** or **B+** in shift solenoid D valve control terminal 3S of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid E malfunction (stuck off) (P0771)
- Difference between engine speed and turbine speed more than 100 rpm in driving in 4GR at D range TCC operation.

Shift solenoid E malfunction (stuck on) (P0772)
- Difference between engine speed and turbine speed below 50 rpm in driving in 4GR at D range TCC no operation.

Shift solenoid E malfunction (electrical) (P0773)
- If voltage is stuck at **0V** or **B+** in shift solenoid E control terminal 3P of the PCM when the solenoid valve operates according to PCM calculation.

Oil pressure switch circuit malfunction (P0841)
- No oil pressure switch signal input and revolution ratio of forward clutch drum revolution to differential gear case revolution is below 0.91 or above 3.08 while in 1, 2 or 3GR.
- Oil pressure switch signal input and revolution ratio of forward clutch drum revolution to differential gear case revolution is below 0.64 or above 0.82 while in 4GR.

K

FAIL-SAFE FUNCTION

A6E567001030T04

- In the fail-safe function, minimum vehicle drivability is obtained by changing the signals that are determined to be malfunctioning by the failure detection function to present values, and limiting the PCM control.

DTC No.	Definition	Fail-safe	TCC
P0122	TP circuit low input	Throttle valve opening angle is fixed at the time in order to determine shift	Inhibition
P0123	TP circuit high input		Inhibition
P0500	Vehicle speed sensor (VSS) circuit malfunction	–	Available
P0706	Transaxle range (TR) switch circuit range/ performance	Inhibits gear shifting and maximizes line pressure	Inhibition
P0707	Transaxle range (TR) switch circuit low input		
P0708	Transaxle range (TR) switch circuit high input		
P0711	Transaxle fluid temperature (TFT) sensor circuit range/performance (stuck)	–	Inhibition
P0712	Transaxle fluid temperature (TFT) sensor circuit malfunction (short to ground)	Sets temperature to cold condition	Inhibition
P0713	Transaxle fluid temperature (TFT) sensor circuit malfunction (Open circuit)		
P0715	Input/turbine speed sensor circuit malfunction	Inhibits 4GR	Inhibition
P0731	Gear 1 incorrect	Inhibits 1GR and maximizes line pressure	Available
P0732	Gear 2 incorrect	Inhibits 2GR and maximizes line pressure	Available
P0733	Gear 3 incorrect	–	Available
P0734	Gear 4 incorrect	Inhibits 4GR and maximizes line pressure	Available
P0741	Torque converter clutch (TCC) (stuck off)	Inhibits TCC and maximizes line pressure	Inhibition
P0742	Torque converter clutch (TCC) (stuck on)	Inhibits TCC and maximizes line pressure	Inhibition
P0745	Pressure control solenoid valve malfunction	–	Available
P0751	Shift solenoid A malfunction (Stuck off)	Inhibits 4GR and TCC and maximizes line pressure	Inhibition
P0752	Shift solenoid A malfunction (Stuck on)	Inhibits 1GR, 2GR, and 3GR and maximizes line pressure	Available
P0753	Shift solenoid A malfunction (Electrical)	Inhibits 4GR and TCC and maximizes line pressure	Inhibition
P0756	Shift solenoid B malfunction (Stuck off)	Inhibits 1GR and 4GR and maximizes line pressure	Available
P0757	Shift solenoid B malfunction (Stuck on)	Inhibits 2GR and 4GR and maximized line pressure	Available
P0758	Shift solenoid B malfunction (Electrical)	Inhibits 1GR and 4GR and maximizes line pressure	Available
P0761	Shift solenoid C malfunction (Stuck off)	Inhibits 1GR and 2GR and maximizes line pressure	Available

DTC No.	Definition	Fail-safe	TCC
P0762	Shift solenoid C malfunction (Stuck on)	Inhibits 3GR and 4GR and maximizes line pressure	Available
P0763	Shift solenoid C malfunction (Electrical)	Inhibits 1GR and 2GR and maximizes line pressure	Available
P0766	Shift solenoid D malfunction (Stuck off)	Inhibits 4GR and maximizes line pressure	Available
P0767	Shift solenoid D malfunction (Stuck on)	Inhibits 2GR, 4GR, and TCC and maximizes line pressure	Inhibition
P0768	Shift solenoid D malfunction (Electrical)	Inhibits 4GR and maximizes line pressure	Available
P0771	Shift solenoid E malfunction (Stuck off)	Inhibits TCC and maximized line pressure	Inhibition
P0772	Shift solenoid E malfunction (Stuck on)	Inhibits 1GR and maximizes line pressure	Available
P0773	Shift solenoid E malfunction (Electrical)	Inhibits TCC and maximizes line pressure	Inhibition
P0841	Oil pressure switch circuit malfunction	–	Available

PARAMETER IDENTIFICATION (PID) ACCESS

A6E567001030T05

- The PID mode allows access to certain data values, analog and digital input and output, calculated values, and system states information.

Monitor Item Table

Display on the tester	Definition	Unit/Condition		PCM terminal
GEAR	Gear commmanded by module	—		3P, 3S, 3Y, 4Y, 4AB, 4AC
LINEDES	Target line pressure	kPa	inHg	3V, 3Y
LPS	Pressure control solenoid control signal in PCM	%		3V, 3Y
OP SW B	Oil pressure switch	ON/OFF		3T
SSA/SS1	Shift solenoid A control signal in PCM	%		4AB
SSB/SS2	Shift solenoid B control signal in PCM	%		4AC
SSC/SS3	Shift solenoid C control signal in PCM	%		4Y
TCS	HOLD switch	ON/OFF		3Q
TFT	ATF temperature	°C	°F	3D
TFTV	ATF temperature signal voltage	V		3D
THOP	TP signal in PCM	%		2A
TP	TP signal voltage	V		2A
TR	TR switch signal	P/R/N/D/S/L		1W
TR SENS	TR switch signal voltage	V		1W
TSS	Input/turbine speed	rpm		3G, 3J
VPWR	Battery positive voltage	V		2Y, 2Z
VSS	Vehicle speed	km/h	mph	3C

Simulation Item Table

Simulation item	Applicable component	Operation	Operation		PCM terminal
			IG ON	Idle	
LPS	Pressure control solenoid control signal in PCM	%	×	×	3V, 3Y
SSA/SS1	Shift solenoid A control signal in PCM	%	×	—	4AB
SSB/SS2	Shift solenoid B control signal in PCM	%	×	—	4AC
SSC/SS3	Shift solenoid C control signal in PCM	%	×	—	4Y
SSD/ SS4	Shift solenoid D control signal in PCM	ON/OFF	×	—	3S
SSE/SS5	Shift solenoid E control signal in PCM	ON/OFF	×	—	3P

X : Available
— : Not applied

FRONT AND REAR AXLES

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ABBREVIATIONS M-2
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DRIVE SHAFT OUTLINE M-4
DRIVE SHAFT (LF ATX) CROSS-SECTIONAL VIEW M-4

ABBREVIATIONS

ABBREVIATIONS

A6E630100000T03

ATX	Automatic transaxle
MTX	Manual transaxle
4SD	4 door sedan
5HB	5 door hatchback

OUTLINE

OUTLINE OF CONSTRUCTION

A6E630201018T01

- The construction and operation of the front and rear axles is essentially carried over from that of the 626 (GF) model, except for the following features. (See 626 Training Manual 3303-10-97D.)

FEATURES

A6E630201018T04

Improved rigidity

- Large size rear hub spindle has been adopted.

Reduced Vibration

- Improved tripod joint has been adopted. (LF ATX model)

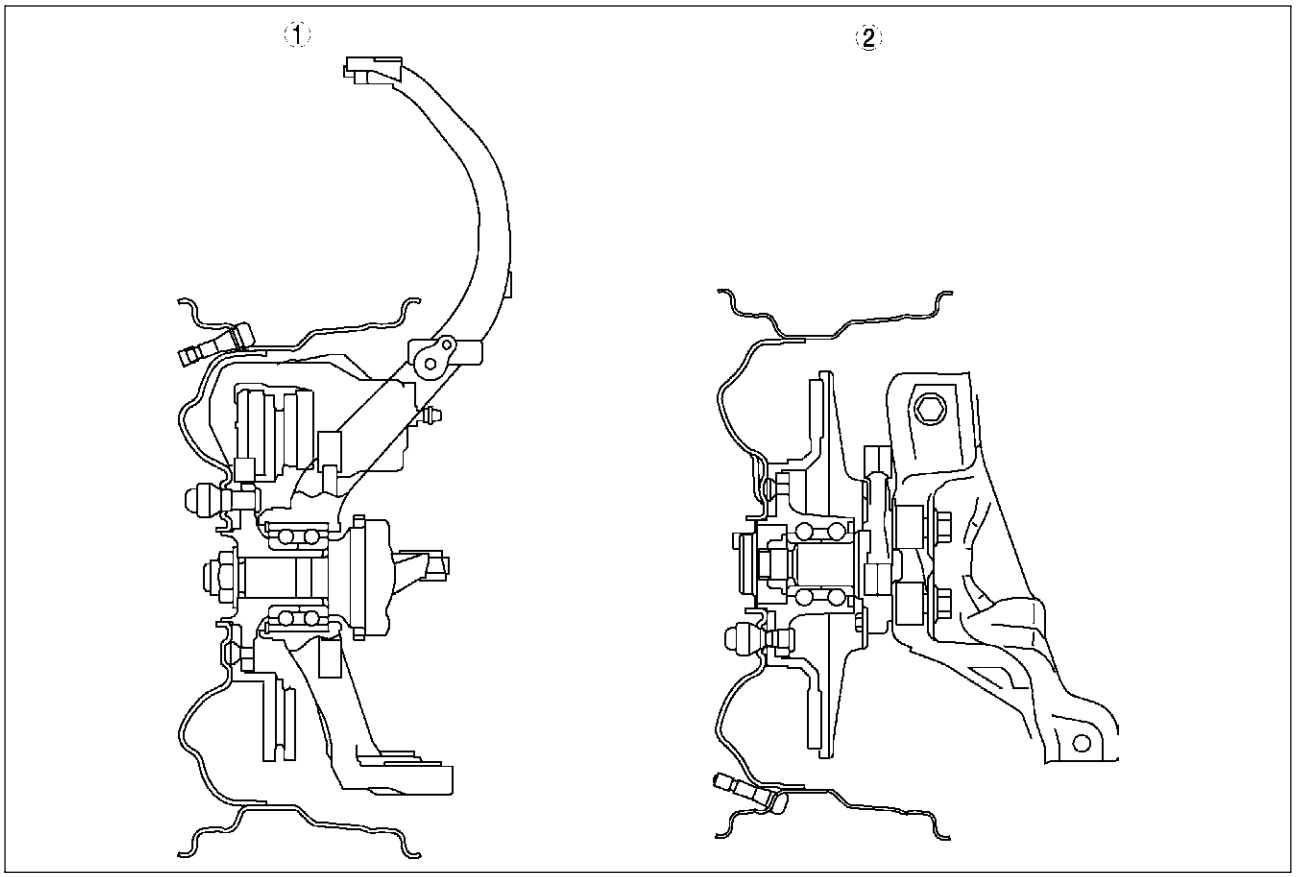
SPECIFICATIONS

A6E630201018T02

Item			Specification					
			Mazda6 (GG) (4SD, 5HB)				626 (GF) (4SD, 5HB)	
Engine			**L8**	**LF**		**L3**	**FS**	
Transaxle			**MTX**	**MTX**	**ATX**	**MTX**	**MTX**	**ATX**
Front axle	Bearing type		Angular ball bearing				Angular ball bearing	
Rear axle	Bearing type		Angular ball bearing				Angular ball bearing	
Drive shaft	Joint type	Wheel side	Bell joint				Bell joint	
		Differential side	Double offset joint		Tripod joint (With free ring)	Double offset joint	Double offset joint	Tripod joint
	Shaft diameter (mm {in})		24.5 {0.96}		24.0 {0.94}	24.5 {0.96}	26.0 {1.02}	22.7 {0.89}
Joint shaft	Shaft diameter (mm {in})		26.0 {1.02}				26.0 {1.02}	

CROSS-SECTIONAL VIEW

A6E630201018T03



A6E6302T001

1	Front axle

2	Rear axle

DRIVE SHAFT

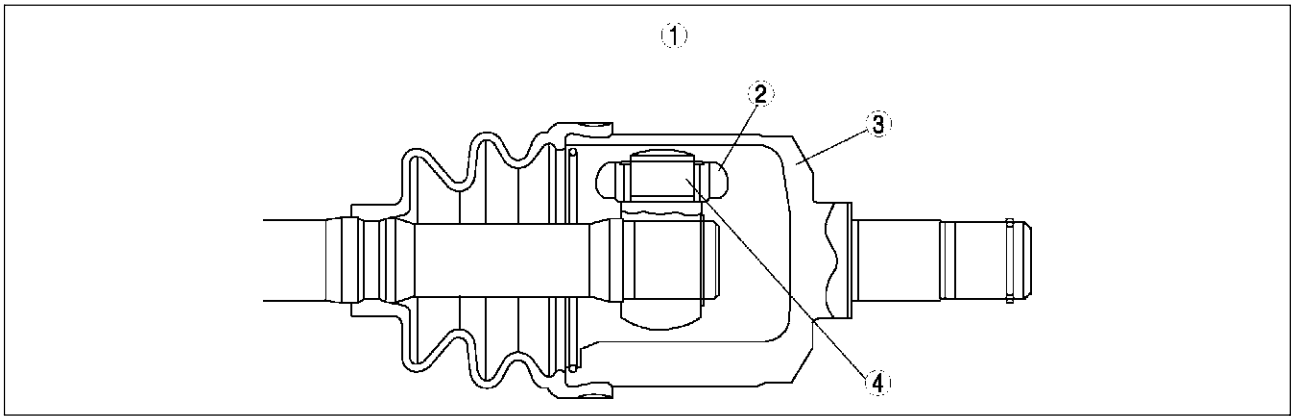
DRIVE SHAFT OUTLINE

A6E631625500T01

- Construction of the joint is essentially carried over from that of the previous tripod joint.
- A free ring has been adopted for the transaxle side joint. A contact region between the outer ring and free ring has been formed to reduce axial vibratory force when the joint slides (LF ATX model).

DRIVE SHAFT (LF ATX) CROSS-SECTIONAL VIEW

A6E631625500T02



A6E6316T001

1	Transaxle side joint
2	Free ring

3	Outer ring
4	Tripod joint

STEERING SYSTEM

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ENERGY ABSORBING SYSTEM N-4

ABBREVIATIONS

ABBREVIATIONS

A6E660100000T01

ATX	Automatic transaxle
MTX	Manual transaxle
4SD	4 door sedan
5HB	5 door hatchback

OUTLINE

OUTLINE OF CONSTRUCTION

A6E660201036T01

- The construction and operation of the steering system is essentially carried over from that of the 626 (GF) model, except for the following features. (See 626 Training Manual 3303-10-97D.)

FEATURES

A6E660201036T02

Improved Operability

- Tilt and telescope mechanism has been adopted.

Improved Safety in Collision

- Steering shaft with energy absorbing system has been adopted.

SPECIFICATIONS

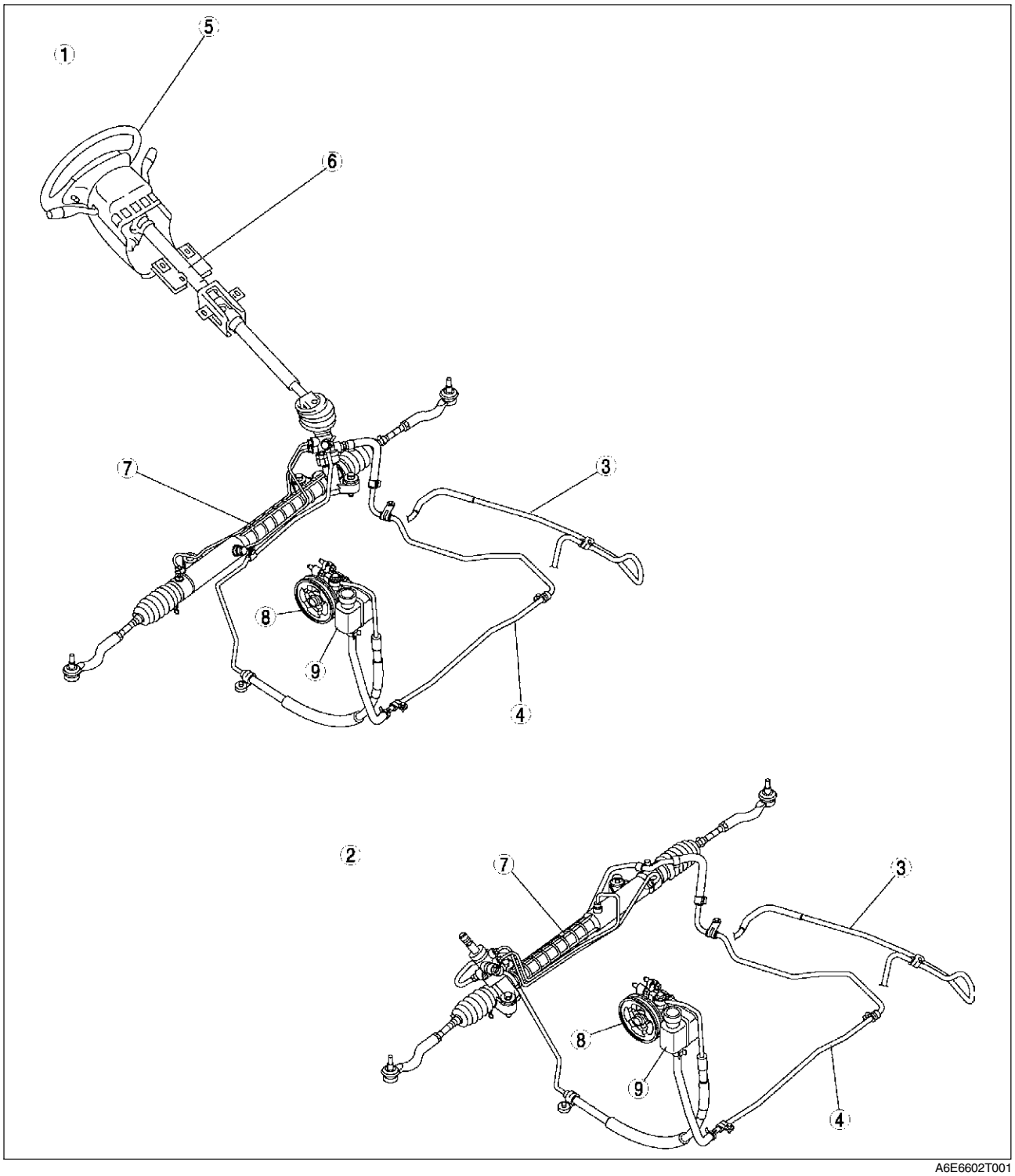
A6E660201036T03

Item			Mazda6 (GG) (4SD, 5HB)	626 (GF) (4SD, 5HB)
Steering wheel	Outer diameter mm {in}		370 {14.6}	380 {15.0}
	Lock-to-lock (turns)		2.75	2.8
Steering gear and linkage	Type		Rack-and-pinion	Rack-and-pinion
	Rack stroke mm {in}		146.8—148.8 {5.78—5.85}	130—132 {5.11—5.19}
Steering column and shaft	Shaft type		Collapsible	Collapsible
	Joint type		2-cross joint	2-cross joint
	Amount of tilt mm {in}		45 {1.8}	40 {1.6}
	Amount of telescope mm {in}		50 {2.0}	–
Power steering system	Power assist type		Engine speed sensing	Engine speed sensing
	Power steering fluid	Type	M-III or equivalent (e.g. Dexron®II)	M-III or equivalent (e.g. Dexron®II)
		Fluid capacity* (approximate quantity) (L {US qt, Imp qt})	0.80 {0.85, 0.70} (MTX) 0.87 {0.92, 0.77} (ATX)	0.98 {1.04, 0.86}

* : When reservoir tank is at maximum volume

STRUCTURAL VIEW

A6E660201036T04



A6E6602T001

1	L.H.D.
2	R.H.D.
3	ATX
4	MTX
5	Steering wheel

6	Steering column and shaft
7	Steering gear
8	Power steering oil pump
9	Fluid reservoir

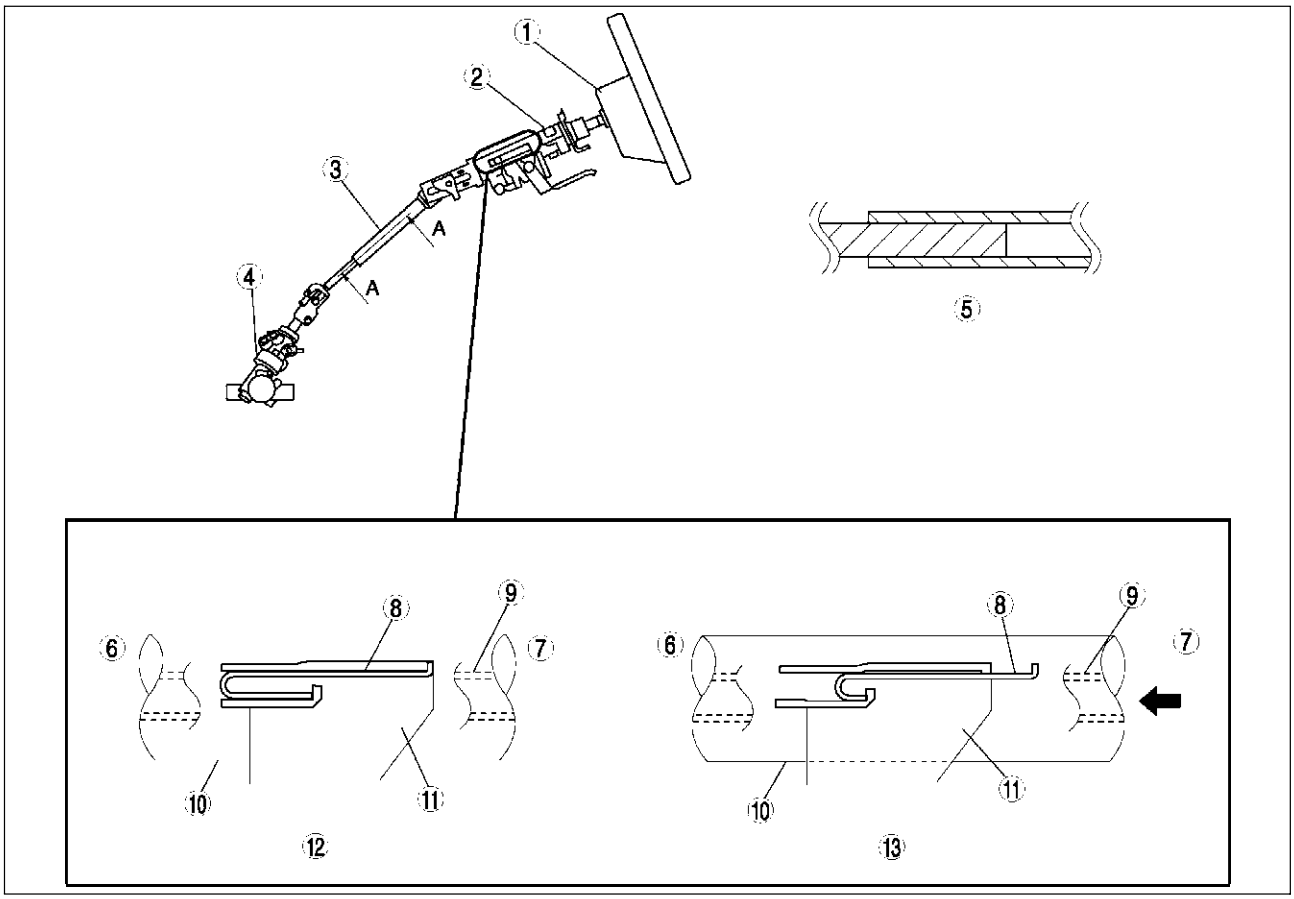
ENGINE SPEED SENSING POWER STEERING

ENERGY ABSORBING SYSTEM

A6E661432010T01

Structure and Operation

- The steering gear is joined to the steering shaft through the intermediate shaft.
- In a collision, the intermediate shaft is crushed as the steering gear moves rearward, thereby absorbing the impact.
- If the driver's body hits the steering wheel, the force applied to the steering wheel is transmitted through the inner shaft, outer column, and fixing bracket. As a result, the fixing bracket is disengaged from the dashboard, and the whole steering shaft will move forward.
  At this moment, the U-shaped plate, which is fixed to the dashboard at one end and held by the fixing bracket at the other, will deform and absorb the impact.



A6E6614T001

1	Steering wheel
2	Steering shaft
3	Intermediate shaft
4	Steering gear
5	Section A—A
6	Steering gear side
7	Steering wheel side

8	U-shaped plate
9	Inner shaft
10	Outer column
11	Fixing bracket
12	Normal condition
13	During collision

BRAKING SYSTEM

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ABBREVIATIONS

ABBREVIATIONS

A6E690100000T01

CAN	Controller area network
CM	Control module
DSC	Dynamic stability control
EBD	Electronic brakeforce distribution
HU	Hydraulic unit
IG	Ignition switch
LF	Left front
LR	Left rear
RF	Right front
RR	Right rear
4SD	4 door sedan
5HB	5 door hatchback

OUTLINE

OUTLINE OF CONSTRUCTION

A6E690201020T01

- The construction and operation of the conventional braking system is essentially carried over from that of the 626 (GF), except for the following features and specifications. (See 626 Training Manual 3303-10-97D.)
- The construction and operation of the ABS/TCS/DSC and on-board diagnosis system is essentially carried over from that of the current 323 (BJ), except for the following features. (See 323 Workshop Manual Supplement 1704-1*-00J.)

FEATURES

A6E690201020T02

Improved Braking Stability

- Large diameter front disc plate has been adopted.
- Large diameter rear disc plate has been adopted.

Improved Safety and Marketability

- DSC OFF switch has been adopted.
- Electrical brake assist has been adopted.
- Intrusion-minimizing brake pedal has been adopted.

Improved Serviceability

- Integrated DSC HU/CM has been adopted.
- Combine sensor has been adopted.
- CAN communication function has been adopted.
- TBS terminal of DLC has been eliminated.

SPECIFICATIONS

A6E690201020T03

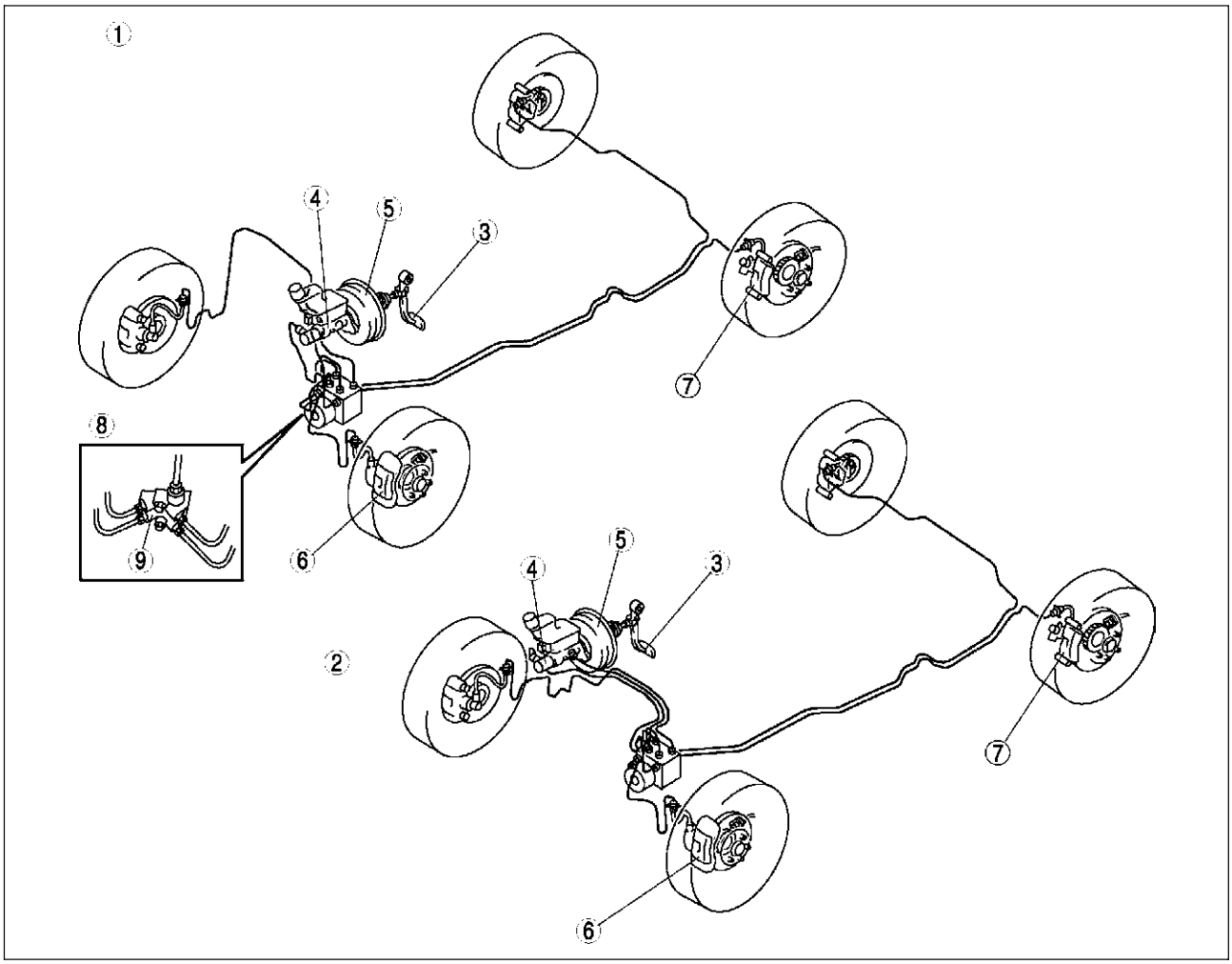
Item			Specification	
			Mazda6 (GG) (4SD, 5HB)	626 (GF) (4SD, 5HB)
Brake pedal	Type		Suspended	
	Pedal lever ratio		2.7	3.7
	Max. stroke	(mm {in})	128.5 {5.06}	116 {4.57}
Master cylinder	Type		Tandem (with level sensor)	
	Cylinder diameter	(mm {in})	20.64 {0.813}	23.81 {0.937}
Front brake (disc)	Type		Ventilated disc	
	Cylinder bore	(mm {in})	57.15 {2.250}	
	Pad dimensions (area × thickness)	(mm^2 {in^2} × mm {in})	L8: 4,220 {6.75} × 10.0 {0.39} LF, L3: 4,010 {6.42} × 12.5 {0.02}	4,800 {7.44} × 10.0 {0.39}
	Disc plate dimensions (outer diameter × thickness)	(mm {in})	L8: 274 {10.8} × 24.0 {0.945} LF, L3: 283 {11.1} × 25.0 {0.984}	258 {10.2} × 24.0 {0.945}
Rear brake (disc)	Type		Solid disc	
	Cylinder bore	(mm {in})	34.93 {1.375}	
	Pad dimensions (area × thickness)	(mm^2 {in^2} × mm {in})	2,820 {4.51} × 8.0 {0.31}	
	Disc plate dimensions (outer diameter × thickness)	(mm {in})	280 {11.0} × 10.0 {0.39}	261 {10.3} × 10.0 {0.39}
Rear brake (drum)	Type		–	Leading-trailing
	Wheel cylinder inner diameter	(mm {in})	–	20.64 {0.813}
	Lining dimension (outer diameter × thickness)	(mm {in})	–	42.0 {1.65}× 229.4 {9.03} × 4.5 {0.18}
	Drum inner diameter	(mm {in})	–	228.6 {9.000}
	Shoe clearance adjustment		–	Automatic adjuster
Power brake unit	Type		Vacuum multiplier, single diaphragm	
	Diameter	(mm {in})	276 {10.9}	239 {9.41}
Braking force control device	Type		With ABS: EBD (Electronic Brakeforce Distribution) Without ABS: Dual proportioning valve	
Parking brake	Type		Mechanical two-rear-wheel control	
	Operation system		Center lever type	
Brake fluid	Type		European (L.H.D. U.K.) specs.: SAE J1703, FMVSS 116 DOT3 OR DOT4 GCC specs.: SAE J1703, FMVSS 116 DOT3	

Bold frames: New specifications

P

STRUCTURAL VIEW

A6E690201020T04



A6E6912T001

1	L.H.D.
2	R.H.D.
3	Brake pedal
4	Master cylinder
5	Power brake unit

6	Front brake (disc)
7	Rear brake (disc)
8	Without ABS
9	Dual proportioning valve

CONVENTIONAL BRAKE SYSTEM

INTRUSION-MINIMIZING BRAKE PEDAL

A6E691201020T01

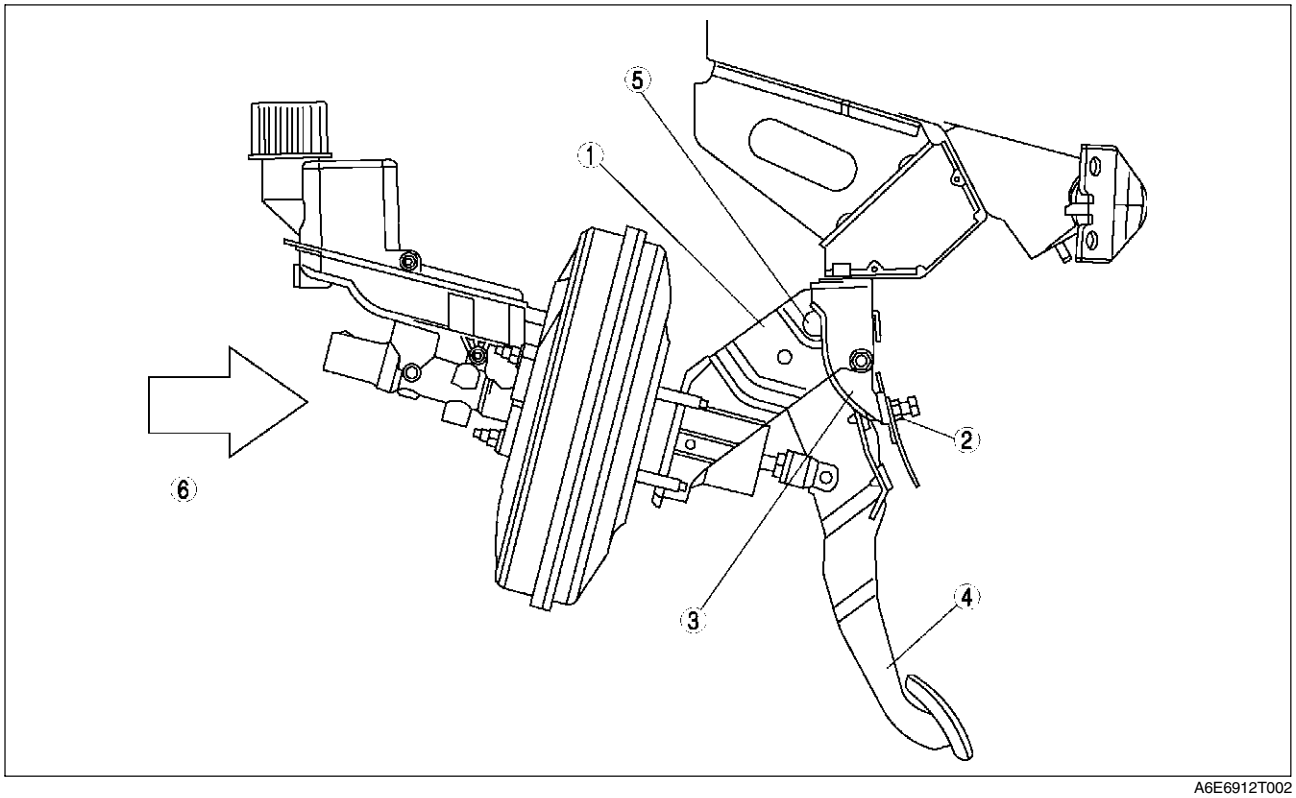
Function

- An intrusion-minimizing brake pedal construction, which minimizes the amount of backward thrust of the pedal, has been adopted. It has been designed to soften the force of impact on the lower body of the driver.

Structure/operation

- During a frontal collision, the backward thrust of the engine and other parts forces brake pedal bracket A rearward and it separates from brake pedal bracket B.
- The rearward movement of the brake pedal arm, connected at the fulcrum of brake pedal bracket A, is prevented due to the stopper on brake pedal bracket B.
- Due to this, the rearward movement of the brake pedal arm is suppressed by the displacement of brake pedal bracket A.

Before collision



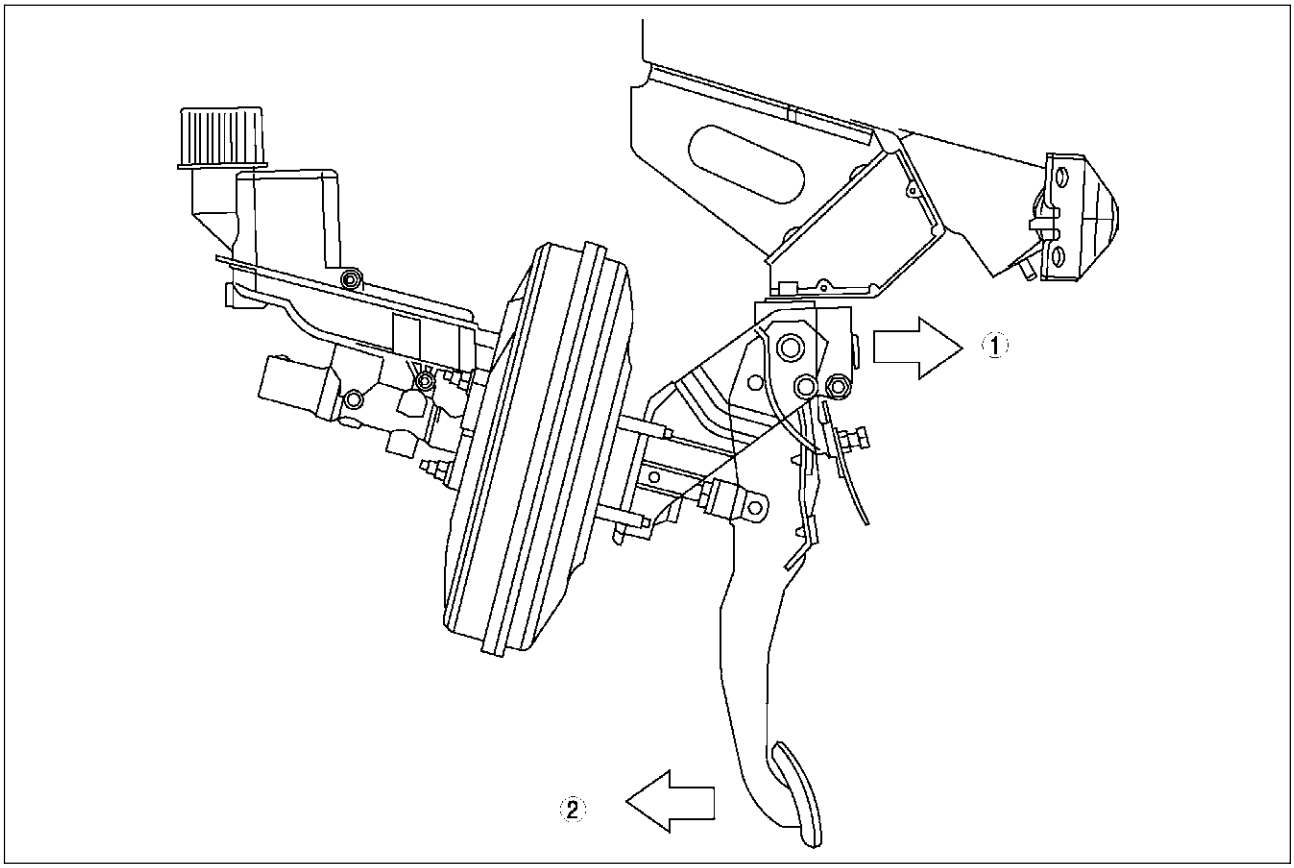
A6E6912T002

1	Brake pedal bracket A
2	Stopper
3	Brake pedal bracket B

4	Brake pedal arm
5	Fulcrum
6	Backward thrust

P

After collision



A6E6912T003

1	Backward thrust
2	Pivot away from the driver

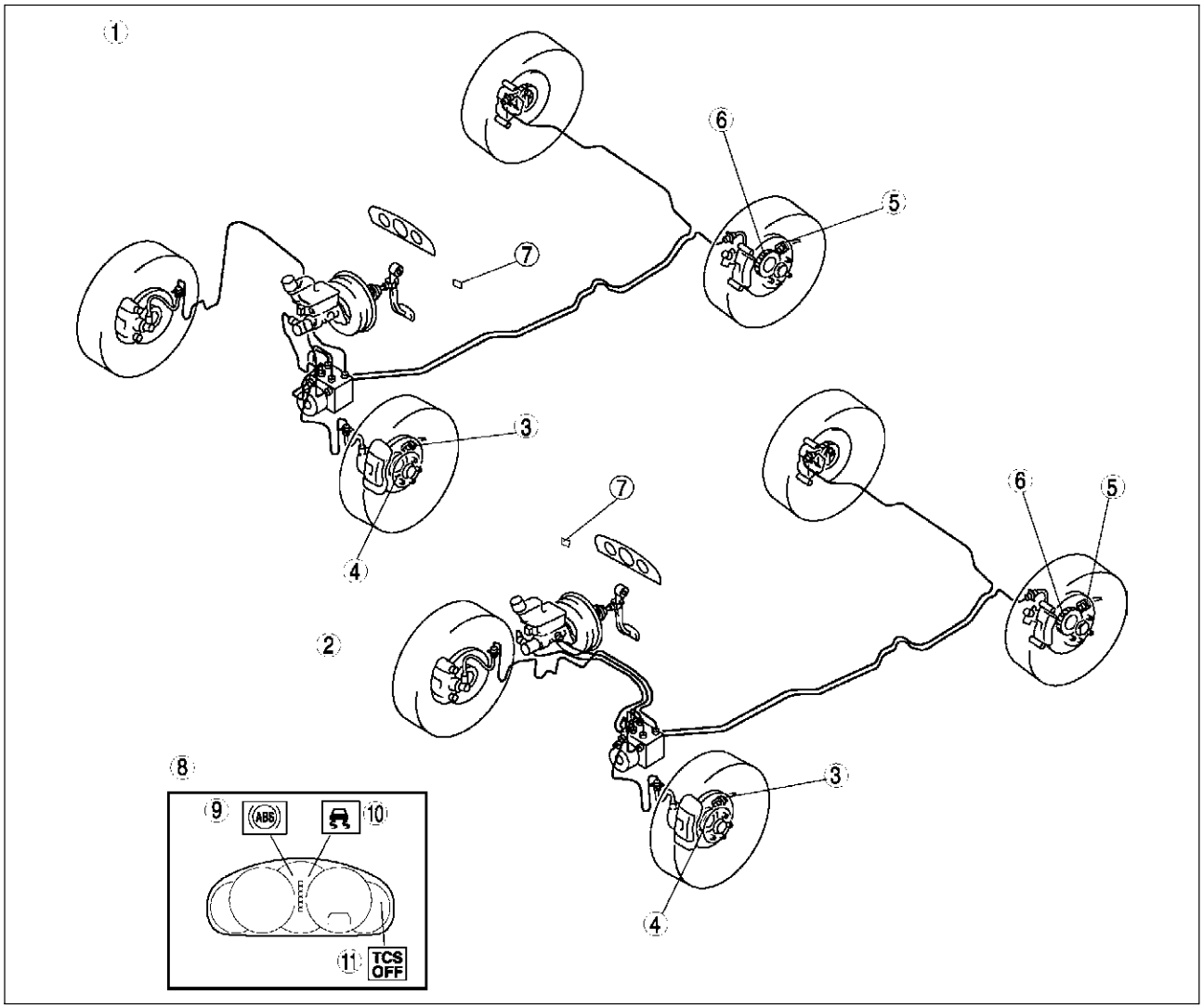
ABS/TCS

OUTLINE

A6E692143000T01

- The hydraulic pressure control mechanism in the ABS (ABS/TCS) hydraulic unit (HU) and the system control strategy is essentially carried over from that of the current 323 (BJ), except for the following:
  — Input/output terminals of ABS (ABS/TCS) HU/CM have been changed.
  — CAN communication system has been adapted.
  — The ABS (ABS/TCS) HU/CM outputs a speed signal to the audio unit, wiper and washer switch, car-navigation unit, cruise actuator, and auto leveling control unit though a hard wire, and also outputs speed signal through CAN.
  — TCS indicator light is the same light as the DSC indicator light.

Structural View

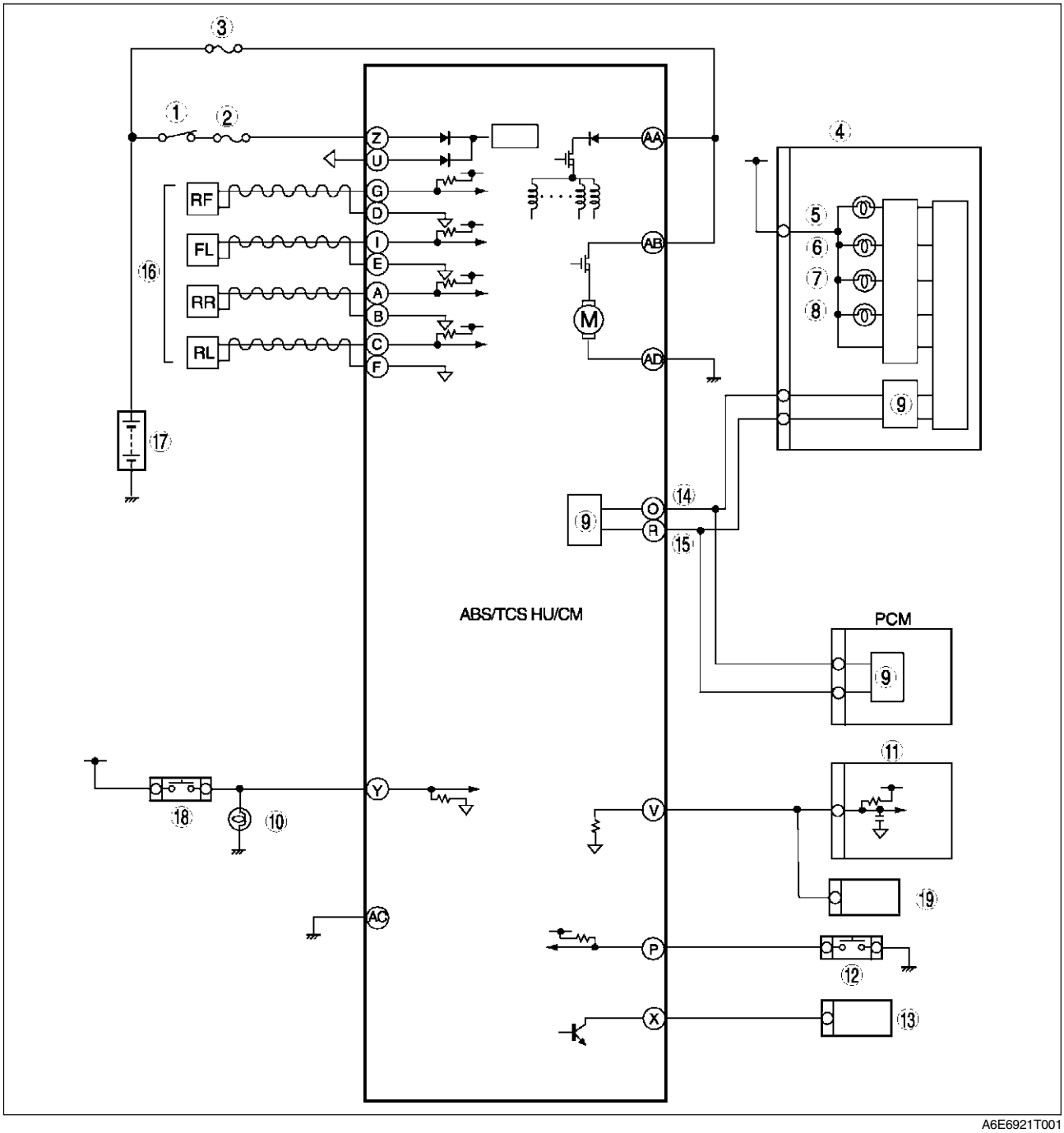


A6E6921T002

1	L.H.D.
2	R.H.D.
3	ABS wheel-speed sensor (front)
4	ABS sensor rotor (front)
5	ABS wheel-speed sensor (rear)
6	ABS sensor rotor (rear)

7	TCS OFF switch
8	Instrument cluster
9	ABS warning light
10	TCS indicator light
11	TCS OFF light

System Diagram



A6E6921T001

1	IG switch
2	SUS 15 A fuse
3	ABS 60 A fuse
4	Meter
5	ABS warning light
6	Brake system warning light
7	TCS OFF light
8	TCS indicator light (with TCS only)
9	CAN driver
10	Brake light

11	Cruise actuator
12	TCS OFF switch (with TCS only)
13	DLC-2
14	CAN-H
15	CAN-L
16	ABS Wheel-speed sensor
17	Battery
18	Brake switch
19	Audio unit, Wiper and washer switch, Car-navigation unit, Auto leveling control unit

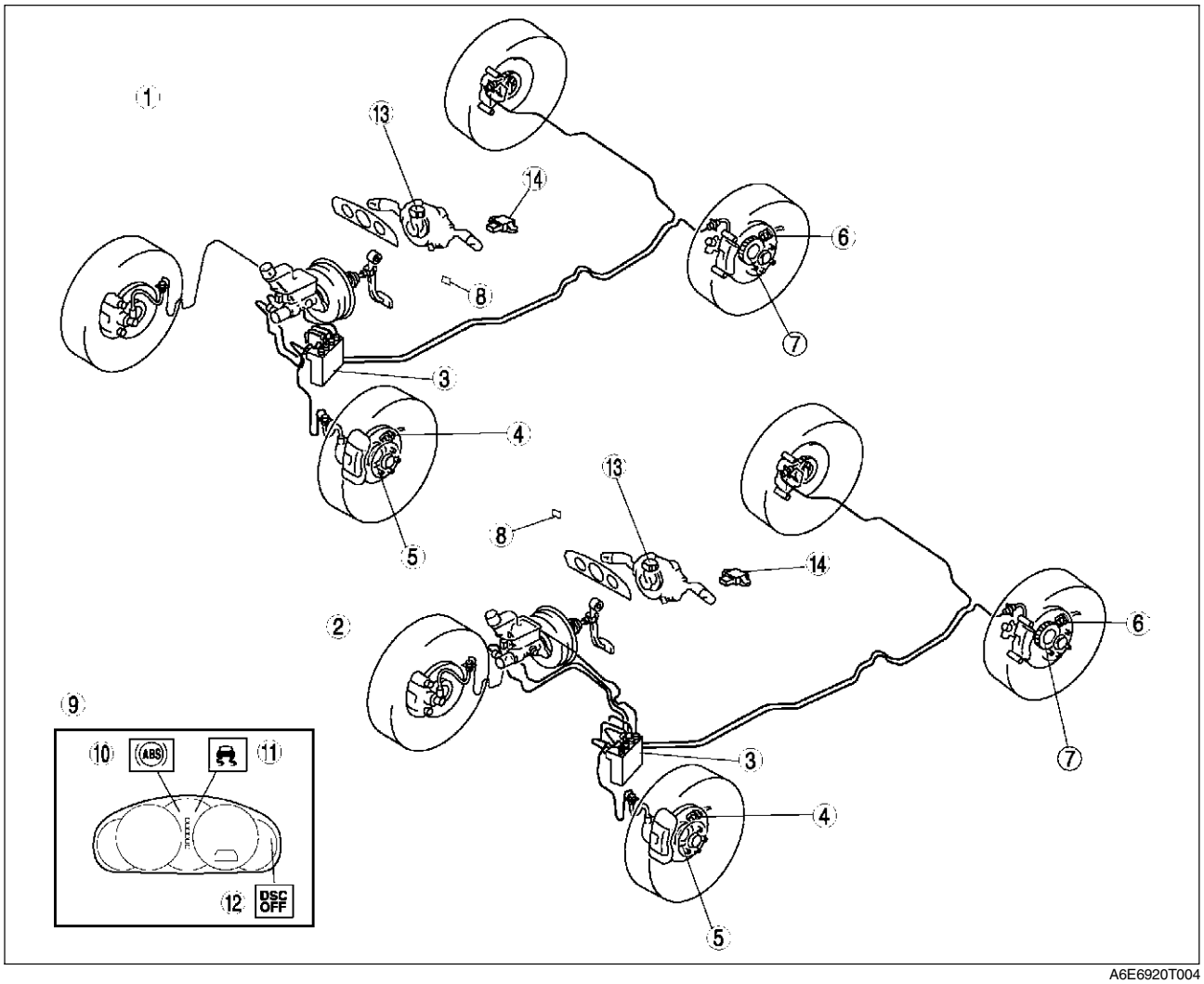
DYNAMIC STABILITY CONTROL

OUTLINE

A6E692067650T01

- The hydraulic pressure control mechanism in the DSC HU/CM and the system control strategy is essentially carried over from that of the previous 323 (1704-1*-00J), except for the following:
  - — DSC unit and hydraulic unit has been integrated to improve service ability.
  - — Lateral-G sensor and yaw rate sensor has been integrated to improve serviceability.
  - — Brake fluid pressure sensor has integrated to DSC HU/CM.
  - — Input/output terminals of DSC HU/CM have been changed.
  - — Electrical brake assist function has been adapted to improve safety.
  - — DSC OFF switch has been adapted to cancel the DSC function.
  - — The DSC HU/CM outputs a speed signal to the audio unit, wiper and washer switch, car-navigation unit, cruise actuator, and auto leveling control unit through a hard wire, and also outputs speed signal to the CAN line.
  - — CAN communication system has been adapted.

Structural view



A6E6920T004

1	L.H.D.
2	R.H.D.
3	DSC HU/CM
4	Wheel-speed sensor (front)
5	Sensor rotor (front)
6	Wheel-speed sensor (rear)
7	Sensor rotor (rear)

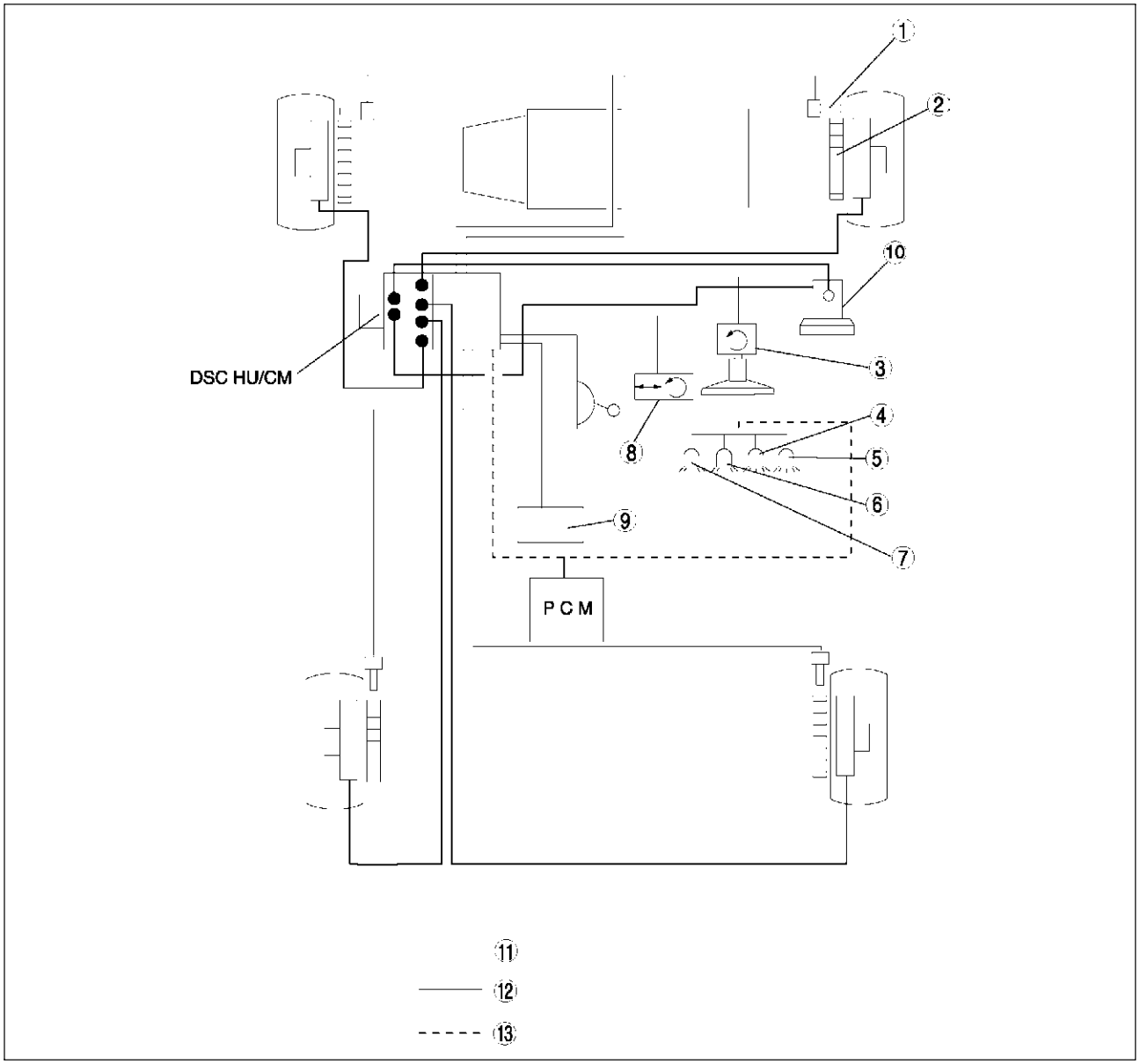
8	DSC OFF switch
9	Instrument cluster
10	ABS warning light
11	DSC indicator light
12	DSC OFF light
13	Steering angle sensor
14	Combine sensor

Components and Functions

- The DSC system consists of the following components. Moreover, the function of common components in other systems as they are related to each DSC structural component is explained in terms of DSC system functions.

Part name	Function
DSC HU/CM	• Calculates input signal from each sensor, and controls brake fluid pressure applied to each wheel, and activates each DSC system function (ABS, EBD, TCS, and DSC). • Outputs control signal regulating the function of the TCS/DSC system and speed signal through CAN. • Outputs speed signal to the audio unit, wiper and washer switch, car-navigation unit, cruise actuator, and auto leveling control unit through a hard wire
	• Controls the diagnosis system and fail-safe function when an abnormality is detected in the DSC system.
PCM	• Controls engine torque based on the signal from DSC HU/CM. • Transmits engine conditions and tire information to DSC HU/CM through CAN.
DSC indicator light	• Notifies driver of DSC operation (Vehicle is in side slip situation). • Notifies driver of TCS operation (Drive-wheel slippage situation).
DSC OFF switch	• DSC system non-operation based on driver intention is transmitted to DSC HU/CM.
DSC OFF light	• Notifies driver of DSC system non-operation by DSC OFF switch. • Notifies driver of DSC system is forbidden by fail-safe function.
Wheel speed sensor	• Detects rotation state of each wheel and transmits signal to the DSC HU/CM.
Combine sensor	• Detects lateral-G force and yaw rate (vehicle cornering angle velocity) of vehicle and transmits to DSC HU/CM.
Steering angle sensor	• Detects steering angle and transmits to the DSC HU/CM.

System Diagram

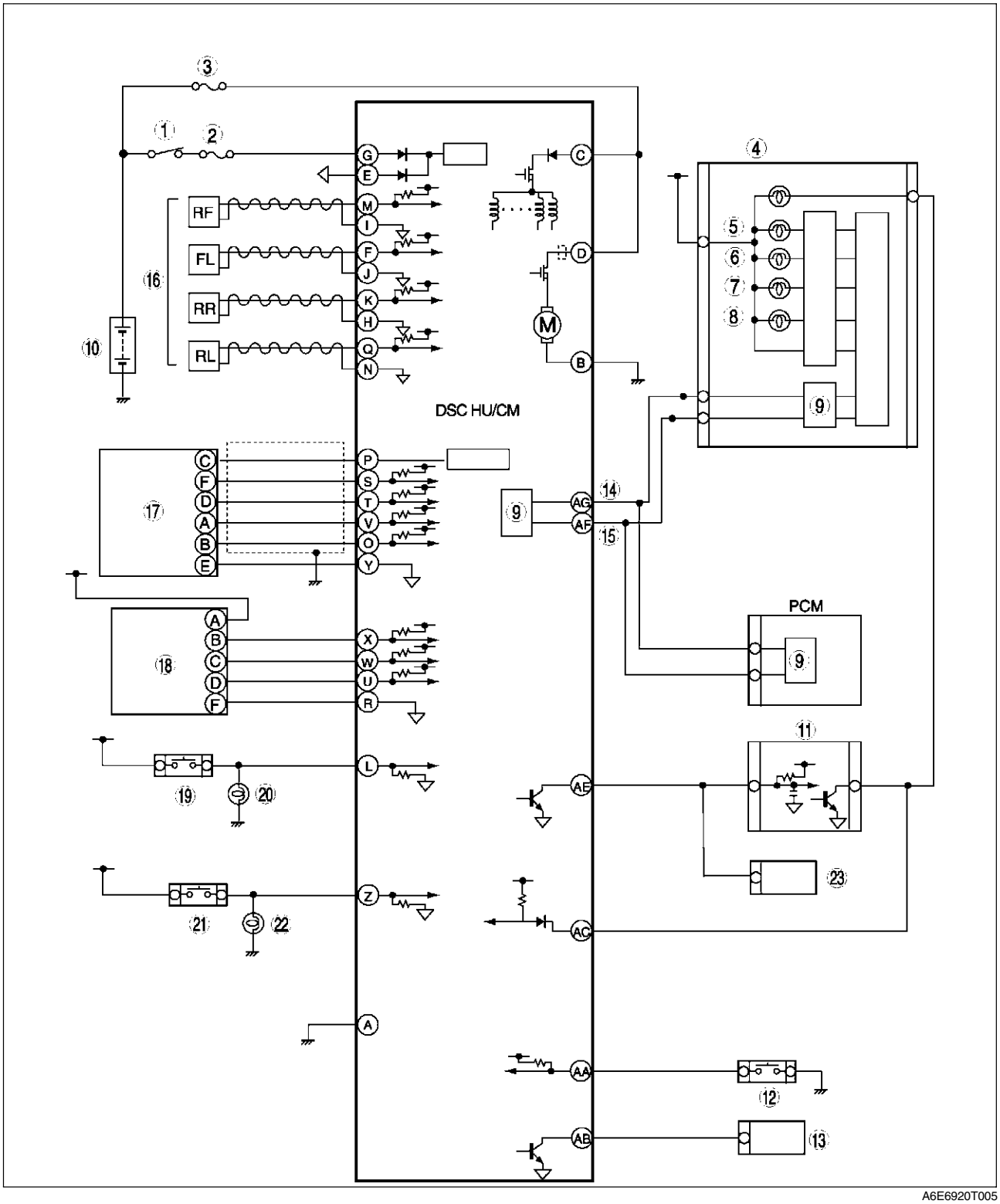


A6E6920T001

1	Wheel speed sensor
2	Sensor rotor
3	Steering angle sensor
4	DSC indicator light
5	DSC OFF light
6	BRAKE system warning light
7	ABS warning light

8	Combine sensor
9	Audio unit, Wiper and washer switch, Car-navigation unit, Cruise actuator, and Auto leveling control unit
10	Master cylinder
11	Electric signal
12	Brake fluid
13	CAN line

Wiring Diagram



A6E6920T005

1	IG switch
2	SUS 15A fuse
3	ABS 60 A fuse
4	Meter
5	ABS warning light
6	Brake system warning light
7	DSC OFF light
8	DSC indicator light
9	CAN driver
10	Battery
11	Cruise actuator
12	DSC OFF switch

13	DLC-2
14	CAN-H
15	CAN-L
16	Wheel-speed sensor
17	Combine sensor
18	Steering angle sensor
19	Brake switch
20	Brake light
21	Back-up light switch (MTX only)
22	Back-up light
23	Audio unit, Wiper and washer switch, Car-navegation unit, Auto leveling control unit

DSC INDICATOR LIGHT

A6E692067650T02

Function

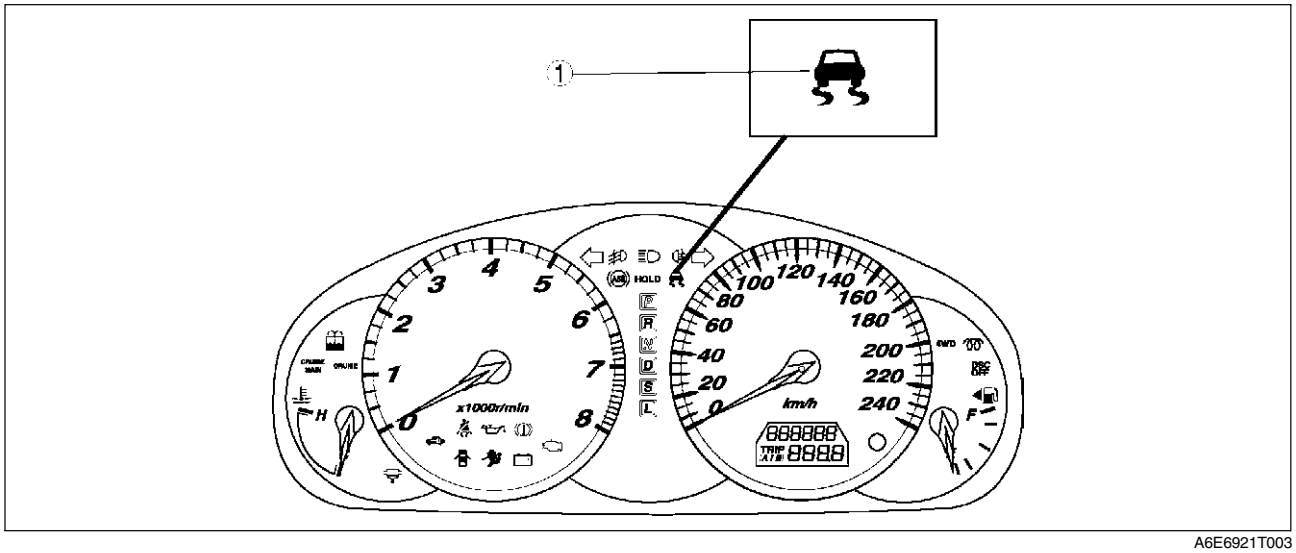
- The DSC indicator light is integrated in the instrument cluster and notifies the driver of DSC activation (vehicle is in side slip situation) or TCS activation (drive-wheel slippage situation) when DSC has not been canceled by pressing the DSC OFF switch.

Structure/Operation

- When the DSC and CAN system is normal, the DSC indicator light illuminates for **2.4 seconds** when the ignition switch is at ON, and goes out, checking the light function. When the system is malfunctioning, the DSC indicator light remains illuminated.
- When DSC and TCS are operating, the DSC indicator light operates as follows:

DSC indicator light operation table

Item	DSC indicator light
TCS, DSC non-operation	Not illuminated
TCS operation	Flashes (0.5 s intervals)
DSC operation	Flashes (0.5 s intervals)



A6E6921T003

1	DSC indicator light

DSC OFF SWITCH, DSC OFF LIGHT

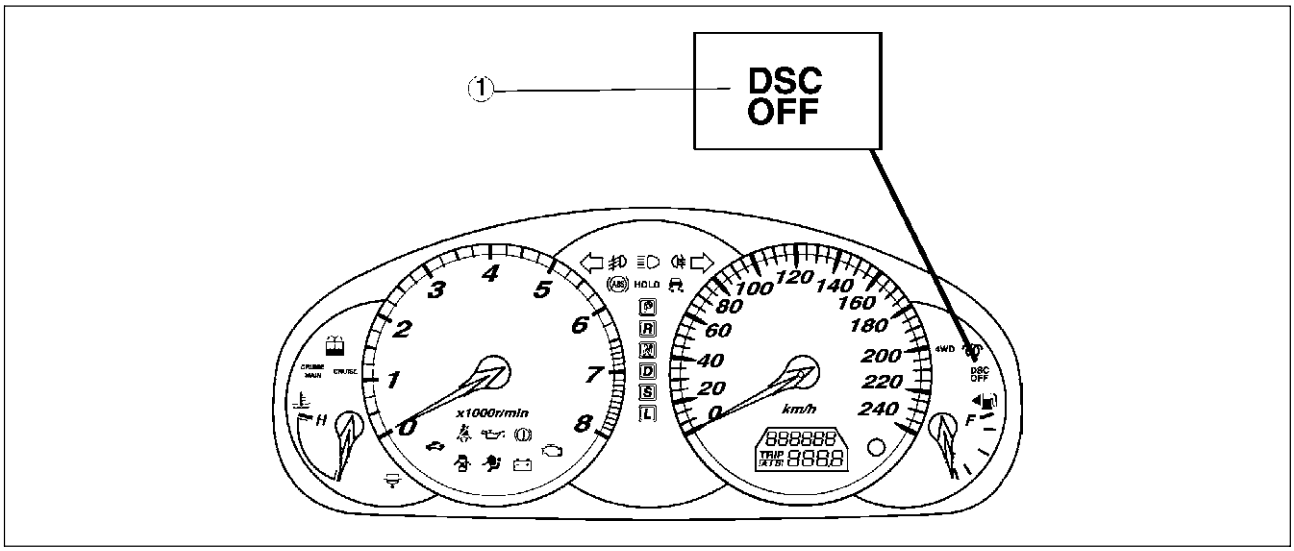
A6E692067650T15

Function

- The DSC OFF switch is installed in the instrument panel and cancels the DSC activation by pressing the DSC OFF switch.
- The DSC OFF light is integrated in the instrument cluster and notifies the driver of DSC activation is cancelled by pressing the DSC OFF switch.

Structure/Operation

- When the DSC and CAN system is normal, the DSC indicator light illuminates for **2.4 seconds** when the ignition switch is at ON, and goes out, checking the light function. When the system is malfunctioning, the DSC OFF indicator light remains illuminated.



A6E6921T040

1	DSC OFF light

COMBINE SENSOR

A6E692067650T05

Function

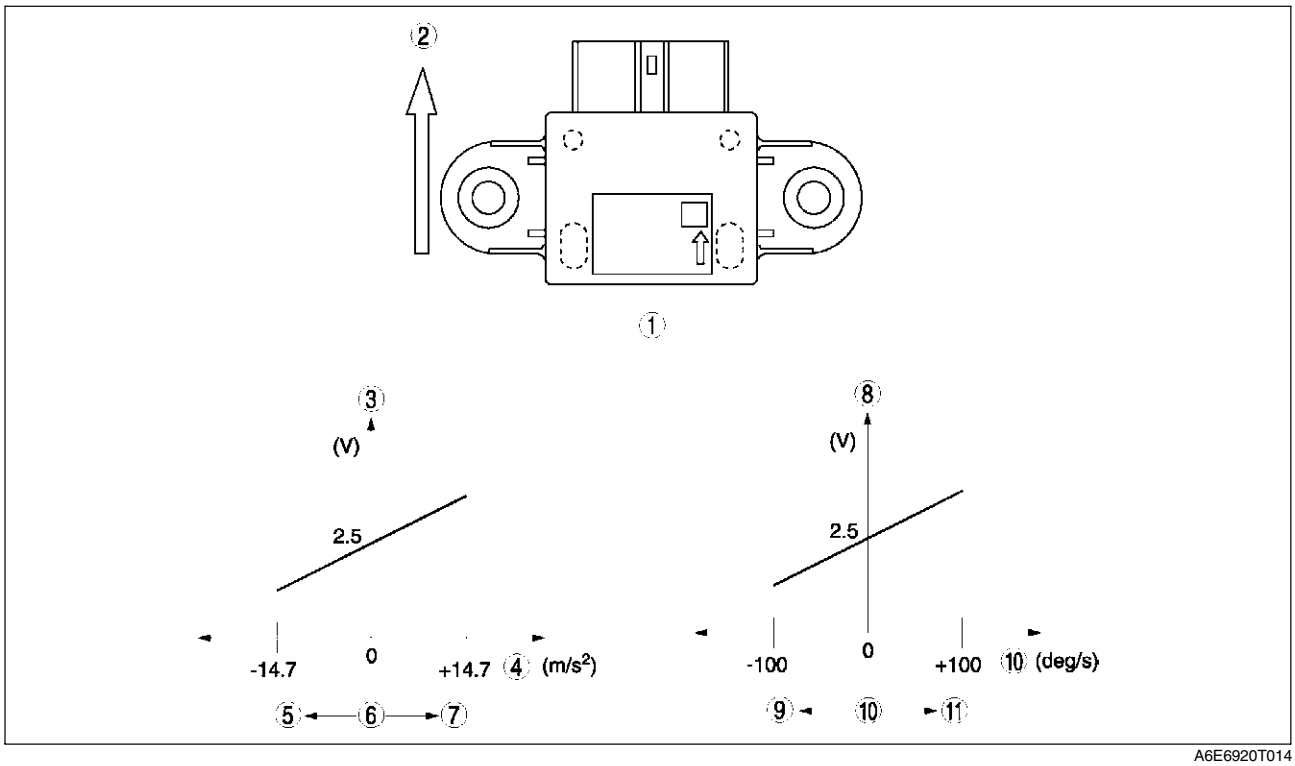
- Yaw rate sensor and lateral-G sensor have been integrated to combine sensor.
- The combine sensor is installed on the left side of the parking brake lever (L.H.D.), or right side of the parking brake lever (R.H.D.) and detects vehicle yaw rate (vehicle cornering angle velocity) and lateral G, and transmits the signal to the DSC HU/CM.

Structure/Operation

- The output voltage characteristic for the combine sensor is 2.5 V when the vehicle is standing still, and changes accordingly as yaw rate and lateral-G is formed.
- Yaw rate is formed when the sensor detects a Coriolis force created by, and in proportion to, the rotation speed of a rotating tuning fork.
- Lateral G is formed when the sensor detects an inertial force created by, and in proportion to, a G force acting on a silicon detection component.

Note

- The Coriolis force: When an object on a rotating disc attempts to move toward the disc's center, force is produced at a right angle to the object's intended path of travel. This results in the object's direction of movement being unchanged from its original point of departure, and it not reaching the center. When looking at this effect from outside the disc, it appears as force deflecting the object away from the center. This appearance of force is called Coriolis force, and the object's actual direction of advance takes a straight course.



A6E6920T014

1	External view
2	Front of vehicle
3	Output voltage characteristic
4	Acceleration
5	Left cornering
6	Lateral-G

7	Right cornering
8	Output voltage characteristic
9	Left cornering
10	Yaw rate
11	Right cornering

DSC HU/CM

A6E692067650T09

Function

- The integrated DSC HU/CM, which is compact and lightweight, highly reliable has been adapted.
- The DSC HU/CM calculates the input signal of each sensor and controls each solenoid valve and the pump motor (ON/OFF), adjusts fluid pressure to the caliper pistons, and activates each function of the DSC system (ABS, Electronic Brakeforce Distribution (EBD), TCS, DSC and electrical brake assist).
- The construction and operation of DSC hydraulic pressure mechanism is the same as that of the current 323 (BJ), except for the operation of electric brake assist system. (See 323 Workshop Manual Supplement 1704-1*-00J.)
- The DSC HU/CM outputs the engine torque control signal and vehicle speed signal through CAN line.
- The DSC HU/CM also outputs vehicle speed signal through a hard wire.

Function

Function	Content
ABS control function	• When braking, maintains direction stability during braking operation, secures handling and provides shortened braking distance by control of brake fluid pressure.
EBD (Electronic brakeforce distribution) control	• Prevents rear-wheel lockup through optimum control of normal brake fluid pressure distribution to front and rear wheels in response to vehicle load, condition of road surface and vehicle speed.
TCS control	• Provides improved safety of start and acceleration performance by keeping traction within limits of road surface friction in response to road and vehicle speed conditions.
DSC control	• Inhibits strong tendency of the vehicle to oversteer or understeer, by controlling engine torque and braking on each wheel to provide assured vehicle stability.
Brake assist control	• Controls the fluid of the caliper piston during emergency braking, provides increased fluid pressure to each wheels.
Vehicle speed output	• The value of the calculation from the 4 wheel speed sensors is output as a speed signal to CAN line, and to wiper and washer switch, cruise actuator, audio unit, auto leveling control unit by a hard wire.
Diagnostic system	• Important parts in the DSC control have a self-detection function that, in the event of any abnormality, illuminate each warning light to inform the driver of an abnormality together with recording the DTC in the DSC unit. • When occurrence of an abnormality is judged by self-detection, cancels the controls so as not to cause loss of driving safety.

BRAKE ASSIST CONTROL

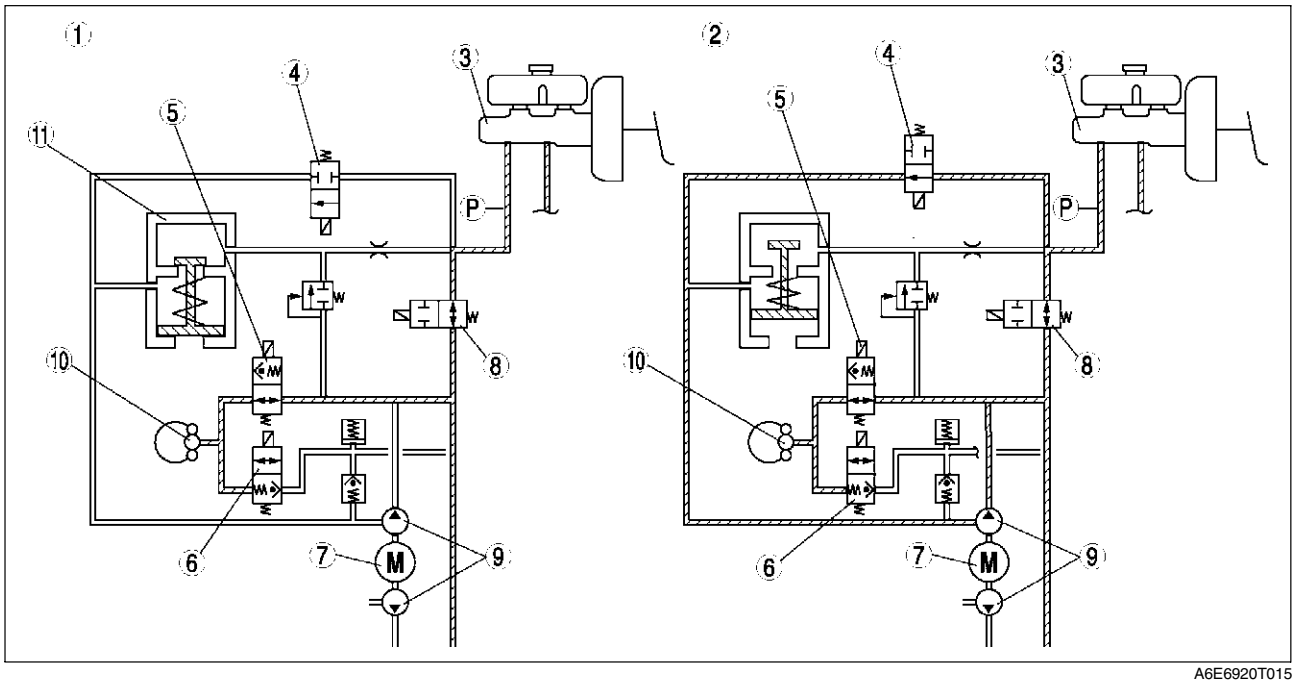
A6E692067650T16

Function

- During emergency braking, the DSC HU/CM increases brake fluid pressure by increasing the master cylinder pressure, and therefore lessens the burden on the driver and enables use of a large braking force.

Operation

- The DSC HU/CM uses the built-in brake fluid pressure sensor to monitor the rate at which the master cylinder pressure changes, and it initiates brake assist when it determines, from the pressure change, that emergency braking is occurring.
- The DSC HU/CM calculates the caliper piston pressure, increases fluid pressure in the master cylinder above the specified amount and, due to the change in master cylinder pressure, caliper piston pressure can be increased.
- In addition to normal brake fluid pressure, as each solenoid valve is switched, the pump motor is operated to rotate the pump which increases brake pressure force in the caliper pistons.
- Break assist is initiated at speeds of **17 km/h or above**, and is inhibited at speeds of **5 km/h or below**.



A6E6920T015

1	Normal brake mode
2	Brake assist reduction mode
3	Master cylinder
4	Stability control solenoid valve
5	Pressure-retention solenoid valve

6	Pressure-reduction solenoid valve
7	Pump motor
8	Traction switch solenoid valve
9	Pump
10	caliper piston

P

CONTROLLER AREA NETWORK (CAN)

A6E692067650T17

- ABS (ABS/TCS) or DSC HU/CM transmit/received the information through the CAN. For detail information of the CAN, see the “CONTROLLER AREA NETWORK.” (See T–5 OUTLINE.)

Transmit Information

- Travelled distance
- Wheel Speed
  - — Front Left
  - — Front right
  - — Rear left
  - — Rear right
- Brake system status
- Torque reduction request
- Brake system configuration

Received Information

- Engine conditions from PCM
- Engine speed from PCM
- Transmission/axle type from PCM
- Tire circumference from PCM
- Gear/change lever position from PCM
- Brake system warning light condition (brake fluid level) from instrument cluster
- ABS configuration from instrument cluster

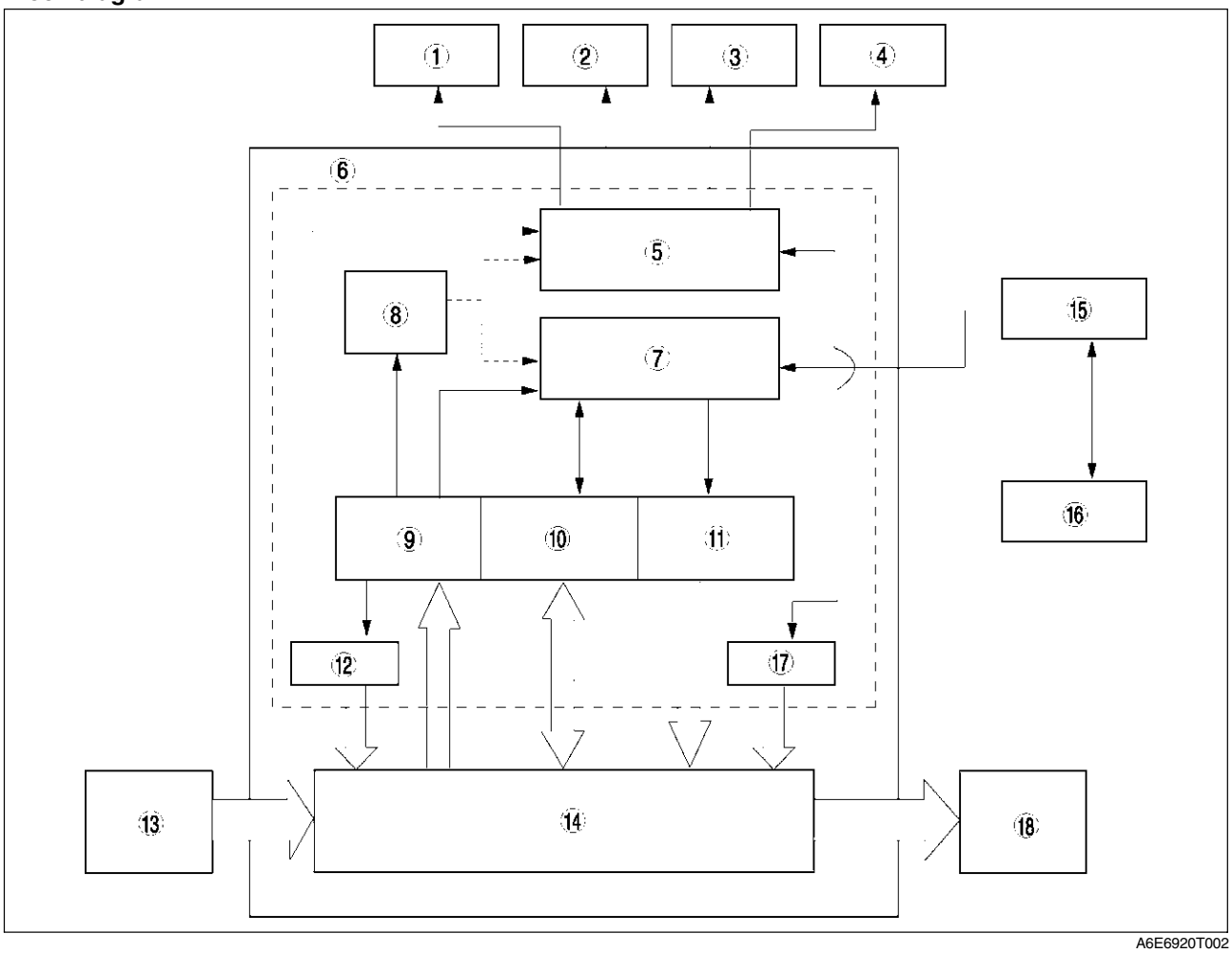
ON-BOARD DIAGNOSTIC

OUTLINE

A6E697067650T03

- The operation of the on-board diagnostic system for ABS (ABS/TCS) or DSC is essentially carried over from that of the previous 323 (BJ) model except for the following. (See Mazda 323 Workshop Manual Supplement 1704-1*-99H.)
  - — Changed of DTC code, PID data monitor function, and active command function
  - — Eliminated TBS terminal of DLC
- Using the WDS or equivalent with the ABS (ABS/TCS) or DSC HU/CM, allows for a 4-digit DTC display function, a PID/DATA monitor function, and an active command modes function, and thus improves serviceability.

Block diagram



A6E6920T002

1	TCS (DSC) indicator light
2	TCS (DSC) OFF light
3	ABS warning light
4	Brake system warning light
5	Malfunction indication function
6	On-board diagnosis function
7	Serial communication
8	Memory function
9	Malfunction detection function

10	Data monitor function
11	Active command function
12	Fail-safe function
13	Input devices
14	Normal control area
15	Data link connector-2
16	WDS or equivalent
17	Hydraulic inspection function
18	Output devices

Fail-safe Function

- If a failure is detected in the self-diagnostic function, the fail-safe illuminates the ABS warning light, BRAKE system warning light, DSC indicator light, and/or TCS (DSC) OFF light to notify the driver. At the same time, the ABS (ABS/TCS) or DSC HU/CM controls the ABS, EBD, TCS, DSC and brake assist. The fail-safe function ensures normal braking even when ABS, EBD, TCS, DSC and/or brake assist control stops, as shown in the figure.

Caution

- **In the event that EBD control stops, the rear wheels may lock before the front wheels, causing the vehicle to skid. Inspect the system immediately if EBD control stops.**

Fail-safe function table

Malfunction location	DTC	Fail-safe function								
		Warning light illumination condition				Control condition				
	WDS or equivalent	ABS warning light	BRAKE system warning light (when parking brake is released)	DSC(TCS) indicator light	DSC (TCS) OFF light	ABS control	EBD control	TCS control	DSC control	Brake assist control
Brake fluid pressure sensor	C1953	Not illuminated	Not illuminated	Illuminated	Not illuminated	Available	Available	Available	Stop	Stop
	C1954									
Combine sensor	C1280	Not illuminated	Not illuminated	Illuminated	Not illuminated	Available	Available	Available	Stop	Available
	C1730									
	C1951									
	C1952									
	C1959									
Wheel-speed sensor	C1145	Illuminated *1	Not illuminated *1, 2	Illuminated *1	Illuminated *1	Stop	Available *3	Stop	Stop	Stop
	C1155									
	C1165									
	C1175									
Wheel-speed sensor/sensor rotor	C1148									
	C1158									
	C1168									
	C1178									
	C1233									
	C1234									
	C1235									
	C1236									
Engine control system, engine speed signal line	C1119	Not illuminated	Not illuminated	Illuminated	Not iluminated *22	Available	Available	Stop	Stop	Available
								Available	Available	
									Stop *23	
								Stop *24	Stop *25	
Engine coolant temperature	U2021	Not illuminated	Not illuminated	Not illuminated	Illuminated	Available	Available	Stop *5	Stop	Available

P

Malfunction location	DTC	Fail-safe function								
		Warning light illumination condition				Control condition				
	WDS or equivalent	ABS warning light	BRAKE system warning light (when parking brake is released)	DSC (TCS) indicator light	DSC (TCS) OFF light	ABS control	EBD control	TCS control	DSC control	Brake assist control
Solenoid valve	C1194	Illuminated *6, 7	Illuminated *7, 8	Illuminated *6	Not illuminated	Stop *9	Stop *10	Stop *14	Stop	Stop
	C1198									
	C1210									
	C1214									
	C1242									
	C1246									
	C1250									
	C1254									
	C1400									
	C1410									
	C1957									
	C1958									
DSC HU/CM (pump)	C1140	Illuminated	Not illuminated	Illuminated *22	Not illuminated	Stop	Available	Stop *14	Stop	Stop
Solenoid valve, ABS motor or ABS wheel-speed sensor/ sensor rotor	C1510		Not illuminated *2		Illuminated		Available *3	Stop *15		
	C1511									
	C1512									
	C1513									
DSC control	C1507	Not illuminated	Not illuminated			Available	Available			
	C1508									
Fail-safe relay	C1186	Illuminated	Illuminated	Not illuminated	Illuminated	Stop	Stop	Stop *14	Stop	Stop
	C1266		Not illuminated				Available			
ABS motor and/or ABS motor relay	C1095	Illuminated *6	Not illuminated	Illuminated *6	Not illuminated	Stop	Available	Stop *14	Stop	Stop
	C1096									
ABS (ABS) or DSC HU/CM	B1342	Illuminated *12, 16	Illuminated *12, 16	Illuminated *12, 18	Illuminated *18	Stop *13, 17	Stop *13, 17	Stop *17	Stop	Stop *13, 17
Power supply system	B1318	Illuminated	Illuminated	Illuminated	Illuminated	Available	Available	Available	Available	Available
DSC unit mismatched installation	C1414	Illuminated *20	Not illuminated	Illuminated *20	Illuminated	Stop *21	Available	Stop	Stop	Stop
Steering angle sensor	C1955	Not illuminated	Not illuminated	Not illuminated	Illuminated	Available	Available	Available	Stop	Available
	C1956									
Brake fluid level sensor	C1125	Not illuminated	Not illuminated	Illuminated	Not illuminated	Available	Available	Stop *14	Stop	Stop
Reverse signal	B1627	Not illuminated	Not illuminated	Illuminated	Not illuminated	Available	Available	Available	Stop	Available
Brake switch	B1483	Not illuminated	Not illuminated	Illuminated	Not illuminated	Available	Available	Available	Available	Stop
	B1484									
	B1486									
Module configuration	B2477	Not illuminated	Not illuminated	Illuminated	Illuminated	Available	Available	Stop	Stop	Stop
CAN communication	U1900	Not illuminated	Not illuminated	Illuminated	Not illuminated	Available	Available	Available	Available	Stop
	U2516	Not illuminated	Not illuminated	Illuminated	Illuminated	Available	Available	Stop	Stop	Stop

*1 : If a malfunction was detected in the previous driving mode, the light remains illuminated until the wheel-speed sensor is verified to be normal.
*2 : The warning light illuminates during rear wheel malfunction.
*3 : Stops control when there is malfunction in both rear wheels.
*4 : The light will go out when engine coolant temperature rises.
*5 : When engine coolant temperature is **0°C {32°F}** or less, and TCS operation is inhibited by PCM. When engine coolant temperature rises and TCS OFF light goes out, the system is normal.
*6 : If a malfunction was detected in the previous driving mode, the light remains illuminated until the system is verified to be normal when the vehicle is driven at a speed of **10 km/h {6.2 mph}** or more.
*7 : The warning light does not illuminates only during stability control solenoid valve or traction switch solenoid valve off stuck malfunction.
*8 : The warning light illuminates during rear solenoid valves off stuck malfunction.
*9 : Control dose not stop during stability control solenoid valves or traction switch solenoid valve off stuck malfunction.
*10 : Control does not stop during each solenoid valves (except rear inlet solenoid valve) off stuck malfunction.
*11 : The light will go out when the failure is solved.
*12 : If malfunction is related to CAN, light does not illuminate.
*13 : If malfunction is related to CAN, system does not stop.
*14 : Engine TCS is only available
*15 : Engine TCS is only available when pressure reduction inoperation is detected.
*16 : If malfunction is related to combine sensor 0 point adjustment or configuration, light dose not illuminate.
*17 : If malfunction is related to combine sensor 0 point adjustment or configuration, system dose not stop.
*18 : If the module does not configurated, light flashes.
*19 : When engine speed malfunction is detected, brake TCS is only available.
*20 : When engine is mismatch installed, the light does not illuminate.
*21 : When engine is mismatch installed, the system does not stop.
*22 : If malfunction is related to CAN (engine speed), the light illuminates.
*23 : When engine speeed signal has malfunction, only brake DSC is available.
*24 : When engine control system has malfunction, only brake TCS is available.
*25 : When engine control system has malfunction, only brake DSC is available.

PID/DATA Monitor Function

- This function allows access to certain data values, input signal, calculated values, and system status information.

PID/DATA monitor table

PID name	Input/output part	Operation/unit (WDS or equivalent)
ABS_LAMP	ABS warning light driver output state	ON/OFF
ABSLF_ I	LF ABS pressure retention valve output state	ON/OFF
ABSLF _O	LF ABS pressure reduction valve output state	ON/OFF
ABSLR_ I	LR ABS pressure retention valve output state	ON/OFF
ABSLR_ O	LR ABS pressure reduction valve output state	ON/OFF
ABSRF_ I	RF ABS pressure retention valve output state	ON/OFF
ABSRF_ O	RF ABS pressure reduction valve output state	ON/OFF
ABSRR _I	RR ABS pressure retention valve output state	ON/OFF
ABSRR _O	RR ABS pressure reduction valve output state	ON/OFF
ABS_VOLT	System battery voltage value	VOLTAGE
BOO _ABS	Brake pedal switch input	ON/OFF
BRK_FLUID	Brake fluid level sensor input	OK/LOW
BRAKE_LAMP	BRAKE system warning light driver output state	ON/OFF
CCNTABS	Number of continuous trouble code set	Number of continuous codes
LAT ACC	Lateral-G sensor	ACCELERATION
L_DSC O	Stability control solenoid valve (LF—RR)	ON/OFF
LF_ WSPD	LF wheel-speed sensor input	KPH or MPH
LR_ WSPD	LR wheel-speed sensor input	KPH or MPH
MCYLI P	Brake fluid pressure sensor	MPA
ABSVLVRLY	ABS valve control relay	ON/OFF
ABSPMPRLY	ABS pump motor relay	ON/OFF
PMPSTAT	ABS pump motor states	ON/OFF
RF _WSPD	RF wheel-speed sensor input	KPH or MPH
RPM	PCM	RPM
RR_ WSPD	RR wheel-speed sensor input	KPH or MPH
SWA POS	Steering angle sensor	ANGLE
R_DSC O	Stability control solenoid valve (RF—LR)	ON/OFF
TC LVAL	Traction switch solenoid valve (LF—RR)	ON/OFF
TC RVAL	Traction switch solenoid valve (RF—LR)	ON/OFF
TCSOUTD	PCM	PERCENTAGE
TPI	PCM	PERCENTAGE
TRAC_SW	TCS OFF switch	ON/OFF
TRANSGR	PCM	Number of continuous codes
ACCLMTR	Fail-safe relay output state	ACCELERATION
YAW_RATE	Yaw rate sensor	PERCENTAGE

Active Command Modes Function

- This function allows control of devices through the WDS or equivalent.

Active Command Modes Table

Command Name	Definition	Operation	Note
RF_DSC_V	Stability control solenoid valve (RF-LR)	ON/OFF	Ignition key at ON (Engine OFF), and driving
LF_DSC_V	Stability control solenoid valve (LF-RR)	ON/OFF	
ABS_POWER	Fail-safe relay	ON/OFF	
LR_OUTLET	Left rear ABS pressure reduction solenoid valve	ON/OFF	
LR_INLET	Left rear ABS pressure retention solenoid valve	ON/OFF	
RR_INLET	Right rear ABS pressure retention solenoid valve	ON/OFF	
RR_OUTLET	Right rear ABS pressure reduction solenoid valve	ON/OFF	
LF_INLET	Left front ABS pressure retention solenoid valve	ON/OFF	
LF_OUTLET	Left front ABS pressure reduction solenoid valve	ON/OFF	
RF_INLET	Right front ABS pressure retention solenoid valve	ON/OFF	
RF_OUTLET	Right front ABS pressure reduction solenoid valve	ON/OFF	
PMP_MOTOR	ABS motor	ON/OFF	
RF_TC_VLV	Traction switch solenoid valve (RF-LR)	ON/OFF	
LF_TC_VLV	Traction switch solenoid valve (LF-RR)	ON/OFF	
TRAC OFF	Traction control off indicator	ON/OFF	
STAB_IND	DSC indicator light	ON/OFF	
YAWRATE	Yaw rate sensor initialization start	ON/OFF	
LATACCEL	Lateral accel sensor initialization start	TRUE/FALSE	

Note

- When operating the ABS motor and each valve forcibly, turn VPWR RLY on, and then each command on. VPWR RLY regulates the power supply for the ABS motor and eight valves.

External Tester Communication Function

- The external tester communication function communicates diagnostic information (reading DTCs, reading input/output signal, driving output parts) by sending and receiving signal between the DSC unit and external tester.

Connection and communication information

	External tester	
	WDS or equivalent	
	Connection	Communication method
On-board diagnostic (malfunction detection) function	Input/output: KLN signal	Serial communication
Data monitor function	Input/output: KLN signal	Serial communication
Active command modes function	Input/output: KLN signal	Serial communication

Serial Communication

- Serial communication (synchronous communication) is a method of communication in which many pieces of information are sent and received instantaneously through a single wire.
- By connecting the WDS or equivalent to data link connector, diagnostic information can be sent and received between the WDS or equivalent and the ABS (ABS/TCS) or DSC HU/CM via the KLN terminal.
- The DSC HU/CM receives signals for the malfunction detection function, data monitor function, and active command modes function from the WDS or equivalent, and sends information about DTCs and input/output part operating conditions to the WDS or equivalent .

Diagnostic function	Signal received	Signal sent
Malfunction detection function	DTC verification signal	DTC
Data monitor function	Request signal to read selected monitor item	Monitor information for requested monitor item
Active command modes function	Request signal to read selected active command modes item	Output part drive signal

SUSPENSION

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ABBREVIATIONS

ABBREVIATIONS

A6E740101013T01

LF	Left front
LR	Left rear
RF	Right front
RH	Right hand
RR	Right rear
4SD	4 door sedan
5HB	5 door hatchback

OUTLINE

OUTLINE OF CONSTRUCTION

A6E740201013T01

- Both front and rear suspension systems, unique to the Mazda6 (GG) model, have been adopted as follows.
  - — High-mount double wishbone (with double-pivoted lower arm(s)) front suspension
  - — E-type multi-link rear suspension
- Both the front and rear suspension, employ newly developed systems, to improve the following features.

FEATURES

A6E740201013T02

Improved Handling And Straight Driving Stability
- The king-pin to wheel-center offset of the front suspension has been minimized.
- A low-friction ball joint has been adopted for the front lower arms and front upper arm.
- The tread has been widened 50 mm {1.97 in} (compared to 626 (GF) model).
- The rolling axis is set slightly aslant.
- A front shock absorber with rebound spring has been adopted.

Improved Riding Comfort
- A separate input type shock absorber mount has been adopted.
- Front and rear crossmembers with rubber mounts have been adopted.

Improved Rigidity
- A perimeter frame structure front crossmember has been adopted.
- A stiffener has been adopted for the front suspension.

Improved Serviceability
- An adjusting cam to adjust the rear camber has been adopted on the rear lower arm (rear suspension).
- A turnbuckle mechanism to adjust rear toe has been adopted on the rear lateral link (rear suspension).

Improved Marketability
- An adhesive-type balance weight has been adopted (16-inch and 17-inch aluminium alloy wheel).

Environmental Consideration
- A balance weight made of steel has been adopted (adhesive-type balance weight).

SPECIFICATIONS

A6E740201013T03

Item				Specification	
				Mazda6 (GG) (4SD, 5HB)	626 (GF) (4SD, 5HB)
Front suspension	Type			High-mount double wishbone (with double-pivoted lower arm(s))	Strut
	Spring type			Coil spring	
	Shock absorber type			Cylindrical, double-acting (Low-pressure gas charged with rebound spring)	Cylindrical, double-acting (Low-pressure gas charged)
	Stabilizer	Type		Torsion bar	
		Diameter	(mm {in})	23 {0.91}	27 {1.06}
	Wheel alignment (Unloaded)*1	Total toe-in	(mm {in})	Tire: 2±4 {0.08±0.16}, Rim inner: 1.4±2.8 {0.06±0.12}	Tire: 3±4 {0.12±0.16}, Rim inner: 2±3 {0.08±0.12}
			(degree)	0°11′±0°22′	0°17′±0°23′
		Maximum steering angle	inner	39°±3°	38°±3°
			outer	31°±3°	32°30′±3°
		Caster angle*2	normal	3°47′±1° (reference value)	1°52′±1°
			hight up*3	3°42'±1° (reference value)	—
		Camber angle*2	normal	–0°17′±1° (reference value)	–0°20′±1°
			hight up*3	–0°10'±1° (reference value)	—
		Steering axis inclination	normal	5°28′ (reference value)	12°43′(reference value)
			hight up*3	5°18' (reference value)	—
Rear suspension	Type			E-type multi-link	Strut
	Spring type			Coil spring	
	Stabilizer	Type		Torsion bar	
		Diameter	(mm {in})	4SD: 19 {0.75} 5HB: 18 {0.71}	17 {0.67}
	Shock absorber type			Cylindrical, double-acting (Low-pressure gas charged)	
	Wheel alignment (Unloaded)*1	Total toe-in	(mm {in})	Tire: 2±4 {0.08±0.16} Rim inner: 1.4±2.8 {0.06±0.12}	
			(degree)	0°11′±0°22′	0°12′±0°23′
		Camber angle*2	normal	–1°13′±1°	–0°47′±1°
			hight up*3	–1°05′±1°	—
		Thrust angle	(degree)	0°±0°48′	

*1 : Engine coolant and engine oil are at specified level. Fuel is full. Spare tire, jack and tools are in designated position.
*2 : Difference between left and right must not exceed 1°30'.
*3 : Distance between wheel center and fender brim is following. Front: 402 mm {15.8 in} (reference value) Rear: 392 mm {15.4 in} (reference value)

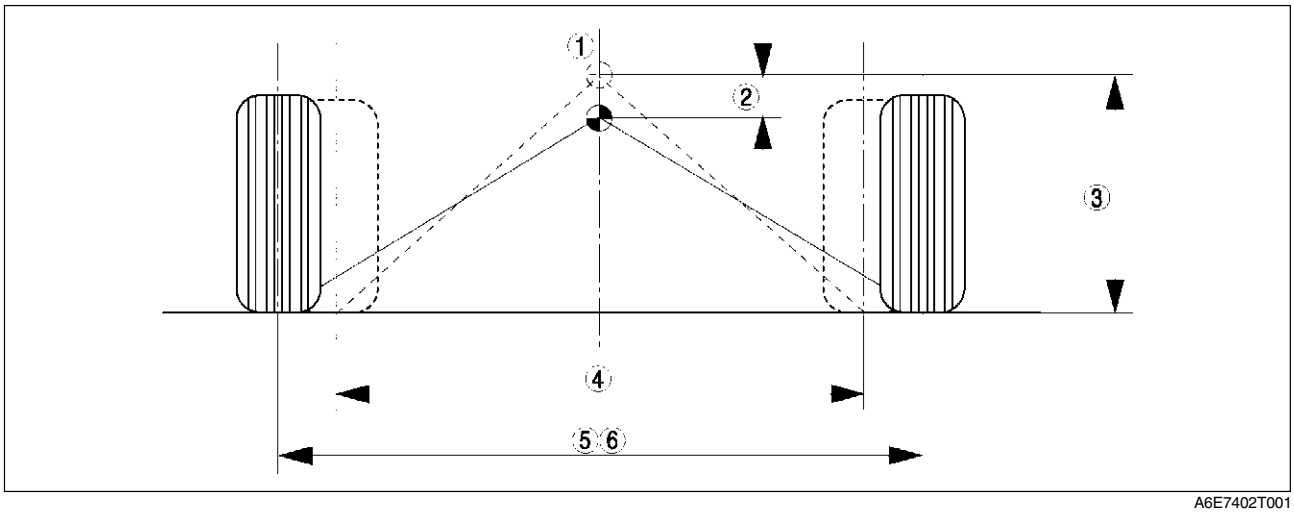
R

SUSPENSION DESCRIPTION

A6E740201013T04

Vehicle Platform Feature

- The newly developed platform of Mazda6 (GG) model is 50 mm wider than the platform of the 626 (GF) model. This feature gives a benefit equivalent to that of a 20 mm {0.79 in} reduction in the vehicle's center of gravity. As a result, handling stability and cornering capability are improved. At the same time, the platform geometry places the yaw axis (the invisible vertical axis about which the vehicle responds to driver inputs) in the center of the vehicle, resulting in reassuringly predictable response to driver inputs.



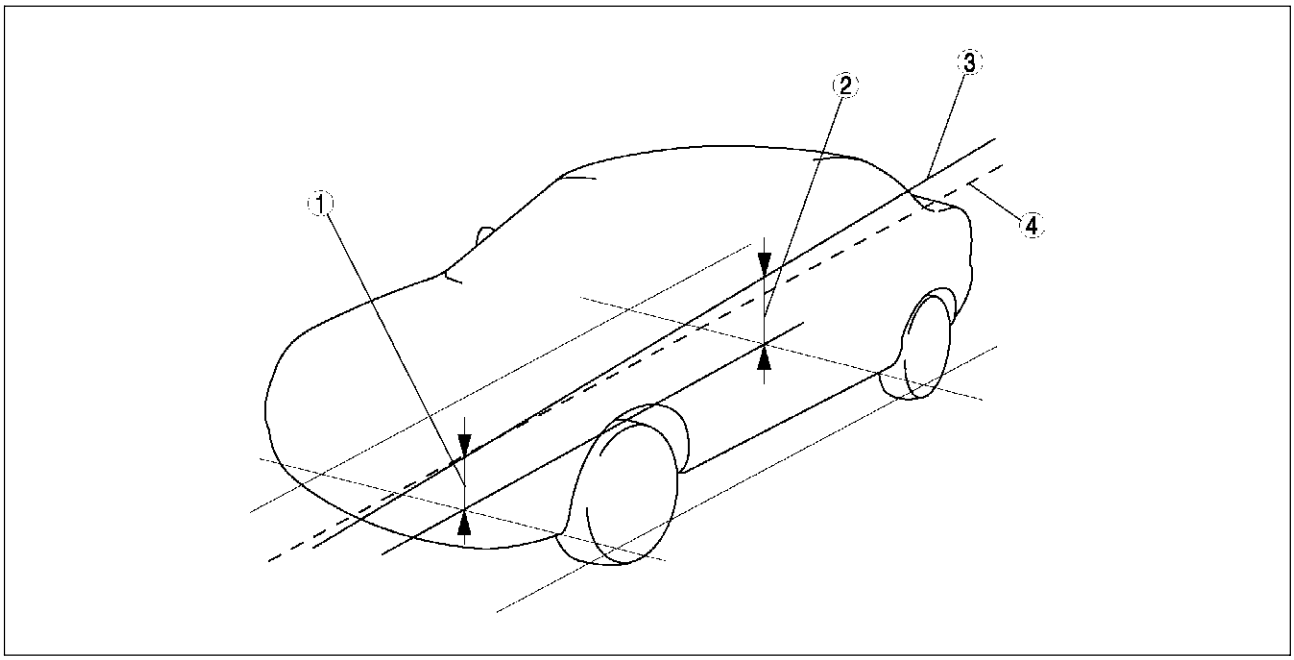
A6E7402T001

1	Center of gravity
2	Reduced 20 mm {0.79 in}
3	Height

4	Tread (626 (GF) model)
5	Tread (Mazda6 (GG) model)
6	+50 mm {1.97 in}

Vehicle Roll Center Height Setting

- The front roll center height is set lower than the rear. Straight- ahead driving handling is improved by setting the rolling axis at a slightly forward angle.



A6E7402T002

1	Front roll center height
2	Rear roll center height

3	Rolling axis
4	Extended line (parallel to the ground) from front roll center height

FRONT SUSPENSION

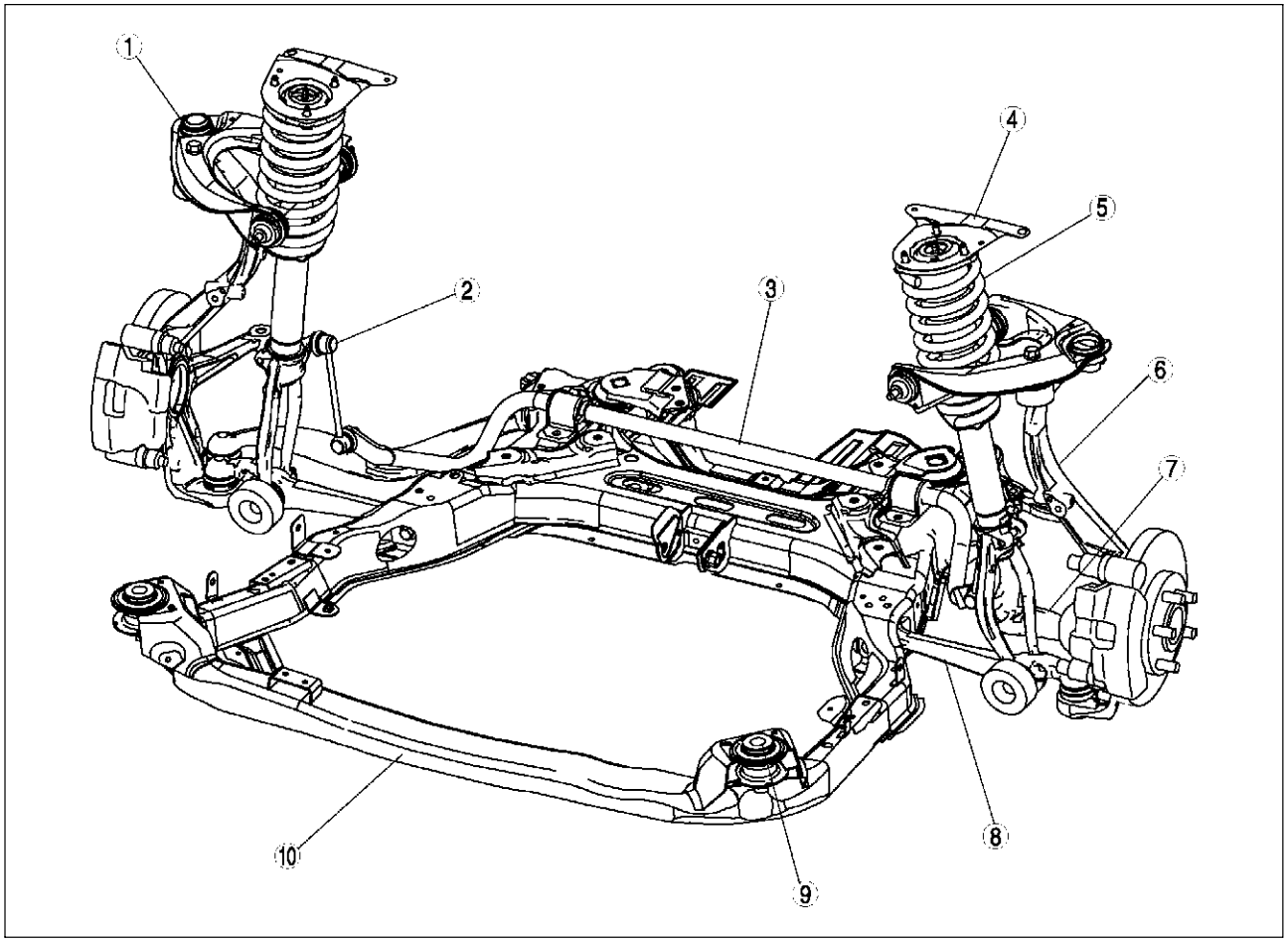
OUTLINE

A6E741401015T01

- A high-mount double wishbone (with double-pivoted lower arm(s)) front suspension, unique to the Mazda6 (GG) model, has been adopted.
- The front suspension design includes a link layout that provides both handling stability and riding comfort, and creates suitable camber control characteristics.
- The upper arm and lower arm(s) of the front suspension have a similar link layout to that of the conventional double wishbone suspension, except for the double-pivoted lower arm(s).
- The double-pivoted lower arm(s) allows for a small king-pin to wheel-center offset, as well as a small moment of inertia around the king-pin axis.

STRUCTURAL VIEW

A6E741401015T02



A6E7414T001

1	Front upper arm
2	Front stabilizer control link
3	Front stabilizer
4	Stiffener
5	Front shock absorber and coil spring

6	Knuckle
7	Front lower arm (rear)
8	Front lower arm (front)
9	Front crossmember mounting bushing
10	Front crossmember

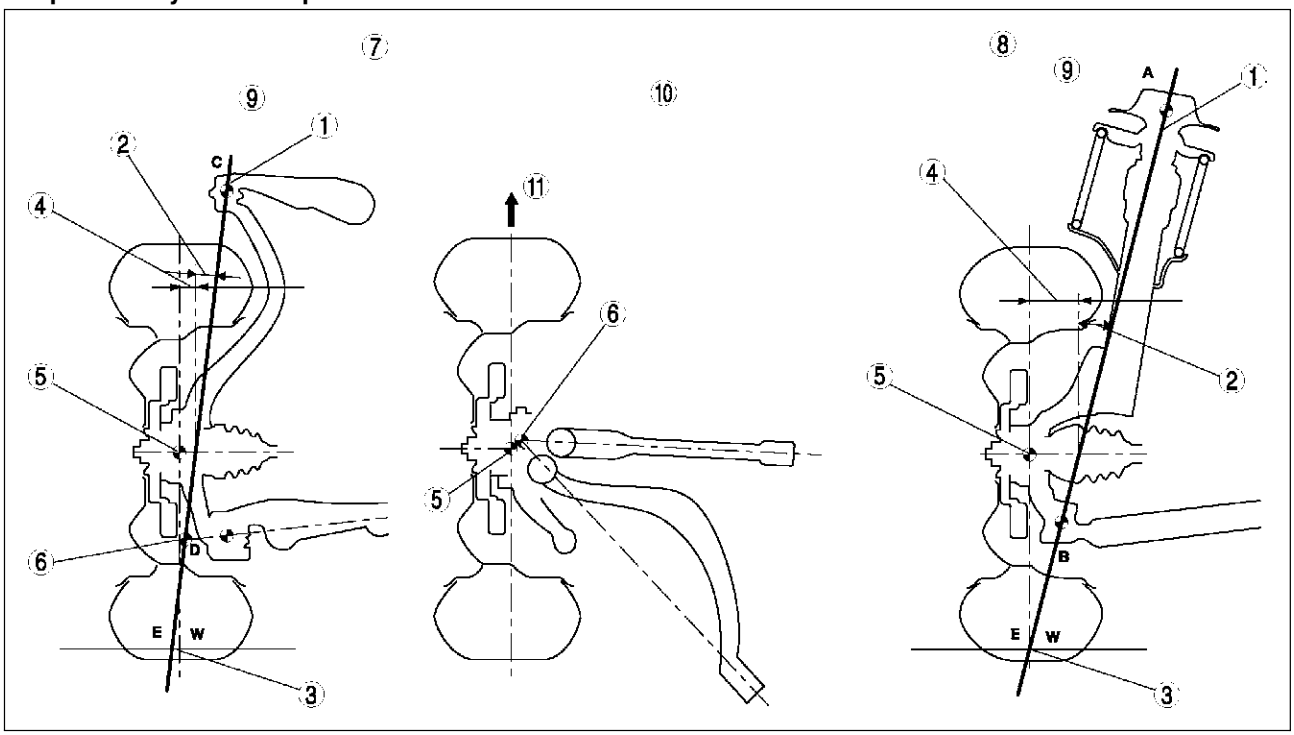
FRONT SUSPENSION DESCRIPTION

A6E741401015T03

King-pin Axis Configuration

- The king-pin axis, depending on the type of front suspension, is as follows:
  - — In the strut type front suspension, wheels rotate around the king-pin axis going from the point where the shock absorber is attached to the body (point A) to the ball joint (point B).
  - — In the high-mount double wishbone type front suspension (with double-pivoted lower arm(s)), wheels rotate around the king-pin axis going from the upper arm ball joint (point C) to the imaginary pivot line (point D) extended from the lower arm(s).
- The intersection of king-pin axis and the road surface (point E) is offset in the vehicle from the wheel setting center point of on the road (point W), producing a king-pin offset.
- Compared to the strut front suspension, the high-mount double wishbone front suspension (with double-pivoted lower arm(s) has the following technical advantages:
  - — The moment of inertia around the king-pin axis is reduced due to the short king-pin to wheel-center offset. This feature reduces undesirable vehicle behaviour such as steering pull and judder when breaking, smooth steering obstruction due to road conditions, and the influence of steering torque due to road undulation.
  - — The king-pin offset value (negative king-pin offset) is optimized. Due to this, the influence of the axis weight is not felt and steering control is lightened. Also, straight driving stability is improved because the toe-in moment from the braking effort the wheels counteracts the yaw moment caused by road surface conditions and/or the difference of right and left wheel braking effort.

Suspension system comparison



A6E7414T002

1	King-pin axis
2	King-pin inclination
3	King-pin offset
4	King-pin to wheel-center offset
5	Wheel center
6	Imaginary pivot

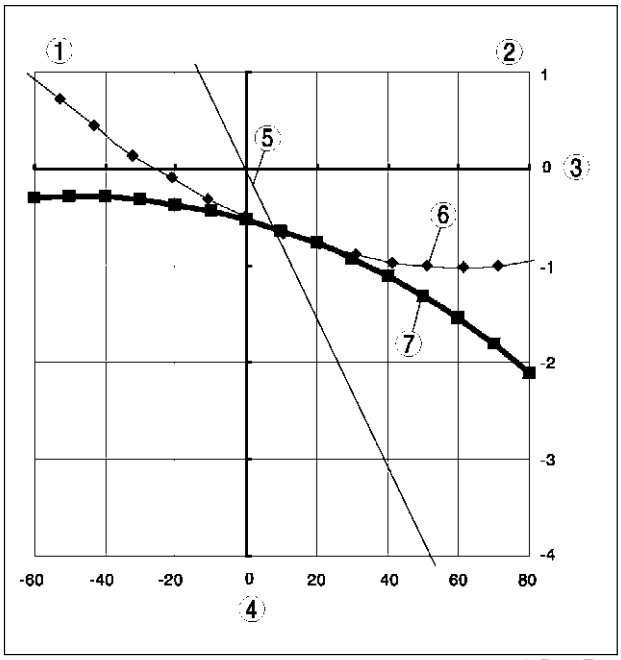
7	High-mount double wishbone front suspension
8	Strut front suspension (626 (GF) model)
9	View from horizontal axis of the vehicle
10	View from vertical axis of the vehicle
11	Front

Camber Control

- The camber change during a front suspension stroke is properly controlled by optimizing the ratio of the front upper arm and the front lower arm(s) lengths.

Camber control characteristic comparison

1	Rebound stroke area
2	Bump stroke area
3	Camber angle (°)
4	Wheel stroke (mm)
5	Vehicle roll angle (°)
6	Strut front suspension (626 (GF) model)
7	High-mount double wishbone front suspension

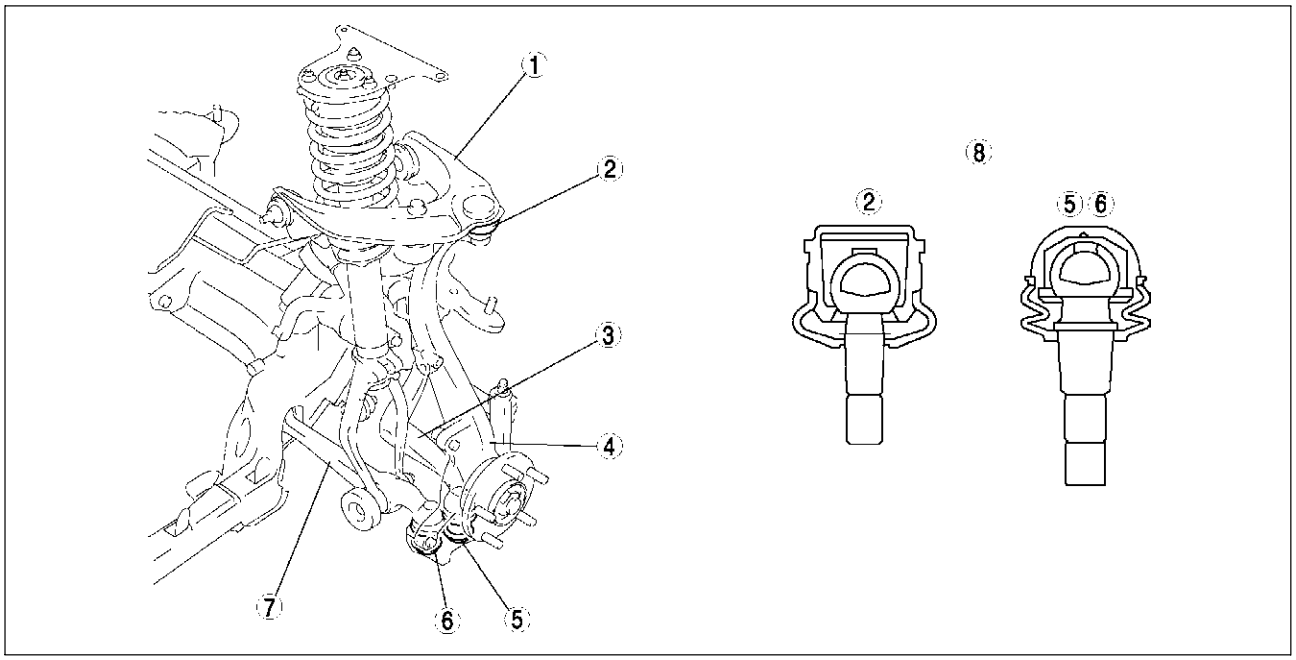


A6E7414T003

R

Low-friction Ball Joint

- A low-friction ball joint is used on the knuckle side of the front upper arm and lower arm(s) to improve steering response and to smoothness.



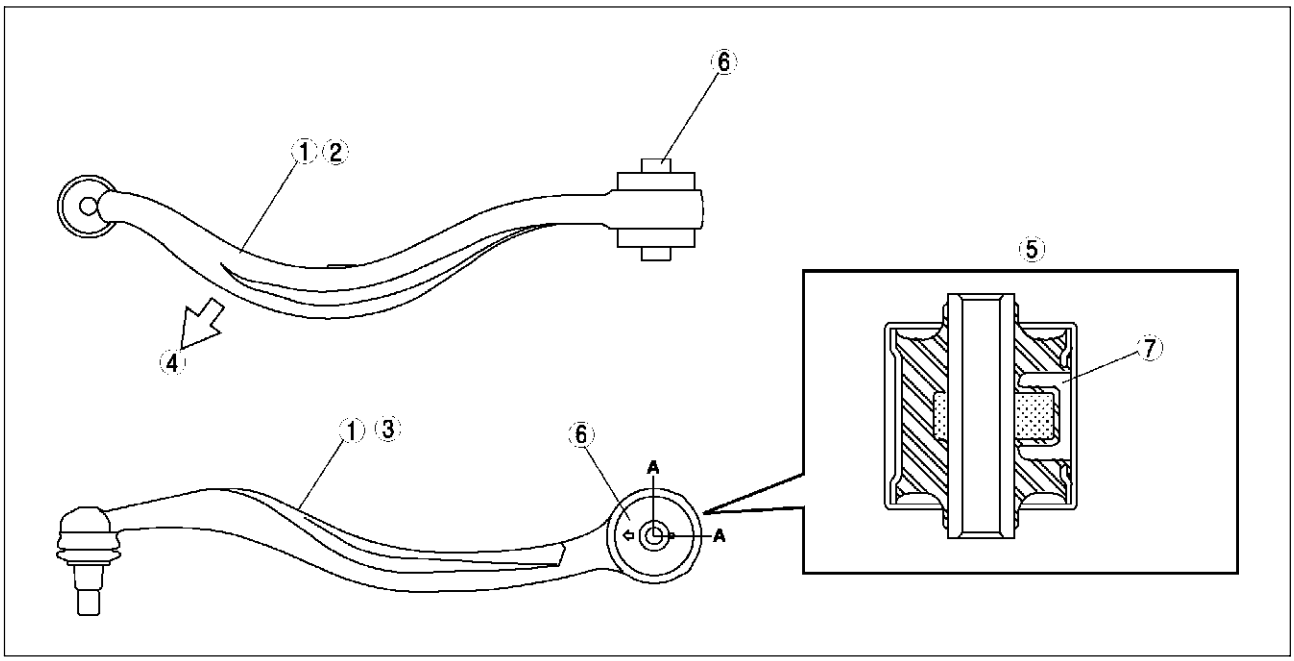
A6E7414T004

1	Front upper arm
2	Low-friction ball joint (for front upper arm)
3	Front lower arm (rear)
4	Knuckle

5	Low-friction ball joint (for front lower arm (rear))
6	Low-friction ball joint (for front lower arm (front))
7	Front lower arm (front)
8	Cross-sectional view

Front Lower Arm (Rear)

- An oil-filled bushing is used with the front lower arm (rear) to reduce vibrations such as shimmy, judder, and road noise.



A6E7414T005

1	RH front lower arm (rear)
2	Vertical view
3	Horizontal view
4	Front

5	Cross-section A—A
6	Oil-filled bushing
7	Oil

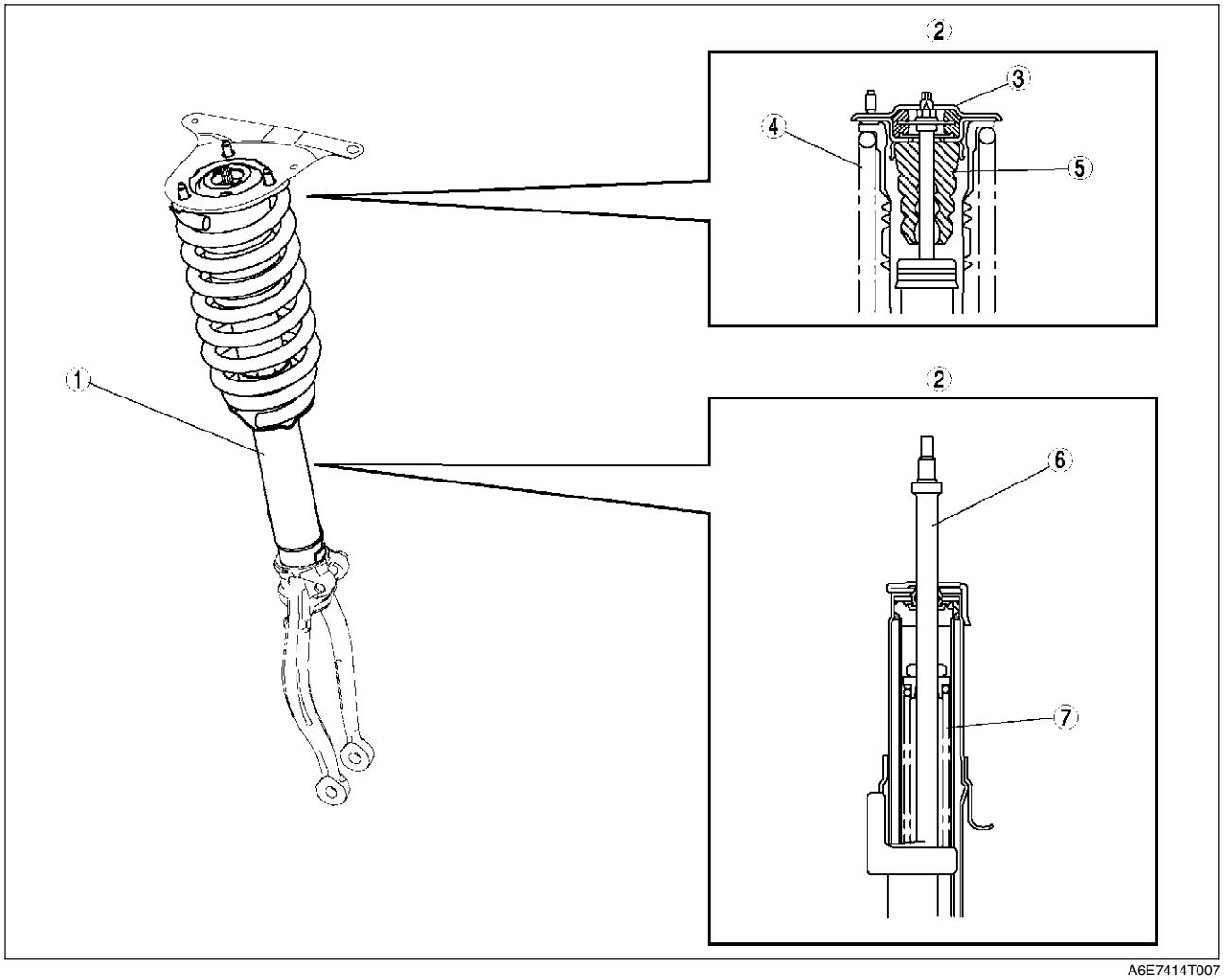
FRONT SHOCK ABSORBER AND COIL SPRING

A6E741434700T01

Outline

- A rebound spring is included in the shock absorber which controls the increase in the spring rate to improve handling stability and rolling feeling when cornering, thereby improving riding comfort.
- A separate input type shock absorber mount, with a plate that receives the reaction force of the coil spring and the piston rod separately, has been adopted. This construction enhances the damping force and improves cornering when changing lanes. At the same time it reduces the damping force of the low speed range of the piston rod to improve riding comfort.

Cross-sectional View



A6E7414T007

1	Front shock absorber and coil spring
2	Cross-sectional view
3	Separate input type shock absorber mount
4	Coil spring

5	Bound stopper
6	Piston rod
7	Rebound spring

R

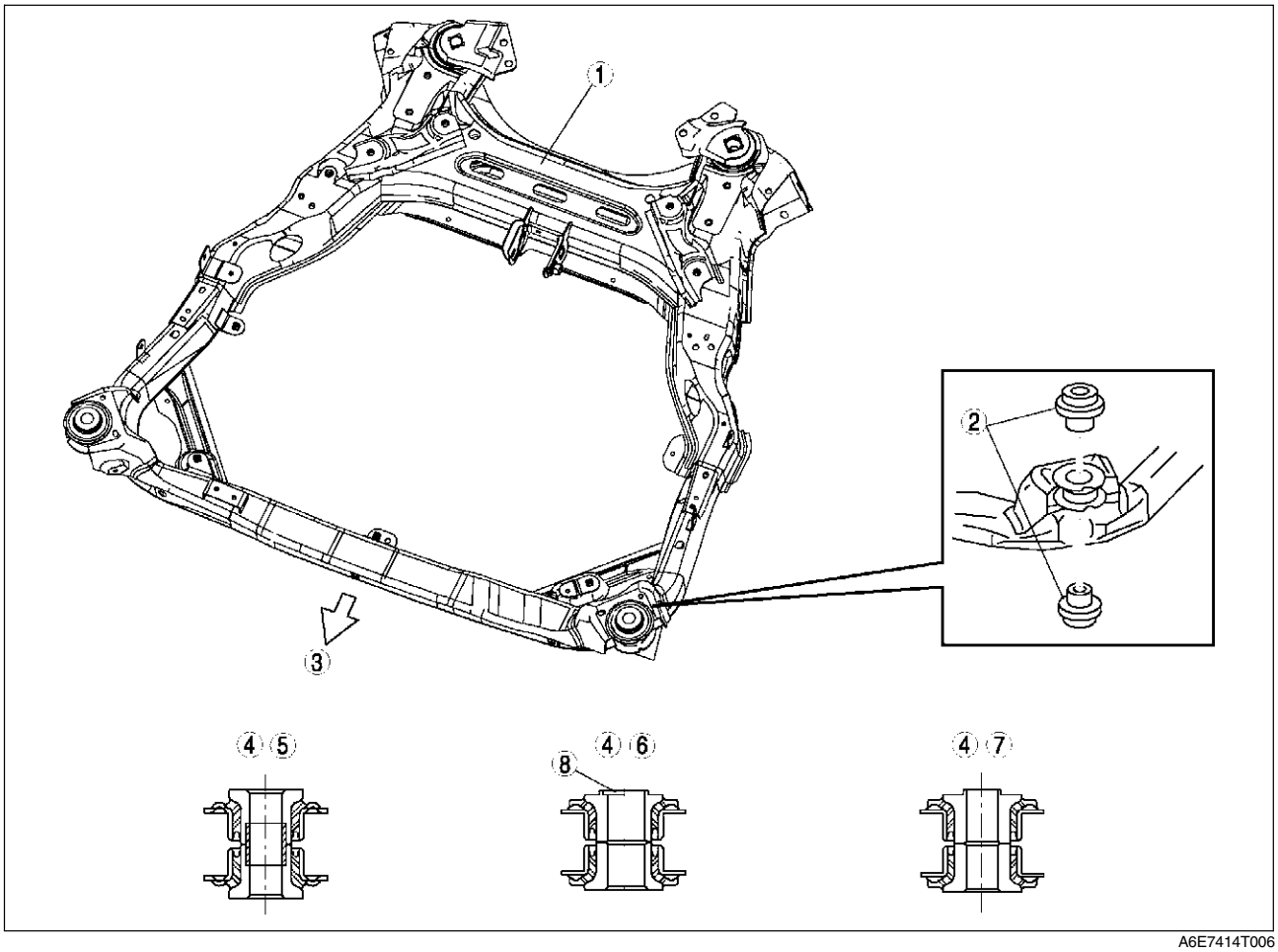
FRONT CROSSMEMBER

A6E741434400T01

Outline

- A perimeter frame structure type front crossmember has been adopted to increase rigidity.
- The main parts of the front crossmember are made from a high-tension steel by hydro-formed process to improve strength without increasing weight.
- To reduce the transmission of vibration and noise from suspension system to the body, rubber mounts are used at the four connecting points of the front crossmember to the body.
- The crossmember mounting bushings have optimally low spring rates, and they each have a two- piece structure that realizes the softness necessary for riding comfort without compromising the firmness necessary for handling stability.

Structural View



A6E7414T006

1	Front crossmember main frame
2	Two-piece structure crossmember mounting bushings
3	Front
4	Crossmember mounting bushings cross-sectional view

5	Crossmember mounting bushings (LF and RF)
6	Crossmember mounting bushings (LR)
7	Crossmember mounting bushings (RR)
8	Oval hole

REAR SUSPENSION

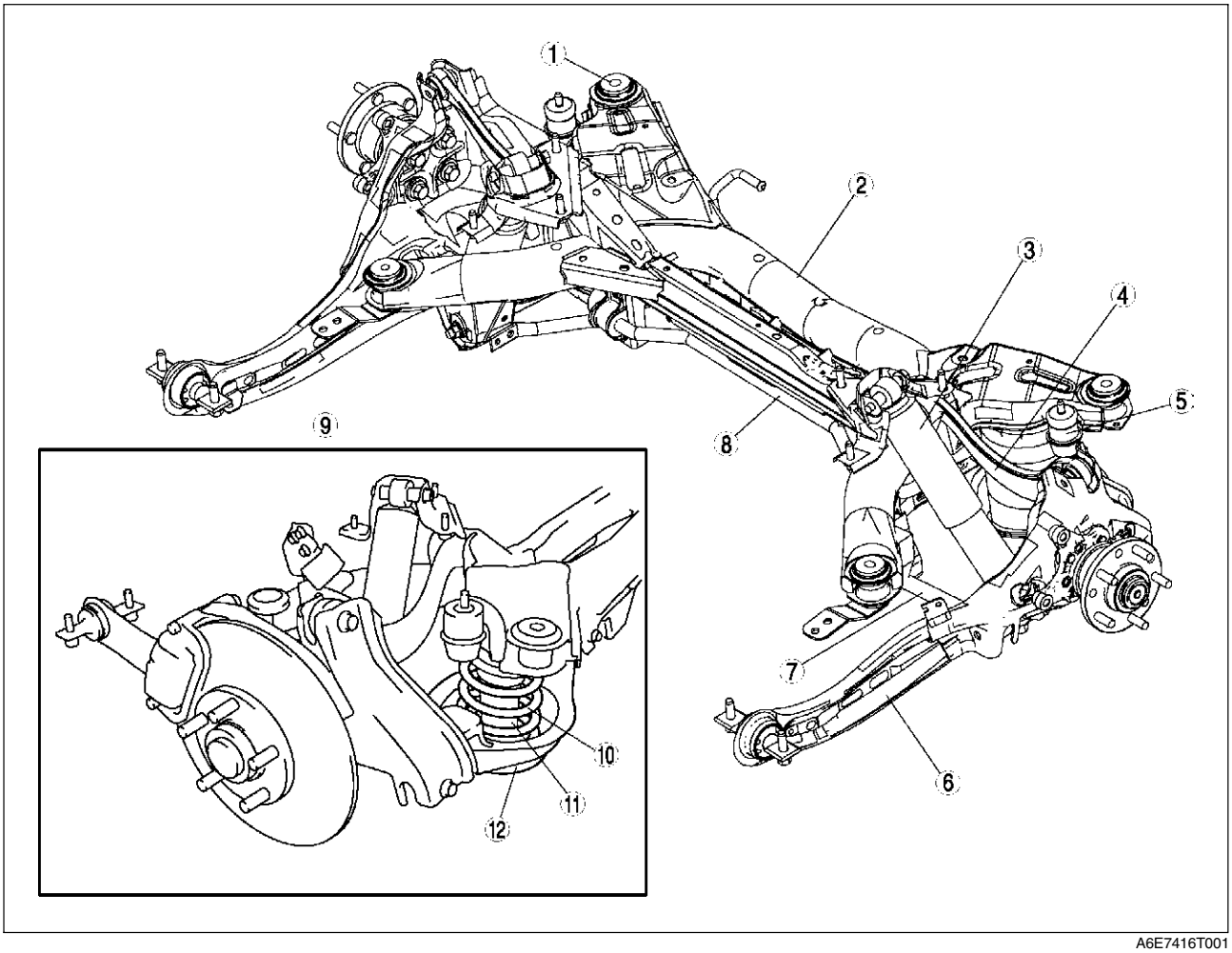
OUTLINE

A6E741601016T01

- An E-type multi-link rear suspension, unique to the Mazda6 (GG) model, has been adopted.
- The rear suspension design includes a link layout that provides both handling stability and riding comfort, and creates suitable camber control characteristics.
- E-type multi-link rear suspension arm/link layout is similar link layout to that of the conventional multi-link rear suspension, except for the separated layout of shock absorber and coil spring.
- The coil spring and shock absorber have been separated, and the coil spring is held between the rear crossmember and rear lower arm. This enables the shock absorber and the coil spring to be located closer together for a lower and flatter passenger cabin floor.
- The separated layout of shock absorber and coil spring eliminayes friction between the two parts. Also, shock absorber side force is reduced so the suspension system operates smoothly and riding comfort is improved.

STRUCTURAL VIEW

A6E741601016T02



A6E7416T001

1	Rear crossmember mounting bushing
2	Rear crossmember
3	Rear shock absorber
4	Rear upper arm
5	Bound stopper (body side)
6	Rear trailing arm

7	Rear lateral link
8	Rear stabilizer
9	View from vehicle rear side
10	Rear coil spring
11	Bound stopper (spring side)
12	Rear lower arm

REAR SUSPENSION DESCRIPTION

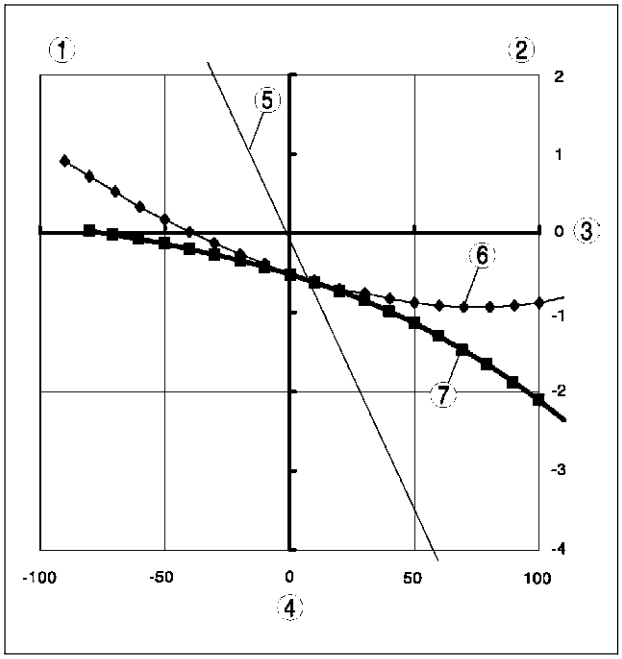
A6E741601016T03

Camber Control

- The camber change during a suspension stroke of the E-type multi-link rear suspension is properly controlled by optimizing the ratio of the rear lower arm and the rear upper arm.

Camber control characteristic comparison

1	Rebound stroke area
2	Bump stroke area
3	Camber angle (°)
4	Wheel stroke (mm)
5	Vehicle roll angle (°)
6	Strut rear suspension (626 (GF) model)
7	E-type multi-link rear suspension

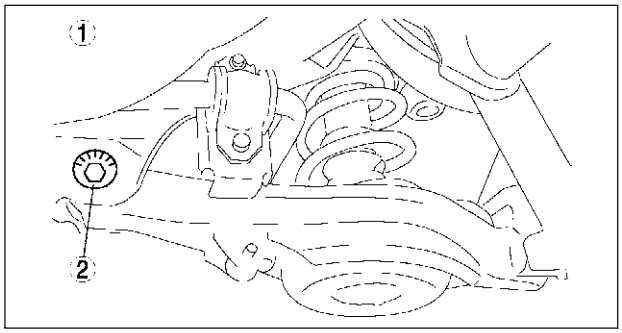


A6E7416T002

Camber Adjustment

- The camber is adjusted by turning the adjusting cam on the rear lower arm.
- Turning the cam one graduation changes the camber angle approx. 0°20′.

1	Left rear side
2	Adjusting cam

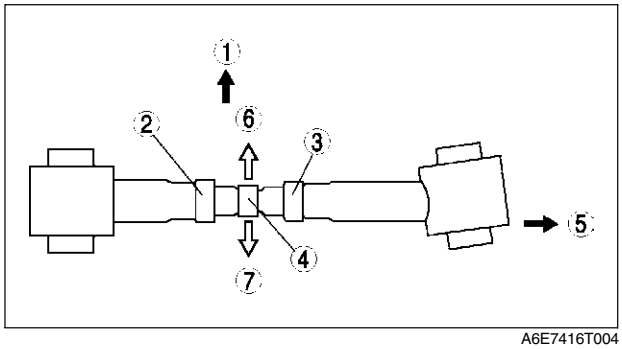


A6E7416T003

Toe Adjustment

- The turnbuckle mechanism for toe-in adjustment is located in the center of rear lateral link.
- By rotating the adjusting rod, the amount of toe can be changed. (One turn of the adsjusting rod changes the toe approx. 0°43′.)

1	Front
2	Left threaded
3	Right threaded
4	Adjusting rod
5	Axle side
6	For toe-out
7	For toe-in



A6E7416T004

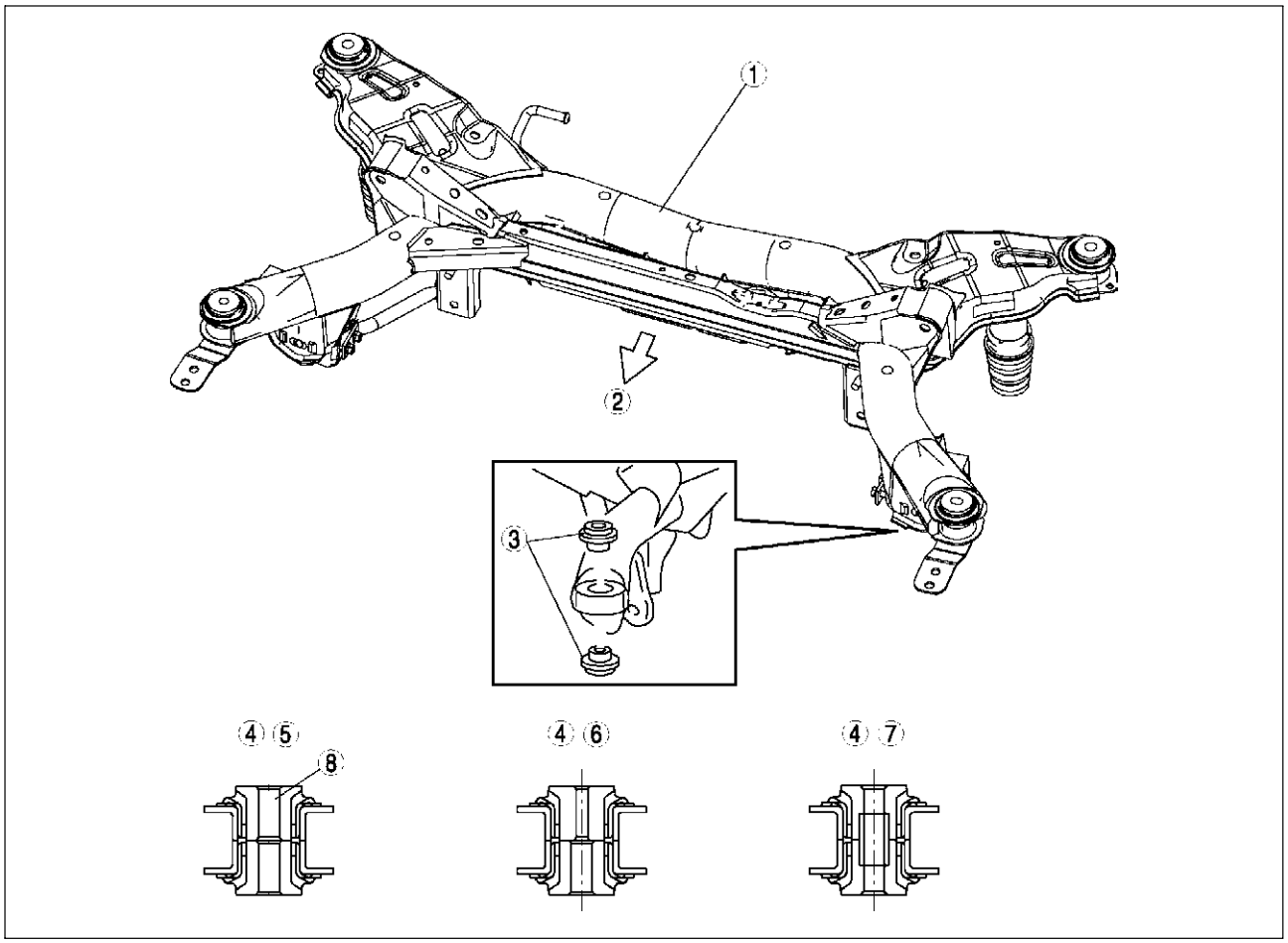
REAR CROSSMEMBER

A6E741628400T01

Outline

- The rear crossmember main frame is made from a steel pipe, improving strength without increasing weight.
- To reduce the noise from the suspension system to the body, rubber mounts are used at the four connecting points of ther ear crossmember to the body.
- The construction of the rear crossmember mounting bushings are same as that of the front crossmember mounting bushings.

Structural View



A6E7416T005

1	Rear crossmember main frame
2	Front
3	Two-piece structure crossmember mounting bushings
4	Crossmember mounting bushings cross-sectional view

5	Crossmember mounting bushings (LF)
6	Crossmember mounting bushings (RF)
7	Crossmember mounting bushings (LR and RR)
8	Oval hole

WHEEL AND TIRE

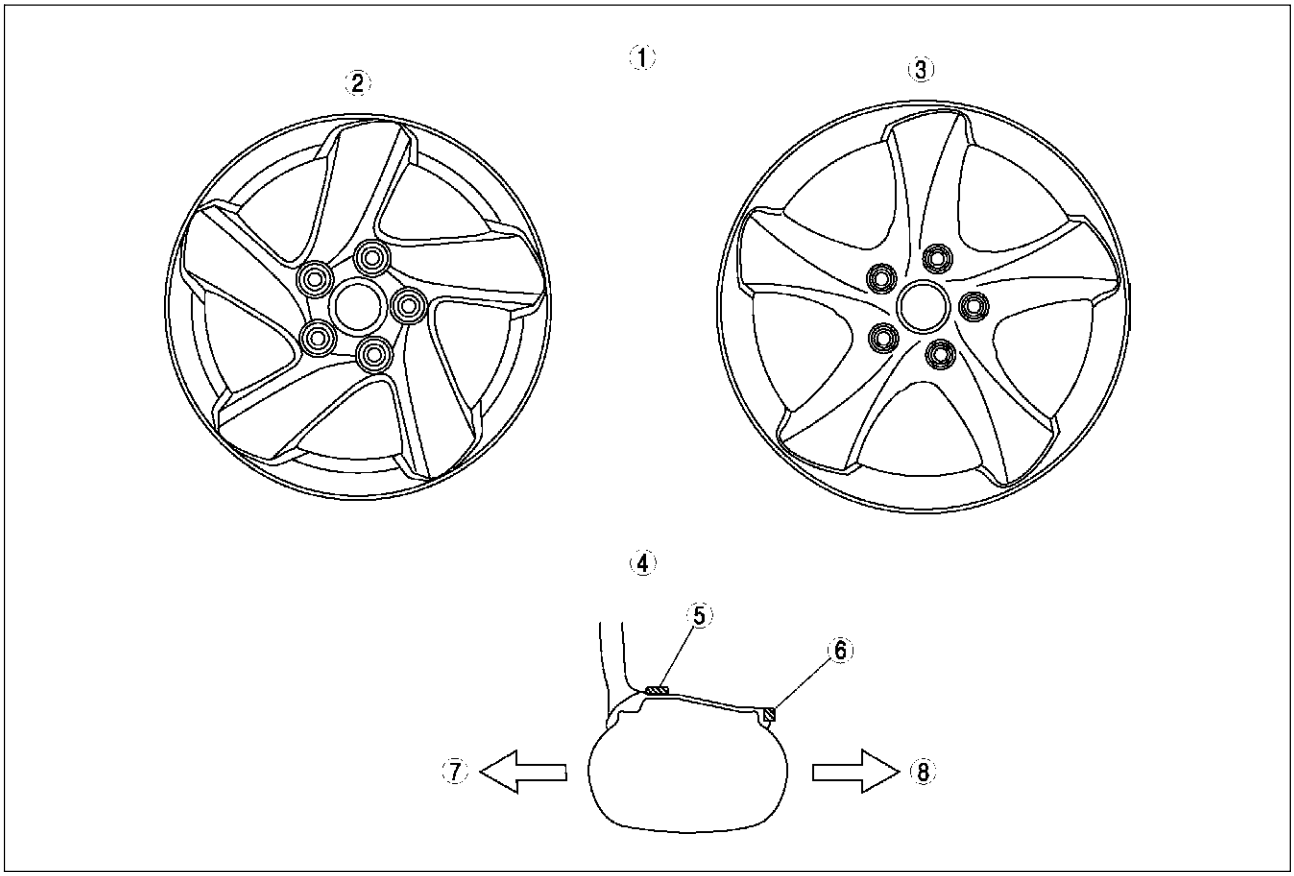
OUTLINE

A6E741701014T01

- In consideration of the environment, an adhesive-type balance weight made of steel has been adopted to reduce amount of lead used in the vehicle (16-inch and 17-inch aluminum alloy wheel).
- An adhesive-type balance weight is fastened on the inner side of the wheel. Since it is not visible from the styled side of the wheel, the design of the wheel is favored.

STRUCTURAL VIEW

A6E741701014T02



A6E7417T001

1	Styled side of wheel
2	16-inch aluminum alloy wheel
3	17-inch aluminum alloy wheel
4	Cross-sectional view

5	Adhesive-type balance weight
6	Knock-type balance weight
7	Outer
8	Inner

BODY

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OUTLINE

ABBREVIATION

A6E770201086T01

B+	Battery positive voltage
IG	Ignition
L.H.D.	Left hand drive
M	Motor
P/W CM	Power window control module
SEC.	Section
4SD	4 door sedan
5HB	5 door hatchback

OUTLINE OF CONSTRUCTION

A6E770201086T02

- The construction and operation of the body system is essentially carried over from that of the current PREMACY (CP) model, except for the following features. (See PREMACY Training Manual 3336-1*-99C.)

FEATURES

A6E770201086T03

Improved Safety

- A steel bumper reinforcement has been adopted.

Improved Convenience

- An easy fold-down function has been adopted for rear seat.

Improved Marketability

- A lumber support has been adopted for driver's side front seat.

Improved Serviceability

- The keyless unit and the door lock timer unit have been integrated.
- Power window system initial setting procedure has been simplified.

Consideration for Environment

- Recycled materials are used in the door units and shroud panel.

DOOR

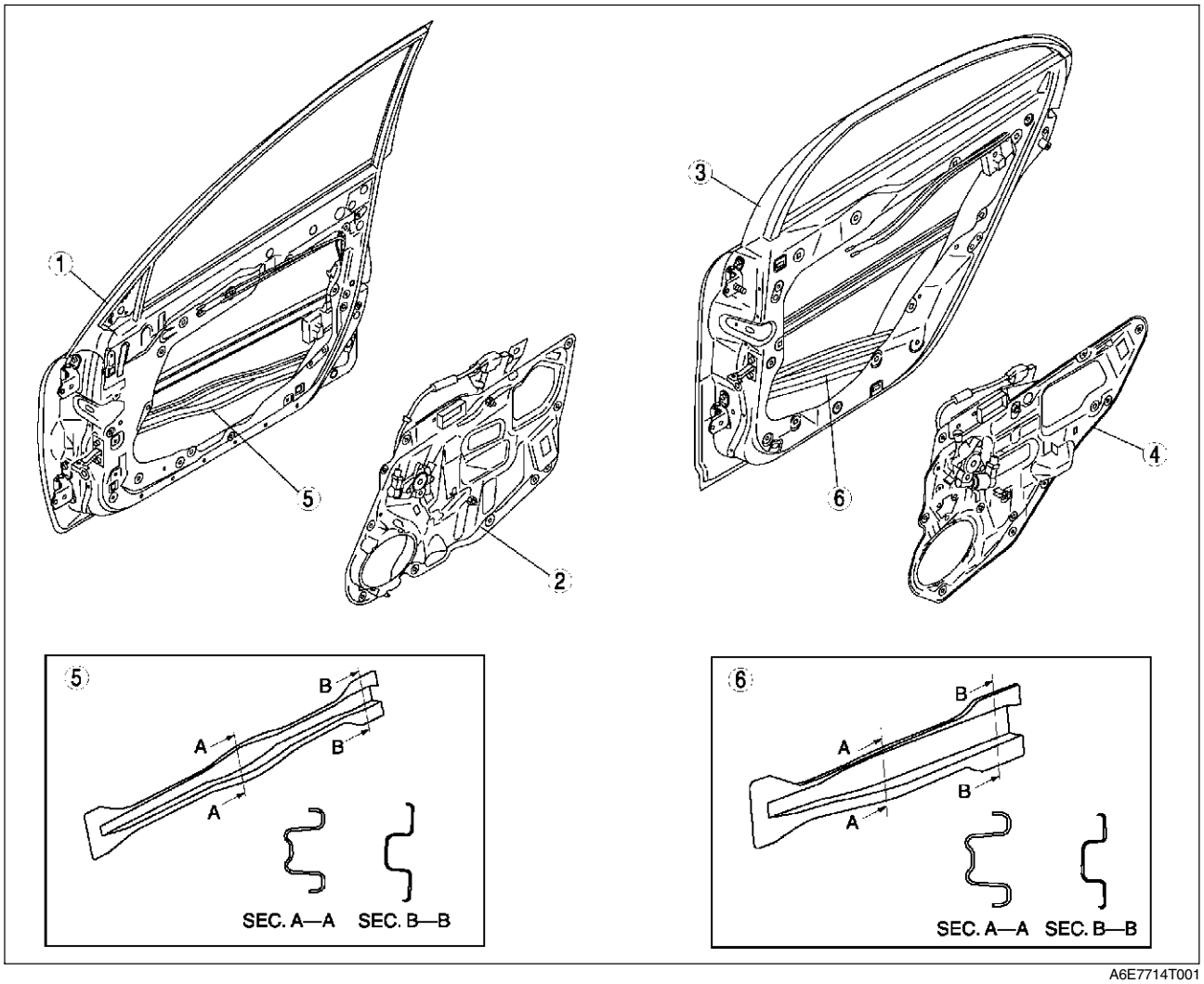
OUTLINE

A6E771458010T01

- A ripple-shaped side impact bar has been adopted to improve rigidity in case of a collision.
- The inner construction of the door, including the power window regulator, inner handle, door speaker, harness and others, have been integrated into a single door unit.
- Due to the integrated door unit, weight reduction has been achieved for the whole door.
- Waterproofing of the inner door unit parts is achieved due to sectional design.
- Fiberglass reinforced plastics have been adopted for the door unit to improve the rigidity. Additionally, in order to address environmental concerns, recycled materials are used in the unit.

STRUCTURAL VIEW

A6E771458010T02



A6E7714T001

1	Front door
2	Front door unit
3	Rear door

4	Rear door unit
5	Front side impact bar
6	Rear side impact bar

S

POWER WINDOW SYSTEM

OUTLINE

A6E771658000T01

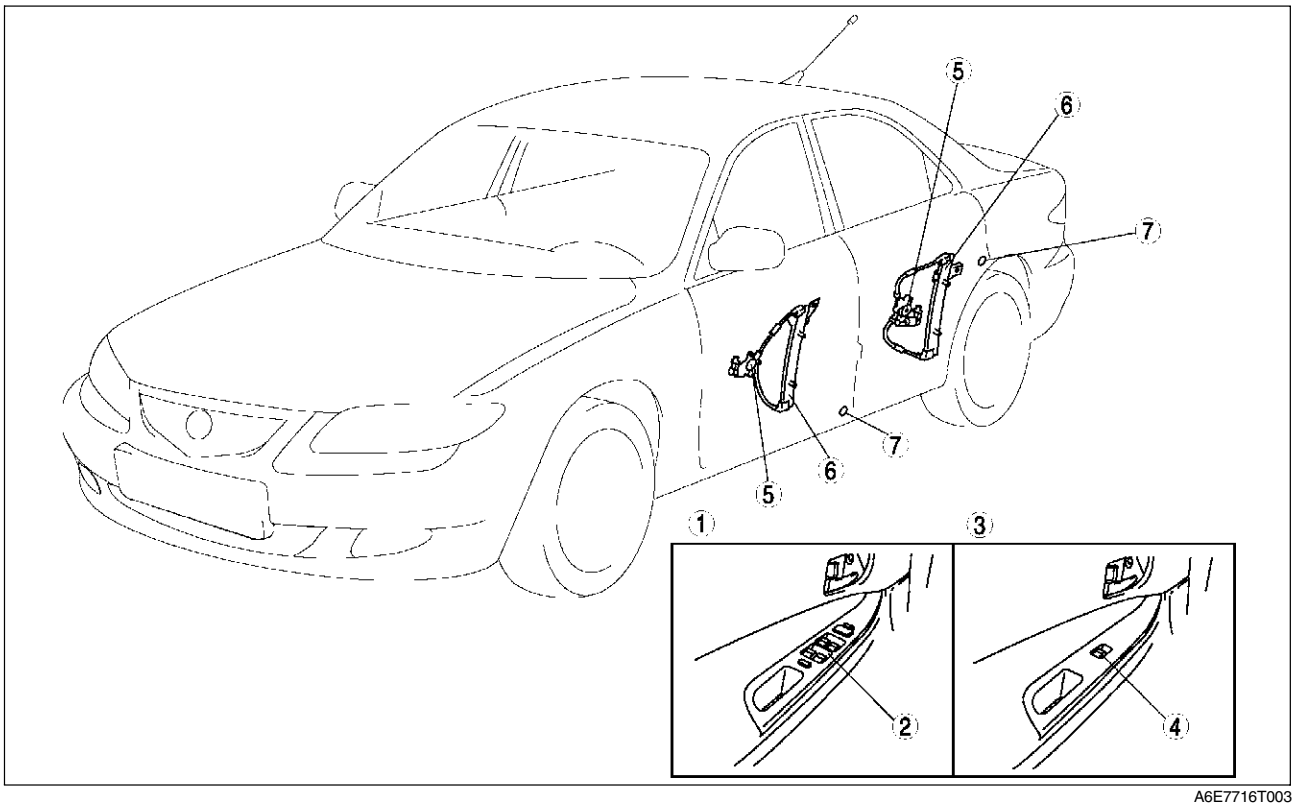
- The function, structure and operation of power window system is essentially carried over from that of the current PREMACY (CP) model, except for the following.
  — The driver-side power window system, which previously operated on the basis of the limit switch and the pulse signal, has been changed to a system that operates on the basis of two kinds of pulse signals. Although the new system maintains the current functions, the system and the initial setting have been simplified to increase serviceability.

×: Available

Function	Mazda6 (GG)	PREMACY (CP)
Manual up/down	×	×
Auto up/down (driver's only)	×	×
Automatic window return function (driver's only)	×	×
Two-step down function (driver's only)	×	×
IG-OFF timer function	×	×
Fail-safe function	×	×

STRUCTURAL VIEW

A6E771658000T02



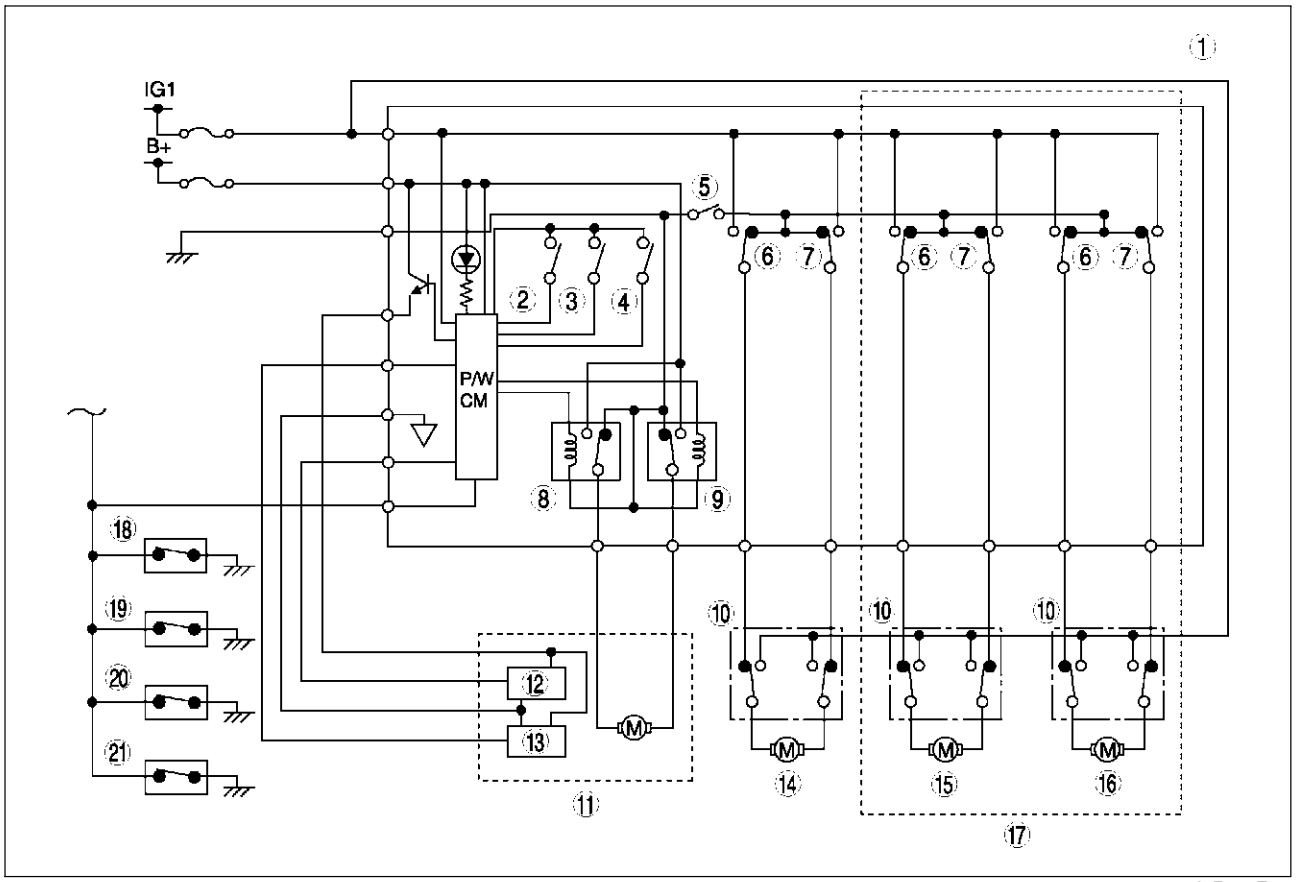
A6E7716T003

1	Driver's side
2	Power window main switch
3	Except driver's side
4	Power window subswitch

5	Power window motor
6	Power window regulator
7	Door switch

SYSTEM WIRING DIAGRAM

A6E771658000T03



A6E7716T001

1	Power window main switch
2	Manual close
3	Manual open
4	Auto
5	Power-cut switch
6	Close
7	Open
8	Close relay
9	Open relay
10	Power window subswitch
11	Front power window motor (Driver's side)

12	Hall effect switch No. 1
13	Hall effect switch No. 2
14	Front power window motor (Passenger's side)
15	Rear power window motor (Right side)
16	Rear power window motor (Left side)
17	With rear power window system
18	Door switch (Driver's side)
19	Door switch (Passenger's side)
20	Door switch (Rear right side)
21	Door switch (Rear left side)

S

DRIVER SIDE POWER WINDOW SYSTEM

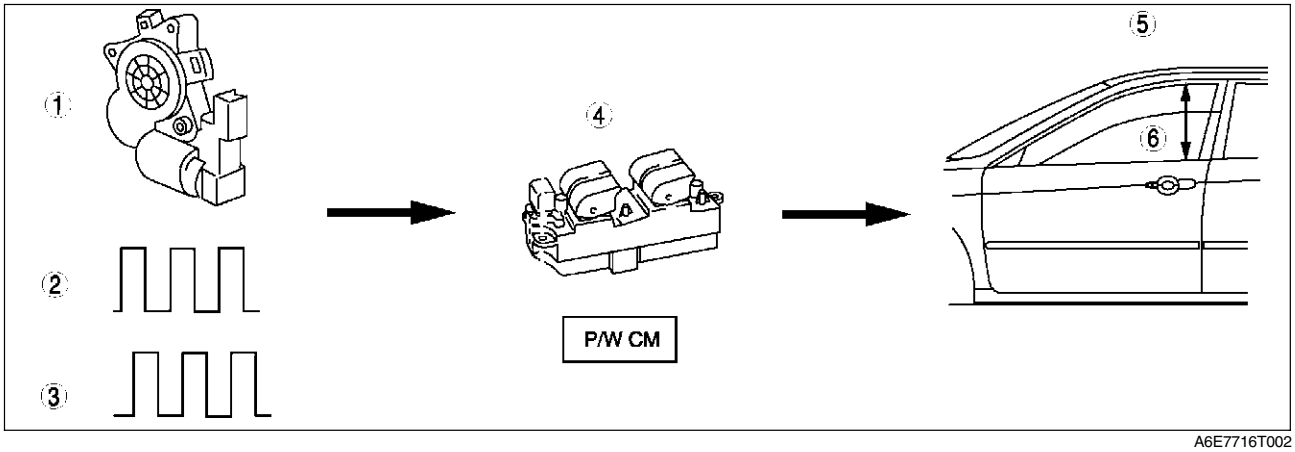
A6E771658000T04

Outline

- On the basis of the pulse signals from the Hall effect switches in the power window motor, the power window control module in the power window main switch determines the window position and the operation direction. Accordingly, the power window main switch controls the driver-side power window system.
- When the initial position is set before vehicle delivery, the window position and the operation direction are stored in the power window control module in the power window main switch. Thus resetting the initial position is necessary if the battery negative cable, power window main switch connector, or power window motor connector is disconnected.

Note

- If the initial position has not been set, the driver-side power window system's auto function, the auto window return function and the precise motion function will not function.
- See the workshop manual for more information about setting the initial position. (Mazda6 Training Manual 3359-1*-02C)



A6E7716T002

1	Power window motor
2	Pulse A
3	Pulse B

4	Power window main switch
5	Driver's side door
6	Open/close

Fail-safe Function

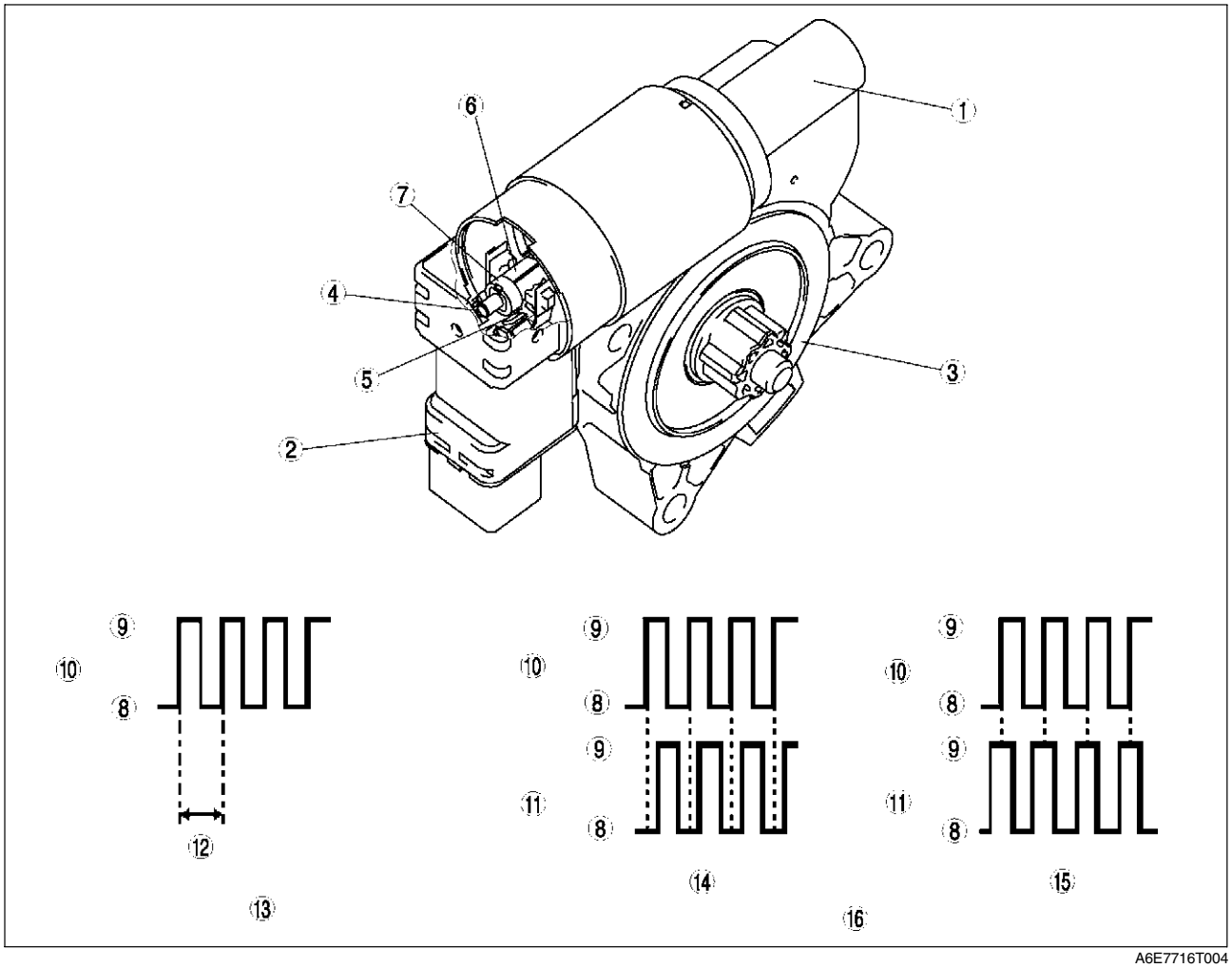
Detection Condition	Fail-safe		Recovery Items
	IG switch ON	IG switch OFF	
Hall effect switch No. 1 (for jam-safe and door glass position detection) operation malfunction • During up/down movement, Hall effect switch No. 2 pulse detected but Hall effect switch No. 1 pulse not detected.	Automatic operation is prohibited.	Automatic and manual operation are prohibited.	During up movement, pulse signals for Hall effect switches No. 1 and No. 2 are detected normally and fully closed position and return/non-return ranges are redetected.
Hall effect switch No. 2 (for door glass movement direction detection) operation malfunction • During up/down movement, Hall effect switch No. 1 pulse detected but Hall effect switch No. 2 pulse not detected.			
Pulse signal malfunction detection (Inversion of input signals of, or large phase deviation between, Hall effect switches No. 1 and No. 2.) • During up/down movement, difference detected between the direction detection signals from Hall effect switches No. 1 and No. 2, and the actual direction.			
Non-return range downturn malfunction • During up movement, the signal input from Hall effect switch No. 1 was higher than the position stored in the P/W main switch.			
Hall effect switches No. 1 and No. 2 operation malfunction • Hall effect switches No. 1 and No. 2 pulse signal not detected after down movement was initiated from the fully closed position.			

POWER WINDOW MOTOR

A6E771658000T05

Structure and Operation

- The power window motor consists of a motor, connector and gear.
- Two Hall effect switches are set in the connector.
- The Hall effect switch utilizes magnets set on a rotating axis to sense the power window motor rotation, and outputs a synchronized pulse to the power window main switch.
- Hall effect switch No. 1 outputs one pulse cycle for each rotation of the power window motor axle. Accordingly, the power window main switch detects the rotational speed of the power window motor.
- The power window main switch detects the rotational direction of the power window motor by the difference between high and low pulse points from each Hall effect switch No. 1 and 2.



A6E7716T004

1	Motor
2	Connector
3	Gear
4	Hall effect switch No.1
5	Hall effect switch No.2
6	Shaft
7	Magnet
8	Low

9	High
10	Pulse (Hall effect switch No.1)
11	Pulse (Hall effect switch No.2)
12	One revolution of power window motor
13	Detection of window movement distance
14	Up
15	Down
16	Detection of window movement direction

POWER DOOR LOCK SYSTEM

OUTLINE

A6E771866000T01

- The keyless unit and the door lock timer unit have been integrated.
- The power door lock system has the following functions. These functions are the same as those of current MPV (LW).
- An interior light control system has been added as the keyless unit and the door lock timer unit were integrated. This function is the same as thatof current MPV (LW).

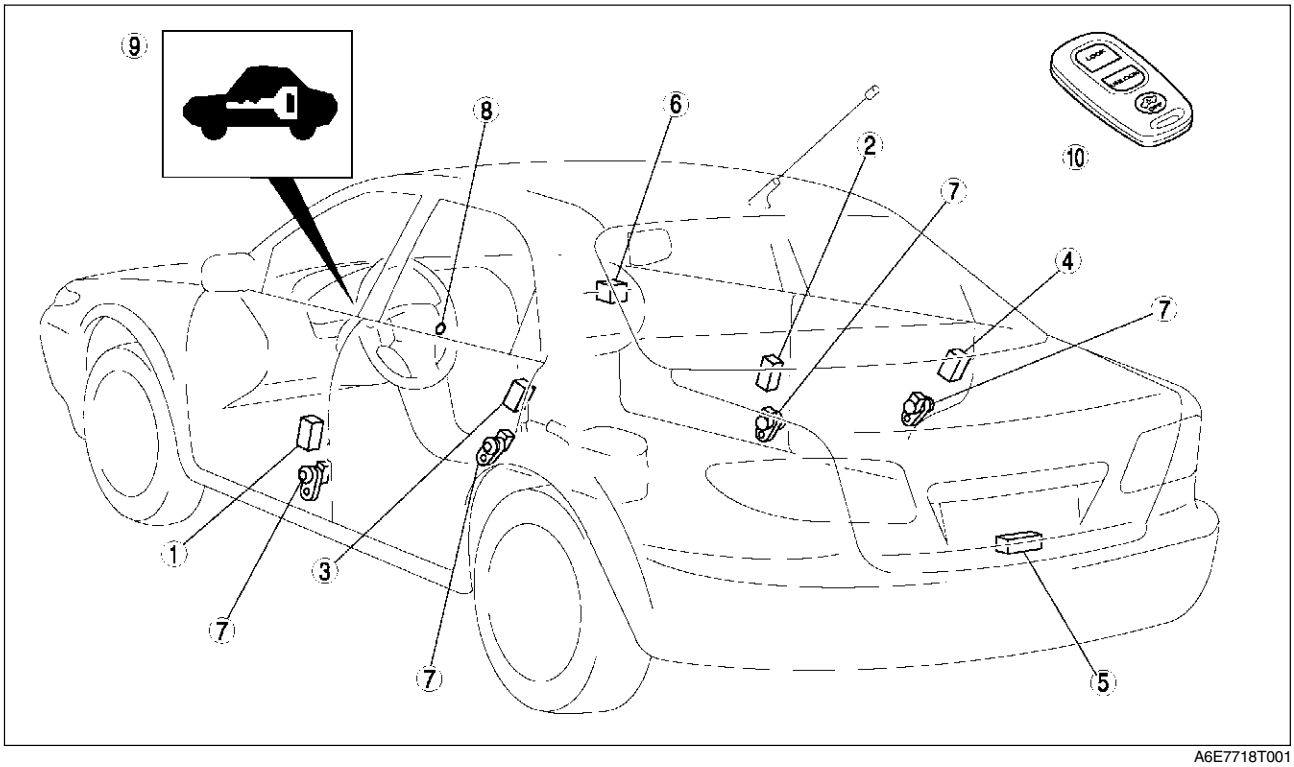
×: Applied
–: Not applied

Function		European (L.H.D.) specs.	U.K. specs.	GCC specs.
Double lock function		×	×	–
Passenger's side power door lock system (only vehicles without keyless entry system)		×	×	–
Keyless entry system	Auto lock function	×	×	–
	Answer back function	×	×	–
Keyless lock cancel function		×	×	×
Interior light control function		×	×	×

- The intrusion sensor cancel button has been adopted for the transmitter. For details, See T–47 INTRUDER SENSOR.
- The double lock function is same as that of current MPV (LW) with the exception of the following items.
  — The key cylinder switch is built in the door latch.

STRUCTURAL VIEW

A6E771866000T02



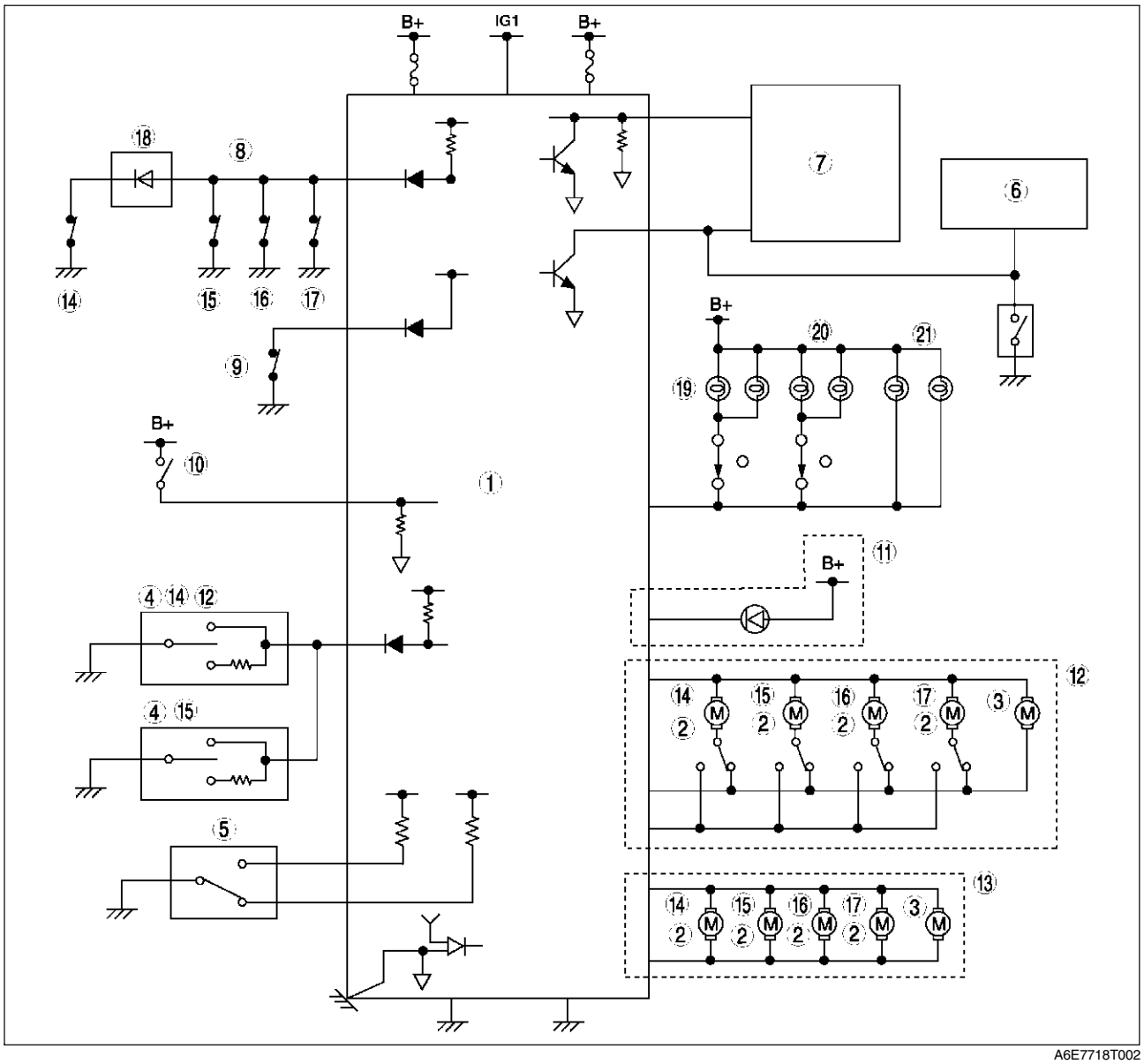
A6E7718T001

1	Door lock actuator (driver's side: door lock-link switch, key cylinder switch)
2	Door lock actuator (passenger's side; key cylinder switch)
3	Door lock actuator (rear left)
4	Door lock actuator (rear right)

5	• Trunk lid lock actuator (4SD) • Liftgate lock actuator (5HB)
6	Door lock timer unit
7	Door switch
8	Key reminder switch
9	Security light
10	Transmitter

SYSTEM WIRING DIAGRAM

A6E771866000T03



A6E7718T002

1	Door lock timer unit
2	Door lock actuator
3	• Trunk lid lock actuator (4SD) • Liftgate lock actuator (5HB)
4	Key cylinder switch
5	Door lock-link switch (Driver's side)
6	Flasher unit
7	Theft-deterrent control module
8	Door switch
9	Cargo compartment light switch
10	Key reminder switch

11	Security light
12	With double locking system
13	Without double locking system
14	Driver's side
15	Passenger's side
16	Rear left
17	Rear right
18	Instrument cluster
19	Front map light
20	Front map light
21	Courtesy light

KEYLESS ENTRY SYSTEM

A6E771869000T01

Outline

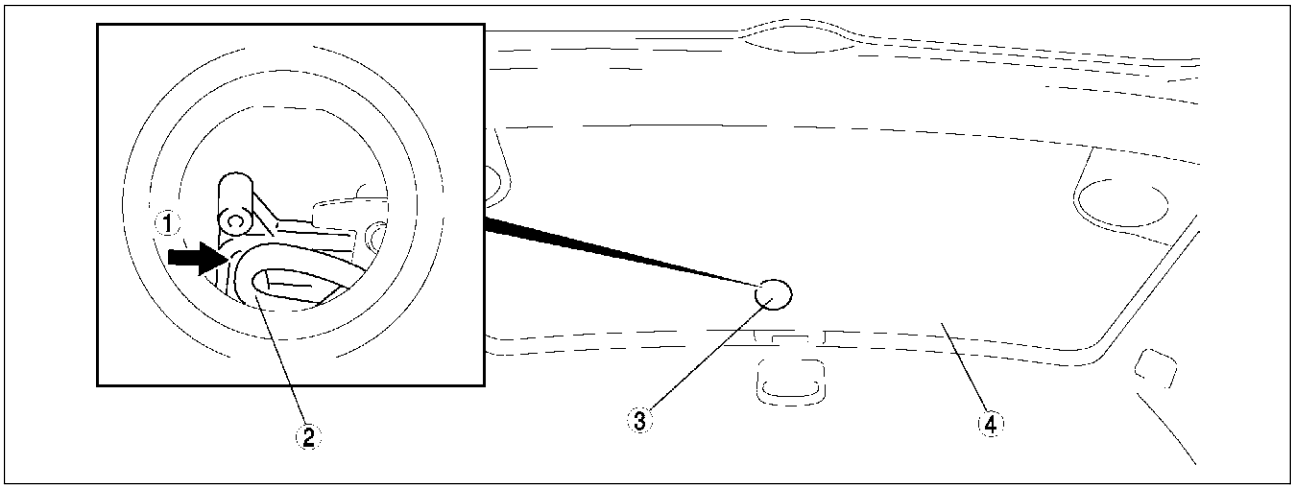
- The keyless entry system is also controlled by the door lock timer unit as the keyless unit and the door lock timer unit have been integrated.

LIFTGATE LOCK ACTUATOR

A6A771862310T01

Outline

- Models equipped with the keyless entry system do not have a liftgate key cylinder. If there are malfunctions in the keyless entry system with the liftgate locked, the liftgate cannot be unlocked. Instead, the liftgate lock actuator can be unlocked manually from a newly- adopted access hole on the liftgate lower trim.



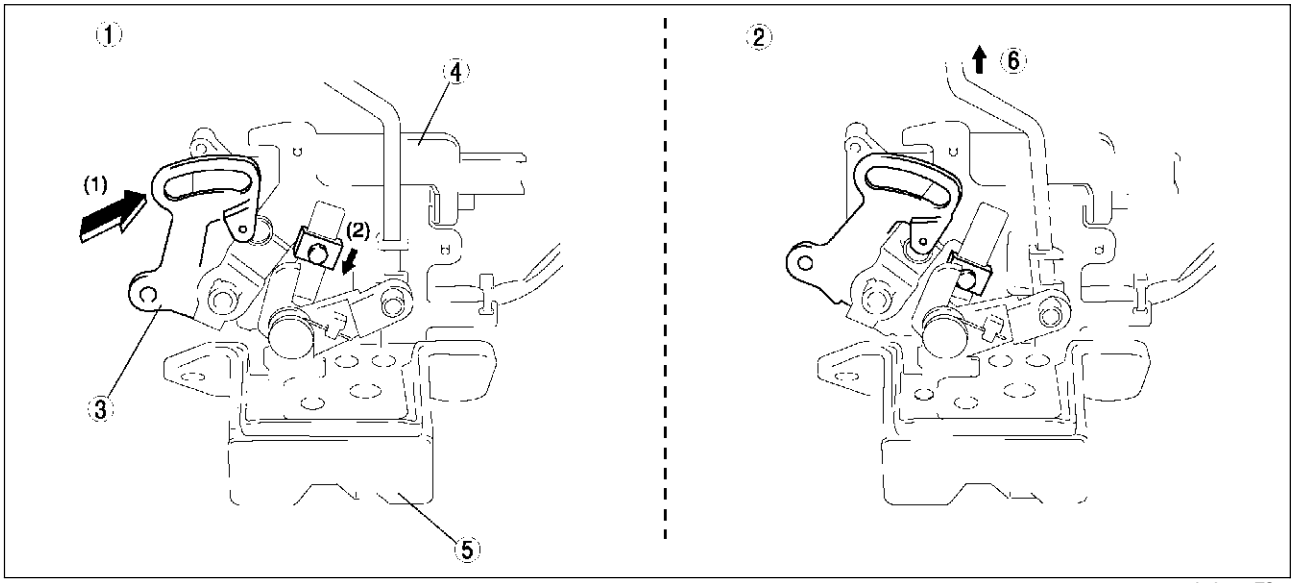
A6A7718TS01

1	Press
2	Link plate

3	Access hole
4	Liftgate lower trim

Operation

- The liftgate latch is switched from the lock to unlock position when the link plate is moved in the direction of arrow (2) after the link plate is pressed in the direction of arrow (1) .



A6A7718TS02

1	Lock
2	Unlock
3	Link plate

4	Liftgate lock actuator
5	Liftgate latch
6	Outer handle

OUTSIDE MIRROR

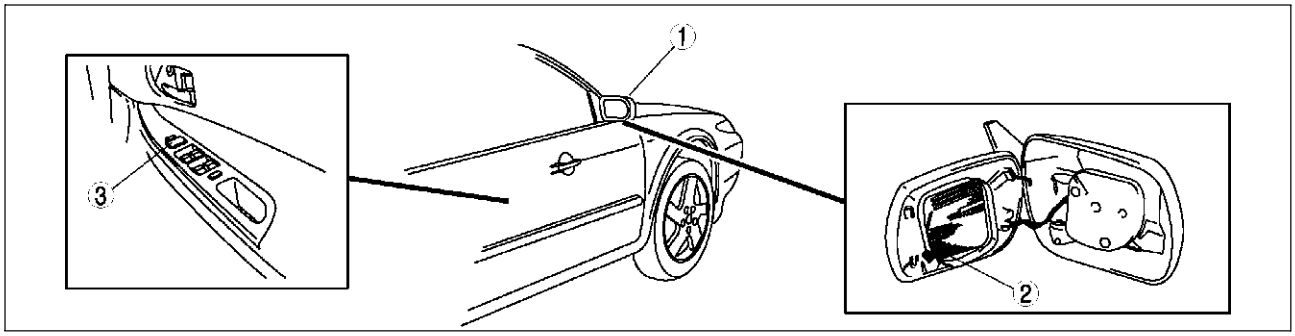
OUTLINE

A6E773269110T01

- The function, structure and operation is the same as that of the current PREMACY (CP) model. (See PREMACY Training Manual 3336-1*-99C.)

STRUCTURAL VIEW

A6E773269110T02

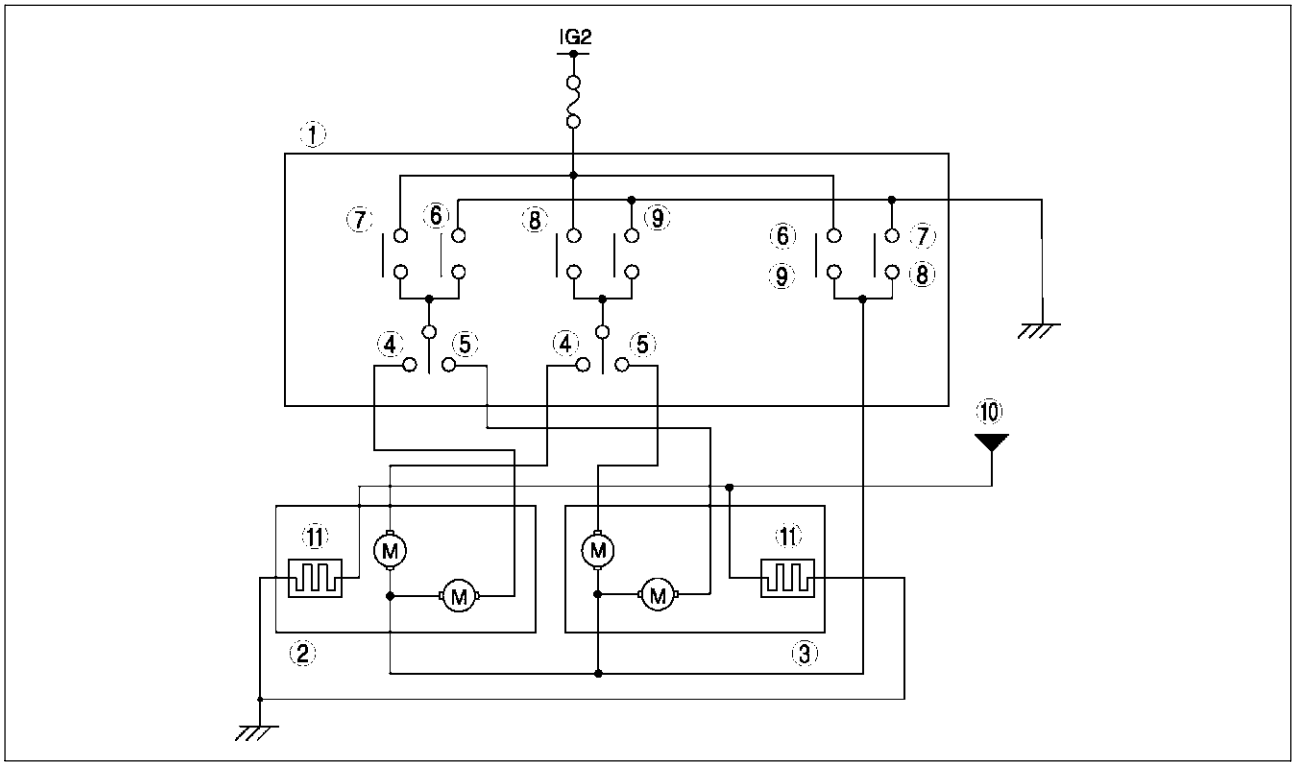


A6E7732T001

1	Power outside mirror
2	Heated filament
3	Power outside mirror switch

SYSTEM WIRING DIAGRAM

A6E773269110T03



A6E7732T002

1	Power outside mirror switch
2	Power outside mirror (left side)
3	Power outside mirror (right side)
4	Left side
5	Right side
6	Right
7	Left
8	Up
9	Down
10	Rear defroster relay
11	Heated filament

REAR WINDOW DEFROSTER

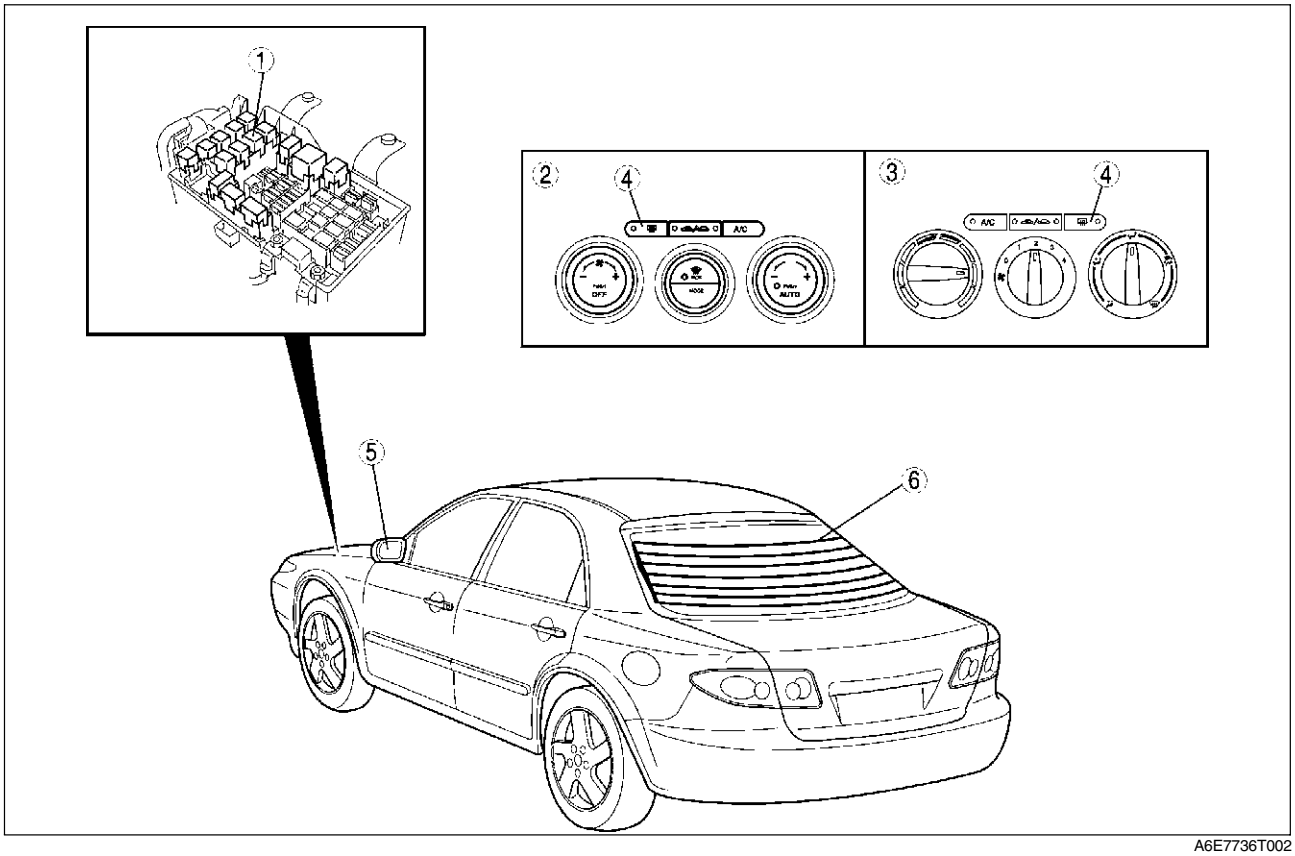
OUTLINE

A6E773663000T01

- The function, structure and operation is the same as that of the current PREMACY (CP) model.

STRUCTURAL VIEW

A6E773663000T02



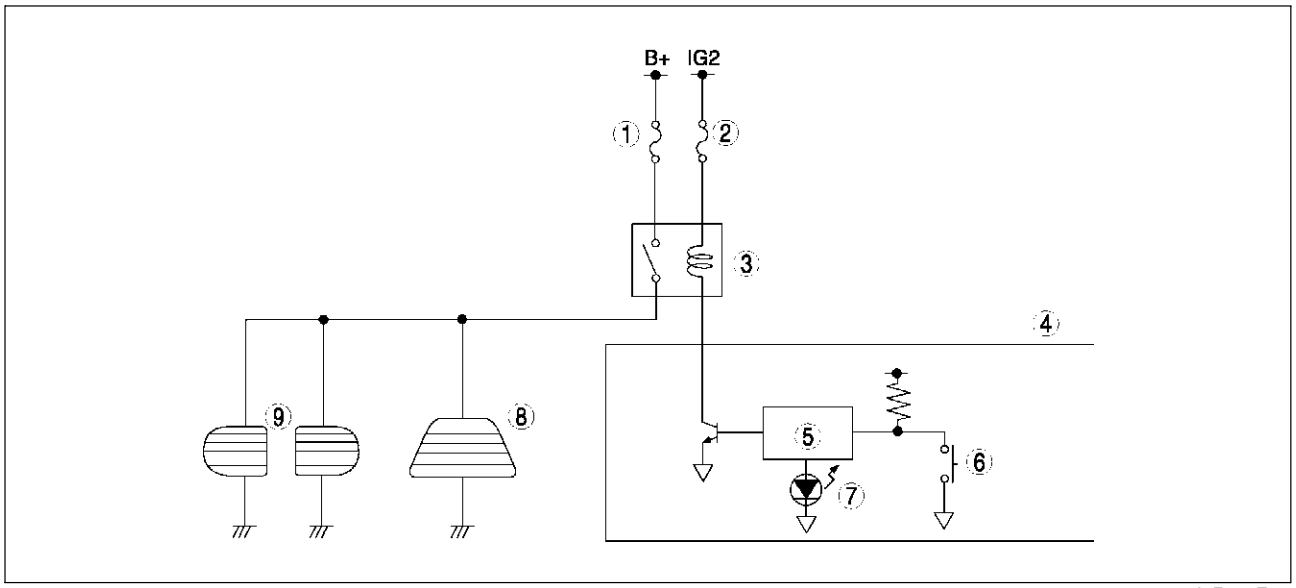
A6E7736T002

1	Rear window defroster relay
2	Climate control unit (full-auto air conditioner type)
3	Climate control unit (manual air conditioner type)

4	Rear window defroster switch
5	Heated outside mirror
6	Rear window defroster filament

SYSTEM WIRING DIAGRAM

A6E773663000T03



A6E7736T001

1	DEFOG 40 A fuse
2	METER IG 15 A fuse
3	Rear defroster relay
4	Climate control unit
5	Microcomputer

6	Rear defroster switch
7	Rear defroster indicator light
8	Rear window defroster
9	Heated outside mirror

S

SLIDING SUNROOF

OUTLINE

A6E774001049T01

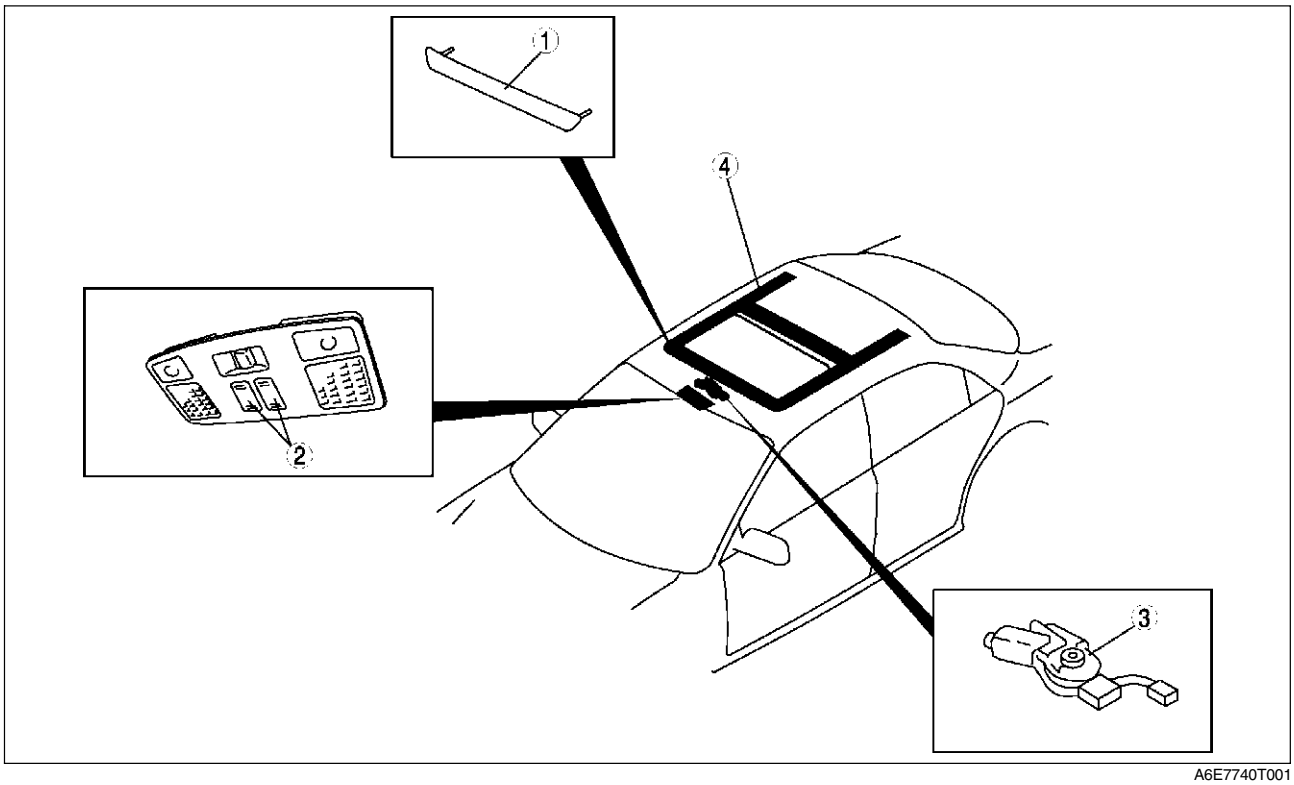
- The construction and operation (slide open/close and tilt up/down) are the same as the 626 (GF) 5HB model.

×: Available
–: Not available

Item	Mazda6 (GG)	626 (GF) 5HB
Slide open/close function	×	×
Auto-stop function (when closing)	–	×
Tilt up/down function	×	×
Number of limit switch	3	←
Sliding amount (mm {in})	285 {11.2}	360 {14.1}
Tilt up amount (mm {in})	28 {1.1}	←

STRUCTURAL VIEW

A6E774001049T02

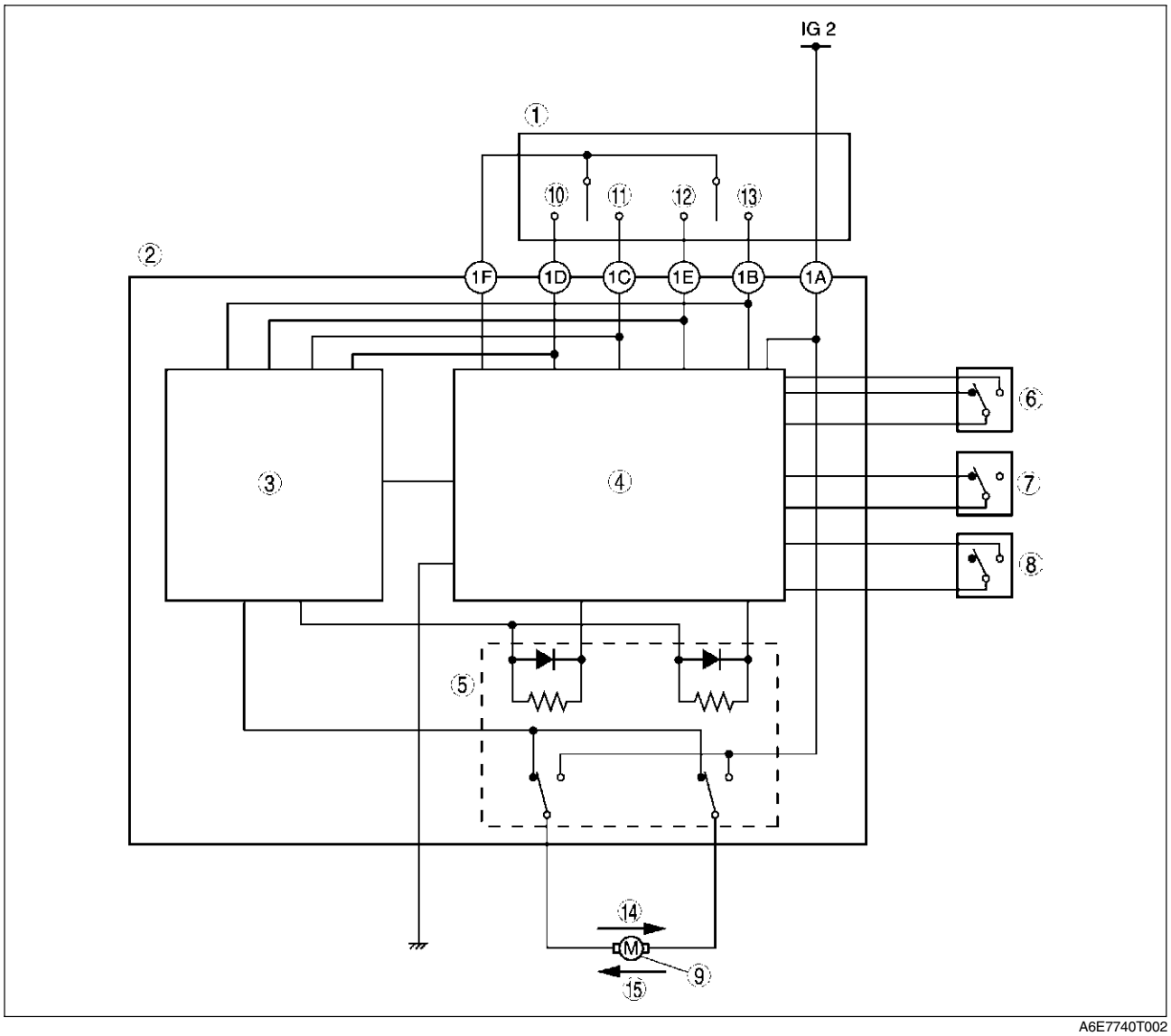


A6E7740T001

1	Deflector	3	Sunroof motor
2	Sunroof switch	4	Sunroof unit

SYSTEM WIRING DIAGRAM

A6E774001049T03



A6E7740T002

1	Sunroof switch
2	Sunroof relay
3	Motor control circuit
4	Motor lock current detection circuit
5	Relay
6	Limit switch No. 1
7	Limit switch No. 2
8	Limit switch No. 3

9	Sunroof motor
10	Slide open
11	Slide close
12	Tilt down
13	Tilt up
14	Slide open/tilt down
15	Slide close/tilt up

S

DASHBOARD AND CONSOLE

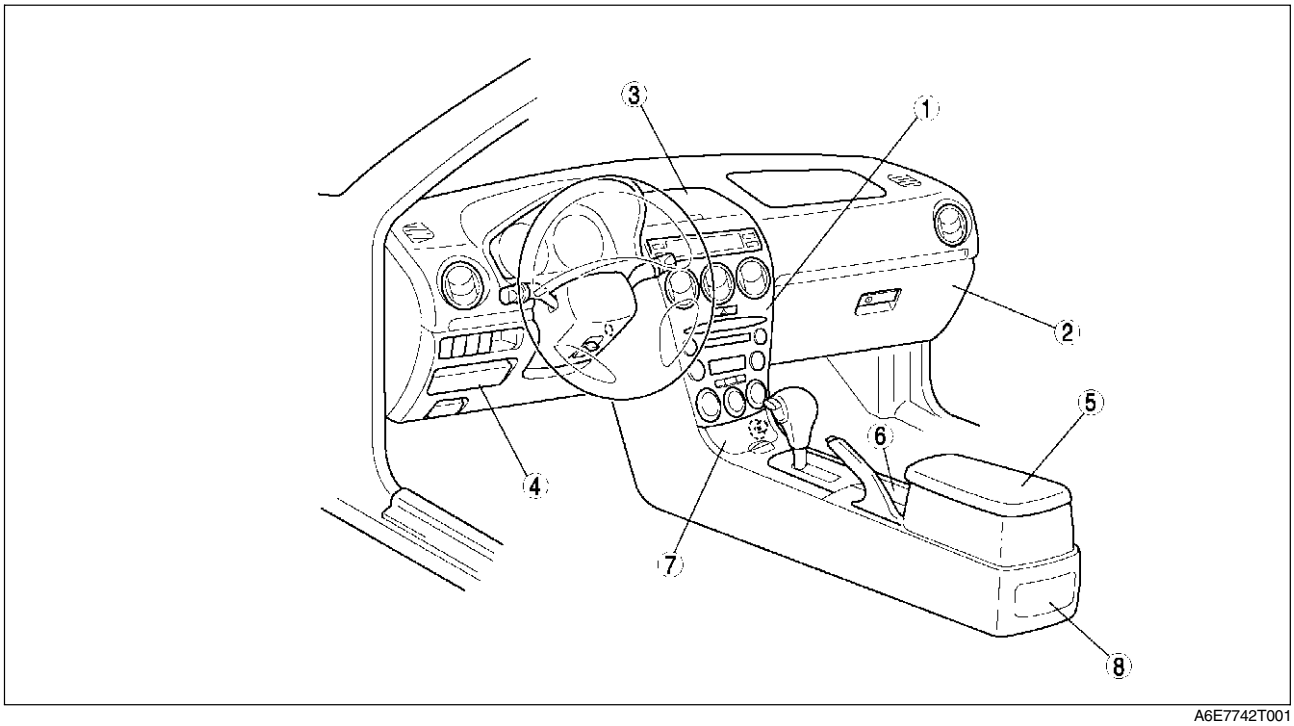
OUTLINE

A6E774255000T01

- The center module, which integrates the audio and climate control units, is located at the center of the dashboard panel. This improves the functionality and gives it a unified appearance.
- Various storage spaces have been kept.

STRUCTURAL VIEW

A6E774255000T02



A6E7742T001

1	Center module
2	Glove compartment
3	Center box (without car-navigation system)
4	Storage pocket

5	Console box
6	Cup holder
7	Front ashtray
8	Rear ashtray

SEAT

OUTLINE

A6E775257100T01

Front Seat

- Three types of seats are available:
  - — Manual seat with seat lifter (driver's side)
  - — Manual seat without seat lifter (passenger's side)
  - — Power seat
- A lumber support has been adopted for driver's seat.

Rear seat

- An easy fold-down function has been adopted.
- Child restraint seat anchors have been adopted. There are two types of anchors used for child restraint systems: the ISOFIX and tether strap anchors.

Specifications

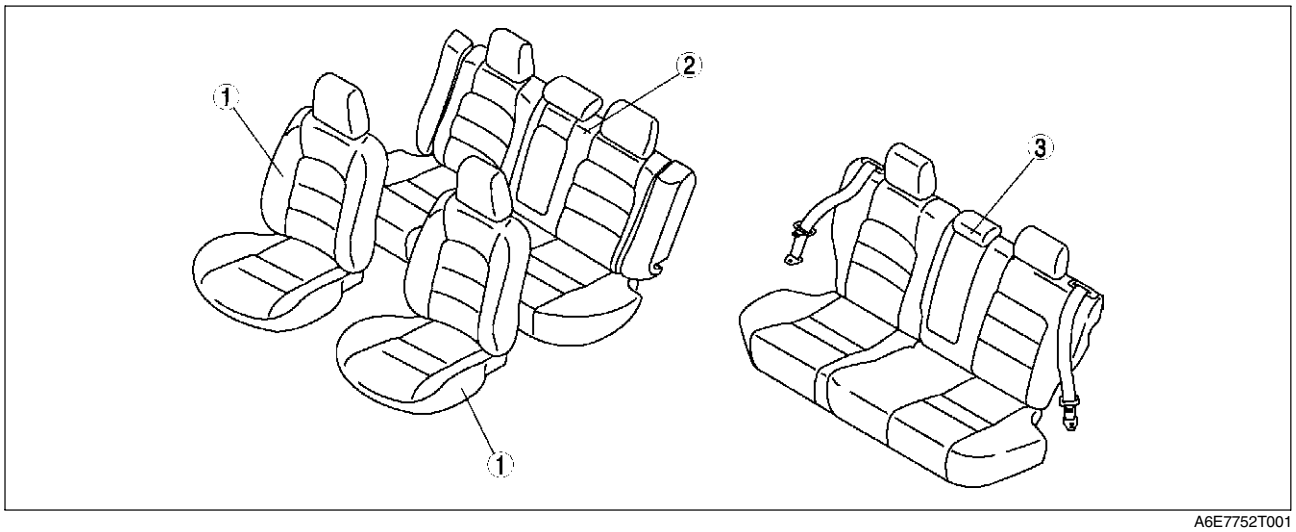
×: Available
–: Not available

Item			Body type	
			4SD	5HB
Front seat	Type	Manual	×	×
		Power	×	×
	Lumber support (Driver's side only)		×	×
	Seat lifter (Driver's side only)		×	×
	Side air bag		×	×
Rear seat	Easy fold-down type	Remote handle lever	×	×
		Push knob	–	×
	Child restraint seat anchor type	ISOFIX	×	×
		Tether strap	×	×
	Armrest		×	×

S

STRUCTURAL VIEW

A6E775257100T02



A6E7752T001

1	Front seat
2	Rear seat (4SD)

3	Rear seat (5HB)

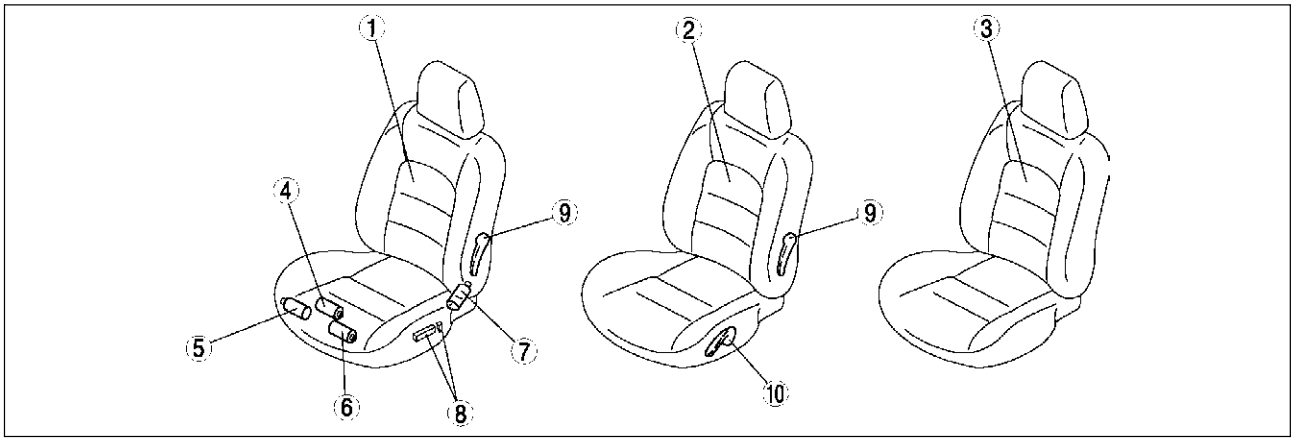
FRONT SEAT

A6E775257100T03

Outline

- Three types of seats are available.
  - — Manual seat with seat lifter (Driver's side)
  - — Manual seat without seat lifter (Passenger's side)
  - — Power seat (Driver's side)
- A lumber support has been adopted for driver's seat.
- The function and operation of the power seat is basically the same as the current MELLENIA (TA) model.

Structural View



A6E7752T002

1	Power seat (Driver's side)
2	Manual seat with seat lifter (Driver's side)
3	Manual seat without seat lifter (Driver's side)
4	Slide motor (With power seat)
5	Rear tilt motor (With power seat)

6	Front tilt motor (With power seat)
7	Recliner motor (With power seat)
8	Power seat switch (With power seat)
9	Lumber support lever (Driver's side only)
10	Seat lifter lever (Driver's side only)

REAR SEAT

A6E775257200T01

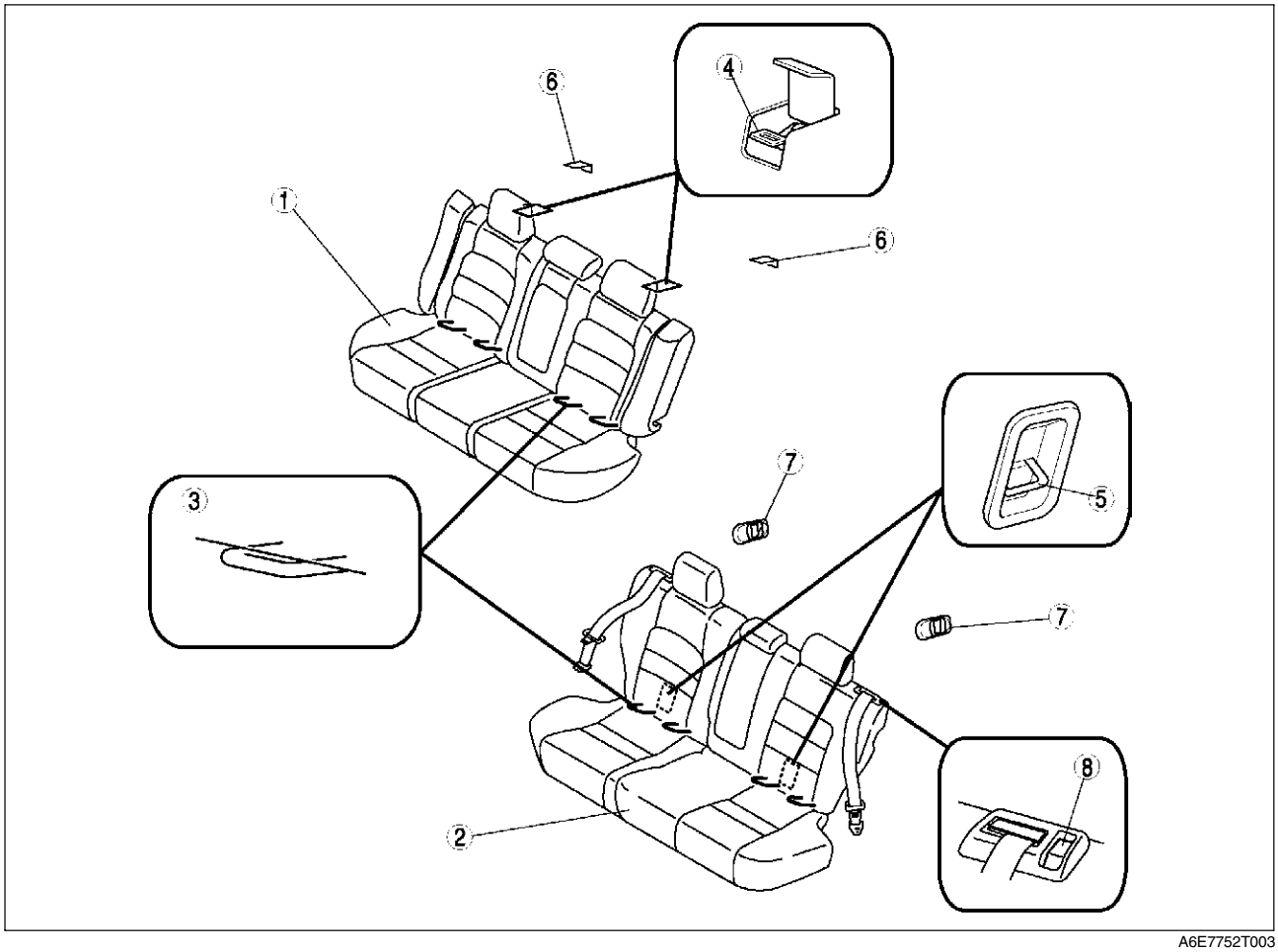
Outline

- An easy fold-down function has been adopted.
- Child restraint seat anchors have been adopted. There are two types of anchors used for child restraint systems: the ISOFIX and tether strap anchors.

Caution

- **Installation procedure varies with the type of child restraint seat. When installing a child restraint seat, be sure to follow the prescribed procedure for each type.**
- **A child restraint seat using a tether strap cannot be completely secured with only the tether strap. Use an ISOFIX anchor, or a rear seat belt in conjunction with the anchor used with the tether strap.**

Structural View



A6E7752T003

1	Rear seat (4SD)
2	Rear seat (5HB)
3	ISOFIX anchor
4	Tether strap anchor (4SD)

5	Tether strap anchor (5HB)
6	Remote handle lever (4SD)
7	Remote handle lever (5HB)
8	Push knob (5HB)

EASY FOLD-DOWN FUNCTION

A6E775257200T02

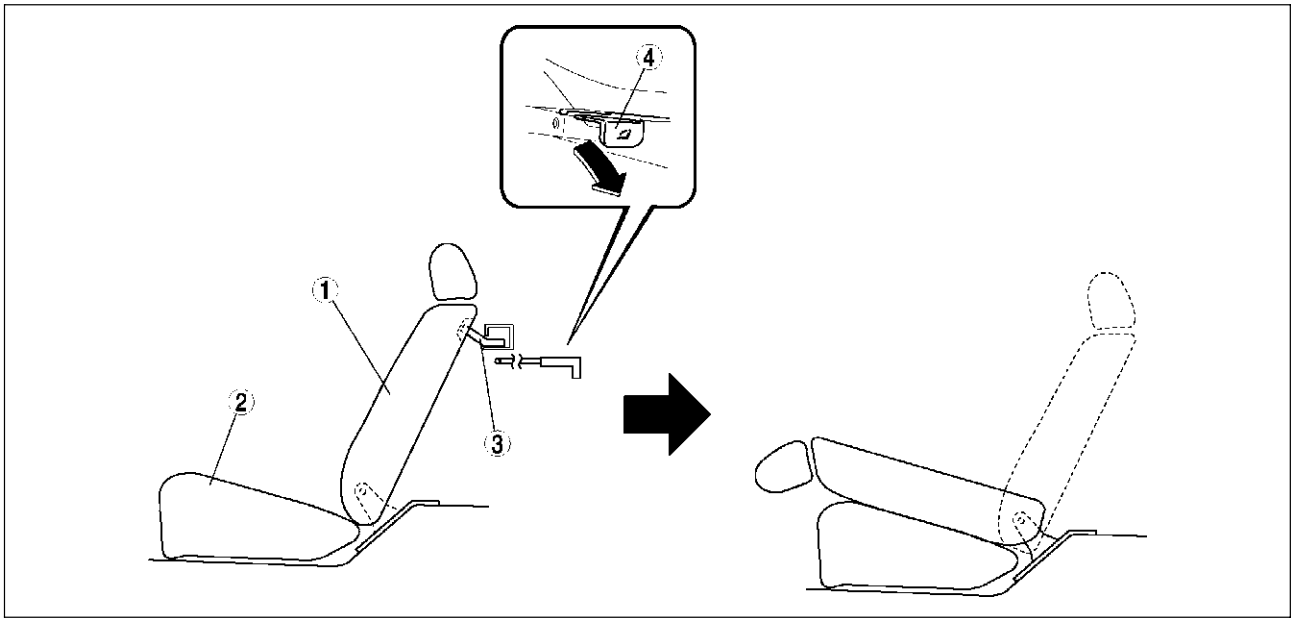
Outline

- Operating the remote handle lever or the push knob (5HB only), automatically folds down the seat for extra cargo space.

Operation

4SD

1. When the remote handle lever is operated, the seat back catch unlocks via the wire.
2. The unlocked seat back folds forward under its own weight.



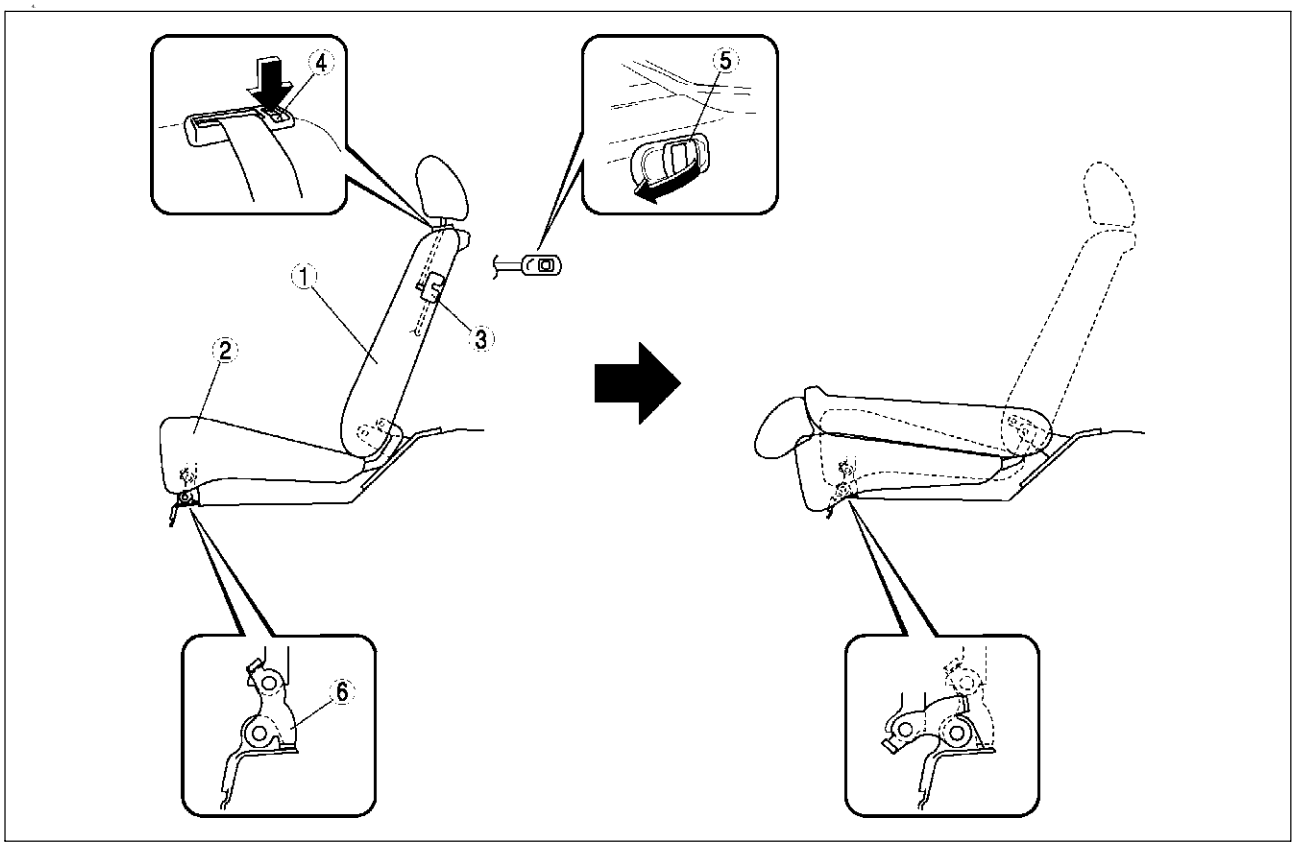
A6E7752T004

1	Rear seat back
2	Rear seat cushion

3	Catch
4	Remote handle lever

5HB

1. When the remote handle lever or push knob is operated, the seat back catch unlocks via the wire.
2. The unlocked seat back folds forward under its own weight.
3. Continuing to press the seat back down causes the seat cushion hinge to fold in and the seat back to slide forward into the lower recess.



A6E7752T005

1	Rear seat back
2	Rear seat cushion
3	Seat back catch

4	Push knob
5	Remote handle lever
6	Seat cushion hinge

BODY SHELL

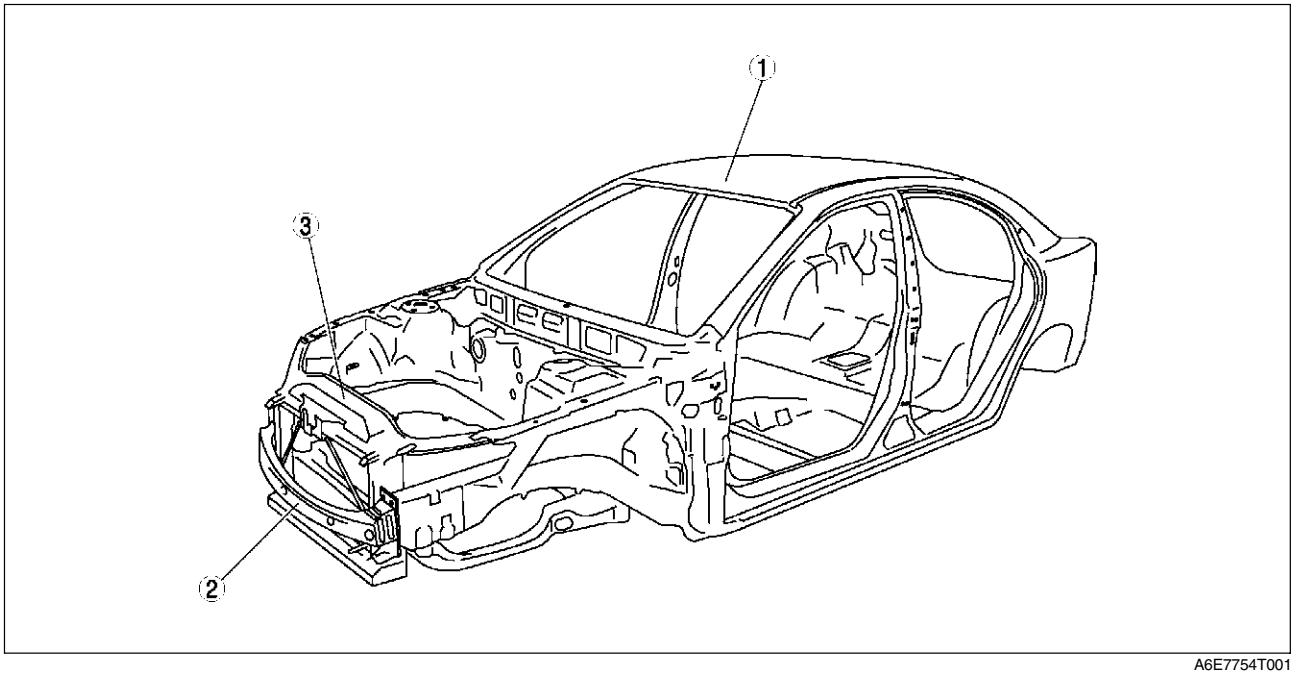
OUTLINE

A6E775407000T01

- The body shell has been designed to increase vehicle structural rigidity and reduce shock to the body, thus improving safety.
- The crushable zone, an H-shaped frame (triple-H structure), absorbs impact energy and prevents it from reaching the occupants.
- A steel bumper reinforcement has been adopted for improved safety.
- A resin shroud panel has been adopted for improved serviceability.

STRUCTURAL VIEW

A6E775407000T02



A6E7754T001

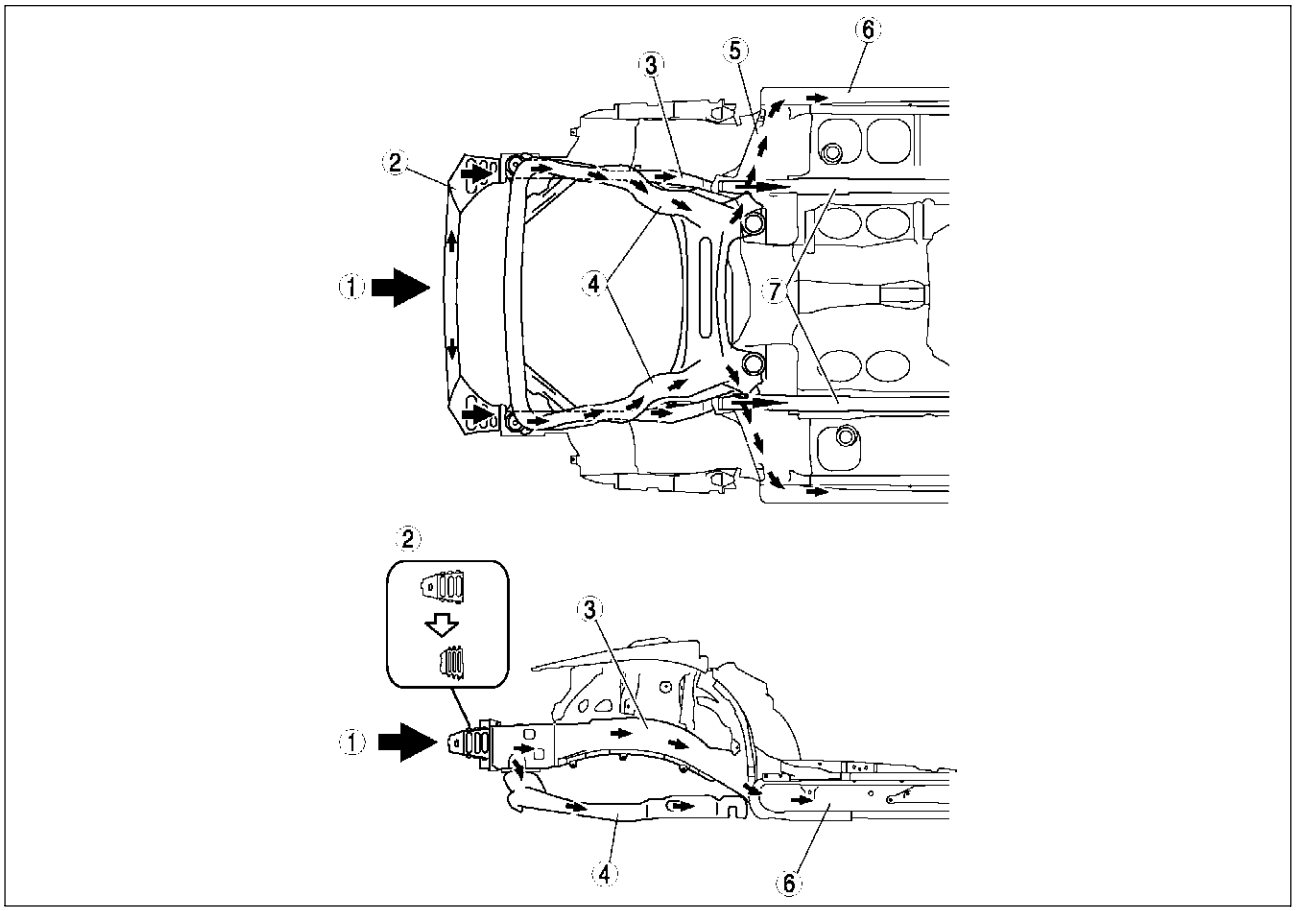
1	Body shell
2	Front bumper reinforcement

3	Shroud panel

CRUSHABLE ZONE

A6E775407000T03

- To reduce cabin damage, the front and rear of the frame are designed to deform when incurring an impact, and effectively absorb/disperse energy from a collision.
  - — In moderate collisions at the front bumper reinforcement, impact is diffused to the front side frames and front suspension members.
  - — If the collision comes close to the cabin, impact is diffused to the side sills and front B frames through the torque box, reducing impact to the cabin.



A6E7754T002

1	Collision energy
2	Front bumper reinforcement
3	Front side frame
4	Front crossmember

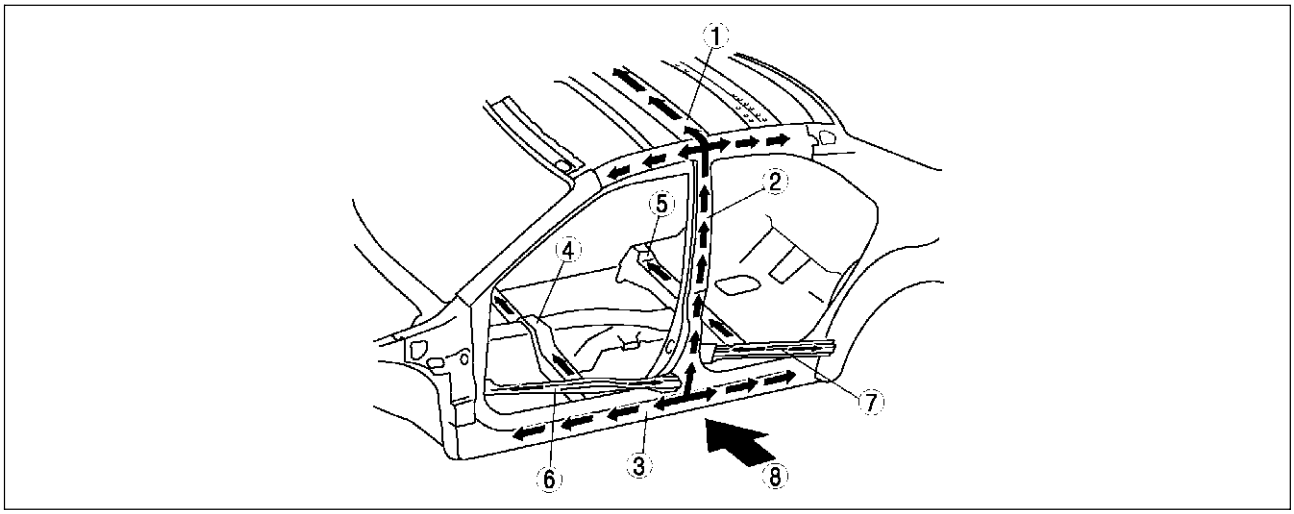
5	Torque box
6	Side sill
7	Front B-frame

S

CABIN

A6E775407000T04

- The floor, the side frame and the roof form three rigid, H-shaped frames (triple-H structure) that resist impact forces in the event of a side collision.
- Handling stability is improved by preventing body torsion.



A6E7754T003

1	Roof reinforcement
2	B-pillar
3	Side sill
4	Crossmember No. 2

5	Crossmember No. 3
6	Front door impact bar
7	Rear door impact bar
8	Collision energy

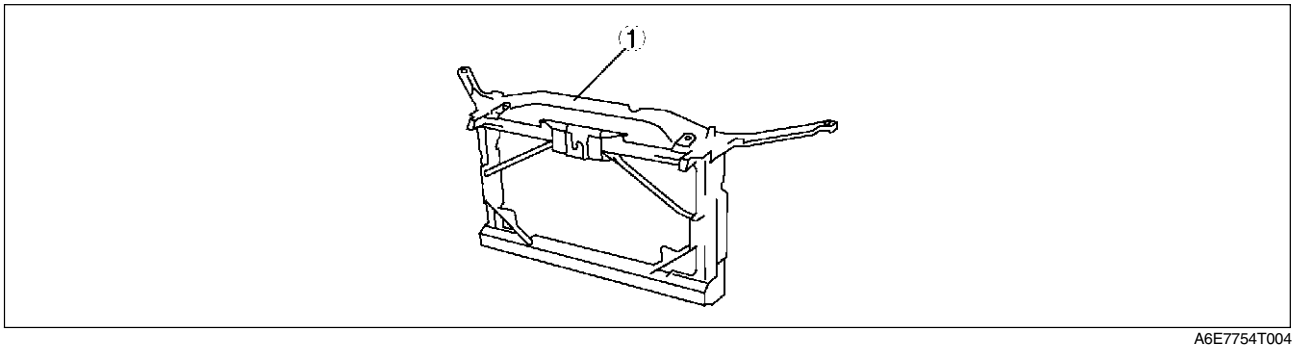
SHROUD PANEL

A6E775453140T01

Outline

- The shroud panel is a glass-fiber impregnated strong plastic.
- Easily replaced for improved serviciblity.
- Recycled materials are used in consideration of the environment.

Structural View



A6E7754T004

1	Shroud panel

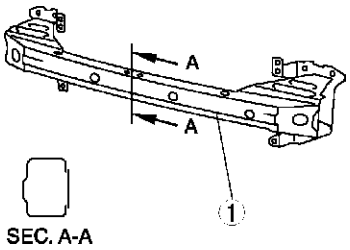
FRONT BUMPER REINFORCEMENT

A6E775450031T01

Outline

- A large sectional form has been adopted for improved strength.
- The frame and connection area have adopted a crushable structure. At low-speed collisions, impact is absorbed and diffused, reducing impact to the frame and other parts.

Structural View



A6E7754T005

1	Front bumper reinforcement

S

BODY ELECTRICAL SYSTEM

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ABBREVIATIONS

ABBREVIATIONS

A6E810101088T01

ABS	Antilock brake system
ACC	Accessories
ALC	Auto level control
ATX	Automatic transaxle
CAN	Controller area network
CM	Control module
CPU	Central processing unit
DIS	Drive information system
DRL	Daytime running light
DSC	Dynamic stability control
DTC	Diagnostic trouble code
EBD	Electronic brakeforce distribution
ECT	Engine coolant temperature
GPS	Global positioning system
HI	High
HU	Hydraulic unit
IG	Ignition
INT	Intermittent
LCD	Liquid crystal display
LED	Light emitting diode
LH	Left hand
L.H.D.	Left hand drive
LO	Low
MTX	Manual transaxle
PATS	Passive anti theft-system
PCM	Powertrain control module
PID	Parameter identification
RDS	Radio data system
RH	Right hand
R.H.D.	Right hand drive
SAS	Sophisticated air bag sensor
SEC.	Section
SST	Special service tool
TFT	Thin film transistor
TNS	Tail number side lights
TR	Transmission (Transaxle) range
4SD	4 door sedan
5HB	5 door hatchback

OUTLINE

OUTLINE OF CONSTRUCTION

A6E810201088T01

- The construction and operation of the body electrical system is essentially carried over from that of the 626 (GF) model, except the following features.

FEATURES

A6E810201088T02

Improved Serviceability

- A controller area network (CAN) system has been adopted for communication between the PCM, ABS (ABS/TCS) HU/CM or DSC HU/CM, and instrument cluster.
- Cruise actuator with built-in control module has been adopted.

Improved Marketability

- Headlight with built-in front fog light and front turn and parking light has been adopted.
- A projector type has been adopted to the headlight (low-beam) and front fog light.
- Stepped reflectors have been adopted to the rear combination lights and inboard combination lights.
- Information display has been adopted to instrument panel center.
- A vehicle-speed sensing type windshield wiper system has been adopted.
- Drive information system has been adopted to instrument cluster and information display
- Auto level control (ALC) function has been adopted to audio unit (base unit).
- Car-navigation system has been newly adopted.

Improved Security

- Theft-deterrent siren and intruder sensor have been adopted to theft-deterrent system.
- The current immobilizer unit function has been incorporated into the PCM as the passive anti-theft system (PATS).

Design Improvement

- A center panel module, which integrates the audio control, climate control and other units, has been adopted.

Improved Safety

- 2-step deployment control has been added to the front air bag system (driver- and passenger-side) deployment control.
- Curtain air bag module has been adopted.

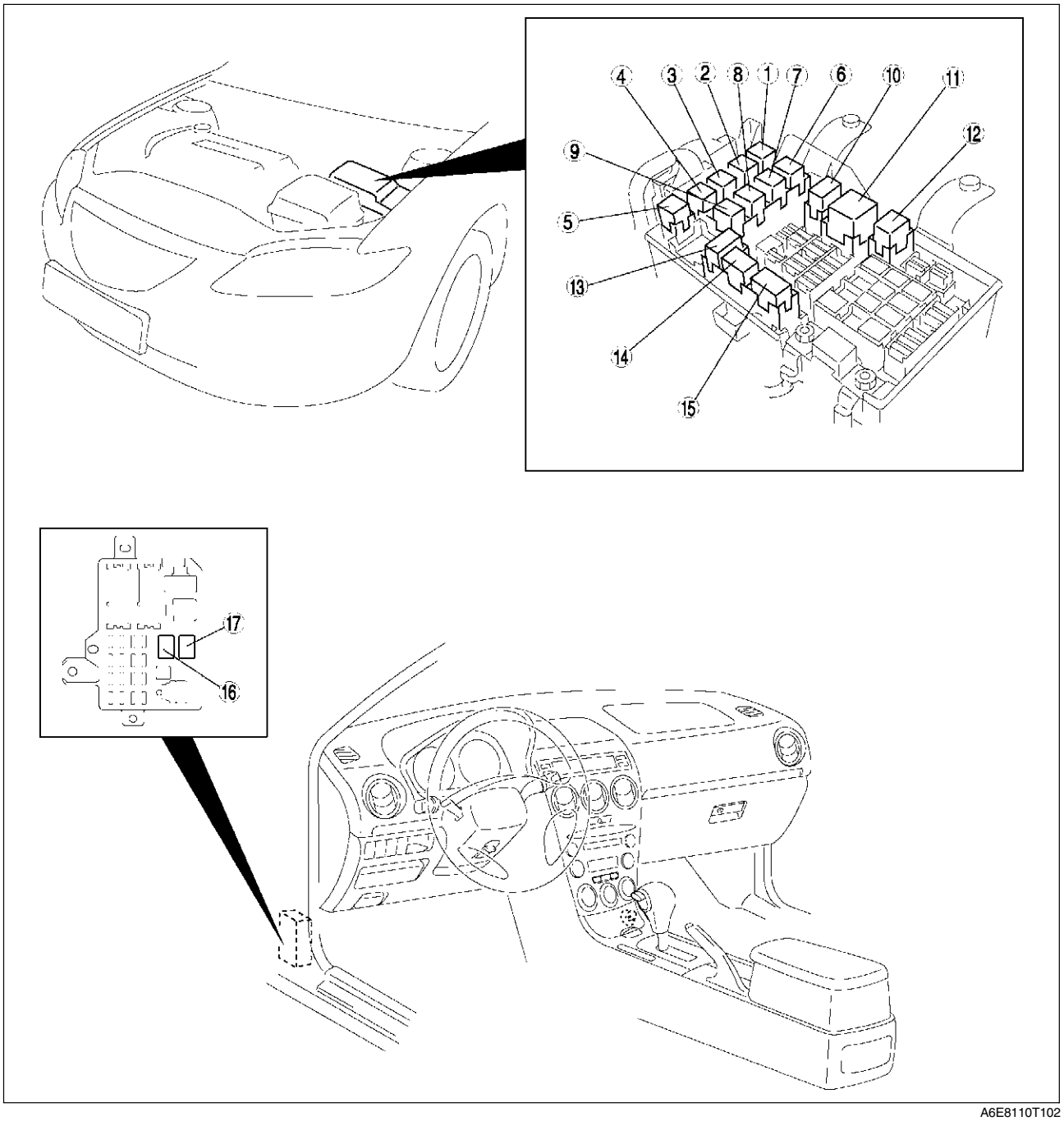
Improved Visibility

- Discharge headlight have been adopted for the headlights (low beam). (For vehicles equipped with discharge headlights.)
- A headlight auto leveling system has been adopted. (For vehicles equipped with discharge headlights.)

POWER SYSTEM

RELAY LOCATION

A6E811067730T01



A6E8110T102

1	Cooling fan relay No.2
2	Horn relay
3	Cooling fan relay No.3
4	Stater relay
5	Cooling fan relay No.4
6	Woofer relay
7	Rear window defroster relay
8	Rear fog light relay
9	A/C relay

10	Main relay
11	Headlight relay
12	TNS relay
13	Cooling fan relay No.1
14	Headlight cleaner relay
15	Front fog light relay
16	Fuel pump relay
17	Blower relay

MULITIPLE COMMUNICATION SYSTEM

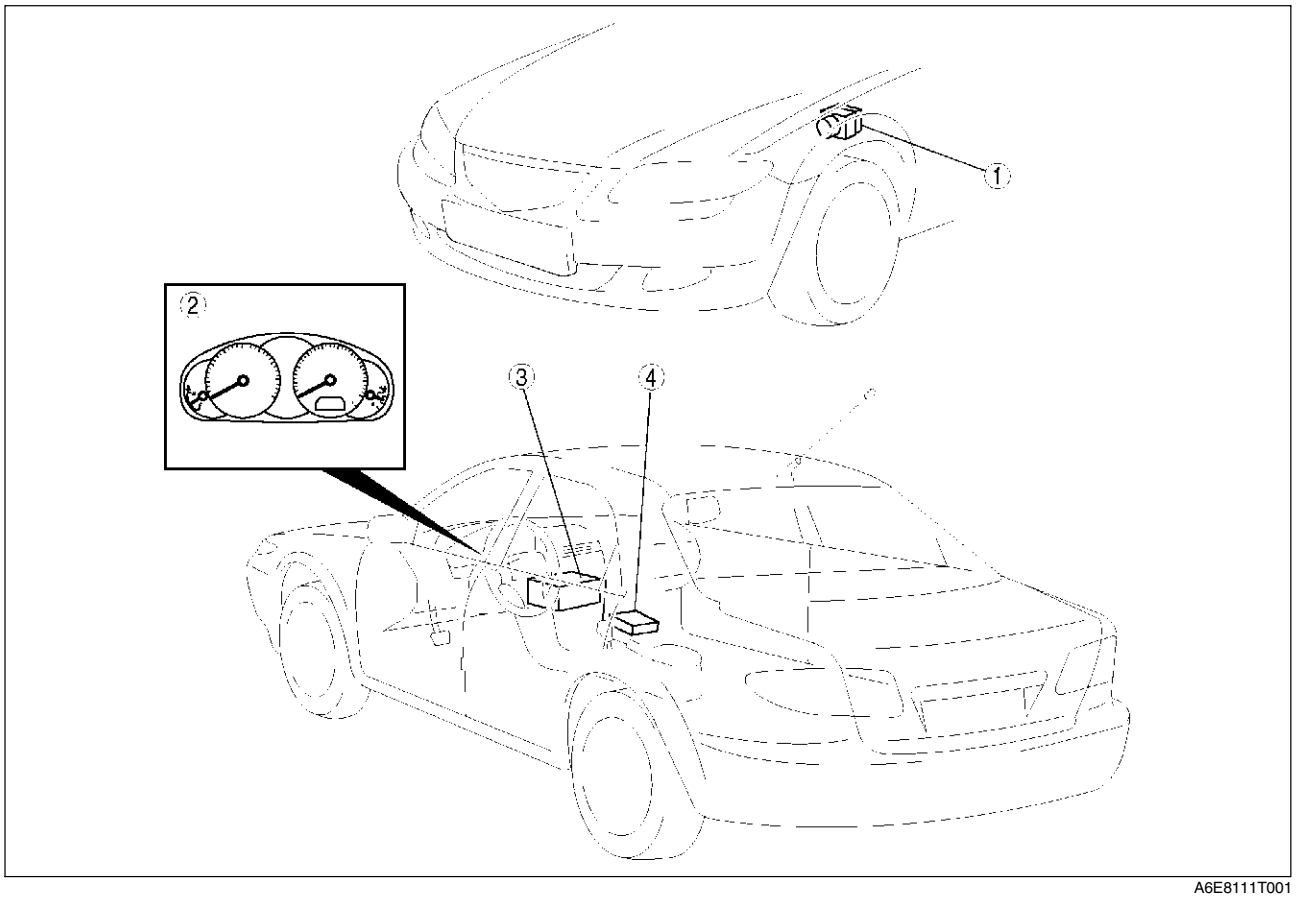
OUTLINE

A6E811155430T01

- Due to the simplification of the wiring harness, a controller area network (CAN) system for transmission of multiplex input/output signals among electrical modules has been adopted.
- Twisted-pair wiring is used for connections between the following modules (Each electrical module hereafter referred to as a CAN system-related module):
  — PCM to ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS) or DSC HU/CM (with DSC) to instrument cluster.
  — Instrument cluster to audio unit.
- With an on-board diagnostic function included for each multiplex module, display of DTCs using the SST (WDS or equivalent) has improved serviceability.

STRUCTRURAL VIEW

A6E811155430T02



A6E8111T001

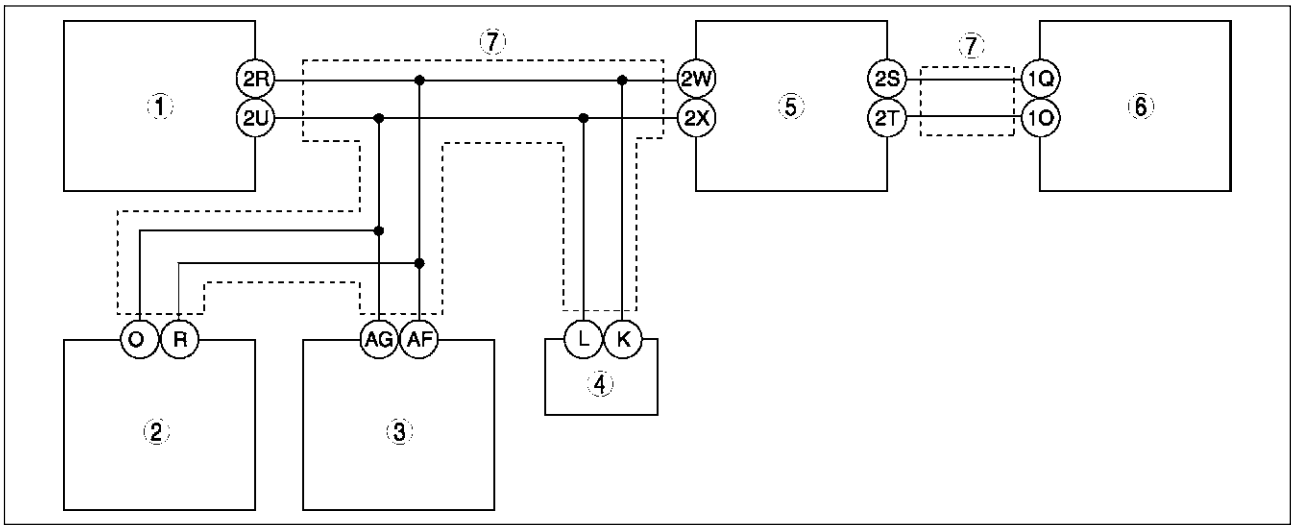
1	ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS))
	DSC HU/CM (with DSC)
2	Instrument cluster

3	Audio unit
4	PCM

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SYSTEM WIRING DIAGRAM

A6E811155430T03



A6E8111T002

1	PCM
2	ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS))
3	DSC HU/CM (with DSC)
4	Data link connector

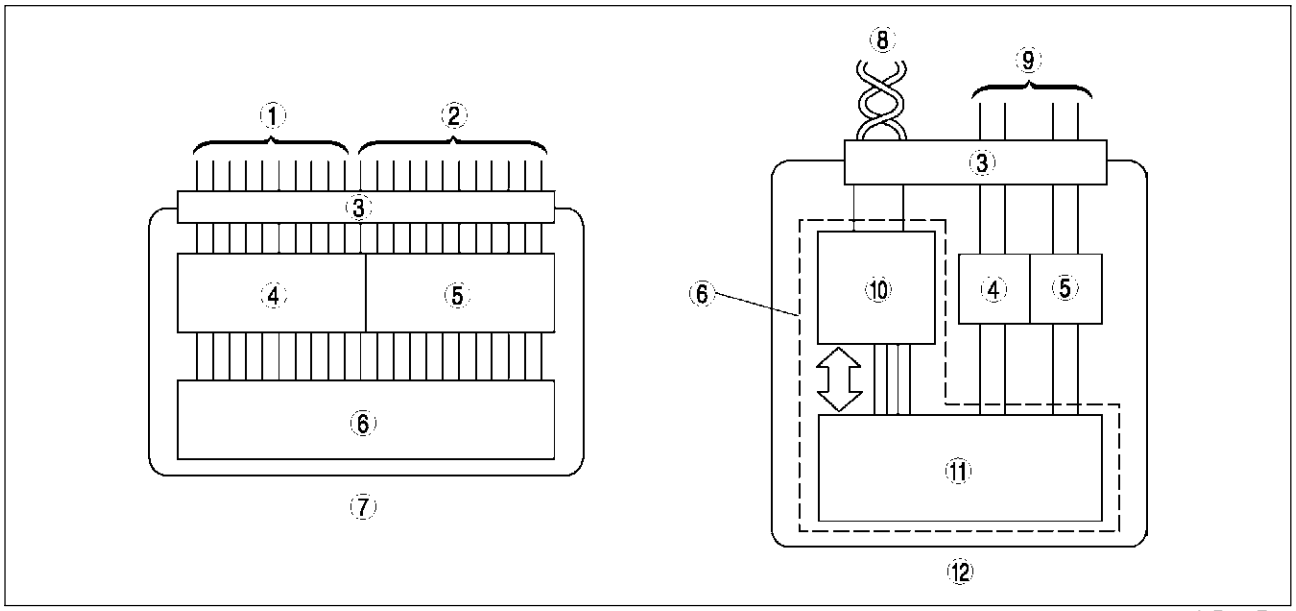
5	Instrument cluster
6	Audio unit
7	Twist pair

MECHANISM OF CAN SYSTE-RELATED MODULE

A6E811155430T04

- A CAN system-related module is composed of an electrical circuit, CPU, and input/output interface.
- The size of the module has been reduced due to the elimination of the bulky, superfluous, input/output interface in the conventional type of electrical module.
- The CPU (multiplex block) controls all signals exchanged on the CAN harness.
- Communication with non-multiplex parts is carried out by conventional input/output interface.
- The functions of each component are shown below.

Component		Function
Electrical circuit		Supplies power to CPU and vicinity, and to input/output interface.
CPU	Computation processing block	Control function has been expanded, and when transmission is necessary, transmitted data is stored in a multiplex block. If a multiplex block receives a request to read stored data, transmitted data is read from the multiplex block.
	Multiplex block	Transmits to computation processing block data received from bus line. In addition, sends to bus line transmitted data stored from computation processing block.
Input/Output interface		Electrically converts information signals from switches practically input to CPU, and signals output from CPU for operating actuator or indicator lights.



A6E8111T003

1	Input signal
2	Output signal
3	Connector
4	Input interface
5	Output interface
6	CPU

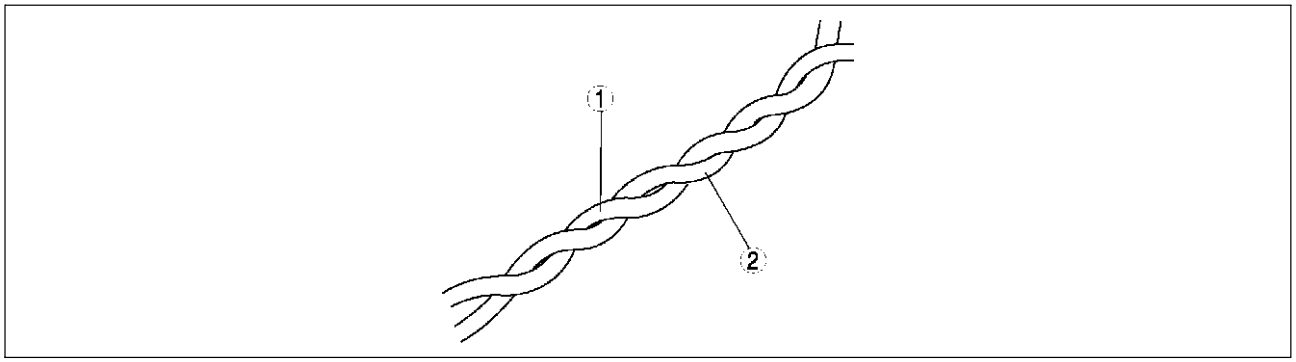
7	Conventional module
8	CAN harness
9	Conventional wiring harness
10	Multiplex block
11	Computation processing block
12	CAN system-related module

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TWIST PAIR

A6E811155430T05

- The multichannel use two spirally twisted wires called the twist pair, and each wire, bus line A and bus line B, has its own special function.
- Both bus lines are opposite phase voltage. This allows for hardly any noise being emitted and makes if difficult for noise interference to be received.



A6E8111T004

1	Bus line A

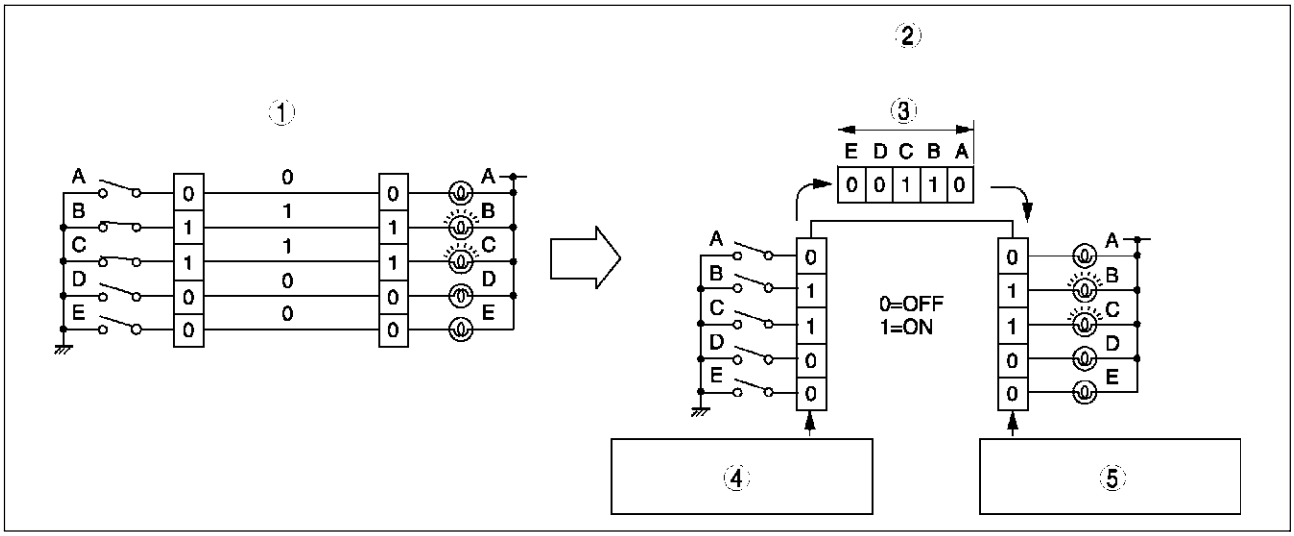
2	Bus line B

CAN SYSTEM OUTLINE

A6E811155430T06

Time Division Multiplex

- For information exchange between the electrical modules in the conventional system, a wire connection was necessary for each information signal. However, by sending the different signal at varying times over one channel, it is possible to send a large amount of information via a small harness.
- In the conventional, non-multiplex system, in order to control the illumination of the five bulbs, one switch and one channel was necessary for each bulb. For bulbs B and C to illuminate, switches B and C must be ON and electricity must flow through the channel. With the time multiplex system, this can be done through one channel. The channel is comprised of five data signal transmitters which transmit either “0” or “1” signal to indicate for a bulb to turn ON or OFF. For example, to illuminate bulbs B and C, transmitters B and C transmit a “1” and transmitters A, D, and E transmit a “0”. When the receiver receives these signal, bulbs B and C illuminate.



A6E8111T005

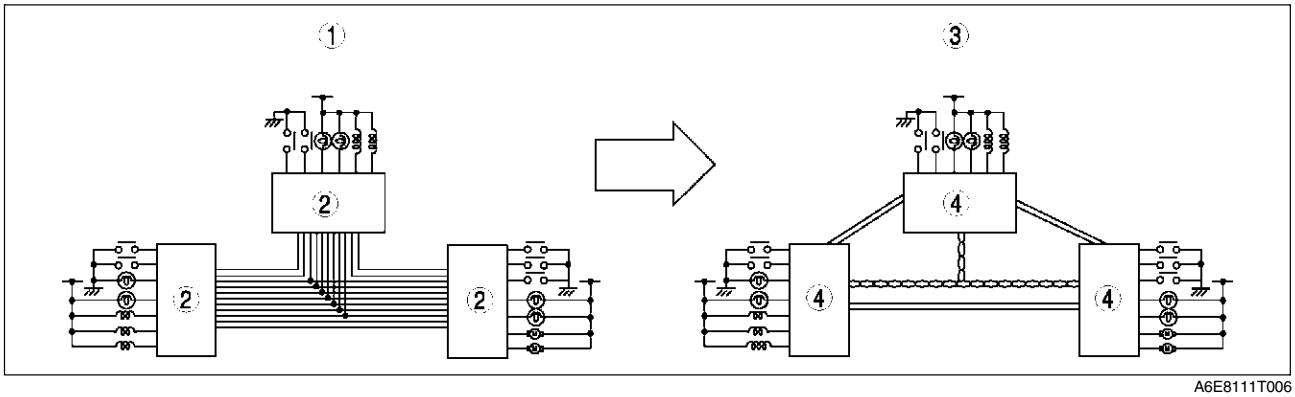
1	Non-multiplex system
2	Time division multiplex system
3	Data

4	Each signal is transmitted one by one through the channel as it is received.
5	Each signal is output one by one it is received from the channel.

VEHICLE CAN SYSTEM

A6E811155430T07

- By rearranging the multiple signal, common information between the CAN system-related modules is transmitted and received through the multichannel.
- The signal transmitted by one CAN system-related module is sent through the multichannel to all the CAN system-related modules, but only the concerned module(s) receives the signal and performs the appropriate operation (ex. light illumination, fan operation).



A6E8111T006

1	Conventional system
2	Electrical module

3	CAN system
4	CAN system-related module

CAN SIGNAL-CHART

A6E811155430T08

OUT: Output (sends signal)
IN: Input (receives signal)

Signal		Multiplex module			
		PCM	ABS (ABS/TCS) HU/CM or DSC HU/CM	Instrument cluster	Audio unit (information display)
Engine condition		OUT	IN		
Torque reduction inhibit		OUT	IN		
Engine speed		OUT	IN	IN	
Wheel speed (front left/front right/rear left/ rear right)	With ABS (ABS/ TCS) or DSC	IN	OUT		
		OUT		IN	
	Without ABS	OUT		IN	
TP		OUT	IN		
ECT		OUT		IN	
Travelled distance	—	IN	OUT		
	MTX, without ABS	OUT		IN	
Fuel injection amount		OUT	IN		
MIL condition		OUT		IN	
Generator warning light conditions		OUT		IN	
Engine displacement		OUT	IN		
Number of cylinders		OUT	IN		
Air induction type		OUT	IN		
Fuel type and delivery		OUT	IN		
Country		OUT	IN		
Transmission/axle type		OUT	IN		
Tire circumference (front/rear)		OUT	IN		
Desired gear/Change lever position		OUT	IN	IN	
HOLD switch conditions		OUT		IN	
Torque reduction request		IN	OUT		
Brake system configuration (EBD/ ABS/TCS/DSC)		IN	OUT	IN	
Brake system status	ABS	IN	OUT		
	EBD/ABS/TCS/ DSC		OUT	IN	
Brake system warning light conditions (brake fluid level sensor)			IN	OUT	
ABS configuration		IN	IN	OUT	
Drive information system switch operation				IN	OUT
Drive information system display				OUT	IN

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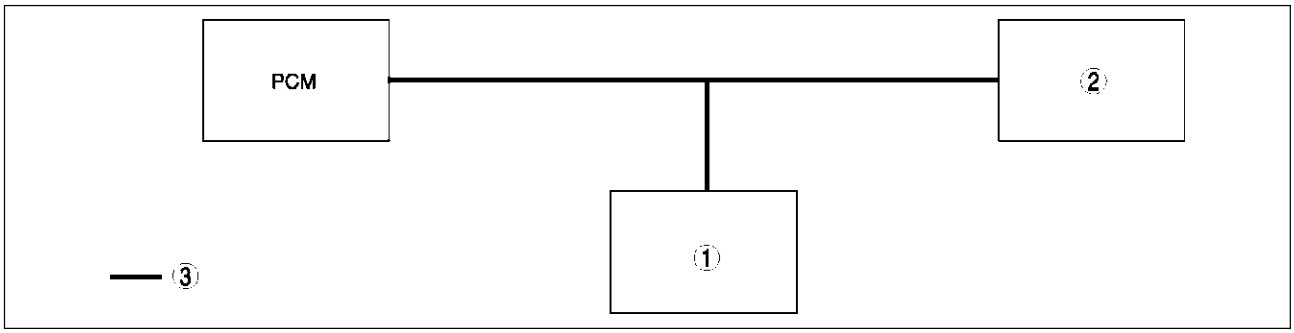
ON-BOARD DIAGNOSTIC FUNCTION

A6E811155430T09

Outline

- The on-board diagnostic function is incorporated into the PCM, ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS)), DSC HU/CM (with DSC), and instrument cluster. This function can narrow down CAN system malfunction locations.
- The on-board diagnostic function consists of the following functions: a failure detection function, which detects malfunctions in CAN system-related parts; a memory function, which stores detected DTCs; a self-malfunction diagnostic function, which indicates system malfunctions using DTCs and warning lights; and a PID/data monitoring function, which verifies the input/output condition of specific input/output signals being read out.
- Using an SST (WDS or equivalent), DTCs can be read out and deleted, and the PID/data monitoring function can be activated.
- The CAN system has a fail-safe function. When a malfunction occurs in CAN system, the transmission module sends a warning signal and the receiving module illuminates the warning light.

Block Diagram



A6E8111T007

1	ABS (ABS/TCS) HU/CM or DSC HU/CM
2	Instrument cluster

3	Twist pair

Failure detection function

- The failure detection function in each CAN system-related module detects malfunctions in input/output signals.
- This function outputs the DTC for the detected malfunction to the DLC-2, and also sends the detected result to the memory function and fail-safe function.

Fail-Safe Function

- When the failure detection function determines that there is a malfunction, the fail-safe function illuminates a warning light to advise the driver of the malfunction.

Module	Fail-safe functionì®Ì§ä
PCM	• MIL illuminated
• ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS)) • DSC HU/CM (with DSC)	• ABS (ABS/TCS) suspended (with ABS (ABS/TCS)) • DSC suspended (with DSC) • ABS warning light illuminated • DSC/TCS indicator light illuminated • DSC OFF light illuminated • TCS OFF light illuminated
Instrument cluster	• Speedometer, tachometer, water temperature gauge: 0 displayed • MIL illuminated • ABS warning light illuminated

Memory Function

- The memory function stores the DTC for the malfunction of input/output signals for related parts, as determined by the failure detection function.

Self-Malfunction Diagnostic Function

- The self-malfunction diagnostic function determines that there is a malfunction, and outputs a signal, as a DTC, to the DLC-2. The DTC can be read out using an SST (WDS or equivalent).

DTC table

DTC	Malfunction location	Related module
U0073	CAN system communication error	PCM
U0121	Communication error to ABS (ABS/TCS) HU/CM or DSC HU/CM	
U0155	Communication error to instrument cluster	
U1900	CAN system communication error	• ABS (ABS/TCS) HU/CM (vehicles with ABS (ABS/TCS)) • DSC HU/CM (vehicles with DSC) • Instrument cluster
U2516	CAN system wiring harness open and short circuit	

PID/Data Monitoring Function

- The PID/data monitoring function is used to freely select and read out, in real time, the monitored items for the input/output signals of the ABS (ABS/TCS) HU/CM, DSC HU/CM and instrument cluster.
- An SST (WDS or equivalent) is used to read out the PID/data monitor information.

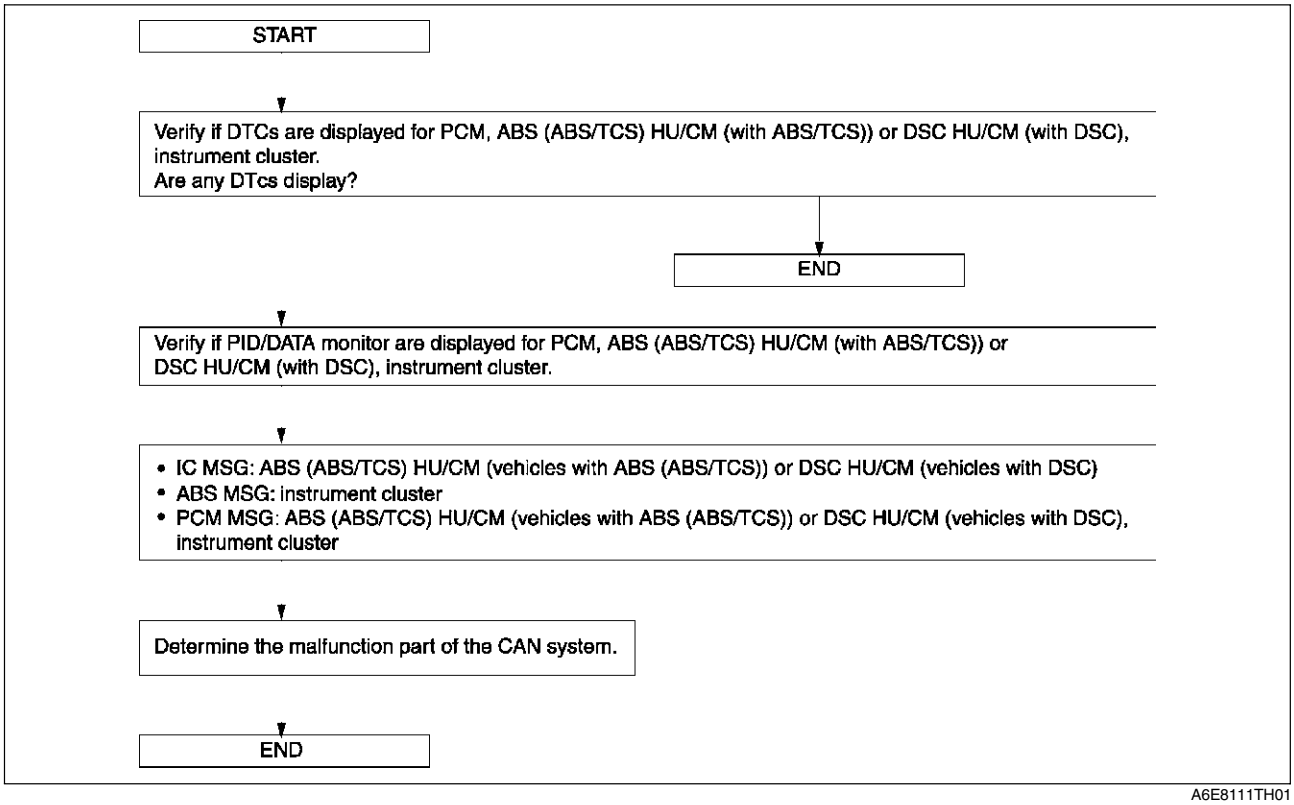
PID name (definition)	Condition	Specification	Related module	Terminal
IC_MSG (Missing message from the instrument cluster)	Present	Circuit in the Instrument cluster is normal	ABS (ABS/TCS) HU/CM or DSC HU/CM	• ABS (ABS/TCS) HU/CM: O, R • DSC HU/CM: AF, AG • Instrument cluster: 2W, 2X
	Not Present	Circuit in the Instrument cluster is abnormal		
ABS_MSG (Missing message from the ABS (ABS/TCS) HU/CM or DSC HU/CM)	Present	Circuit in the ABS (ABS/TCS) HU/CM or DSC HU/CM is normal	Instrument cluster	
	Not Present	Circuit in the ABS (ABS/TCS) HU/CM or DSC HU/CM is abnormal		
PCM_MSG (Missing message from the PCM)	Present	Circuit in the PCM is normal	• ABS (ABS/TCS) HU/CM or DSC HU/CM • Instrument cluster	
	Not Present	Circuit in the PCM is abnormal		

Narrowing Down Malfunction Locations

- The on-board diagnostic function, by verifying the detected DTC and PID/data monitor information from each module, can narrow down a CAN system malfunction location. Refer to the Self-Malfunction Diagnostic Function and PID/Data Monitoring Function for detailed information regarding DTCs and the PID/data monitor. (See T–11 Self-Malfunction Diagnostic Function.) (See T–11 PID/Data Monitoring Function.)

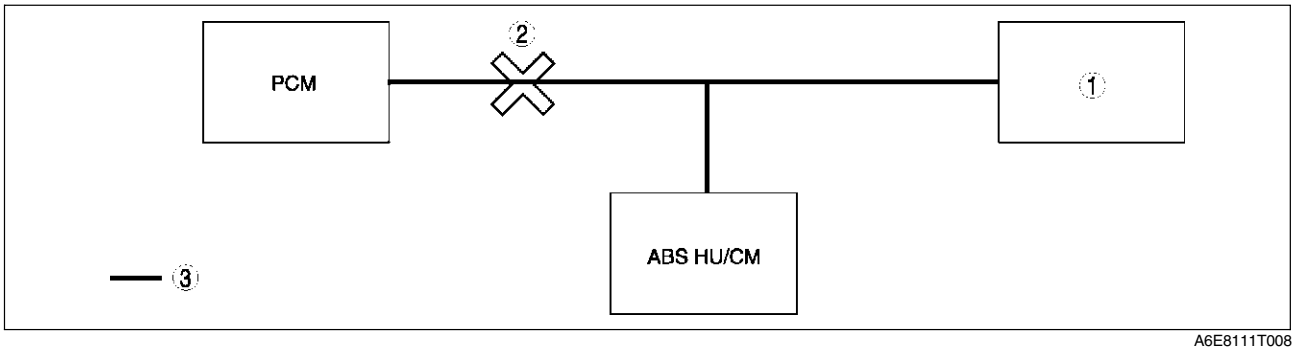
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Flowchart



A6E8111TH01

Example (Open circuit in PCM-related wiring harness)



A6E8111T008

1	Instrument cluster
2	Circuit open

3	Twist pair

Note

- This example is for vehicles not equipped with a TCS or DSC.

1. DTCs for the PCM, ABS HU/CM and instrument cluster can be verified using a SST (WDS or equivalent).

Module	Displayed DTC	Probable malfunction location
PCM	U0073	PCM-related CAN system malfunction
	U0121	Communication error between PCM and ABS HU/CM
	U0155	Communication error between PCM and instrument cluster
ABS HU/CM	U1900, U2516	ABS HU/CM-related CAN system malfunction
Instrument cluster	U1900, U2516	Instrument cluster-related CAN system malfunction

2. PID/data monitor information for the PCM, ABS HU/CM can be verified using an SST (WDS or equivalent).

Module	PID name (definition)	Condition	Probable malfunction point
ABS HU/CM	PCM MSG (Missing message from the PCM)	Not Present	Communication error between ABS HU/CM and PCM
	IC MSG (Missing message from the instrument cluster)	Present	Normal communication between ABS HU/CM and instrument cluster
Instrument cluster	PCM MSG (Missing message from the PCM)	Not Present	Communication error between instrument cluster and PCM
	ABS MSG (Missing message from the ABS (ABS/TCS) HU/CM or DSC HU/CM)	Present	Normal communication between instrument cluster and ABS HU/CM

3. If there is a communication error between the ABS HU/CM and PCM, or between the instrument cluster and PCM, even if the communication between the ABS HU/CM and the instrument cluster is normal, it is probable that there is a malfunction in the PCM or PCM-related wiring harnesses.

EXTERIOR LIGHTING SYSTEM

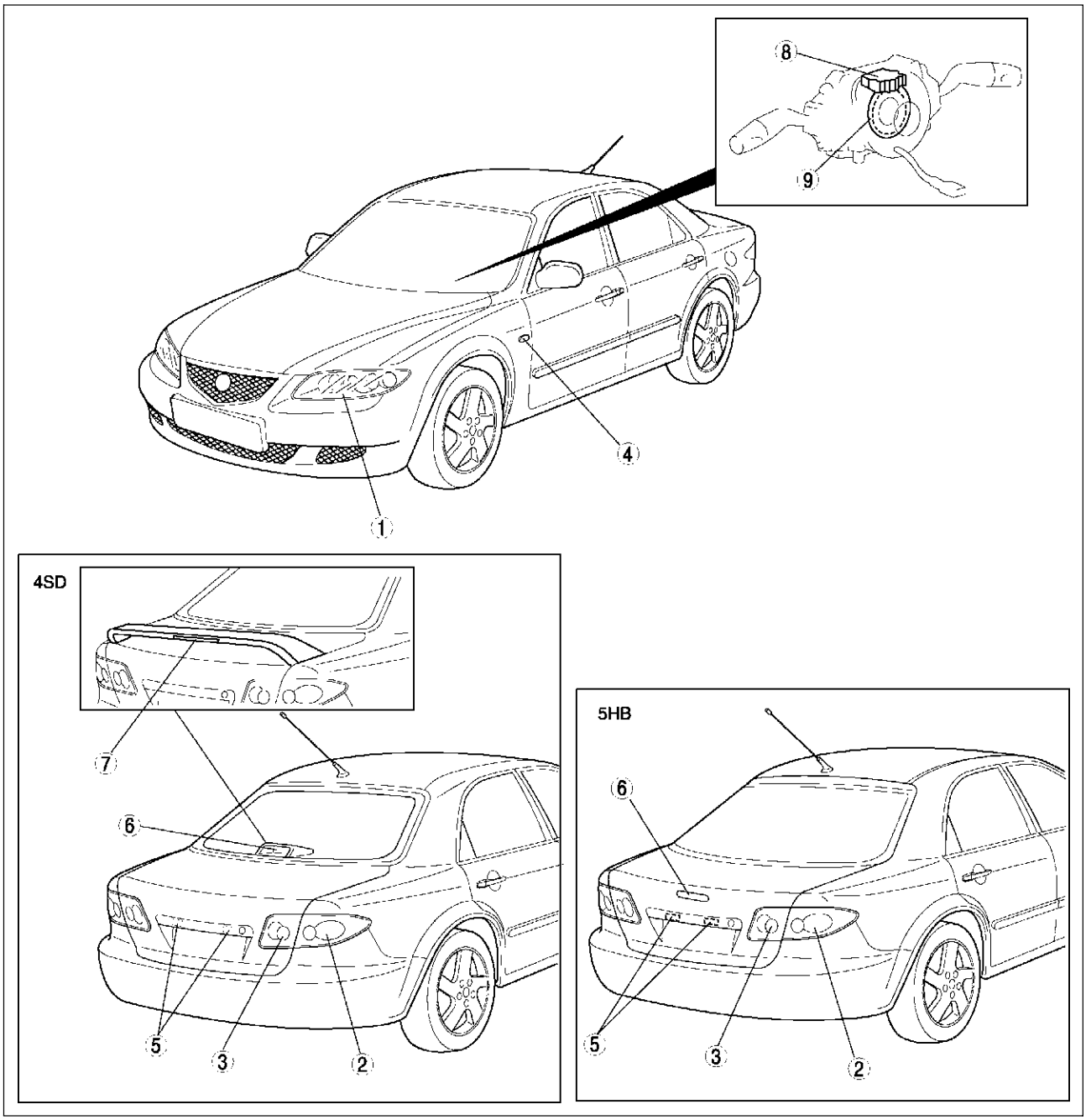
OUTLINE

A6E811201052T01

- Headlight with built-in front fog light,front turn and parking light has been adopted.
- A projector type has been adopted to the headlight (low-beam) and front fog light. The operation of projector-type headlight and front fog light is the same as that of the current XEDOS 9/MILLENIA (TA) models.
- Discharge headlight, that illuminate a wide area, have been adopted for the headlights (low beam). (For vehicles equipped with discharge headlights.)
- A headlight auto leveling system, which responds to the vehicle attitude and automatically adjusts the optical axis of the headlights, has been adopted. (For vehicles equipped with discharge headlights.)
- Stepped reflectors have been adopted to the rear combination lights and inboard combination lights.

STRUCTURAL VIEW

A6E811201052T02



A6E8112T102

1	Front combination light
2	Rear combination light
3	Inboard combination light
4	Front side turn light
5	License plate light

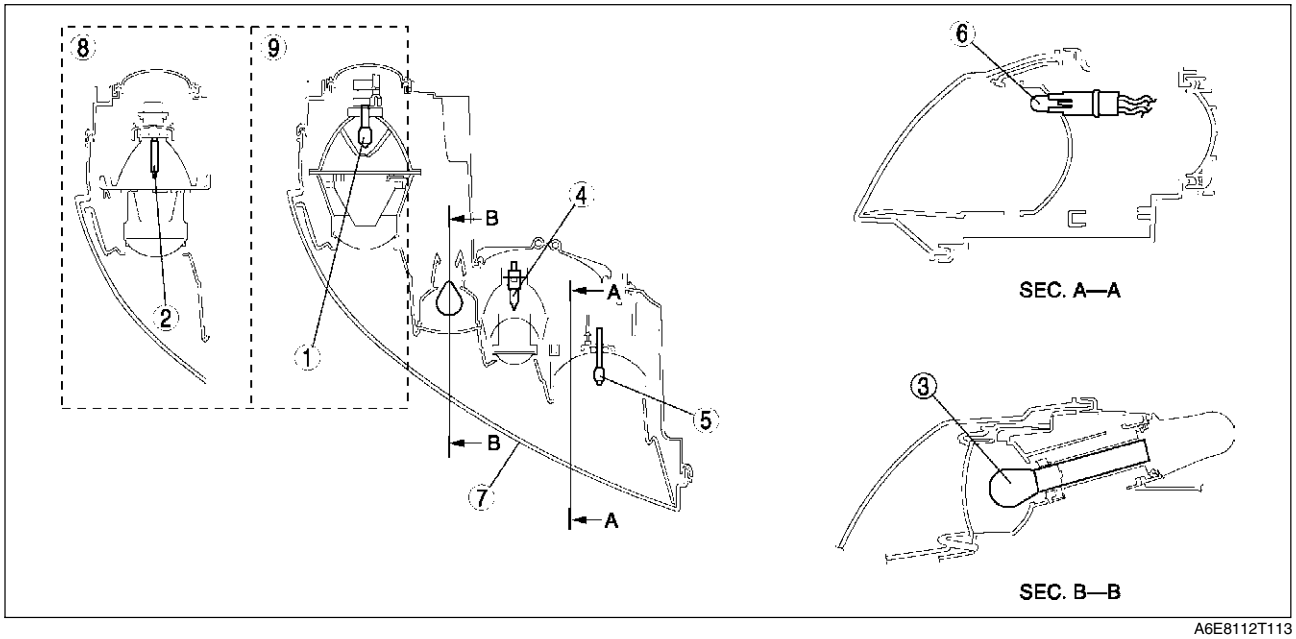
6	High-mount brake light
7	High-mount brake light (rear spoiler type)
8	Steering angle sensor (with DSC)
9	Disc (with DSC)

FRONT COMBINATION LIGHT

A6E811201052T03

Outline

- Projector type headlights (low-beam) and front fog lights have been adopted, and these have been incorporated, along with the front turn light and the parking light, into a single unit to improve size reduction.
- Discharge headlights, with a wide illumination area and projection of white light with a hue approaching that of the sunlight, have been adopted. (For vehicles equipped with discharge headlights.)



A6E8112T113

1	Headlight bulb (low-beam)
2	Discharge headlight bulb (low-beam)
3	Front turn light bulb
4	Front fog light bulb
5	Headlight bulb (high-beam)

6	Parking light bulb
7	Front combination light
8	Discharge type
9	Halogen type

T

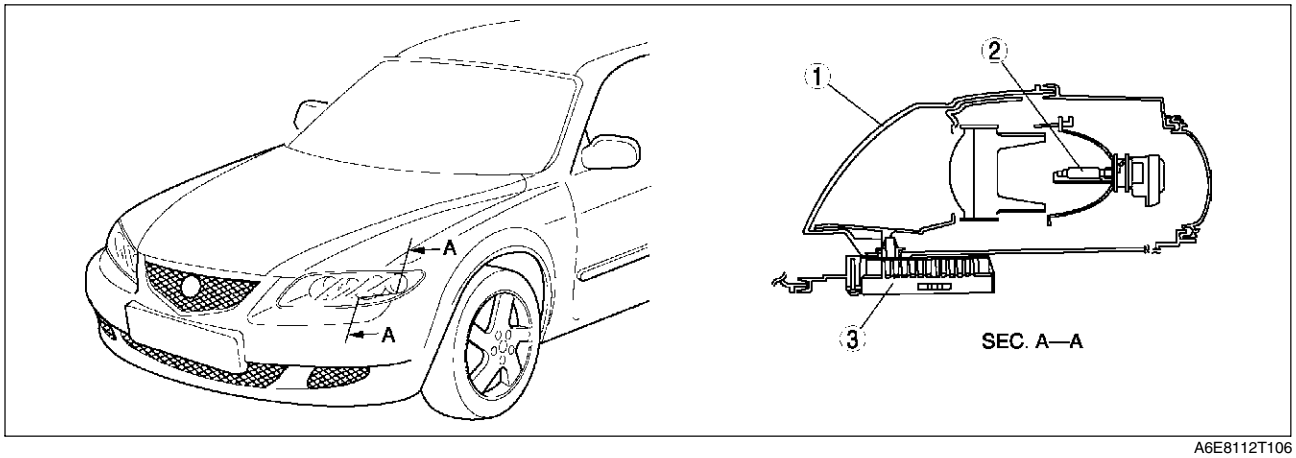
DISCHARGE HEADLIGHT

A6E811201052T04

Outline

- Compared with the current headlights, the illumination area is wider. Moreover, due to projection of white light with a hue approaching that of the sunlight, night visibility white driving has been improved.
- Use of the gas discharge bulb realizes high efficiency and low power consumption luminosity.

Structural View



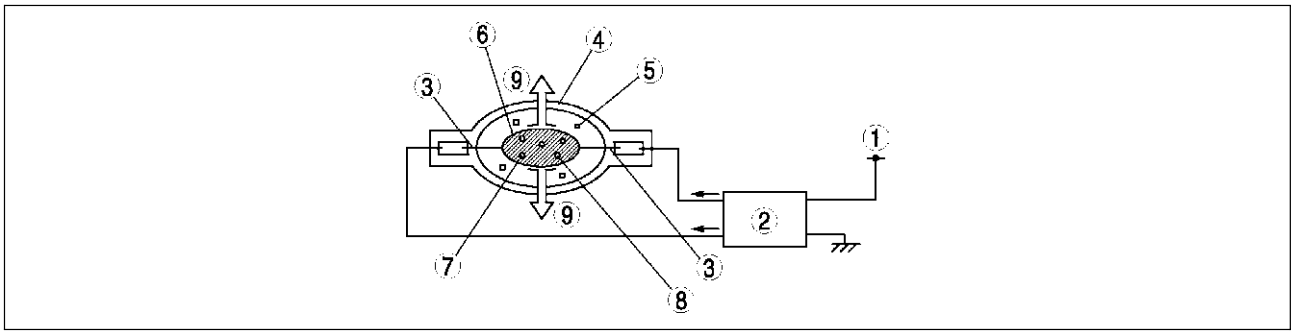
A6E8112T106

1	Front combination light
2	Discharge headlight bulb

3	Discharge headlight control unit

Structre And Operation

1. The high voltage pulse (alternating current approx. 25,000 V) traveling from the discharge headlight control unit is applied between both discharge headlight bulb terminals, energizing the xenon gas in the bulb.
2. Based on the energizing of the xenon gas, the temperature of the discharge headlight bulb interior increases, vaporizing the mercury and discharging the arc.
3. By the mercury and discharging the arc, the temperature of the discharge headlight bulb interior increases further, metallic iodide is vaporized and separated, and metallic atoms are discharged, producing light.



A6E8112T111

1	B+
2	Discharge headlight control unit
3	Terminal
4	Discharge headlight bulb
5	Xenon gas

6	Metallic atoms
7	Metallic iodide
8	Mercury
9	Light

DISCHARGE HEADLIGHT CONTROL UNIT

A6E811201052T05

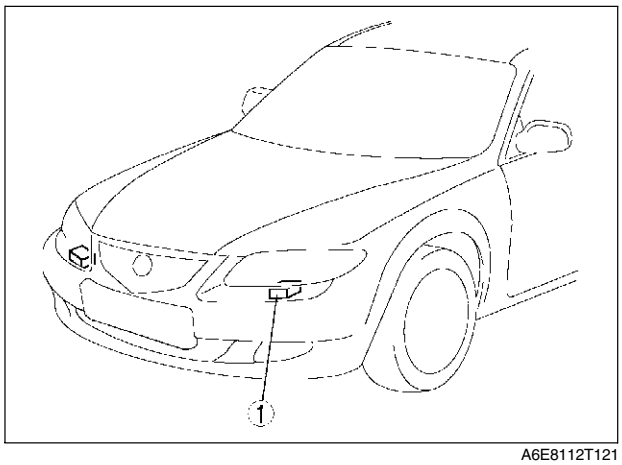
Function

- Controls the amount of electrical current while the discharge headlight are on to maintain optimum brightness together with lighting stability.
- The failure detection functions are as follows:
  — Abnormal input detection function
  — Abnormal output detection function

Structure And Operation

- Built into the headlight and installed on the headlight lower side.
- Switches the direct current from the battery to alternating current and optimally controls the current supply output to the bulb.

1	Discharge headlight control unit



A6E8112T121

Failure Detection Function

Abnormal input detection function

- If the discharge headlight control unit input voltage (9—16 V) fails to maintain operational voltage (except for the drop in voltage immediately after the headlights are turned on), the discharge headlight control unit turns off the headlights for protection or to prevent part operation errors.
- The discharge headlight control unit turns the headlights back on at resumption of normal operational voltage.

Abnormal output detection function

- If there is an abnormality in the output system (detects an open or GND short circuit in harness), the discharge headlight control unit turns off the headlights for protection or to prevent part operation errors.
- If the discharge headlight control unit turns off the headlights due to an abnormality in the output system, the discharge headlight control unit will maintain them in the off condition until the light switch is turned again from off to on.

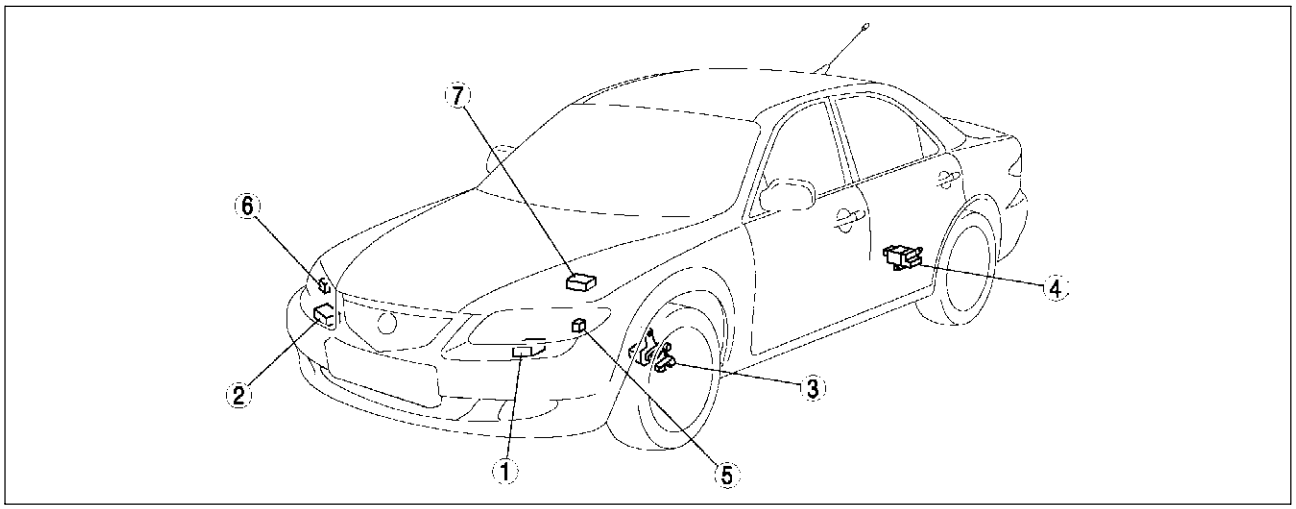
HEADLIGHT AUTO LEVELING SYSTEM

A6E811201052T06

Outline

- The optical axis of the headlights adjusts automatically at fixed angles to improve visibility and prevent the blinding of oncoming traffic when the vehicle changes speed or is under varying cargo and passenger weight conditions, among other variables.

Structural View

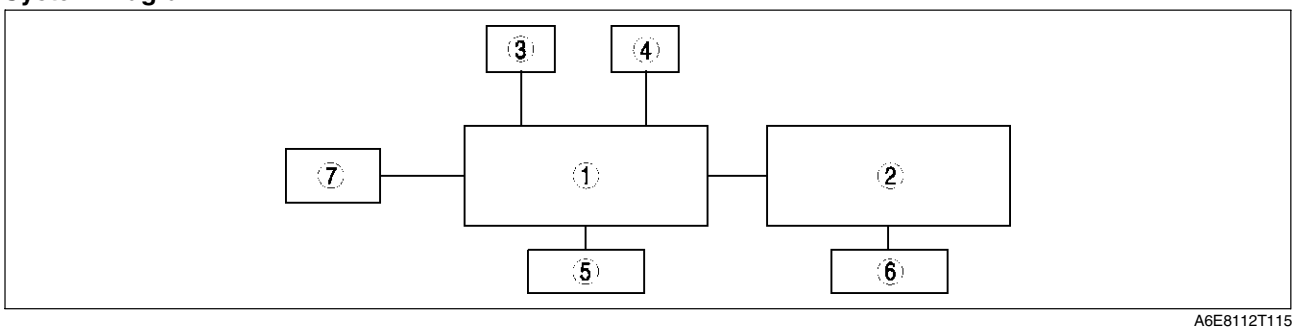


A6E8112T114

1	Auto leveling control unit (main)
2	Auto leveling control unit (sub)
3	Front auto leveling sensor
4	Rear auto leveling sensor

5	Headlight leveling actuator (LH)
6	Headlight leveling actuator (RH)
7	ABS/TCS HU/CM or DSC HU/CM

System Diagram



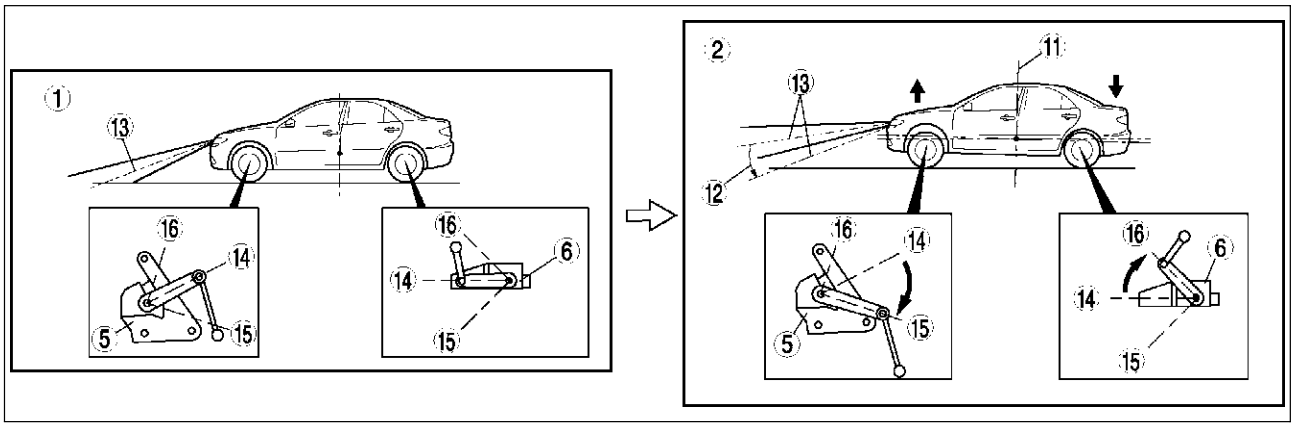
A6E8112T115

1	Auto leveling control unit (main)
2	Auto leveling control unit (sub)
3	Front auto leveling sensor
4	Rear auto leveling sensor

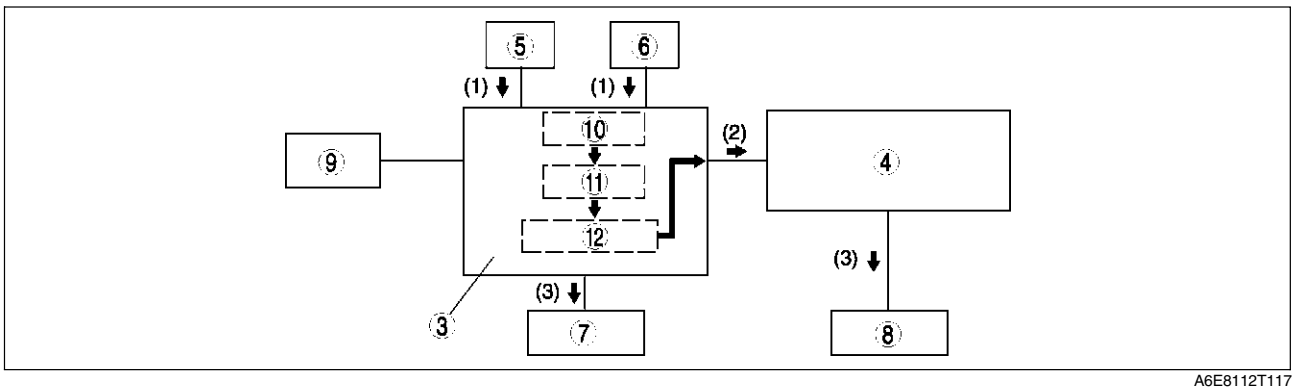
5	Headlight leveling actuator (LH)
6	Headlight leveling actuator (RH)
7	ABS/TCS HU/CM or DSC HU/CM

Varying Passenger And Cargo Conditions Operation

1. According to the fluctuation of the suspension, the auto leveling sensors installed in the front and rear of the vehicle send a signal to auto leveling control unit (main).
2. When a difference between two of the signal inputted from the auto leveling sensors is detected, the auto leveling control unit (main) verifies the vehicle attitude, then calculates the amount of optical axis adjustment and sends signal to the auto leveling control unit (sub).
3. The auto leveling control unit compares the actual and the required position of the reflector, then inputs a command signal to the headlight leveling actuator.



A6E8112T116



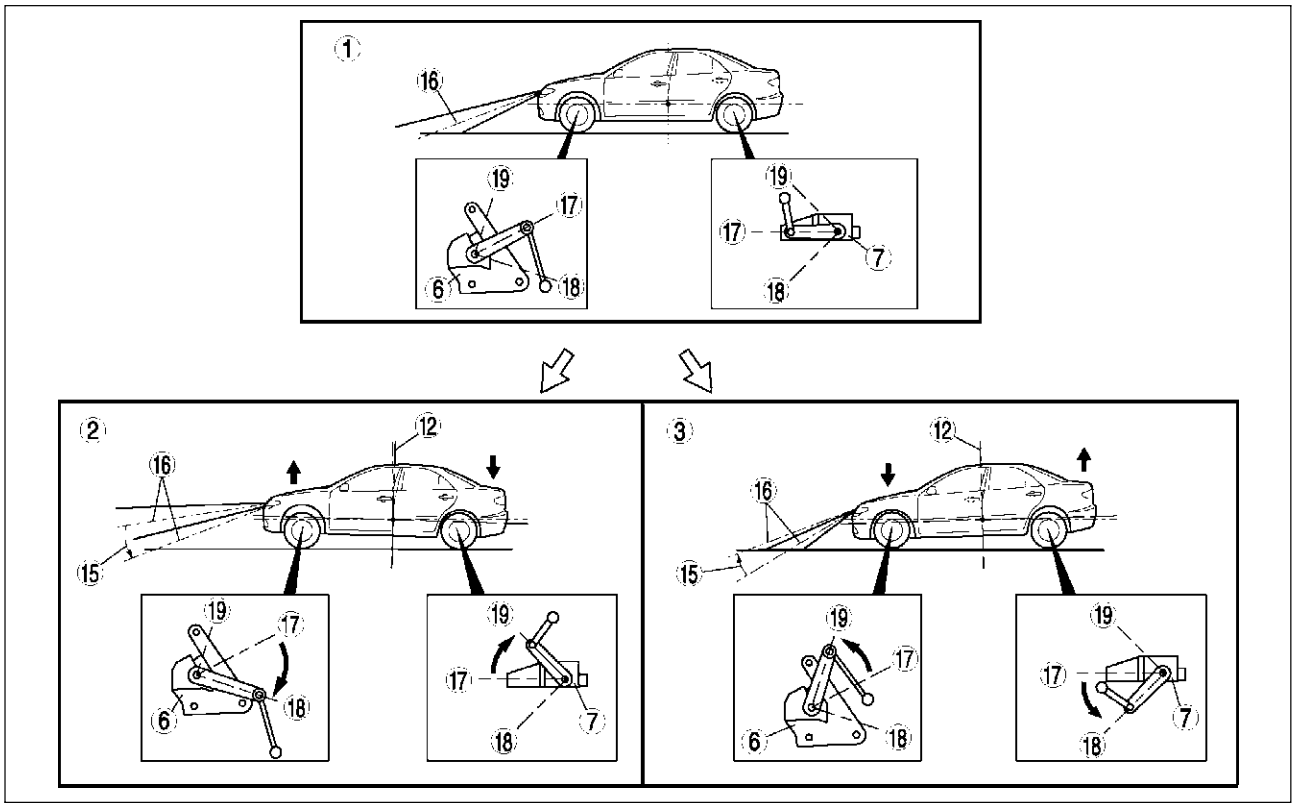
A6E8112T117

1	Zero setting
2	Large passenger or cargo weight
3	Auto leveling control unit (main)
4	Auto leveling control unit (sub)
5	Front auto leveling sensor
6	Rear auto leveling sensor
7	Headlight leveling actuator (LH)
8	Headlight leveling actuator (RH)

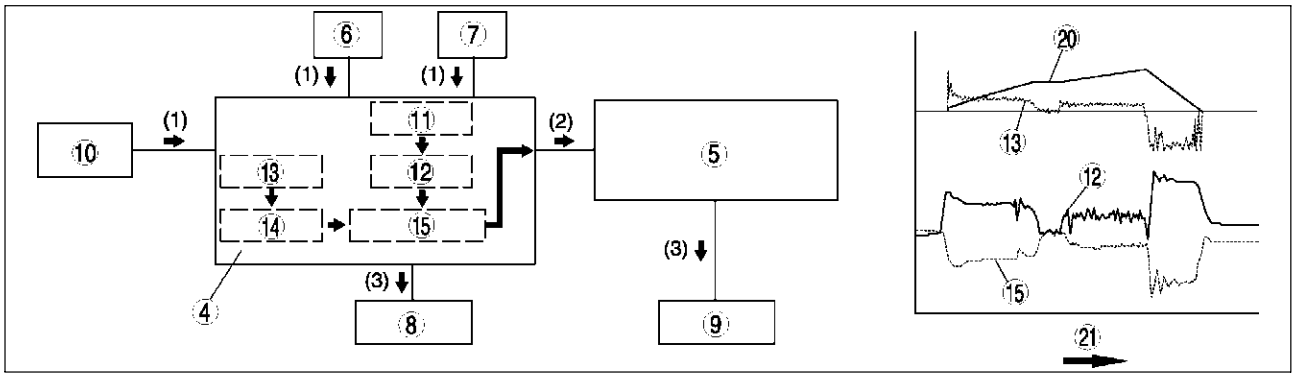
9	ABS/TCS HU/CM or DSC HU/CM
10	Difference between two voltage signals
11	Vehicle attitude
12	Optical axis adjustment amount
13	Optical axis
14	Zero reference
15	High
16	Low

Operation when driving

1. While driving with the headlights on, the auto leveling control unit (main) receives an inputted vehicle speed signal from the ABS/TCS HU/CM or DSC HU/CM unit (referred to as ABS (DSC) HU/CM in this section) and a signal based on suspension fluctuation from the front and rear auto leveling sensors.
2. Based on the inputted vehicle speed signal, the auto leveling control unit calculates acceleration angle and verifies the change in vehicle speed. Also, if there is a difference between two signal inputted from the front and rear auto leveling sensors, the auto leveling control unit (main) unit verifies the actual attitude of the vehicle. The auto leveling control unit (main) calculates the optical axis adjustment amount based on the condition of these two signal, and sends signal to the auto leveling control unit (sub).
3. The auto leveling control unit compares the actual and the required position of the reflector, then inputs command signal to the leveling actuator.



A6E8112T118



A6E8112T119

1	Zero setting
2	Acceleration
3	Deceleration
4	Auto leveling control unit (main)
5	Auto leveling control unit (sub)
6	Front auto leveling sensor
7	Rear auto leveling sensor
8	Headlight leveling actuator (LH)
9	Headlight leveling actuator (RH)
10	ABS/TCS HU/CM or DSC HU/CM
11	Difference between two voltage signals

12	Vehicle attitude
13	Acceleration degree calculation
14	Change in vehicle speed
15	Optical axis adjustment amount
16	Optical axis
17	Zero reference
18	High
19	Low
20	Vehicle speed
21	Time

Note

- When the ignition switch is turned to ON, it is normal to hear the headlight leveling acutuator operating for a few second, as it verifies system operating condition.
- When driving on a consistently rough or uneven road, the auto leveling function would cause a flickering effect for oncoming traffic. Therefore, to prevent the blinding of oncoming traffic, the auto leveling function is slowed down.

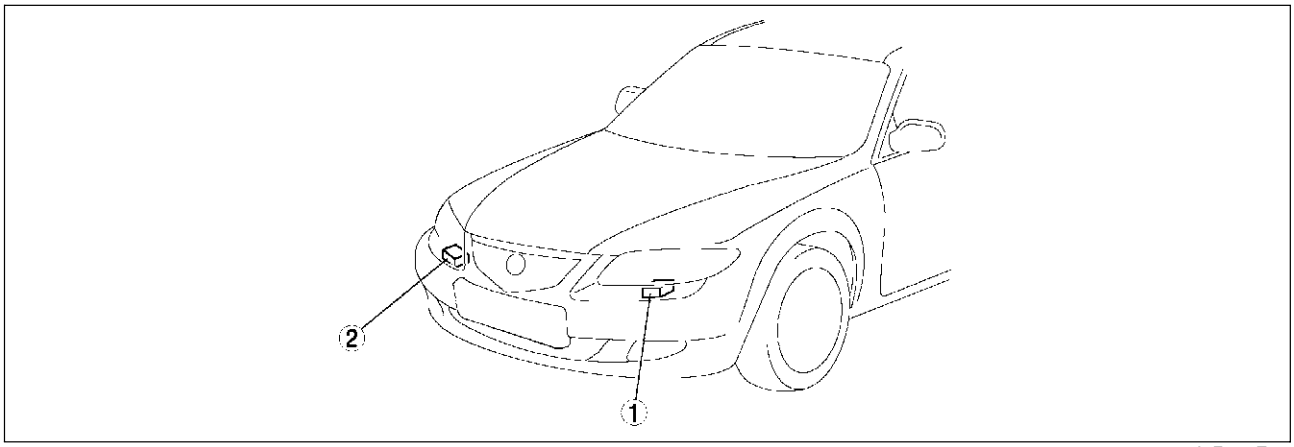
AUTO LEVELING CONTROL UNIT

A6E811201052T07

Function

- In order to prevent the blinding of oncoming traffic and improve visibility, the auto leveling control units automatically control the optical axis direction for optimal illumination based on signal inputted from the ABS (DSC) HU/CM and the auto leveling sensor.
- With an on-diagnostic function included for auto leveling control unit, servicing based on display of DTCs using the SST (WDS or equivalent) has been improved.

Structural View



A6E8112T120

1	Auto leveling control unit (main)

2	Auto leveling control unit (sub)

Strucutre And Operation

- The auto leveling control units (main and sub) are installed within the discharge control units, located under the front combination lights.
- The auto leveling control unit (main) verifies changes in vehicle speed and attitude based on signal inputted from the ABS (DSC) HU/CM, and front and rear auto leveling sensors. The unit then calculates the optimal direction for the optical axis and sends signal to the auto leveling control unit (sub).
- Based on the calculation of the optical axis adjustment amount, the auto leveling control unit controls the headlight leveling actuator.

Caution

- **After performing the following service items, configuration and zeroset must be performed using the WDS or equivalent.**

×:Applied
—:Not applied

	Service Item	Auto Leveling Control Unit Configuration	Headlight Zeroset *1	Headlight Aiming*1
1	Auto leveling control unit (main or sub) replaced with new part.	×	×	×
2	Front combination light removal/installation	—	—	×
3	Front auto leveling sensor or rear auto leveling sensor replaced with new part, or harness or connector replaced with new part.	—	×	×
4	Front auto leveling sensor connector or rear auto leveling sensor connector removal.	—	×	×
5	Front auto leveling sensor or rear auto leveling sensor removal/installation.	—	×	×

*1 : Execute headlight aiming for both headlights and together with headlight zeroset (which is performed by auto leveling control unit (main))

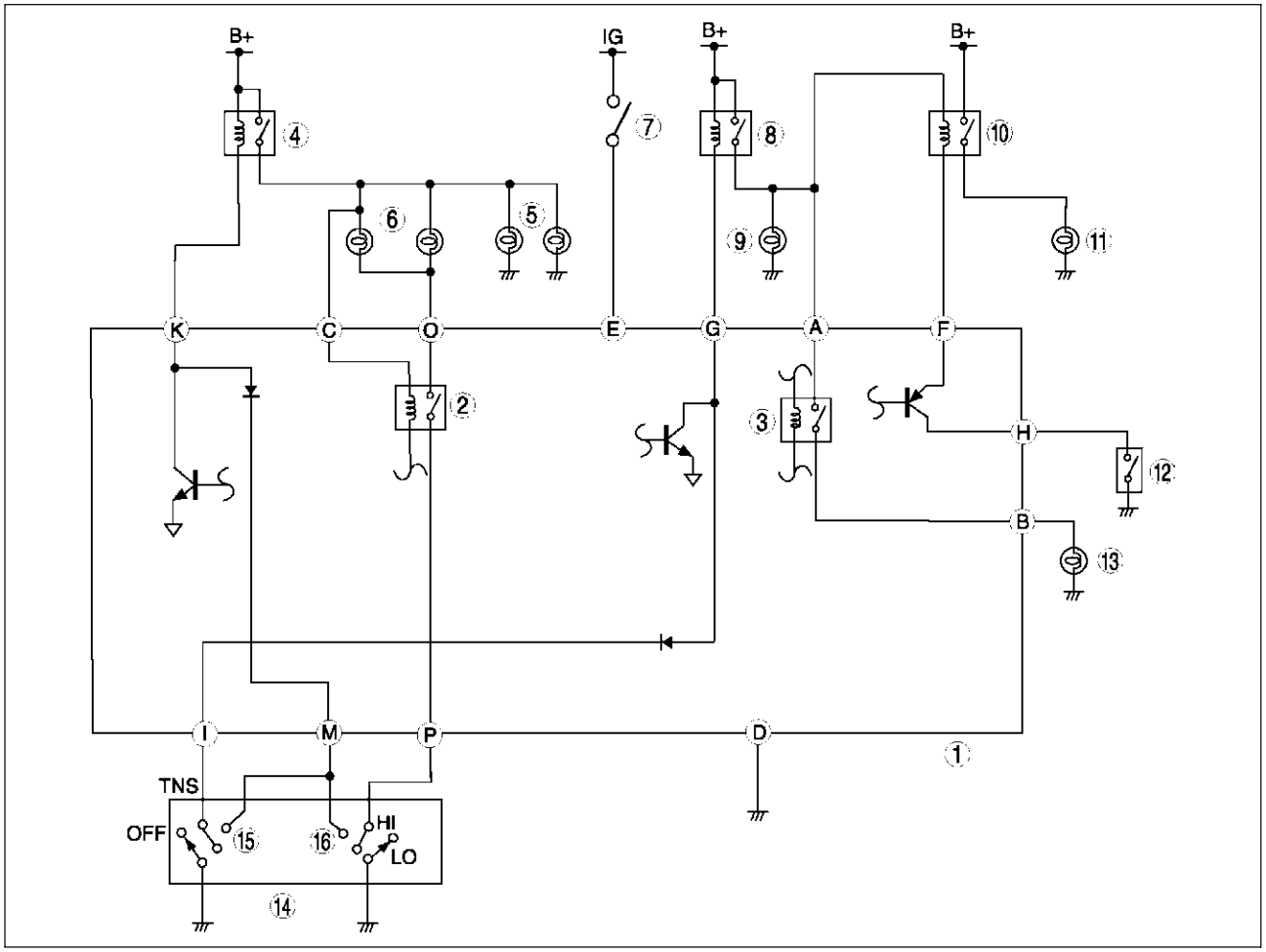
RUNNING LIGHT SYSTEM

A6E811201052T08

Outline

- The running light system operates the low-beam headlight and TNS automatically when the ignition switch turns on. It is controlled by the running light unit.

System Diagram



A6E8112T122

1	Running light unit
2	Relay A
3	Relay B
4	Headlight relay
5	Headlight (low-beam)
6	Headlight (high-beam)
7	Ignition switch
8	TNS relay

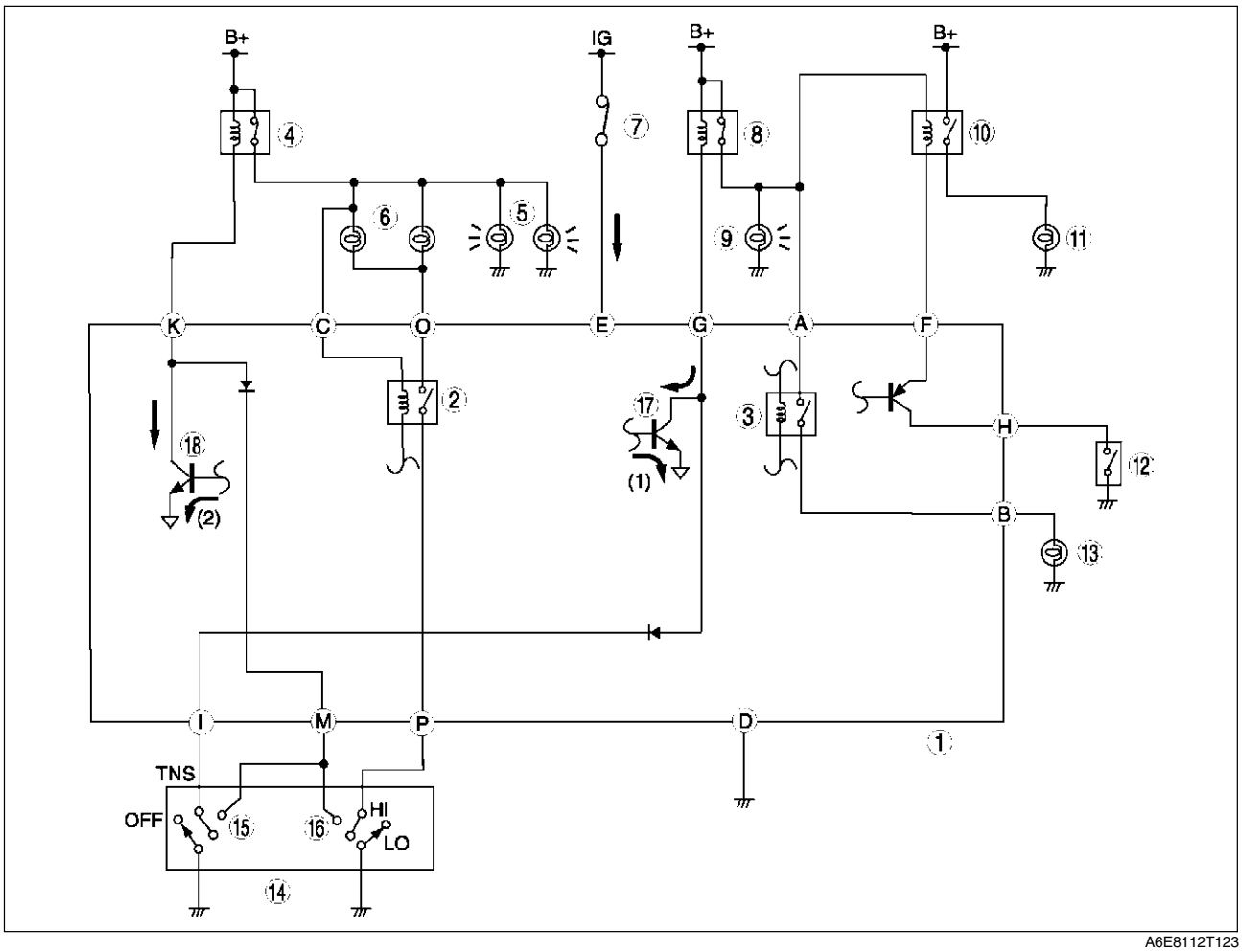
9	Parking light/taillight/license plate light
10	Front fog light relay
11	Front fog light
12	Front and rear fog light switch
13	Illumination light
14	Headlight switch
15	Headlight
16	Flash-to-pass

Outline Of System Operation

Operation condition (Input signal)	Operation condition of illumination (Output signal)				
	Low beam headlight	High beam headlight	TNS	Illumination light	Front fog light
Ignition switch at ON	ON	OFF	ON	OFF	Does not illuminate
Ignition switch at ON and headlight switch at TNS position	OFF	OFF	ON	ON	Can be illuminated
Ignition switch at ON and flash-to-pass on	ON	ON	ON	OFF	Does not illuminate

System Operation
When the ignition switch turns to on:

1. Two transistors are turned on with current (1) flowing in transistor 1, and current (2) in transistor 2.
2. When transistors 1 and 2 are on, the headlight relay and TNS relay turn on, and the headlights (low-beam), parking lights/taillights/license plate light illuminate.



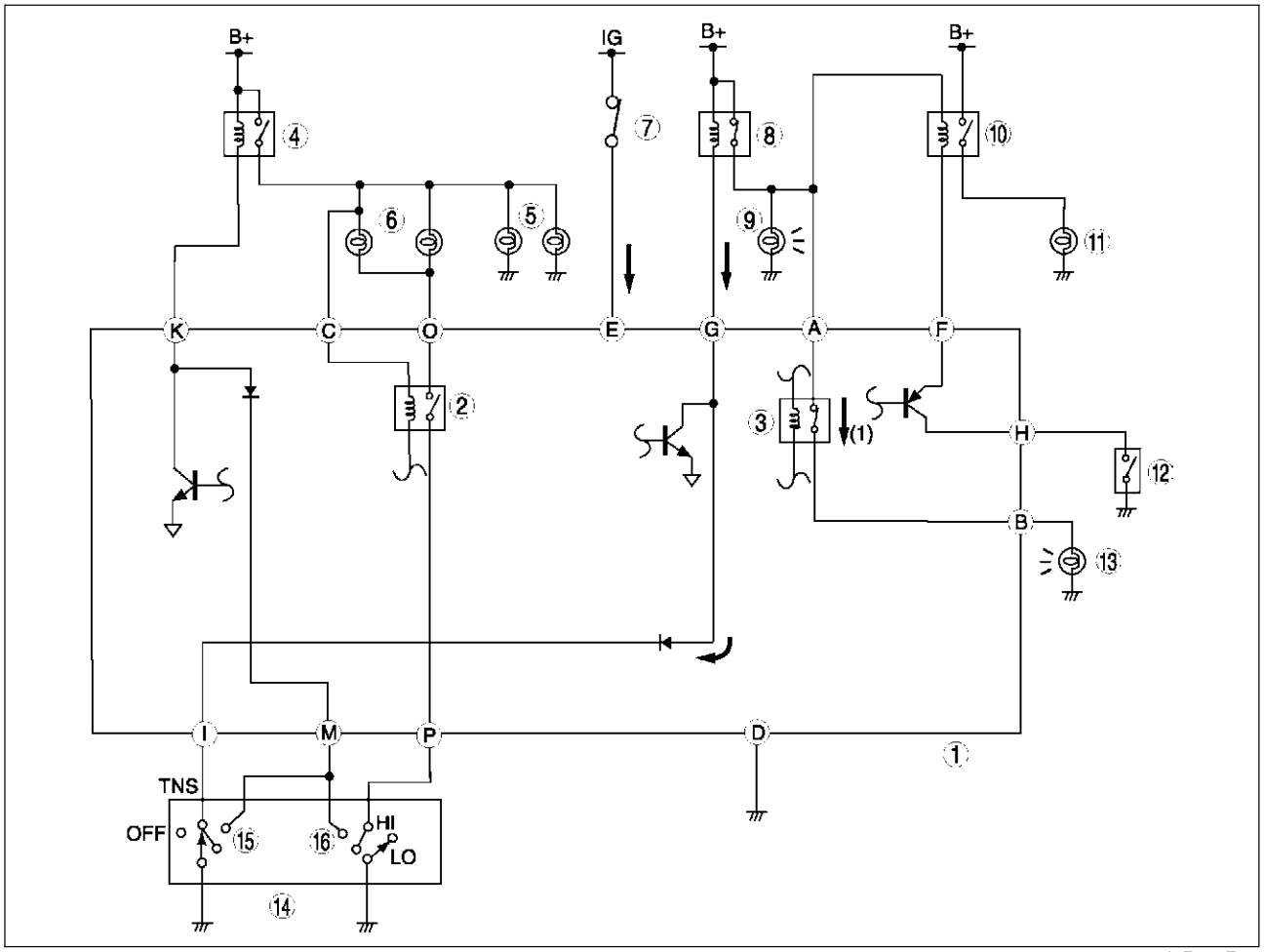
A6E8112T123

1	Running light unit
2	Relay A
3	Relay B
4	Headlight relay
5	Headlight (low-beam)
6	Headlight (high-beam)
7	Ignition switch
8	TNS relay
9	Parking light/taillight/license plate light

10	Front fog light relay
11	Front fog light
12	Front and rear fog light switch
13	Illumination light
14	Headlight switch
15	Headlight
16	Flash-to-pass
17	Transistor 1
18	Transistor 2

When the ignition switch is at ON and the headlight switch is at TNS position:

1. When the headlight switch is turned to the TNS position, battery voltage from the TNS relay flows from the headlight switch to the ground, and the TNS relay is turned on.
2. When the TNS is on, the parking lights/taillights/license plate light illuminate. Also, current (1) flows in relay B, and relay B is turned on.
3. When relay B is on, the illumination light illuminates.



A6E8112T124

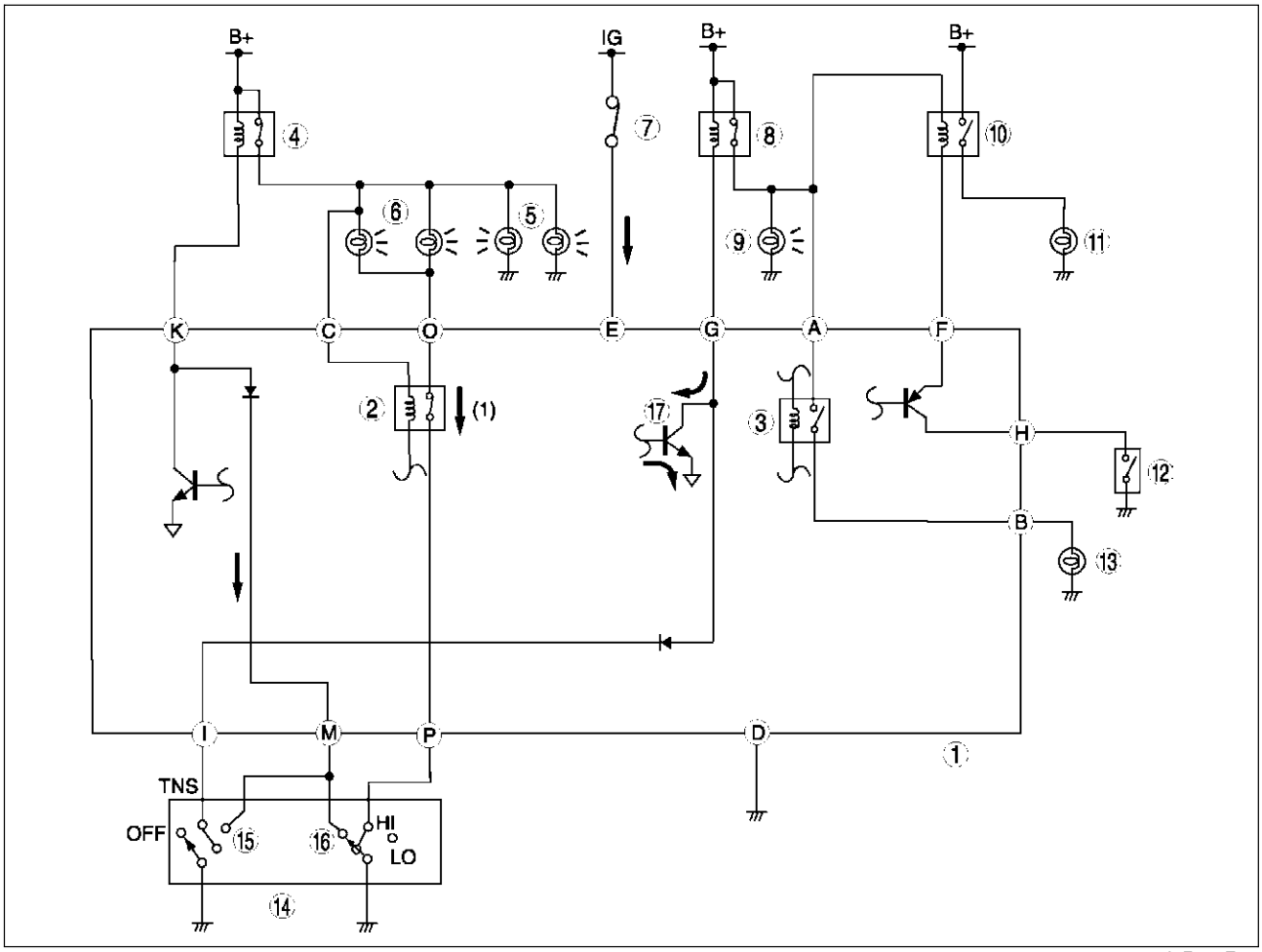
1	Running light unit
2	Relay A
3	Relay B
4	Headlight relay
5	Headlight (low-beam)
6	Headlight (high-beam)
7	Ignition switch
8	TNS relay
9	Parking light/taillight/license plate light

10	Front fog light relay
11	Front fog light
12	Front and rear fog light switch
13	Illumination light
14	Headlight switch
15	Headlight
16	Flash-to-pass
17	Transistor 1

T

When the ignition switch is at ON and when the flash-to-pass is on:

1. When the headlight switch is turned to the flash-to-pass position, battery voltage from the headlight relay flows from the headlight switch to the ground, and the headlight relay is turned on.
2. When the headlight relay and TNS relay are on, the headlights (low-beam), parking lights/taillights/license plate light illuminate. Due to the flow of current (1) in relay A are turned on.
3. When relay A turns on, and the headlights (high-beam) illuminate.



A6E8112T125

1	Running light unit
2	Relay A
3	Relay B
4	Headlight relay
5	Headlight (low-beam)
6	Headlight (high-beam)
7	Ignition switch
8	TNS relay
9	Parking light/taillight/license plate light

10	Front fog light relay
11	Front fog light
12	Front and rear fog light switch
13	Illumination light
14	Headlight switch
15	Headlight
16	Flash-to-pass
17	Transistor 1

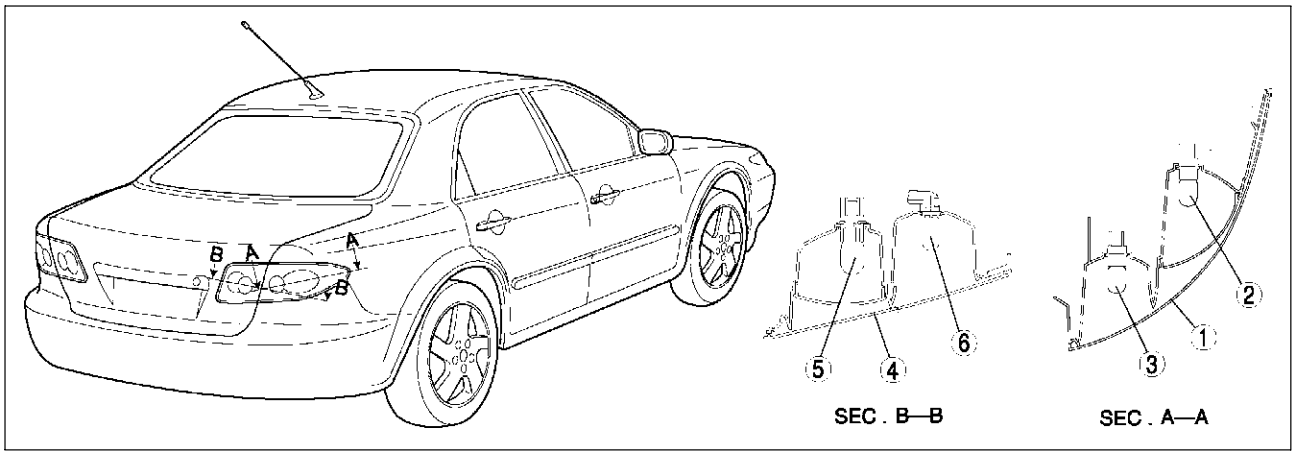
REAR COMBINATION LIGHT AND INBOARD COMBINATION LIGHT

A6E811201052T09

Outline

- A step reflector that diffuses and reflects the light of the rear combination and inboard combination light bulbs, has been adopted. A flat, uncut lens has been adopted to control illumination distribution.
- A round reflector for the rear combination and inboard combination lights has been adopted to improve design.

Structural View



A6E8112T103

1	Rear combination light
2	Brake light/taillight bulb
3	Rear turn light bulb
4	Inboard combination light

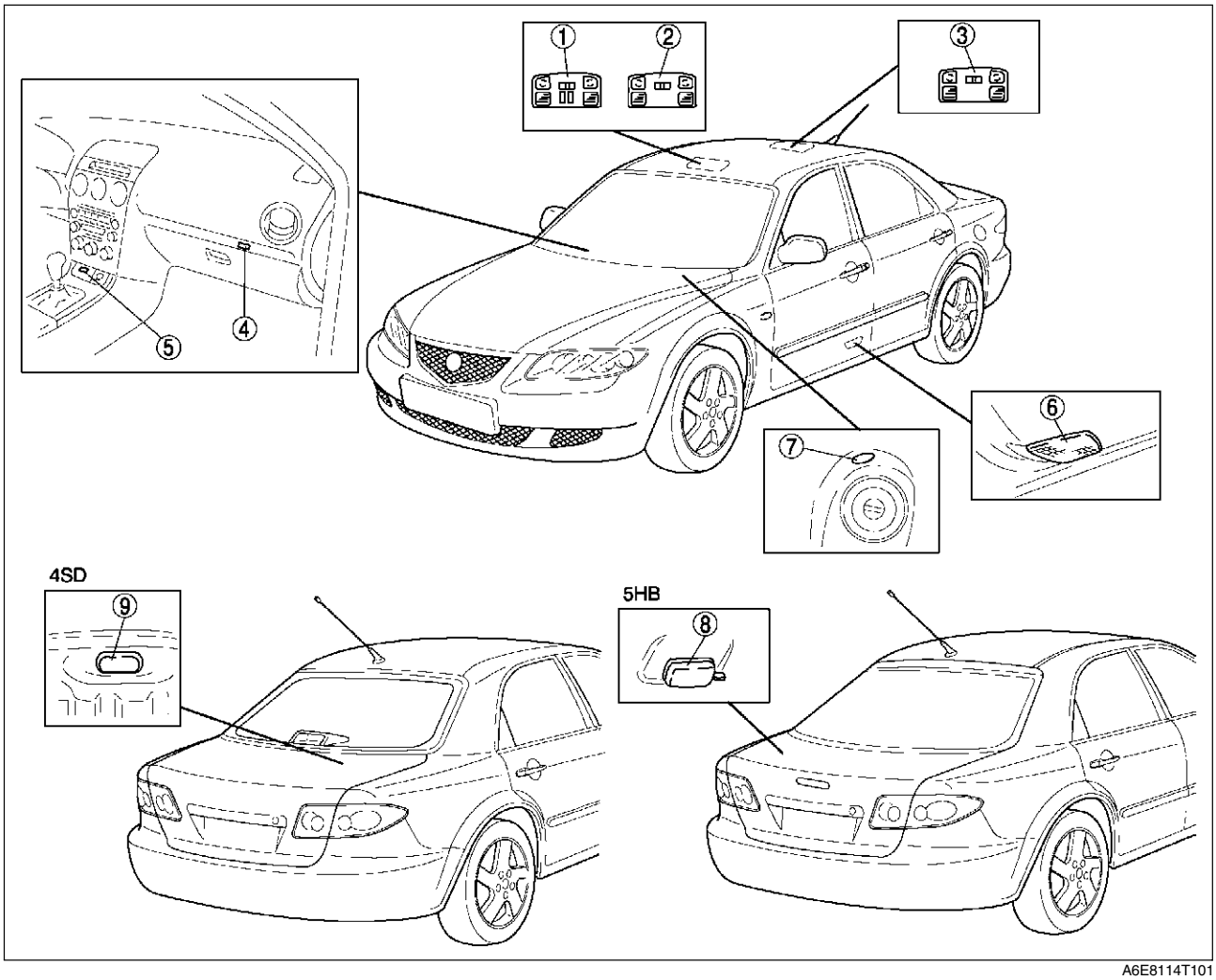
5	Back-up light bulb
6	Rear fog light bulb (R.H.D.: right side only, L.H.D.: left side only)

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INTERIOR LIGHTING SYSTEM

STRUCTURAL VIEW

A6E811401052T01



A6E8114T101

1	Front map light (with sliding sunroof)
2	Front map light (without sliding sunroof)
3	Rear map light
4	Glove compartment light
5	Ashtray illmination light

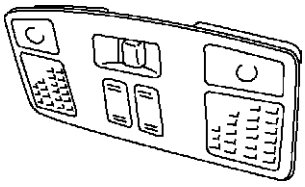
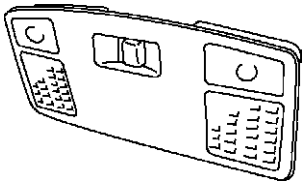
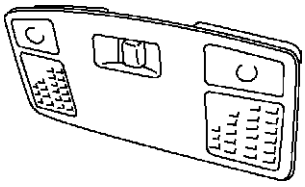
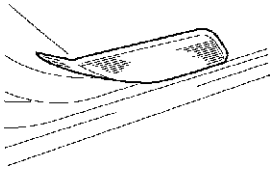
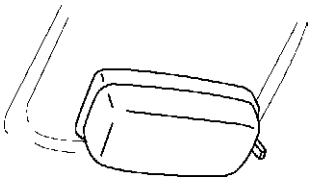
6	Courtesy light
7	Ignition key illumination
8	Cargo compartment light
9	Trunk compartment light

OUTLINE

A6E811401052T02

- The interior lights are shown below.
- The interior light control system turns on, turns off, or dims the interior light when the interior light switch is in the DOOR position.

×: Equipped
—: Not equipped

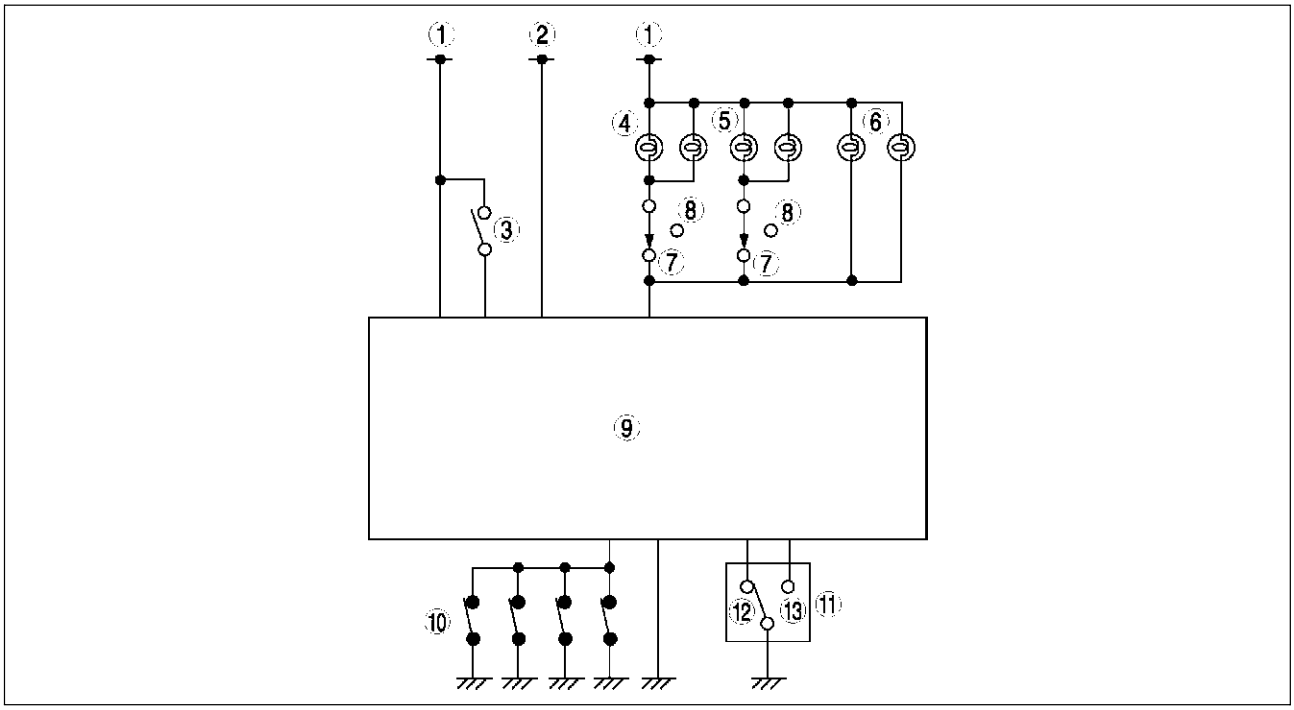
Type		Installation position	Interior light control	Roof
Front map light		Front	×	Sunroof
Front map light			×	Normal roof
Rear map light		Rear	×	Both
Courtesy light		Door	×	
Cargo compartment light		Cargo room	—	
Trunk compartment light		Trunk room	—	

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INTERIOR LIGHT CONTROL SYSTEM

A6E811401052T03

System Diagram



A6E8114T102

1	B+
2	IG1
3	Key reminder switch
4	Front map light
5	Rear map light
6	Courtesy light
7	DOOR

8	OFF
9	Door lock timer unit
10	Door switch
11	Door lock-link switch
12	Lock
13	Unlock

System Operation

- The interior light switch must be at DOOR position.

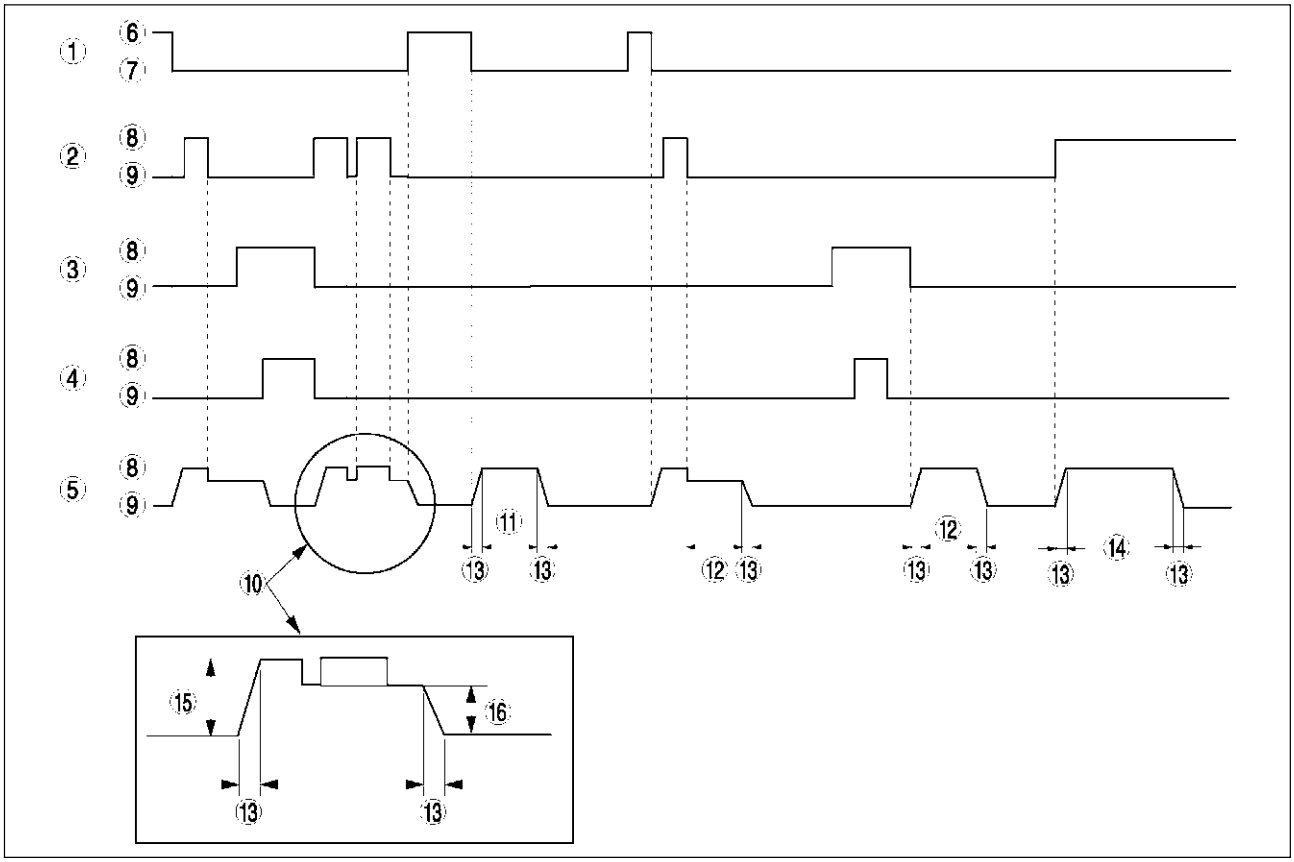
Condition before operation (When all conditions are satisfied)	Operation condition	Interior light		Cancel condition (When any condition is safisfied)
		Illumination time	Brightness	
• Ignition switch at LOCK or ACC position. (IG off.) • All doors are closed. (All door switches are off.)	Any door is open. (Any door switch is on.)	Approx. 5 minutes	100%	• All doors are closed. (All door switches are off.) • After illumination time.*1
• Key extracted from steering lock. (Key reminder switch is off.) • All doors are closed. (All door switches are off.) • Driver's door lock knob is locked. (Door lock-link switch is in lock position.)	Driver's door lock knob is unlocked. (Door lock-link switch is in unlock position.)	Approx. 30 seconds	100%	• Ignition switch at ON position. (IG on.) • Any door is open. (Any door switch is on.) • Driver's door lock knob is locked. (Door lock-link switch is in lock position.) • After illumination time.*1
• Key inserted into steering lock. (Key reminder switch is on.) • All doors are closed. (All door swiches are off.)	Key extracted from steering lock. (Key reminder switch is off.)	Approx. 15 seconds	100%	• Ignition switch at ON position. (IG on.) • Any door is open. (Any door switch is on.) • Driver's door lock knob is locked. (Door lock-link switch is in lock position.) • After illumination time.*1
• Ignition switch at LOCK or ACC position. (IG off.) • Any door is open. (Any door switch is on.) • Driver's door lock knob is unlocked. (Door lock-link switch is in unlock position.)	All doors are closed. (All door switches are off.)	Approx. 15 seconds	60%	• Ignition switch at ON position. (IG on.) • Any door is open. (Any door switch is on.) • Driver's door lock knob is locked. (Door lock-link switch is in lock position.) • After illumination time.*1

*1 : After interior light is turned off according to this cancel condition, the light will illuminate again when either of the following conditions are satisfied.

- After all doors are closed, then any door is reopened. (After all door switches are off, any door switch is on.)
- Ignition switch is at ON position. (IG on.)

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Timing Chart



A6E8114T103

1	Door lock-link switch
2	Door switch
3	Key reminder switch
4	IG1
5	Front map light, Rear map light, courtesy light
6	Lock
7	Unlock
8	On

9	Off
10	View A
11	Approx. 30 seconds
12	Approx. 15 seconds
13	Approx. 1 seconds
14	Approx. 5 minutes
15	100%
16	60%

WIPER AND WASHER

OUTLINE

A6E811601052T01

Windshield

- The windshield wiper system has an autostop function, one-touch function, and intermittent function with various timer.
- The operation is the same as that of the 626 (GF) model.
- A vehicle-speed sensing type windshield wiper system, which automatically adjusts the intermittent wiping time according to vehicle speed, has been adopted.

Rear (5HB)

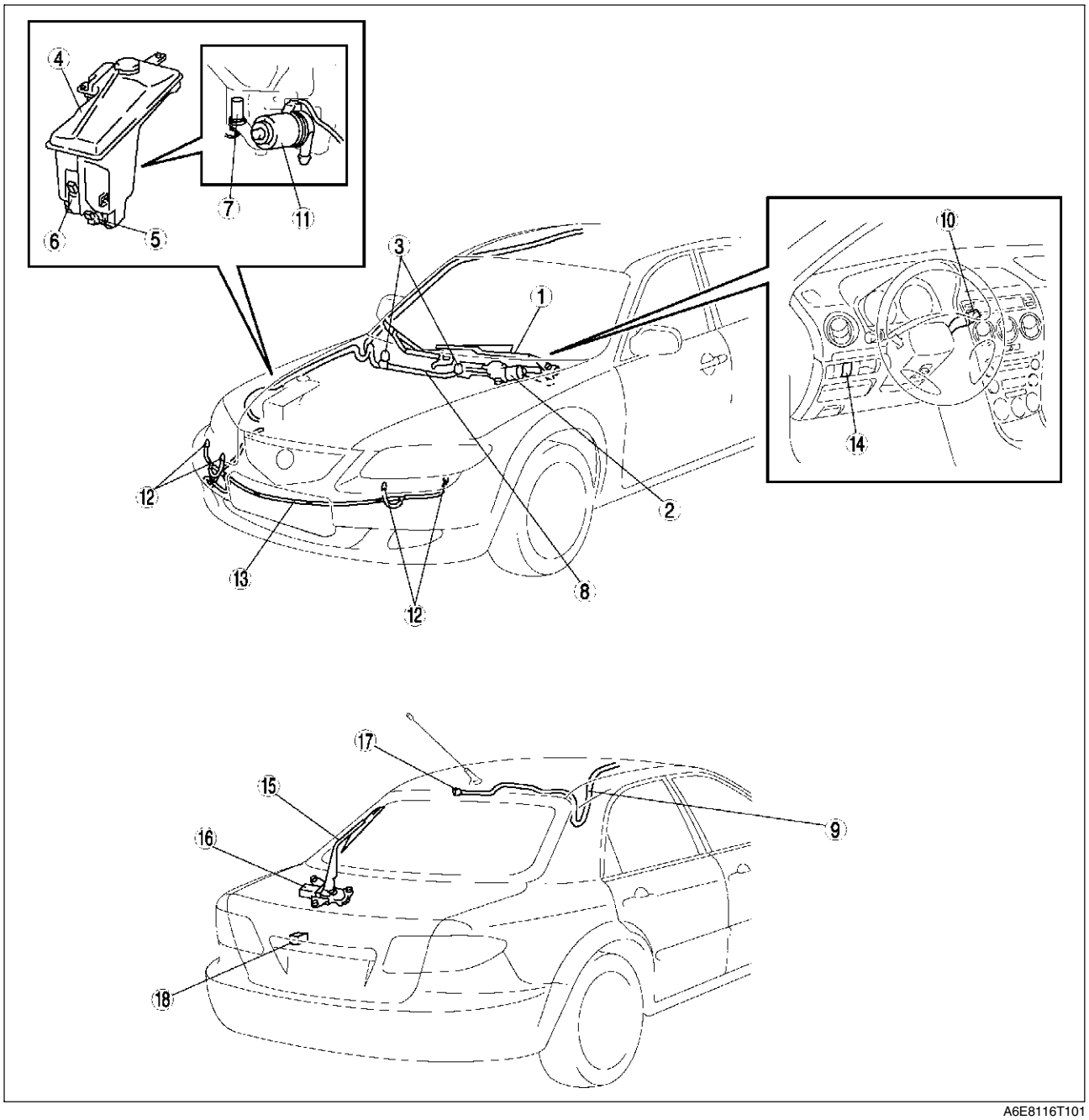
- The rear wiper system has an autostop function and intermittent function.
- The construction and operation is the same as that of the 626 (GF) model.

Headlight Cleaner

- The construction and operation is the same as that of the current 323 (BJ) model.

STRUCTURAL VIEW

A6E811601052T02



A6E8116T101

1	Windshield wiper arm and blade
2	Windshield wiper motor
3	Windshield washer nozzle
4	Washer tank
5	Windshield washer motor
6	Rear washer motor (5HB)
7	Washer fluid-level sensor (5HB)
8	Windshield washer hose
9	Rear washer hose (5HB)
10	Wiper and washer switch • Windshield wiper and washer switch • Rear wiper and washer switch (5HB)

11	Headlight cleaner motor
12	Headlight cleaner nozzle
13	Headlight cleaner hose
14	Headlight cleaner switch
15	Rear wiper arm and blade (5HB)
16	Rear wiper motor (5HB)
17	Rear washer nozzle (5HB)
18	Intermittent rear wiper relay (5HB)

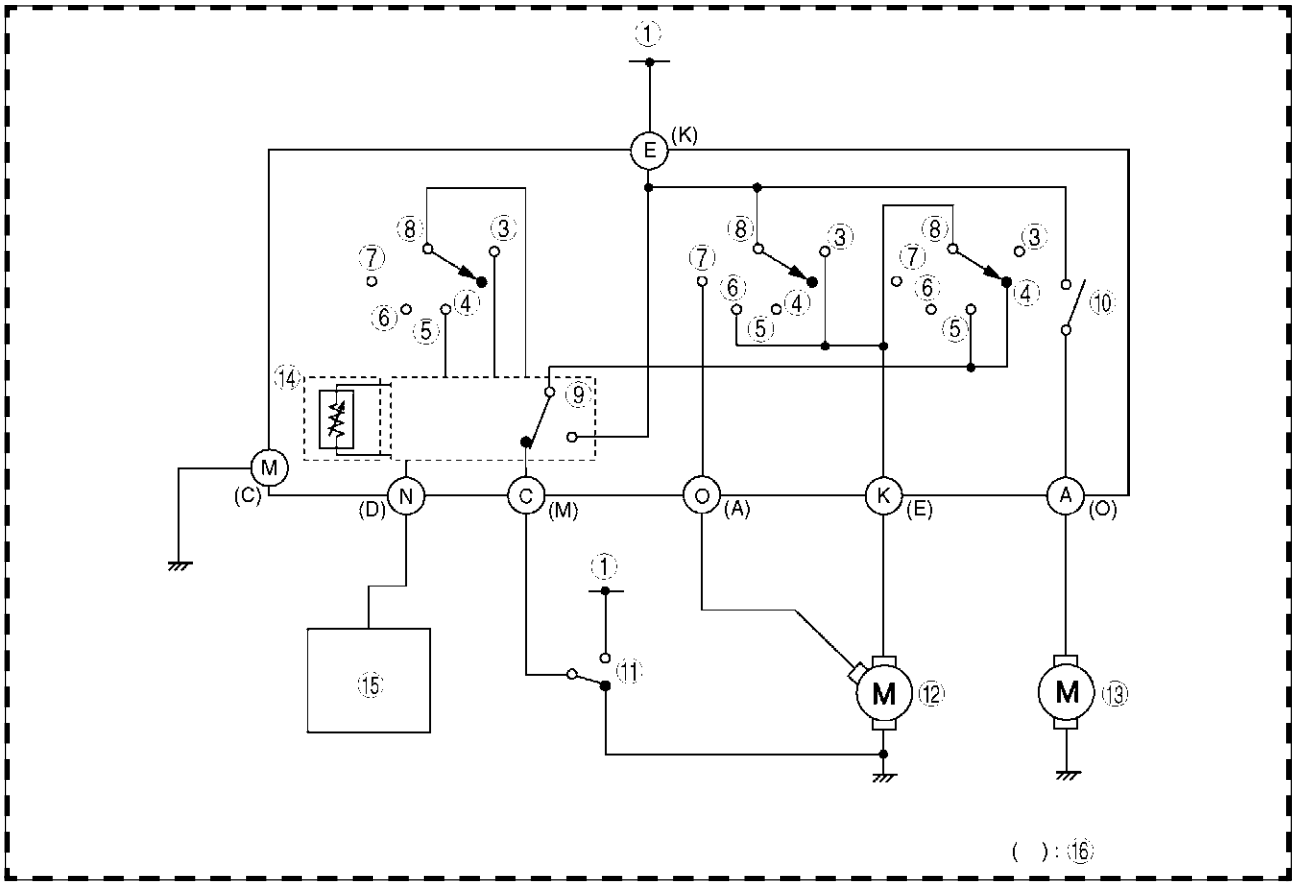
WINDSHIELD WIPER SYSTEM (VEHICLE-SPEED SENSING TYPE)

A6E811601052T03

Function

- A vehicle-speed sensing type windshield wiper system, which automatically adjusts the intermittent wiping time according to vehicle speed, has been adopted. Accordingly, this system reduces the bothersome need for the driver to adjust the intermittent wiping time.

Structural View



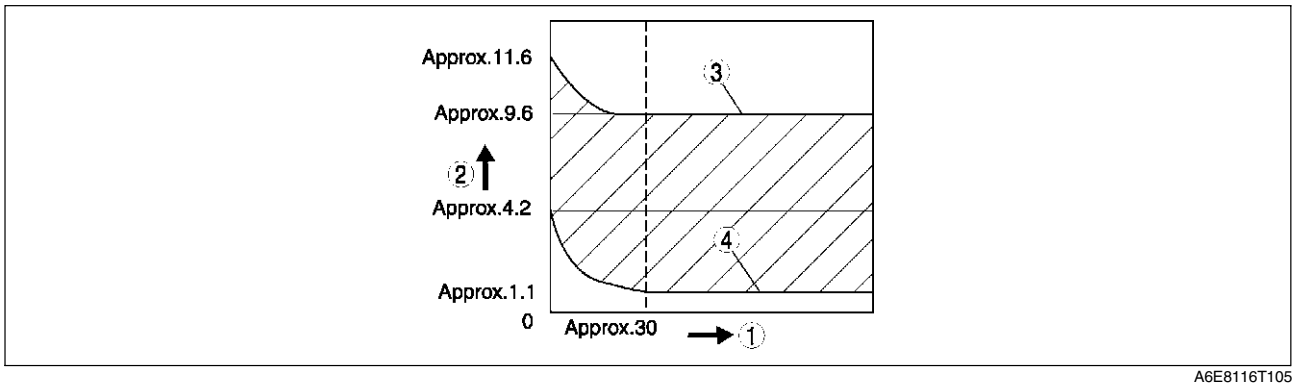
A6E8116T102

1	IG1
2	Wiper and washer switch
3	One-touch switch
4	OFF
5	INT
6	1
7	2
8	Wiper switch

9	Intermittent wiper relay
10	Washer switch
11	Autostop switch
12	Windshield wiper motor
13	Windshield washer motor
14	INT volume
15	ABS/TCS HU/CM or DSC HU/CM
16	Wiper and washer switch RH side

Operation

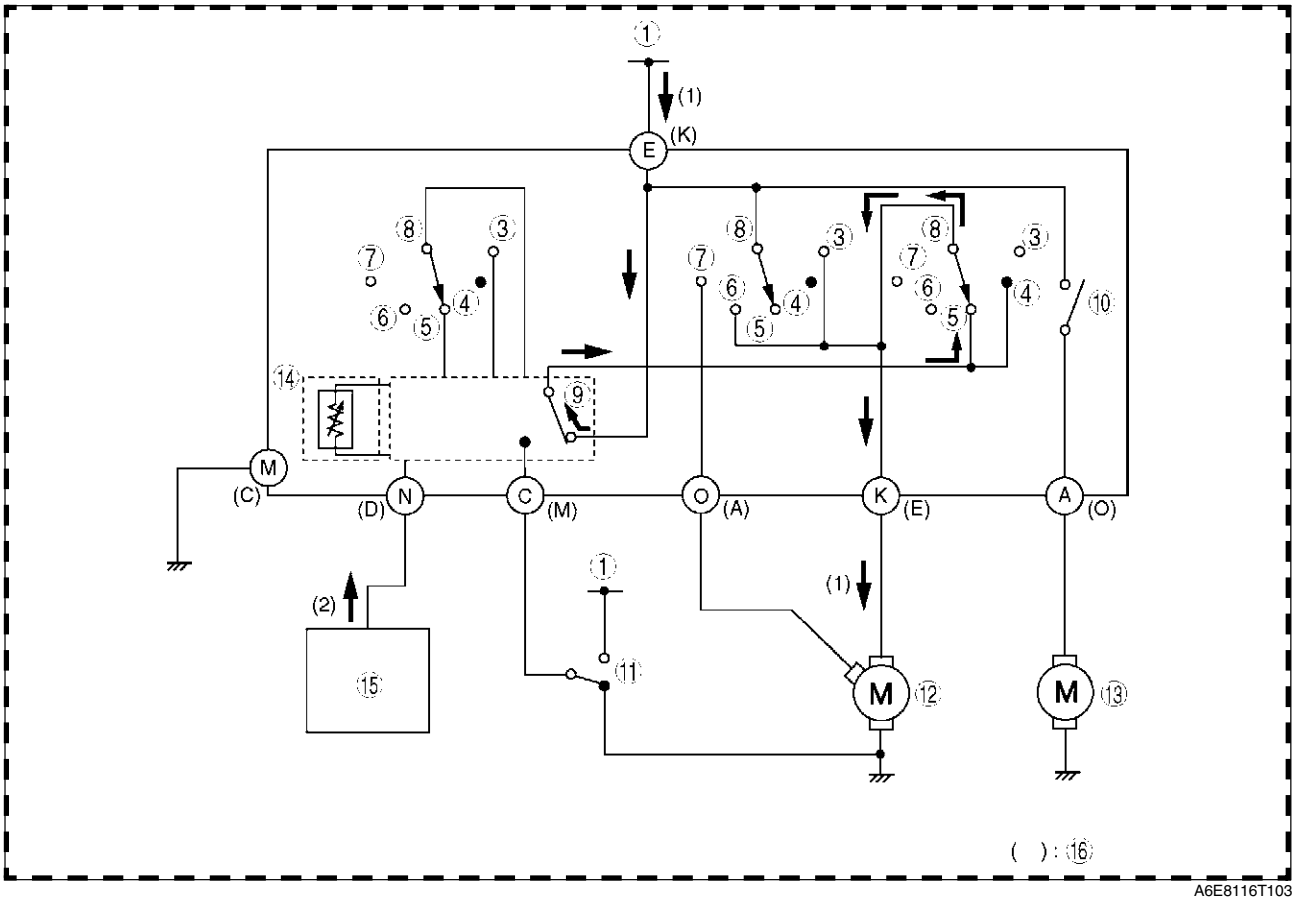
1. When the wiper switch is placed in the INT position, the intermittent wiper relay is turned on and current flows to the windshield wiper motor, which is driven at low speed.
2. Based on the vehicle speed signal sent from the ABS (DSC) HU/CM, the intermittent wiper relay controls the timing is as follows:
   - Vehicle speed of 0 km/h:
     — INT volume max.—approx. once each 11.6 seconds
     — INT volume min. —approx. once each 4.2 seconds
   - Vehicle speed of 30 km/h and above:
     — INT volume max.—approx. once each 9.6 seconds
     — INT volume min. —approx. once each 1.1 seconds



A6E8116T105

1	Vehicle speed (km/h)
2	Time (S)

3	INT volume max.
4	INT volume min.



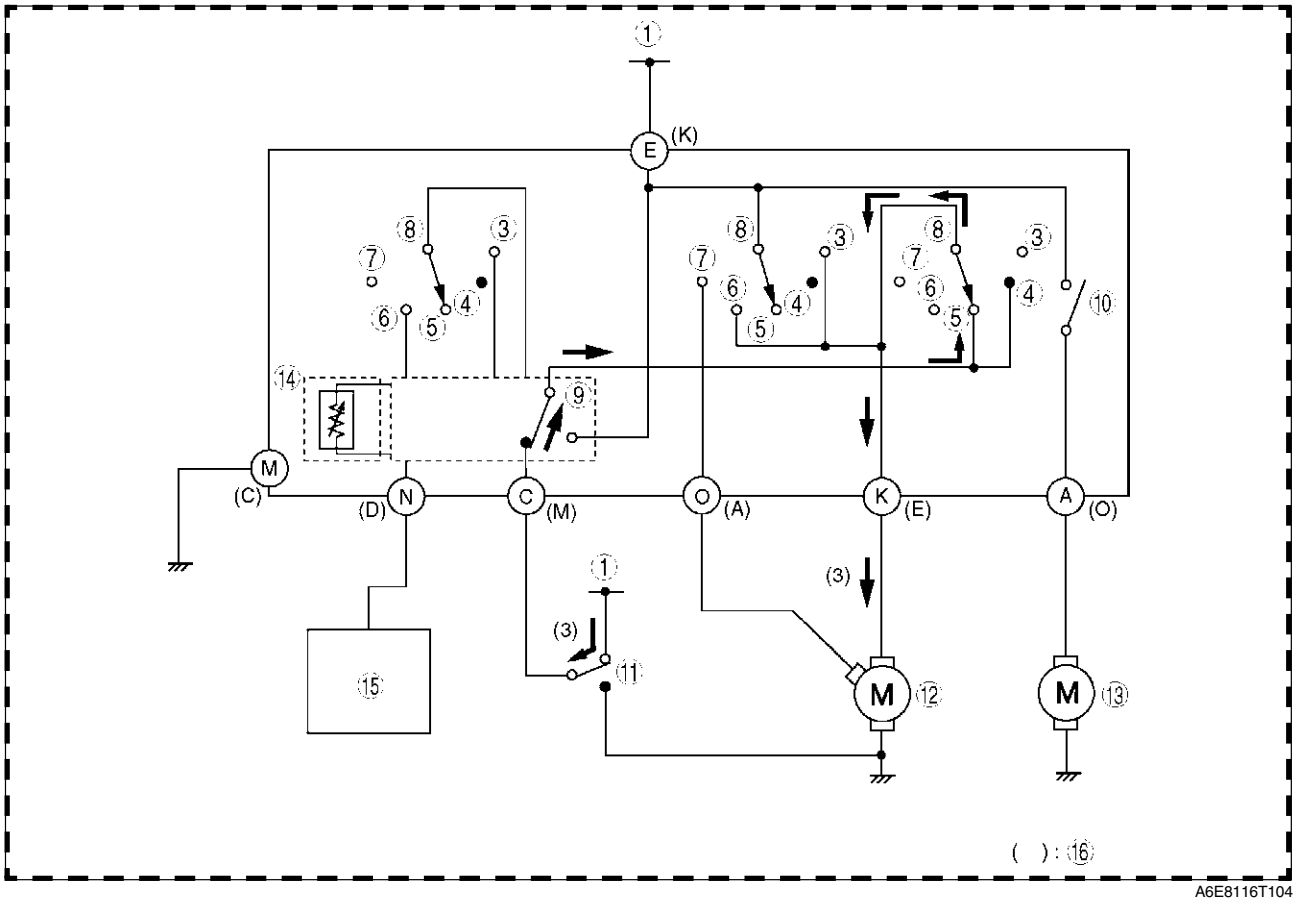
A6E8116T103

1	IG1
2	Wiper and washer switch
3	One-touch switch
4	OFF
5	INT
6	1
7	2
8	Wiper switch

9	Intermittent wiper relay
10	Washer switch
11	Autostop switch
12	Windshield wiper motor
13	Windshield washer motor
14	INT volume
15	ABS/TCS HU/CM or DSC HU/CM
16	Wiper and washer switch RH side

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3. When the controlled intermittent time is passed, the intermittent wiper relay is turned off, stopping the flow of current to the windshield wiper motor, and the autostop function returns the wipers to the resting position. This action is repeated intermittently.



A6E8116T104

1	IG1
2	Wiper and washer switch
3	One-touch switch
4	OFF
5	INT
6	1
7	2
8	Wiper switch

9	Intermittent wiper relay
10	Washer switch
11	Autostop switch
12	Windshield wiper motor
13	Windshield washer motor
14	INT volume
15	ABS/TCS HU/CM or DSC HU/CM
16	Wiper and washer switch RH side

WARNING AND INDICATOR SYSTEM

OUTLINE

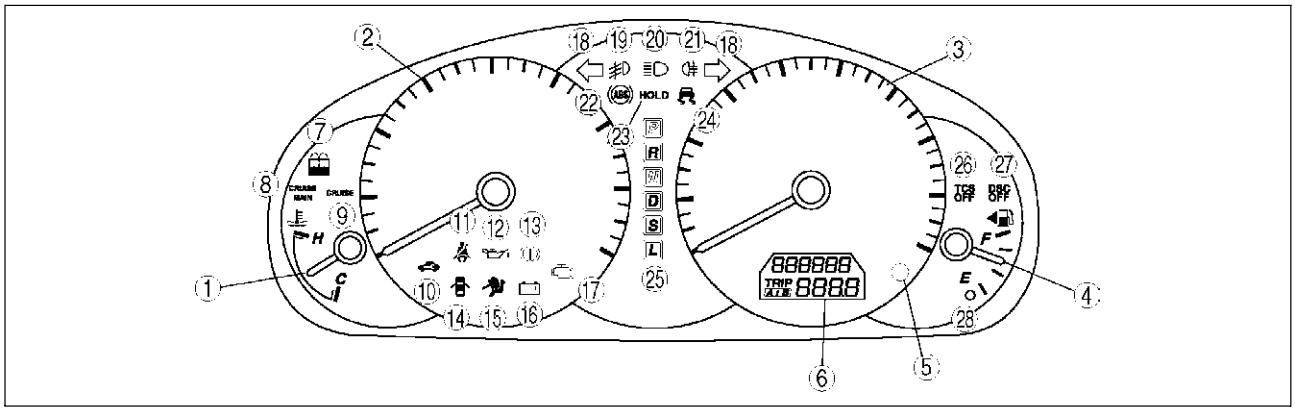
A6E811801069T01

- A CAN system has been adopted for the control signals of the input/output communication circuit of the meters, gauges and warning and indicator lights. (See T–5 OUTLINE.)
- LEDs have been adopted for all warning and indicator lights installed on the instrument cluster.
- The information display, which includes clock, audio system, and A/C system displays, has been placed in the center of the instrument panel. It also includes the drive information system, depending on the vehicle grade.
- A trumpet-type horn with spiral, resonant pipes, has been adopted.

INSTRUMENT CLUSTER

A6E811855430T01

Structural View



A6E8118T001

1	Water temperature gauge
2	Tachometer
3	Speedometer

4	Fuel gauge
5	Odometer/tripmeter switch
6	Odometer/tripmeter

T

X: Applied

No.	Warning and indicator light	Input signal source	CAN system	Note
7	Washer fulid-level warning light	Washer fulid-level sensor	—	—
8	Cruise main indicator light	Cruise actuator	—	With cruise control system
9	Cruise set indicator light	Cruise actuator	—	With cruise control system
10	Security light	• PCM • Theft-deterrent control module • Door lock timer unit	—	—
11	Seat belt warning light	Buckle switch	—	—
12	Oil pressure warning light	Oil pressure switch	—	—
13	Brake system warning light	• Parking brake switch • Brake fluid level sensor	—	—
14	Door ajar warning light	Door switch	—	—
15	Air bag system warning light	SAS unit	—	—
16	Generator warning light	PCM	X	—
17	MIL	PCM	X	—
18	Turn indicator light	Turn switch	—	—
19	Front fog light indicator light	Front fog light relay	—	European (L.H.D. U.K.) specs.
20	High-beam indicator light	Head light switch	—	—
21	Rear fog light indicator light	Rear fog light relay	—	European (L.H.D. U.K.) specs.
22	ABS warning light	ABS (ABS/TCS) HU/CM	X	Vehicles with ABS (ABS/TCS)
		DSC HU/CM	X	Vehicles with DSC
23	HOLD indicator light	PCM	X	ATX
24	TCS indicator light	ABS/TCS HU/CM	X	Vehicles with TCS
	DSC indicator light	DSC HU/CM	X	Vehicles with DSC
25	Selector indicator light	PCM	X	ATX

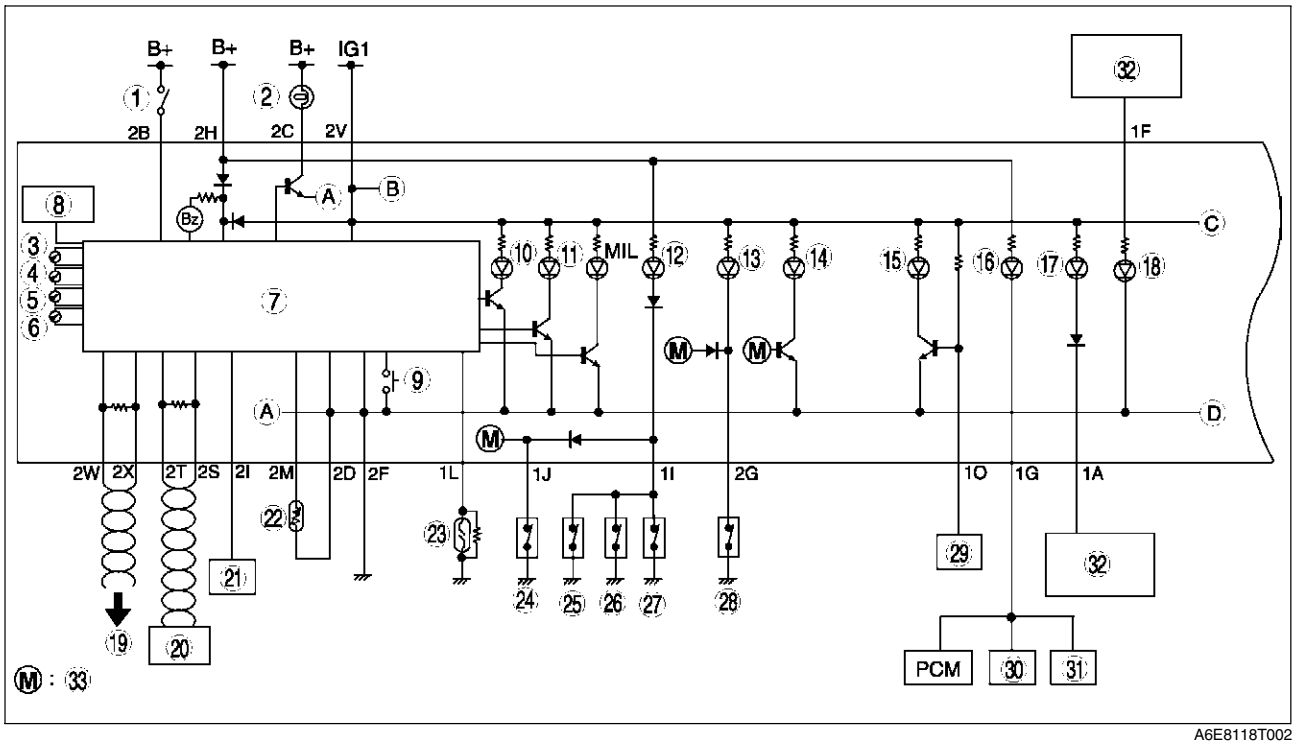
No.	Warning and indicator light	Input signal source	CAN system	Note
26	TCS OFF light	ABS/TCS HU/CM	X	Vehicles with TCS
27	DSC OFF light	DSC HU/CM	X	Vehicles with DSC
28	Fuel-level warning light	Fuel gauge sender unit	—	—

Specifications

Item				Specification
Speedometer	Meter type			Stepping motor type
	Indication range		(km/h)	0—240
			(mph {km/h})	0—150 {0—240}
	Input signal communication system			CAN system
	Input signal source	Vehicles with ABS (ABS/TCS) HU/CM		ABS (ABS/TCS) HU/CM
		Vehicles with DSC		DSC HU/CM
		Vehicles without ABS		PCM
	Rated voltage		(V)	DC 12
Tachometer	Meter type			Stepping motor type
	Indication range		(rpm)	0—8,000
	Red zone		(rpm)	6,500—8,000
	Input signal communication system			CAN system
	Input signal source			PCM
	Rated voltage		(V)	DC 12
Fuel gauge	Meter type			Stepping motor type (Reset-to-zero type)
	Input signal communication system			Conventional communication system
	Input signal source			Fuel tank gauge unit
	Rated voltage		(V)	DC 12
Water temperature gauge	Meter type			Stepping motor type (Medium range stabilized type)
	Input signal communication system			CAN system
	Input signal source			PCM
	Rated voltage		(V)	DC 12
Odometer/ Tripmeter	Display			LCD
	Indication digits			Odometer: 6 digits, Tripmeter: 4 digits
	Input signal communication system			CAN system
	Input signal source	Vehicles with ABS (ABS/TCS) HU/CM		ABS (ABS/TCS) HU/CM
		Vehicles with DSC		DSC HU/CM
		Vehicles without ABS		PCM
	Rated voltage		(V)	DC 12

SYSTEM WIRING DIAGRAM

A6E811855430T02

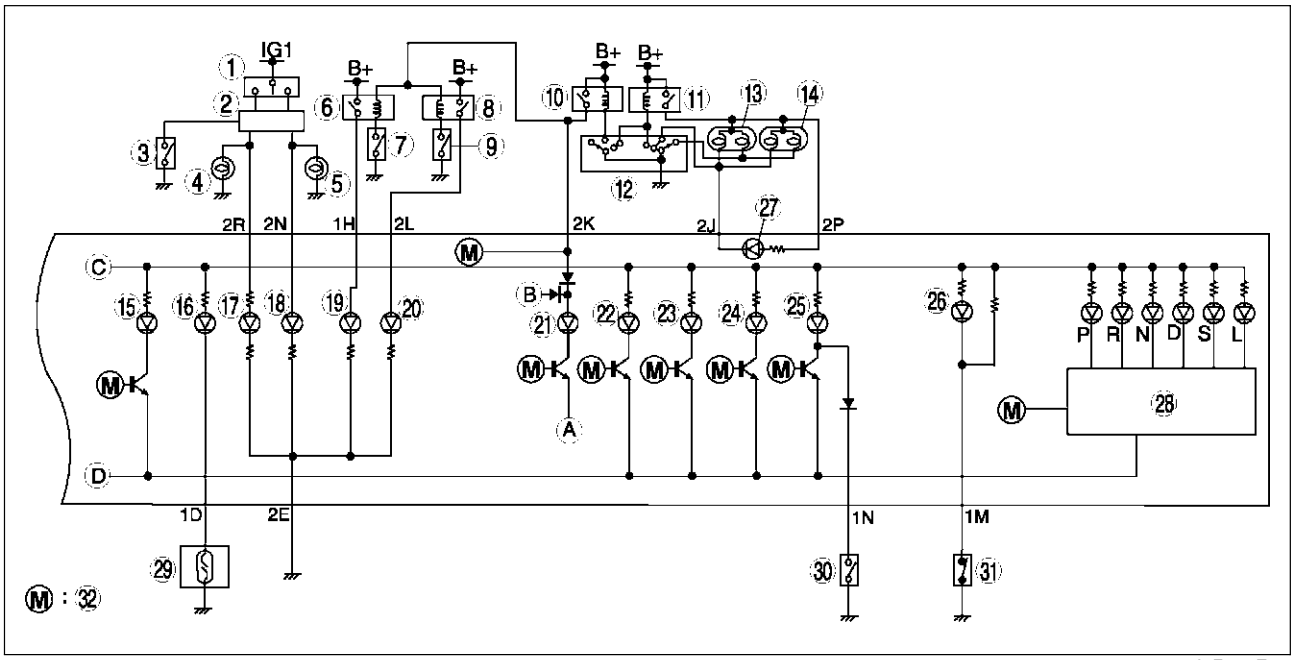


A6E8118T002

1	Key reminder switch
2	Ignition key illumination
3	Speedometer
4	Tachometer
5	Fuel gauge
6	Water temperature gauge
7	Microcomputer
8	Odometer/tripmeter
9	Odometer/tripmeter switch
10	Fuel-level warning light
11	Generator warning light
12	Door ajar warning light
13	Seat belt warning light
14	HOLD indicator light
15	Air bag system warning light
16	Security light
17	Cruise set indicator light

18	Cruise main indicator light
19	To PCM, ABS (ABS/TCS) HU/CM (with (ABS/TCS)) or DSC HU/CM (with DSC)
20	Audio unit
21	Panel light control switch
22	Fuel gauge sender unit
23	Brake fluid-level sensor
24	Door switch (driver's side)
25	Door switch (passenger's side)
26	Door switch (rear left side)
27	Door switch (rear right side)
28	Buckle switch
29	SAS unit
30	Door lock timer unit
31	Theft-deterrent control module
32	Cruise actuator
33	To microcomputer

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A6E8118T003

1	Turn switch
2	Flasher unit
3	Hazard warning switch
4	Turn light (left)
5	Turn light (right)
6	Front fog light relay
7	Front fog light switch
8	Rear fog light relay
9	Rear fog light switch
10	TNS relay
11	Headlight relay
12	Headlight switch
13	Headlight (left)
14	Headlight (right)
15	TCS OFF light
16	Washer fluid-level warning light

17	Turn indicator light (left)
18	Turn indicator light (right)
19	Front fog light indicator light
20	Rear fog light indicator light
21	Instrument cluster illumination
22	DSC/TCS indicator light
23	DSC OFF light
24	ABS warning light
25	Brake system warning light
26	Oil pressure warning light
27	High beam indicator light
28	Selector indicator drive circuit
29	Washer fluid-level sensor
30	Parking brake switch
31	Oil pressure switch
32	To microcomputer

INPUT/OUTPUT CHECK MODE

A6E811855430T03

- The microcomputer built into instrument cluster detects the quality of input signal or individual part.
- Input/output check mode has both input circuit check and individual part check functions.
- The operating order of the input/output check mode is the same as that of the current MPV (LW) model.
- A comparison of available DTCs for the Mazda6 and the current MPV (LW) model is shown below.

Input circuit check

X: Applied
—: Not applied

No.	Mazda6	MPV (LW)	Parts sending input signal
01	X	X	Buckle switch
04	X	X	Door switch
05	—	X	Door lock-link switch
07	—	X	Rear window defroster switch
08	X	X	TNS relay
09	—	X	Headlight switch
10	—	X	PCM
11	—	X	PCM
22	X	X	Fuel gauge sender unit
24	—	X	ECT sensor
29	—	X	Rear fog light switch
31	—	X	Key reminder switch
40	—	X	Front fog light relay
41	—	X	P positionswitch

Individual circuit check

X: Applied
—: Not applied

No.	Mazda6	MPV (LW)	Parts sending input signal
12	X	X	Speedometer
13	X	X	Tachometer
14	X	X	Buzzer
15	—	X	Rear fog light relay
16	X	X	Fuel-level warning light
17	—	X	Rear window defroster indicator light
18	X	X	Ignition key illumination
20	—	X	Rear window defroster relay
21	—	X	Door lock timer unit
23	X	X	Fuel gauge
25	X	X	Water temperature gauge
26	X	X	LCD
27	—	X	Interior light
42	—	X	Key interlock solenoid

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PID/DATA MONITOR AND RECORD

A6E811855430T04

- The PID/DATA monitoring items for the instrument cluster is as shown in the table below.

Monitor item table

—: Not applicable

PID item	Definition	Unit/Condition		Terminal
CCNT_HE	Continuous codes	Number of continuous codes		—
ECT_GAUGE	Temperature gauge	°C	°F	2W, 2X
FUEL	Fuel flow	l/min		2M
ODOMETR	Total distance	km	mile	2W, 2X
SPEEDSG	Speedometer	km/h	mile/h	
RPM	Tachometer	rpm		

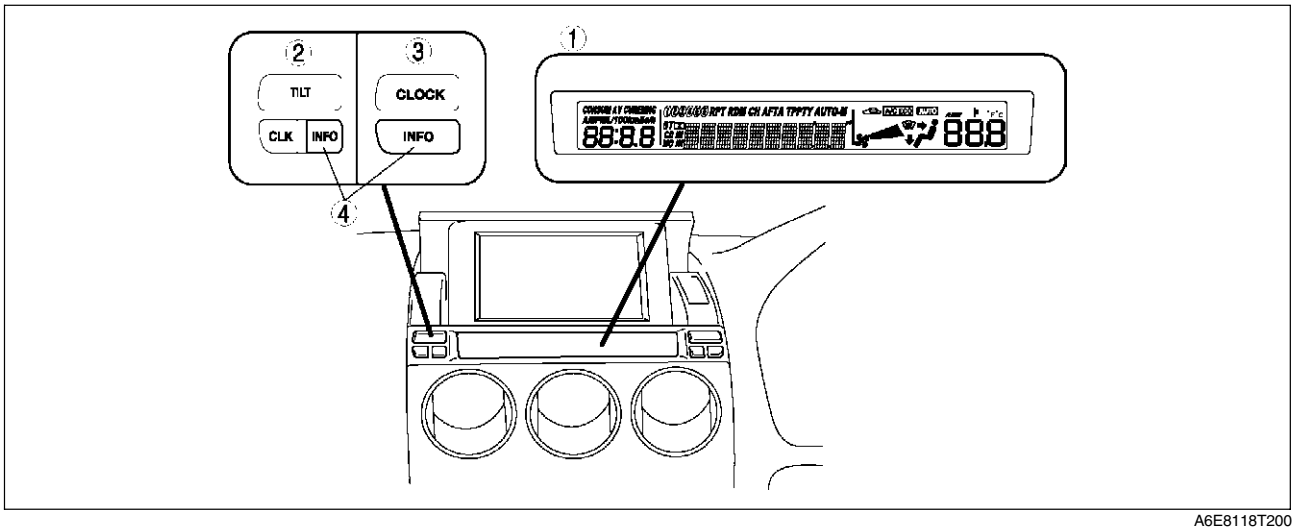
DRIVE INFORMATION SYSTEM

A6E811801069T02

Outline

- The microcomputer in the instrument cluster calculates ambient temperature data, distance driven and specified time data, fuel consumption data, and fuel remaining data according to signal from signal source.
- Using these data, the microcomputer displays the following in the information display;
  - — Instant fuel economy
  - — Average fuel economy
  - — Distance to empty
  - — Average vehicle speed
- The driver information system switch comprises an INFO switch.

Structural View

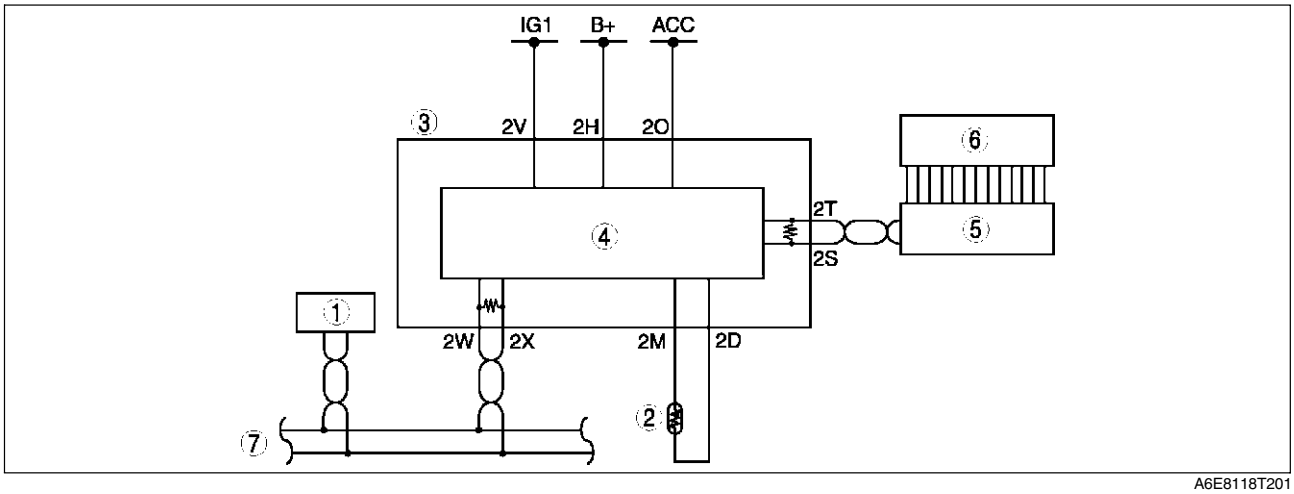


A6E8118T200

1	Information display
2	With car navigation system

3	Without car navigation system
4	INFO switch

System wiring diagram

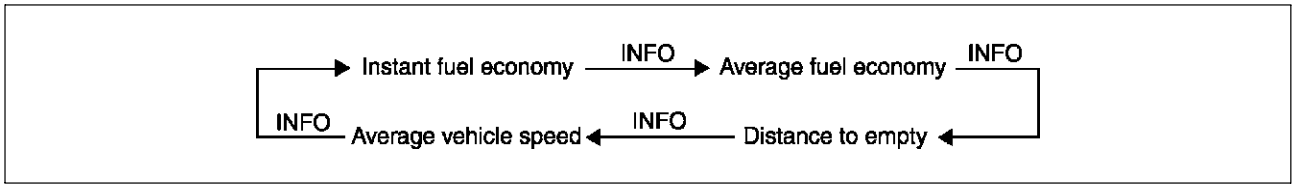


A6E8118T201

1	PCM
2	Fuel gauge sender unit
3	Instrument cluster
4	Microcomputer

5	Audio unit
6	Information display
7	CAN system

Operation
Drive information system switch
- The drive information system switch comprises an INFO switch.
- The modes can be charged in a cyclic pattern by pressing the INFO switch.



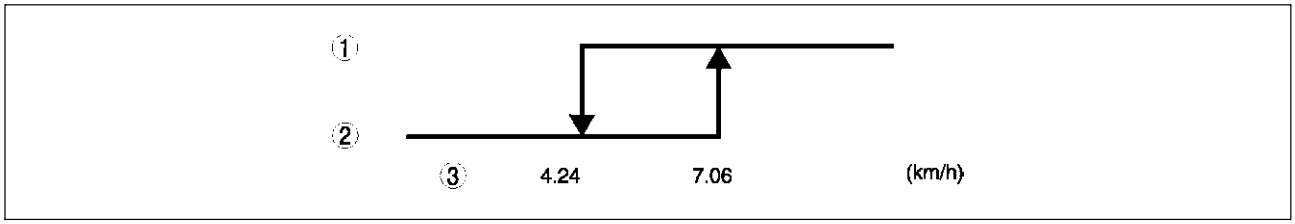
A6E8118T202

- The data displayed at the time can be reset by holding the INFO switch for 1 second or more. Data are calculated as soon as the INFO switch is released.

Drive information system display
- The display changes for each mode as shown.

Market	Instant fuel economy	Average fuel economy	Distance to empty	Average vehicle speed
U.K. specs.	CONSUM CUR L/100 mile 12.8	CONSUM AV L/100 mile 12.8	REMNG mile 212	AV mile/h 70
Except U.K. specs.	CONSUM CUR L/100km 10.5	CONSUM AV L/100km 10.5	REMNG km 310	AV km /h 72

Construction
Instant fuel economy mode
- Instant fuel economy is calculated from trip distance and fuel consumption in the previous 2 seconds.
- Instrument fuel economy is updated from every 2 seconds. (the indication only changes when the difference between the present value and the next value is 0.8 L/100 km (0.8 L/100 mile) or more.)
  Calculation
  Instant fuel economy (L/100 km or L/100 mile)=
  Fuel consumption over 2 seconds (L) / Distance travelled over last 2 seconds (km or mile) × 100
- When fuel is not consumed, for example, when applying an engine brake, <0.0 L/100 km> or <0.0 L/100 mile> is displayed.
- When the vehicle speed is in the invalid display range (see the following chart), <----/100 km> or <----/100 mile> is displayed.



A6E8118T211

1	Valid (normal) display
2	Invalid display

3	Vehicle speed

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Average fuel economy mode

- Average fuel economy is calculated from trip distance and fuel consumption since the time when the battery is connected or the average fuel economy data is reset.
- Average fuel economy is updated every 1 minute.
  Calculation
  Average fuel economy (L/100 km or L/100 mile)=
  Cumulative fuel consumption (L) / Cumulative trip distance (km or mile) × 100
- When the cumulative trip distance is 0 km (0 mile) (the vehicle has not traveled since the battery was last connected or average fuel economy function was last reset), <999.9 L/km> or <999.9 L/100 mile> is displayed.
- When the INFO switch is pressed for 1 second or more while displaying the average fuel economy, the cumulative fuel consumption data and cumulative trip distance data are reset.
- After the data are reset, <---- L/100 km> or <---- L/100 mile> is displayed for 1 minute.

Distance to empty mode

- Distance to empty is calculated from fuel consumption for last 32 km (32 mile) driven and remaining fuel amount.
- Average vehicle speed is updated every 10 seconds.
  Calculation
  Distance to empty (km or mile)=
  Remaining fuel amount × 32 (km or mile) / Fuel consumption for last 32 (km or mile) driven
- <---- km> or <---- mile> is displayed until the vehicle drives 100 km (100 mile) from the time when the battery is last connected or when the distance to empty is less than 50 km (50 mile).

Average vehicle speed mode

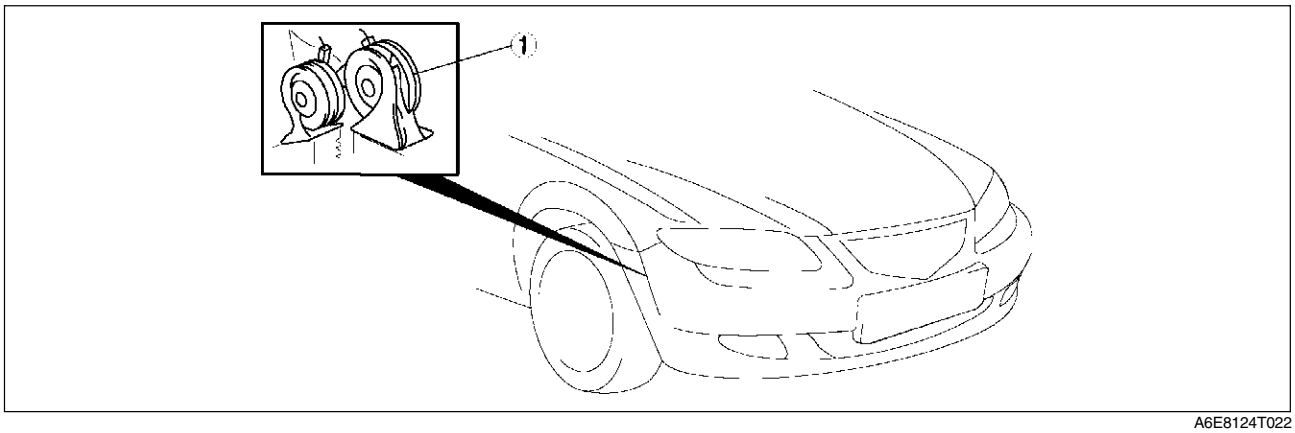
- Average vehicle speed is calculated from distance driven and specified time* since the time when the battery is last connected or the average vehicle speed data is last reset.
- Average vehicle speed is updated every 10 seconds.
  Calculation
  Average vehicle speed (km/h or mile/h)=
  Cumulative distance driven (km or mile) / Cumulative specified time (hour)
- When the INFO switch is pressed for 1 second or more while displaying the average vehicle speed, the cumulative distance driven data cumulative specified time data are reset.
- After the data are reset, <---- km/h> or <---- mile/h> is displayed for 1 minute.

*: Specified time is the period of time from when the ignition switch is turned to ON position, to when the microcomputer starts calculating the average of vehicle speed.

HORN

A6E811866790T01

- A trumpet-type hone with spiral, resonant pipes, has been adopted.



A6E8124T022

1	Horn

THEFT-DETERRENT SYSTEM

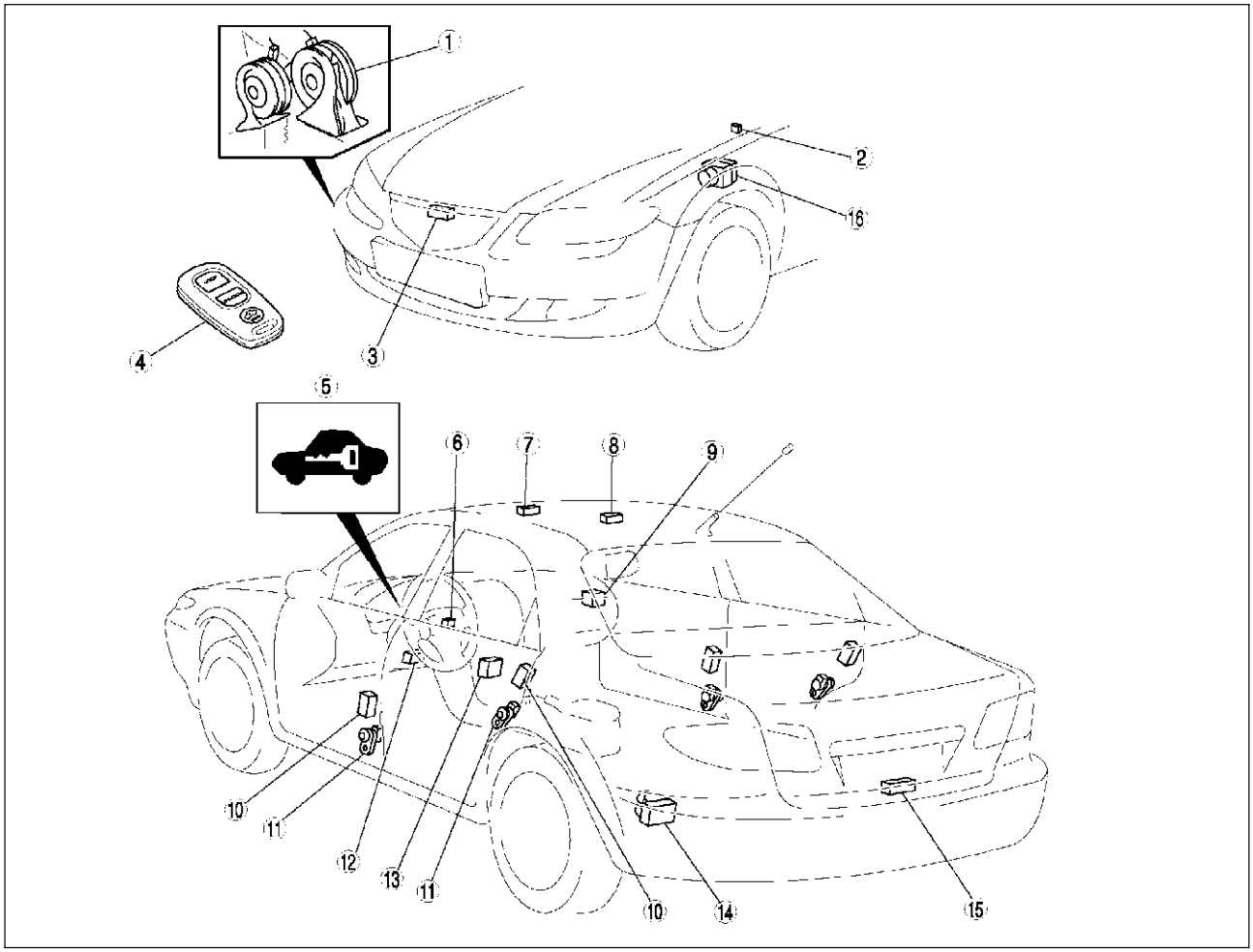
OUTLINE

A6E812050000T01

- The theft-deterrent system includes sound and light alarms that activate when the bonnet, the trunk lid (4SD) or liftgate (5HB), or a door is opened by means other than the transmitter. The turn lights flash and the horn and the theft-deterrent siren sound.
- When the transmitter unlock button is pressed, the alarms stop.
- An intruder sensor has been installed in the forward part of the roof (without sliding sunroof) or in the center part of the roof (with sliding sunroof). The intruder sensor senses movement in the vehicle based on radio waves, and sends an alert signal to the theft-deterrent control module.
- A theft-deterrent siren has been installed on the rear, left side of the trunk (4SD) or liftgate (5HB). The theft-deterent siren includes an internal back-up power supply so that if power from the battery is cut by any means, the siren will still sound.

STRUCTURAL VIEW

A6E812050000T02



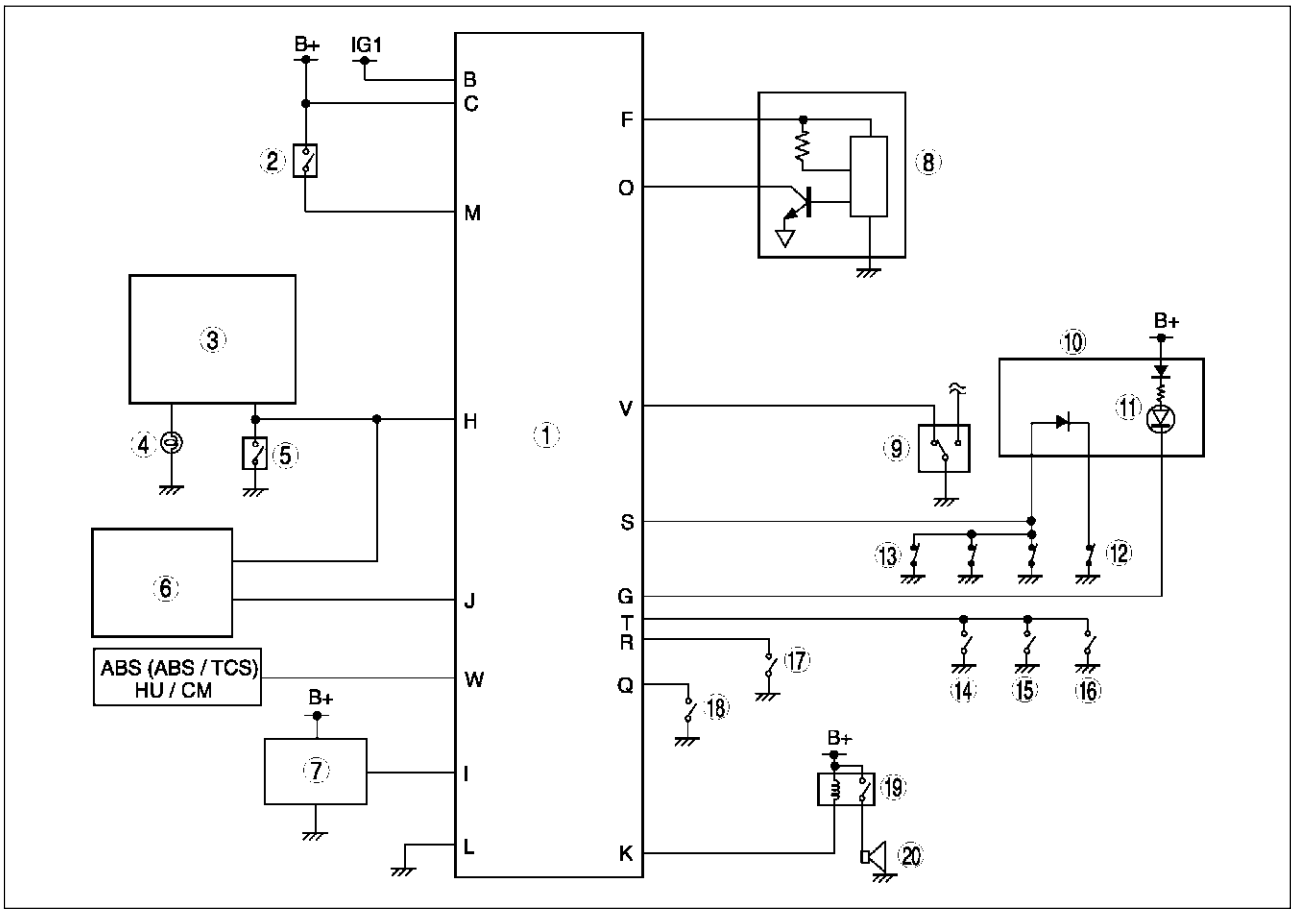
A6E8120T002

1	Horn
2	Horn relay
3	Bonnet switch
4	Transmitter
5	Security light
6	Key reminder switch
7	Intruder sensor (Vehicles without sliding sunroof)
8	Intruder sensor (Vehicles with sliding sunroof)
9	Door lock timer unit

10	Door lock-link switch
11	Door switch
12	Flasher unit
13	Theft-deterrent control module
14	Theft-deterrent siren
15	Trunk lid light switch (4SD)
	Cargo compartment light switch (5HB)
16	ABS (ABS/TCS) HU/CM

SYSTEM WIRING DIAGRAM

A6E812050000T03



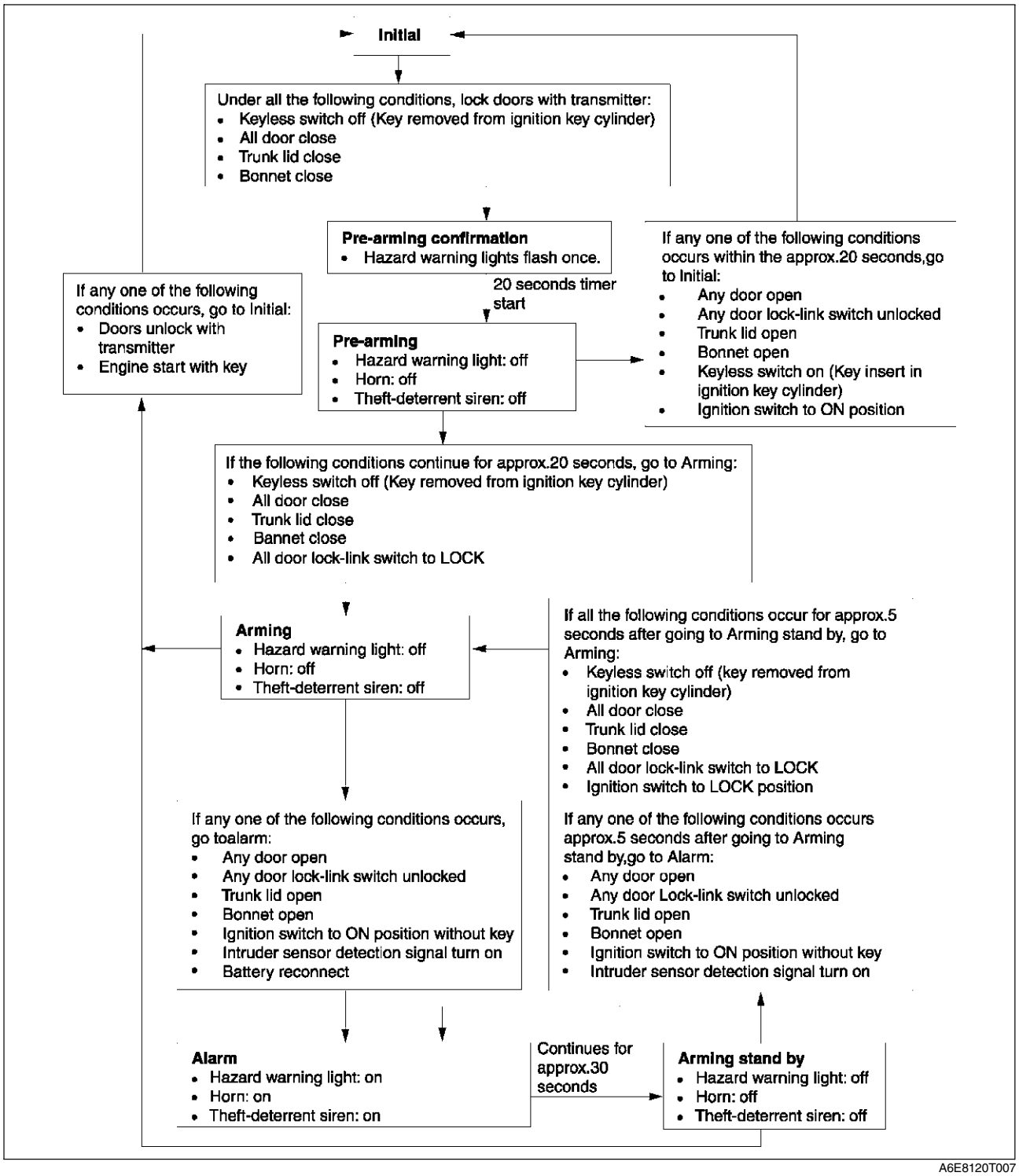
A6E8120T001

1	Theft-deterrent control module
2	Key reminder switch
3	Flasher unit
4	Turn light
5	Hazard warning switch
6	Door lock timer unit
7	Theft-deterrent siren
8	Intruder sensor
9	Driver's door lock-link switch
10	Instrument cluster
11	Security light

12	Door switch (driver's side)
13	Door switch (except driver's side)
14	Passenger's door lock-link switch
15	Rear door lock-link switch (right)
16	Rear door lock-link switch (left)
17	Trunk compartment light switch (4SD)
	Cargo compartment light switch (5HB)
18	Bonnet switch
19	Horn relay
20	Horn

SYSTEM FLOWCHART

A6E812050000T04



A6E8120T007

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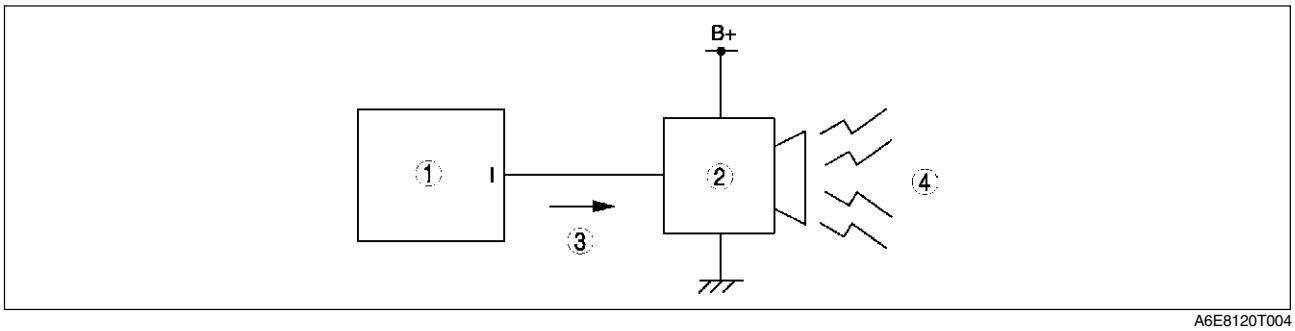
THEFT-DETERRENT SIREN

A6E812050000T05

- The theft-deterrent siren is located on the rear, left side of the trunk lid (4SD) or liftgate (5HB).
- Controlled by the following vehicle conditions:
  — Standard alert control
  — Open circuit alert control

Standard Alert Control

- The siren beeps when receiving an alert initialization signal from the theft-deterrent control module. When a go-to-initial signal is received the siren is stopped.



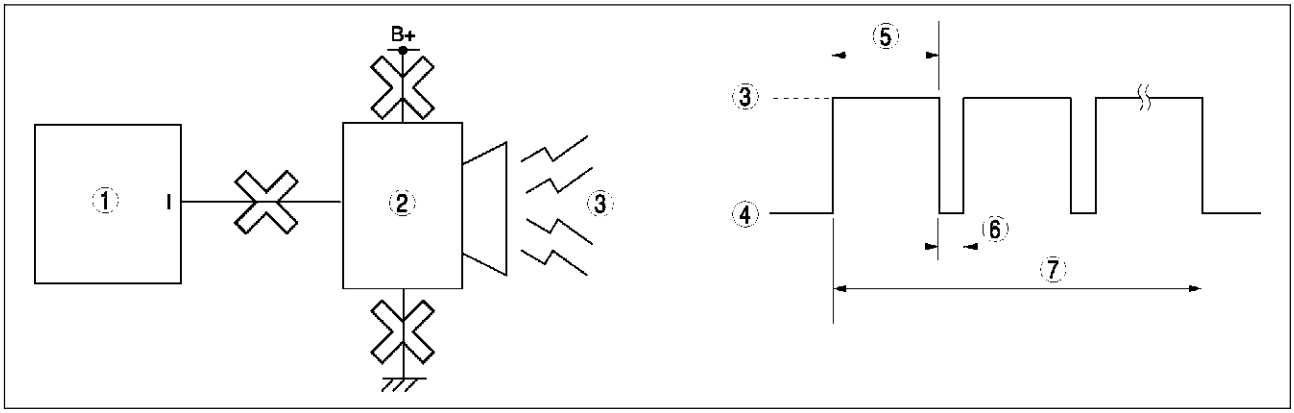
A6E8120T004

1	Theft-deterrent control module
2	Theft-deterrent siren

3	Alert initialization signal
4	Siren beeps

Open Circuit Alert Control

- A back-up power supply is integrated in the theft-deterrent siren.
- When an open circuit is detected in the related wiring harness, the theft-deterrent siren beeps using the back-up power supply.
- If any one of the following conditions are met, the siren is stopped:
  — Detects that all related wiring harness are properly connected.
  — Receives go-to-initial signal from the theft-deterrent control module.



A6E8120T005

1	Theft-deterrent control module
2	Theft-deterrent siren
3	Siren beeps
4	Siren stops

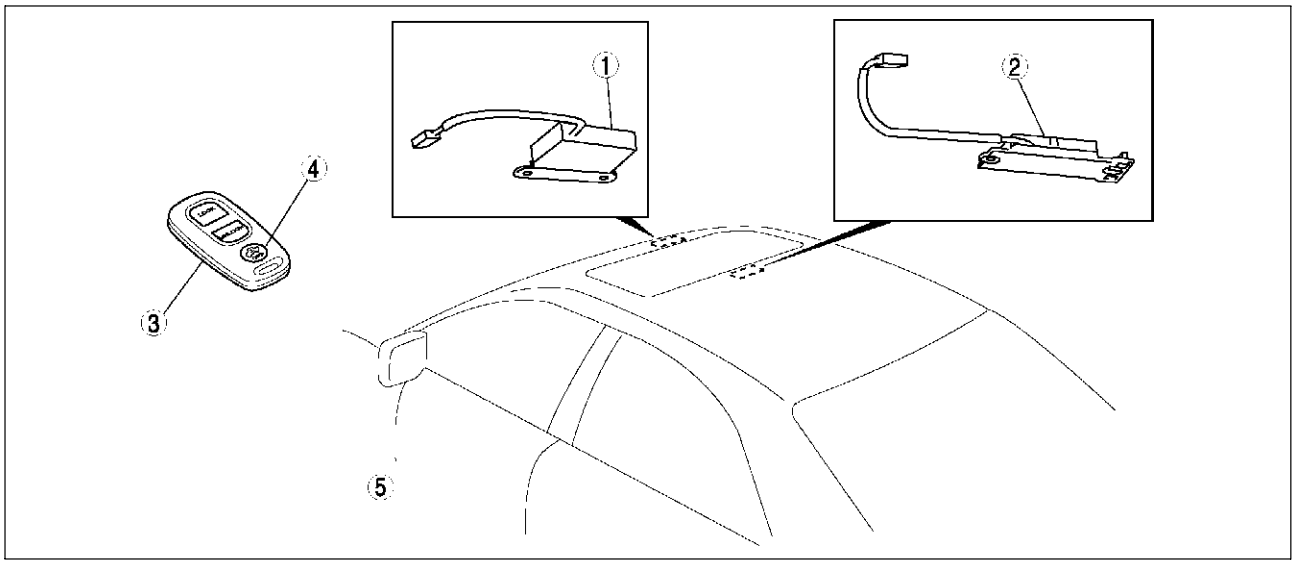
5	Approx. 30 seconds
6	Approx. 5 seconds
7	Maximum 9 cycles

INTRUDER SENSOR

A6E812050000T06

Outline

- The intruder sensor is located in center part of the roof on sliding sunroof-equipped vehicles or the forward part of the roof on sliding sunroof non-equipped vehicles.
- The intruder sensor detects movement in the vehicle by radio waves and sends the detection signal to the theft-deterrent control module.
- An intruder sensor cut-off switch has been installed on the keyless entry system transmitter. If the intruder sensor cut-off switch is on while the theft-deterrent system is pre-armed, intruder sensor radio wave output is cut, and movement detection is stopped.



A6E8120T003

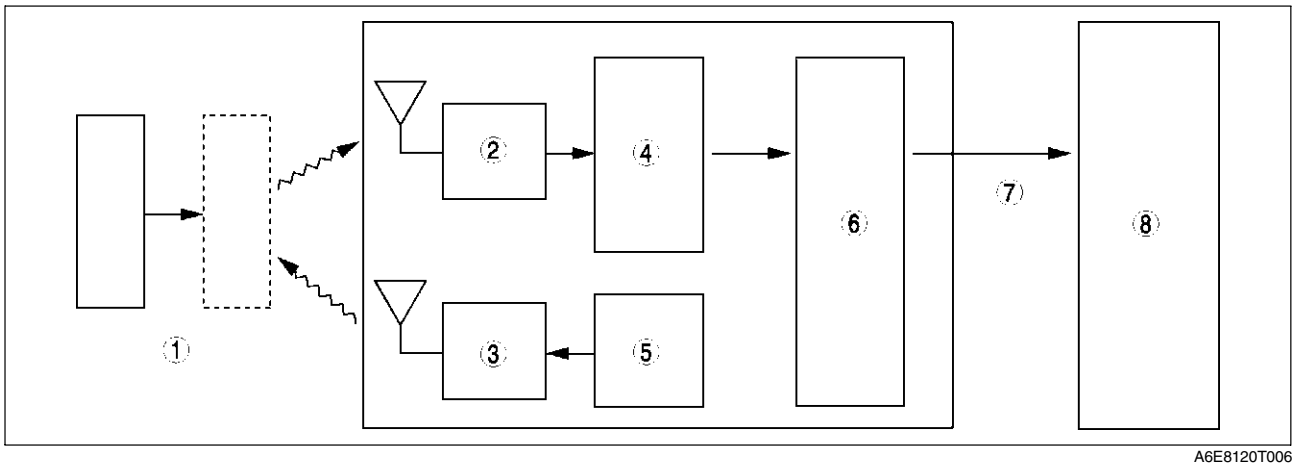
1	Intruder sensor (without sliding sunroof)
2	Intruder sensor (with sliding sunroof)

3	Transmitter
4	Intruder sensor cut-off switch

T

Operation

1. When the theft-deterrent system is armed, the intruder sensor outputs a 2.45 GHz radio wave in the passenger compartment. The intruder sensor detects phase differences in radio waves (reflected waves) that are output and bounced off a target object.
2. When a phase difference in reflected waves occurs by movement in the vehicle (intruder), the CPU calculates the level of phase difference.
3. If the level of phase difference is higher than specified, the intruder sensor sends a detection signal to the theft-deterrent module.



A6E8120T006

1	Target object
2	Receiver
3	Transmitter
4	Phase detection area

5	Oscillator
6	CPU
7	Detection signal output
8	Theft-deterrent control module

IMMOBILIZER SYSTEM

OUTLINE

A6E812267000T01

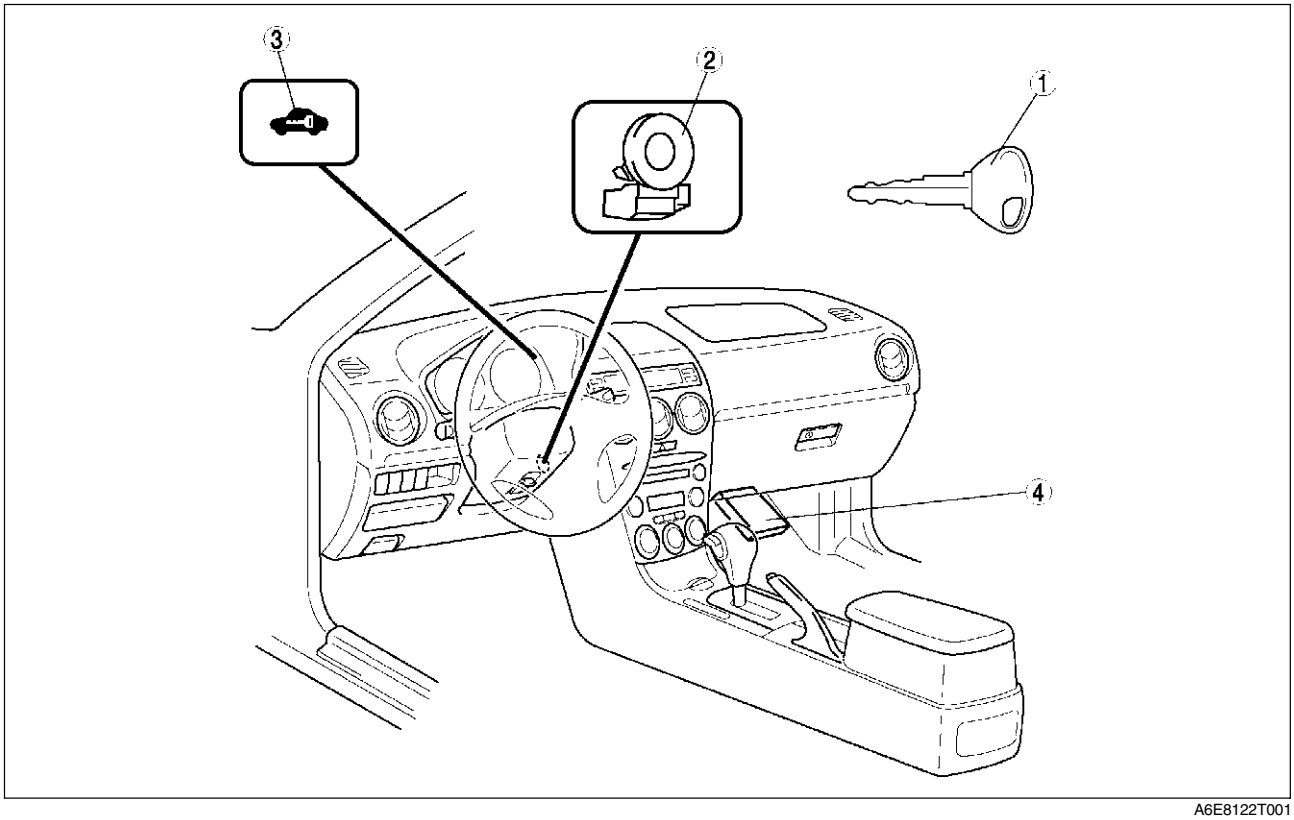
- The immobilizer system is essentially carried over from that of the current TRIBUTE (BU/CU/YU) model's passive anti-theft system (PATS). However, some items have been changed and/or added to improve security. Refer to the following table.

Comparison with current TRIBUTE (BU/CU/YU) model

Item	Comparison
Key (transponder)	Same as the current TRIBUTE (BU/CU/YU) model
Coil	
On-board diagnostic function	• DTC B2431 is added. • Procedure is changed.
ID number input procedure	Procedure is changed.

STRUCTURAL VIEW

A6E812267000T02

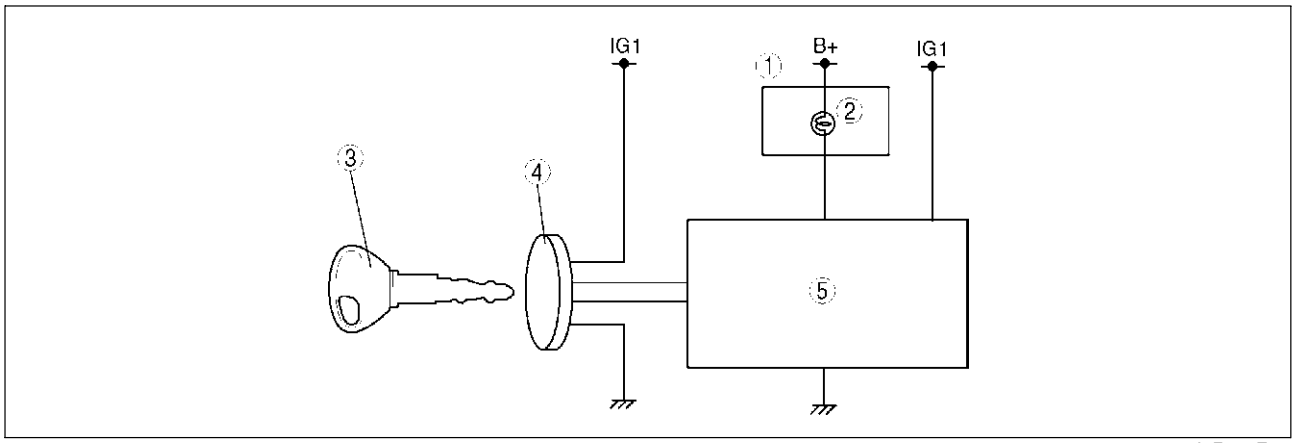


A6E8122T001

1	Key (transponder)	3	Security light
2	Coil	4	PCM

SYSTEM WIRING DIAGRAM

A6E812267000T03



A6E8122T002

1	Instrument cluster
2	Security light
3	Key (transponder)

4	Coil
5	PCM

AUDIO AND NAVIGATION SYSTEM

OUTLINE (AUDIO SYSTEM)

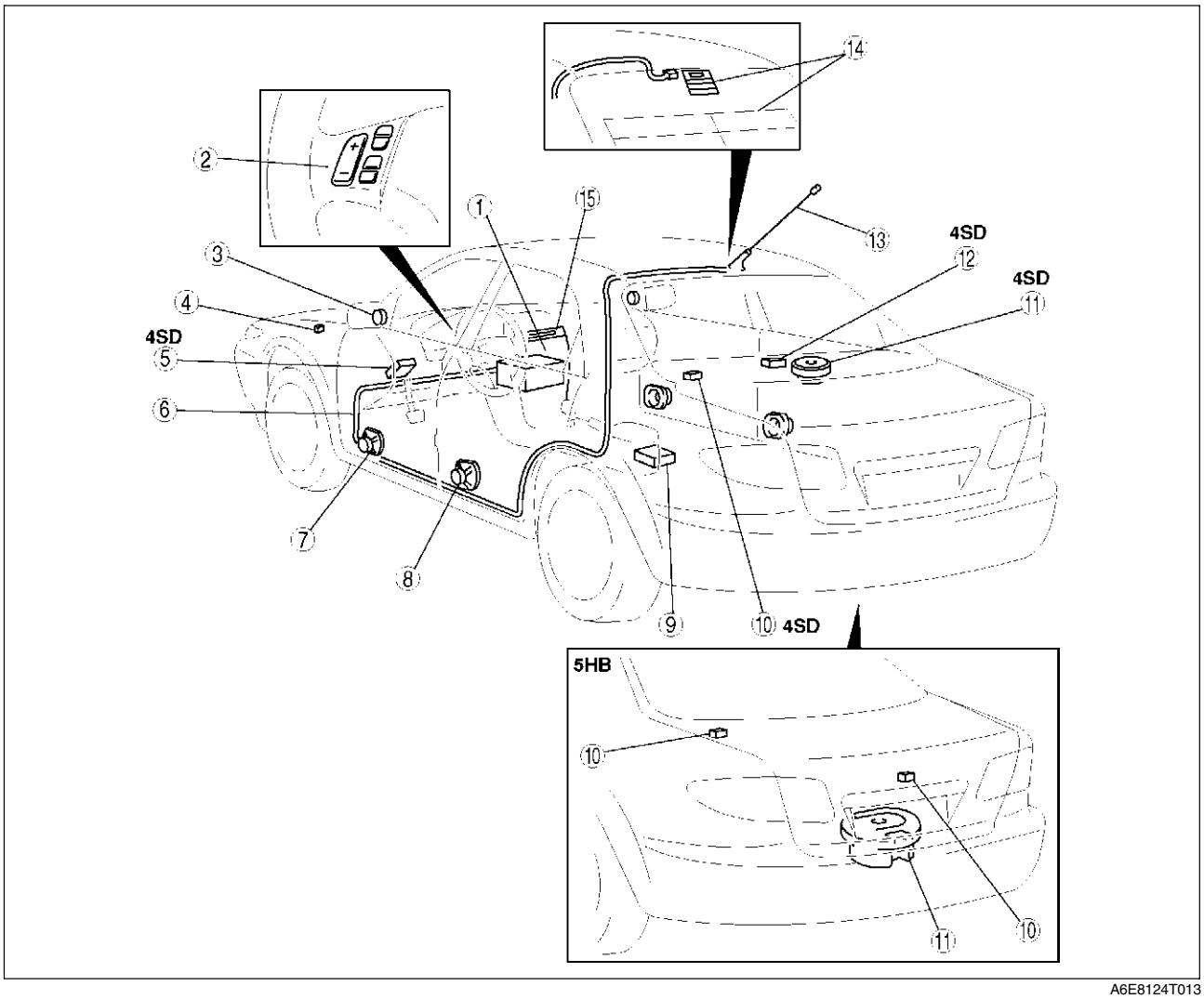
A6E812401066T01

- The center panel module installed with the audio unit and climate control unit (automatic A/C only), and the audio switch, A/C switch, hazard warning switch and rear window defroster switch built into the center panel has been adopted.
- The audio unit consists of the following parts:
  - — Base unit, which has AM/FM tuner and control function for each module
  - — Upper module (CD player or CD changer)
  - — Lower module (cassette deck or MD player)
  - — Cover
- Upper module (CD player or CD changer) and lower module (cassette deck or MD player) are options.
- Module availability depends on vehicle grade.
- The operation of audio unit is the same as that of current XEDOS 9, MILLENIA (TA) models.
- The audio control switch is equipped on the steering wheel for audio operation.
- The following two types of antennas have been adopted.
  - — Center roof antenna (European (L.H.D. U.K.) specs. and GCC specs. (5HB)): The construction of center roof antenna is the same as that of current 323 (BJ) model.
  - — Glass antenna (GCC specs. (4SD))
- Four speakers installed as standard, one each to the front and rear doors, have been adopted. For BOSE specified speakers, 7 speakers, including the door speakers, are installed on the inner garnish of the front doors (tweeters), and in the rear package (4SD) or temporary spare tire (5HB) (woofer).
- A noise filter has been installed on the brake light and rear window defroster circuit (GCC specs.), and a condenser has been installed on the high-mount brake light and rear wiper motor circuit for improved noise reduction.
- All information related to the audio system appears on the information display's LCD.

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STRUCTURAL VIEW (AUDIO SYSTEM)

A6E812401066T02



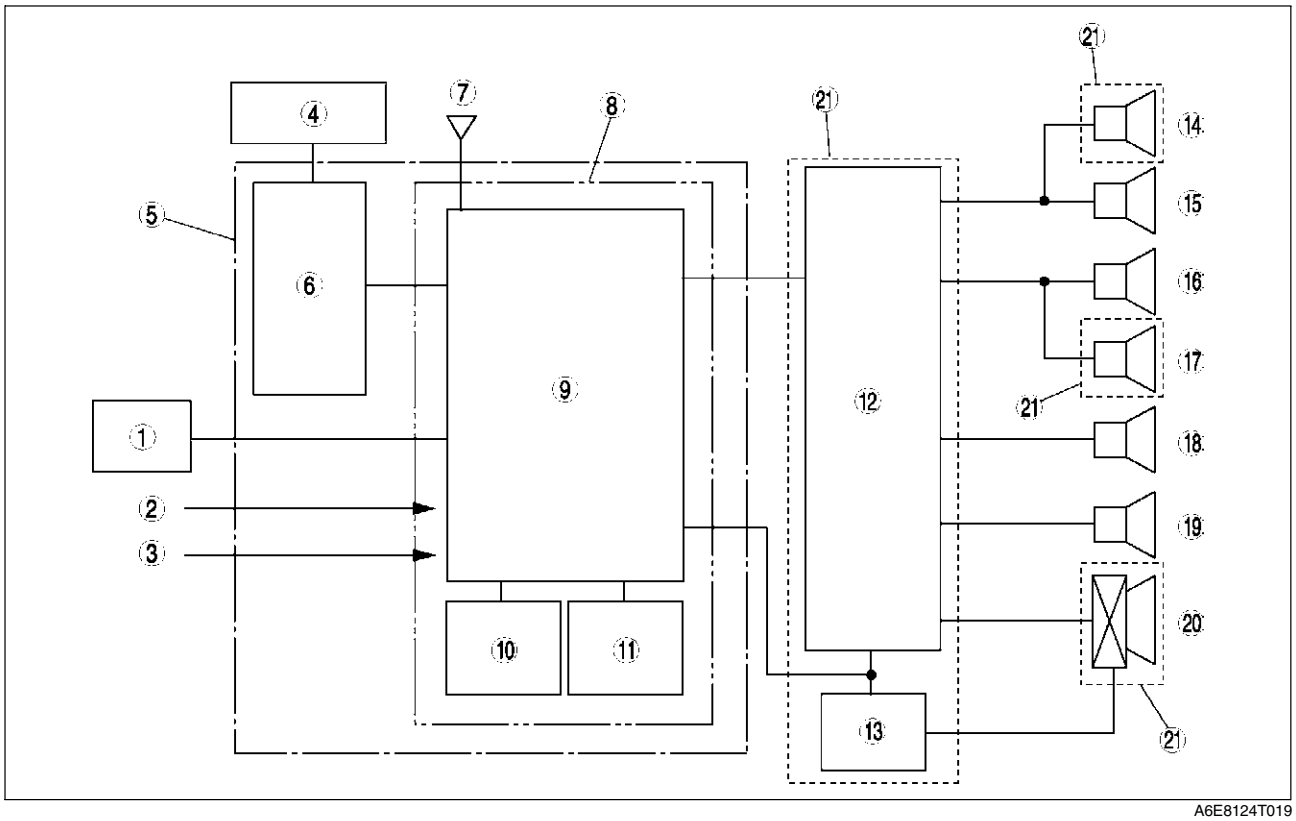
A6E8124T013

1	Center panel module (built-in audio unit)
2	Audio control switch
3	Tweeter (BOSE)
4	Woofer relay (BOSE)
5	Noise filter (brake switch)
6	Antenna feeder
7	Front door speaker
8	Rear door speaker

9	Audio amplifier (BOSE)
10	Condenser
11	Woofer (BOSE)
12	Noise filter (rear window defroster)
13	Center roof antenna
14	Glass antenna
15	Information display

BLOCK DIAGRAM (AUDIO SYSTEM)

A6E812401066T03



A6E8124T019

1	Audio control switch
2	TNS signal
3	Vehicle speed signal
4	Information display
5	Center panel module (built-in audio unit)
6	Audio control circuit
7	Antenna
8	Audio unit
9	Base unit
10	Upper module
11	Lower module

12	Audio amplifier
13	Woofer relay
14	Tweeter (left)
15	Front door speaker (left)
16	Front door speaker (right)
17	Tweeter (right)
18	rear door speaker (left)
19	rear door speaker (right)
20	Woofer
21	BOSE system only

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SPECIFICATIONS (AUDIO SYSTEM)

A6E812401066T04

Audio Unit

Item				Specification			
				BOSE	Standard		
				Type A	Type B	Type C	Type D
Rated voltage			(V)	12			
Frequency band	AM	LW	(kHz)	153—279		—	
		MW	(kHz)	531—1602		522—1629	530—1620
	FM		(MHz)	87.5—108.0			
Information system				RDS	—		
Audio amplifier maximum output power			(W)	25×4 (External type audio amplifier)	25×4		
Output impedance			(ohm)	2	4		

Speaker

Item		Specification					
		Door speaker			Tweeter	Woofer	
		Standard	BOSE				
			Front	Rear		4SD	5HB
Maximum input	(W)	25				100	
Impedance	(ohm)	4	2		3.2	0.5	
Size	(in)	5.5×7.5	6.5	5.25	2	9	5.25

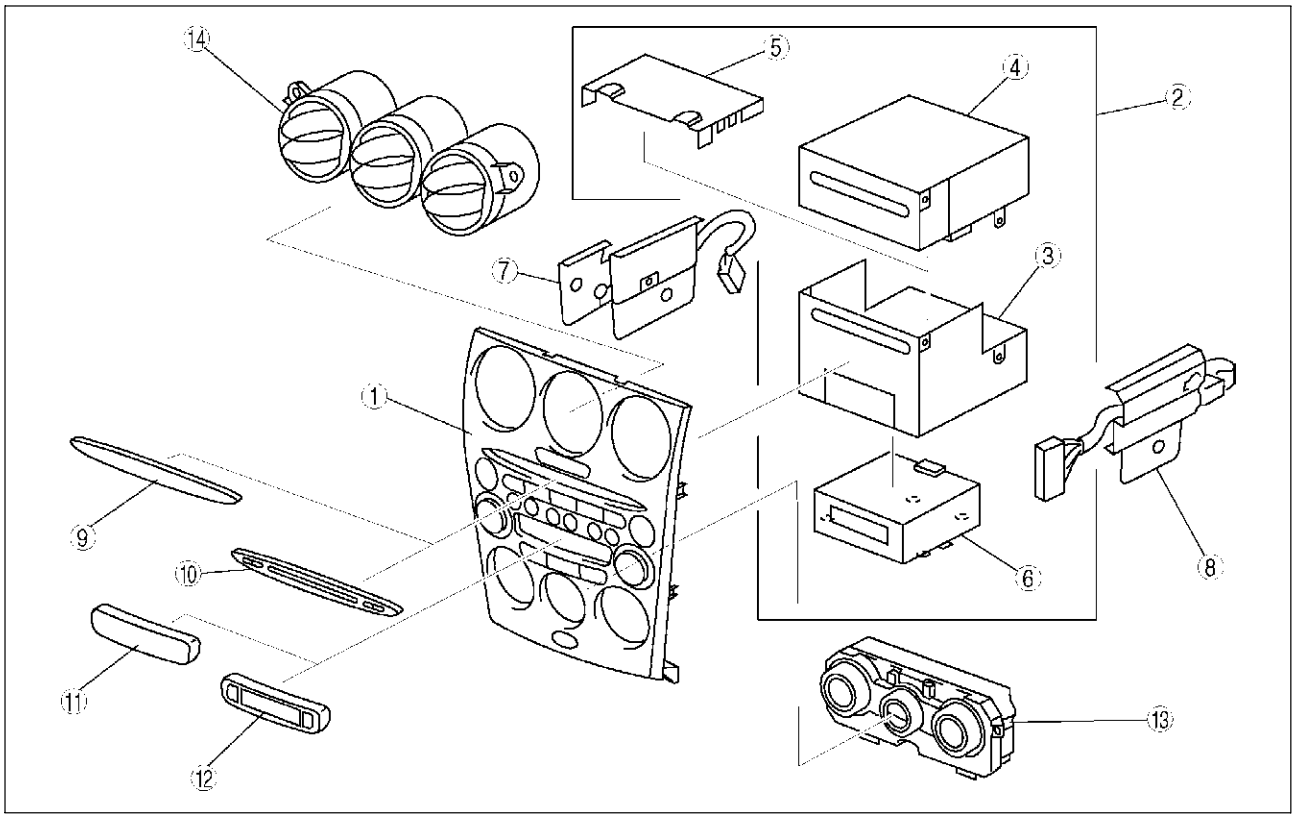
CENTER PANEL MODULE

A6E812466900T01

Outline

- The center panel module is composed of the installed audio unit and climate control unit (automatic A/C only) with the audio switch, A/C switch, hazard warning switch, and rear window defroster switch built into the center panel.
- The passenger-side air bag cut-off indicator light is installed on the lower part of the center panel. (with passenger-side air bag cut-off system)

Structural View



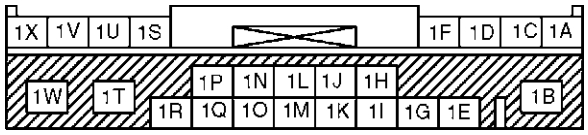
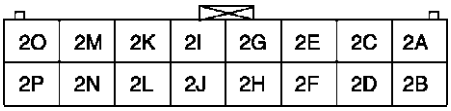
A6E8124T014

1	Center panel
2	Audio unit
3	Base unit
4	Upper module
5	Cover (without upper module)
6	Lower module
7	Circuit board (manual A/C only)

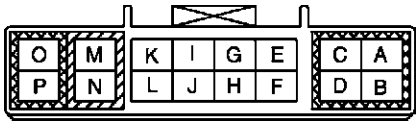
8	Information display harness
9	Cover (without upper module)
10	Cover (with upper module)
11	Cover (without lower module)
12	Cover (with lower module)
13	Climate control unit (auto A/C only)
14	Ventilator grille

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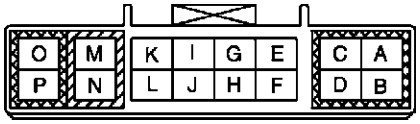
Terminal Layout and Signal
Audio unit

Terminal		Signal
	1A	Left front speaker (+)
	1B	B+ (Power back up)
	1C	Left front speaker (–)
	1D	Right front speaker (+)
	1E	Illumination (+)
	1F	Right front speaker (–)
	1G	Illumination (–)
	1H	—
	1I	Vehicle speed signal
	1J	AMP. control
	1K	UART-1
	1L	TEL. mute
	1M	UART-2
	1N	Steering switch
	1O	CAN (+)
	1P	Steering switch
	1Q	CAN (–)
	1R	ACC
	1S	Left rear speaker (+)
	1T	Ground
	1U	Left rear speaker (–)
	1V	Right rear speaker (+)
	1W	Ground (power)
	1X	Right rear speaker (–)
	2A	Ground (power)
	2B	System mute
	2C	Right input (+)
	2D	Right input (–)
	2E	Left input (+)
	2F	Left input (–)
	2G	Signal ground
	2H	AUX control
	2I	AUX control
	2J	—
	2K	Bus (–)
	2L	Bus (+)
	2M	—
	2N	—
	2O	ACC
	2P	B+

Information display harness

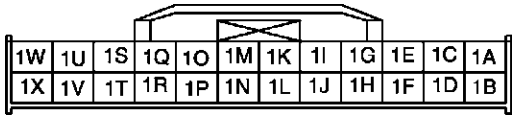
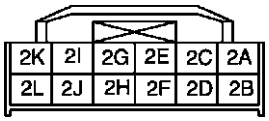
Terminal		Signal
	A	ACC
	B	LCD DRV+
	C	LCD PL+
	D	LCD
	E	Switch check
	F	LCD DATA
	G	LCD AC
	H	LCD RS
	I	LCD CS
	J	LCD CLK
	K	LCD RST
	L	Illumination (+)
	M	Digital ground
	N	Digital ground
	O	Power ground
	P	Power ground

Circuit board (manual A/C only)

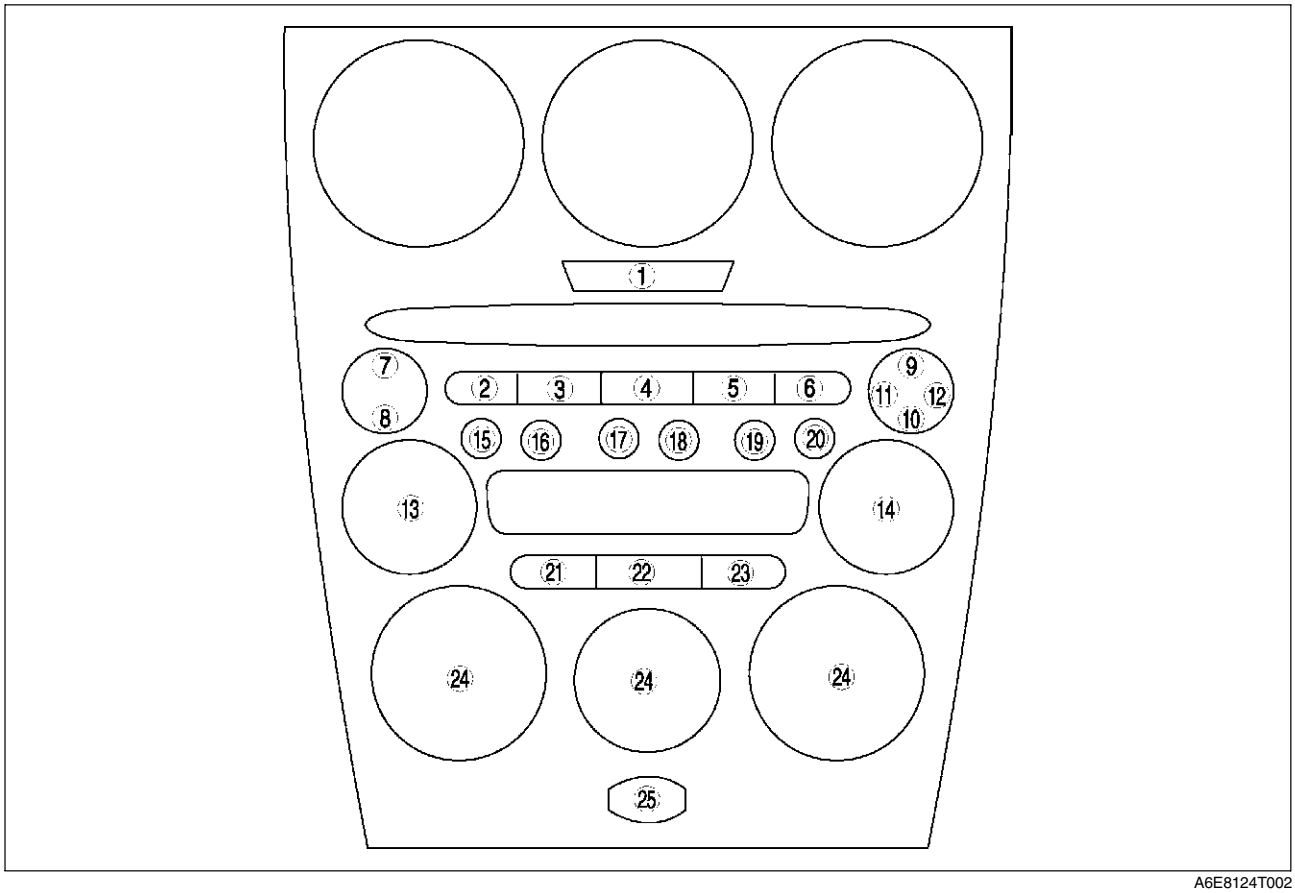
Terminal		Signal
	A	Ground
	B	IG2
	C	Hazard warning ground
	D	Hazard warning switch
	E	Evaporator temperature sensor
	F	A/C ambient temperature sensor
	G	—
	H	Sensor ground
	I	—
	J	Rear window defroster switch
	K	Fan switch
	L	A/C
	M	Air intake actuator drive (FRESHÆRECIRCULATE)
	N	Air intake actuator drive (RECIRCULATE→FRESH)
	O	Rear window defroster relay
	P	—

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Climate control unit (auto A/C only)

Terminal		Signal
	1A	Blower motor feedback
	1B	+5 V
	1C	Blower motor control
	1D	—
	1E	Rear window defroster relay
	1F	On-board diagnostic
	1G	Wiper deicer relay
	1H	—
	1I	Sensor ground
	1J	HNTI
	1K	A/C ambient temperature sensor
	1L	HNTI
	1M	Cabin temperature sensor
	1N	—
	1O	Water temperature sensor
	1P	A/C
	1Q	Evaporator temperature sensor
	1R	—
	1S	Solar radiation sensor
	1T	Hazard warning ground
	1U	Potentiometer (air mix actuator)
	1V	—
	1W	Potentiometer (airflow mode actuator)
	1X	Hazard warning switch
	2A	Panel light control
	2B	TNS
	2C	Air mix actuator drive (HOT→COLD)
	2D	Air mix actuator drive (COLD→HOT)
	2E	Airflow mode actuator drive (VENT→DEFROSTER)
	2F	B+ (Power back up)
	2G	Airflow mode actuator drive (DEFROSTER→VENT)
	2H	IG2
	2I	Air intake actuator drive (FRESH→RECIRCULATE)
	2J	—
	2K	Air intake actuator drive (RECIRCULATE→FRESH)
	2L	Ground

Switch/Button/Indicator light Location



A6E8124T002

No.	Switch/button/light	Related system
1	Hazard warning switch	Hazard warning system
2	FM1 button	Audio system
3	FM2 button	Audio system
4	AM button	Audio system
5	CD button	Audio system
6	TAPE/MD button	Audio system
7	SEEK button (upper) (type A)	Audio system
	SCAN button (type B)	Audio system
8	SEEK button (lower) (type A)	Audio system
	AUTO-M button (type B)	Audio system
9	TA button (type A)	Audio system
	SEEK button (upper) (type B)	Audio system
10	AUTO-M button (type A)	Audio system
	SEEK button (lower) (type B)	Audio system
11	AF button (type A)	Audio system
12	PYT button (type A)	Audio system
13	POWER button (type A)	Audio system
	AUDIO CONT button (type B)	Audio system
14	AUDIO CONT button (type A)	Audio system
	POWER button (type B)	Audio system

No.	Switch/button/light	Related system
15	Preset button “1”	Audio system
16	Preset button “2”	Audio system
17	Preset button “3”	Audio system
18	Preset button “4”	Audio system
19	Preset button “5”	Audio system
20	Preset button “6”	Audio system
21	Rear window defroster switch (auto A/C)	Rear window defroster system
	A/C switch (manual A/C)	Air conditioner system
22	REC/FRESH switch	Air conditioner system
23	A/C switch (auto A/C)	Air conditioner system
	Rear window defroster switch (manual A/C)	Rear window defroster system
24	Climate control unit (See U–13 CLIMATE CONTROL UNIT)	Air conditioner system
25	Passenger-side air bag cut-off indicator light	Air bag system

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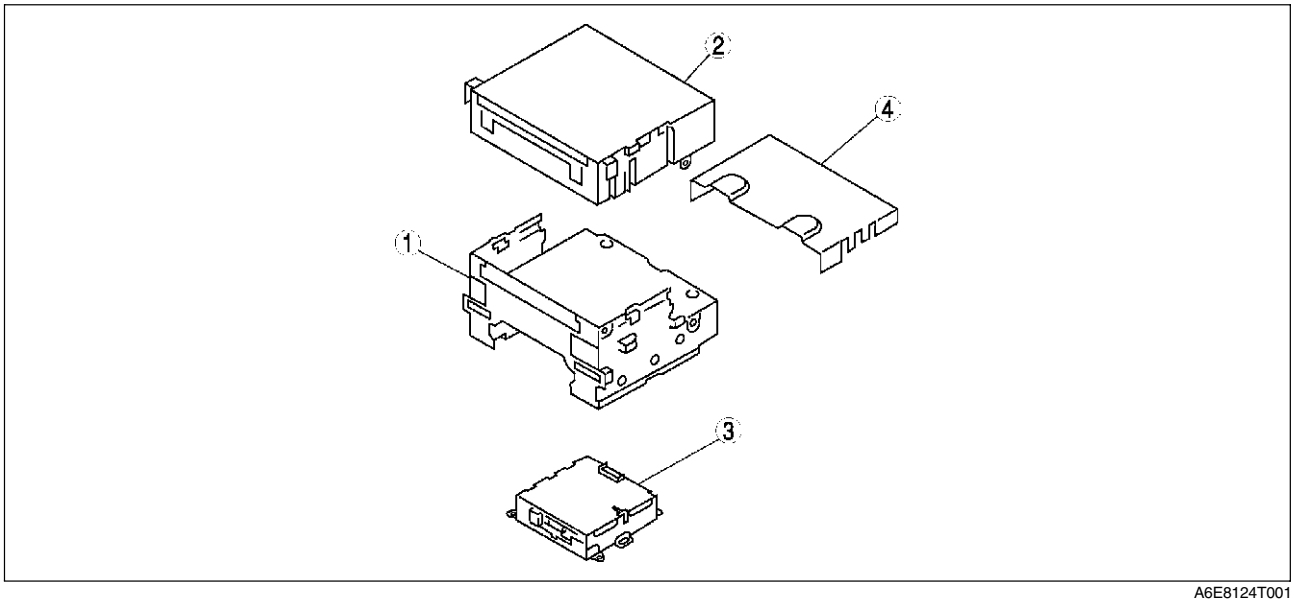
AUDIO UNIT

A6E812466900T02

Outline

- The audio unit is composed of the base unit, upper module, and lower module.
- Upper and lower module availability depends on vehicle grade.
- The construction and operation of upper module and lower module are the same as that of current XEDOS 9, MILLENIA (TA) models.

Structural View



A6E8124T001

1	Base unit
2	Upper module (CD player or CD changer)

3	Lower module (cassette deck or MD player)
4	Cover (without upper module)

Terminal Layout and Signal

- (See T–53 CENTER PANEL MODULE.)

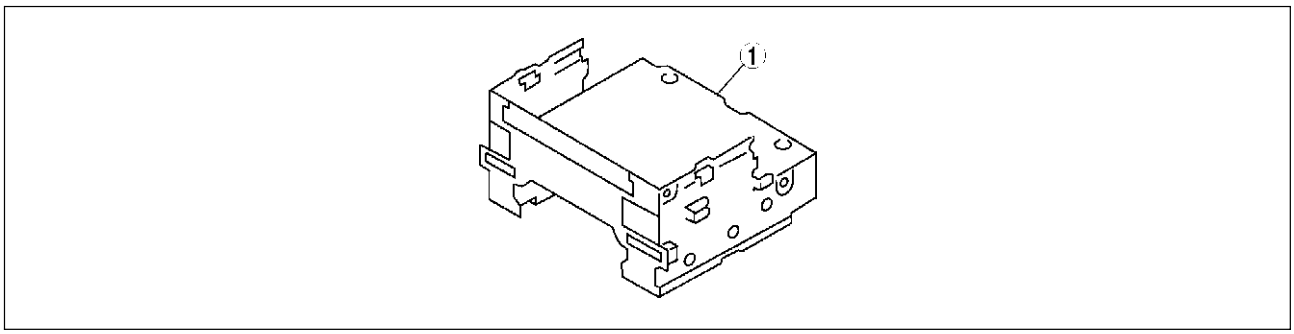
BASE UNIT

A6E812466900T03

Outline

- The base unit controls the AM/FM tuner, upper/lower modules, and externally extended unit (e.g. CD changer).
- An auto level control (ALC) function that controls speaker volume according to vehicle speed has been adopted.
- For drive information system (DIS) equipped vehicles, a CAN communication control circuit is included in the base unit. The base unit receives, using the CAN system, the DIS display signal from the instrument cluster, and converts it to a signal sent to the information display. (See T–40 DRIVE INFORMATION SYSTEM)

Structural View



A6E8124T003

1	Base unit

AUTO LEVEL CONTROL (ALC) FUNCTION

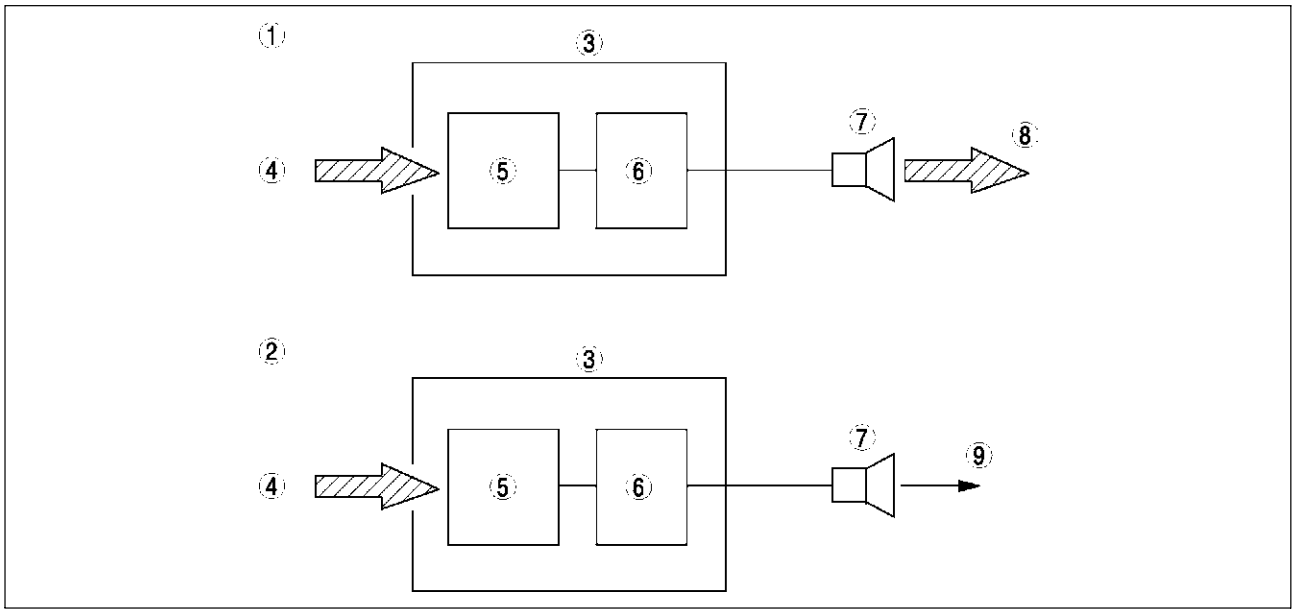
A6E812466900T04

Function

- Adjusts the audio volume so that the sound is balanced against wind and road noise while driving.

Operation

- The audio unit changes the volume automatically based on the vehicle speed signal sent from the instrument cluster.



A6E8124T021

1	Higher vehicle speed
2	Lower vehicle speed
3	Audio unit (base unit)
4	Vehicle speed signal
5	ALC circuit

6	Power amplifier
7	Speaker
8	Higher volume
9	Normal volume

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- The ALC function is divided into four modes, and can be used effectively to match the driving conditions.

Mode	Condition
ALC OFF	ALC function cancel
ALC LEVEL1	Outside road noise low
ALC LEVEL2	Outside road noise rather high
ALC LEVEL3	Outside road noise high

ON-BOARD DIAGNOSTIC SYSTEM (AUDIO SYSTEM)

A6E812466900T05

Outline

- The on-board diagnostic system has a self-diagnostic function and diagnostic assist function to help technicians locate malfunctions.

Self-diagnostic Function

Malfunction detection function

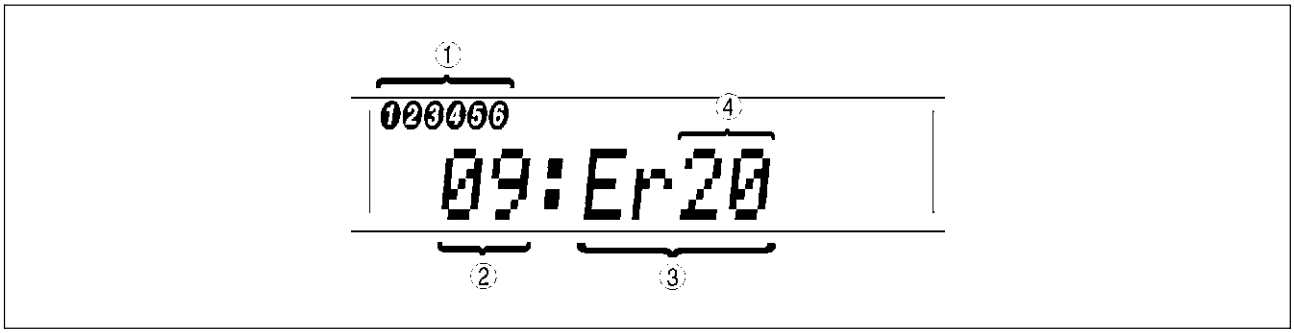
- The malfunction detection section detects malfunctions occurring in the system.

Memory function

- The memory function detects a malfunction, changes it to a DTC, and stores it in the memory. The memory can store a maximum of three DTCs. If another malfunction is detected when three DTCs are already stored, the memory function clears the oldest DTC and stores the new one.
- Once a DTC is stored, it can only be cleared by the designated procedure; not by turning the ignition switch to the LOCK position or disconnecting the negative battery cable. The procedure is mentioned in the Service Section.

Display function

- When the self-diagnostic function is activated, the information display displays the DTC stored in the memory.
- The DTC consists of the following codes and numbers:
  - — Part number (indicates malfunctioning part)
  - — Error code (indicates malfunction description)
  - — Manufacture code (indicates manufacturer)
- Refer to the Service Section for the display method.



A6E8124T008

1	Supplier code
2	Part number

3	DTC
4	Error code

Supplier code	Supplier name
1	FMS Audio
2	Panasonic
3	Clarion

Parts number	Parts name
00	Cassette deck (lower module)
03	CD player (upper module)
05	CD changer (external type)
06	CD changer (upper module)
07	MD player (lower module)
09	Base unit

Error code	Malfunction description
01	Internal mechanism error
02	Servo mechanism error
03	Mechanism stuck
07	Disc reading error
10	BUS line (communication line) error
20	Insufficient power supply
22	Tuner error

Screen display		Malfunction location
DTC	Output signal	
09:Er22	—	Base unit (peripheral circuit)
09:Er20	—	Power supply circuit of base unit
00:Er10	—	Cassette deck—base unit communication line
03:Er10	—	CD player—base unit communication line
05:Er10	—	CD changer (external type)—base unit communication line
06:Er10	—	CD changer (upper module)—base unit communication line
07:Er10	—	MD player—base unit communication line
03:Er01	—	CD player
03:Er02	CHECK*1 CD*2	CD player
03:Er07	CHECK*1 CD*2	CD player
00:Er01	—	Cassette deck
00:Er03	—	Cassette deck
00:Er04	CHECK*1 TAPE*2	Cassette tape
05:Er01	—	CD changer (external type)
05:Er07	CHECK*1 CD*2	CD changer (external type)
06:Er01	—	CD changer (upper module)
06:Er02	CHECK*1 CD*2	CD changer (upper module)
06:Er07	CHECK*1 CD*2	CD changer (upper module)
07:Er01	—	MD player
07:Er02	CHECK*1 MD*2	MD player
07:Er07	CHECK*1 MD*2	MD player
NO Err	—	No stored DTCs

*1,*2:When an error occurs, the error messages are displayed three times in the order of *1 and *2, respectively.

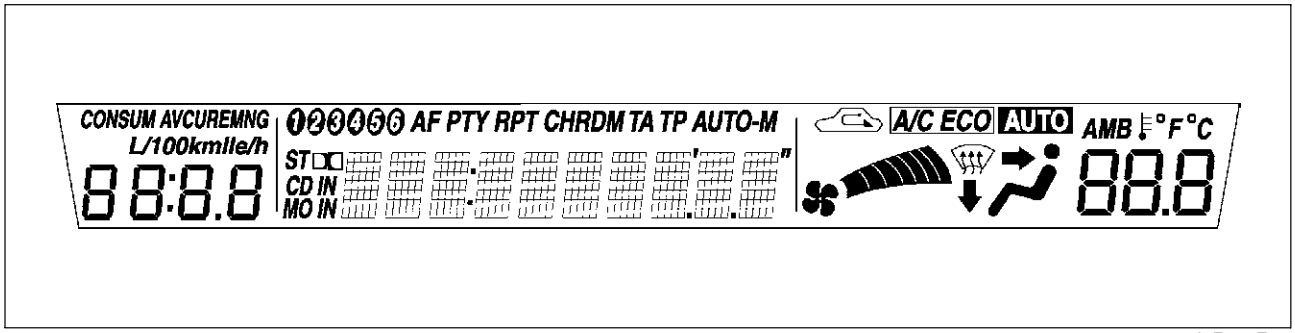
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Diagnostic Assist Function

- The diagnostic assist function displays the operating condition of the following functions (components) and forces them to operate in order to examine whether they are malfunctioning or not.
- For the start procedure of each mode, refer to the Service Section.

LCD

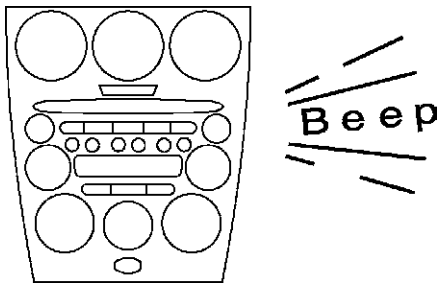
- The diagnostic assist function illuminates all characters in the LCD to check for truncated or faint characters.



A6E8124T009

Switch

- The diagnostic assist function sounds the buzzer when the switches are pressed to check the switches.



A6E8124T010

Speaker

- The diagnostic assist function outputs sound to the speakers in the following order to determine condition of the speakers and wiring harness between the base unit and each speaker.
  1. Left door speaker and tweeter
  2. Right door speaker and tweeter
  3. Right rear door speaker and woofer
  4. Left rear door speaker and woofer

Radio

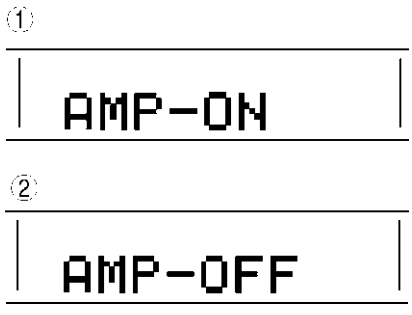
- The diagnostic assist function displays the radio reception condition to determine condition of the antenna, antenna feeders, and base unit (tuner).



A6E8124T011

Audio amplifier (external)

- The diagnostic assist function displays the output state of the audio amplifier operating signal to determine condition of the audio amplifier, base unit, and wiring harness between the base unit and audio amplifier.



A6E8124T012

1	Audio amplifier operating signal is output

2	Audio amplifier operating signal is not output

OUTLINE (CAR-NAVIGATION SYSTEM)

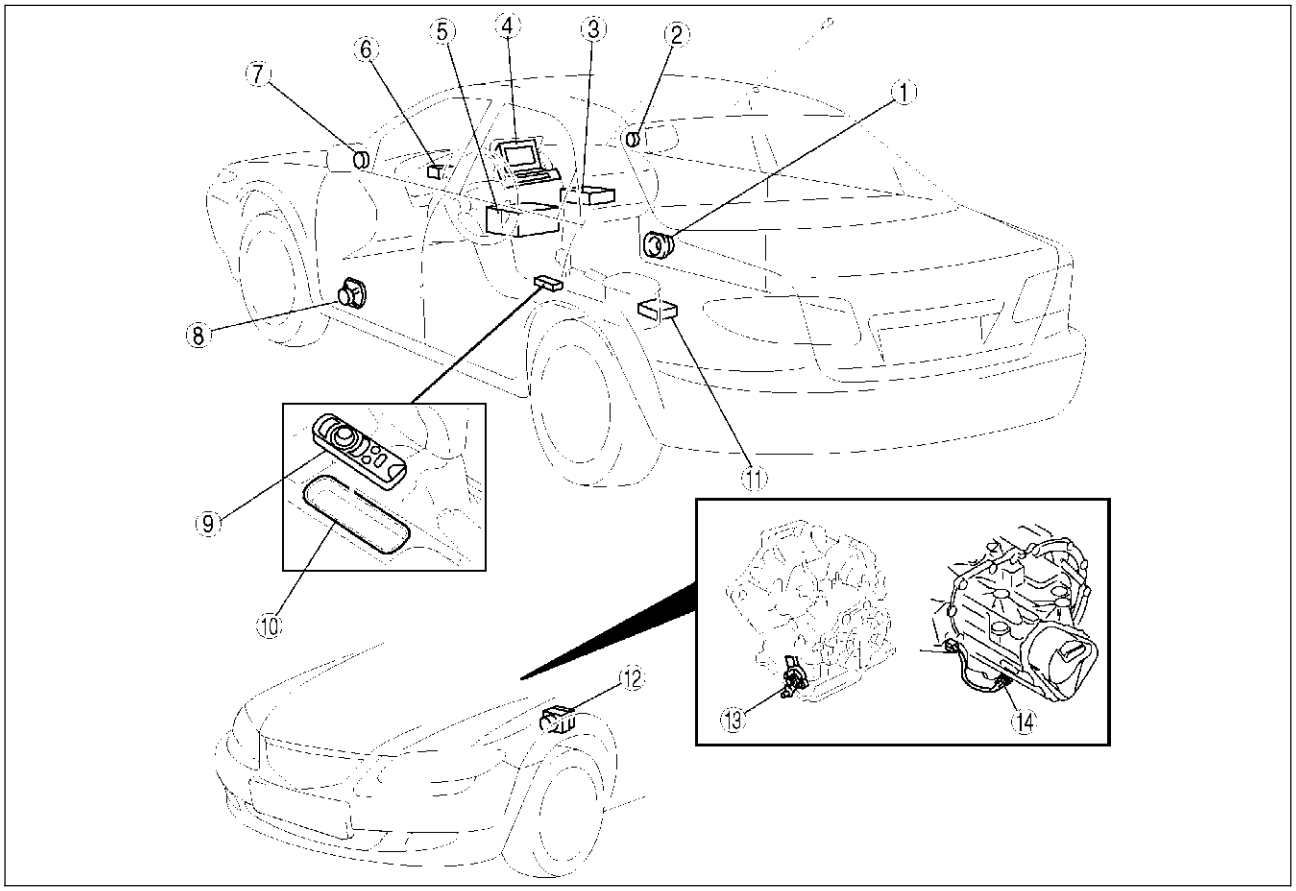
A6E812466000T01

- A 7 inch wide, pop-up LCD (*TFT) has been adopted to improve marketability.
- A hybrid incar-navigation system and map-matching function has been adopted to improve accuracy of detection of the vehicle's position.
- A remote control with an infrared transmitter has been adopted to improve operational ability.
- The languages and voices available for use with the car-navigation unit include English, French, German, Dutch, Spanish, and Italian. However, the language used in this manual is in **English only**.
- The following parts and position detecting functions are the same as those of the XEDOS 9/MILLENIA (TA) model. (See XEDOS 9/Mazda MILLENIA Workshop Manual Supplement 1694-1*-00H.)
  - — GPS antenna
  - — Gyro sensor
  - — Autonomous navigation function
  - — GPS navigation function
  - — Map matching function

*TFT: Thin Film Transistor

STRUCTURAL VIEW (CAR-NAVIGATION SYSTEM)

A6E812466000T02



A6E8126T050

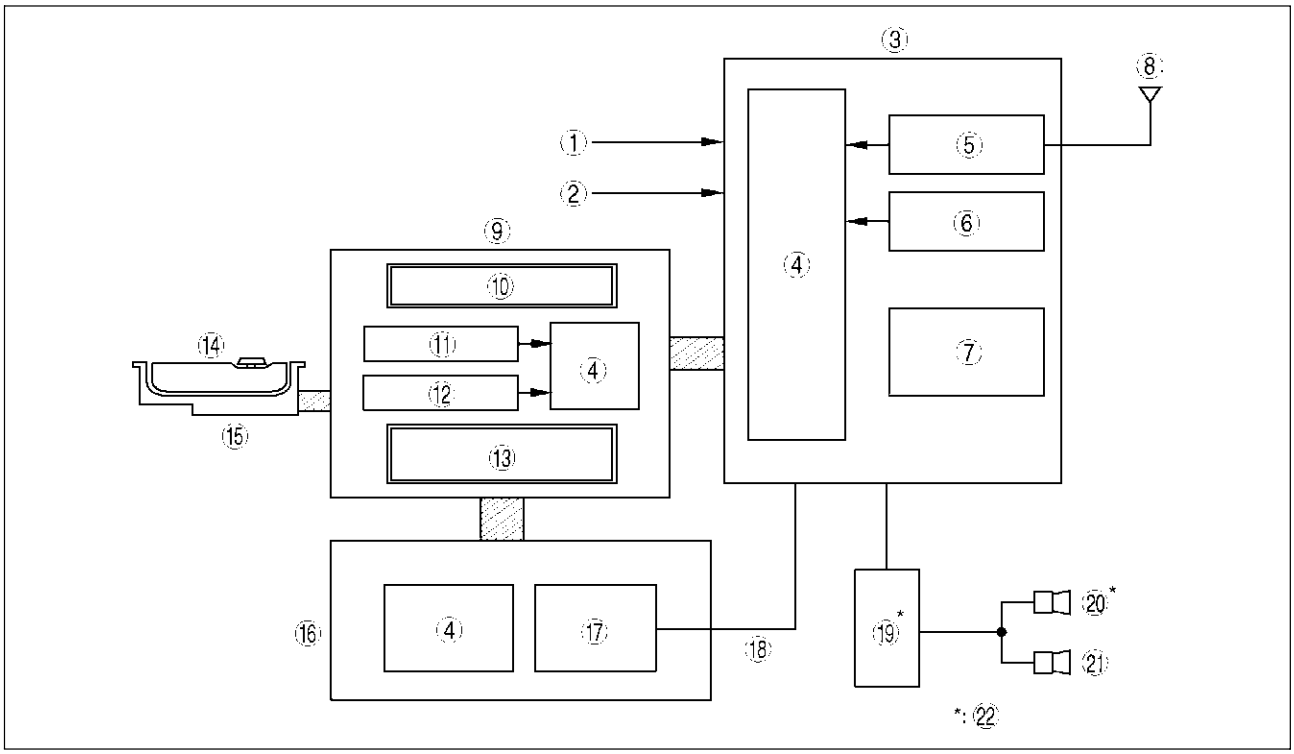
1	Front door speaker (right)
2	Tweeter (right) (BOSE)
3	Car-navigation unit
4	LCD unit
5	Audio unit
6	GPS antenna
7	Tweeter (left) (BOSE)

8	Front door speaker (left)
9	Remote control
10	Cradle
11	Audio amplifier (BOSE)
12	DSC HU/CM (with DSC) or ABS/TCS HU/CM (with ABS/TCS)
13	TR switch (ATX)
14	Back-up light switch (MTX)

T

BLOCK DIAGRAM (CAR-NAVIGATION SYSTEM)

A6E812466000T03



A6E8126T051

1	DSC HU/CM (with DSC) or ABS/TCS HU/CM (with ABS/TCS) (vehicle speed signal)
2	TR switch (ATX) or back-up light switch (MTX) (R-range signal)
3	Car-navigation unit
4	CPU
5	GPS receiver
6	Gyro sensor
7	DVD driver
8	GPS antenna
9	LCD unit
10	LCD

11	TILT switch
12	OPEN/CLOSE switch
13	Information display
14	Remote control
15	Cradle
16	Audio unit
17	Power amplifier
18	Driver side only
19	Audio amplifier
20	Tweeter (driver side)
21	Front door speaker (driver side)
22	BOSE system only

SPECIFICATIONS (CAR-NAVIGATION SYSTEM)

A6E812466000T04

Car-navigation Unit

Item		Specification
Unit type		Stand alone
Rated voltage	(V)	12
ROM type		DVD-ROM
Output impedance	(ohm)	Standard: 4, BOSE: 4.7
Voice guidance output power	(W)	5

LCD Unit

Item			Specification
Unit type			Pop-up
Rated voltage		(V)	12
Display (for car-navigation system)	Size	(inch)	7 (wide)
	Type		TFT (Thin Film Transistor); Full-color
Display (for audio, DIS and A/C)	Type		LCD; Amber-color

Speaker

- Refer to audio system. (See T–52 SPECIFICATIONS (AUDIO SYSTEM).)

COMPONENT PART AND FUNCTIONS

A6E812466000T05

Item	Function
Car-navigation unit	• Reads the data (map,voice and other) from the DVD-ROM. • Calculates and displays the vehicle's position from various signals. • Calculates the route to the destination. • Navigates the driver to the destination using the map screen and/or the voice. **Note** • DVD audio and video are not supported by this system. • This unit does not support all Video CD and CD formats.
LCD unit	• Displays the screen (menus, maps and other screens) by remote control operation. • Displays the status of audio, DIS and A/C by button operation on the information display.
GPS antenna	• Receives GPS signal from satellites.
Gyro sensor (inside of the car-navigation unit)	• Sends yaw-rate signal to the CPU in the car-navigation unit.
TR switch (ATX) or back-up light switch (MTX)	• Sends R-range or reverse signal to the car-navigation unit.
DSC unit (with DSC) or ABS/TCS HU/CM (with ABS/TCS)	• Sends vehicle speed signal to the car-navigation unit by CAN system.
Front speaker and tweeter (driver side)	• Outputs voice and audio sound.
DVD-ROM (inside of the car-navigation unit)	• Map information data of each country is recorded. • Voice data used to guide the route is recorded. • Route information data to search for the route is recorded.
Remote control	• Changes display screens, settings etc., by button operation.
Cradle	• Provides power source (B+, TNS) for remote control. • Sends remote control signal to the car-navigation unit.

CAR-NAVIGATION UNIT

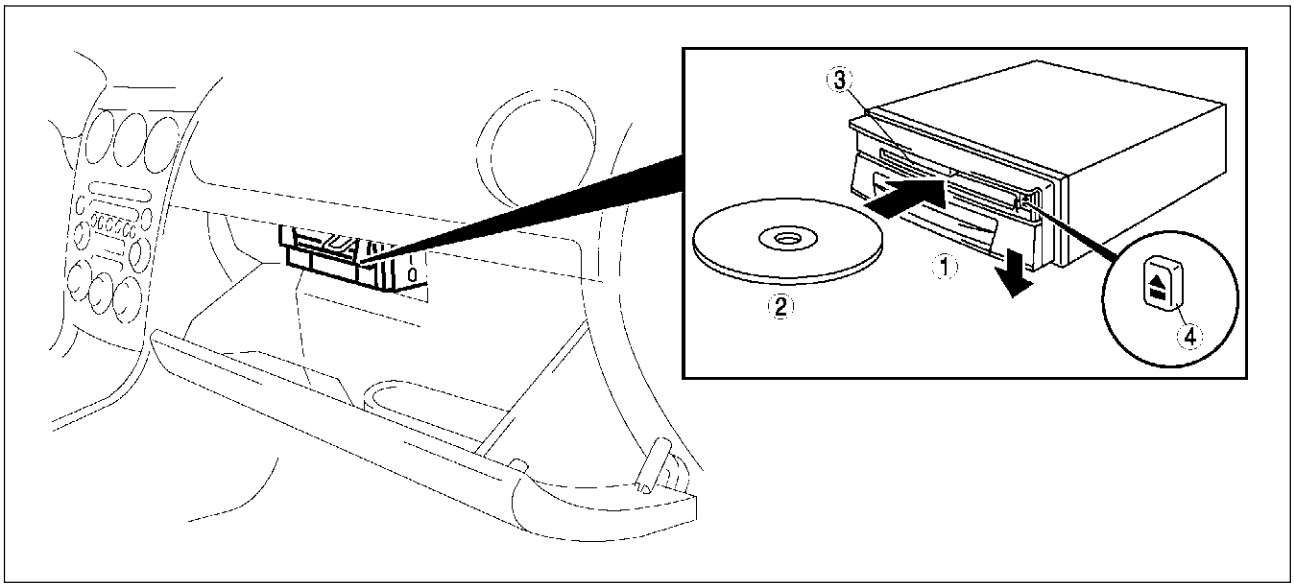
A6E812466902T01

Outline

- Using exterior signal input and DVD-ROM information, this unit detects vehicle position, provides destination route guidance, and displays color maps.

Structure

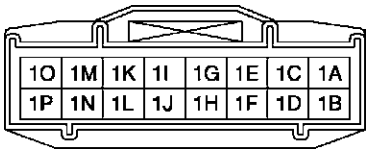
- The car-navigation unit is located in the glove compartment.
- An Eject button, to eject the DVD-ROM from the loading slot, is included in the unit.
- A gyro sensor which detects vehicle cornering angle is built into the unit.

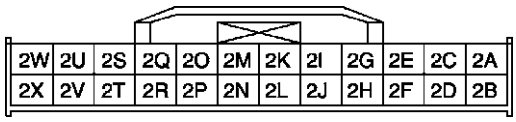


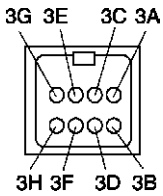
A6E8126T052

1	Car-navigation unit	3	DVD-ROM loading slot
2	DVD-ROM	4	[EJECT] button

Terminal Layout and Signals

Terminal		Signals
		16-pin connector
	1A	GND
	1B	B+
	1C	–
	1D	ACC
	1E	PR front speaker input (-)
	1F	Illumination (-)
	1G	PR front speaker input (+)
	1H	Vehicle speed
	1I	PR front speaker output (-)
	1J	Parking brake switch
	1K	PR front speaker output (+)
	1L	R-range
	1M	Front speaker output (-)
	1N	Front speaker output (+)
	1O	Front speaker input (-)
	1P	Front speaker input (+)

Terminal		Signals
		24-pin connector
	2A	–
	2B	–
	2C	–
	2D	–
	2E	–
	2F	–
	2G	–
	2H	–
	2I	–
	2J	–
	2K	–
	2L	–
	2M	–
	2N	Monitor serial input
	2O	Shield GND
	2P	Monitor serial output
	2Q	Shield GND
	2R	Video (composite sync)
	2S	–
	2T	Video (B)
	2U	Video GND
	2V	Video (G)
	2W	–
	2X	Video (R)

Terminal		Signals
		8-pin connector (for extended function)
	3A	–
	3B	Serial output
	3C	–
	3D	Serial input
	3E	Power
	3F	Reset
	3G	B+
	3H	GND

Terminal		Signal
		1-pin connector
	4A	GPS antenna input

LCD UNIT

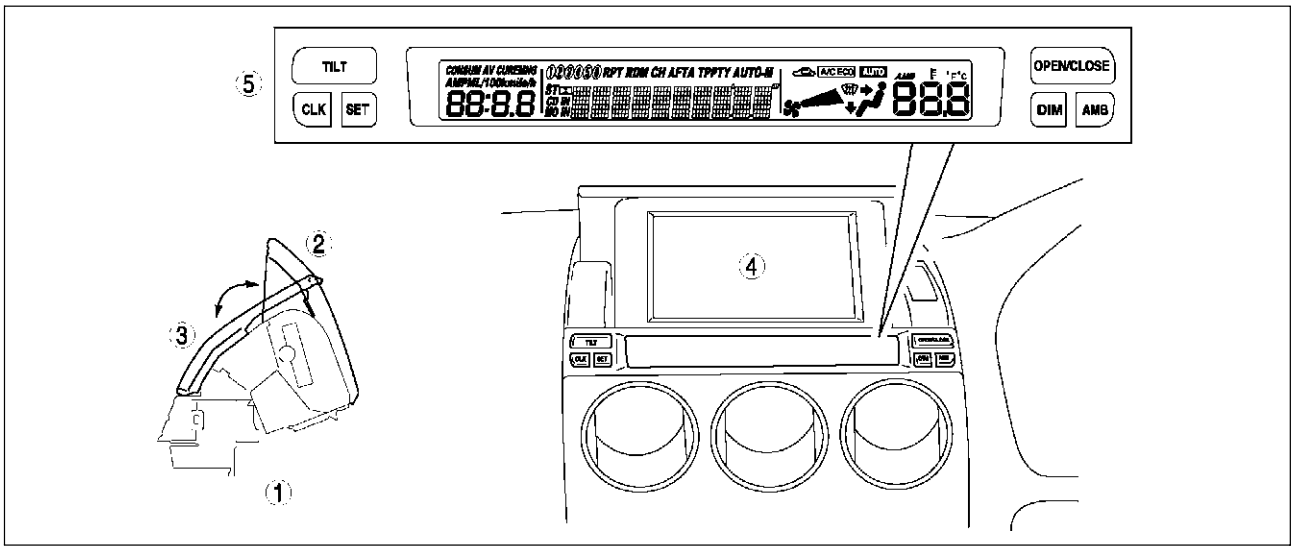
A6E812466902T02

Outline

- The car-navigation system LCD and the information display are incorporated into one unit. Based on signals from the car-navigation unit and remote control, the LCD displays navigational information. Based on signals from a specialized systems (audio, DIS and A/C) module, the LCD displays information about these systems
- The LCD unit senses the user operations from the remote control and sends a signal to the car-navigation unit.

Structure

- An LCD unit, located in the upper-center part of the dashboard to improve visibility, has been adopted.
- A pop-up LCD, controlled by an [OPEN/CLOSE] switch, has been adopted.
- The angle of the display screen can be adjusted in stages using the [TILT] switch.
- The audio, DIS and A/C information display is located on the lower portion of the unit. (See T–40 DRIVE INFORMATION SYSTEM.)

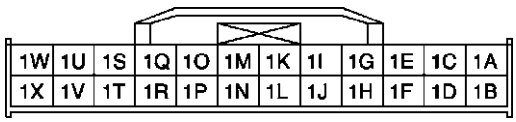


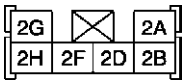
A6E8126T060

1	LCD unit
2	Open
3	Close

4	LCD for car-navigation system
5	Information display

Terminal Layout and Signals

Terminal		Signals
		24-pin connector
	1A	Video (B)
	1B	Video (G)
	1C	Video (composite sync)
	1D	Video (R)
	1E	Video GND
	1F	–
	1G	Shield GND
	1H	–
	1I	Monitor serial output
	1J	–
	1K	Monitor serial input
	1L	–
	1M	Control illumination
	1N	–
	1O	ACC
	1P	GND
	1Q	B+
	1R	–
	1S	Shield GND
	1T	R-range
	1U	UART2
	1V	Illumination
	1W	UART1
	1X	–

Terminal		Signals
		6-pin connector
	2A	Remote-data
	2B	Power
	2D	Shield GND
	2F	–
	2G	GND
	2H	Illumination

Terminal		Signal
		1-pin connector
	3A	GND

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REMOTE CONTROL AND CRADLE

A6E812400174T01

Outline

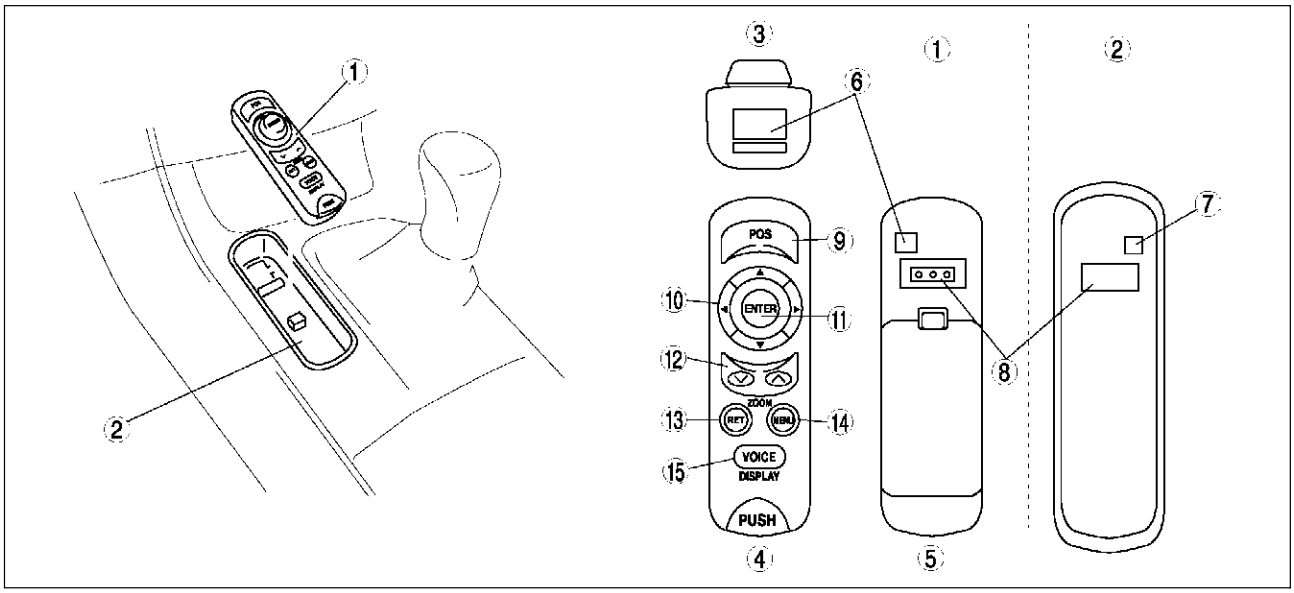
- A remote control for the car-navigation system, with simplified design for easy operation, has been adopted.
- A cradle to hold the remote control has been adopted.

Structure

- The remote control and cradle are located on the console.
- The buttons and joystick for controlling car-navigation are located on the top side of the remote control. The infrared transmitter sends signals through a terminal on the front and back of the remote control.
- An infrared sensor that receives signals from the remote control is located on the cradle. The received signals are sent to the LCD unit.
- The remote control uses the batteries as a power source when not in the cradle and uses the power supply connector when set in the cradle. (Ignition switch at ACC or ON position)

Note

- The batteries are not charged when the remote control is in the cradle.



A6E8126T061

1	Remote control
2	Cradle
3	Front view
4	Top view

5	Underside view
6	Infrared transmitter
7	Infrared sensor
8	Power supply connector

No.	Button (component)	Function
9	[POS (Position)] button	Displays the current position.
10	Joystick	Selects items by tilting it up, down, right and left.
11	[ENTER] button	Executes a selected item.
12	[ZOOM] button	Changes the map scale.
13	[RET] button	Returns to the previous screen.
14	[MENU] button	Select a menu.
15	[VOICE] button	Initiates vocal guidance for route maneuvers.

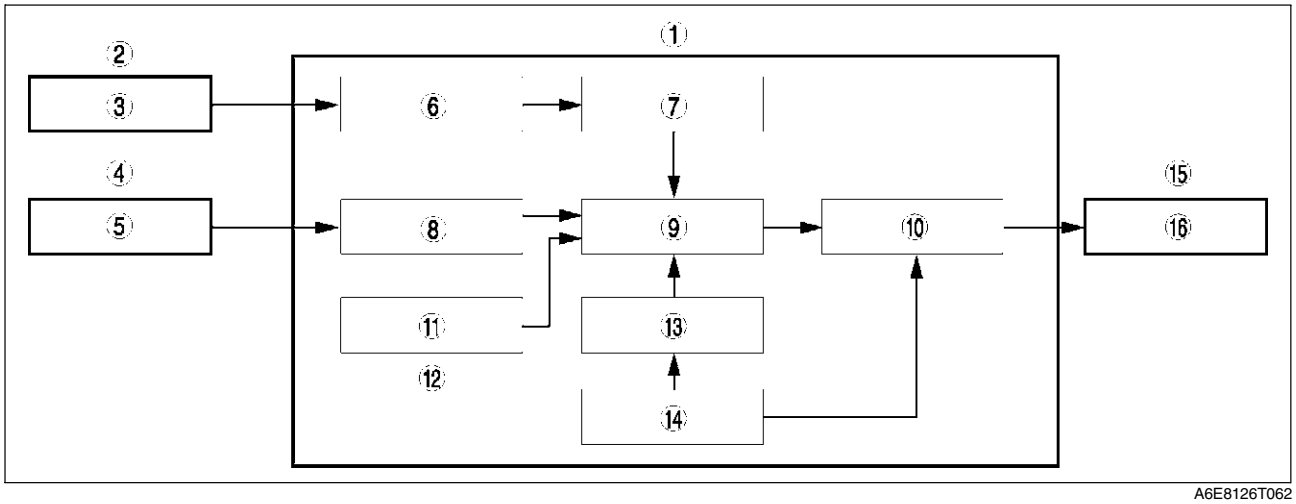
NAVIGATION FUNCTION

A6E812466000T06

Outline

- A vehicle's position is measured by a hybrid method of autonomous navigation (using yaw-rate signals from the gyro sensor and vehicle speed signals from the DSC unit (with DSC) or ABS/TCS HU/CM (with ABS/TCS) and GPS navigation (using signals from GPS satellites). Accurate detection of the vehicle's position is possible based on the adoption of a map-matching function which specifies the vehicle's position as compared with the map data read from the DVD-ROM and the vehicle's position measured from autonomous navigation and GPS navigation.
- Guidance to destination is provided via display of the recommended route on the map screen, as well as voice messaging guidance at intersections and points of divergence.
- Based on inputted signals and information on the DVD-ROM, the following features are available:
  - — Destination can be selected based on address, intersection, POI (Point of Interest), history, memory or map.
  - — Route information is available in map and guide mode.
  - — Voice guidance and menus are available in six languages.
  - — A map screen that displays maps in twelve steps with scales from 100m to 500km.
  - — A map screen that displays routes according to Shortest Route and Avoid Motorway functions.
  - — A detour function which provides three routes to select from based on streets selected to avoid, up to five via points and calculation of set detour distance.
  - — A wide variety of preferential settings are available.

Block Diagram



A6E8126T062

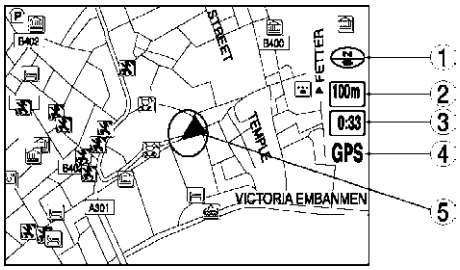
1	Car-navigation unit
2	GPS antenna
3	Signal from satellite
4	DSC unit (with DSC) or ABS/TCS HU/CM (with ABS/TCS)
5	Vehicle speed signal
6	Detection of current measured position
7	Correction by GPS
8	Detection of vehicle travel distance

9	Detection of vehicle's position
10	Map matching
11	Yaw-rate signal
12	Gyro sensor
13	Map data
14	DVD-ROM
15	LCD unit
16	Display

T

Map Screen Selection
Current position map

- The location of the vehicle and surrounding area are shown.
- By pressing the [POS] button, the display switches to guide mode. (Only while in route guidance.)



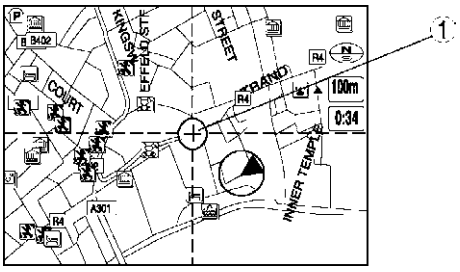
A6E8126T063

1	Map orientation
2	Map scale
3	Clock

4	GPS reception indicator • Lights up when receiving signals from 3 or more satellites.
5	Vehicle position

Scroll map mode

- The scroll map is displayed when operating the joystick on the current position map.
- This map can be scrolled with the crosshair cursor.
- By moving the crosshair cursor to a road and pressing [ENTER] button, the road name is displayed on the screen.

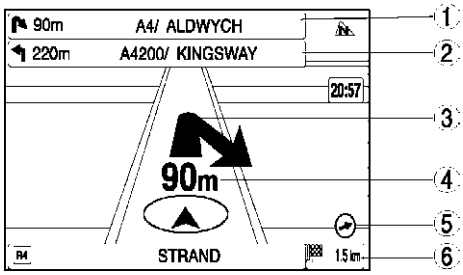


A6E8126T066

1	Crosshair cursor

Guide mode

- Displays an enlarged view of the road using an arrow to indicate destination, and also displays route and destination guidance information. (While in route guidance)
- By pressing the [POS] button, the display switches to the current position map.



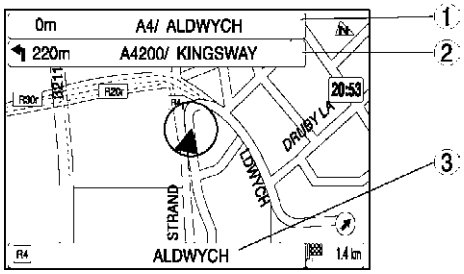
A6E8126T064

1	Distance to the next turn
2	Distance to the turn after the next turn
3	Arrow guidance for the next turn

4	Distance to the next turn
5	Destination direction
6	Destination distance

Intersection zoom map

- An enlarged map is displayed when approaching a roundabout or intersection. (While in route guidance.) Activated by selecting Zoom (On) in setup mode.



A6E8126T065

1	Distance to the next turn
2	Distance to the turn after the next turn

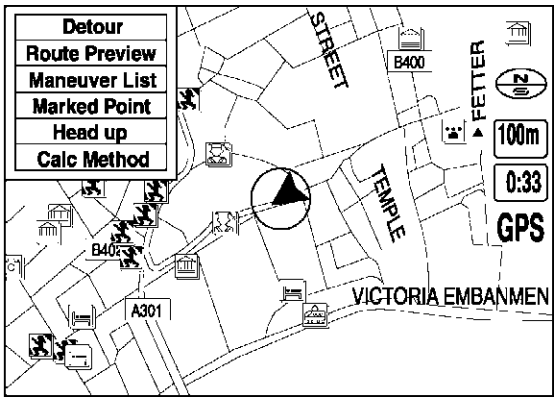
3	Current road name

Pop Up Menu

- Pop up menu appears when pressing [ENTER] button.
- The following items are displayed on the pop-up menu. The actual displayed items vary according to the selected map, guidance, and other factors.

Note

- Pop up menu is not available on intersection zoom maps.
- Pop up menu cannot be displayed when the intersection zoom map is displayed.

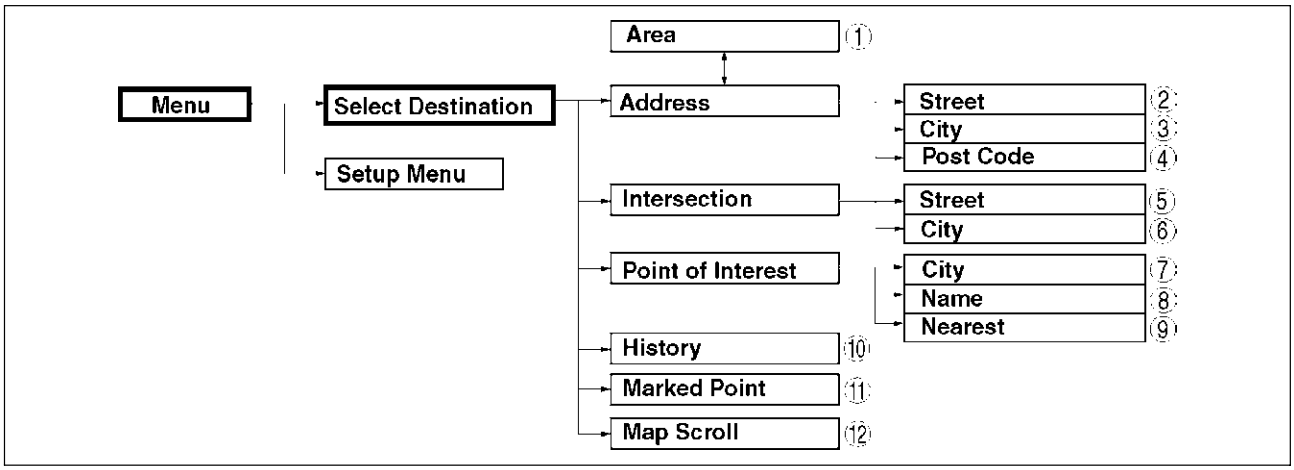


A6E8126T079

No.	Contents	Description
1	Detour	Displays route change options. (See T–76 Detour function.)
2	Route Preview	Displays complete route preview.
3	Maneuver List	Displays a route list.
4	Marked Point	Registers a point indicated by the crosshair cursor.
5	North up/Head up	Selects either north up or head up map display direction.
6	Stop Calc	Cancels route search.
7	Reroute	Searches for another route to return to the original route when the vehicle has moved away from it. (Appears only when the auto reroute function is inactivated. See T–76 Setup Function.)
8	Calc Method	Changes route search settings. (See T–75 Whole route search function.)
9	Volume	Adjusts volume of voice guidance.
10	Guidance Off	Selects/cancels voice guidance.
11	Destination	Registers a point indicated by the crosshair cursor as a destination.
12	Nearest POI	Searches for POI's close to current location of the vehicle.

Destination Setting Function
Outline
- The following instructions explain how destinations can be chosen and set.

Note
- A destination can be set to where the crosshair cursor indicates by selecting the Destination option of the scroll map mode pop-menu.



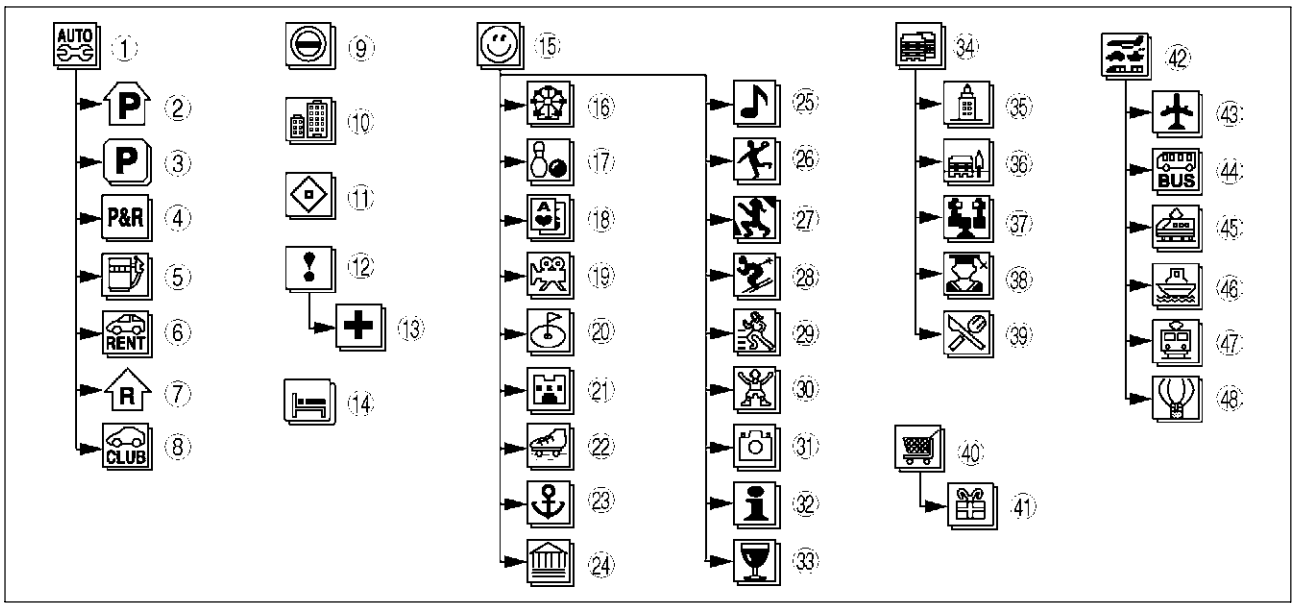
A6E8126T069

No.	Contents
1	Changes area set from the previous destination.
2	Sets destination by selecting city name*, inputting street name and selecting house number.
3	Sets destination by inputting city name*, inputting street name and selecting house number.
4	Sets destination by inputting postal code and street name, and selecting house number.
5	Sets intersection as destination by inputting main street name → cross street names.
6	Sets intersection as destination by inputting city name → main street name → cross street names.
7	Sets destination by selecting POI category, inputting city name and selecting POI.
8	Sets destination by selecting POI category, inputting target name and selecting POI.
9	Sets destination from a list of 20 POI destinations closest to the current position (within a radius of 50 km) by inputting POI category and selecting POI.
10	Sets destination from a list of recent destinations. Up to 50 points including the latest starting point are in the system memory.
11	Sets destination from a list of points stored by the user. Up to 100 points can be stored in the memory.
12	Sets destination by moving the crosshair cursor to the destination when in scroll map mode.

* : Memory stores up to 10 cities visited recently, and city names can be selected.

POI categories

- When setting POI destination, the following categories can be selected. Data for categories according to the selected country will be displayed.



A6E8126T067

1	Auto services
2	Parking garage
3	Open parking area
4	Park & Ride
5	Petrol station
6	Rent a car facility
7	Rest area
8	Motoring organization office
9	Border crossing
10	Business facility
11	City center
12	Emergency
13	Hospital/Polyclinic
14	Hotel or motel
15	Leisure/Recreation
16	Amusement park
17	Bowling center
18	Casino
19	Cinema
20	Golf course
21	Historical monument
22	Ice skating rink
23	Marina
24	Museum

25	Night life
26	Recreation facility
27	Theater
28	Ski resort
29	Sports activity
30	Sports center
31	Tourist attraction
32	Tourist office
33	Winery
34	Public facility
35	City hall
36	Community center
37	Exhibition or conference center
38	University or college
39	Restaurant
40	Shopping
41	Shopping center
42	Transportation
43	Airport
44	Bus station
45	Commuter rail station
46	Ferry terminal
47	Rail way station
48	Public sport airport

Route Search Function

Whole route search function

- After setting a destination, the following route search methods can be used:

No.	Items	Route search method
1	Shortest route setting	• Selects a route according to the shortest distance.
2	Avoid motorway setting	• Selects a route that reduces use of motorways.

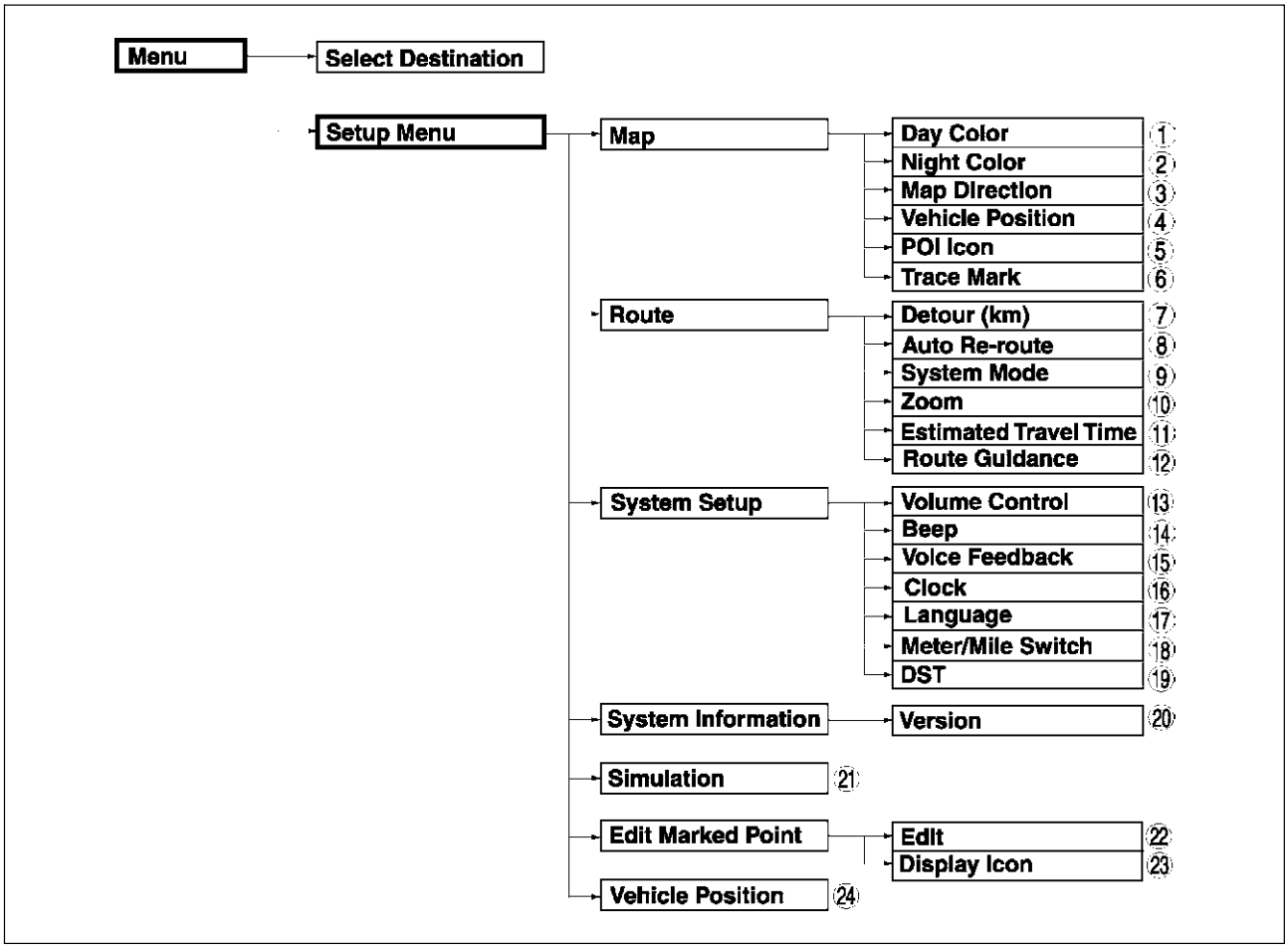
Detour function

- The following settings are available when using the detour function:

No.	Items	Contents
1	Alt route setting	• Searches for a maximum of three routes.
2	Detour distance (xx km) setting	• Calculates a detour for the current route based on inputted (xx km) detour distance. • Detour distance (xx km) is designated in setup (route).
3	Avoid streets setting	• Calculates a detour for the current route to avoid user selected streets.
4	Via point setting	• Selects via points. • Up to five points can be set.

Setup Function

- Map, route and system settings can be changed using this function. Also, system information and route simulation can be displayed.



A6E8126T070

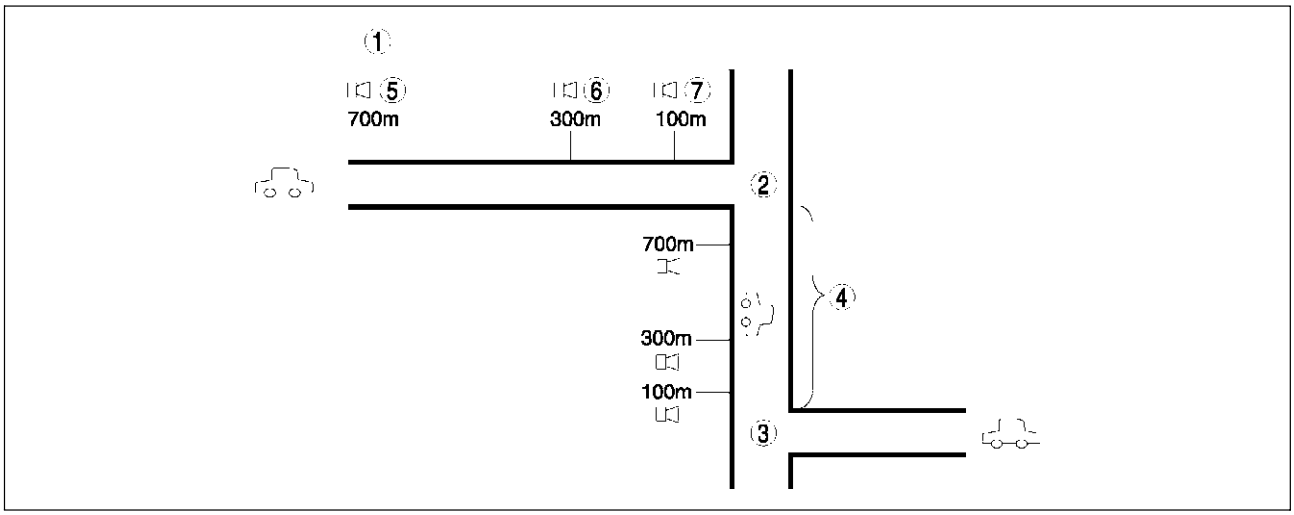
No.	Contents	Selected items	Default
1	Sets map screen color (daytime).	Green, Beige, Black	Beige
2	Sets map screen color (nighttime).	Green, Beige, Black	Beige
3	Sets map direction.	North up, Head up	North up
4	Sets display of the vehicle position indicator on the map screen.	Center: The current vehicle position indicator is displayed in the center of the screen. Off Ctr: The current vehicle position indicator is displayed at the bottom of the screen.	Center
5	Selects/cancels display of the POI icons on the map screen.	On (Icons displayed), Off (Icons not displayed)	On
6	Selects/cancels display of the traced route mark on the map screen.	On (Mark displayed), Off (Mark not displayed)	Off
7	Sets the detour distance for the detour xx km function. If mile are selected in the meter/mile setting, then the distance will be in miles.	1, 2, 5, 10, 20	5
8	Selects/cancels automatic activation of auto re-route function.	On (Automatically activated), Off (Not automatically activated)	On
9	Selects map mode/guide map mode after start-up and route calculation. Guide map mode is displayed only while vehicle is on set route.	Map (Map screen), Guide (Guide mode)	Map
10	Selects/cancels automatic display of intersection zoom map.	On (Automatically displayed), Off (Not automatically displayed)	On
11	Selects/cancels voice guidance announcement of estimated travel time.	On (Makes announcement), Off (No announcement)	On
12	Selects/cancels route guidance. The route will not be deleted if route guidance is disabled.	On (Route guidance enabled), Off (Route guidance disabled)	On
13	Adjusts volume for voice guidance.	0, 1, 2, 3, 4,	2
14	Selects/cancels beeping sound when pressing buttons.	On (Emits beep), Off (No beep)	On
15	Selects/cancels voice guidance.	On (Voice guidance enabled), Off (Voice guidance disabled)	On
16	Selects/cancels display of the clock.	On (Displayed), Off (Not displayed)	Off
17	Sets language used.	GB (English), FRE (French), GER (German), ITA (Italian), SPA (Spanish), DUT (Dutch)	GB
18	Sets unit of measurement used.	Metric (Meters), Imperial (Miles)	Metric
19	Selects/cancels daylight saving time mode.	On (enabled), Off (Disabled)	On
20	Displays map disc and software version/information.	–	–
21	Performs a simulation of a route, after Route setup, from starting point to destination.	–	–
22	Displays detailed information about a marked point from the stored list. The icon and name can be changed, or the marked point can be deleted.	–	–
23	Selects/cancels display of icons on the map.	On (Icons displayed), Off (Icons not displayed)	On
24	Adjusts position and direction of the vehicle on the map display.	–	

Guidance Function

- When using route guidance, the map displays and the system voice announces upcoming intersections, highway entrances/ exits, destination information, and passing via points.
- The types of voice guidance are as follows:
  - — Normal intersection guidance
  - — Roundabout guidance
  - — Highway entrance guidance
  - — Destination guidance
  - — Via point guidance.
  - — Highway exit guidance

Simple junction guidance

- The following voice guidance is provided:



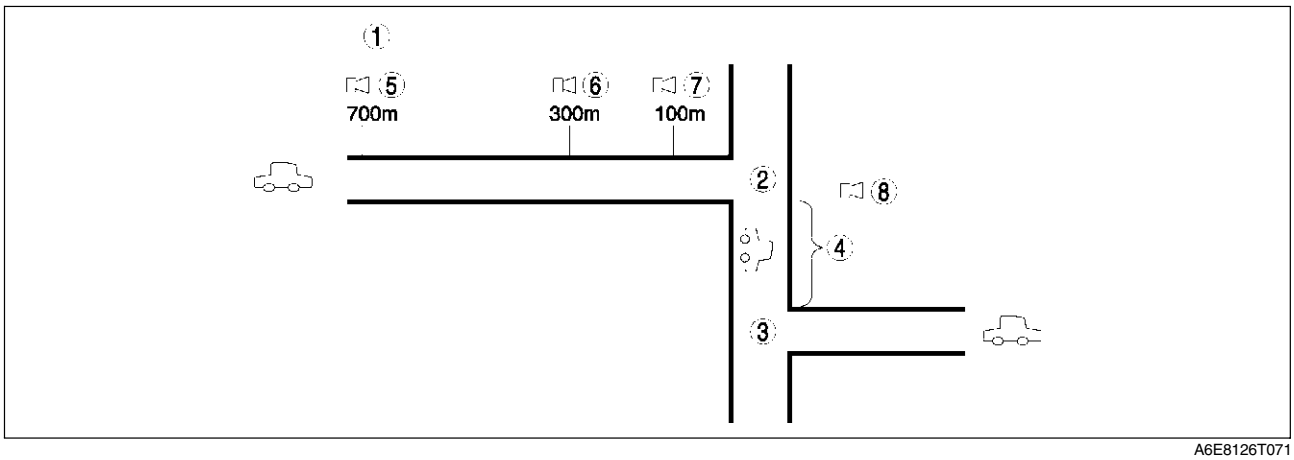
A6E8126T072

1	Right turn guidance example
2	Right turn point
3	Next turn point
4	X m (X>750 m)

5	In 700 meters right turn
6	In 300 meters right turn
7	Right turn ahead

Continuous junction guidance

- A continuous junction condition occurs when the distance from the first to the second turn point is more than 150 meters and less than or equal to 750 meters.
- After passing the first turn point, the next voice guidance is provided.



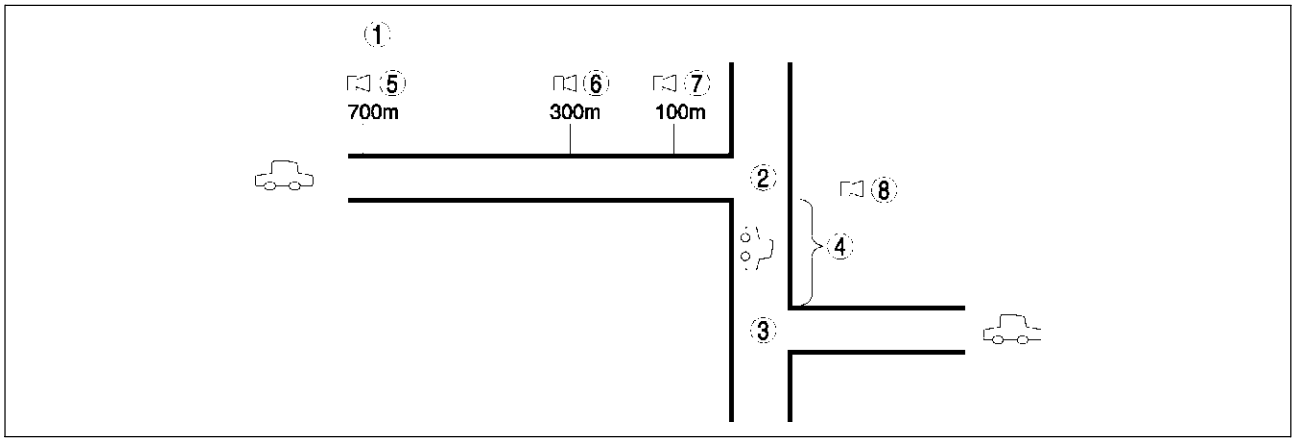
A6E8126T071

1	Right turn followed by left turn guidance example
2	Right turn point
3	Left turn point
4	X m (150 m <X<=750 m)

5	In 700 meters right turn
6	In 300 meters right turn
7	Right turn ahead
8	In X meters, left turn

Multiple junction guidance

- A multiple junction condition occurs when the distance from the first to the second turn point is less than or equal to 150 meters.
- When the last guidance for the first turn point is announced, guidance for the second turn point is also provided.



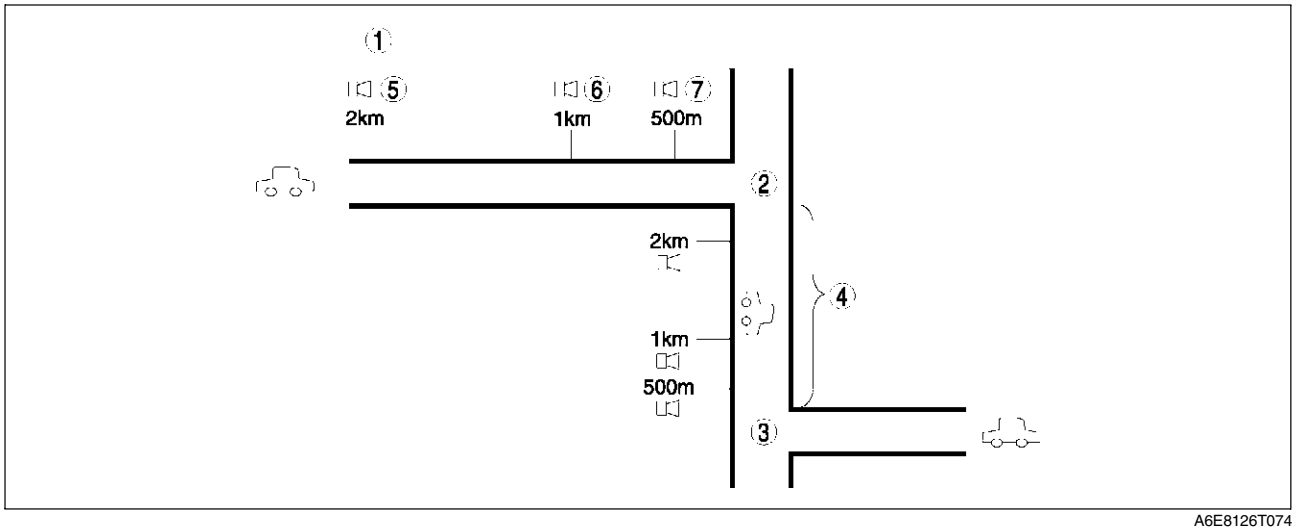
A6E8126T071

1	Right turn followed by left turn guidance example
2	Right turn point
3	Left turn point
4	X m (X<=150 m)

5	In 700 meters right turn
6	In 300 meters right turn
7	Right turn ahead, then left turn
8	Left turn ahead

Simple highway junction guidance

- The following guidance is provided:



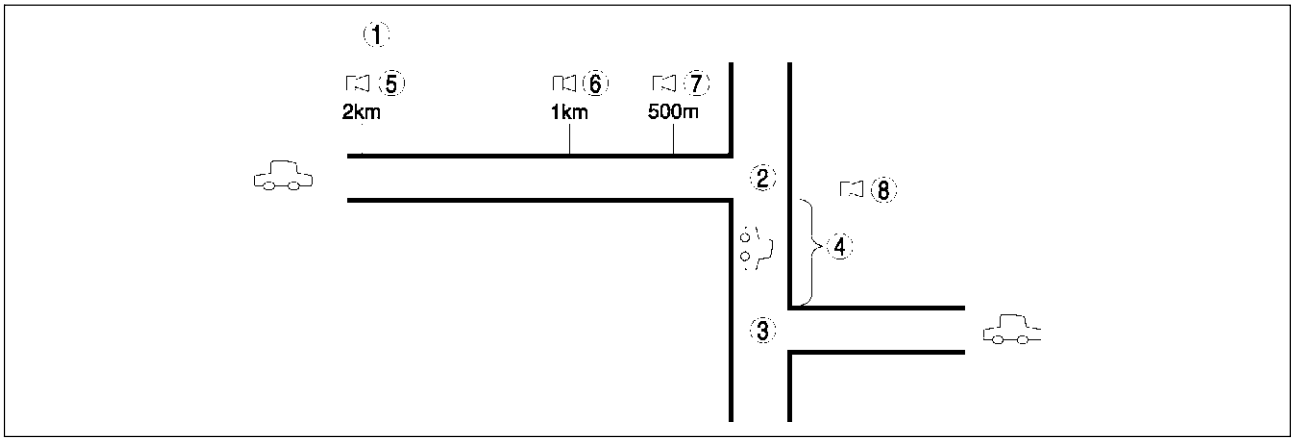
A6E8126T074

1	Right turn guidance example
2	Right turn point
3	Next turn point
4	X m (X>750 m)

5	In 2 kilometers right turn to exit motorway
6	In 1 kilometer right turn to exit motorway
7	Right turn ahead to exit motorway

Continuous highway junction guidance

- A continuous highway junction condition occurs when the distance from the first to the second turn point is more than 500 meters and less than or equal to 750 meters.
- After passing the first turn point, the next voice guidance is provided.



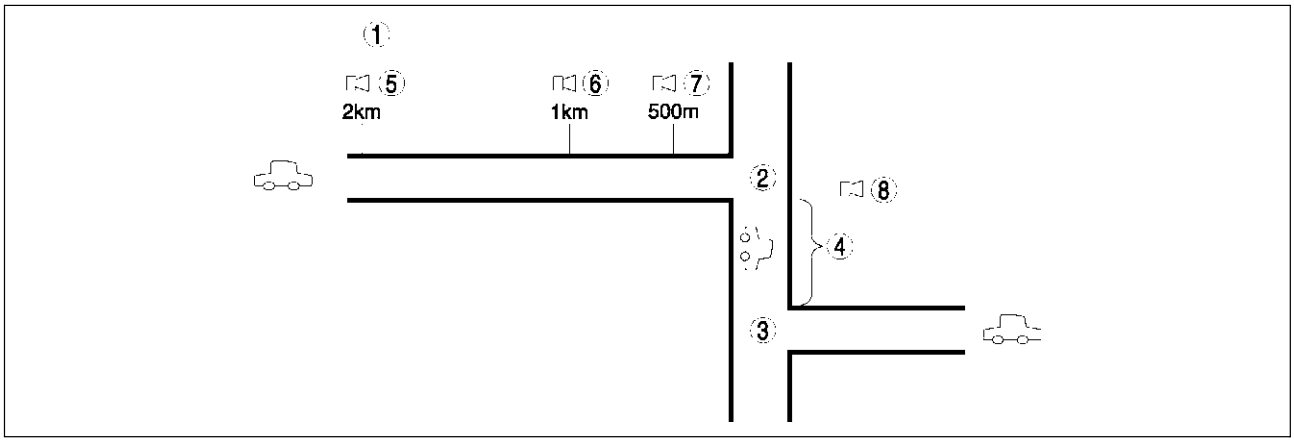
A6E8126T073

1	Right turn followed by left turn guidance example
2	Right turn point
3	Left turn point
4	X m (500 m<X<=750 m)

5	In 2 kilometers right turn to exit motorway
6	In 1 kilometer right turn to exit motorway
7	Right turn ahead to exit motorway
8	In X meters keep left

Multiple highway junction guidance

- A multiple highway junction condition occurs when the distance from the first to the second turn point is less than or equal to 500 meters.
- When the last guidance for the first turn point is announced, guidance for the second turn point is also provided.



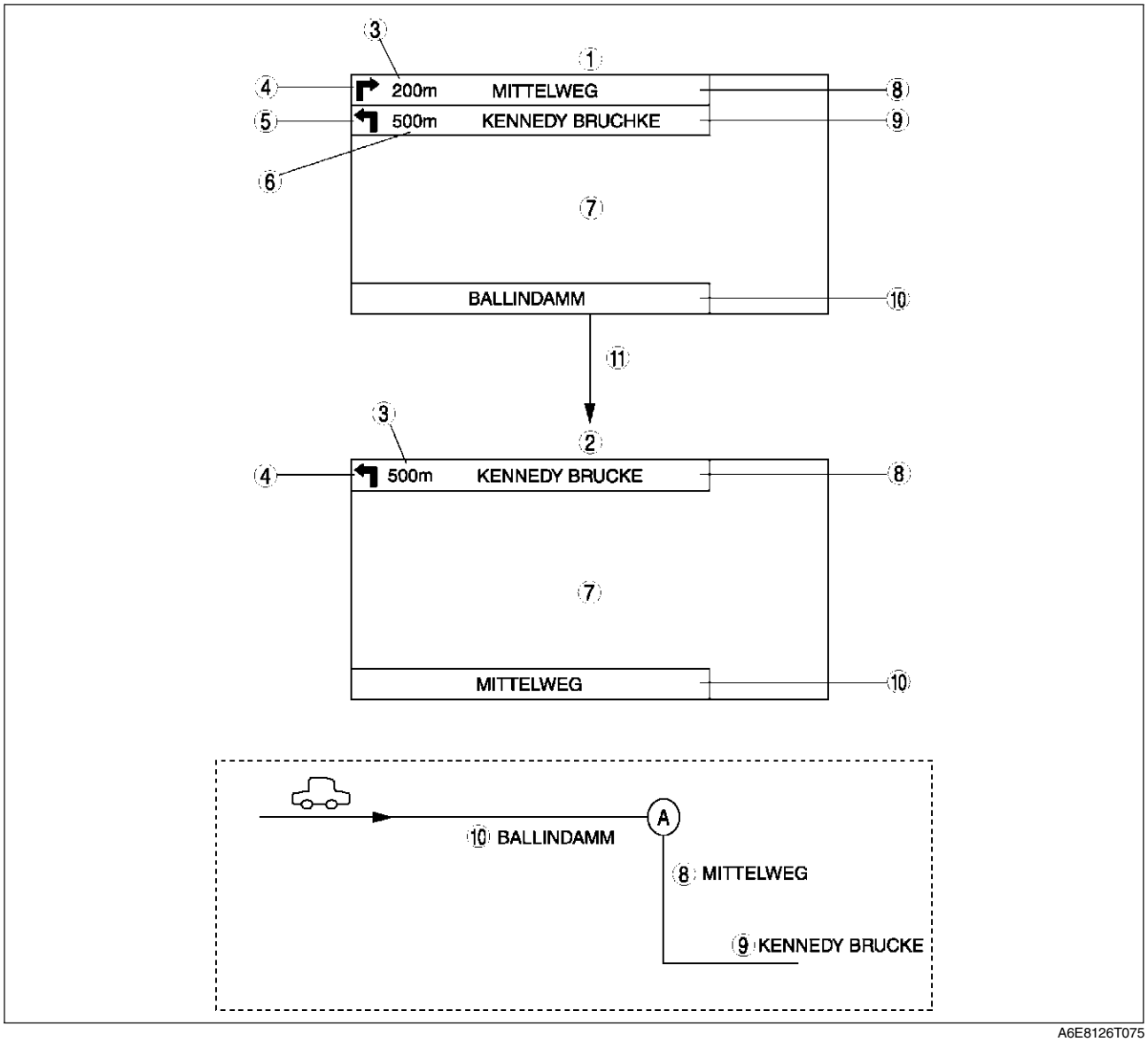
A6E8126T073

1	Right turn followed by left turn guidance example
2	Right turn point
3	Left turn point
4	X m (X<=500 m)

5	In 2 kilometers right turn to exit motorway
6	In 1 kilometer right turn to exit motorway
7	Right turn ahead to exit motorway then keep left
8	Keep left ahead

Intersection Distance Display

- When approaching the next guidance point, the distance to that point is counted down.
- In case of a continuous or multiple junction, guidance point bars for the next two turns will be displayed.
- In case of a continuous or multiple junction, after the first turn point is passed the following occurs:
  1. Next turn guidance point bar → Current road
  2. Turn after next turn guidance point bar → Next turn guidance point bar



A6E8126T075

1	Continuous, multiple junction
2	Simple junction
3	Distance to the next turn
4	Shape of the next turn
5	Shape of the turn after the next turn
6	Distance to the turn after the next turn

7	Current map screen
8	Name of the next road
9	Name of the road after the next road
10	Name of the current road
11	Vehicle arriving at point A

T

Operation While Driving Display Function
Screen activation

- The following operation while driving warning screen appears when the unit determines from the pulse of the speedometer sensor that the vehicle is moving.



A6E8126T076

Activation condition

- When driving and the following screens are displayed, operating the following buttons will activate the warning screen.

No.	Items		Screen contents/Cursor position	Indicated buttons
1	Menu screen		Menu screen, destination setting screen, set up screen	[Joystick], [ENTER], [ZOOM], [MENU]
2	Current position map screen, scroll map screen	No pop-up	–	[Joystick], [MENU]
		Pop-up	Detour, Destination, Nearest POI	[ENTER], [MENU]
			Route Preview, Maneuver List, Marked Point, Head up/North up, Calc Method, Reroute, Volume, Guidance Off	[MENU]
3	Guide mode map screen	No pop-up	–	[MENU]
		Pop-up	Detour	[ENTER], [MENU]
			Route Preview, Maneuver List, Marked Point, Calc Method, Reroute, Volume, Guidance Off	[MENU]
4	Intersection zoom map		–	[MENU]

CRUISE CONTROL SYSTEM

OUTLINE

A6E812801011T01

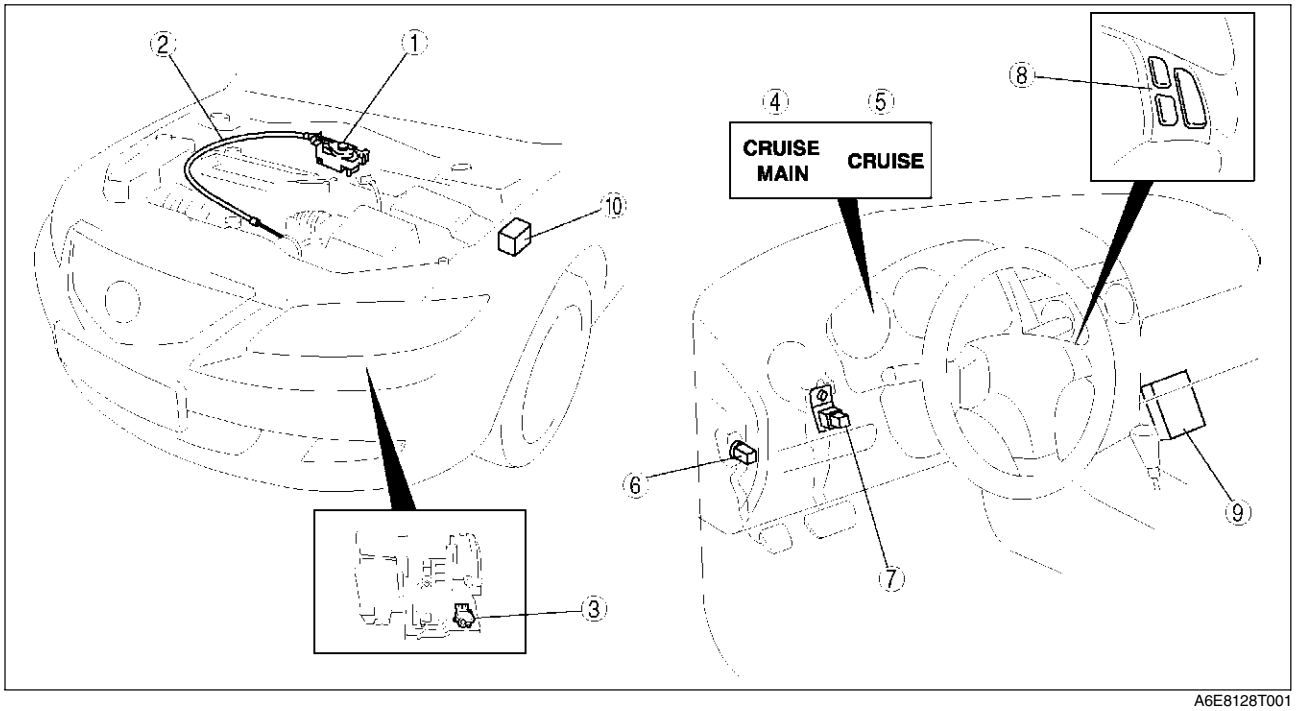
- The cruise control system allows the driver to maintain selected vehicle speed without operating the accelerator when driving on an open highway.
- The cruise actuator controls the throttle valve to maintain vehicle speed.
- The construction and operation of cruise control system is essentially carried over from that of the 626 (GF) model, except for the following:

Comparison with 626 (GF) model

Item		Comparison
Cruise actuator		• Cruise actuator with built-in control module has been adopted • Motor-type system has been adopted • Tap up/tap down function has been added • Vehicle speed at which cruise control setting is available has been changed
Actuator cable		Actuator cable with adjuster has been adopted
Cruise control switch		Embedded type (in steering wheel) has been adopted
Vehicle speed signal input		ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS))
		DSC HU/CM (with DSC)
Instrument cluster	Cruise set indicator light	LED has been adopted
	Cruise main indicator light	
Clutch switch (MTX)		Same as the 626 (GF) model
TR switch (ATX)		
Brake switch		

STRUCTURAL VIEW

A6E812801011T02



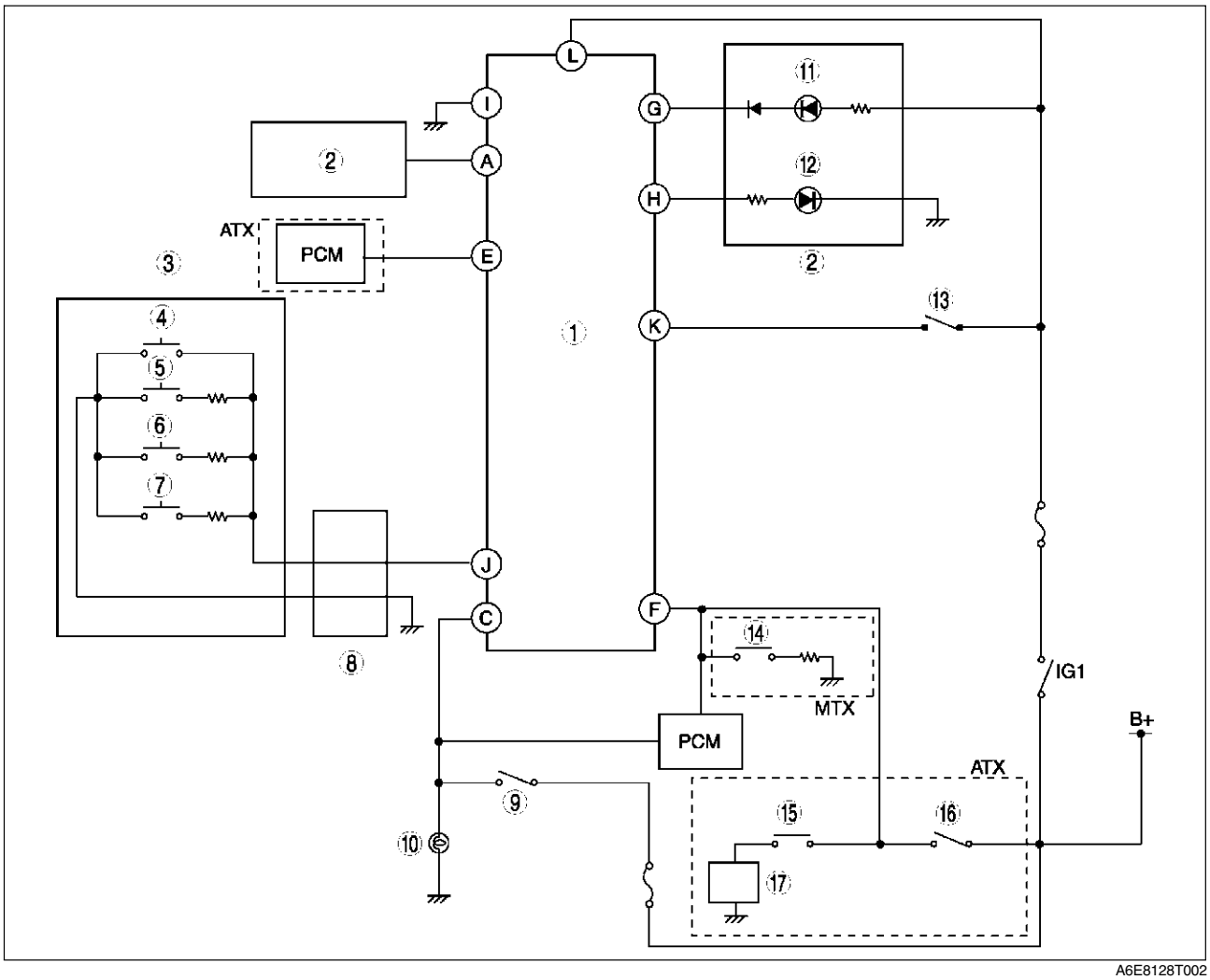
A6E8128T001

1	Cruise actuator
2	Actuator cable
3	TR switch (ATX)
4	Cruise main indicator light
5	Cruise set indicator light
6	Clutch switch (MTX)

7	Brake switch
8	Cruise control switch
9	PCM
10	ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS))
	DSC HU/CM (with DSC)

SYSTEM WIRING DIAGRAM

A6E812801011T03



A6E8128T002

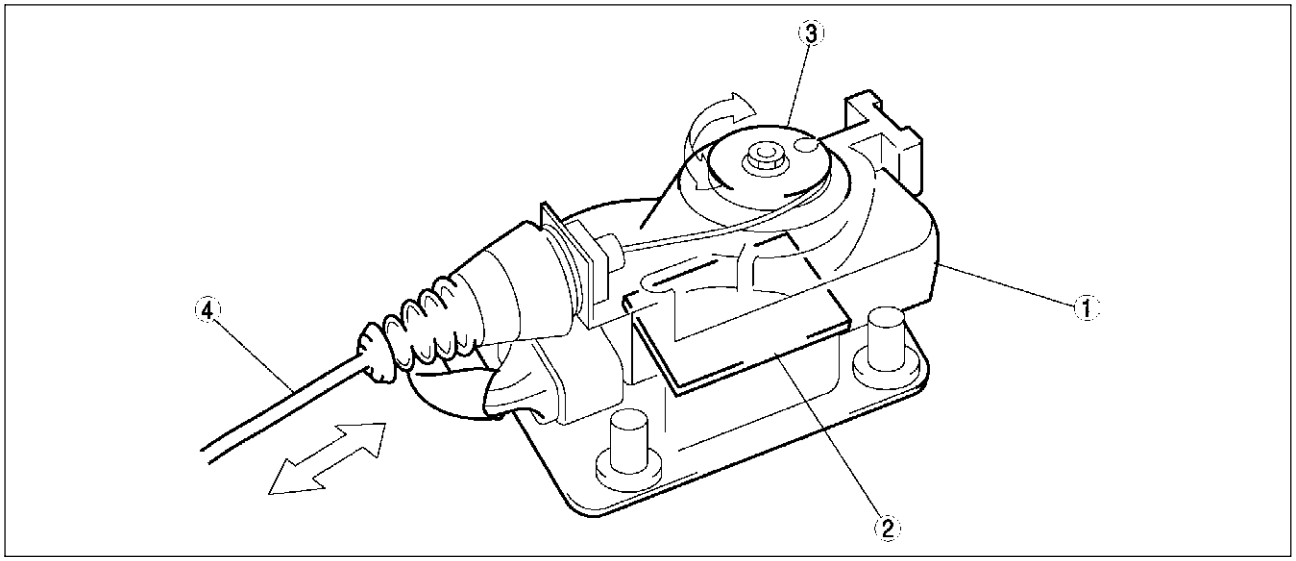
1	Cruise actuator (includes control module)
2	ABS (ABS/TCS) HU/CM (with ABS (ABS/TCS))
	DSC HU/CM (with DSC)
3	Cruise control switch
4	Cruise control main switch
5	CANCEL switch
6	SET/COAST switch
7	RESUME/ACCEL switch
8	Clock spring

9	Brake switch
10	Brake light
11	Cruise set indicator light
12	Cruise main indicator light
13	Brake switch 2
14	Clutch switch
15	TR switch (N or P position)
16	Ignition switch (START position)
17	Starter

CRUISE ACTUATOR

A6E812801011T04

- A cruise actuator with a built-in control module has been adopted. With the integration of the cruise actuator and control module, component structure has been simplified and serviceability has been improved.
- A motor-type system has been adopted for the operating structure of the actuator cable. In comparison to the previous vacuum-type system, system control is more exact and smooth.
- Operation of the cruise control system is basically the same as that of the 626 (GF) model, except for the following:
  - — Tap up/tap down function
  - — Cancel condition of cruise control system
  - — Vehicle speed at which cruise control setting is available: 30 km/h {18.6 mph} or more



A6E8128T003

1	Cruise actuator
2	Control module

3	Plate
4	Actuator cable

T

Tap Up/Tap Down Function

- When the vehicle is driving at a constant speed sat by the cruise control system, and a signal from either the SET/COAST or RESUME/ACCEL switch is sent to the control module (in cruise actuator) for a very short period (a one-touch control function), the control module increases or decreases the vehicle speed by 1.6 km/h {1.0 mph}.

Cancel Condition of Cruise Control System

- When the vehicle speed becomes less than 22.5 km/h {14.0 mph}, the cruise control system operation is canceled, however the speed sat in the memory is not cleared.

ON-BOARD DIAGNOSTIC

A6E812801011T05

- For easily detecting and locating a malfunction in the cruise control system, a condition detection mode has been included, as well as an operation mode that can check the operation of switches.
- The on-board diagnostic is essentially carried over from that of the 626 (GF) model, except for the following:
  — Due to the integration of the control module in the cruise actuator, the circuit between the cruise actuator and control module is obsolete. As a result, the procedure for the DTC 01 has been changed.
- As the control module is installed in the engine compartment, a waterproof connector is used. As a result, the terminal voltage measurement method for the control module (in cruise actuator) with the on-board diagnostic has been changed. For details, see the workshop manual.

Operation code list

DTC	Output pattern	Diagnosed circuit	
		Mazda 6	626 (GF) model
21		Cruise control switch (SET/COAST switch)	Cruise control switch (SET/COAST switch)
22		Cruise control switch (RESUME/ACCEL switch)	Cruise control switch (RESUME/ACCEL switch)
31		Brake switch	Brake switch
35		• Clutch switch (MTX) • TR switch (ATX)	• Clutch switch (MTX) • TR switch (ATX)
37		Vehicle speed sensor	Vehicle speed sensor

Condition code list

DTC	Output pattern	Diagnosed circuit	
		Mazda 6	626 (GF) model
01		Cruise actuator (Drive circuit)	Cruise actuator
05		Brake switch	Brake switch
07		Brake switch Brake switch 2	Brake switch Brake switch 2
11		Cruise control switch (SET/COAST switch)	Cruise control switch (SET/COAST switch)
12		Cruise control switch (RESUME/ACCEL switch)	Cruise control switch (RESUME/ACCEL switch)
13		Cruise control switch (Ground circuit)	Cruise control switch (Ground circuit)
15		Cruise actuator (Control circuit)	Cruise control module

AIR BAG SYSTEM

OUTLINE

A6E813001046T01

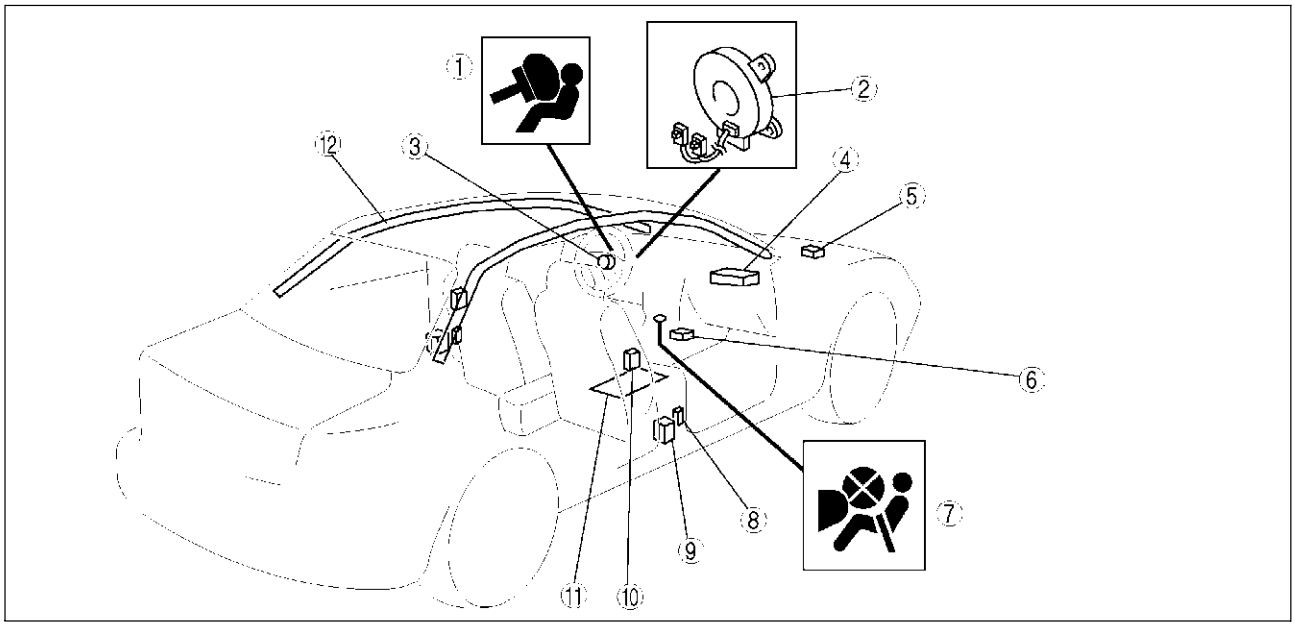
- The air bag system is a device that supplements the passenger restraint function of the seat belts. The air bag system will not have the designed effect if the seat belts are not worn properly.
- The air bag system is composed of the following parts:

Item	Outline
SAS unit	• 2-step deployment control has been added to the front air bag system (driver and passenger-side) deployment control. • Recognizes actually equipped air bag module or pre-tensioner seat belt based on module configuration.
Crash zone sensor	• Detect degree of impact, convert to an electrical signal, and send the signal to the SAS unit. For operation, refer to SAS UNIT, Air Bag Module and Pre-tensioner Seat Belt Deployment Operation. (See T–89 SAS UNIT.)
Side air bag sensor	
Driver-side air bag module	• Dual inflator, 1 inflator divided into 2, has been adopted in accordance with the front air bag system 2-step deployment control.
Passenger-side air bag module	
Side air bag module	• Chest-protection type side air bag module is used in accordance with the adoption of the curtain air bag module.
Curtain air bag module	• Adopted to improve safety in lateral collisions.
Pre-tensioner seat belt	• Ball-type pre-tensioner seat belt has been adopted.
Air bag system warning light	• LED has been adopted.
Passenger-side air bag cut-off indicator light	• Installed on the lower part of the center panel.
Occupancy sensor (passenger-side air bag cut-off system)	• Same as the 626 (GF) model.
Deployment authorization procedure	• Switches to the air bag deployment authorization condition upon configuration performance.

T

STRUCTURAL VIEW

A6E813001046T02



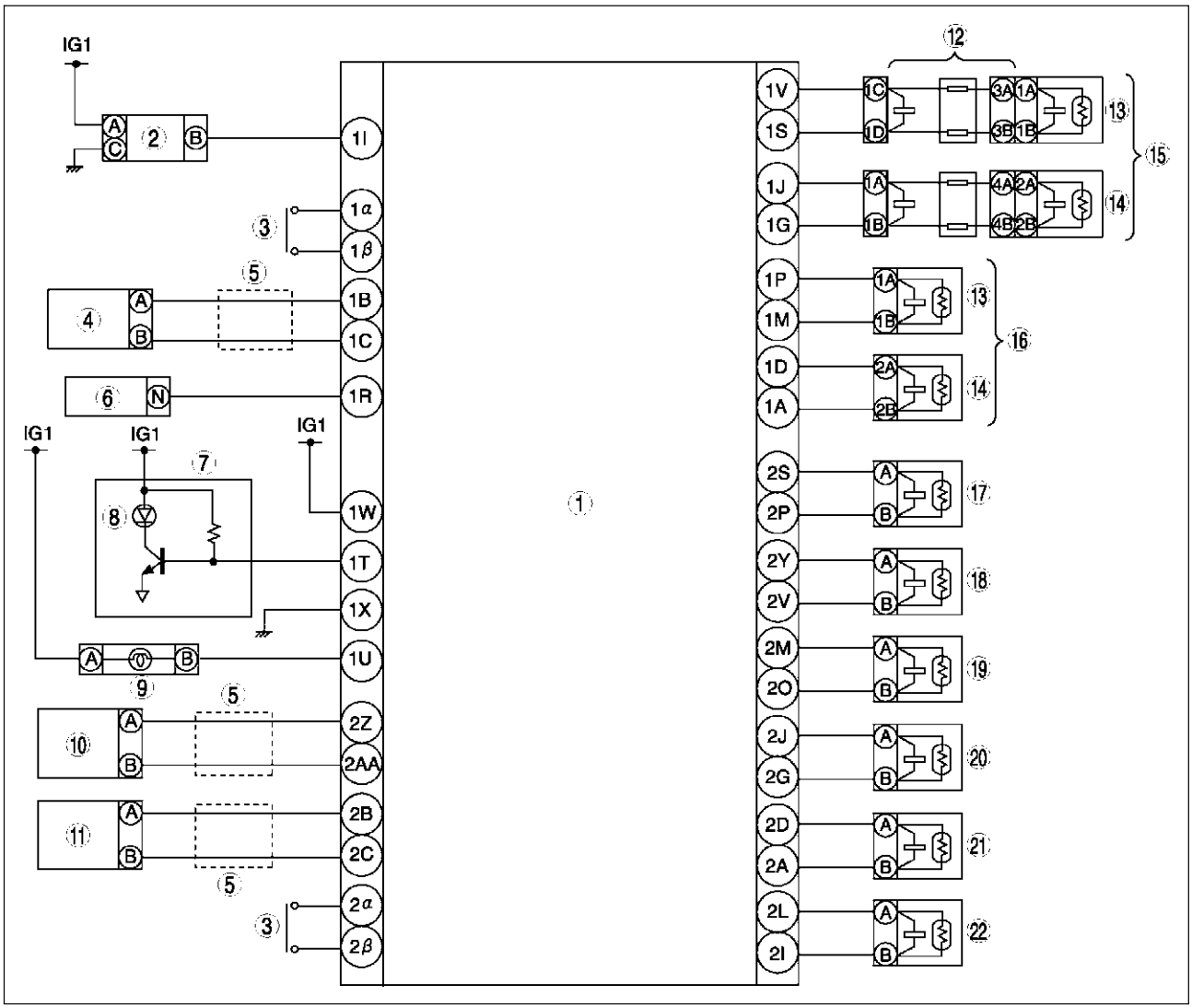
A6E8130T010

1	Air bag system warning light
2	Clock spring
3	Driver-side air bag module
4	Passenger-side air bag module
5	Crash zone sensor
6	SAS unit

7	Passenger-side air bag cut-off indicator light
8	Side air bag sensor
9	Pre-tensioner seat belt
10	Side air bag module
11	Occupancy sensor
12	Curtain air bag module

SYSTEM WIRING DIAGRAM

A6E813001046T03



A6E8130T002

1	SAS unit
2	Occupancy sensor
3	Poor connection detector bar
4	Crash zone sensor
5	Twist pair
6	Data link connector
7	Instrument cluster
8	Air bag system warning light
9	Passenger-side air bag cut-off indicator light
10	Driver-side side air bag sensor
11	Passenger-side side air bag sensor

12	Clock spring
13	Inflator No.1
14	Inflator No.2
15	Driver-side air bag module
16	Passenger-side air bag module
17	Driver-side pre-tensioner seat belt
18	Driver-side curtain air bag module
19	Driver-side side air bag module
20	Passenger-side pre-tensioner seat belt
21	Passenger-side curtain air bag module
22	Passenger-side side air bag module

SAS UNIT

A6E813057030T01

Outline

- A 2-step air bag deployment control system has been adopted. In case of a frontal or frontal offset collision, an optimal air bag deployment force is matched to the impact force. The inflators for the driver and passenger-side air bag modules have two tiers, and deploy at either a low or high rate, according to the force of the impact.
- Based on the module configuration, operation (deployment) matching the actual type of air bag module or pre-tensioner seat belt setting variation can be controlled. If the module configuration is incomplete or incorrect, the on-board diagnosis function displays a DTC. (See T–97 ON-BOARD DIAGNOSTIC FUNCTION.) If the SAS unit is replaced, it is necessary to perform the module configuration to match the specifications of the vehicle in which it is being installed. Refer to the Workshop Manual for the procedure.

Air Bag Module and Pre-tensioner Seat Belt Deployment Operation

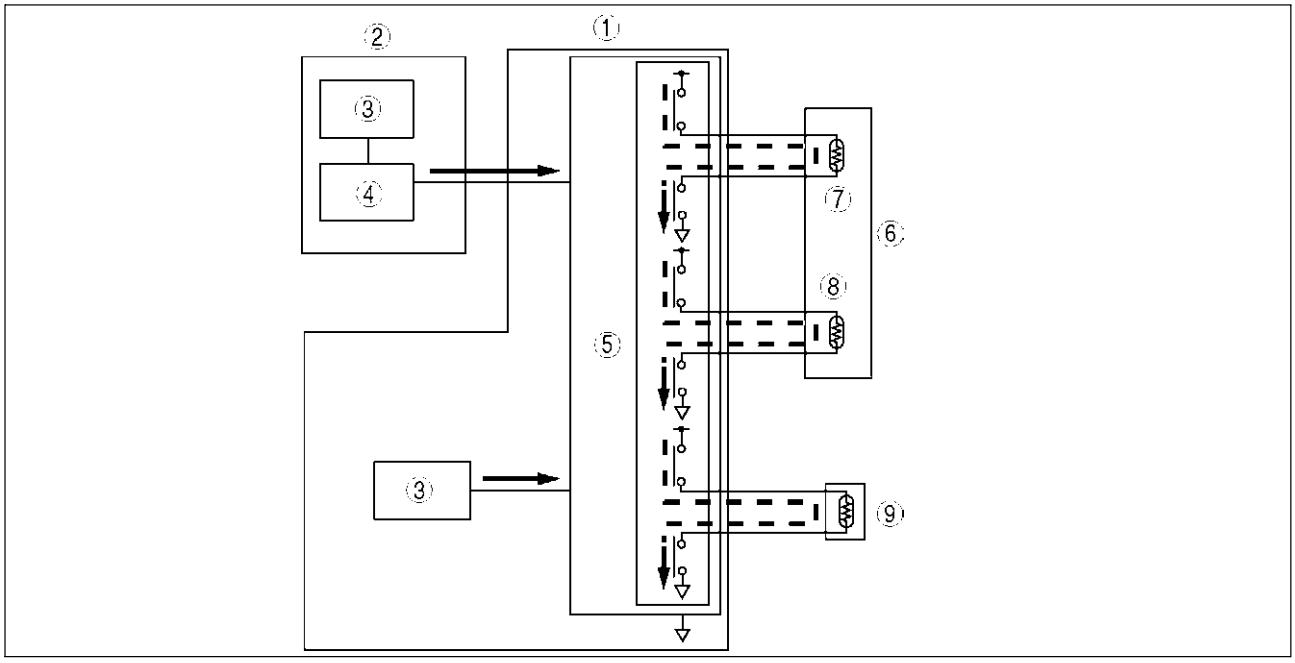
Front air bag system (2-step deployment controlj

1. During a frontal or frontal offset collision, the crash sensors in the crash zone sensor and the SAS unit detect the impact.
2. The degree of impact detected by the crash sensor in the crash zone sensor is converted to an electric signal and sent to the SAS unit.
3. Simultaneously, the SAS unit crash sensor converts the degree of impact detected to an electrical signal.
4. The SAS unit processes the calculations for the two electrical signals at the output control circuit and compares the value to a preset value.
5. The output control circuit determines the degree of impact to the vehicle by the value from the crash sensors, completes an inflator No. 1 or inflator No. 2 ignition circuit, and sends the deployment signal to the air bag modules.

No.	Degree of collision force	Air bag module deployment force	Inflator deployment pattern
1	Large	100 %	Inflator No.1 and inflator No.2 deploy simultaneously.
2	Small	60 %	Inflator No. 1 deploys, then inflator No.2*.

: To scrap the air bag module, inflator No. 2 is deployed.

6. The SAS unit completes an ignition circuit for the pre-tensioner seat belts that is synchronized to the deployment of the driver and passenger-side air bag modules, and an operation signal is sent to the pre-tensioner seat belts.



A6E8130T005

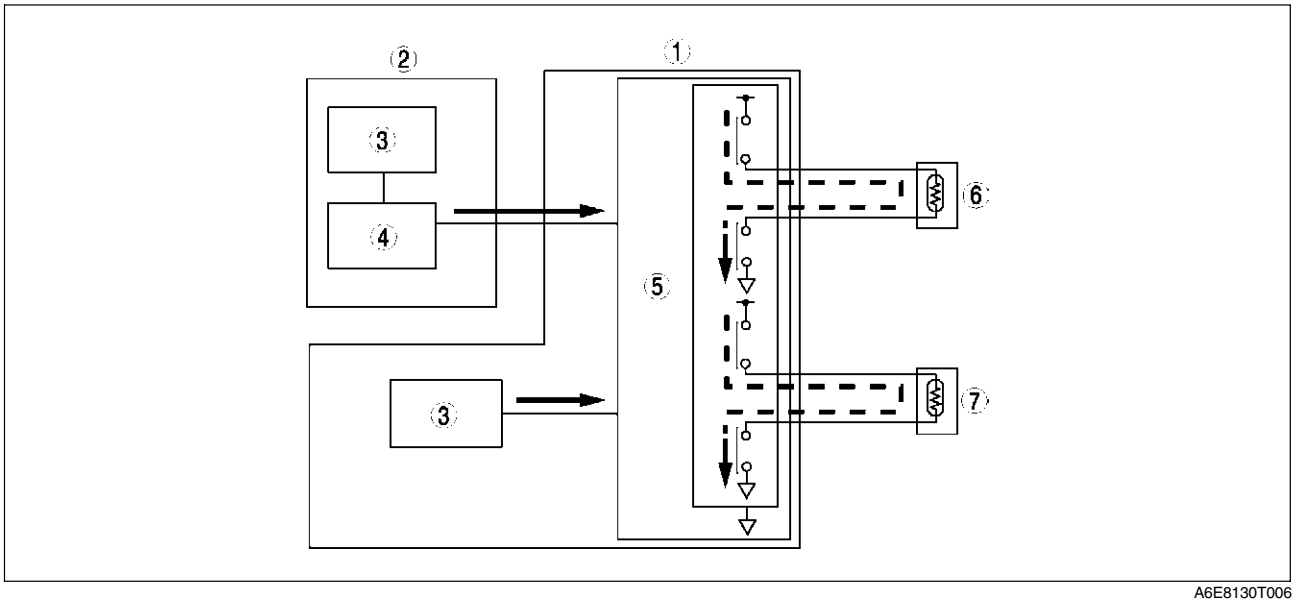
1	SAS unit
2	Crash zone sensor
3	Crash sensor
4	Signal amplification circuit
5	Output control circuit

6	Front air bag module (driver or passenger-side air bag module)
7	Inflator No.1
8	Inflator No.2
9	Pre-tensioner seat belt

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Side air bag system

1. During a lateral collision to the vehicle, the crash sensors in the side air bag sensor and SAS unit detect the collision.
2. The degree of impact detected by the crash sensor in the side air bag sensor is converted to an electrical signal and sent to the SAS unit through the signal amplification circuit.
3. Simultaneously, the SAS unit crash sensor converts the degree of impact detected to an electrical signal.
4. The SAS unit processes the calculations for the two electrical signals at the ouput control circuit and compares the value to a preset value.
5. The output control circuit determines the degree of impact to the vehicle by the value from the crash sensors, completes a side air bag module and curtain air bag module ignition circuit, and sends the deployment signal to the air bag modules.



A6E8130T006

1	SAS unit
2	Side air bag sensor
3	Crash sensor
4	Signal amplification circuit

5	Output control circuit
6	Side air bag module
7	Curtain air bag module

Module configuration

Function

- Module configuration is performed to provide an initial setting for the SAS unit according to the actually equipped air bag module, pre-tensioner seat belt and occupancy sensor.
- If there is a mismatch between the air bag system configuration and the initial setting for the SAS unit, a DTC is displayed.
- The module configuration is performed using only the **SST** (WDS or equivalent).

DRIVER-SIDE AIR BAG MODULE

A6E813057010T01

Outline

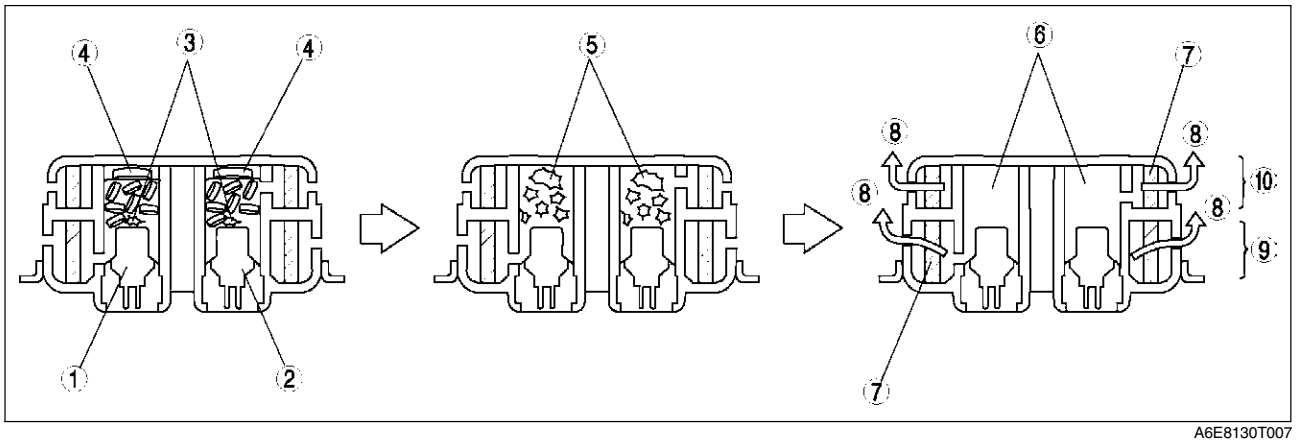
- A dual inflator, 1 inflator divided into 2, has been adopted in accordance with the front air bag system 2-step deployment control.

Inflator Operation

1. The igniter built into the inflator begins to build up heat when the operation (deployment) signal is sent from the SAS unit. The inflammation agent is ignited by the build up of heat of the igniter.
2. The ignition of the inflammation agent causes the combustion of an agent which releases nitrogen gas.
3. The nitrogen gas is cooled at the filter, and the filtrate is injected into the air bag.

Note

- The gas injection outlets for inflators are divided into two tiers. Gas from inflator No.1 is injected from the No.1 tier, and from the No. 2 tier of is inflator No. 2.



A6E8130T007

1	Ignitor (inflator No.1)
2	Ignitor (inflator No.2)
3	Ignition of inflammation agent
4	Gas generating agent
5	Gas generating agent combustion

6	Nitrogen gas
7	Filter
8	To air bag
9	Ist step
10	2nd step

T

PASSENGER-SIDE AIR BAG MODULE

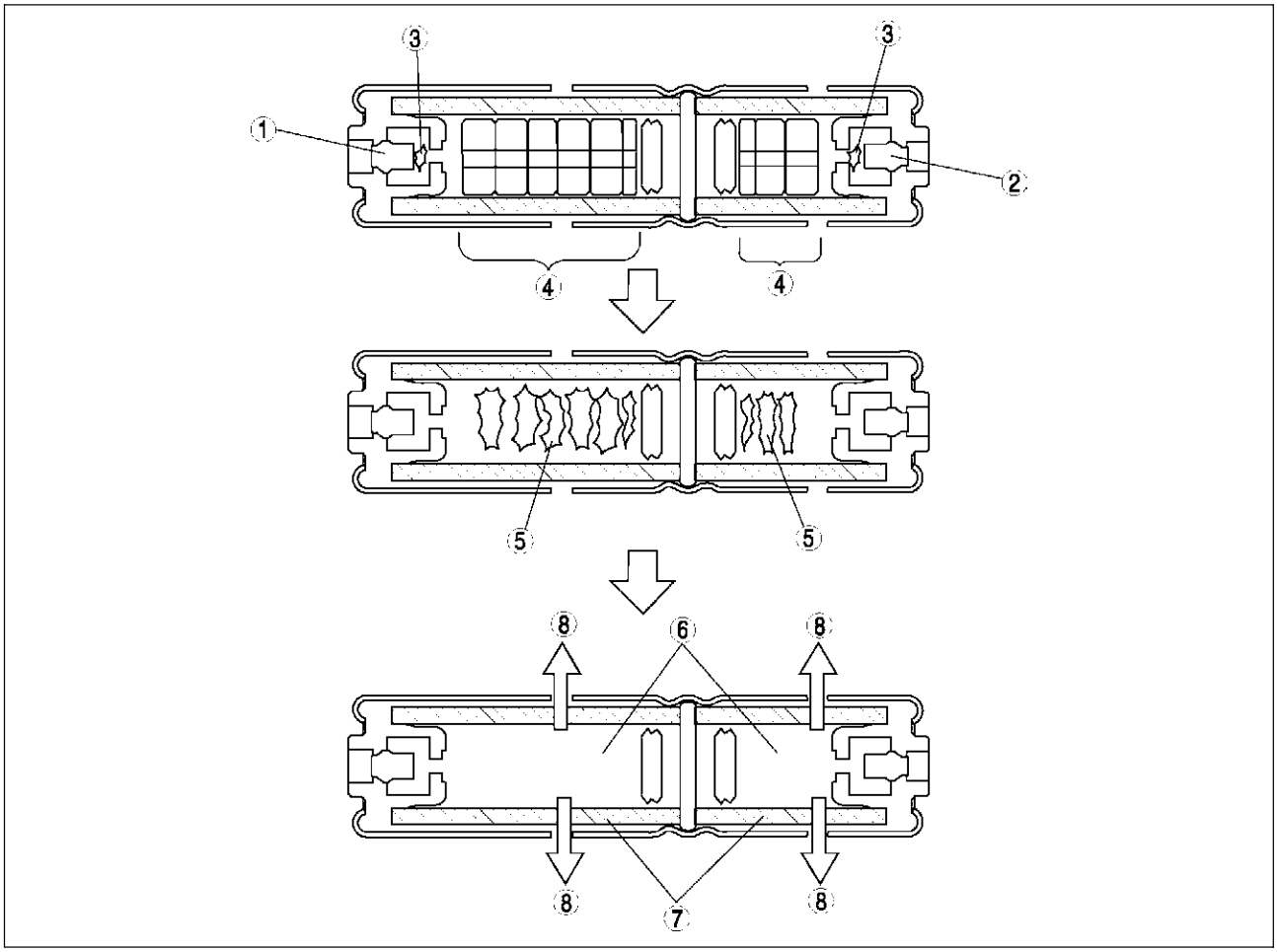
A6E813057050T01

Outline

- A dual inflator, 1 inflator divided into 2, has been adopted in accordance with the front air bag system 2-step deployment control.

Inflator Operation

1. The igniter built into the inflator begins to build up heat when the operation (deployment) signal is sent from the SAS unit. The inflammation agent is ignited by the build up of heat of the igniter.
2. The ignition of the inflammation agent causes the combustion of an agent which releases nitrogen gas.
3. The nitrogen gas is cooled at the filter, and the filtrate is injected to the air bag.



A6E8130T008

1	Ignitor (inflator No.1)
2	Ignitor (inflator No.2)
3	Ignition of inflammation agent
4	Gas generating agent

5	Gas generating agent combustion
6	Nitrogen gas
7	Filter
8	To air bag

SIDE AIR BAG MODULE

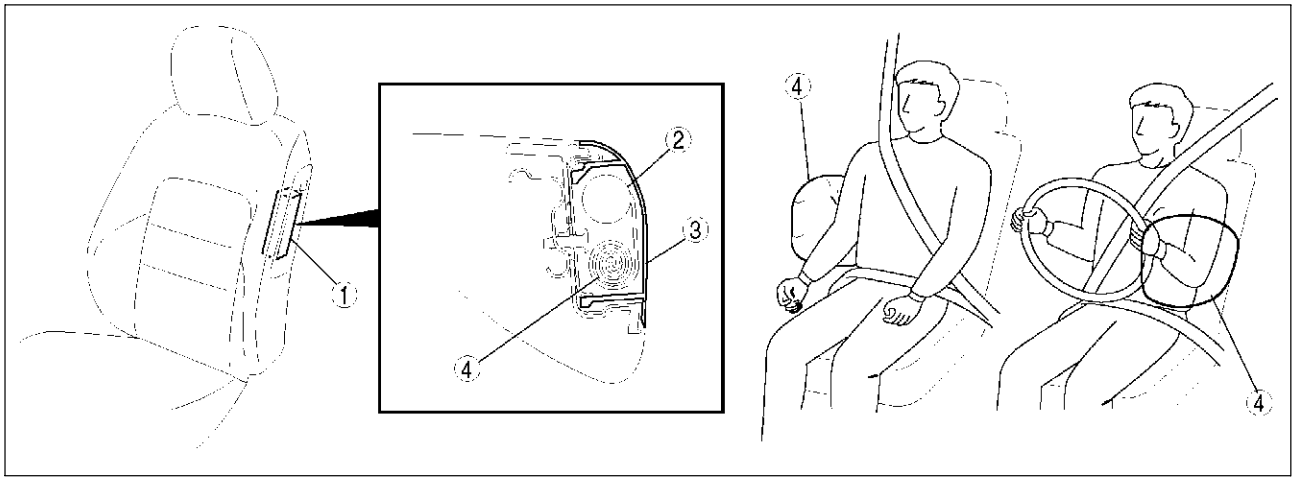
A6E813000147T01

Function

- During a collision to the side of the vehicle, the air bag operates (deploys) after receiving an operation signal from the SAS unit, defusing impact to the chest area of the driver and front passenger.

Construction

- Side air bag modules are installed on the outboard sides of the front seat backs.
- The side air bag module is composed of an inflator, module cover and air bag.
- When an air bag deploys, the side air bag module cover is spread apart by the generation of argon gas from the inflator, inflating the air bag.



A6E8130T003

1	Side air bag module
2	Inflator

3	Module cover
4	Air bag

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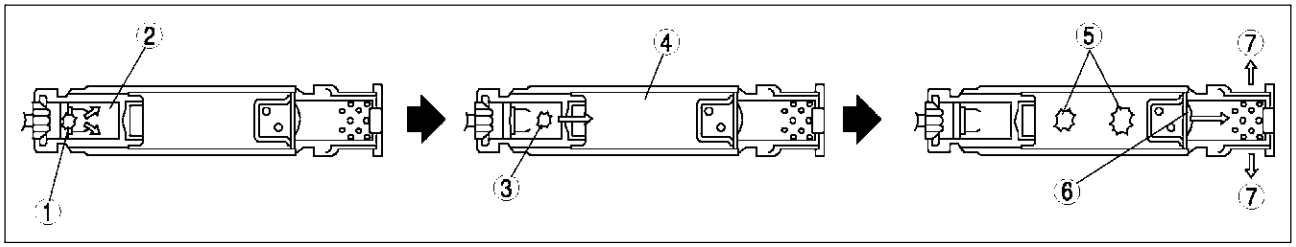
Operation

Air bag module deployment operation

- Refer to the SAS UNIT, Air Bag Module and Pre-tensioner Seat Belt Deployment Operation. (See T–89 SAS UNIT.)

Inflator operation

1. The igniter built into the inflator begins to build up heat when the operation (deployment) signal is sent from the SAS unit. The inflammation agent is ignited by the build up of heat of the igniter.
2. The combustion of the inflammation agent is transmitted to the argon gas.
3. The argon gas expands, breaks the discharge barrier and is injected into the air bag.



A6E8130T009

1	Ignitor
2	Inflammation agent
3	Combustion of inflammation agent
4	Argon gas

5	Argon gas expansion
6	Discharge barrier
7	To air bag

CURTAIN AIR BAG MODULE

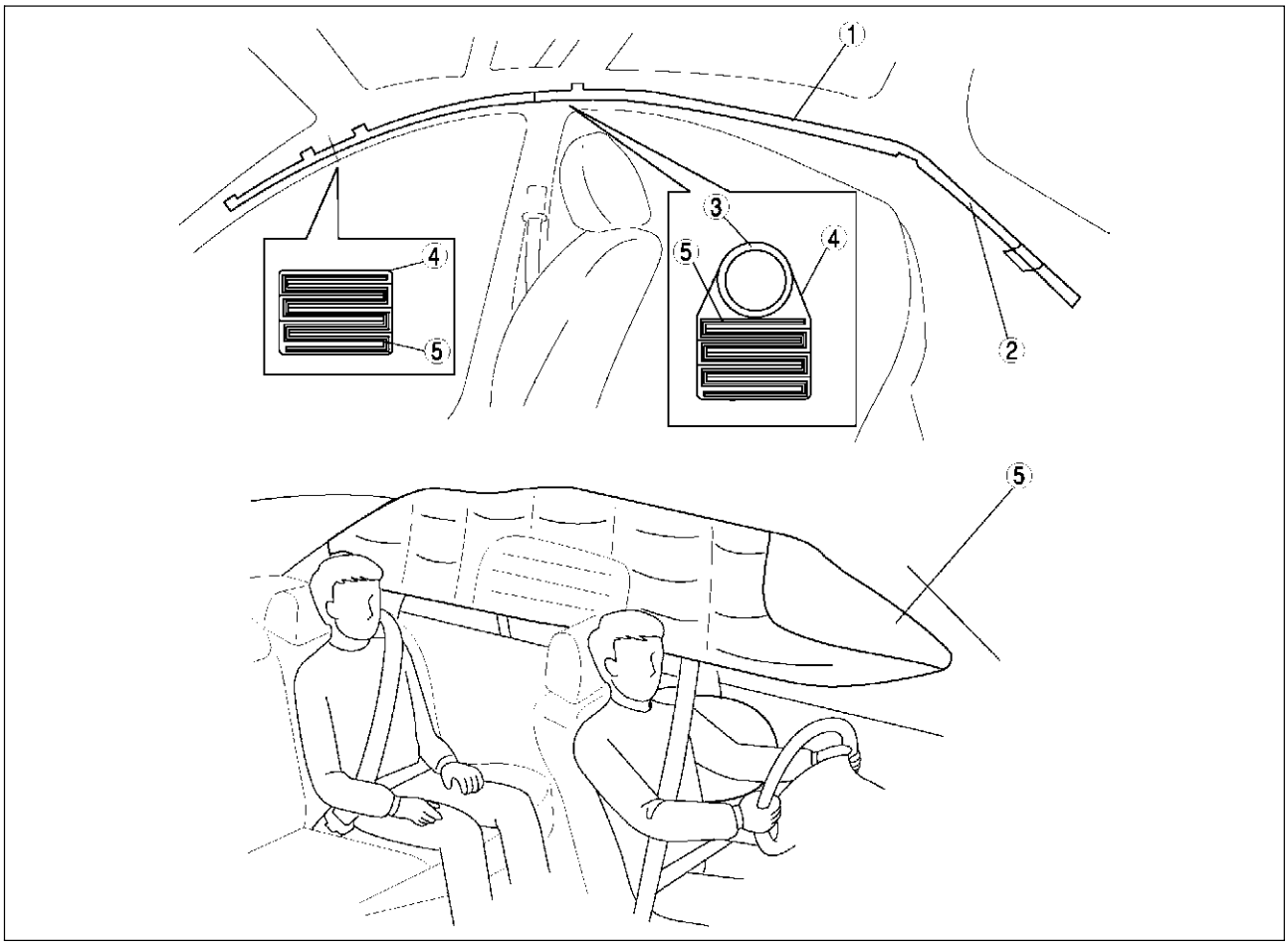
A6E813000171T01

Function

- During a lateral collision to the vehicle, the air bag operates (deploys) after receiving an operation signal from the SAS unit, defusing impact to the side of the head of the driver and other passengers (passenger-side and rear outboard-seated passenger).

Construction

- The curtain air bag modules are equipped along the roof edge between the A and B pillars.
- The curtain air bag module is composed of the inflator, pipe, bag cover, and air bag.
- When the curtain air bag deploys, the A-pillar trim and headliner is spread apart by argon gas generated from the inflator, inflating the air bag.



A6E8130T004

1	Curtain air bag module
2	Inflator
3	Pipe

4	Bag cover
5	Air bag

Operation

Air bag module deployment operation

- Refer to SAS UNIT Air Bag Module and Pre-tensioner Seat Belt Deployment Operation. (See T–89 SAS UNIT.)

Inflator operation

- The inflator operation is the same as the side air bag module. Refer to SIDE AIR BAG MODULE. (See T–93 SIDE AIR BAG MODULE.)

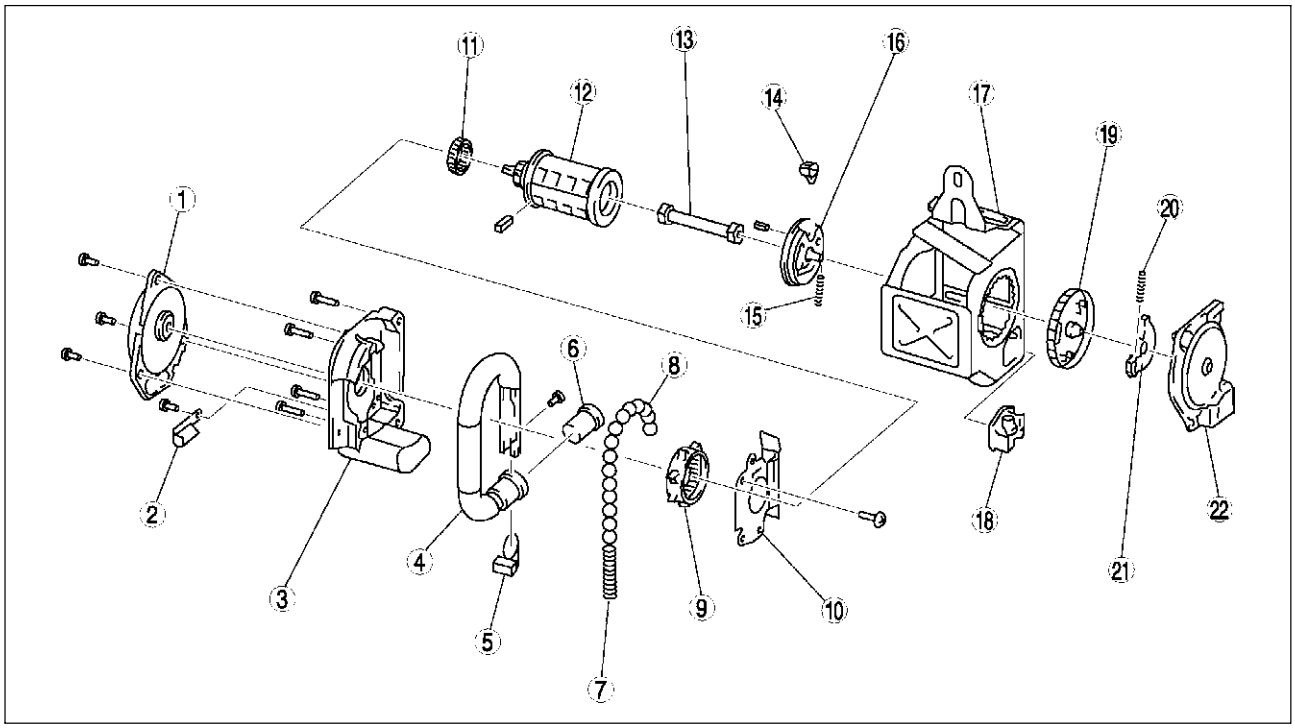
PRE-TENSIONER SEAT BELT

A6E813057630T01

Function

- When a vehicle is involved in a frontal or frontal offset collision, the pre-tensioner seat belt system receives an operation signal from the SAS control module, retracting and tightening the belt webbing instantly on the driver and front passenger restraints.

Construction



A6E8130T011

1	Spring unit
2	Guide plate
3	Pre-tensioner cover
4	Pipe
5	Guide block
6	Gas generator
7	Stopper spring
8	Ball
9	Ring gear
10	Pre-tensioner plate
11	Pinion

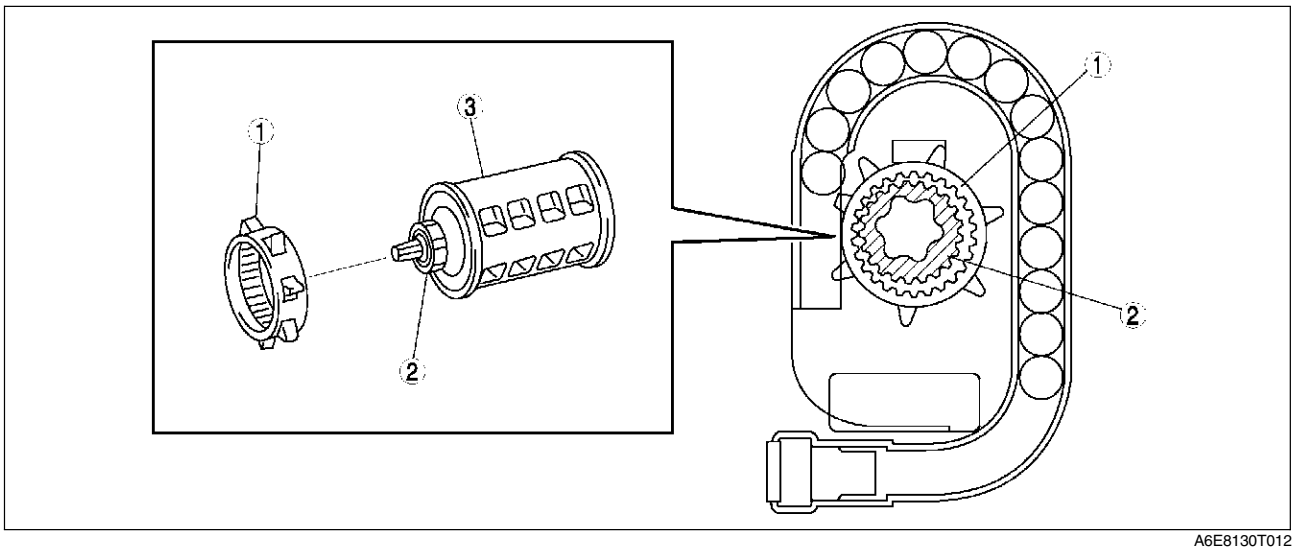
12	Spool
13	Torsion bar
14	Pawl
15	Pawl spring
16	Locking base
17	Housing
18	Sensor unit
19	Lock gear
20	Hook spring
21	Fly wheel
22	Retainer

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Operation

Before Activation (Normal Condition)

- The spool has a pinion on its end, which rotates with the spool when the belt webbing is retracted or withdrawn.
- There is a ring gear around the pinion. Because the pinion does not engage with the ring gear during normal operation, the ring gear does not rotate even when the belt webbing is retracted or withdrawn.



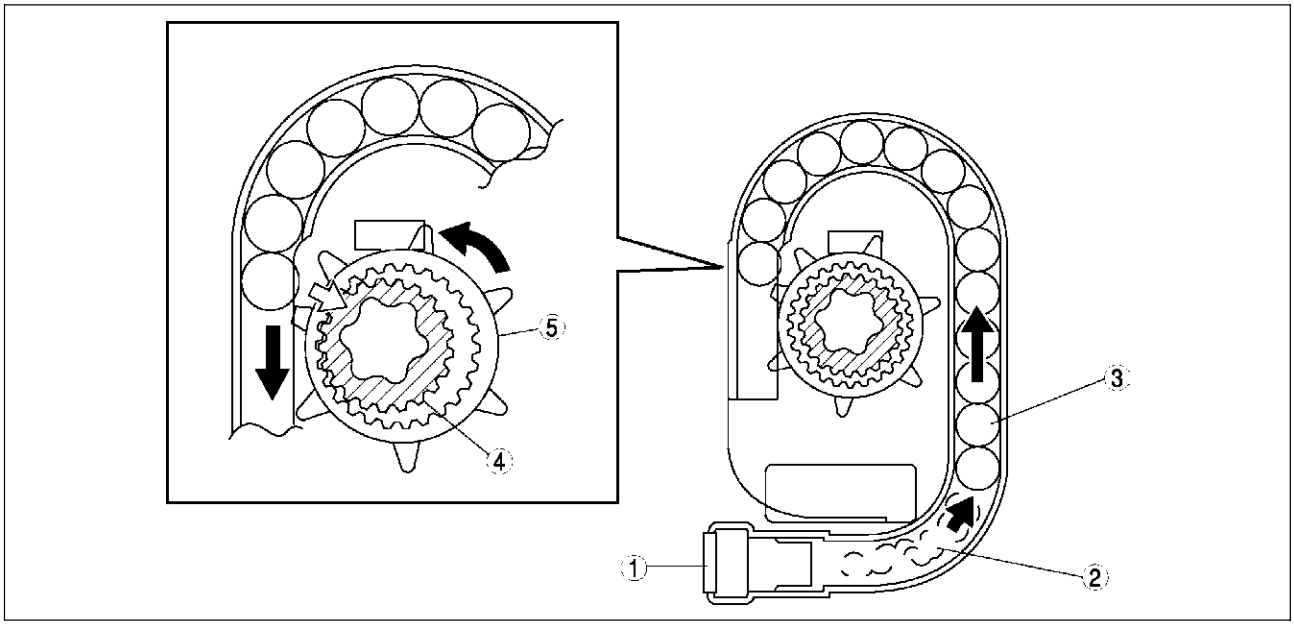
A6E8130T012

1	Ring gear
2	Pinion

3	Spool

During Activation

1. When the pre-tensioner seat belt system receives an operation signal from the SAS control module, gas is produced from each generator forcing up the balls in the tube.
2. The balls shift, pushing the ring gear toward the pinion. Due to this, the ring gear and pinion are engaged.
3. The ball shifting makes the ring gear rotate. The pinion, coupled with the rotation of the ring gear, rotates the spool in the direction of retraction. Thus the belt webbing is tightened.



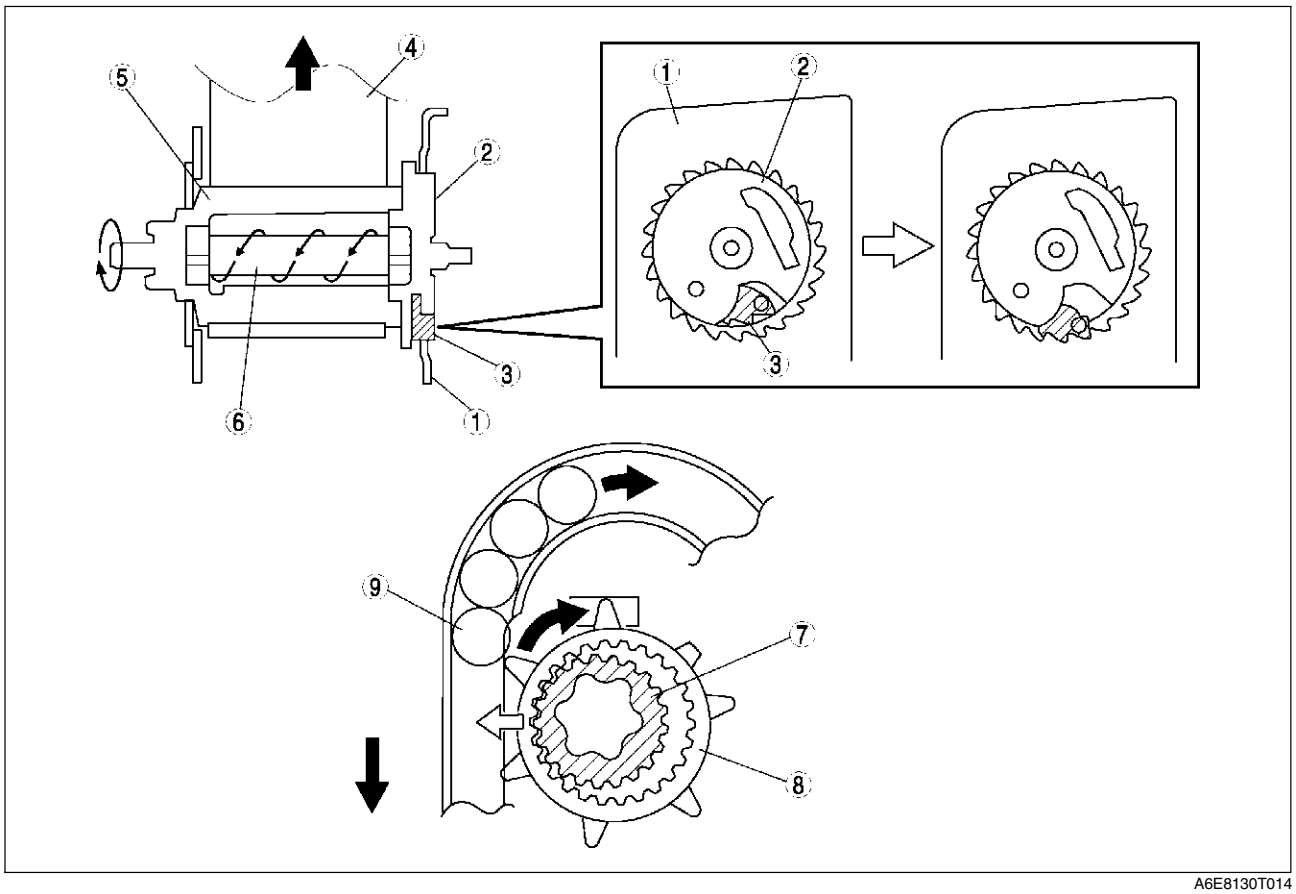
A6E8130T013

1	Gas generator
2	Gas
3	Ball

4	Pinion
5	Ring gear

After Activation

1. Directly after the activation of the pre-tensioner seat belt system and the application of a load to the seat belt in the direction of withdrawal, the ELR lock mechanism operates and the pawl engages the housing gear.
2. When a larger than specified load is applied to the seat belt with the locking base locked by the pawl, the torsion bar twists. Thus the spool rotates and the belt webbing is withdrawn.
3. Because the spool rotates in the direction of withdrawal, the ring gear pushes the balls back and the pinion is disengaged from the ring gear.



A6E8130T014

1	Housing
2	Locking base
3	Pawl
4	Belt
5	Spool

6	Torsion bar
7	Pinion
8	Ring Gear
9	Ball

ON-BOARD DIAGNOSTIC FUNCTION

A6E813001046T04

Outline

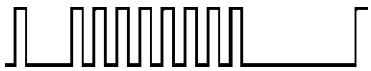
- The on-board diagnostic function consists of the following functions: a failure detection function, which detects malfunctions in the air bag system-related parts; a memory function, which stores detected DTCs; a self-malfunction diagnostic function, which indicates system malfunctions using DTCs; a PID/data monitoring function, which reads out specific input/output signals; and, an active command mode function, which actively controls the operation of output parts.
- Using an SST (WDS or equivalent), DTCs can be read out and deleted, and the PID/data monitoring function and active command mode function can be activated.
- A fail-safe function, which prevents the abrupt activation of the air bag module and the pre-tensioned seat belt in case of an air bag system malfunction, is included.
- The failure detection function, memory function, and fail-safe function are the same as that of the 626 (GF) model.

Self-Malfunction Diagnostic Function

- The self-malfunction diagnosis function determines that there is a malfunction, outputs a signal, as a DTC, to the DLC-2, and at the same time, flashes the air bag system warning light to advise the driver of a malfunction.
- The air bag system warning light illuminates or flashes to indicate a single DTC according to the present malfunction. (If there is more than one present malfunction, only one DTC will be displayed according to the preset priority ranking.)
- The air bag system warning light will flash the DTC pattern for five cycles, and then will remain illuminated until the ignition switch is turned to the LOCK position.
- If both of the driver-side air bag module connectors are disconnected when SAS unit module configuration is performed, the air bag system warning light will flash. Approx. 15 seconds after the connectors are properly reconnected, the light will go out.
- The self-malfunction diagnostic function consists of two function: present malfunction diagnostic and past malfunction diagnostic. The function of present malfunction diagnostic and past malfunction diagnostic are the same as that of the 626 (GF) model.

DTC table

DTC				Malfunction location
WDS or equivalent	Air bag system warning light			
	Flashing pattern		Priority ranking	
B1231	13		3	SAS unit activation (deployment) control freeze
B1342	12		2	SAS unit
	—	Air bag system warning light is illuminated all the time.	1	SAS unit (DTC 12 detection circuit malfunction)
B1869	—	Air bag system warning light is illuminated all the time.	1	Air bag system warning light system circuit open
	—	Air bag system warning light is illuminated does not illuminate.	—	Air bag system warning light system circuit short to ground
B1870	—	Air bag system warning light is illuminated all the time.	1	Air bag system warning light system circuit short to power supply
B1871	47		19	Occupancy sensor system (communication error)
	48		20	Occupancy sensor system (sensor internal circuit abnormal)
B1877	33		13	Driver-side pre-tensioner seat belt system resistance high
B1878				Driver-side pre-tensioner seat belt system circuit short to power supply
B1879				Driver-side pre-tensioner seat belt system circuit short to ground
B1881	34		12	Passenger-side pre-tensioner seat belt system resistance high
B1882				Passenger-side pre-tensioner seat belt system circuit short to power supply
B1883				Passenger-side pre-tensioner seat belt system short to ground
B1884	18		18	Passenger-side air bag cut-off indicator light system circuit open or short to ground
B1885	33		13	Driver-side pre-tensioner seat belt system resistance low

DTC				Malfunction location
WDS or equivalent	Air bag system warning light			
	Flashing pattern		Priority ranking	
B1886	34		12	Passenger-side pre-tensioner seat belt system resistance low
B1890	18		18	Passenger-side air bag cut-off indicator light system circuit short to power supply
B1913	19		11	Driver-side air bag module (inflator No.1) system circuit short to ground
	21		10	Passenger-side air bag module (inflator No.1) system circuit short to ground
B1916	19		11	Driver-side air bag module (inflator No.1) system circuit short to power supply
B1921	14		4	Deployment prohibited because configuration is not set
B1925	21		10	Passenger-side air bag module (inflator No.1) system circuit short to power supply
B1932	19		11	Driver-side air bag module (inflator No.1) system resistance high
B1933	21		10	Passenger-side air bag module (inflator No.1) system resistance high
B1934	19		11	Driver-side air bag module (inflator No.1) system resistance low
B1935	21		10	Passenger-side air bag module (inflator No.1) system resistance low
B1992	22		15	Driver-side side air bag module system circuit short to power supply
B1993				Driver-side side air bag module system circuit short to ground
B1994				Driver-side side air bag module system resistance high
B1995				Driver-side side air bag module system resistance low
B1996	23		14	Passenger-side side air bag module system circuit short to power supply
B1997				Passenger-side side air bag module system circuit short to ground
B1998				Passenger-side side air bag module system resistance high
B1999				Passenger-side side air bag module system resistance low

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DTC				Malfunction location
WDS or equivalent	Air bag system warning light			
	Flashing pattern		Priority ranking	
B2228	19		11	Driver-side air bag module (inflator No.2) system circuit short to ground
B2229	21		10	Passenger-side air bag module (inflator No.2) system circuit short to ground
B2230	19		11	Driver-side air bag module (inflator No.2) system circuit short to power supply
B2231	21		10	Passenger-side air bag module (inflator No.2) system circuit short to power supply
B2232	19		11	Driver-side air bag module (inflator No.2) system resistance high
B2233	21		10	Passenger-side air bag module (inflator No.2) system resistance high
B2234	19		11	Driver-side air bag module (inflator No.2) system resistance low
B2235	21		10	Passenger-side air bag module (inflator No.2) system resistance low
B2296	42		9	Crash zone sensor system (communication error, sensor internal circuit abnormal)
B2444	43		8	Driver-side side air bag sensor system (sensor internal circuit abnormal)
B2445	44		7	Passenger-side side air bag sensor system (sensor internal circuit abnormal)
B2477	54		5	Configuration error
B2773	24		17	Driver-side curtain air bag module system resistance low
B2774				Driver-side curtain air bag module system resistance high
B2775				Driver-side curtain air bag module system circuit short to ground
B2776				Driver-side curtain air bag module system circuit short to power supply

DTC				Malfunction location
WDS or equivalent	Air bag system warning light			
	Flashing pattern		Priority ranking	
B2777	25		16	Passenger-side curtain air bag module system resistance low
B2778				Passenger-side curtain air bag module system resistance high
B2779				Passenger-side curtain air bag module system circuit short to ground
B2780				Passenger-side curtain air bag module system circuit short to power supply
B2867	31		6	SAS unit connector poor connection
U2017	43		8	Driver-side side air bag sensor system (communication error)
U2018	44		7	Passenger-side side air bag sensor system (communication error)

PID/Data Monitoring Function

- By using the PID/data monitoring function, the monitored item of the input/output signal, as set on the SAS unit, can be freely selected and read out in real-time.
- An SST (WDS or equivalent) is used to read out PID/data monitor information.

PID/data monitor table

PID name (definition)	Unit/condition	Condition/specification	SAS unit terminal
CONT_RCM (Number of continuous DTC)	—	• DTC is detected: 1—255 • DTC is not detected: 0	—
D_ABAGR2 (Driver-side air bag module (inflator No.2) resistance)	ohm	Under any condition: 1.5—3.7 ohm	1G, 1J
D_CRSH_S (Driver-side side air bag sensor state)	OK/ COMM FAIL/ INT FAIL	• Sensor normal: OK • Sensor communication error: COMM FAIL • Sensor internal circuit abnormal: INT FAIL	2Z, 2AA
DABAGR (Driver-side air bag module (inflator No.1) resistance)	ohm	Under any condition: 1.5—3.7 ohm	1S, 1V
DR_CURTN (Driver-side curtain air bag module resistance)	ohm	Under any condition: 1.4—3.2 ohm	2V, 2Y
DR_PTENS (Driver-side pre-tensioner seat belt resistance)	ohm	Under any condition: 1.5—3.1 ohm	2P, 2S
DS_AB (Driver-side side air bag module resistance)	ohm	Under any condition: 1.4—3.2 ohm	2M, 2O
DS_AB_ST (Driver-side side air bag module circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2M, 2O
DS_CURT_ST (Driver-side curtain air bag module circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2V, 2Y
DS1_STAT (Driver-side air bag module (inflator No.1) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1S, 1V

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PID name (definition)	Unit/condition	Condition/specification	SAS unit terminal
DS2_STAT (Driver-side air bag module (inflator No.2) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1G, 1J
DSB_P_ST (On demand driver-side pre-tensioner seat belt circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2P, 2S
DSSBLT_PF (Driver-side pre-tensioner seat belt circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2P, 2S
FRNT_CRSH_SNSR (Crash zone sensor state)	OK/ COMM FAIL/ INT FAIL	• Sensor normal: OK • Sensor communication error: COMM FAIL • Sensor internal circuit abnormal: INT FAIL	1B, 1C
OD_D_CRSH (On demand driver-side side air bag sensor state)	OK/ COMM FAIL/ INT FAIL	• Sensor normal: OK • Sensor communication error: COMM FAIL • Sensor internal circuit abnormal: INT FAIL	2Z, 2AA
OD_D_CURT (On demand driver-side curtain air bag module circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2V, 2Y
OD_DAB1_ST (On demand driver-side air bag module (inflator No.1) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1S, 1V
OD_DAB2_ST (On demand driver-side air bag module (inflator No.2) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1G, 1J
OD_DSAB_ST (On demand driver-side side air bag circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2M, 2O
OD_F_CRSH (On demand crash zone sensor state)	OK/ COMM FAIL/ INT FAIL	• Sensor normal: OK • Sensor communication error: COMM FAIL • Sensor internal circuit abnormal: INT FAIL	1B, 1C
OD_P_CRSH (On demand passenger-side side air bag sensor state)	OK/ COMM FAIL/ INT FAIL	• Sensor normal: OK • Sensor communication error: COMM FAIL • Sensor internal circuit abnormal: INT FAIL	2B, 2C
OD_P_CURT (On demand passenger-side curtain air bag module circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2A, 2D
OD_PAB1ST (On demand passenger-side air bag module (inflator No.1) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1M, 1P
OD_PAB2_ST (On demand passenger-side air bag module (inflator No.2) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1A,1D
OD_P_PSAB_ST (On demand passenger-side side air bag sensor circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2I, 2L
P_ABAGR2 (Passenger-side air bag module (inflator No.2) resistance)	ohm	Under any condition: 1.4—2.9 ohm	1A, 1D
P_PTENSFLT (Passenger-side pre-tensioner seat belt circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2G, 2J

PID name (definition)	Unit/condition	Condition/specification	SAS unit terminal
PABAGR (Passenger-side air bag module (inflator No.1) resistance)	ohm	Under any condition: 1.4—2.9 ohm	1M, 1P
PCRSH_SNSR (Passenger-side side air bag sensor state)	OK/ COMM FAIL/ INT FAIL	• Sensor normal: OK • Sensor communication error: COMM FAIL • Sensor internal circuit abnormal: INT FAIL	2B, 2C
PS_AB (Passenger-side side air bag module resistance)	ohm	Under any condition: 1.4—3.2 ohm	2I, 2L
PS_AB_ST (Passenger-side side air bag sensor circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2I, 2L
PS_CURTN (Passenger-side curtain air bag module resistance)	ohm	Under any condition: 1.4—3.2 ohm	2A, 2B
PS_CURT_ST (Passenger-side curtain air bag module circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2A, 2D
PS_PTENS (Passenger-side pre-tensioner seat belt resistance)	ohm	Under any condition: 1.5—3.1 ohm	2G, 2J
PS1_STAT (Passenger-side air bag module (inflator No.1) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1M, 1P
PS2_STAT (Passenger-side air bag module (inflator No.2) circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	1A, 1D
PSB_P_ST (On demand passenger-side pre-tensioner seat belt circuit state)	NORMAL/ OPEN/ SHRT GND/ SHRT B+	• Related wiring harness normal: NORMAL • Related wiring harness circuit open: OPEN • Related wiring harness short to ground: SHRT GND • Related wiring harness short to power supply: SHRT B+	2G, 2J
RCM_VOLT (System IG1 voltage value)	V	• Ignition switch to ON position: B+ • Other: 0 V	1W

Active Command Mode Function

- The active command mode function is used to freely select simulation items for the output-related parts of the SAS unit, without needing to control the SAS unit.
- A SST (WDS or equivalent) is used to activate this function.

Active command mode table

Command name	Definition	Operation
WRNLAMPCHM	Air bag system warning light	ON/OFF

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HEATER AND AIR CONDITIONER SYSTEMS

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- BASIC SYSTEM U-6
- AIR FILTER U-7
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- SENSOR SIGNAL DELAY FUNCTION U-35
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OUTLINE

ABBREVIATION

A6E850201038T04

A/C	Air conditioning
B+	Battery positive voltage
CPU	Central processing unit
HI	High
IAC	Idle air control
IG	Ignition
L.H.D.	Left hand drive
LO	Low
M	Motor
MAX	Maximum
OFF	Switch off
ON	Switch on
PCM	Powertrain control module
REC	Recirculate
R.H.D.	R.H.D.
TNS	Tail number side light

OUTLINE OF CONSTRUCTION

A6E850201038T01

- The construction and operation of the air conditioner system is essentially carried over from that of the previous PREMACY (CP) model, except for the following features. (See PREMACY Training Manual 3336-1*-99C.) (See PREMACY Training Manual 3351-1A-01A.)

FEATURES

A6E850201038T02

Improved air Conditioning Performance

- A sub-cooling system integrating the condenser and receiver/drier has been adopted to facilitate evaporator operation. This system also reduces the number of parts and the amount of refrigerant.

Improved Visibility

- To improve windshield and front door glass defogging, the climate control unit is designed to automatically turn the air intake mode to FRESH when the airflow mode selector dial is turned to DEFROSTER position.

Reduce Weight

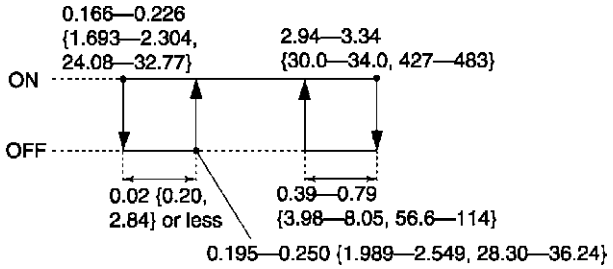
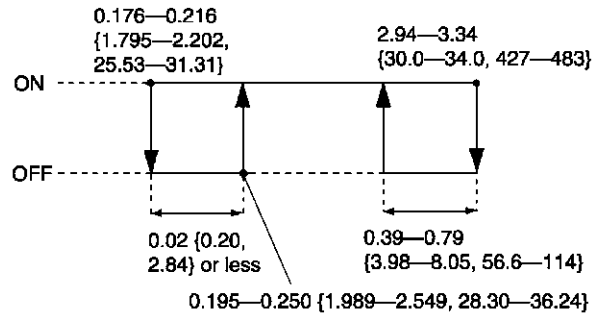
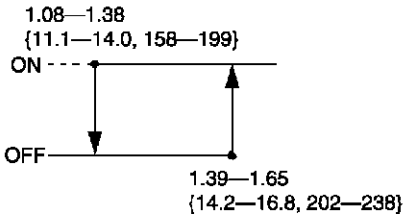
- The A/C unit integrating the cooling unit and heater unit has been adopted to reduce weight.

SPECIFICATIONS

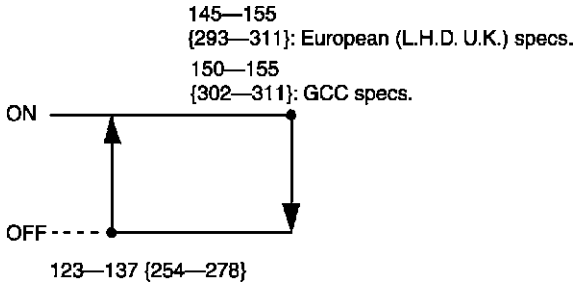
A6E850201038T03

Manual Air Conditioner

Item			Specification
Heating capacity		(kW {kcal/h})	4.400 {3,784}
Airflow volume (during heater operation)	Blower motor	(m^3/h)	310 (L.H.D.) 300 (R.H.D.)
Electricity consumption (during heater operation)	Blower motor	(W)	184
Cooling capacity		(kW {kcal/h})	4.200 {3,612}
Airflow volume (during air conditioner operation)	Blower motor	(m^3/h)	460
Electricity consumption (during air conditioner operation)	Blower motor	(W)	225
	Magnetic clutch	(W)	46
Fan type	Blower motor		Sirocco fan
Refrigerant	Type		R-134a
	Regular amount (approximate quantity)	(g {oz})	470 {16.6} (L.H.D.) 430 {15.2} (R.H.D.)

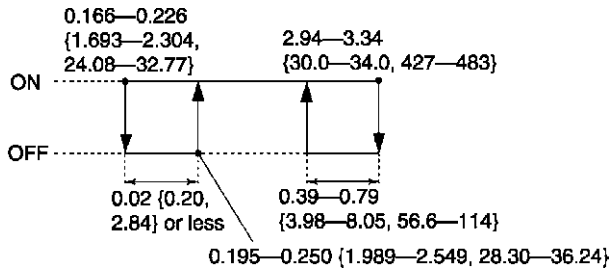
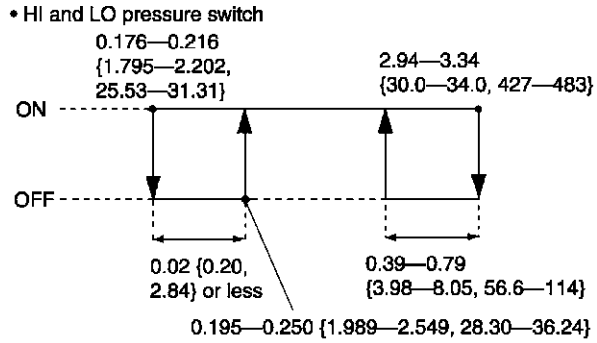
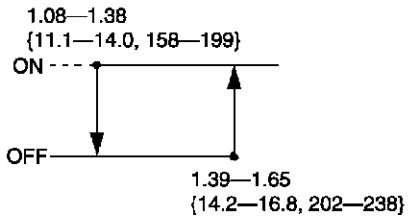
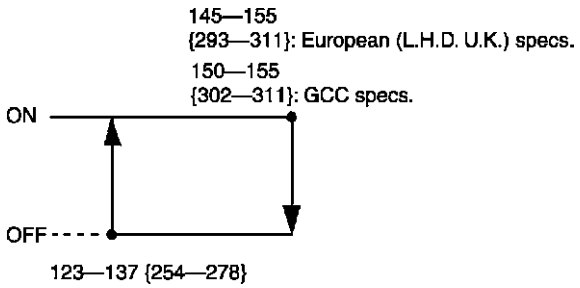
Item			Specification
A/C compressor	Type		Vane-rotary
	Discharge capacity (ml {cc, fl oz})		120 {120, 4.06}
	Max. allowable speed (rpm)		6,400
	Lube oil	Type	ATMOS GU10
		Sealed volume (approximate quantity) (ml {cc, fl oz})	120 {120, 4.06}
	Magnetic clutch clearance (mm {in})		0.3—0.5 {0.012—0.019}
Condenser	Type		Multiflow (sub-cooling type)
	Radiated heat (kW {kcal/h})		4.69 {4,030}: European (L.H.D.) specs. 5.96 {5,130}: European (U.K.), GCC specs.
	Receiver/drier capacity (ml {cc, fl oz})		190 {190, 6.42}
	Desiccant		Synthetic zeolite
Expansion valve	Type		Block type
Evaporator	Type		Double-tank drawn cup
Refrigerant pressure switch	Type		Dual-pressure: General area
	Operating pressure (MPa {kgf/cm^2, psi})		
	Type		Triple-pressure: L3 engine, intensely hot area
	Operating pressure (MPa {kgf/cm^2, psi})		• HI and LO pressure switch  • Middle pressure switch 

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Item		Specification
Thermal protector	Type	Bimetallic (Indirect sensing type)
	Operating temperature (°C {°F})	
Temperature control		Reheat full air mix type

Full-auto Air Conditioner

Item			Specification
Heating capacity		(kW {kcal/h})	4.400 {3,784}
Airflow volume (during heater operation)	Blower motor	(m^3/h)	310 (L.H.D.) 300 (R.H.D.)
Electricity consumption (during heater operation)	Blower motor	(W)	184
Cooling capacity		(kW {kcal/h})	4.200 {3,612}
Airflow volume (during air conditioner operation)	Blower motor	(m^3/h)	460
Electricity consumption (during air conditioner operation)	Blower motor	(W)	225
	Magnetic clutch	(W)	46
Fan type	Blower motor		Sirocco fan
Refrigerant	Type		R-134a
	Regular amount (approximate quantity)	(g {oz})	470 {16.6} (L.H.D.) 430 {15.2} (R.H.D.)
A/C compressor	Type		Vane-rotary
	Discharge capacity	(ml {cc, fl oz})	120 {120, 4.06}
	Max. allowable speed	(rpm)	6,400
	Lube oil: Type		ATMOS GU10
	Lube oil: Sealed volume (approximate quantity)	(ml {cc, fl oz})	120 {120, 4.06}
	Magnetic clutch clearance	(mm {in})	0.3—0.5 {0.012—0.019}
Condenser	Type		Multiflow (sub-cooling type)
	Radiated heat	(kW {kcal/h})	4.69 {4,030}: European (L.H.D.) specs. 5.96 {5,130}: European (U.K.), GCC specs.
	Receiver/drier capacity	(ml {cc, fl oz})	190 {190, 6.42}
	Desiccant		Synthetic zeolite
Expansion valve	Type		Block type
Evaporator	Type		Double-tank drawn cup

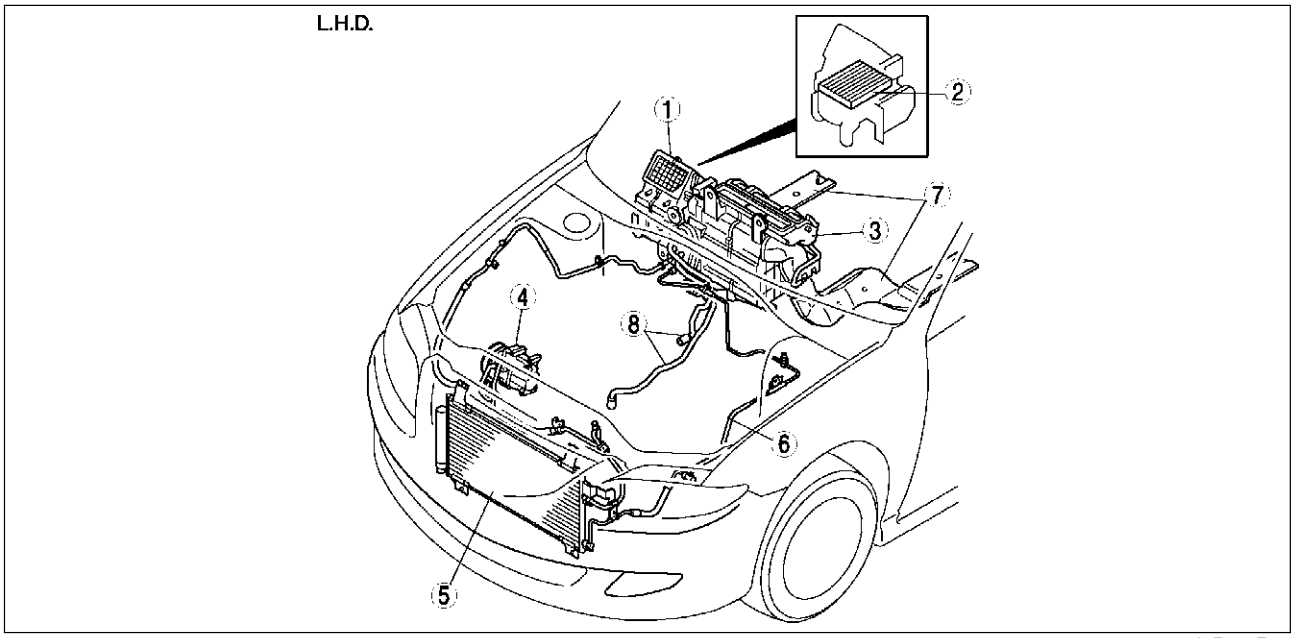
Item		Specification
Refrigerant pressure switch	Type	Dual-pressure: General area
	Operating pressure (MPa {kgf/cm^2, psi})	
	Type	Triple-pressure: L3 engine, intensely hot area
	Operating pressure (MPa {kgf/cm^2, psi})	• HI and LO pressure switch  • Middle pressure switch 
Thermal protector	Type	Bimetallic (Indirect sensing type)
	Operating temperature (°C {°F})	
Sensor	Solar radiation sensor	Photodiode
	Ambient temperature sensor	Thermistor
	Cabin temperature sensor	
	Evaporator temperature sensor	
	Water temperature sensor	
Actuator	Air intake actuator	Sliding contact type
	Air mix actuator, airflow mode actuator	Potentiometer type
Temperature control		Reheat full air mix type

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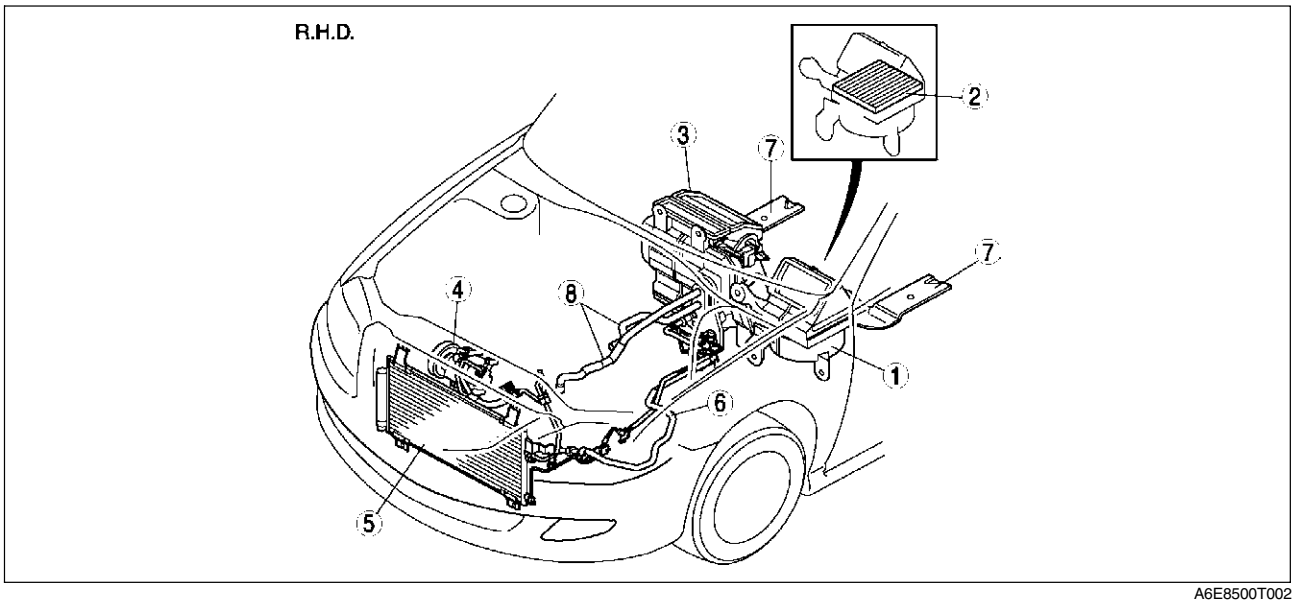
BASIC SYSTEM

BASIC SYSTEM

A6E851601040T01



A6E8500T001



A6E8500T002

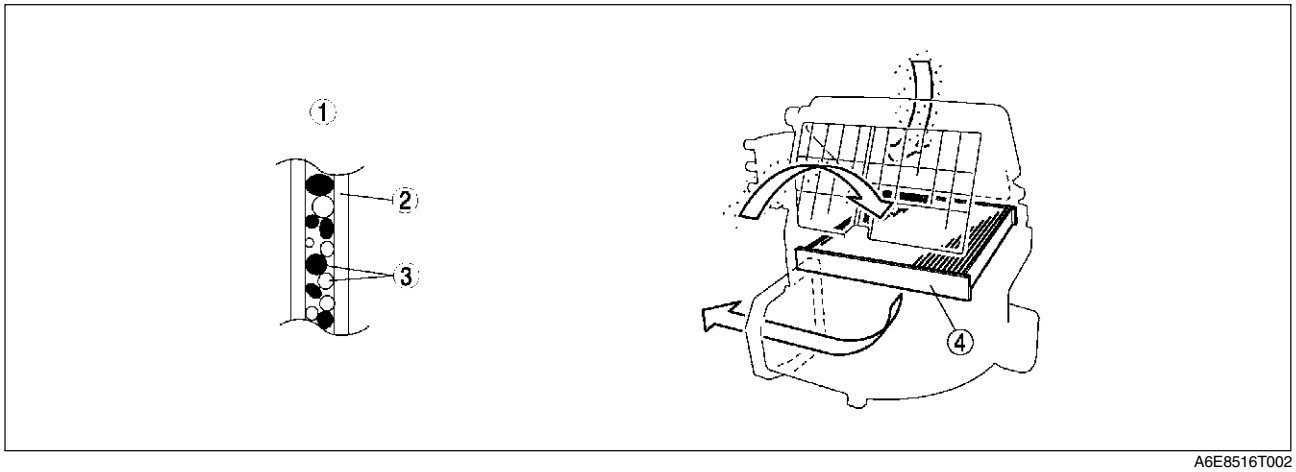
1	Blower unit
2	Air filter
3	A/C unit
4	A/C compressor

5	Condenser
6	Refrigerant lines
7	Rear heat duct
8	Heater hose

AIR FILTER

A6E851613988T01

- An air filter that can deodorize and remove pollen and dust have been added.
- The air filter consists of deodorizer surrounded by dust filter.
- The dust filter removes pollen and dust. The deodorizer removes odors containing aldehyde.
- The air filter can not be reused and must be replaced periodically. Even new air filters are gray; be careful not to mistake the gray color as dirt.



A6E8516T002

1	Profile of air filter
2	Staple fiber

3	Deodorant
4	Air filter

A/C UNIT

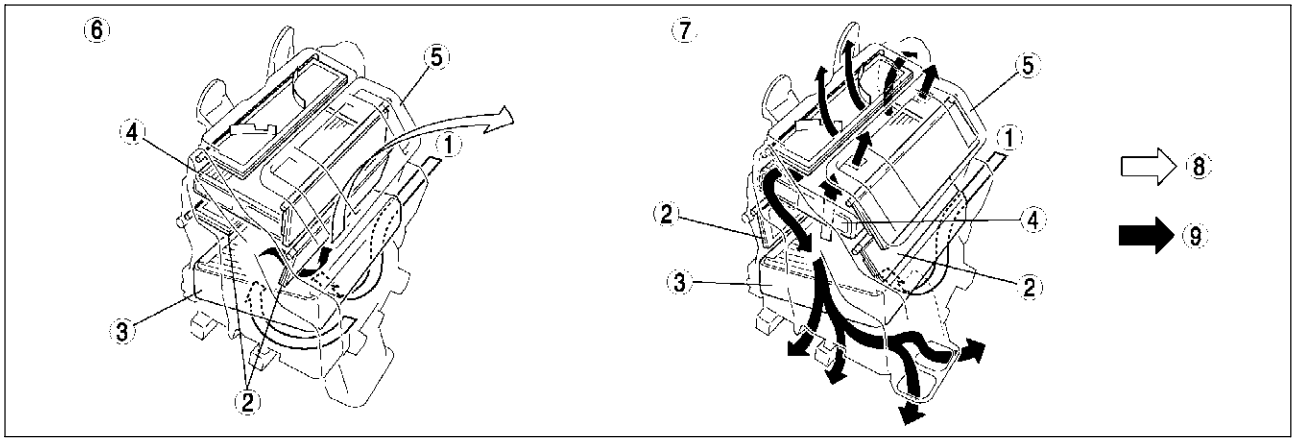
A6E851661130T01

- The A/C unit which integrates the cooling and heater units has been adopted.

Air Mix Door Operation

- The air mix door, installed in the A/C unit, controls HOT or COLD position, depending on the position of the temperature control dial. As a result, airflow distribution changes, and the airflow temperature is controlled.

U



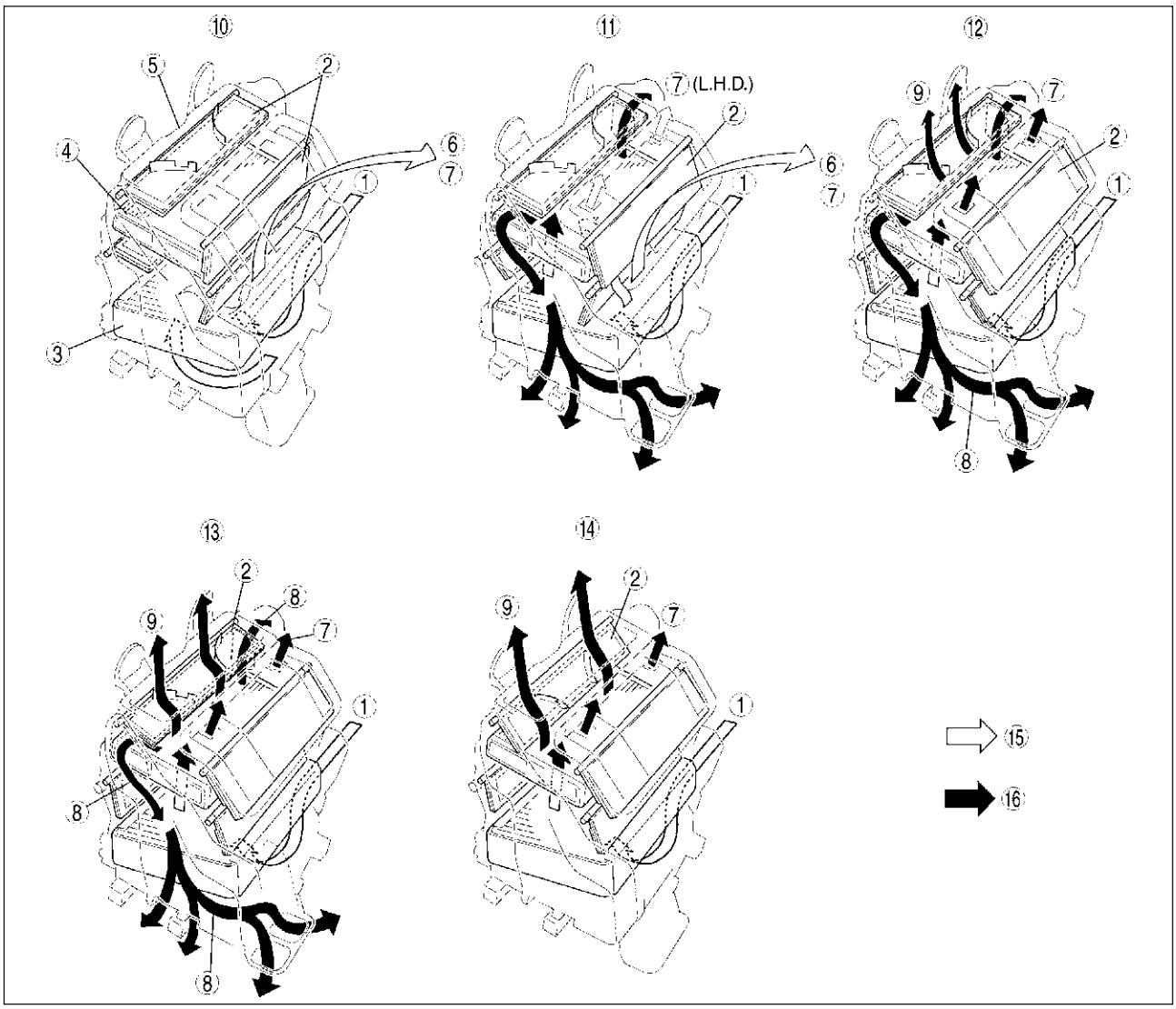
A6E8516T005

1	Airflow
2	Air mix door
3	Evaporator
4	Heater core
5	A/C unit

6	COLD
7	HOT
8	Cold air
9	Warm air

Airflow Mode Door Operation

- The airflow mode doors move to VENT, BI-LEVEL, HEAT, HEAT/DEF, or DEFROSTER position, depending on the position of the airflow mode selector dial. As a result, airflow mode changes.



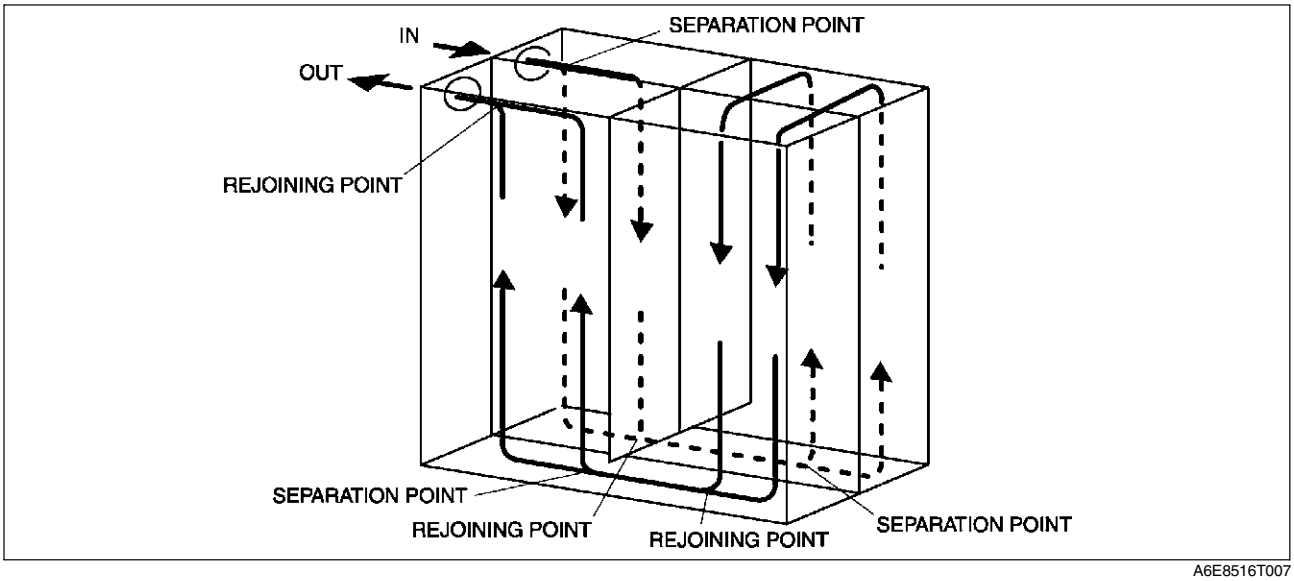
A6E8516T006

1	Airflow
2	Airflow mode door
3	Evaporator
4	Heater core
5	A/C unit
6	To center vent
7	To side vent
8	To front and rear heat

9	To defroster and side demister
10	VENT
11	BI-LEVEL
12	HEAT
13	HEAT/DEF
14	DFROSTER
15	Cold air
16	Warm air

Evaporator

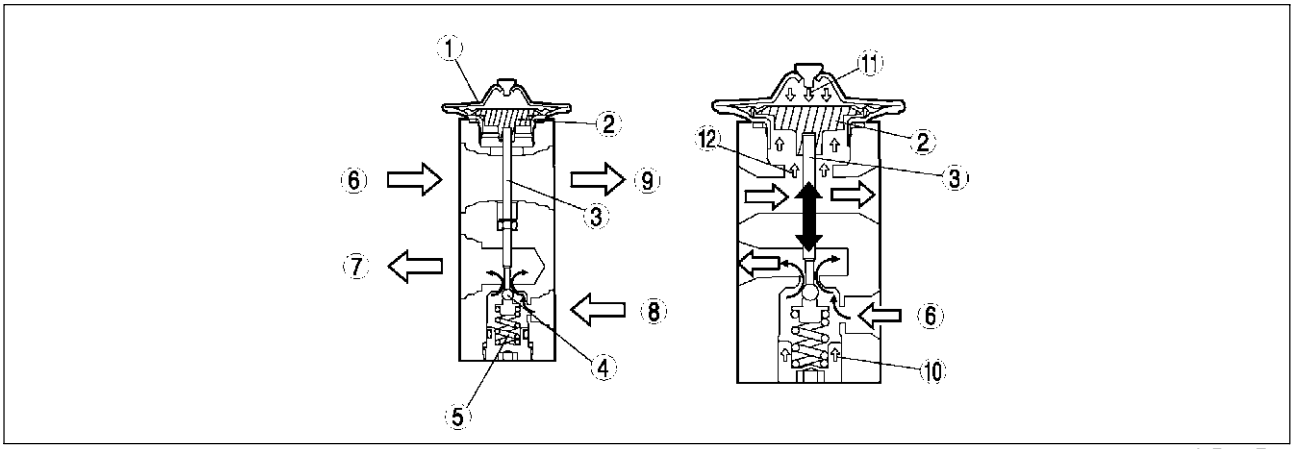
- The double-tank drawn cup is the same as the previous model except that a new refrigerant flow pattern has been adopted. Due to this, size and weight reduction is achieved while maintaining performance.



A6E8516T007

Expansion Valve

- The expansion valve causes a sudden decrease in the pressure of the liquid refrigerant. This atomizes the refrigerant, making it easier for the evaporator to vaporize it. The expansion valve also regulates the flow volume of the refrigerant sent to the evaporator.
- The amount of refrigerant delivered to the evaporator is adjusted by the opening angle of the ball valve in the expansion valve.
- Opening angle is adjusted by a balance of the R-134a pressure (Pb) in the diaphragm, and a composite force of evaporator discharge pressure (PI) against the lower part of the diaphragm and spring force (Fs) pushing up the ball valve. When PI increases, the temperature of the temperature sensor near the diaphragm rises and the Pd heated by the R-134a in the diaphragm increases. When the Pd increases more than PI + Fs, the diaphragm is pushed down, and the shaft attached to end of the temperature sensor rod pushes down the ball valve, increasing the amount of liquid refrigerant flow. When the evaporator discharge refrigerant temperature decreases, PI + Fs increases more than Pd, the ball valve is pushed up, and the amount of liquid refrigerant flow decreases.



A6E8516T003

1	Diaphragm
2	Temperature sensor
3	Shaft
4	Ball valve
5	Spring
6	From evaporator

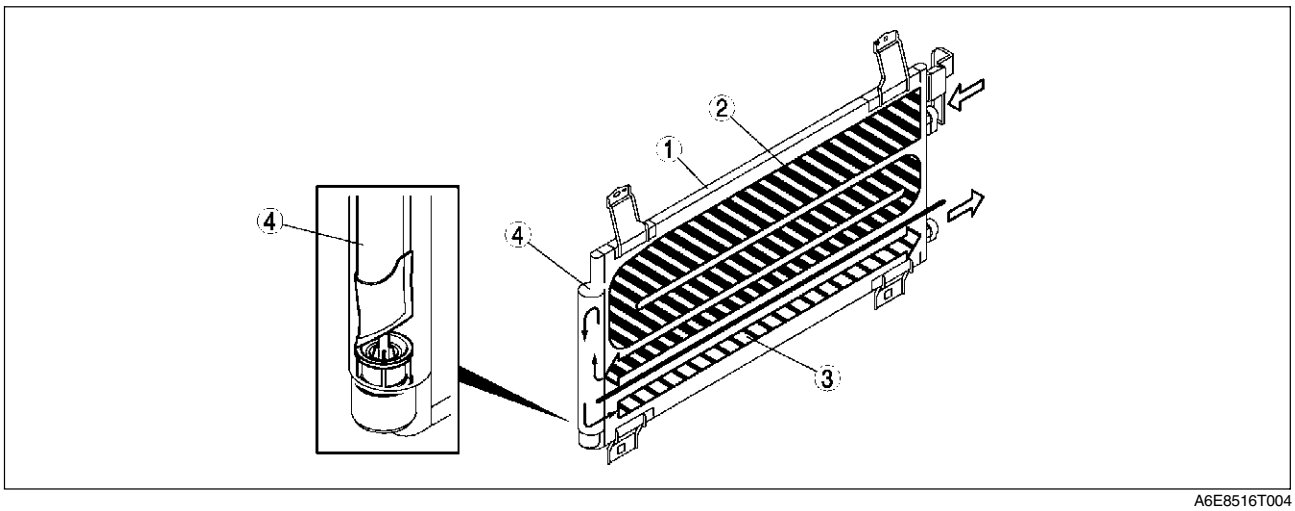
7	To evaporator
8	From condenser
9	To condenser
10	Spring force
11	HFC-134a pressure
12	Discharge pressure

CONDENSER

A6E851661480T01

Construction

- A sub cool condenser has been adopted. It is a multi-flow condenser which is equipped with a sub cooling part and integrated with a receiver/drier.
- The sub cool condenser separates liquid-gas refrigerant initially cooled at the condenser via the receiver/drier, where it returns again to the condenser sub cooling part and is cooled, accelerating liquefaction and improving cooling capacity.



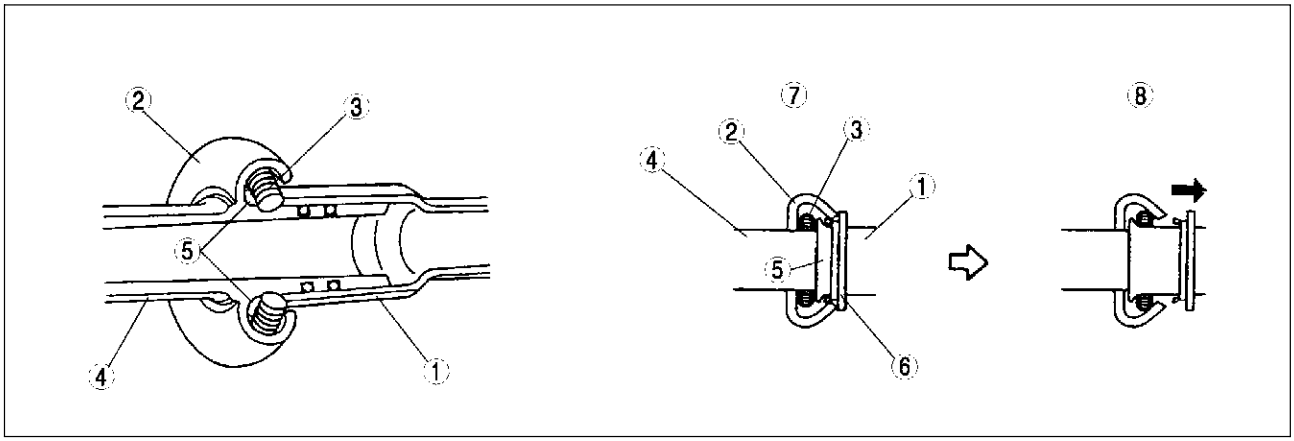
A6E8516T004

1	Condenser	3	Sub cooling part
2	Cooling part	4	Receiver/drier

REFRIGERANT LINES

A6E851661460T01

- Spring-lock coupling is used for pipe-to-pipe connections. As a result, pipes can be connected easily, maintenance of torque is unnecessary, and serviceability is improved.
- There is a garter spring in the cage on the female side (cooler hose (LO) (L.H.D.), cooler pipe No.3, 4 (R.H.D.)) of spring-lock coupling type and the end of the pipe on the male side (A/C unit) is flared. When the pipes are being connected, the flared end of the male side forces the garter spring on the female side to expand, and by fully inserting the male side into the female side, the flared end is locked by the garter spring.
- When the cooler hose (LO) (L.H.D.) or cooler pipe No.3, 4 (R.H.D.) is replaced, the additional indicator ring comes out after connection, indicating that the flared end is locked.



A6E8516T001

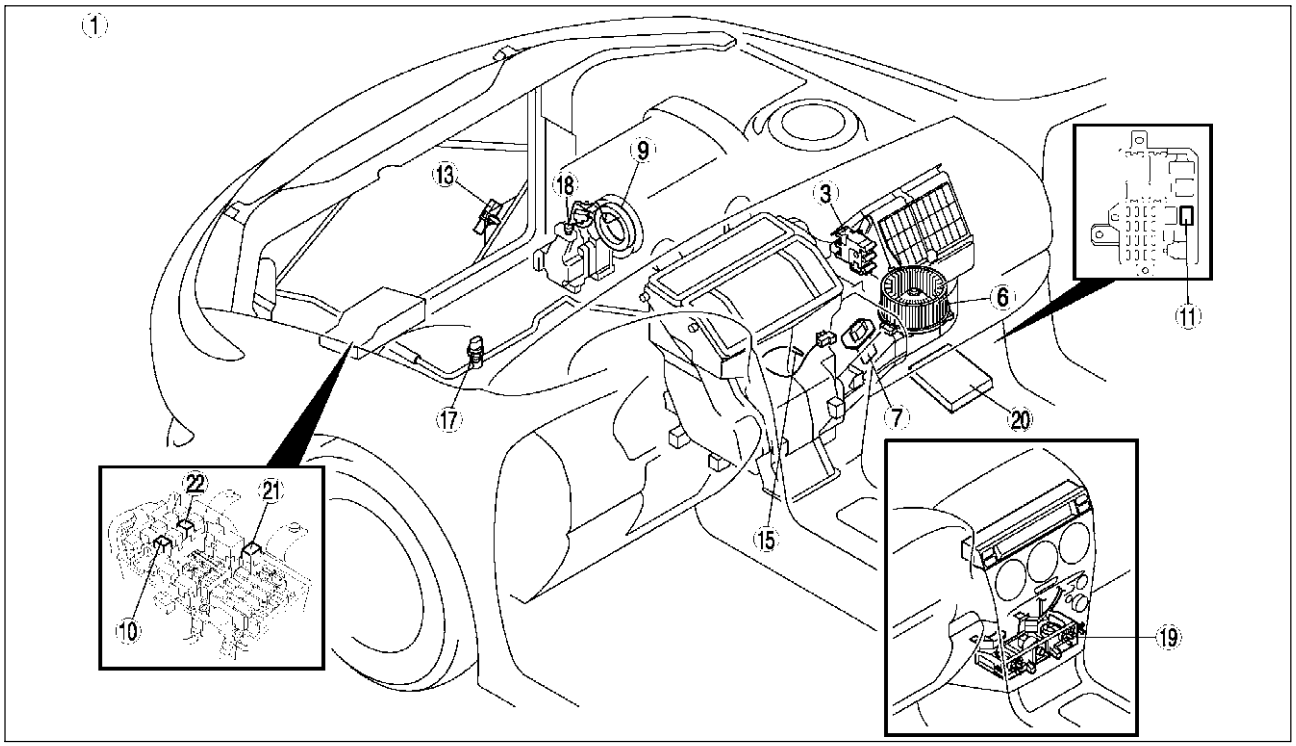
1	Female side	5	Flared end
2	Cage	6	Indicator ring
3	Garter spring	7	Unlocked
4	Male side	8	Locked

CONTROL SYSTEM

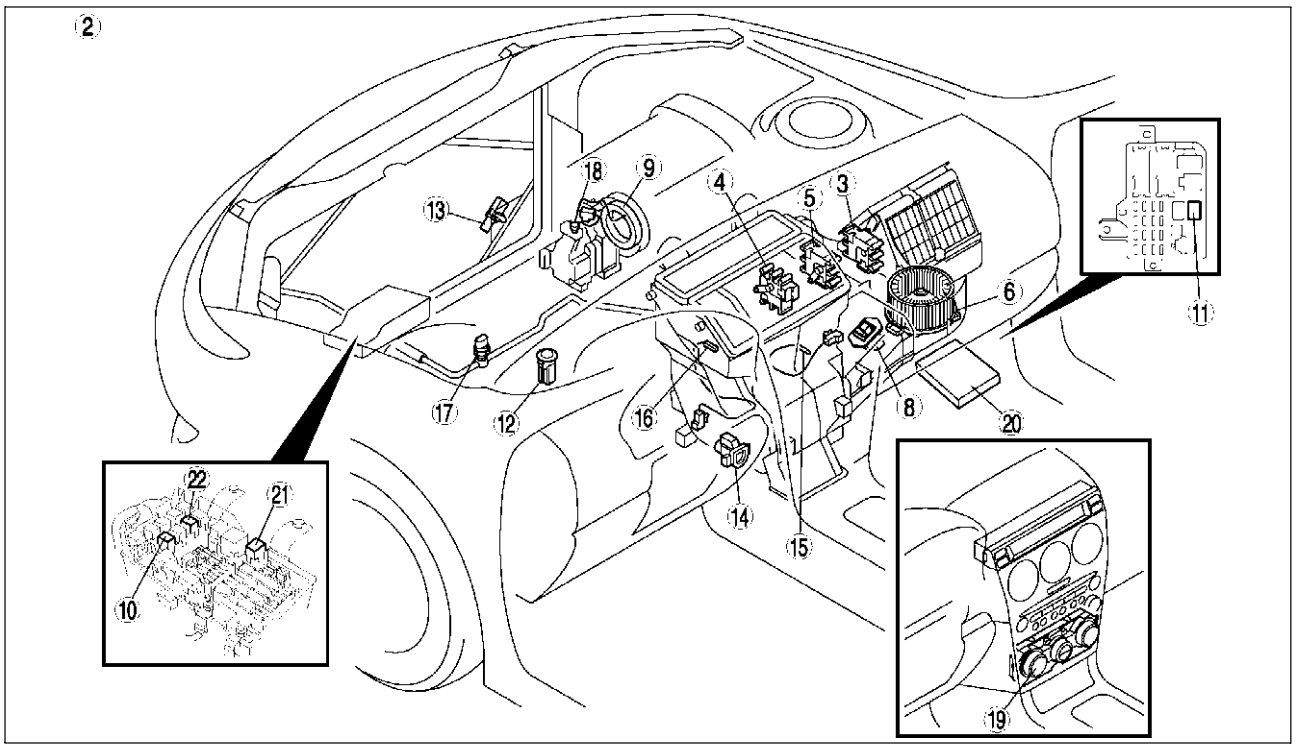
CONTROL SYSTEM

A6E854001042T10

L.H.D.

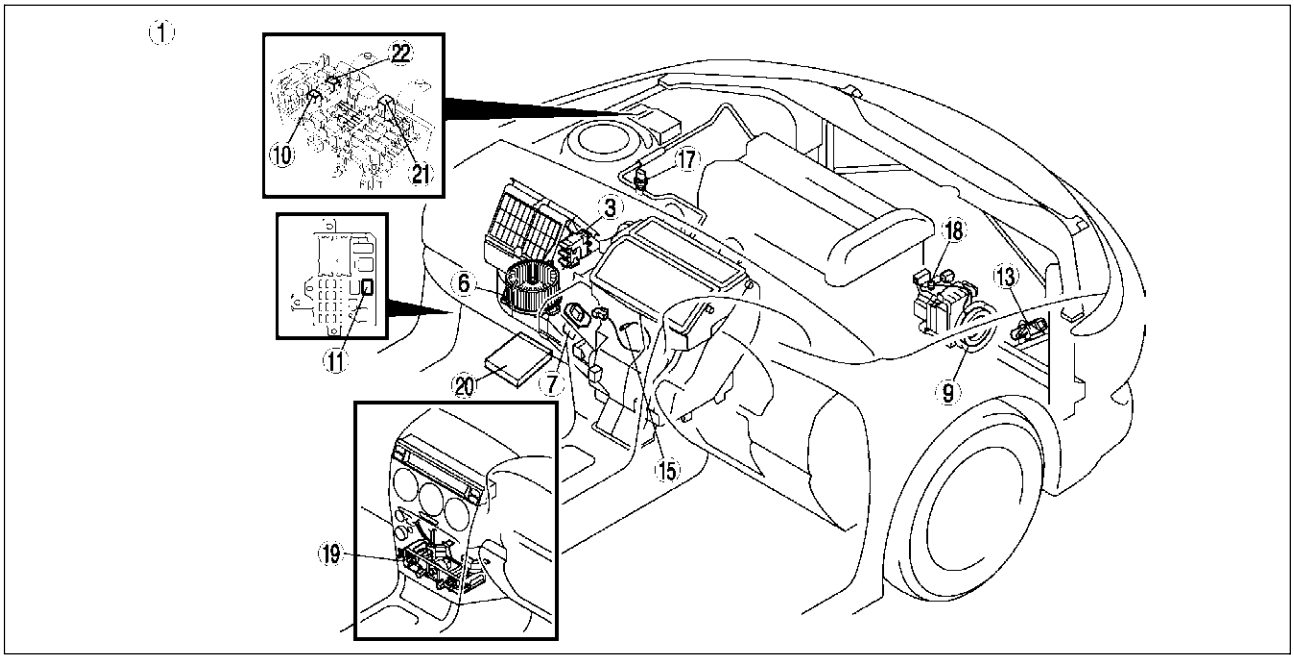


A6E8500T003

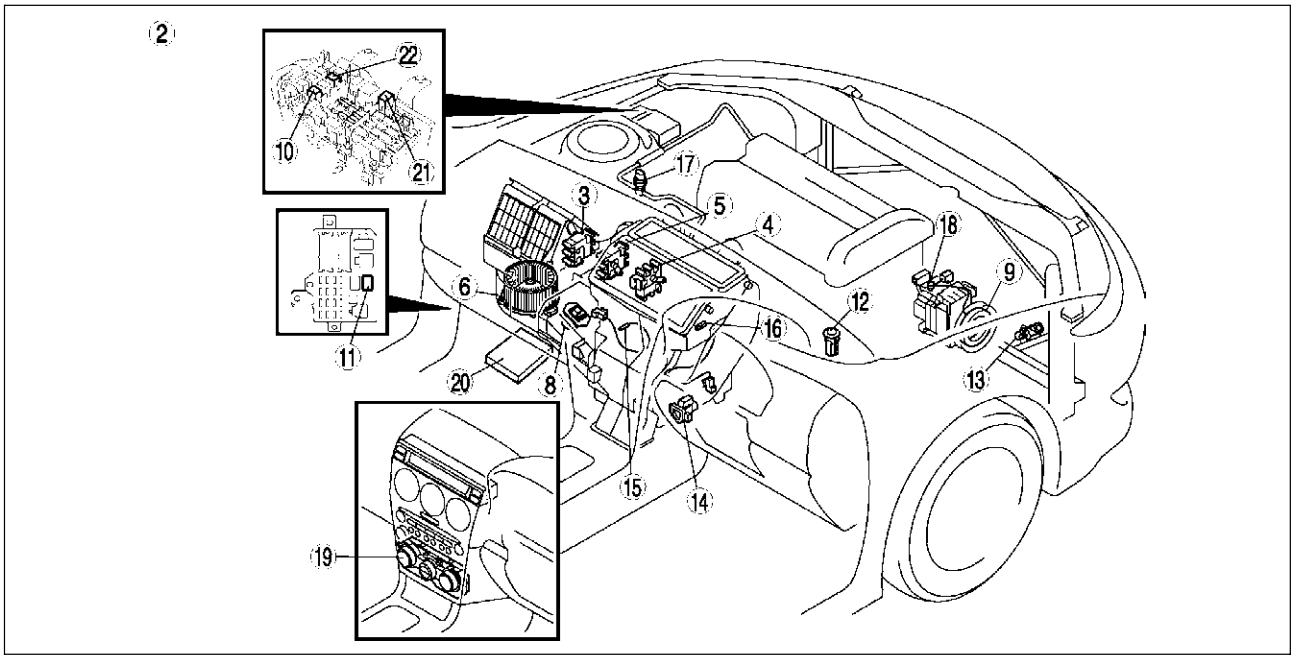


A6E8500T004

R.H.D.



A6E8500T005



A6E8500T006

1	Manual air conditioner
2	Full-auto air conditioner
3	Air intake actuator
4	Air mix actuator
5	Airflow mode actuator
6	Blower motor
7	Resister
8	Power MOS FET
9	Magnetic clutch
10	A/C relay
11	Blower relay

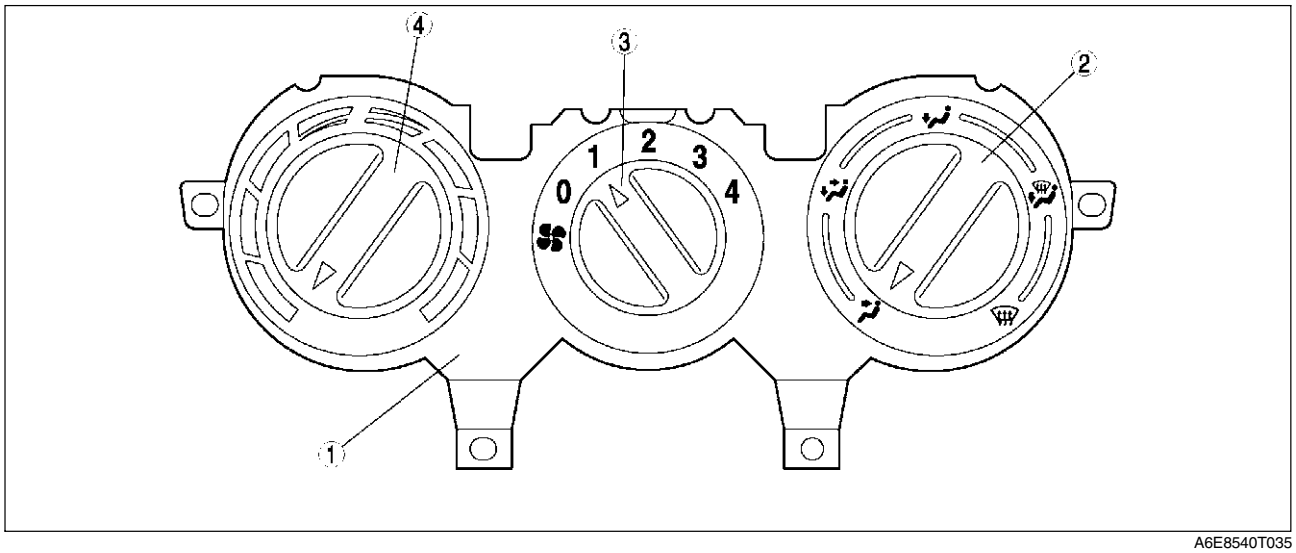
12	Solar radiation sensor
13	Ambient temperature sensor
14	Cabin temperature sensor
15	Evaporator temperature sensor
16	Water temperature sensor
17	Refrigerant pressure switch
18	Thermal protector
19	Climate control unit
20	PCM
21	TNS relay
22	Rear window defroster relay

CLIMATE CONTROL UNIT

A6E854061190T01

Manual Air Conditioner

- A wire-type climate control unit is used with the manual air conditioner.
- The airflow mode selector dial, temperature control dial, fan switch have been enlarged to improve ease of operation.
- The A/C, REC/FRESH and rear defroster switches equipped in the current climate control unit have been relocated to the center panel.

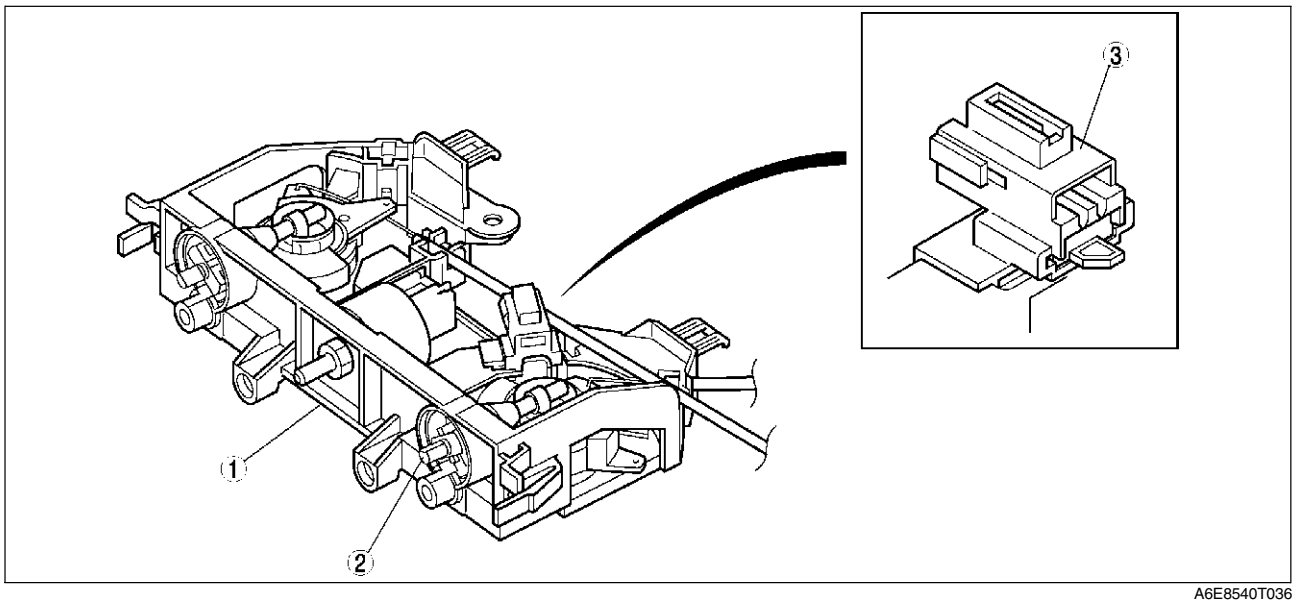


A6E8540T035

1	Climate control unit
2	Airflow mode selector dial

3	fan switch
4	Temperature control dial

- A defroster switch into the climate control unit detects when the airflow mode selector dial is turned to DEFROSTER position. When the defroster switch turned on, the center panel starts defroster control. (See U–17 Defroster Control.)



A6E8540T036

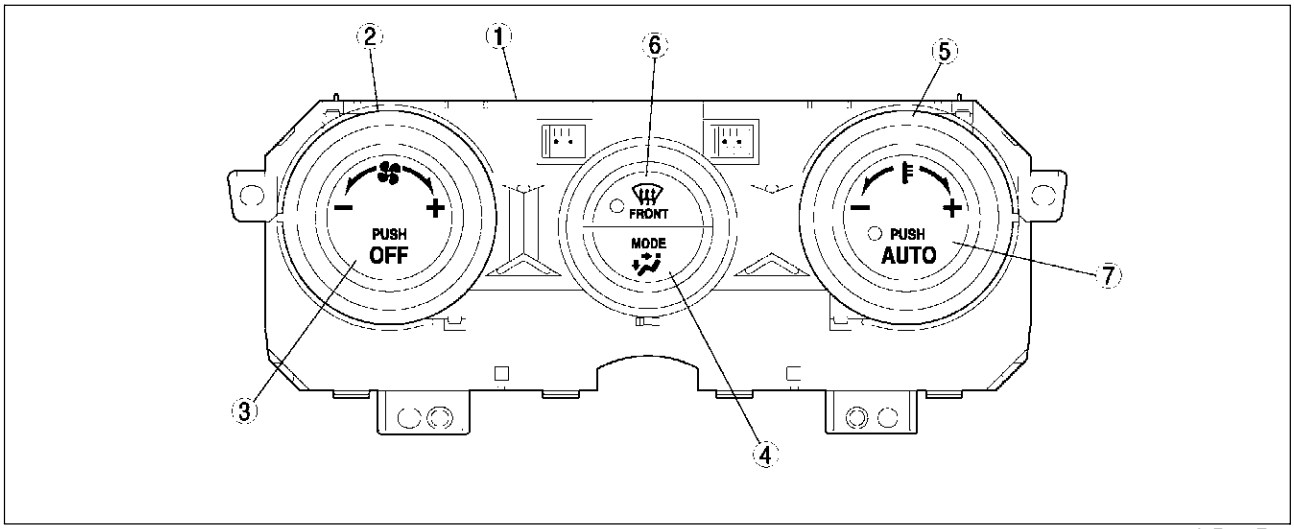
1	Climate control unit
2	Airflow mode selector dial

3	Defroster switch

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Full-auto Air Conditioner

- A logic-type climate control unit is used with the full-auto air conditioner.
- The airflow mode selector dial, temperature setting dial, fan switch have been enlarged to improve ease of operation.
- The A/C, REC/FRESH and rear defroster switches equipped in the current climate control unit have been relocated to the center panel.

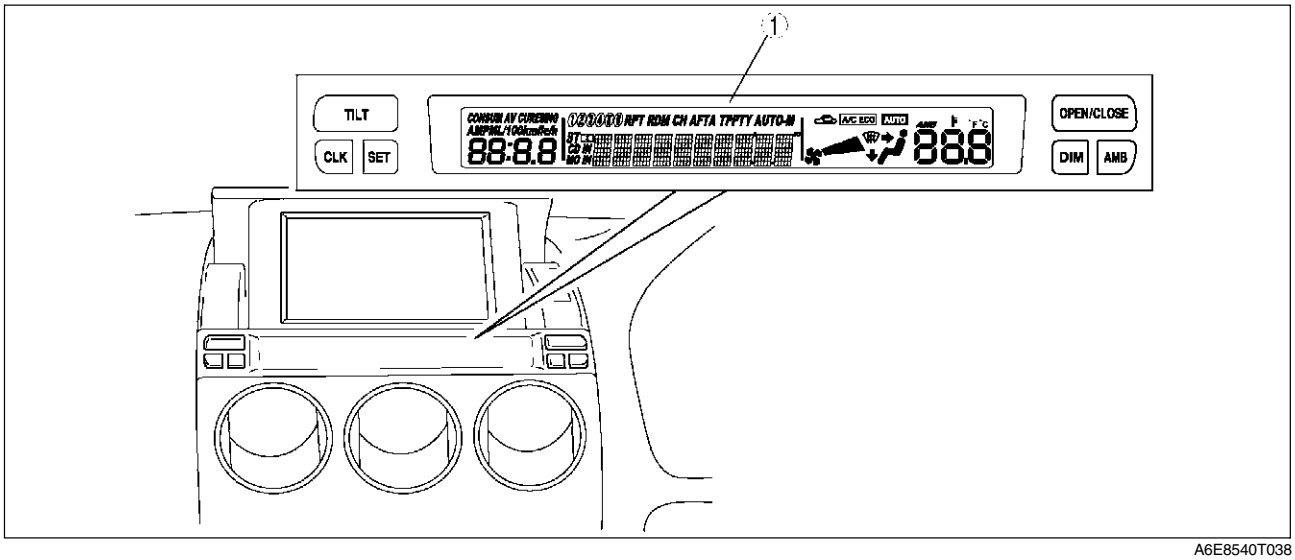


A6E8540T037

1	Climate control unit
2	Fan switch
3	OFF switch
4	MODE switch

5	Temperature setting dial
6	Defroster switch
7	AUTO switch

- Information about the operating condition of the system is displayed on the information display.



A6E8540T038

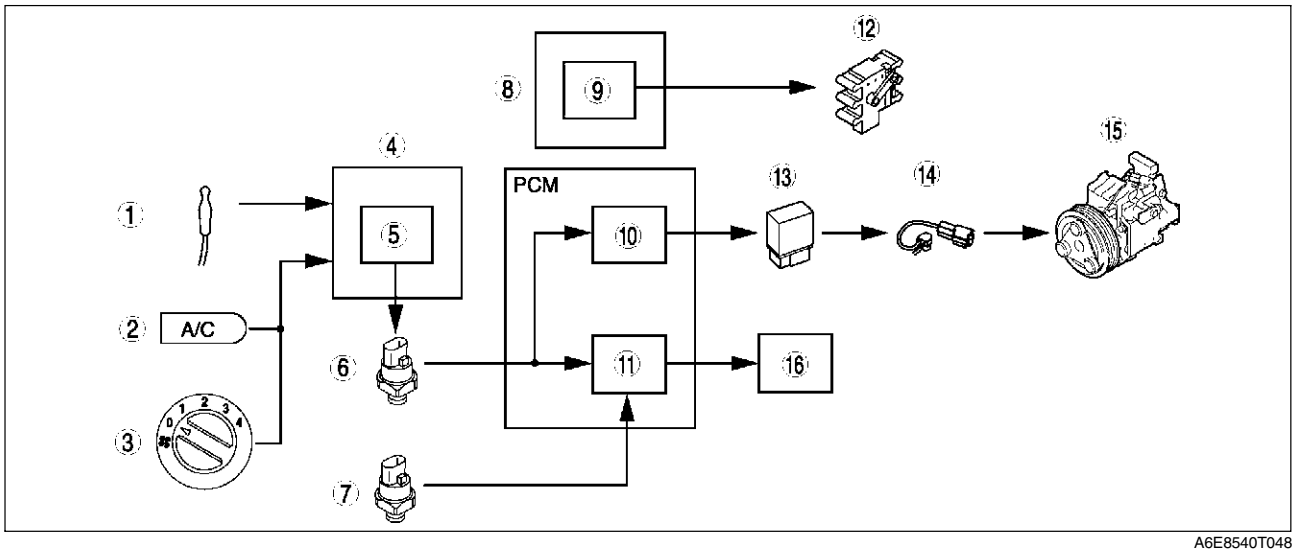
1	Information display

MANUAL AIR CONDITIONER CONTROL SYSTEM

A6E854001081T01

Block Diagram

- The climate control unit carries out the defroster control base on signal sent from the airflow mode selector dial, and sends an operating signal to the air intake actuator.
- The center panel sends an A/C signal to the PCM via the refrigerant pressure switch based on signals sent from the A/C switch, fan switch and evaporator temperature sensor.
- The PCM sends operating signals to the A/C relay and IAC valve based on A/C signal and vehicle signal.



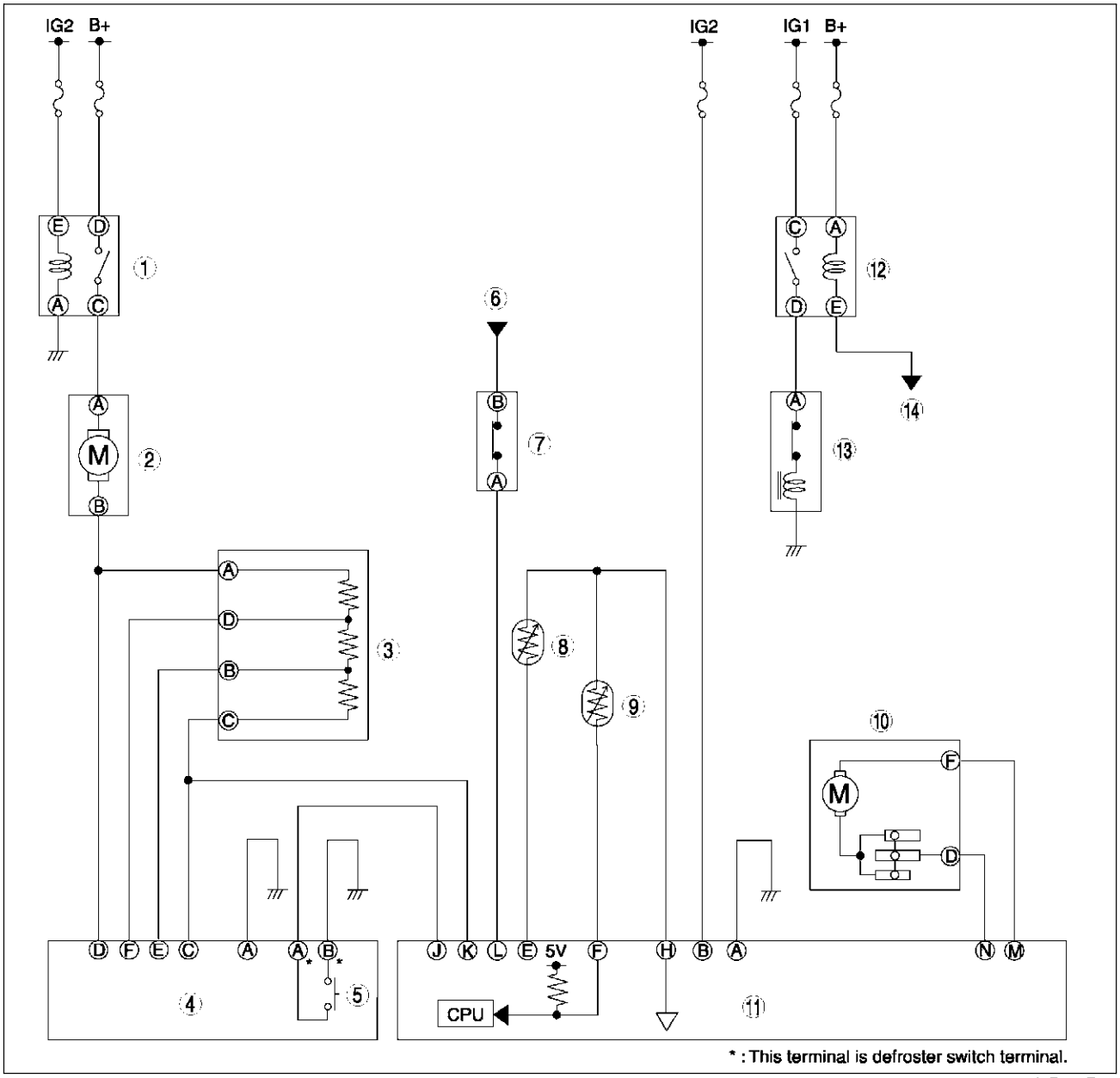
A6E8540T048

1	Evaporator temperature sensor
2	A/C switch
3	Fan switch
4	Center panel
5	A/C compressor control
6	Refrigerant pressure switch (HI and LO pressure)
7	Refrigerant pressure switch (middle pressure) (L3 engine only)
8	Climate control unit

9	Defroster control
10	A/C cut-off control
11	Idle air control
12	Air intake actuator
13	A/C relay
14	Thermal protector
15	Magnetic clutch
16	IAC valve

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System Wiring Diagram



A6E8540T039

1	Blower relay
2	Blower motor
3	Resistor
4	Climate control unit
5	Defroster switch
6	From PCM
7	Refrigerant pressure switch

8	Ambient temperature sensor
9	Evaporator temperature sensor
10	Air intake actuator
11	Center panel
12	A/C relay
13	Magnetic clutch
14	To PCM

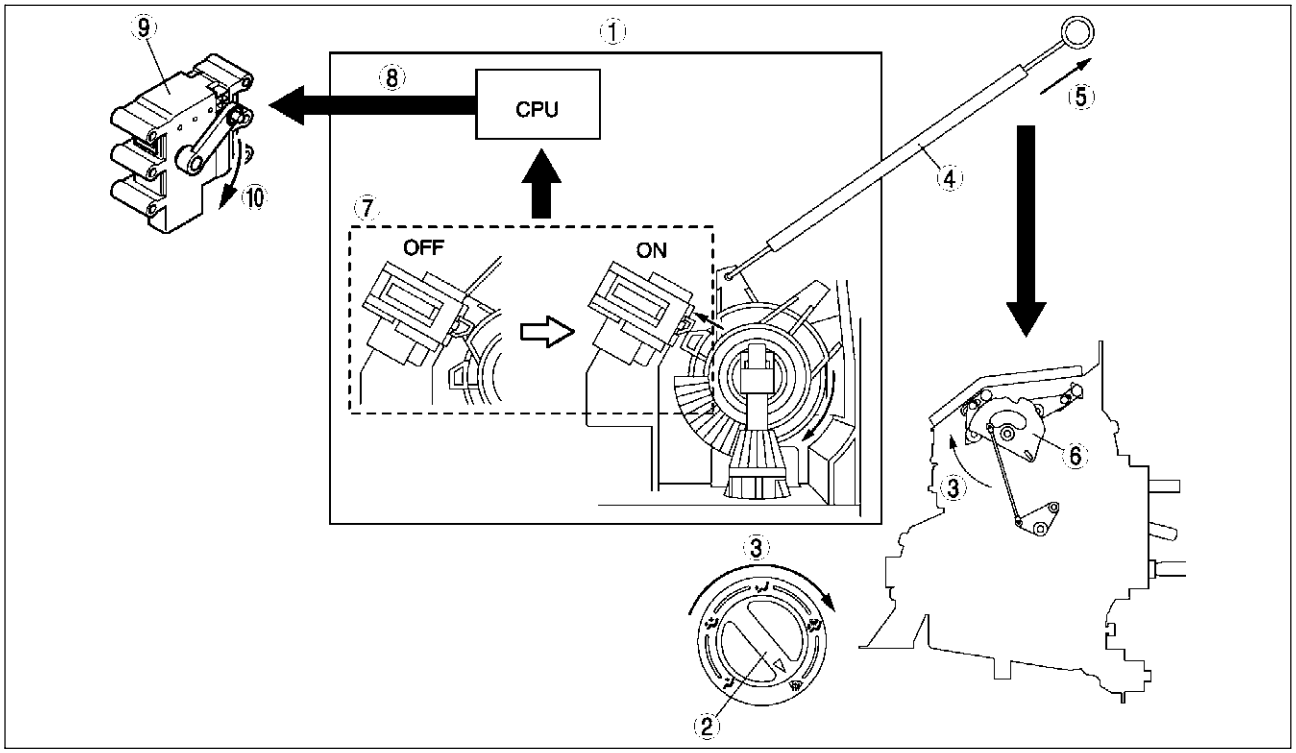
Outline of Control System

- Manual air conditioner defroster control and A/C compressor control.

Control name	Control part
Defroster control	Climate control unit
A/C compressor control	Center panel

Defroster Control

1. When the airflow mode selector dial is turned to DEFROSTER position, a wire moves the airflow mode main link, turning the airflow mode to DEFROSTER.
2. The defroster switch turns on at the same time, and the CPU sends a signal to turn the air intake mode to FRESH.
3. The air intake actuator operates and turns the air intake mode to FRESH.



A6E8540T034

1	Climate control unit
2	Airflow mode selector dial
3	DEFROSTER
4	Wire
5	Move

6	Airflow mode main link
7	Defroster switch
8	FRESH signal
9	Air intake actuator
10	FRESH

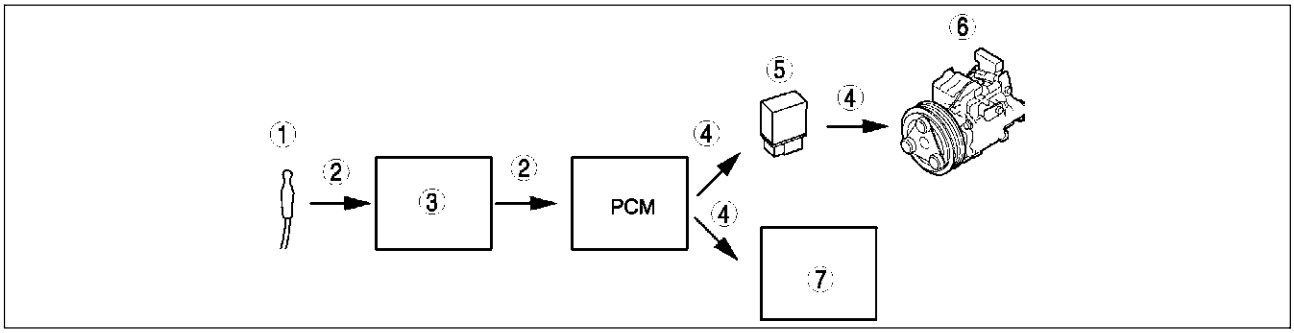
X: Operates
–: Does not operate

Airflow mode	Air intake mode (REC/FRESH switch pushed)	Defroster control
VENT	REC ⇔ FRESH	–
BI-LEVEL	REC ⇔ FRESH	–
HEAT	REC ⇔ FRESH	–
HEAT/DEF	REC ⇔ FRESH	–
DEFROSTER	FRESH	x

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A/C Compressor Control

- The center panel sends an A/C signal to the PCM via the refrigerant pressure switch based on signals sent from the A/C switch, fan switch and evaporator temperature sensor.
- The PCM controls the A/C relay and IAC valve based on the input signal from the center panel.



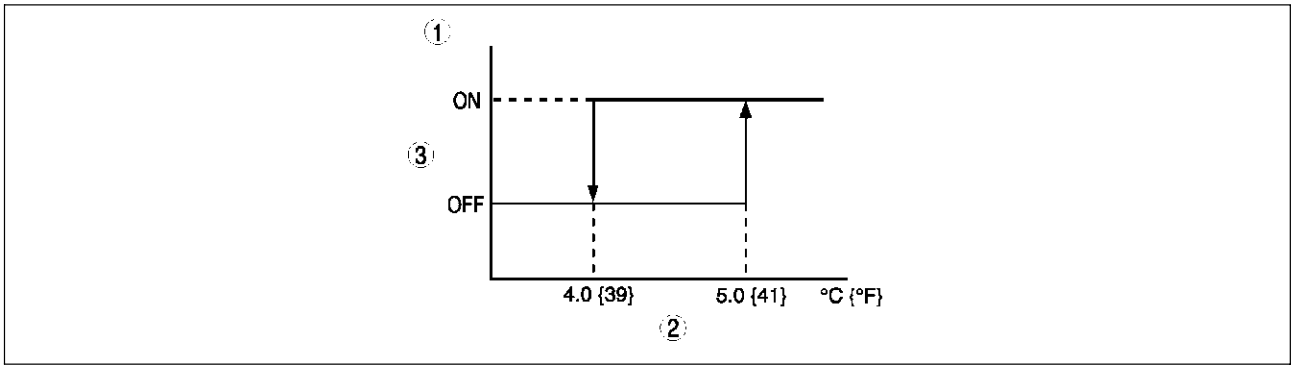
A6E8540T049

1	Evaporator temperature sensor
2	A/C signal
3	Center panel
4	Output

5	A/C relay
6	Magnetic clutch
7	IAC valve

A/C signal on/off control

- The center panel turns the A/C signal (magnetic clutch) on and off based on the temperature of the air passing through the evaporator when the A/C and fan switches are on. This keeps the evaporator surface temperature within the specified range, preventing the evaporator from freezing while the fan switch and A/C switch are turned on.



A6E8540T047

1	A/C signal on/off decision
2	Evaporator temperature sensor

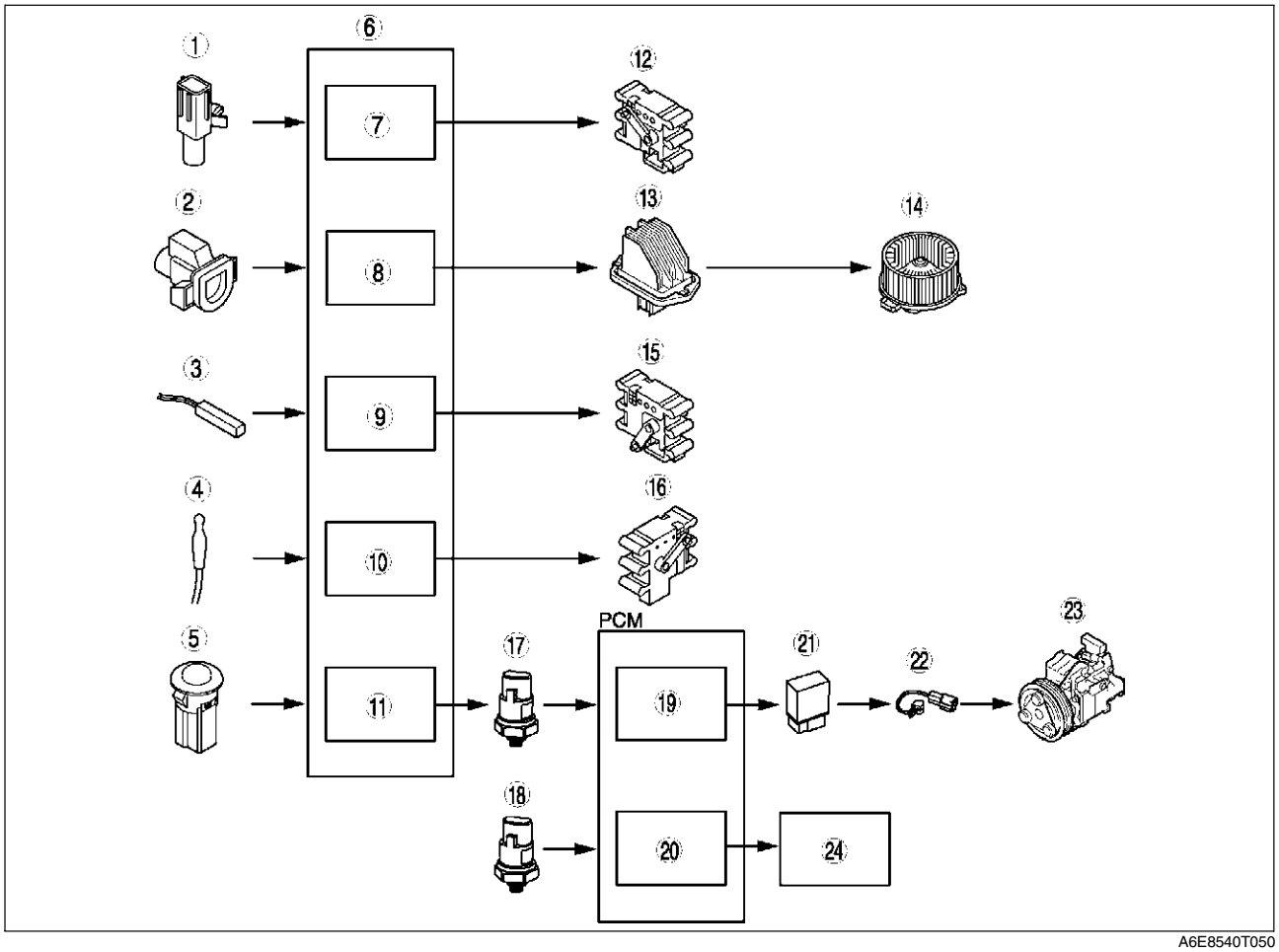
3	A/C signal

FULL-AUTO AIR CONDITIONER CONTROL SYSTEM

A6E854001044T01

Block Diagram

- The control system consists of input components (sensors), output components (actuators, magnetic clutch, power MOS FET, and other parts), and a control device (climate control unit).



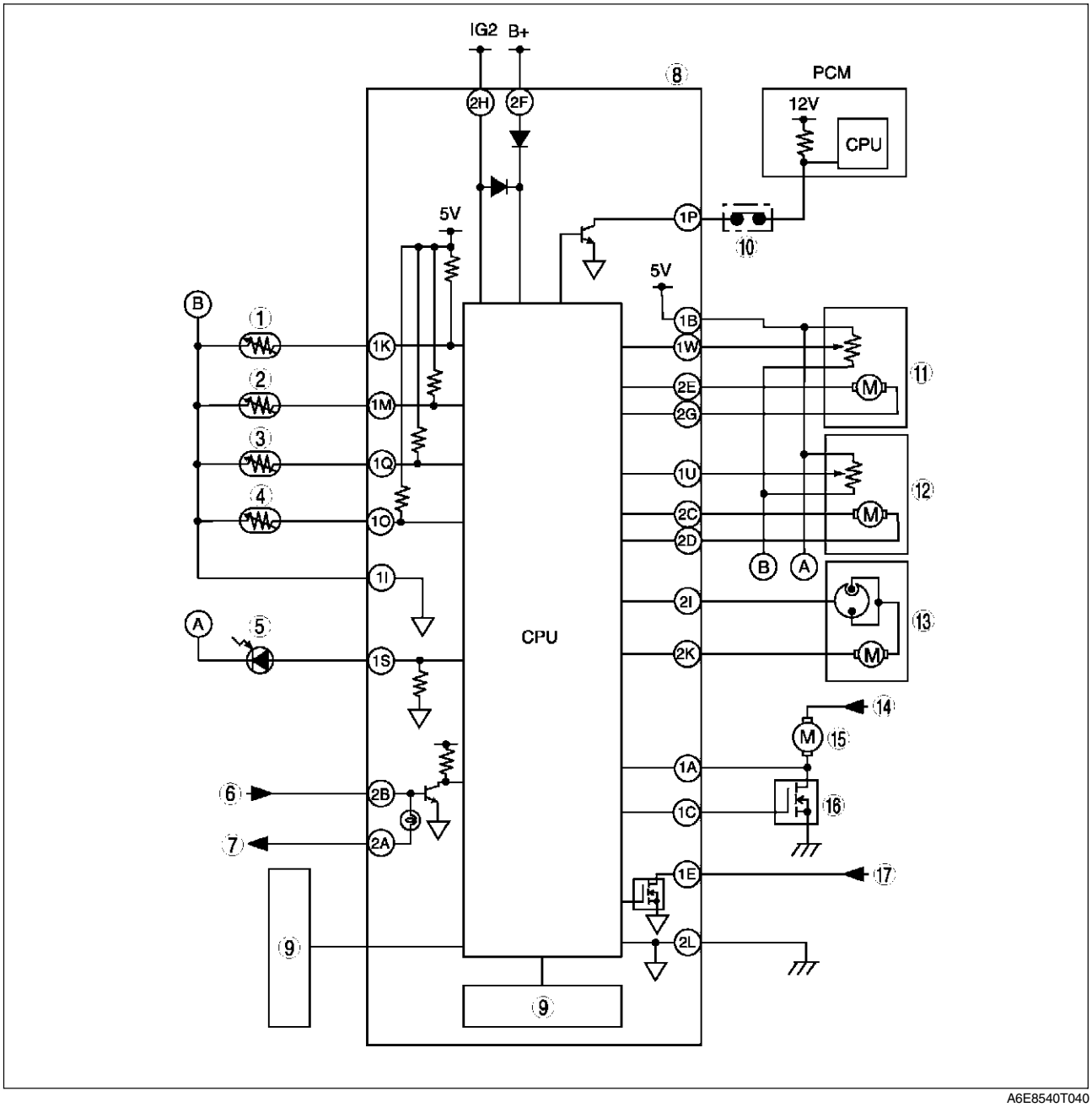
A6E8540T050

1	Ambient temperature sensor
2	Cabin temperature sensor
3	Water temperature sensor
4	Evaporator temperature sensor
5	Solar radiation sensor
6	Climate control unit
7	Airflow temperature control
8	Airflow volume control
9	Airflow mode control
10	Air intake control
11	A/C compressor control
12	Air mix actuator

13	Power MOS FET
14	Blower motor
15	Airflow mode actuator
16	Air intake actuator
17	Refrigerant pressure switch (HI and LO pressure)
18	Refrigerant pressure switch (middle pressure) (L3 engine only)
19	A/C cut control
20	Idle speed control
21	A/C relay
22	Thermal protector
23	Magnetic clutch
24	IAC valve

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System Wiring Diagram



A6E8540T040

1	Ambient temperature sensor
2	Cabin temperature sensor
3	Evaporator temperature sensor
4	Water temperature sensor
5	Solar radiation sensor
6	From TNS relay
7	Panel light control
8	Climate control unit
9	Each switch

10	Refrigerant pressure switch
11	Airflow mode actuator
12	Air mix actuator
13	Air intake actuator
14	From blower relay
15	Blower motor
16	Power MOS FET
17	From rear window defroster relay

Outline of Control System

- In the full-auto air conditioner system, the climate control unit carries out five basic types of controls based on signals from various sensors and control signals from the climate control unit. The climate control unit also has three supplementary functions.

Basic control	Control description	Correction
Airflow temperature control	Airflow temperature automatic control	• Air intake correction • A/C correction • MAX HOT and MAX COLD correction • Coolant temperature correction • Fail-safe function
Airflow volume control	Airflow volume automatic control	• Coolant temperature correction (warm-up correction) • Mild start correction • MAX HOT and MAX COLD correction • Windshield mist prevention correction • Start compensation correction • Defroster correction • Fail-safe function
	Airflow volume manual control	• Defroster correction • Fail-safe function
Airflow mode control	Airflow mode automatic control	• Ambient temperature correction (European (L.H.D. U.K.) specs.) • Coolant temperature correction • Fail-safe function
	Airflow mode manual control	• Fail-safe function
Air intake control	Air intake automatic control	• MAX COLD correction • Defroster correction • Ambient temperature correction • A/C OFF correction
	Air intake manual control	• Defroster correction
A/C compressor control	A/C compressor automatic control	• Defroster correction • Ambient temperature correction • Windshield mist prevention correction • MAX COLD correction
	A/C compressor manual control	• Defroster correction • Ambient temperature correction • Windshield mist prevention correction

Supplementary function
Sensor fail-safe function
Sensor signal delay function
On-board diagnostic function

Control Transition
Air mix, airflow volume control

Operation switch		Air mix control	Airflow volume control								
		Control before switched	Control before switched								
		Automatic control	Automatic control	Defroster correction	Manual control						
					OFF	1	2	3	4	5	6	7
OFF switch		AUTO	OFF	OFF	OFF							
AUTO switch		AUTO	AUTO	AUTO	AUTO							
Fan switch	+	AUTO	MANUAL*2	MANUAL*2	1	2	3	4	5	6	7	7
	–	AUTO	MANUAL*3	MANUAL*3	1	1	1	2	3	4	5	6
MODE switch		AUTO	AUTO	*5	No change							
DEFROSTER switch		AUTO	Defroster correction	*5	Defroster correction							
A/C switch		AUTO	AUTO	No change	No change							
REC/FRESH switch		AUTO	AUTO	No change	No change							
Temperature setting dial*1	15.0 (18.0)	MAX COLD	MAX HI	MAX HI	No change							
	15.5—28.5 (18.5—31.5)	AUTO	AUTO	No change	No change							
	29.0 (32.0)	MAX HOT	AUTO HI*4	AUTO HI	No change							

( ) : GCC specs.
*1 : Setting temperature fluctuates up or down in increments of 0.5, within the range of 15.0 to 29.0 (European (L.H.D. U.K.) specs.) or 18.0 to 32.0 (GCC specs.). When the fan is OFF, the setting temperature can be adjusted in the range of ±1.0.
*2 : Goes up to the closest manual voltage to auto voltage or defroster correction voltage.
*3 : Goes down to the closest manual voltage to auto voltage or defroster correction voltage.
*4 : Coolant temperature correction takes precedence.
*5 : Returns to condition prior to defroster operation. However, if it is off prior to defroster operation, it switches to automatic control.

Airflow mode control, air intake control, A/C compressor control

Operation switch		Airflow mode control		Air intake control		A/C compressor control	
		Control before switched		Control before switched		Control before switched	
		Automatic control	Manual control	Automatic control	Manual control	Automatic control	Manual control
OFF switch		Condition before OFF switch ON*2	No change*2	Condition before OFF switch ON*2	No change*2	OFF	OFF
AUTO switch		AUTO	AUTO	AUTO	AUTO	AUTO	AUTO
Fan switch	+	AUTO	No change	AUTO	No change	AUTO	No change
	–	AUTO	No change	AUTO	No change	AUTO	No change
MODE switch		VENT→BI-LEVEL BI-LEVEL→HEAT HEAT→HEAT/DEF HEAT/DEF→VENT DEFROSTER→HEAT	VENT→BI-LEVEL BI-LEVEL→HEAT HEAT→HEAT/DEF HEAT/DEF→VENT DEFROSTER→HEAT	AUTO	No change*2	AUTO	No change*3
DEFROSTER switch		DEFROSTER*2	DEFROSTER*2	DEFROSTER correction*2	DEFROSTER correction*2	DEFROSTER correction*3	DEFROSTER correction*3
A/C switch		AUTO	No change	AUTO	No change	A/C→ECO ECO→A/C OFF→A/C*4	A/C→ECO ECO→A/C OFF→A/C*4
REC/FRESH switch		AUTO	No change	FRESH→REC REC→FRESH	FRESH→REC REC→FRESH	AUTO	No change

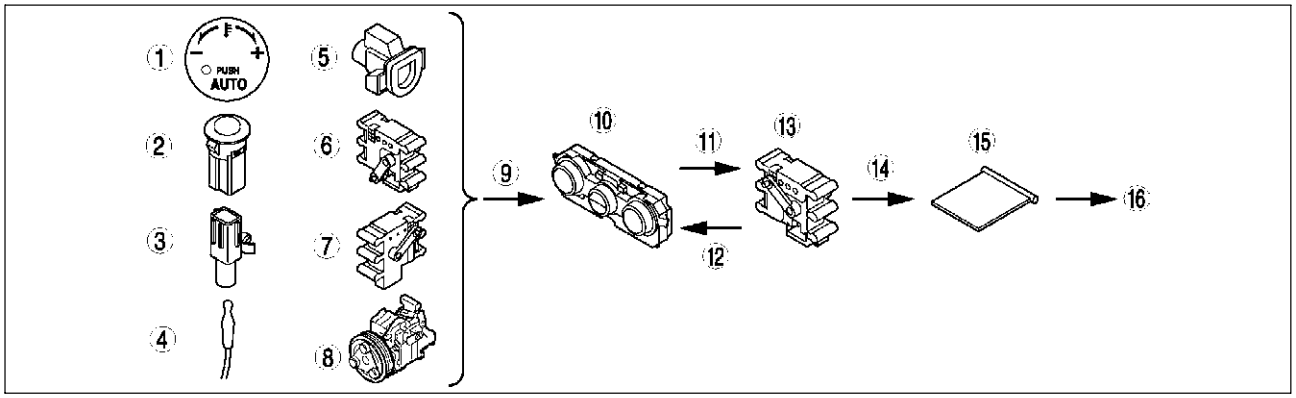
Operation switch		Airflow mode control		Air intake control		A/C compressor control	
		Control before switched		Control before switched		Control before switched	
		Automatic control	Manual control	Automatic control	Manual control	Automatic control	Manual control
Temperature setting dial*1	15.0 (18.0)	AUTO	No change	AUTO	No change	AUTO	No change
	15.5—28.5 (18.5—31.5)						
	29.0 (32.0)						

( ) : GCC specs.
*1 : Setting temperature fluctuates up or down in increments of 0.5, within the range of 15.0 to 29.0 (European (L.H.D. U.K.) specs.) or 18.0 to 32.0 (GCC specs.). When the fan is OFF, the setting temperature can be adjusted in the range of ±1.0.
*2 : If operated when in defroster correction, it returns to the condition prior to defroster operation.
*3 : Ambient temperature correction takes precedence. If operated when in defroster correction, it returns to the condition prior to defroster operation. However, if it is off prior to defroster operation, it switches to automatic control.
*4 : Ambient temperature correction takes precedence. When the fan is OFF, the A/C is fixed at off.

AIRFLOW TEMPERATURE CONTROL

A6E854001044T04

- Airflow temperature is controlled by the air mix actuator so that the passenger compartment temperature remains at the target temperature (control computation value T1).
- Control computation value T1 is the target temperature in the cabin set by the climate control unit based on differences among set temperature, input temperature from the sensors, and sunlight intensity.



A6E8540T041

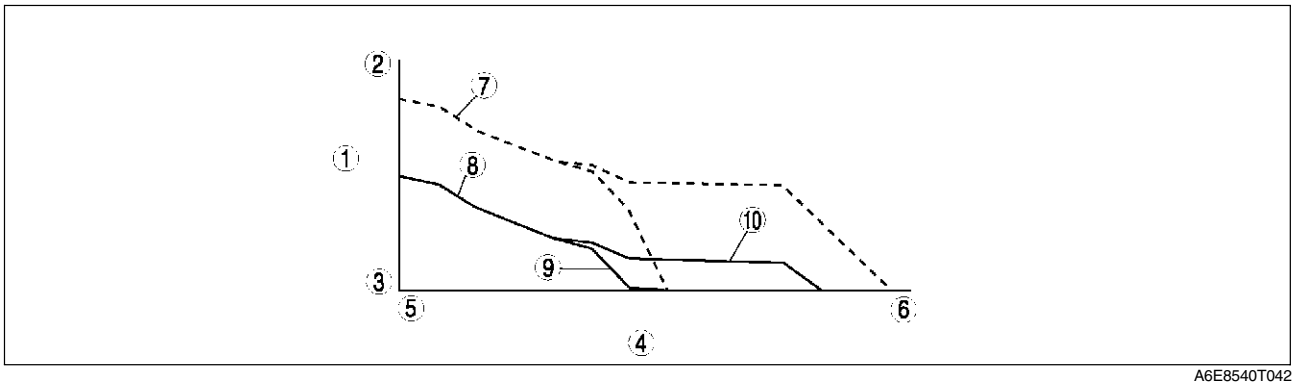
1	Set temperature
2	Sunlight intensity
3	Ambient temperature
4	Evaporator temperature
5	Cabin temperature
6	Airflow mode
7	Air intake mode
8	A/C compressor control condition

9	Signals
10	Climate control unit
11	Output
12	Feedback
13	Air mix actuator
14	Operation
15	Air mix doors
16	Airflow temperature changes

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Airflow Temperature Automatic Control

- Based on the set temperature and sunlight intensity, the climate control unit calculates the air mix actuator opening angle characteristic. The higher the sunlight intensity, the lower the air mix actuator opening angle characteristic.
- The climate control unit compares the air mix actuator opening angle characteristic, the present ambient temperature and target temperature (control computation value T1) and determines a basic angle of opening for the air mix actuator.



A6E8540T042

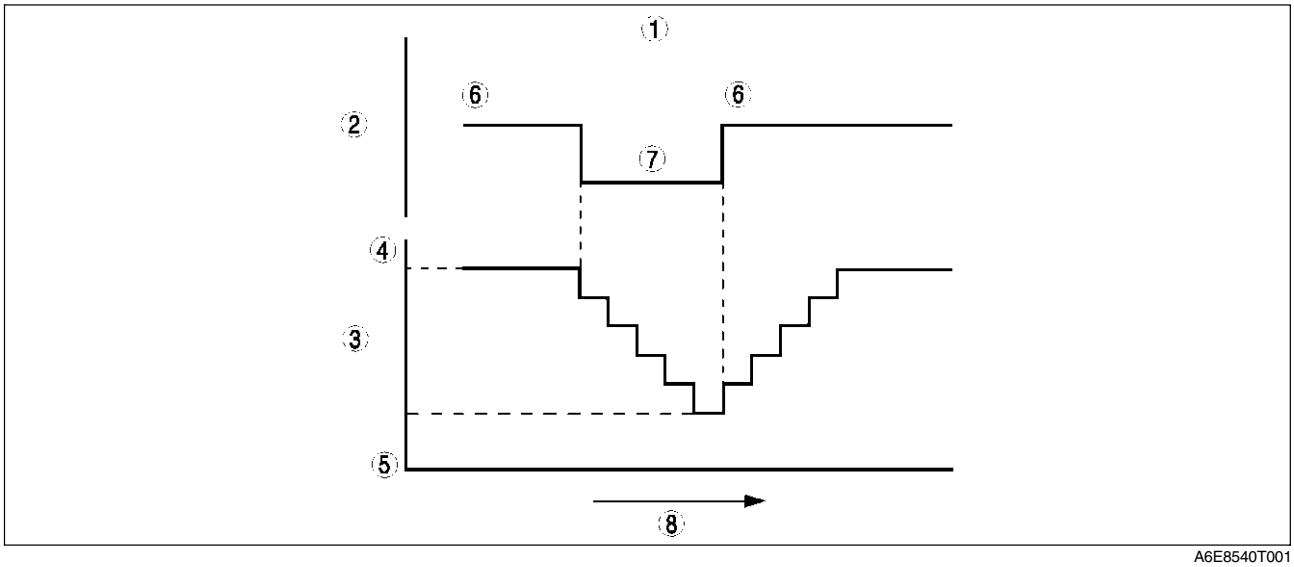
1	Air mix actuator basic opening
2	MAX HOT
3	MAX COLD
4	Ambient temperature
5	Low
6	High

7	When the sunlight intensity is low
8	When the sunlight intensity is high
9	Air mix actuator opening angle characteristic (A/C off mode)
10	Air mix actuator opening angle characteristic (A/C on mode)

Correction

Air intake correction

- When the A/C mode is off, the air mix actuator opening angle is corrected to prevent airflow temperature rise when the air intake mode is switched from fresh air to recirculated air. In addition, this correction retards the air mix actuator operation to prevent a sudden drop in airflow temperature.



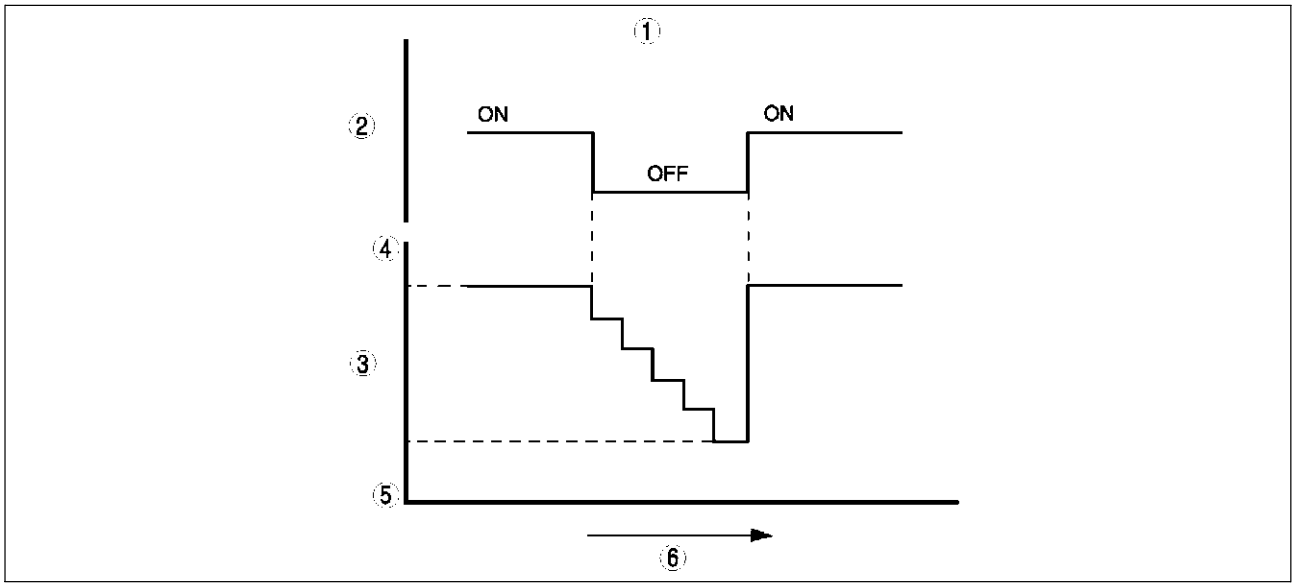
A6E8540T001

1	Air mix actuator opening angle delay
2	Air intake mode
3	Air mix actuator opening angle correction amount
4	HOT

5	COLD
6	FRESH
7	RECIRCULATE
8	Time

A/C correction

- When the A/C compressor is switched from A/C ON mode to OFF mode, the basic opening angle of the air mix actuator is switched from the A/C ON mode opening angle to the A/C OFF mode opening angle. This prevents a rise in airflow temperature. In addition, this correction retards the air mix actuator operation to prevent a sudden drop in airflow temperature.



A6E8540T002

1	Air mix actuator opening angle delay
2	A/C mode
3	Air mix actuator opening angle correction amount

4	HOT
5	COLD
6	Time

MAX HOT and MAX COLD correction

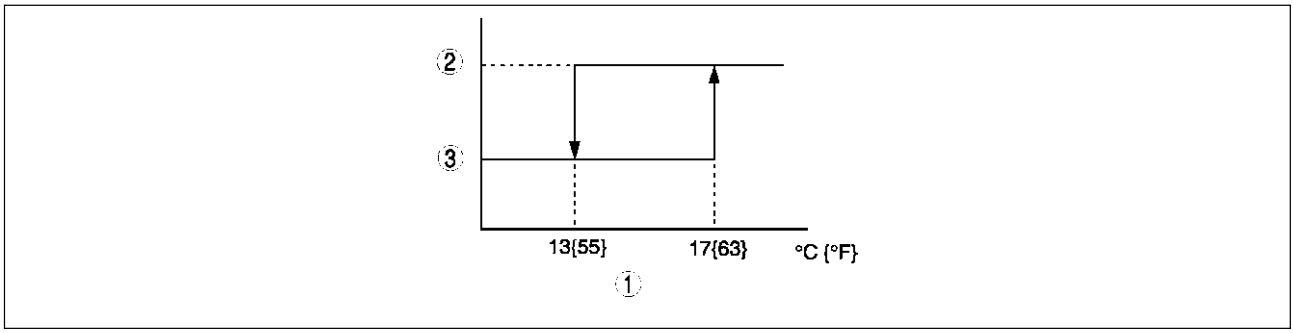
- When the temperature is set to MAX HOT (temperature setting dial is turned to the right), air mix actuator is completely open (100%), when set to MAX COLD (temperature setting dial is turned to the left), it is firmly closed.

Coolant temperature correction

- There are cases where the engine coolant temperature is lowered when continuously idling in extremely low outside temperature. To prevent lower airflow temperature in this situation, the climate control unit adjusts the HOT air mix actuator to opening according to the engine coolant temperature. However, coolant temperature correction does not operate when the ambient temperature is **above 10°C {50°F}**.

Fail-safe function

- When the potentiometer of air mix actuator is malfunctioning, the air mix door is fixed. Under this situation, if the ignition switch is turned to the ON/LOCK position, the air mix door is controlled to be fully opened (MAX HOT) or closed (MAX COLD) based on the ambient temperature. In addition, the door is fully closed (MAX COLD) at the set temperature MAX COLD (15.0: European (L.H.D. U.K.) specs. 18.0: GCC specs.), and fully opened (MAX HOT) at the set temperature MAX HOT (29.0: European (L.H.D. U.K.) specs. 32.0: GCC specs.).



A6E8540T003

1	Ambient temperature
2	MAX COLD

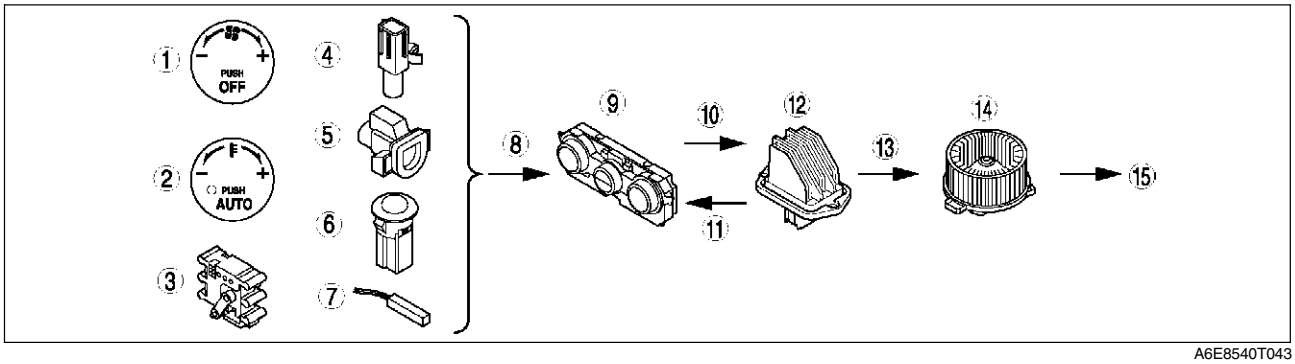
3	MAX HOT

- If the air mix door locks and the target air mix actuator opening angle is not reached within **20 seconds**, the air mix actuator drive signal is stopped to prevent burning the motor.

AIRFLOW VOLUME CONTROL

A6E854001044T05

- Airflow volume is controlled by the power MOS FET so that the passenger compartment temperature remains at the target temperature (control computation value T2).
- Control computation value T2 is the target temperature in the cabin set by the climate control unit based on differences between set temperature and input temperature from the sensors.



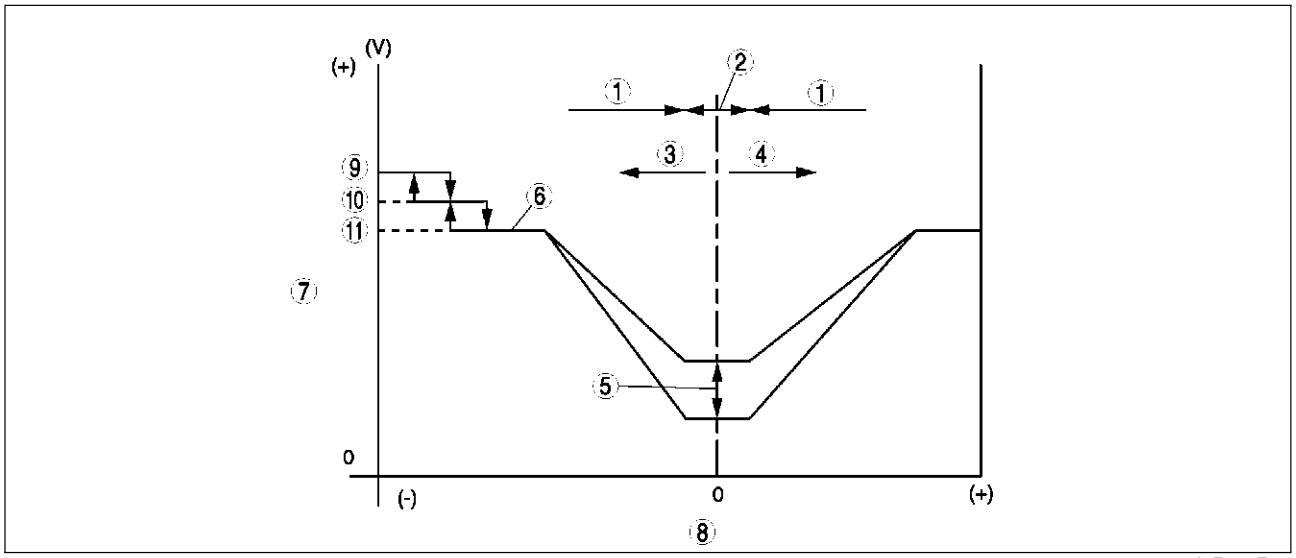
A6E8540T043

1	Fan switch
2	Set temperature
3	Airflow mode
4	Ambient temperature
5	Cabin temperature
6	Sunlight intensity
7	Coolant temperature
8	Signals

9	Climate control unit
10	Output
11	Feedback
12	Power MOS FET
13	Operation
14	Blower motor
15	Airflow volume changes

Airflow Volume Automatic Control

- Based on the set temperature, the ambient temperature, and sunlight intensity, the climate control unit calculates the blower motor voltage characteristic (AUTO voltage). It compares the differences among this voltage characteristic, and the target temperature (control computation value T2) and then determines the voltage to be applied to the blower motor.



A6E8540T044

1	Transition period
2	Stable period
3	When cooling
4	When heating
5	Increases/decreases linearly with sunlight intensity
6	Blower motor applied voltage characteristic

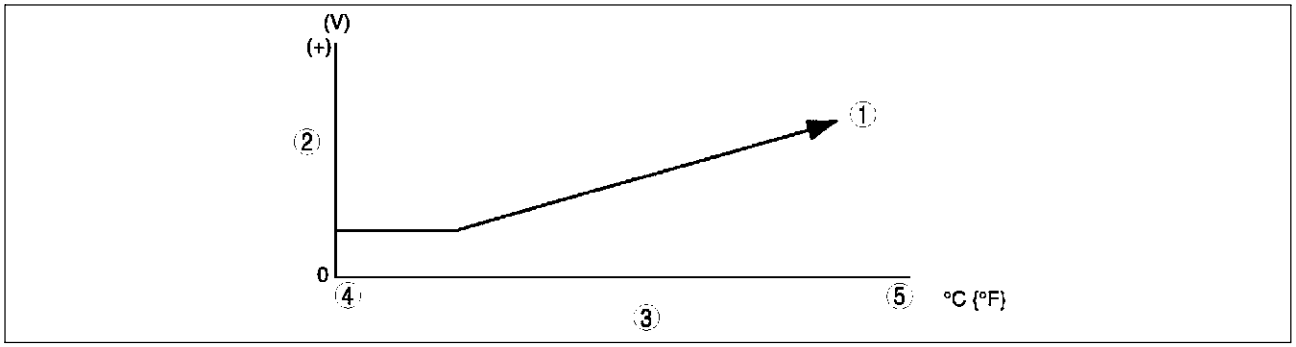
7	Blower motor applied voltage
8	Control computain value T2
9	MAX-HI
10	MIDDLE-HI
11	AUTO-HI

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Correction

Coolant temperature correction (warm-up correction)

- To prevent a large volume of cold air from blowing through the ventilation outlets when the engine is started in winter, coolant temperature control links the blower motor voltage to the rise in engine coolant temperature. However, coolant temperature correction does not operate when the defroster correction is running, when the cabin temperature is **above 20°C {68°F}**, or when airflow is in VENT mode.



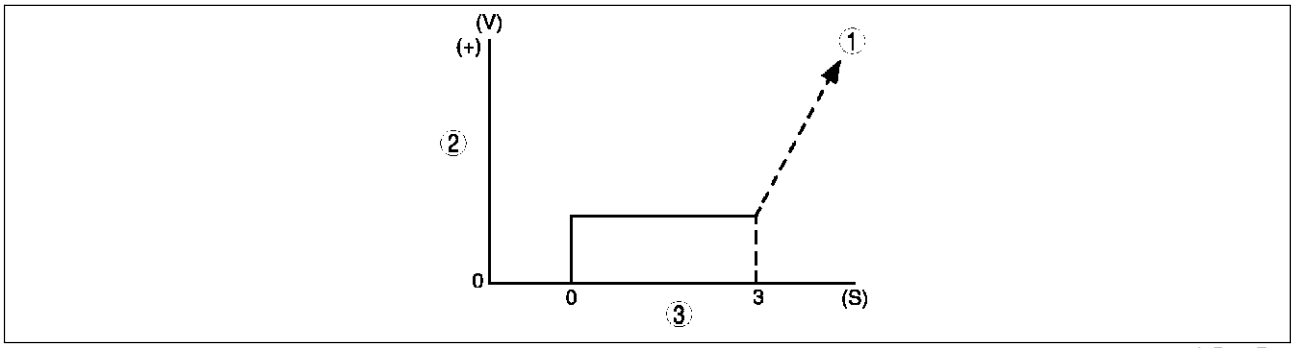
A6E8540T004

1	Rise to auto voltage
2	Blower motor applied voltage
3	Coolant temperature

4	Low
5	High

Mild start correction

- To prevent a large volume of warm air from blowing through the ventilation outlets when the blower motor is started in summer, the voltage applied to the blower motor is restricted for **3 seconds** after it starts. However, mild start correction does not operate when the passenger compartment temperature is **below 20°C {68°F}**, or when airflow is in any mode other than VENT.



A6E8540T005

1	Rises to auto voltage
2	Blower motor applied voltage

3	Time

MAX HOT and MAX COLD correction

- When the temperature is set to 29.0 (European (L.H.D. U.K.) specs.) or 32.0 (GCC specs.), the applied voltage of the blower motor is set at AUTO-HI, when at 15.0 (European (L.H.D. U.K.) specs.) or 18.0 (GCC specs.), the applied voltage of the blower motor is set at MAX-HI. However, when in water temperature correction, MAX HOT correction does not take place.

Correction	Set temperature	Blower motor applied voltage
MAX HOT	29.0 (European (L.H.D. U.K.) specs.) 32.0 (GCC specs.)	12.1 (V): AUTO-HI
MAX COLD	15.0 (European (L.H.D. U.K.) specs.) 18.0 (GCC specs.)	B+: MAX-HI

Windshield mist prevention correction

- To prevent the air blown from the defroster when the heater is started in winter from clouding the windows, the blower motor and the A/C signal output are switched off for **6 seconds** after the ignition is turned to the ON position. This control only operates if the airflow is in HEAT, HEAT/DEF, or DEFROSTER mode.

Start compensation correction

- When the blower motor is started at **3.2 V**, it is run at a voltage of **4.4 V** for **2 seconds** to help it stabilize at the target voltage.

Defroster correction

- To improve defrosting and heating, **2.0 V** is added to the AUTO voltage calculated airflow volume automatic control when the defroster switch is turned on.

Fail-safe function

- If the blower motor is started with **more than 4.4 V**, a surge will occur and the motor may burn. To prevent this, the voltage applied to the blower motor is regulated to **4.4 V** for **1 second** when it is started.

Airflow Volume Manual Control

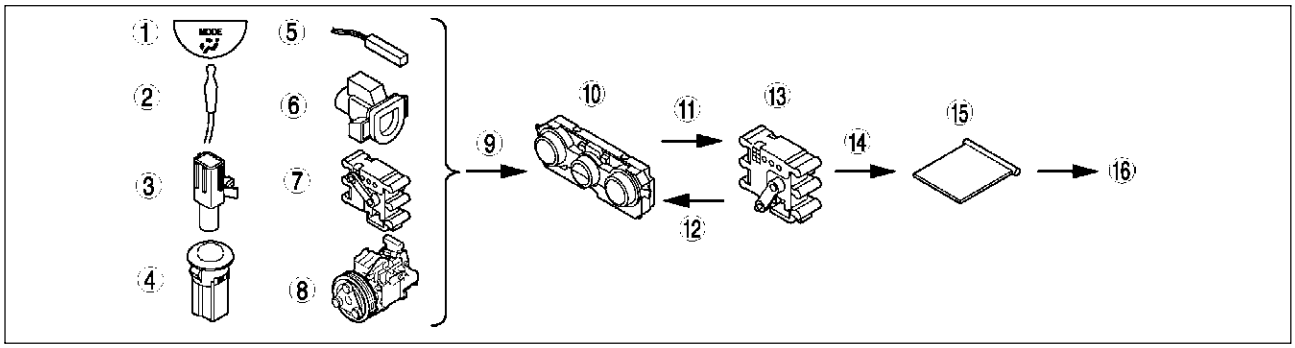
- The blower motor (airflow) has seven speeds and is operated by the fan switch.

Fan speed	Switch operation		Control device	Blower motor voltage
1st	Airflow volume automatic control, manual 2nd (–), manual 1st (–) or OFF (+ or –)	→manual 1st	Power MOS FET	4.4 (V)
2nd	Airflow volume automatic control, manual 1st (+), or manual 4th (–)	→manual 2nd	Power MOS FET	6.1 (V)
3rd	Airflow volume automatic control, manual 2nd (+), or manual 4th (–)	→manual 3rd	Power MOS FET	7.8 (V)
4th	Airflow volume automatic control, manual 3rd (+), or manual 5th (–)	→manual 4th	Power MOS FET	9.5 (V)
5th	Airflow volume automatic control, manual 4th (+), or manual 6th (–)	→manual 5th	Power MOS FET	10.8 (V)
6th	Airflow volume automatic control, manual 5th (+), or manual 7th (–)	→manual 6th	Power MOS FET	12.1 (V)
7th	Airflow volume automatic control, manual 6th (+), or manual 7th (+)	→manual 7th	Power MOS FET	B+

AIRFLOW MODE CONTROL

A6E854001044T06

- Airflow mode is controlled by the airflow mode actuator to improve efficiency, heating, and A/C comfort.



A6E8540T045

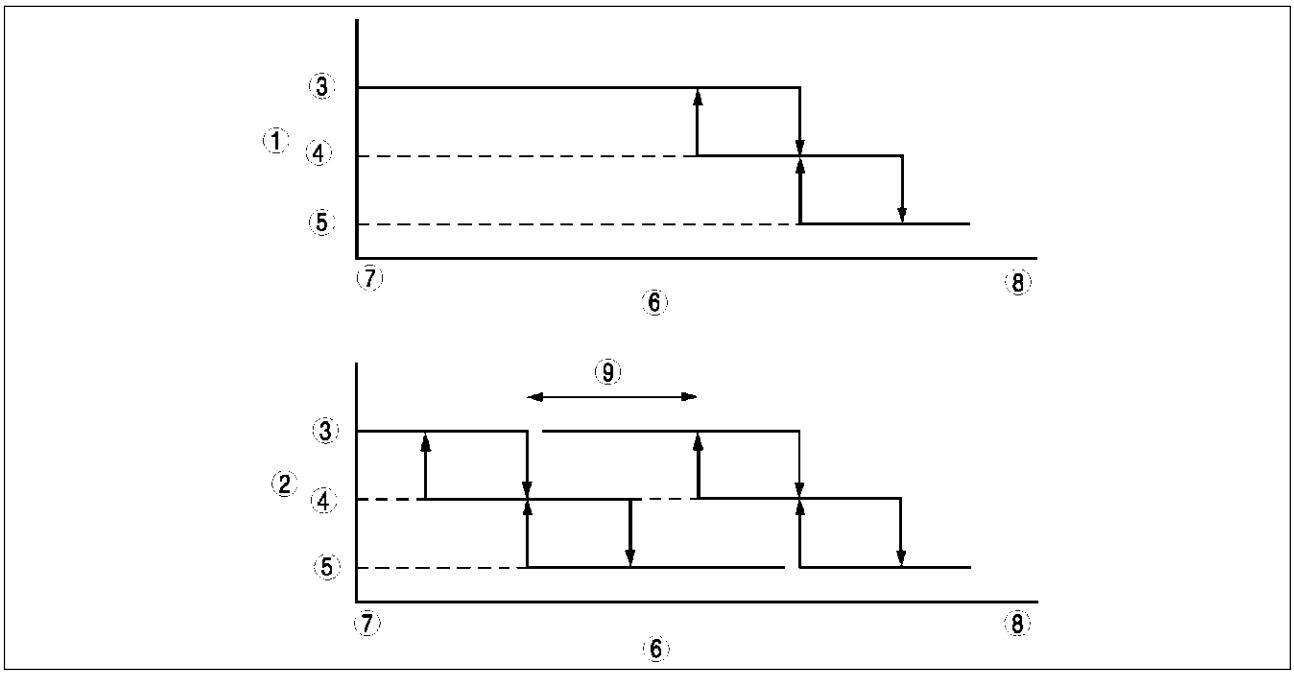
1	MODE switch
2	Evaporator temperature
3	Ambient temperature
4	Sunlight intensity
5	Coolant temperature
6	Cabin temperature
7	Air mix actuator opening degree
8	A/C compressor control condition

9	Signals
10	Climate control unit
11	Output
12	Feedback
13	Airflow modeactuator
14	Operation
15	Airflow mode doors
16	Airflow mode changes

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Airflow Mode Automatic Control

- The climate control unit uses the present opening angle of the air mix actuator and the control condition of the A/C compressor to determine the airflow mode. When the A/C compressor is in OFF mode, the climate control unit varies the determined value of airflow mode according to the temperature signals received from the evaporator temperature sensor.



A6E8540T006

1	Airflow mode (A/C on mode)
2	Airflow mode (A/C off mode)
3	VENT
4	BI-LEVEL
5	HEAT

6	Air mix actuator
7	COLD
8	HOT
9	Amount varies

Correction

Ambient temperature correction (European (L.H.D. U.K.) specs.)

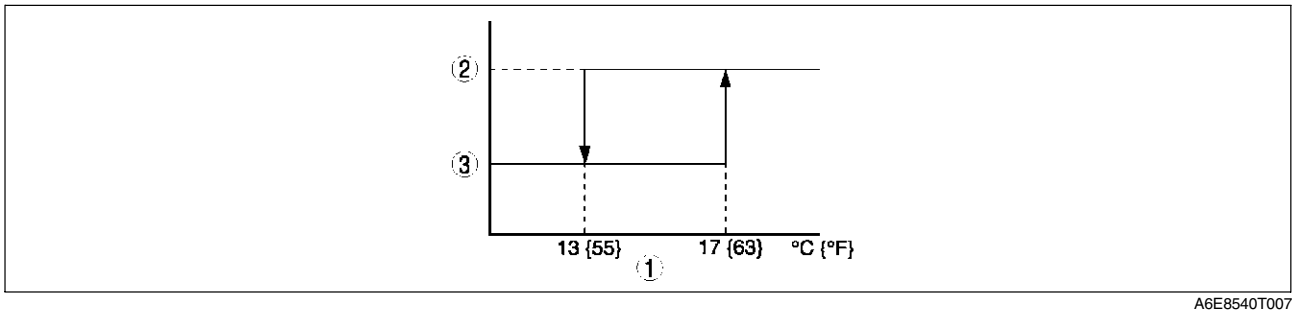
- To improve windshield and front door glass from fogging, airflow mode is fixed at HEAT/DEF when the ambient temperature is low. However, ambient temperature correction does not operate when the temperature is set at MAX COLD. (temperature setting dial is turned to the left)

Coolant temperature correction

- To prevent uncomfortable draughts of cold air blowing around the driver's feet soon after the engine is started in winter, airflow mode is switched from DEFROSTER to HEAT/DEF to HEAT mode to match the rise in engine coolant temperature. This control only operates when the passenger compartment temperature is **below 13°C {55°F}**, or when the passenger compartment temperature is **below 23°C {73°F}** and sunlight intensity is comparatively low.

Fail-safe function

- When the potentiometer of airflow mode actuator is malfunctioning, the airflow mode door is fixed. Under this situation, if the ignition switch is turned to the ON/LOCK position, the airflow mode door is controlled to be fully opened (DEFROSTER) or closed (VENT) based on the ambient temperature. In addition, the door is fully closed (VENT) in the manual VENT, and fully opened (DEFROSTER) in the manual DEFROSTER.



A6E8540T007

1	Ambient temperature
2	VENT
3	DEFROSTER

- If the airflow mode doors are locked and the target airflow mode is set by the climate control unit which does not reach to within **9 seconds**, the airflow mode actuator drive signal will be stopped to prevent the motor from burning.

Airflow Mode Manual Control

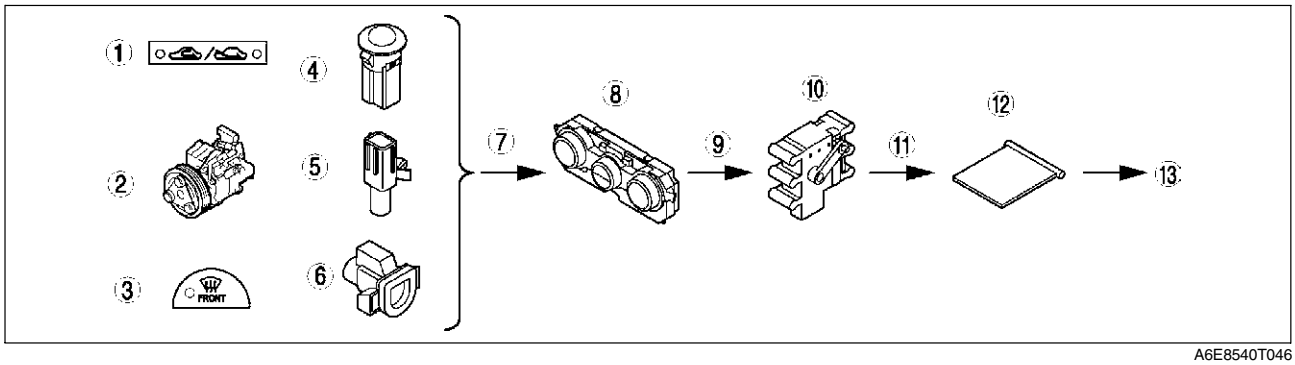
- Airflow can be selected by operating the MODE switch and the DEFROSTER switch.

Airflow mode	Switch operation	Air outlet
VENT	MODE switch set from HEAT/DEF to VENT	CENTER VENT, SIDE VENT
BI-LEVEL	MODE switch set from VENT to BI-LEVEL	CENTER VENT, SIDE VENT, HEAT
HEAT	MODE switch set from BI-LEVEL to HEAT MODE switch set from DEFROSTER to HEAT	SIDE VENT (L.H.D. only), HEAT, REAR HEAT (minimum air from DEFROSTER and SIDE DEMISTER)
HEAT/DEF	MODE switch set from HEAT to HEAT/DEF	SIDE VENT (L.H.D. only), HEAT, REAR HEAT, DEFROSTER, SIDE DEMISTER
DEFROSTER	DEFROSTER switch to ON	SIDE VENT (L.H.D. only), DEFROSTER, SIDE DEMISTER

AIR INTAKE CONTROL

A6E854001044T07

- Air intake mode is controlled by air intake actuator to adjust and cool down the cabin temperature quickly adjusting to cooling condition.

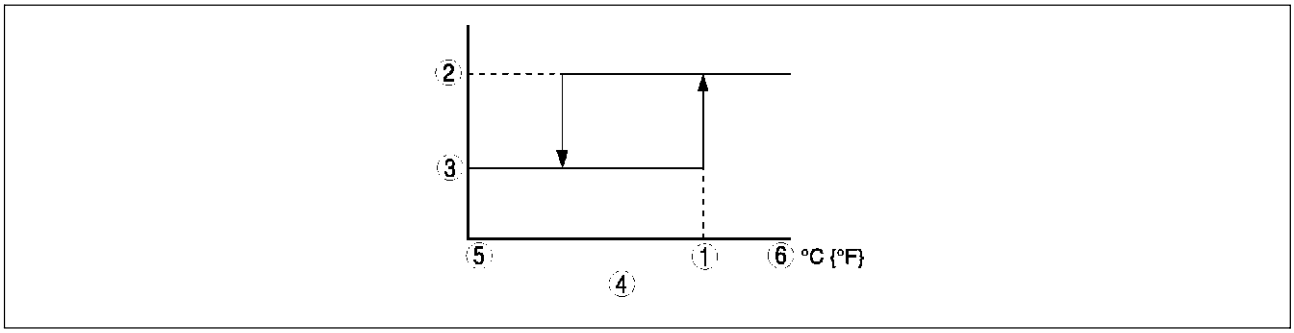


A6E8540T046

1	REC/FRESH switch
2	A/C compressor control condition
3	Defroster switch
4	Sunlight intensity
5	Ambient temperature
6	Cabin temperature
7	Signals
8	Climate control unit
9	Output
10	Air intake actuator
11	Operation
12	Air intake door
13	Air intake mode changes

Air Intake Automatic Control

- Based on the ambient temperature and sunlight intensity, the climate control unit calculates the cabin temperature computation value. By comparison with this cabin temperature computation value and actual cabin temperature, air intake mode is determined.



A6E8540T008

1	Cabin temperature computation value
2	Recirculate
3	Fresh

4	Cabin temperature
5	Low
6	High

Correction

MAX COLD correction

- When the temperature is set to 15.0 (European (L.H.D. U.K.) specs.) or 18.0 (GCC specs.), air intake is fixed in recirculated air intake mode to improve cooling effect. This correction does not operate when defroster correction is on or when the A/C compressor is in OFF mode or when the ambient temperature is **below 5°C {41°F}**.

Defroster correction

- When the defroster switch is on, air intake is fixed in fresh air intake mode to improve defrosting effect, and this correction also operates when recirculated air intake mode is on by manual operation.

Ambient temperature correction

- When the ambient temperature is **5 °C {41°F}** or below, air intake mode is fixed at FRESH to prevent windshield and front door glass fogging.

A/C OFF correction

- While in air intake automatic control and A/C OFF mode, air intake mode is fixed at FRESH.

Air Intake Manual Control

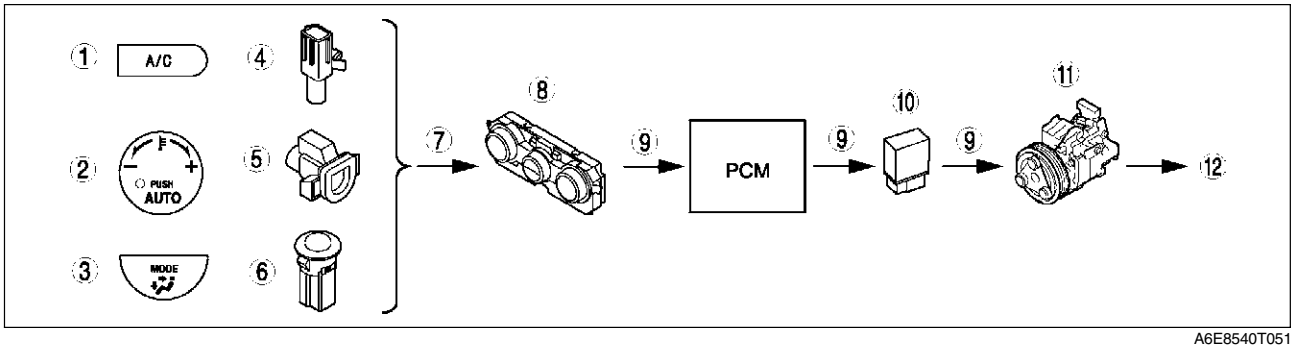
- The driver can switch air intake mode by operating the REC/FRESH switch.

Air intake mode	REC/FRESH switch operation
FRESH	Switching from RECIRCULATE to FRESH fixes mode in FRESH
RECIRCULATE	Switching from FRESH to RECIRCULATE fixes mode in RECIRCULATE

A/C COMPRESSOR CONTROL

A6E854001044T08

- In A/C compressor control, the A/C relay (A/C compressor) is controlled via the PCM so that discharged air is simultaneously cooled and dehumidified to provide comfortable air conditioning.
- The climate control unit sends A/C signals to the PCM which actuates the A/C relay.



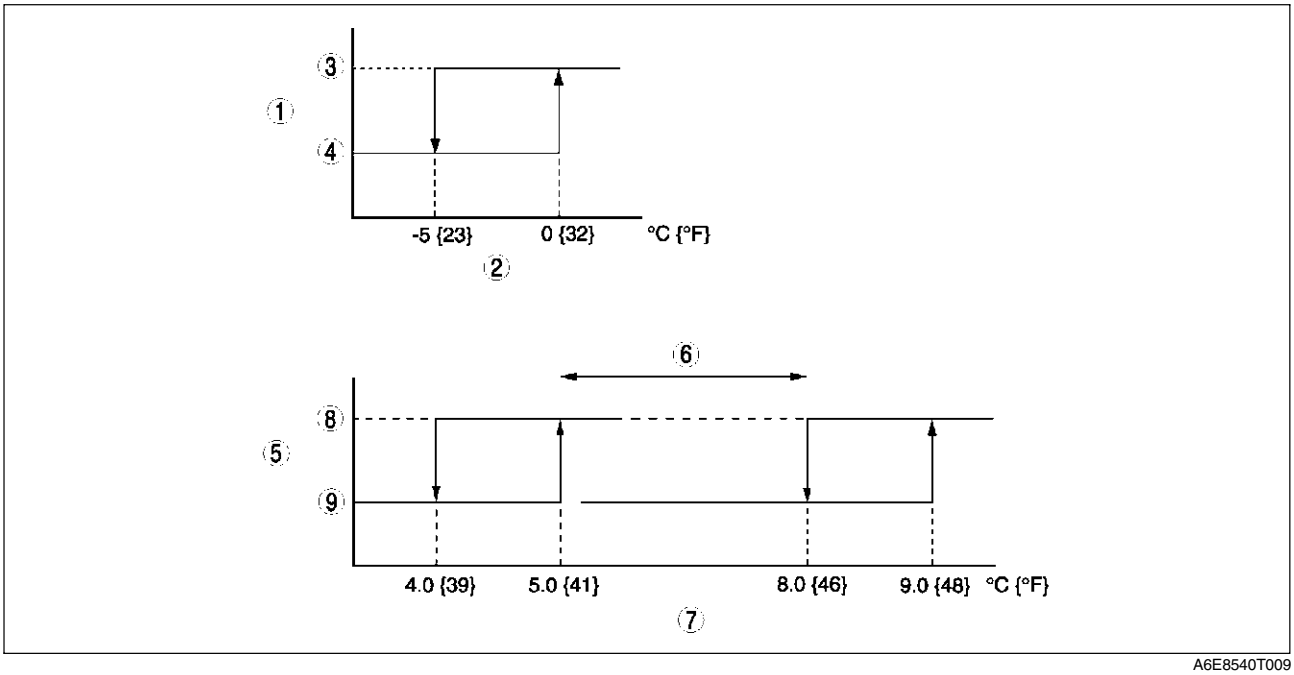
A6E8540T051

1	A/C switch
2	Set temperature
3	MODE switch
4	Ambient temperature
5	Cabin temperature
6	Sunlight intensity

7	Signals
8	Climate control unit
9	Output
10	A/C relay
11	A/C compressor
12	Operation

A/C Compressor Automatic Control

- The climate control unit determines A/C ON/OFF mode based on the ambient temperature. When A/C is in ON mode, an ambient temperature computation value is calculated based on the ambient temperature, set temperature, and temperatures from various sensors. This value is used to determine the temperature of the air passing through the evaporator. The temperature of this air determines whether the climate control unit turns the magnetic clutch (A/C signal) off or on. When the ambient temperature is high/low, the climate control unit lowers/raises the magnetic clutch off temperature. This improves cooling comfort.



A6E8540T009

1	A/C mode ON/OFF decision
2	Ambient temperature
3	A/C ON
4	A/C OFF
5	A/C ON/OFF mode determination when A/C is in ON mode.

6	Varies with an ambient temperature computation value.
7	Evaporator temperature
8	A/C signal on
9	A/C signal off

Correction

Defroster correction

- To improve defrost effect when the DEFROSTER switched on, select A/C mode and set the A/C signal ON/OFF temperature is set at **5.0/4.0°C**. However, when in ambient temperature correction, defroster correction does not take place.

Ambient temperature correction

- When the ambient temperature is **below –5°C {23°F}**, this correction fixes the A/C compressor in OFF mode to protect the A/C compressor (that is, to prevent A/C compressor fluid compression). If the A/C switch is pressed, only the indicator will indicate; the A/C compressor will not operate.

Windshield mist prevention correction

- To prevent the air blown from the defroster when the heater is started in winter from clouding the windows, the blower motor and the A/C signal output are switched off for **6 seconds** after the ignition is turned to ON position. This control only operates if the airflow is in HEAT, HEAT/DEF, or DEFROSTER mode during airflow volume automatic control.

MAX COLD correction

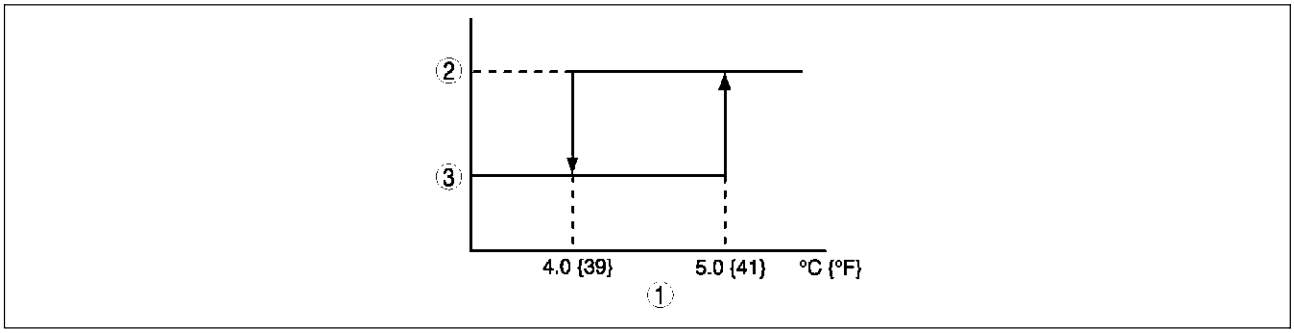
- When temperature is set to MAX COLD (temperature setting dial is turned to the left), the A/C signal ON/OFF temperature is at **5.0/4.0°C**. However, when in ambient temperature correction, MAX COLD correction does not take place.

A/C Compressor Manual Control

- A/C ON (A/C mode, ECO mode) or OFF mode is selected by operating the A/C switch.

A/C mode		Operation condition
A/C ON MODE	A/C MODE (A/C display)	A/C compressor is set in ON mode A/C compressor operates below evaporator freezing level so that the evaporator temperature is within a certain range
	ECO MODE (ECO display)	A/C compressor is set in ON mode Magnetic clutch operates at higher evaporator temperature level than manual A/C mode to reduce A/C compressor operation time and improve driving economy
A/C OFF MODE		A/C compressor does not operate

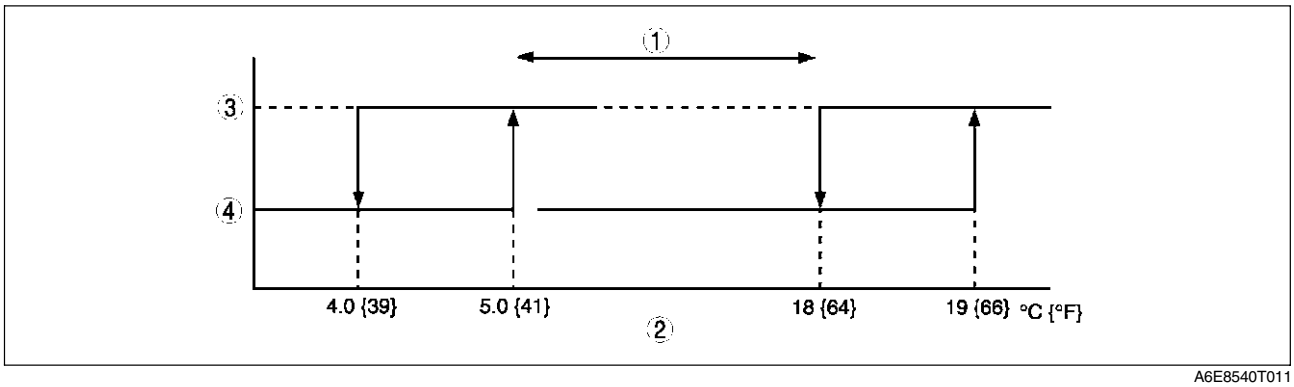
A/C ON/OFF mode determination in A/C mode



A6E8540T010

1	Evaporator temperature
2	A/C ON
3	A/C OFF

A/C ON/OFF mode determination in ECO mode



A6E8540T011

1	Varies with an ambient temperature computation value.
2	Evaporator temperature
3	A/C ON
4	A/C OFF

SENSOR FAIL-SAFE FUNCTION

A6E854001044T09

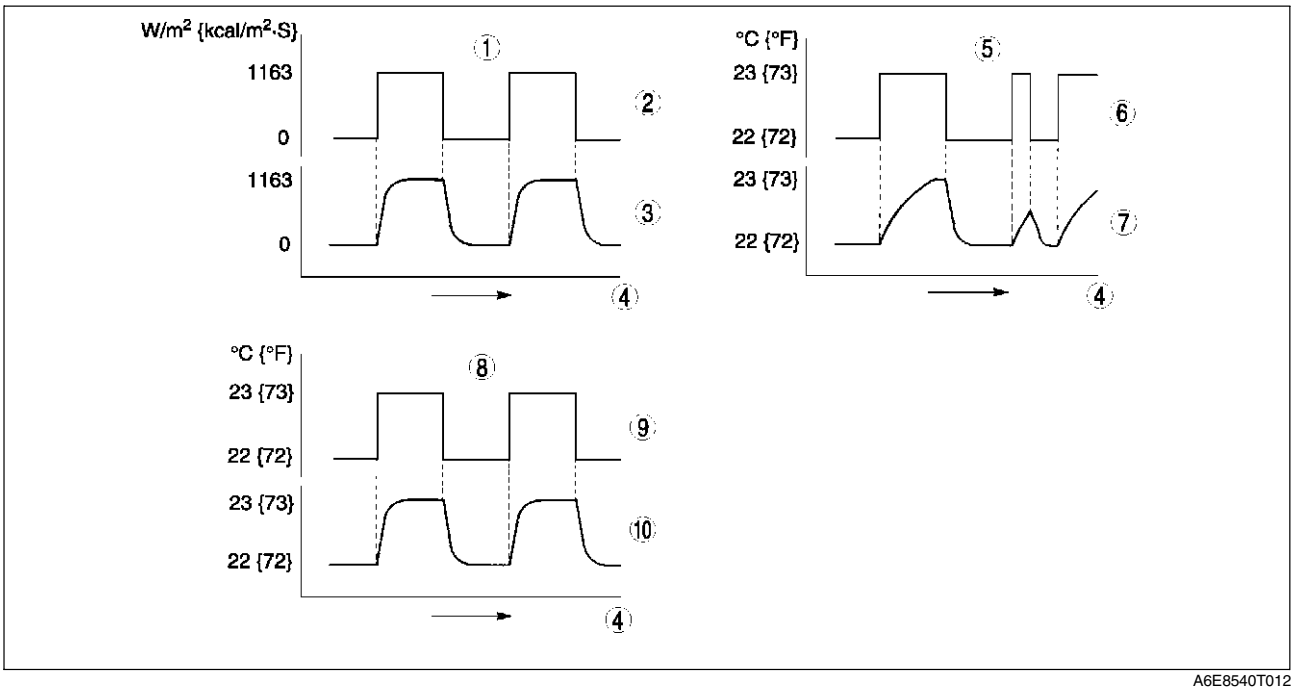
- If the input signals received from the sensors are abnormal, the climate control unit will assume a malfunction and fix the values for the temperature signals from the sensors as shown below to prevent abnormal A/C control.

Sensor	Temperature fixed in case of malfunction
Cabin temperature sensor	25°C {77°F}
Ambient temperature sensor	15°C {59°F}
Water temperature sensor	85°C {185°F}
Evaporator temperature sensor	0°C {32°F}
Solar radiation sensor	0 W/m^2 {0 $kcal/m^2 \cdot s$}

SENSOR SIGNAL DELAY FUNCTION

A6E854001044T10

- Sometimes signals received from sensors will indicate abnormal readings. For example, intermittent or obstructed sunlight (when the vehicle is traveling on city streets or through highway tunnels) causes the sensor signals to be abnormal. When the vehicle is parked and the doors are opened/closed, sunlight intensity, ambient temperature, and cabin temperature signals may be interrupted or may vary suddenly and extremely due to heat radiation from the road. If control is carried out faithfully according to the signals input by the sensors, conditions in the passenger compartment may become uncomfortable and control will not be smooth. The climate control unit delays the input signals for sunlight intensity, ambient temperature, and cabin temperature. It then takes an average value of the readings it receives so that control remains stable, as shown below.
- In winter, once the engine is stopped and then restarted and the temperature around the engine remains high, the ambient temperature sensor will detect the engine heat, therefore, the system controls do not operate according to the actual ambient temperature. To prevent this from happening, each control operates based on the ambient temperature data stored in the climate control unit prior to the engine being stopped, as long as the engine coolant temperature is **55 °C**or above when the engine is restarted.



A6E8540T012

1	Sunlight intensity delay (example)
2	Actual sunlight intensity
3	Sunlight intensity input
4	Time
5	Ambient temperature delay (example)

6	Actual ambient temperature
7	Ambient temperature input
8	Cabin temperature delay (example)
9	Actual cabin temperature
10	Cabin temperature input

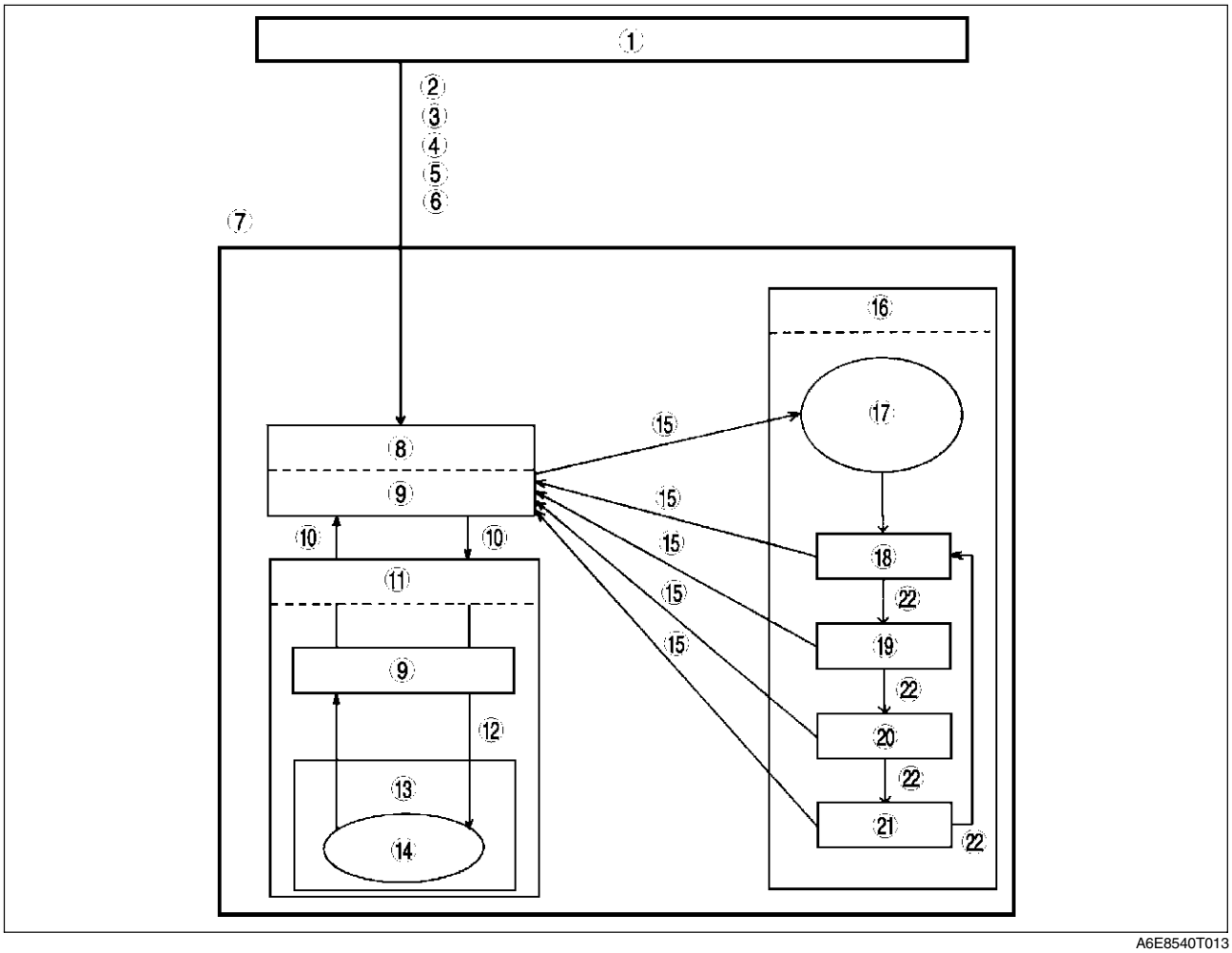
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ON-BOARD DIAGNOSTIC FUNCTION

A6E854001044T11

Outline

- Based on the sunlight intensity and temperature signals from the various sensors, the climate control unit performs very complex control to the output actuation devices. Therefore, the operating condition of the output devices may vary due to input conditions, even though the controls on the climate control unit are not changed. As a result, when a malfunction occurs in the control system, it may be difficult to reproduce the symptom and to isolate the malfunctioning part of the system. To avoid such difficulty, the climate control unit is programmed with a on-board diagnostic function which input system is malfunctioning. It can also check the output system separately from the input system.
- The on-board diagnostic function has three modes: present failure indication, past failure indication, and output device operation check.
- The climate control unit terminal 1F is connected to the body ground by the body grounding of the A/C check connector, whereby voltage fluctuation occurs. The climate control unit detects this voltage fluctuation and activates the on-board diagnostic function.



A6E8540T013

1	Normal control
2	Warm up the engine
3	Turn the ignition switch to LOCK position
4	Short the A/C check connecotr to the body ground using a jumper wire
5	Light the solar radiation sensor with **60 W** lamp at a distance **100 mm {3.9 in}**
6	Start the engine
7	On-board diagnostic
8	Present failure indication
9	Diagnostic trouble code(s) indicated
10	A/C switch on
11	Past failure indication

12	Press REC/FRESH switch and AUTO switch at the same time
13	Past failure memory deletion
14	Rear defroster indicator light flashes once
15	AUTO switch on
16	Output device operation check
17	Check indicator lights illuminate for **4 seconds**.
18	Step 1
19	Step 2
20	Step 3
21	Step 4
22	REC/FRESH switch on

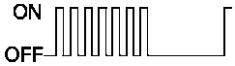
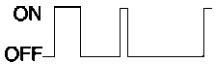
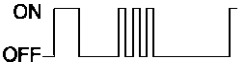
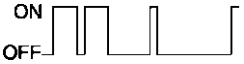
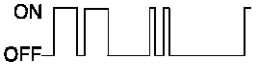
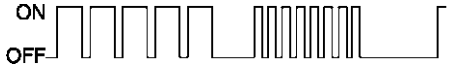
Present Failure Indication Mode

- In present failure indication mode, present failures in the control system circuits (open, short circuits) are detected, and the flashing of the rear defroster indicator light on the climate control unit indicates the DTCs shown in the table below.

Past Failure Indication Mode

- In past failure indication mode, past failures (intermittent problems) in the input sensor circuits (open, short circuits) are stored, and the flashing of the rear defroster indicator light on the climate control unit indicates the DTCs shown in the table below. Erase DTCs from the memory after failures have been corrected so they are not maintained as past failures.

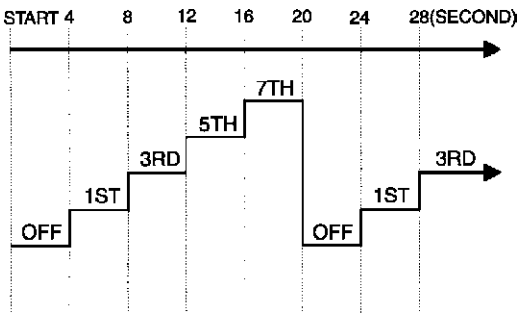
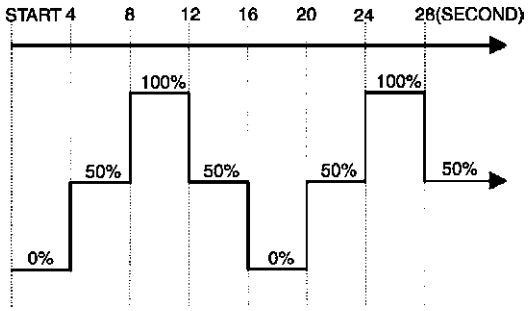
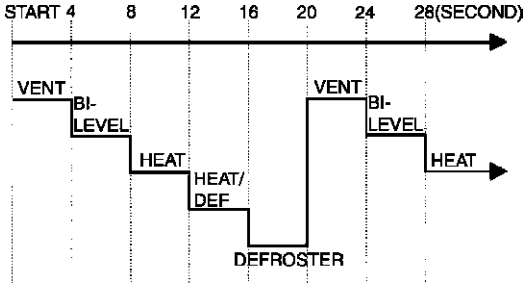
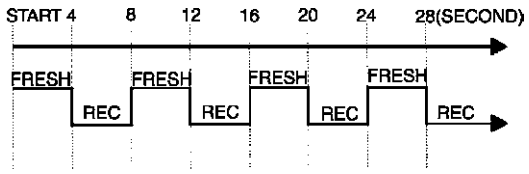
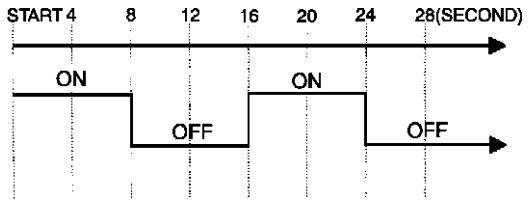
Diagnostic trouble codes

DTC No.	Indicator pattern	Diagnosed circuit	Detected condition	Memorized
02		Solar radiation sensor (present)	Open circuit in solar radiation sensor circuit Short circuit in solar radiation sensor circuit (terminal B side only)	No
06		Cabin temperature sensor (present)	Open/short circuit is in cabin temperature sensor circuit	No
07		Cabin temperature sensor (past)	Cabin temperature sensor circuit is entered fail-safe mode at least once	Yes
10		Evaporator temperature sensor (present)	Open/short circuit is in evaporator temperature sensor circuit	No
11		Evaporator temperature sensor (past)	Evaporator temperature sensor circuit is entered fail-safe mode at least once	Yes
12		Ambient temperature sensor (present)	Open/short circuit is in Ambient temperature sensor circuit	No
13		Ambient temperature sensor (past)	Ambient temperature sensor circuit is entered fail-safe mode at least once	Yes
14		Water temperature sensor (present)	Open/short circuit is in Water temperature sensor circuit	No
15		Water temperature sensor (past)	Water temperature sensor circuit is entered fail-safe mode at least once	Yes
18		Air mix actuator (potentiometer) (present)	Open/short circuit is in air mix actuator (potentiometer) circuit	No
19		Air mix actuator (potentiometer) (past)	Air mix actuator (potentiometer) circuit is entered fail-safe mode at least once	Yes
21		Airflow mode actuator (potentiometer) (present)	Open/short circuit is in airflow mode actuator (potentiometer) circuit	No
22		Airflow mode actuator (potentiometer) ((past)	Airflow mode actuator (potentiometer) circuit is entered fail-safe mode at least once	Yes
58		Air mix actuator (motor lock) (past)	Air mix actuator circuit is entered fail-safe mode at least once	Yes
59		Airflow mode actuator (motor lock) (past)	Airflow mode actuator circuit is entered fail-safe mode at least once	Yes

Output Device Operation Check Mode

- In the output device operation check mode, the climate control unit forces all the output system actuation devices to operate regardless of the input system. The displays change and the switch indicator lights illuminate automatically according to the actuator operated.
- Inspect visually, listen for operation sound, and place hands over air discharge outlets to check for correct operating conditions and to locate the malfunctioning system.

Output device operation check table

Step	Operating device	Operating conditions	Monitor*	Other device conditions
1	Blower motor speed		1	• Air mix actuator operation — 50% • Airflow mode actuator operation — VENT • Air intake actuator operation — FRESH • A/C compressor operation — ON
2	Air mix actuator operation		21.0 20.5 20.0	• Blower motor speed — 3rd • Airflow mode actuator operation — VENT • Air intake actuator operation — FRESH • A/C compressor operation — ON
3	Airflow mode actuator operation		3	• Blower motor speed — 3rd • Air mix actuator operation — 50% • Air intake actuator operation — FRESH • A/C compressor operation — ON
4	Air intake actuator operation		4	• Blower motor speed — 3rd • Air mix actuator operation — 0% • Airflow mode actuator operation — VENT
	A/C compressor operation			

* : Shown on the information display according to step.

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