2000 Mazda MPV Service Highlights

FOREWORD

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

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.

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.

Mazda Motor Corporation
HIROSHIMA, JAPAN

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

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VEHICLE IDENTIFICATION NUMBERS (VIN)

JM3 LW28G∗Y# 100001—

RELATED MATERIALS

1989 MPV Service Highlights	9999–95–029F–89
1989 B-Series, RX-7, MPV 4 Wheel Drive Service Highlights	9999–95–030F–89
1990 626, MX-6, MPV, 929, 929S Service Highlights	9999–95–065F–90
1996 Protegé, MX-3, MX-5, 626, MX-6, MPV, millenia Service Highlights	9999–95–MODL–96
1997 Protegé, MX-5, 626, MX-6, MPV, millenia Service Highlights	9999–95–MODL–97
1995, 1996, 1997 OBD-II Service Highlights	9999–95–OBD2–97
1998 Protegé, MPV, millenia Service Highlights	9999–95–MODL–98
1998 626 Service Highlights	9999–95–039F–98
1999 626, millenia Service Highlights	9999–95–050F–99
1999 Protegé Service Highlights	9999–95–064F–99

ENGINE

01
SECTION

01–00 OUTLINE

ENGINE ABBREVIATIONS

YMU100S01

ABDC	After bottom dead center
A/C	Air conditioning
ATDC	After top dead center
BARO	Barometric pressure
BBDC	Before bottom dead center
BTDC	Before top dead center
CDCV	Canister drain cut valve
CKP	Crankshaft position
CMP	Camshaft position
C/P	Crankshaft pulley
DI	Distributor ignition
DLC	Data link connector
DLC-2	Data link connector-2
DLI	Distributorless ignition
DOHC	Double overhead camshaft
DTC	Diagnostic trouble code
ECT	Engine coolant temperature
EGR	Exhaust gas recalculation
ESA	Electric spark advance
EVAP	Evaporative emission
EX	Exhaust
GEN	Generator
GND	Ground
HLA	Hydraulic lash adjuster
HO2S	Heated oxygen sensor
IAC	Idle air control

IAT	Intake air temperature
IMRC	Intake manifold runner control
IN	Intake
LH	Left hand
MAF	Mass air flow
MIL	Malfunction indicator light
NGS	New generation star
OHC	Overhead camshaft
P	Primary
PCM	Powertrain control module
PCV	Positive crankcase ventilation
PID	Parameter identification
PRC	Pressure regulator control
P/S	Power steering
PSP	Power steering pressure
RH	Right hand
S	Secondary
TCM	Transmission control module
TDC	Top dead center
TEN	Tensioner
TP	Throttle position
TR	Transaxle range
TWC	Three way catalytic converter
VSS	Vehicle speed sensor
W/P	Water pump
WU-TWC	Warm-up three way catalytic converter

ENGINE NEW FEATURES

YMU100S02

Improved Engine Performance
- DOHC with 4 valves per cylinder
- Swing arm type rocker arms for high valve lift
- Pentroof combustion chamber
- Intake manifold runner control (IMRC) system
- Distributorless ignition (DLI) system

Reduced Engine Weight
- Main parts (cylinder block, cylinder head, and oil pan) made of aluminum alloy
- Hollow camshafts
- Short-skirt pistons
- Sintered metal connecting rods
- Eliminated the voltage regulator of the generator (Generator control is carried out by the PCM.)

Reduced Engine Noise and Vibration
- High-rigidity aluminum alloy cylinder block
- Aluminum alloy oil pan
- Forged steel crankshaft
- Silent timing chains
- Sintered connecting rods

Reduced Engine Size
- Camshaft-driven water pump
- Oil pump directly connected to and driven by crankshaft
- Single auxiliary parts driving belt

Improved Serviceability
- Tension of the auxiliary parts driving belt is adjusted automatically with an auto tensioner
- Timing chain tension is adjusted automatically with hydraulic tensioners
- Valve clearance is adjusted automatically to 0 mm {0 in} with HLA
- Timing chains have been adopted to eliminate the need for replacement.
- Divided DTC
- Three type quick release connectors

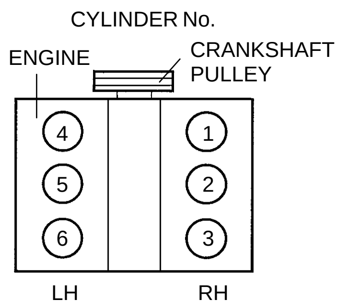
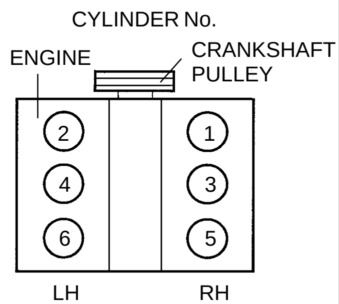
Improved Emission System
- Stepping motor type EGR valve
- Warm-up three way catalytic converter (California emission regulations applicable model only)

Improved Durability
- Platinum spark plugs
- Timing chains

ENGINE SPECIFICATIONS

YMU100S03

Item				Specifications 2000MY GY	Specifications 1998MY JE
MECHANICAL					
Type				Gasoline, 4-cycle	←
Cylinder arrangement and number				60° V configuration, 6-cylinder	←
Combustion chamber				Pentroof	←
Valve system				DOHC, Timing chain driven, 24 valves	SOHC, Timing belt driven, 18 valves
Displacement (ml {cc, cu in})				2,498 {2,498, 152.4}	2,954 {2,954, 180.2}
Bore × stroke (mm {in})				81.7 × 79.5 {3.22 × 3.13}	90.0 × 77.4 {3.54 × 3.05}
Compression ratio				9.7 : 1	8.5 : 1
Valve timing	IN	Open	BTDC	17°	9°
		Close	ABDC	47° (Primary), 53° (Secondary)	53°
	EX	Open	BBDC	67°	51°
		Close	ATDC	13°	11°
Valve clearance (Engine cold)	IN		(mm {in})	0 {0} Maintenance-free	←
	EX		(mm {in})	0 {0} Maintenance-free	←
LUBRICATION SYSTEM					
Type				Force-fed type	←
Oil pump	Type			Trochoid gear	←
Oil filter	Type			Full flow, paper element	←
Engine oil				ILSAC (GF-II)	API Service SG (Energy Conserving II), SH (Energy Conserving II) or ILSAC (GF-I) SJ or ILSAC (GF-II)
COOLING SYSTEM					
Type				Water-cooled, forced circulation	←
Coolant capacity (L {US qt, Imp qt})				10.2 {10.8, 9.0} (without rear heater) 12.0 {12.7, 10.6} (with rear heater)	7.2 {7.6, 6.3}
Water pump	Type			Centrifugal	←
	Water seal			Unified mechanical seal	←
Thermostat	Type			Wax, bottom-bypass	←
Radiator	Type			Corrugated fin	←
Cooling fan	Type			Electric	Thermo-modulated
	Blade	Outer diameter	(mm {in})	320 {12.6}	430 {16.9}
		Number		Without A/C 5 With A/C No.1: 5, No.2: 7	7
INTAKE-AIR SYSTEM					
Air cleaner element	Type			Paper element (wet type)	←
FUEL SYSTEM					
Fuel pump	Type			Electrical	←
Fuel tank	Capacity (L {US gal, Imp gal})			70 {18, 15}	74.0 {19.6, 16.3} (2WD) 75.0 {19.8, 16.5} (4WD)
Required fuel				Unleaded (RON 91 or higher)	←
Fuel pressure (kPa {kgf/cm^2, psi})				310—350 {3.1—3.6, 45—51}	220—260 {2.2—2.7, 31—38}

Item			Specifications	
			2000MY	1998MY
			GY	JE
EMISSION SYSTEM				
EGR control	Type		Stepping motor type	N/A
CHARGING SYSTEM				
Battery	Voltage (V)		12	←
	Type and capacity (5-hour rate) (A·h)		55D23L(48), 75D26L(52)*1	←
Generator	Output (V–A)		12–100	12–70
	Regulated voltage (V)		Controlled PCM	14.1—14.7 [20°C {68°F}]
	Self-diagnosis function			Equipped
IGNITION SYSTEM				
Type			DLI	DI
Spark advance			Electronic	←
Firing order			1–4–2–5–3–6 	1–2–3–4–5–6 
Spark plug	Type	NGK	—	BKR5E-11*2, BKR6E-11*3
		DENSO	—	K16PR-U11*2, K20PR-U11*3
		Motorcraft	AWSF-32F	—
STARTING SYSTEM				
Starter	Type		Coaxial reduction	←
	Output (kW)		1.6	1.0, 1.7*1

*1 : Cold area
*2 : Standard plug
*3 : Cold type plug

01–10 MECHANICAL

MECHANICAL OUTLINE

YMU110S01

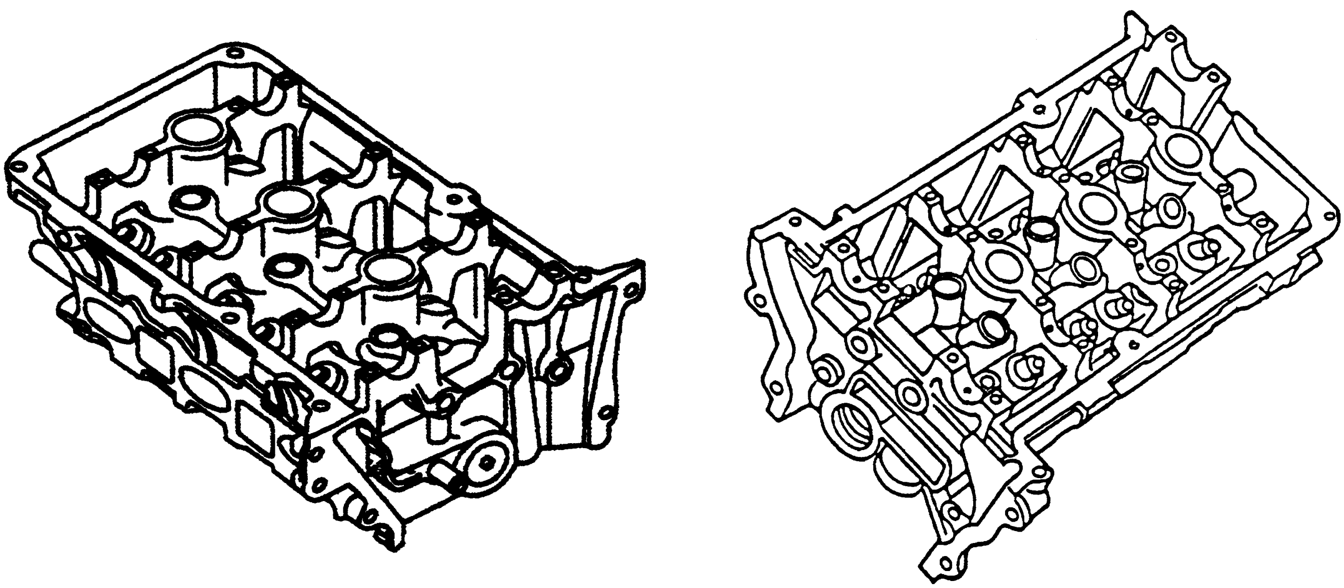
- The new GY engine (2.5L) has been adopted.
- The main features are as follows:
  - V6 24-valve DOHC engine
  - The main engine components are made of aluminum (cylinder block, cylinder head and oil pan).
  - Cast iron inserts for each cylinder because the cylinder block is made of aluminum
  - The camshaft is driven by the timing chain.
  - The camshaft and sprocket are integrated and cannot be disassembled.
  - An automatically adjusted V-ribbed belt drives the accessories.
  - V-ribbed belt in a serpentine configuration has been adopted.

CYLINDER HEAD DESCRIPTION

YMU110S02

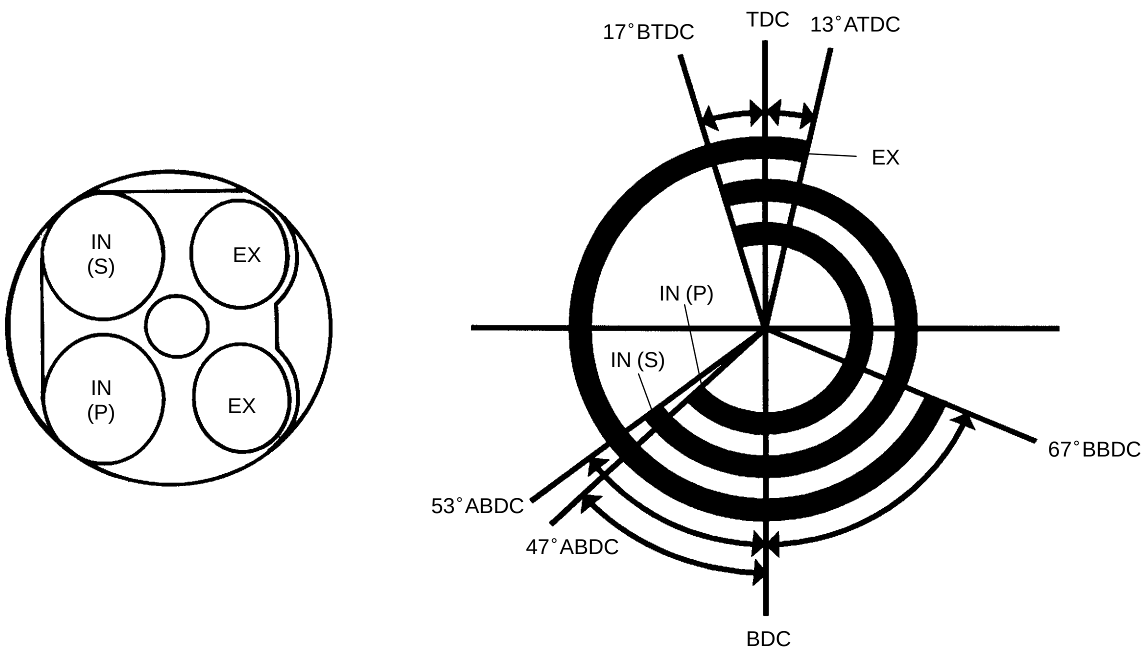
- The aluminum cylinder head is shaped differently on either bank.
- The cylinder head bolts are pliant type and cannot be reused.

RH LH



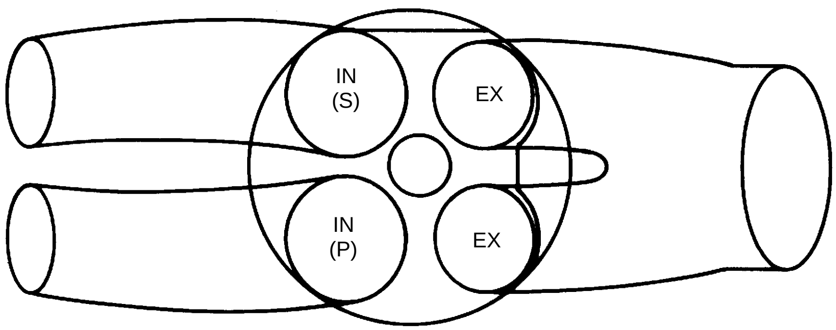
YMU110SA0

- Each cylinder consists of two intake valves and two exhaust valves.
- The two intake valves, primary (P) and secondary (S), close at different times.



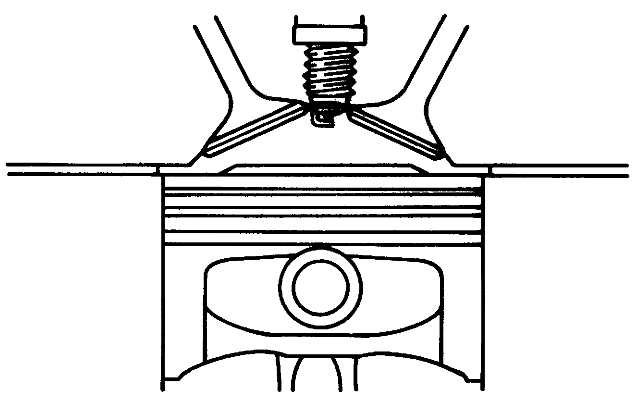
YMU110SA2

- Separated intake passages in the cylinder head are adopted.



YMU110SA4

- Pentroof type combustion chambers are adopted.

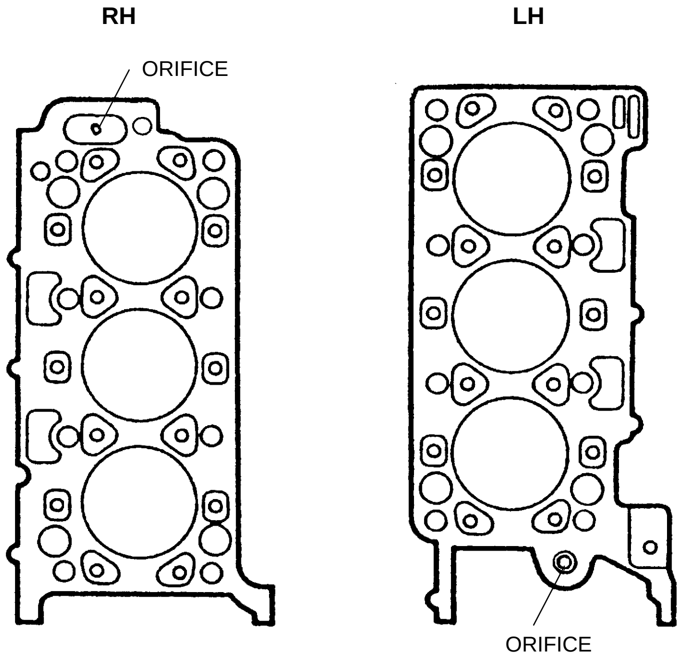


YMU110SA5

HEAD GASKET DESCRIPTION

YMU110S03

- The head gaskets are steel laminated.
- The orifice, which controls the amount of oil flowing to the cylinder head, is located on the head gasket.

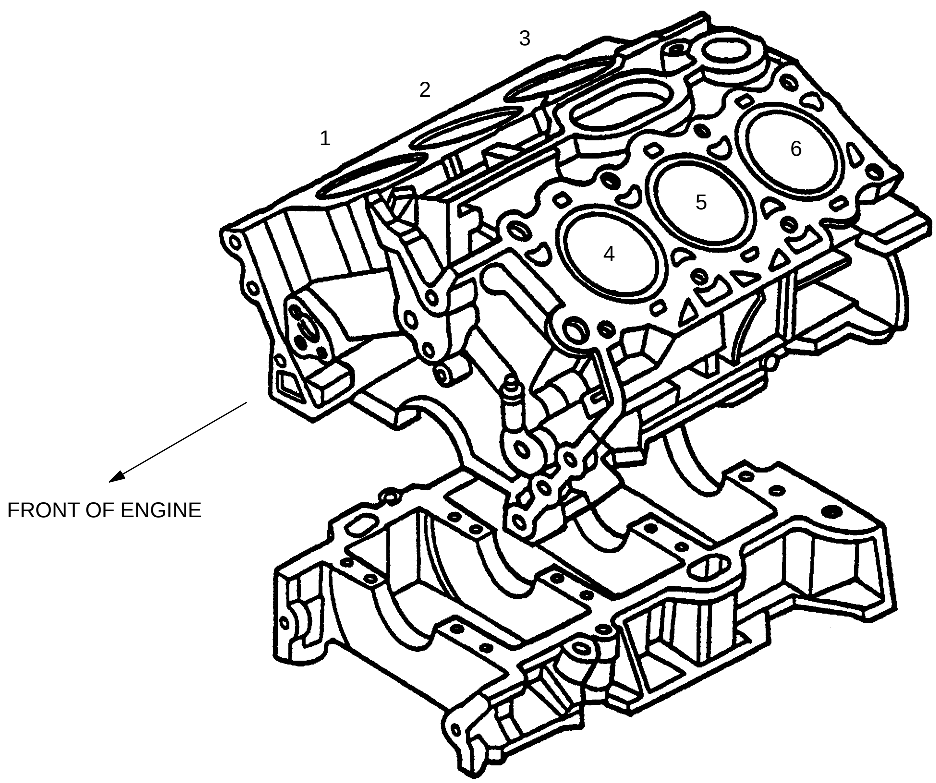


YMU110SA6

CYLINDER BLOCK DESCRIPTION

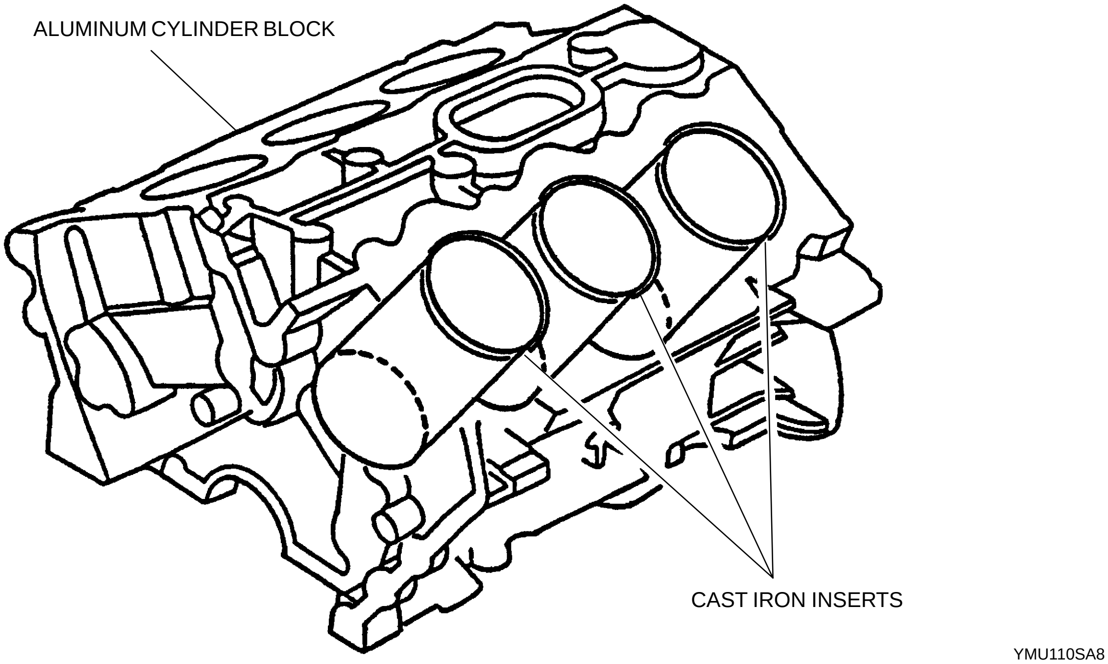
YMU110S04

- The aluminum cylinder block consists of an upper and a lower block.
- The cylinders are numbered one, two, and three beginning from the front right bank, and four, five, and six beginning from the front left bank.

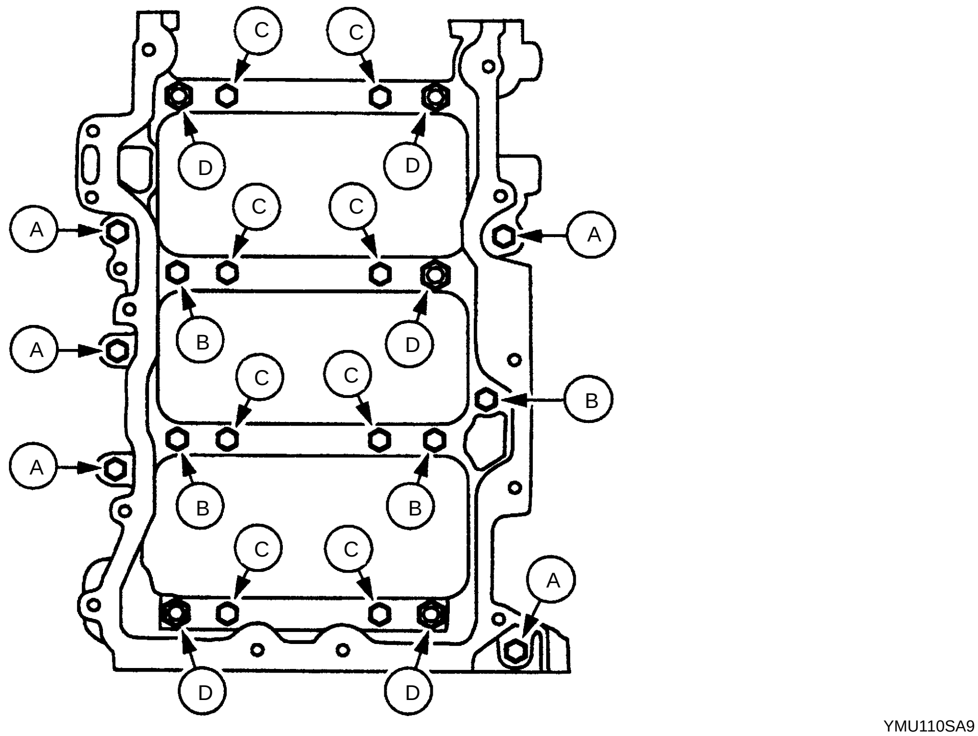


YMU110SA7

- Cast iron inserts are installed in the cylinder block and cannot be bored or replaced.



- The upper and lower blocks are connected by 22 bolts.
- Bolts B, C and D are pliant type and cannot be reused.



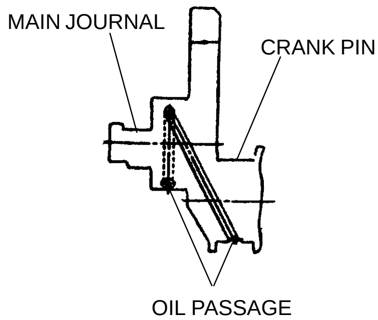
- The bolts have the following shapes and specifications.

Bolt	Bolt shape	Description
A	 YMU110SAA	M8 × 1.25 × 79.3 Bolt & Washer Pilot
B	 YMU110SAB	M8 × 1.25 × 95.3 Pliant Type Bolt & Washer Pilot
C	 YMU110SAC	M10 × 1.5 × 106 Pliant Type Bolt & Washer Pilot
D	 YMU110SAD	M6 × 1.0 × 19.5/ M8 × 1.25 × 95.3 Pliant Type Stud & Washer Pilot

CRANKSHAFT DESCRIPTION

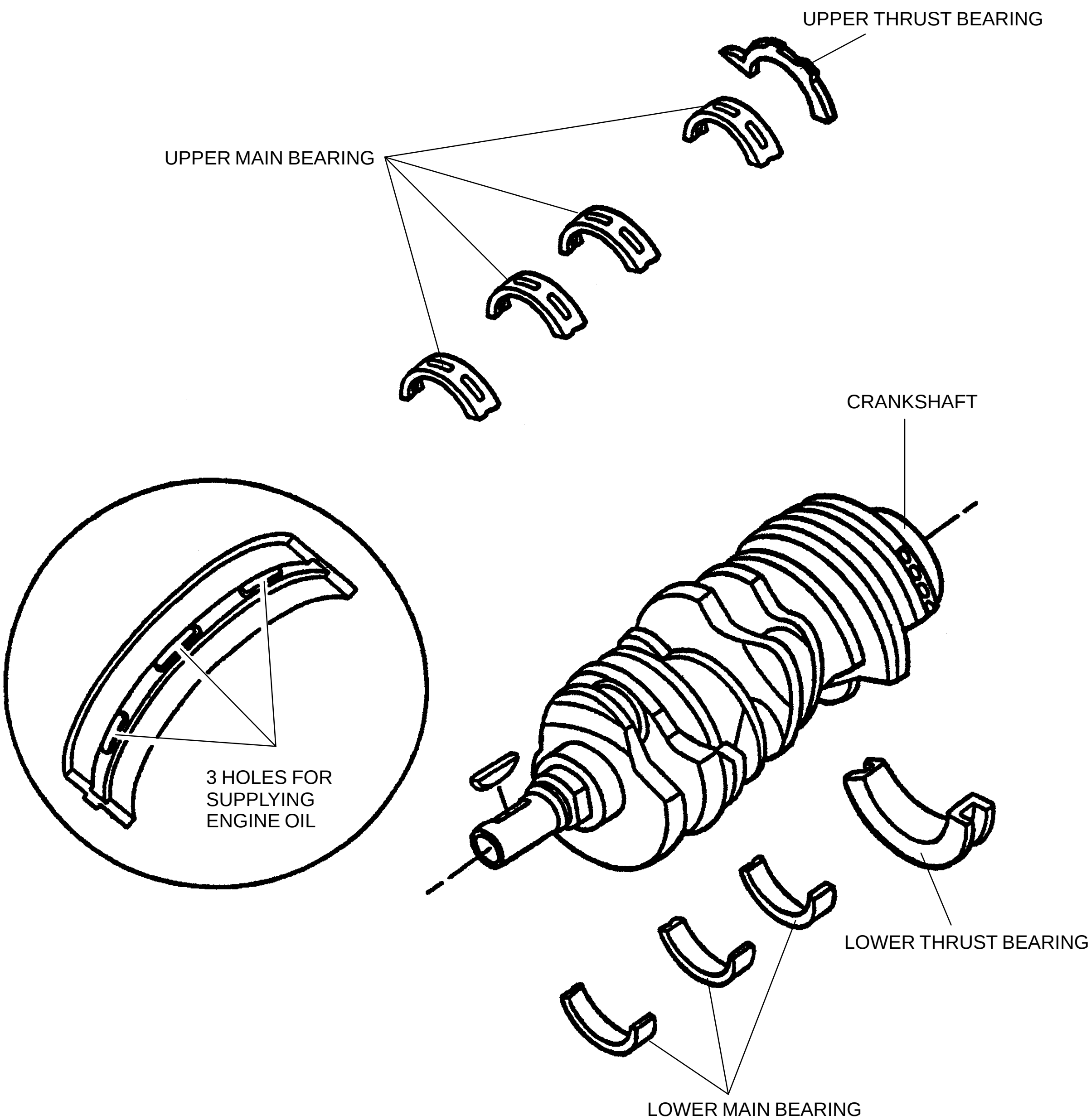
YMU110S05

- The crankshaft main journal has an oil passage as shown in the figure.



YMU110SAE

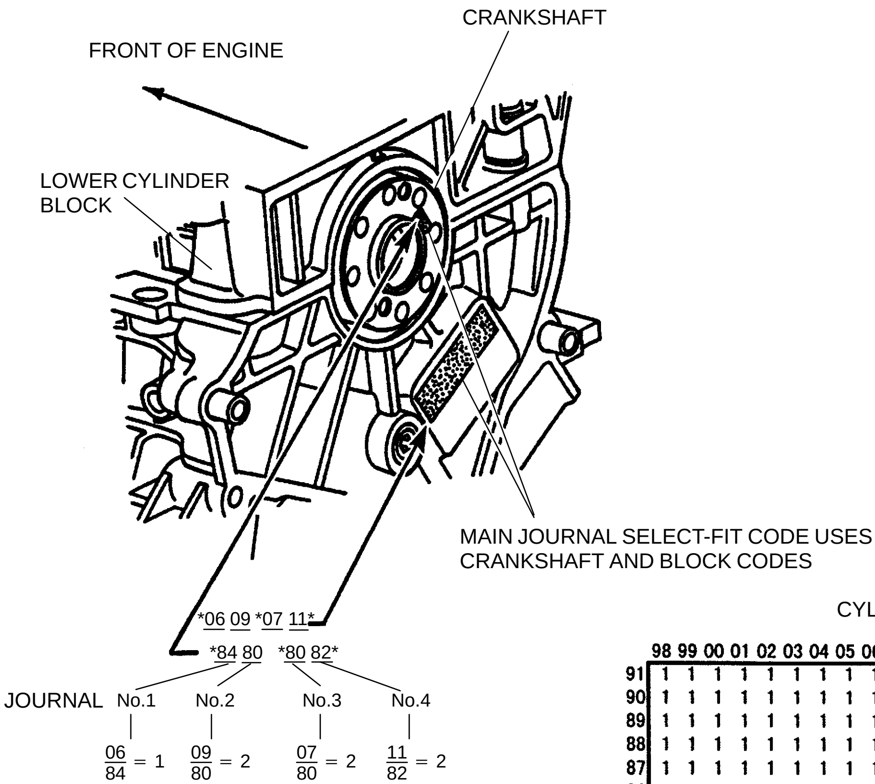
- A thrust bearing receives the thrust force of the crankshaft.
- There are three holes for supplying engine oil in the upper main bearing.

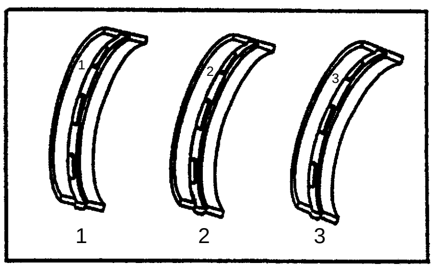


YMU110SAF

- To obtain an appropriate clearance of main bearings, three kinds of main bearings are available as service parts.
- The selection codes are marked on the cylinder block and the crankshaft.
- Refer to the chart below to select the necessary bearings.

AN EXAMPLE OF MAIN BEARING SELECTION





CYLINDER BLOCK CODE

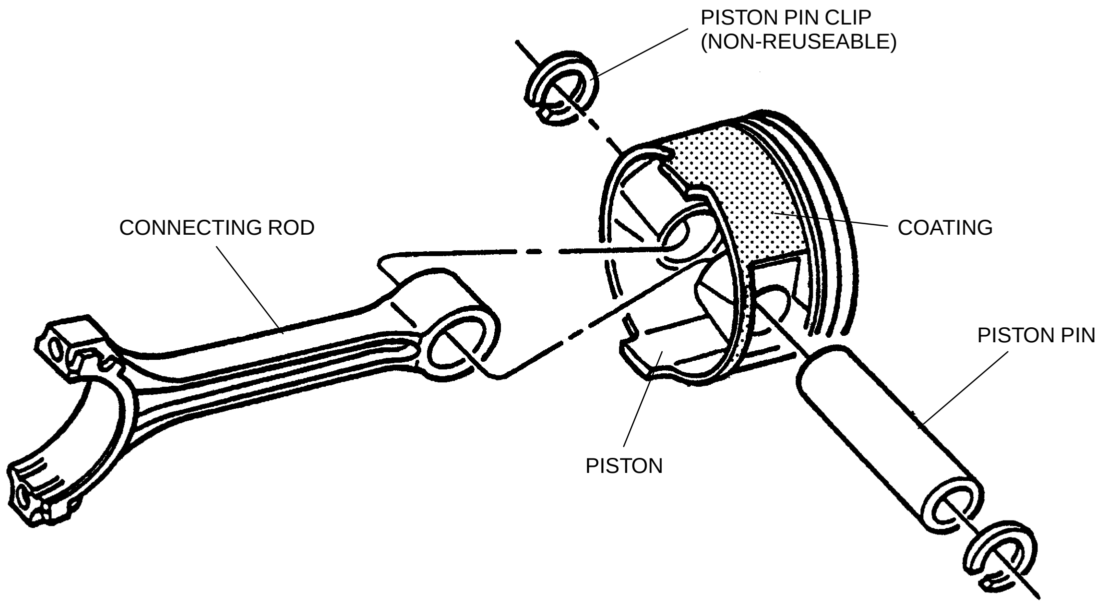
CRANKSHAFT CODE	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
91	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
90	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
89	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
88	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
87	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
86	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
85	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
84	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3
83	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
82	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
81	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
80	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3
79	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
78	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3
77	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
76	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3
75	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
74	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
73	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
72	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
71	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
70	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
69	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
68	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

YMU110SAG

PISTON DESCRIPTION

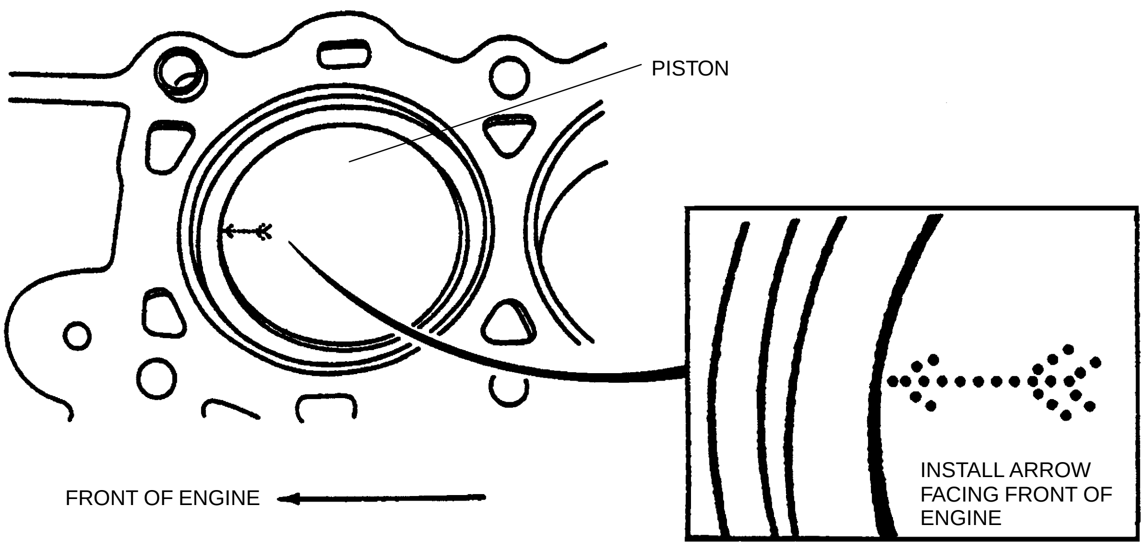
YMU110S06

- The piston skirt is coated to improve wear resistance.
- The connection between the piston and the connecting rod is full floating.
- The piston pin clips cannot be reused; use new clips when reassembling the piston and connecting rod.



YMU110SAH

- When reassembling the piston to the engine, make sure the arrow mark on the piston faces the front of the engine.

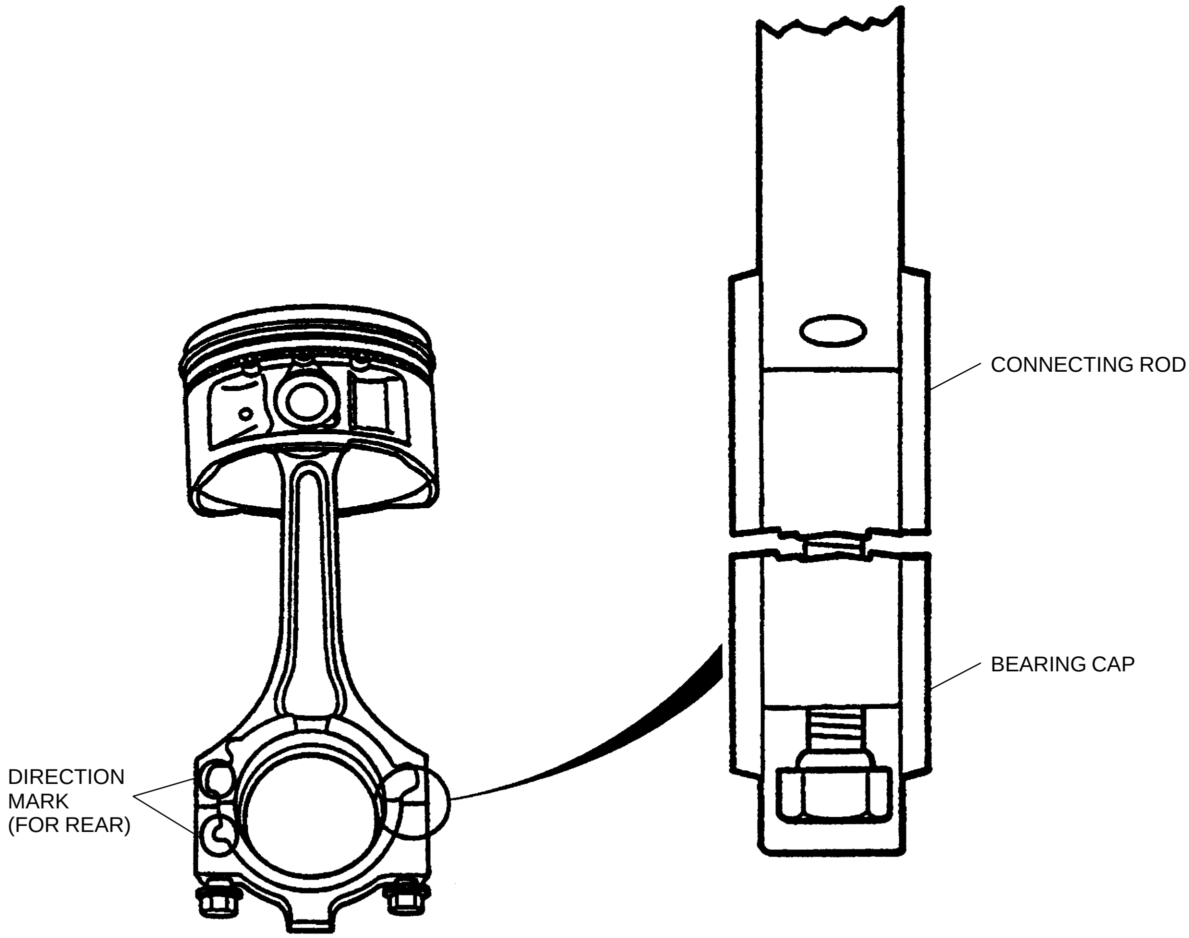


YMU110SAI

CONNECTING ROD DESCRIPTION

YMU110S07

- Pliant bolts are used in the connection with the connecting rod caps and are not reusable.
- The big end is sheared off during production instead of being machined to fit together cleanly.
  - Avoid contact with dirt, grease or other contaminants on the mating faces, as they may cause improper bearing fit.

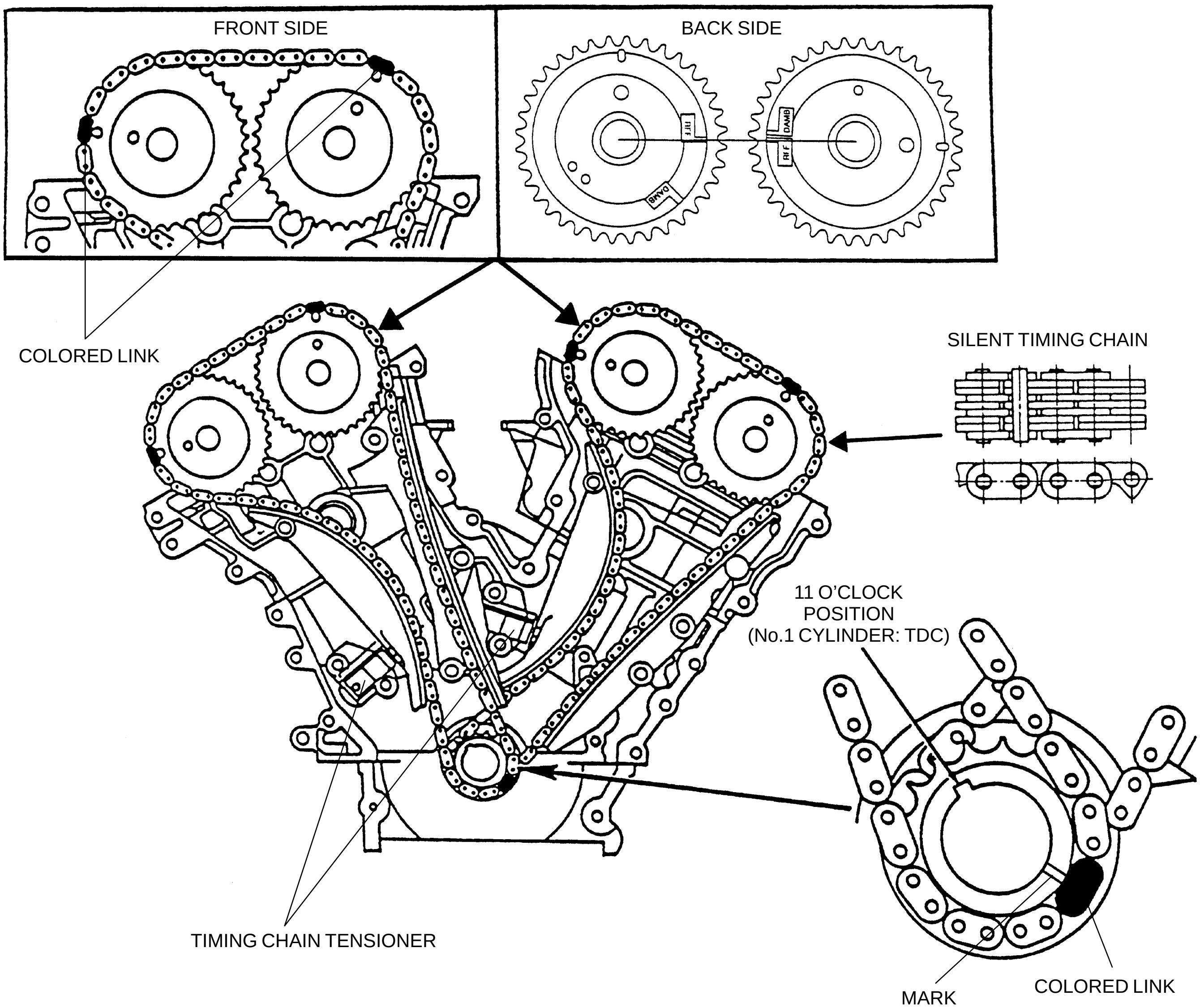


YMU110SAJ

CAMSHAFT DRIVE DESCRIPTION

YMU110S08

- Silent timing chains that are extremely quiet and durable have been adopted.
- The camshafts are driven by timing chains.
- There are three colored links on the timing chains for each bank.
- The timing chain adjusters mounted in the cylinder block use both engine oil pressure and spring pressure to automatically maintain timing chain tension.
- The colored links on the timing chain are used as reference for adjusting the timing chain.
- To check the TDC No.1 firing position, verify that RFF flags on the back side of the camshaft sprockets are pointing toward each other when the crankshaft keyway is at 11 o’clock position.

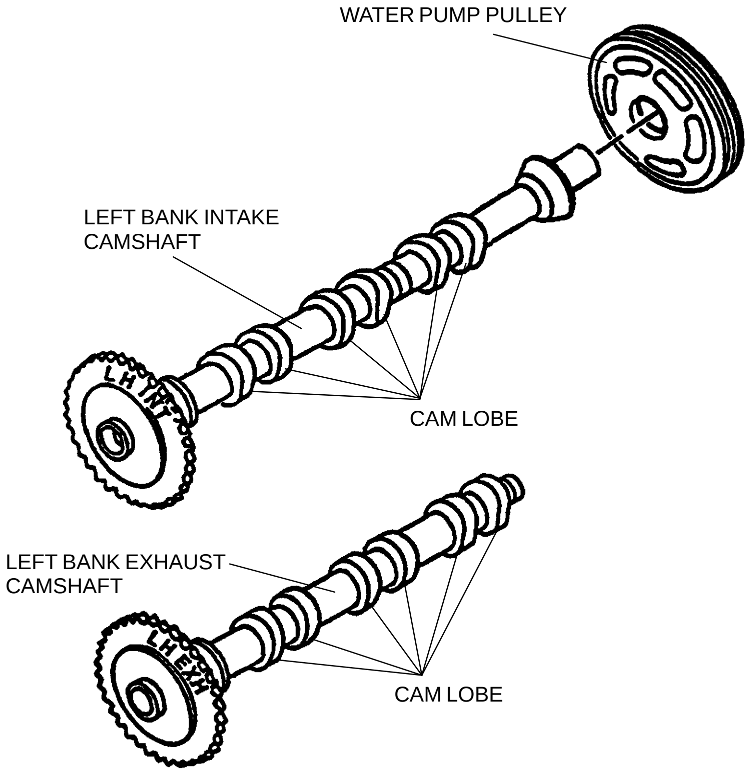


YMU110SAK

CAMSHAFT DESCRIPTION

YMU110S09

- The camshafts and sprockets are integrated and cannot be disassembled.
- The camshafts are hollow.
- The cam lobes are pressed onto the camshafts.
- The left and right banks, and intake and exhaust identifications are on the sprocket of the camshaft.

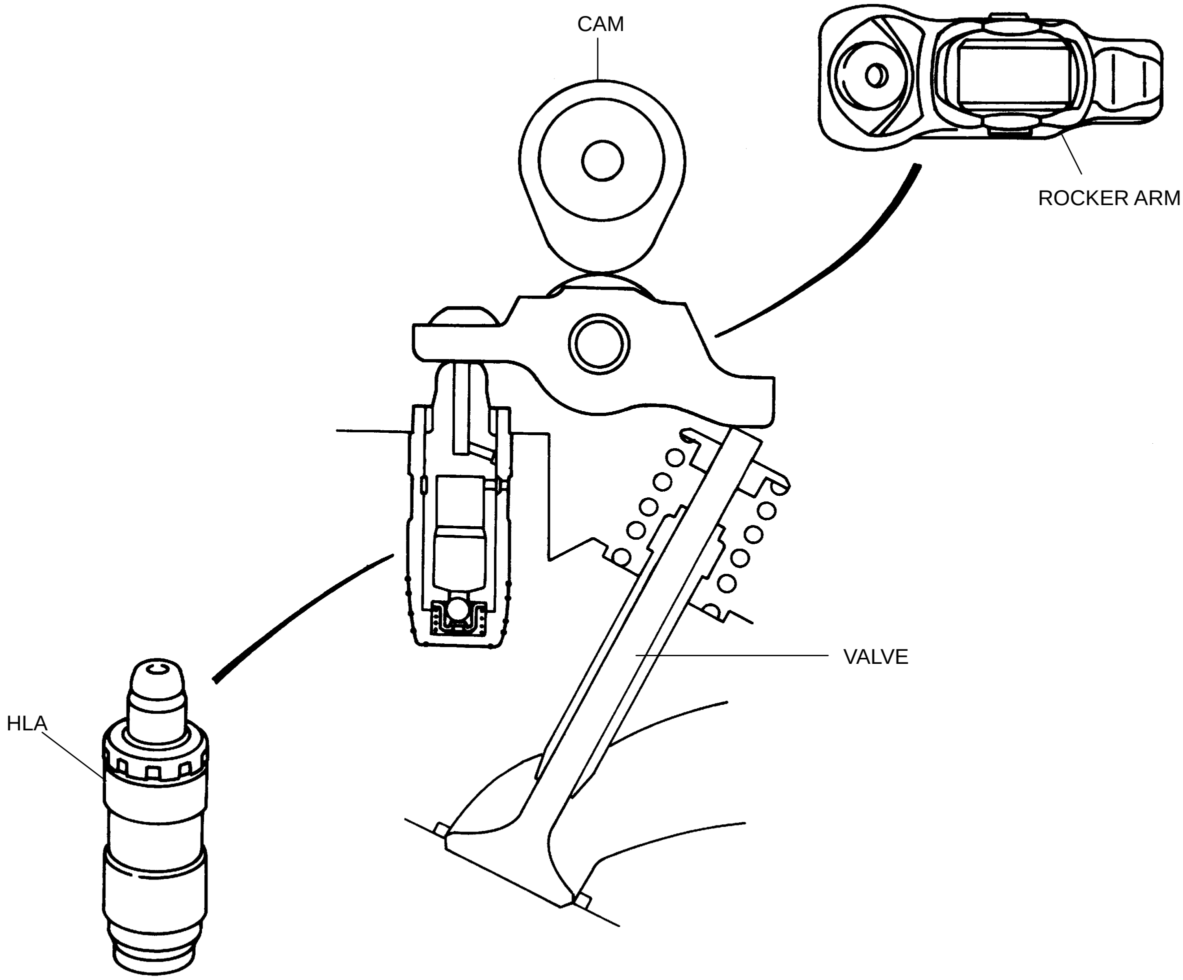


YMU110SAL

VALVE DRIVE DESCRIPTION

YMU110S10

- The valve is driven by the cam through the rocker arm.
- The HLA automatically maintains valve clearance at 0 mm {0 in}.



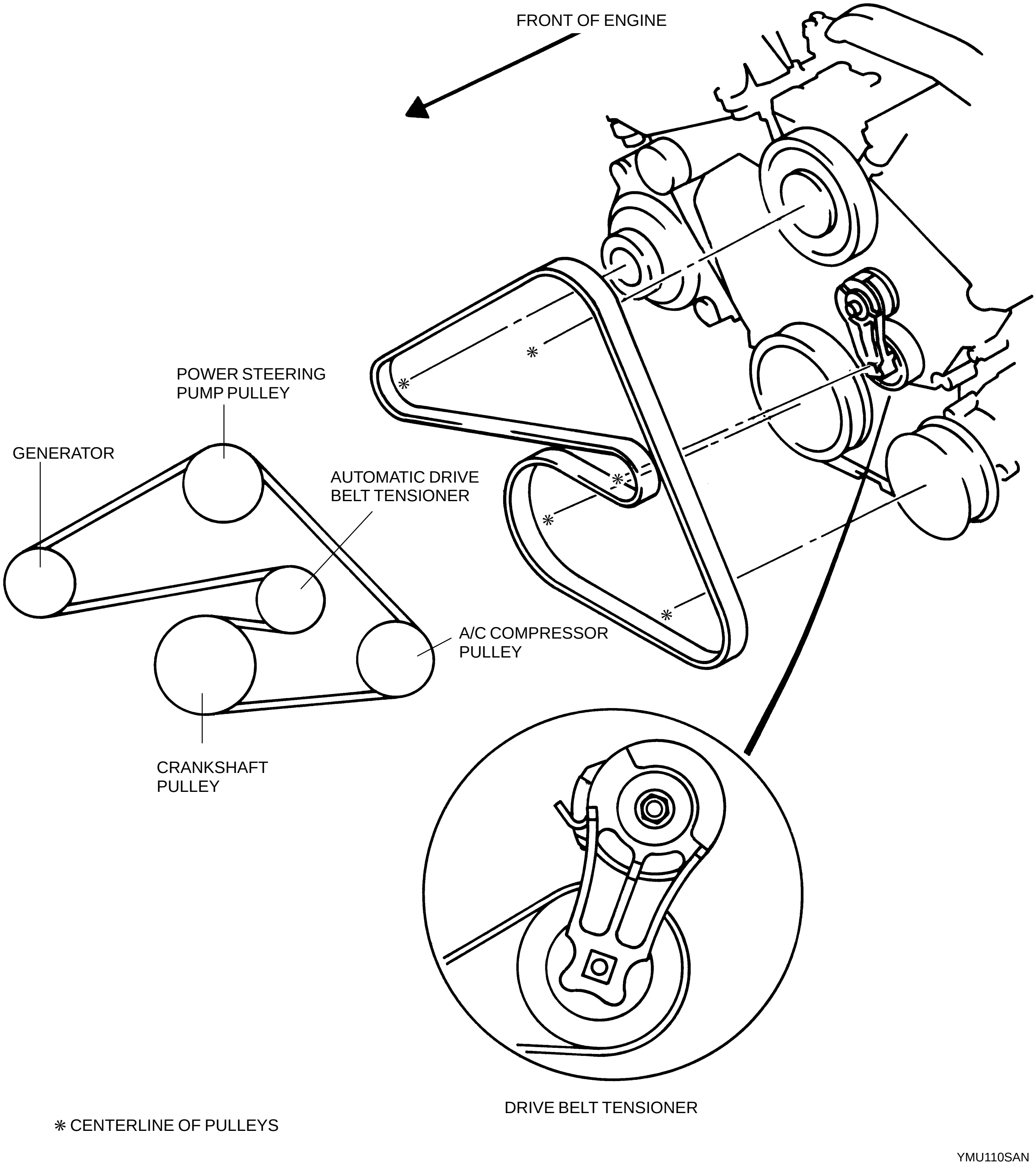
YMU110SAM

ACCESSORY DRIVE DESCRIPTION

YMU110S11

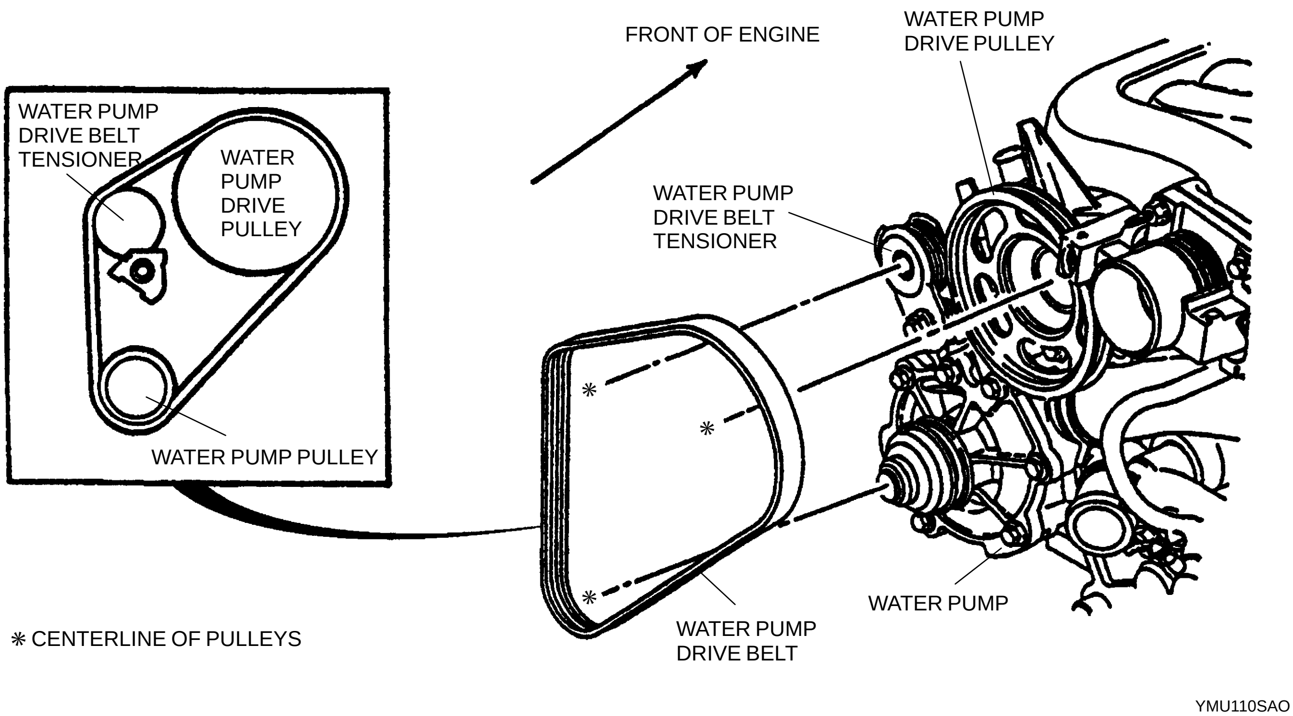
Front

- The generator, power steering pump, and A/C compressor are driven by the V-ribbed belt in a serpentine configuration.
- Tension is automatically adjusted by the drive belt tensioner.



Rear

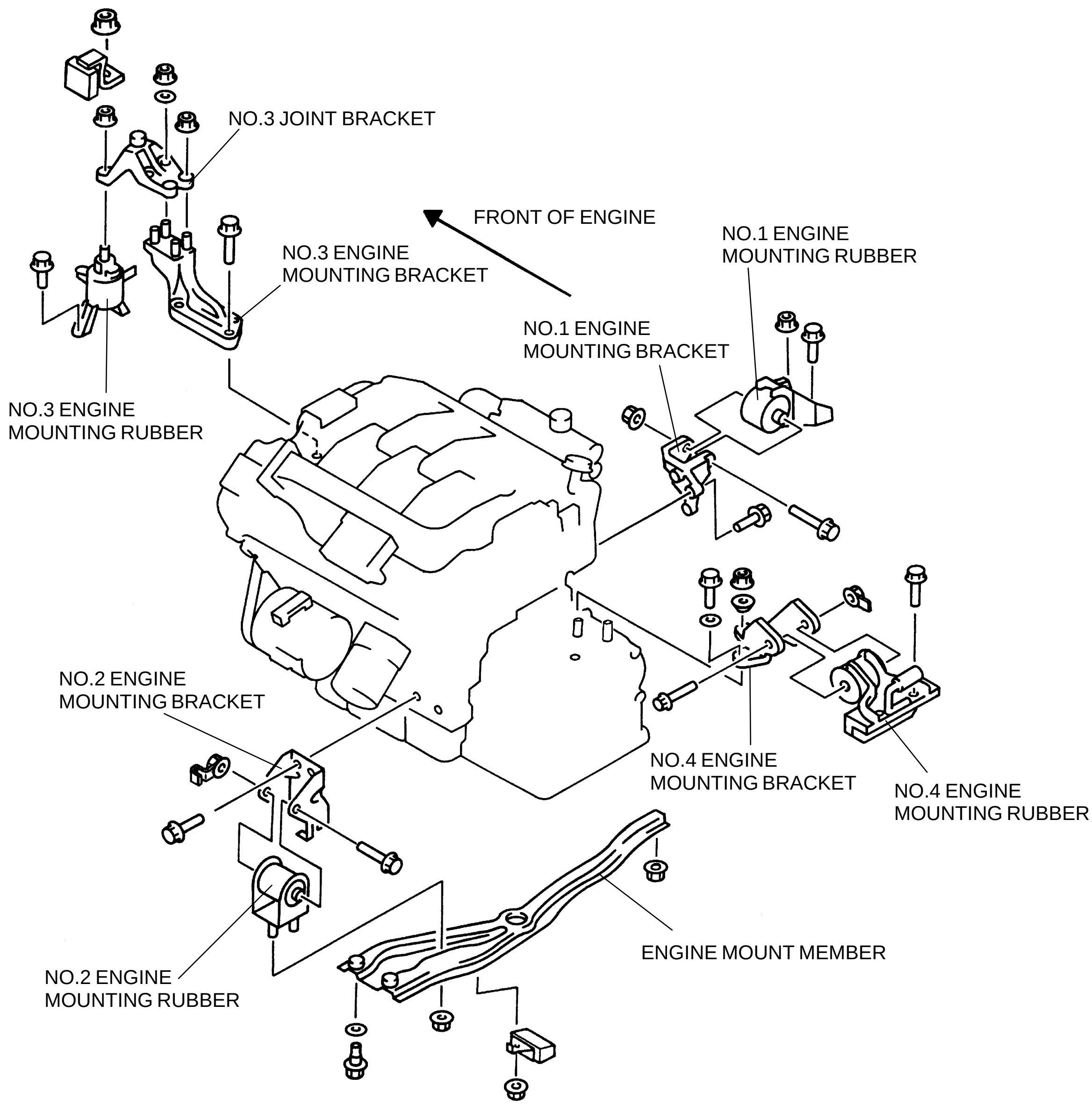
- The water pump is driven by the V-ribbed belt from the water pump drive pulley on the left bank intake camshaft.
- The tension is automatically adjusted by the drive belt tensioner.



ENGINE MOUNT DESCRIPTION

YMU110S12

- The engine is supported by four engine mounts.
- The No.3 engine mount is oil-filled.

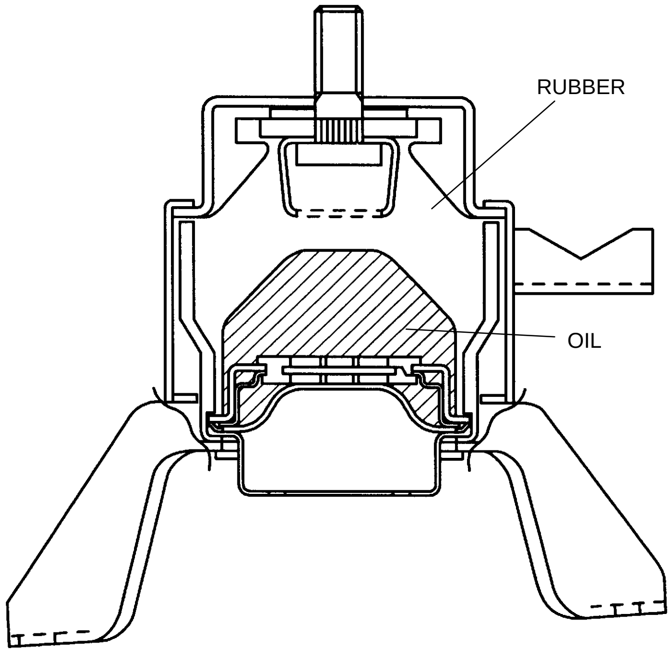


YMU110SAP

NO.3 ENGINE MOUNTING RUBBER DESCRIPTION

YMU110S13

- The No.3 engine mount is oil-filled for noise decrease and vibration insulation.



YMU110SAQ

01–11 LUBRICATION

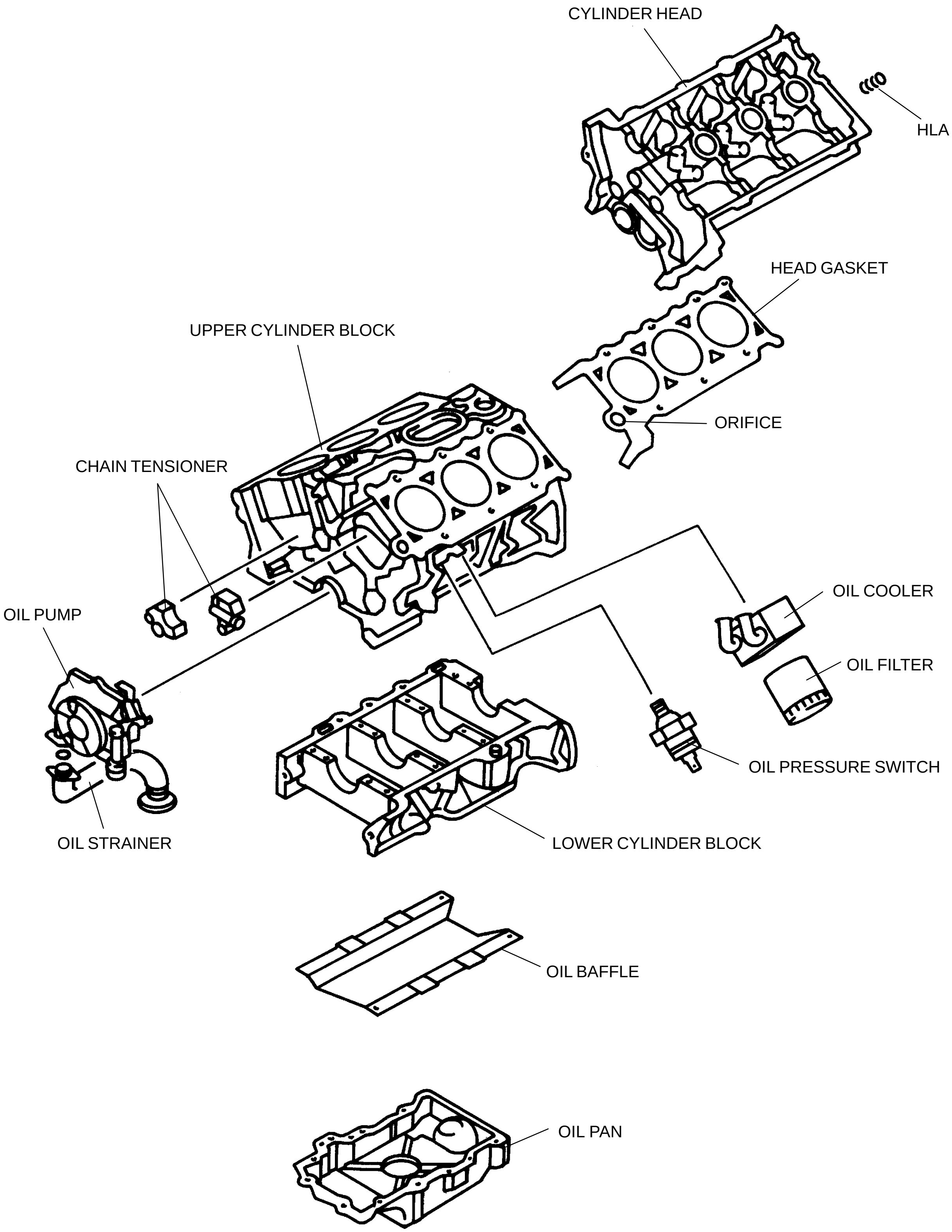
LUBRICATION OUTLINE

YMU111S01

- The oil pump is driven directly by the crankshaft.
- As the oil pump is not serviceable, it must be replaced as a unit.
- A water-cooled oil cooler has been adopted to cool the engine oil.

LUBRICATION STRUCTURAL VIEW

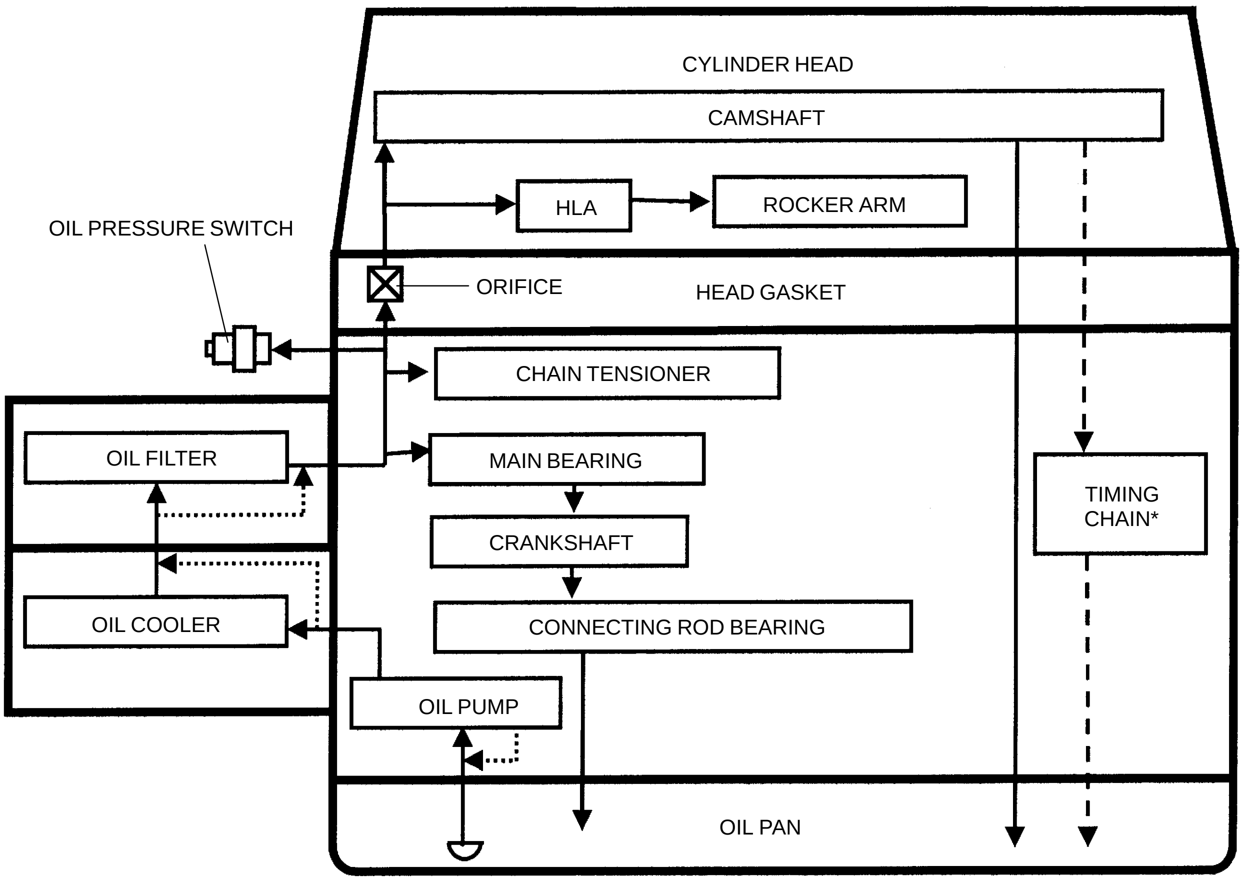
YMU111S02



YMU111SA0

LUBRICATION FLOW DIAGRAM

YMU111S03



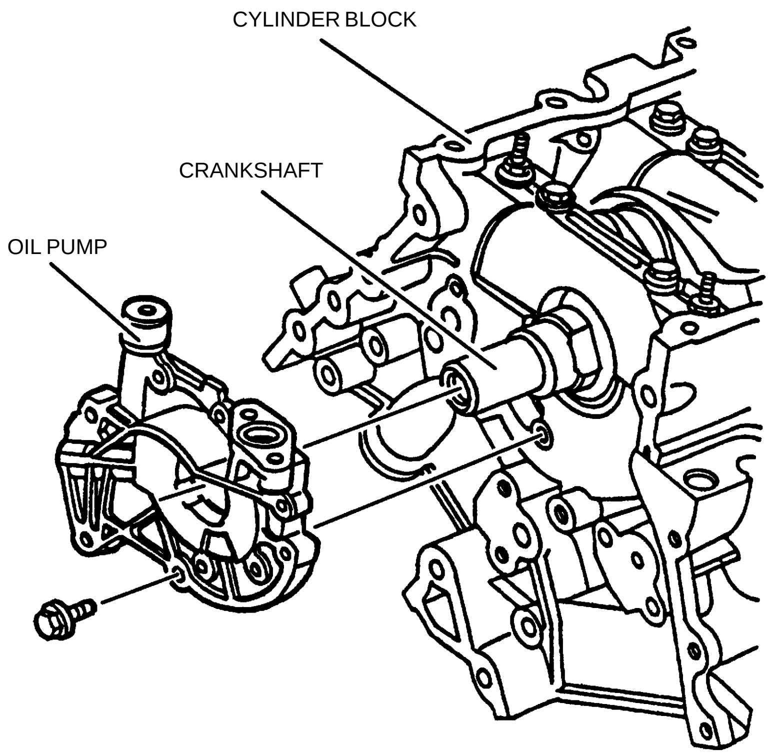
YMU111SA1

* : Timing chains are lubricated by the oil returning from the camshaft bearing.

OIL PUMP DESCRIPTION

YMU111S04

- The oil pump is driven directly by the crankshaft.
- As the oil pump is not serviceable, it must be replaced as a unit if any of the following conditions exist.
  - Major repairs on a high mileage engine.
  - Contaminated oil due to internal engine part failure or wear.
  - Excessive bearing wear or bearing failure.
  - Low oil pressure on a high mileage engine.

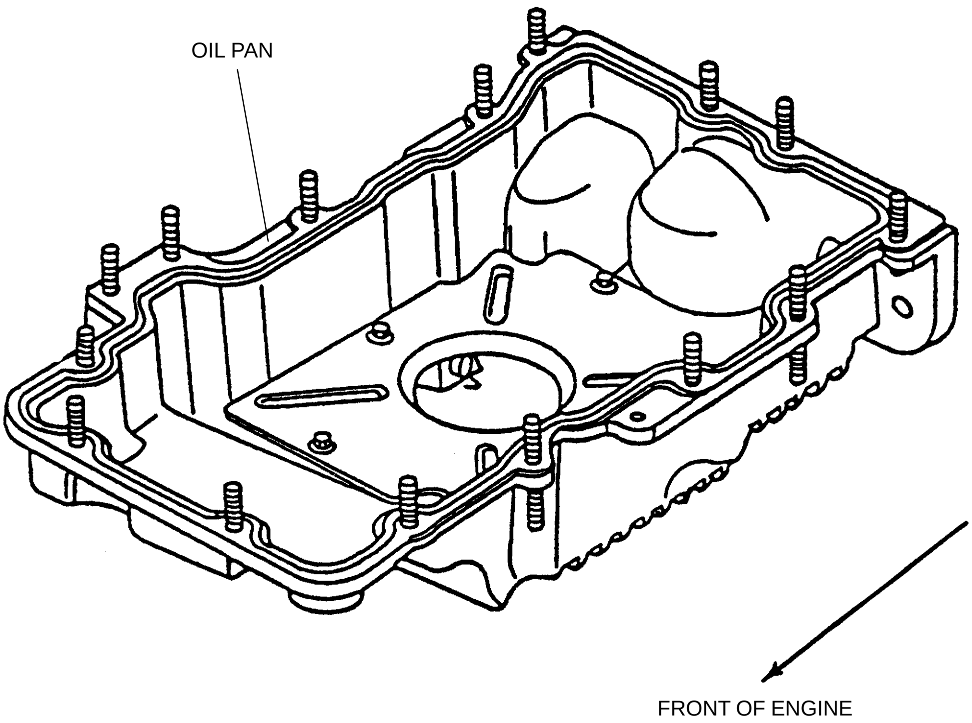


YMU111SA2

OIL PAN DESCRIPTION

YMU111S05

- The oil pan is made of aluminum with ribs to increase the crankcase rigidity.



YMU111SA3

01–12 COOLING SYSTEM

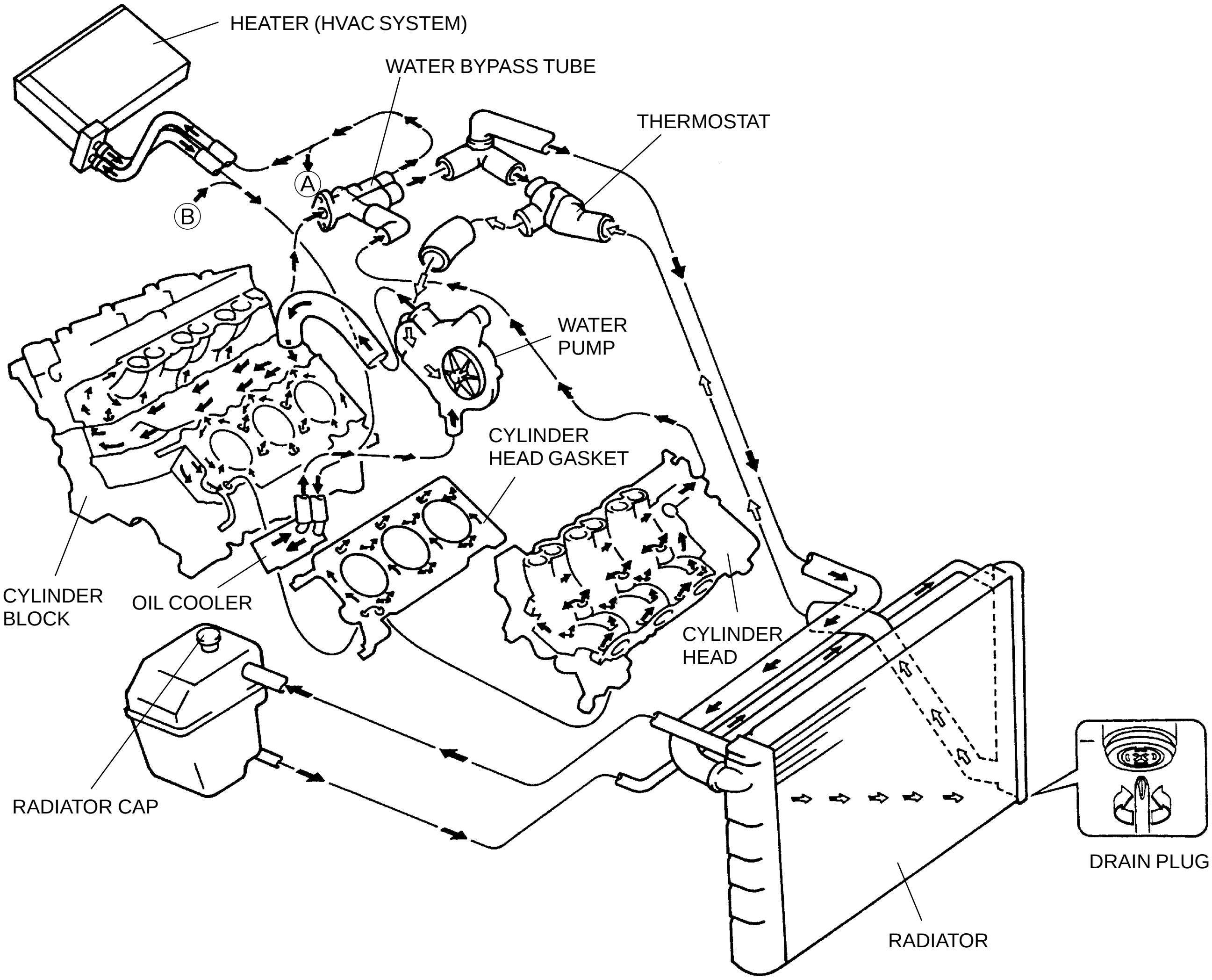
COOLING SYSTEM OUTLINE

YMU112S01

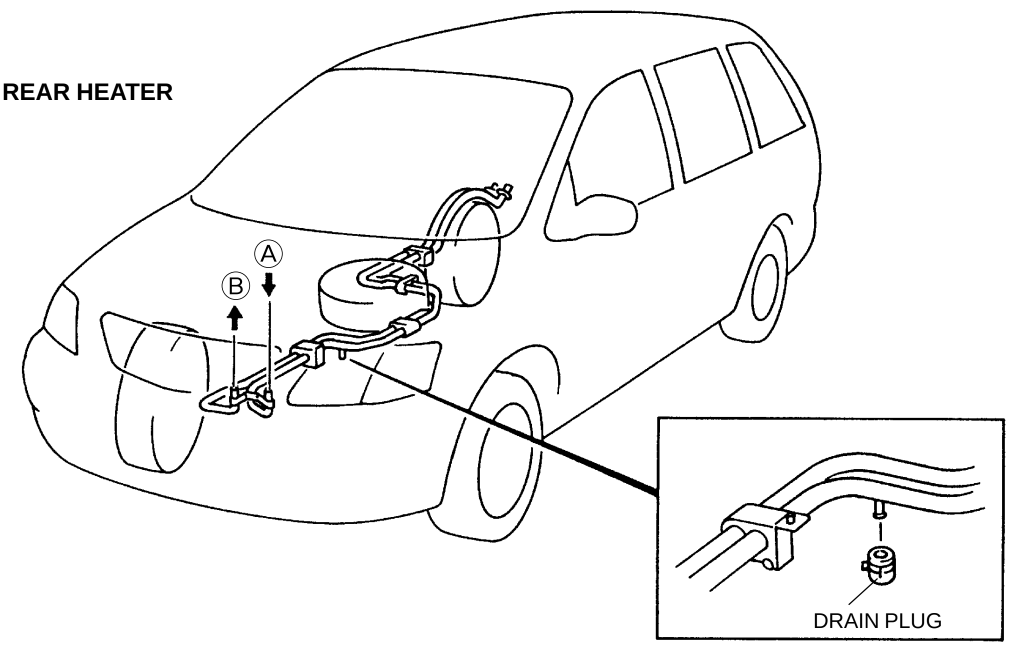
- The water pump is mounted to the left bank on the back of the engine.
- The tension of the V-ribbed belt is automatically adjusted by the auto tensioner.
- A sealed cooling system is used.
- The radiator cap is located on the coolant reservoir.
- On vehicles equipped with a rear heater, coolant must also be removed from the drain plug under the vehicle during coolant replacement.

COOLING SYSTEM FLOW DIAGRAM

YMU112S02



WITH REAR HEATER

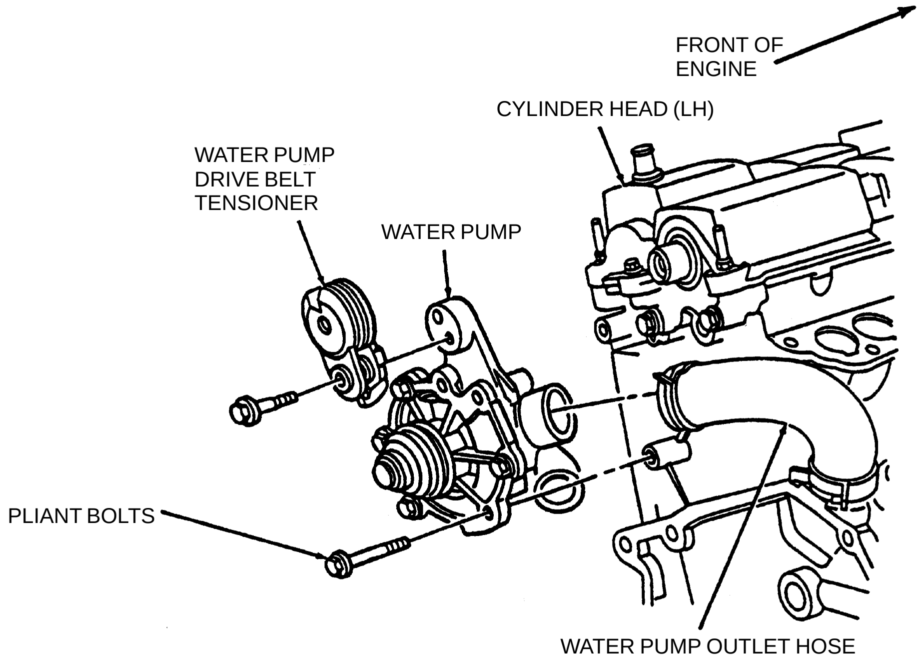


YMU112SA0

WATER PUMP DESCRIPTION

YMU112S03

- The water pump is driven by the V-ribbed belt from the pulley on the back of the intake camshaft on the cylinder head (LH).
- The V-ribbed belt is automatically adjusted by the auto tensioner.
- The water pump is not serviceable and must be replaced as a unit if faulty.
- The pump installation bolts are pliant bolts and cannot be reused.

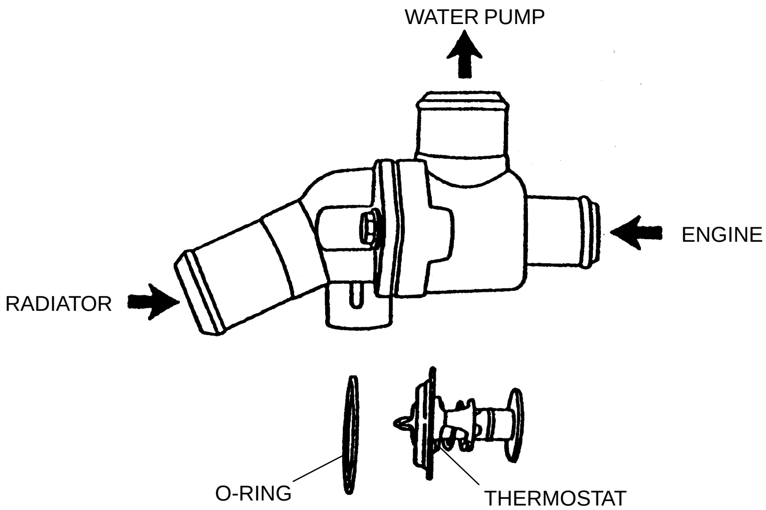


YMU112SA1

THERMOSTAT DESCRIPTION

YMU112S04

- The thermostat is a bottom-bypass type.

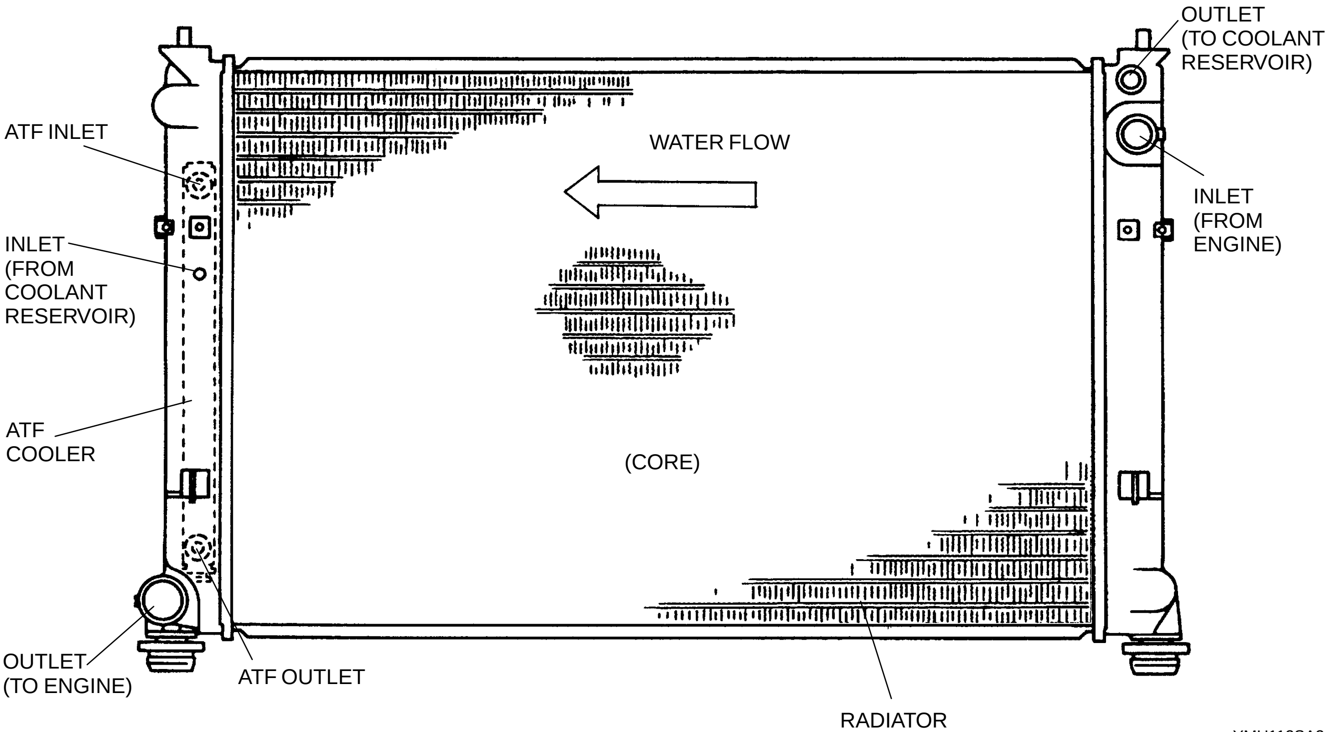


YMU112SA2

RADIATOR DESCRIPTION

YMU112S05

- The cross flow type radiator has been adopted.
- There is no cap on the radiator.

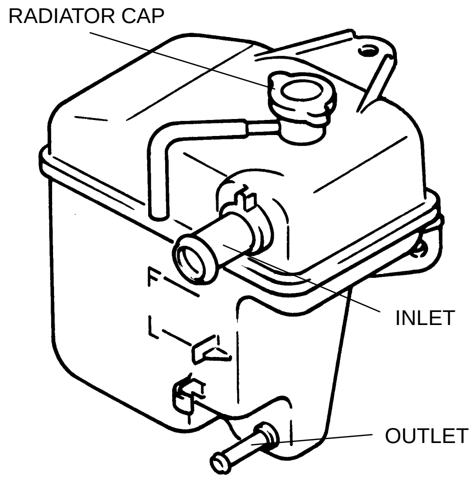


YMU112SA3

COOLANT RESERVOIR DESCRIPTION

YMU112S06

- The pressure type coolant reservoir with radiator cap has been adopted.
- The coolant reservoir is under great pressure. Allow the engine to cool before removing the radiator cap.



YMU112SA4

01–13 INTAKE-AIR SYSTEM

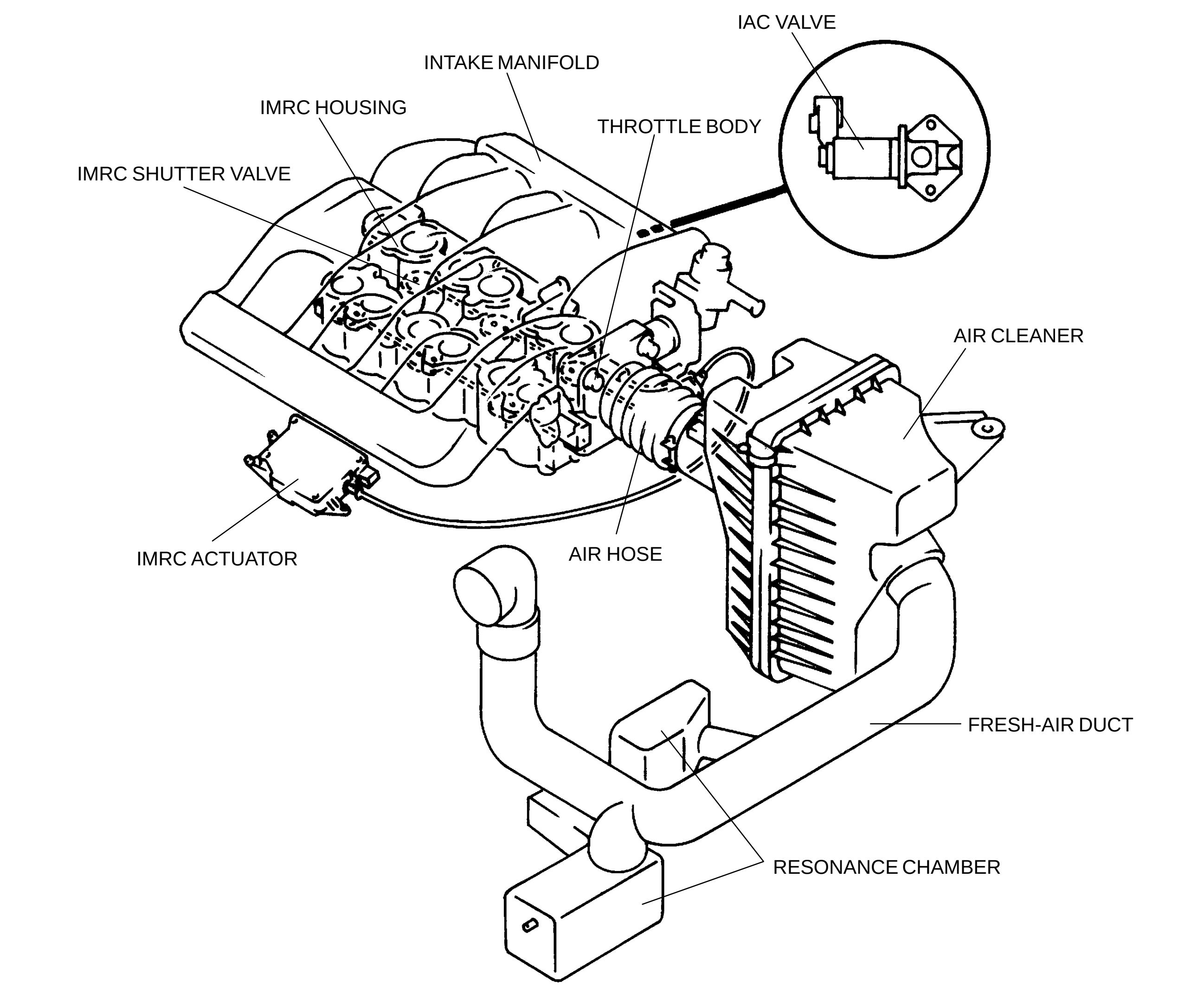
INTAKE-AIR SYSTEM OUTLINE

YMU113S01

- The Intake Manifold Runner Control (IMRC) system components have been adopted.

INTAKE-AIR SYSTEM STRUCTURAL VIEW

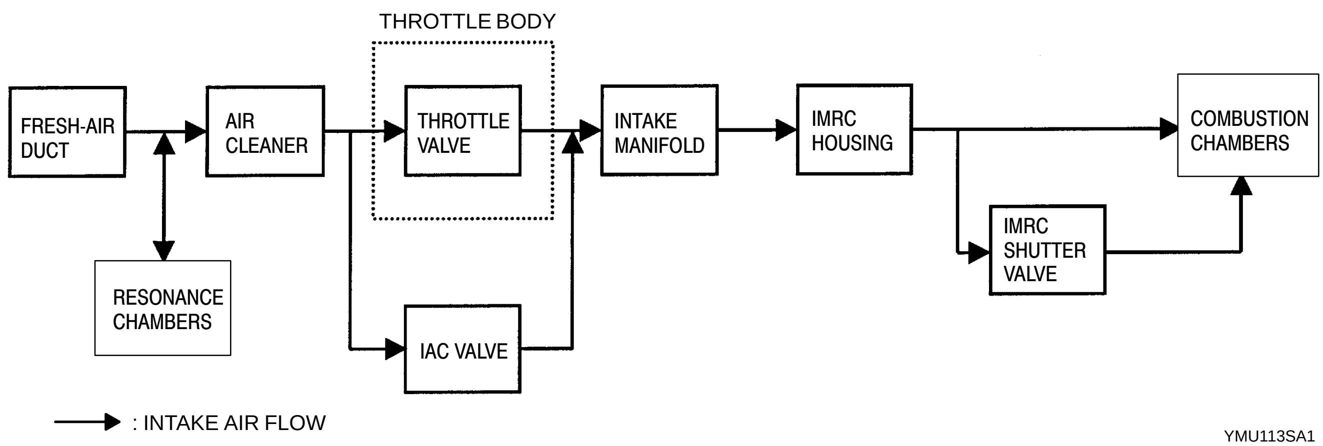
YMU113S12



YMU113SA0

INTAKE-AIR SYSTEM FLOW DIAGRAM

YMU113S13



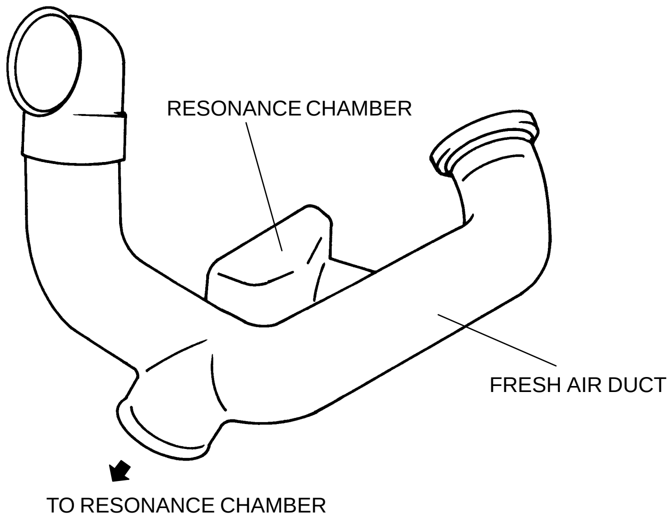
YMU113SA1

FRESH-AIR DUCT DESCRIPTION

YMU113S02

Function

- The fresh-air duct directs fresh air from the radiator grille to the air cleaner.
- The fresh-air duct is equipped with a resonance chamber to reduce air suction noise.



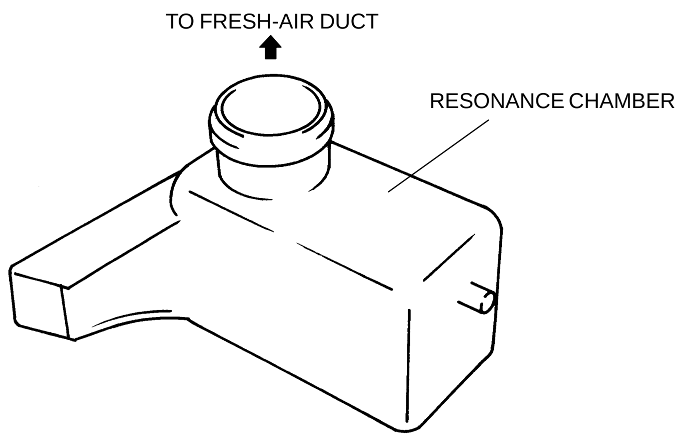
YMU113SA2

RESONANCE CHAMBER DESCRIPTION

YMU113S03

Function

- The resonance chamber reduces air suction noise.
- A resonance chamber has been adopted to reduce high-frequency sound, which tends to be produced at medium to high engine speeds.



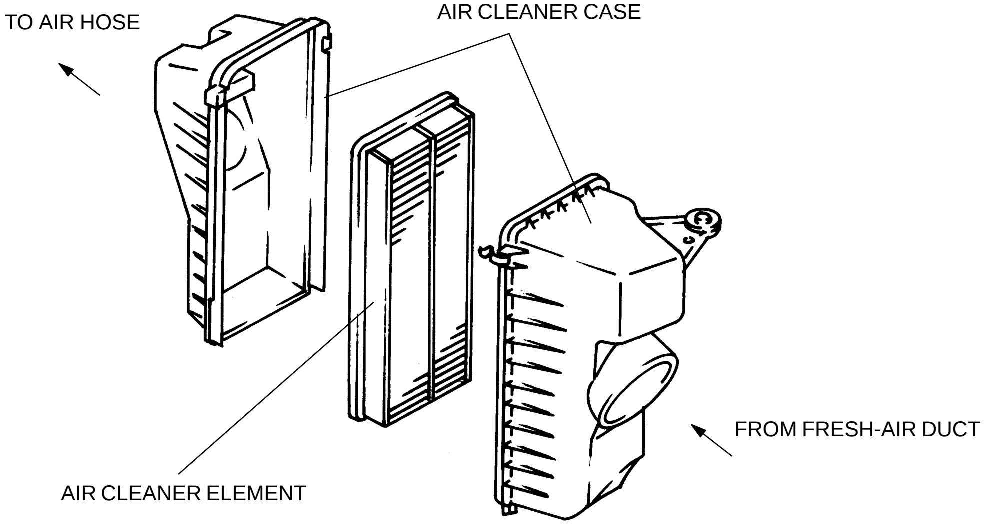
YMU113SA3

AIR CLEANER DESCRIPTION

YMU113S04

Structure

- The air cleaner element is oil permeated type.
- The air cleaner case has been enlarged to reduce air suction noise.



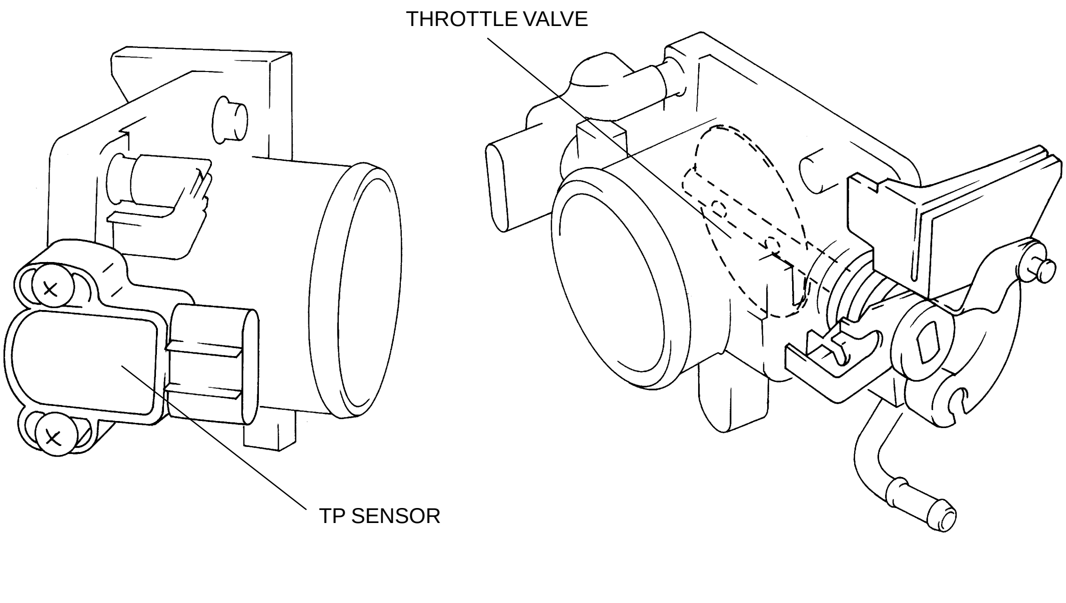
YMU113SA4

THROTTLE BODY DESCRIPTION

YMU113S05

Structure

- The throttle body is composed of the TP sensor and throttle valve.
- Idle speed does not require adjustment. The throttle body is not equipped with an air adjust screw (AAS).



YMU113SA5

IDLE AIR CONTROL (IAC) VALVE DESCRIPTION

YMU113S06

Function

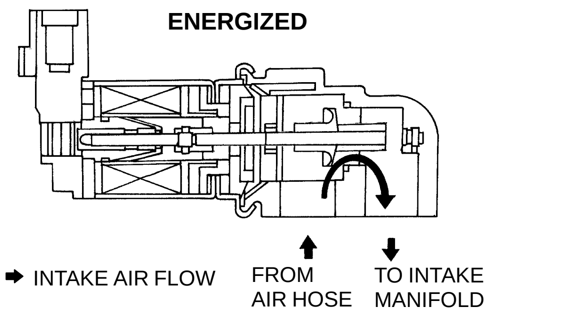
- The IAC valve adjusts the intake air amount that bypasses the throttle valve controlled by PCM signal.
- The air, which bypass the throttle valve, flows through the IAC valve from inlet port (air hose side) to outlet port (intake manifold side).

Structure

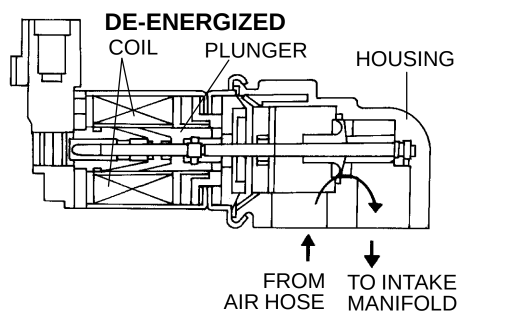
- IAC valve is composed of a housing, plunger, and coil.

Operation

- When a signal from the PCM reaches the IAC valve, the plunger is pulled back to allow bypass air into the outlet port.



YMU113SA6

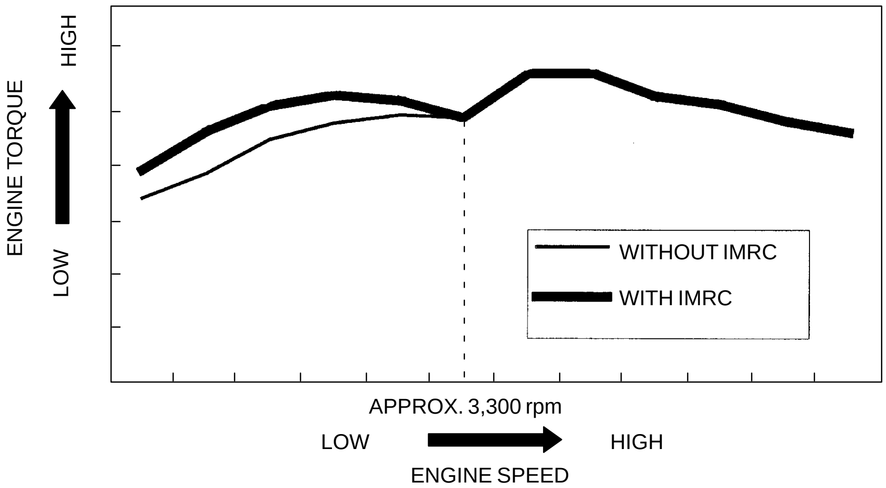


YMU113SA7

INTAKE MANIFOLD RUNNER CONTROL (IMRC) SYSTEM OUTLINE

YMU113S07

- Due to the adoption of an IMRC system, higher engine torque has been obtained at all engine speeds.
- The IMRC system concept is the same as the variable inertia charging system (VICS).



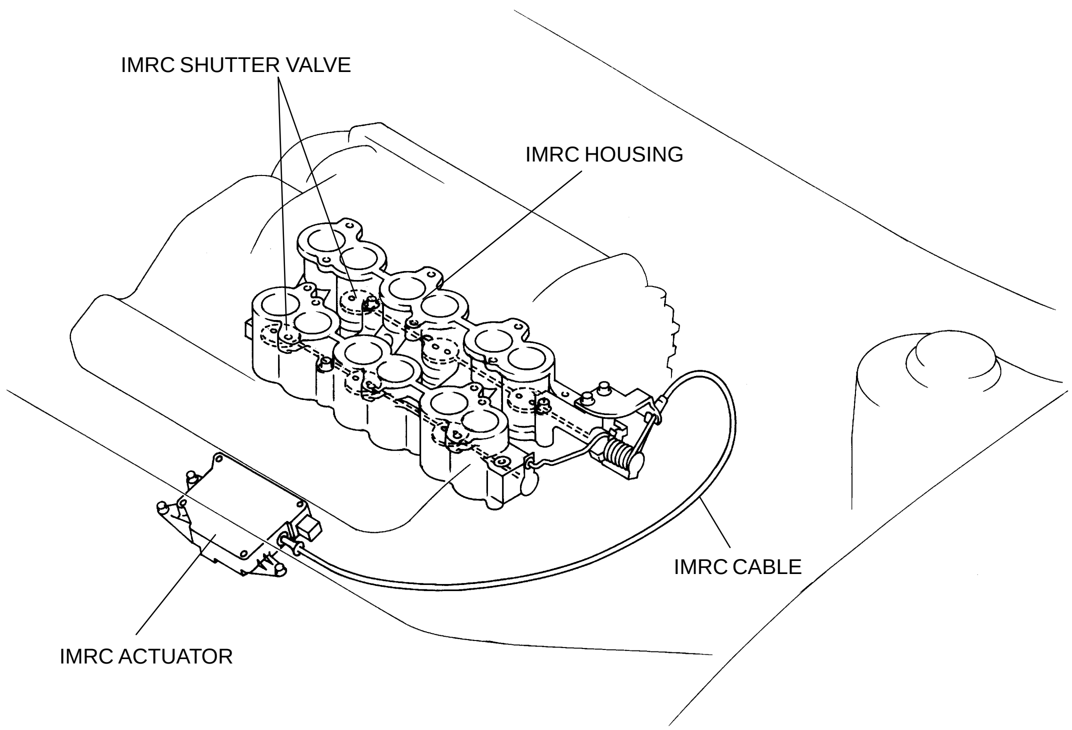
YMU113SAC

INTAKE MANIFOLD RUNNER CONTROL (IMRC) SYSTEM STRUCTURAL VIEW

YMU113S08

Structure

- The IMRC system is composed of the IMRC actuator, IMRC housing, IMRC cable and IMRC shutter valves.



YMU113SA8

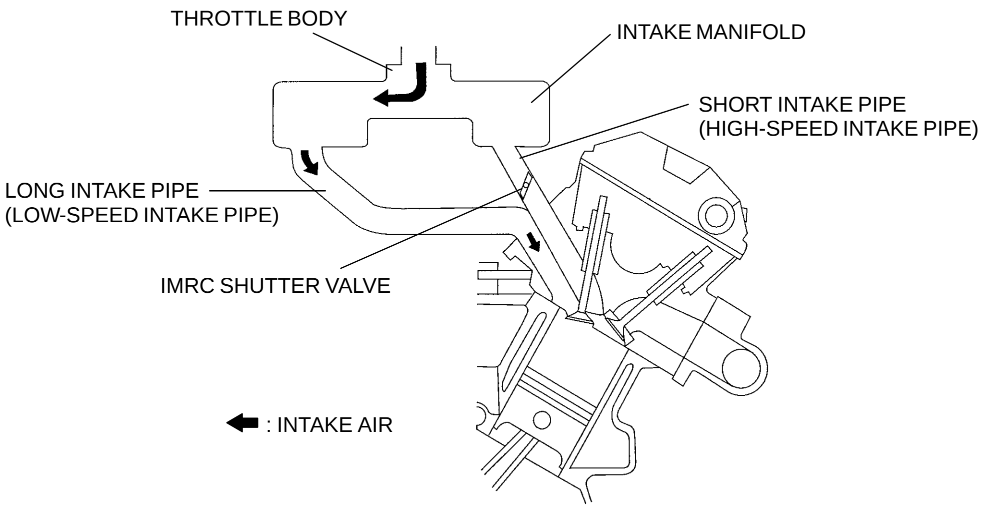
INTAKE MANIFOLD RUNNER CONTROL (IMRC) SYSTEM DESCRIPTION

YMU113S09

Function

Low engine speed

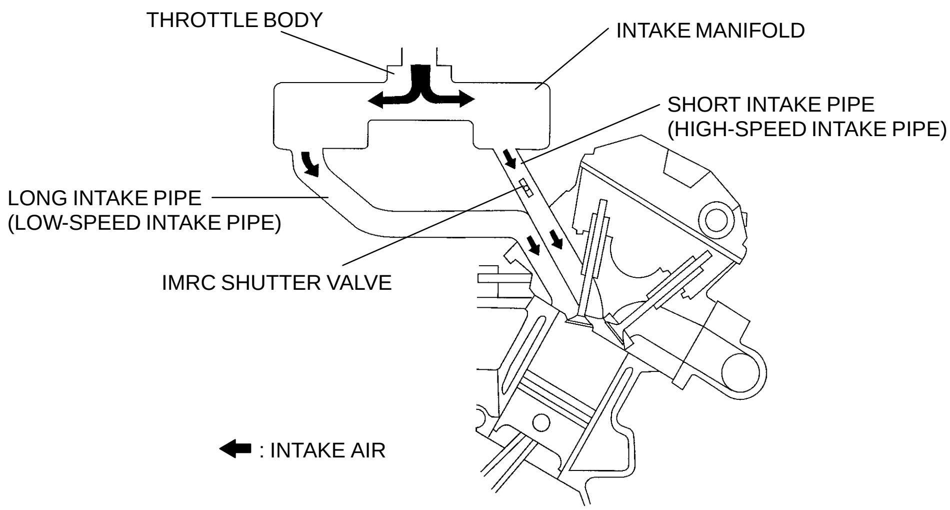
- Because the IMRC shutter valve is closed at low engine speeds, intake air is supplied to the engine through the long intake pipe (low-speed intake pipe). This increases the intake airflow and creates strong swirl in the combustion chamber, thereby improve engine torque at low speeds.



YMU113SAD

High engine speed

- IMRC shutter valve is opened. At high engine speed, by opening the IMRC shutter valve, the intake pipes are switched and the short intake pipe (high-speed intake pipe) for high engine speed operates, resulting in high performance.



YMU113SAE

Operation

- The IMRC shutter valve operates when the IMRC actuator receives the signal from the PCM when the engine speed is approx. 3,300 rpm.

INTAKE MANIFOLD RUNNER CONTROL (IMRC) ACTUATOR DESCRIPTION

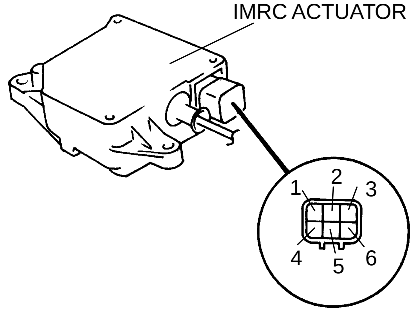
YMU113S10

Function

- IMRC actuator actuates the IMRC shutter valve according to the signal from the PCM.

Structure

- The IMRC actuator is installed on the cylinder head cover (LH).
- The six terminals are as follows.



YMU113SA9

Terminal	Description
1	IMRC actuation signal (From PCM)
2	Power supply (B+)
3	IMRC actuator (motor) ground
4	Not used.
5	IMRC cable monitor signal (To PCM)
6	IMRC cable monitor signal ground

Operation

- When the motor in the IMRC actuator receives a signal from the PCM and starts to operate, the IMRC cable is pulled and the IMRC shutter valve opens. The IMRC actuator also sends a signal to the PCM to verify operation of the IMRC actuator.

INTAKE MANIFOLD RUNNER CONTROL (IMRC) HOUSING DESCRIPTION

YMU113S11

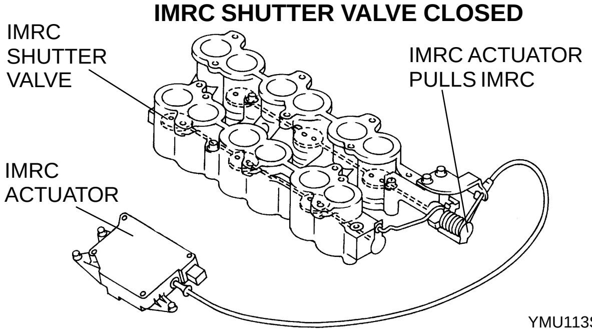
Function

- The IMRC cable connects the IMRC actuator and the IMRC housing lever. When the IMRC actuator pulls the cable, the lever is pulled and the IMRC shutter valve located in both banks of the intake manifold (short side) opens.

Structure

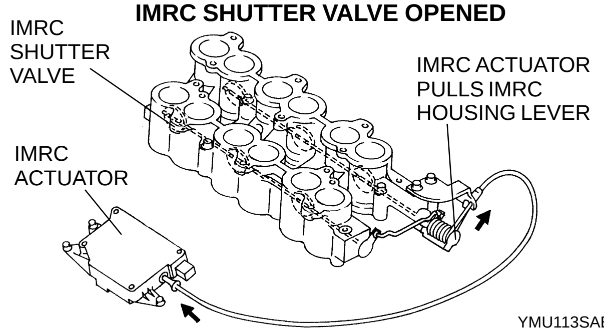
- The IMRC housing is installed between the intake manifold and cylinder head.
- The IMRC housing is composed of the IMRC lever and IMRC shutter valve.

IMRC SHUTTER VALVE CLOSED



YMU113SAA

IMRC SHUTTER VALVE OPENED



YMU113SAB

01–14 FUEL SYSTEM

FUEL SYSTEM OUTLINE

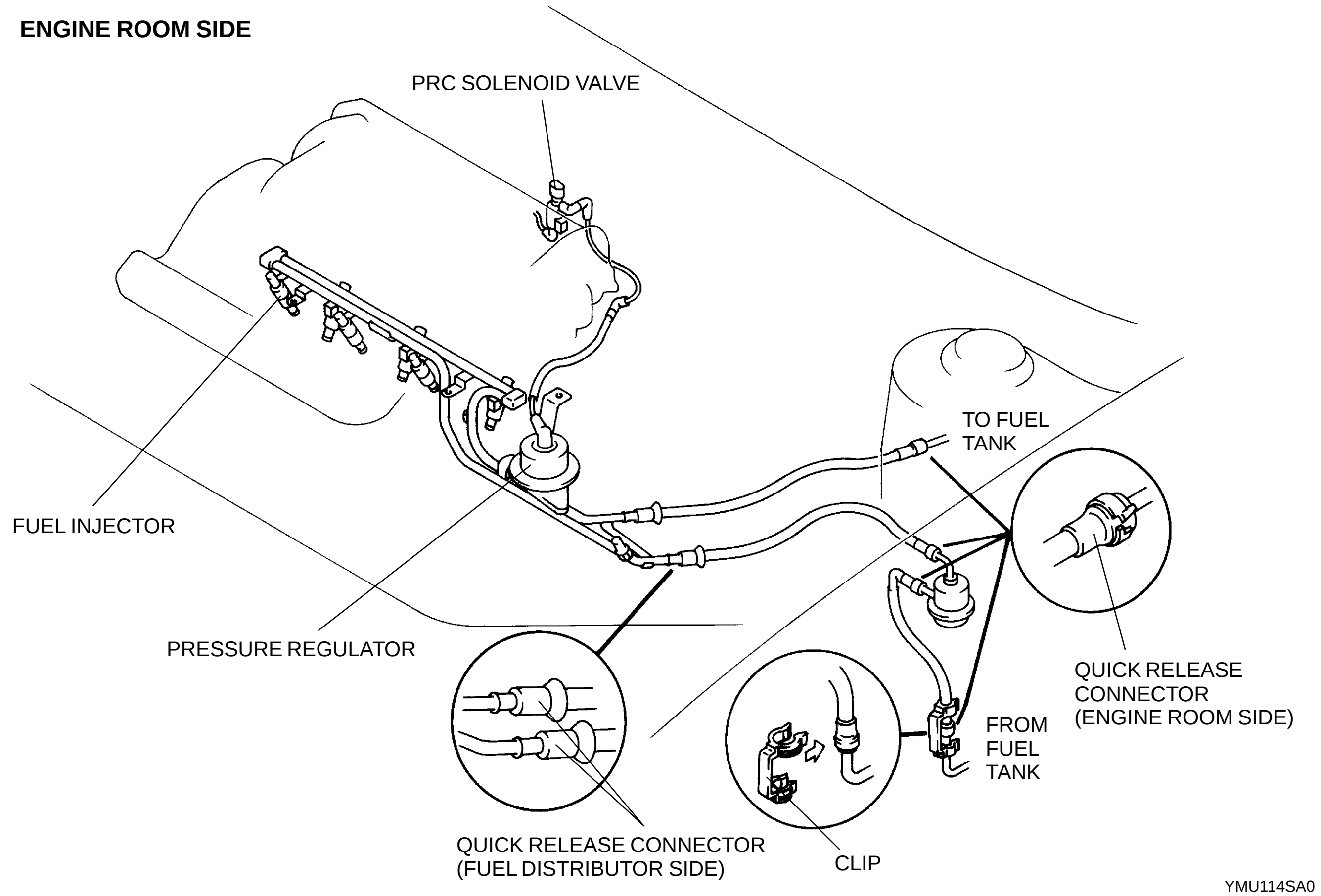
YMU114S01

- Compared to the 1998MY MPV, the following have been adopted to the fuel system of the 2000MY MPV.
  - Adopted a one-stage PRC system
  - Adopted a pulsation damper
  - Adopted a fuel tank with built-in rollover valves, and fuel shut-off valve
  - Adopted a fuel pump unit equipped with fuel filters (high- and low-pressure)
  - Adopted three types of quick release connectors for fuel lines
  - Clips designed to prevent static electrical charges have been installed in one place on the quick release connector (engine room) between the pulsation damper and the fuel tank, and in two places on the quick release connector (inlet, return) between the fuel pump and the fuel distributor.

FUEL SYSTEM STRUCTURAL VIEW

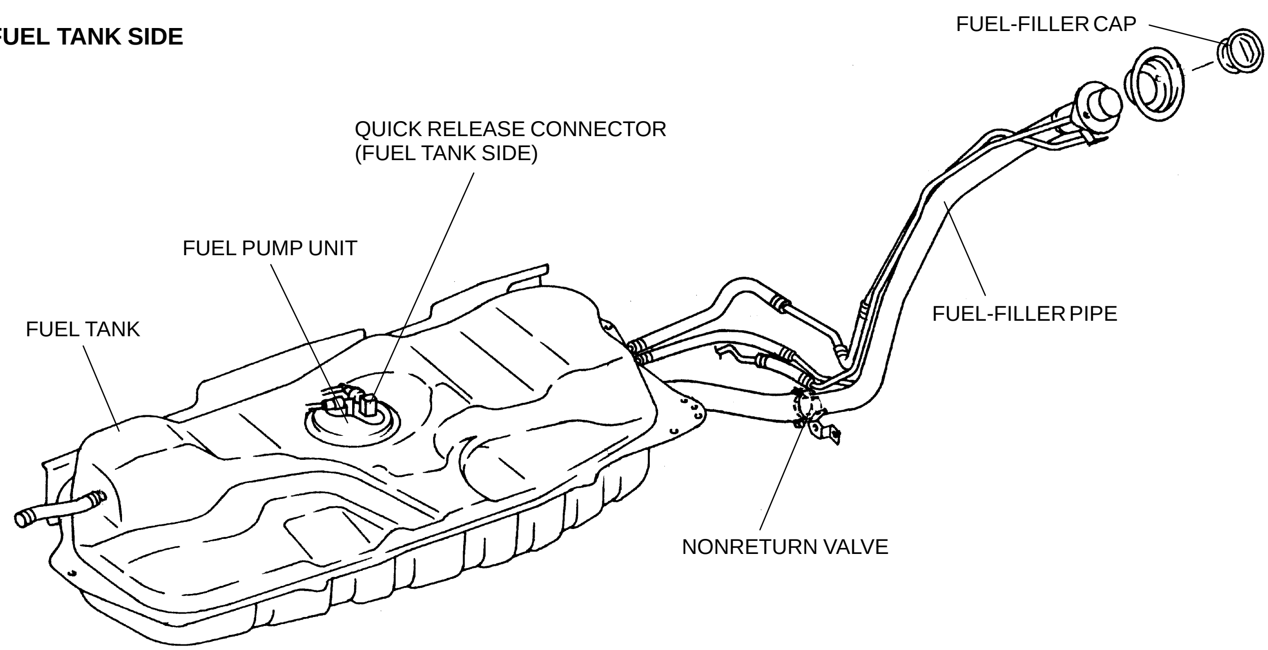
YMU114S02

ENGINE ROOM SIDE



YMU114SA0

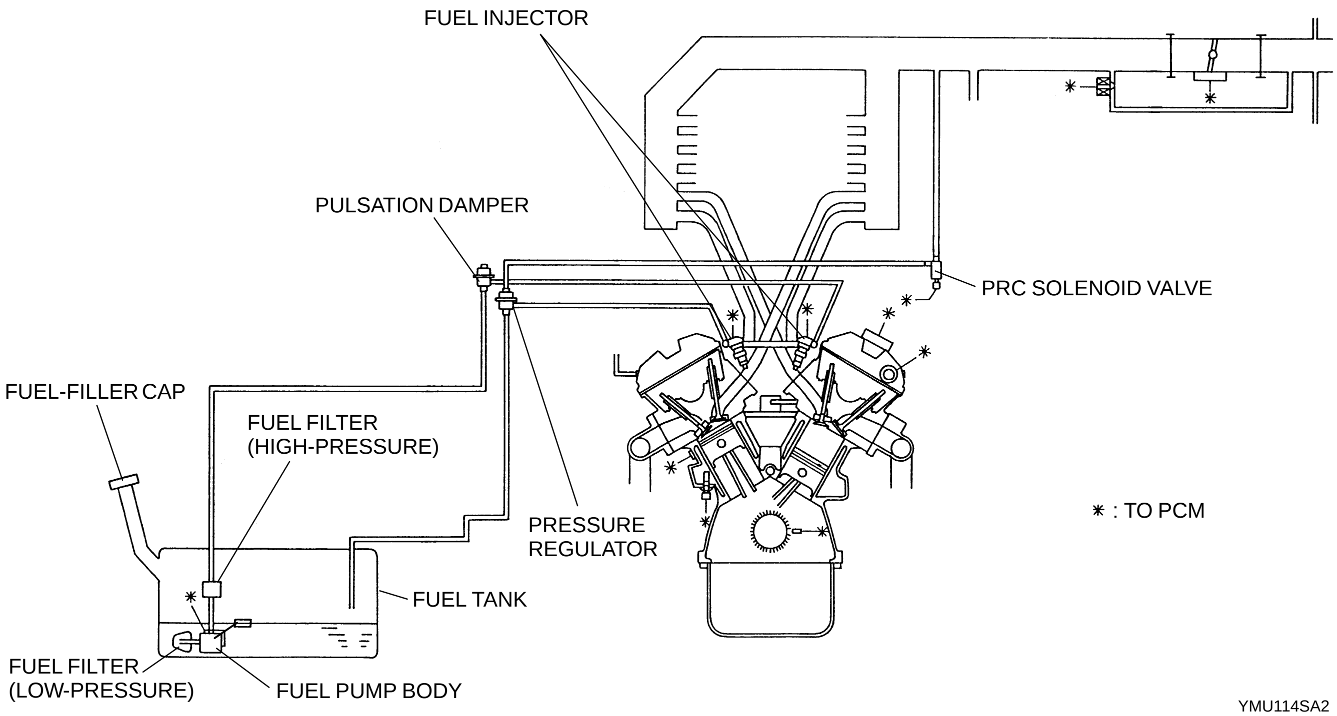
FUEL TANK SIDE



YMU114SA1

FUEL SYSTEM DIAGRAM

YMU114S03



FUEL TANK DESCRIPTION

YMU114S04

Structure

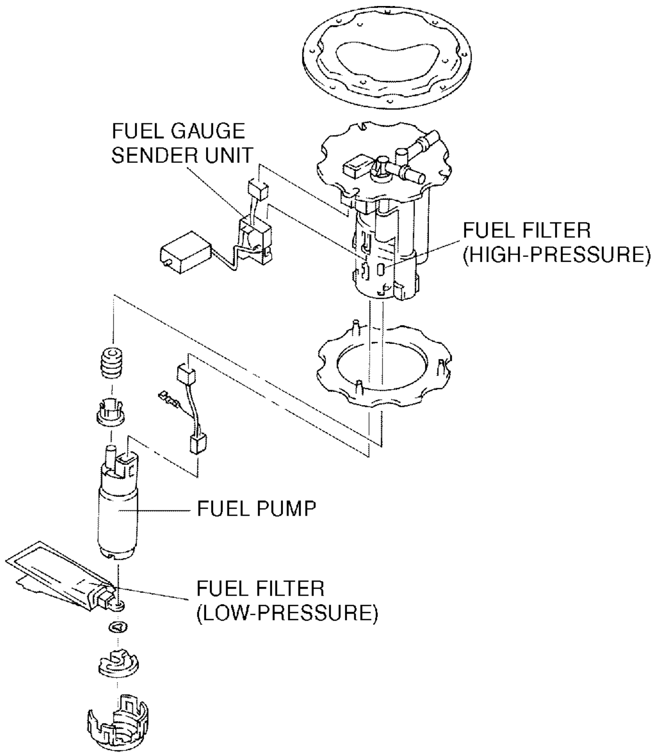
- The fuel shut-off valve, fuel filters (high- and low-pressure) and two rollover valves are integrated into the fuel tank.
- The fuel shut-off valve and rollover valves are not replaceable.
- The fuel filters (high- and low-pressure) are replaceable.

FUEL PUMP UNIT DESCRIPTION

YMU114S05

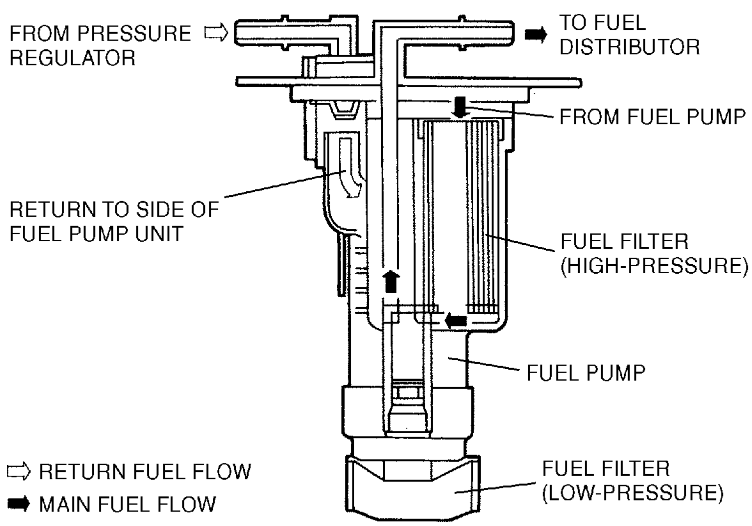
Structure

- The construction and operation of the fuel pump unit for the 2000MY MPV and the 1999MY Protegé are the same.
- The fuel pump unit is composed of a fuel filter (low-pressure), fuel pump, fuel filter (high-pressure) and fuel gauge sender unit.



YMU114SA3

Fuel Flow



YMU114SA4

FUEL PUMP DESCRIPTION

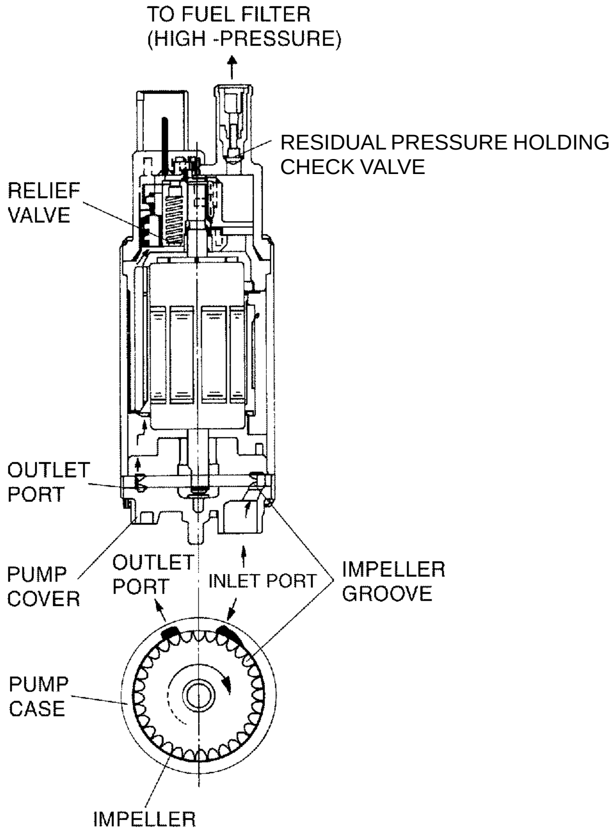
YMU114S06

Structure

- The circumference flow type fuel pump is mainly composed of the impeller, pump case and pump cover.
- The residual pressure holding check valve maintains the residual fuel line pressure when the engine is not running. This prevents fuel vapor lock and improves engine restarting.
- As a safety measure to protect the fuel line, the relief valve will open and maintain the fuel line pressure if the fuel line pressure is increased to over 590—780 kPa {6.0—8.0 kgf/cm^2, 86—110 psi}.

Operation

- Rotating the impeller makes the fuel flow from the inlet port to the outlet port.



YMU114SA5

QUICK RELEASE CONNECTOR (FUEL DISTRIBUTOR SIDE) DESCRIPTION

YMU114S08

Function

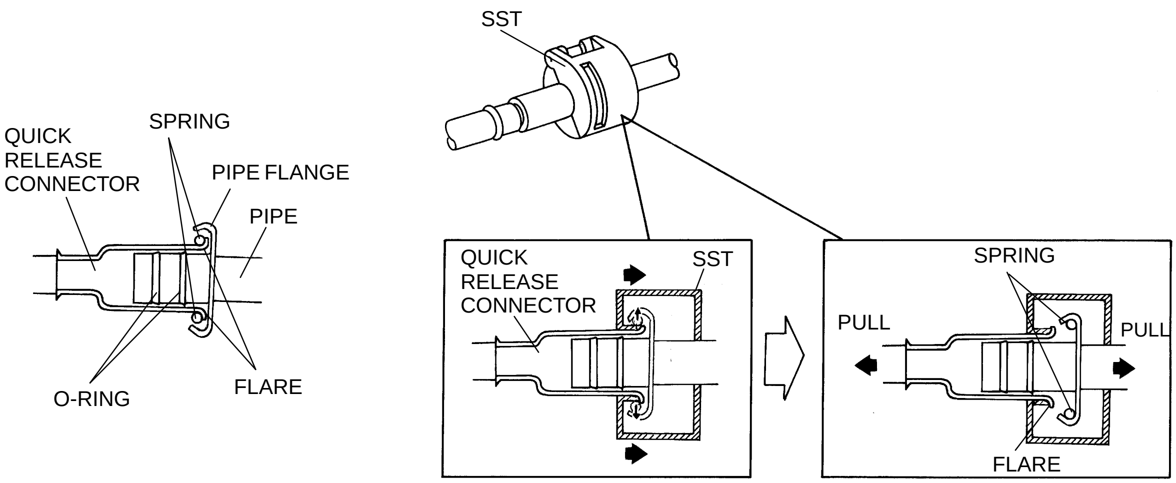
- Plastic fuel hoses and metal quick release connectors have been adopted on the fuel distributor side to improve serviceability.

Structure

- The quick release connector (fuel distributor side) is similar to 1998—1999MY B-series.
- The quick release connector and plastic fuel hose are integrated and cannot be disconnected.
- The **SST** is required to disconnect the quick release connector.

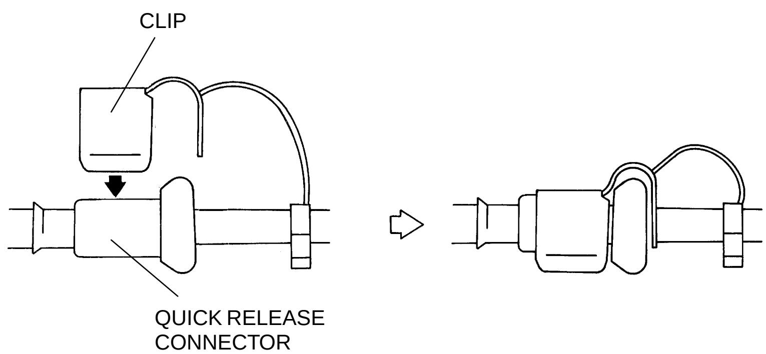
Operation

- When the quick release connector is coupled, the flare of the pipe is fixed by the spring in the pipe flange. By positioning the **SST** as shown in the figure, the spring expands to unlock the flare of the pipe, and the quick release connector can be uncoupled.



YMU114SA7

- A click is heard when the flare of the quick release connector are correctly pushed into the locked position.
- Fixing the quick release connector with the clip ensures that the highly pressurized fuel will not leak, even if the quick release connector should happen not to be completely coupled.



YMU114SA8

QUICK RELEASE CONNECTOR (ENGINE ROOM SIDE) DESCRIPTION

YMU114S09

Function

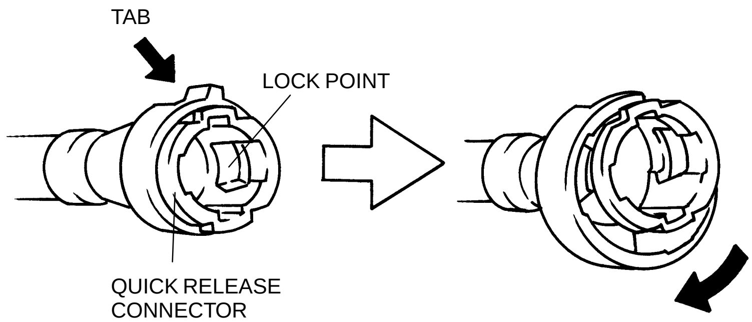
- Plastic fuel hoses and quick release connectors have been adopted on the engine room side to ease connecting and disconnecting the fuel lines for improved serviceability.

Structure

- A new-type quick release connector is adopted for engine room side.
- The quick release connector and plastic fuel hose are integrated and cannot be disconnected.
- An **SST** is not required to uncouple this type of quick release connector.

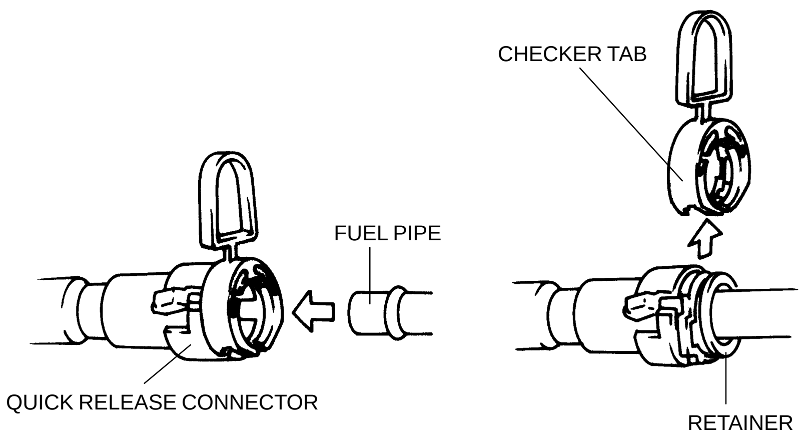
Operation

- The quick release connector will be disconnected from the fuel pipe when the tab is squeezed.



YMU114SA9

- A click is heard when the retainer is correctly pushed into the locked position.
- The new quick release connectors are equipped with a checker tab, which fixes the retainer. The checker tab can be removed from the quick release connector when the connector is correctly seated in the fuel pipe. This enables verification that the quick release connector has been completely coupled.



YMU114SAA

QUICK RELEASE CONNECTOR (FUEL TANK SIDE) DESCRIPTION

YMU114S07

Function

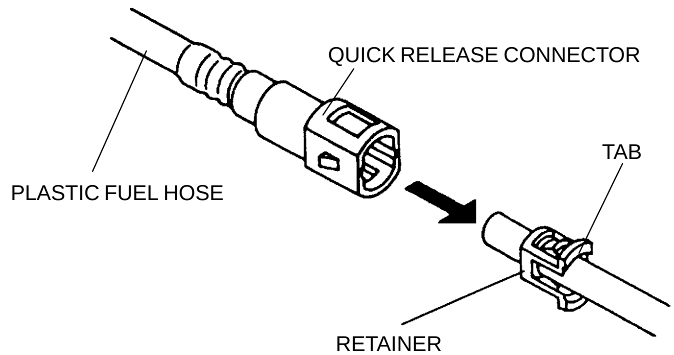
- Plastic fuel hoses and quick release connectors have been adopted on the fuel tank side to ease connecting and disconnecting the fuel lines for improved serviceability.

Structure

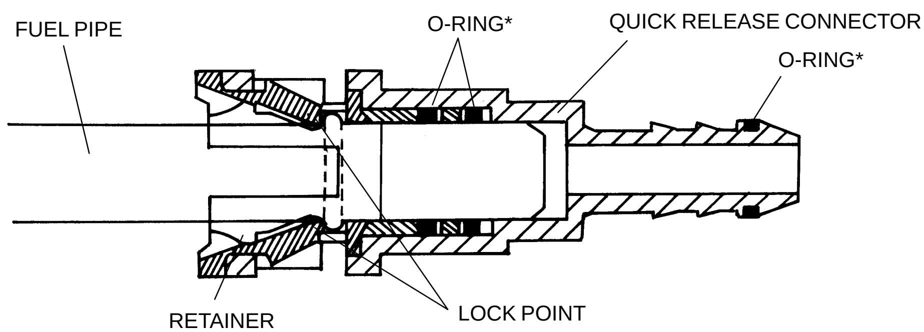
- The construction of the quick release connector (fuel tank side) for the 2000MY MPV and the 1999MY MX-5 are the same.
- A new quick release connector has a pre-inserted retainer.
- The retainer is installed on the fuel pipe, cannot be removed, and remains on the fuel pipe when the quick release connector is uncoupled from the fuel pipe.
- The quick release connector and plastic fuel hose are integrated and cannot be disconnected.
- An **SST** is not required to uncouple this type of quick release connector as well as the 1999MY Protegé.

Operation

- Squeeze the tabs of the retainer to unlock and uncouple the quick release connector from the fuel pipe.
- A click is heard when the tabs of the retainer are correctly pushed into the lock point of the quick release connector.



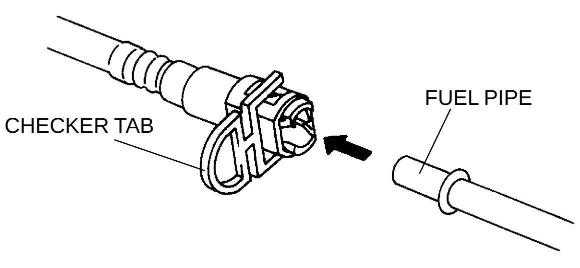
X5U114SA4



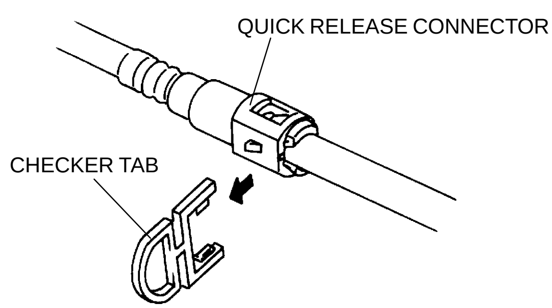
*: O-ring is not available as a service part.

YMU114SA6

- The new quick release connectors are equipped with a checker tab, as well as the engine room side quick release connector. The checker tab can be removed from the quick release connector when the connector is correctly seated in the fuel pipe.



YMU114SAE



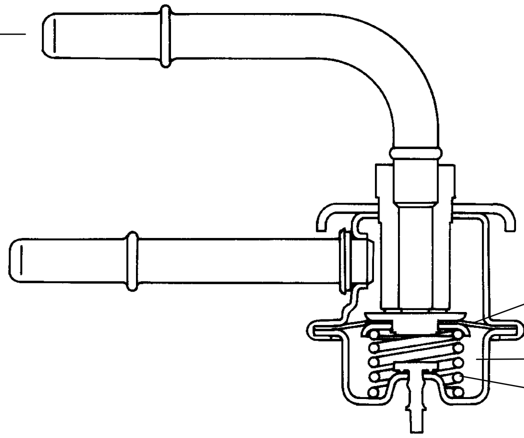
YMU114SAF

PULSATION DAMPER DESCRIPTION

YMU114S10

Function

- The pulsation damper maintains fuel line pressure and reduces the fuel pulsation that is created by the operation of the fuel injector.



YMU114SAD

FUEL INJECTOR DESCRIPTION

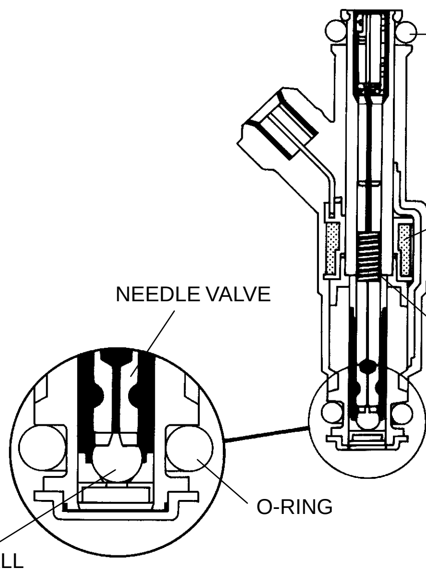
YMU114S11

Structure

- The fuel injectors are installed on the intake manifold.

Operation

- The injection amount is determined by the period of time current is applied to the coil circuit. This current opens the needle valve, allowing fuel to flow.



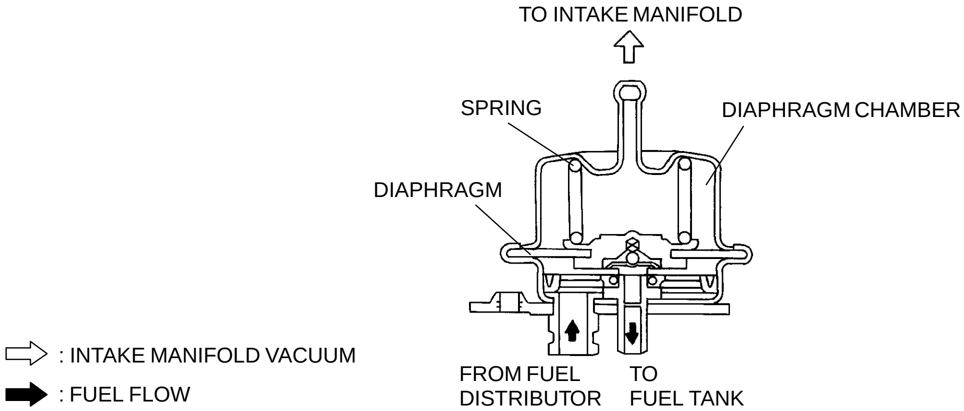
YMU114SAB

PRESSURE REGULATOR DESCRIPTION

YMU114S12

Structure

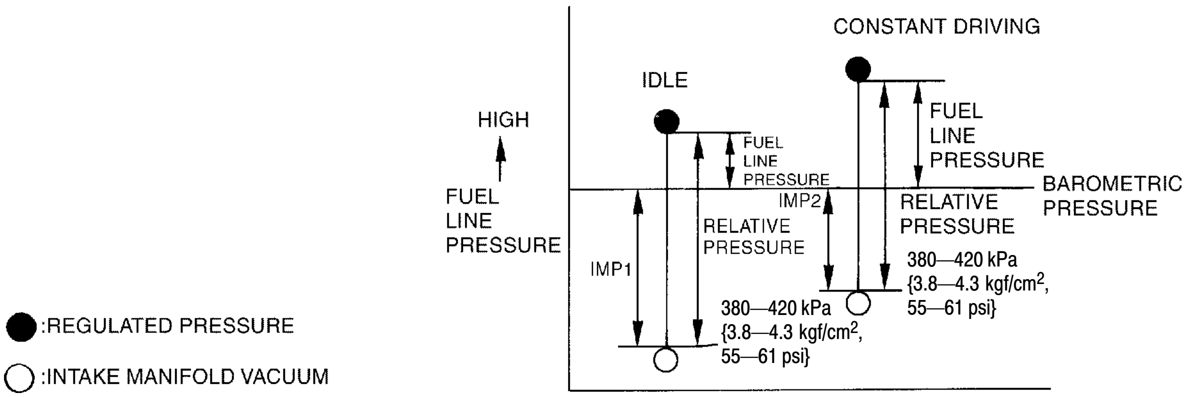
- The pressure regulator has been installed at the end of the fuel distributor.



YMU114SAC

Operation

- The valve opens when the pressure differece between the diaphragm chamber pressure and fuel line pressure in the pressure regulator is over 380—420 kPa {3.8—4.3 kgf/cm^2, 55—61 psi}. The excess fuel is returned to the fuel tank.
- During engine idling, the diaphragm chamber pressure increases with intake manifold vacuum (IMP1). Spring force is reduced by fuel line pressure in the fuel distributor, and the valve opens during low fuel line pressure.
- During constant driving, the diaphragm chamber pressure decreases with intake manifold vacuum (IMP2). Spring force increases, and the valve opens during high fuel line pressure condition.



X3U114SB4

PRESSURE REGULATOR CONTROL (PRC) SOLENOID VALVE DESCRIPTION

YMU114S13

Function

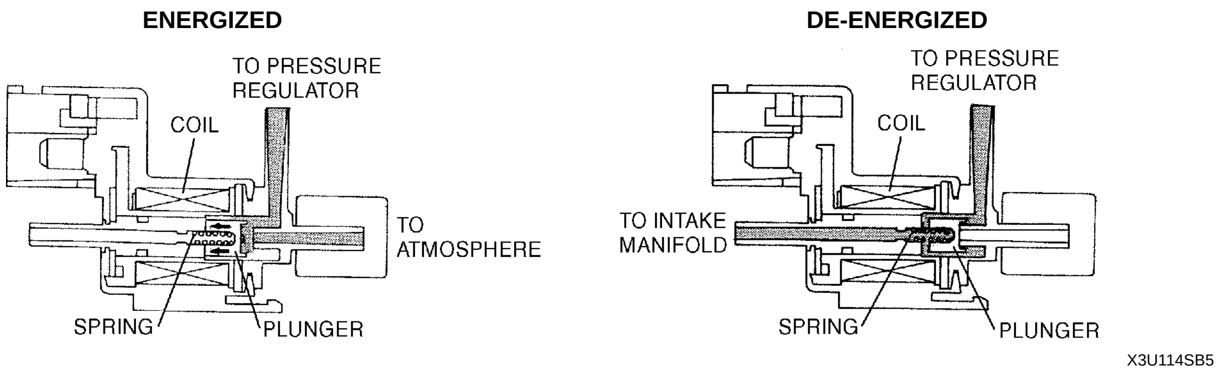
- The PRC solenoid valve cuts the vacuum applied to the pressure regulator from the intake manifold. This increases the fuel line pressure in order to prevent vapor lock in the fuel line during starting when the engine is hot and for a specified period after start. (Refer to 01–40 PRESSURE REGULATOR CONTROL (PRC) OUTLINE.) (Refer to 01–40 PRESSURE REGULATOR CONTROL (PRC) OPERATION.)

Structure

- The PRC solenoid valve is located on the intake manifold.
- The PRC solenoid valve is composed of a coil, plunger, spring and air filter.

Operation

- The air passage between the pressure regulator and intake manifold is closed or opened depending upon whether the PRC solenoid valve is energized or de-energized.



01–15 EXHAUST SYSTEM

EXHAUST SYSTEM OUTLINE

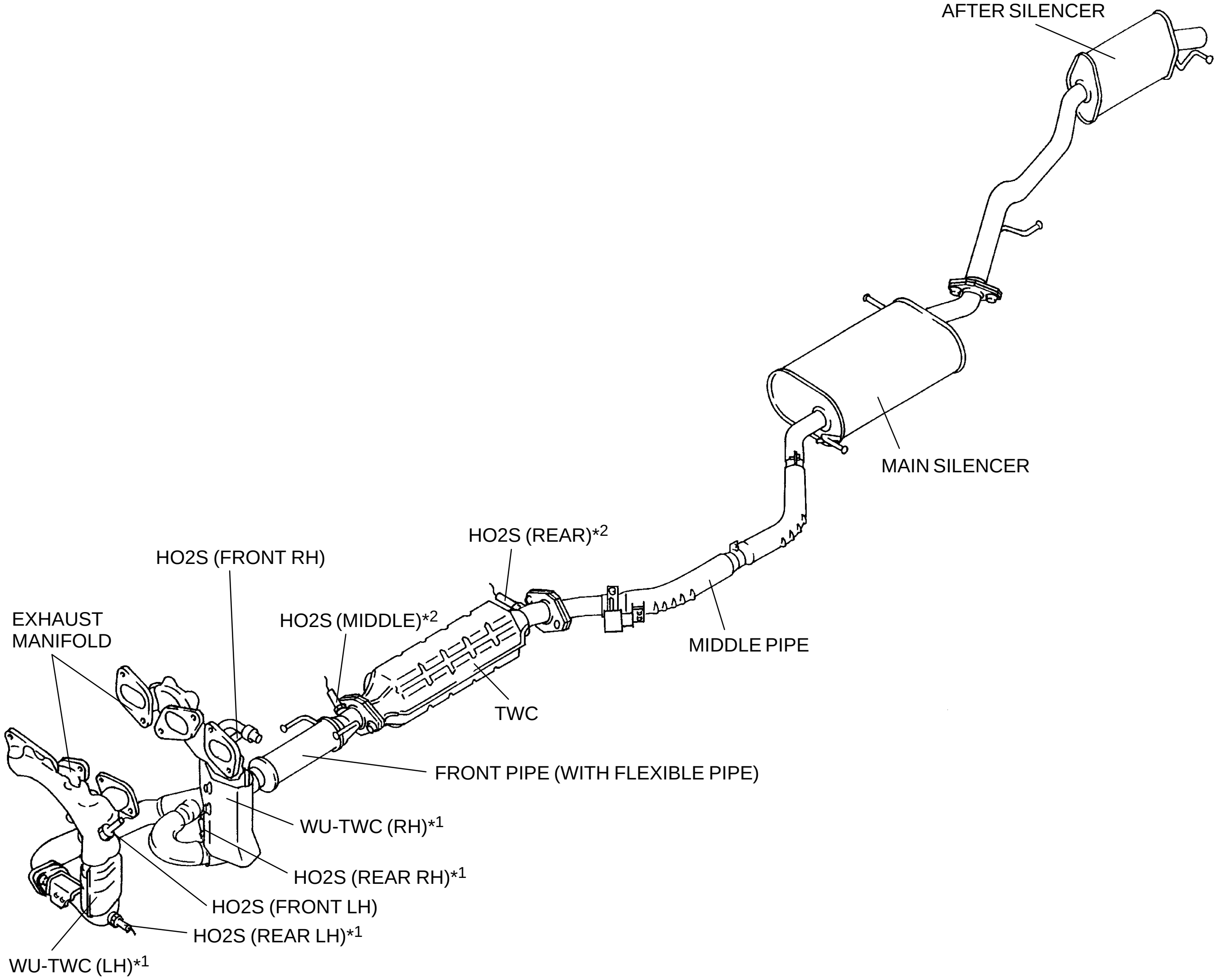
YMU115S01

- A flexible pipe has been adopted to reduce the engine vibration transmitted past the front pipe.

EXHAUST SYSTEM STRUCTURAL VIEW

YMU115S02

- The exhaust system is composed of exhaust manifolds, WU-TWC (California emission regulation applicable model), front pipe, TWC, middle pipe, and silencers.



*1: California emission regulation applicable models
*2: Federal emission regulation applicable models

YMU115SA0

01–16 EMISSION SYSTEM

EMISSION SYSTEM OUTLINE

YMU116S01

Structure

- The emission system is composed of the EGR system, evaporative emissions (EVAP) control system, positive crankcase ventilation (PCV) system and catalytic converter system.
- A new fuel shut-off valve not only prevents the back flow of fuel, but also enables the evaporative gas in the fuel tank to be absorbed directly by the charcoal canister.

Emission System New Feature

- The changes in the emission systems of the 2000MY MPV compared to the 1998MY MPV are indicated below.
  - **EGR system**
    - The stepping motor type EGR valve has been adopted.
  - **EVAP control system**
    - The separator, cut valve, and tank pressure control valve have been abolished.
  - **PCV system**
    - Blow-by gas is inducted from the oil separator located between the banks of engine.

EGR SYSTEM OUTLINE

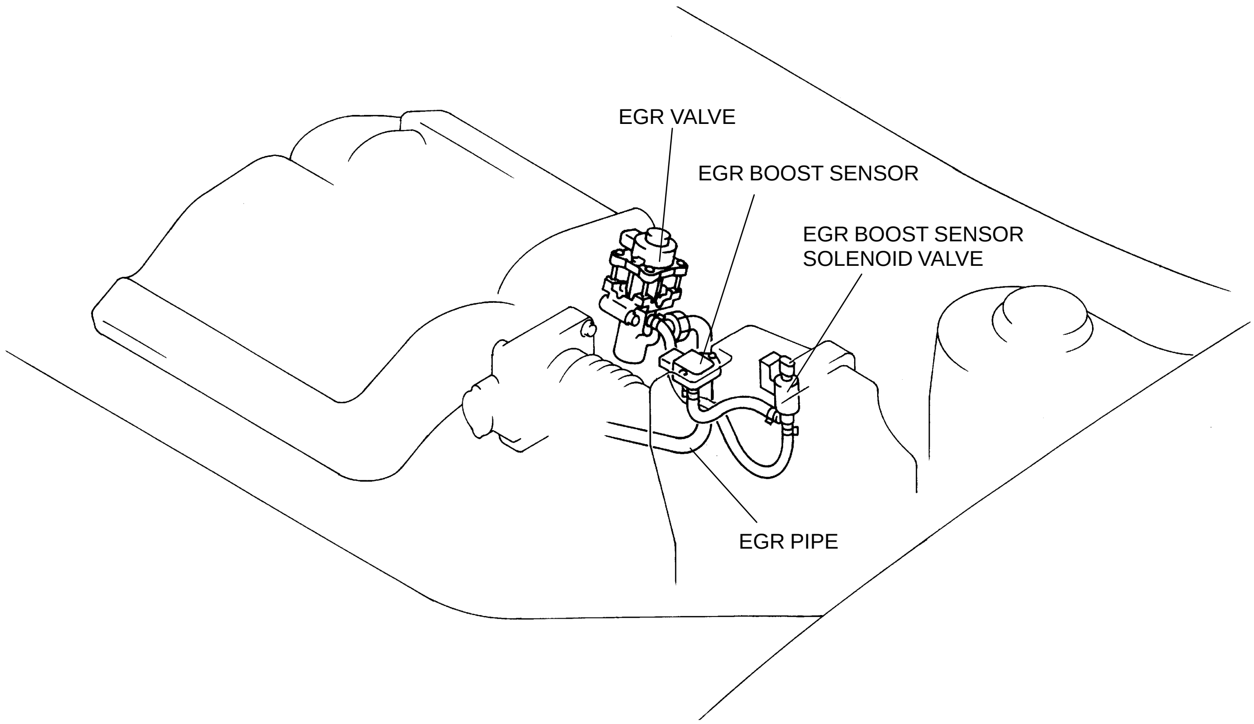
YMU116S02

- The EGR system controls the amount of exhaust gas recirculated to the combustion chamber, which lowers combustion temperature and reduces NOx emissions.

EGR SYSTEM STRUCTURAL VIEW

YMU116S03

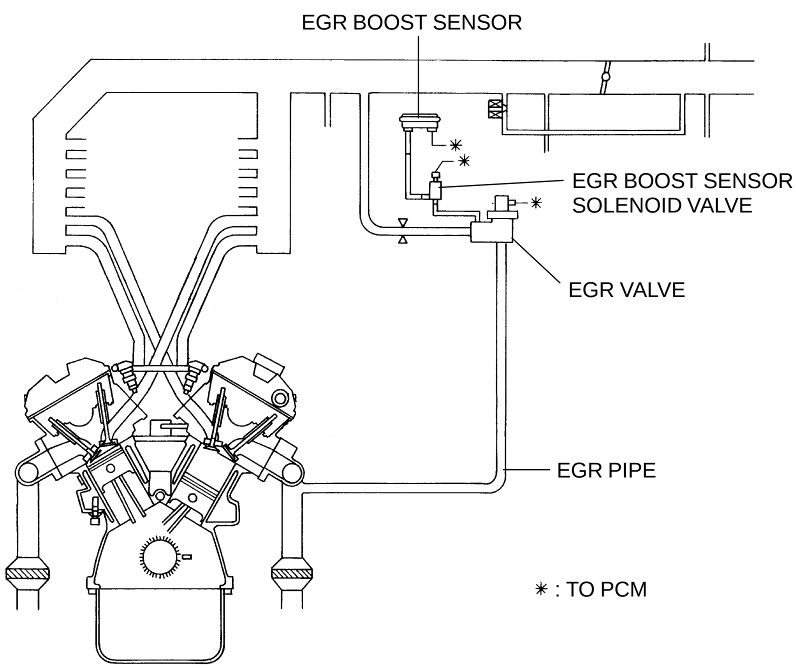
- The EGR system is composed of the EGR pipe, EGR valve, EGR boost sensor and EGR boost sensor solenoid valve.



YMU116SA0

EGR SYSTEM DIAGRAM

YMU116S04



YMU116SA1

EGR BOOST SENSOR SOLENOID VALVE DESCRIPTION

YMU116S05

Function

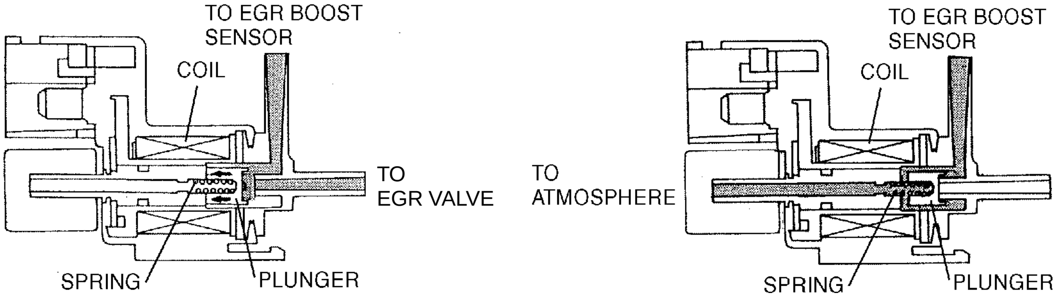
- The EGR boost sensor solenoid valve switches the application of barometric pressure or intake manifold vacuum to the EGR boost sensor.

Structure

- The EGR boost sensor solenoid valve is located between the EGR valve and EGR boost sensor.
- The EGR boost sensor solenoid valve is composed of a coil, plunger and spring.

Operation

- Intake manifold vacuum is applied to the EGR boost sensor when the EGR boost solenoid valve is energized.



YMU116SA2

EGR VALVE DESCRIPTION

YMU116S06

Function

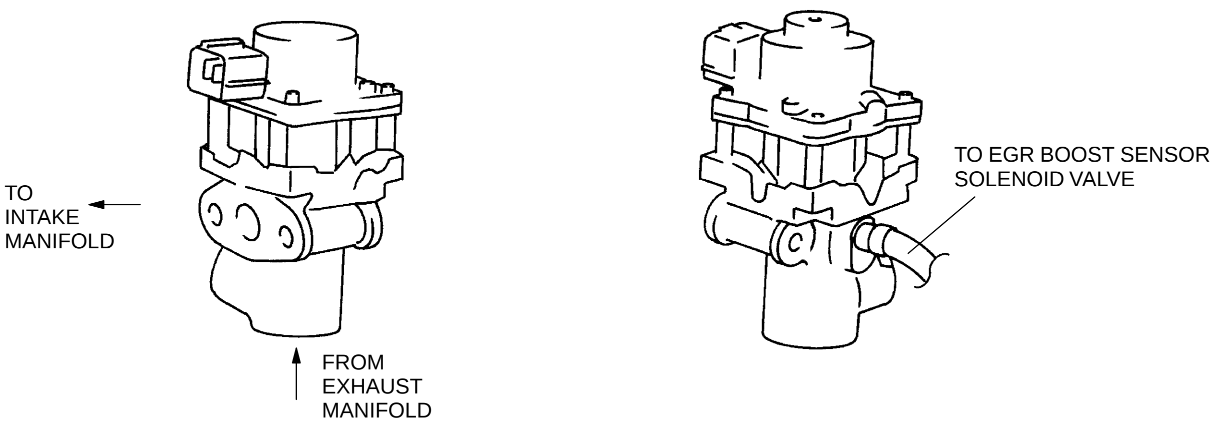
- The EGR valve controls the EGR flow via a stepping motor that is integrated into the EGR valve and actuated by a signal from the PCM.
- The EGR valve is actuated in 0—52 steps according to the PCM signals.

Structure

Note

- The EGR valve cannot be disassembled.

- The 2000MY MPV has adopted the same type EGR valve as the 1999MY Protegé.



YMU116SAB

EVAPORATIVE EMISSIONS (EVAP) CONTROL SYSTEM OUTLINE

YMU116S08

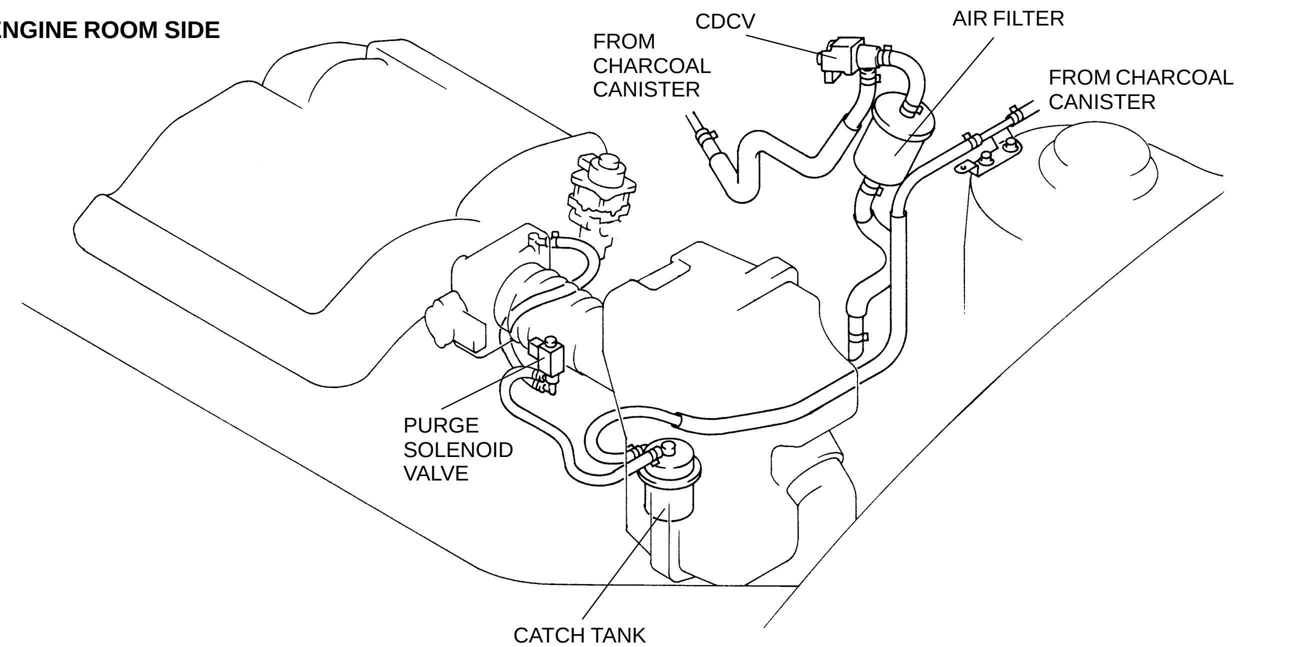
- The new fuel shut-off valve prevents the back flow of fuel, and enables the evaporative gas in the fuel tank to be absorbed directly by the charcoal canister.
- The vent cut valve prevents release of evaporative gas into the atmosphere during fuelling.
- To improve control of the evaporative gas in the fuel tank during fuelling, the diameter of evaporative hose between the fuel tank and the charcoal canister has been increased.
- No pressure control valve is in the system.

EVAPORATIVE EMISSIONS (EVAP) CONTROL SYSTEM STRUCTURAL VIEW

YMU116S07

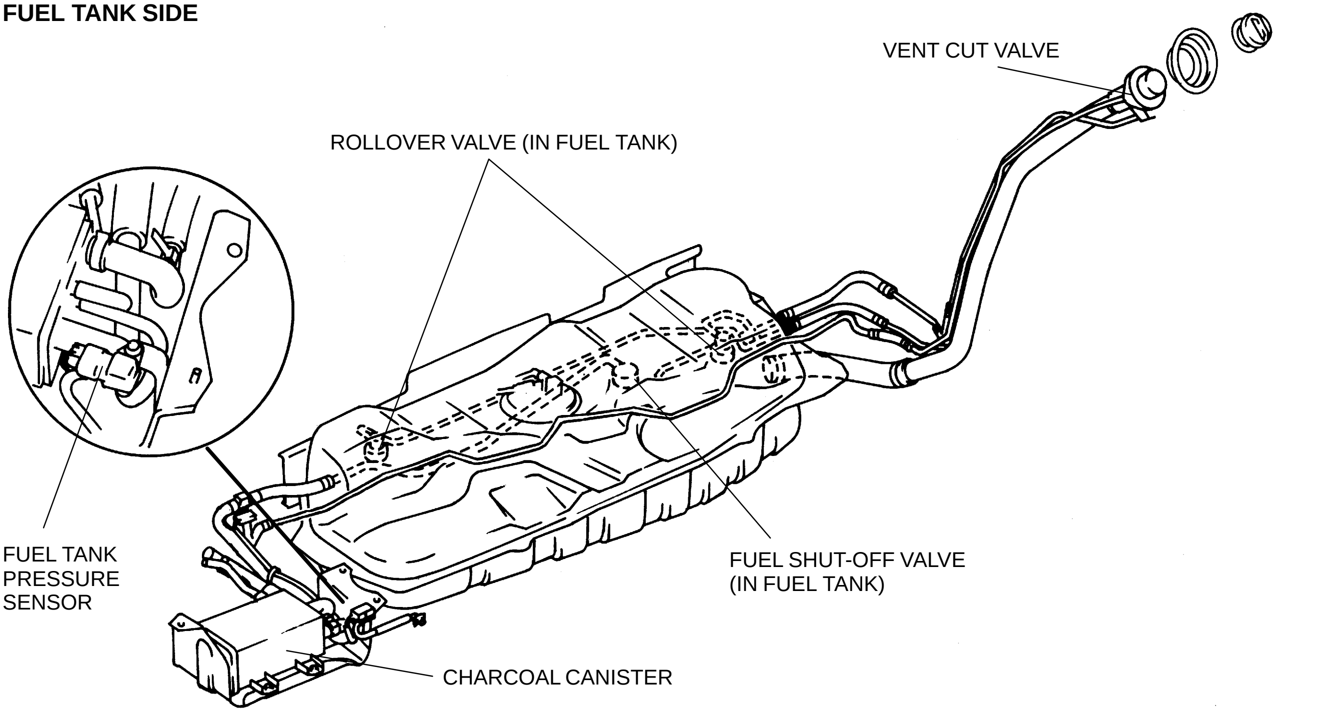
- The EVAP control system is composed of the fuel shut-off valve, rollover valve, charcoal canister, canister drain cut valve (CDCV), air filter, catch tank and purge solenoid valve.

ENGINE ROOM SIDE



YMU116SA3

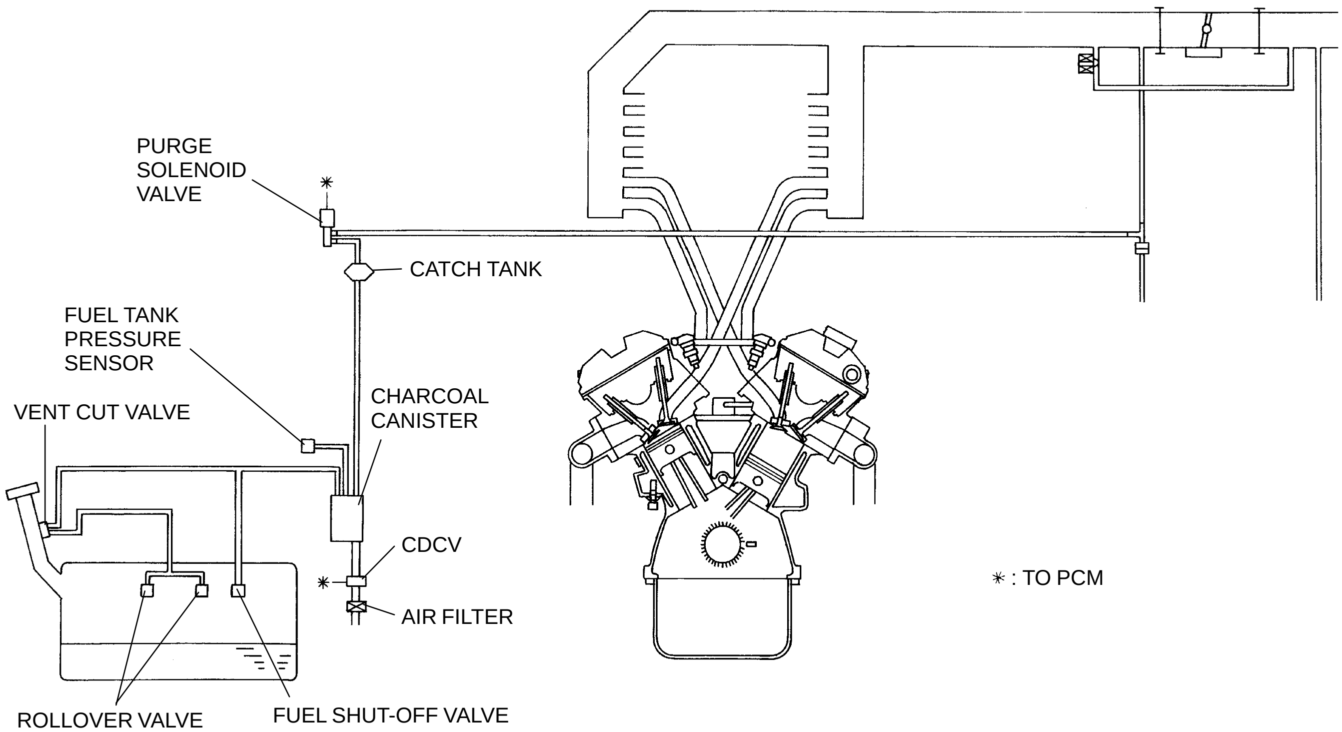
FUEL TANK SIDE



YMU116SA4

EVAPORATIVE EMISSIONS (EVAP) CONTROL SYSTEM DIAGRAM

YMU116S09



YMU116SA5

VENT CUT VALVE DESCRIPTION

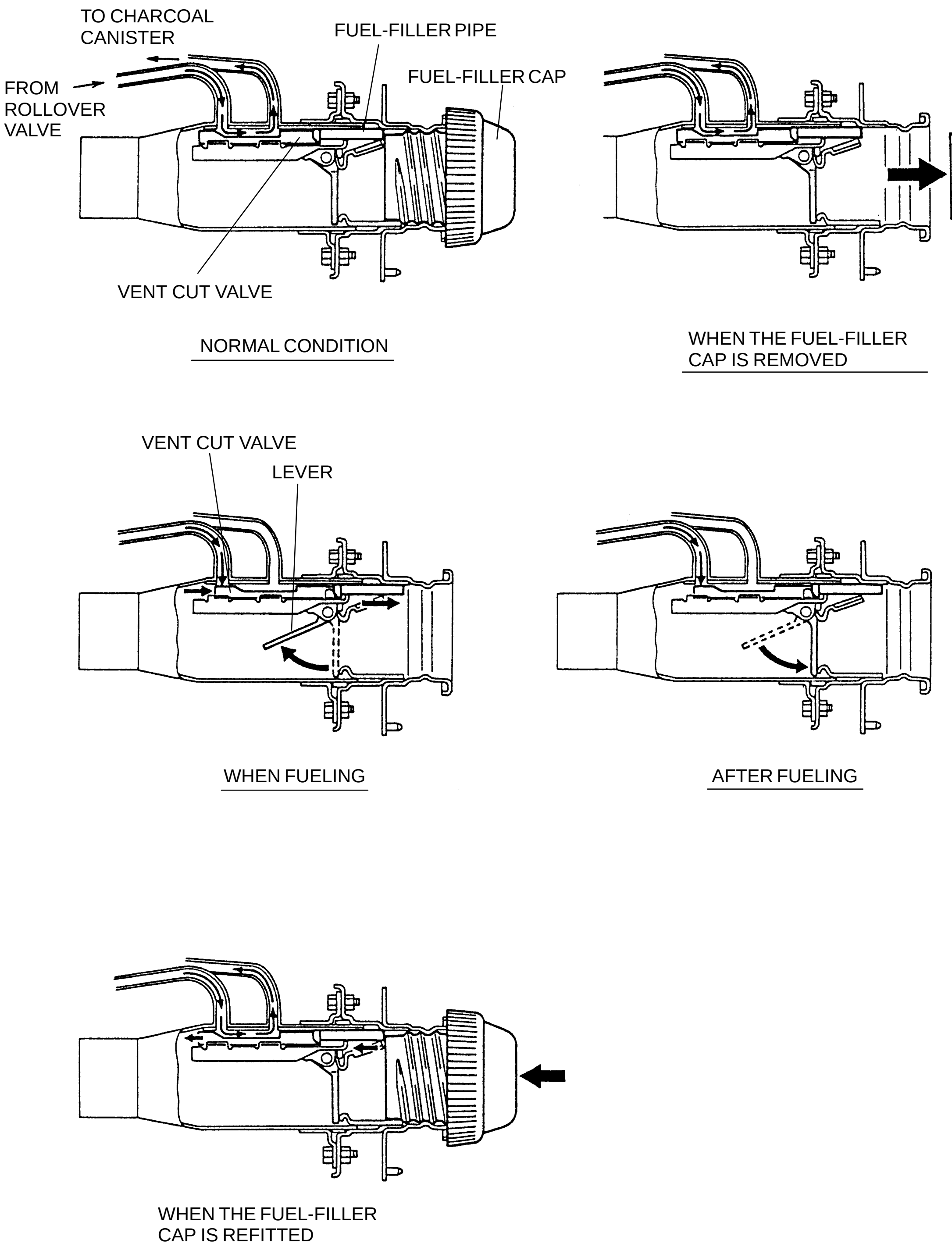
YMU116S10

Function

- The vent cut valve prevents release of evaporative gas into the atmosphere during fueling.

Operation

- The evaporative passage is open under normal conditions (fuel-filler cap is closed).
- When fueling, the fuel-filler nozzle trips a lever that position the vent cut valve to close the evaporative passage. The evaporative passage remains closed even after the fuel-filler nozzle is removed.
- When the fuel-filler cap is refitted, the cap pushes the vent cut valve to the original position, and the evaporative passage again opens.



YMU116SA6

FUEL SHUT-OFF VALVE DESCRIPTION

YMU116S11

Function

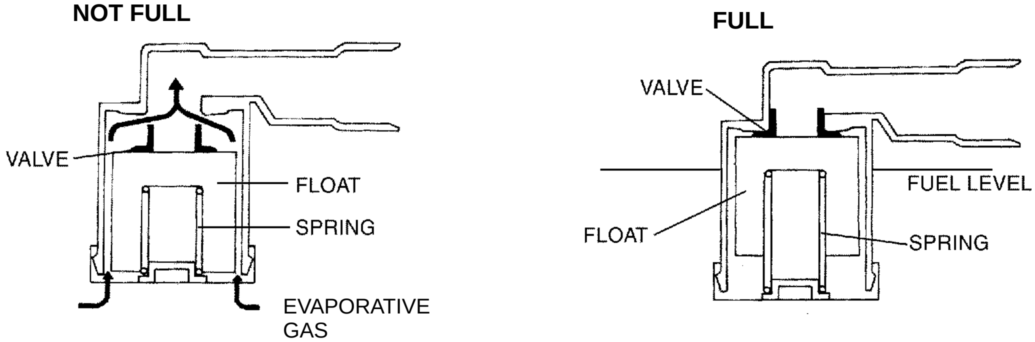
- The fuel shut-off valve prevents fuel from flowing to the charcoal canister during tight turns or vehicle rollover.
- The fuel shut-off valve releases evaporative gas to the charcoal canister.

Structure

- The fuel shut-off valve is composed of a valve, float and spring.

Operation

- When the fuel flows into the fuel shut-off valve, the float (valve) closes the flow passage by relation of float weight, spring force and float floating force.



YMU116SA7

ROLLOVER VALVE DESCRIPTION

YMU116S12

Function

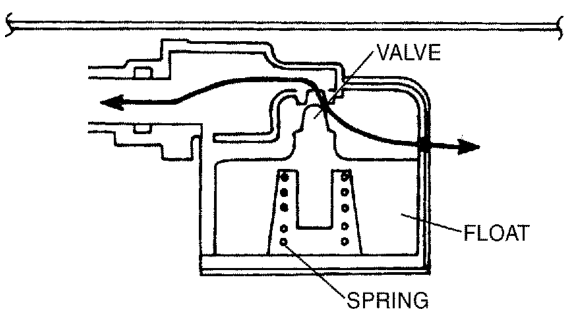
- The rollover valve prevents fuel from flowing to the charcoal canister during tight turns, vehicle rollover or when the fuel tank is full.

Structure

- The rollover valve is composed of a valve, float and spring.

Operation

- When the fuel flows into the rollover valve, the float (valve) closes the flow passage by relation of float weight, spring force and float floating force.



X3U116SAE

CHARCOAL CANISTER DESCRIPTION

YMU116S13

Function
- The charcoal canister stores the evaporative gas from fuel in the fuel tank.

Structure
- The charcoal canister contains activated carbon.

CANISTER DRAIN CUT VALVE (CDCV) DESCRIPTION

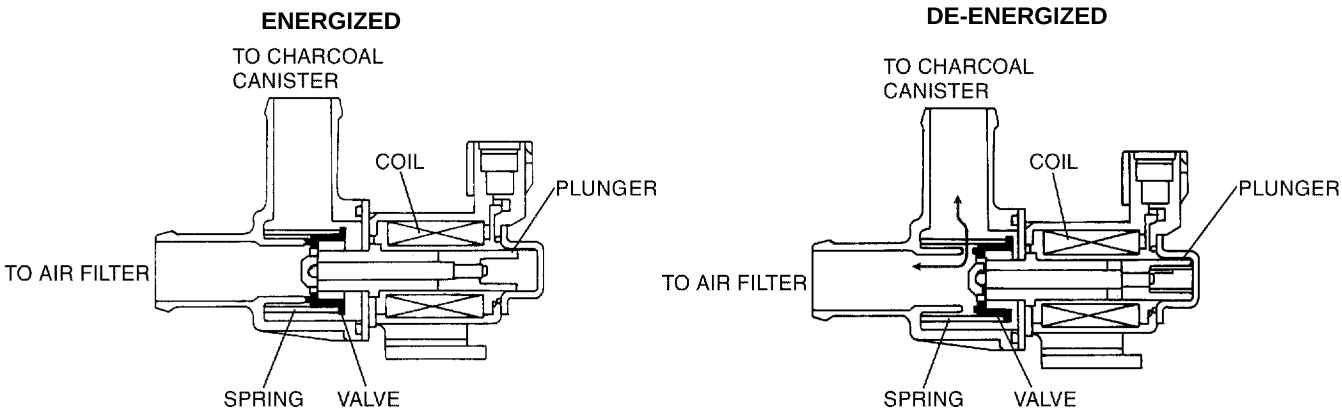
YMU116S14

Function
- The CDCV closes the passage on the atmospheric pressure side of the charcoal canister to make the evaporative system airtight during leak monitoring.

Structure
- The CDCV is composed of a spring, plunger, coil and valve.

Operation
Energized
- The plunger (with valve) is pushed forward to close the air passage between the charcoal canister and air filter.

De-energized
- The plunger (with valve) is pushed back to open the air passage between the charcoal canister and air filter.



YMU116SAG

AIR FILTER DESCRIPTION

YMU116S15

Function
- The air filter filters the dust from the air drawn to the charcoal canister.

Structure
- The air filter is located the CDCV on the atmosphere side.

CATCH TANK DESCRIPTION

YMU116S16

Function
- Due to a drop in temperature, evaporative gas condenses between the charcoal canister and the purge solenoid valve before reaching the intake manifold. The catch tank prevents the condensed evaporative gas from being supplied to the intake manifold and making the air-fuel mixture too rich.

PURGE SOLENOID VALVE DESCRIPTION

YMU116S17

Function

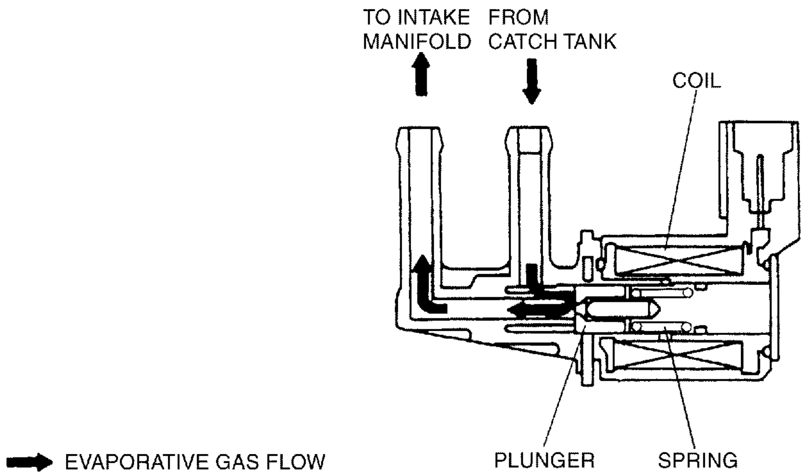
- The purge solenoid valve controls the amount of evaporative gas that flows from the charcoal canister through the catch tank to the intake manifold.

Structure

- The purge solenoid valve is composed of a coil, spring and plunger.

Operation

- When a signal from the PCM reaches the purge solenoid valve, the plunger is pulled to allow the evaporative gas to flow from the catch tank to the intake manifold.
- The flow amount of evaporative gas flow is controlled by the period of time that current is applied to the coil circuit. This current opens the plunger, allowing evaporative gas to enter the intake manifold.



X3U116SAH

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM OUTLINE

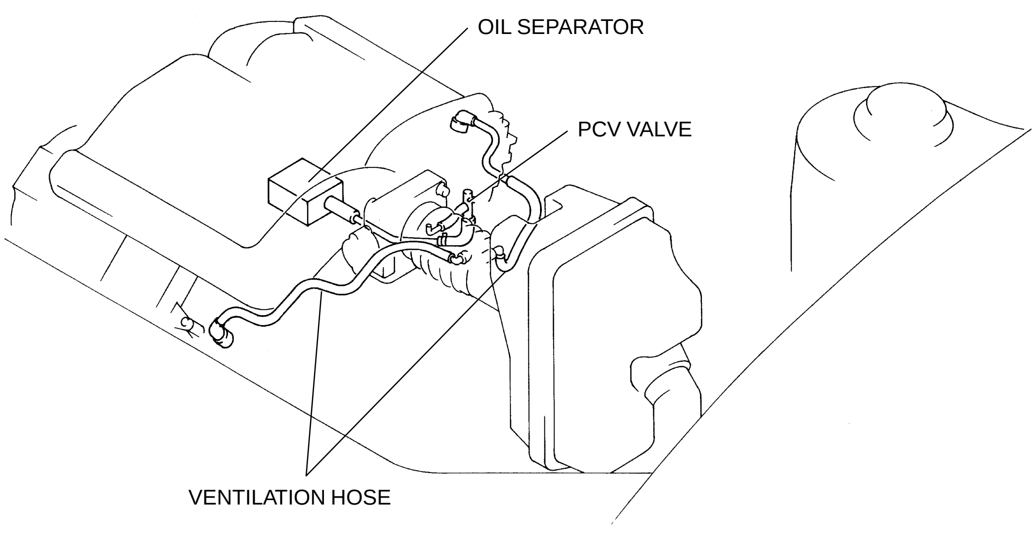
YMU116S18

- The PCV system discharges blow-by gas from the crankcase to the intake manifold.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM STRUCTURAL VIEW

YMU116S19

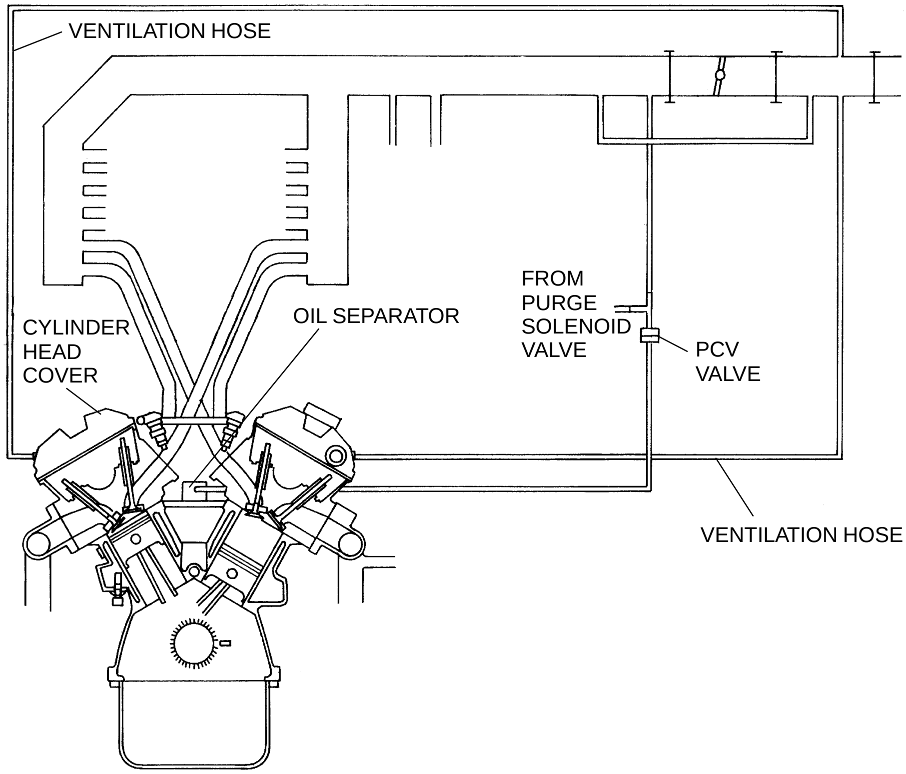
- The PCV system is composed of ventilation hoses, oil separator and PCV valve.



YMU116SA8

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM DIAGRAM

YMU116S20



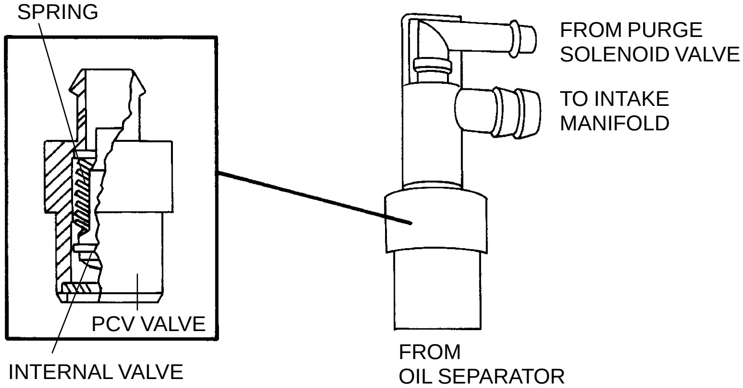
YMU116SA9

POSITIVE CRANKCASE VENTILATION (PCV) VALVE DESCRIPTION

YMU116S21

Structure

- The PCV valve is composed of springs and an internal valve.



YMU116SAC

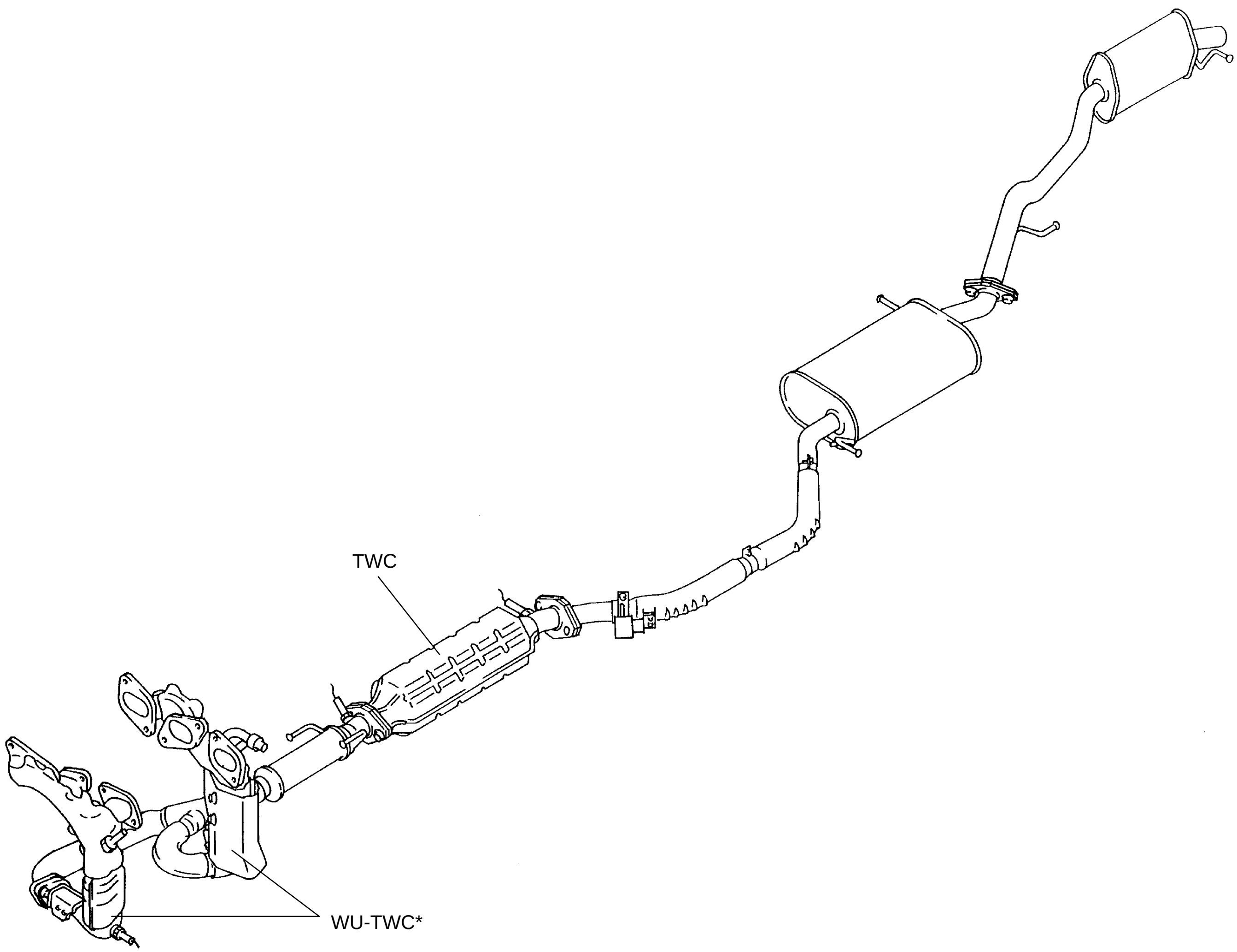
CATALYTIC CONVERTER SYSTEM OUTLINE

YMU116S22

- The catalytic converter system uses a TWC for all models.
- The catalytic converter system also uses a WU-TWC for California emission regulation applicable models.

CATALYTIC CONVERTER SYSTEM STRUCTURAL VIEW

YMU116S23



*: California emission regulation applicable models

YMU116SAA

WARM-UP THREE WAY CATALYTIC CONVERTER (WU-TWC) DESCRIPTION [CALIFORNIA EMISSION REGULATION APPLICABLE MODELS]

YMU116S24

Function

- The WU-TWC oxidizes/deoxidizes exhaust gas to reduce HC, CO and NOx.

THREE WAY CATALYTIC CONVERTER (TWC) DESCRIPTION [ALL MODELS]

YMU116S25

Function

- The TWC oxidizes/deoxidizes exhaust gas to reduce HC, CO and NOx (other than California emission regulation applicable models).
- The TWC oxidizes/deoxidizes exhaust gas, which has already had its HC, CO, and NOx content reduced by the WU-TWC (California emission regulation applicable models).

01–17 CHARGING SYSTEM

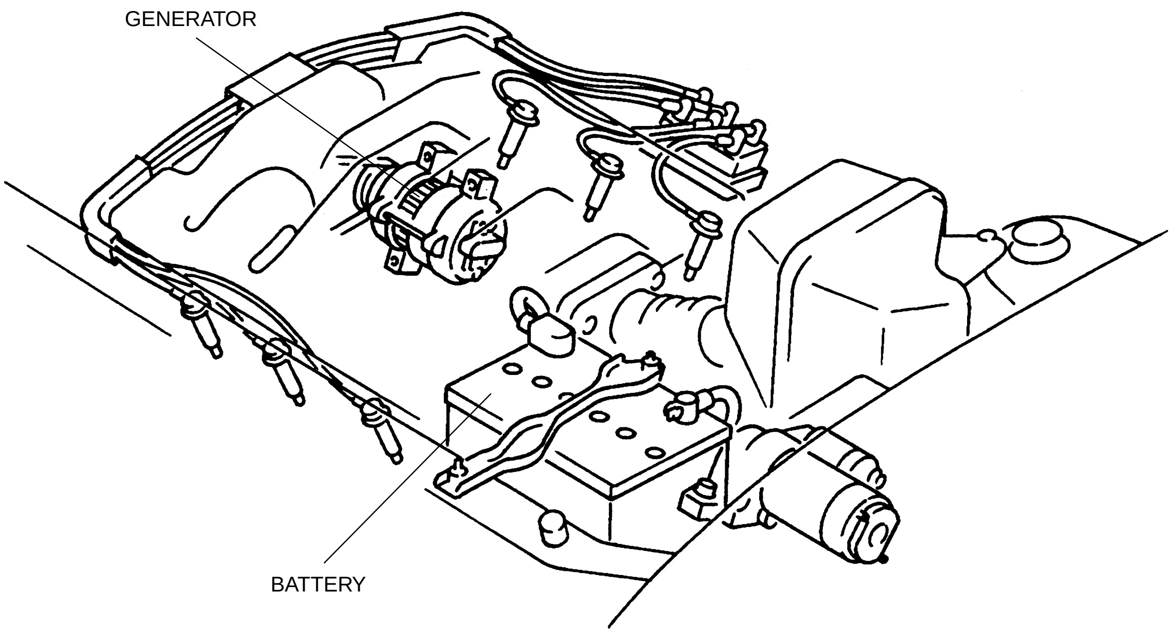
CHARGING SYSTEM OUTLINE

YMU117S01

- The construction and operation of the charging system are basically the same as the 1998MY MPV. However, the following items have been changed.
  - Current generated by the generator is regulated by the PCM.
  - Due to the adoption of the auto tensioner, adjustment of the front drive belt is unnecessary. (Refer to 01–10–13 ACCESSORY DRIVE DESCRIPTION.)

CHARGING SYSTEM STRUCTURAL VIEW

YMU117S02



YMU117SA0

GENERATOR DESCRIPTION

YMU117S03

- As in the 1999MY Protegé, the voltage regulator has been eliminated, and generator control is carried out by the PCM.

01–18 IGNITION SYSTEM

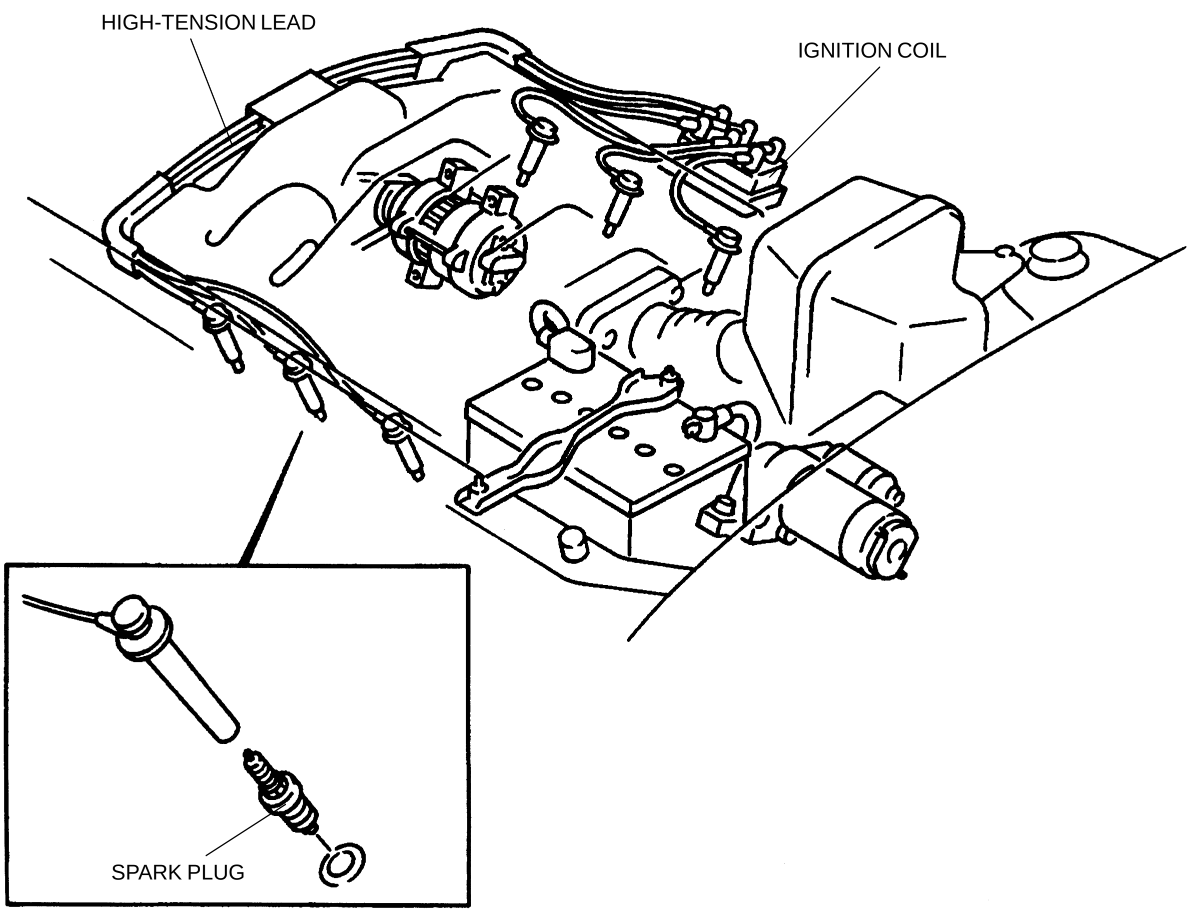
IGNITION SYSTEM OUTLINE

YMU118S01

- The construction and operation of the ignition system are basically the same as the 1998MY MPV. However, the following items have been changed.
  - DLI system has been adopted. This system is the same as the 1999MY 626.
  - Spark plugs that have a platinum-tipped center electrode have been adopted.

IGNITION SYSTEM STRUCTURAL VIEW

YMU118S02

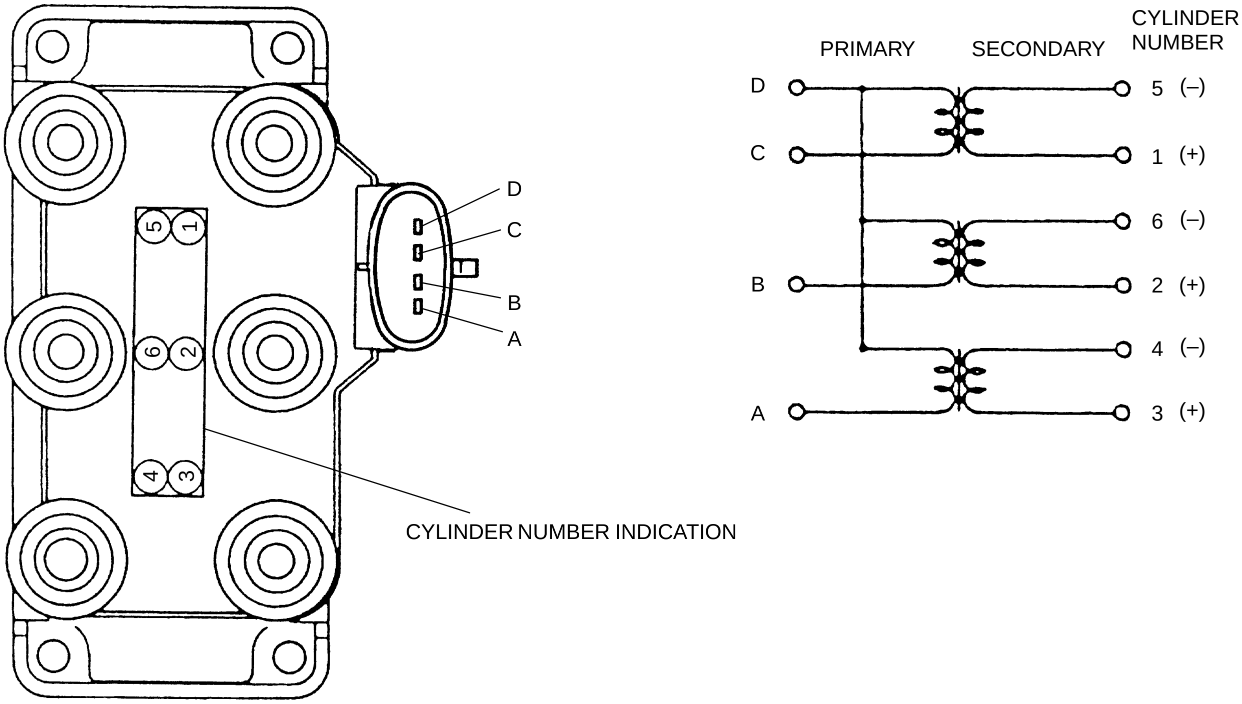


YMU118SA0

IGNITION COIL DESCRIPTION

YMU118S03

- The ignition coil is the same type as the 1999MY 626 KL engine.
- The ignition coil contains three coils. Due to the adoption of an electric wiring system, each coil has two secondary terminals.

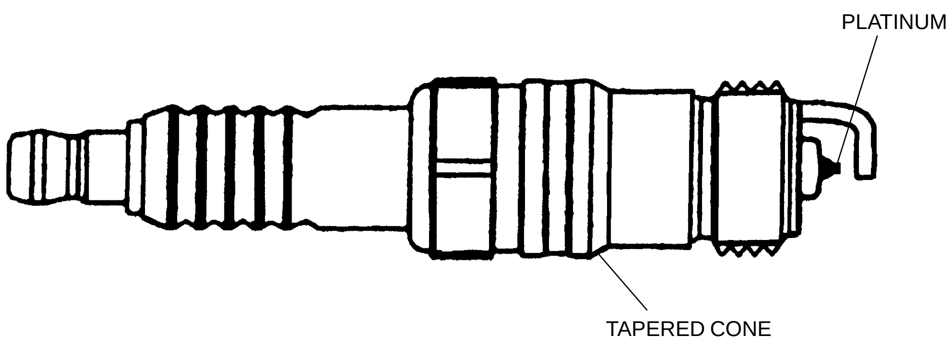


YMU118SA1

SPARK PLUG DESCRIPTION

YMU118S04

- Spark plugs with platinum-tipped center electrodes are used for longer life.
- A tapered cone type of seal is used in the spark plug. Use only the specified type of spark plug. Otherwise the effectiveness of seal between the spark plug and the cylinder head may be reduced.



YMU118SA2

01–19 STARTING SYSTEM

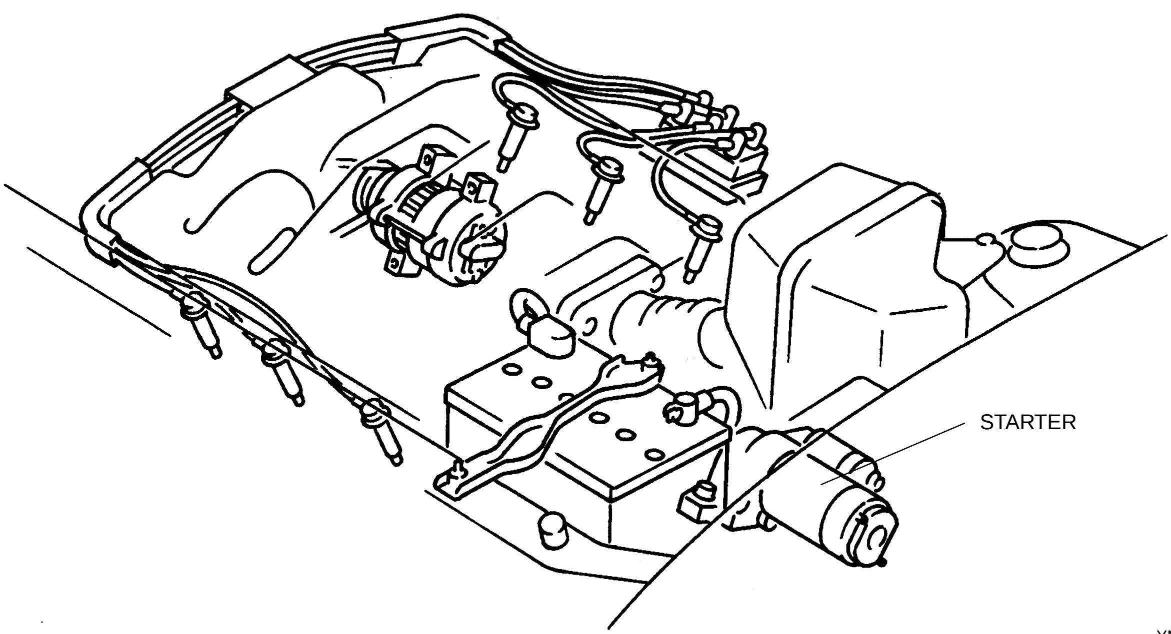
STARTING SYSTEM OUTLINE

YMU119S01

- The construction and operation of the starting system are basically the same as the 1998MY MPV.

STARTING SYSTEM STRUCTURAL VIEW

YMU119S02



01–20 CRUISE CONTROL SYSTEM

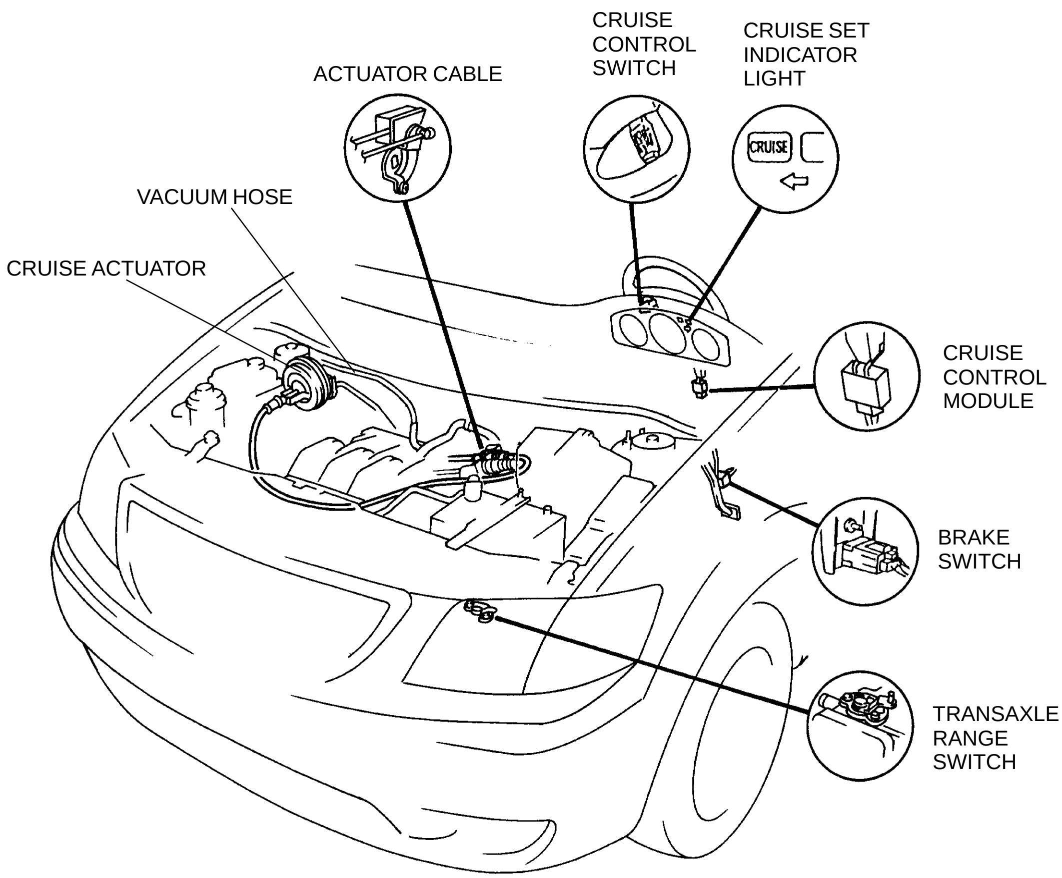
CRUISE CONTROL SYSTEM OUTLINE

YMU120S01

- The cruise control system consists of the cruise control switch, cruise actuator, actuator cable, vacuum hose, vehicle speed sensor, brake switch, transaxle range switch, cruise control module, and cruise set indicator light.
- The system operation is basically the same as the 1998MY MPV except for the following. The following items are the same as the 1999MY Protegé.
  - The cruise control main switch is integrated with the cruise control switch, it can be operated by the lever. This switch is the same as the 1999MY Protegé.
  - Because the cruise control main switch is integrated with the cruise control switch, the terminal arrangement of the cruise control module has been changed.
  - DTC13 in on-board diagnosis has been added.

CRUISE CONTROL SYSTEM STRUCTURAL VIEW

YMU120S02

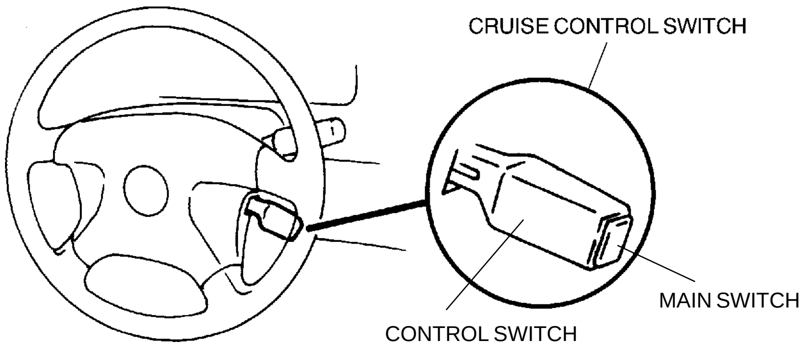


YMU120SA0

CRUISE CONTROL SYSTEM DESCRIPTION

YMU120S03

Cruise Control Switch



YMU120SA1

Function

Main switch

- The main switch is the main power supply of the system.
- When the ignition switch is turned to LOCK position, the main switch is automatically turned off.
- When the ignition switch has been turned to LOCK or ACC position while the main switch is on and the ignition switch is later turned to ON position, the main switch will remain on but the set cruise control speed will not be stored in the memory.

Control switch

- The lever type control switch has five functions (SET, COAST, RESUME, ACCEL, and CANCEL).
- SET and COAST functions are operated in the same direction.
- RESUME and ACCEL functions are operated in the same direction.

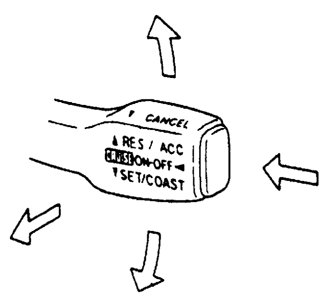
Operation

Main switch

- The main switch is turned on or off by pressing it.

Control switch

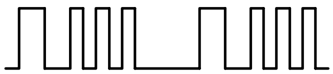
- By moving the lever down and releasing it, the current driving speed is set. (SET)
- By moving the lever down and holding it, the cruising speed is decreased. (COAST)
- By moving the lever upward and releasing it, the most recent set speed is resumed. (RESUME)
- By moving the lever upward and holding it, the cruising speed is increased. (ACCEL)
- By pulling the lever forward, the set speed is canceled. (CANCEL)



YMU120SA2

On-Board Diagnosis

- There are two on-board diagnostic functions:
  - Operation Mode, which inspects for and indicates correct operation of the input signals to the control module.
  - Condition Detection Mode, which indicates malfunctions in the system.
- DTC13, which indicates a malfunction in the ground circuit on the cruise control switch, has been added.

DTC	Output pattern	Display on the NGS	Diagnosed circuit
13	 X3U120SA9	SET/COAST SW OR RES/ACC SW DEFECT	Cruise control switch (Ground circuit)

01–40 CONTROL SYSTEM

CONTROL SYSTEM OUTLINE

YMU140S01

- The 2000MY MPV uses a 104-pin PCM. Since the TCM has been integrated into the PCM, the PCM controls both the engine and automatic transaxle.
- The PCM is established independently to meet California or Federal emission regulations.
- The PCM receives all input signals and controls output devices based on these signals.
- The intake manifold runner control (IMRC) system has been adopted to increase the engine torque.
- Since the electric spark advance (ESA) system, including the electric distribution ignition function, has been adopted, the distributor has been eliminated on the 2000MY MPV.
- The front-heated oxygen sensor heater is controlled by a duty value to control the heater temperature precisely in accordance with the driving situation.
- To improve serviceability, DTCs have been divided by system(s) and, additions and changes have been made to the monitoring system.
- A Flash EPROM Power Supply (FEPS) line has been added between the DLC-2 inside the driver compartment and the PCM for PCM reprogramming.
- EGR system monitor has been adopted.
- The following changes have been made to the input and output devices for the “2000MY MPV”.

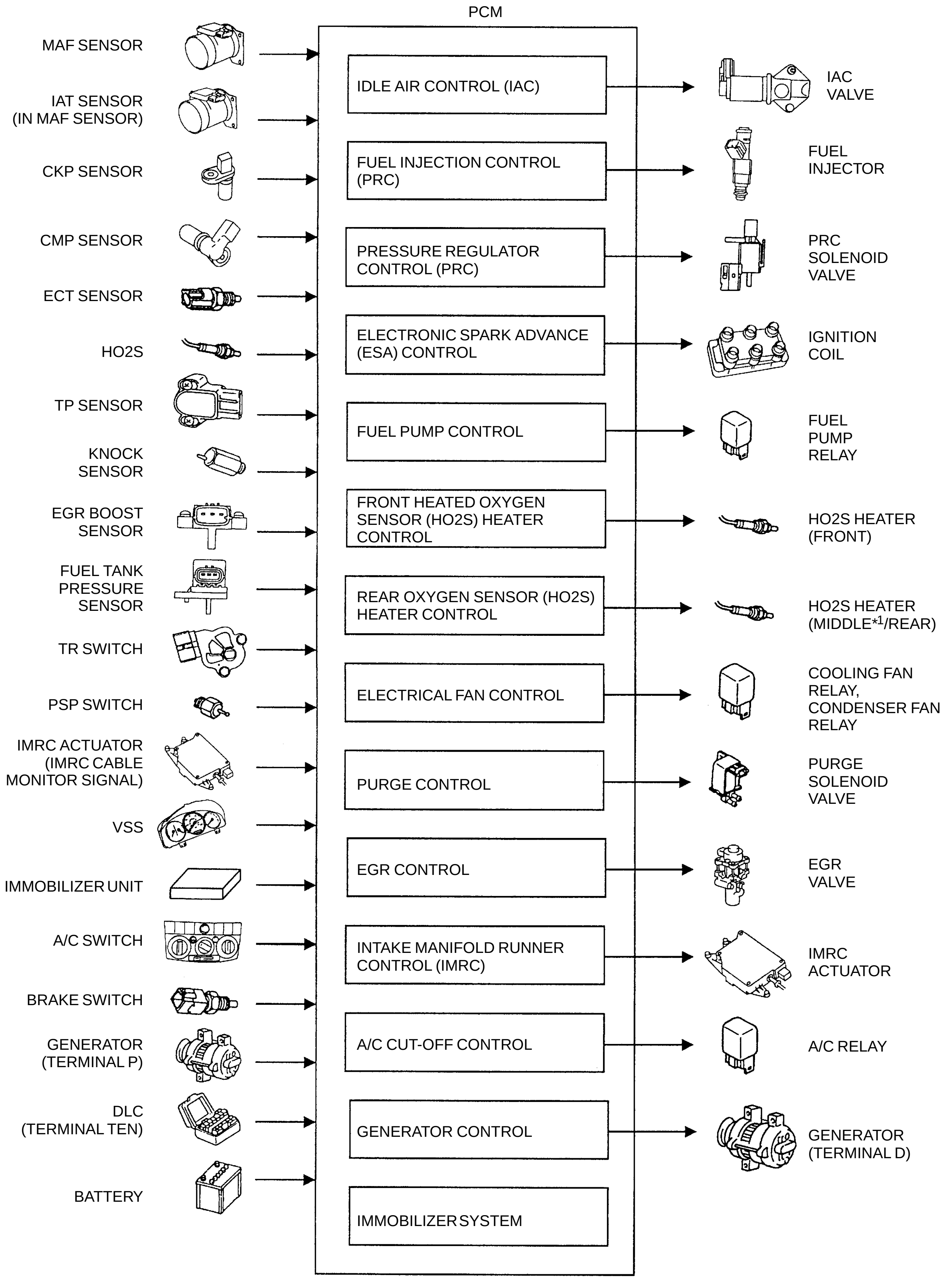
Input

Component	Remarks
Brake switch	Same function as 1998MY MPV
Refrigerant pressure switch, A/C switch, blower fan switch and A/C amplifier	Same function as 1998MY MPV
CKP sensor	The sensor generates an alternating current wave from the 35-tooth CKP sensor pulse wheel, and inputs it into the PCM
CMP sensor	Uses inductive sensors
VSS	Same function as 1998MY MPV
EGR boost sensor	Signal used for barometric pressure detection and EGR monitoring
MAF sensor	Uses hot wire type. The IAT sensor is integrated into the MAF sensor
ECT sensor	Same function as 1998MY MPV
IAT sensor	Integrated into the MAF sensor
TP sensor	Eliminated the idle switch
Knock sensor	• Used piezoelectrical type • Newly adopted
HO2S (Front/Middle/Rear)	Same function as 1998MY MPV
Fuel gauge sender unit	Same function as 1998MY MPV
PSP switch	Same function as 1998MY MPV
Main relay	Same function as 1998MY MPV
Generator	Generator control system newly adopted
Fuel tank pressure sensor	Same function as 1998MY MPV

Output

Component	Remarks
IAC valve	Same function as 1999MY Protegé
A/C relay	Same function as 1998MY MPV
Fuel pump relay	Same function as 1998MY MPV
Purge solenoid valve	Same function as 1998MY MPV
Cooling fan relay	Same function as 1998MY MPV
Condenser fan relay	Same function as 1998MY MPV
IMRC actuator	Newly adopted
Immobilizer unit	Same function as 1998–1999 626
EGR valve	Same function as 1999MY Protegé
EGR boost sensor solenoid valve	Same function as 1999MY Protegé
HO2S (Front/Middle/Rear) heater	Heater controlled by duty value. (Front RH, LH) Heater controlled ON/OFF. (others)
Ignition coil	Ignition coil creates secondary ignition energy and distributes it to each spark plug. The ignition coils ignite in pairs (cylinders 1 and 5, cylinders 2 and 6 and cylinders 3 and 4).
Fuel injectors	Same function as 1998MY MPV
Pressure regulator control (PRC) solenoid valve	Same function as 1998MY MPV
Tachometer	Same function as 1998MY MPV
Canister drain cut valve (CDCV)	Same function as 1998MY MPV
Generator	Generator control system newly adopted
Generator warning light	Newly adopted
MIL	Same function as 1998MY MPV

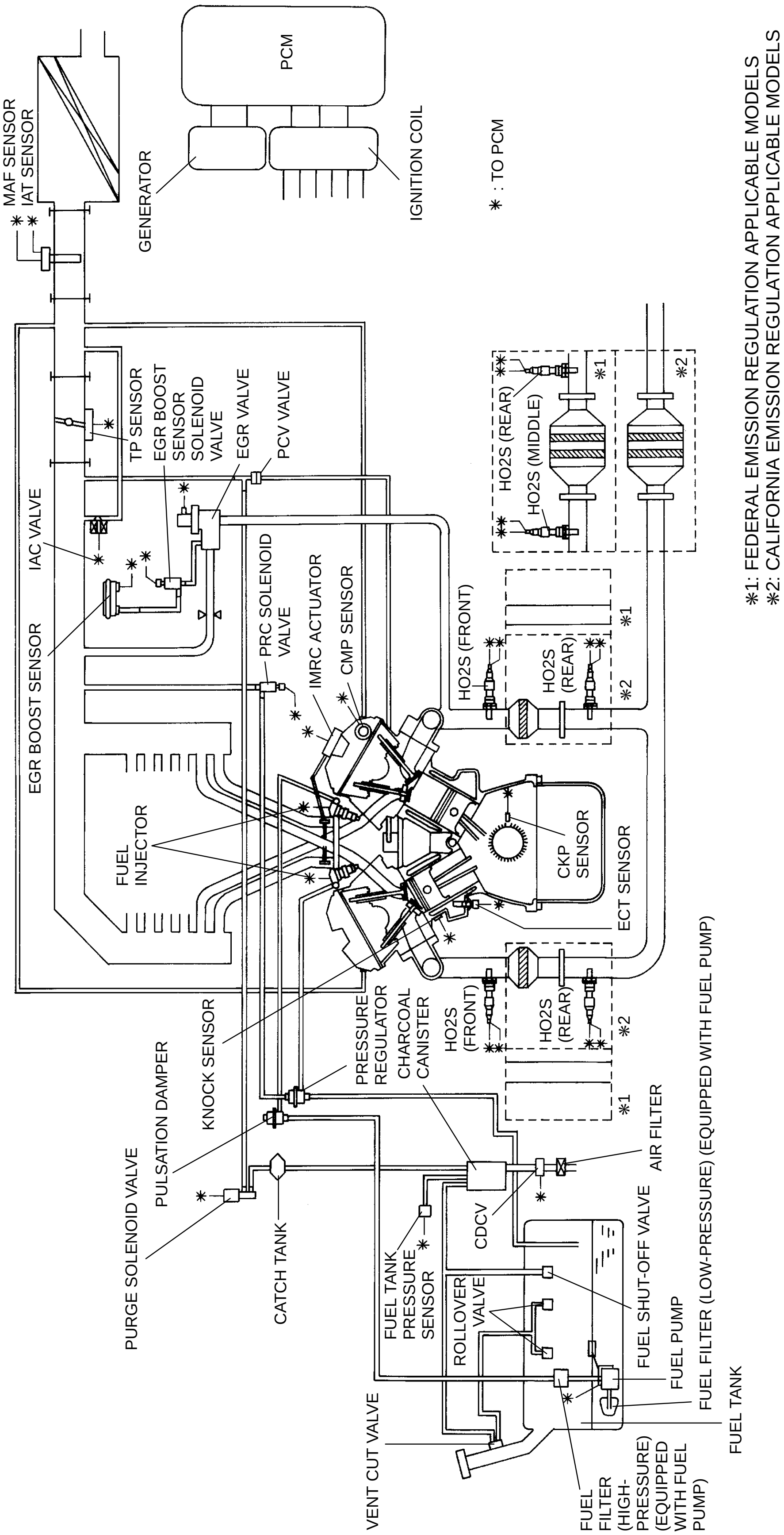
Block Diagram



*1: FEDERAL EMISSION REGULATION APPLICABLE MODELS

CONTROL SYSTEM DIAGRAM

YMU140S02

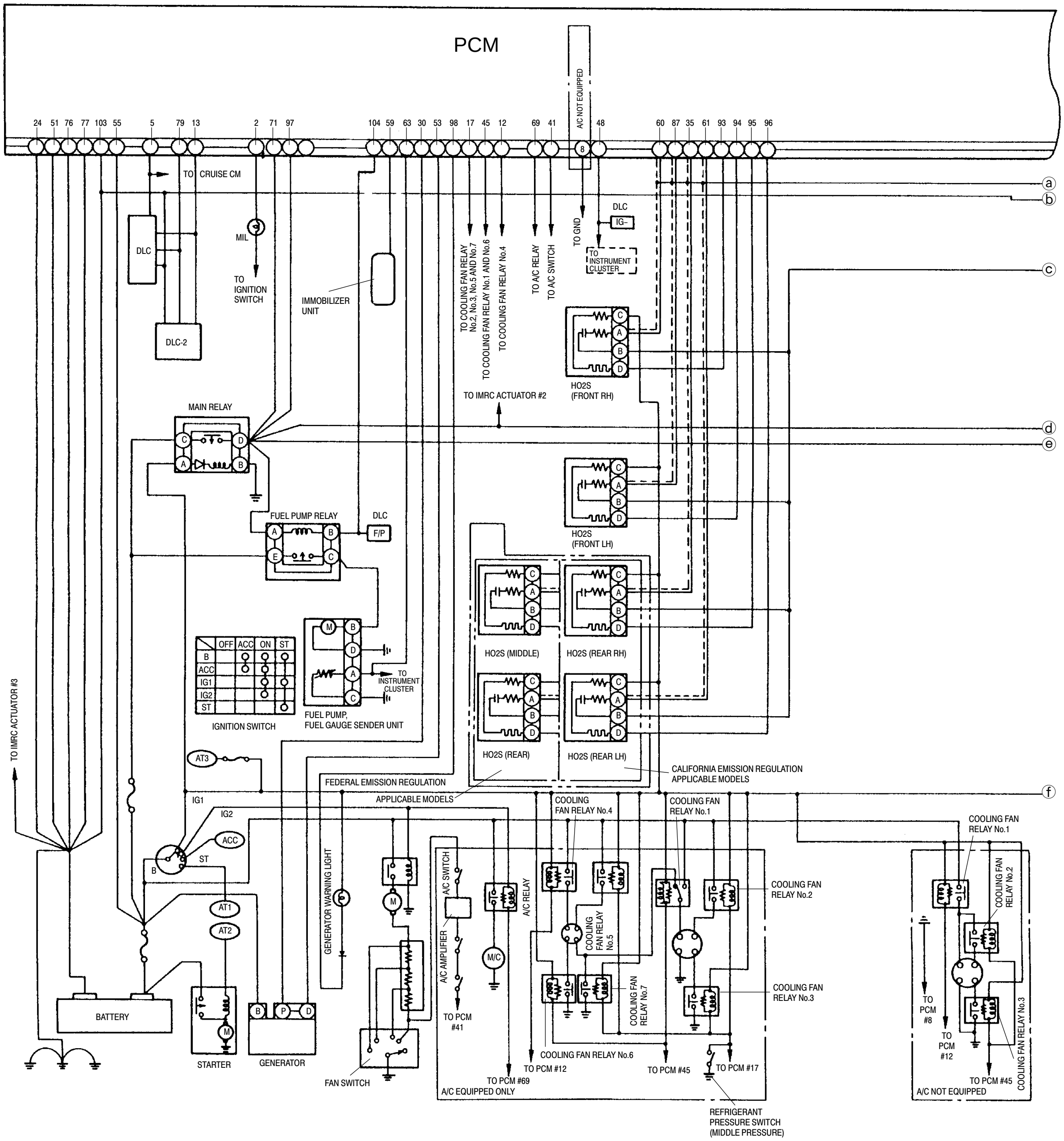


YMU140SA1

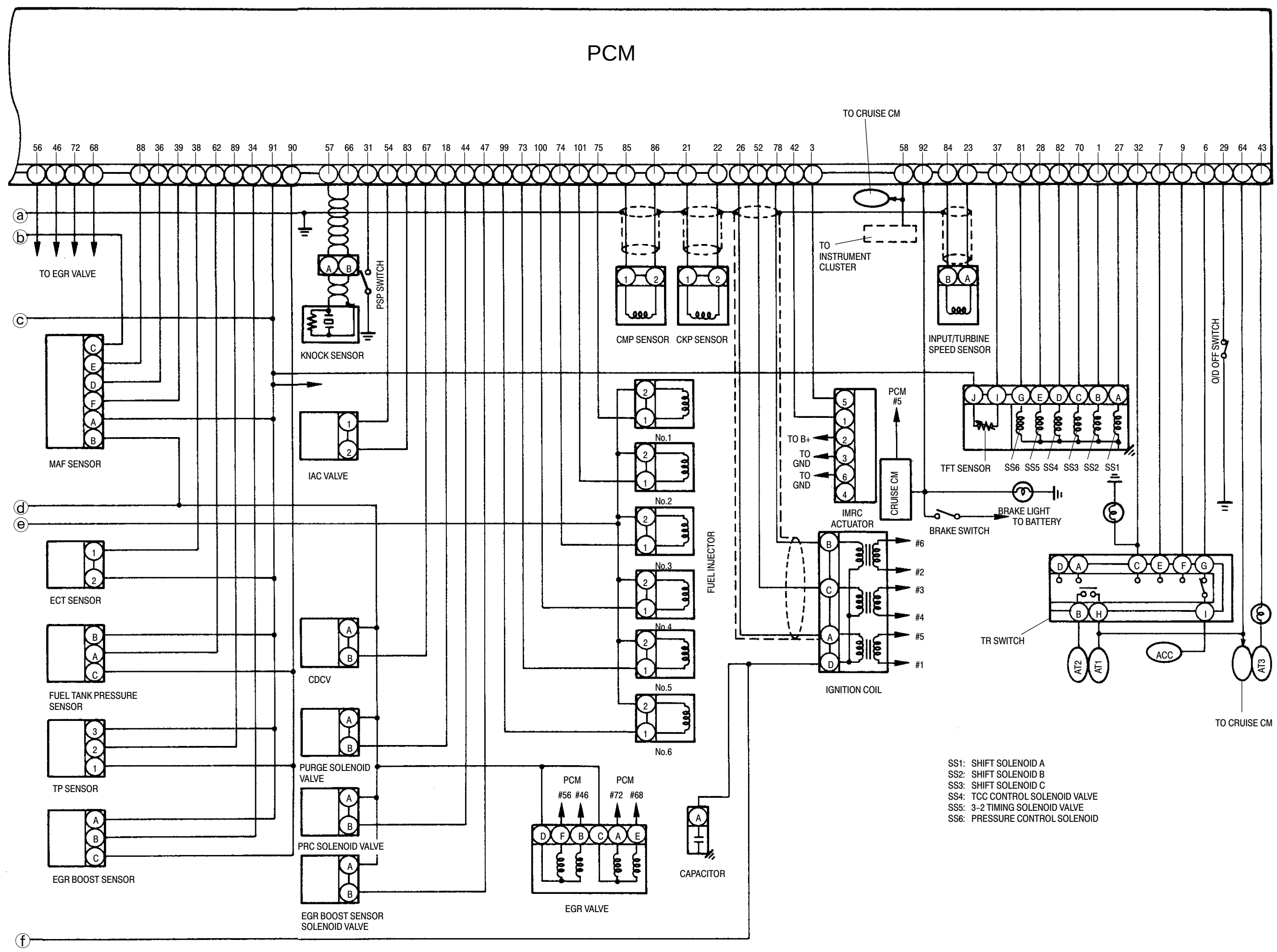
CONTROL SYSTEM WIRING DIAGRAM

YMU140S03

With immobilizer system

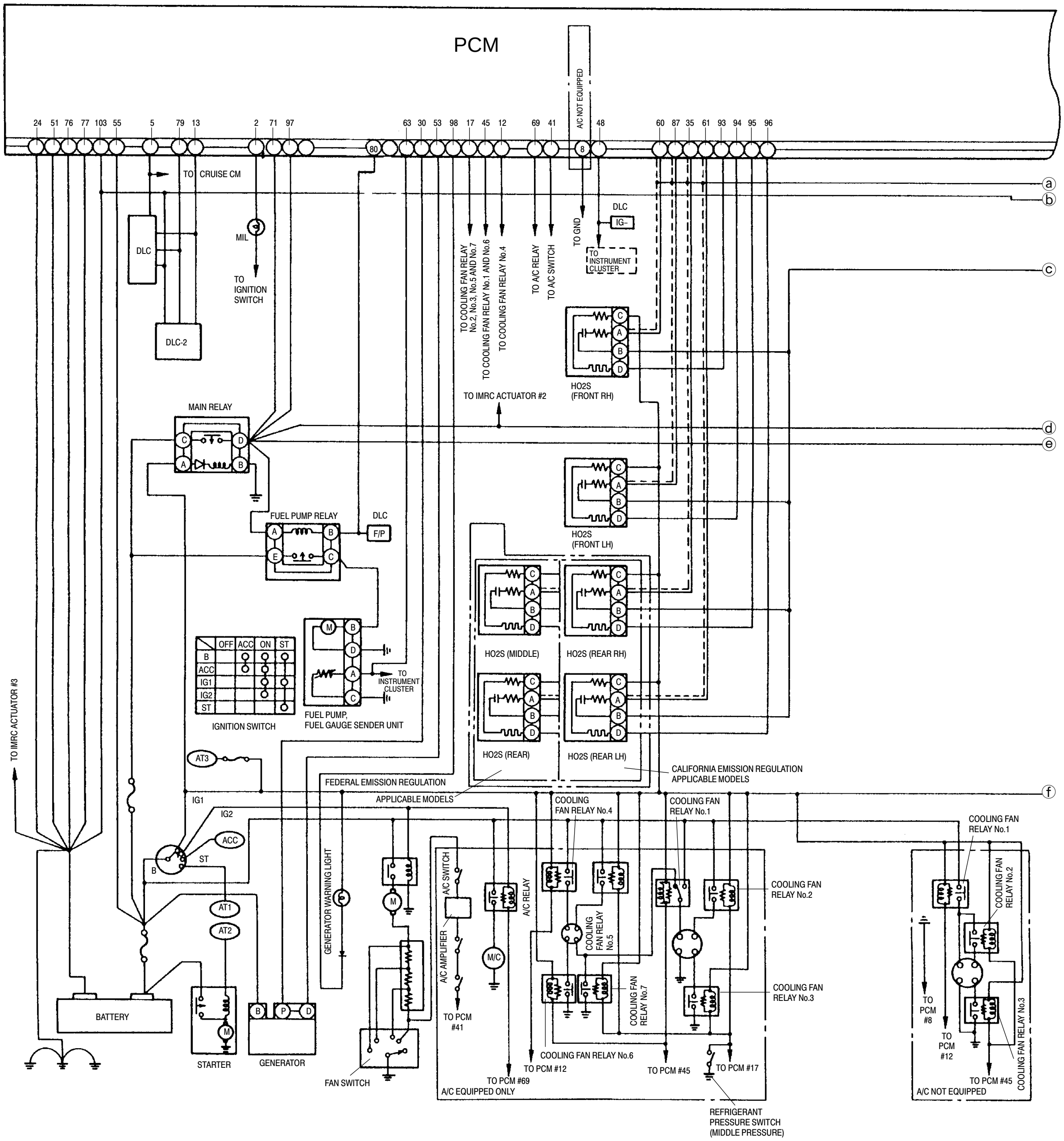


YMU140SA2

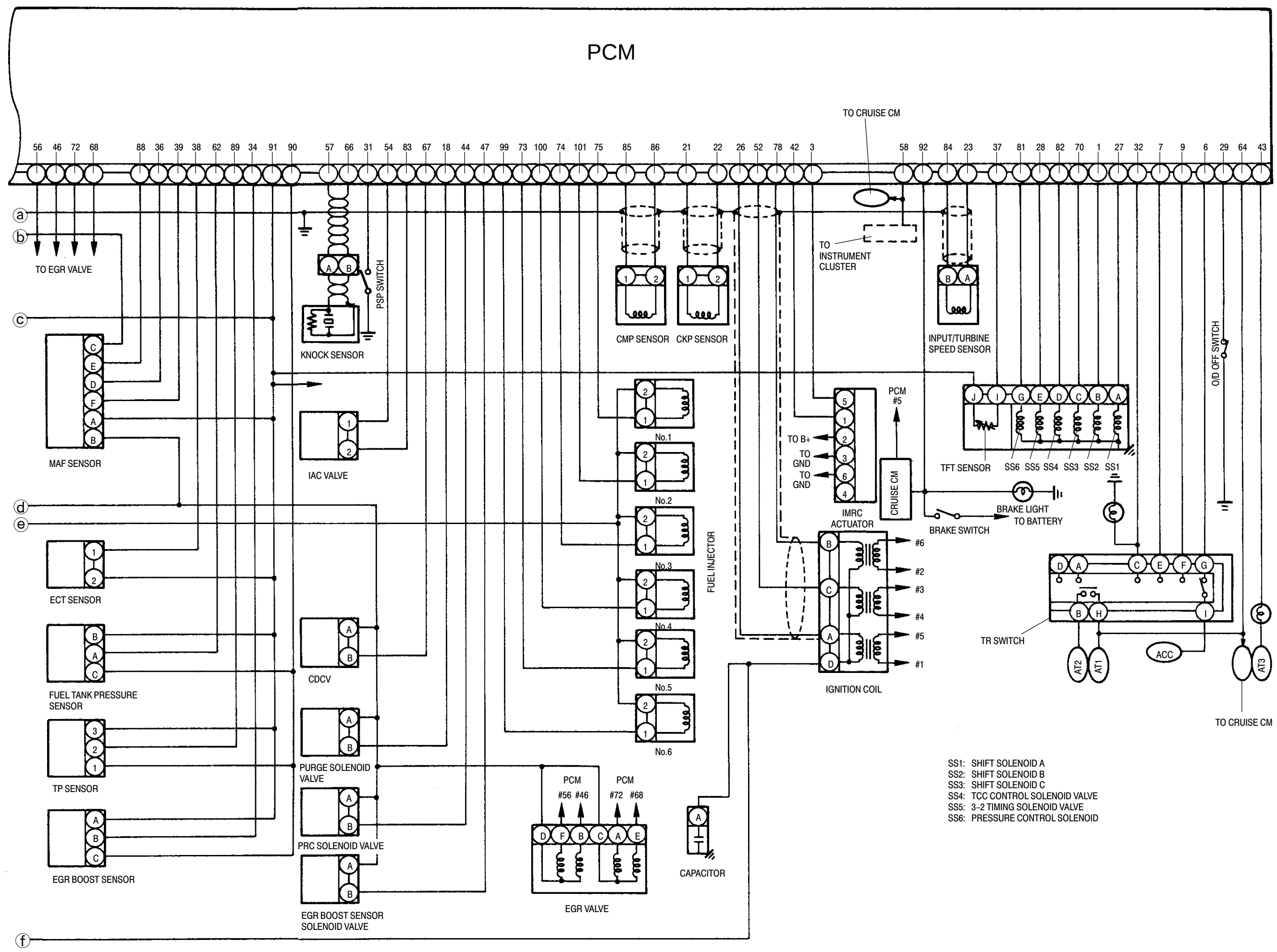

PCM
TO CRUISE CM
TO EGR VALVE
KNOCK SENSOR
PSP SWITCH
CMP SENSOR
CKP SENSOR
TO INSTRUMENT CLUSTER
INPUT/TURBINE SPEED SENSOR
O/D OFF SWITCH
MAF SENSOR
IAC VALVE
FUEL INJECTOR
No.1
No.2
No.3
No.4
No.5
No.6
TO B+
TO GND
TO GND
IMRC ACTUATOR
CRUISE CM
PCM #5
TFT SENSOR
SS6 SS5 SS4 SS3 SS2 SS1
BRAKE LIGHT TO BATTERY
BRAKE SWITCH
ECT SENSOR
FUEL TANK PRESSURE SENSOR
CDCV
IGNITION COIL
TR SWITCH
ACC
AT2
AT1
AT3
TO CRUISE CM
TP SENSOR
PURGE SOLENOID VALVE
PCM #56 #46
PCM #72 #68
PRC SOLENOID VALVE
EGR BOOST SENSOR
EGR VALVE
CAPACITOR
EGR BOOST SENSOR SOLENOID VALVE
SS1: SHIFT SOLENOID A
SS2: SHIFT SOLENOID B
SS3: SHIFT SOLENOID C
SS4: TCC CONTROL SOLENOID VALVE
SS5: 3–2 TIMING SOLENOID VALVE
SS6: PRESSURE CONTROL SOLENOID

YMU140SA3

Without immobilizer system



YMU140SC0


PCM
TO CRUISE CM
TO EGR VALVE
KNOCK SENSOR
PSP SWITCH
CMP SENSOR
CKP SENSOR
TO INSTRUMENT CLUSTER
INPUT/TURBINE SPEED SENSOR
O/D OFF SWITCH
MAF SENSOR
IAC VALVE
FUEL INJECTOR
IMRC ACTUATOR
CRUISE CM
TFT SENSOR
SS6 SS5 SS4 SS3 SS2 SS1
BRAKE LIGHT
TO BATTERY
BRAKE SWITCH
TO B+
TO GND
ECT SENSOR
FUEL TANK PRESSURE SENSOR
CDCV
IGNITION COIL
TR SWITCH
TP SENSOR
PURGE SOLENOID VALVE
PRC SOLENOID VALVE
EGR BOOST SENSOR
EGR BOOST SENSOR SOLENOID VALVE
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YMU140SC1

CONTROL SYSTEM DEVICE AND CONTROL RELATIONSHIP CHART

YMU140S04

Engine Control System

× : Applied

Component	Idle air control (IAC)	Fuel injection control	Pressure regulator control (PRC)	Electronic spark advance control	Fuel pump control	HO2S heater (Front RH, LH)	HO2S heater (Rear RH, LH*1 and Middle*2)	Electrical fan control	Purge control	EGR control	IMRC	A/C cut-off control	Generator control	Immobilizer system
Input														
Brake switch		×												
Refrigerant pressure switch, A/C switch, A/C amplifier	×	×						×				×		
CKP sensor	×	×	×	×	×	×			×	×	×		×	
CMP sensor		×		×										
VSS		×		×						×	×		×	
EGR boost sensor (BARO sensor)		×		×					×					
MAF sensor	×	×		×		×			×	×				
ECT sensor	×	×	×	×		×	×	×	×	×	×	×	×	
IAT sensor	×	×	×						×	×			×	
TP sensor	×	×	×	×				×		×	×	×	×	
HO2S (Front)		×												
Knock sensor				×										
TR switch	×	×	×	×										
PSP switch		×		×								×		
Generator (Terminal P)	×												×	
DLC (TEN terminal)	×			×				×						
Battery		×		×					×				×	
IMRC actuator (IMRC cable monitor signal)		×									×			
Immobilizer unit		×		×										×
Output														
IAC valve	×													
Fuel injector		×												×
PRC solenoid valve			×											
Ignition coil				×										×
Fuel pump relay					×									
HO2S heater (Front)						×								
HO2S heater (Middle*2, Rear)							×							
Cooling fan relay								×						
Purge solenoid valve									×					
EGR valve										×				
IMRC actuator											×			
A/C relay												×		
Generator (Terminal D)													×	
Generator warning light													×	

*1: California emission regulation applicable models
*2: Federal emission regulation applicable models

YMU140SA4

Monitoring System

× : Applied

Component	Catalyst monitor	Misfire monitor	Evaporative system monitor	Fuel system monitor	Oxygen sensor monitor	Oxygen sensor heater monitor	EGR system monitor
Input							
Refrigerant pressure switch, A/C switch, blower fan switch and A/C amplifier							×
PSP switch							×
CKP sensor	×	×	×	×	×	×	×
CMP sensor	×	×	×	×	×	×	×
VSS	×	×	×	×	×		×
MAF sensor	×	×	×	×	×	×	×
ECT sensor	×	×	×	×	×	×	×
IAT sensor	×	×	×	×	×		×
TP sensor	×	×	×	×	×		×
EGR boost sensor							×
Fuel level sensor			×				
Fuel gauge sender unit			×				
HO2S (Rear/Middle*[1])	×				×	×	
HO2S (Front)	×			×	×	×	
Output							
DLC-2 in driver compartment (Terminal KLN)	×	×	×	×	×	×	×
MIL	×	×	×	×	×	×	×
Purge solenoid valve			×	×	×		
EGR valve							×
EGR boost sensor solenoid valve							×
Canister drain cut valve			×				
Fuel injectors				×			

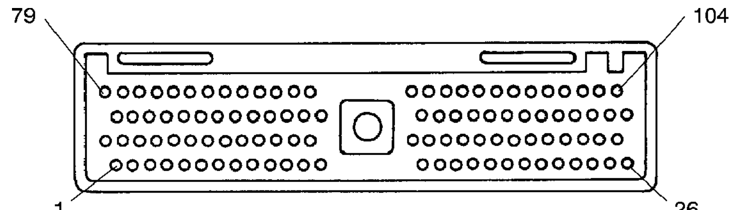
*[1]: Federal emission regulation applicable models

YMU140SA5

PCM DESCRIPTION

X3U140S06

- The PCM controls the output devices according to the signals from various input sensors and switches.
- A one-connector, 104-pin type PCM is used.
- Input/output PCM signals are easily inspected by using the PID/DATA MONITOR AND RECORD function of the NGS tester with the ignition switch in the ON position and/or the engine running.
- They are separate PCMs for California and Federal emission regulations.
- The TCM has been integrated into the PCM.



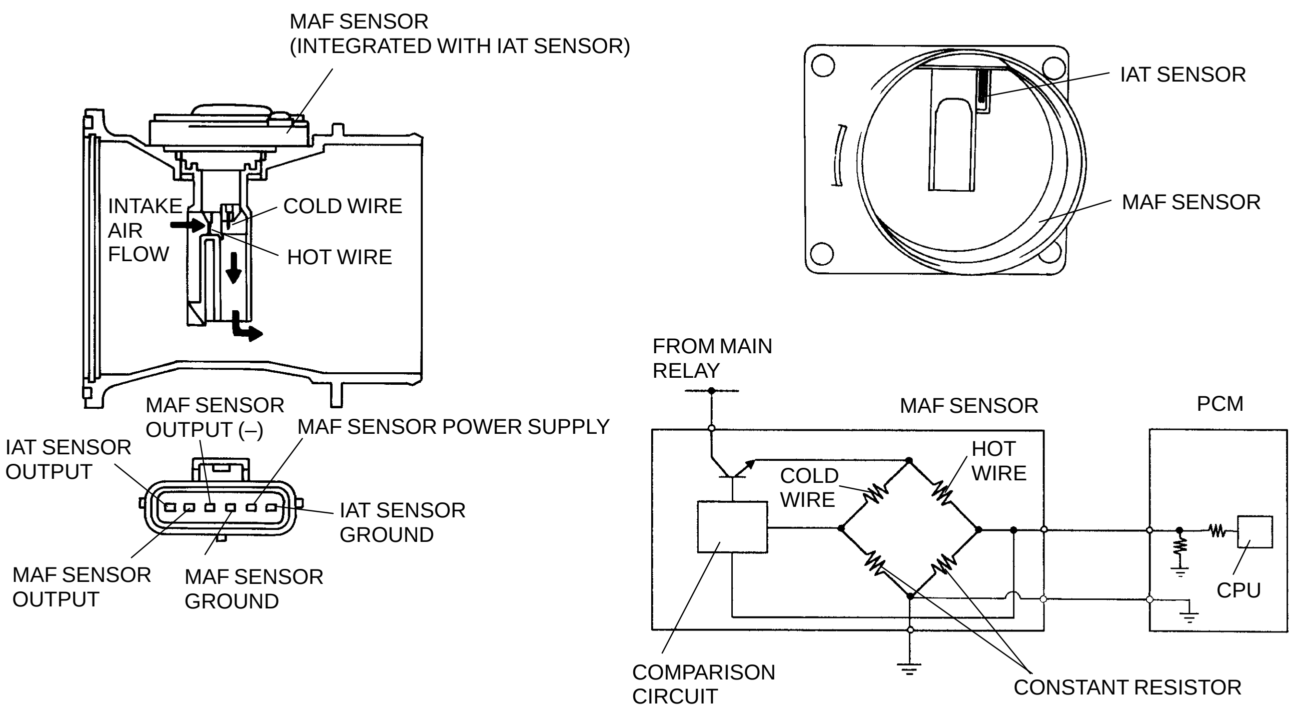
PCM PART SIDE

W6U140SA6

MASS AIR FLOW (MAF) SENSOR DESCRIPTION

YMU140S05

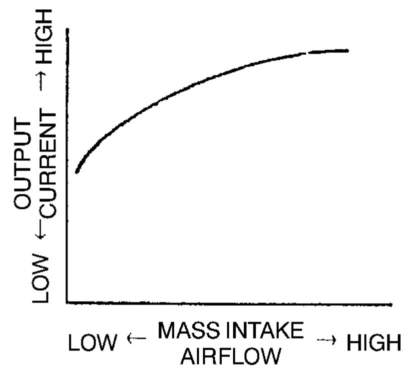
- A hot-wire type MAF sensor is used.
- The MAF sensor has a built-in IAT sensor.



YMU140SA6

Structure and Operation

- The hot wire type MAF sensor detects the mass intake airflow that corresponds to the output current.
- The output current is controlled by the control circuit within the MAF sensor and heats the hot wire so that the temperature difference between the hot wire and the intake air is constant.
- The output current required to maintain the hot wire temperature is proportional to the intake airflow volume. The output current characteristic against the mass intake airflow is as shown in the figure below.
- The cold wire corrects the variation in resistance of the hot wire which is caused by the intake air temperature.



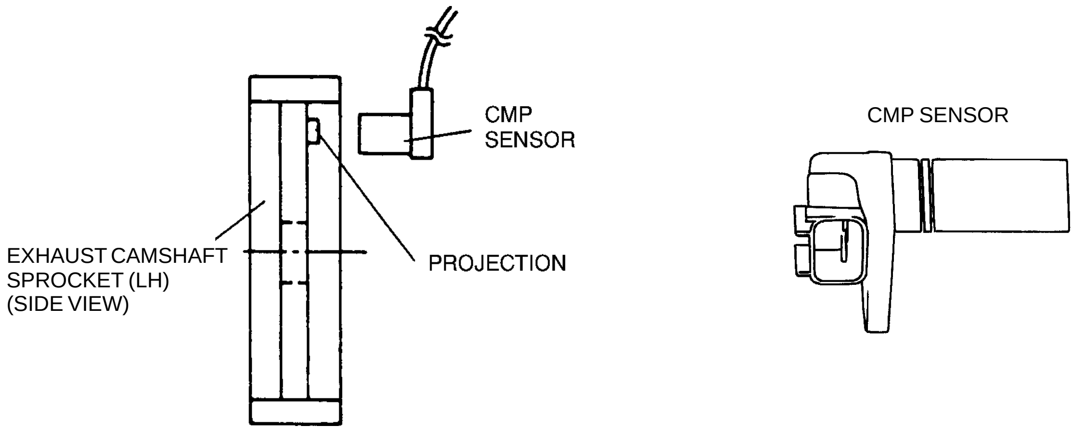
X3U140SF0

CAMSHAFT POSITION (CMP) SENSOR DESCRIPTION

YMU140S06

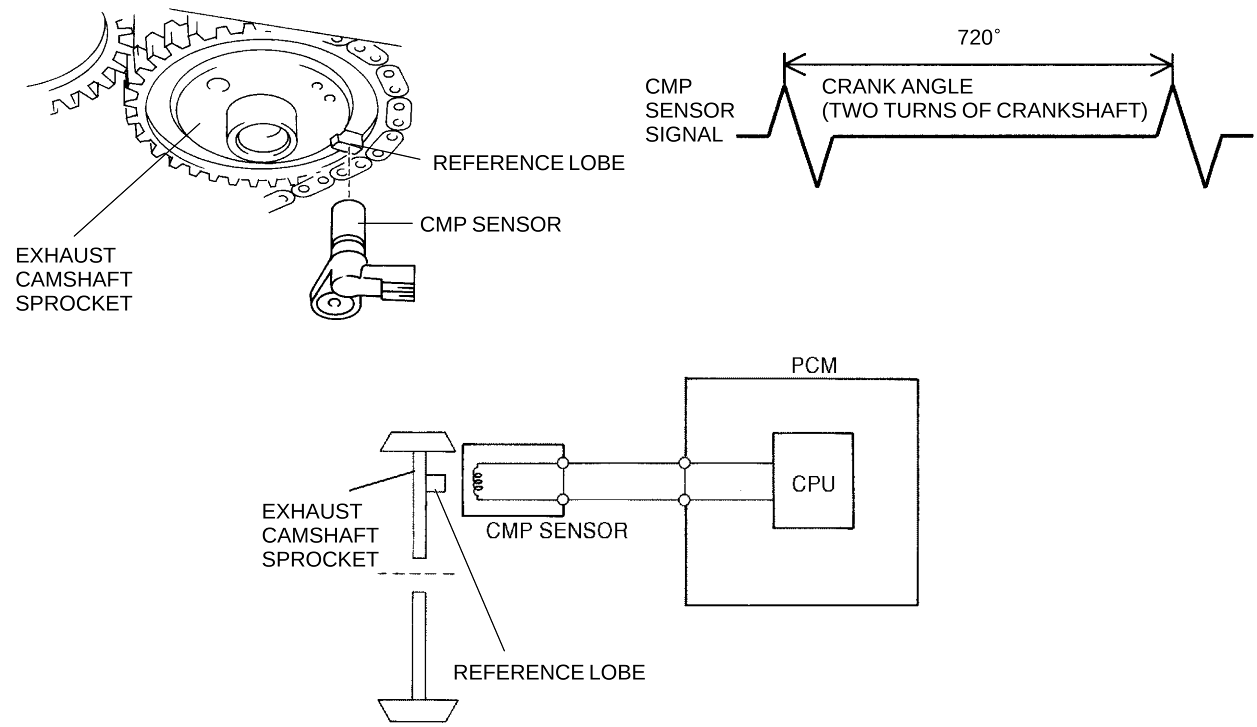
Function

- The inductive type CMP sensor, which is installed to the engine front cover, detects the reference lobe signal on the exhaust camshaft sprocket. The PCM uses this signal to identify TDC of the No.1 cylinder.



YMU140SA7

Structure and Detection Principle
- There is a reference lobe on the exhaust camshaft sprocket. The CMP sensor detects one signal every rotation of the exhaust camshaft sprocket.
- The CMP sensor is an inductive sensor which detects the magnetic force variations caused by the rotating reference lobe and converts these variations into a certain voltage.

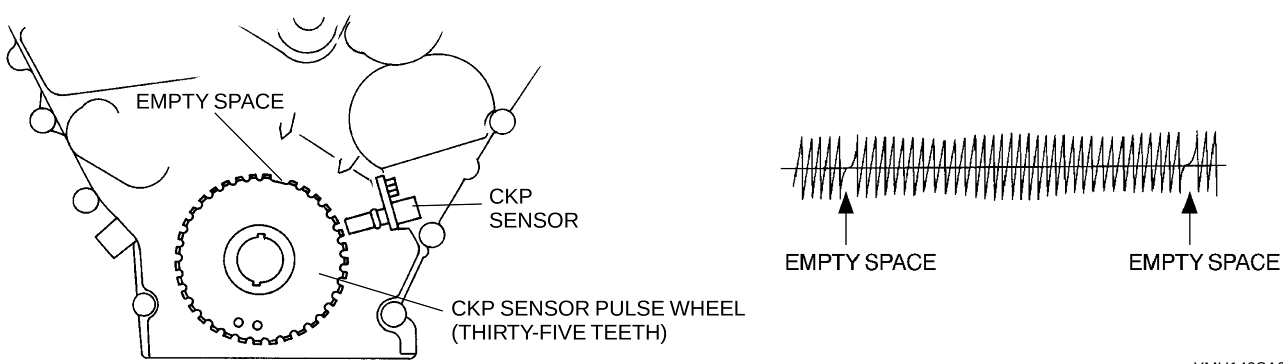


YMU140SA8

CRANKSHAFT POSITION (CKP) SENSOR DESCRIPTION

YMU140S07

Function
- The CKP sensor is located near the crankshaft pulley. It detects the pulley rotation signal (NE signal), and changes the signal into the engine speed. Since the NE signal is detected directly by the projections on the CKP sensor pulse wheel, accuracy is high and is not influenced by timing belt looseness or camshaft pulley misalignment.



YMU140SA9

Structure and Detection Principle
- There are thirty-five teeth, and one spot where a tooth has been removed, spaced ten degrees apart on the plate. The CKP sensor detects seventy alternating current waves every two rotations of the crankshaft. By monitoring the spot where the tooth is missing, the CKP sensor is able to identify the piston travel and synchronize the ignition system.

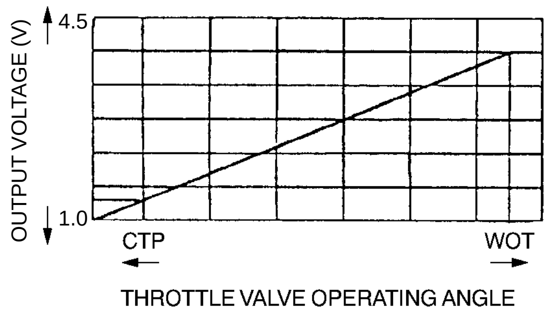
THROTTLE POSITION (TP) SENSOR DESCRIPTION

YMU140S08

- A linear type TP sensor which output voltage is proportional to throttle valve operating angle is used.
- The TP sensor detects the throttle position.

Characteristic

- The output voltage characteristic of TP sensor is as shown.

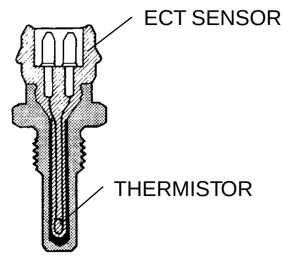


X3U140F3

ENGINE COOLANT TEMPERATURE (ECT) SENSOR DESCRIPTION

YMU140S09

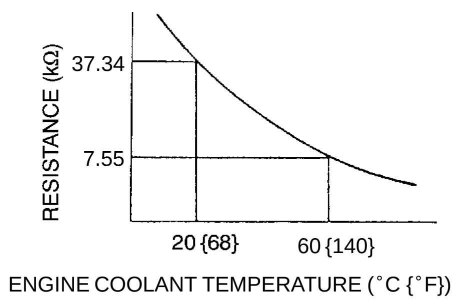
- ECT sensor detects the engine coolant temperature.



YMU140SAA

Characteristic

- The resistance characteristic of the ECT sensor is as shown.

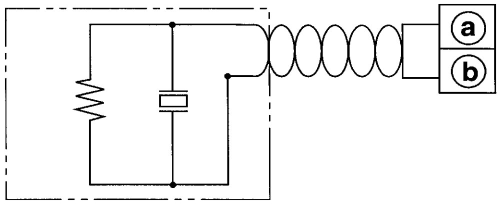


YMU140SC2

KNOCK SENSOR DESCRIPTION

YMU140S12

- A two-terminal type of knock sensor is used. The signal and ground lines through which the knocking signal is sent to the PCM are crossed in order to prevent the affect of noise.
- A piezoelectrical type knock sensor (which utilizes the piezo electric effect) is used.



YMU140SAC

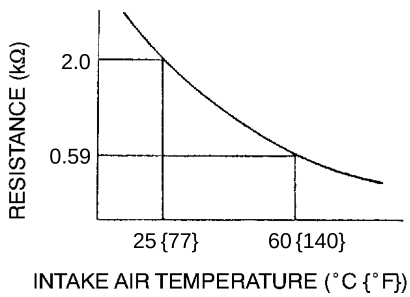
INTAKE AIR TEMPERATURE (IAT) SENSOR DESCRIPTION

YMU140S10

- The IAT sensor detects the intake air temperature.
- The IAT sensor is integrated into the MAF sensor.

Characteristic

- The resistance characteristic of the IAT sensor is as shown.



YMU140SAB

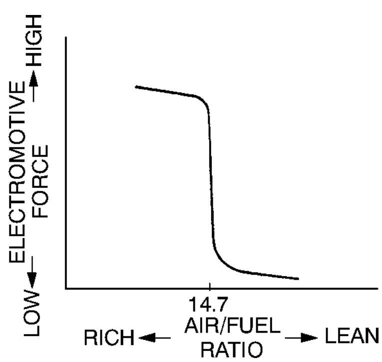
HEATED OXYGEN SENSOR (HO2S) DESCRIPTION

YMU140S11

- The HO2S is equipped with a heater to provide constant detection of oxygen concentration in the exhaust gas even when exhaust gas temperature is low.
- The principle of the solid electrolyte oxygen density battery is applied to this sensor.
- The signal from the front HO2S indicates how rich/lean the engine is operating and serves as an input to the oxygen sensor monitor. The signal from the rear and middle HO2S shows how the catalytic converter is operating and is used as a signal to the catalyst effiiciency monitor.

Characteristic

- The current producing characteristic of the HO2S sensor is as shown.



X3U140SF7

EGR BOOST SENSOR DESCRIPTION

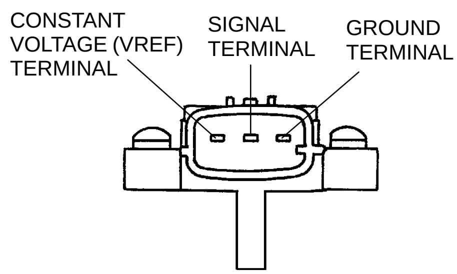
YMU140S13

- The EGR boost sensor (BARO sensor) convert the intake manifold pressure into the voltage values, and outputs the voltage values to the PCM.
- The EGR boost sensor is used to monitor the EGR flow from the EGR valve into the intake manifold. The EGR boost sensor detects the pressure differential of intake manifold when the EGR valve is forced open or closed. When the pressure difference is not within specification during 2 continuous drive cycles, insufficient or excessive EGR flow is indicated by illuminating MIL, and DTC will be stored.

Operation

- The PCM controls the EGR boost sensor solenoid valve depending on the EGR monitoring condition.

Condition	Valve operation	Item measured
EGR monitor stopped	OFF	Barometric pressure
EGR monitor executed	ON	EGR pressure

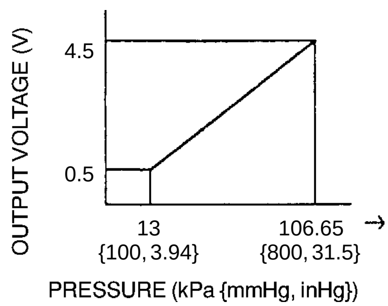


EGR BOOST SENSOR (BARO SENSOR)

YMU140SAD

Characteristic

- The output characteristic of the EGR boost sensor is as shown.

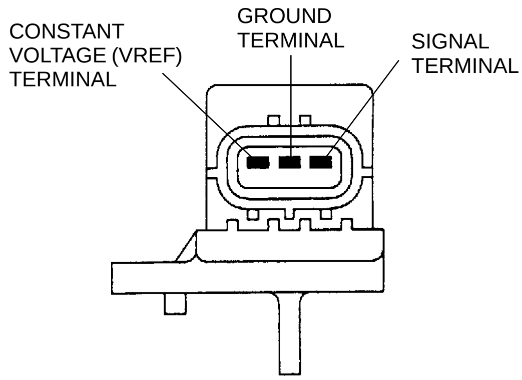


YMU140SAE

FUEL TANK PRESSURE SENSOR DESCRIPTION

YMU140S14

- The fuel tank pressure sensor detects the fuel tank pressure.
- The fuel tank pressure sensor converts pressure into voltage.
- The fuel tank pressure sensor is used to determine if there are any evaporative gas leaks in the evaporative system. The fuel tank pressure sensor detects the evaporative gas leaks by measuring the change in vacuum when vacuum is applied to the fuel tank and evaporative system and its vacuum is shut in the evaporative system during the drive cycle.

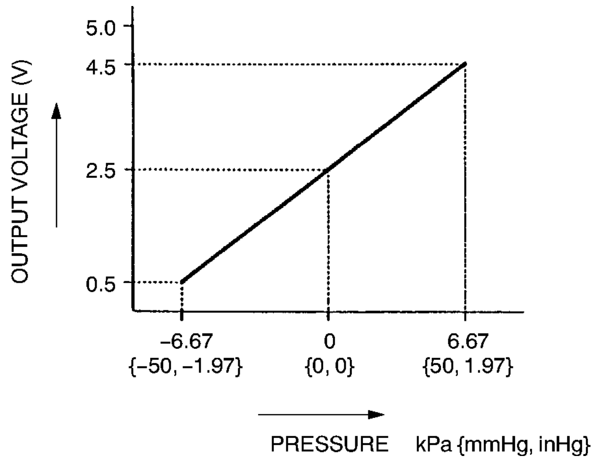


FUEL TANK PRESSURE SENSOR

YMU140SAF

Characteristic

- The output characteristic of the fuel tank pressure sensor is as shown.

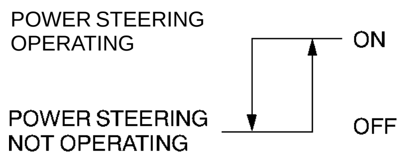


POWER STEERING PRESSURE (PSP) SWITCH DESCRIPTION

YMU140S15

- The PSP switch detects the power steering operation by variation of the fluid pressure in the power steering oil pump.

Operation
- The PSP switch is turned on when the oil pressure in the power steering pump reaches the actuation pressure point by turning the steering wheel. The switch is then turned off when the oil pressure has dropped to a certain level.



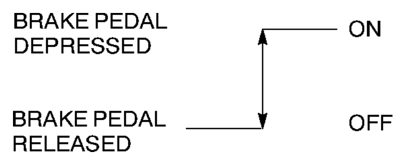
X3U140SFB

BRAKE SWITCH DESCRIPTION

YMU140S16

- The brake switch detects the brake pedal depressed/released condition.

Operation
- The brake switch operates as shown.

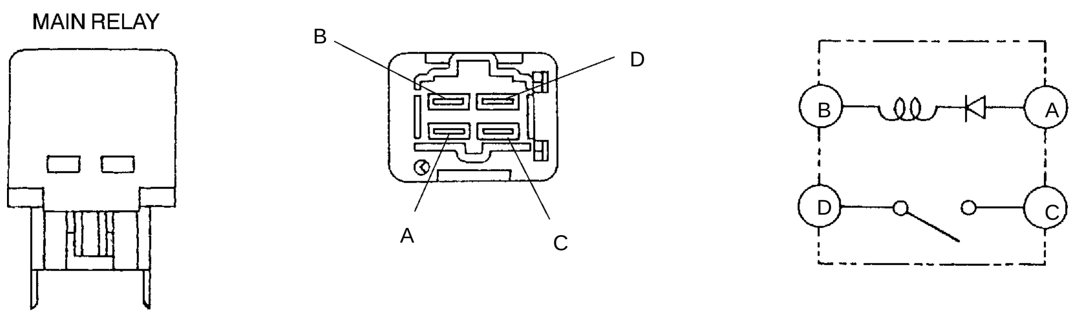


YMU140SFC

MAIN RELAY DESCRIPTION

YMU140S17

- The main relay controls power to PCM when the ignition switch is turned ON/OFF.



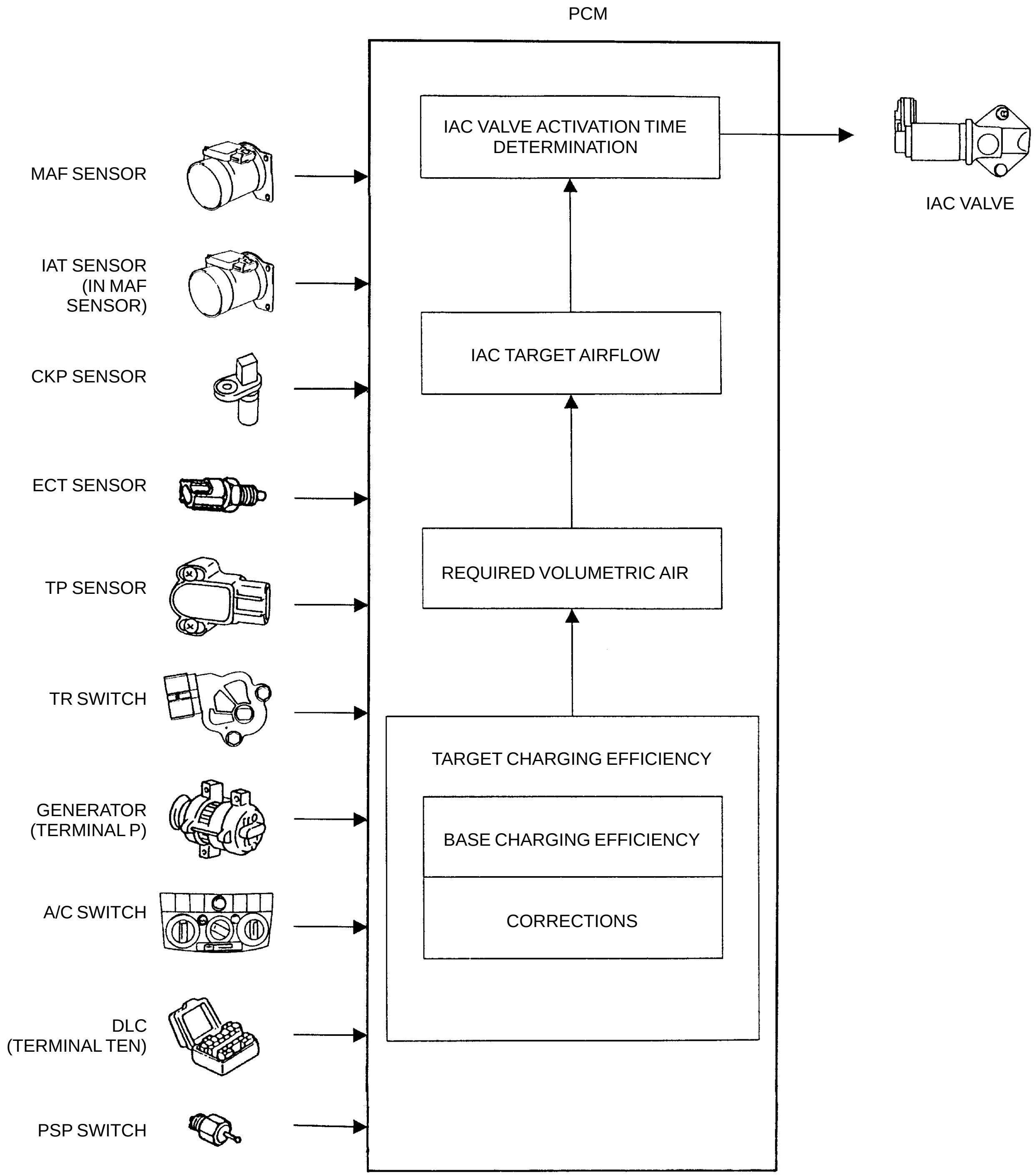
X3U140SFF

IDLE AIR CONTROL (IAC) OUTLINE

YMU140S18

- Idle air control stabilizes idle speed by supplying the optimum amount of air (which bypasses the throttle valve) to the engine according to its operating condition. Based on the signals from the input sensors shown in the figure below, the PCM detects the engine operating conditions and controls idle speed by activating the IAC valve. (Refer to 01–13–4 THROTTLE BODY DESCRIPTION.)

Block Diagram



YMU140SAG

IDLE AIR CONTROL (IAC) DESCRIPTION

YMU140S19

IAC Valve Activation Time Determination

- The PCM calculates the amount (IAC target airflow) of air required to stabilize idle speed, and determines the duty signal to the IAC valve.
- The IAC valve receives the signal and moves the plunger in the solenoid valve. By changing the area of the opening, the idle speed is kept at the target idle speed.
- When the ignition switch is turned ON, the IAC valve activation time is kept at the minimum value and the IAC valve is closed for both starting and normal control.

IAC Target Airflow

- IAC target airflow is obtained by subtracting the estimated airflow that does not pass through the IAC valve (air that leaks from spaces in the throttle valve) from the airflow required to stabilize idle speed (requested air volume).

Required Volumetric of Air

- Required amount of air is calculated by supplementing either the change in airflow based on the “target charging efficiency”, or the change in airflow density that results from the change in air temperature.

Target Charging Efficiency

- Target charging efficiency refers to the charging efficiency*[1] required according to each engine load condition.
- Target charging efficiency is calculated by adding corrections to the base charging efficiency determined according to engine coolant temperature.

*[1] : Charging efficiency is the ratio of airflow to the maximum airflow of the cylinder. This value increases as engine load increases.

Corrections

Correction	Purpose	Condition	Amount of correction
A/C load correction	Prevent drop in engine speed during A/C operation	A/C operation	A/C operation → correction
P/S load correction	Prevent drop in engine speed during P/S operation	P/S operation	P/S operation → correction
Electrical load correction	Prevent drop in engine speed during operation of electrical loads	Idling or driving	Electrical load increases → correction increases
Coasting clutch engagement increase correction	Reduce shock during coasting clutch (in transaxle) engagement	Coasting clutch engagement, according to vehicle speed	Vehicle speed increases → correction increases
Fuel cut recovery decrease correction	Reduce shock during fuel cut recovery	In deceleration fuel cut zone, decrease by set amount	In deceleration fuel cut zone → correction by set amount
Accelerate warm up correction	Accelerate activation of catalytic converter	Idling when engine speed > 1000 rpm and atmospheric pressure > 72.0 kPa {540 mmHg, 21.3 inHg}, according to engine coolant temperature	ECT decreases → correction increases
D range correction	Prevent drop in engine speed during shift into D position	Input of D range signal (TR switch)	Difference between engine speed and turbine speed signal decreases → correction increases
Dashpot correction	Prevent drop in engine speed caused by insufficient air during acceleration	Deceleration	Engine speed increases → correction increases
Starting correction	Prevent drop in engine speed during starting	Cranking or just after engine start	ECT increases → correction increases
Warm restart correction	Prevent drop in engine speed during warm restarting	Cranking when water temperature above 60 °C {140 °F}	IAT above 60 °C {140 °F} → increases correction
Closed loop correction A	Make engine speed approach target engine speed	Engine speed while idling (vehicle stopped) > target engine speed, or condition below (with engine speed above 300 rpm)	Below target engine speed → increase correction Above target engine speed → decreased correction

Correction	Purpose	Condition	Amount of correction
Closed loop correction B	When engine speed drops, make engine speed approach target engine speed in zone where closed loop correction A cannot compensate	Engine speed below target engine speed during deceleration (with engine speed above 300 rpm) and when closed loop correction A not active	Difference between engine speed and target engine speed increases → correction increases
Learning correction	Memorize change in air intake amount caused by differences in each engine and change that occurs over time, and gives closed loop	Idling when ECT above 80 °C {176 °F} and IAT below 75 °C {167 °F} (during closed loop correction A)	During idling → average value of closed loop correction A

Target speed

Load condition	P, N position	Except P, N position
A/C operation	850	850
During electrical load *1	750	700
Power steering operating	750	750

*1 : When headlights, rear defroster, blower fan (level two or higher), cooling fan, and condenser fan are all operated.

Prohibition Condition

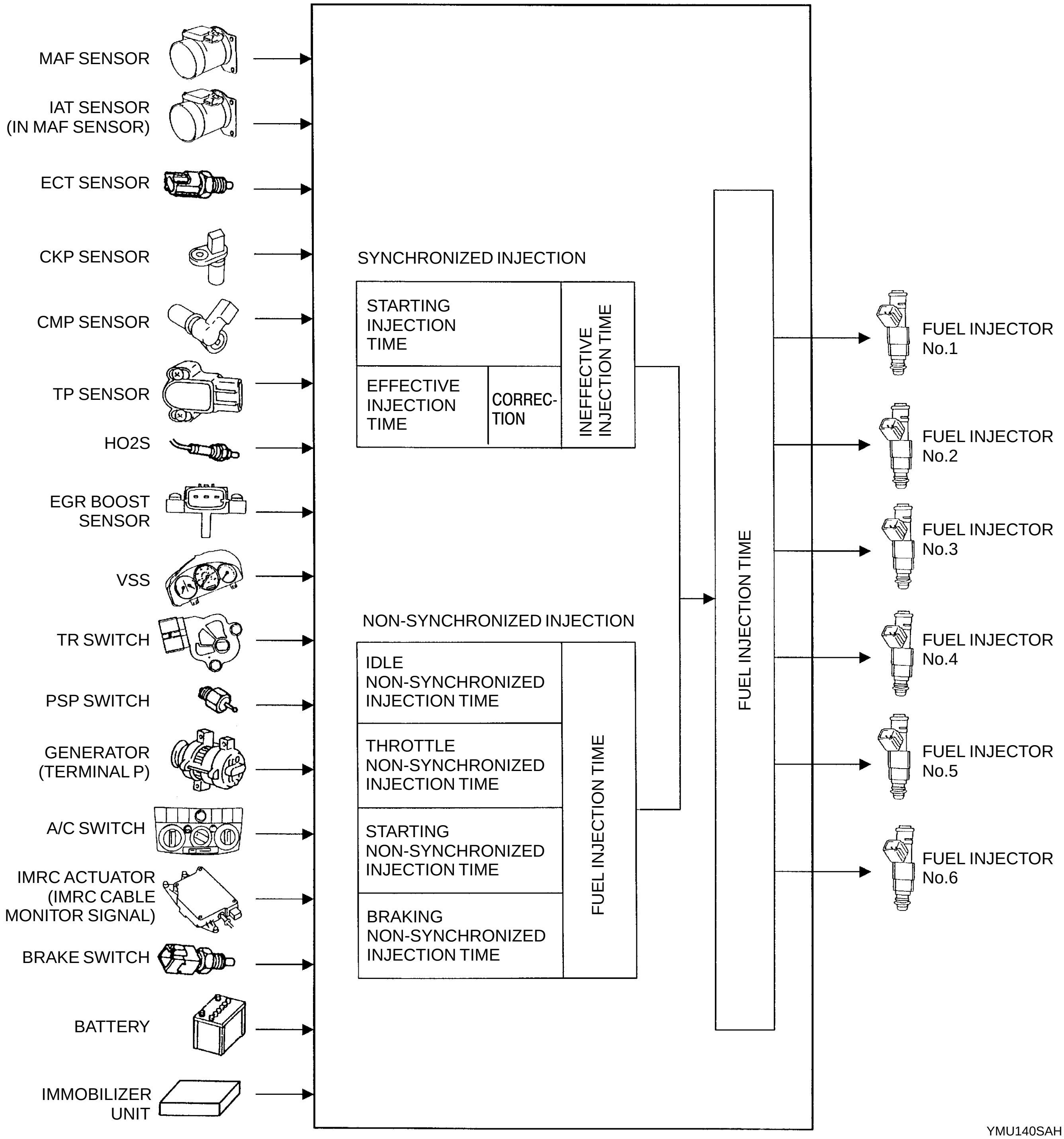
- When IAC valve malfunctions (open or short IAC valve related circuit), engine flare-up during idling is prevented by cutting the power supply to IAC valve (IAC valve is closed). Air intake at this time comes merely from air leaking through the throttle valve passage.

FUEL INJECTION CONTROL OUTLINE

YMU140S20

- Fuel injection control varies injector pulse width (injection time) according to mass intake airflow amount signals and engine speed signals from the CKP sensor, based on the program stored in the PCM memory.
- To obtain the most efficient pulse width (injection time), fuel injection control applies corrections according to the engine operating conditions and load conditions detected by various sensors.
- There are two types of injection timing control; The synchronized injection (simultaneous injection of all cylinders or sequential injection) according to engine speed, and the non-synchronized injection according to engine load conditions.

Block Diagram



YMU140SAH

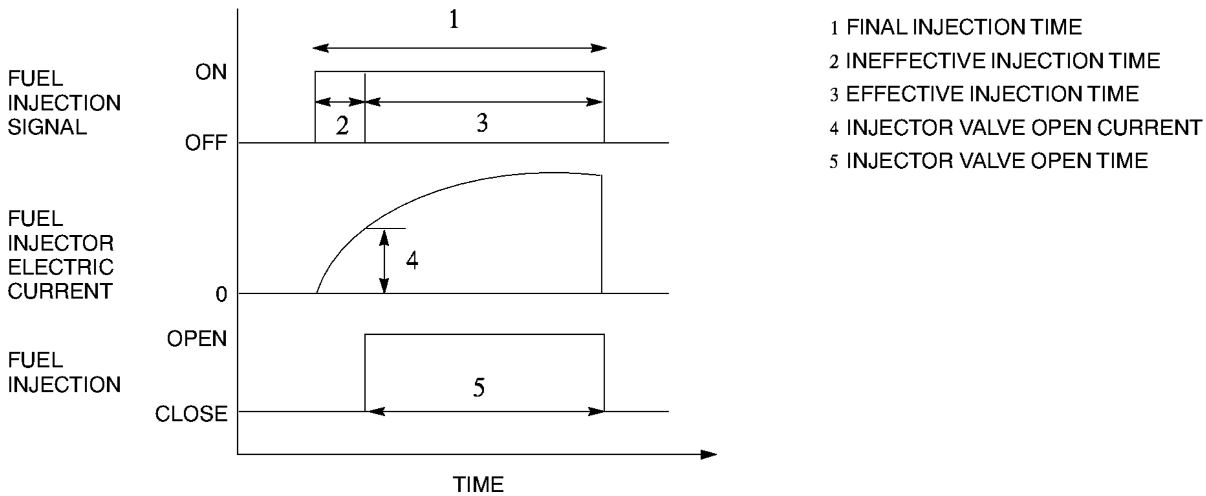
FUEL INJECTION CONTROL DESCRIPTION

YMU140S21

Fuel Injection Time

Outline of control

- The PCM controls the injection time to obtain the theoretical air/fuel ratio (stoichiometric) at all engine operation ranges according to engine operating condition.



X3U140SFY

Final injection time

- Final injection time is calculated using the following formula:

Formula

Final injection time	=	Effective injection time	+	Ineffective injection time

X3U140SFZ

- Injection in response to the PCM signal is delayed by initial current delay due to inductance, the weight of the needle valve and the plunger, and the resistance of the spring. This delay in injection is called “ineffective injection time”.
- Ineffective injection time varies with fluctuations in battery positive voltage and is corrected according to the battery positive voltage.
- Effective injection time is calculated using the following formula:

Formula

Effective injection time	=	Basic injection time	×	Correction coefficients

X3U140SG0

- Basic injection time is calculated using the following formula:

Formula

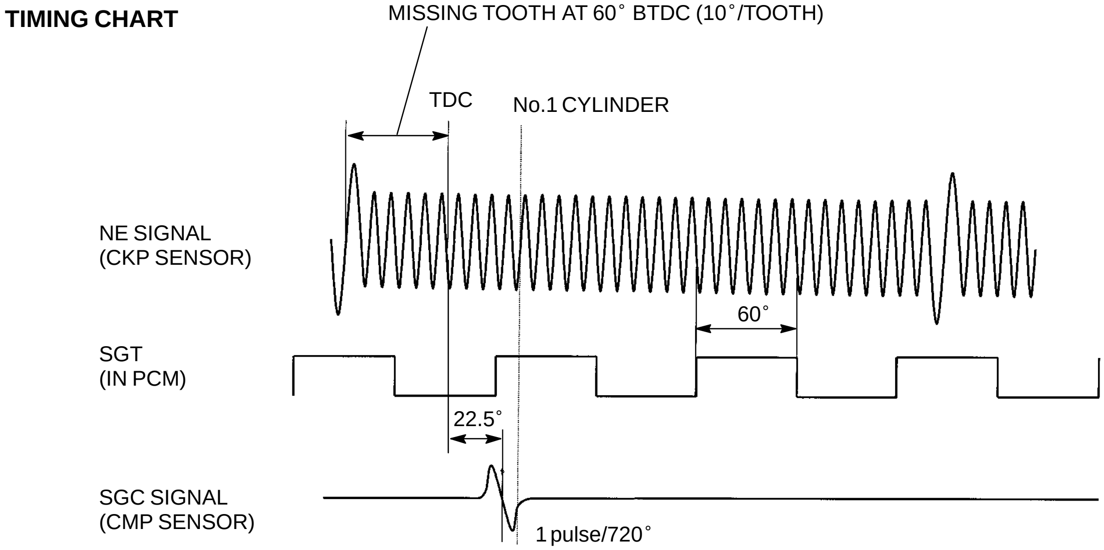
Basic injection time	=	Charging efficiency	×	Fuel flow coefficient

X3U140SG1

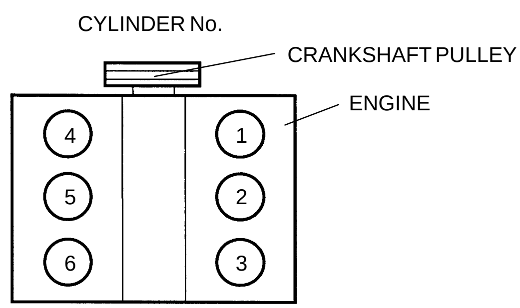
- Charging efficiency indicates the ratio of the air capacity in the cylinder and the actual intake air amount, and is calculated by the intake air amount detected by the MAF sensor.
- Charging efficiency varies with the engine operating conditions.
- Fuel flow coefficient is the calculated fuel injection time so that the optimum air/fuel ratio is always obtained. The effective injection time is roughly calculated by the charging efficiency and the fuel flow coefficient.
- Fuel flow coefficient is calculated by the fuel injection amount and the fuel pressure.
- The correction coefficients are applied according to the ECT, IAT, and engine load. The correction coefficients vary with the control zone.

Fuel Injection Timing
Outline of control

- There are two types of injection timing, “synchronized timing” and “non-synchronized timing”. Synchronized timing describes fuel injected at a preset timing. Non-synchronized timing describes fuel injected when certain conditions are satisfied regardless of the crankshaft’s position.



YMU140SAJ

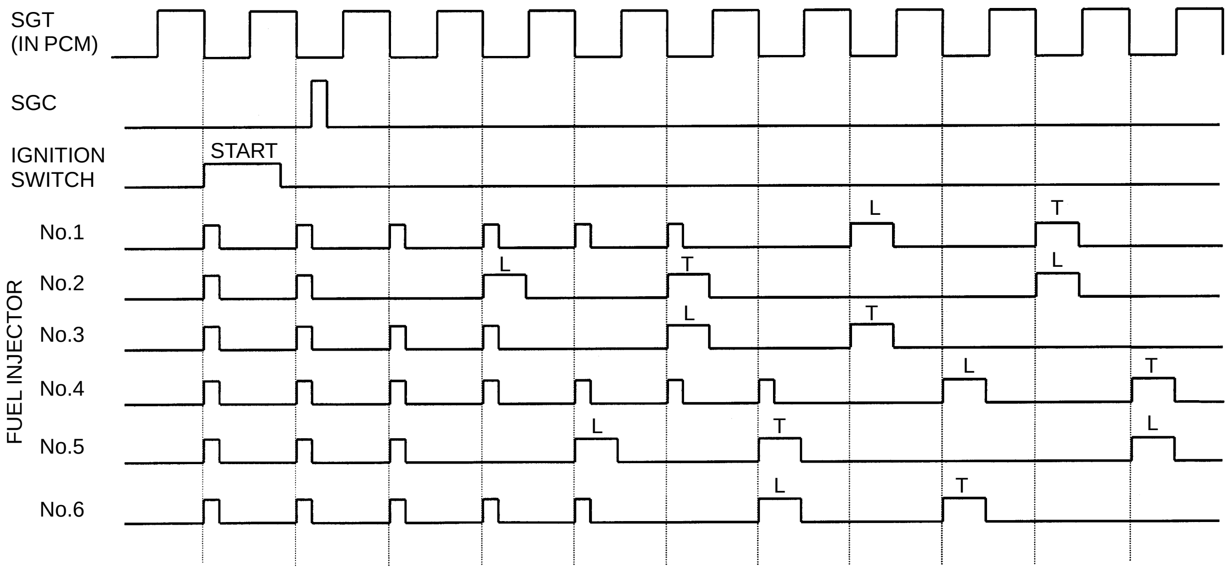


YMU140SC5

Synchronized injection

1. When a cylinder is not identified, synchronize fuel injection takes place at the end of the SGT (in PCM) signal.
2. When a cylinder is identified, synchronize fuel injection takes place at the start of the SGT (in PCM) signal. Sequential injection, in which fuel is injected two times (leading injection and trailing injection) to divide fuel injection amount, has been used.

TIMING CHART



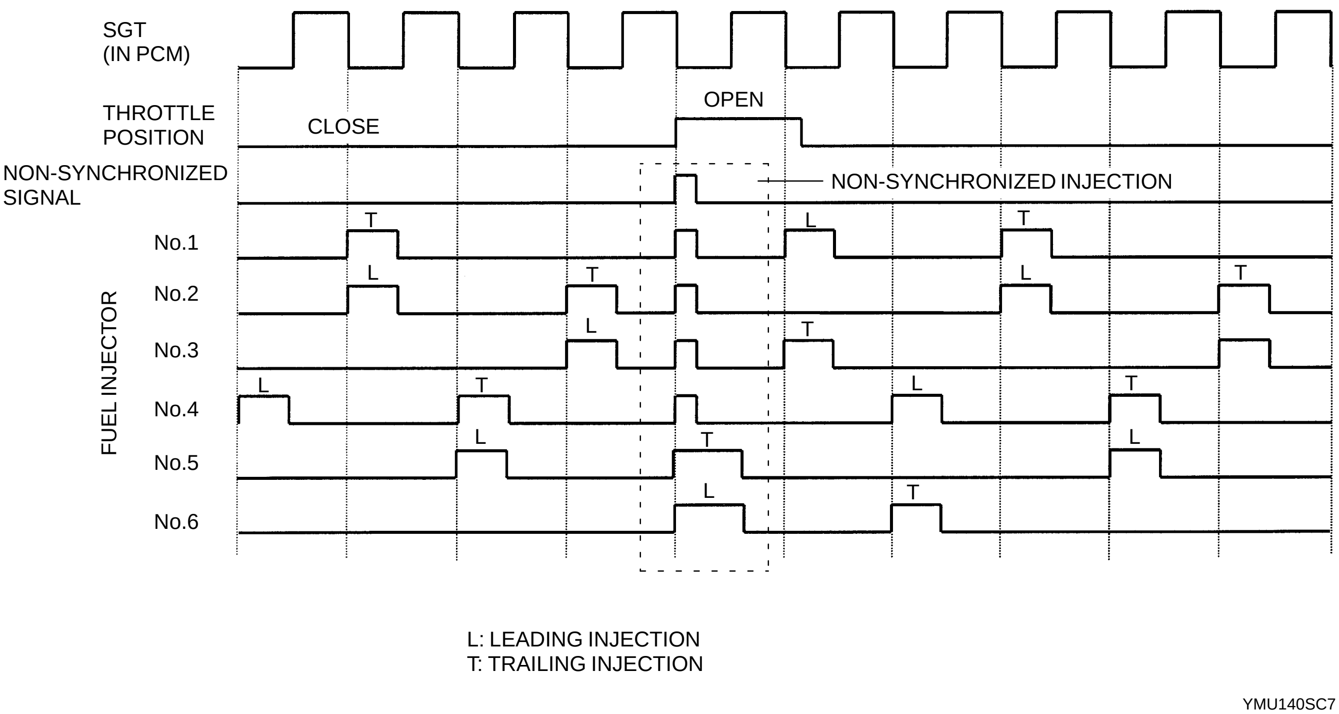
L: LEADING INJECTION
T: TRAILING INJECTION
OTHERS: INJECTION BEFORE CYLINDER IDENTIFICATION SIGNAL IS DETECTED

YMU140SC6

Non-synchronized injection

- There are the following types of non-synchronized control:
  - Idle non-synchronized control
    - When the TP is closed position, all cylinders are simultaneously injected for a certain period of time according to engine coolant temperature.
  - Throttle non-synchronized control
    - When the throttle opening angle variation rate exceeds a specified value, fuel is simultaneously injected to all cylinders for a certain period of time according to ECT.
  - Starting non-synchronized injection
    - All cylinders are simultaneously injected with fuel when the engine is cranked (started) and a set amount of time has passed. The injection amount is determined according to the ECT.
  - Braking non-synchronized injection
    - All cylinders are simultaneously injected with fuel during braking deceleration after engine warm up and when the drop in turbine speed is large.

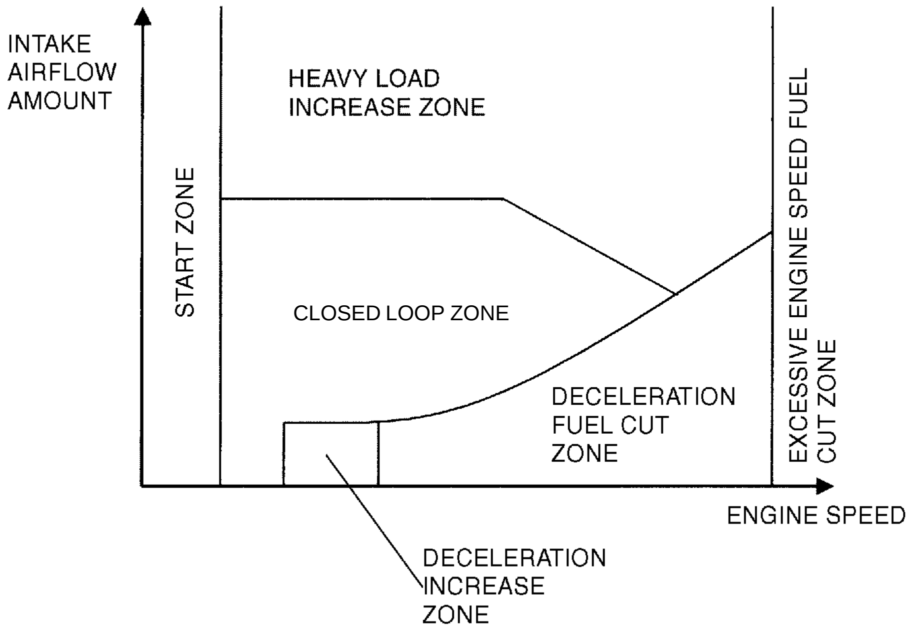
TIMING CHART



Control Zones

Operation outline

- The PCM controls effective injection time by dividing engine operation into six zones according to engine conditions and load.



YMU140SAL

1. Start zone

- The purpose of this zone is to maintain startability.
- The definition of the start zone is that the engine speed is below 500 rpm when cranking.
- The final injection time in start zone is calculated by the ECT, engine speed and barometric pressure.
- When the throttle valve is fully opened, the final injection timing is set to 0 sec. and fuel injection is stopped (dechoke control).

2. Excessive engine speed fuel cut zone

- The purpose of these zones is for engine protection and safety driving.
- The excessive engine speed fuel cut zone is for when engine speed is above 6,700 rpm.
- Fuel injection resumes when the engine speed has dropped below 6,600 rpm.
- To prevent overheating, the fuel cut function also activates when there is no load and engine speed stays above 2,400 rpm for two minutes.

3. Deceleration fuel cut zone

- The purpose of this zone is to improve fuel economy and prevent overheating of the TWC.
- The deceleration fuel cut zone is determined by the engine speed, and load condition during deceleration with the throttle valve fully closed.

4. Deceleration increase zone

- The purpose of this zone is to improve drivability during deceleration.
- The control system enters this zone when all of the following conditions are met:
  - Throttle valve is fully closed
  - Shift lever is in D, 1 or 2 range
  - Control is in other than deceleration fuel cut zone
- The correction coefficients for this zone are calculated using the following formula:

Formula

Correction coefficients = **Warm-up correction** ± **Deceleration correction** + **Load correction** ± **Learning correction**

YMU140SAM

5. Heavy load increase zone

- The purpose of this zone is to improve drivability under heavy load condition.
- The control system enters heavy load increase zone when either of the following conditions is met:
  - Throttle opening angle is above specified value
  - Charging efficiency exceeds a specified level
  - Engine speed is above 4,500 rpm
- The correction coefficients in the heavy load increase zone are calculated using the following formula.

Formula

$$\boxed{\text{Correction coefficients}} = \boxed{\text{Fuel injection volume increase correction after start}}$$
$$+ \left(\boxed{\text{Basic heavy load increase correction}} \text{ or } \boxed{\text{Warm-up correction}} \right)$$
$$+ \boxed{\text{Load correction}} + \boxed{\text{D range correction}} \pm \boxed{\text{Acceleration/deceleration correction}}$$
$$+ \boxed{\text{IMRC increase correction}} \pm \boxed{\text{Learning correction}}$$

YMU140SAN

- When both warm-up correction and basic heavy load increase correction are required, the one that requires the larger correction will be carried out.

6. Closed loop zone

- The purpose of this zone is to improve fuel economy and to reduce exhaust emissions level.
- The control system is in the closed loop zone when it is in other than the above-mentioned.
- The correction coefficients in the feedback zone are calculated using the following formula.

Formula

$$\boxed{\text{Correction coefficients}} = \boxed{\text{Fuel injection volume increase correction after start}} + \boxed{\text{Warm-up correction}}$$
$$+ \boxed{\text{D range correction}} + \boxed{\text{Load correction}}$$
$$\pm \boxed{\text{Basic closed loop correction}} \pm \boxed{\text{Learning correction}}$$

YMU140SAP

Corrections

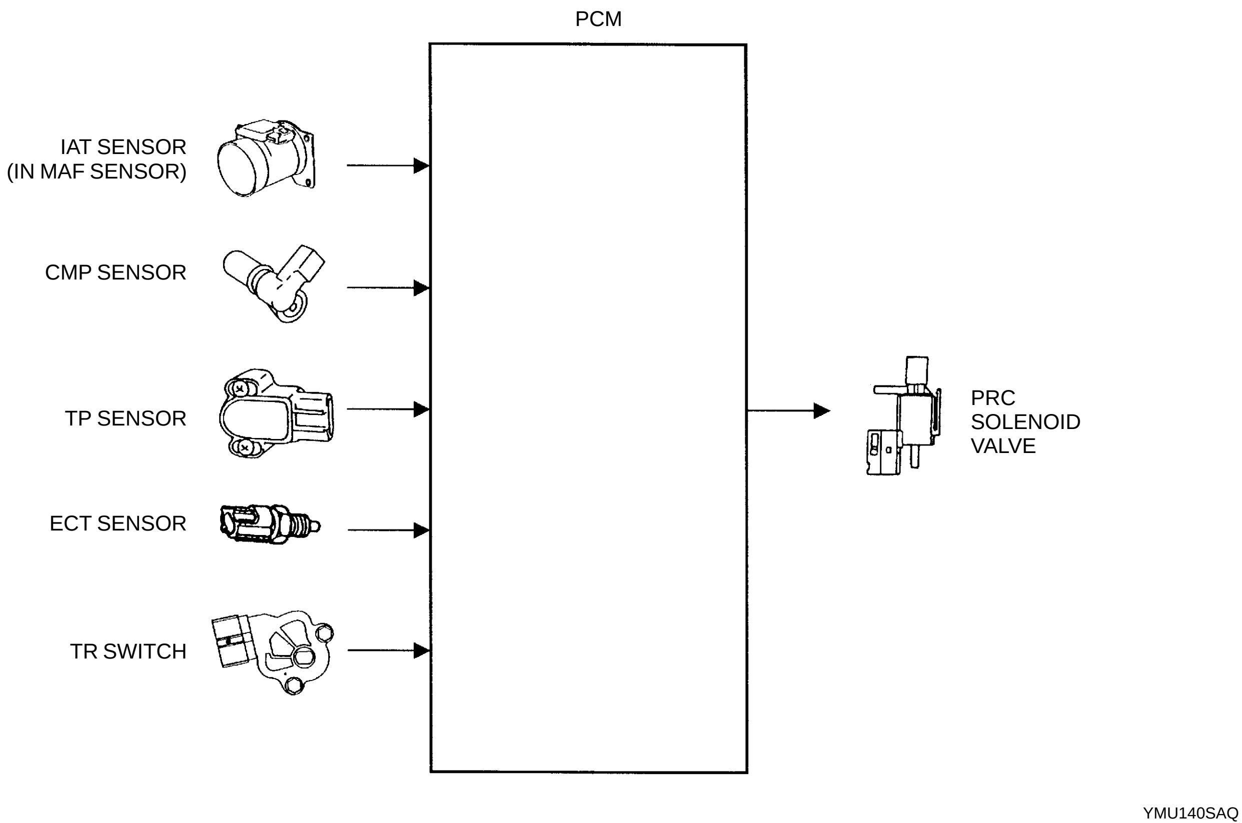
Correction	Purpose	Conditions	Action
Fuel injection volume increase correction after start	To maintain engine speed stability after start	Certain period after start determined by ECT	Lower ECT: Larger correction
Warm-up correction	To maintain drivability during warm-up	According to ECT	Lower ECT: Larger correction
Load correction	To maintain engine stability when load is applied	According to engine coolant temperature when P/S or A/C is operated	Load applied: Larger correction
Basic heavy load increase correction	To maintain drivability under heavy load	As required by engine load and engine speed under heavy load	—
Basic closed loop correction	To control air/fuel ratio close to stoichiometric	When control is in closed loop zone	—
Learning correction	To deal with change in air/fuel ratio caused by aging	At all times	—
D range correction	To maintain engine speed stability when shifting to D range	According to ECT at D range shift	Lower ECT: Larger correction
Acceleration/deceleration correction	Corrects change in air-fuel ratio during deceleration or acceleration when engine is cold	According to ECT	Lower ECT: larger correction
IMRC increase correction	Corrects air-fuel ratio (makes it rich) when IMRC is operating	According to engine speed and charging efficiency when IMRC system is operating	High engine speed: larger correction Larger charging efficiency: larger correction

PRESSURE REGULATOR CONTROL (PRC) OUTLINE

YMU140S22

- In order to improve startability and idle stability, the pressure regulator control cuts the vacuum applied to the pressure regulator during engine starting and for a specific time after starting the engine if the engine is hot.
- The PCM switches the solenoid ON and OFF to change the vacuum or atmospheric pressure applied to the pressure regulator.

Block Diagram



PRESSURE REGULATOR CONTROL (PRC) DESCRIPTION

YMU140S23

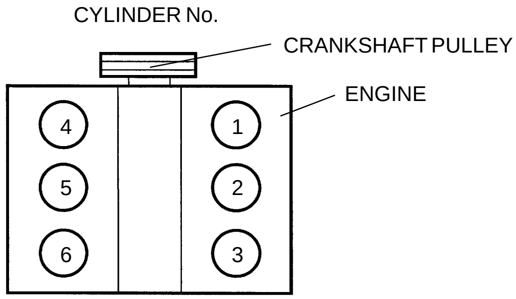
Operation

- The PRC solenoid valve turns ON for 60 seconds after starting the engine when all of the following conditions are met:
  - ECT is above 80 °C {176 °F}
  - IAT is above 75 °C {167 °F}
  - No load is applied or engine is running below 2,500 rpm and throttle valve opening angle is below 37.5%

ELECTRIC SPARK ADVANCE (ESA) CONTROL OUTLINE

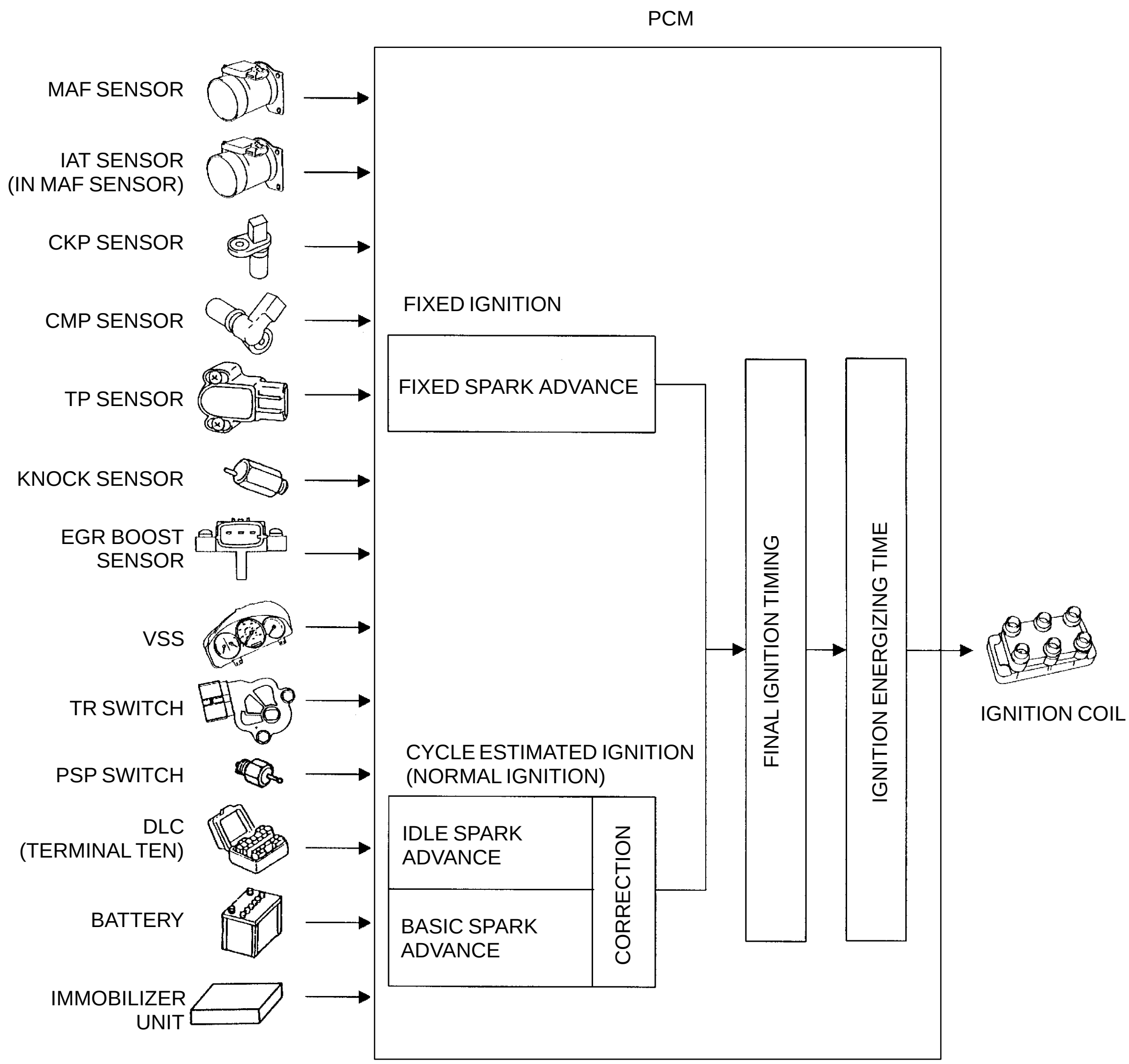
YMU140S24

- Ignition timing is controlled by the PCM for improved fuel economy, idle stability and drivability. The PCM also controls the ignition coil's spark duration.
- The ESA control is broadly divided into three zones: start, idle, and normal driving. The PCM carries out necessary corrections for each zone, decided by engine and load conditions, to determine the final ignition timing and the energization time of the ignition coil.
- The four cylinders ignite in three sets. The No.1 and No.5 cylinders ignite simultaneously, the No.2 and No.6 cylinders ignite simultaneously, and the No.3 and No.4 cylinders ignite simultaneously.



YMU140SC5

Block Diagram



YMU140SAR

ELECTRIC SPARK ADVANCE (ESA) CONTROL DESCRIPTION

YMU140S25

Ignition Timing

Control outline

- The PCM controls the ignition timing to either fixed ignition or cycle estimated ignition (normal ignition) ignition according to the engine operation conditions.

Fixed ignition

- The final ignition timing is fixed at the NE signal trailing edge (BTDC 10°).

Cycle estimated ignition (normal ignition)

- To obtain the optimum ignition timing, the PCM determines the final ignition timing by estimating the next ignition timing according to the engine operation conditions.

Final ignition timing

- The final ignition timing is calculated using the following formula.

Formula

Final ignition timing = **Target ignition timing** ± **ECT spark advance correction** + **EGR spark advance correction**

YMU140SB7

- The target ignition timing is determined by the ECT, IAT and load.
- The ECT spark advance correction is carried out only when engine is cold.
- EGR spark advance correction is carried out only when the EGR control is carried out (EGR valve opening angle is increased) in the normal driving zone.

Energizing Time

- The PCM controls the energization time of the ignition coil according to the estimated final ignition timing and the engine operation conditions.

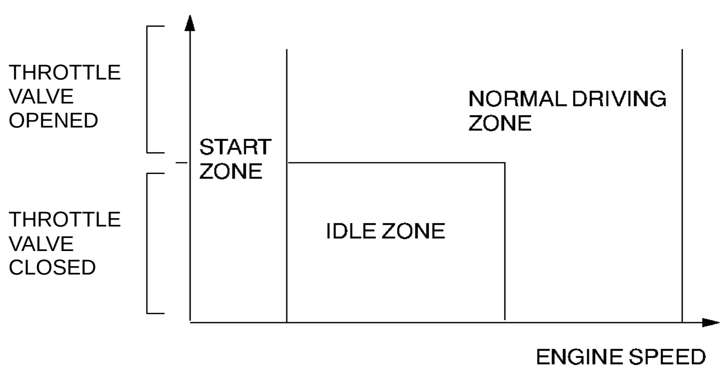
Ignition coil energization time

- The PCM detects the driving condition (constant speed, acceleration or deceleration) based on signals from the CKP sensor and CMP sensor. Ignition coil energizing time signal from the PCM to the igniter in the ignition coil is determined according to the battery voltage and driving condition.
- When the energizing time exceeds the predetermined period, the signal is automatically cut to prevent damage to the transistor caused by continuous energizing to the igniter in the ignition coil.

Control Zones

Control outline

- To obtain the optimum ignition timing control, the PCM divides the ignition timing control into three zones and calculates the final ignition timing according to the engine conditions.



X3U140SFL

1. Start zone

- The definition of the start zone is that the engine speed is below 500 rpm when cranking, or that the MAF sensor is malfunctioning.
- Fixed ignition is applied in the start zone.

2. Idle zone

- The definition of the idle zone is that the engine speed is below a preset level when idling with the throttle valve fully closed.
- Cycle estimated ignition (normal ignition) ignition is applied in the idle zone.
- The target ignition timing in the idle zone is calculated using the following formula.

Formula

Target ignition timing = **Idle spark advance** − **Fuel cut recovery spark retard correction** − **Accelerate warm up spark retard correction**

YMU140SAS

- The idle spark advance is determined by the charging efficiency and the engine speed during idling.
- Charging efficiency varies with the engine operating conditions.

3. Normal driving zone

- The normal driving zone corresponds to the engine driving time without idling.
- Cycle estimated ignition (normal ignition) ignition is applied in the normal driving zone.
- The target ignition timing in the normal driving zone is calculated using the following formula.

Formula

Target ignition timing = **Basic spark advance** − **Shift spark retard correction** − **Acceleration spark retard correction** − **Fuel cut recovery spark retard correction** − **Knocking spark retard correction**

YMU140SAT

- Basic spark advance is determined by the charging efficiency and the engine speed.
- Charging efficiency varies with the engine operating conditions.

Correction

Correction	Purpose	Conditions	Action
EGR spark advance correction	To maintain drivability during EGR operation	According to engine load and engine speed during EGR operation	Higher EGR rate: Larger spark advance
ECT spark advance correction	To maintain engine speed stability when engine is cold	When engine is cold, according to ECT	Lower ECT: Larger spark advance
Knocking spark retard correction	To improve engine reliability	When knocking is detected	Heavy knocking → Large spark retard
Accelerate warm up spark retard correction	Accelerates activation of catalytic converter	According to ECT during 18-second period for engine start when engine speed > 1,000 rpm and atmospheric pressure > 72.0 kPa {540 mmHg, 21.3 inHg}	Lower ECT → Large spark retard
Fuel cut recovery spark retard correction	To prevent shock during fuel cut recovery	When fuel injection is resumed	Fuel injection is resumed: Spark retard
Acceleration spark retard correction	To prevent knocking during sudden acceleration	When sudden acceleration is detected	During sudden acceleration: Spark retard
Shift spark retard correction	To soften shift shock during downshift	During downshift	During downshift: Spark retard

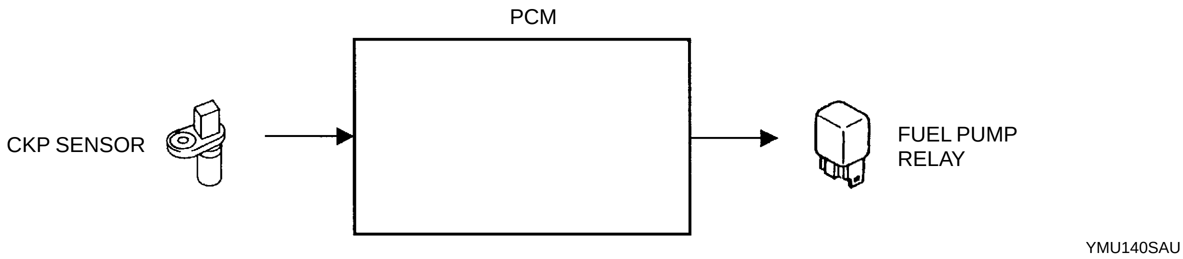
FUEL PUMP CONTROL OUTLINE

YMU140S26

- The fuel pump relay is actuated only after the PCM has detected the NE signal for safety and improved durability of the fuel pump.
- The fuel pump relay can be actuated by either of the following methods:
  - Connect DLC terminals F/P and body GND with a jumper wire and turn the ignition switch ON.
  - Activate the “FP RLY” simulation function on the NGS tester with either the ignition switch ON and engine off, or during idling.

  These methods are used to check the fuel pump relay and fuel pump operation.

Block Diagram



FUEL PUMP CONTROL DESCRIPTION

YMU140S27

Operation

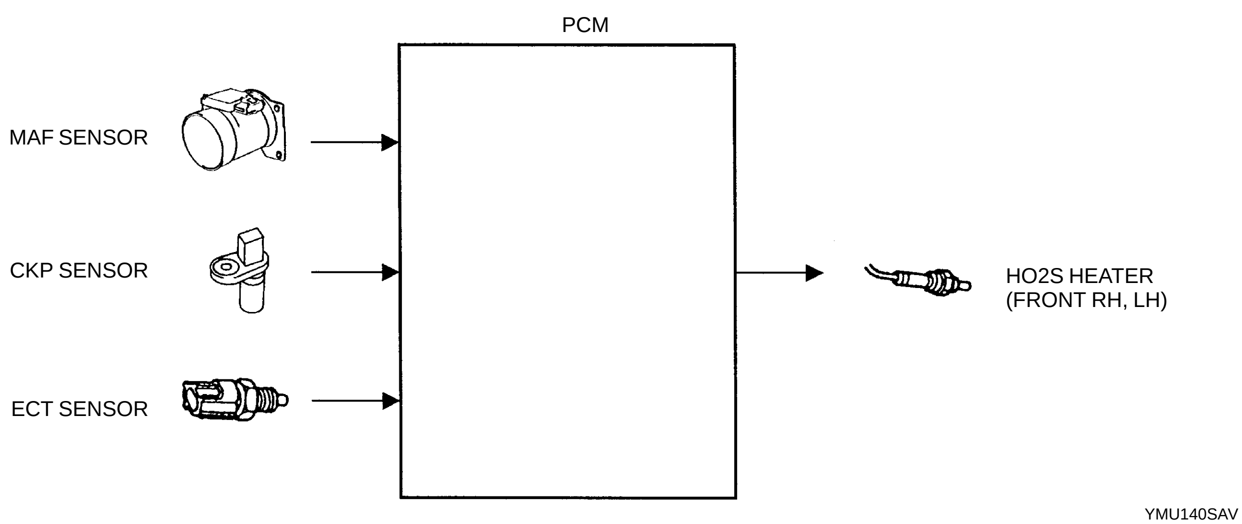
- While the engine is running, PCM terminal 80 (Without immobilizer system), 104 (With immobilizer system) is ON (0 V) and the fuel pump is actuated by the fuel pump relay.
- While the engine is stopped, PCM terminal 80 (Without immobilizer system), 104 (With immobilizer system) is OFF (B+) and the fuel pump is not actuated.

HEATED OXYGEN SENSOR (HO2S) (FRONT) HEATER CONTROL OUTLINE

YMU140S28

- The PCM sends the duty signals to the heater.
- Heater control has three levels: 0%, 30% and 100%-duty values.

Block Diagram



HEATED OXYGEN SENSOR (HO2S) (FRONT) HEATER CONTROL DESCRIPTION

YMU140S29

Operation

- HO2S heater is controlled by the PCM as follows:

Duty value 0%

- The PCM cuts power supply to the heater circuit at high engine speeds and under heavy loads, and while an HO2S heater malfunction is detected.

Duty value 100%

- When the engine is started after being allowed to cool sufficiently (ECT 10—30 °C {50—86 °F}), the HO2S heater is run at a duty value of 100% for 15 seconds.

Duty value 30%

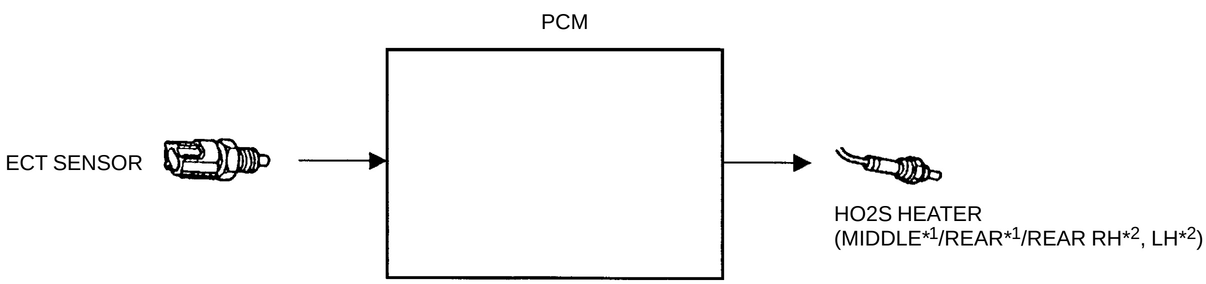
- The PCM runs the HO2S heater at a duty value of 30% under all driving conditions other than the above.

HEATED OXYGEN SENSOR (HO2S) (MIDDLE/REAR) HEATER CONTROL OUTLINE

YMU140S30

- Heater control is adopted to activate the HO2S (Middle*1/Rear*1/Rear RH*2, LH*2) even when exhaust gas temperature is low.
- The PCM controls turning the heater ON and OFF.

Block Diagram



*1: FEDERAL EMISSION REGULATION APPLICABLE MODELS
*2: CALIFORNIA EMISSION REGULATION APPLICABLE MODELS

YMU140SAW

HEATED OXYGEN SENSOR (HO2S) (MIDDLE/REAR) HEATER CONTROL DESCRIPTION

YMU140S31

Operation

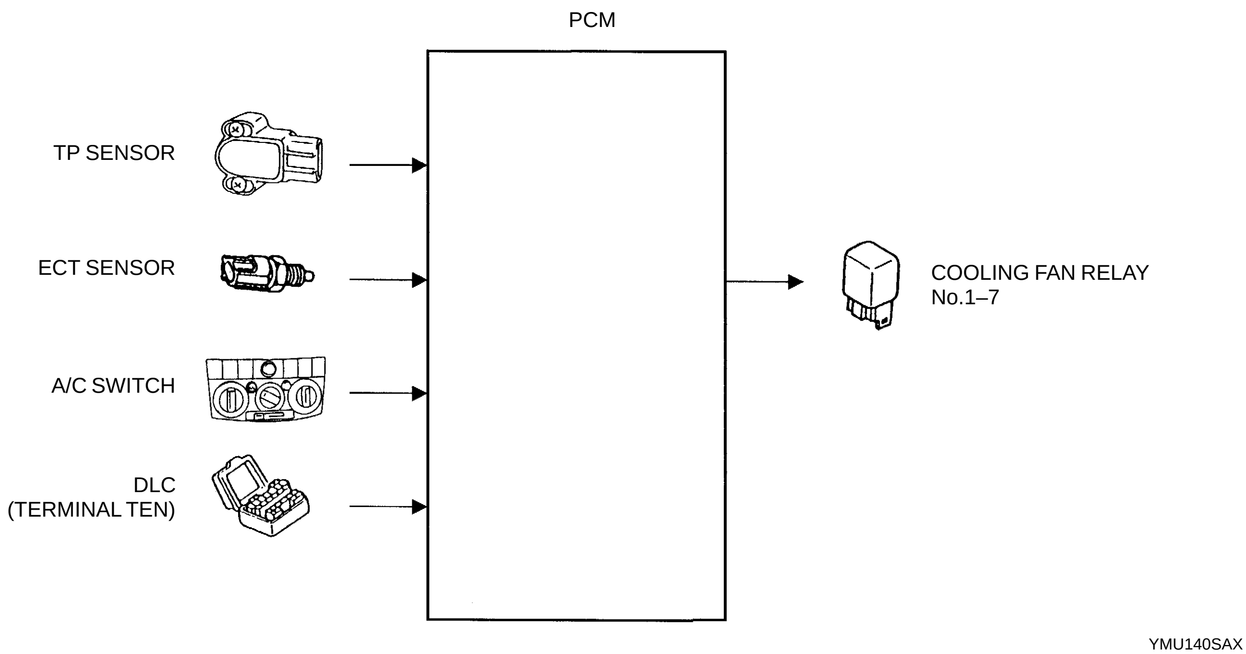
- HO2S heater control will run immediately after the engine is started when the ECT is above 70°C {158°F}.
- When the ECT is below 70 °C {158 °F}, the heater will run after engine is started and approx. 72 seconds pass.

ELECTRIC FAN CONTROL OUTLINE

YMU140S32

- The PCM controls the cooling fan relay according to vehicle operating conditions for improved engine reliability and idle stability.
- The cooling fan relays can be actuated by either of the following methods:
  – Connect DLC terminals TEN and GND with a jumper wire and open the throttle valve with the ignition switch ON
  – Activate the simulation function on the NGS tester with either the ignition switch ON and engine off, or during idle. Select the “FAN1” “FAN2” or “FAN3” PID for the cooling fan relay.

Block Diagram



ELECTRIC FAN CONTROL DESCRIPTION

YMU140S33

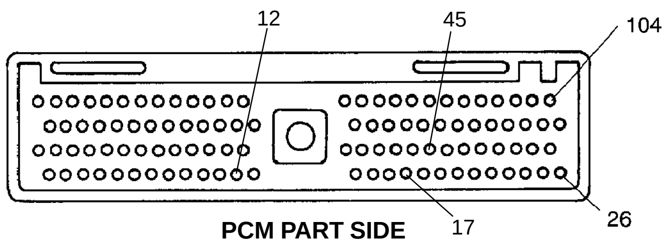
Operation
A/C is equipped

ON: Energized
OFF: De-energized

Condition		PCM terminal 17	PCM terminal 12	PCM terminal 45	Operation conditions
Cooling fan	Condenser fan	Cooling fan relay No.2, No.3, No.5 and No.7	Cooling fan relay No.4	Cooling fan relay No.1 and No.6	
Stopped	Stopped	OFF	OFF	OFF	ECT: 100 °C {212 °F} or below and A/C is not operated
Low speed	Low speed	OFF	ON	OFF	ECT: 100 °C {212 °F} or below and A/C is operated
Middle speed	Middle speed	OFF	ON	ON*1	ECT: 101—107 °C {214—225 °F}
High speed	High speed	ON	ON	ON	ECT: 108 °C {226 °F} or above
High speed	High speed	ON	ON	ON	ECT sensor malfunction
High speed	High speed	ON	ON	ON	TEN terminal (in DLC) shorted to GND and accelerator pedal depressed

*1 : To prevent battery positive voltage from dropping just after the fan motor operation is started, PCM terminal 12 is energized (fan is in low speed), and approximately 3 seconds later, PCM terminal 45 is energized (fan is in middle speed).

PCM TERMINAL



PCM PART SIDE

YMU140SC3

A/C is not equipped

ON: Energized
OFF: De-energized

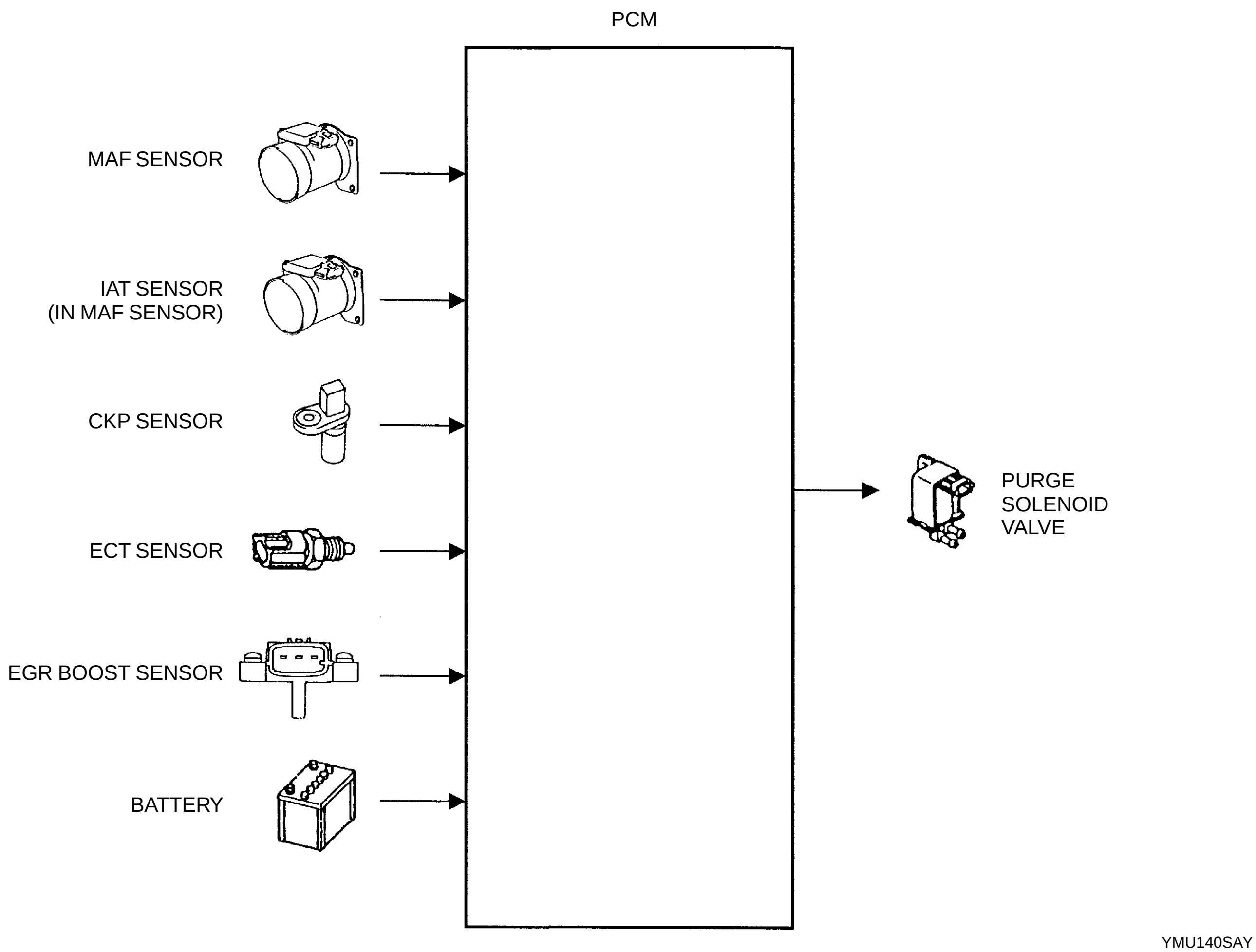
Condition	PCM terminal 12	PCM terminal 45	Operation conditions
Cooling fan	Cooling fan relay No.1	Cooling fan relay No.2 and No.3	
Stopped	OFF	OFF	ECT: 100 °C {212 °F} or below
High speed	ON	ON*1	ECT: 101—107 °C {214—225 °F}
High speed	ON	ON	ECT: 108 °C {226 °F} or above
High speed	ON	ON	ECT sensor malfunction
High speed	ON	ON	TEN terminal (in DLC) shorted to GND and accelerator pedal depressed

PURGE CONTROL OUTLINE

YMU140S34

- Purge control uses the purge solenoid valve to control the amount of fuel vapor that is purged into the intake-air system for improved emission performance while maintaining drivability.

Block Diagram



PURGE CONTROL DESCRIPTION

YMU140S35

Purge solenoid valve actuation time

- The purge solenoid valve actuation time is calculated using the following formula.

Formula

Purge solenoid valve actuation time = **Target purge flow amount** × **B+ correction**

YMU140SAZ

Target purge flow amount

- The target purge flow amount is calculated using the following formula.

Formula

Target purge flow amount = **Basic purge flow amount** × **IAT correction** × **BARO correction** × **Learning correction**

YMU140SB0

- Basic purge amount according to fuel efficiency.

Operation

- PCM actuates the purge solenoid valve by duty control when all of the following conditions are met.
  - Fuel injection control is in the closed loop zone or heavy load increase zone.
  - After warm-up.
  - The PRC solenoid valve is not turned ON.
  - The evaporative gas leak monitor is not operating.
  - MAF sensor is normal.

Corrections

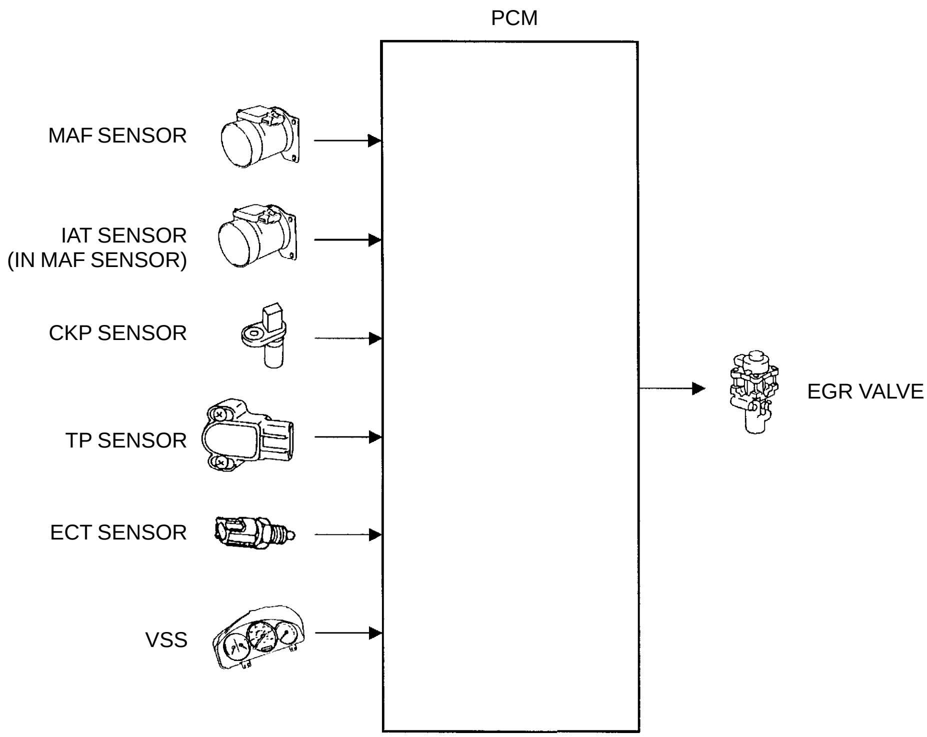
Item	Purpose	Conditions
B+ correction	To correct delay in purge solenoid valve actuation caused by low B+	According to B+
IAT correction	To improve emission performance	According to IAT
BARO correction	To improve emission performance	According to BARO
Learning correction	To deal with change in air/fuel ratio caused	At all time

EGR CONTROL OUTLINE

YMU140S36

- EGR control system uses a stepping motor type EGR valve to control amount of exhaust gas that is supplied to the intake air system in order to reduce NOx and improve fuel economy.
- The PCM adjusts the EGR amount by controlling the stepping motors in the EGR valve.

Block Diagram



YMU140SB1

EGR CONTROL DESCRIPTION

YMU140S37

Outline of Control

- The PCM initializes the stepping motor position in the EGR valve when EGR operation is canceled.
- The PCM opens/closes the EGR valve by controlling the stepping motor (#1 COIL-#4 COIL). The stepping motor is controlled according to the difference between the EGR valve position value (actual EGR valve opening angle) and the target EGR valve position value which is set according to the engine condition.
- When the actual EGR valve position value is smaller than the target value, the PCM opens the EGR valve. When the actual EGR valve position value is larger than the target value, the PCM closes the EGR valve.
- The target EGR valve position value is calculated using the following formula.

Formula

Target EGR valve position value = **ECT correction** × **IAT correction** × **Acceleration correction** × **Basic EGR valve position value**

YMU140SB2

- The basic EGR valve position value is determined by the charging efficiency and the engine speed.

Operation

- The EGR operation is carried out when the vehicle is running after warm up and the engine speed is over 1,400 rpm.
- To maintain drivability, the EGR operation is canceled when any of the following conditions has been met.
  - Engine is idling. (Throttle valve is at the closed position.)
  - ECT is below 55 °C {131 °F}.
  - Vehicle is stopped.
  - Engine speed is below 1,200 rpm.
  - Engine speed is above 3,500 rpm.
  - Charging efficiency is not within specified range.

Correction

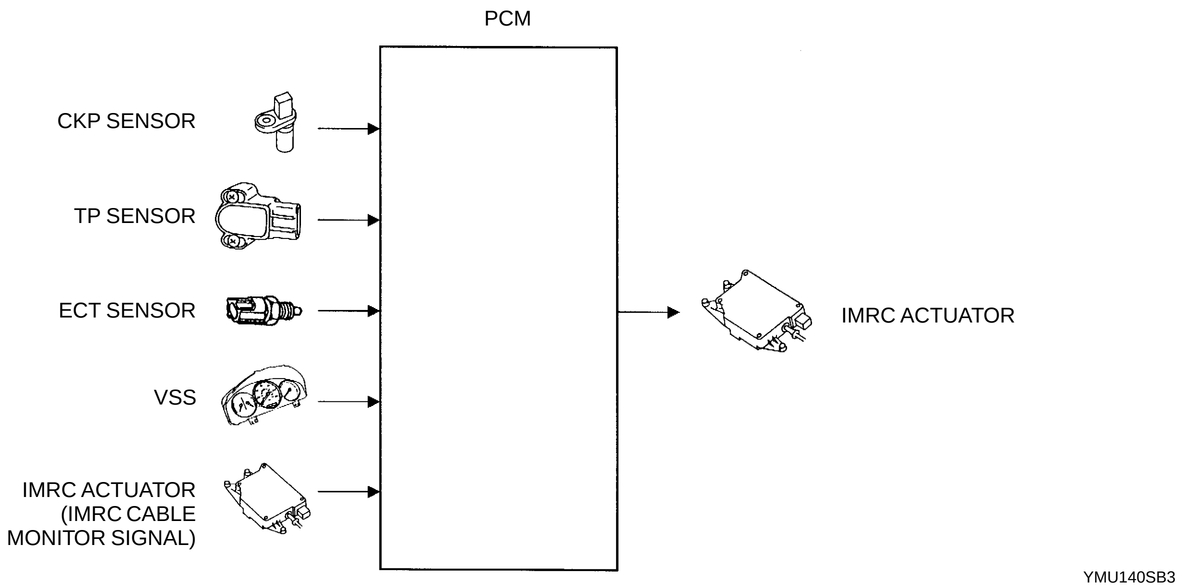
Item	Purpose	Conditions	Action
ECT correction	To improve driveability	**ECT is below 55 °C {131 °F}** ● No correction	—
		ECT is above 55 °C {131 °F} ● According to ECT	Lower ECT: small correction
IAT correction	To improve driveability	**IAT is below 55 °C {131 °F}** ● No correction	—
		IAT is above 55 °C {131 °F} ● According to IAT	Lower IAT: small correction
Acceleration correction	To improve driveability	During acceleration when change in TP is above a set level	Accelerating: 50% correction

INTAKE MANIFOLD RUNNER CONTROL (IMRC) OUTLINE

YMU140S38

- The IMRC concept is same as VICS.
- The IMRC actuator operates the IMRC shutter valve in the IMRC housing to change the intake air pipe length, thus enhancing the inertia charging effect.

Block Diagram



INTAKE MANIFOLD RUNNER CONTROL (IMRC) DESCRIPTION

YMU140S39

Operation

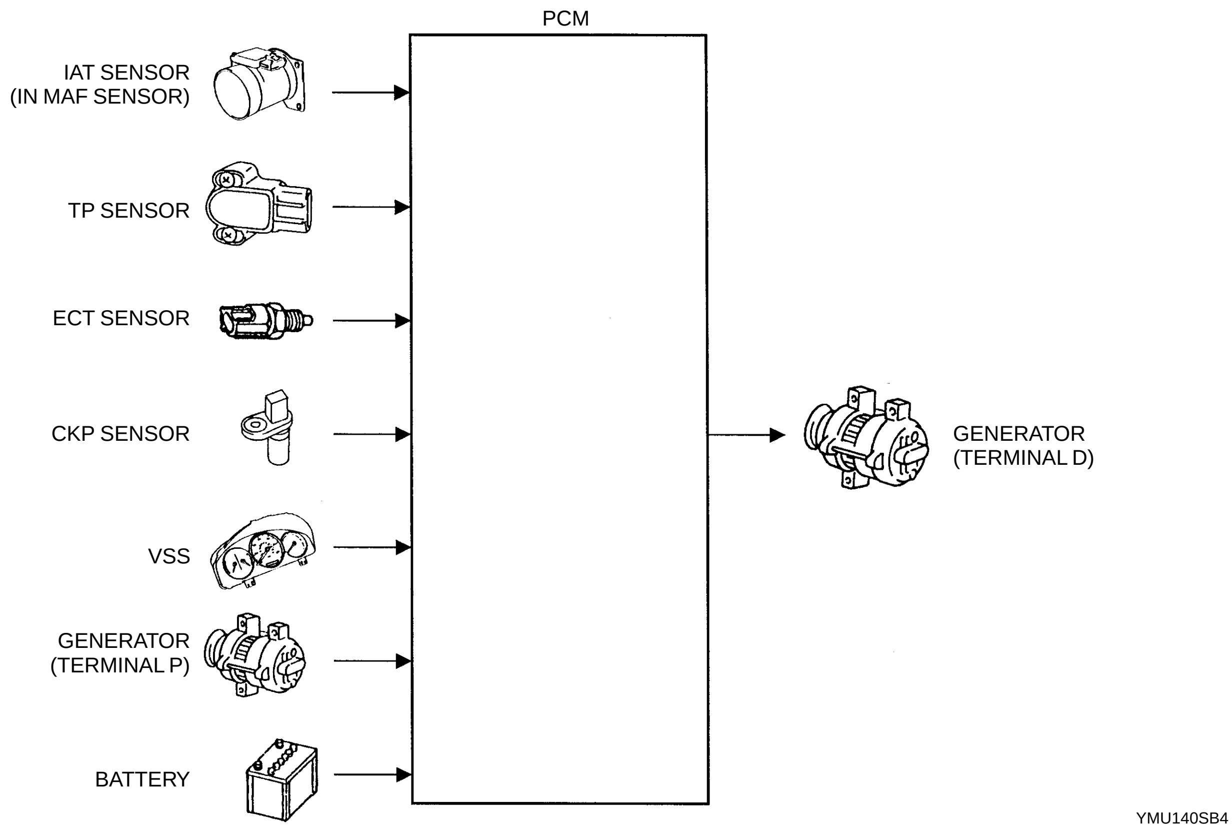
- The PCM turns the IMRC actuator ON to open the IMRC shutter valve in the IMRC housing when the engine speed is approx. 3,300 rpm.
- To verify the IMRC actuator operation, the PCM monitors an operation verification signal from the IMRC actuator. Regardless of whether the PCM is activating the IMRC or not, if the PCM does not receive an operation verification signal from the IMRC actuator, the PCM judges that the IMRC system is malfunctioning and outputs a DTC.

GENERATOR CONTROL OUTLINE

YMU140S40

- The PCM adjusts the field coil excitation current by controlling the duty value to obtain the optimum generator voltage according to driving conditions.
- The PCM calculates the electrical load from the adjusted field coil excitation current, and uses this calculated value for idle air control.
- The PCM also turns the generator warning light on if a malfunction is found in the charging system.

Block Diagram

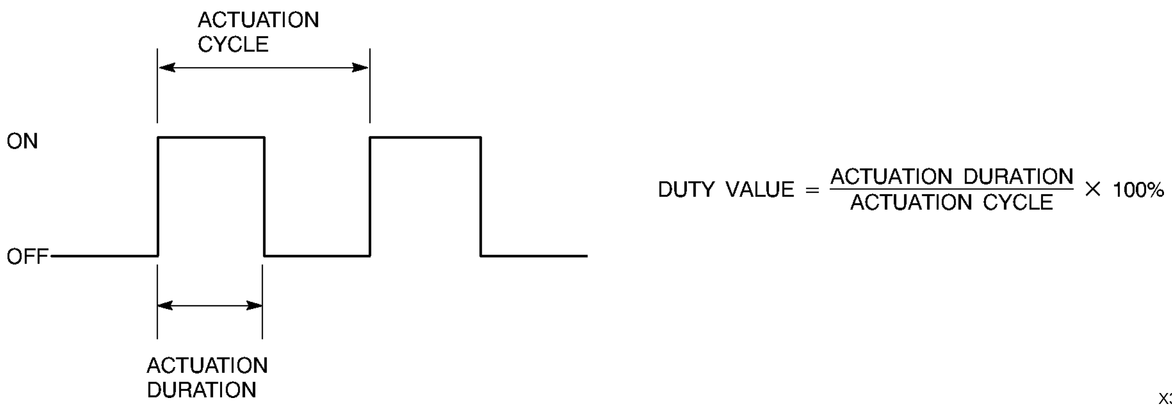


GENERATOR CONTROL DESCRIPTION

YMU140S41

Duty Control

- To obtain the optimum generated current, the PCM carries out duty control by calculating the battery positive voltage and the generator field coil excitation duration. The field coil excitation duration becomes the target excitation current of the generator field coil. The target excitation current varies with the target generated current, which is set for each engine condition.



X3U140SG3

Field coil excitation duration

- The field coil excitation duration is determined by the target generated current and the engine speed (generator pulley rotation speed).
- The target generated current is calculated using the following formula.

Formula

Target generated current

= **Previous target generated current** + (**Regulated voltage** − **Battery positive voltage**)

× **Coefficients**

X3U140SFU

- The regulated voltage is determined by the battery fluid temperature. The battery fluid temperature is determined by the IAT, the ECT and the vehicle speed.

Operation

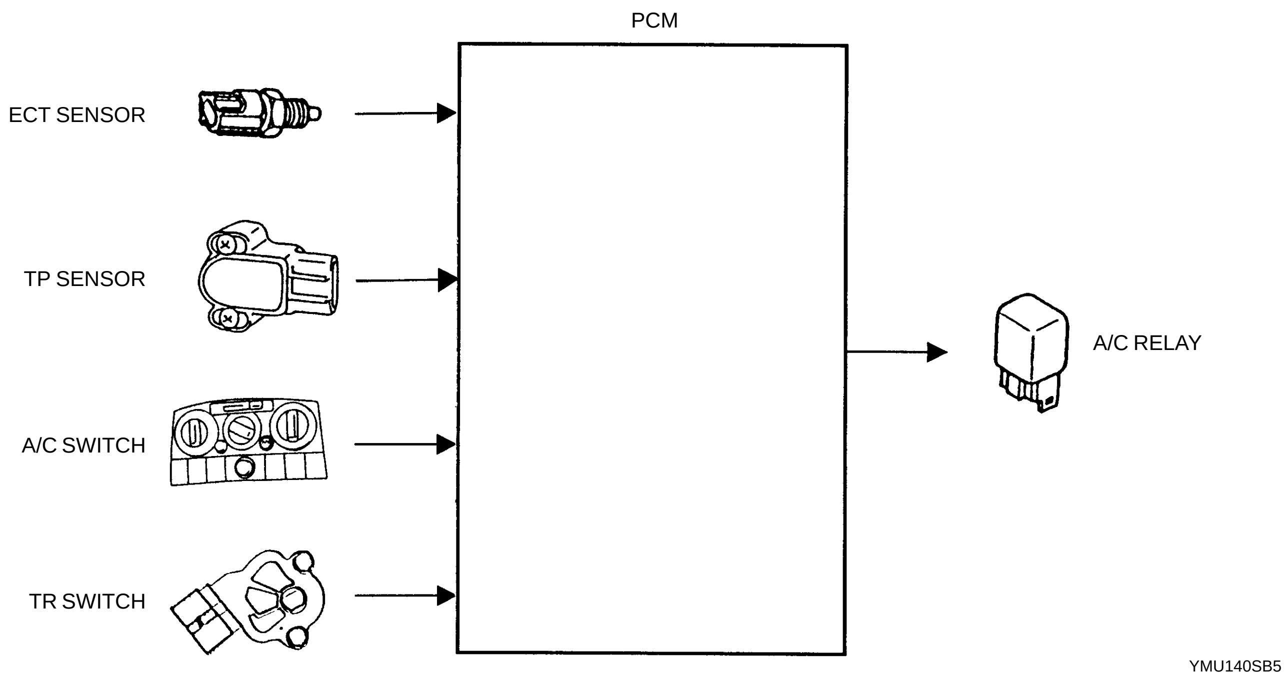
- The duty control is carried out when the generator rotation speed is over 860 rpm.
- To increase the generated current, the field coil excitation duration is increased to increase current flow to the field coil, thus magnetic force is increased and increased current is generated.
- To decrease the generated current, the field coil excitation duration is decreased.
- When electrical load is operated, increased voltage is consumed and the battery positive voltage is reduced accordingly. Electrical load increases the target generated current and excitation current flow to the field coil is increased so that the required generated current is maintained.
- The PCM illuminates the generator warning light under any of the following when generator rotation speed is over 860 rpm.
  – Generator generated voltage is too low.
  – Generator terminal B is open.
  – Battery is overcharged.
  – IAT sensor circuit malfunction.

A/C CUT-OFF CONTROL OUTLINE

YMU140S42

- Under A/C cut-off control, the operation of the A/C system is controlled according to engine operating conditions for engine startability, stability and acceleration performance improvements, and to prevent engine overheating.

Block Diagram



A/C CUT-OFF CONTROL DESCRIPTION

YMU140S43

Operation

A/C cut condition	A/C stop time	Purpose
At start	For approx. 10 secs.	Startability improvement
During acceleration	For approx. 3 secs.	Acceleration performance improvement
Throttle valve is opened more than 50%	For approx. 5 secs.	
ECT is above approx. 113 ˚C {235 ˚F}	Alternates between 10 seconds on and 10 seconds off until ECT falls below 107 ˚C {225 ˚F}	Engine reliability improvement
ECT is above approx. 117 ˚C {243 ˚F}	Until ECT falls below 110 ˚C {230 ˚F}	

IMMOBILIZER SYSTEM OUTLINE

YMU140S44

- Immediately after the engine is started, the immobilizer unit judges if the ignition key is valid or not. When it is judged that the key is valid, the PCM continues to run the engine. When the key is invalid, the immobilizer unit actuates the PCM to carry out the fuel injection stop and the ignition cut-off operations, and as a result, the engine stops in a few seconds. (Refer to 09–14–9 IMMOBILIZER SYSTEM OUTLINE.)

ON-BOARD DIAGNOSTIC SYSTEM OUTLINE

YMU140S45

- Several PID data monitor items for specific modes have been added, including those which allow checks of engine conditions (freeze frame data) during pending code detection or when the MIL illuminates.

PID Data Monitor (Freeze Frame Data) when DTC is Set (MIL illuminates)

- Retrieve the following freeze frame data from GENERIC OBDII FUNCTIONS, excluding FDMTIME, FDMIAT, FDMECTS and FDMTP.
- Retrieve the freeze frame data for FDMTIME, FDMIAT, FDMECTS and FDMTP from PID/DATA monitor & RECORD in DIAGNOTIC DATA LINK

Note

- Freeze frame data is a snapshot of the conditions that are present when DTC or pending code is stored. Once freeze frame data is stored, this data will remain in PCM memory even if another emission-related DTC or pending code is stored additionally, except for misfire- or fuel system-related DTC or pending code. Once misfire- or fuel system-related DTC or pending code is stored, it will overwrite any previous data and the freeze frame data will not be further overwrite. When DTC associated with the freeze frame data is erased or PCM is reset, new freeze frame data can be stored.

PID data monitor (when MIL illuminates) when MIL illuminates table

PID item	Definition
FDMTIME	Time recorded between engine start and MIL illumination
FDMIAT	Intake air temperature
FDMECTS	Engine coolant temperature recorded when the engine is started
FDMTP	Throttle opening angle

PID Data Monitor (Freeze Frame Data) when Pending Code is Set

- Retrieve the following freeze frame data from PID/DATA MONITOR & RECORD in DIAGNOSTIC DATA LINK.

Note

- The data will remain in the memory even if another emission-related DTC is stored, including the misfire- and fuel system-monitor DTCs.

PID data monitor (when pending code is set) table

PID item	Definition
FDPFS1	Fuel system feedback control status (RH)
FDPFS2	Fuel system feedback control status (LH)
FDPLOAD	Calculated engine load
FDPECT	ECT when pending code is detected
FDPSFT1	Current bank 1 fuel trim adjustment
FDPSFT2	Current bank 2 fuel trim adjustment
FDPLFT1	Current bank 1 fuel trim adjustment (learning correction value)
FDPLFT2	Current bank 2 fuel trim adjustment (learning correction value)
FDPRPM	Engine speed
FDPVS	Vehicle speed
FDPTIME	Time recorded between engine start and pending code is stored
FDPIAT	Intake air temperature
FDPECTS	Engine coolant temperature recorded when the engine is started
FDPTP	Throttle opening angle

ON-BOARD DIAGNOSTIC SYSTEM DESCRIPTION

YMU140S46

Parameter Identification (PID) Access

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

Monitor item table

—: Not applied

Display on the NGS tester	Definition	Unit/ Condition	PCM terminal
1GR	Calculated gear range in PCM (1st gear)	ON/OFF	1, 27, 70
2GR	Calculated gear range in PCM (2nd gear)	ON/OFF	1, 27, 70
3–2 TIME	3–2 timing solenoid control signal in PCM	ON/OFF	28
3GR	Calculated gear range in PCM (3rd gear)	ON/OFF	1, 27, 70
4GR	Calculated gear range in PCM (4th gear)	ON/OFF	1, 27, 70
A/C RLY	A/C relay	ON/OFF	69
A/C SW	A/C on-demand circuit, including refrigerant pressure switch, A/C amplifier, A/C switch and fan switch	ON/OFF	41
ALTF	Generator field coil control duty valve in PCM	%	53
ALTT V	Generator output voltage	V	30
ATFT	ATF temperature	˚C or ˚F	37
ATFT V	ATF temperature signal voltage	V	37
B+	Battery positive voltage	V	71, 97
BARO	Barometric pressure	kPa or Hg	34
BARO V	Barometric pressure signal voltage	V	34
BRK SW	Brake switch	ON/OFF	92
CDCV	CDCV control signal in PCM	ON/OFF	67
CHRGLMP	Generator warning light control signal in PCM	ON/OFF	98
D SW	TR switch (D range switch)	ON/OFF	6
ECT	Engine coolant temperature	˚C or ˚F	38
ECT V	Engine coolant temperature voltage	V	38
EGRBV	EGR boost sensor solenoid valve control signal in PCM	ON/OFF	47
FAN1	Fan control signal in PCM	ON/OFF	17
FAN2	Fan control signal in PCM	ON/OFF	12
FAN3	Fan control signal in PCM	ON/OFF	45
FDMIAT*1	Intake air temperature	˚C or ˚F	39
FDMTIME*1	Time recorded between engine start and MIL illumination	˚C or ˚F	—
FDMECTS*1	Engine coolant temperature recorded when the engine is started	MIN	38
FDMTP*1	Throttle opening angle	%	89
FDPECT*2	ECT when pending code is detected	˚C or ˚F	38
FDPECTS*2	Engine coolant temperature recorded when the engine is started	˚C or ˚F	38
FDPFS1*2	Fuel system feedback control status (RH)	—	—
FDPFS2*2	Fuel system feedback control status (LH)	—	—
FDPIAT*2	Intake air temperature	˚C or ˚F	39
FDPLFT1*2	Current bank 1 fuel trim adjustment	%	—
FDPLFT2*2	Current bank 2 fuel trim adjustment	%	—
FDPLOAD*2	Calculated engine load	%	—
FDPRPM*2	Engine speed	RPM	21, 22
FDPSFT1*2	Current bank 1 fuel trim adjustment (learning correction value)	%	—
FDPSFT2*2	Current bank 2 fuel trim adjustment (learning correction value)	%	—
FDPTIME*2	Time recorded between engine start and pending code is stored	MIN	—
FDPTP	Throttle opening angle	%	89

Display on the NGS tester	Definition	Unit/ Condition	PCM terminal
FDPVS	Vehicle speed	KPH or MPH	58
FHO2S L	HO2S (Front LH) signal voltage	V	87
FHO2S R	HO2S (Front RH) signal voltage	V	60
FHO2SHL	HO2S heater (Front LH) control signal in PCM	ON/OFF	94
FHO2SHR	HO2S heater (Front RH) control signal in PCM	ON/OFF	93
FP RLY	Fuel pump relay control signal in PCM	ON/OFF	80*[5], 104*[6]
FTL V	Fuel tank level signal voltage	V	63
FTP	Fuel tank pressure	kPa or Hg	62
FTP V	Fuel tank pressure signal voltage	V	62
FTP1SV	Fuel tank pressure 1 (For leak test)	kPa or Hg	62
FTP2SV	Fuel tank pressure 2 (For leak test)	kPa or Hg	62
IACV	IAC valve duty value in PCM	%	54, 83
IAT	IAT	°C or °F	39
IAT V	IAT signal voltage	V	39
IGT	Ignition timing control signal in PCM	BTC	26 for #1 & #5 52 for #3 & #4 78 for #2 & #6
IMRC	Intake manifold runner control actuator control signal in PCM	ON/OFF	42
IMRCMTR	IMRC operation verification signal	ON/OFF	3
INJ L	Fuel injection duration (LH) in PCM	MS	73, 99, 100
INJ R	Fuel injection duration (RH) in PCM	MS	74, 75, 101
KR	Spark retard value to prevent knocking	DEG	57, 66
L SW	TR switch (1 range switch)	ON/OFF	7
LINE	Line pressure control solenoid control signal in PCM	%	81
LINE DES	Target automatic transaxle oil line pressure	KPA	—
LOAD	Calculated engine load in PCM	%	—
LONGFT1	Current long fuel trim (RH) adjustment (Learning correction value) in PCM	%	—
LONGFT2	Current long fuel trim (LH) adjustment (Learning correction value) in PCM	%	—
MAF	Mass air flow amount	g/sec	88
MAF V	MAF signal voltage	V	88
MHO2S*[4]	HO2S (Middle) signal voltage	V	35
MHO2SH*[4]	HO2S heater (Middle) control signal in PCM	ON/OFF	95
MIL	Malfunction indicator light control signal in PCM	ON/OFF	2
NON A/C	A/C installation confirmation signal	ON/OFF	8
O/DF LP	Overdrive OFF indicator control signal in PCM	ON/OFF	43
O/DF SW	Overdrive OFF switch	ON/OFF	29
PRCV	PRC solenoid valve control signal in PCM	ON/OFF	44
PRGV	Purge solenoid valve duty value in PCM	%	18
PSP SW	PSP switch	ON/OFF	31
R SW	TR switch (R position switch)	ON/OFF	32
RFCFLAG	Adaptive memory condition	ON/OFF	—
RHO2S*[4]	HO2S (Rear) signal voltage	V	61
RHO2S L*[3]	HO2S (Rear LH) signal voltage	V	61
RHO2S R*[3]	HO2S (Rear RH) signal voltage	V	35
RHO2SH*[4]	HO2S heater (Rear) control signal in PCM	ON/OFF	96
RHO2SHL*[3]	HO2S heater (Rear LH) control signal in PCM	ON/OFF	96
RHO2SHR*[3]	HO2S heater (Rear RH) control signal in PCM	ON/OFF	95

Display on the NGS tester	Definition	Unit/ Condition	PCM terminal
RPM	Engine speed	rpm	21, 22
RPMDES	Target engine speed	rpm	—
S SW	TR switch (2 range switch)	ON/OFF	9
SEGRP	EGR valve (stepping motor) position in PCM	No. of step	46, 56, 68, 72
SHIFT A	Shift solenoid A control signal in PCM	ON/OFF	27
SHIFT B	Shift solenoid B control signal in PCM	ON/OFF	1
SHIFT C	Shift solenoid C control signal in PCM	ON/OFF	70
SHRTFT1	Current short fuel trim (RH) adjustment in PCM	%	—
SHRTFT2	Current short fuel trim (LH) adjustment in PCM	%	—
TCC CON	Lockup control solenoid control signal in PCM	ON/OFF	82
TEN	TEN terminal (DLC in engine compartment)	ON/OFF	5
TP V	TP sensor signal voltage	V	89
TR SW	TR switch (P and N position switches)	ON/OFF	64
TURBINE	Turbine speed	rpm	23, 84
VS	Vehicle speed	KPH or MPH	58

*1 : Freeze frame data while MIL is illuminated
*2 : Freeze frame data while pending code is detected
*3 : California emission regulation applicable models
*4 : Federal emission regulation applicable models
*5 : Without immobilizer system
*6 : With immobilizer system

DTC Comparsion Lists

- The following codes are divided to improve serviceability

—: Not applied

Part Name	2000MY		1998MY	
	DTC	Definition	DTC	Definition
MAF sensor	P0102	Circuit low input	P0100	Circuit malfunction
	P0103	Circuit high input		
	P1102	Inconsistent with MAF sensor lower than expected		
	P1103	Inconsistent with MAF sensor higher than expected		
EGR boost sensor (BARO sensor)	P0106	Circuit range/performance problem	—	—
	P0107	Circuit low input		
	P0108	Circuit high input		
IAT sensor	P0111	Circuit range/performance problem	P0110	Circuit malfunction
	P0112	Circuit low input		
	P0113	Circuit high input		
ECT sensor	P0116	Circuit range/performance problem	P0115	Circuit malfunction
	P0117	Circuit low input		
	P0118	Circuit high input		
TP sensor	P0122	Circuit low input	P0120	Circuit malfunction
	P0123	Circuit high input		
	P1122	Close stuck		
	P1123	Open stuck		
Closed loop control	P0125	Insufficient coolant temperature for closed loop fuel control	←	←
Thermostat	P0128	Coolant thermostat	—	—
HO2S (Front RH)	P0130	Circuit malfunction	←	←
	P0134	No activity		
	P1170	Inversion		
HO2S (Middle)	P0136*2	Circuit malfunction	—	—
HO2S (Rear RH)	P0138*1	High voltage	—	—
HO2S (Rear RH)	P0140*1	No activity	←	←
HO2S (Middle)	P0140*2	No activity	—	—
HO2S (Rear)	P0144*2	High voltage	—	—
	P0146*2	No activity		
HO2S (Front LH)	P0150	Circuit malfunction	—	—
	P0154	No activity		
	P1173	Inversion		
HO2S (Rear LH)	P0158*1	High voltage	—	—
	P0160*1	No activity		
Fuel injection system (RH)	P0171	Fuel trim system (RH) too lean	P0170	Fuel trim system malfunction
	P0172	Fuel trim system (RH) too rich		
Fuel injection system (LH)	P0174	Fuel trim system (LH) too lean		
	P0175	Fuel trim system (LH) too rich		

Part Name	2000MY		1998MY	
	DTC	Definition	DTC	Definition
Misfire	P0300	Random	←	←
	P0301	Cylinder #1		
	P0302	Cylinder #4		
	P0303	Cylinder #2		
	P0304	Cylinder #5		
	P0305	Cylinder #3		
	P0306	Cylinder #6		
Knock sensor	P0325	Circuit malfunction	—	—
CKP sensor	P0335	Circuit malfunction	←	←
EGR system	P0401	EGR flow insufficient	—	—
	P0402	EGR flow excessive		
Catalyst system	P0420*2	Efficiency below threshold (TWC)	←	←
	P0421*1	Efficiency below threshold (WU-TWC [RH])	—	—
	P0431*1	Efficiency below threshold (WU-TWC [LH])		
Evaporative emission system	P0442	Small leak	←	←
	P0455	Large leak or blockage		
	P0456	Very small leak	—	—
	P1450	Excessive vacuum	←	←
Purge solenoid valve	P0443	Circuit malfunction	←	←
Fuel tank pressure sensor	P0451	Circuit range/performance problem	P0450	Circuit malfunction
	P0452	Circuit low input		
	P0453	Circuit high input		
Fuel gauge sender unit	P0461	Circuit range/performance problem	P1455	Circuit malfunction
	P0462	Circuit low input		
	P0463	Circuit high input		
	P0464	Circuit intermittent		
VSS	P0500	Circuit malfunction	←	←
IAC	P0506	RPM lower than expected	P0505	Idle control system malfunction
	P0507	RPM higher than expected		
PSP switch	P0550	Circuit malfunction	←	←
Brake switch	P0703	Circuit malfunction	←	←
TR switch	P0705	Circuit malfunction	←	←
Torque converter system	P0740	System malfunction	←	←
Lockup control solenoid	P0743	Circuit malfunction	—	—
Pressure control solenoid	P0745	Circuit malfunction	←	←
Shift solenoid A	P0750	Circuit malfunction	←	←
Shift solenoid B	P0755	Circuit malfunction	←	←
Shift solenoid C	P0760	Circuit malfunction	—	—
HO2S heater (Front RH)	P0031	Circuit low	P0135	Circuit malfunction
	P0032	Circuit high		
HO2S heater (Rear RH)	P0037*1	Circuit low	—	—
HO2S heater (Middle)	P0037*2	Circuit low		
HO2S heater (Rear RH)	P0038*1	Circuit high	—	—
HO2S heater (Middle)	P0038*2	Circuit high		

Part Name	2000MY		1998MY	
	DTC	Definition	DTC	Definition
HO2S heater (Rear)	P0043*2	Circuit low	P0141	Circuit malfunction
	P0044*2	Circuit high		
HO2S heater (Front LH)	P0051	Circuit low	—	—
	P0052	Circuit high		
HO2S heater (Rear LH)	P0057*1	Circuit low	—	—
	P0058*1	Circuit high		
HO2S (Middle)	P1169*2	Inversion	—	—
PRC solenoid valve	P1250	Circuit malfunction	←	←
CMP sensor	P1345	No SGC signal	←	←
CDCV	P1449	Circuit malfunction	←	←
EGR boost sensor solenoid valve	P1487	Circuit malfunction	—	—
EGR valve	P1496	Coil #1 circuit malfunction	—	—
	P1497	Coil #2 circuit malfunction		
	P1498	Coil #3 circuit malfunction		
	P1499	Coil #4 circuit malfunction		
IAC valve	P1504	Circuit malfunction	—	—
IMRC actuator	P1512	Close stuck	—	—
	P1518	Open stuck		
	P1520	Circuit malfunction		
PCM (IC)	P1309	For misfire detected	—	—
PCM (keep alive memory)	P1562	Circuit malfunction	—	—
Immobilizer system	P1602	Immobilizer unit — PCM communication error	—	—
	P1603	ID number is unregistered (Immobilizer)		
	P1604	Code word is unregistered (Immobilizer)		
	P1621	Code words do not match (Immobilizer)		
	P1622	ID numbers do not match (Immobilizer)		
	P1623	Code word/ID number writing and reading error (Immobilizer)		
	P1624	PCM does not receive unlock signal from immobilizer unit (PCM is okay)		
Generator	P1631	Output voltage signal no electricity	—	—
Battery	P1633	Overcharge	—	—
Generator	P1634	Generator terminal B circuit open	—	—
3–2 timing solenoid	P1765	Circuit malfunction	—	—

*1 : California emission regulation applicable models
*2 : Federal emission regulation applicable models

DTC Table

×: Applied
—: Not applied

DTC No.	Condition	Relative control system		MIL	O/D OFF indicator light flashes	DC	*1Monitor item	Memory function
		Engine	ATX					
P0031	HO2S heater (Front RH) circuit low	×	—	ON	No	2	O2 sensor heater	×
P0032	HO2S heater (Front RH) circuit high	×	—	ON	No	2	O2 sensor heater	×
P0037	*3HO2S heater (Middle) circuit low *2HO2S heater (Rear RH) circuit low	×	—	ON	No	2	O2 sensor heater	×
P0038	*3HO2S heater (Middle) circuit high *2HO2S heater (Rear RH) circuit high	×	—	ON	No	2	O2 sensor heater	×
*3P0043	HO2S heater (Rear) circuit low	×	—	ON	No	2	O2 sensor heater	×
*3P0044	HO2S heater (Rear) circuit high	×	—	ON	No	2	O2 sensor heater	×
P0051	HO2S heater (Front LH) circuit low	×	—	ON	No	2	O2 sensor heater	×
P0052	HO2S heater (Front LH) circuit high	×	—	ON	No	2	O2 sensor heater	×
*2P0057	HO2S heater (Rear LH) circuit low	×	—	ON	No	2	O2 sensor heater	×
*2P0058	HO2S heater (Rear LH) circuit high	×	—	ON	No	2	O2 sensor heater	×
P0102	MAF circuit low input	×	×	ON	No	1	CCM	×
P0103	MAF circuit high input	×	×	ON	No	1	CCM	×
P0106	BARO circuit performance problem	×	—	ON	No	2	CCM	×
P0107	BARO circuit low input	×	—	ON	No	1	CCM	×
P0108	BARO circuit high input	×	—	ON	No	1	CCM	×
P0111	IAT circuit performance problem	×	—	ON	No	2	CCM	×
P0112	IAT circuit low input	×	—	ON	No	1	CCM	×
P0113	IAT circuit high input	×	—	ON	No	1	CCM	×
P0116	ECT circuit performance problem	×	—	ON	No	2	CCM	×
P0117	ECT circuit low input	×	×	ON	No	1	CCM	×
P0118	ECT circuit high input	×	×	ON	No	1	CCM	×
P0122	TP circuit low input	×	×	ON	Yes	1	CCM	×
P0123	TP circuit high input	×	×	ON	Yes	1	CCM	×
P0125	Excessive time to enter CL fuel control	×	—	ON	No	2	CCM	×
P0128	Coolant thermostat stuck open	×	—	ON	No	2	Thermostat	×
P0130	HO2S (Front RH) circuit malfunction	×	—	ON	No	2	O2 sensor	×
P0134	HO2S (Front RH) circuit no activity detected	×	—	ON	No	2	CCM	×
*3P0136	HO2S (Middle) circuit malfunction	×	—	ON	No	2	O2 sensor	×
*2P0138	HO2S (Rear RH) circuit high input	×	—	ON	No	2	CCM	×
P0140	*2HO2S (Rear RH) circuit no activity detected	×	—	ON	No	2	CCM	×
	*3HO2S (Middle) circuit no activity detected	×	—	ON	No	2	CCM	×
*3P0144	HO2S (Rear) circuit high input	×	—	ON	No	2	CCM	×
*3P0146	HO2S (Rear) circuit no activity detected	×	—	ON	No	2	CCM	×
P0150	HO2S (Front LH) circuit malfunction	×	—	ON	No	2	O2 sensor	×
P0154	HO2S (Front LH) circuit no activity detected	×	—	ON	No	2	CCM	×
*2P0158	HO2S (Rear LH) circuit high input	×	—	ON	No	2	CCM	×
*2P0160	HO2S (Rear LH) circuit no activity detected	×	—	ON	No	2	CCM	×

DTC No.	Condition	Relative control system		MIL	O/D OFF indicator light flashes	DC	*1Monitor item	Memory function
		Engine	ATX					
P0171	Fuel trim system (RH) too lean	×	—	ON	No	2	Fuel	×
P0172	Fuel trim system (RH) too rich	×	—	ON	No	2	Fuel	×
P0174	Fuel trim system (LH) too lean	×	—	ON	No	2	Fuel	×
P0175	Fuel trim system (LH) too rich	×	—	ON	No	2	Fuel	×
P0300	Random misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0301	Cylinder 1 misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0302	Cylinder 2 misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0303	Cylinder 3 misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0304	Cylinder 4 misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0305	Cylinder 5 misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0306	Cylinder 6 misfire detected	×	—	Flash or ON	No	1 or 2	Misfire	×
P0325	Knock sensor circuit malfunction	×	—	ON	No	1	CCM	×
P0335	CKP sensor circuit malfunction	×	×	ON	No	1	CCM	×
P0401	EGR flow insufficient detected	×	—	ON	No	2	EGR	×
P0402	EGR flow excessive detected	×	—	ON	No	2	EGR	×
*3P0420	Catalyst system efficiency below threshold	×	—	ON	No	2	Catalyst	×
*2P0421	Warm-up catalyst system (RH) efficiency below threshold	×	—	ON	No	2	Catalyst	×
*2P0431	Warm-up catalyst system (LH) efficiency below threshold	×	—	ON	No	2	Catalyst	×
P0442	Evaporative emission control system leak detected (small leak)	×	—	ON	No	2	Evaporative	×
P0443	Evaporative emission control system purge control valve circuit malfunction (Equip leak check)	×	—	OFF	No	1	Other	—
P0451	Fuel tank pressure sensor performance problem	×	—	ON	No	2	CCM	×
P0452	Evaporative emission control system pressure sensor low input	×	—	ON	No	2	CCM	×
P0453	Evaporative emission control system pressure sensor high input	×	—	ON	No	2	CCM	×
P0455	Evaporative emission control system leak detected (gross leak)	×	—	ON	No	2	Evaporative	×
P0456	Evaporative emission control system leak detected (very small leak)	×	—	ON	No	2	Evaporative	×
P0461	Fuel gauge sender unit circuit range/performance	×	—	ON	No	2	CCM	×
P0462	Fuel gauge sender unit circuit low input	×	—	ON	No	2	CCM	×
P0463	Fuel gauge sender unit circuit high input	×	—	ON	No	2	CCM	×
P0464	Fuel gauge sender unit circuit performance problem (slosh check)	×	—	ON	No	2	CCM	×
P0500	VSS malfunction	×	×	ON	Yes	2	CCM	×
P0506	Idle control system RPM lower than expected	×	—	ON	No	2	CCM	×
P0507	Idle control system RPM higher than expected	×	—	ON	No	2	CCM	×

DTC No.	Condition	Relative control system		MIL	O/D OFF indicator light flashes	DC	*1Monitor item	Memory function
		Engine	ATX					
P0550	PSP switch circuit malfunction	×	—	ON	No	2	CCM	×
P0703	Brake switch input malfunction	×	—	ON	No	2	CCM	×
P0705	TR switch circuit malfunction (Short circuit)	—	×	ON	No	1	CCM	×
P0706	TR switch circuit malfunction (Open circuit)	—	×	ON	No	2	CCM	×
P0710	TFT sensor circuit malfunction (Open/short)	—	×	ON	No	1	CCM	×
P0711	TFT sensor circuit range/performance (Stuck)	—	×	ON	No	2	CCM	×
P0715	Input/turbine speed sensor circuit malfunction	—	×	ON	Yes	1	CCM	×
P0731	Gear 1 incorrect	—	×	ON	No	2	CCM	×
P0732	Gear 2 incorrect	—	×	ON	No	2	CCM	×
P0733	Gear 3 incorrect	—	×	ON	No	2	CCM	×
P0734	Gear 4 incorrect	—	×	ON	No	2	CCM	×
P0740	TCC system malfunction	—	×	ON	No	1	CCM	×
P0743	TCC control solenoid valve malfunction	—	×	ON	Yes	1	CCM	×
P0745	Pressure control solenoid malfunction	—	×	OFF	Yes	1	CCM	×
P0750	Shift solenoid A malfunction (Open/short)	—	×	ON	Yes	1	CCM	×
P0755	Shift solenoid B malfunction (Open/short)	—	×	ON	Yes	1	CCM	×
P0760	Shift solenoid C malfunction (Open/short)	—	×	ON	Yes	1	CCM	×
P1102	MAF sensor inconsistent with TP sensor (lower than expected)	×	—	ON	No	2	CCM	×
P1103	MAF sensor inconsistent with RPM (greater than expected)	×	—	ON	No	2	CCM	×
P1122	TP stuck close	×	—	ON	No	2	CCM	×
P1123	TP stuck open	×	—	ON	No	2	CCM	×
*3P1169	HO2S (Middle) no inversion	×	—	ON	No	2	CCM	×
P1170	HO2S (Front RH) no inversion	×	—	ON	No	2	CCM	×
P1173	HO2S (Front LH) no inversion	×	—	ON	No	2	CCM	×
P1250	PRC solenoid valve circuit malfunction	×	—	OFF	No	1	Other	×
P1309	PCM IC for misfire detection	×	—	ON	No	2	CCM	×
P1345	CMP sensor circuit malfunction	×	—	ON	No	1	CCM	×
P1449	CDCV circuit malfunction	×	—	OFF	No	1	Other	—
P1450	Evaporative emission control system malfunction (excessive vacuum)	×	—	ON	No	2	CCM	×
P1487	EGR boost sensor solenoid valve circuit malfunction	×	—	OFF	No	1	Other	—
P1496	EGR valve motor coil 1 open or short	×	—	OFF	No	1	Other	—
P1497	EGR valve motor coil 2 open or short	×	—	OFF	No	1	Other	—
P1498	EGR valve motor coil 3 open or short	×	—	OFF	No	1	Other	—
P1499	EGR valve motor coil 4 open or short	×	—	OFF	No	1	Other	—
P1504	IAC valve circuit malfunction	×	—	ON	No	1	CCM	×
P1512	IMRC shutter valve close stuck	×	—	ON	No	2	CCM	×
P1518	IMRC shutter valve open stuck	×	—	ON	No	2	CCM	×
P1520	IMRC drive circuit malfunction	×	—	ON	No	2	CCM	×
P1562	PCM +BB voltage low	×	—	ON	No	1	CCM	×
P1602	Immobilizer unit — PCM communication error	×	—	OFF	No	—	Other	×
P1603	Code word unregistered in PCM	×	—	OFF	No	—	Other	×
P1604	Key ID number unregistered in PCM	×	—	OFF	No	—	Other	×

DTC No.	Condition	Relative control system		MIL	O/D OFF indicator light flashes	DC	*1Monitor item	Memory function
		Engine	ATX					
P1621	Code word mismatch after engine cranking	×	—	OFF	No	—	Other	×
P1622	Key ID number mismatch	×	—	OFF	No	—	Other	×
P1623	Code word or key ID number read/write error in PCM	×	—	OFF	No	—	Other	×
P1624	Immobilizer system communication counter=0	×	—	OFF	No	—	Other	×
P1631	Generator output voltage signal no electricity	×	—	OFF	No	—	Other	×
P1633	Battery overcharge	×	—	OFF	No	—	Other	×
P1634	Generator terminal B circuit open	×	—	OFF	No	—	Other	×
P1765	3-2 timing solenoid valve	—	×	OFF	Yes	—	CCM	×

*1 : Indicates the applicable item in On-Board System Readiness Test defined by CARB.
*2 : California emission regulation applicable models.
*3 : Federal emission regulation applicable models.

Failure Detection Functions

- The failure detection functions include the self-diagnosis function, fail-safe function, auxiliary diagnosis function, and memory function.

Self-diagnosis function and fail-safe function

- Failure detection of the input sensor system is carried out when the ignition switch is at the ON position, or when the engine is running. When a failure is detected, the diagnosis system outputs the diagnostic trouble code. At the same time, the PCM switches the input signal value to the preset value in its memory to ensure vehicle drivability. The former function is called the self-diagnosis function and the latter is called the fail-safe function.

Auxiliary diagnosis function

- Failure detection of the output device system is carried out at the moment when the ignition switch is turned to the ON position. When a failure is detected, the diagnosis system outputs the diagnostic trouble code.

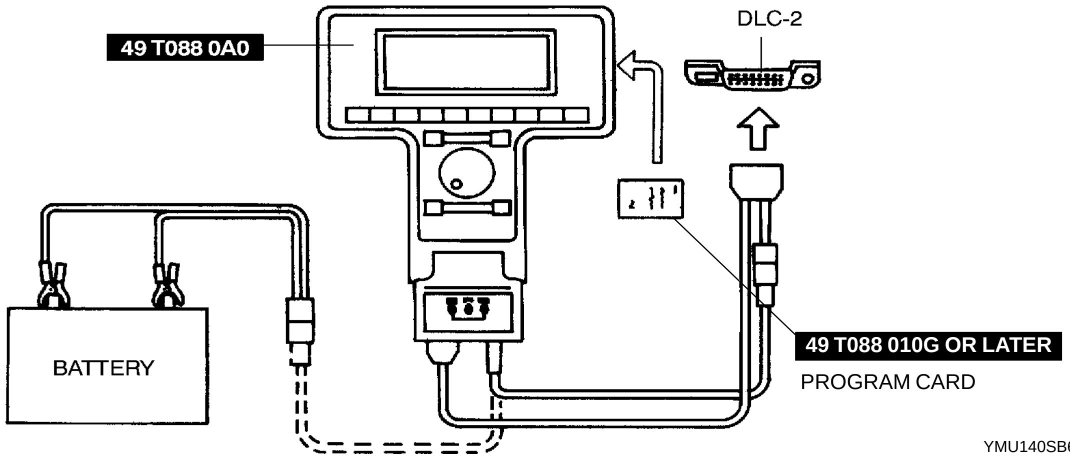
Memory function

- The memory function stores a record of the failure even after failure is solved. Because failed systems are memorized even after the ignition switch is turned to the OFF position, this function can be used to detect intermittent failures.
- The memory can be erased by using the NGS or disconnecting the negative battery cable.

Failure Indication Function

- When a failure is detected, the indication function outputs the diagnostic trouble code.

Using the NGS tester
- Displays information being processed by the PCM on the screen.
- Communicates with the PCM by serial communication.
- For functions and operation description, refer to the instruction manual supplied by the manufacturer.



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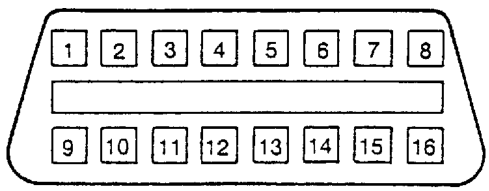
DLC-2 Outline
- The DLC-2 located in the driver compartment is a service connector defined by OBD II regulations.



DLC-2

X3U140SJ4

- The DLC-2 includes 16 terminals.
- Following is function of each terminal.

—: Not applied

Terminal		Function	Remarks
No.	Name		
1	+BB	Battery positive voltage	For NGS tester
2	–	–	–
3	–	–	–
4	FEPS	Flash EPROM power supply	For NGS tester
5	–	–	–
6	–	–	–
7	–	–	–
8	–	–	–
9	–	–	–
10	KLN	For PCM and ABS HU/CM-related functions; PID/data monitor and record and simulation test For simulation function	For NGS tester
11	–	–	–
12	SGND	Ground (signal)	For communication
13	CGND	Ground (chassis)	For NGS tester
14	–	–	–
15	–	–	–
16	–	–	–

Simulation Test

- By using the SIMULATION TEST function (NGS tester), output devices can be operated regardless of the PCM control while the ignition switch is at the ON position (engine OFF) or the engine is running.

  Note
  - Simulation items for the automatic transaxle control are not included in the following table. (Refer to 05–17–23 Simulation Test.)

Simulation item table

×: Applied
—: Not applied

Simulation item	Applicable component	Operation	Test condition		PCM terminal
			IG ON	Idle	
3–2 TIME	3–2 timing solenoid	ON or OFF	×	—	28
A/C RLY	A/C relay	ON or OFF	×	×	69
CHRGLMP	Generator warning light	ON or OFF	×	×	98
FAN1	Cooling fan relay No.2, No.3, No.5 and No.7	ON or OFF	×	×	17
FAN2	Cooling fan relay No.4	ON or OFF	×	×	12
FAN3	Cooling fan relay No.1 and No.6	ON or OFF	×	×	45
FP RLY	Fuel pump relay	ON or OFF	×	×	80*2, 104*1
IACV	Idle air control valve	Actuated by any duty value (0—100%)	×	×	54, 83
IMRC	IMRC actuator	ON or OFF	×	×	42
INJ	Fuel injection duration	Actuated +50%— –50% of fuel injection time	—	×	73, 74, 75, 99, 100, 101
INJ#1	Fuel injector (Cylinder No.1)	OFF	—	×	75
INJ#2	Fuel injector (Cylinder No.2)	OFF	—	×	101
INJ#3	Fuel injector (Cylinder No.3)	OFF	—	×	74
INJ#4	Fuel injector (Cylinder No.4)	OFF	—	×	100
INJ#5	Fuel injector (Cylinder No.5)	OFF	—	×	73
INJ#6	Fuel injector (Cylinder No.6)	OFF	—	×	99
LINE	Pressure control solenoid	Actuated by any duty value (0—100%)	×	×	81
PRCV	PRC solenoid valve	ON or OFF	×	×	18
PRGCHK	Purge solenoid valve and canister drain cut valve	For purge solenoid valve: Actuated by any duty value (0—100%) For CDCV: ON	×	×	18, 67
PRGV	Purge solenoid valve	Actuated by any duty value (0—100%)	×	×	67
SEGRP	EGR valve (stepping motor)	Actuated by any stepping value (0—60 steps)	×	×	46, 56, 68, 72
ATLF	Generator field coil control duty value	OFF	—	×	53
CDCV	Canister drain cut valve	ON or OFF	×	×	67
EGRBV	EGR boost sensor solenoid valve	ON or OFF	×	×	47
SHIFT A	Shift A solenoid	ON or OFF	×	—	27
SHIFT B	Shift B solenoid	ON or OFF	×	—	1
SHIFT C	Shift C solenoid	ON or OFF	×	—	70
TCC CON	Lockup control solenoid	ON or OFF	×	—	82

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

Failure Detection Condition
- The failure detection function monitors input/output devices and system components and compare their value with normal values that are stored in the PCM.
- The following failure detection conditions are summarized information.

Note
- All values indicated below are approximate values in order to match the NGS display.

Mass air flow (MAF) sensor
MAF sensor circuit low input (P0102)
- PCM monitors input voltage from MAF sensor when engine is running. If input voltage is below 0.24 V, PCM determines that MAF sensor circuit is malfunctioning.

MAF sensor circuit high input (P0103)
- PCM monitors input voltage from TP sensor after the ignition switch is turned to the ON position. If input voltage is above 4.8 V, PCM determines that TP sensor circuit is malfunctioning.

MAF sensor value inconsistent with TP sensor (P1102)
- PCM compares actual input signal from MAF sensor with the expected input signal from MAF sensor which the PCM calculates by input voltage from TP sensor. If the mass intake air flow amount is below 8.25 g/sec. {1.09 lb/min.} for 5 seconds and throttle opening angle is greater than 50% with the engine running, the PCM determines that the measured mass intake air flow amount is too low.

MAF sensor value inconsistent with RPM (P1103)
- PCM compares actual input signal from MAF sensor with the expected input signal from MAF sensor which PCM calculates by engine speed. If the mass intake air flow amount is above 103 g/sec. {13.6 lb/min.} for 5 seconds and engine speed is less than 2,000 rpm with the engine running, PCM determines that detected mass intake air flow amount is too high.

EGR boost sensor (BARO sensor)
EGR boost sensor circuit performance problem (P0106)
- PCM monitors differences between intake manifold vacuum and atmospheric pressure at idle, which EGR boost sensor detects by switching EGR boost sensor solenoid valve. If difference is below 6.43 kPa {48.2 mmHg, 1.90 inHg}, the PCM determines that there is a EGR boost sensor performance problem.
  Diagnostic hint note:
  - This is a continuous monitor (CCM).
  - MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  - PENDING CODE is available if PCM detects the above malfunction condition during first drive cycle.
  - FREEZE FRAME DATA is available.

  DTC is stored in the PCM memory.

EGR boost sensor circuit low input (P0107)
- PCM monitors input voltage from EGR boost sensor when monitoring conditions are met. If input voltage is below 0.2 V, the PCM determines that EGR boost sensor circuit is malfunctioning.
  [MONITORING CONDITION]
  - Intake air temperature is above 10 °C {50 °F}.
  - EGR boost sensor solenoid valve is turned OFF.

  Diagnostic hint note:
  - This is a continuous monitor (CCM).
  - MIL illuminates if PCM detects the above malfunction condition during first drive cycle. Therefore, PENDING CODE is not available.
  - FREEZE FRAME DATA is available.

  DTC is stored in the PCM memory.

EGR boost sensor circuit high input (P0108)
- PCM monitors input voltage from EGR boost sensor when monitoring conditions are met. If input voltage is above 4.8 V, the PCM determines that EGR boost sensor circuit is malfunctioning.
  [MONITORING CONDITION]
  - Intake air temperature is above 10 °C {50 °F}.
  - EGR boost sensor solenoid valve is turned OFF.

  Diagnostic hint note:
  - This is a continuous monitor (CCM).
  - MIL illuminates if PCM detects the above malfunction condition during first drive cycle. Therefore, PENDING CODE is not available.
  - FREEZE FRAME DATA is available.

  DTC is stored in the PCM memory.

Intake air temperature (IAT) sensor
IAT sensor circuit performance problem (P0111)
- Intake air temperature is higher than engine coolant temperature by 40 °C {104 °F}.

IAT sensor circuit low input (P0112)
- PCM detected IAT sensor voltage below 0.2 V.

IAT sensor circuit high input (P0113)
- PCM detected IAT sensor voltage above 4.8 V.

Engine coolant temperature (ECT) sensor
ECT sensor signal stuck (P0116)
- When vehicle is soaked more than 6 hours, the PCM monitors ECT value for 5 minutes after starting the engine. If the difference between maximum and minimum value during monitoring is less than 5.6 °C {10.1 °F}, the PCM determines that the ECT sensor signal stuck.

ECT sensor circuit low input (P0117)
- PCM detected ECT sensor voltage below 0.14 V.

ECT sensor circuit high input (P0118)
- PCM detected ECT sensor voltage above 4.57 V.

Throttle position (TP) sensor
TP sensor circuit low input (P0122)
- PCM monitors input voltage from TP sensor after the ignition switch is turned on (engine OFF or running). If input voltage is below 0.16 V, the PCM determines that the TP sensor circuit is malfunctioning.

TP sensor circuit high input (P0123)
- PCM monitors input voltage from TP sensor after ignition switch is turned on (engine OFF or running). If input voltage is above 4.96 V, PCM determines that TP sensor circuit is malfunctioning.

TP sensor close stuck (P1122)
- PCM detects that throttle valve opening angle is below 12.5% for 5 seconds. PCM determines that TP sensor is stuck closed if engine coolant temperature is above 70 °C {158 °F} and MAF sensor signal is above 88.3 g/sec. {11.7 lb/min.} for 5 seconds.

TP sensor open stuck (P1123)
- PCM detects that throttle valve opening angle is above 50% for 5 seconds. PCM determines that TP sensor is stuck open if engine speed is above 500 rpm and MAF sensor signal is below 8.25 g/sec. {1.09 lb/min.}.

Closed loop control
Excessive time to enter closed loop fuel control (P0125)
- The PCM monitor ECT sensor signal at PCM terminal 38 after engine is started at the engine is cold. If ECT voltage does not reach the expected temperature for specified period, 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.

Thermostat
Thermostat open stuck (P0128)
- If accumulated temperature between predicted ECT and actual ECT is above threshold, PCM determines that the coolant thermostat is stuck open.

Heated oxygen sensor (HO2S) (Front RH)
HO2S (Front RH) circuit malfunction (P0130)
- PCM monitors inversion cycle period, lean-to-rich response time and rich-to-lean response time of the sensor. PCM calculates the average inversion cycle period, average lean-to-rich, rich-to-lean response time when monitoring conditions are met. If any exceeds the expected value, the PCM determines that circuit is malfunctioning.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when all of the following conditions are met:
    - Calculation load 28—59% depends on engine speed.
    - Engine speed 1,500—3,000 rpm
    - Vehicle speed is above 5.6 km/h {3.5 mph}
    - Engine coolant temperature is above –10 °C {14 °F}

HO2S (Front RH) no activity detected (P0134)
- PCM monitors input voltage from HO2S (front RH) when monitoring conditions are met. If input voltage never exceeds 0.55 V for 94 seconds, the PCM determines that the sensor circuit is not activated.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when both the following:
    - Engine speed is above 1,500 rpm.
    - Engine coolant temperature is above 70 °C {158 °F}

HO2S (Front RH) no inversion (P1170)

- PCM monitors input voltage from HO2S (front RH) when monitoring conditions are met. If input voltage stays at a value other than 0.45 V for 43.2 seconds, PCM determines that there is no HO2S (front RH) inversion.
  [Monitoring Conditions]
  - In drive mode 3 or when both of the following conditions are met:
    - Engine speed is above 1,500 rpm.
    - Engine coolant temperature is above 70 °C {158 °F}.

Heated oxygen sensor (HO2S) (Middle) (Federal emission regulation applicable models)
HO2S (Middle) circuit malfunction (P0136)

- PCM monitors the inversion cycle period, lean-to-rich response time and rich-to-lean response time of the sensor. PCM calculates the average of the inversion cycle period, average lean-to-rich and rich-to-lean response time when monitoring conditions are met. If any exceeds expected value, the PCM determines that circuit is malfunctioning.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when all of the following conditions are met:
    - Calculation load 25—70% depends on engine speed.
    - Engine speed 1,500—3,000 rpm
    - Vehicle speed is over 5.6 km/h {3.5 mph}
    - Engine coolant temperature is above –10 °C {14 °F}

HO2S (Middle) no activity detected (P0140)

- PCM monitors input voltage from HO2S (middle) when monitoring conditions are met. If input voltage never exceeds 0.55 V for 94 seconds, PCM determines that sensor circuit is not activated.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when both of the following conditions are met:
    - Engine speed is above 1,500 rpm.
    - Engine coolant temperature is above 70 °C {158 °F}

HO2S (Middle) no inversion (P1169)

- PCM monitors input voltage from HO2S (Middle) when the following monitoring conditions are met. If input voltage from sensor is below or above 0.45 V for 43.2 seconds, PCM determines that there is no HO2S (Middle) inversion.
  [Monitoring conditions]
  - Engine speed is above 1,500 rpm.
  - Engine coolant temperature is above 70 °C {158 °F}

Heated oxygen sensor (HO2S) (Rear RH) (California emission regulation applicable models)
HO2S (Rear RH) signal high stuck (P0138)

- PCM monitors input voltage from HO2S (rear RH) when monitoring conditions are met. If input voltage is above 0.45 V for 6 seconds during deceleration (fuel cut), the PCM determines that the circuit input is high.

HO2S (Rear RH) no activity detected (P0140)

- PCM monitors input voltage from HO2S (rear RH) when monitoring conditions are met. If input voltage never exceed 0.55 V for 30 seconds, the PCM determines that sensor circuit is not activated.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when both of the following conditions are met:
    - Engine speed is above 1,500 rpm.
    - Engine coolant temperature is above 70 °C {158 °F}

Heated oxygen sensor (HO2S) (Rear) (Federal emission regulation applicable models)
HO2S (Rear) signal high stuck (P0144)

- PCM monitors input voltage from HO2S (rear RH) when monitoring conditions are met. If input voltage is above 0.45 V for 6 seconds during deceleration (fuel cut), the PCM determines that the circuit input is high.

HO2S (Rear) no activity detected (P0146)

- PCM monitors input voltage from HO2S (rear) when the following monitoring conditions are met. If input voltage never exceed 0.55 V for 30 seconds, the PCM determines that sensor circuit is not activated.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when both of the following conditions are met:
    - Engine speed is above 1,500 rpm.
    - Engine coolant temperature is above 70 °C {158 °F}

Heated oxygen sensor (HO2S) (Front LH)
HO2S (Front LH) circuit malfunction (P0150)

- PCM monitors inversion cycle period, lean-to-rich response time and rich-to-lean response time of the sensor. PCM calculates the average inversion cycle period, average lean-to-rich and rich-to-lean response time when monitoring conditions are met. If any exceeds expected value, the PCM determines that circuit is malfunctioning.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when all of the following conditions are met:
    – Calculation load 28—59% depends on engine speed.
    – Engine speed 1,500—3,000 rpm
    – Vehicle speed is over 5.6 km/h {3.5 mph}
    – Engine coolant temperature is above –10 °C {14 °F}

HO2S (Front LH) no activity detected (P0154)

- PCM monitors input voltage from HO2S (front LH) when the following monitoring conditions are met. If the input voltage never exceeds 0.55 V for 94 seconds, PCM determines that sensor circuit is not activated.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when both of the following conditions are met:
    – Engine speed is above 1,500 rpm.
    – Engine coolant temperature is above 70 °C {158 °F}

HO2S (Front LH) no inversion (P1173)

- PCM monitors input voltage from HO2S (front LH) when the following monitoring conditions are met. If input voltage stays at a value other than 0.45 V for 43.2 seconds, the PCM determines that there is no HO2S (front RH) inversion.
  [Monitoring Conditions]
  - In OBDII drive mode 3 or when both of the following conditions are met:
    – Engine speed is above 1,500 rpm.
    – Engine coolant temperature is above 70 °C {158 °F}.

Heated oxygen sensor (HO2S) (Rear LH) (California emission regulation applicable models)
HO2S (Rear LH) signal high stuck (P0158)

- PCM monitors input voltage from HO2S (rear LH) when monitoring conditions are met. If input voltage is above 0.45 V for 6 seconds during deceleration (fuel cut), the PCM determines that the circuit input is high.

HO2S (Rear LH) no activity detected (P0160)

- PCM monitors input voltage from HO2S (rear LH) when monitoring conditions are met. If input voltage never exceeds 0.55 V for 30 seconds, the PCM determines that sensor circuit is not activated.
  [Monitoring conditions]
  - In OBDII drive mode 3 or when both of the following conditions are met:
    – Engine speed is above 1,500 rpm.
    – Engine coolant temperature is above 70 °C {158 °F}

Fuel injection system
Fuel trim system too lean (P0171: RH, P0174: LH)

- PCM monitors short fuel trim (SHRTFT) and long fuel trim (LONGFT) values when the monitoring conditions are met or during OBDII DRIVE MODE 1. If fuel trim exceeds the expected value, the PCM determines that the fuel system is too lean.

Fuel trim system too rich (P0172: RH, P0175: LH)

- PCM monitors short fuel trim (SHRTFT) and long fuel trim (LONGFT) values when the monitoring conditions are met or during OBDII DRIVE MODE 1. If fuel trim exceeds the expected value, the PCM determines that the fuel system is too rich.

Misfire
Random/multiple misfire detected (P0300)

- PCM monitors CKP sensor input signal interval time. PCM calculates the change of the interval time for each cylinder. If the change of interval time exceeds the preprogrammed criteria, PCM detects a misfire in the corresponding cylinder. While the engine is running, 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, PCM determines that a misfire, which can damage the catalytic converter or affect emission performance, has occurred.

Specific cylinder misfire detected (P0301, P0302, P0303, P0304, P0305, P0306)

- PCM monitors crankshaft position sensor input signal interval time. PCM calculates the change of the interval time for each cylinder. If the change of interval time exceeds the preprogrammed criteria, PCM detects a misfire in the corresponding cylinder. While the engine is running, 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, PCM determines that a misfire, which can damage the catalytic converter or affect emission performance, has occurred.

Knock sensor

Knock sensor circuit malfunction (P0325)

- PCM monitors input signal from knock sensor when the following monitoring conditions are met. If PCM does not receive input signal from sensor for 5 seconds, PCM determines that knock sensor circuit is malfunctioning.

  [MONITORING CONDITION]
  - Engine load is above 12%
  - Engine coolant temperature is above 65 °C {149 °F}.
  - Engine speed is within 1,000—4,500 rpm.

  Diagnostic hint note:
  - This is a continuous monitor (CCM).
  - MIL illuminates if PCM detects the above malfunction condition during first drive cycle.
  - PENDING CODE is not available.
  - FREEZE FRAME DATA is available.

  DTC is stored in the PCM memory.

CKP sensor

CKP sensor circuit malfunction (P0335)

- PCM monitors input voltage from CKP sensor while MAF is above 2.7 g/sec {0.36 lb/min}. If PCM does not receive input voltage from CKP sensor for 4.2 sec, the PCM determines that CKP sensor circuit is malfunctioning

EGR system

EGR flow insufficiency detected (P0401)

- Difference in intake manifold pressure when the EGR is operated and when it is stopped is too small.

EGR flow excess detected (P0402)

- Difference in intake manifold pressure when the EGR is operated and when it is stopped is too large.

Catalyst system

Catalyst system efficiency below expected value (P0420) (Federal emission regulation applicable models)

- PCM compares the number of HO2S (middle) and HO2S (rear) inversions for a predetermined time. PCM monitors the number of inversions the rear side performs while the middle side inverts for a specified number of times when the following monitoring conditions are met. PCM detects the inversion ratio. If inversion ratio is below threshold, PCM determined that catalyst system has deteriorated.
  - Engine speed 1,250—2,500 rpm
  - Calculated load 16—60%(*1)
  - Vehicle speed 38—100 km/h {24—62 mph}

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

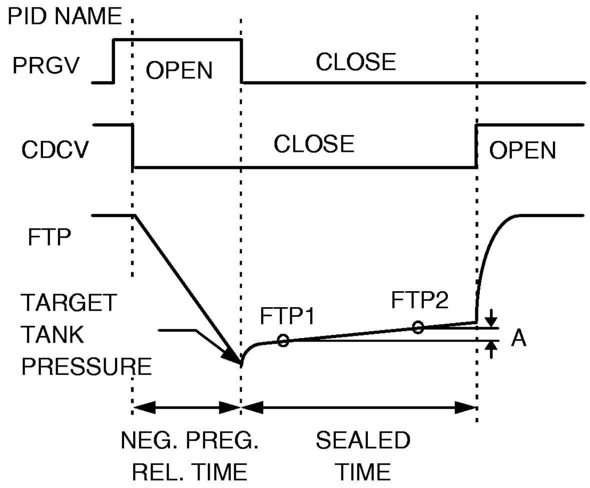
Warm-up catalyst system efficiency below expected value (P0421: RH, P0431:LH) (California emission regulation applicable models)

- PCM compares the number of HO2S (front) and HO2S (rear) inversions for a predetermined time. 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. PCM detects the inversion ratio. If inversion ratio is below threshold, PCM determined that catalyst system has deteriorated.
  - Engine speed 1,000—3,000 rpm
  - Calculated load 22—45%(*1)
  - Vehicle speed 39.5—96.0 km/h {24.5—59.5 mph}

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

Evaporative emission system
Small leak detected (P0442)

- PCM measures the fuel tank pressure (ftp2), which is the vacuum when a specified period has passed after EVAP system is sealed. The PCM determines the pressure difference between ftp1 and ftp2. If pressure differential exceeds the threshold, PCM determines that the EVAP system has a small leak. This monitor can activate when the PCM determines that the CONSTANTLY LEAK DETECTED test results are passed.



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[Monitoring Conditions]

- Target pressure: –2.16 kPa {–16.2 mmHg, –0.638 inHg}
- PCM monitors EVAP system when driving under following conditions:
  - Remaining fuel 15—18%
  - IAT at engine start above –10 °C {14 °F}
  - ECT at engine start –10.0—32.5 °C {14.0—90.5 °F}
  - Atmospheric pressure above 72.0 kPa {540 mmHg, 21.3 inHg}
  - Vehicle speed 39—130 km/h {25—80 mph}
  - Engine speed 1,100—3,400 rpm
  - Calculated load 7—80%
  - Throttle opening angle 3.1—12.5%
  - IAT during monitor –10—55 °C {14—131 °F}

Diagnostic hint note:

- This is an intermittent monitor (Evaporative leak monitor).
- MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
- PENDING CODE and DIAGNOSTIC MONITORING TEST RESULTS are available.
- FREEZE FRAME DATA is available.

DTC is stored in the PCM memory.

Large leak or blockage detected (P0455)

- PCM measures the fuel tank pressure (ftp1), which is the vacuum when a specified period has passed after the tank pressure has reached the preprogrammed target pressure and purge solenoid valve has been closed while monitoring conditions are met. If fuel tank pressure is below threshold, PCM determines that the EVAP system is blocked or has a large leak.

[Monitoring Condition]

Target pressure: –2.16 kPa {–16.2 mmHg, –0.638 inHg}

PCM monitors evaporative control system when driving under following conditions:

- Remaining fuel 15—85%
- IAT at engine start above –10 °C {14 °F}
- ECT at engine start –10.0—32.5 °C {14.0—90.5 °F}
- Atmospheric pressure above 72.0 kPa {540 mmHg, 21.3 inHg}
- Vehicle speed 39—130 km/h {25—80 mph}
- Engine speed 1,100—3,400 rpm
- Calculated load 7—80%
- Throttle opening angle 3.1—12.5%
- IAT during monitor –10—55 °C {14—131 °F}

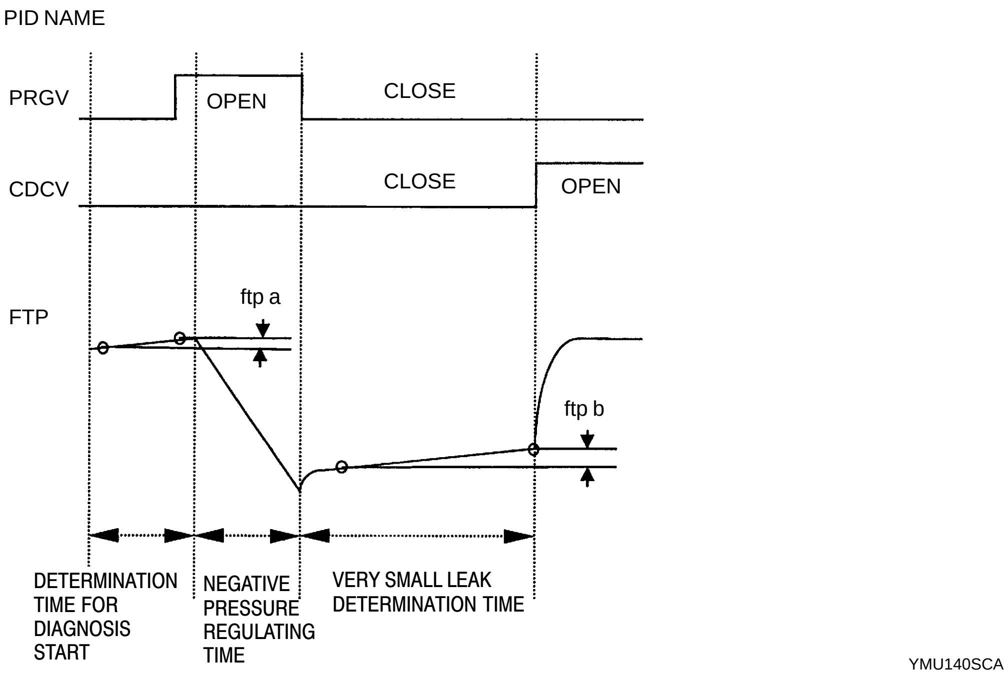
Diagnostic hint note:

- This is an intermittent monitor (Evaporative leak monitor).
- MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
- PENDING CODE is available if PCM detects the above malfunction condition during first drive cycle.
- FREEZE FRAME DATA is available.

DTC is stored in the PCM memory.

Very small leak (P0456)

- PCM measures the fuel tank pressure which is the vacuum when a specified period has passed after EVAP system is sealed. PCM determines the pressure difference (ftp b) with correction (ftp a). If pressure difference exceeds the threshold, PCM determines that the EVAP system has a very small leak. This monitor can activate when the PCM determines that the CONSTANTLY LEAK DETECTED test results are passed and the following monitoring conditions are met at idle.



 – ECT at engine start 32.5 °C {90.5 °F} or below
 – Remaining fuel 35% or above
 – ECT 79—121 °C {175—249 °F}
 – Vehicle speed 11 km/h {6.8 mph} or below
 – Throttle opening angle 1.4% or below

Excessive vacuum (P1450)

- PCM monitors fuel tank pressure when monitoring conditions are met. If pressure is below –3.92 kPa {–29.4 mmHg, –1.16 in Hg} for 8 seconds, PCM determines the excessive vacuum.

  [Monitoring Condition]
  - Intake air temperature is above –10 °C {14 °F}.
  - Engine coolant temperature is 105 °C {221 °F} or below.
  - Vehicle speed is 95.2 km/h {59.0 mph} or below.
  - Engine coolant temperature at engine start is below 35 °C {95 °F}.

  Diagnostic hint note:
  - This is a continuous monitor (CCM).
  - MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  - PENDING CODE is available if PCM detects the above malfunction condition at first drive cycle.
  - FREEZE FRAME DATA is available.

  DTC is stored in the PCM memory.

Purge solenoid valve
Purge solenoid valve circuit malfunction (P0443)

- The PCM monitors the input voltages from purge solenoid valve while turning the ignition switch to ON (engine OFF). If the PCM terminal No.18 does not read B+ unless circuit is grounded during operation, the PCM determines that the purge solenoid valve circuit has malfunction.

Fuel tank pressure sensor
Fuel tank pressure sensor low stuck (P0451)

- Difference in fuel tank presure, which PCM monitors while operating evaporative leak monitor function or purge solenoid valve is intentionally closed, is too small or too large.

  Diagnostic hint note:
  - This is a continuous monitor (CCM).
  - MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  - PENDING CODE is available if PCM detects the above malfunction condition during first drive cycle.
  - FREEZE FRAME DATA is available.

  DTC is stored in the PCM memory.

Fuel tank pressure sensor circuit low input (P0452)

- PCM monitors input voltage from fuel tank pressure sensor when monitoring conditions are met. If input voltage is below 0.2 V for 2 seconds after engine is started. The PCM determines that fuel tank pressure sensor circuit is malfunctioning.
  [Monitoring Condition]
  – After 2 second after engine is started
  – Engine coolant temperature is below 80 °C {176 °F}
  Diagnostic hint note:
  – This is a continuous CCM monitor (CCM).
  – MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  – PENDING CODE is available if PCM detects the above malfunction condition at first drive cycle.
  – FREEZE FRAME DATA is available.
  DTC is stored in the PCM memory.

Fuel tank pressure sensor circuit high input (P0453)

- PCM monitors input voltage from fuel tank pressure sensor when monitoring conditions are met. If input voltage is above 4.8 V for 2 seconds after engine is started. PCM determines that fuel tank pressure sensor circuit is malfunctioning.
  [Monitoring Condition]
  – After 2 second after engine is started
  – Engine coolant temperature is below 80 °C {176 °F}
  Diagnostic hint note:
  – This is a continuous monitor (CCM).
  – MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  – PENDING CODE is available if PCM detects the above detection condition during first drive cycle.
  – FREEZE FRAME DATA is available.
  DTC is stored in the PCM memory.

Fuel gauge sender unit

Fuel gauge sender unit circuit range/performance problem (P0461)

- PCM monitors fuel gauge sender unit input voltage difference before and after PCM-calculated fuel consumption has reached 25.0 liters {26.4 US qt, 22.0 Imp qt}. If fuel gauge sender unit operation reflects 5% less than PCM-calculated fuel consumption, PCM determines that fuel gauge sender unit signal range/performance is in error.
  Diagnostic hint note:
  – This is a continuous monitor (CCM).
  – MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  – PENDING CODE is available if PCM detects the above malfunction condition during first drive cycle.
  – FREEZE FRAME DATA is available.
  DTC is stored in the PCM memory.

Fuel gauge sender unit circuit low input (P0462)

- The PCM monitors the voltage of the fuel gauge sender unit. If the input voltage at PCM terminal 63 is below 0.1 V for 5 seconds, the PCM determines that the fuel gauge sender unit circuit has malfunction.

Fuel gauge sender unit circuit high input (P0463)

- The PCM monitors the voltage of the fuel gauge sender unit. If the input voltage at PCM terminal 63 is above 4.9 V for 5 seconds, the PCM determines that the fuel gauge sender unit circuit has malfunction.

Fuel gauge sender unit circuit performance (slosh check) (P0464)

- PCM monitors fuel gauge sender unit input voltage while engine is running. If fuel gauge sender unit input voltage differences are above 1 V for 14 seconds while vehicle is stopped, PCM determines that fuel gauge sender unit signal is incorrect.
  Diagnostic hint note:
  – This is a continuous monitor (CCM).
  – MIL illuminates if PCM detects the above malfunction condition in two consecutive drive cycles.
  – PENDING CODE is available if PCM detects the above malfunction condition during first drive cycle.
  – FREEZE FRAME DATA is available.
  DTC is stored in the PCM memory.

Vehicle speed sensor (VSS)

VSS circuit malfunction (P0500)

- If input signal from VSS indicates 0 km/h during the following monitoring conditions:
  – D, 2, or 1 range switch ON
  – Engine coolant temperature above 60 °C
  – Turbine speed above 1,500 rpm

Idle air control (IAC) system
Idle speed lower than expected (P0506)
- Actual idle speed is lower than expected by 100 rpm for 14 seconds, when brake pedal is depressed (brake switch is ON) and steering wheel is held straight ahead (power steering pressure switch is OFF).

Idle speed higher than expected (P0507)
- Actual idle speed is higher than expected by 200 rpm for 14 seconds, when brake pedal is depressed (brake switch is ON) and steering wheel is held straight ahead (power steering pressure switch is OFF).

Power steering pressure (PSP) switch
PSP switch circuit malfunction (P0550)
- The PCM monitors input voltage from PSP switch. If input voltage is low (switch stays ON: power steering fully turned condition) for 1 minute when the VSS is above 60.1 km/h {37.3 mph} and ECT is above 60 °C {140 °F}, the PCM determines that PSP switch circuit has malfunction.

Brake switch
Brake switch circuit malfunction (P0703)
- PCM does not detected the brake switch input voltage changes at 10 times while accelerating and deceleration repeatedly.

Heated oxygen sensor (HO2S) heater (Front RH/LH)
HO2S heater circuit low input (P0031: Front RH, P0051: Front LH)
- PCM terminal (93: RH, 94: LH) voltage is low when HO2S heater conditions is OFF.

HO2S heater circuit high input (P0032: Front RH, P0052: Front LH)
- PCM terminal (93: RH, 94: LH) voltage is high when HO2S heater conditions is ON.

Heated oxygen sensor (HO2S) heater (Middle/Rear) (Federal emission regulation applicable models)
HO2S heater circuit low input (P0037: Middle, P0043: Rear)
- PCM terminal (95: middle, 96: rear) voltage is low when HO2S heater conditions is OFF.

HO2S heater circuit high input (P0038: Front RH, P0044: Front LH)
- PCM terminal (95: middle, 96: rear) voltage is high when HO2S heater conditions is ON.

Heated oxygen sensor (HO2S) heater (Rear RH/LH) (California emission regulation applicable models)
HO2S heater circuit low input (P0037: Rear RH, P0057: Rear LH)
- PCM terminal (95: RH, 96: LH) voltage is low when HO2S heater conditions is OFF.

HO2S heater circuit high input (P0038: Rear RH, P0058: Rear LH)
- PCM terminal (95: RH, 96: LH) voltage is high when HO2S heater conditions is ON.

PRC solenoid valve
PRC solenoid valve circuit malfunction (P1250)
- The PCM monitors the input voltages from the PRC valve when the ignition switch is at ON position (engine OFF). If the PCM terminal No.44 does not read B+ unless circuit is grounded during operation, the PCM determines that the PRC valve circuit has malfunction.

Camshaft position (CMP) sensor
No SGC signal (P1345)
- PCM monitors input voltage from the CMP sensor while the MAF is above 2.43 g/sec. {0.321 lb/min.}. If the PCM does not receive input voltage from CMP sensor while the PCM receives input signal from CKP sensor, PCM determines that CMP circuit is malfunctioning.

Canister drain cut valve (CDCV)
CDCV circuit malfunction (P1449)
- The PCM monitors the input voltages from the CDCV when the ignition switch is at ON position (engine OFF). If the PCM terminal No.67 does not read B+ unless circuit is grounded during operation, the PCM determines that the CDCV circuit has malfunction.

EGR boost sensor solenoid valve
EGR boost sensor solenoid valve circuit malfunction (P1487)
- The PCM monitors the input voltages from the EGR boost sensor solenoid valve when the ignition switch is at ON position (engine OFF). If the PCM terminal 47 does not read B+ unless circuit is grounded during operation, the PCM determines that the EGR boost sensor solenoid valve circuit has malfunction.

EGR valve
EGR valve stepping motor coil circuit malfunction (P1496, P1497, P1498, P1499)
- The PCM monitors the input voltages from EGR valve coil control circuit while turn the ignition key to ON. If the PCM terminal 46, 56, 68 or 72 does not receive input signals unless circuit is grounded during operation. The PCM determines that the EGR valve circuit has malfunction.

Idle air control (IAC) valve
IAC valve circuit malfunction (P1504)

- The PCM monitors the electrical current of the IAC valve circuit when IAC duty is above 18%. If the PCM detects IAC valve circuit electrical current is below 100 mA (at 25 °C {77 °F}) or above 4.5 A (at 25 °C {77 °F}) for 1 second, the PCM determines that the IAC valve circuit has malfunction.

IMRC actuator
Intake manifold runner control (IMRC) close stuck

- The PCM monitors the voltage of IMRC monitor switch circuit. If the PCM terminal 3 voltage between 1.6 V and 4.9 V for 3.15 seconds when the IMRC valve is open. The PCM determines that the IMRC system has malfunction.

Intake manifold runner control (IMRC) open stuck

- The PCM monitors the voltages of IMRC monitor switch circuit. If the PCM terminal 3 voltage below 1.582 for 3.15 seconds when the IMRC valve change from open to close. The PCM determines that the IMRC circuit has malfunction.

Intake manifold runner control (IMRC) drive circuit malfunction

- The PCM monitors the voltages from IMRC circuit. If the PCM terminal 42 voltage is 3.0 V or below unless circuit is grounded during operation. The PCM determines that the IMRC circuit has malfunction.

PCM
PCM (keep alive memory) circuit malfunction (P1562)

- The PCM monitors the voltage of battery positive terminal at PCM terminal 55. If the PCM detected battery positive terminal voltage below 2.5 V for 2 seconds, the PCM determines that the backup voltage circuit has malfunction.

Generator
Generator output voltage signal no electricity (P1631)

- PCM detects the generator output voltage is below 8.5 V for 5 seconds while engine running.

Generator terminal B circuit open (P1634)

- PCM detects that the generator output voltage above 17.0 V and battery positive voltage below 11.0 V for 5 seconds while engine running.

Battery
Battery overcharge (P1633)

- PCM detects that the generator output voltage above 18.5 V or battery positive voltage above 16.0 V for 5 seconds while engine running.

Fail-safe Function

Detection Name	Fail-safe (value)
MAF sensor (circuit low input)	• Adjust charging efficiency to preset valve
MAF sensor (circuit high input)	
EGR boost sensor (circuit low input)	• Sets barometric pressure to 101.3 kPa {760 mmHg, 29.9 inHg}
EGR boost sensor (circuit high input)	
IAT sensor (circuit low input)	• Sets IAT to 20 °C {68 °F}
IAT sensor (circuit high input)	
ECT sensor (circuit low input)	• Sets ECT to 80 °C {176 °F}
ECT sensor (circuit high input)	
TP sensor (circuit low input)	• Sets throttle opening angle to wide open throttle position
TP sensor (circuit high input)	
Knock sensor (circuit malfunction)	• Sets knock correction (ESA control) to fixed value
HO2S (no activity)*1, *2	• Stop feedback control of fuel injection control
Closed loop	
Over charge	• Stops generator control
CKP sensor	• Stop fuel injection

*1 : HO2S (Front RH, LH) California emission regulation applicable models
*2 : HO2S (Front) Federal emission regulation applicable models

SUSPENSION

02
SECTION

02–00 OUTLINE

SUSPENSION NEW FEATURES

YMU200S01

Reduced Weight and Improved Rigidity

- A pipe type front crossmember main frame has been adopted.
- A high rigidity, W-shaped, lower arm has been adopted.

Improved Handling Stability and Driving Comfort

- The front lower arm bushing (rear side) is installed vertically.
- Separate input type shock absorber mounts (front) have been adopted.
- Low-pressure gas charged shock absorber has been adopted.
- A torsion beam axle type rear suspension has been adopted. This type of suspension has minimal camber / toe change and offers stable handling irrespective of the load.

SUSPENSION SPECIFICATIONS

YMU200S02

Item			Specification: 2000MY	Specification: 1998MY
WHEEL ALIGNMENT (UNLOADED)*1				
Front	Maximum steering angle	Inner	37°6′±3°	40°45′±2°
		Outer	32°0′±3°	31°50′±2°
	Total toe-in	(mm {in})	2±4 {0.08±0.16}	0±4
		(degree)	0°11′±0°22′	0°24′±18′
	Camber angle		−0°54′±1°	0°22′
	Caster angle		1°46′±1°	5°27′
	Kingpin angle (Reference value)		11°12′	12°56′
Rear	Total toe-in	(mm {in})	3±4 {0.12±0.16}	0 {0}
		(degree)	0°8′±11′	0°
	Camber angle		−1°±1°	0°
Suspension type		Front	Strut	←
		Rear	Torsion beam	5 link
Shock absorber			Cylindrical, double-acting (low-pressure gas charged)	Cylindrical, double-acting (oil-filled)
Spring type			Coil spring	←
Stabilizer	Type		Torsion bar	←
	Diameter (mm {in})	Front	18 {0.71}	34 {1.34}
		Rear	34 {1.34}	24 {0.94}

*1 : Engine coolant and engine oil are at specified levels. Spare tire, jack and tools are in designated position.

02–12 WHEELS AND TIRES

WHEELS AND TIRES OUTLINE

YMU212S01

- Construction of the wheels and tires are basically the same as the 1999MY Protegé. However, the following points have been changed:
  - Adoption of P215/60R 16 94H, P205/65 R15 92S tires

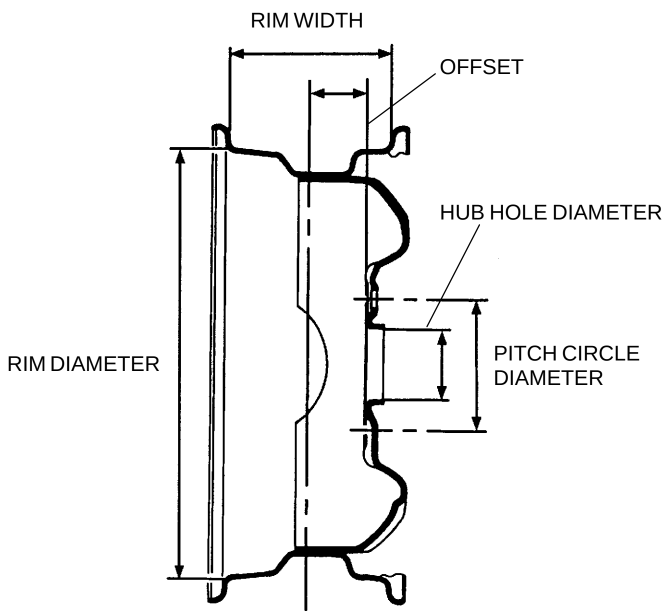
Wheel Specifications

(mm {in})

	RIM WIDTH	RIM DIAMETER	PITCH CIRCLE DIAMETER	HUB HOLE DIAMETER	OFFSET
15 × 6JJ Steel wheel	152.0 {6.0}	380.2 {15.0}	114.3 {4.50}	67.0 {2.64}	50 {1.97}
15 × 6JJ Aluminum wheel	152.0 {6.0}	380.2 {15.0}	114.3 {4.50}	67.0 {2.64}	50 {1.97}
16 × 6JJ Aluminum wheel	152.0 {6.0}	405.6 {16.0}	114.3 {4.50}	67.0 {2.64}	50 {1.97}

WHEEL CROSS-SECTIONAL VIEW

YMU212S02



YMU212SA0

02–13 FRONT SUSPENSION

02

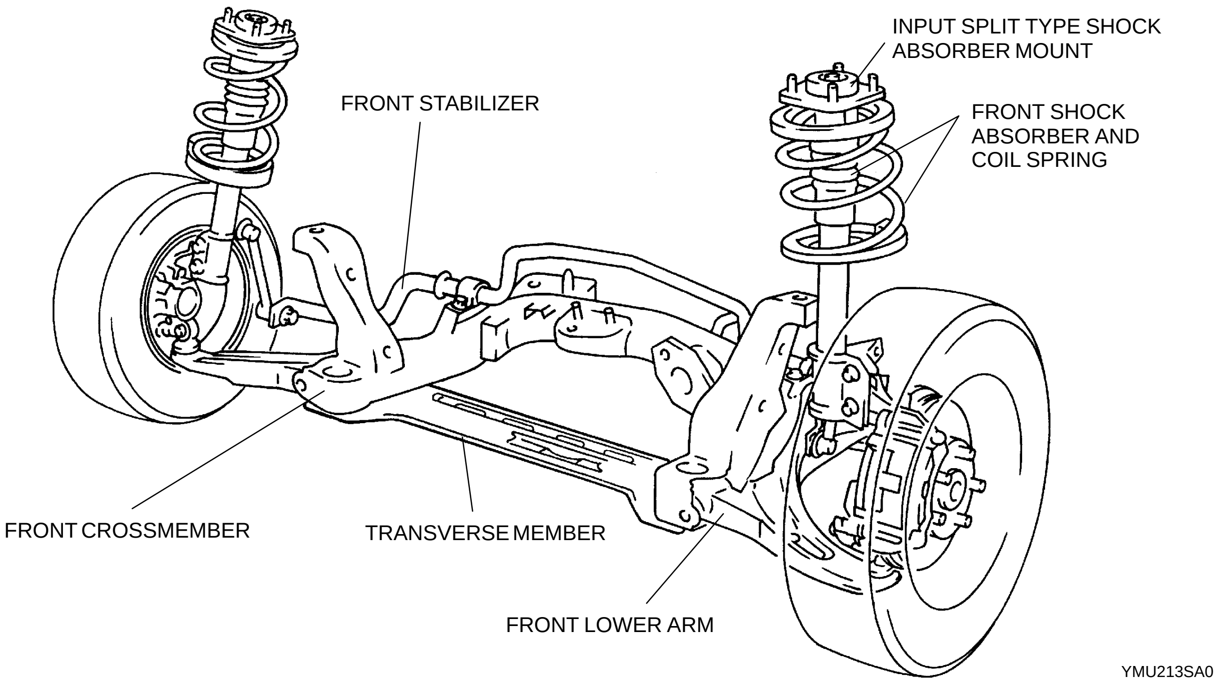
FRONT SUSPENSION OUTLINE

YMU213S01

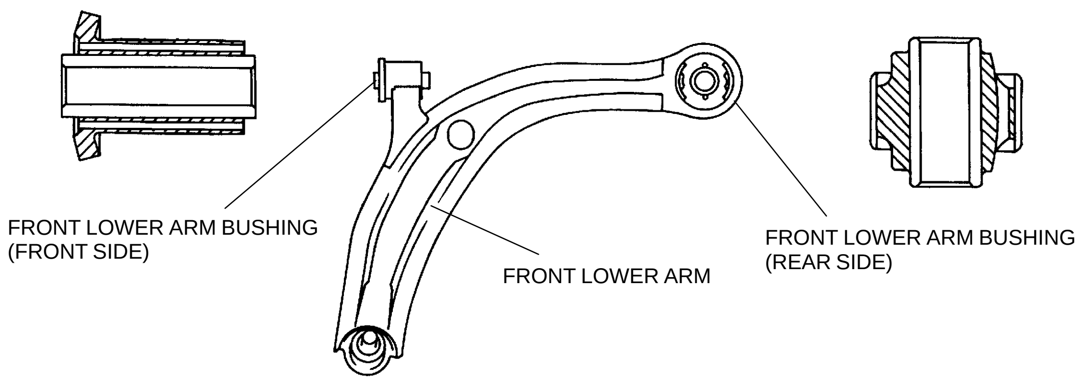
- The front suspension is strut type. Construction and operation of the front suspension is the same as the 1999MY Protegé.

FRONT SUSPENSION STRUCTURAL VIEW

YMU213S02

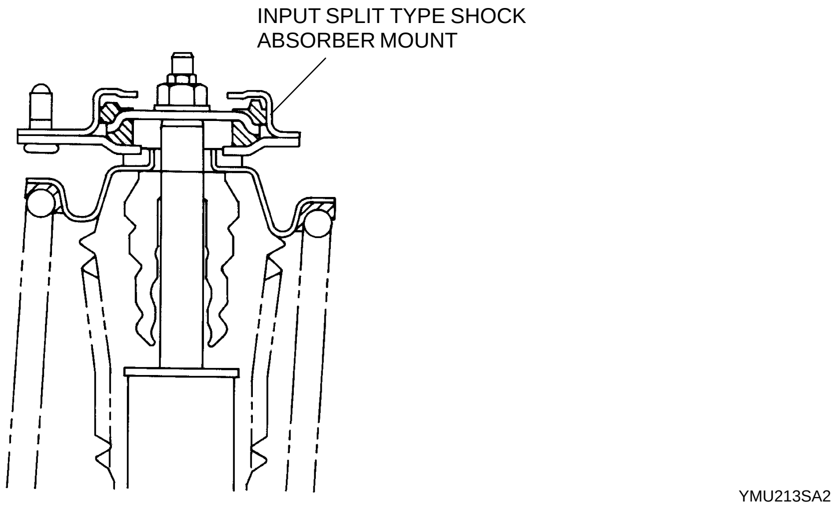


YMU213SA0



YMU213SA1

Shock Absorber Mount



- An input split type mount with a separated plate that receives the reaction force of the coil spring and the piston rod has been adopted. This construction enhances damping, which reduces road noise and jounce transmitted to the vehicle.

02–14 REAR SUSPENSION

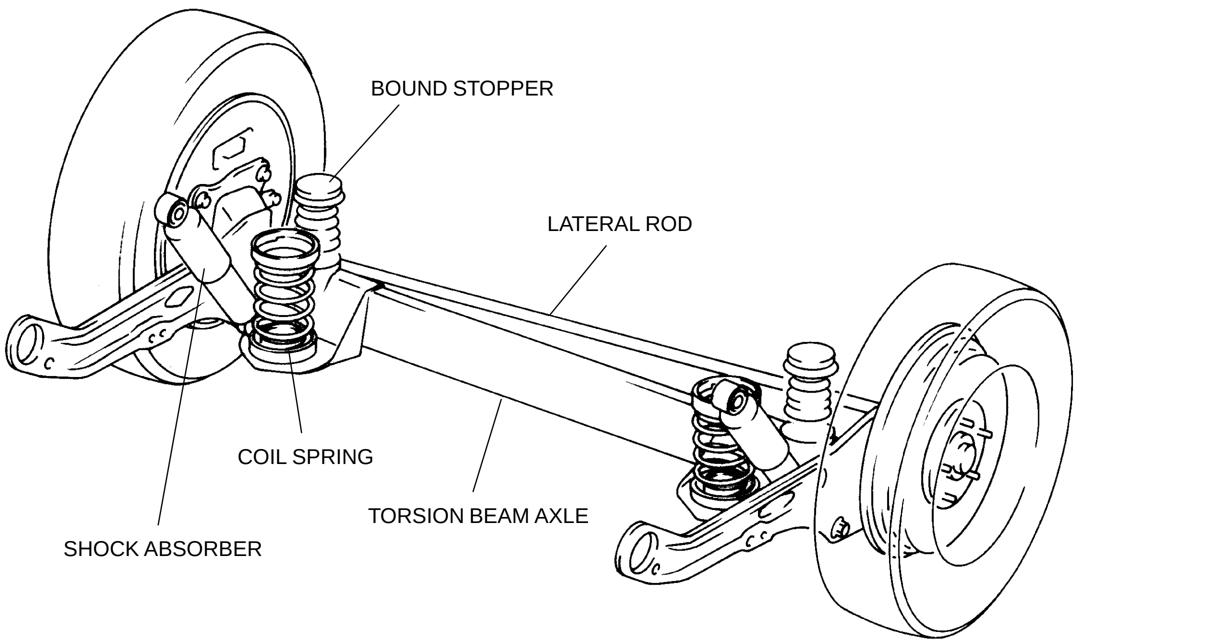
REAR SUSPENSION OUTLINE

YMU214S01

- The rear suspension is a torsion beam axle type, which minimizes the change in the camber/toe, and provides stable handling irrespective of the load. Also, the coil spring and the shock absorber have been separated, and the coil spring has been offset from the trailing arm. This enables the shock absorber and the coil spring to be located closer together for a lower and flatter passenger cabin floor.

REAR SUSPENSION STRUCTURAL VIEW

YMU214S02



DRIVELINE/AXLE

03
SECTION

03–00 OUTLINE

DRIVELINE/AXLE ABBREVIATION

YMU300S01

ATX	Automatic transaxle

DRIVELINE/AXLE NEW FEATURES

YMU300S02

Improved Durability

- Plastic drive shaft boot has been adopted.

Reduced Vibration

- Adoption of rubber mount type joint shaft bracket.

DRIVELINE/AXLE SPECIFICATIONS

YMU300S03

Item		2000MY	1998MY
Front axle			
Bearing type		Angular ball bearing	←
Rear axle			
Bearing type		Angular ball bearing	←
Drive shaft			
Joint type	Wheel side	Bell joint	N/A
	Transaxle side	Tripod joint	N/A
Shaft diameter (mm {in})		24.0 {0.94}	N/A
Joint shaft			
Shaft diameter (mm {in})		26.0 {1.02}	N/A
Differential			
Type		N/A	Standard
Reduction gear		N/A	Hypoid gear
Reduction ratio		N/A	3.909
Differential gear		N/A	Straight-bevel gear
Ring gear size (mm {in})		N/A	203.2 {8.0}
Oil	Grade	N/A	API Service GL-5, SAE80W–90
	Capacity (L {US qt, Imp qt})	N/A	1.5 {1.6, 1.3}

03–11 FRONT AXLE

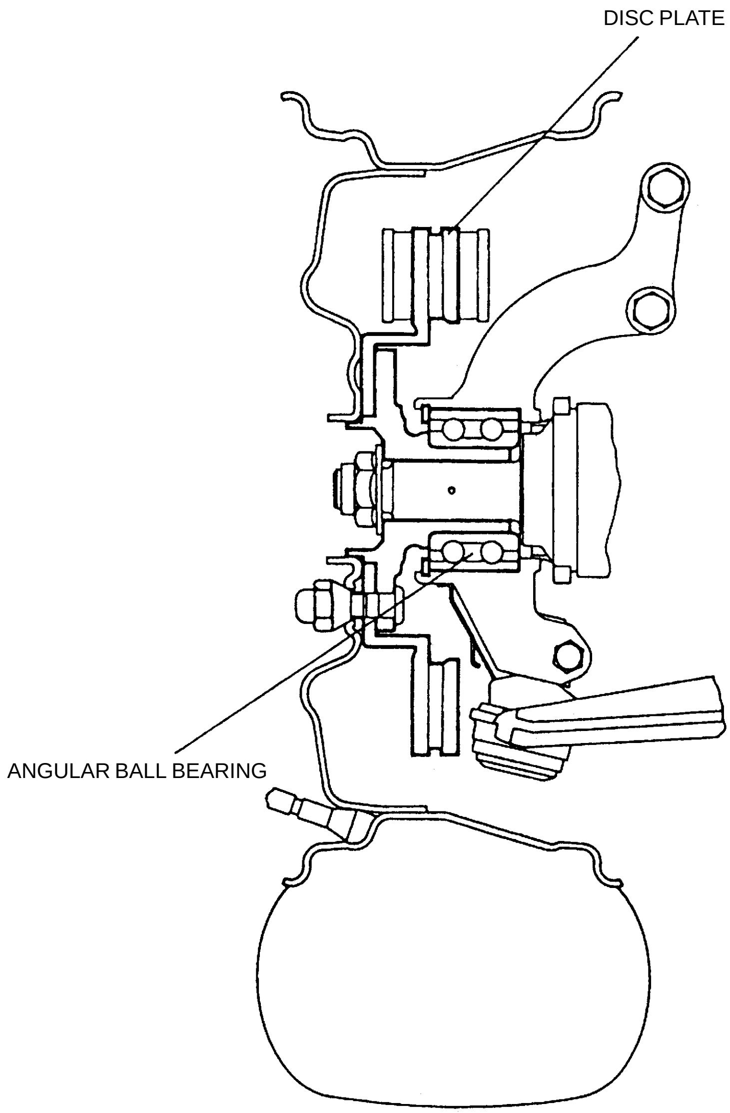
FRONT AXLE OUTLINE

YMU311S01

- Construction of the front axle is the same as the 1999MY 626.

FRONT AXLE CROSS-SECTIONAL VIEW

YMU311S02



W6U311SA0

03–12 REAR AXLE

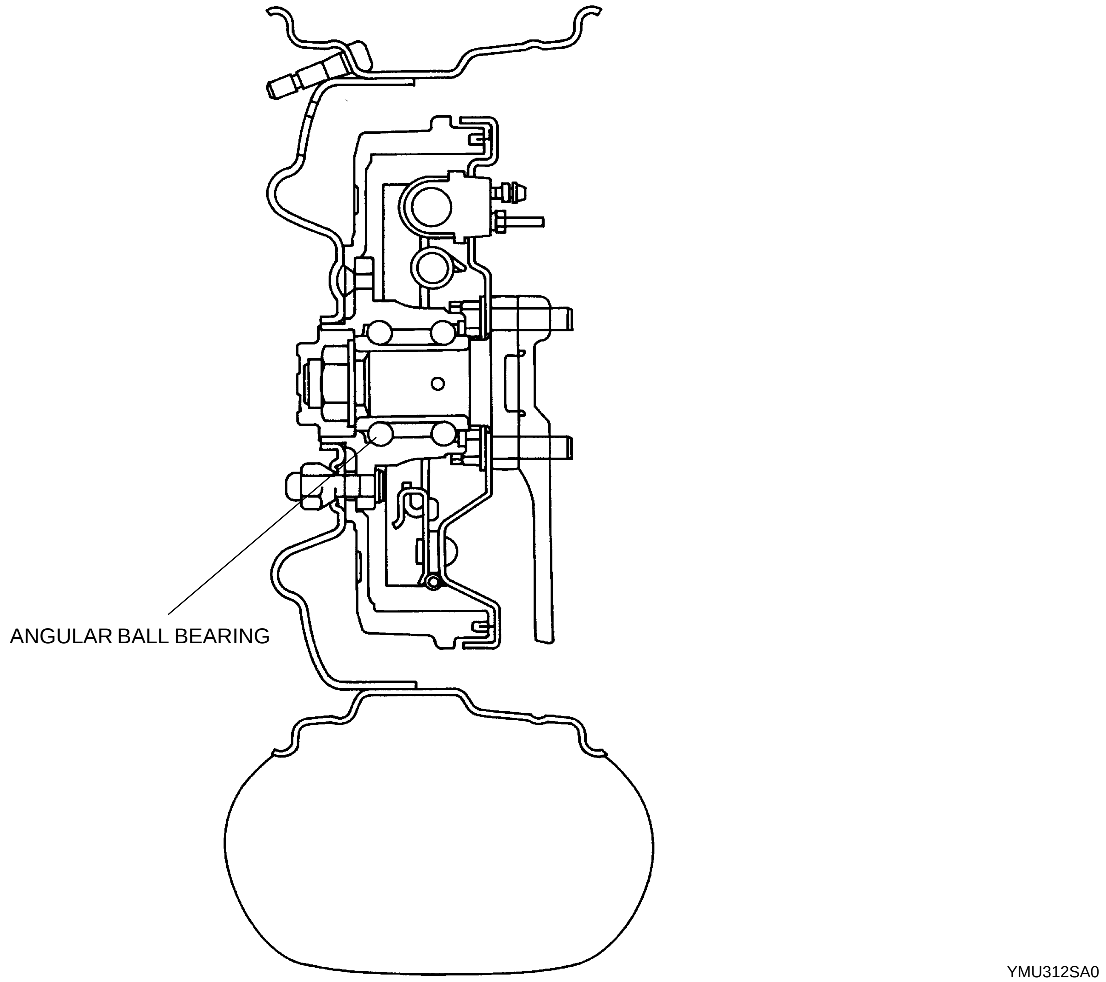
REAR AXLE OUTLINE

YMU312S01

- Construction of the rear axle is the same as the 1999MY 626 drum brake type.

REAR AXLE CROSS-SECTIONAL VIEW

YMU312S02



03–13 DRIVE SHAFT

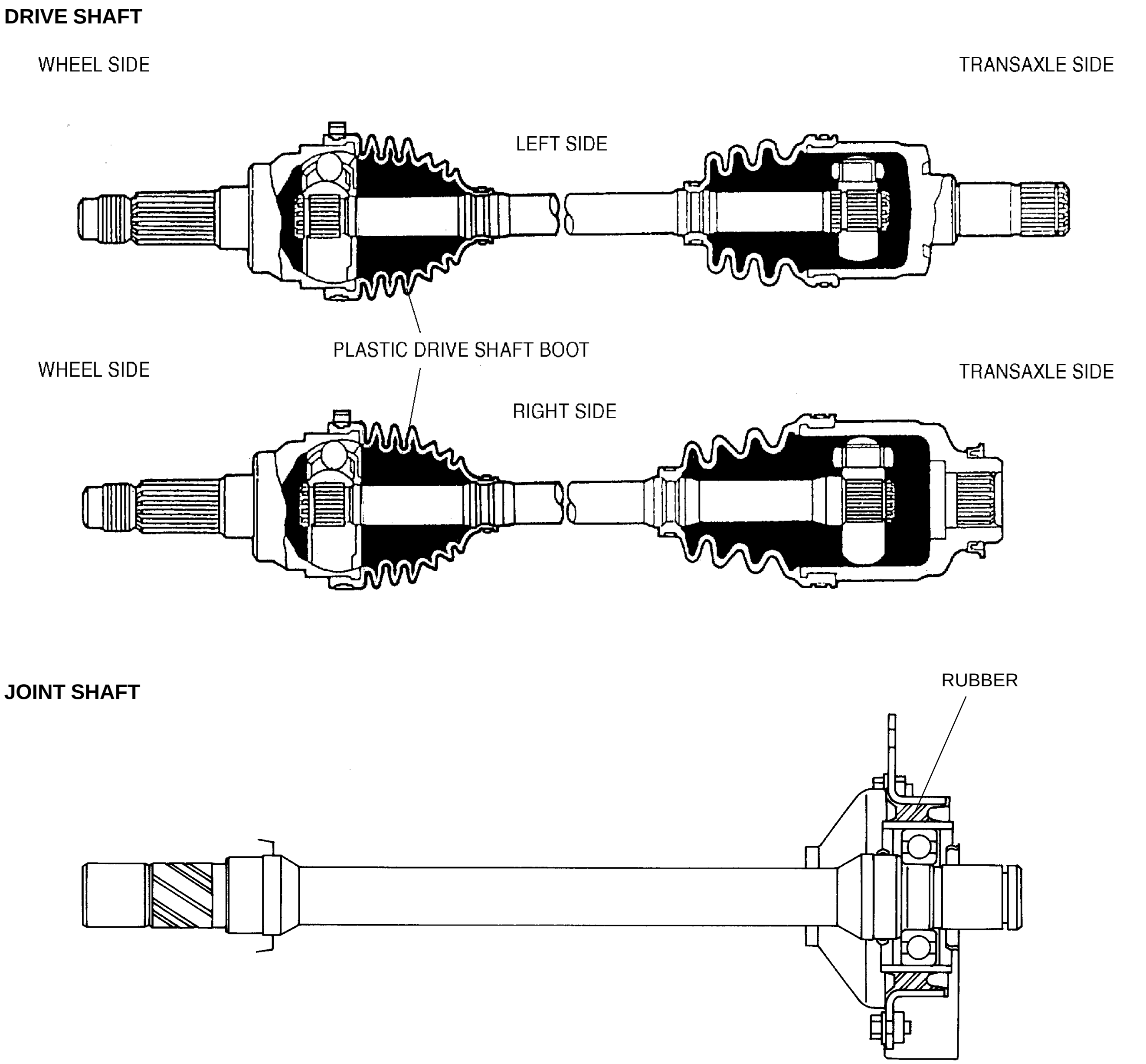
DRIVE SHAFT OUTLINE

YMU313S01

- Construction of the drive shaft is basically the same as the 1999MY 626. However, by adopting a rubber type bracket to the support section of the joint shaft, vibration has been reduced.

DRIVE SHAFT CROSS-SECTIONAL VIEW

YMU313S02



YMU313SA0

BRAKES

04 SECTION

04–00 OUTLINE

BRAKES ABBREVIATIONS

YMU400S01

ABS	Antilock brake system
CM	Control module
EBP	Electronic brakeforce proportioning
HU	Hydraulic unit

LF	Left front
LR	Left rear
RF	Right front
RR	Right rear

BRAKES NEW FEATURES

YMU400S02

Improved Reliability

- Adoption of integrated ABS control module (CM) and ABS hydraulic unit (HU)

Improved Serviceability

- Subdivided ABS DTCs
- Adoption of a four-digit service code indicator
- Adoption of a data monitor function
- Adoption of an active command mode function
- Adoption of Electronic Brakeforce Proportioning

BRAKES SPECIFICATIONS

YMU400S03

Item		2000MY	1998MY
CONVENTIONAL BRAKE SYSTEM			
Brake pedal	Type	Suspended	←
	Pedal lever ratio	4.10	4.01
	Max. stroke (mm {in})	125 {4.92}	153 {6.02}
Master cylinder	Type	Tandem (with level sensor)	←
	Cylinder inner diameter (mm {in})	23.8 {0.94}	←
Front disc brake	Type	Ventilated disc	←
	Cylinder bore (mm {in})	42.85 {1.69} × 2	←
	Pad dimensions (area × thickness) (mm^2 {in^2} × mm {in})	5850 {9.36} × 10.5 {0.41}	6000 {9.60} × 9.5 {0.37}
	Disc plate dimensions (outer diameter × thickness) (mm {in})	274 × 28 {10.8 × 1.1}	276 × 28 {10.9 × 1.1}
Rear disc brake	Type	N/A	Ventilated disc
	Cylinder bore (mm {in})	N/A	41.3 {1.63}
	Pad dimensions (area × thickness) (mm^2 {in^2} × mm {in})	N/A	3300 {5.28} × 10 {0.39}
	Disc plate dimensions (outer diameter × thickness) (mm {in})	N/A	286 × 18 {11.25 × 0.71}
Rear drum brake	Type	Leading-trailing	N/A
	Wheel cylinder inner diameter (mm {in})	19.05 {0.75}	N/A
	Lining dimensions (width × length × thickness) (mm {in})	50.0 × 243.8 × 4.5 {1.97 × 9.60 × 0.18}	N/A
	Drum inner diameter (mm {in})	254 {10}	N/A
	Shoe clearance adjustment	Automatic adjuster	N/A
Power brake unit	Type	Vacuum multiplier	←
	Diameter (mm {in})	293 {11.5}	213 + 240 {8.4 + 9.4}
Brake force control device	Type	Electronic brakeforce proportioning control (with ABS) Dual proportioning valve (without ABS)	Load sensing proportioning valve
Brake fluid		SAE J1703 or FMVSS116 DOT3	←
PARKING BRAKE SYSTEM			
Parking brake	Type	Mechanical rear-wheel control	←
	Operation system	Center lever	←

04–11 CONVENTIONAL BRAKE SYSTEM

CONVENTIONAL BRAKE SYSTEM OUTLINE

YMU411S01

Front brake

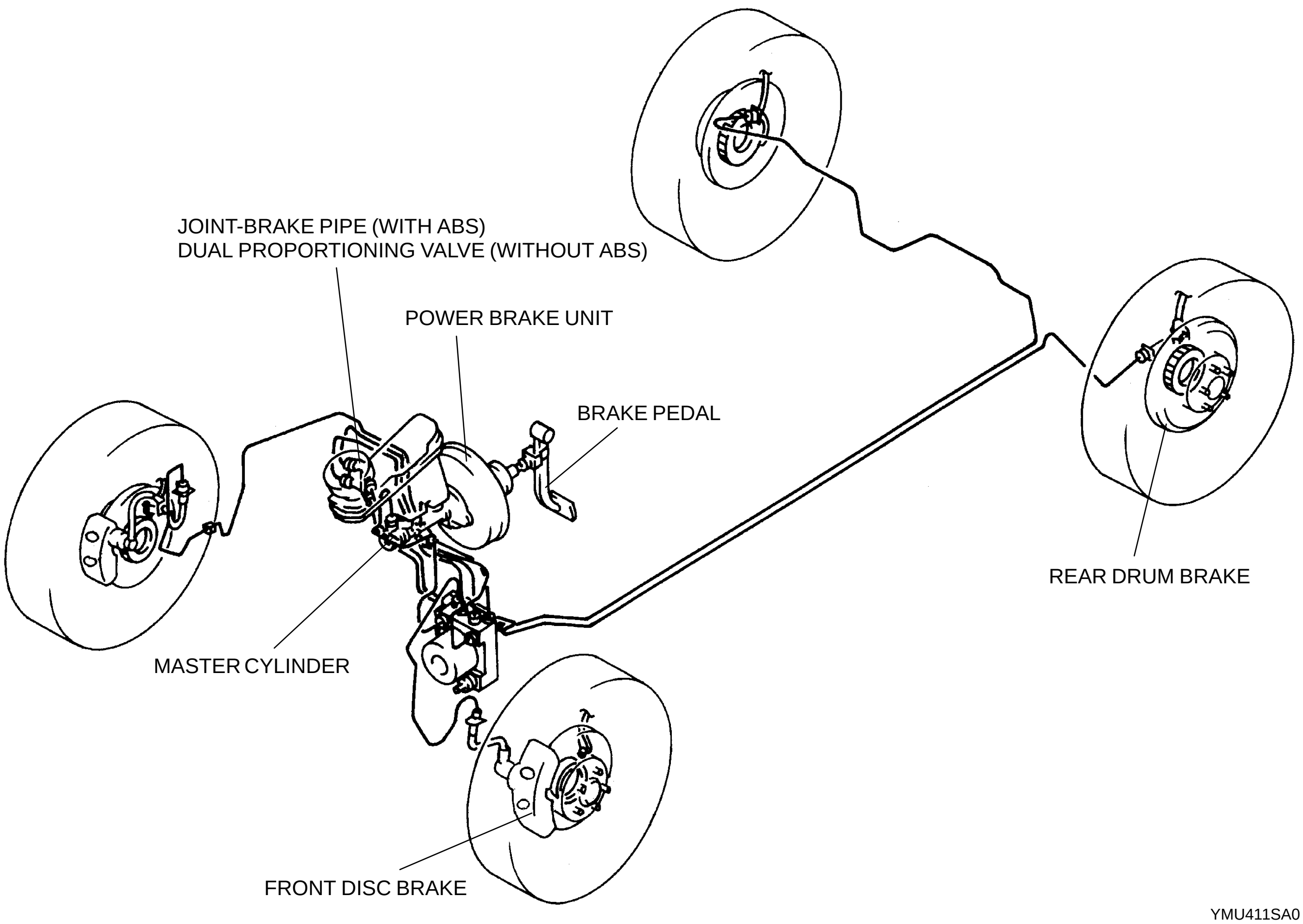
- The construction and operation of the conventional front brake system is the same as the 1998MY MPV.

Rear brake

- The construction and operation of the conventional rear brake system is the same as the 1999MY 626 drum brake type.

CONVENTIONAL BRAKE SYSTEM STRUCTURAL VIEW

YMU411S02



04–12 PARKING BRAKE SYSTEM

PARKING BRAKE SYSTEM OUTLINE

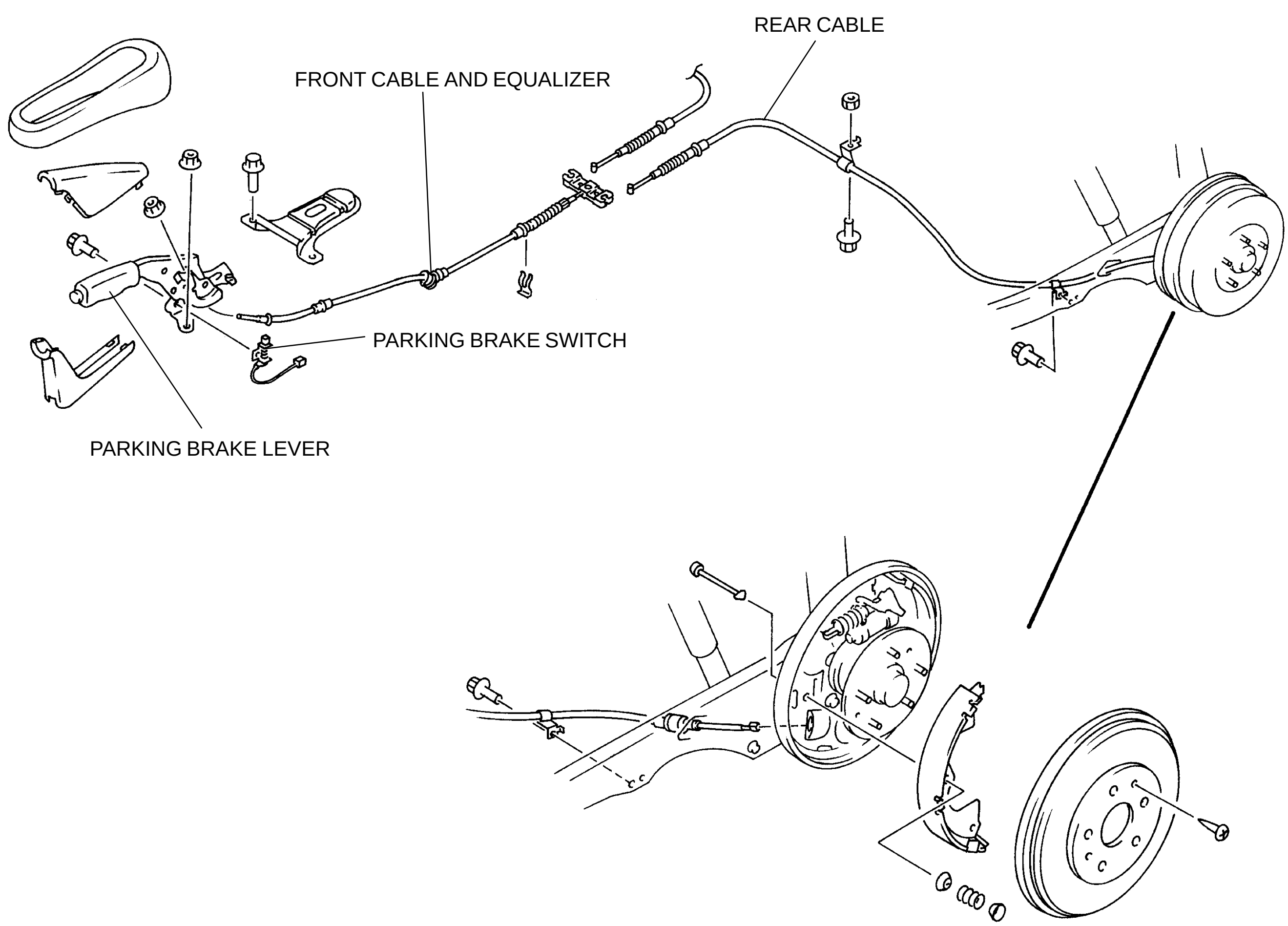
YMU412S01

- The parking brake system is a mechanical rear-wheel control, center lever type. The construction and operation is the same as the 1999MY Protegé.

04

PARKING BRAKE SYSTEM STRUCTURAL VIEW

YMU412S02



YMU412SA0

04–13 ANTILOCK BRAKE SYSTEM

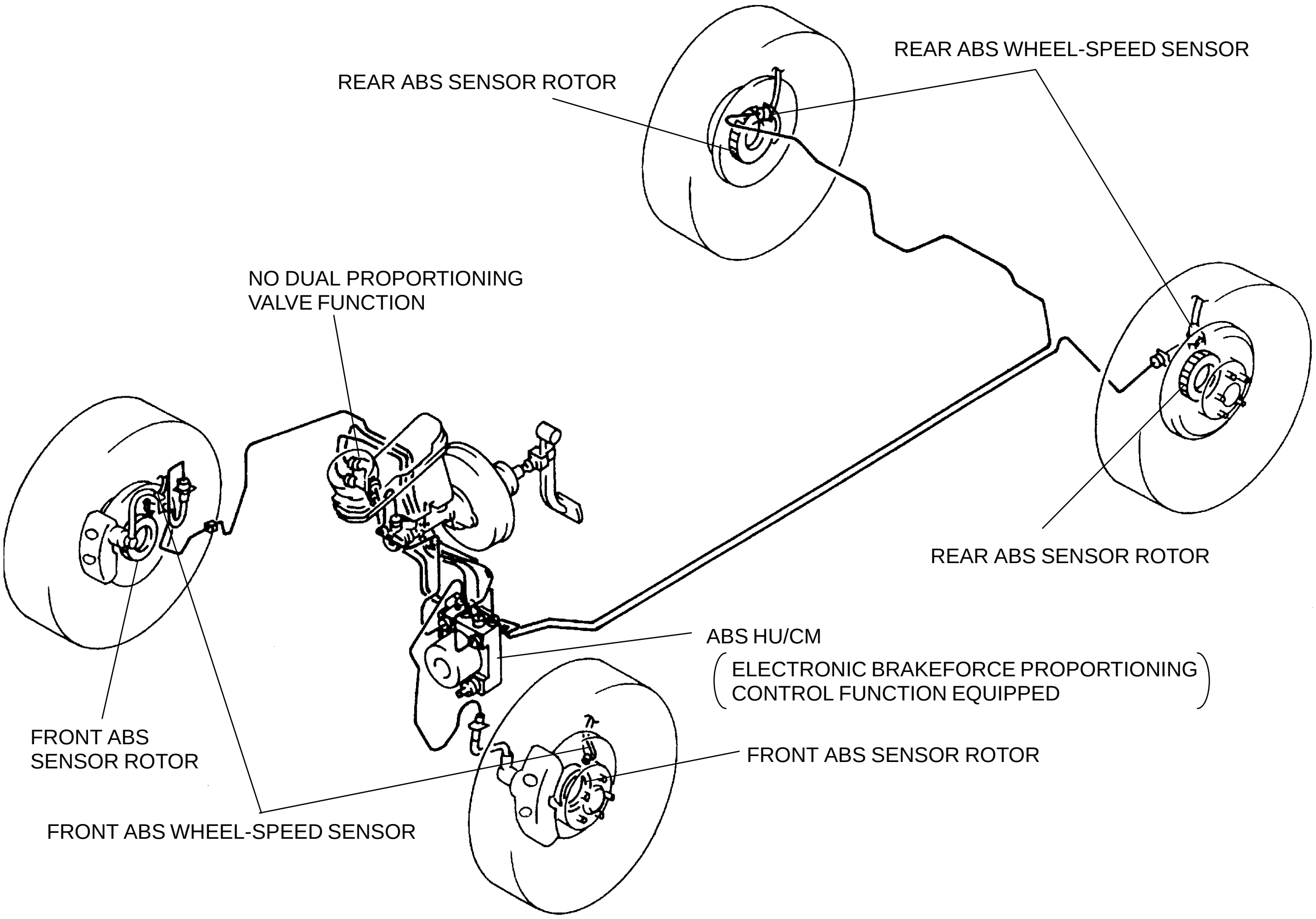
ABS OUTLINE

YMU413S01

- The integrated ABS Hydraulic Unit/Control Module (HU/CM) system is compact and lightweight, highly reliable.
- The Electronic Brakeforce Proportioning (EBP) control has been adopted in the ABS HU/CM instead of mechanical control, and the dual-proportioning valve has been eliminated.
- The integrated ABS HU/CM system controls the ABS and EBP. The ABS is an independent front wheel control, rear axle control (select low control), 4-sensor, 3-channel system same as the 1999MY 626. The EBP is an independent front wheel control, independent rear wheel control, 4-sensor, 4-channel system.
- The On-Board Diagnosis (OBD) system has been improved.
  – The PID/DATA monitor function is adopted.
  – The active command modes is adopted.
  – The serial communication is adopted.
  – The DTC function is modified.
- The NGS tester is used for diagnostics.

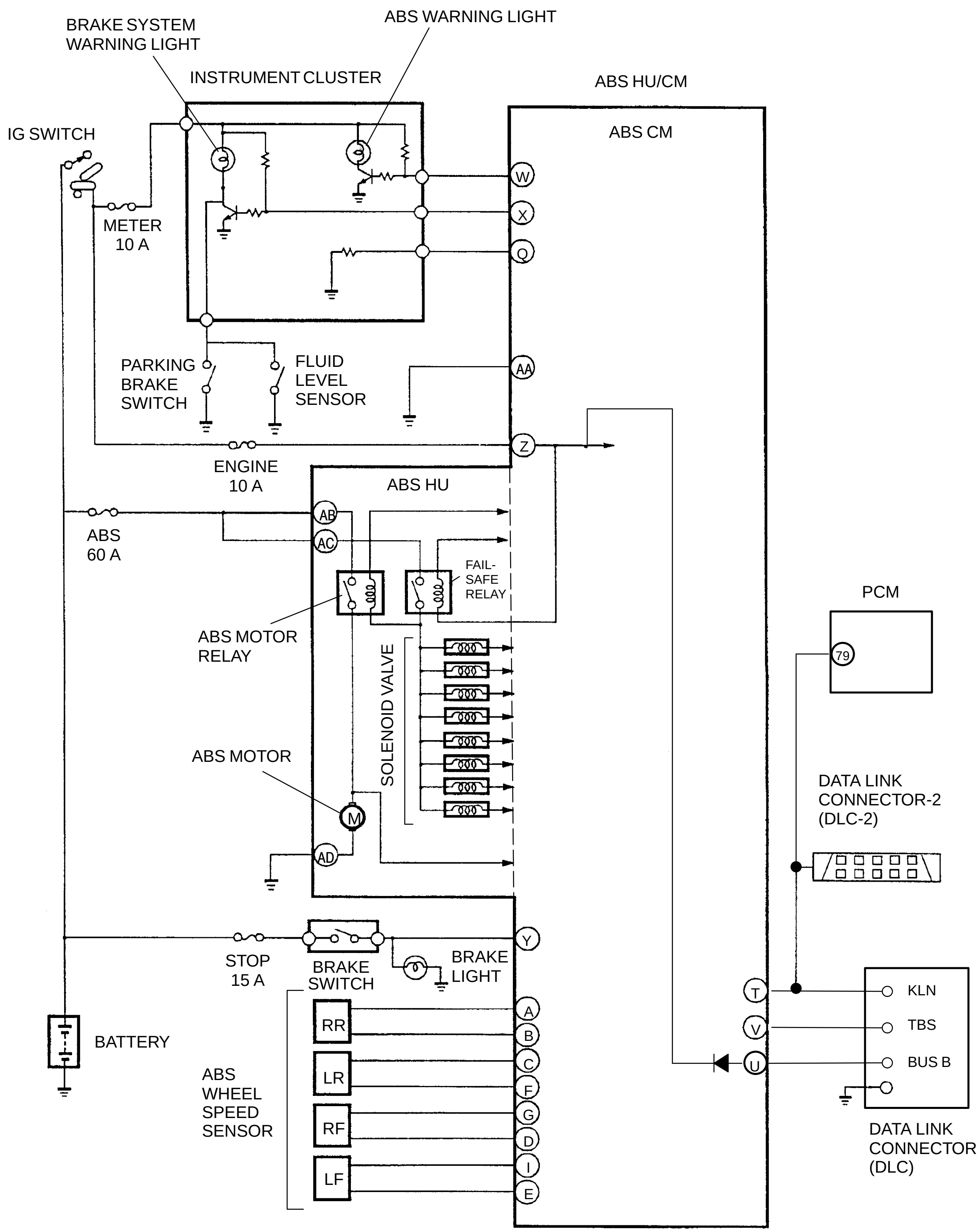
ANTILOCK BRAKE SYSTEM STRUCTURAL VIEW

YMU413S02



ABS SYSTEM DIAGRAM

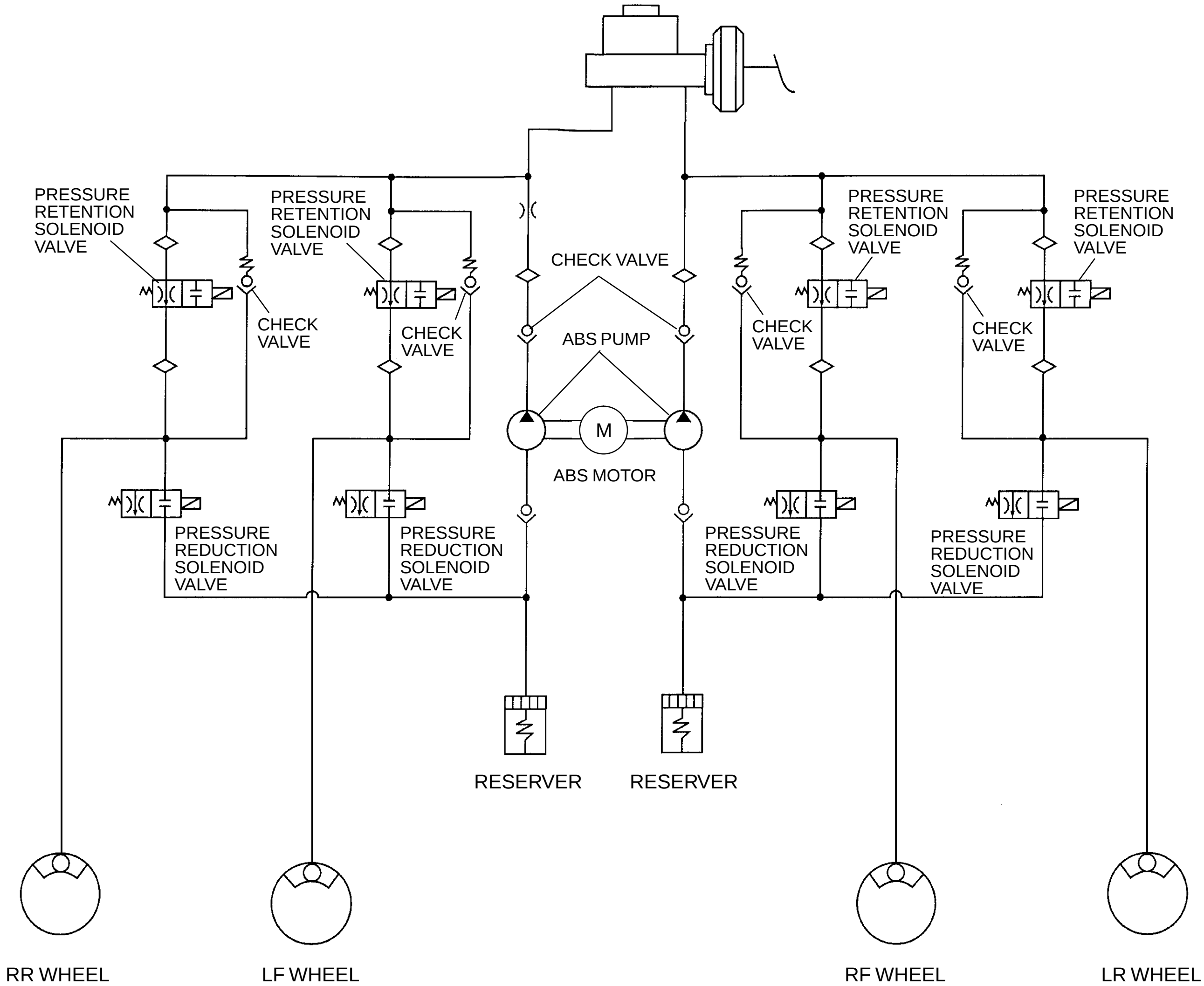
YMU413S03



YMU413SA1

ABS HYDRULIC LINE DIAGRAM

YMU413S04



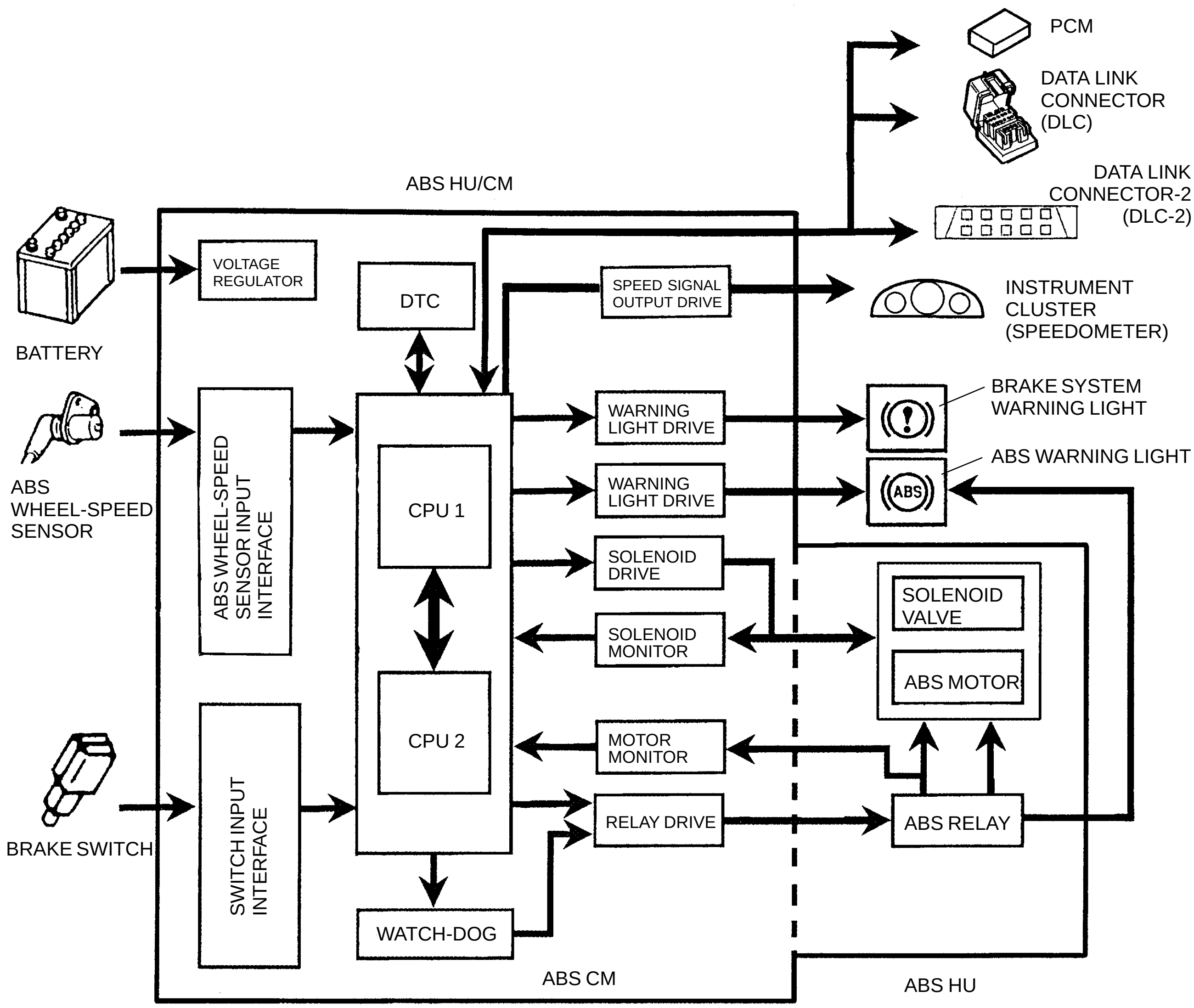
YMU413SB4

ABS HU/CM DESCRIPTION

YMU413S05

- The ABS HU/CM detects wheel-speed and driving conditions based on the ABS wheel-speed sensors. The ABS HU/CM converts this information to outputs on/off electronic signals to the pressure retention solenoid valves and pressure reduction solenoid valves to control the following functions.
  - 4 sensor, 3-channel.select low control ABS control
  - Electronic Brakeforce Proportioning (EBP) control uses a 4 sensor, 4-channel system
- CPU1 and CPU2 in the ABS HU/CM monitor each other for the ABS HU/CM safety. The function of CPU1 and CPU2 is as follows.
  - CPU1 controls the ABS operation by activating the pressure retention and pressure reduction solenoid valves based on the signals from each wheel-speed sensor.
  - CPU2 has a self-diagnosis function that monitors the system operation and input/output signals from CPU1. When CPU2 detects an abnormal condition, it stops the ABS operation.
- The ABS HU/CM constantly calculates the average value of the signals from the front ABS wheel-speed sensors, and sends a vehicle speed signal to the instrument cluster.
  - The ABS HU/CM constantly sends the average value of the two sensors on either side of front wheels. In case a malfunction occurs in one of the sensors, however, the ABS sends a value from only the normal sensor.

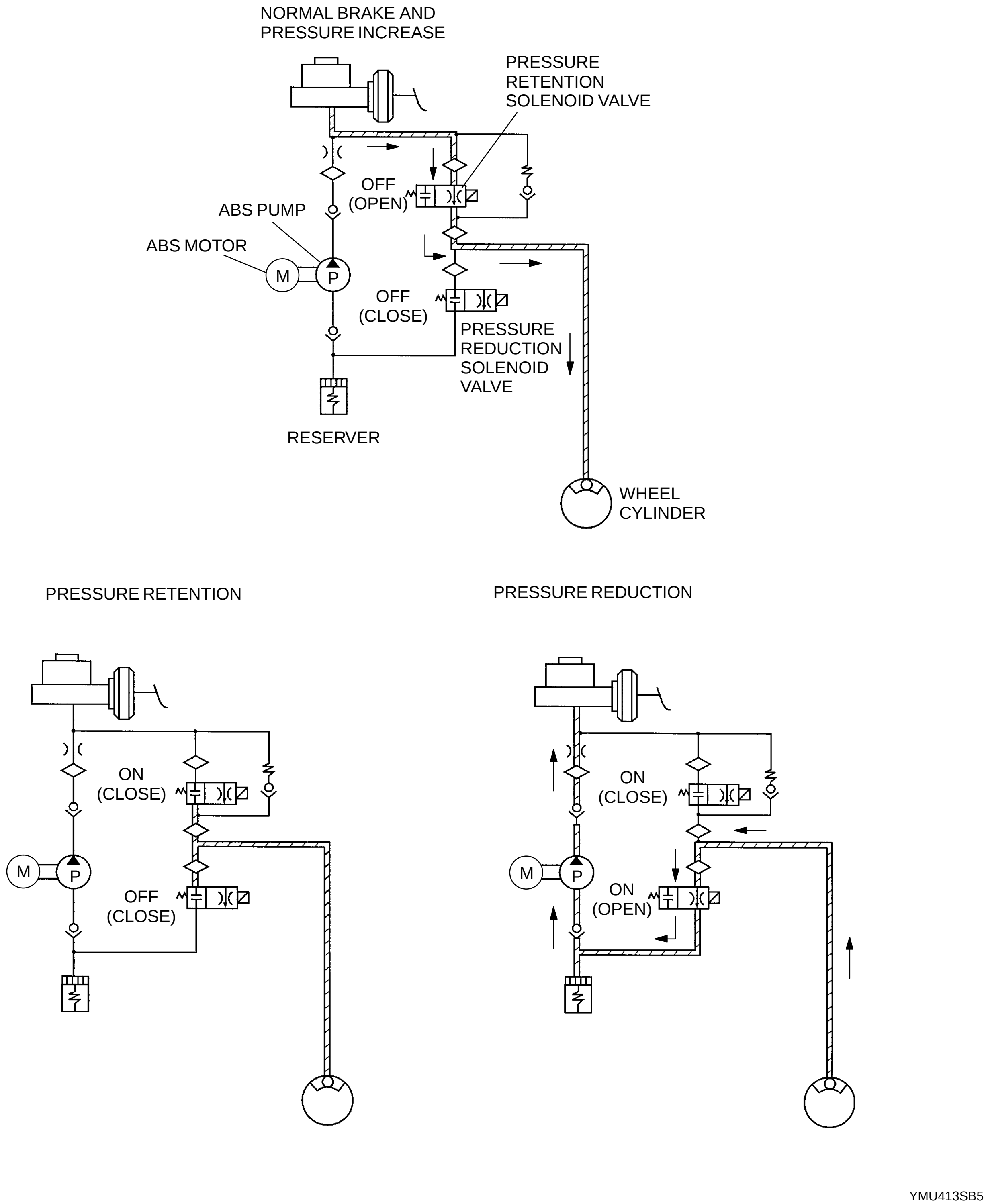
Block Diagram



YMU413SA3

ABS Control

- 4-sensor, 3-channel, select low control ABS control is the same as that on the 1999MY 626.
- The ABS HU/CM calculates wheel slip from the ABS wheel-speed sensor signals, and adjusts brake pressure.



	Pressure retention solenoid valve	Pressure reduction solenoid valve	ABS motor
Normal brake and Pressure increase	Off (open)	Off (close)	Stopped
Pressure retention	On (close)	Off (close)	Stopped
Pressure reduction	On (close)	On (open)	Operating

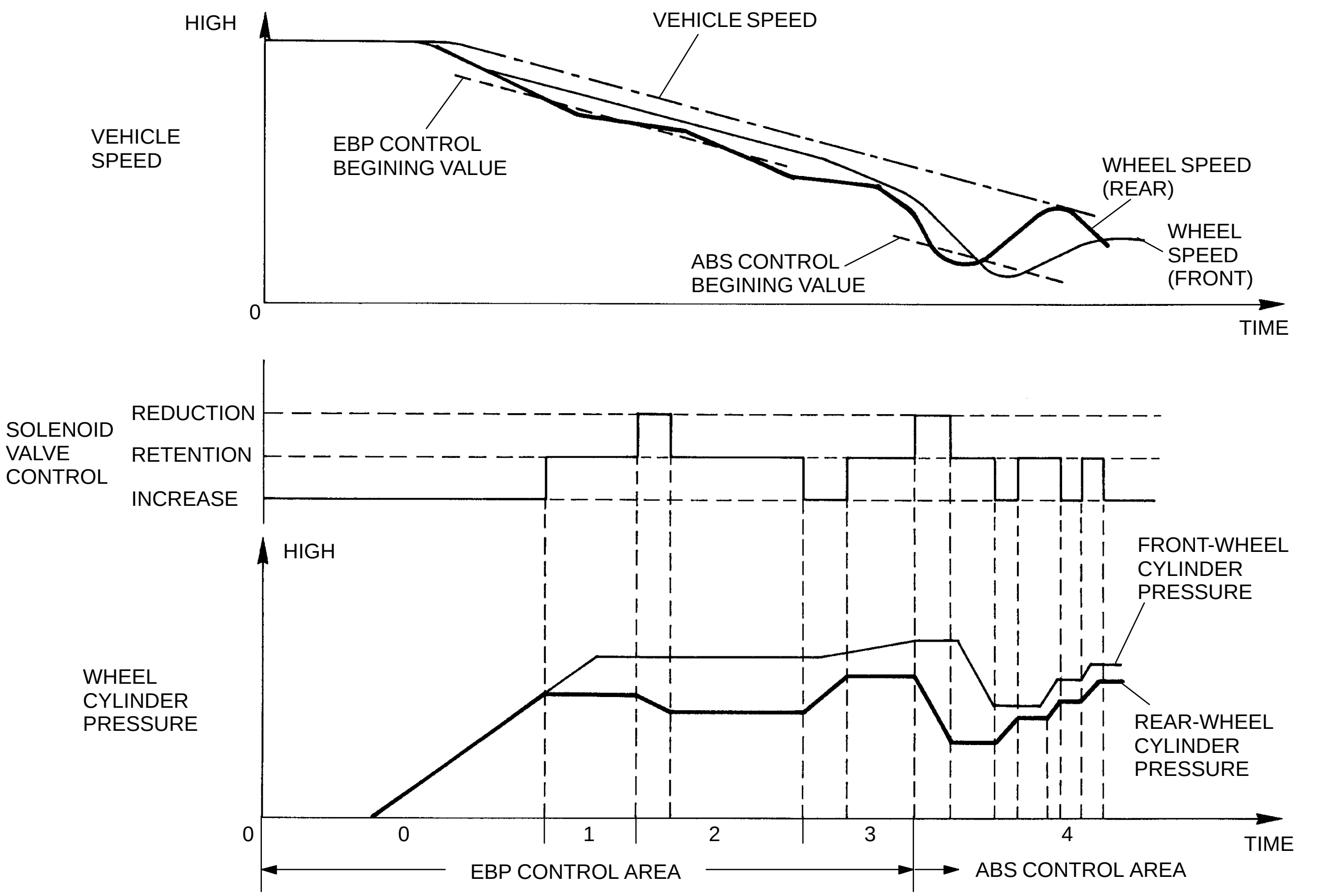
Electronic Brakeforce Proportioning (EBP) Control System Outline

- The EBP control system measures front-vs-rear wheel slippage. When rear wheel slippage exceeds the present “proportional” limit (front to rear), the ABS HU/CM reduces brake fluid pressure to the rear wheel through the proportioning valve to maintain the estimated vehicle speed. (See chart below.)
- The chart and table below show condition under which the EBP control operates.

Control condition table

Condition	Rear wheel slip	Electronic brakeforce proportioning control	Rear brake fluid pressure	Note
0	No slip	No control	Increase	Normal brake
1	a%–b%	Control	Retention	EBP control
2	b% or more (During EBP control)		Reduction/Retention	
3	c% or less (During EBP control)			
4	Front wheel slip d% or more	Stop control	Reduction/Retention/increase	ABS control

Note: a, b, c and d are preset values.



YMU413SB8

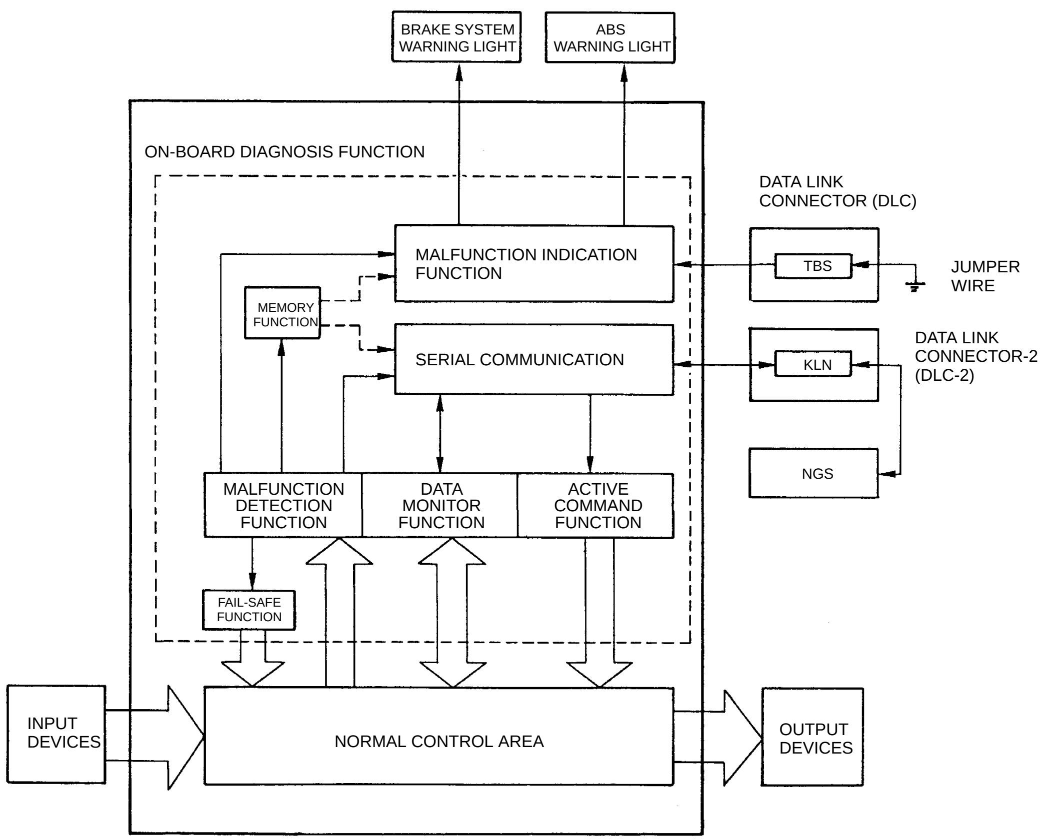
ON-BOARD DIAGNOSTIC SYSTEM DESCRIPTION

YMU413S06

The following on-board diagnostic functions are available.

Function Name	Detail function	Comparison of 1999MY 626
Failure detection function	• The failure detection function detects failure of input and output devices of the ABS HU/CM system. • The failure detection function includes a self-diagnosis function, fail-safe function, and memory function	• Adopted diagnosis system for EBP control • Sub divided DTC • Both 4-digit DTC (by using NGS) and 2-digit DTC (by using ABS warning light) are available
Self-diagnosis function	• The input and output device self-diagnosis function is carried out when the ignition switch is at the ON position, include when driving. • When a failure is detected, the diagnosis system warn the driver by illuminating the ABS warning light and/or BRAKE system warning light.	
Fail-safe function	• When the failure is detected, ABS HU/CM limits ABS control and EBP control operate at a preset mode to ensure braking performance.	
Memory function	• The memory function stores malfunction as a DTC even after failure is solved. Because failed devices are memorized even after the ignition switch is turned to OFF, this function can be used to detect intermittent failure. • The memory can be erased by using the NGS or by shorting TBS terminal of DLC to ground with the brake pedal is depressed 10 times with intervals of less than one second.	
Failure indication function	• When a failure is detected, the indication function outputs the DTC • DTC can be retrieved by using the NGS. DTC can also be retrieved by using ABS warning light by shorting the TBS terminal of DLC to ground	
PID data monitoring function	• By using the PID/Data monitor function of NGS, the input and output signals and calculated value of the ABS HU/CM can be monitored	Revised and added PID
Active command modes function	• By using the active command modes function of NGS, output devices in ABS HU/CM can be operated regardless of the ABS HU/CM control (Same function at the SIMULATION TEST)	Revised and added active command modes function
Serial communication	• Communicates with NGS via KLN of DLC-2.	Same function as 1999MY 626

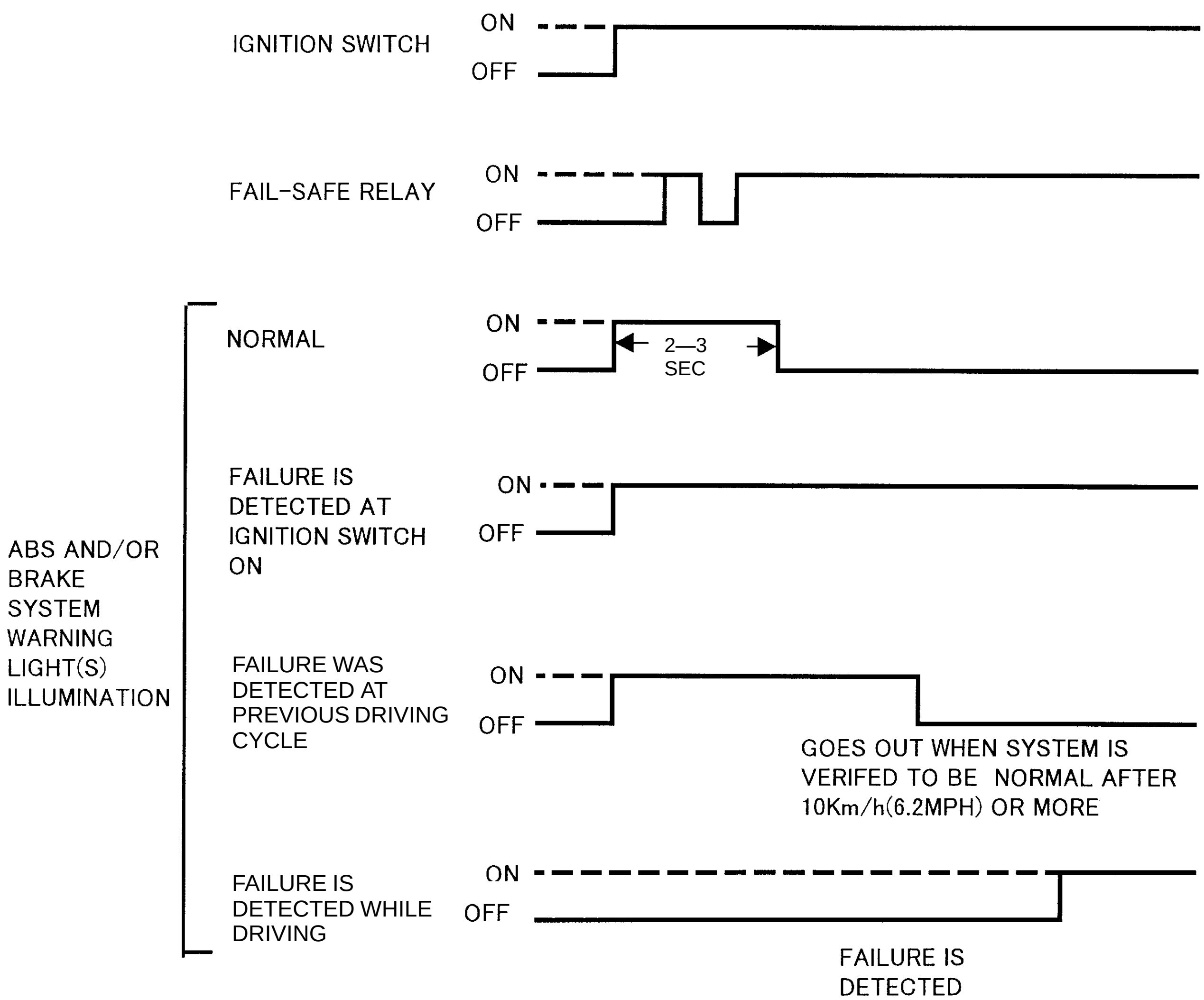
Block diagram



YMU413SA4

Self-diagnosis Function

- Diagnosis begins everytime the ignition key is turned from “OFF” to “ON”.
- “ABS” and “BRAKE” system warning light illuminate during self-diagnosis and stay illuminate **2—3 seconds** after diagnosis is complete and no problem is found.
  - When an ABS control failure is detected, only the “ABS” warning light remains illuminated. (during initial start or driving)
  - When an EBP control failure is detected, the “ABS” and “BRAKE” warning light remain illuminated. (during initial start or driving)
  - Vehicle speed of **10 km/h {6.2 mph}** is required from a previous drive cycle to detect a failure in the wheel speed sensors, solenoid valve and/or ABS motor.
- When the failure related to the ABS control is detected while driving, ABS warning light will be illuminated. When the failure related to the EBP control is detected while driving, ABS and BRAKE system warning lights remain illuminated.



YMU413SB9

Fail-safe, Memory, and Failure indication Function

DTC retrieve and clear procedure

- Two-digit DTCs can be displayed according to the number of flashes of the ABS warning light after shorting (to ground) the TBS terminal at the data link connector (test mode). The two-digit display is read and erased in the same way as in the 1999MY Protegé. Two digit DTCs are displayed only by the ABS warning light; the brake system warning light is not used.
- Four-digit DTCs can be displayed on the NGS tester display by connecting the NGS to the data link connector-2. The DTCs are read and erased the same as the 1999MY 626.

DTC comparison list

- The following DTCs are divided to improve serviceability.

×: Available

Part Name	2000MY MPV				1999MY 626		
	DTC		Detection condition	Memory	DTC	Detection condition	Memory
	NGS tester display	ABS warning light					
Right front wheel-speed sensor and/or sensor rotor	C1145	11	Abnormal input is detected.	×	C1145	When open circuit is detected in sensor system	×
	C1148	41	ABS wheel-speed signal is out of specification when the vehicle is starting move.	×	C1148	When short to ground is detected in sensor system. While speed signal is out of specification	×
	C1234	45	ABS wheel-speed signal malfunction (distortion/sudden change/noise) is detected during driving.	×			
Left front wheel-speed sensor and/or sensor rotor	C1155	12	Abnormal input is detected.	×	C1155	When open circuit is detected in sensor system	×
	C1158	42	ABS wheel-speed signal is out of specification when the vehicle is starting move.	×	C1158	When short to ground is detected in sensor system. While speed signal is out of specification	×
	C1233	46	ABS wheel-speed signal malfunction (distortion/sudden change/noise) is detected during driving.	×			
Right rear wheel-speed sensor and/or sensor rotor	C1165	13	Abnormal input is detected.	×	C1165	When open circuit is detected in sensor system	×
	C1168	43	ABS wheel-speed signal is out of specification when the vehicle is starting move.	×	C1168	When short to ground is detected in sensor system. While speed signal is out of specification	×
	C1235	47	ABS wheel-speed signal malfunction (distortion/sudden change/noise) is detected during driving.	×			
Left rear wheel-speed sensor and/or sensor rotor	C1175	14	Abnormal input is detected.	×	C1175	When open circuit is detected in sensor system	×
	C1178	44	ABS wheel-speed signal is out of specification when the vehicle is starting move.	×	C1178	When short to ground is detected in sensor system. While speed signal is out of specification	×
	C1236	48	ABS wheel-speed signal malfunction (distortion/sudden change/noise) is detected during driving.	×			

Part Name	2000MY MPV					1999MY 626		
	DTC		Detection condition		Memory	DTC	Detection condition	Memory
	NGS tester display	ABS warning light						
For right front brake control solenoid valve	C1210	22	Pressure reduction	Solenoid monitor signal does not track in response to solenoid ON/OFF command	×	C1210	Solenoid monitor signal does not track in response to solenoid ON/OFF command	×
	C1214	23	Pressure retention			C1214		
For left front brake control solenoid valve	C1194	24	Pressure reduction		×	C1194		
	C1198	25	Pressure retention			C1198		
For light rear brake control solenoid valve	C1246	26	Pressure reduction		×	C1246		
	C1254	27	Pressure retention			C1254		
For left rear brake control solenoid valve	C1242	28	Pressure reduction		×	C1242		
	C1250	29	Pressure retention			C1250		
Fail-safe relay	C1186	51	Fail-safe relay in ABS HU/CM stuck OFF when ignition switch is turned ON, fail-safe relay ON is commanded.		×	C1266	Three or more solenoid valves are detected to be faulty among eight solenoid valves	×
	C1266	52	Fail-safe relay in ABS HU/CM stuck ON when ignition switch is turned OFF, fail-safe relay OFF is commanded.		×			
ABS motor and/or motor relay	C1095	54	ABS motor stuck ON when vehicle is started or during ABS operation, ABS motor OFF is commanded		×	C1095	Motor monitor signal does not track in response to motor relay ON/OFF command	×
	C1096	53	ABS motor stuck OFF when vehicle is started or during ABS operation, ABS motor ON is commanded		×			
ABS HU/CM (HU system)	C1140	30	Right front and left rear wheels, or left front and right rear wheels lock is detected during ABS operation.		×	N/A	N/A	N/A
	C1510	32	Wheel lock is detected during ABS operation (pressure reduction inoperative).		×	N/A	N/A	N/A
	C1511	33				N/A	N/A	N/A
	C1512	34				N/A	N/A	N/A
	C1513	35				N/A	N/A	N/A
ABS HU/CM	B1342	61	The on-board diagnostic function detects computer malfunction.		×	B1342	The on-board diagnostic system detects a control module malfunction	×
Battery and/or generator	B1318	63	Voltage at Z terminal of ABS HU/CM drops below 9 V when driving vehicle.		×	B1318	ABS control module detects low voltage	×
Brake switch	N/A	N/A	N/A		N/A	B1484	When open circuit detected in the following harness: • Brake switch–ABS CM • ABS CM-brake light	×
Wheel-speed sensor and sensor rotor	N/A	N/A	N/A		N/A	C1222	Wheel speed signal is out of specification	×

Fail-safe function

- If a failure is detected during self-diagnosis function, the fail-safe illuminates the ABS and/or brake system warning light to notify the driver. When the failure is detected, the ABS HU/CM controls the ABS and electronic brakeforce proportioning (EBP) based on preprogramed fail-safe function shown in the table below. The fail-safe function ensures normal braking even when ABS or EBP control stops, as shown in the figure.

Fail-safe function table

Malfunction location	DTC		Fail-safe function			
			Warning light illumination condition		Control condition	
	NGS tester display	ABS warning light	ABS warning light	Brake system warning light (when parking brake is released)	ABS control	EBP control
Solenoid valve system	C1210	22	Illuminated*[1,2]	Illuminated*[1,2]	Stop	Stop*[3]
	C1214	23				
	C1194	24				
	C1198	25				
	C1246	26				
	C1254	27				
	C1242	28				
	C1250	29				
Fail-safe relay	C1266	52	Illuminated	Not illuminated	Stop	Available
	C1186	51		Illuminated		Stop
ABS motor and motor relay system	C1096	53	Illuminated*[1]	Not illuminated	Stop	Available
	C1095	54				
ABS wheel-speed sensor system	C1145	11	Illuminated	Not illuminated*[4]	Stop	Available*[5]
	C1155	12				
	C1165	13				
	C1175	14				
	C1148	41	Illuminated*[1]			
	C1158	42				
	C1168	43				
	C1178	44				
	C1234	45				
	C1233	46				
	C1235	47				
	C1236	48				
Power supply system	B1318	63	Illuminated*[6]	Illuminated*[6]	Available	Available
ABS HU/CM (CM)	B1342	61	Illuminated	Illuminated	Stop	Stop
ABS HU/CM (HU)	C1510	32	Illuminated	Not illuminated	Stop	Available
	C1511	33				
	C1512	34		Illuminated		Available*[5]
	C1513	35				
	C1140	30		Not illuminated		Available

*[1] : If a malfunction was detected during 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.
*[2] : The warning light does not illuminate during a front solenoid valve OFF malfunction (pressure retention solenoid valve is stuck open; pressure reduction solenoid valve is stuck closed).
*[3] : Control continues only during a front solenoid valve OFF malfunction (pressure retention solenoid valve is stuck open; pressure reduction solenoid valve is stuck closed).
*[4] : Illuminates during rear wheel malfunction.
*[5] : Stops control when there is a malfunction in both rear wheels.
*[6] : The light will go out when the failure is resolved.

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 (Tester display)
ABSLAMP	ABS warning light driver control signal in ABS HU/CM	ON/OFF
ABSLF I	LF ABS pressure retention valve control signal in ABS HU/CM	ON/OFF
ABSLF O	LF ABS pressure reduction valve control signal in ABS HU/CM	ON/OFF
ABSLR I	LR ABS pressure retention valve control signal in ABS HU/CM	ON/OFF
ABSLR O	LR ABS pressure reduction valve control signal in ABS HU/CM	ON/OFF
ABSRF I	RF ABS pressure retention valve control signal in ABS HU/CM	ON/OFF
ABSRF O	RF ABS pressure reduction valve control signal in ABS HU/CM	ON/OFF
ABSRR I	RR ABS pressure retention valve control signal in ABS HU/CM	ON/OFF
ABSRR O	RR ABS pressure reduction valve control signal in ABS HU/CM	ON/OFF
B+	System battery voltage value	V
BOO ABS	Brake switch input	ON/OFF
BRKLAMP	Brake system warning right control signal in ABS HU/CM	
CCNTABS	Number of continuous DTC	—
LF WSPD	LF wheel-speed sensor input	KPH or MPH
LR WSPD	LR wheel-speed sensor input	KPH or MPH
PMPSTAT	ABS motor state	ON/OFF
PMP MTR	ABS motor relay control signal in ABS HU/CM	ON/OFF
RF WSPD	RF wheel-speed sensor input	KPH or MPH
RR WSPD	RR wheel-speed sensor input	KPH or MPH
VLV CTR	Fail-safe relay control signal in ABS HU/CM	ON/OFF

Active command modes function

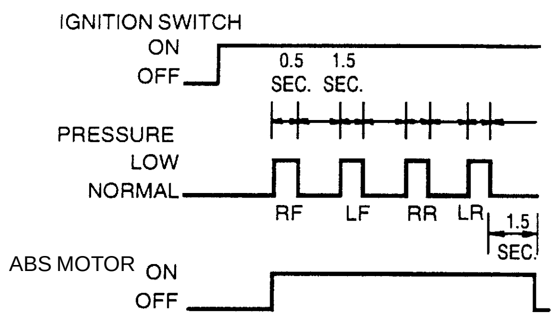
- This function allows control of devices through the NGS tester

Active command modes table

NGS display		Output part	Operation
Menu	Command name		
ABS OUTPUT CONTROL	PMP MOTR	ABS motor	ON/OFF
	LF INLET	LF ABS pressure retention solenoid valve	ON/OFF
	LF OUTLET	LF ABS pressure reduction solenoid valve	ON/OFF
	RF INLET	RF ABS pressure retention solenoid valve	ON/OFF
	RF OUTLET	RF ABS pressure reduction solenoid valve	ON/OFF
	LR INLET	LR ABS pressure retention solenoid valve	ON/OFF
	LR OUTLET	LR ABS pressure reduction solenoid valve	ON/OFF
	RR INLET	RR ABS pressure retention solenoid valve	ON/OFF
	RR OUTLET	RR ABS pressure reduction solenoid valve	ON/OFF
	VPWR RLY	Fail-safe relay	ON/OFF

ABS HU System Inspection Function

- By shorting the TBS terminal of the DLC to body ground with the ignition switch OFF and then turning the ignition switch ON with the brake pedal depressed, the brake fluid pressure to each wheel cylinder is reduced as shown in the figure below. Operation of the ABS HU can be inspected using this function.



U3U41304

TRANSMISSION/TRANSAXLE

05
SECTION

05–00 OUTLINE

TRANSMISSION/TRANSAXLE ABBREVIATIONS

YMU500S01

ATF	Automatic transaxle fluid
ATX	Automatic transaxle
BARO	Barometric pressure
B+	Battery positive voltage
CCM	Comprehensive component monitor
CDCV	Canister drain cut valve
CKP	Crankshaft position
CL	Closed loop
DC	Drive cycle
DLC	Data link connector
DTC	Diagnostic trouble code(s)
ECT	Engine coolant temperature
EC-AT	Electronically controlled automatic transaxle
EGR	Exhaust gas recirculation
HO2S	Heated oxygen sensor
IAC	Idle air control
MAF	Mass air flow
MIL	Malfunction indicator lamp

O/D	Overdrive
OBD	On-board diagnostic
PCM	Powertrain control module
PID	Parameter identification
PRC	Pressure regulator control
PSP	Power steering pressure
SGC	Signal crank
TCC	Torque converter clutch
TFT	Transaxle fluid temperature
TP	Throttle position
TR	Transaxle range
VSS	Vehicle speed sensor
1GR	First gear
2GR	Second gear
3GR	Third gear
4GR	Fourth gear
IAT	Intake air temperature
IG	Ignition

TRANSMISSION/TRANSAXLE NEW FEATURES

YMU500S02

ATX

Improved shift quality

- The column shift type selector lever is adopted.
- The leaf spring type detent spring is adopted.

Improved durability

- The four-pinion gear type differential is adopted.
- The baffle plate is adopted.
- The auxiliary air-cooling type oil cooler and water-cooling type oil cooler are adopted.

Adopted EEC system

- PCM controls ATX.

Simplified structure

- The electrical shift lock system is adopted.
- The shift-lock release lever is used and the shift-lock solenoid is eliminated.

AUTOMATIC TRANSAXLE SPECIFICATIONS

YMU500S03

Item		2000MY MPV	1999MY 626
Transaxle type		GF4A-EL	
Engine type		GY	KL
Gear ratio	1GR	2.800	←
	2GR	1.540	←
	3GR	1.000	←
	4GR	0.700	←
	Reverse	2.333	←
Final gear ratio		4.375	4.157
Speedometer gear ratio (Number of drive/driven gear teeth)		1.25 (25/20)	1.190 (25/21)
ATF	Type	ATF M-III or equivalent (e.g. Dexron®II)	←
	Capacity (L {US qt, Imp qt})	8.0 {8.4, 7.0}	←
Torque converter stall torque ratio		2.00:1	2.05:1
Hydraulic system (Number of drive/driven plates)	Forward clutch	3/3	←
	Coasting clutch	2/3	←
	3-4 clutch	4/4	←
	Reverse clutch	2/2	←
	Low and reverse brake	4/4	←
Band servo (mm {in})	Servo diameter (Piston outer dia./retainer inner dia.)	78.0/40.0 {3.07/1.57}	←
Number of planetary gear teeth	Large sun gear	36	←
	Small sun gear	30	←
	Long pinion gear	24	←
	Short pinion gear	22	←
	Internal gear	84	←
Number of output gear teeth		16	19
Number of idler gear teeth		37	42
Number of ring gear teeth		70	79

05–17 AUTOMATIC TRANSAXLE

AUTOMATIC TRANSAXLE OUTLINE

YMU517S01

- The construction and operation of the automatic transaxle is basically the same as 1999MY 626 GF4A-EL. The following are the major difference between 1999MY 626 and 2000MY MPV.
  - The differential pinion gear has been changed from a two-pinion type to a four-pinion type to cope with the high torque engine.
  - Surface treatment of the differential ring gear, output gear, and idler gear has been made stronger to accommodate higher engine torque.
  - Increasing the capacity coefficient during normal driving reduces the slip of the torque converter, thereby improving driveability and fuel economy.
  - A baffle plate has been installed in the converter housing to reduce friction in the differential gear.
  - The detent spring in the parking mechanism has been changed from a coil spring type to a leaf spring type due to column shift application.
  - Due to the change of detent spring type, the oil pipe on the converter housing has been miniaturized.

Comparison of 2000MY MPV and 1999MY 626

<table>
<tr><th colspan="2" rowspan="2">Item</th><th colspan="2">Model</th></tr>
<tr><th>2000MY MPV</th><th>1999MY 626</th></tr>
<tr><td rowspan="11">Mechanical component</td><td>Forward clutch</td><td>Equipped</td><td rowspan="10">←</td></tr>
<tr><td>Reverse clutch</td><td>Equipped</td></tr>
<tr><td>3-4 clutch</td><td>Equipped</td></tr>
<tr><td>Coasting clutch</td><td>Equipped</td></tr>
<tr><td>2-4 brake band</td><td>Equipped</td></tr>
<tr><td>Low and reverse brake</td><td>Equipped</td></tr>
<tr><td>Number of one-way clutches</td><td>Two</td></tr>
<tr><td>Planetary gear</td><td>Ravigneaux type</td></tr>
<tr><td>Output gear</td><td>Equipped</td></tr>
<tr><td>Idler gear</td><td>Equipped</td></tr>
<tr><td>Differential</td><td>Equipped (four-pinion type)</td><td>Equipped (two-pinion type)</td></tr>
<tr><td rowspan="6">Electronic control</td><td>Line pressure control</td><td>• Pressure control solenoid (duty type) adjusts line pressure according to engine load condition and vehicle driving condition</td><td rowspan="6">←</td></tr>
<tr><td>Shift control</td><td>• Detects throttle valve opening angle and reverse and forward drum revolution speed. Switches to the most suitable gear position according to the preset shift diagram</td></tr>
<tr><td>TCC control</td><td>• TCC control solenoid valve switches the paths for the line pressure applied to the TCC shift valve</td></tr>
<tr><td>Engine-transaxle total control</td><td>• Temporarily lowers engine output torque during shift to improve shift feel</td></tr>
<tr><td>Slope mode control</td><td>• Changes the shift point to prevent frequent up/down shifting when climbing or descending hills</td></tr>
<tr><td>OBD system</td><td>• Detects and/or memorizes failure of input/output part and transaxle condition</td></tr>
</table>

EC-AT Operation Chart

Range	O/D OFF switch position	Mode	Gear position		Engine braking effect	Forward clutch	Coasting clutch	3–4 clutch	Reverse clutch	2–4 brake band Applied	2–4 brake band Released	Low and reverse brake	One-way clutch 1 (Sprag type)	One-way clutch 2 (Roller type)	Shift solenoid A	Shift solenoid B	Shift solenoid C
P	—	—	—		—												×
R	—	—	Reverse	Below approx. 4 km/h {2.5 mph}	Yes				×			×				×	×
				Above approx. 6 km/h {3 mph}	Yes				×			×					
				Above approx. 30 km/h {19 mph}	No				×						×		
N	—	—	—	Below approx. 4 km/h {2.5 mph}	—												×
				Above approx. 6 km/h {3 mph}	—										×		
D	O/D OFF switch OFF	*1*2Normal/ Slope/ Power	1GR		No	×							×	×		×	×
			2GR	Below approx. 10 km/h {6.2 mph}	Yes	×	×			×			×		×	×	
				Above approx. 10 km/h {6.2 mph}	No	×				×			×		×	×	×
			3GR		Yes	×	×	×		⊗	×		×		×		
			4GR		Yes	×		×		×			◎		×		×
	O/D OFF switch ON		1GR		No	×							×	×		×	×
			2nd	Below approx. 10 km/h {6.2 mph}	Yes	×	×			×			×		×	×	
				Above approx. 10 km/h {6.2 mph}	No	×				×			×		×	×	×
			※3GR		Yes	×	×	×		⊗	×		×		×		
2	—	—	2GR		Yes	×	×			×			×		×	×	
1	—	—	1GR		Yes	×	×					×	×	×		×	

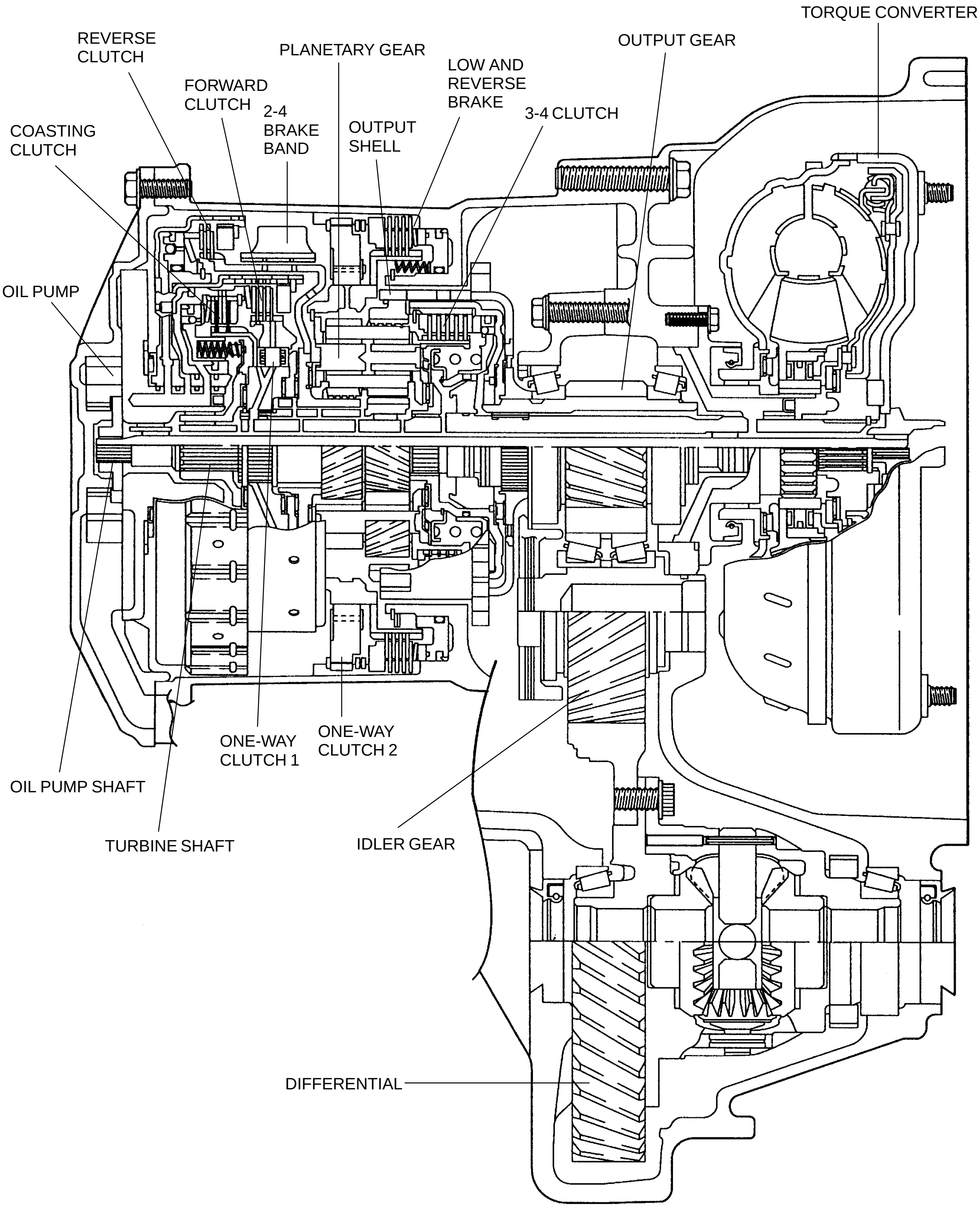
× : Operating
⊗ : Operating but not contributing to transaxle power
◎ : Clutch is freewheeling and does not transmit power
※ : Engine overspeed protection
*1 : The PCM automatically switches between NORMAL and SLOPE modes according to the engine load and vehicle acceleration.
*2 : The PCM automatically switches between POWER and NORMAL modes according to the speed at which the accelerator pedal is depressed.

YMU517SA0

05

AUTOMATIC TRANSAXLE CROSS-SECTIONAL VIEW

YMU517S02

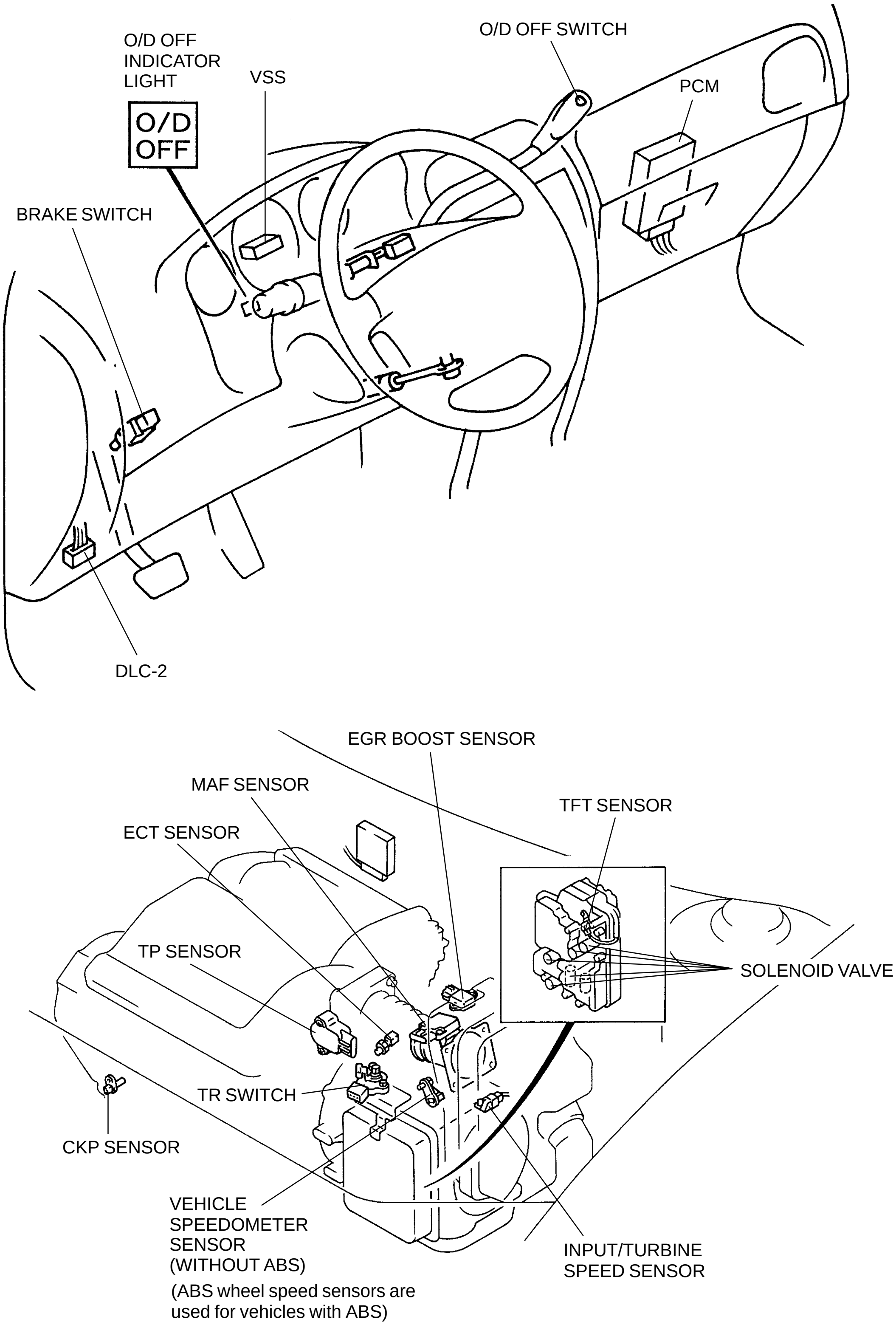


YMU517SA1

ELECTRONIC CONTROL SYSTEM STRUCTURAL VIEW

YMU517S03

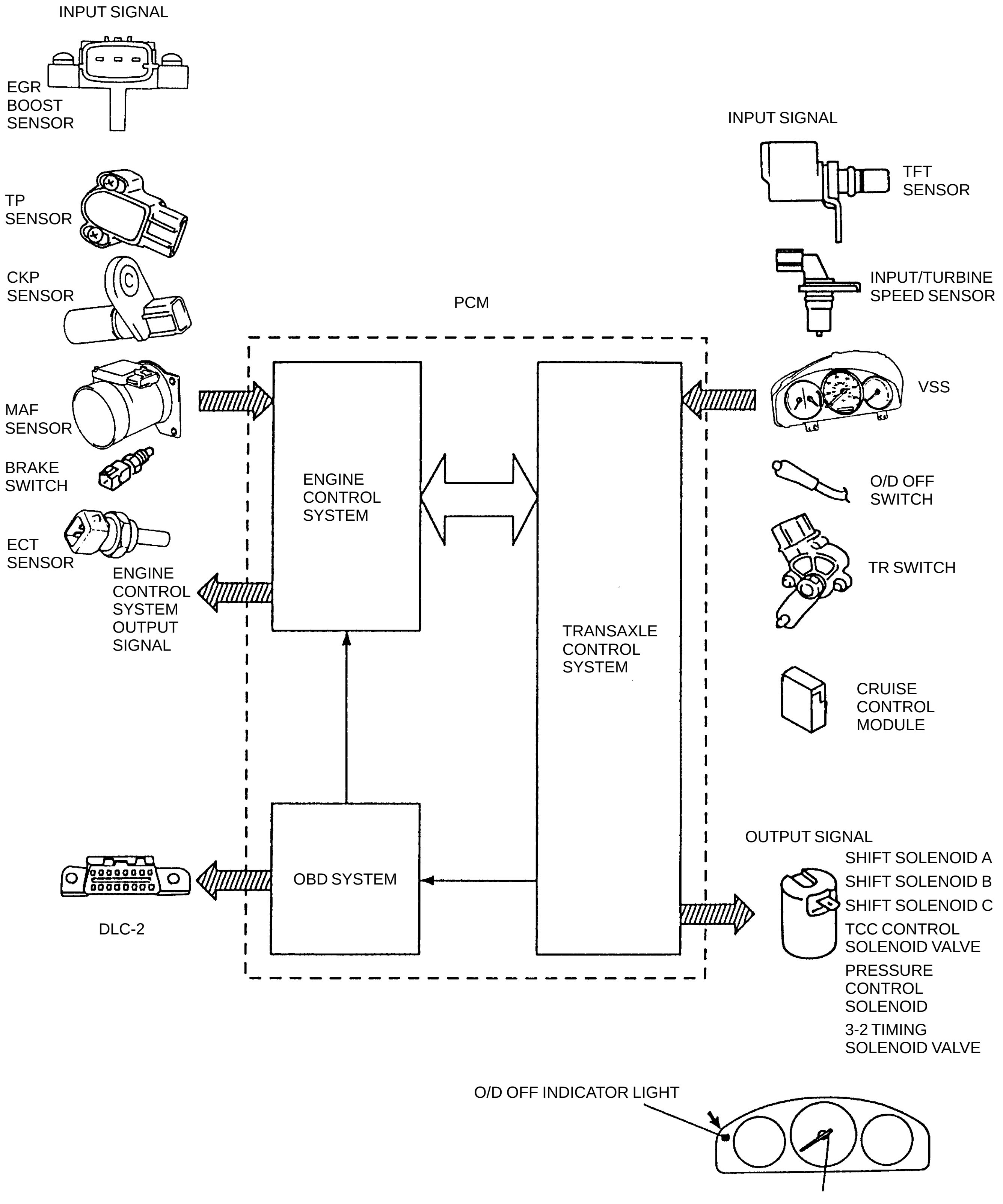
- The PCM controls the engine and automatic transaxle operations. The PCM outputs a control signal to the engine and the transaxle according to the signal from other sensors and/or switches.



YMU517SA2

AUTOMATIC TRANSAXLE BLOCK DIAGRAM

YMU517S04



YMU517SA3

Electronic Control Item and Control

Control item	Contents
Auto power control	• When driving in D range, the transaxle automatically switches between POWER and NORMAL modes depending on driving conditions.
Shift control	• Detects engine load condition and vehicle speed. Shifts to the best gear position according to the programmed automatic shift diagram.
Line pressure control	• Generates line pressure matching the engine load condition and driving conditions. Optimizes line pressure for each shift. When the ATF temperature is low, automatically optimizes line pressure for quick clutch engagement.
Timing control	• Turning the 3-2 timing solenoid valve ON and OFF controls the operation of the 2-4 brake band and the 3-4 clutch.
TCC control	• Controls TCC according to the programmed TCC points
Engine-transaxle total control (Torque reduction control)	• Temporarily lowers engine torque during shift (up and down) to improve shift feel
Engine-transaxle total control (N-D/R select control)	• When a driving range is selected from P/N, the fuel injection amount is controlled to prevent fluctuation in engine speed.
Slope mode control	• Changes the shift point to prevent frequent shifting up/down when climbing or descending hills
OBD system	• Detects and/or memorizes failure of input/output part and transaxle condition

Component Description (Electronic Control)

Part name			Function
Input system	O/D OFF switch		• Selects driving modes (O/D OFF) and changes shift patterns
	TR switch		• Detects selector lever ranges/positions
	TP sensor		• Detects throttle valve opening angle
	Input/turbine speed sensor		• Detects reverse and forward drum revolution speed
	VSS		• Detects vehicle speed
	Brake switch		• Detects braking condition
	TFT sensor		• Detects the ATF temperature
	Cruise control module (4GR inhibit signal)		• When the cruise control is in use, the signal detects when the difference between the target speed and actual speed exceeds specification
	CKP sensor		• Detects engine speed
	EGR boost sensor		• Detects barometric pressure
	ECT sensor		• Detects the engine coolant temperature
	MAF sensor		• Detects the intake air amount
Output system	ON/OFF type	Shift solenoid A	• Switches ON and OFF based on electric signals from the PCM, changes hydraulic circuit to control shifting
		Shift solenoid B	• Switches ON and OFF based on electric signals from the PCM, changes hydraulic circuit to control shifting
		Shift solenoid C	• Switches ON and OFF based on electric signals from the PCM, changes hydraulic circuit to control shifting
		TCC control solenoid valve	• Switches ON and OFF based on electric signals from the PCM to control TCC
		3-2 timing solenoid valve	• Switches ON and OFF based on electric signals from the PCM, changes hydraulic circuit to control shift timing
	Duty type	Pressure control solenoid	• Switches ON and OFF based on electric signal (duty signals) from the PCM adjusts line pressure to match driving conditions
	O/D OFF indicator light		• Illuminates to indicate that the transaxle is in O/D OFF mode • Flashes when failure is detected by diagnosis function

AUTOMATIC TRANSAXLE DEVICE RELATIONSHIP CHART

YMU517S05

Component	Control item							
	Shift control	Line pressure control	Timing control	TCC control	Engine-transaxle total control		Slope mode control	OBD system
					Torque reduction control	N-D/R select control		
Input								
O/D OFF switch	×	×	×	×				
TR switch	×	×	×	×	×	×	×	×
TP sensor	×	×	×	×	×	×	×	×
Input/turbine speed sensor	×	×	×	×	×	×	×	×
VSS	× *1	× *1	× *1	× *1	× *1	× *1	× *1	×
Brake switch				×	×		×	×
TFT sensor	×	×	×	×	×		×	×
Cruise control module (4GR inhibit signal)	×							
CKP sensor	×	×	×	×	×	×	×	×
EGR boost sensor	×	×						×
MAF sensor					×		×	×
ECT sensor				×	×		×	×
Output								
Shift solenoid A	×		×					×
Shift solenoid B	×		×					×
Shift solenoid C	×		×					×
TCC control solenoid valve				×				×
3-2 timing solenoid valve	×		×					×
Pressure control solenoid		×						×

× : Available
*1 : Back up

POWERTRAIN DESCRIPTION

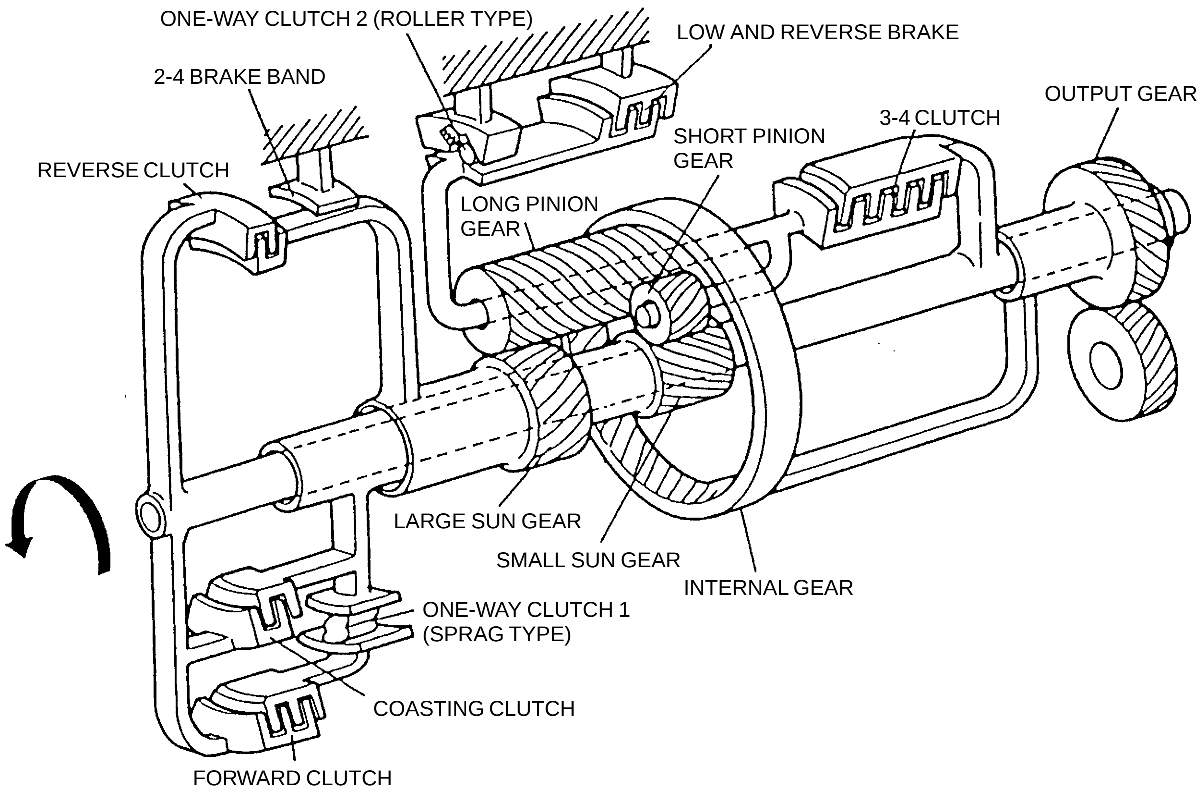
YMU517S06

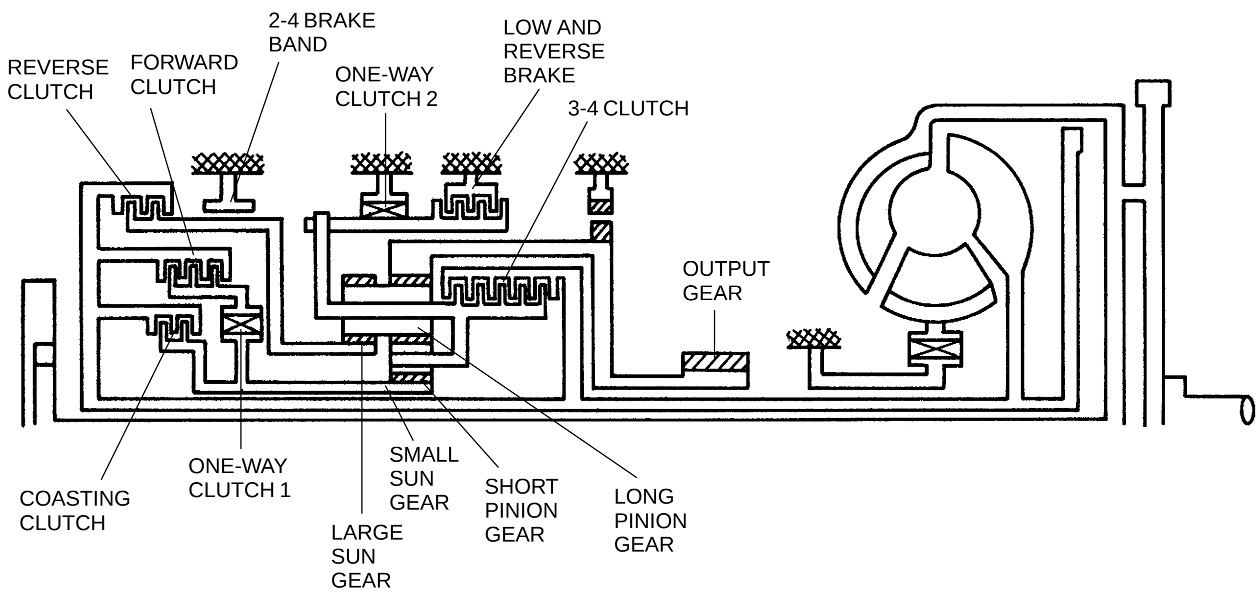
Outline

- In the powertrain system, the hydraulic pressure transported by the control valve operates the clutch, and brake, and the planetary gear changes the gear ratio according to the driving conditions.

Structure

- The powertrain system consists of four pairs of clutches, brake, brake band, two pairs of one-way clutches, and ravigneaux type planetary gears.





YMU517SA4

Operation
Component description

Component	Function
Forward clutch	• Transmits rotation of reverse and forward drum to small sun gear
Coasting clutch	• Transmits rotation of reverse and forward drum to small sun gear (for engine braking)
3-4 clutch	• Transmits rotation of 3-4 clutch drum to planetary carrier
Reverse clutch	• Transmits rotation of reverse and forward drum to large sun gear
2-4 brake band	• Prevents rotation of 2-4 brake drum and prevents rotation of large sun gear
Low and reverse brake	• Prevents rotation of low and reverse brake hub
One-way clutch 1	• Transmits rotation of reverse and forward drum to small sun gear only during driving
One-way clutch 2	• Locks clockwise rotation of planetary carrier

Note
- All rotations are viewed from the oil pump.

Gear Position and Operation of Featured Parts

Range	O/D OFF switch position	Mode	Gear position		Engine braking effect	Forward clutch	Coasting clutch	3–4 clutch	Reverse clutch	2–4 brake band		Low and reverse brake	One-way clutch 1 (Sprag type)	One-way clutch 2 (Roller type)
										Applied	Released			
P	—	—	—		—									
R	—	—	Reverse	Below approx. 4 km/h {2.5 mph}	Yes				×			×		
				Above approx. 6 km/h {3 mph}	Yes				×			×		
				Above approx. 30 km/h {19 mph}	No				×					
N	—	—	—	Below approx. 4 km/h {2.5 mph}	—									
				Above approx. 6 km/h {3 mph}	—									
D	O/D OFF switch OFF	*1*2Normal/ Slope/ Power	1GR		No	×							×	×
			2GR	Below approx. 10 km/h {6.2 mph}	Yes	×	×			×			×	
				Above approx. 10 km/h {6.2 mph}	No	×				×			×	
			3GR		Yes	×	×	×		⊗	×		×	
			4GR		Yes	×		×		×			◎	
	O/D OFF switch ON		1GR		No	×							×	×
			2nd	Below approx. 10 km/h {6.2 mph}	Yes	×	×			×			×	
				Above approx. 10 km/h {6.2 mph}	No	×				×			×	
			※3GR		Yes	×	×	×		⊗	×		×	
2	—	—	2GR		Yes	×	×			×			×	
1	—	—	1GR		Yes	×	×					×	×	×

× : Operating
⊗ : Operating but not contributing to transaxle power
◎ : Clutch is freewheeling and does not transmit power
※ : Engine overspeed protection
*1 : The PCM automatically switches between NORMAL and SLOPE modes according to the engine load and vehicle acceleration.
*2 : The PCM automatically switches between POWER and NORMAL modes according to the speed at which the accelerator pedal is depressed.

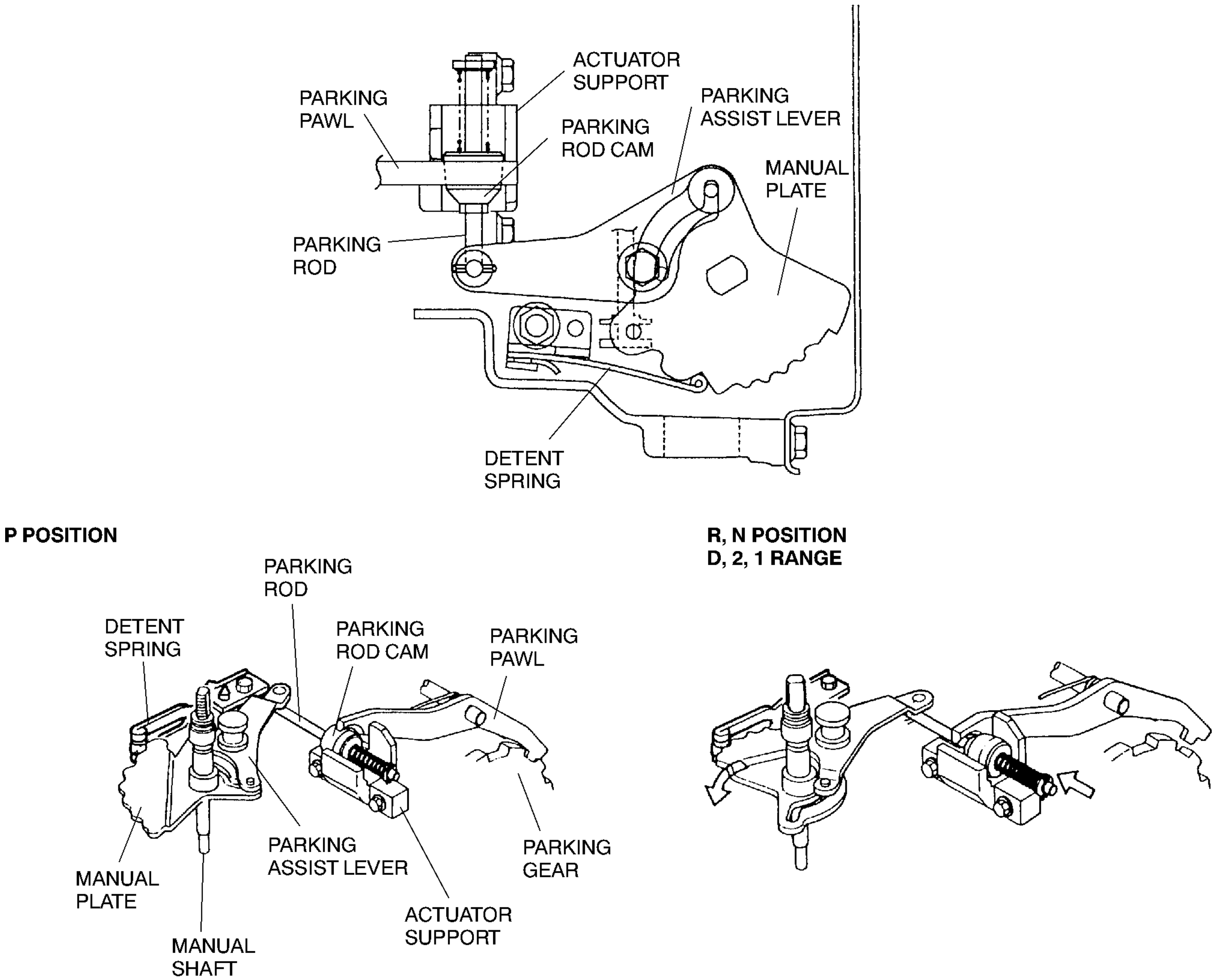
YMU517SA5

PARKING MECHANISM DESCRIPTION

YMU517S15

Outline

- The detent spring in the parking mechanism has been changed from a coil spring type to a leaf spring type due to column shift application.



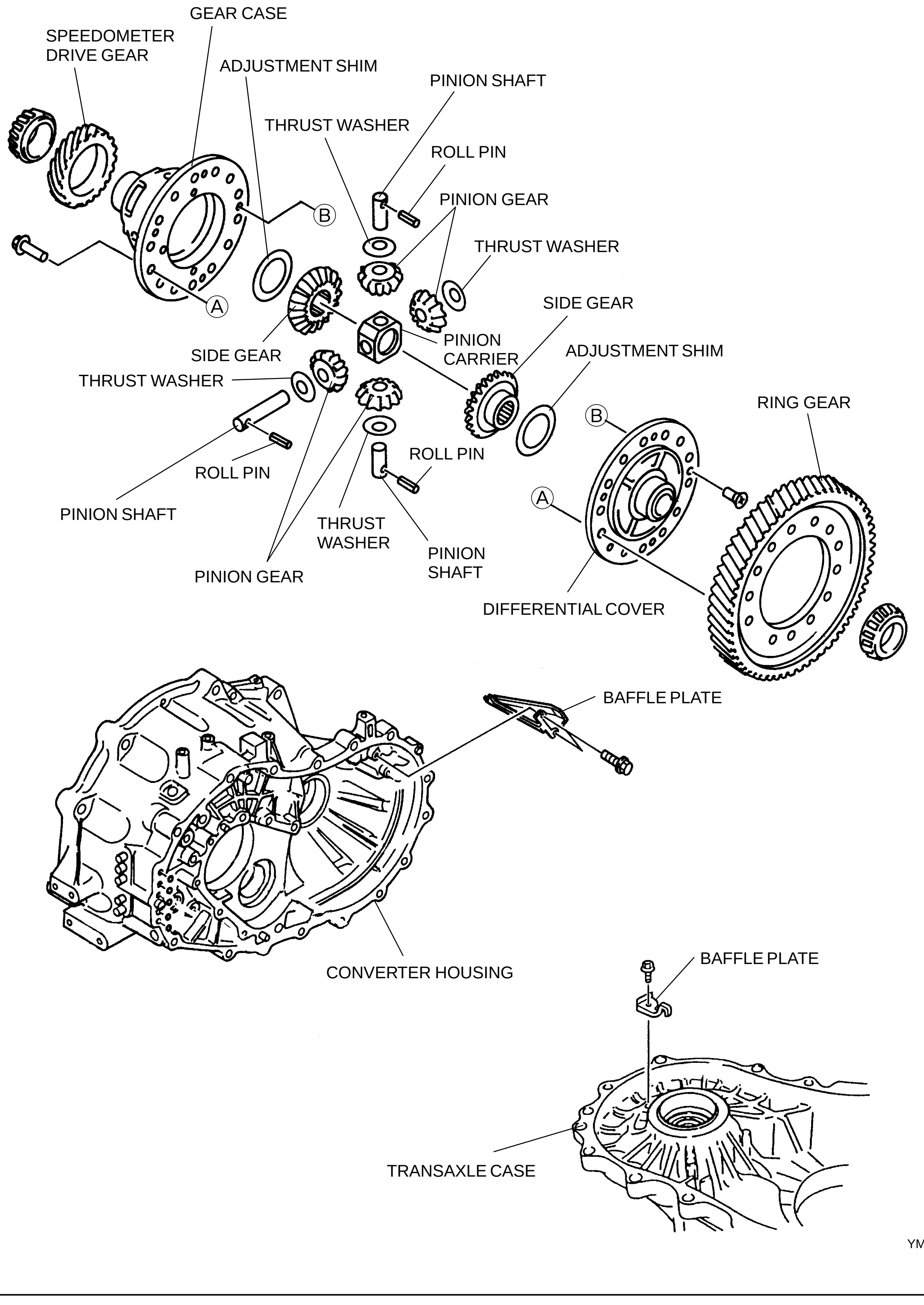
YMU517AB0

DIFFERENTIAL DESCRIPTION

YMU517S07

Outline

- The differential ring gear surface treatment has been made stronger to accommodate higher engine torque.
- Changing from a two-pinion type to a four-pinion type differential increases torque dispersion and pinion gear durability.
- A baffle plate has been installed in the converter housing and transaxle case to reduce friction in the differential gear.



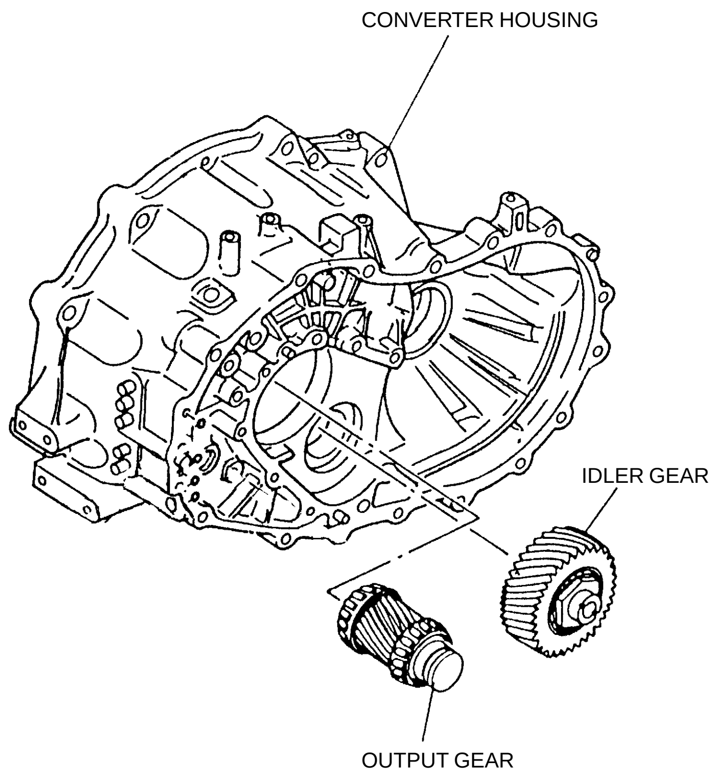
YMU517SA6

OUTPUT GEAR, IDLER GEAR DESCRIPTION

YMU517S08

Outline

- Surface treatment of the output gear and idler gear has been made stronger to accommodate higher engine torque.



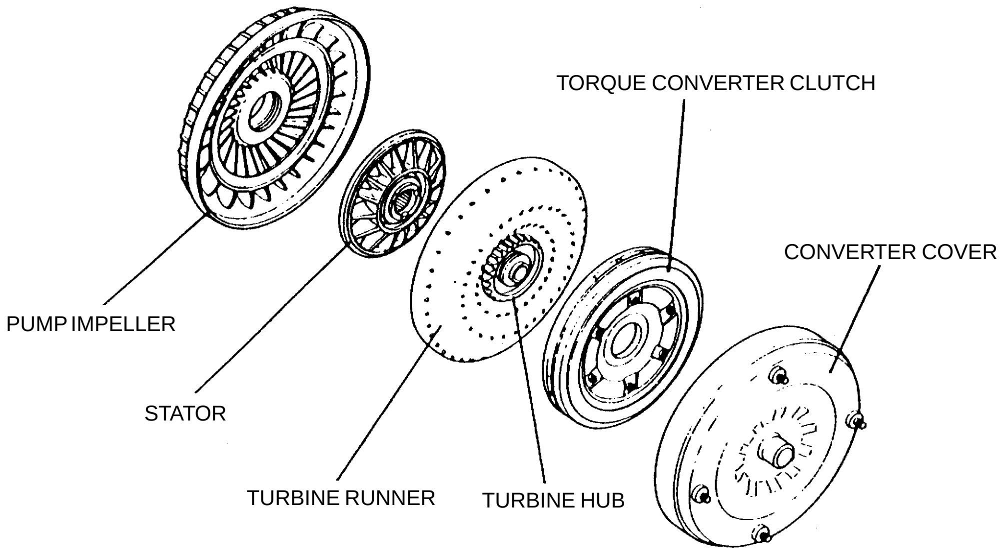
YMU517SAC

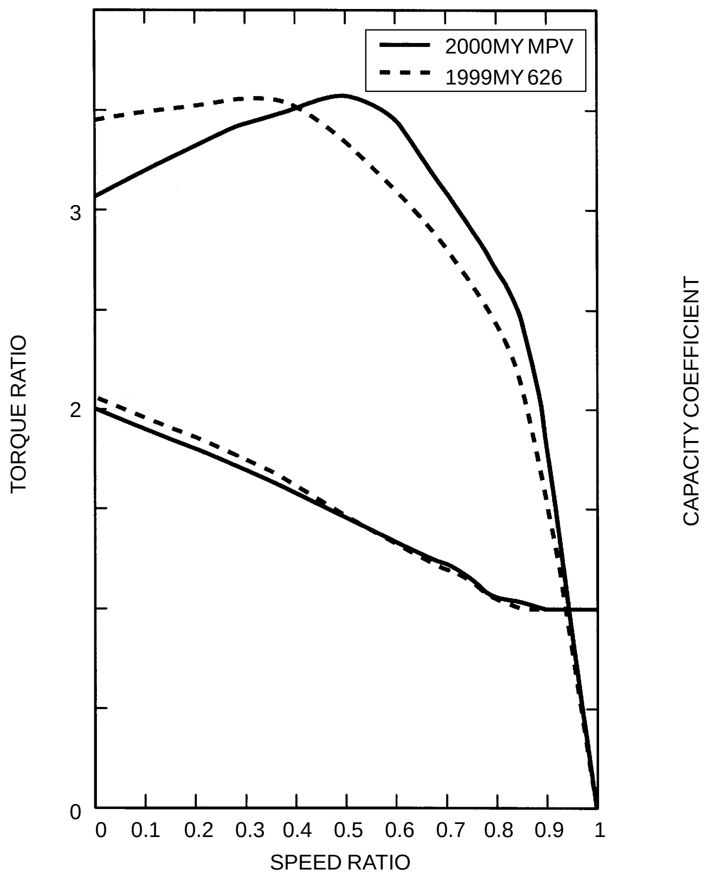
TORQUE CONVERTER DESCRIPTION

YMU517S09

Outline

- The GF4A-EL uses a three-element, single-gear, two-phase torque converter with torque converter clutch (TCC) mechanism.
- The torque converter efficiently matches the output characteristic of GY engine.
- By matching the output characteristics of the engine in order to optimize the configuration of the impellers, the torque converter increases the capacity coefficient in the practical range, thereby improving drivability and fuel economy.
- The TCC mechanism under certain conditions transmits the drive force by automatically connecting the pump impeller with the turbine runner as opposed to using fluid. Therefore it prevents the torque converter from slipping.





YMU517SA7

O/D OFF SWITCH DESCRIPTION

YMU517S10

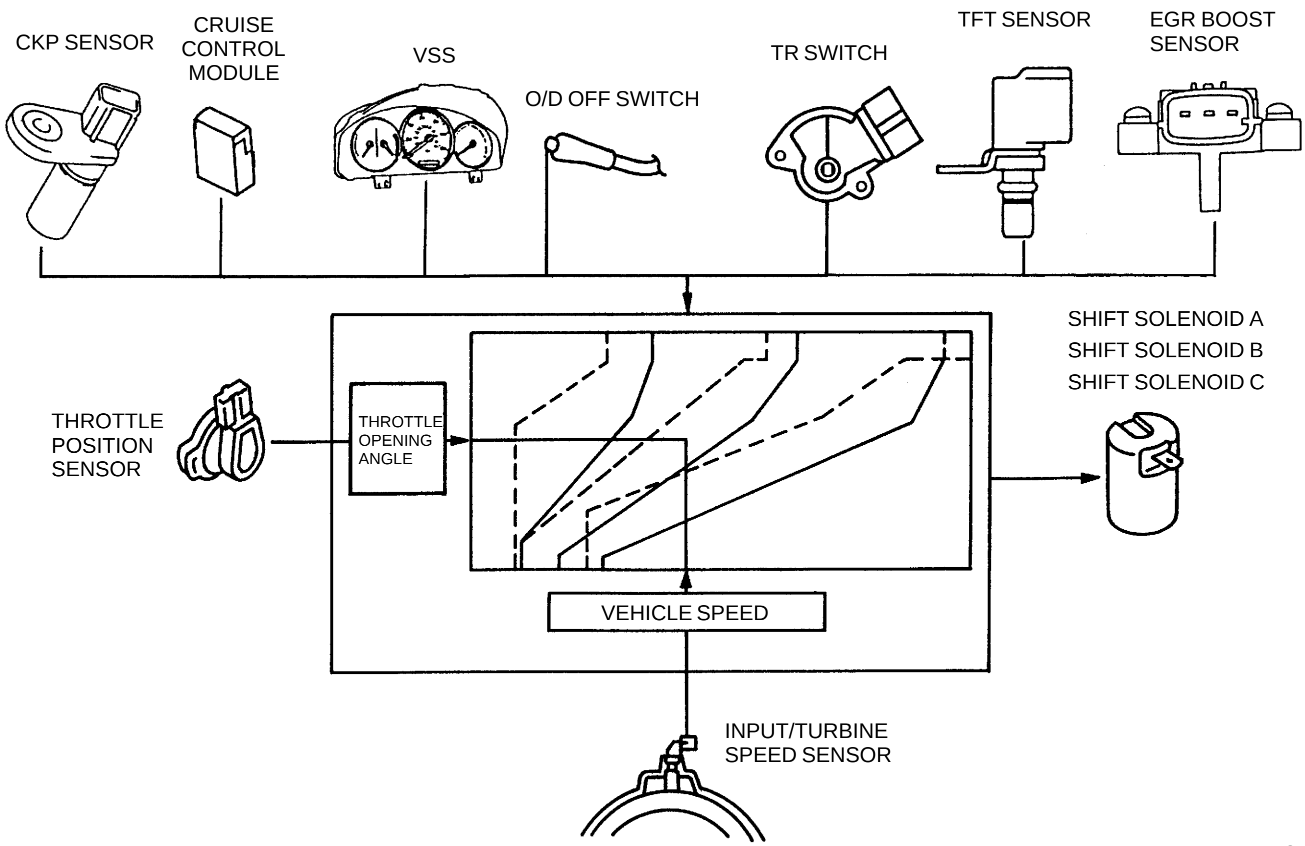
- A momentary type O/D OFF switch is attached to the selector lever knob.

SHIFT CONTROL DESCRIPTION

YMU517S11

Outline

- The PCM selects the shift pattern based on the current mode and range. The PCM then reads the reverse and forward drum speed (vehicle speed) and throttle valve opening angle, and sends a signal to the solenoid valve to set the gear position.



YMU517SA8

Range and Position

Range/Position	Gear	Gear ratio	Shift	TCC	Engine brake
P	Neutral	—			
R	Reverse	2.333			×
N	Neutral	—			
D	1GR	2.800			
	2GR	1.540			
	3GR	1.000		× (O/D OFF mode)	×
	4GR	0.700		×	×
2	2GR	1.540			×
	3GR*1	1.000			×
	4GR*1	0.700			×
1	1GR	2.800			×
	2GR*1	1.540			×

×: TCC or engine braking is available.
*1: Engine overspeed protection

YMU517SAB

Gear Position and Solenoid Valve Operation

Range/Position	Mode	Gear	Solenoid valve (ON/OFF type)			
			Shift solenoid A	Shift solenoid B	Shift solenoid C	TCC control solenoid
P	—	Neutral	OFF	OFF	ON	OFF
R	—	Reverse	OFF	OFF	OFF	OFF
N	—	Neutral	OFF	OFF	ON	OFF
D	POWER*1/ NORMAL/ SLOPE*4	1GR	OFF	ON	ON	OFF
		2GR	ON	ON	ON	OFF
		3GR	ON	OFF	OFF	OFF
		3GR (TCC ON)*5	ON	OFF	OFF	ON
		4GR	ON	OFF	ON	OFF
		4GR (TCC ON) *2	ON	OFF	ON	ON
2	—	2GR	ON	ON	OFF	OFF
		3GR*3	ON	OFF	OFF	OFF
		4GR*3	ON	OFF	ON	OFF
1	—	1GR	OFF	ON	OFF	OFF
		2GR*3	ON	ON	OFF	OFF

*1 : The PCM automatically switches between POWER and NORMAL modes according to accelerator pedal depressing speed.
*2 : Performs TCC operation in NORMAL mode and SLOPE mode
*3 : Engine overspeed protection
*4 : The PCM automatically switches between NORMAL and SLOPE modes according to the engine load and vehicle acceleration.
*5 : Performs TCC operation in O/D OFF mode

DRIVING MODE DETERMINATION DESCRIPTION

YMU517S12

D Range

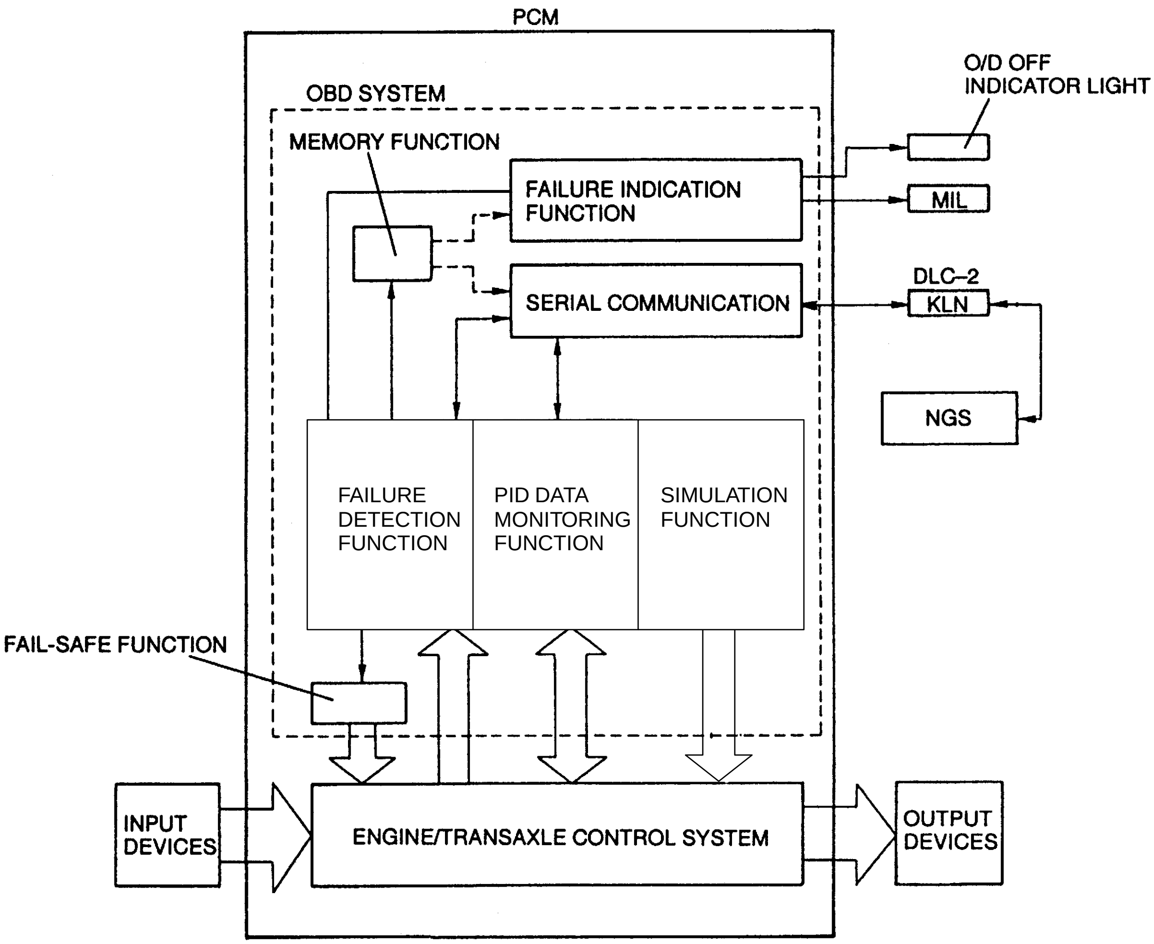
- Driving modes (O/D OFF) can be selected by switching the O/D OFF switch ON or OFF.
- When the vehicle speed and the accelerator pedal depressing speed is above the preset value, the driving mode is automatically switched to POWER mode which shifts the shift point to the high speed side.
- When the ATF temperature is high or low, each shift pattern switches automatically: when the ATF temperature is high (above 135 °C {275 °F}), the TCC point is shifted to low speed side, and when the engine coolant temperature is low (below 40 °C {104 °F}), the shift point is shifted to high speed side.
- When the engine coolant temperature is below 60 °C {140 °F}, the TCC is restricted.

ON-BOARD DIAGNOSTIC (OBD) SYSTEM DESCRIPTION

YMU517S13

- The OBD system has the following functions:
  (1) Failure detection function: detects failure of the input/output devices and system components of the ATX.
  (2) Memory function: memorizes the DTC when a failure is detected.
  (3) 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.
  (4) PID data monitoring function: monitors the input/output signals and calculated values of the PCM and sends the monitoring data to the scan tool (NGS tester).

Block Diagram



YMU517SA9

DTC Comparison Lists

- The following codes are divided to improve serviceability.

Part Name	DTC	2000MY MPV	1999MY 626
		Definition	Definition
TR switch	P0705	Circuit malfunction (short)	←
	P0706	Circuit malfunction (open)	
	P1705	N/A	Out of self-test range
TFT sensor	P0710	Circuit malfunction (open/short)	←
	P0711	Circuit malfunction (stuck)	
Input/turbine speed sensor	P0715	Circuit malfunction (open/short)	Insufficient input from TSS sensor
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	P0740	Circuit malfunction	
TCC control solenoid valve	P0743	Circuit malfunction (open/short)	
Pressure control solenoid	P0745	Circuit malfunction (open/short)	
Shift solenoid A	P0750	Circuit malfunction (open/short)	
Shift solenoid B	P0755	Circuit malfunction (open/short)	
Shift solenoid C	P0760	Circuit malfunction (open/short)	
3-2 timing solenoid valve	P1765	Circuit malfunction (open/short)	
O/D OFF switch	P1780	N/A	Circuit malfunction (open/short)
VSS	P0500	Circuit malfunction (open/short)	Sensor malfunction

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 O/D OFF indicator light flashes or illuminates to warn the driver of a malfunction in the powertrain system components or sensors/switches. (Also, MIL will be illuminated except for DTC P0745 and/or P1765)
- The stored DTCs in the PCM are retrieved using the NGS tester.
- 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. (Refer to 01–40 ON-BOARD DIAGNOSTIC SYSTEM DESCRIPTION.)

Transaxle range (TR) switch short circuit (P0705)

- Two or more input signals from the TR switch to the PCM terminals 6, 9, 7, 32, and 64 when engine speed is above 530 rpm during failure detection period.

Transaxle range (TR) switch open circuit (P0706)

- Input voltage from TR switch to PCM terminal 6, 9, and 7 maintains 0 V when engine speed is above 530 rpm and vehicle speed is above 20 km/h {12 mph} during failure detection period.

Transaxle fluid temperature (TFT) sensor open or short (P0710)

- Input voltage from TFT sensor to PCM terminal 37 maintains 0.2 V when vehicle speed is above 20 km/h {12 mph} during failure detection period.
- Input voltage from TFT sensor to PCM terminal 37 maintains 4.9 V when vehicle speed is above 20 km/h {12 mph} during failure detection period.

Transaxle fluid temperature (TFT) sensor stuck (P0711)

- Fluctuation value of TFT sensor output voltage to PCM terminal 37 is below 20 °C {68 °F} (above 3.6 V) when vehicle speed is above 60 km/h {37 mph} in normal condition during failure detection period.

Input/turbine speed sensor circuit malfunction (P0715)

- No input/turbine speed sensor signal to PCM terminals 23 and 84 when vehicle speed is above 41 km/h {25 mph} and selector lever position is at D, 2, or 1 during failure detection period.

Vehicle speed sensor (VSS) circuit malfunction (P0500)

- No VSS signal is input to PCM terminal 58 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, 2, or 1 range during failure detection period.

Shift or pressure control solenoid valve circuit malfunction
- If there is still voltage in the solenoid valve control terminal of the PCM when solenoid valve operates according to the PCM calculation, OBD system judges “circuit malfunction”.

Shift solenoid A (P0750)
- If there is still voltage in shift solenoid A control terminal 27 of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid B (P0755)
- If there is still voltage in shift solenoid B control terminal 1 of the PCM when the solenoid valve operates according to PCM calculation.

Shift solenoid C (P0760)
- If there is still voltage in shift solenoid C control terminal 70 of the PCM when the solenoid valve operates according to PCM calculation.

Torque converter clutch (TCC) control solenoid valve (P0743)
- If there is still voltage in TCC control solenoid valve control terminal 82 of the PCM when the solenoid valve operates according to PCM calculation.

3-2 timing solenoid valve (P1765)
- If there is still voltage in 3-2 timing solenoid valve control terminal 28 of the PCM when the solenoid valve operates according to PCM calculation.

Pressure control solenoid (P0745)
- If there is still voltage in pressure control solenoid control terminal 81 of the PCM when the solenoid valve operates according to PCM calculation.

Gear incorrect (P0731, P0732, P0733, P0734)
- If the RPM difference between the input/turbine speed sensor signal and VSS signal exceeds or falls below the pre-programmed RPM difference in the PCM while driving in each gear, the OBD system judges “gear incorrect” malfunction.

Gear 1 incorrect (P0731)
- Revolution ratio of input/turbine speed sensor to VSS signal is below 72 while in 1GR.

Gear 2 incorrect (P0732)
- Revolution ratio of input/turbine speed sensor to VSS signal is below 42 or above 72 while in 2GR.

Gear 3 incorrect (P0733)
- Revolution ratio of input/turbine speed sensor to VSS signal is below 28 or above 42 while in 3GR.

Gear 4 incorrect (P0734)
- Revolution ratio of input/turbine speed sensor to VSS signal is above 28 while in 4GR.

Memory Function
- When a failure is detected, DTCs are stored in the PCM memory. The memories are not erased even if the ignition switch is turned off (LOCK position).
- To clear the memorized failure information, disconnect the negative battery cable or use the NGS tester. However, DTCs will be stored in the memory again if the failures are still present.

Fail-safe Function

- In the fail-safe function, minimum vehicle drivability is obtained.

<table>
<tr><th>DTC</th><th>Definition</th><th>Fail-safe</th><th>TCC</th><th>O/D OFF mode selection</th></tr>
<tr><td>P0102</td><td>MAF circuit low input</td><td>Normal shift pattern is performed.</td><td>Inhibit</td><td>Available</td></tr>
<tr><td>P0103</td><td>MAF circuit high input</td><td>Normal shift pattern is performed.</td><td>Inhibit</td><td>Available</td></tr>
<tr><td>P0117</td><td>ECT sensor circuit low input</td><td>Normal shift pattern is performed</td><td>Inhibit</td><td>Available</td></tr>
<tr><td>P0118</td><td>ECT sensor circuit high input</td><td>Normal shift pattern is performed.</td><td>Inhibit</td><td>Available</td></tr>
<tr><td>P0122</td><td>TP sensor circuit low input</td><td rowspan="2">● The throttle valve opening angle is constantly assumed to be 1/2 and the VSS signal is used to determine shift. The automatic shift diagram used in this function is different from the normal pattern.
● If any of the shift solenoids A, B, or C also fails, minimum drivability will be assured using the remaining good solenoid valves.
● If the VSS system fails in addition to the above, operation of all solenoid valves will be suspended. While in D and 2 ranges, gear position is fixed in 3GR; while in 1 range, gear position is fixed in 1GR.
● No shifting will occur.</td><td>Inhibition</td><td>Release</td></tr>
<tr><td>P0123</td><td>TP sensor circuit high input</td><td>Inhibition</td><td>Release</td></tr>
<tr><td>P0107</td><td>EGR boost sensor circuit low input</td><td>Normal shift pattern is performed.</td><td>Available</td><td>Available</td></tr>
<tr><td>P0108</td><td>EGR boost sensor circuit high input</td><td>Normal shift pattern is performed.</td><td>Available</td><td>Available</td></tr>
<tr><td>P0340
P1345</td><td>SGC signal malfunction</td><td>Normal shift pattern is performed.</td><td>Inhibition</td><td>Release</td></tr>
<tr><td>P0500</td><td>VSS malfunction</td><td>● Performs normal shift determination
● If any of the shift solenoids A, B, or C also fails, operation of all solenoid valves will be suspended. While in D and 2 ranges, gear position is fixed in 3GR; while in 1 range, gear position is fixed in 1GR
● No shifting will occur.</td><td>Inhibition</td><td>Release</td></tr>
<tr><td>P0705</td><td>TR switch circuit malfunction (short circuit)</td><td rowspan="2">● Gear position is fixed in 1GR when driving at under 6 km/h {3.7 mph} or in 3GR when driving at over 6 km/h {3.7 mph} if either of the following conditions arises:
– The R position switch and the D, 2, or 1 range switch are on at the same time.
– The TR switch does not output any signals.</td><td>Available</td><td>Available</td></tr>
<tr><td>P0706</td><td>TR switch circuit malfunction (open circuit)</td><td>Available</td><td>Available</td></tr>
<tr><td>P0710</td><td>TFT sensor circuit malfunction (open/short)</td><td>The ATF temperature is assumed to be at 135 °C {275 °F} and normal shift pattern is performed.</td><td>Available</td><td>Available</td></tr>
<tr><td>P0711</td><td>TFT sensor circuit malfunction (stuck)</td><td>Normal shift pattern is performed.</td><td>Available</td><td>Available</td></tr>
<tr><td>P0715</td><td>Input/turbine speed sensor circuit malfunction</td><td>● VSS signals are used for shifting. The automatic shift diagram used in this function is different from the normal pattern.
● If any of the shift solenoids A, B, or C also fails, the minimum drivability will be assured using the remaining good solenoid valves.
● If the VSS system fails in addition to the above, operation of all solenoid valves will be suspended. While in D and 2 ranges, gear position is fixed in 3GR; while in 1 range, gear position is fixed in 1GR.</td><td>Inhibition</td><td>Release</td></tr>
<tr><td>P0731</td><td>Gear 1 incorrect</td><td rowspan="4">Normal shift pattern is performed.</td><td>Available</td><td>Available</td></tr>
<tr><td>P0732</td><td>Gear 2 incorrect</td><td>Available</td><td>Available</td></tr>
<tr><td>P0733</td><td>Gear 3 incorrect</td><td>Available</td><td>Available</td></tr>
<tr><td>P0734</td><td>Gear 4 incorrect</td><td>Available</td><td>Available</td></tr>
<tr><td>P0740</td><td>TCC system</td><td>Normal shift pattern is performed.</td><td>Inhibition</td><td>Available</td></tr>
</table>

DTC	Definition	Fail-safe	TCC	O/D OFF mode selection
P0745	Pressure control solenoid malfunction (open/short)	• If the pressure control solenoid system fails, operation of the solenoid valve will be suspended; and line pressure will be maximized to enable vehicle driving.	Inhibition	Release
P0750	Shift solenoid A malfunction (open/short)	• If any of the shift solenoids A, B, or C fails, minimum drivability will be assured using the remaining good solenoid valves. • If all the solenoid valves fail, operation of all solenoid valves will be suspended. While in D and 2 ranges, gear position is fixed in 3GR; while in 1 range, gear position is fixed in 1GR. • If any of the shift solenoids A, B, or C fails, the 3-2 timing solenoid valve will be OFF in D or 2 range, and ON in 1 range.	Inhibition	Release
P0755	Shift solenoid B malfunction (open/short)		Inhibition	Release
P0760	Shift solenoid C malfunction (open/short)		Inhibition	Release
P0743	TCC control solenoid valve malfunction (open/short)	• If the TCC control solenoid valve system fails, operation of the solenoid valve will be suspended and normal shift pattern will be performed.	Inhibition	Release
P1765	3-2 timing solenoid valve malfunction	• If the 3-2 timing solenoid valve fails, operation of the solenoid valve will be suspended.	Inhibition	Release

Parameter Identification (PID) Access

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

Monitor Item Table

Display on the NGS tester	Definition	Unit/Condition	PCM terminal
1GR	Calculated gear range in PCM (1st gear)	ON/OFF	27, 1, 70
2GR	Calculated gear range in PCM (2nd gear)	ON/OFF	27, 1, 70
3-2 TIME	3-2 timing solenoid valve control signal in PCM	ON/OFF	28
3GR	Calculated gear range in PCM (3rd gear)	ON/OFF	27, 1, 70
4GR	Calculated gear range in PCM (4th gear)	ON/OFF	27, 1, 70
ATFT	ATF temperature	˚C or ˚F	37
ATFT V	ATF temperature signal voltage	V	37
B+	Battery voltage	V	71, 97
D SW	TR switch (D range switch)	ON/OFF	6
L SW	TR switch (1 range switch)	ON/OFF	7
LINE	Pressure control solenoid control signal in PCM	%	81
LINE DES	Calculated line pressure	KPA	81
O/DFLP	O/D OFF indicator control signal in PCM	ON/OFF	43
O/DF SW	O/D OFF switch	ON/OFF	29
R SW	TR switch (R position switch)	ON/OFF	32
S SW	TR switch (2 range switch)	ON/OFF	9
SHIFT A	Shift solenoid A control signal in PCM	ON/OFF	27
SHIFT B	Shift solenoid B control signal in PCM	ON/OFF	1
SHIFT C	Shift solenoid C control signal in PCM	ON/OFF	70
TCC CON	TCC control solenoid valve control signal in PCM	ON/OFF	82
TP V	Throttle position opening angle signal voltage	V	89
TURBINE	Turbine speed	RPM	23, 84
VS	Vehicle speed	KPH/MPH	58

Simulation Test

- Using the SIMULATION TEST function (NGS tester), output devices can be operated regardless of the PCM control while the ignition switch is on or the engine is running.

Simulation item	Applicable component	Operation	Test condition		PCM terminal
			IG ON	Idle	
3-2 TIME	3-2 timing solenoid valve	ON/OFF	×		28
LINE	Pressure control solenoid	Actuated at any duty value (0—100%)	×	×	81
SHIFT A	Shift solenoid A	ON/OFF	×		27
SHIFT B	Shift solenoid B	ON/OFF	×		1
SHIFT C	Shift solenoid C	ON/OFF	×		70
TCC CON	TCC control solenoid valve	ON/OFF	×		82

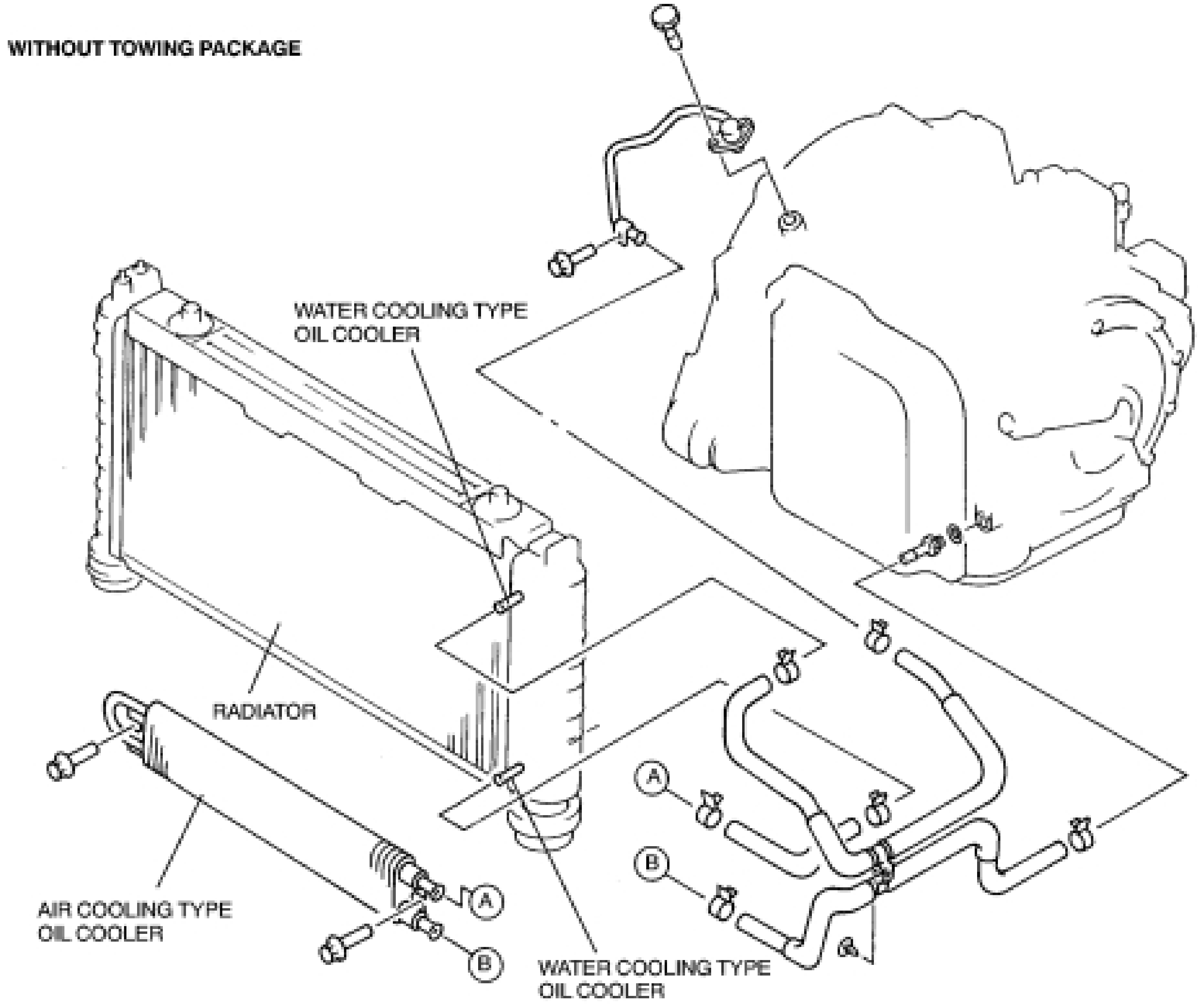
× : Applied

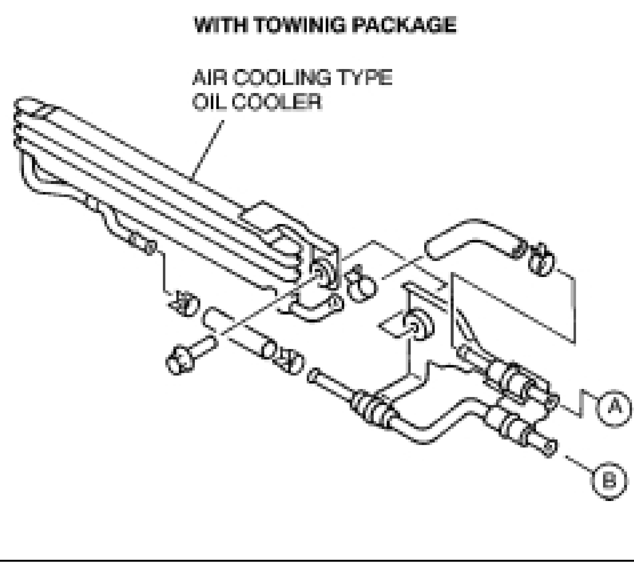
COOLING SYSTEM DESCRIPTION

YMU517S14

Oil Cooler

- A water cooling type ATX oil cooler is adopted and installed in the radiator. The oil cooler cools the ATF heated in the ATX body.
- An air cooling type ATX oil cooler is also adopted.





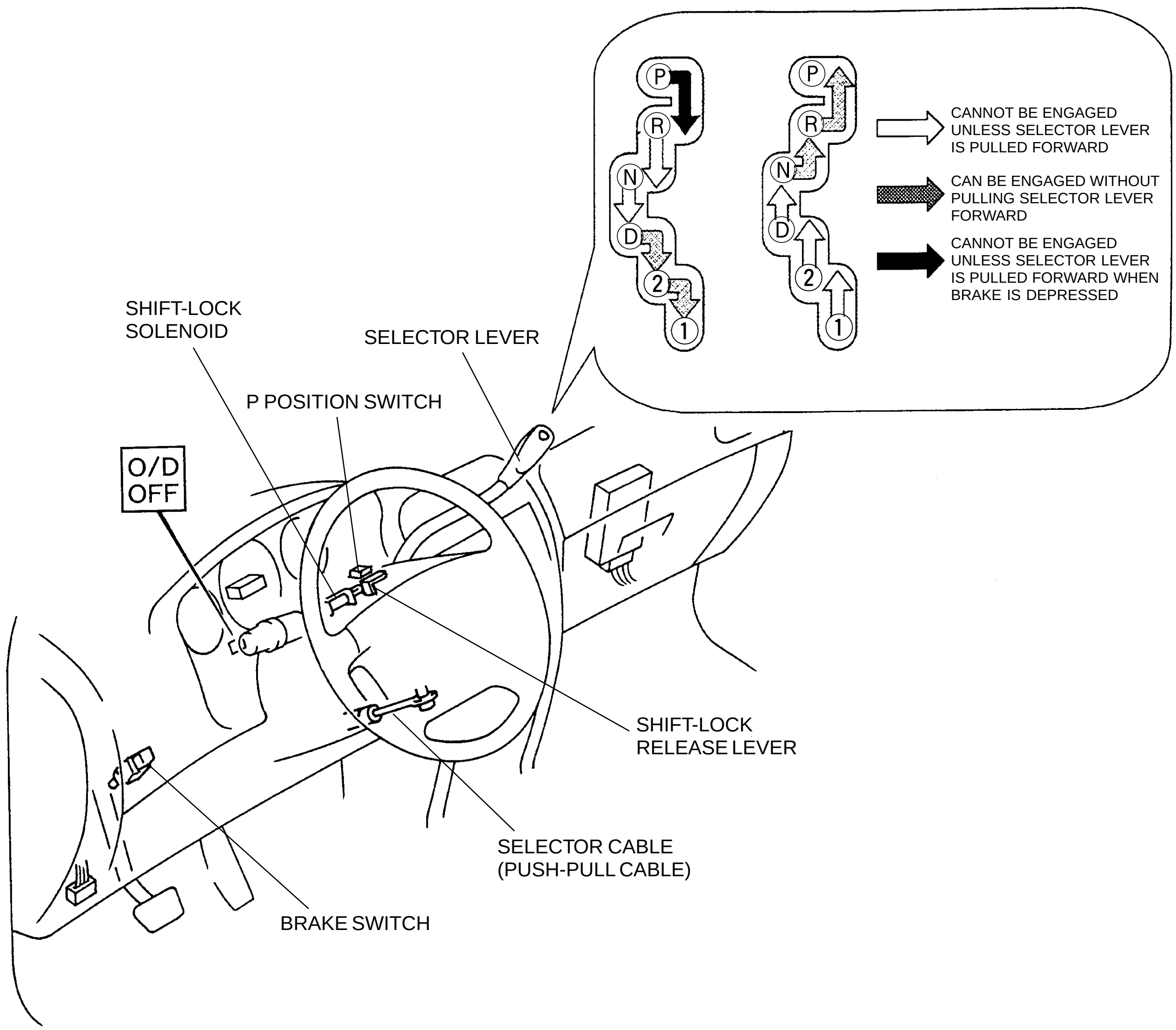
YMU517SAA

05–18 AUTOMATIC TRANSAXLE SHIFT MECHANISM

AUTOMATIC TRANSAXLE SHIFT MECHANISM OUTLINE

YMU518S01

- Remote column shifting operates a push-pull cable.
- The selector lever is attached to the steering column and operates on the same axis as the steering shaft. The selector lever, which is made of resin, has an O/D OFF switch installed on its end.
- A key interlock device and a shift lock device have been adopted. A shift-lock release lever, mounted on the steering column cover, makes operation of the vehicle possible even if the battery becomes discharged and the shift lock cannot be unlocked.



YMU518SA0

SHIFT-LOCK SYSTEM DESCRIPTION

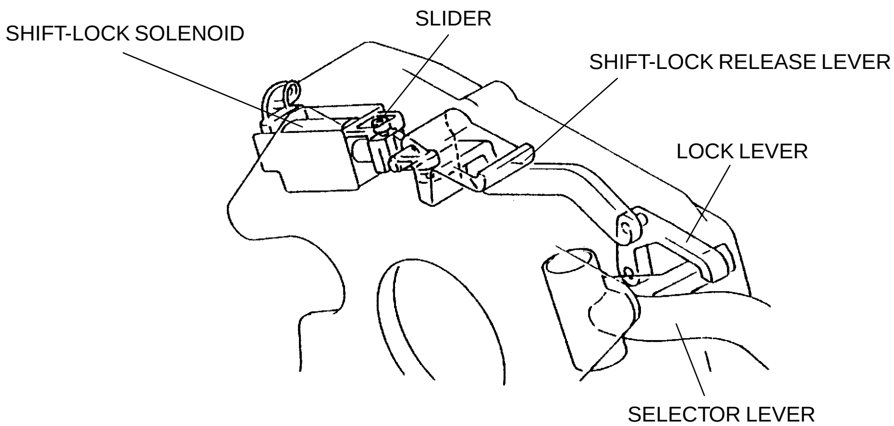
YMU518S02

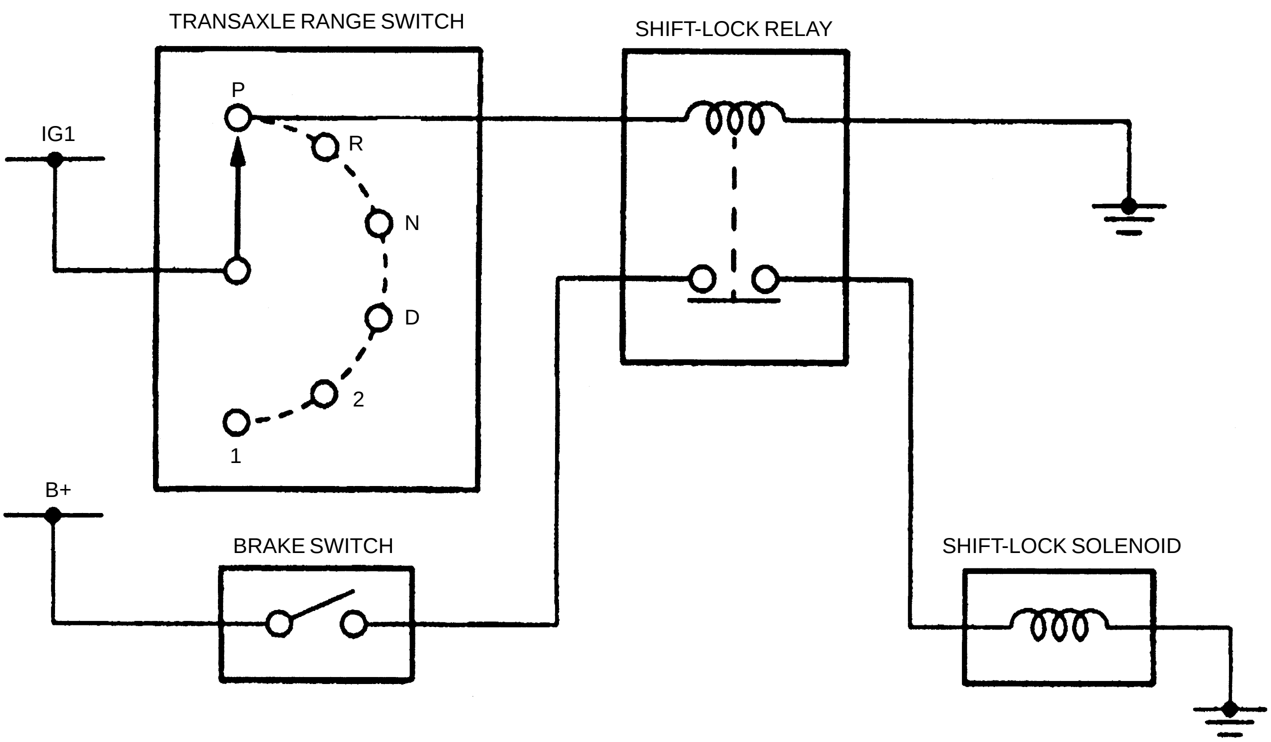
Outline

- The shift-lock system prevents the selector lever from being shifted out of Park unless the brake pedal is depressed.
- The locked selector lever can be manually released by operating the shift-lock release lever.

Structure

- The shift-lock system consists of the shift-lock relay, brake switch, shift-lock solenoid, transaxle range switch, and selector lever component.





YMU518SA1

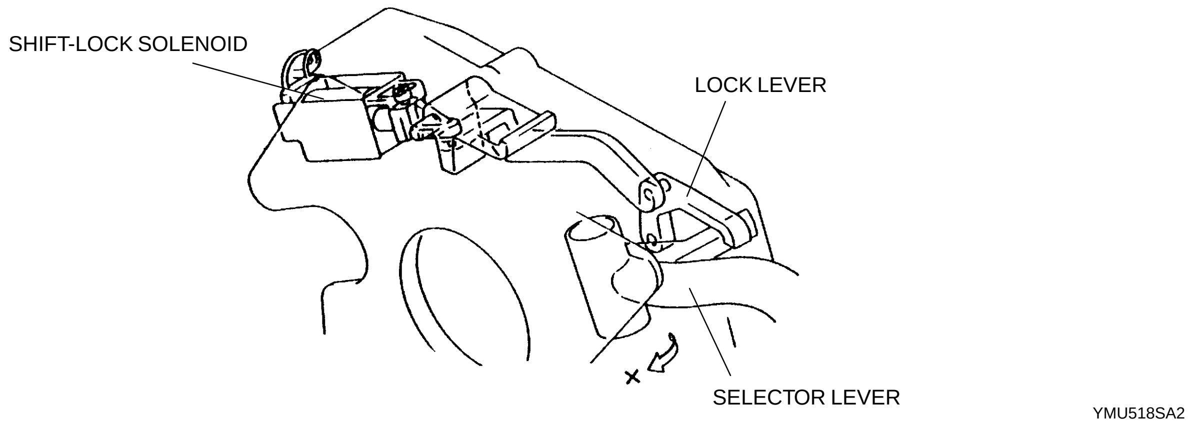
Operation

Shift-lock release conditions

- The shift-lock is released when the transaxle range switch at P position, ignition key is at ON position and the brake pedal is depressed.

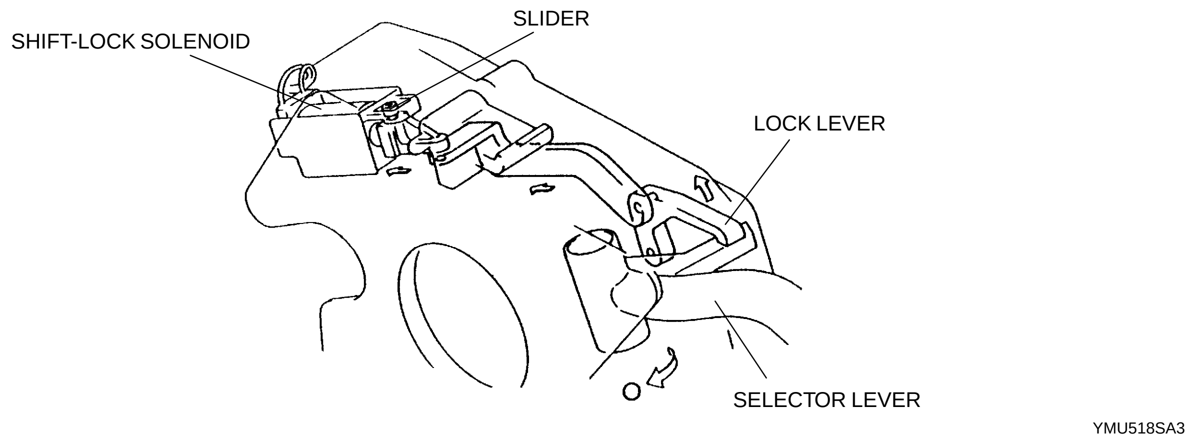
Shift-lock (when the shift-lock conditions are not satisfied)

- When the shift-lock conditions are not satisfied, electrical current does not flow to the shift-lock solenoid from the shift-lock relay. The lock lever therefore mechanically restricts the movement of the selector lever, preventing shifts out of P position.



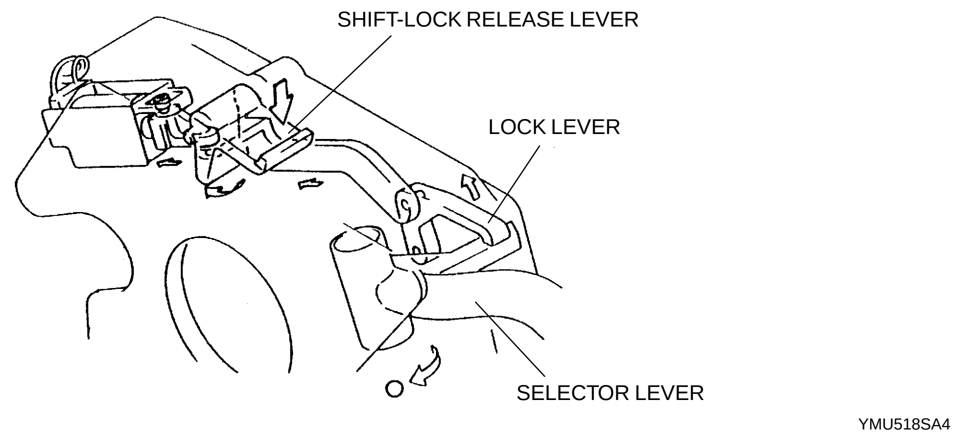
Shift-lock release (when the shift-lock conditions are satisfied)

- When the shift-lock conditions are satisfied, electrical current flows to the shift-lock solenoid from the shift-lock relay. The slider therefore moves toward the shift-lock solenoid and the lock lever moves to a position in which it does not restrict movement of the selector lever, allowing shifts out of P position.



Shift-lock release (when the shift-lock release lever is operated)

- By pushing the shift-lock release lever down, the lock lever is pushed up to a position where it does not restrict movement of the selector lever.



KEY INTERLOCK SYSTEM DESCRIPTION

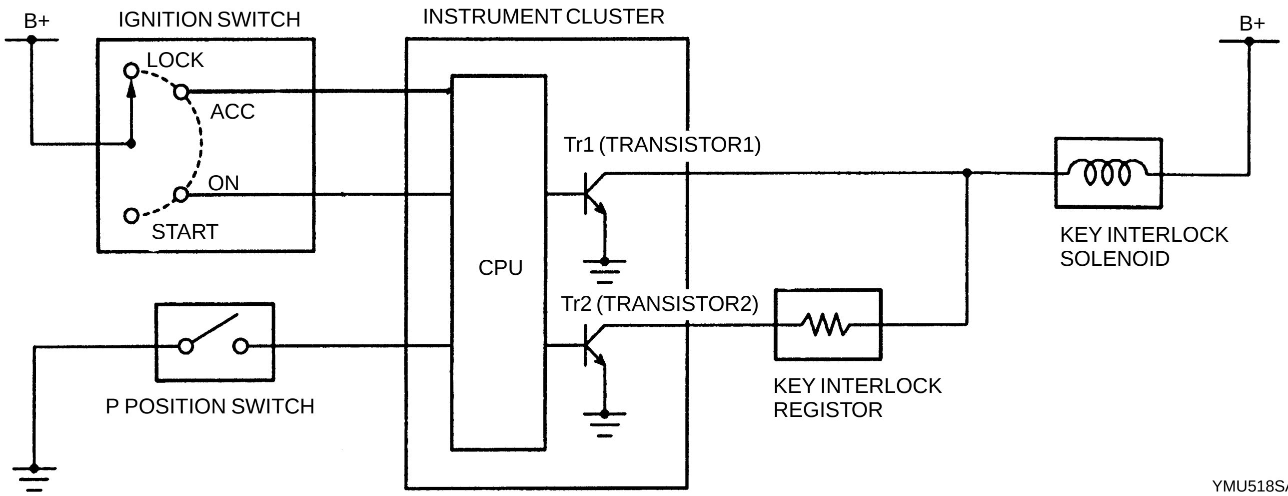
YMU518S03

Outline

- The key interlock system allows the ignition key to be removed only when the selector lever is in P position.

Structure

- The key interlock system consists of the ignition switch, P position switch, key interlock registor, steering lock, key interlock solenoid, and instrument cluster.

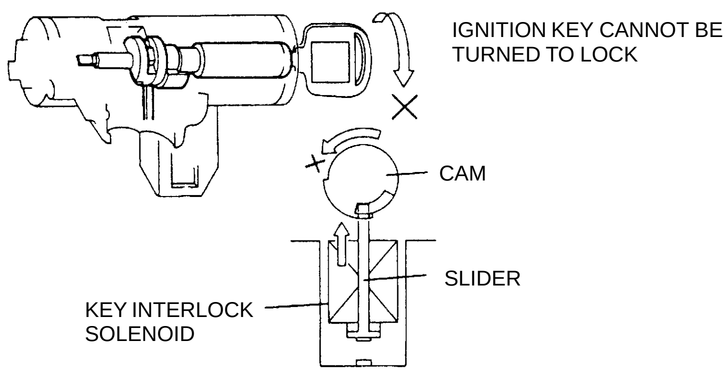


YMU518SA8

Operation

Positions other than P position (key interlock is operating)

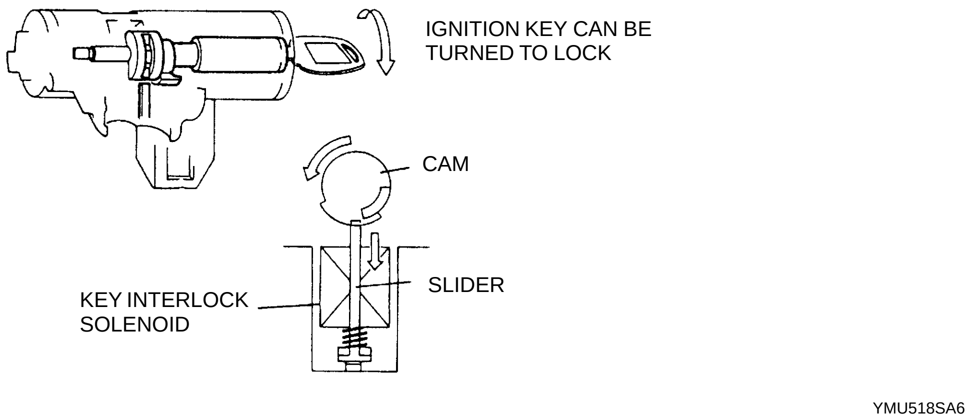
- When the selector lever is in a position other than P position with the ignition switch at ON or ACC position, Tr1 and Tr2 are turned on by the CPU in the instrument cluster and then the key interlock solenoid is energized. Because the slider moves toward the cylinder and the cam contacts the slider, the ignition key cannot be turned to LOCK position.
- When the key interlock solenoid is turned on and approximately two seconds pass, Tr1 goes off and the key interlock solenoid is turned on only by Tr2.



YMU518SA5

P position (key interlock is not operating)

- When the ignition switch is at LOCK position or selector lever is in P position, Tr1 and Tr2 are turned off by the CPU in the instrument cluster, and then the key interlock solenoid goes off. Because the slider is released from the cam by the return spring, the ignition key can be turned to LOCK position.



STEERING

06
SECTION

06–00 OUTLINE

STEERING ABBREVIATION

YMU600S01

ATF	Automatic transaxle fluid

STEERING NEW FEATURES

YMU600S02

Improved driveability
- The steering gear mounting on the gear housing side has been modified.

Improved response
- The steering gear ratio has been modified.

Improved straight-ahead stability
- Steering effort and steering angle have been modified.

STEERING SPECIFICATIONS

YMU600S03

Item			2000MY	1998MY
Engine speed sensing power steering				
Steering wheel	Outer diameter (mm {in})		380 {15.0} [4-spoke]	←
	Lock-to-lock (turns)		3.3	3.6
Steering gear	Type		Rack-and-pinion	←
	Rack stroke (mm {in})		147.2 {5.8}	136.0 {5.4}
Steering column and shaft	Shaft type		Collapsible	←
	Joint type		2-cross joint	←
Power steering	Power assist type		Engine speed sensing	←
	Fluid	Type	ATF M-III or equivalent (e.g Dexron®II)	←
		Capacity (L {Usqt, lpm qt})	1.05 {1.11, 0.92}	0.91 {0.96, 0.80}

06–12 ENGINE SPEED SENSING POWER STEERING

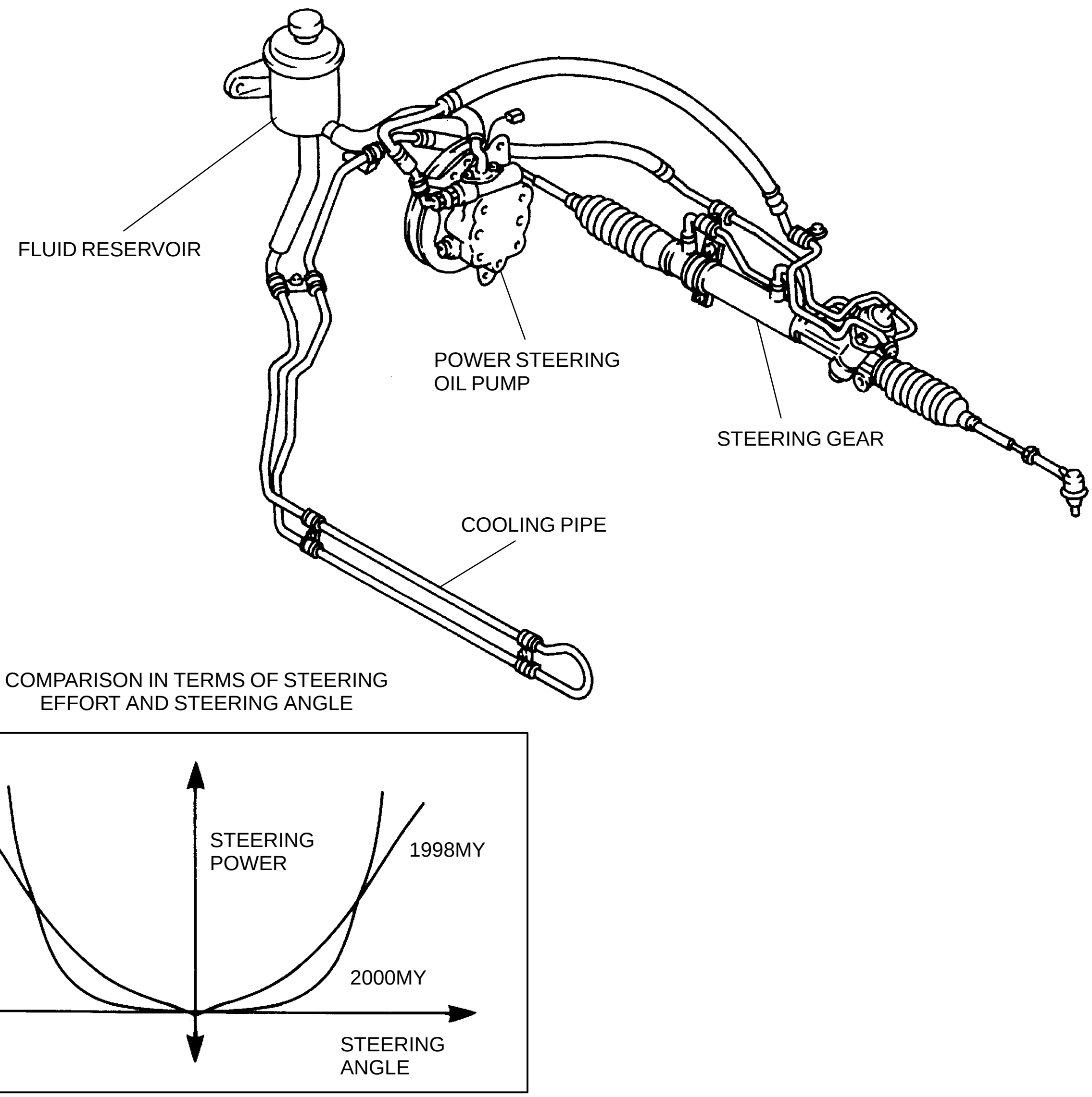
ENGINE SPEED SENSING POWER STEERING OUTLINE

YMU612S01

- Rack-and-pinion steering system with engine speed sensing power steering has been adopted. The construction and operation of the steering system is basically the same as the 1998MY MPV, however, the following points are different.
  (1) A steering gear mounting part has been attached to the gear to increase the mounting rigidity.
  (2) To improve steering response, the steering gear ratio has been changed.
    - The gear ratio has been changed from 20.3:1 to 19:1.
  (3) To improve straight-ahead stability, the relationship between steering power and steering gear angle has been changed.
    - The gear ratio near the steering center has been increased.

ENGINE SPEED SENSING POWER STEERING STRUCTURAL VIEW

YMU612S02



YMU612SA0

HEATER, VENTILATION & AIR CONDITIONING (HVAC)

07 SECTION

07–00 OUTLINE

HVAC ABBREVIATIONS

YMU700S01

A/C	Air conditioning
AMP	Amplifier
HI	High
HVAC	Heater, ventilation, and air conditioning

LO	Low
M	Motor
REC	Recirculate

HVAC NEW FEATURES

YMU700S02

Increased filtration
- Added cabin air filter

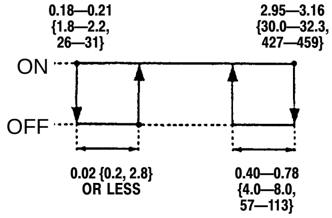
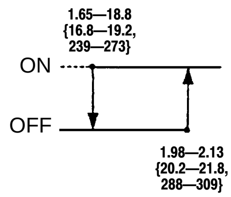
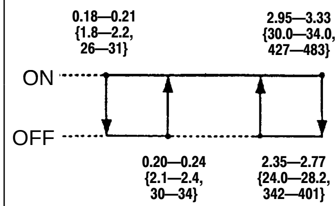
Improved air conditioning performance
- Adopted sub-cooling system to multiflow condenser
- Added middle pressure switch to refrigerant pressure switch

Improved visibility
- Added front defroster control system to prevent window clouding

HVAC SPECIFICATIONS

YMU700S03

Item			2000MY	1998MY
REFRIGERANT SYSTEM				
Refrigerant	Type		R-134a	←
	Regular amount (g {oz})	Twin A/C	850 {30.0}	1,000 {35.3}
		Single A/C	650 {22.9}	900 {31.8}
BASIC SYSTEM				
Heating capacity (kW {kcal/h})		Front	5.000 {4,300}	4.651 {4,000}
		Rear	3.256 {2,800}	2.907 {3,900}
Cooling capacity (kW {kcal/h})		Front	5.814 {5,000}	4.535 {2,500}
		Rear	1.163 {1,000}	2.326 {2,000}
A/C compressor	Type		Swash plate	←
	Discharge capacity (ml {cc, fl oz} /rev)		177 {177, 5.98}	←
	Max. allowable speed (rpm)		6,000	←
	Lubricating	Type	ND-OIL 8	←
		Sealed volume (ml {cc, fl oz})	160 {160, 5.41}	←
Condenser	Type		Multiflow (sub-cooling system)	Multiflow
	Radiated heat (kW {kcal/h})		15.27 {13,100}	13.72 {11,800}
Receiver/drier	Capacity (ml {cc, fl oz})		250 {250, 8.45}	300 {300, 10.1}
	Desiccant		XH-9	←
Expansion valve	Type		External pressure equalizer	Internal pressure equalizer
Evaporator	Type		Drawn cup	←
CONTROL SYSTEM				
Airflow volume (during heater operation)	Blower motor (m^3/h)	Front	343	350
		Rear	200	225
Electricity consumption (during heater operation)	Blower motor (W)	Front	233	200
		Rear	100	50
Airflow volume (during air conditioner operation)	Blower motor (m^3/h)	Front	530	510
		Rear	220	200
Electricity consumption (during air conditioner operation)	Blower motor (W)	Front	316	265
		Rear	100	105
	Magnetic clutch (W)		40	←
Magnetic clutch	Clearance (mm {in})		0.35—0.65 {0.014—0.025}	←
Blower motor	Fan type		Sirocco fan	←
Temperature control			Reheat full air mix type	←

Item		2000MY	1998MY
Refrigerant pressure switch	Operating pressure (MPa {kgf/cm^2, psi})	HIGH AND LOW PRESSURE SWITCH  YMU700SA0 MIDDLE PRESSURE SWITCH  YMU700SA1	 YMU700SA2
Pressure relief valve	Operating pressure (MPa {kgf/cm^2, psi})	3.44—4.13 {35.0—42.2, 498—600}	←

07–10 REFRIGERANT SYSTEM

REFRIGERANT SYSTEM OUTLINE

YMU710S01

- The refrigerant system is the same as the 1998MY MPV.

REFRIGERANT SYSTEM DESCRIPTION

YMU710S02

System Parts

Part	Description
Refrigerant	Hydrofluorocarbon-134a (HFC-134a) (CH_2FCF_3)
Compressor oil	Polyalkylene glycol oil (PAG oil)
O-ring	Rubber in behalf of R-134a (RBR)
Joint nuts	Metric threads
Charging valve	Quick-connect type: HI: 16 mm {0.6 in} diameter LO: 13 mm {0.5 in} diameter

System Service Tools

Part	Description
Tool joints	Metric threads
Charging valve joints	Quick-connect type: HI: 16 mm {0.6 in} diameter LO: 13 mm {0.5 in} diameter
Manifold gauge	High-pressure side maximum reading: 3.5 MPa {35 kgf/cm^2, 500 psi}
Gas leak tester	Electric type

07

07–11 BASIC SYSTEM

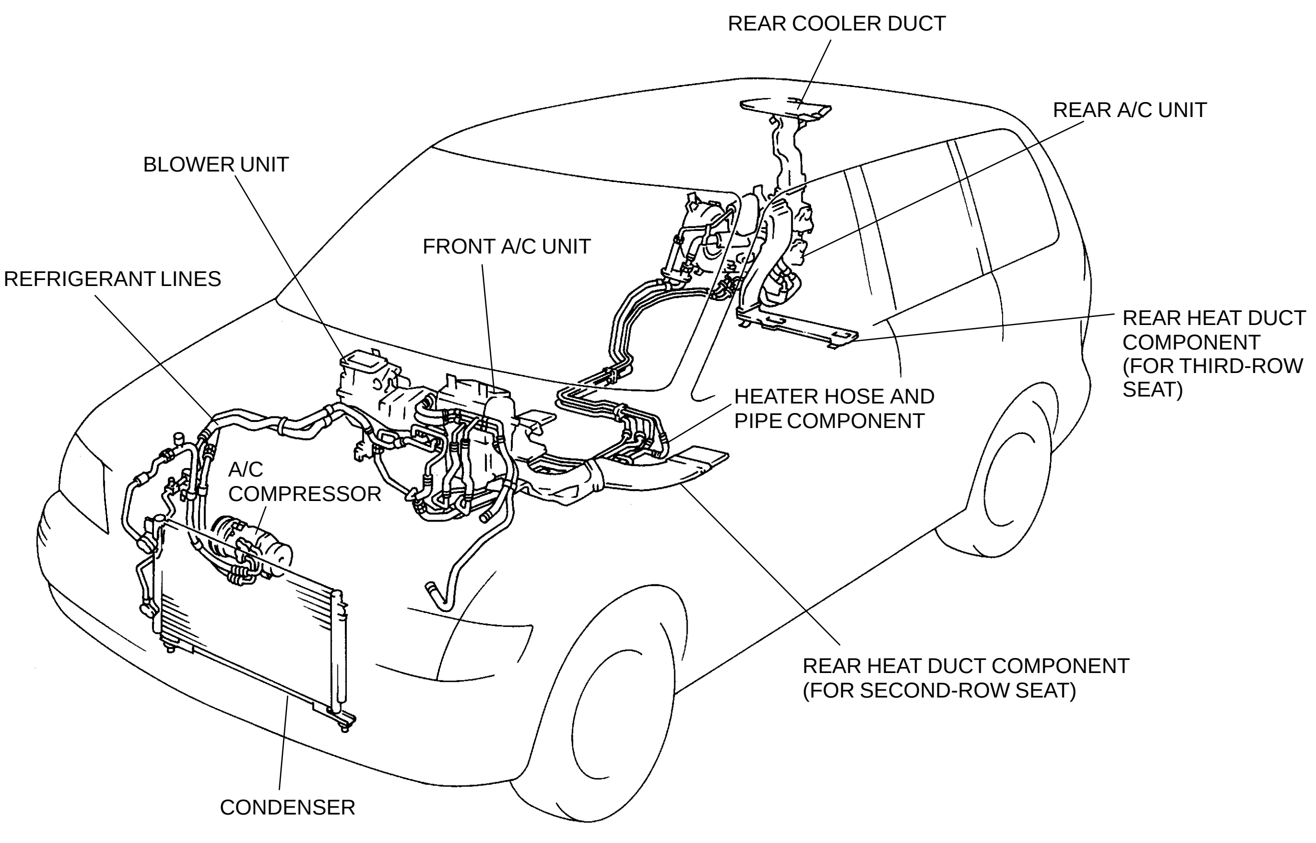
BASIC SYSTEM OUTLINE

YMU711S01

- An air filter has been installed in the blower unit to remove airborne dust and pollen.
- The front A/C unit integrates the cooling and heater units.
- The rear A/C unit integrates the blower, cooling, and heater units.
- A sub-cooling system multi-flow condenser is used for improved cooling.

BASIC SYSTEM STRUCTURAL VIEW

YMU711S02

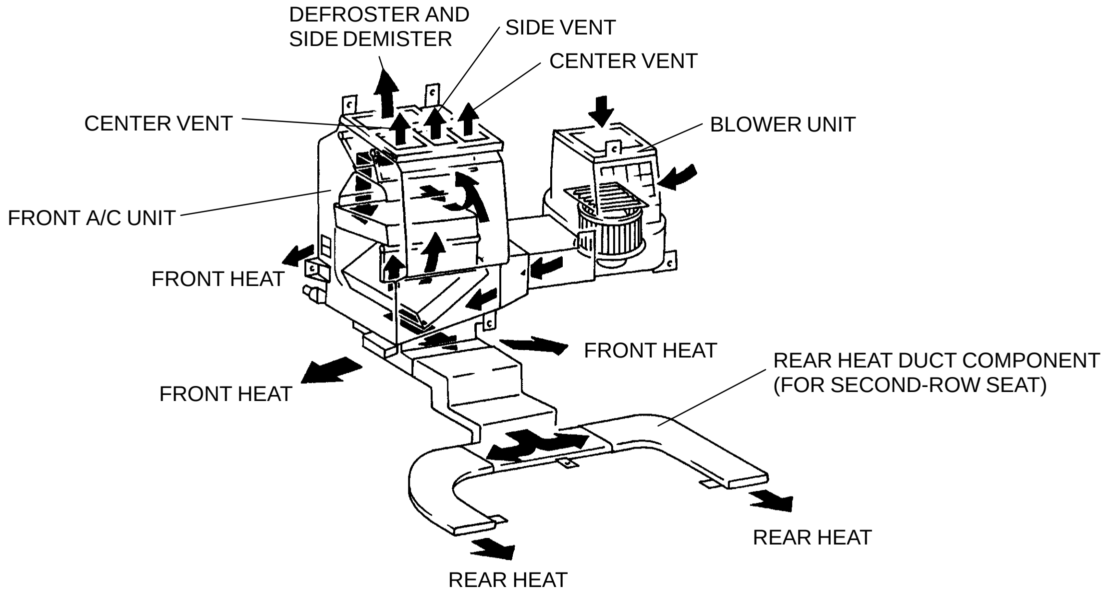


BLOWER AIR FLOW DIAGRAM

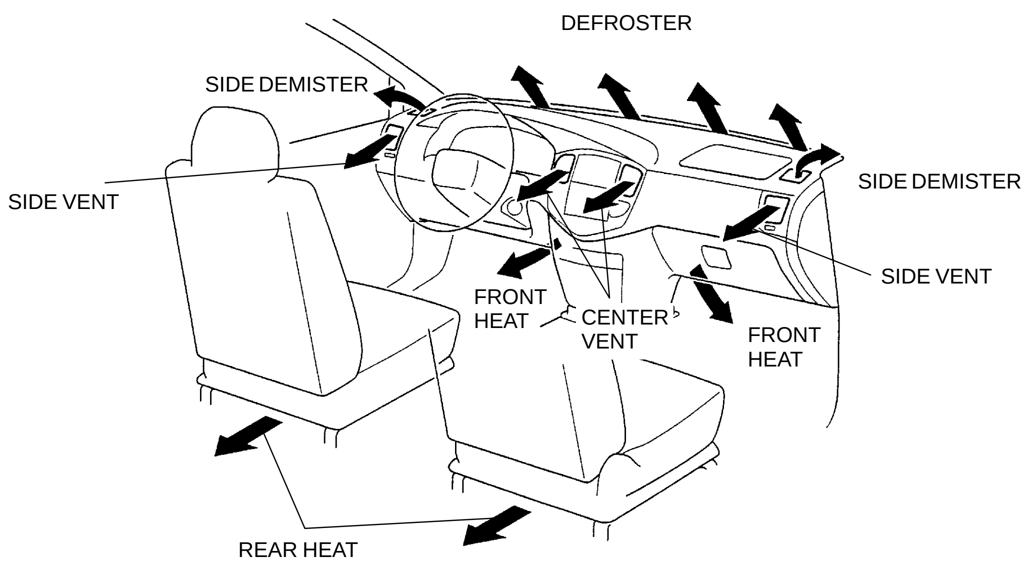
YMU711S03

Front

- When the A/C is turned on, the air that passes through the air filter and front blower motor is cooled, dehumidified and filtered by the front evaporator, then heated by the front heater core.
- The ventilation of the second-row seat is improved using rear heat duct.
- The side windows are defrosted by ventilation from the side demister.



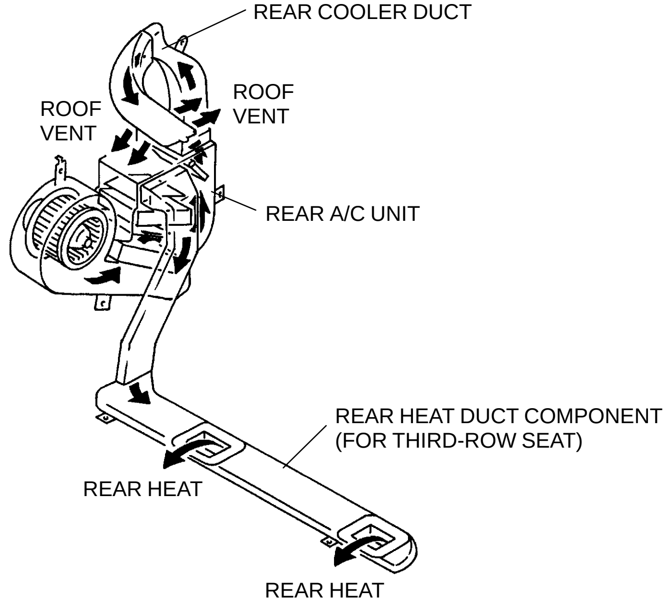
YMU711SA1



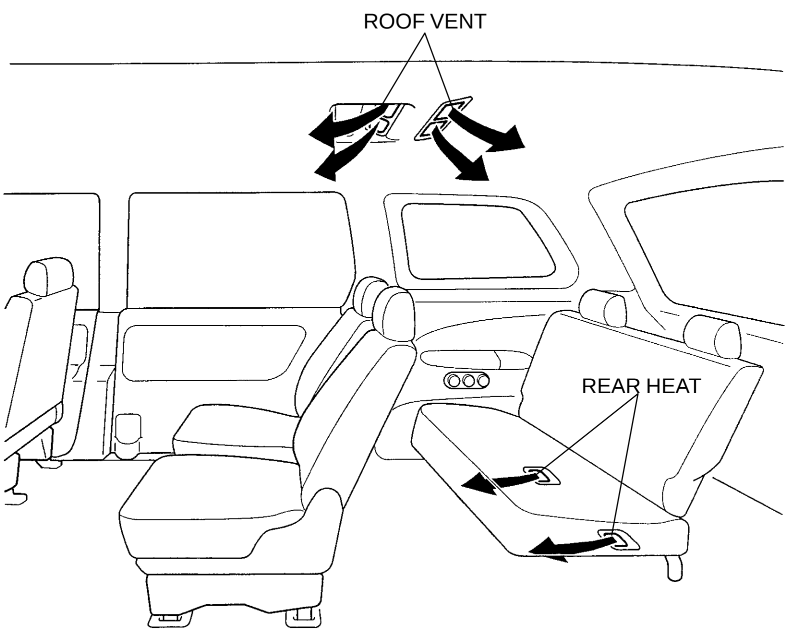
YMU711SA2

Rear

- When the A/C is turned on, the air that passes through the rear blower motor is cooled, dehumidified and filtered by the rear evaporator, then heated by the rear heater core.



YMU711SA3



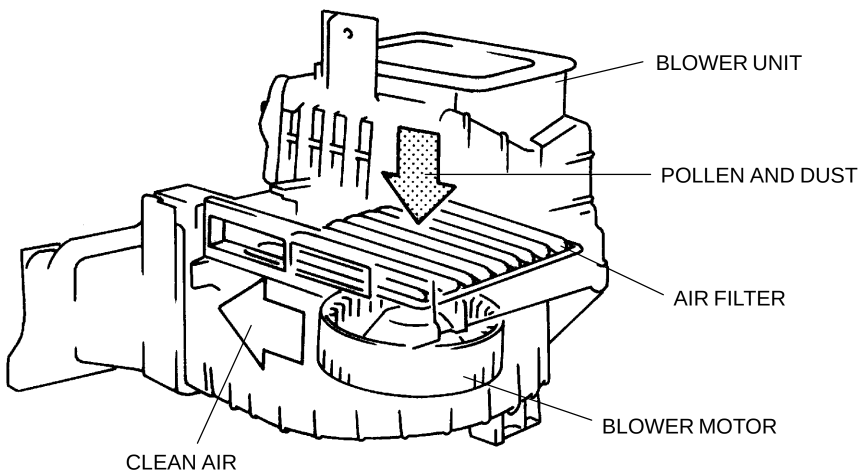
YMU711SA4

AIR FILTER DESCRIPTION

YMU711S04

- The air filter removes pollen, grains, and dust from the air so that the air supplied to the passenger compartment is clean.

  Replace the air filter:
  Once a year or after every 20,000 km {12,400 miles}



YMU711SA5

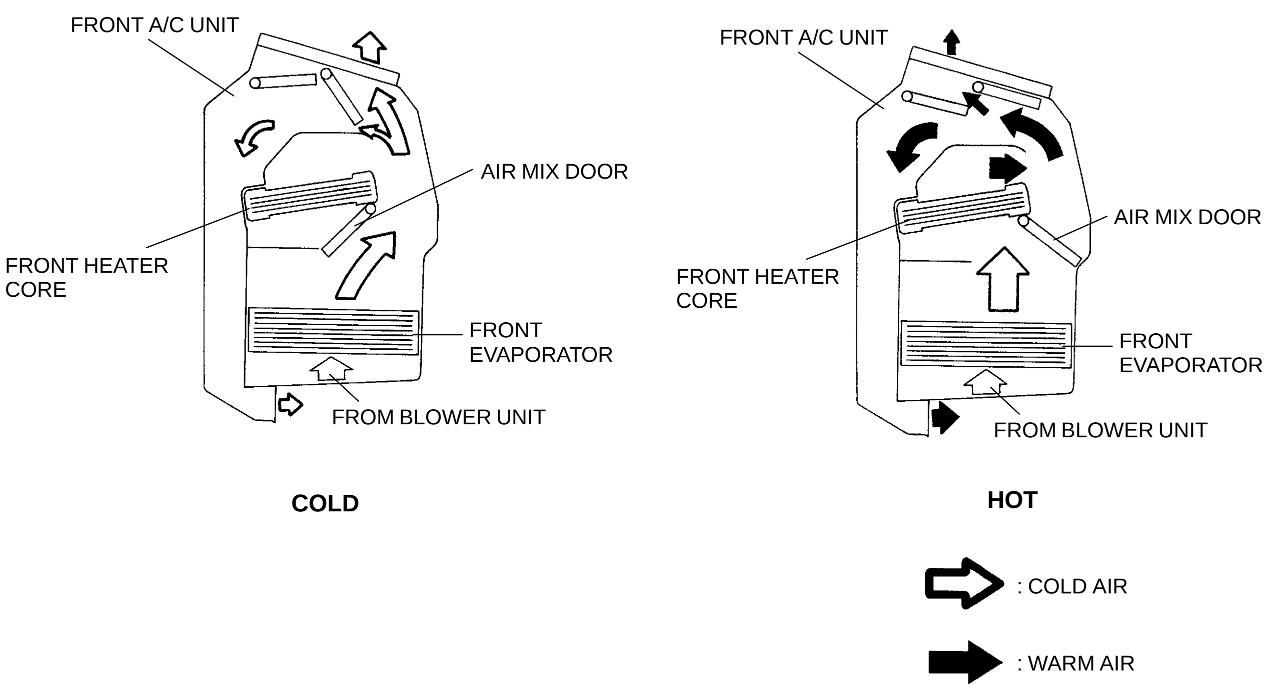
FRONT A/C UNIT DESCRIPTION

YMU711S05

- The front A/C unit, which integrates the cooling and heater unit, is used.

Air Mix Door Operation

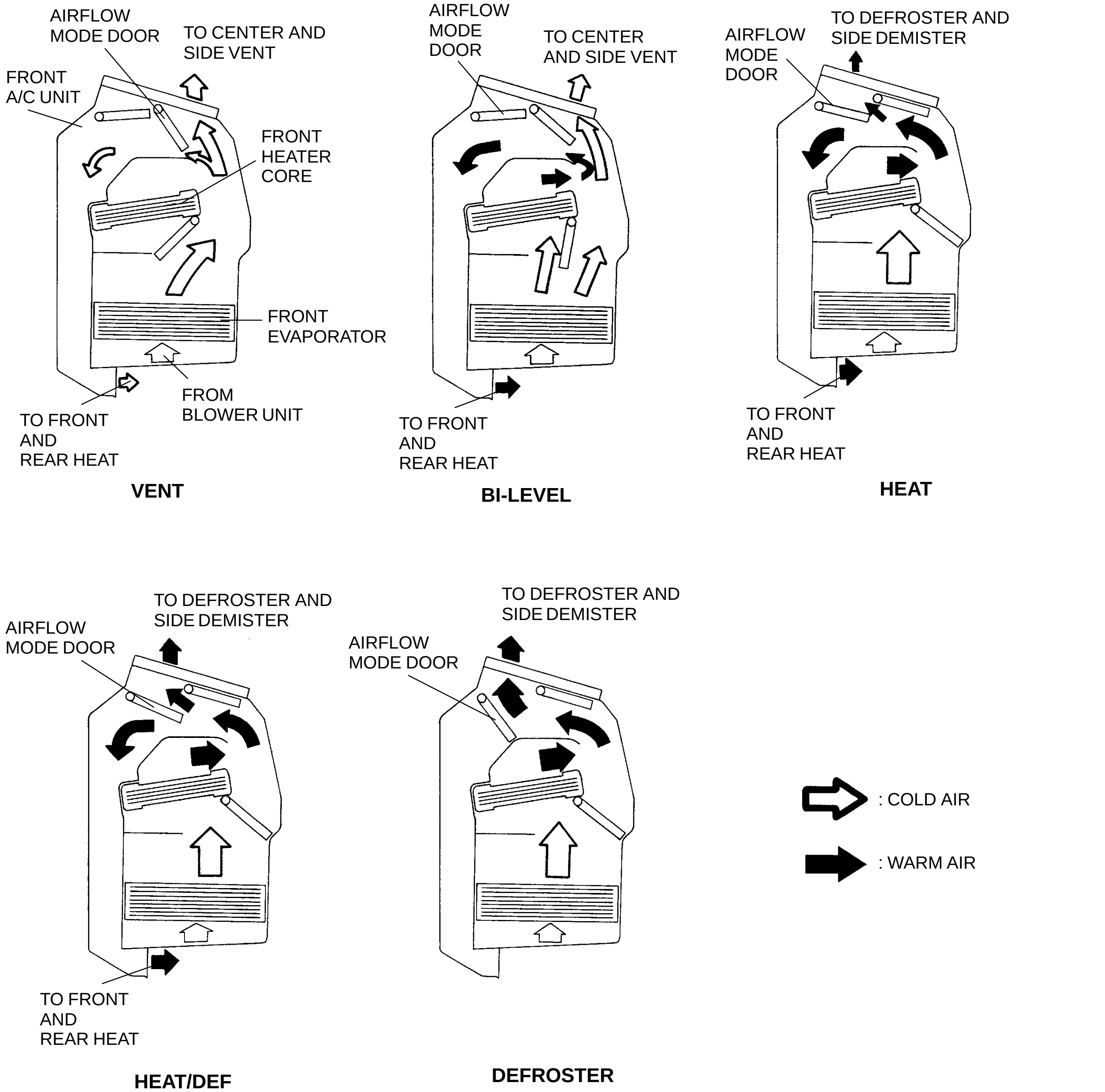
- The air mix door, installed in the front A/C unit, controls HOT or COLD position, using the air mix actuator motor. As a result, airflow distribution changes, and the airflow temperature is controlled.



YMU711SA7

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 mode selector dial. As a result, airflow mode changes.



YMU711SA8

Airflow distribution

Airflow mode	Distribution (%)		
	Center and side vent	Front and rear heat	Defroster and side demister
VENT	90	10	0
BI-LEVEL	50	50	0
HEAT	0	85	15
HEAT/DEF	0	50	50
DEFROSTER	0	0	100

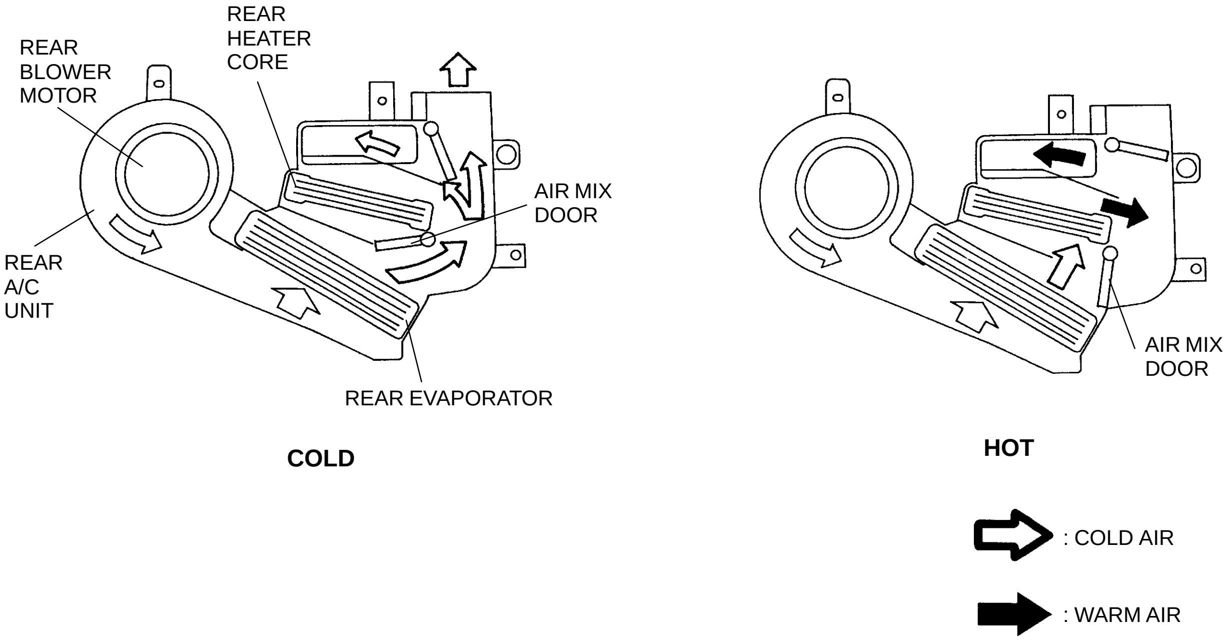
REAR A/C UNIT DESCRIPTION

YMU711S06

- The rear A/C unit, which integrates the blower, cooling and heater unit, has been used.

Air Mix Door Operation

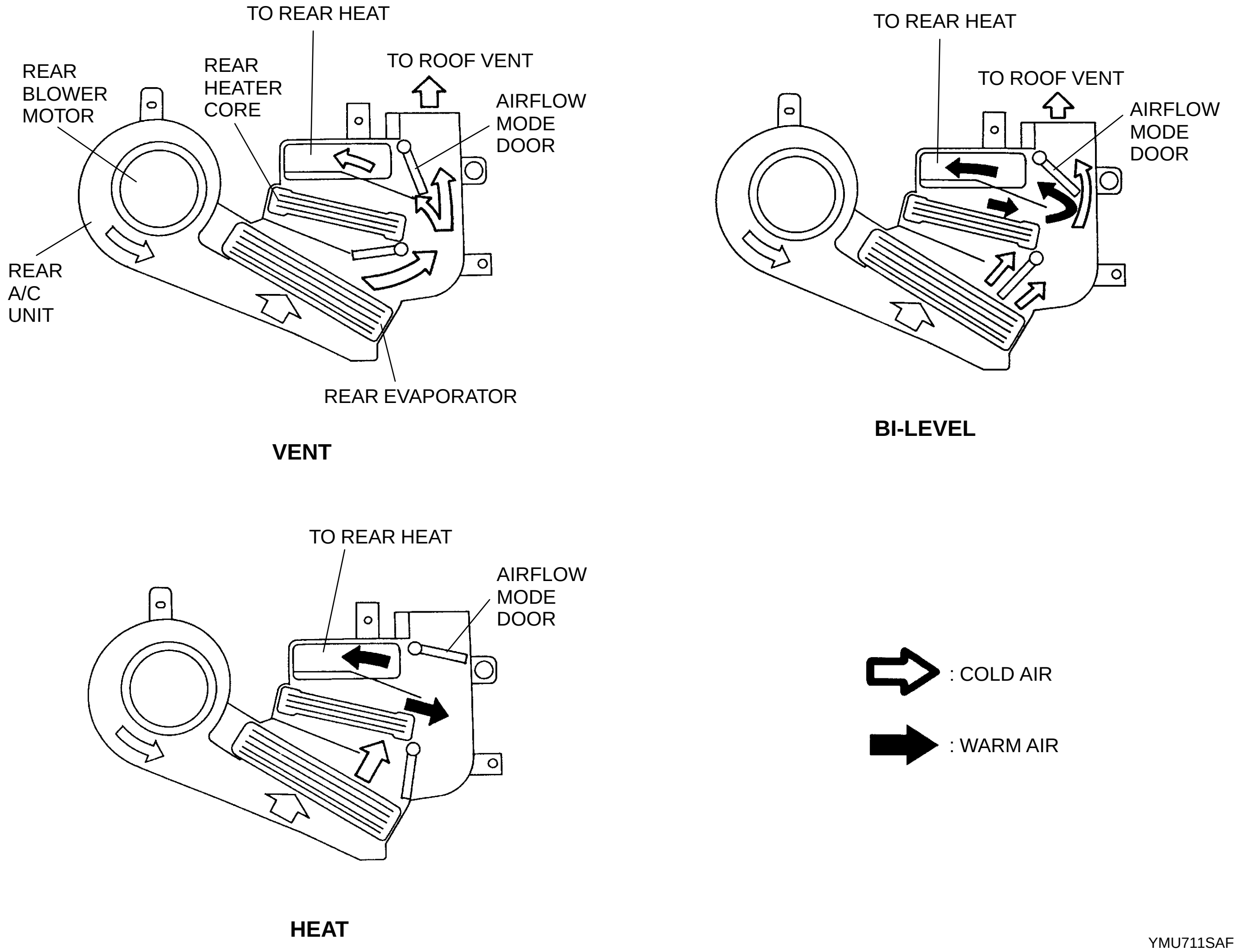
- The air mix door moves to HOT or COLD position, depending on the position of the mode selector dial. As a result, airflow distribution changes, and airflow temperature is controlled.



YMU711SAD

Airflow Mode Door Operation

- The airflow mode doors, installed in the rear A/C unit control VENT, BI-LEVEL, or HEAT position, using the airflow mode actuator motor. As a result, airflow mode changes.



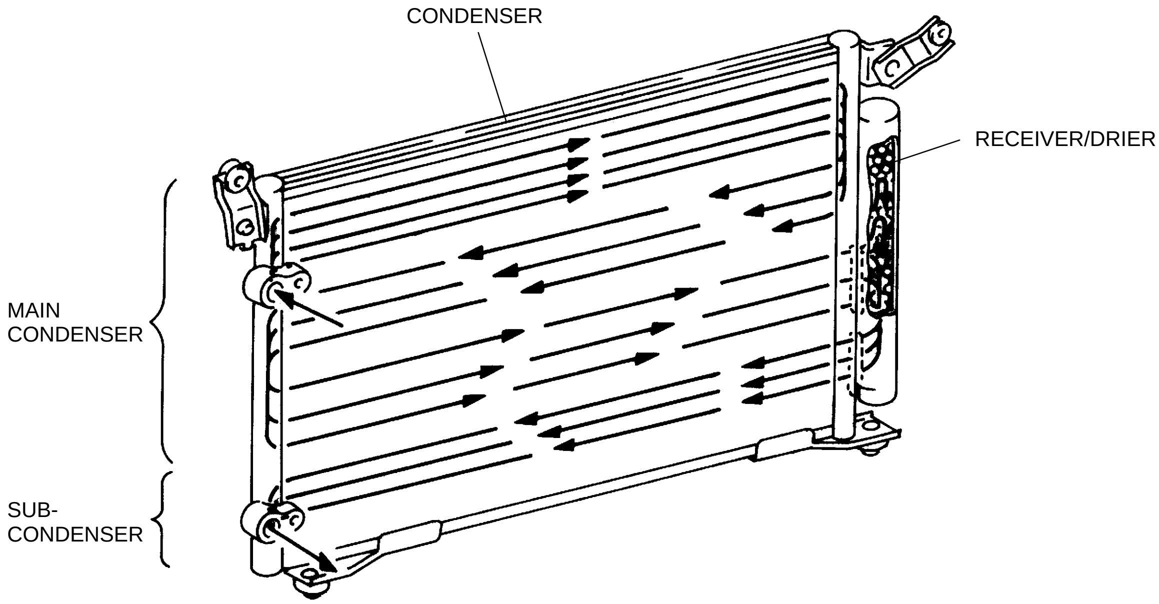
Airflow distribution

Airflow mode	Distribution (%)	
	Roof vent	Rear heat
VENT	85	15
BI-LEVEL	60	40
HEAT	0	100

CONDENSER DESCRIPTION

YMU711S07

- The receiver/drier, main condenser, and sub-condenser are integrated into the sub-cooling system multi-flow condenser.
- The sub-cooling system multi-flow condenser sends refrigerant cooled in the main condenser to the receiver/drier and re-cools it in the sub-condenser for a more efficient cooling process.



YMU711SAJ

07–40 CONTROL SYSTEM

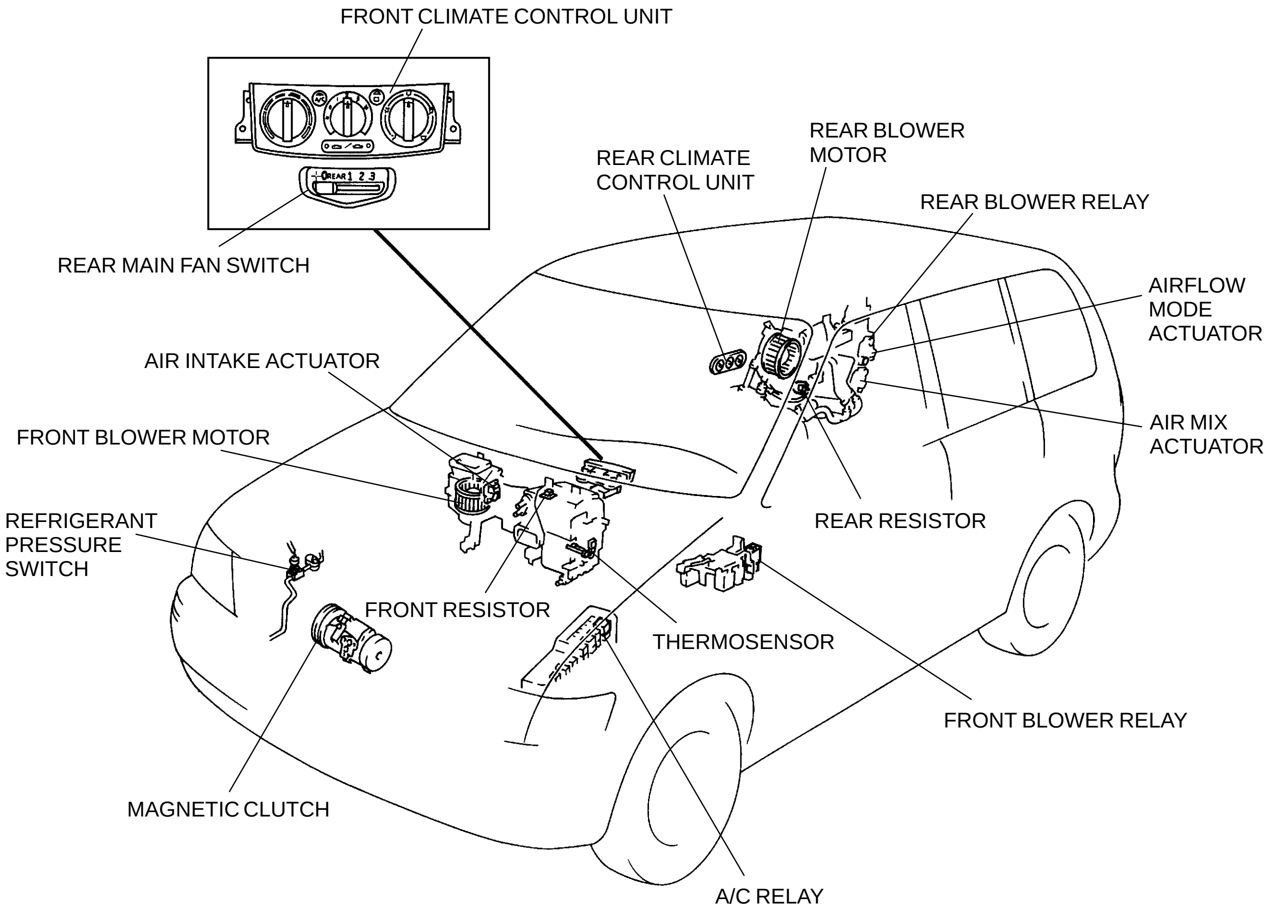
CONTROL SYSTEM OUTLINE

YMU740S01

- A middle pressure switch has been adopted to the refrigerant pressure switch. The middle pressure switch controls the cooling fan while the A/C is operating.
- An air intake actuator installed in the blower unit electrically controls ventilation.
- An airflow mode actuator and air mix actuator installed in the rear A/C electrically controls mode changes and the rear A/C temperature regulation.
- A thermosensor integrated with an amplifier is used.
- A wire and logic type front climate control unit is used.
- A front defroster control in the front climate control unit improves defogging of the windshield and front door glasses.
- A rear main fan switch in the center of the dashboard allows the driver to control the rear A/C airflow.
- A logic type rear climate control unit is used.

CONTROL SYSTEM STRUCTURAL VIEW

YMU740S02

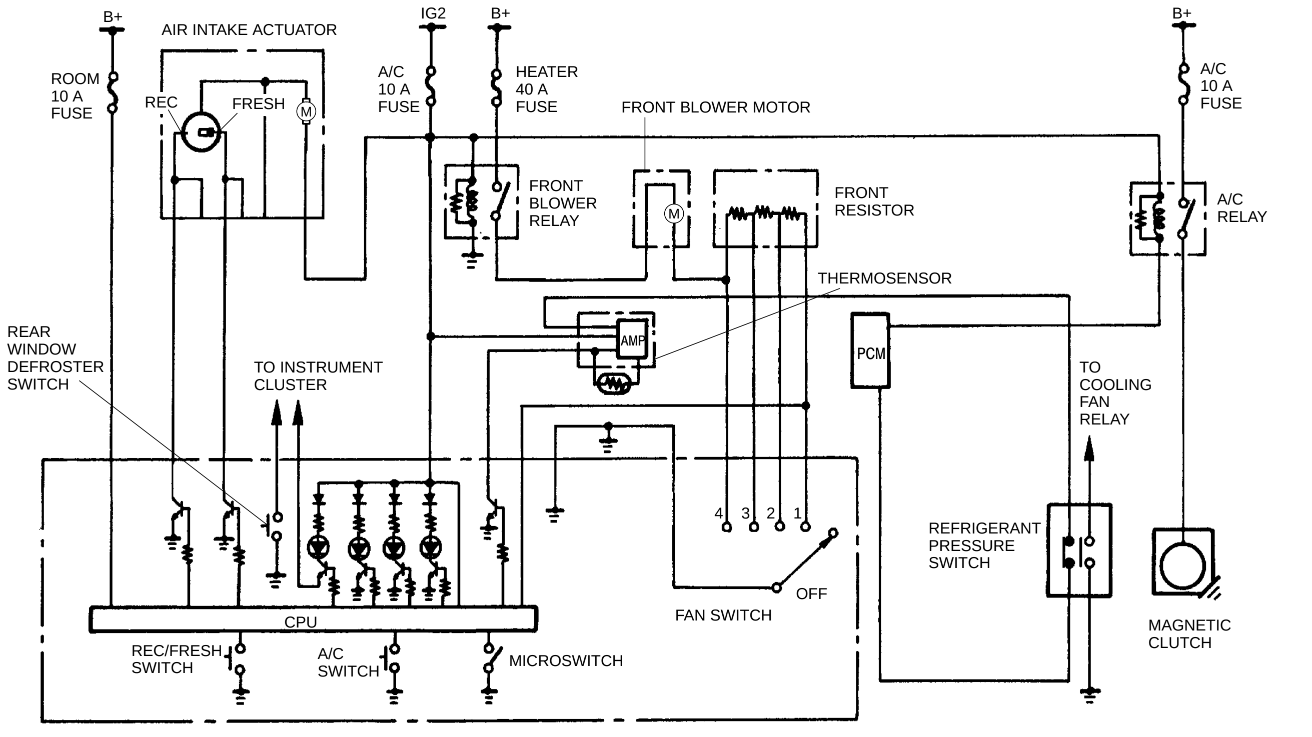


YMU740SA0

CONTROL SYSTEM WIRING DIAGRAM

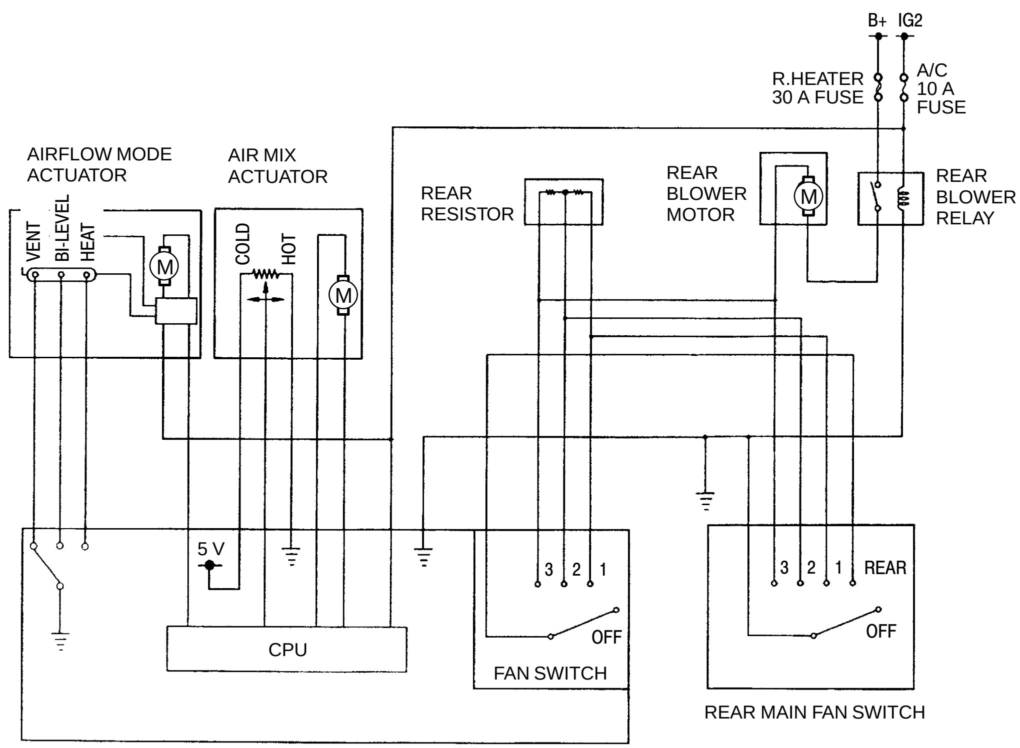
YMU740S03

Front



YMU740SA1

Rear



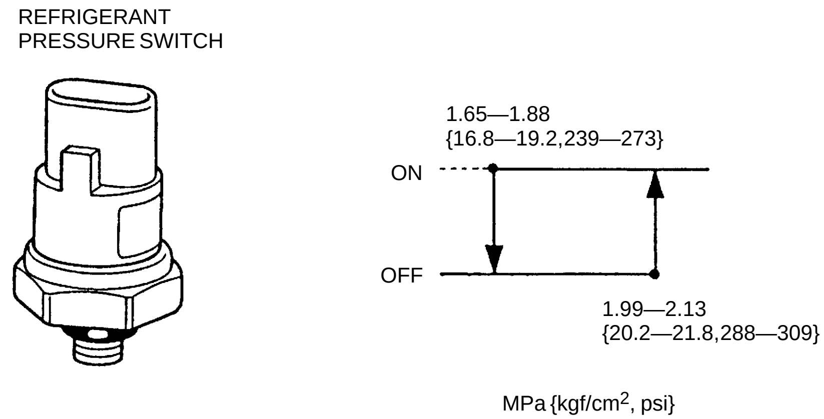
YMU740SA2

REFRIGERANT PRESSURE SWITCH DESCRIPTION

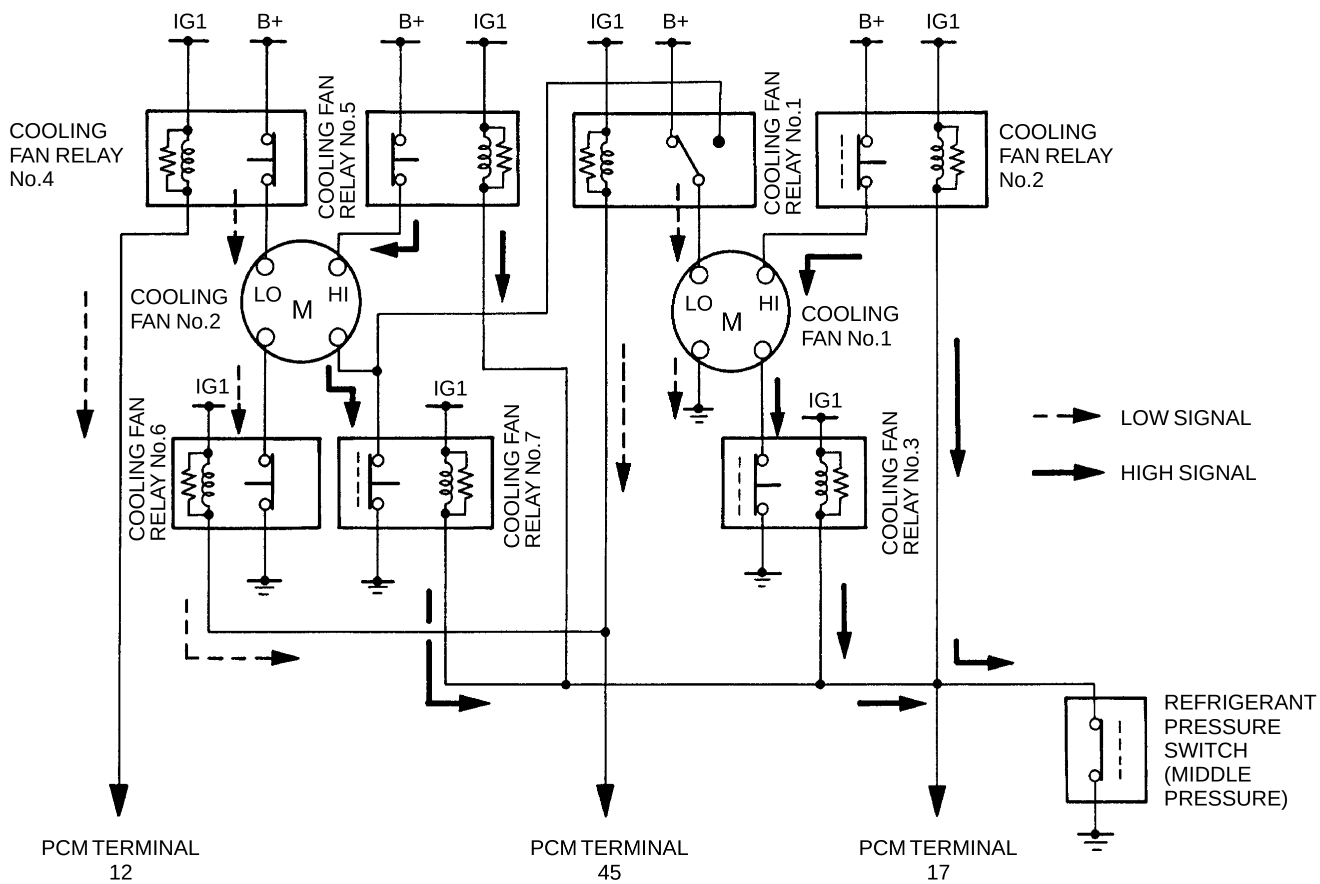
YMU740S04

Middle Pressure Switch Operation

- When the refrigerant pressure exceeds approximately 2.06 MPa {21.0 kgf/cm^2, 299 psi}, the contact point goes on, and the operation of cooling fan is changed from low speed to high speed.
- In regard to the details of cooling fan control, refer to 01–40 ELECTRIC FAN CONTROL DESCRIPTION.



YMU740SAF



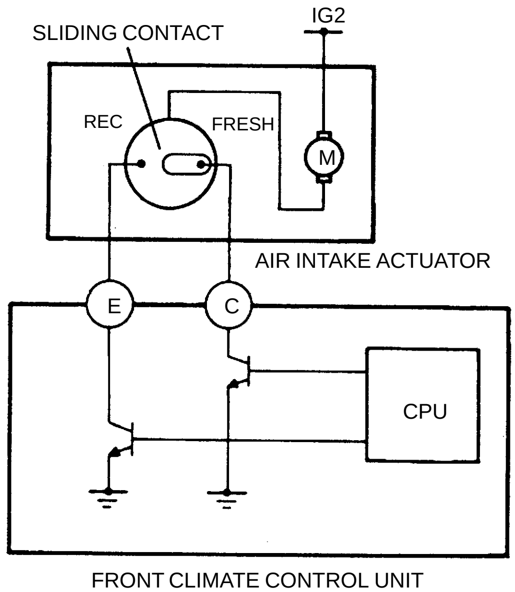
YMU740SAG

AIR INTAKE ACTUATOR DESCRIPTION

YMU740S05

- The air intake actuator is operated by signals from the front climate control unit, and thereby opens and closes the air intake door.
- The air intake actuator has a built-in sliding contact that is linked to the motor.

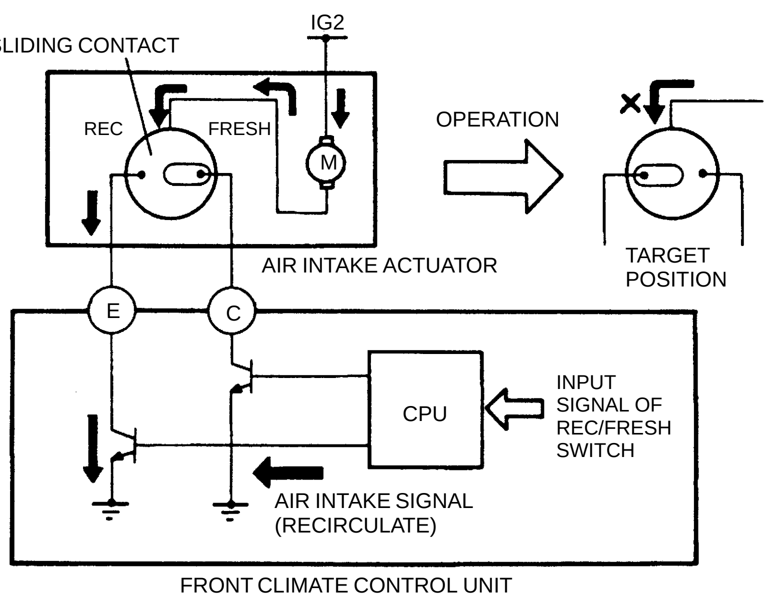
System Wiring Diagram



YMU740SA3

Operation

1. The front climate control unit CPU sends an air intake signal based on the input signal of the REC/FRESH switch and turns the transistor on.
2. The air intake actuator motor operates until the sliding contact rotates to a target position.
3. When the motor has rotated to the target position, the sliding contact opens.
4. The motor drive circuit is cut, and the motor stops.



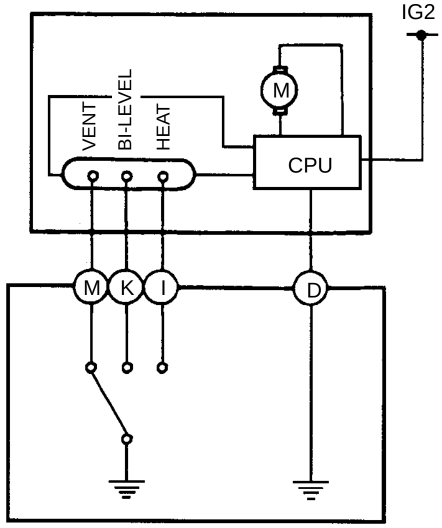
YMU740SA4

AIRFLOW MODE ACTUATOR DESCRIPTION

YMU740S06

- The airflow mode actuator contains a CPU.
- The CPU controls the rotation direction of the motor according to the position of the airflow mode dial on the rear climate control unit.

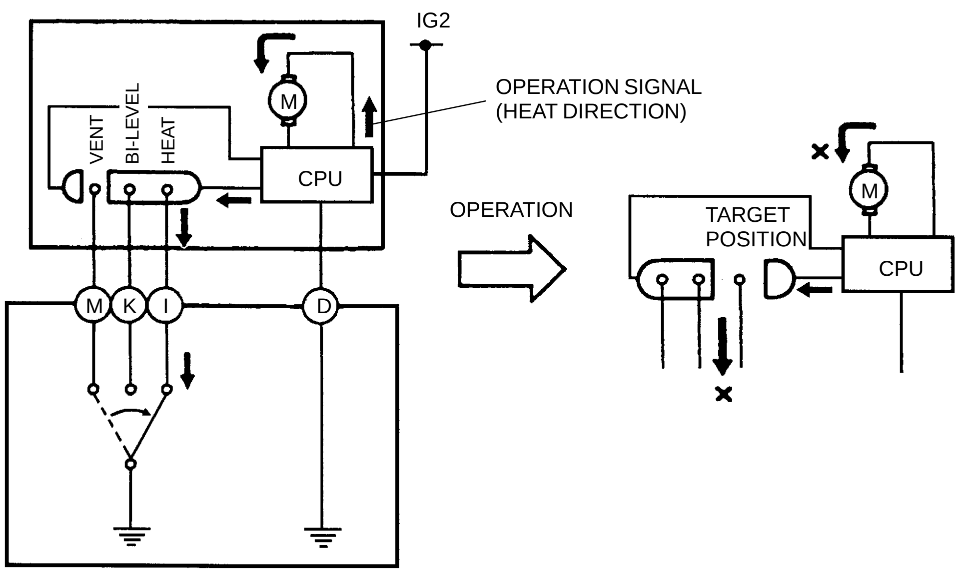
System Wiring Diagram



YMU740SA5

Operation

1. When the airflow mode dial on the rear climate control unit is turned, the signal from the CPU is shorted to ground.
2. When the circuit from the CPU to ground is completed, the CPU sends a signal to the motor to start operating.
3. When the motor has rotated to the target position, the sliding contact opens and the motor is stopped.



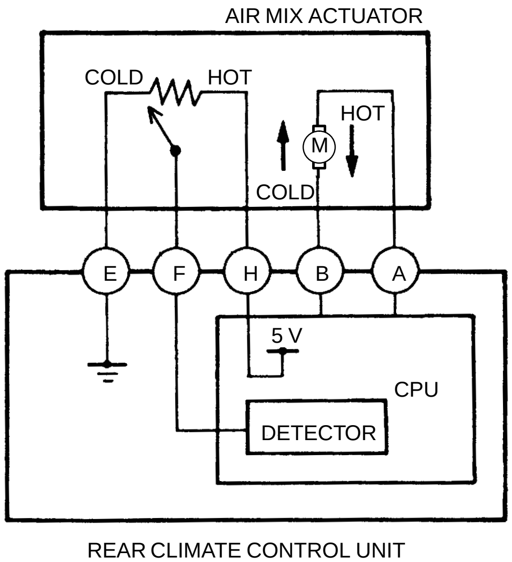
YMU740SA6

AIR MIX ACTUATOR DESCRIPTION

YMU740S07

- The air mix actuator is operated by signals from the rear climate control unit, and opens and closes the air mix doors.
- The air mix actuator is equipped with a potentiometer that is linked to the motor.

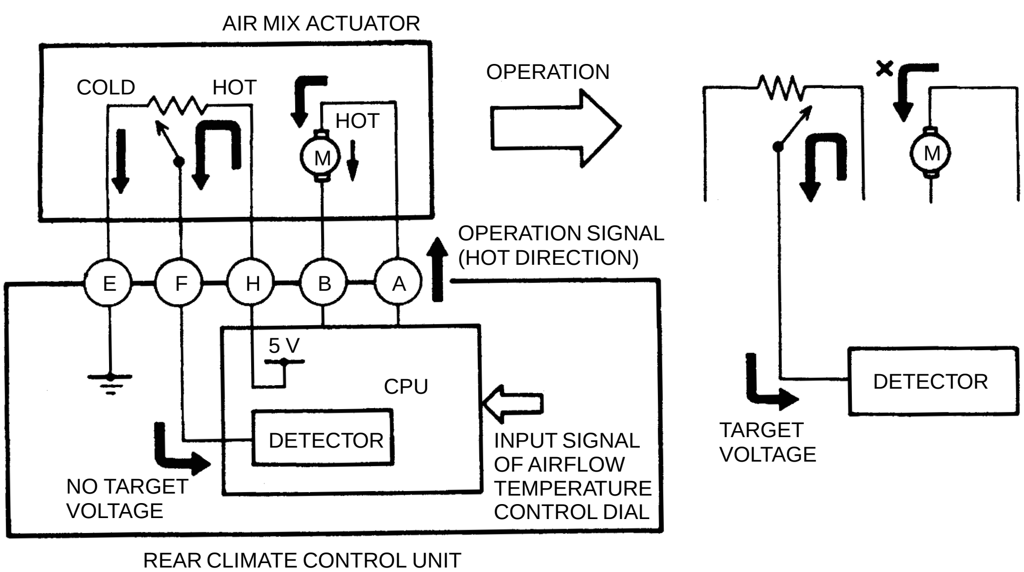
System Wiring Diagram



YMU740SA7

Operation

1. The CPU of the rear climate control unit decides the voltage of the target based on the input signal of the airflow temperature control dial.
2. When the voltage of the target is high compared with the detected voltage, the CPU rotates the motor of the air mix actuator in the direction of HOT. On the other hand, when the voltage is low, the CPU rotates the motor in the direction of COLD.
3. When the CPU detects the target voltage, the motor is stopped.



YMU740SA8

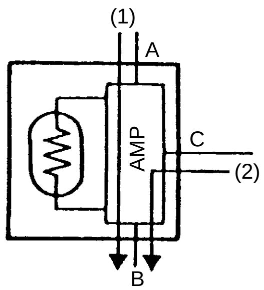
THERMOSENSOR DESCRIPTION

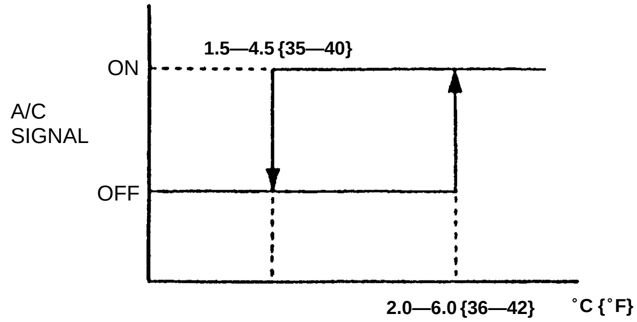
YMU740S08

- The thermosensor is installed in the cooling unit.
- If the evaporator temperature is below specification, the thermosensor cuts the A/C signal to the PCM, and the PCM stops the A/C compressor.

Operation

- Current (1) supplies power to the AMP. If the evaporator temperature is above 1.5—2.7 °C {34.7—36.8 °F}, current (2) flows, and causes the magnetic clutch to operate. This keeps the evaporator surface temperature within the specified range, and prevents the evaporator from freezing while the A/C switch is turned on.





THERMOSENSOR OPERATION

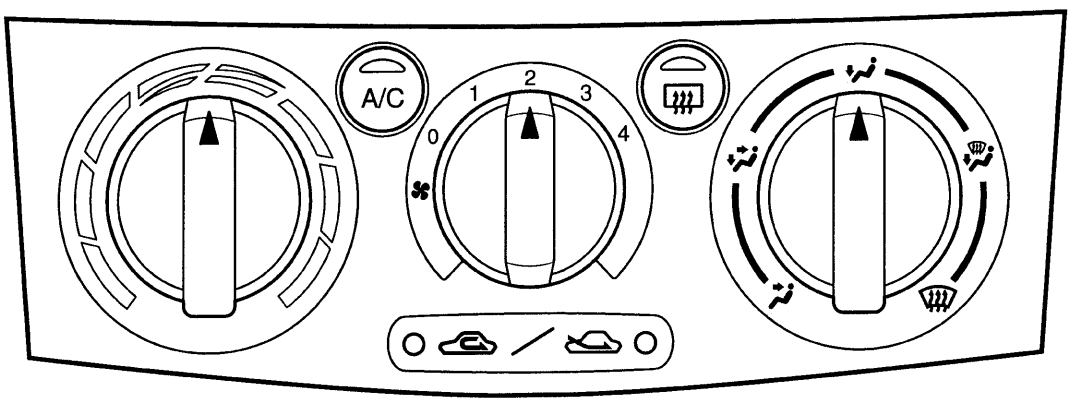
YMU740SA9

CLIMATE CONTROL UNIT DESCRIPTION

YMU740S09

Front Climate Control Unit

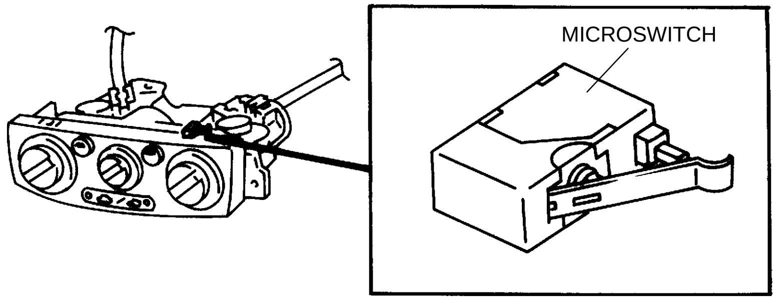
- A wire and logic type front climate control unit is used.
- The front defroster control prevents window fogging.
- The front climate control unit contains a microswitch, which controls operation of the front defroster.



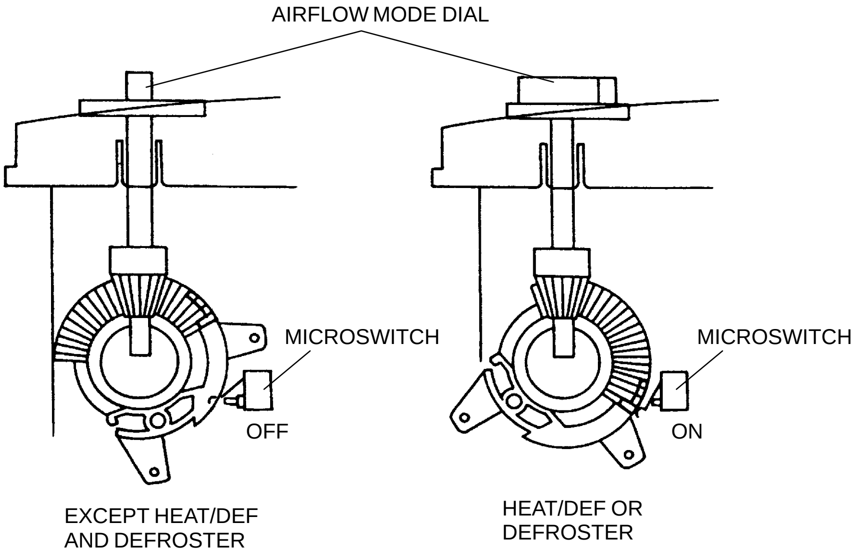
YMU740SAA

Microswitch

- When the airflow mode dial on the front climate control unit is turned to HEAT/DEF or DEFROSTER, the microswitch turns on.
- When the microswitch turns on, the front defroster control switches air intake to FRESH mode, and switches A/C to ON.



YMU740SAB



YMU740SAH

Front defroster control operation

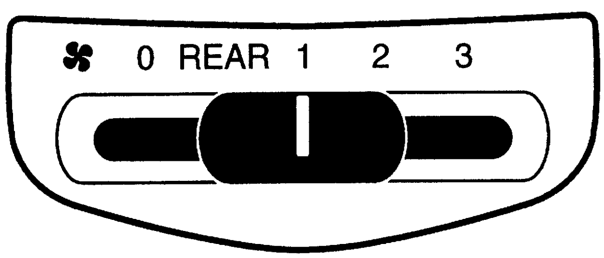
- To improve defogging when the climate control unit's airflow mode dial is turned to HEAT/DEF or DEFROSTER, the front defroster control switches air intake to FRESH mode, and switches A/C to ON.

×: Available

Airflow mode	Air intake mode (REC/FRESH switch pushed)	A/C ON/OFF (A/C switch pushed)		Front defroster control
		A/C	A/C illumination	
VENT	REC↔FRESH	OFF	OFF	N/A
		ON	ON	
BI-LEVEL	REC↔FRESH	OFF	OFF	N/A
		ON	ON	
HEAT	REC↔FRESH	OFF	OFF	N/A
		ON	ON	
HEAT/DEF	FRESH	ON	ON↔OFF	×
DEFROSTER	FRESH	ON	ON↔OFF	×

Rear Main Fan Switch

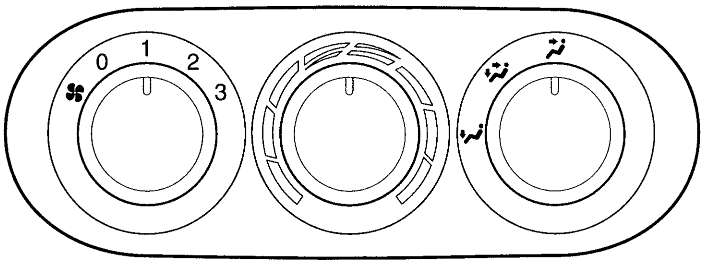
- The rear main fan switch allows the driver to control airflow of the rear A/C.
- Airflow adjustment of the rear climate control unit can be controlled by moving the rear main fan switch to REAR.



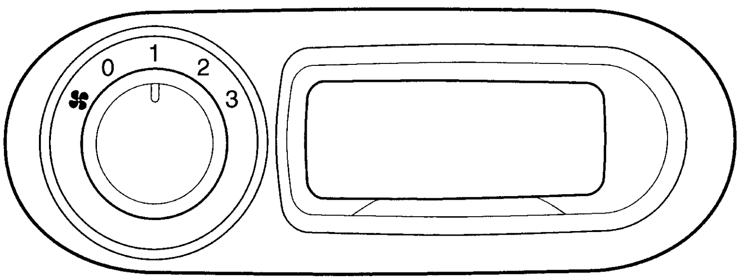
YMU740SAD

Rear Climate Control Unit
- A logic type rear climate control unit is used.
- The rear climate control unit adjusts the temperature and airflow of the rear A/C, and switches modes.
- Airflow adjustment of the rear climate control unit can be stopped by turning the rear main fan switch located on the dashboard to a position other than REAR.

WITH REAR A/C



WITH REAR HEATER OR COOLER ONLY



YMU740SAE

RESTRAINTS

08 SECTION

08–00 OUTLINE

RESTRAINTS ABBREVIATIONS

YMU800S01

ACC	Accessories
DLC	Data link connector
DTC	Diagnostic trouble code
ELR	Emergency locking retractor

IG	Ignition
OFF	Switch off
ON	Switch on
SAS	Sophisticated air bag sensor

RESTRAINTS NEW FEATURES

YMU800S02

Improved Safety
- Adopted load limiter mechanisms to front seat belt
- Added side air bag to front seat

Improved Serviceability
- Added past malfunction diagnosis of air bag system
- Additional DTCs (22, 25, 26, 32, 35, and 37) to detect air bag malfunction

08–10 AIR BAG SYSTEM

AIR BAG SYSTEM OUTLINE

YMU810S01

- A driver-side air bag module and a passenger-side air bag module are standard equipment.
- A side air bag module is equipped as an option.
- The comparison with the 1998MY MPV is indicated below.

Driver-side Air Bag Module

- The module has been changed to a rounded design.

Passenger-side Air Bag Module

- The placement of the passenger-side air bag module is changed. The module is located in the top of the dashboard.

08

Side Air Bag Module

- A side air bag module has been added.

Side Air Bag Sensor

- A side air bag sensor has been added.

Clock Spring

- The design has been changed and uses the 1999MY Protegé type.

SAS Control Module

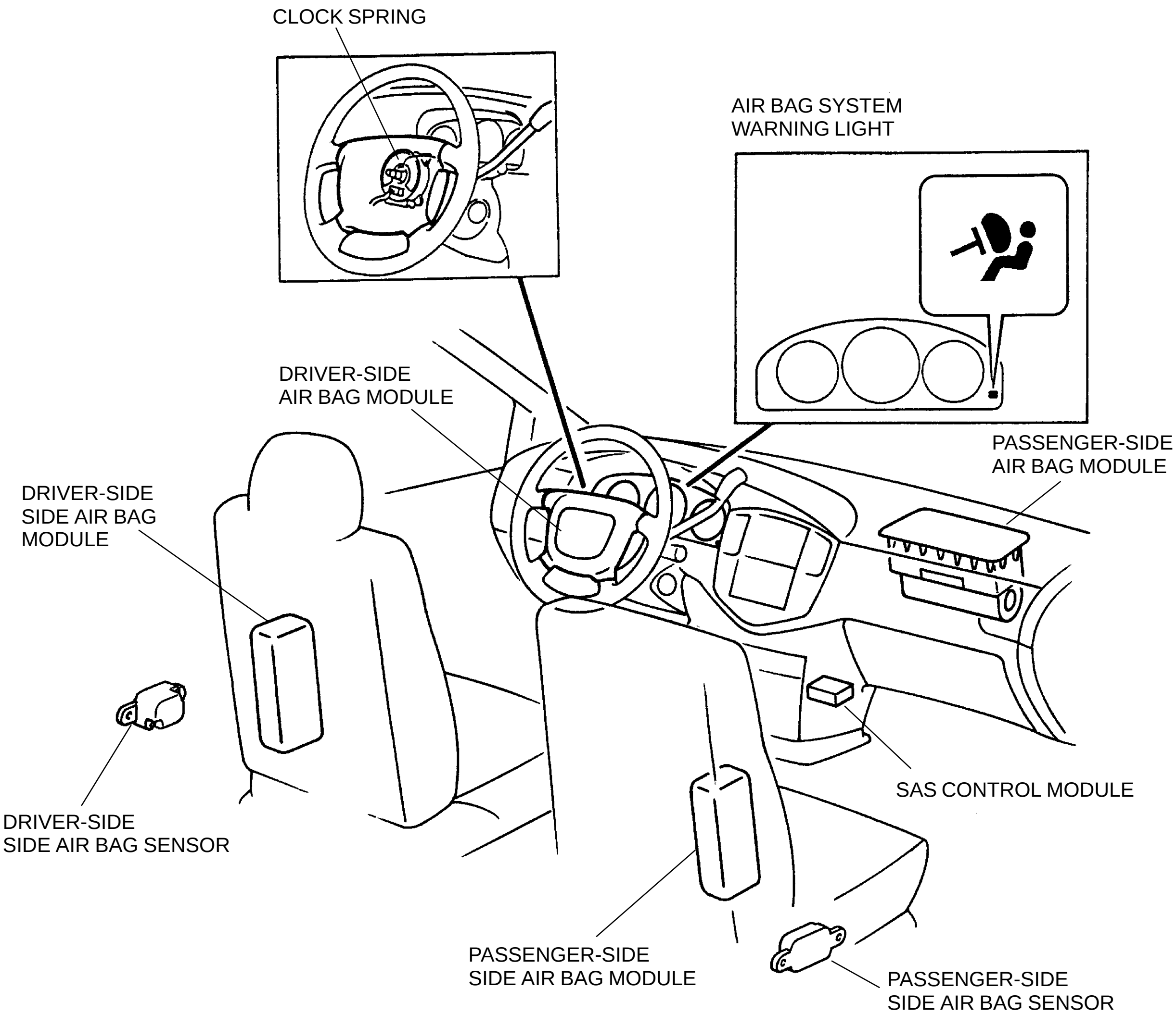
- The past malfunction diagnosis memory has been added to the on-board diagnostic function.
- The DTCs for poor connection in the SAS control module connector (DTC 1) and for malfunctions in SAS control module (DTC 2) have been added instead of illuminating continuously. They are the same as the 1999MY Protegé.
- DTCs for the side air bag system and the air bag system warning light circuit have been added.

Deployment Authorization Procedure

- The deployment authorization procedure for the SAS control module is the same as the 1999MY Protegé.
- A deployment authorization procedure for the side air bag sensor has been added.

AIR BAG SYSTEM STRUCTURAL VIEW

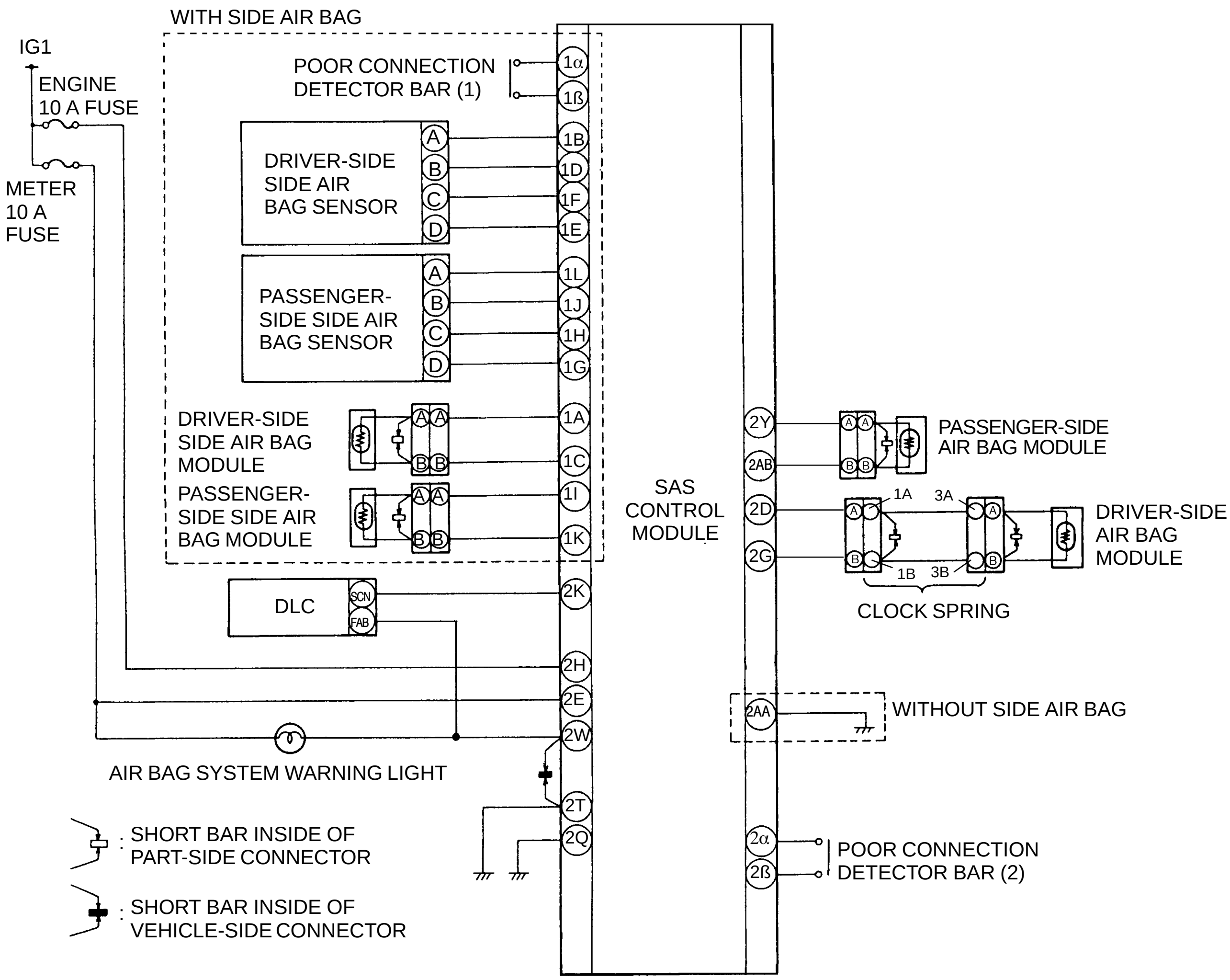
YMU810S02



YMU810SAS

AIR BAG SYSTEM WIRING DIAGRAM

YMU810S03



YMU810SA0

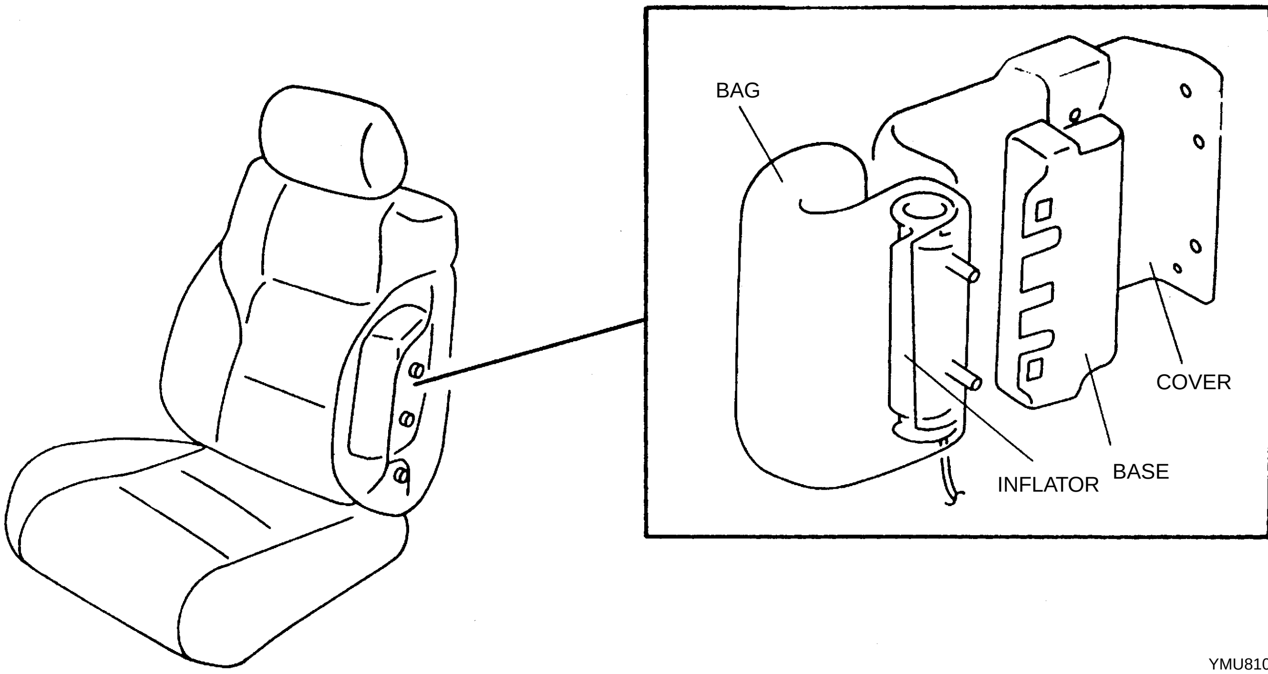
AIR BAG SYSTEM DESCRIPTION

YMU810S04

Side Air Bag Module

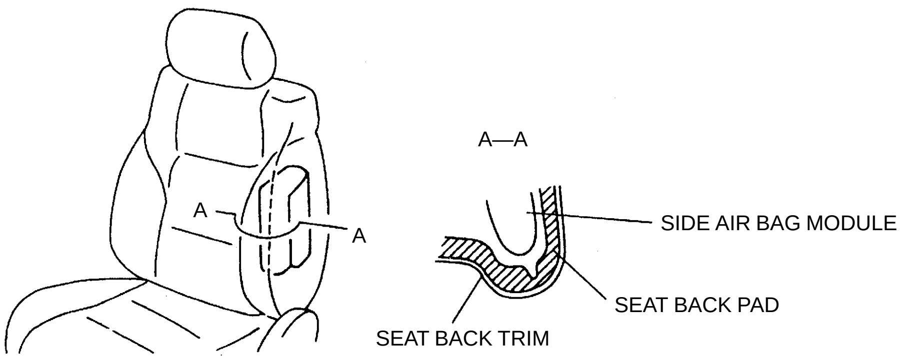
Structure

- The side air bag module is composed of the following parts.



YMU810SA1

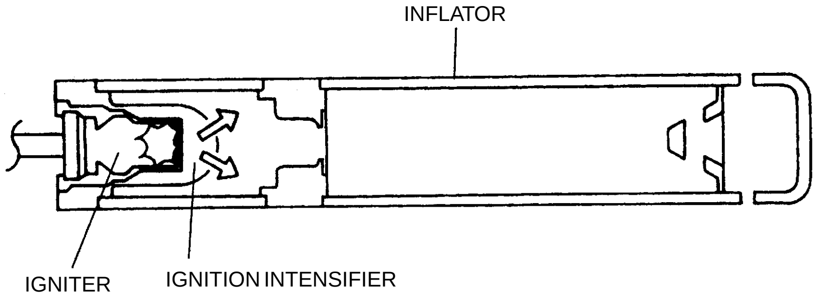
- The bag comes out from the seat back pad. The outside seat back trim separates during inflation.



YMU810SA2

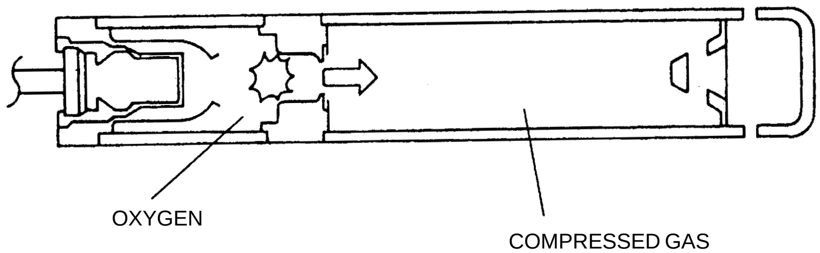
Activation

1. The igniter is activated by electrical current from the SAS control module. This activation heats the ignition intensifier.



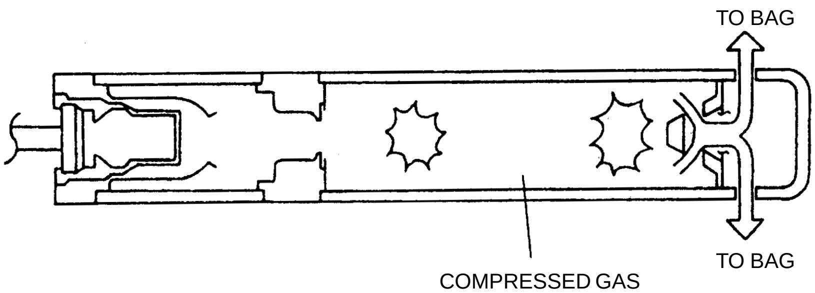
YMU810SA3

2. The ignition intensifier burns due to the surrounding oxygen, and breaks the compressed gas chamber wall igniting the compressed gas.



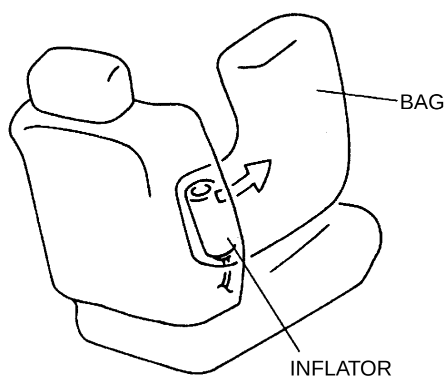
YMU810SA4

3. The compressed gas raises chamber pressure forcing the gas through the outlet.



YMU810SA5

4. In the outlet chamber, the bag swells from being instantaneously injected with gas and deploys, absorbing the collision impact from the driver or passenger.



YMU810SA6

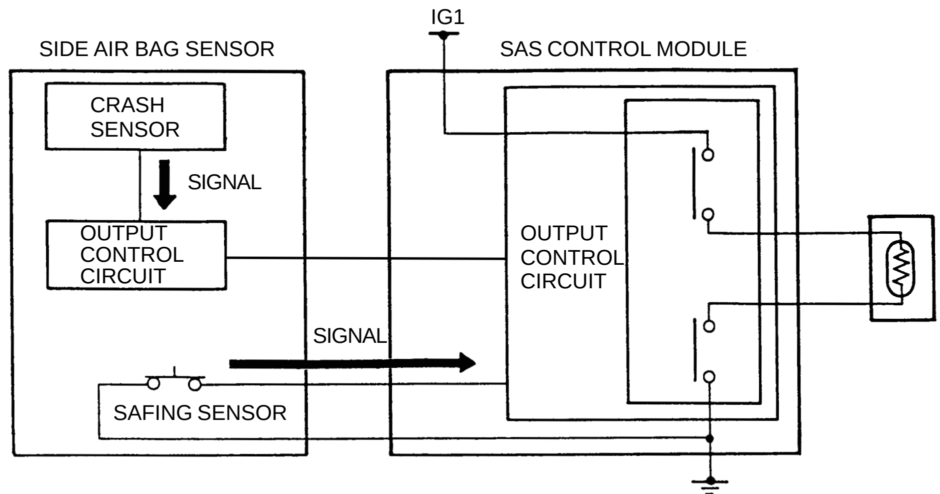
Operation

1. When the vehicle is involved in a lateral (side) collision, the impact is detected by the side air bag sensor. Each side air bag sensor contains:
   - Safing sensor
   - Crash sensor
   - Output control circuit

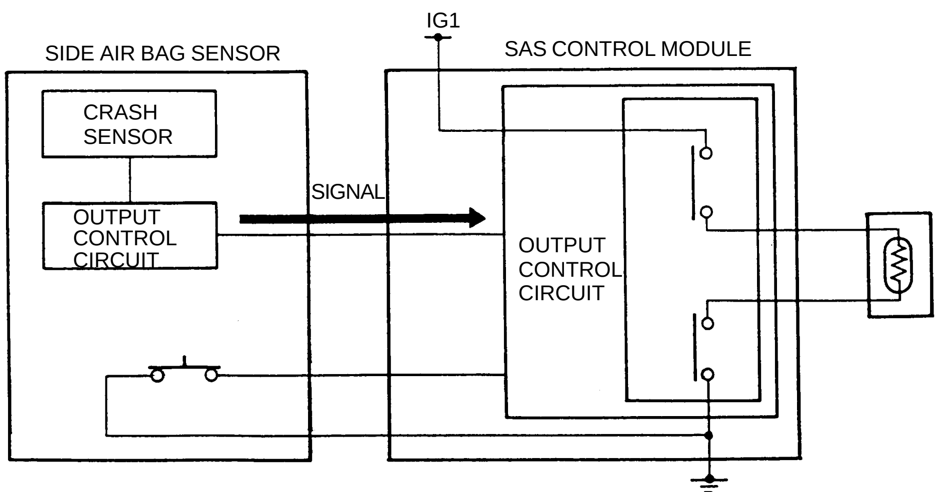
Safing sensor ―――――― This sensor activates during impact and sends an air bag operation (deployment) signal to the SAS control module's output control circuit.

Crash sensor ―――――― This sensor calculates the force of the impact and sends a corresponding electrical signal to the side air bag sensor's output control circuit.

Output control circuit ―― This circuit receives the electrical signal from the crash sensor and compares the signal to a preset value. When the electrical signal exceeds the preset value, the side air bag sensor sends an air bag operation (deployment) signal to the SAS control module's output control circuit.

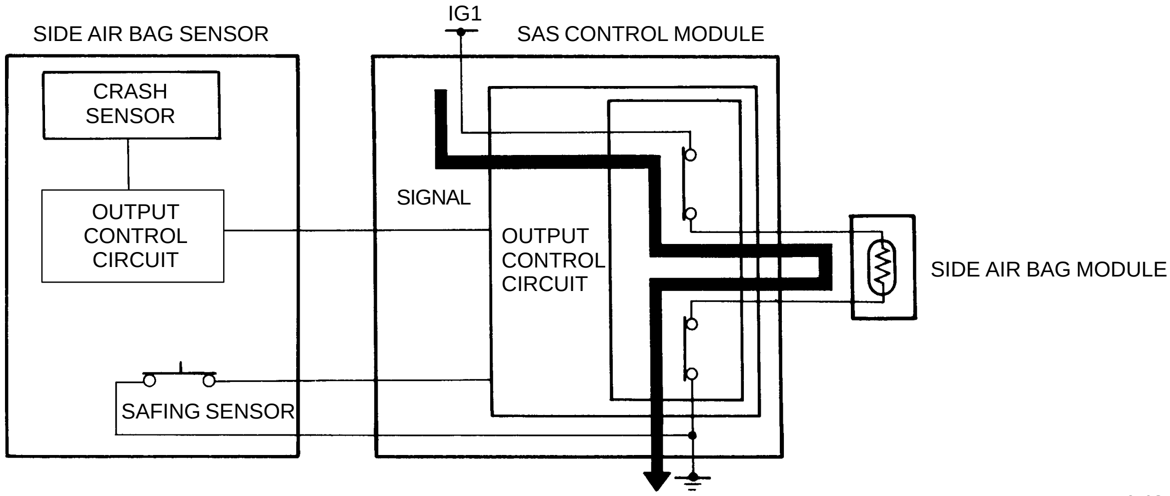


YMU810SA7



YMU810SA8

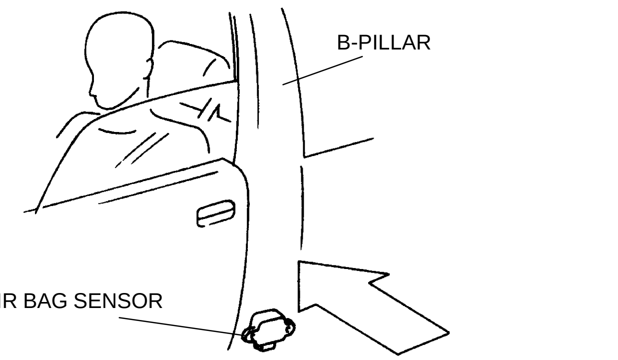
2. When the SAS control module's output control circuit receives two (2) signals (one from the safing sensor and one from the side air bag sensor's output control circuit), the air bag ignition circuit is completed and the side air bag is deployed.



YMU810SA9

Side Air Bag Sensor

- The side air bag sensor is built into the B-pillar and senses a lateral collision.



YMU810SAA

SAS Control Module, Side Air Bag Sensor
Outline

Inside the SAS control module and side air bag sensor is the on-board diagnostic system. This system has the following two functions:

- Memory function
  - The SAS control module and the side air bag sensor store the DTCs of detected malfunctions in their memories.
  - The stored DTCs will not be erased even if the negative battery cable is disconnected.
- Self diagnosis function
  - The self diagnosis function consists of present malfunction diagnosis and past malfunction diagnosis. Because a past malfunction is memorized, the function can diagnose a malfunction that occurred in the past, as well as a malfunction occurring at the time.

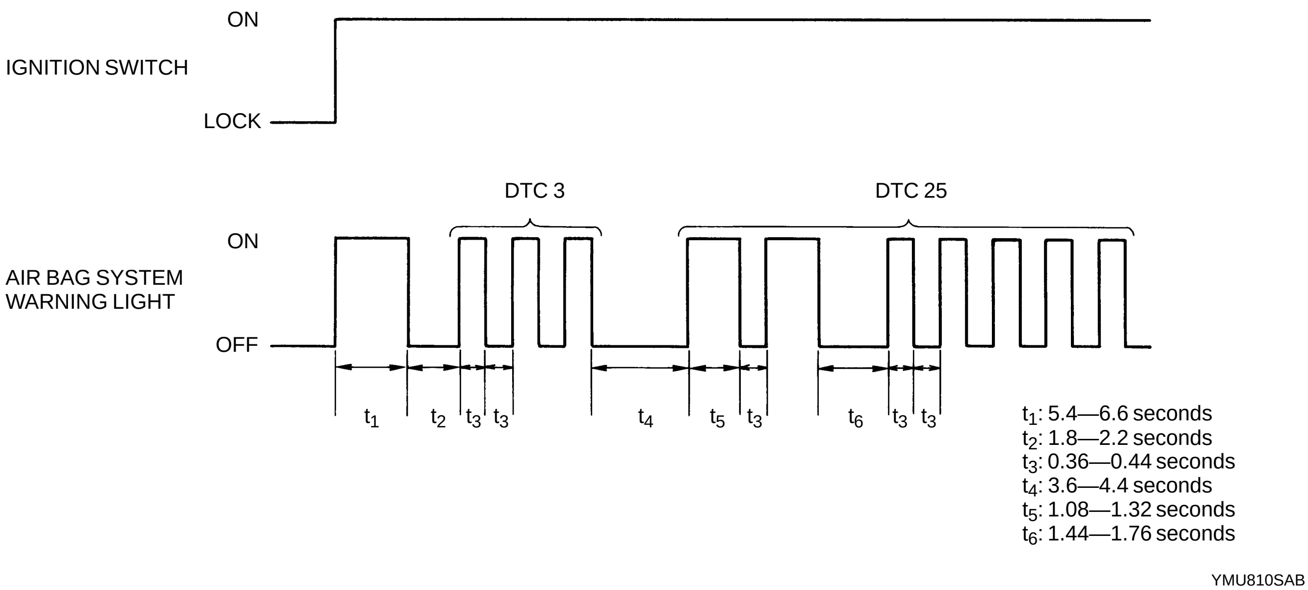
Present malfunction diagnosis

- When a malfunction that is not intermittent occurs, a DTC is stored in the SAS control module present memory. Multiple malfunction DTCs are stored numerically.
- When a DTC is repaired, it is stored as a "past" malfunction.
- If the malfunction is intermittent, a DTC may also be stored as a past malfunction.

Past malfunction diagnosis

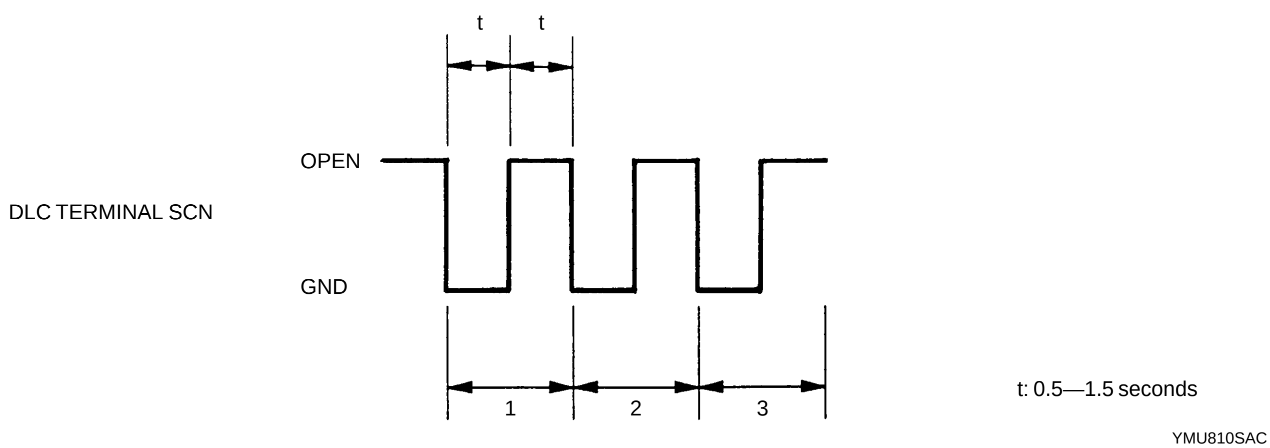
- By shorting the DLC terminal SCN to body GND using a jumper wire and turning the ignition switch to the ON position, you can display DTCs of past malfunctions stored in the memory function. (A present malfunction DTC can be displayed by only turning the ignition switch to the ON position.)
- As with present malfunction diagnosis, when multiple malfunctions have been stored, the DTCs are displayed in numerical order.
- Once a past malfunction is stored, the DTCs can not be erased by any means.

Output pattern



Past malfunction code display cancellation operation procedure

1. Turn the ignition switch to the ON position.
2. Wait until the air bag system warning light illuminates for **approximately 6 seconds** and goes off.
3. Perform the following both steps alternately **three times** each at **0.5—1.5 seconds** intervals.
   (1) Use a jumper wire to short the DLC terminal SCN to body GND.
   (2) Disconnect the jumper wire from body GND.



Malfunction diagnosis procedure

Note

- While performing the inspection for past malfunction codes, the new DTCs may be added to memory by removing or disconnecting the related parts. Inspect only the DTCs that were indicated before inspecting.
- When DTCs stored in present malfunction are no longer output after present and/or past malfunctions have been repaired, be sure to perform past malfunction display cancellation to prevent repeat repair attempts.

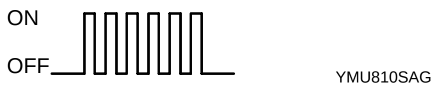
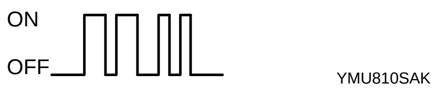
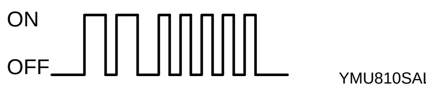
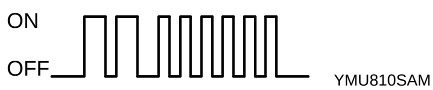
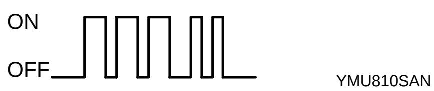
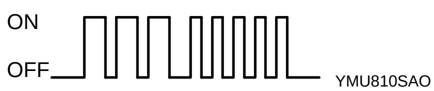
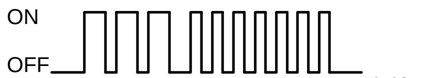
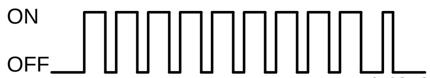
DTC table

- DTCs shown below can be both present and past malfunction diagnosis.
- DTC 0 has been changed to DTC 2 because the SAS control module has changed.

Note

- When DTCs not shown in the DTC table are displayed, replace the SAS control module.
- When installing a new SAS control module, the air bag system warning light continuously flashes after the ignition switch is turned to the ON position. This is the deployment authorization standby code output by the SAS control module. Perform the deployment authorization and restore the system to an operational state. (Refer to MPV Workshop Manual 1647–10–99C.)
- If the air bag system warning light does not illuminate or remains illuminated when the ignition switch is turned to the ON position, inspect and repair the air bag system warning light circuitry and then confirm that the air bag system warning light is operational.

×: Available

DTC	2000MY	1998MY	Output pattern	Malfunction location
0		×	Remains on	SAS control module
1	×		 YMU810SAD	SAS control module connector poor connection
2	×		 YMU810SAE	SAS control module
3	×	×	 YMU810SAF	Power supply of SAS control module
6	×	×	 YMU810SAG	Driver-side air bag module system
7	×	×	 YMU810SAH	Passenger-side air bag module system
22	×		 YMU810SAK	Driver-side side air bag sensor system (Internal circuit abnormal)
25	×		 YMU810SAL	Driver-side side air bag sensor system (Low voltage of power supply)
26	×		 YMU810SAM	Driver-side side air bag module system
32	×		 YMU810SAN	Passenger-side side air bag sensor system (Internal circuit abnormal)
35	×		 YMU810SAO	Passenger-side side air bag sensor system (Low voltage of power supply)
37	×		 YMU810SAP	Passenger-side side air bag module system
91	×		 YMU810SAQ	Air bag system warning light system
—	×		Continuously flashes	Deployment authorization standby code

Deployment authorization procedure
After replacing side air bag sensor

Note

- When replacing both the SAS control module and side air bag sensor together, if deployment authorization is performed for the SAS control module, the side air bag sensor will also be made operational at the same time.

1. Turn the ignition switch to ON position.
2. Verify that the air bag system warning light illuminates for **approximately 6 seconds** then goes off.
3. If it does not operate properly, perform the deployment authorization procedure again.

08–11 SEAT BELT

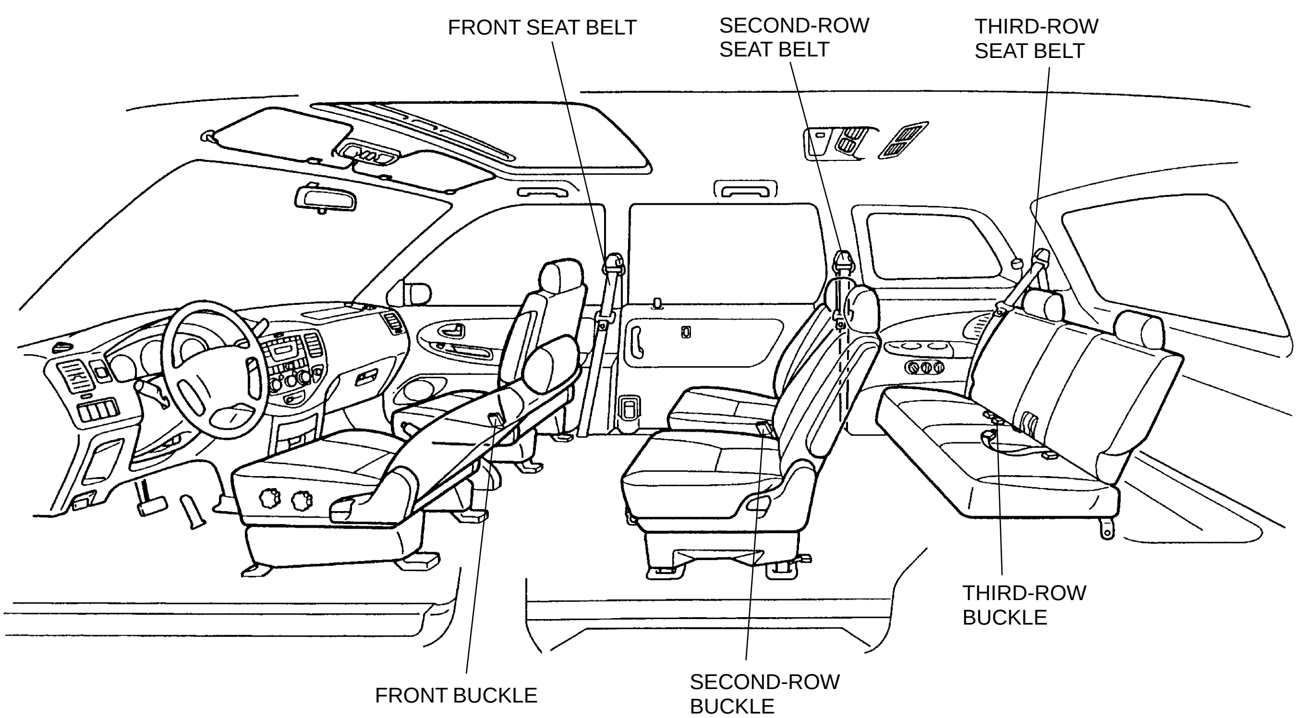
SEAT BELT OUTLINE

YMU811S01

- The seat belt warning system (light and buzzer) reminds the driver to use the seat belt. The operation is the same as the 1999MY Protegé.
- The front seat belts incorporate load limiter mechanism that reduces the force of the belt against the occupants when the belts lock and the force applied to belt exceeds a preset level.

SEAT BELT STRUCTURAL VIEW

YMU811S02



LOAD LIMITER RETRACTOR DESCRIPTION

YMU811S03

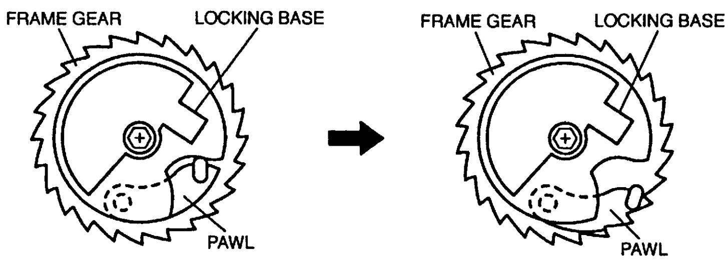
Warning

- **When the load limiter operates, the belt and anchor rub against each other strongly leaving a trace of wear. If the seat belt is used in this state, the seat belt will not function to its designed effect and there is the possibility of serious injury to passengers. Be sure to replace the seat belt once the load limiter operates.**

Operation

1. ELR (Emergency Locking Retractor) locks

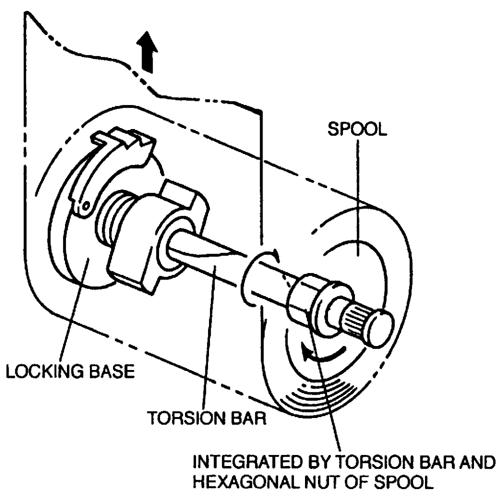
- When the belt is extracted, the ELR lock mechanism is activated, and the pawl engages the frame gear. This locks the locking base as well as the torsion bar and spool integrated to the locking base.



YMU811SA1

2. Torsion bar twists

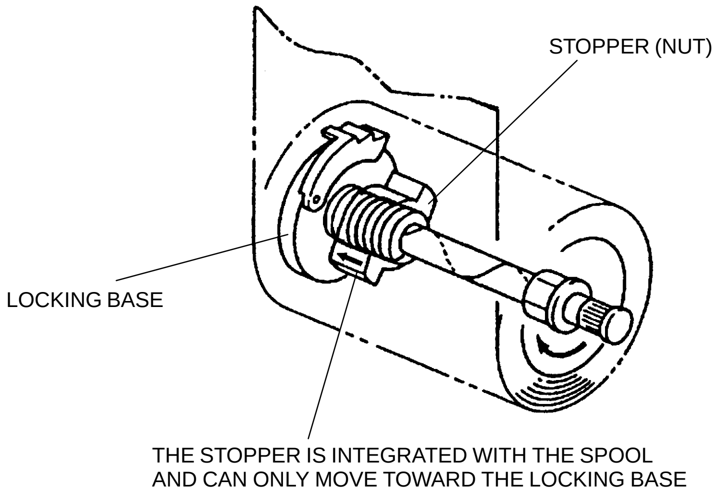
- When the locking base is locked and a load large enough to cause an injury to the chest is applied against the seat belt, the torsion bar twists, the spool rotates, and the belt is extracted.



YMU811SA2

3. Stopper (nut) rotates and moves

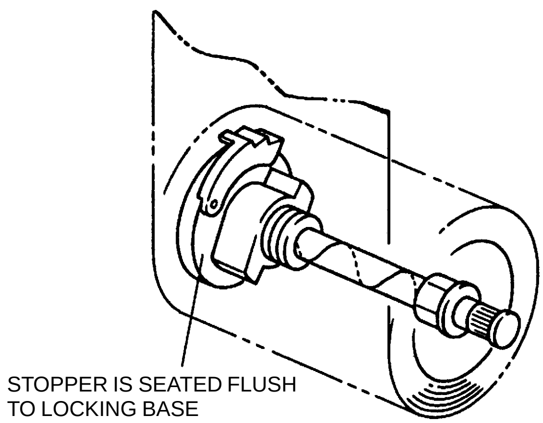
- The stopper on the thread of the locking base moves toward the locking base as it rotates with the spool.



YMU811SA3

4. Stopper (nut) is seated flush to locking base

- The stopper stops rotating when it is seated flush to the locking base, the spool also stops rotating, and belt extraction is stopped.



YMU811SA4

BODY & ACCESSORIES

09
SECTION

09–00 OUTLINE

09

BODY & ACCESSORIES ABBREVIATIONS

YMU900S01

ABS HU/CM	ABS hydraulic unit and control module
ACC	Accessories
ATX	Automatic transaxle
DRL	Daytime running light
DTC	Diagnostic trouble code
HI	High
IG	Ignition
INT	Intermittent
LCD	Liquid crystal display
LED	Light emitting diode
LO	Low
M	Motor
NVH	Noise, vibration, and harshness
OFF	Switch off
ON	Switch on
PCM	Powertrain control module
SAS	Sophisticated air bag sensor
SST	Special service tool
SW	Switch
TNS	Tail number side lights

BODY & ACCESSORIES NEW FEATURES

YMU900S02

Improved Safety
- Adopted triple H structure on body shell

Improved Security
- Adopted theft-deterrent function of keyless entry security system
- Added immobilizer system

Improved Serviceability
- Added instrument cluster input/output check mode

09–10 BODY PANELS

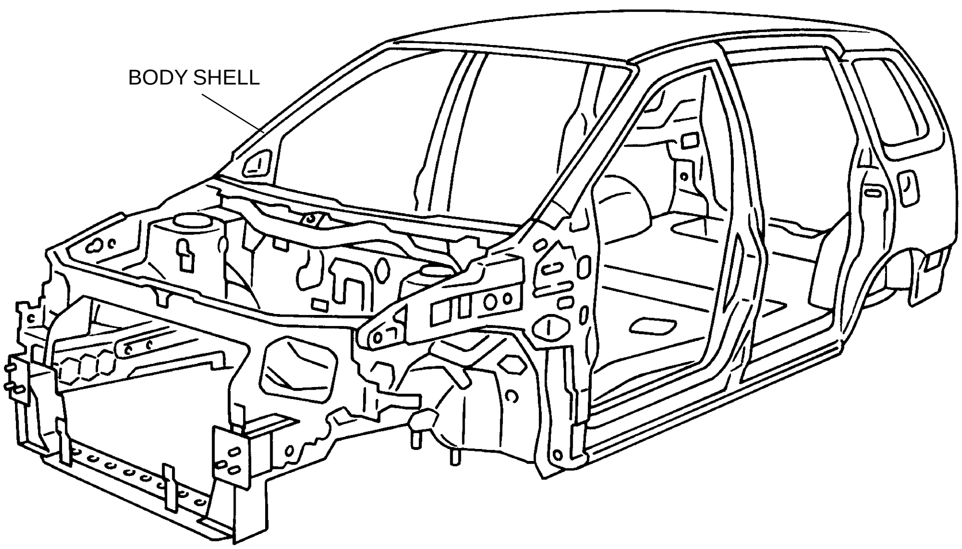
BODY PANEL OUTLINE

YMU910S01

- The floor of the vehicle is made flat to provide a more comfortable ride and to allow for multiple seating arrangements.
- To increase collision protection:
  - The frame is sectional (front, center and rear) to distribute the impact.
  - Several crossmembers and torque boxes have been arranged laterally.
  - Construction has been designed to efficiently absorb and disperse impact forces.
- Approximately half of the parts in the body shell are made of high-tensile steel for a lighter yet stronger body.
- The front overhang has been reduced to improve vehicle maneuverability.

BODY SHELL STRUCTURAL VIEW

YMU910S02



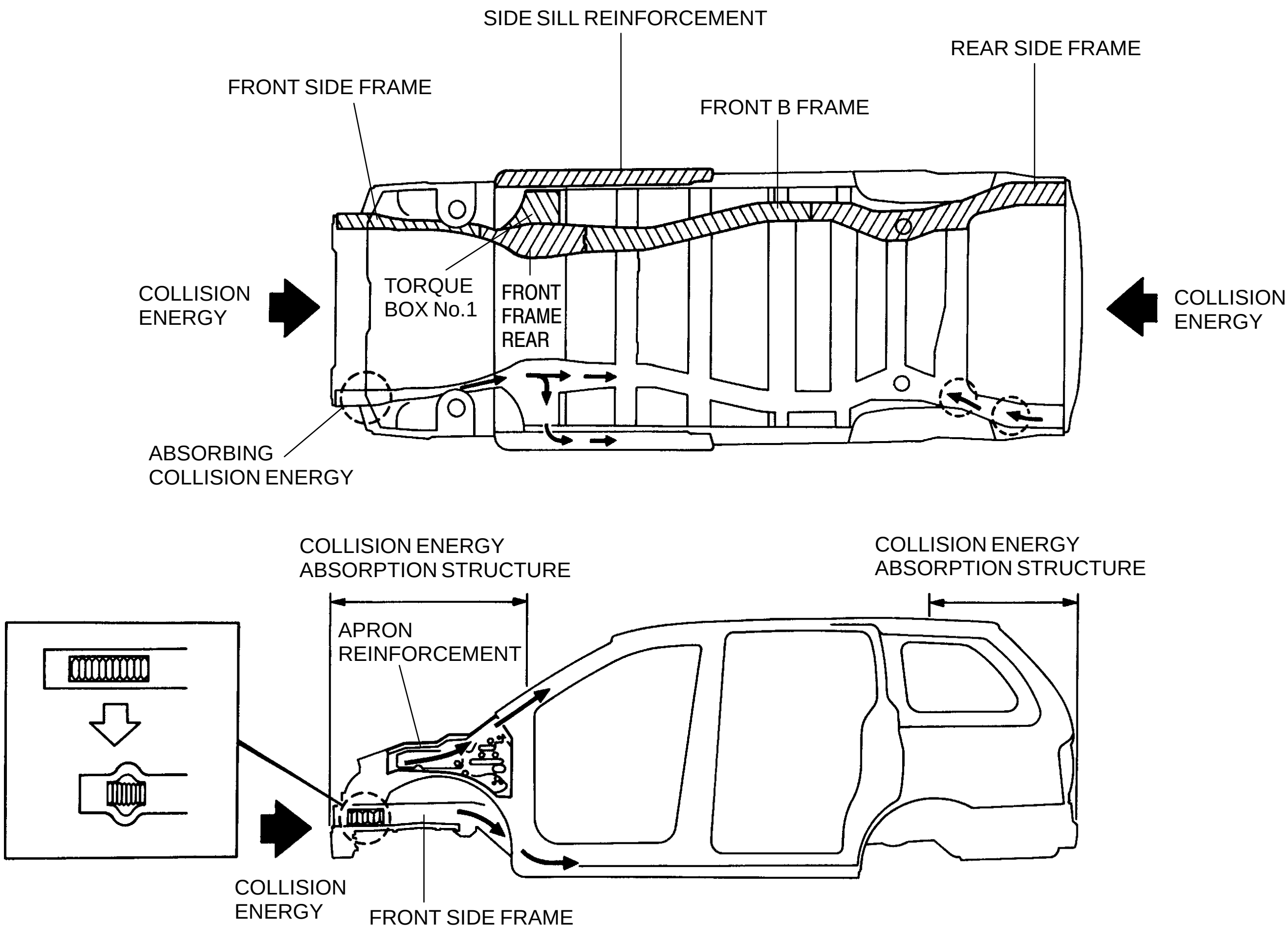
YMU910SA0

BODY SHELL DESCRIPTION

YMU910S03

Crushable Zone

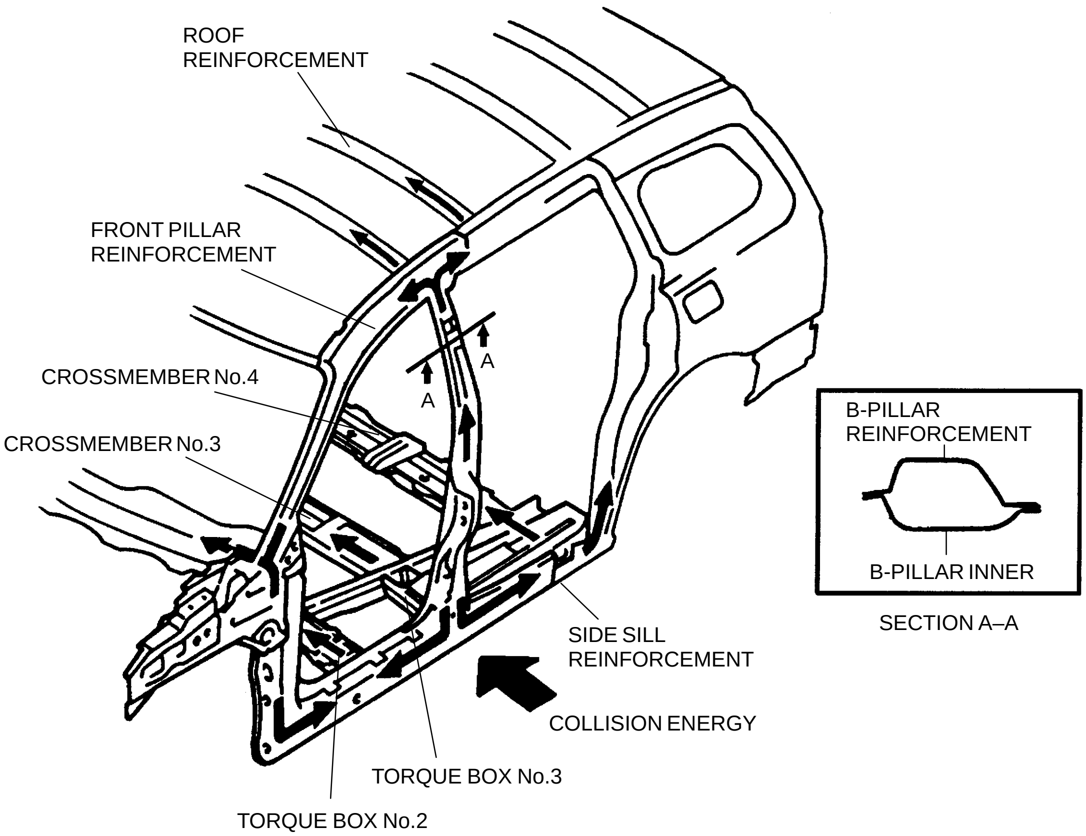
- To reduce cabin damage, the front and rear of the frame are designed to deform when incurring shock, and effectively absorb/disperse energy from a collision.



YMU910SA1

Cabin

- To protect passengers in collisions from various directions, the passenger cabin is constructed as follows:
  - The B-pillar inner and B-pillar reinforcement are thicker.
  - The pillar configuration is designed to prevent pillar intrusions into the cabin during a collision. A thicker pillar has increased its strength.



YMU910SA2

SPARE TIRE CARRIER OUTLINE

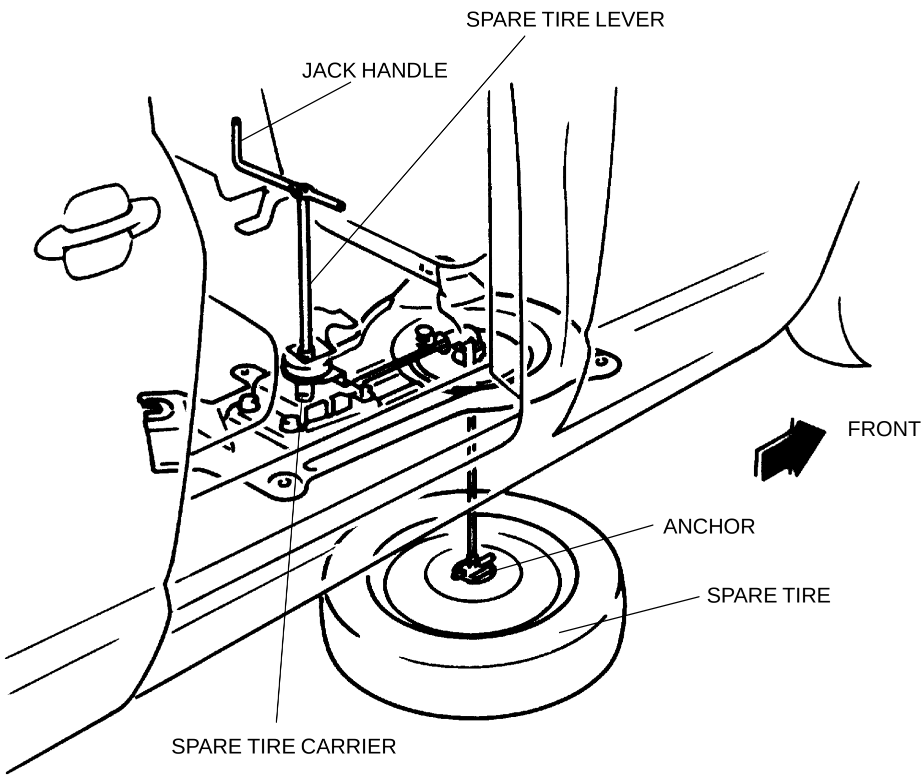
YMU910S04

- The spare tire carrier is designed to secure the spare tire under the vehicle until it is needed.
- The spare tire carrier prevents the tire from hitting the ground, and the anchor from hitting the fuel tank or exhaust pipes.
- The carrier design incorporates safe guards which prevent the spare tire lever from being removed when:
  - The spare tire is installed on the carrier up-side down.
  - A tire other than the spare tire is installed on the carrier.
  - The spare tire carrier anchor is not completely raised.
- If the spare tire carrier's cable breaks, the carrier's hook is designed to lock the anchor and prevent the spare tire from falling.

09

SPARE TIRE CARRIER STRUCTURAL VIEW

YMU910S05



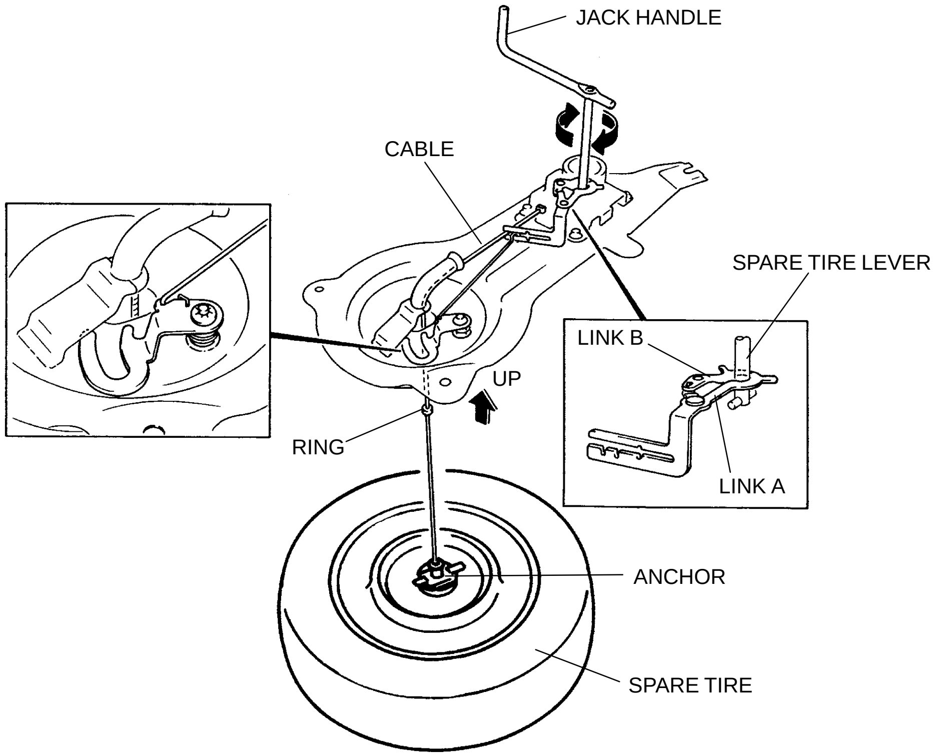
YMU910SA3

SPARE TIRE CARRIER DESCRIPTION

YMU910S06

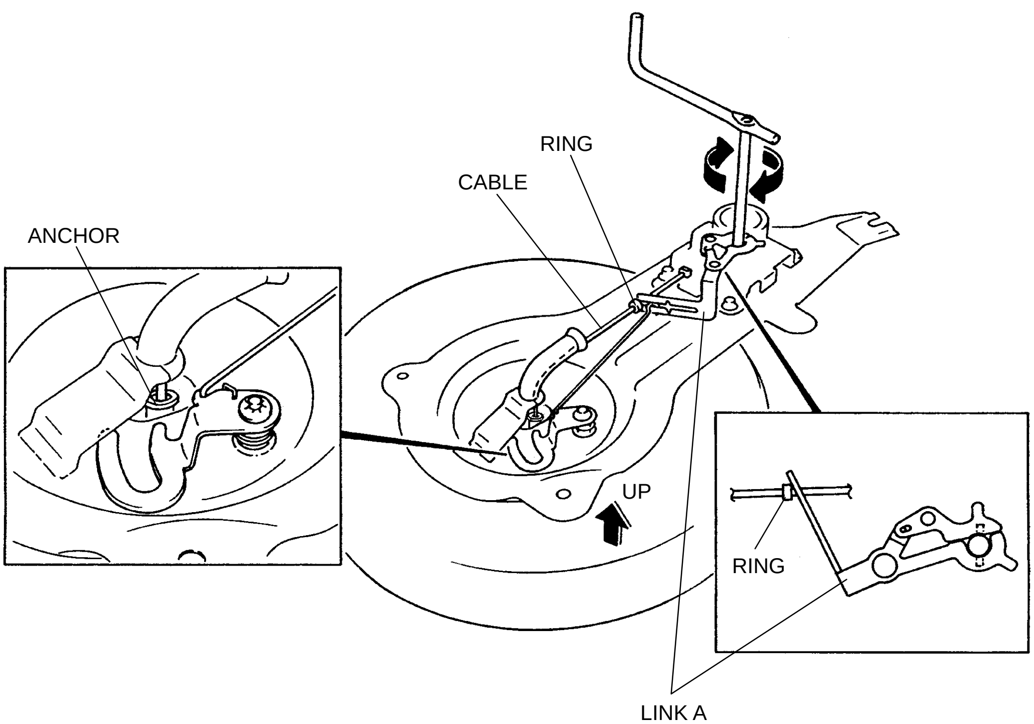
Operation

1. When the jack handle is rotated, the cable is wound clockwise and the spare tire is raised. Until the anchor is completely seated, the spare tire lever is held between links A and B and cannot be removed.



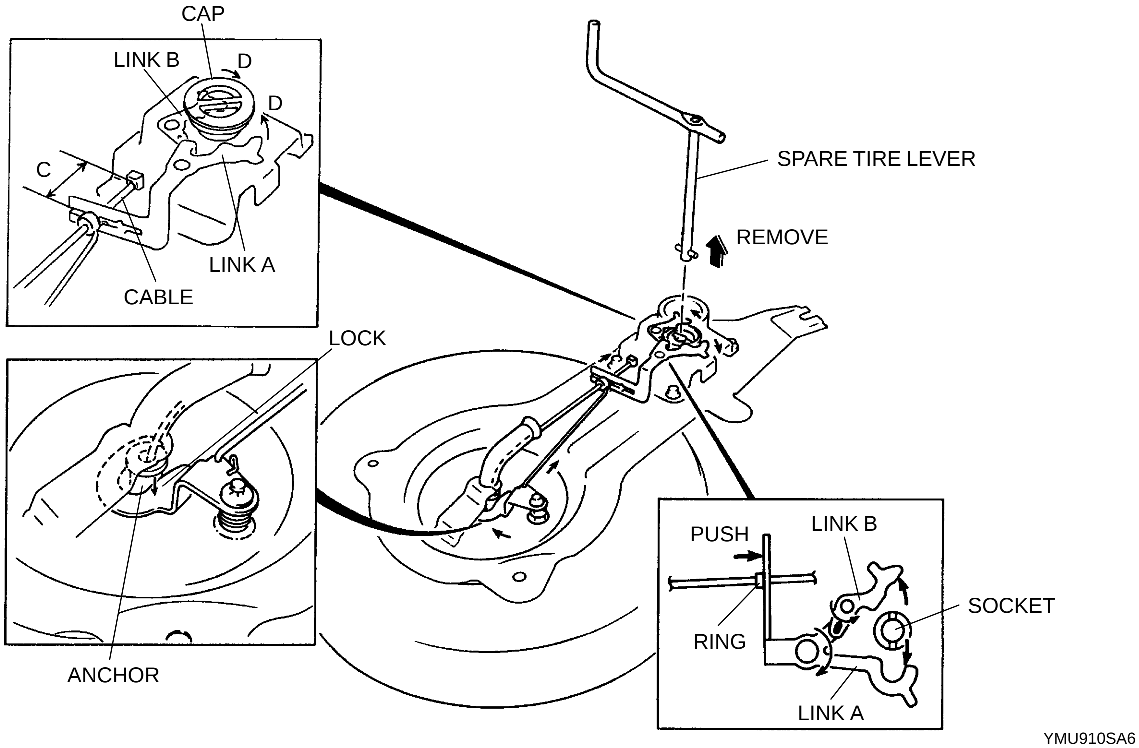
YMU910SA4

2. When the cable is wound until just before the tire is secured, the ring attached to the cable contacts link A.



YMU910SA5

3. The spare tire lever can be removed when the anchor is completely seated, and links A and B are connected and pushed outward, locking the anchor and tire in place. If the cable should break in the section marked C, the cap prevents links A and B from moving in the directions marked D.



09–11 DOORS AND LIFTGATE

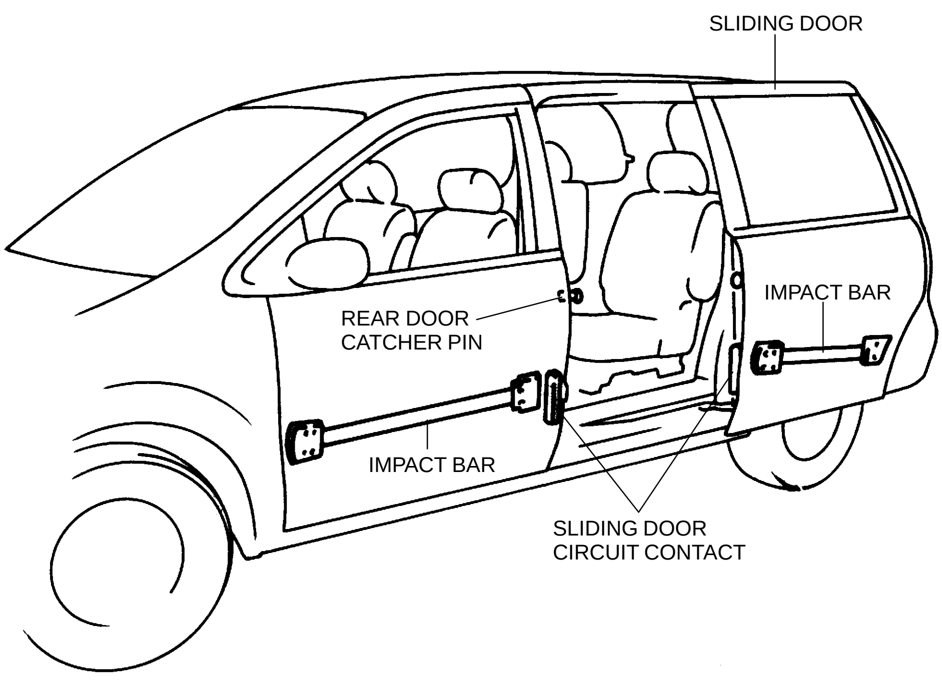
DOORS AND LIFTGATE OUTLINE

YMU911S01

- The rear door is a sliding design with three rails.
- Sliding door circuit contacts are installed on the sliding door and the body for supply power (the power window system and the power door lock system) to the sliding door.
- An impact bar and a rear door catcher pin are used in the sliding door to improve passenger safety in the event of a side collision.
- To prevent the sliding door from hitting the fuel-filler lid, the sliding door cannot be opened when the fuel-filler lid is open.

DOORS AND LIFTGATE STRUCTURAL VIEW

YMU911S02

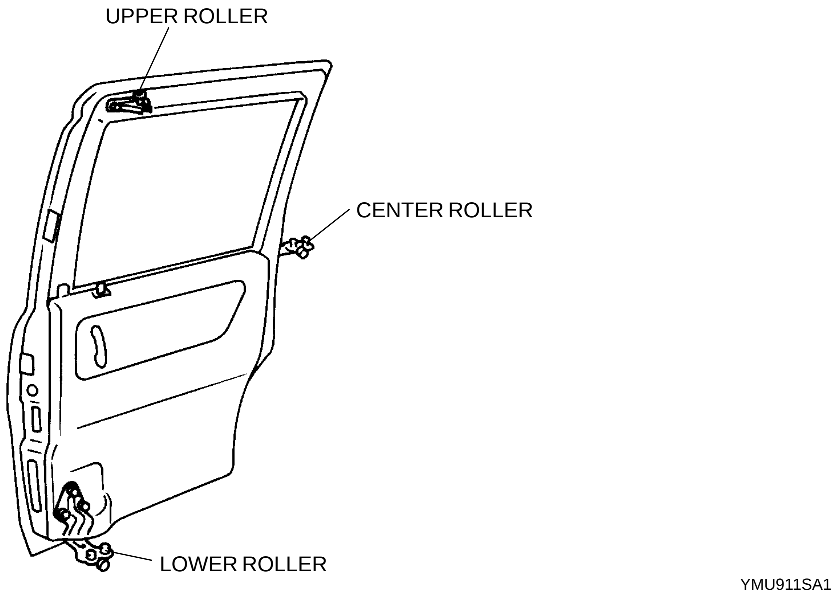


YMU911SA0

SLIDING DOOR DESCRIPTION

YMU911S03

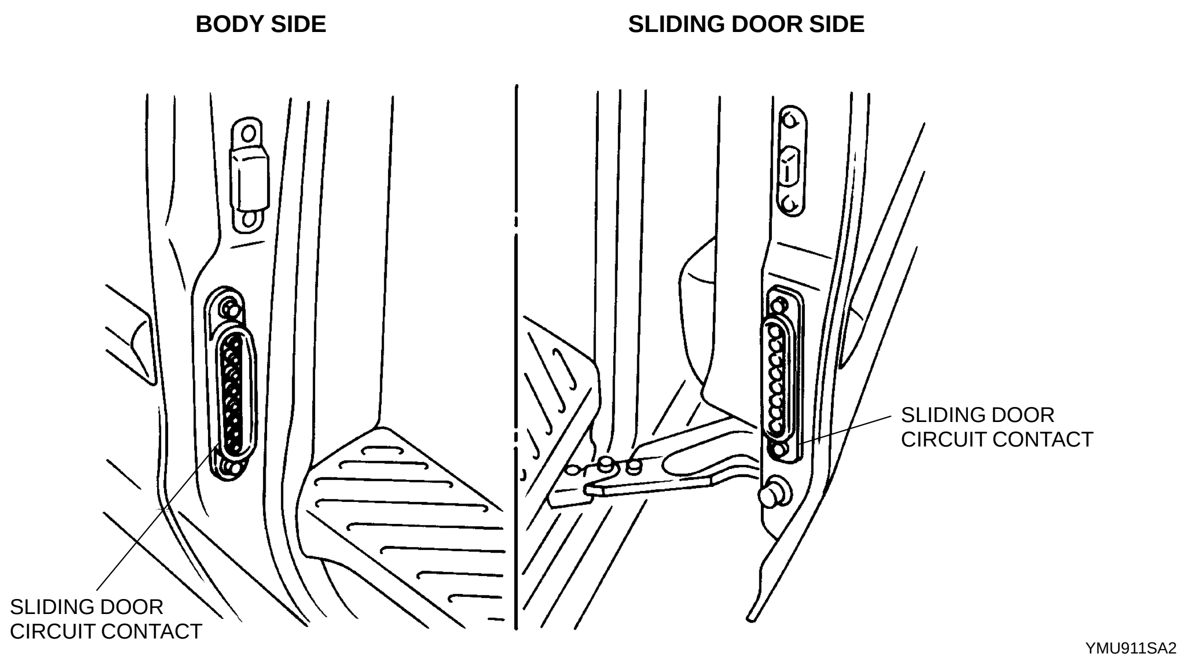
- The sliding door is equipped with three rollers for a more stable sliding action.



SLIDING DOOR CIRCUIT CONTACT DESCRIPTION

YMU911S04

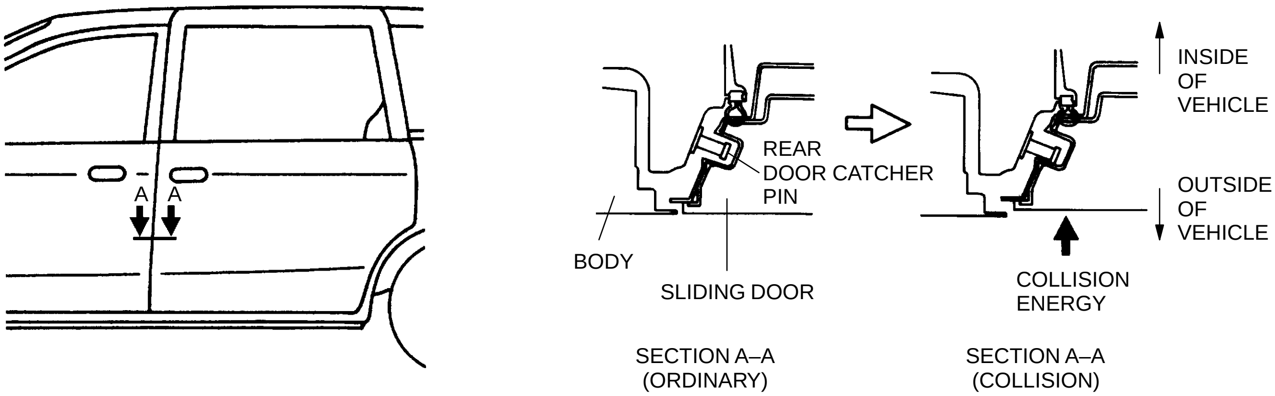
- When the sliding door is closed, the sliding door circuit contacts on the body and the sliding door are connected and the power for the power window system and the power door lock system is supplied to the sliding door.



REAR DOOR CATCHER PIN DESCRIPTION

YMU911S05

- The rear door catcher pin is designed to prevent the door from collapsing inward during a collision.

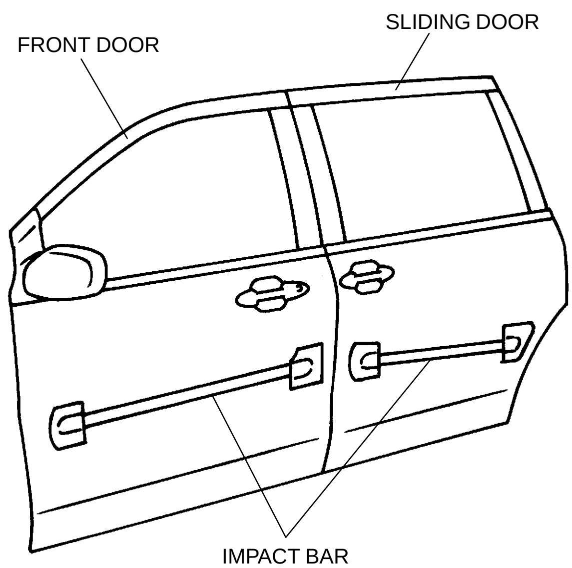


YMU911SA3

IMPACT BAR DESCRIPTION

YMU911S06

- The impact bar improves door rigidity, thereby preventing the door from deforming and intruding into the passenger compartment in a collision.



YMU911SA4

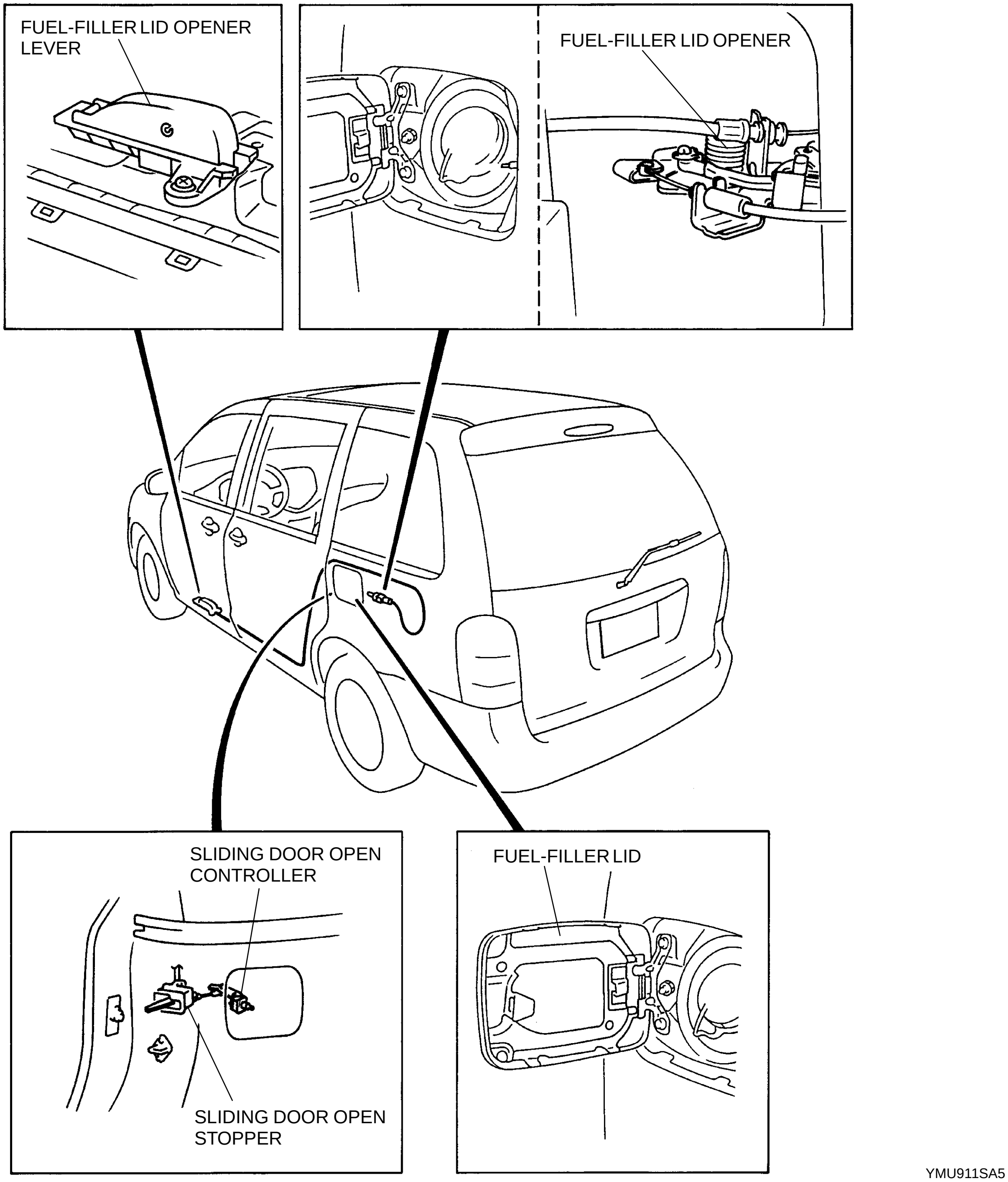
FUEL-FILLER LID/SLIDING DOOR CANCEL SYSTEM OUTLINE

YMU911S07

- The fuel-filler lid system has the following functions:
  - Prevents the fuel-filler lid from being opened while the driver-side sliding door is open (even when the fuel-filler lid opener is operated).
  - Prevents the sliding from hitting the fuel-filler lid. The driver-side sliding door will not open when the fuel-filler lid is open.

FUEL-FILLER LID/SLIDING DOOR CANCEL SYSTEM STRUCTURAL VIEW

YMU911S08

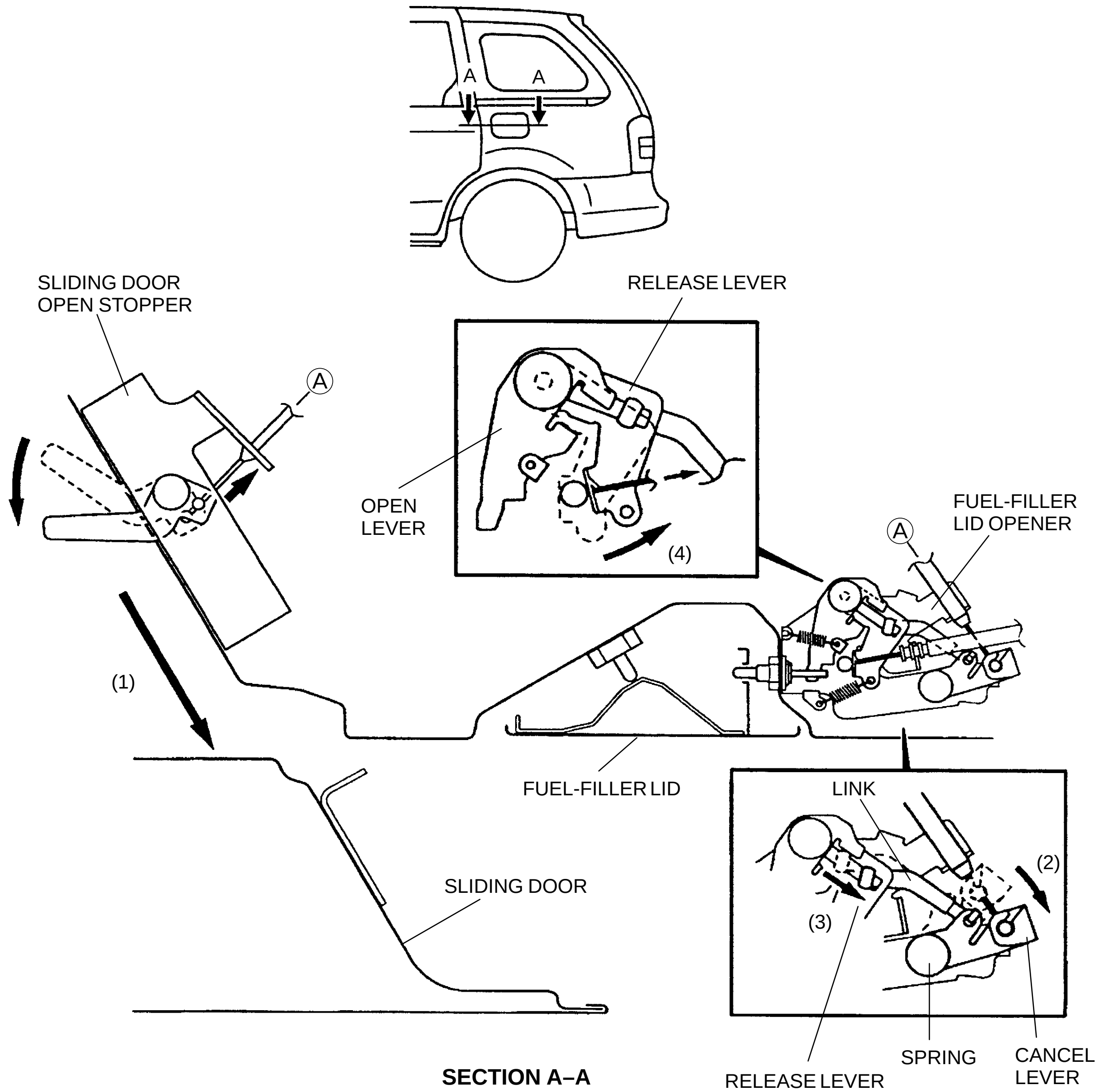


FUEL-FILLER LID OPEN CANCEL FUNCTION DESCRIPTION

YMU911S09

Fuel-filler Lid Cancel Operation

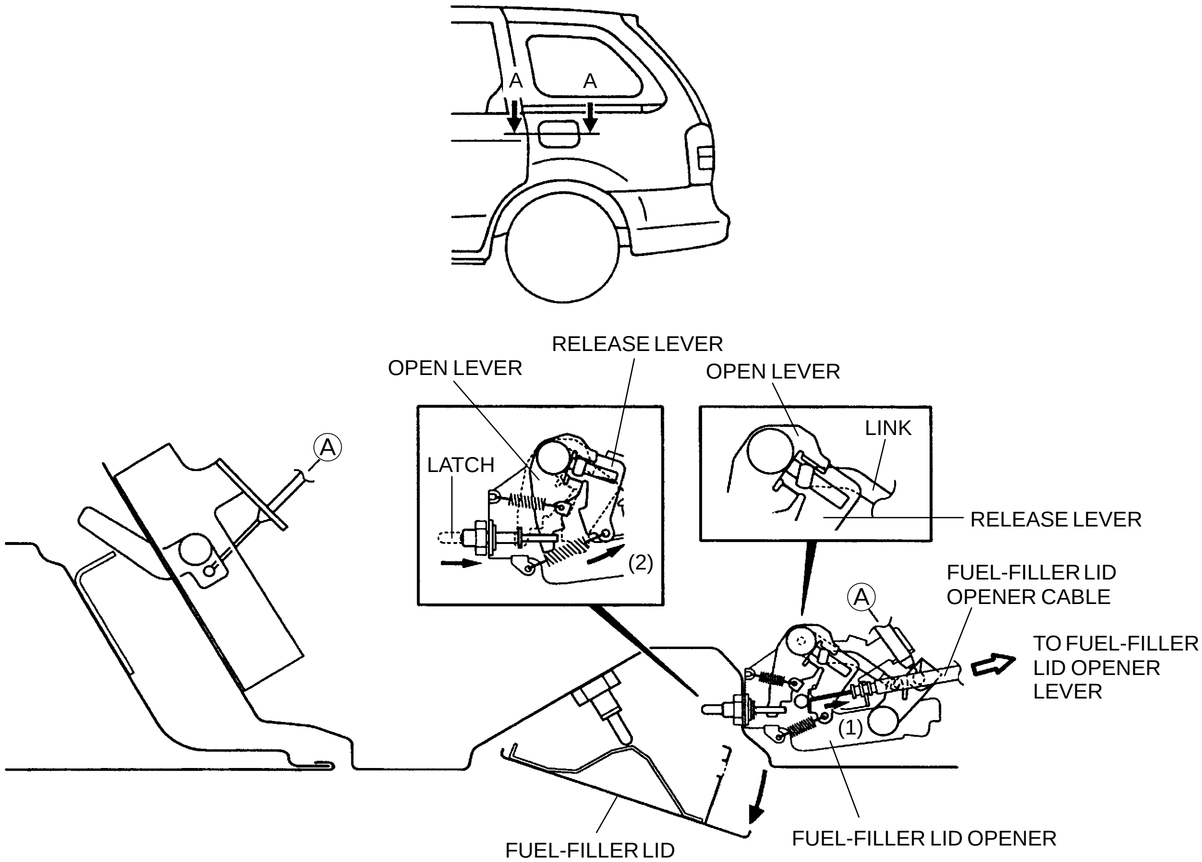
1. When the driver-side sliding door is opened (1), a spring returns the cancel lever to its original position (2).
2. The movement of the cancel lever causes the end of the link to slide through the hole in the release lever (3).
3. The end of the link comes apart from the contact of the open lever. (The release lever and the open lever come apart.)
4. This cuts off the motion of the release lever (4), preventing the fuel-filler lid from opening.



YMU911S09

Fuel-filler Lid Open Operation

1. The fuel-filler lid opener lever is cable operated (1).
2. The cable moves the release and open lever in the direction shown by the arrow (2).



SECTION A–A

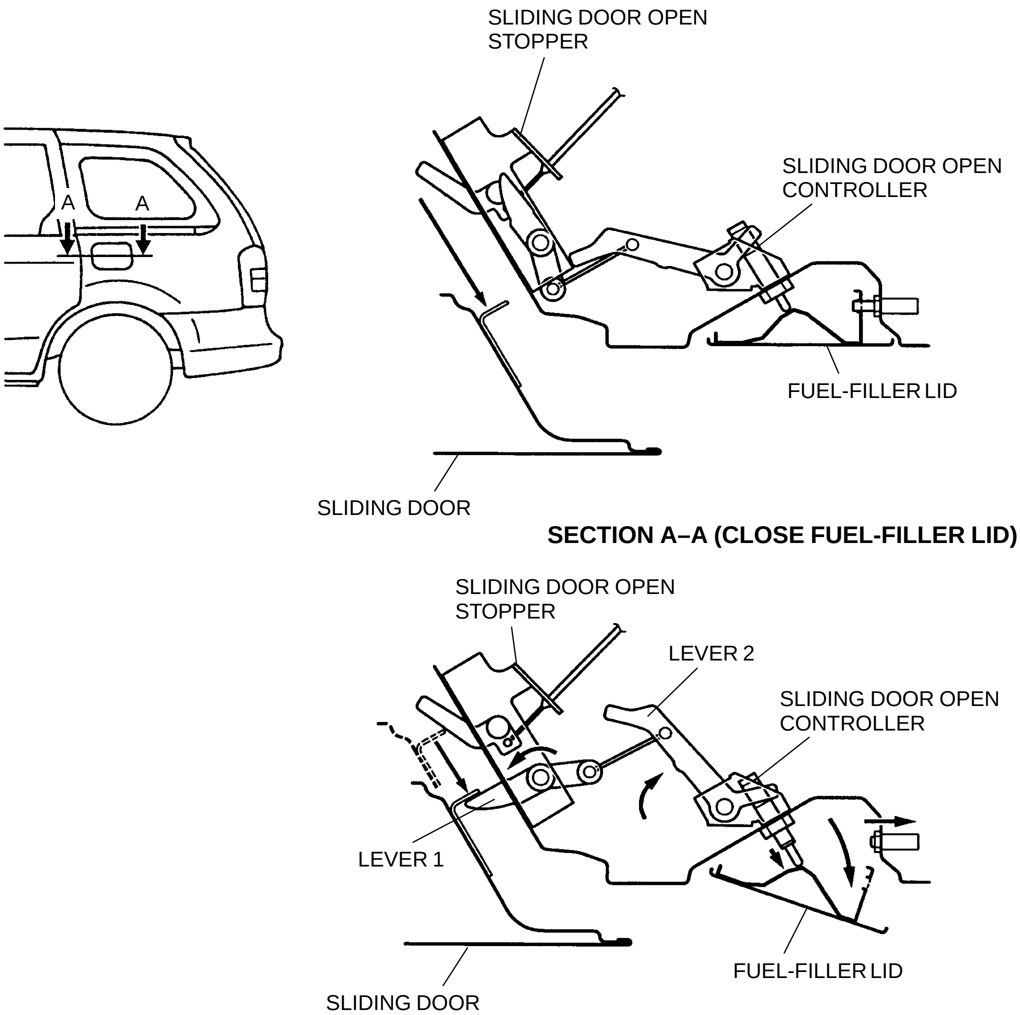
YMU911SA7

SLIDING DOOR CANCEL FUNCTION DESCRIPTION

YMU911S10

Sliding Door Cancel Operation

- When the fuel-filler lid is opened, lever 1 rises and pulls lever 2. Lever 2 prevents the driver-side sliding door from opening further.



SECTION A–A (CLOSE FUEL-FILLER LID)

SECTION A–A (OPEN FUEL-FILLER LID)

YMU911SA8

09–12 GLASS/WINDOWS/MIRRORS

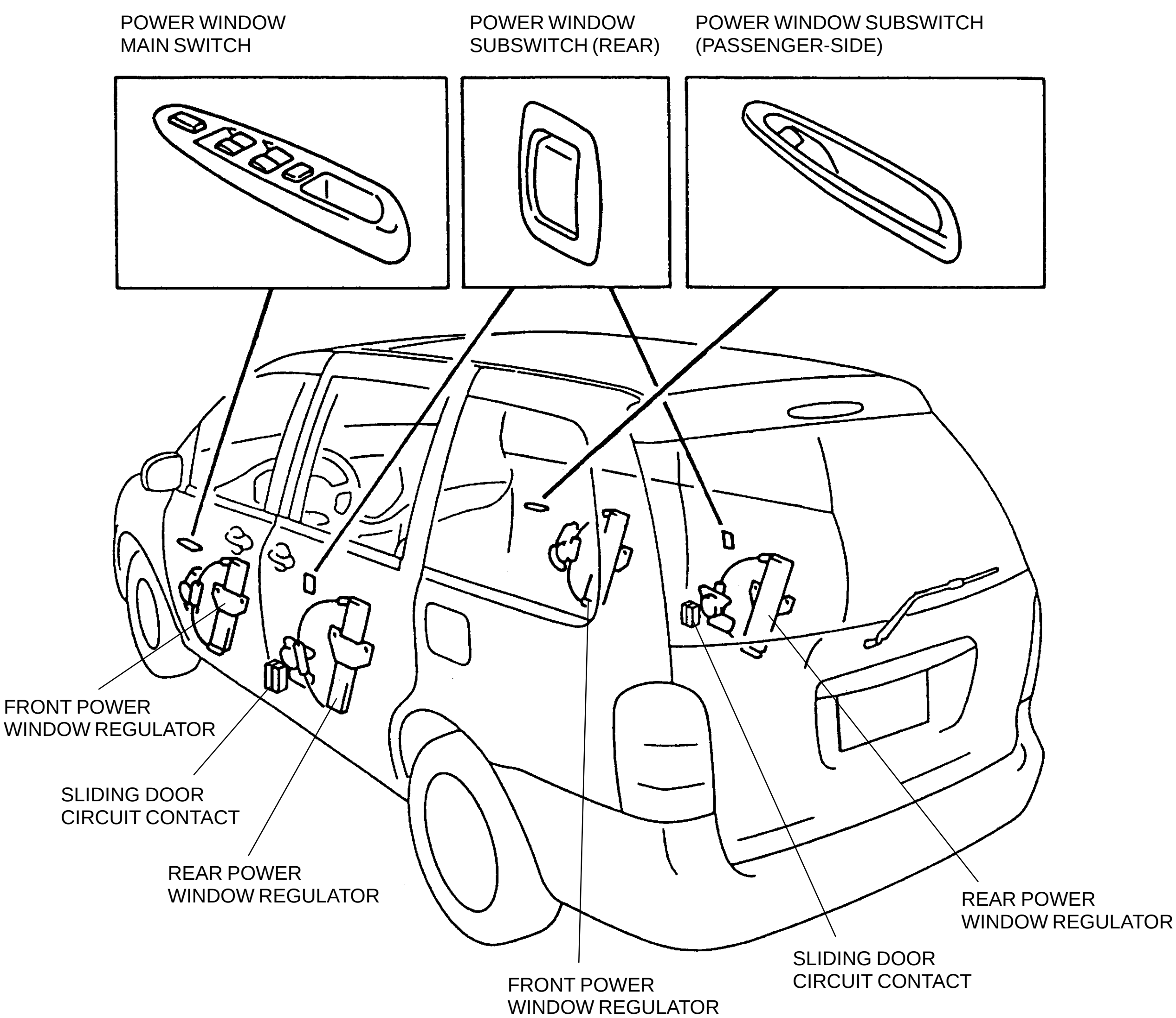
POWER WINDOW SYSTEM OUTLINE

YMU912S01

- The construction and operation, which has manual close/open, auto open, and power-cut functions, is basically the same as the 1998MY MPV. The following are the major differences between the 2000MY and 1998MY MPV.
  - A sliding door circuit contact, which joins harnesses in the sliding door and the body, has been added. (Refer to 09–11–2 SLIDING DOOR CIRCUIT CONTACT DESCRIPTION.)

POWER WINDOW SYSTEM STRUCTURAL VIEW

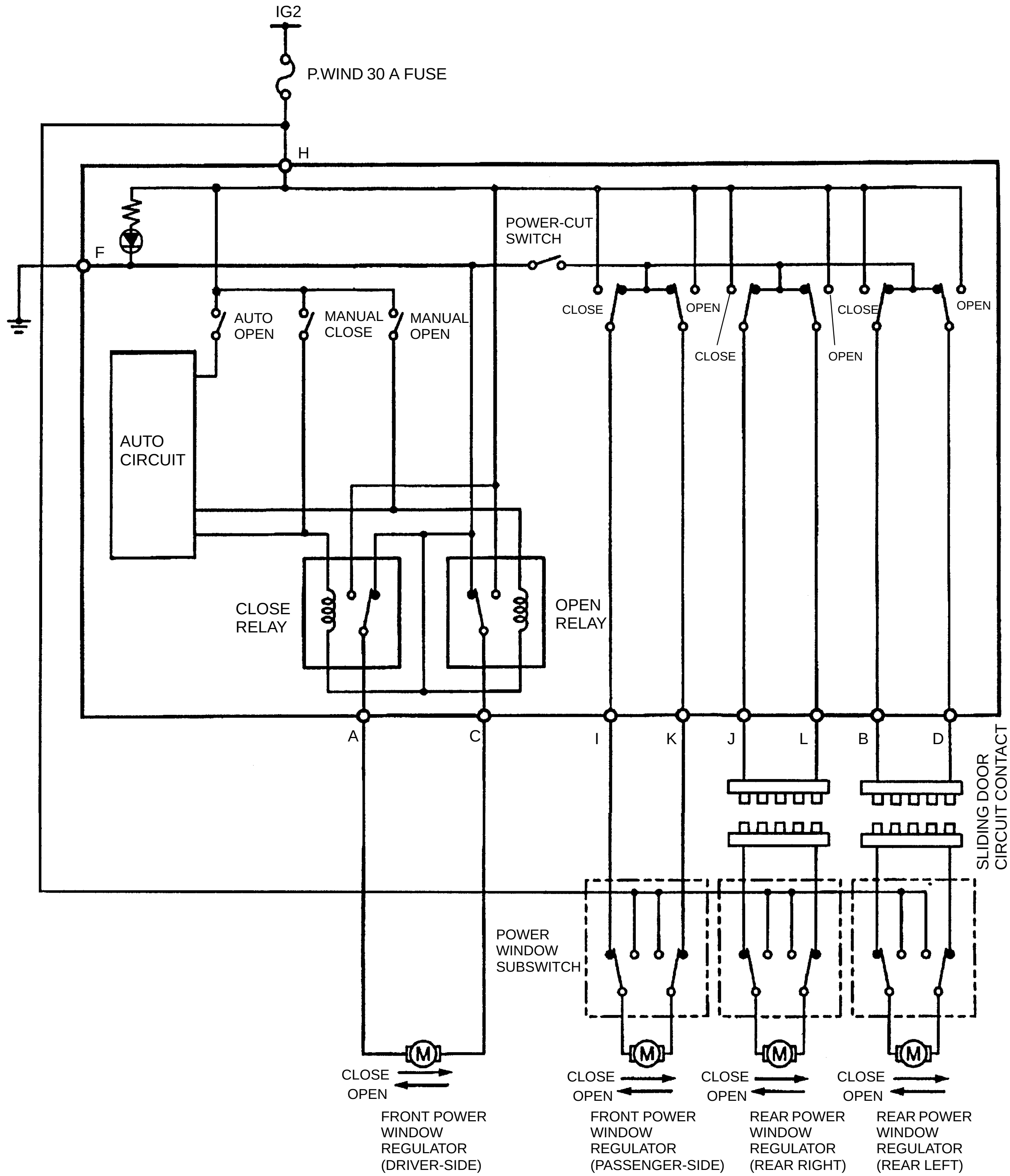
YMU912S02



YMU912SA0

POWER WINDOW SYSTEM WIRING DIAGRAM

YMU912S03



YMU912SA1

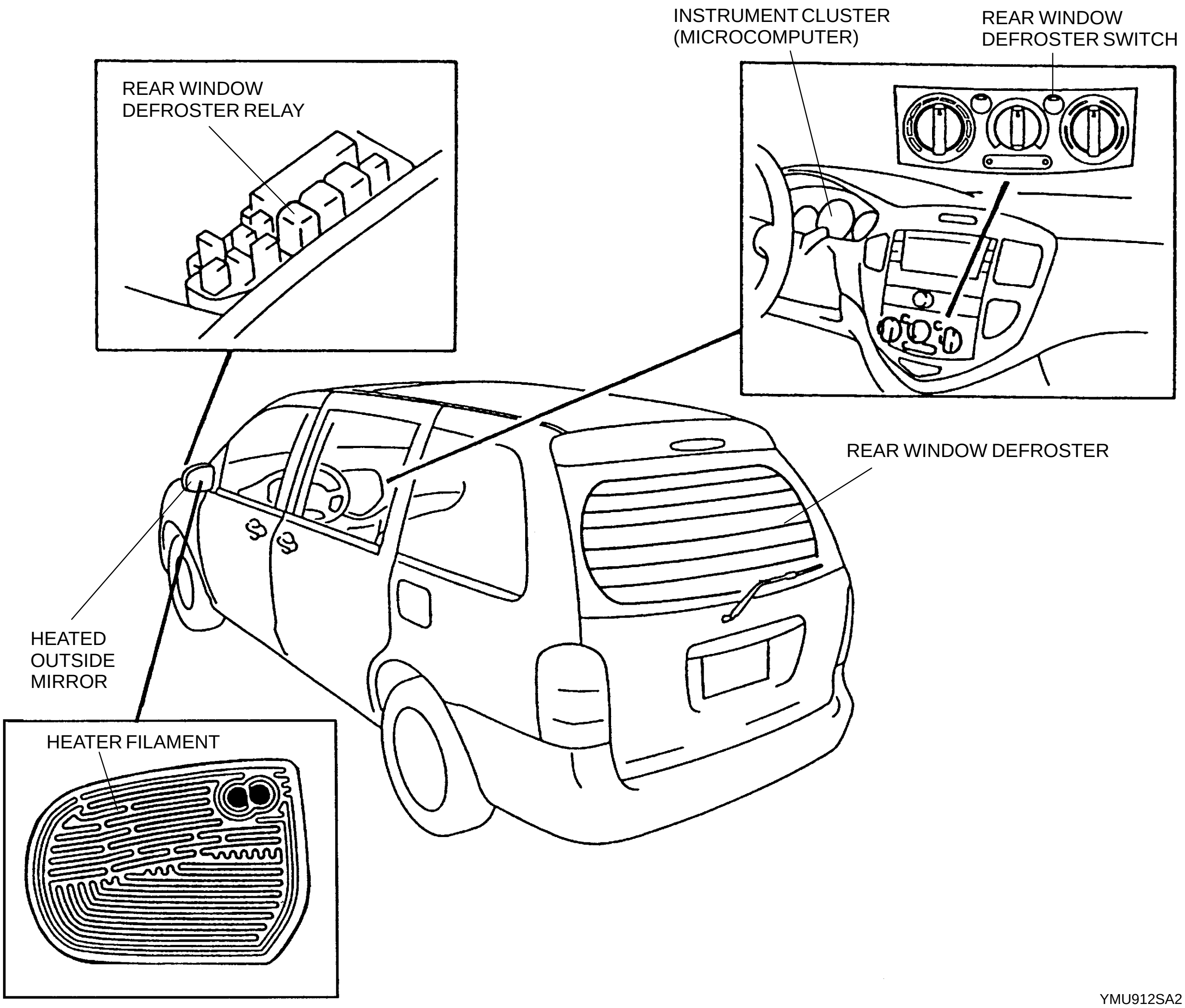
REAR WINDOW DEFROSTER OUTLINE

YMU912S04

- The construction and operation is basically the same as the 1998MY MPV. The following are the major differences between the 2000MY and 1998MY MPV.
  – Heated outside mirrors, which operate with the rear window defroster, have been added.
  – The timer has been added. It is the same as the 1999MY 626, except for the defroster cycle time.

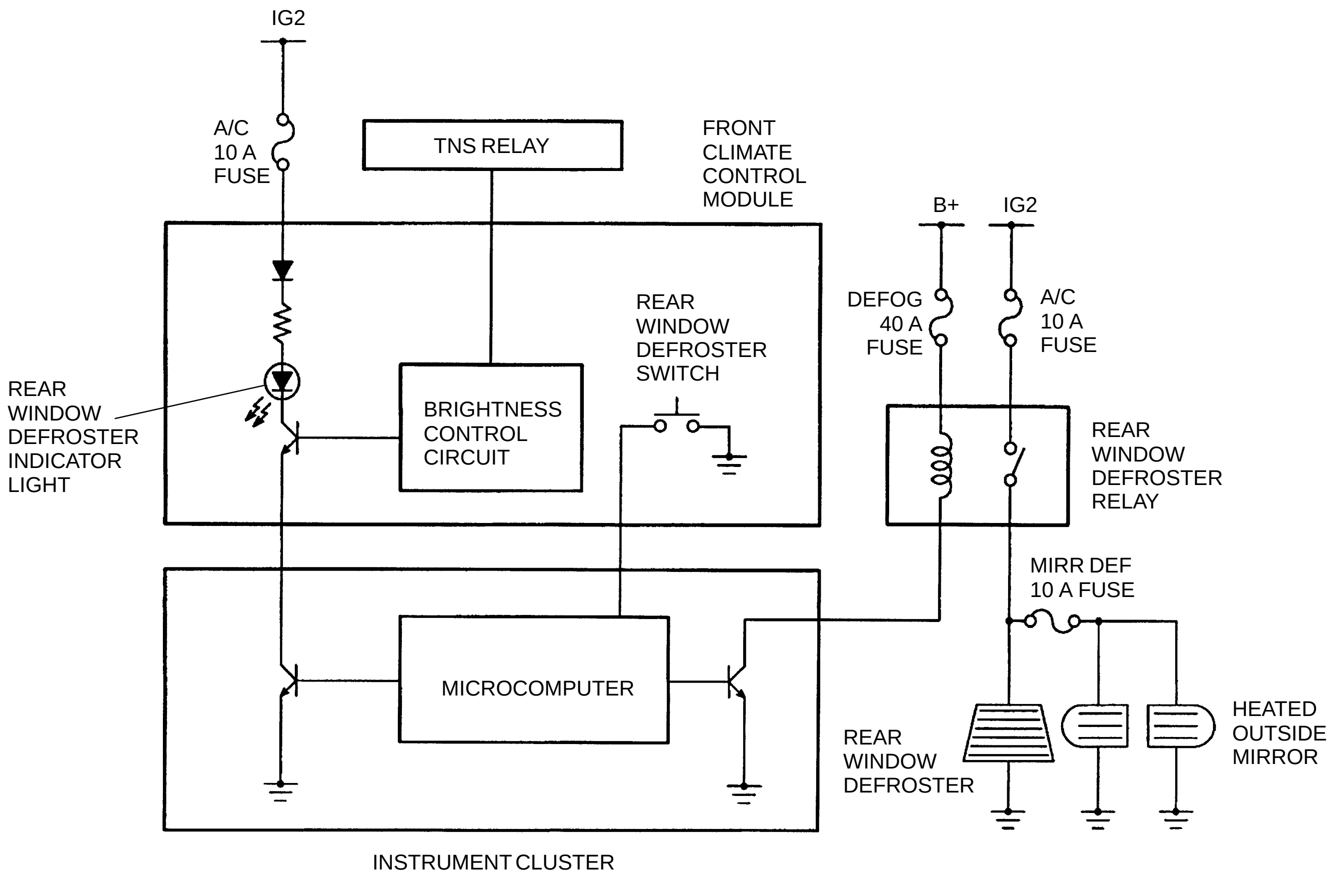
REAR WINDOW DEFROSTER STRUCTURAL VIEW

YMU912S05



REAR WINDOW DEFROSTER SYSTEM WIRING DIAGRAM

YMU912S06



YMU912SA3

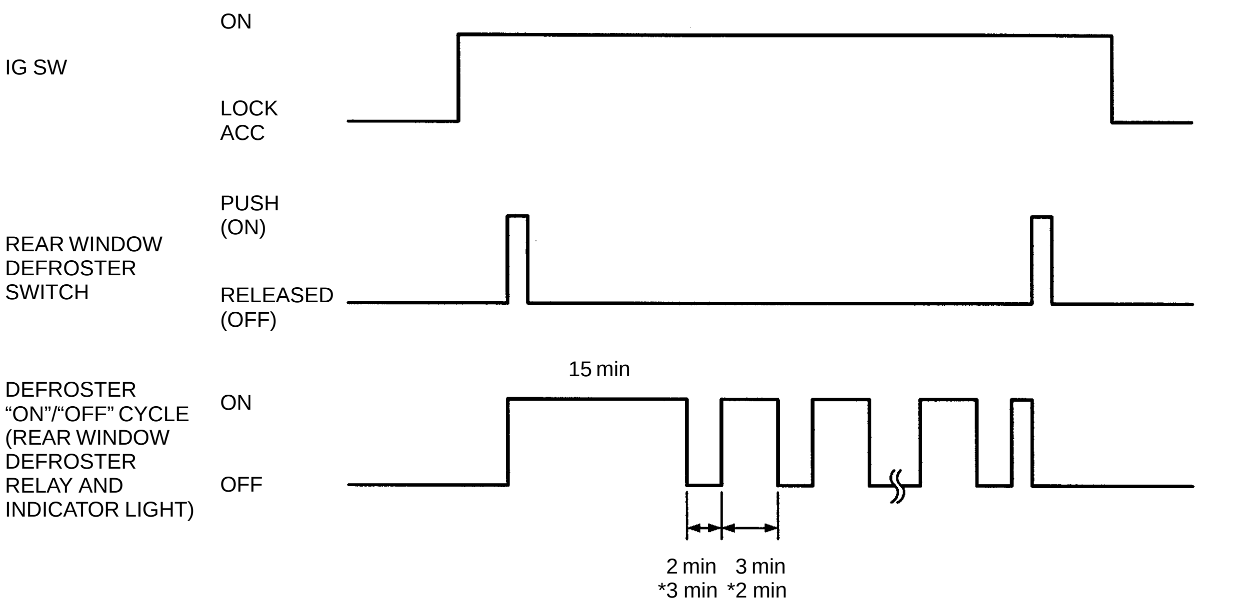
REAR WINDOW DEFROSTER DESCRIPTION

YMU912S07

Timer Operation

- The rear window defroster cycles “ON” and “OFF” according to the microcomputer timer operations.

Timing Chart



*: 1999MY 626

YMU912SA4

OUTSIDE MIRROR OUTLINE

YMU912S08

- The construction and operation of the power outside mirror are the same as the 1998MY MPV.
- Heated outside mirrors have been adopted to improve visibility. (Refer to 09–12–3 REAR WINDOW DEFROSTER OUTLINE.)

09–13 SEATS

SEAT OUTLINE

YMU913S01

Front Seat

- The driver's seat is designed with a seat lifter mechanism that adjusts the seat cushion to the desired height with independent front and rear tilt dials.

Second-row Seat

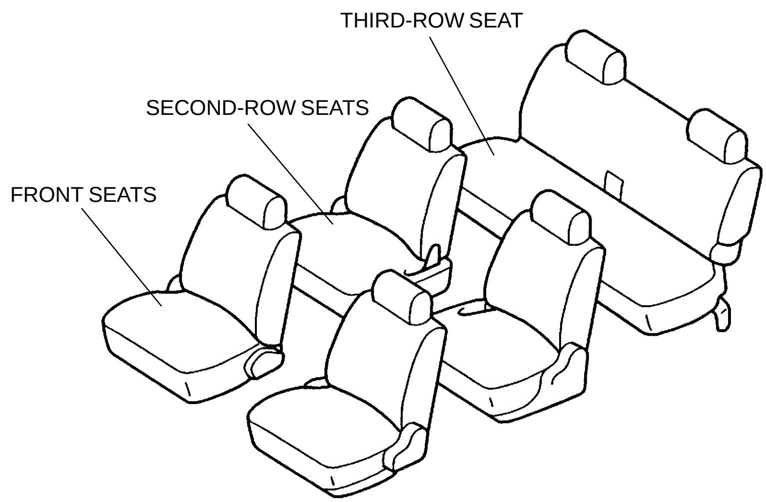
- A sliding mechanism allows passengers to adjust the seats forward and backward for increased comfort.
- The right hand side second-row seat is equipped with a side-sliding mechanism.
- The second-row seat is easily removed with the improved seat anchor lock lever.

Third-row Seat

- The third-row seat can be folded back into the rear well for increased space.
- The third-row seat can be reconfigured for comfortable seating facing rearward with the liftgate open.

SEAT STRUCTURAL VIEW

YMU913S02



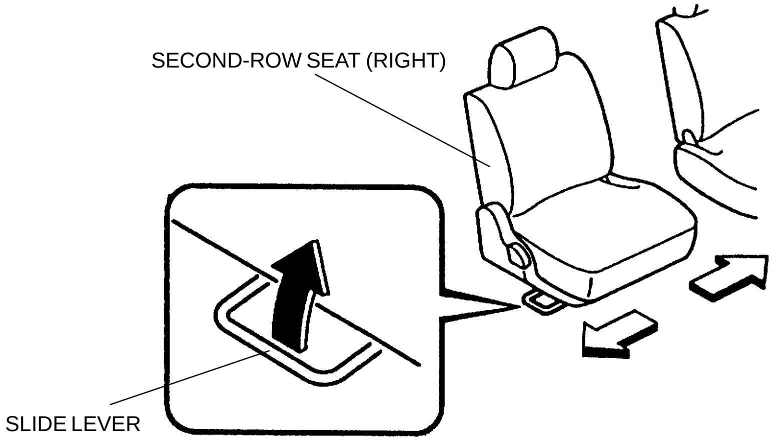
YMU913SA0

SECOND-ROW SEAT DESCRIPTION

YMU913S03

Side-sliding Operation

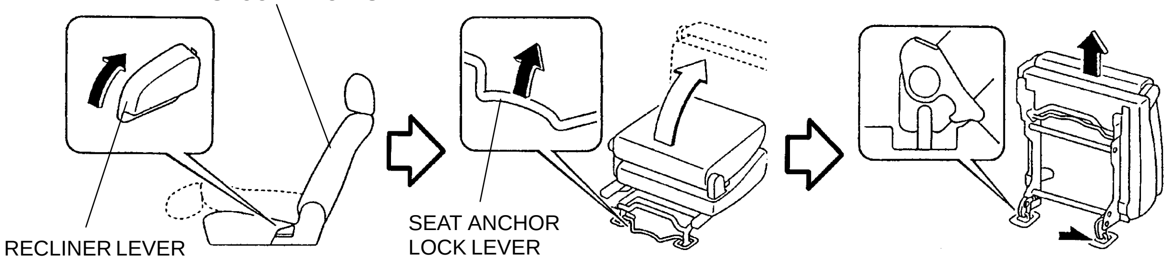
- Pull the slide lever and slide the second-row seat inward or outward.



YMU913SA1

Removal Operation

1. Put the second-row buckles into the pocket in the cushion.
2. Slide the seat to the rearmost position.
3. Pull the recliner lever and lower the seat back forward.
4. Lift and hold the seat anchor lock lever and lift the entire seat up and forward.
5. Remove the second-row seat.



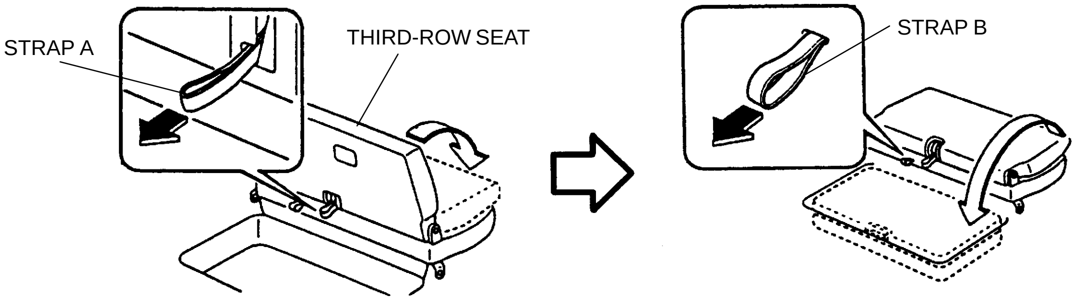
YMU913SA2

THIRD-ROW SEAT DESCRIPTION

YMU913S04

Stowing Third-row Seat Operation

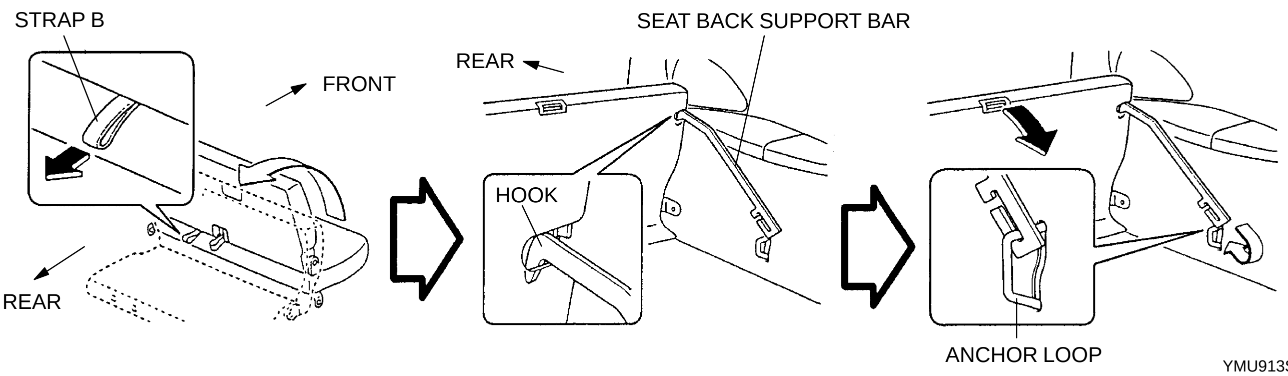
1. Remove the headrests.
2. Pull strap A and fold the seat back forward.
3. Pull strap B while lifting the seat up and to the rear.



YMU913SA3

Rear View Seating Operation

1. Open the liftgate.
2. Remove the headrests.
3. Pull strap B while supporting the seat back with the other hand and carefully ease the seat back rearward and into the seat well.
4. Set the hook on the seat back support bar in the rear of the seat back.
5. Pull the seat back towards the front of the vehicle until the opposite end of the support bar hooks onto the anchor loop.



YMU913SA4

09–14 SECURITY AND LOCKS

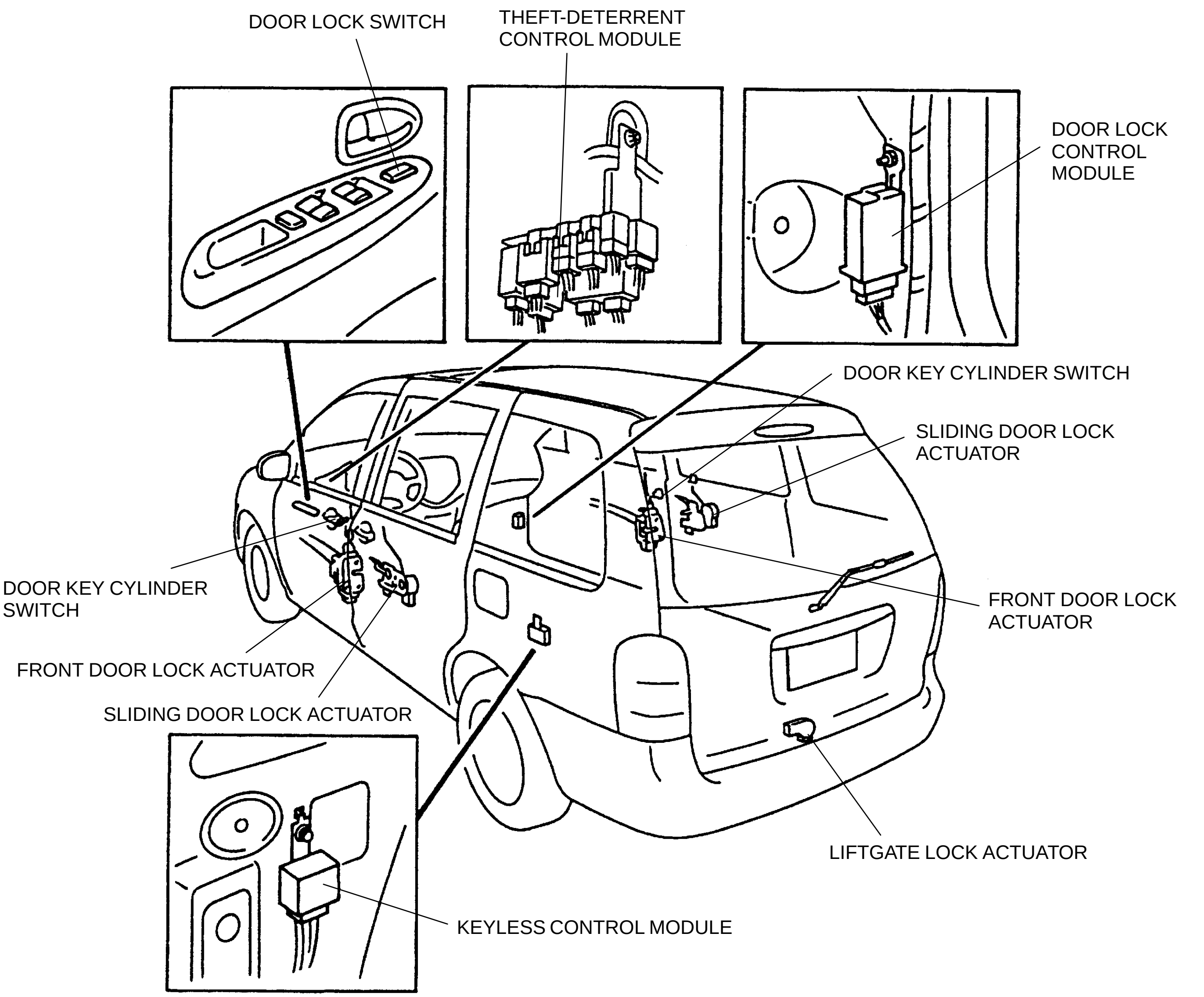
POWER DOOR LOCK SYSTEM OUTLINE

YMU914S01

- The door key interlock function has the following functions:
  - The driver’s door key cylinder can be used to unlock the driver’s door without unlocking the other doors.
  - The driver’s door key cylinder can also be used to lock/unlock all the doors.
  - The passenger’s door key cylinder can be used to lock/unlock all the doors.
- The door lock switch function has the following function:
  - The door lock switch can be used to lock/unlock all the doors.
- The keyless entry function has the following functions:
  - The transmitter can be used to unlock the driver’s door without unlocking the other doors.
  - The transmitter can also be used to lock/unlock all the doors.

POWER DOOR LOCK SYSTEM STRUCTURAL VIEW

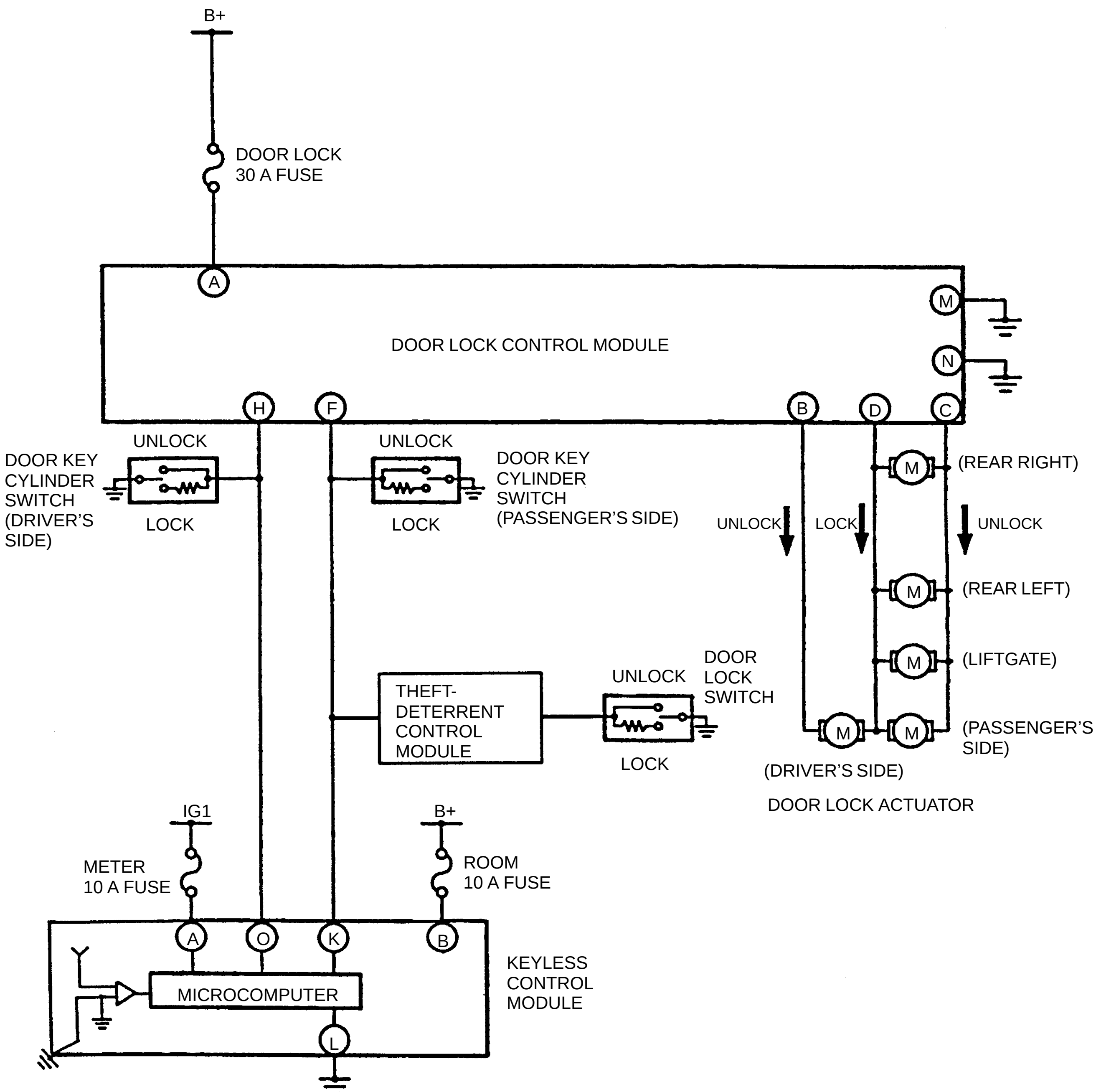
YMU914S02



YMU914SA0

POWER DOOR LOCK SYSTEM WIRING DIAGRAM

YMU914S03



YMU914SA1

POWER DOOR LOCK SYSTEM DESCRIPTION

YMU914S04

Function	Operating condition	Driver-side door	Passenger-side, rear doors and liftgate
Door key interlock	When the key is turned in the driver-side door key cylinder to lock position	Locked	Locked
	When the key is turned in the driver-side door key cylinder to unlock position and held for less than 1 second	Unlocked	Not activated
	When the key is turned in the driver-side door key cylinder to unlock position and held for more than 1 second	Unlocked	Unlocked
	When the key is turned in the passenger-side door key cylinder to lock position	Locked	Locked
	When the key is turned in the passenger-side door key cylinder to unlock position	Unlocked	Unlocked
Door lock switch	When the door lock switch is locked	Locked	Locked
	When the door lock switch is unlocked	Unlocked	Unlocked
Keyless entry	Transmitter LOCK button is pressed*[1]	Locked	Locked
	Transmitter UNLOCK button is pressed once.	Unlocked	Not activated
	Transmitter UNLOCK button is pressed twice for less than 5 seconds.	Unlocked	Unlocked

*[1] : When the transmitter LOCK button is pressed again within 5 seconds, the horn sounds to confirm that all doors and liftgate are closed.

Note
- The door key interlock function is not activated when the liftgate lock cylinder is used.

FUEL-FILLER LID SYSTEM OUTLINE

YMU914S14

- The fuel-filler lid system has the following functions:
  - Prevents the fuel-filler lid from being opened while the driver-side sliding door is open (even when the fuel-filler lid opener is operated). (Refer to 09–11–5 Fuel-filler Lid Cancel Operation.)
  - Prevents the sliding door from hitting the fuel-filler lid. The driver-side sliding door will not open when the fuel-filler lid is open. (Refer to 09–11–7 Sliding Door Cancel Operation.)

KEYLESS ENTRY SECURITY SYSTEM OUTLINE

YMU914S05

Keyless Entry Function

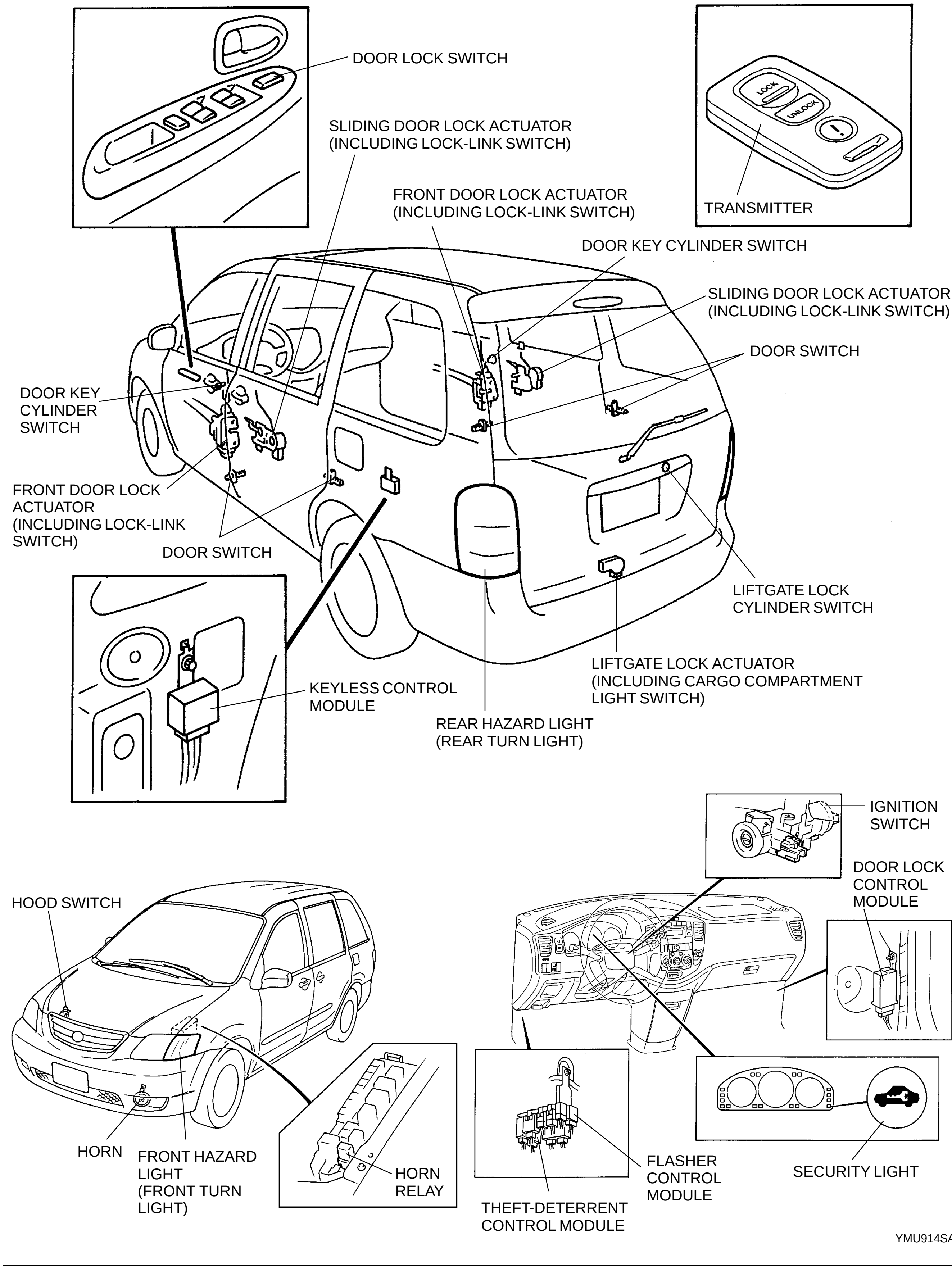
- The construction and operation is basically the same as the 1999MY Protegé. However, the panic function has been modified. The following are the major differences between the panic function in the 2000MY and 1998MY MPV.
  - The panic function has been adopted as in the 1999MY Protegé. This function sounds the horn and flashes the headlights and the hazard lights when the panic button of the transmitter is pressed.
  - The control device has been changed from the CPU to the keyless control module.
  - The serial communication between the keyless control module and the CPU has been eliminated.

Theft-deterrent Function

- The theft-deterrent function includes sound and light alarms that activate when the hood, the liftgate or a door is opened by any means other than the ignition key or the transmitter. The hazard lights and the headlights flash, and the horn sounds. When the ignition key is inserted into the door key cylinder or liftgate lock cylinder and turned to unlock, or the transmitter unlock button is pressed, the warnings stop.

KEYLESS ENTRY SECURITY SYSTEM STRUCTURAL VIEW

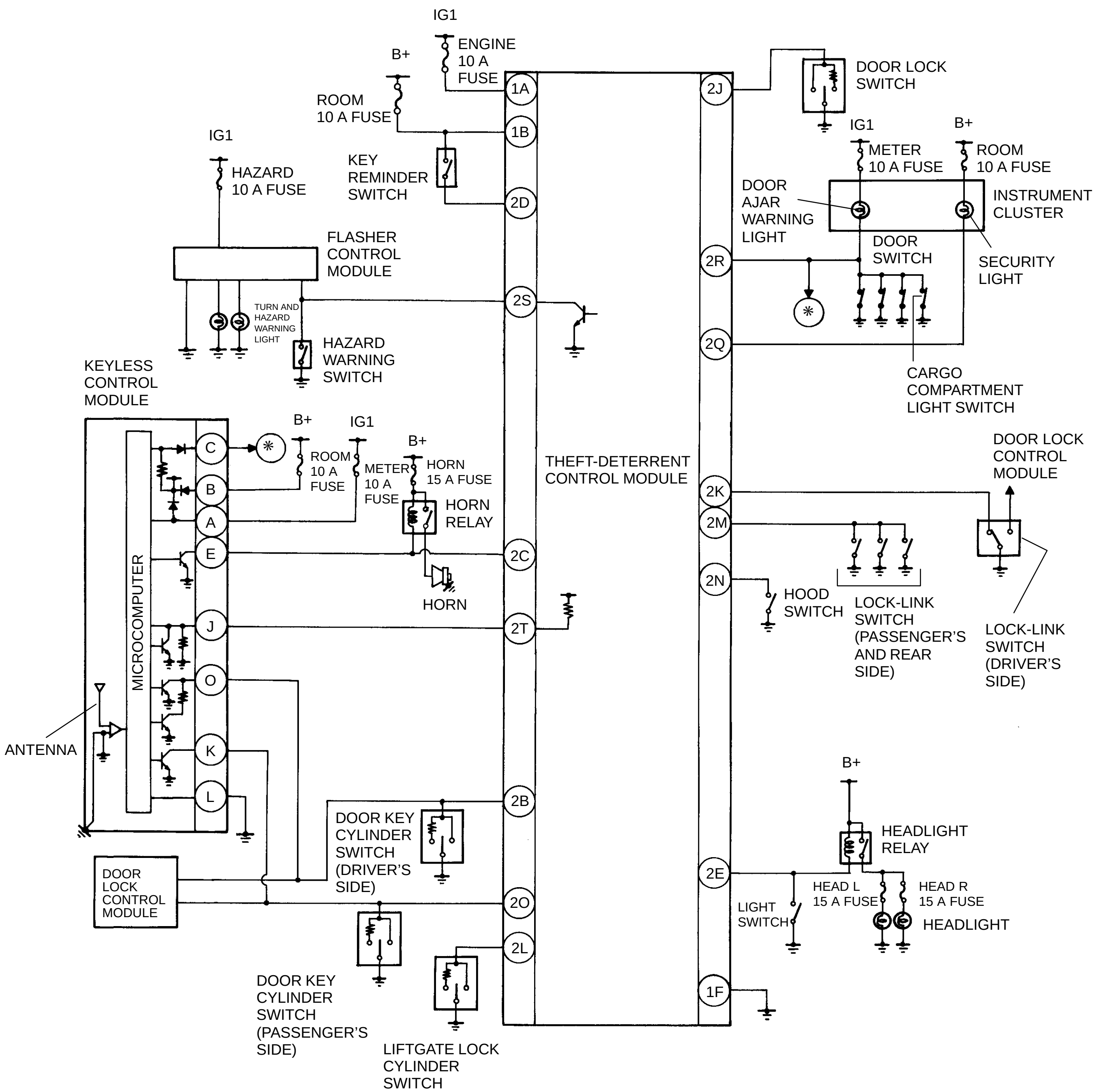
YMU914S06



YMU914SA2

KEYLESS ENTRY SECURITY SYSTEM WIRING DIAGRAM

YMU914S07



YMU914SA3

KEYLESS ENTRY SECURITY SYSTEM DESCRIPTION

YMU914S08

Keyless Entry Function

Operating condition	Driver-side door	Passenger-side, rear doors and liftgate	Warning
Transmitter LOCK button is pressed.	Locked	Locked	Not activate
Transmitter LOCK button is pressed again within 5 seconds.	Not activated	Not activated	Horn sounds
Transmitter UNLOCK button is pressed once.	Unlocked	Not activate	Not activate
Transmitter UNLOCK button is pressed twice within 5 seconds.	Unlocked	Unlocked	Not activate
Panic button is pressed.	Not activated	Not activated	Horn sounds and headlights and hazard lights flash for 2.5 minutes.
Any button of transmitter is pressed again while panic function is in operation.	Not activated	Not activated	Horn stops sounding, and headlights and hazard lights stop flashing.

Theft-deterrent Function
System conditions

System phase		Dead	Initial	Arming 1	Alarm 1	Alarm 2
INPUT	Timer period	—	—	—	2.5 minutes	—
	Key reminder switch	On (at least one is on)	Off	Off	—	—
	Ignition switch		Off	Off	On or Off (after at least one is on)	On or Off
	Door switch	—	—	Off		On or Off
	Hood switch	—	—	Off		On or Off
	Cargo compartment light switch	—	—	Off		On or Off
	Door lock-link switch	—	—	Off		On or Off
	Driver's door key cylinder switch, Passenger's door key cylinder switch, Liftgate lock cylinder switch	—	—	Off/Lock	Off/Lock	Off/Lock
OUTPUT	Horn	Off	Off	Off	On	Off
	Hazard warning light	Off	Off	Off	Flash	Off
	Headlight	Off	Off	Off	Flash	Off
	Security light	Off	Off	Flash	Off	Off

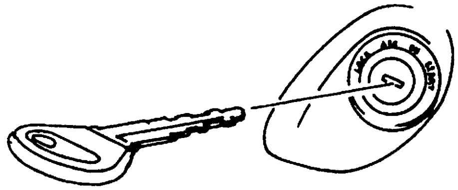
System phase

Dead

- The condition before the key is removed from the steering lock. (The key is at either ON position, ACC position, or LOCK position.)
- The security light is not lit at this time.

Initial

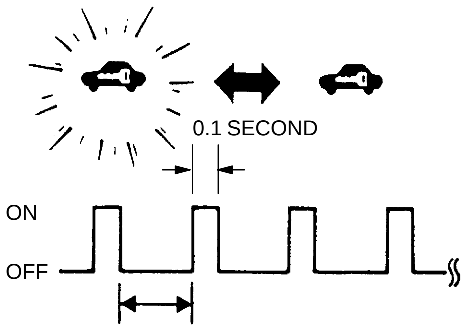
- The condition after the key has been removed from the steering lock.
- The security light is not lit at this time.



YMU914SA4

Arming 1

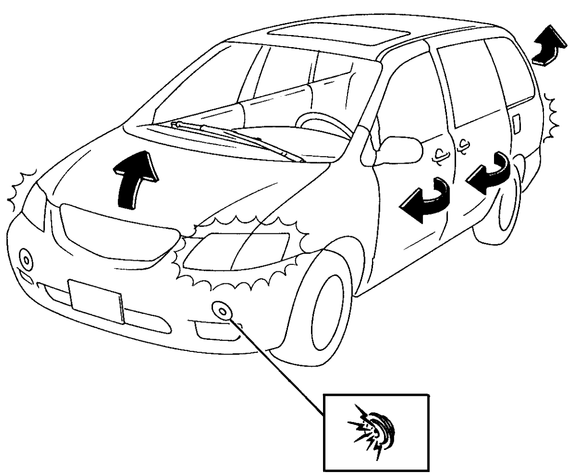
- The condition in which all doors are locked with the key or the transmitter. (A liftgate and a hood are closed.)
- The hazard lights flash 1 time shifting to “Arming 1” phase from the “Initial” phase.
- The security light flashes at 3 second intervals. The alarm function is fully set.



YMU914SA5

Alarm 1

- The condition in which, without using the key or the transmitter, a door, the hood, the liftgate is opened or the ignition circuit is short-circuited. The horn sounds intermittently and the hazard lights and the headlights flash intermittently for 2.5 minutes.
- The horn sounds intermittently and hazard lights and the headlights flash intermittently for 2.5 minutes again when a door, the hood or the liftgate is opened or closed without using the key or the transmitter again after 2.5 minutes have passed.



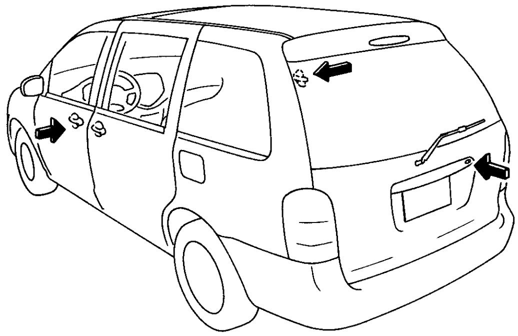
YMU914SA7

Alarm 2

- The condition (after 2.5 minutes have passed from the time “Alarm 1” phase was activated) in which the alarm function is deactivated.
- When a door, the hood or the liftgate is opened or closed without using the key or the transmitter, the condition returns to “Alarm 1” phase.

Alarm Stop Phase (Initial)

- The alarm function is canceled when any door is unlocked using the key, the door lock switch, or the transmitter, or the liftgate is unlocked using the key or the transmitter.
- The hazard lights have been flashed 2 times shifting to “Alarm Stop Phase” phase from “Arming 1”, “Arming 2”, “Alarm 1” or “Alarm 2” phase.



YMU914SA9

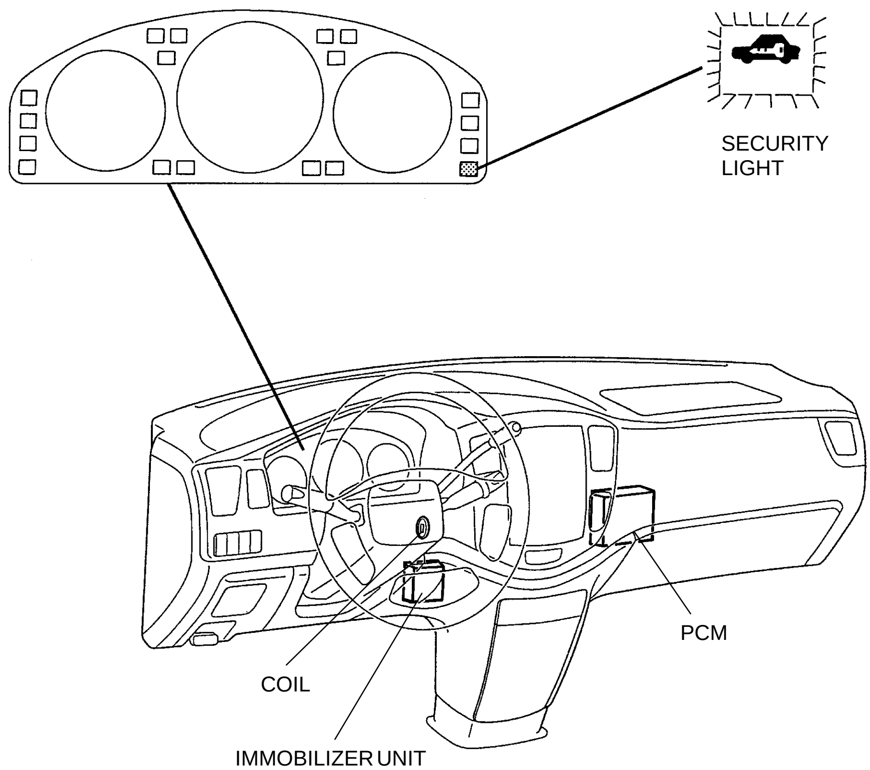
IMMOBILIZER SYSTEM OUTLINE

YMU914S09

- The procedures for component initialization are different depending on the component being replaced. If the component is not registered in the system, the vehicle will not start.
- The immobilizer system prevents the engine from starting when anything other than the programmed ignition key is used to turn the ignition (even if the ignition switch is short-circuited).
- The system components are:
  - Key with transponder
  - Security light
  - Coil
  - Immobilizer unit
  - PCM
- The engine will start only if the key with the corresponding identification number is recognized and verified by the PCM and immobilizer unit.
- The engine can be started using the key, which has an ID number registered in its transponder and which uses an algorithmic verification method. In addition to the ID number verification used for the 1999MY 626, an algorithmic verification method by calculating has been added to further improve security.
- The code word is input to the immobilizer unit and PCM, and the vehicle does not start if the code word is not newly registered when parts are replaced. It is the same as in the 1999MY 626.
- The procedure for registering the ID number and the procedure for inputting the code word are different according to the parts being replaced and the number of the registered keys.
- DTCs are the same as the 1999MY 626.

IMMOBILIZER SYSTEM STRUCTURAL VIEW

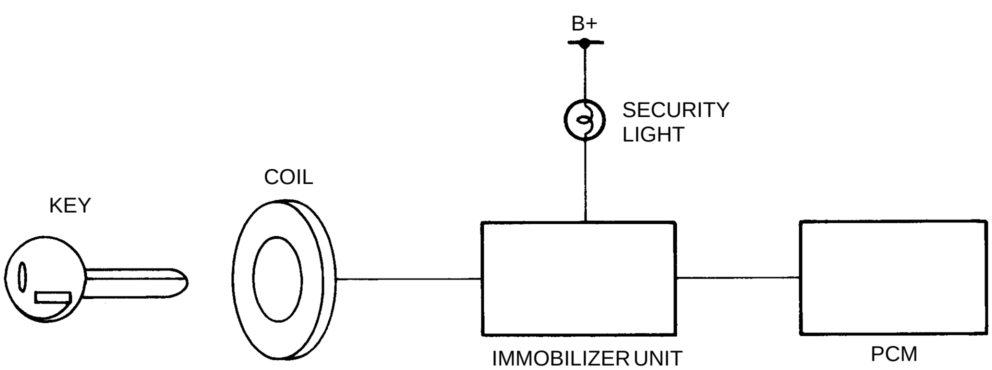
YMU914S10



YMU914SAA

IMMOBILIZER SYSTEM WIRING DIAGRAM

YMU914S11



YMU914SAB

IMMOBILIZER SYSTEM DESCRIPTION

YMU914S12

Key

- The transponder in the key has a registered ID number and performs an algorithmic transaction.

Coil

- The coil is located in the steering lock.

Immobilizer Unit

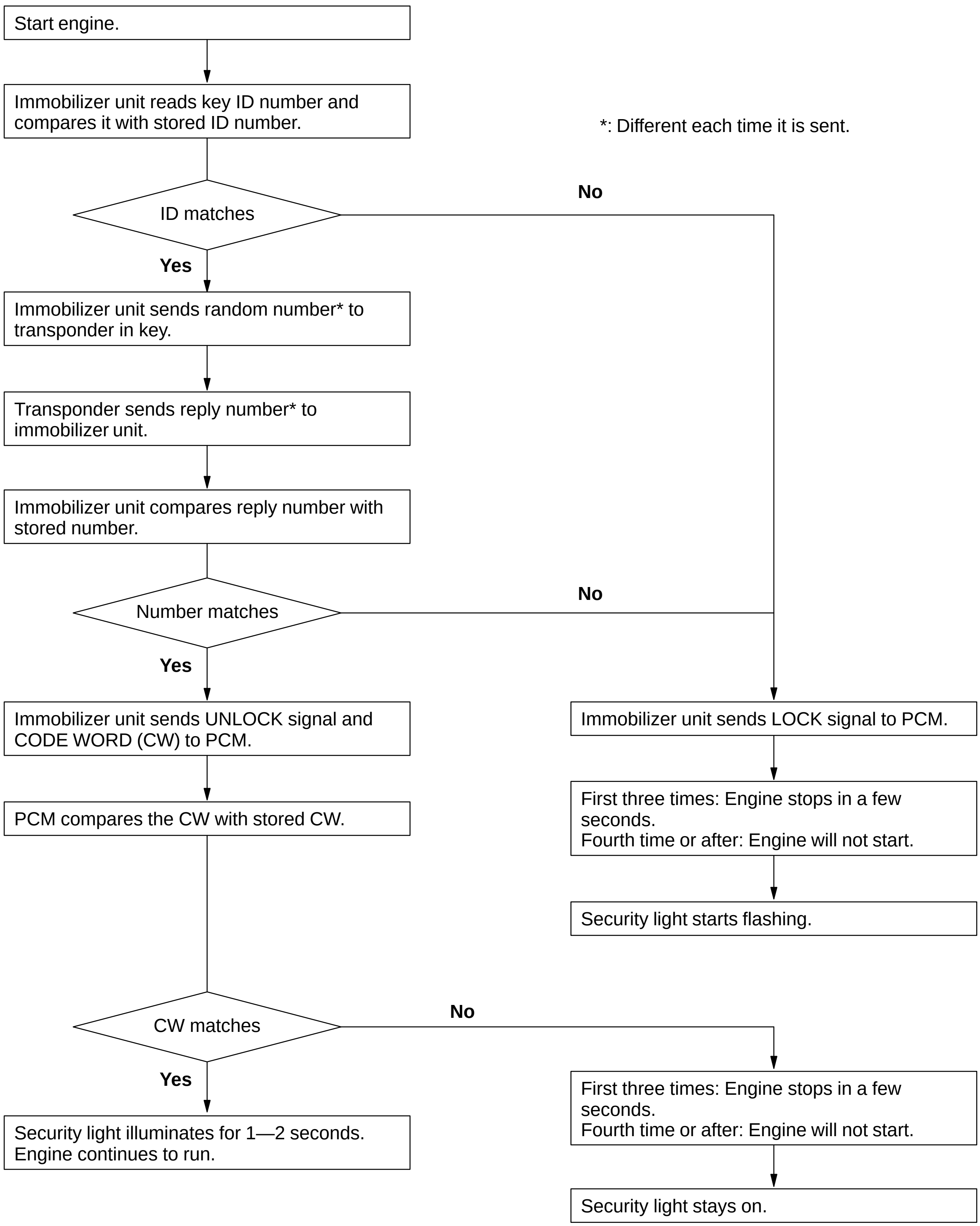
- The immobilizer unit compares the ID number and the algorithmic verification method of the key with those registered in the immobilizer unit.
- When the ID number and the algorithmic verification method are verified, the immobilizer unit sends the code word to the PCM.
- When there is a malfunction in the immobilizer system, the immobilizer unit flashes the security light to indicate a malfunction.

PCM

- The PCM verifies the code word of the immobilizer unit with that of the PCM.

System Operation

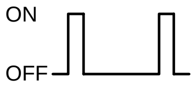
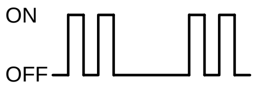
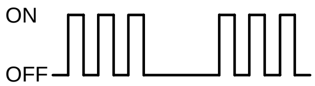
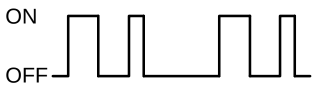
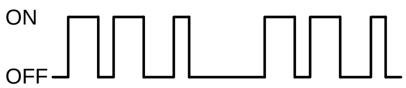
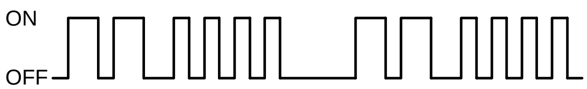
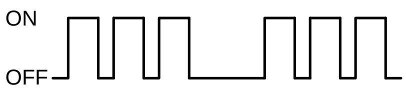
- This is a conceptual flowchart for understanding how the immobilizer system operates. It shows how the system decides whether or not to start the vehicle when the ignition switch is turned to ON position.



IMMOBILIZER SYSTEM ON-BOARD DIAGNOSTIC

YMU914S13

DTC Table
DTC indicated by immobilizer unit

DTC	Output pattern	Description
01		ID number unregistered in immobilizer unit is input after engine cranking.
02		ID number format error (voltage range, frequency)
03		ID number is not input into immobilizer unit after cranking engine.
11		Coil or wiring harness between immobilizer unit and coil is open circuit.
21		Code word/ID number memorized in immobilizer unit EEPROM cannot be read.
24		Open or short circuit in wiring harness between immobilizer unit and PCM
30		Immobilizer unit — PCM communication error

DTC indicated by PCM

DTC No.	Condition	MIL
P1602	Immobilizer unit — PCM communication error	OFF
P1603	Code word unregistered in PCM	OFF
P1604	Key ID number unregistered in PCM	OFF
P1621	Code word does not match after engine cranking	OFF
P1622	Key ID number does not match	OFF
P1623	Code word or key ID number write/read error in PCM	OFF
P1624	Immobilizer system communication counter = 0	OFF

DTC indications after 4th engine cranking under immobilizer system malfunctions (Reference)

Note
- When the following malfunctions occur on the immobilizer system, DTC(s) will be indicated as follows.
- These are not all potential malfunctions.

×: Retreived

<table>
<tr><th colspan="2">Malfunctions</th><th>01</th><th>02</th><th>03</th><th>11</th><th>21</th><th>24</th><th>30</th><th>P1602</th><th>P1603</th><th>P1604</th><th>P1621</th><th>P1622</th><th>P1623</th><th>P1624</th></tr>
<tr><td rowspan="7">Open circuit</td><td>IU – PCM</td><td></td><td></td><td></td><td></td><td></td><td>×</td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td>IU – Ground</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td>IU – Coil</td><td></td><td></td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td>IU – Battery</td><td colspan="14">Engine runs normally and no DTC is indicated.</td></tr>
<tr><td>IU – Ignition switch</td><td colspan="14">Engine runs normally and no DTC is indicated.</td></tr>
<tr><td>IU – Battery and IU – Ignition switch</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td>IU – Security light</td><td colspan="14">Engine runs normally and no DTC is indicated. No security light illumination after cranking.</td></tr>
<tr><td rowspan="3">Short circuit</td><td>IU – PCM</td><td></td><td></td><td></td><td></td><td></td><td>×</td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td>IU – Coil</td><td></td><td></td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td>IU – Security light</td><td colspan="14">Engine runs normally and no DTC is indicated. Security light illuminates at all key positions.</td></tr>
<tr><td colspan="2">Code word mismatch (IU–PCM)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td><td></td><td></td><td>×</td></tr>
<tr><td colspan="2">Key w/o transponder</td><td></td><td></td><td>×</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
<tr><td colspan="2">Unregistered key</td><td>×</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>×</td></tr>
</table>

09–15 SUNROOF

SLIDING SUNROOF OUTLINE

YMU915S01

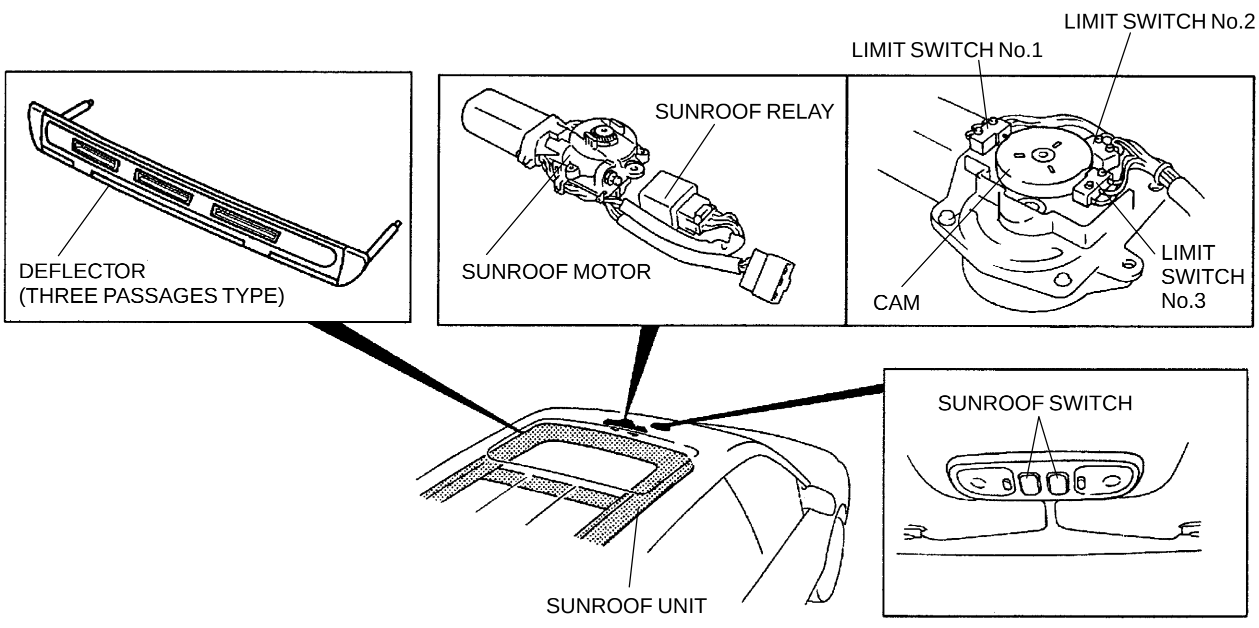
- The construction and operation (slide open/close and tilt up/down) are the same as the 1999MY Protegé except the circuit in the sunroof motor.

×: Available

Item	2000MY MPV	1998MY MPV	1999MY Protegé
Slide open/close function	×	×	×
Auto-stop function (when closing)	×	×	N/A
Tilt up/down function	×	N/A	×
Number of limit switch	3	1	3
Sliding amount (mm {in})	633 {24.9}	702 {27.6}	300 {11.8}
Tilt up amount (mm {in})	28 {1.1}	N/A	30 {1.2}

SLIDING SUNROOF STRUCTURAL VIEW

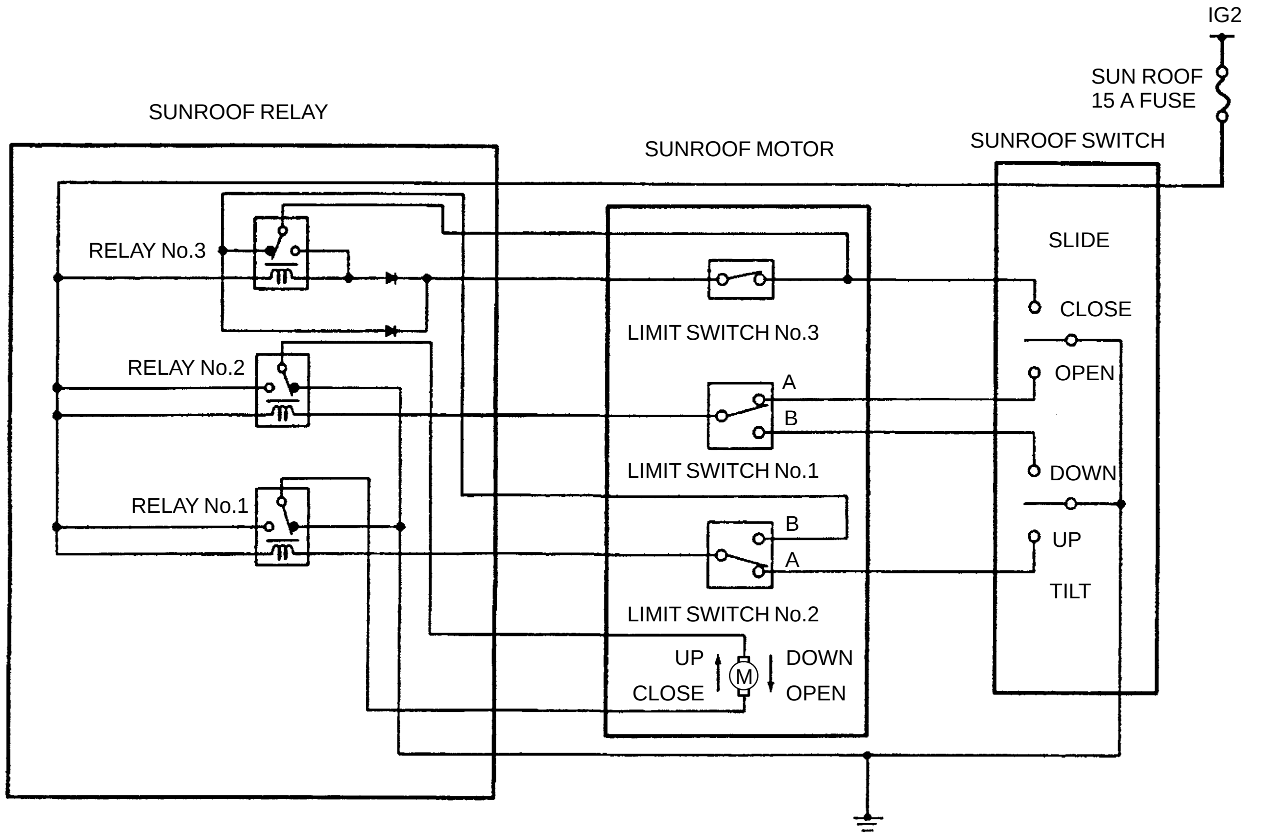
YMU915S02



YMU915SA1

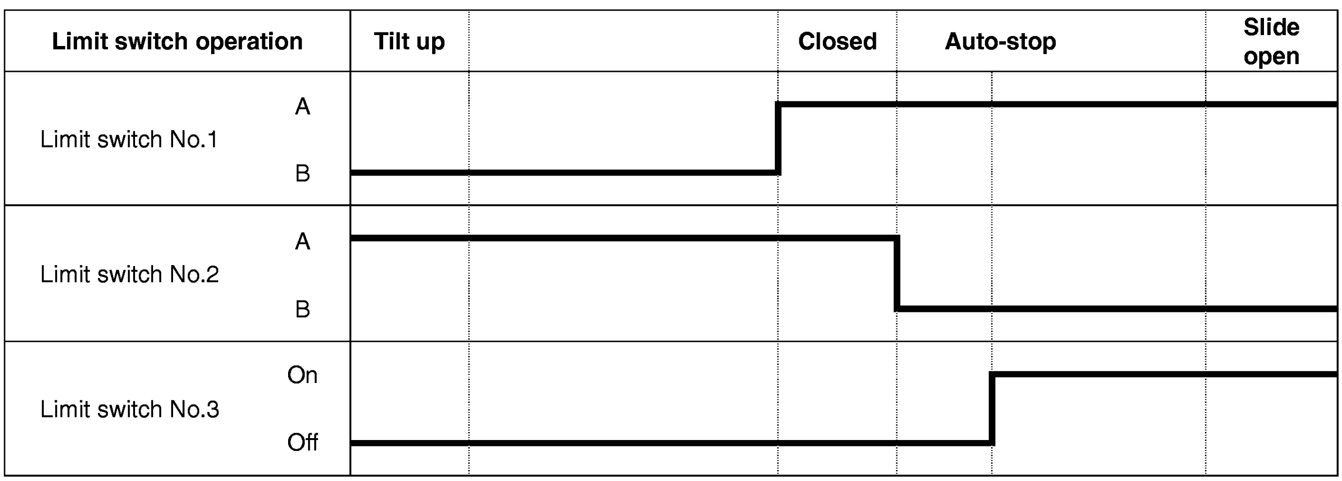
SLIDING SUNROOF SYSTEM WIRING DIAGRAM

YMU915S03



YMU915SA2

Timing Chart



YMU915SA3

09–18 LIGHTING SYSTEMS

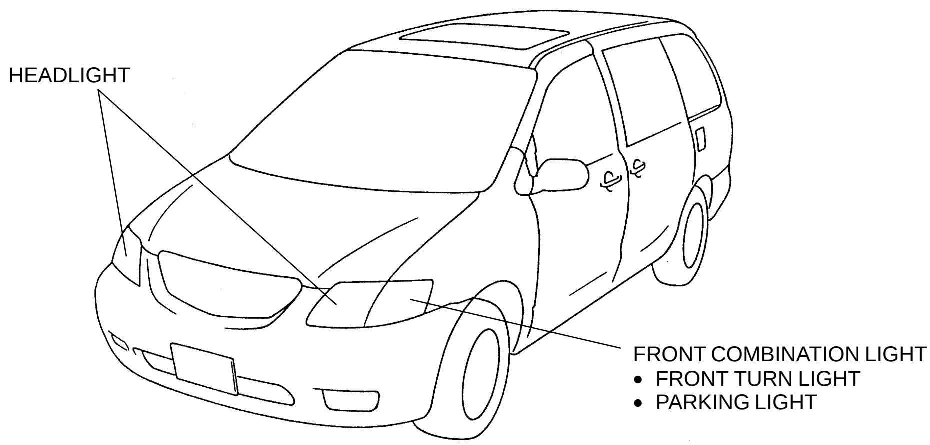
LIGHTING SYSTEMS OUTLINE

YMU918S01

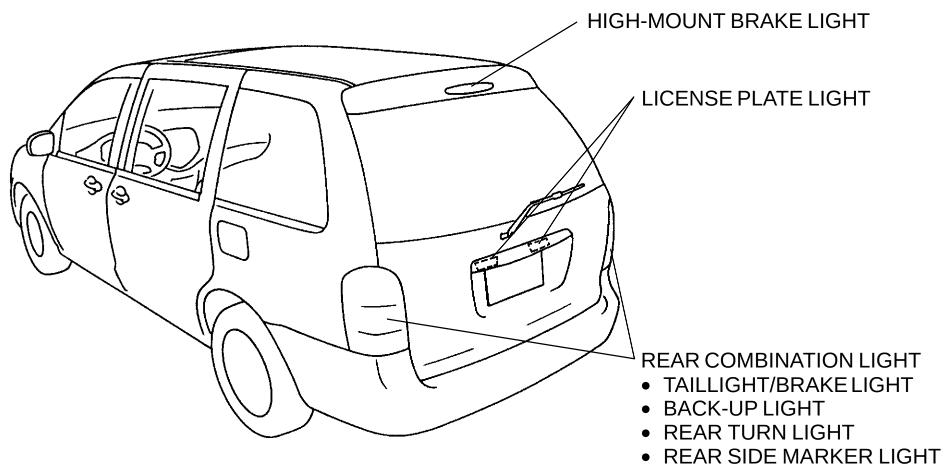
- The DRL system is the same as the 1999MY Protegé. (Canada model)
- The lights-on reminder warning buzzer system is the same as the 1999MY Protegé.
- A map light with overhead storage compartment has been added to normal roof type vehicle.
- An interior light at the center of the roof is controlled by the interior light control system.
- The interior light control system is the same as the 1999MY Protegé.

LIGHTING SYSTEMS STRUCTURAL VIEW

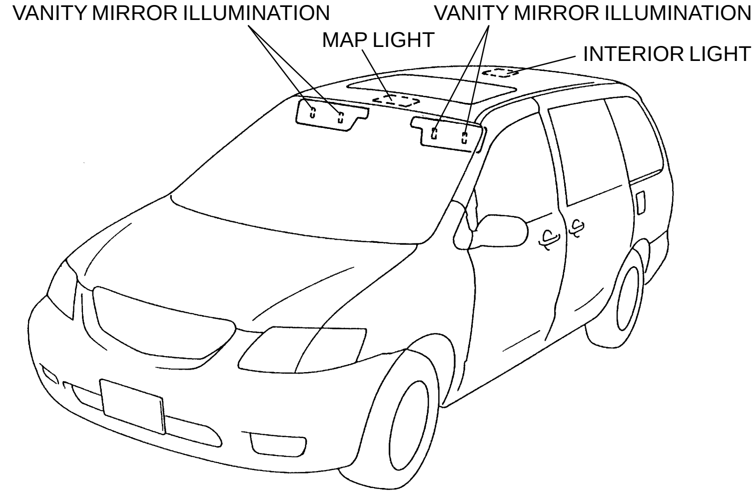
YMU918S02



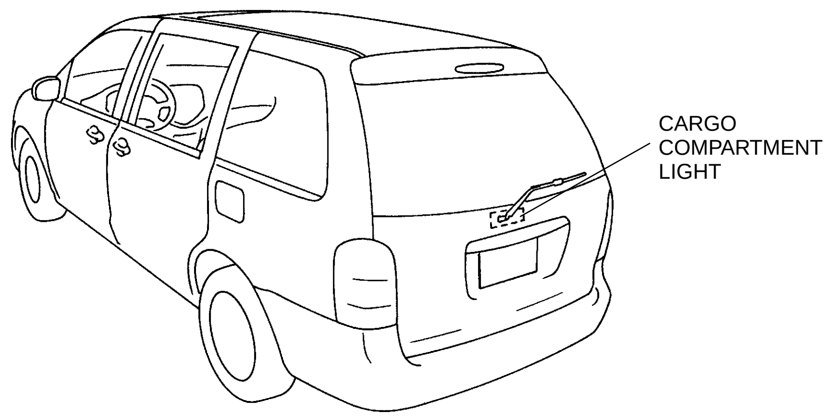
YMU918SA0



YMU918SA1



YMU918SA2



YMU918SA3

DRL SYSTEM OUTLINE (CANADA ONLY)

YMU918S03

- The DRL system is controlled by the DRL control module.

DRL SYSTEM DESCRIPTION

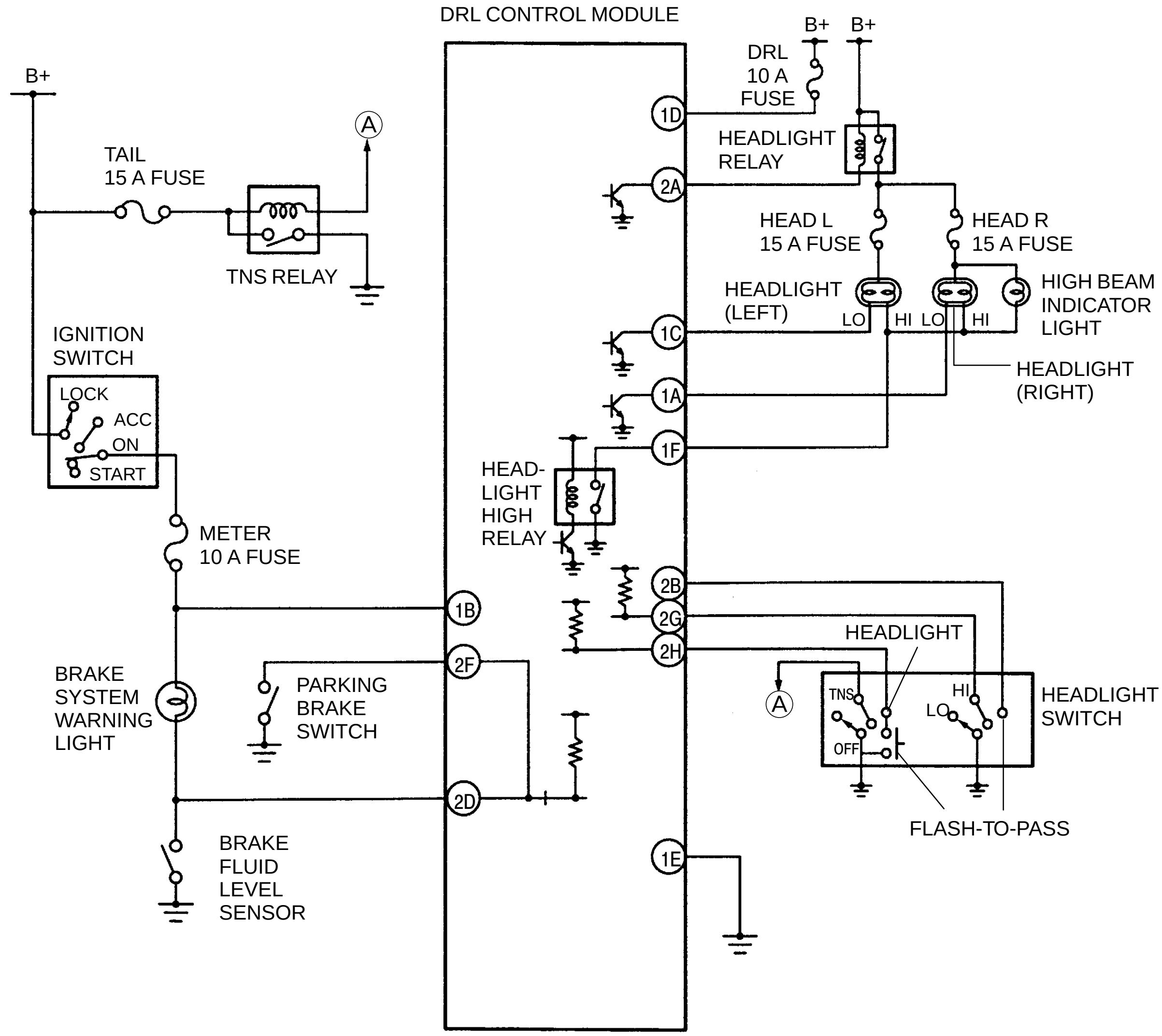
YMU918S04

Operation

- DRL system automatically turns on the low beam headlights at a 60—80% duty value when the following conditions are met:
  - Ignition switch is at ON position.
  - Parking brake switch is off.
  - Headlight switch is off.
  - Flash-to-pass is not activated.
- DRL system turns off the low beam headlights under any of the following conditions:
  - Ignition switch is at LOCK or ACC position.
  - Parking brake switch is on.
  - Headlight switch is on.
  - Flash-to-pass is activated.

DRL SYSTEM WIRING DIAGRAM

YMU918S09

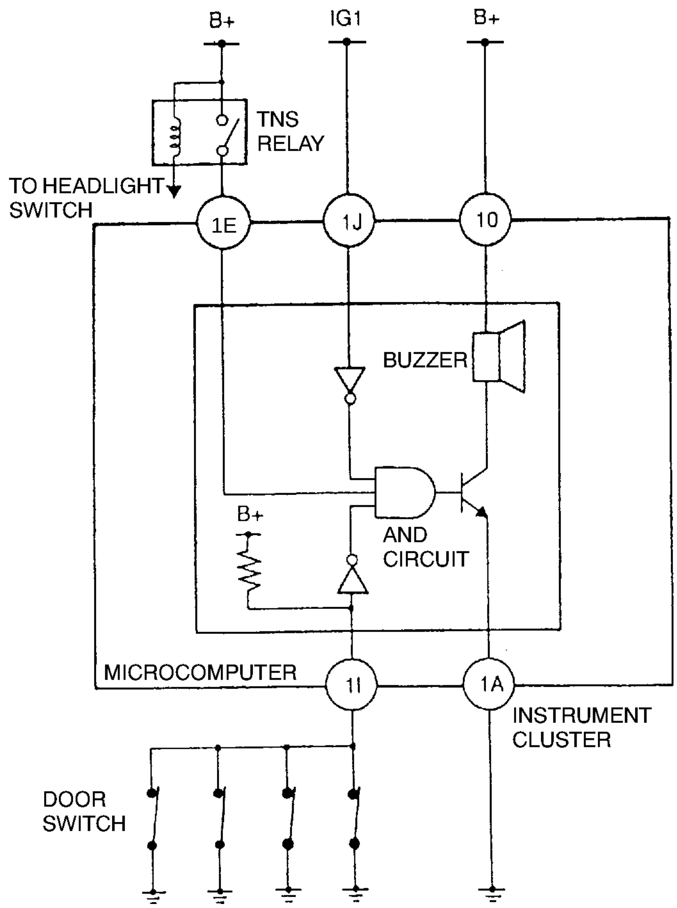


YMU918SA9

LIGHTS-ON REMINDER WARNING BUZZER DESCRIPTION

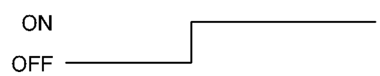
YMU918S05

System Wiring Diagram



YMU918SA4

Specifications

Operating condition (When all conditions are satisfied)	Sounding cycle
• Ignition switch is at LOCK or ACC position. • Headlight switch is at TNS or ON position. • Any door switch is on. (Any door is open.)	Continuous  X3U918SA6

INTERIOR LIGHT SYSTEM OUTLINE

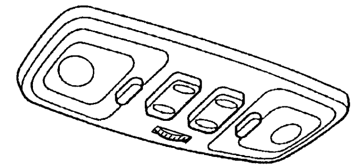
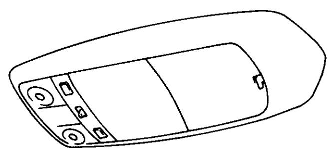
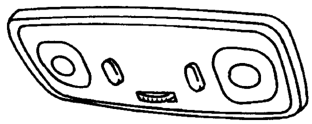
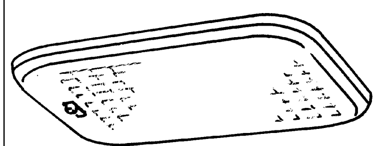
YMU918S06

- The three types of map light are shown below.
- The interior light control system has a function that decreases the illumination brightness to 80% when the interior light switch is in the DOOR position.

INTERIOR LIGHT SYSTEM DESCRIPTION

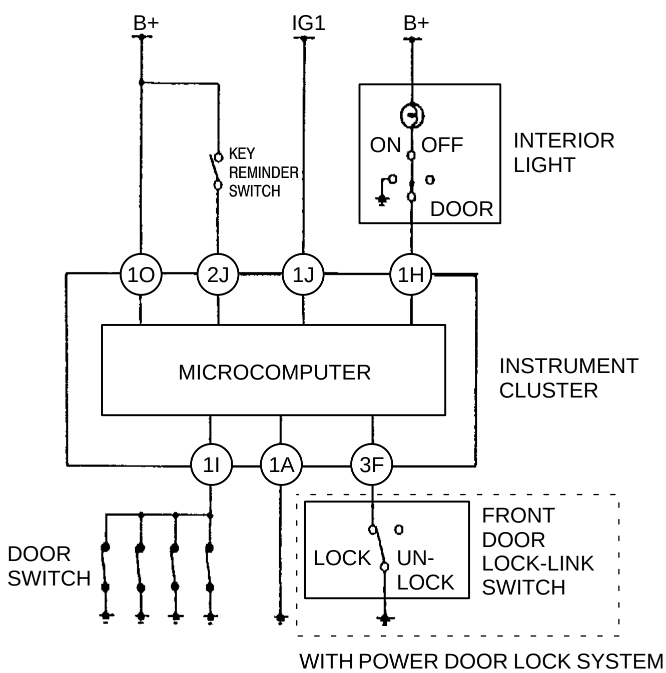
YMU918S07

×: Available

Type		Installation position	Interior light control	Roof
Map light	 YMU918SA8	Front	N/A	Sunroof
Map light (With overhead storage compartment)	 YMU918SA5		N/A	Normal roof
Map light (Without overhead storage compartment)	 YMU918SA6		N/A	
Interior light	 YMU918SA7	Middle	×	Both

INTERIOR LIGHT CONTROL SYSTEM WIRING DIAGRAM

YMU918S08



YMU918SAA

09–19 WIPER/WASHER SYSTEMS

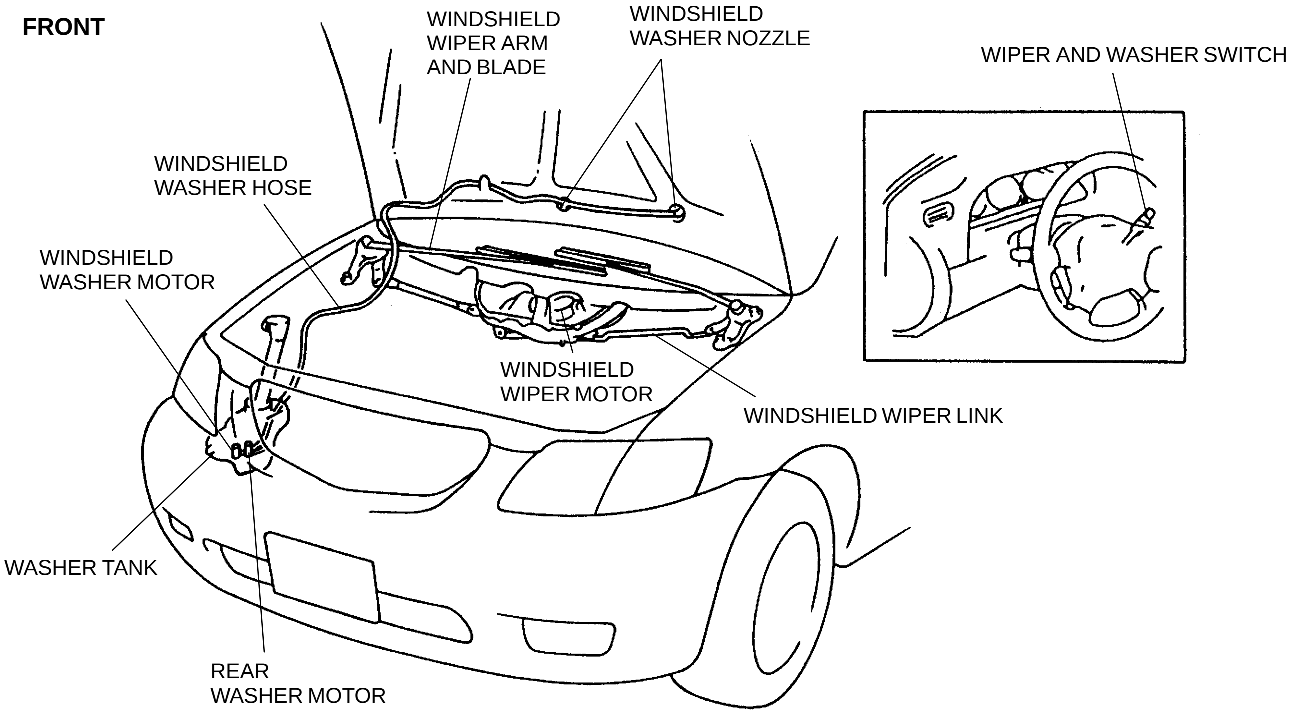
WIPER/WASHER SYSTEMS OUTLINE

YMU919S01

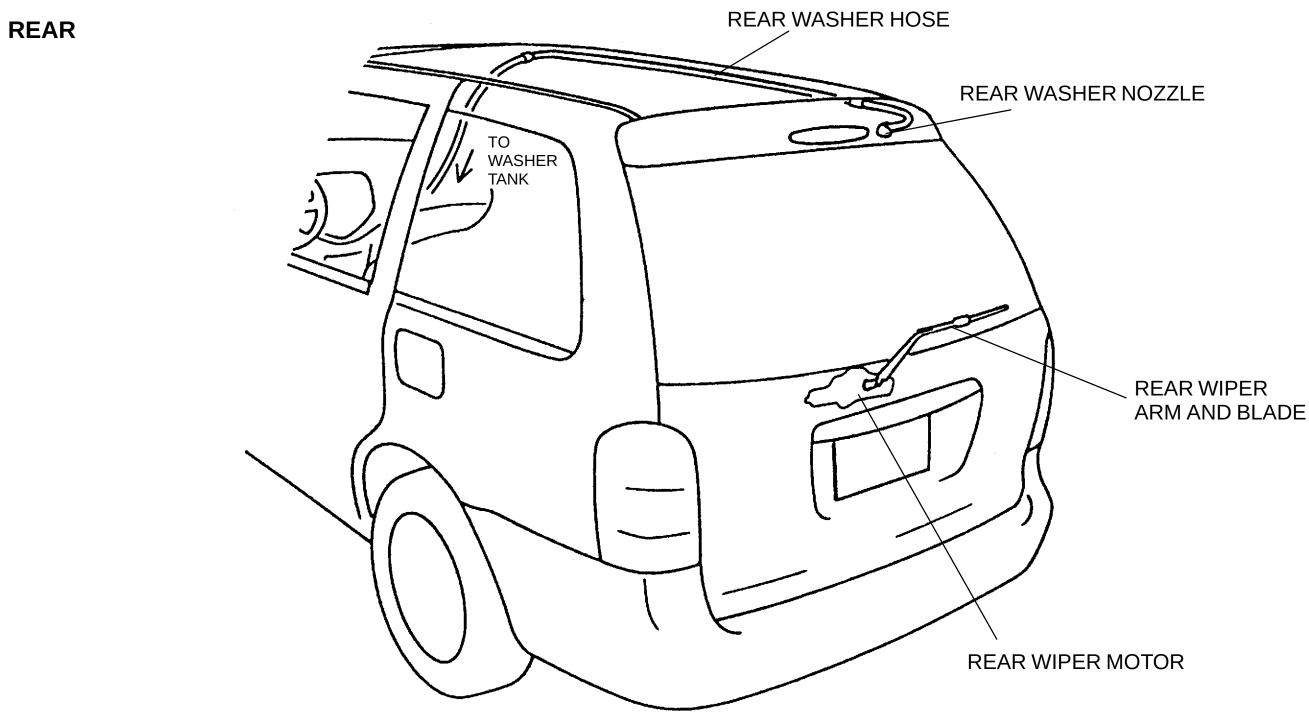
- The wiper system is the same as the 1998MY MPV. It has one-touch operation and intermittent wiper operation functions.
- The windshield wiper motor has been mounted to a frame.
- The washer system is the same as the 1998MY MPV.
- As with the 1998MY MPV, the windshield washer tank capacity is 2.2 L {2.3 US qt, 1.9 Imp qt} or 5.5 L {5.8 US qt, 4.8 Imp qt} (Cold area specification).

WIPER/WASHER SYSTEMS STRUCTURAL VIEW

YMU919S02



YMU919SA2



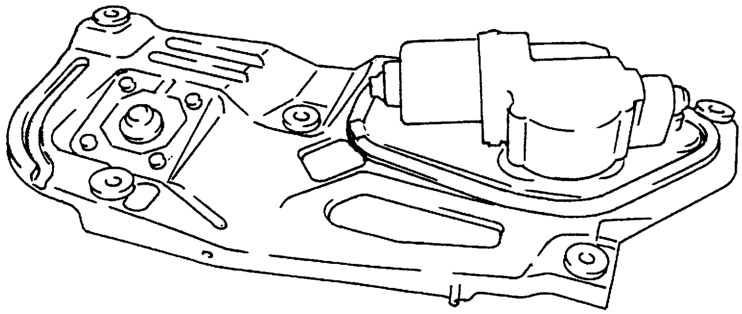
YMU919SA3

WINDSHIELD WIPER SYSTEM DESCRIPTION

YMU919S03

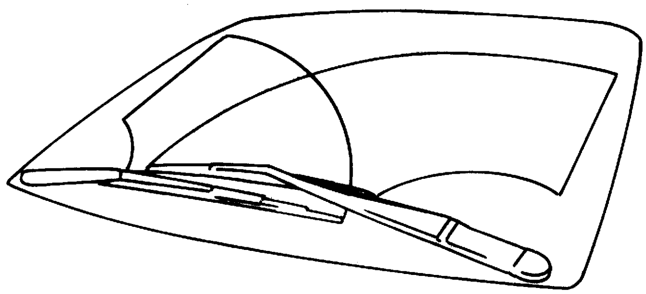
Structure

- The windshield wiper motor is mounted to a frame. The frame absorbs the vibration due to motor operation and reduces variation in wipe.



YMU919SA0

- Due to enlargement of the windshield area, the windshield wiping path has been increased.



YMU919SA1

09–20 ENTERTAINMENT

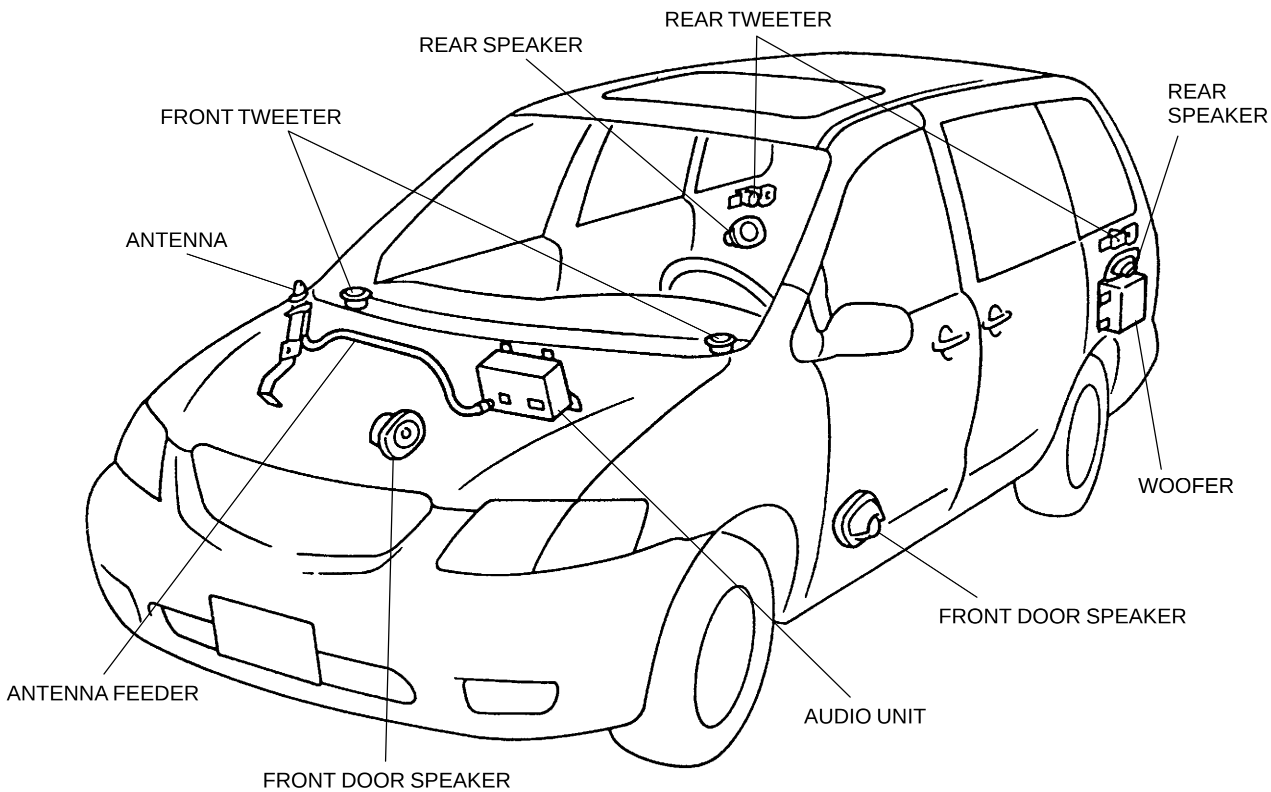
ENTERTAINMENT OUTLINE

YMU920S01

- There are two types of audio systems: an AM/FM radio with CD player, which is the same as the 1998MY MPV, and a new AM/FM radio with CD player, which has a built-in CD changer.
- There are two types of speaker systems: a 4-speaker system, which is the same as the 1998MY MPV, and a new 9-speaker system.

ENTERTAINMENT STRUCTURAL VIEW

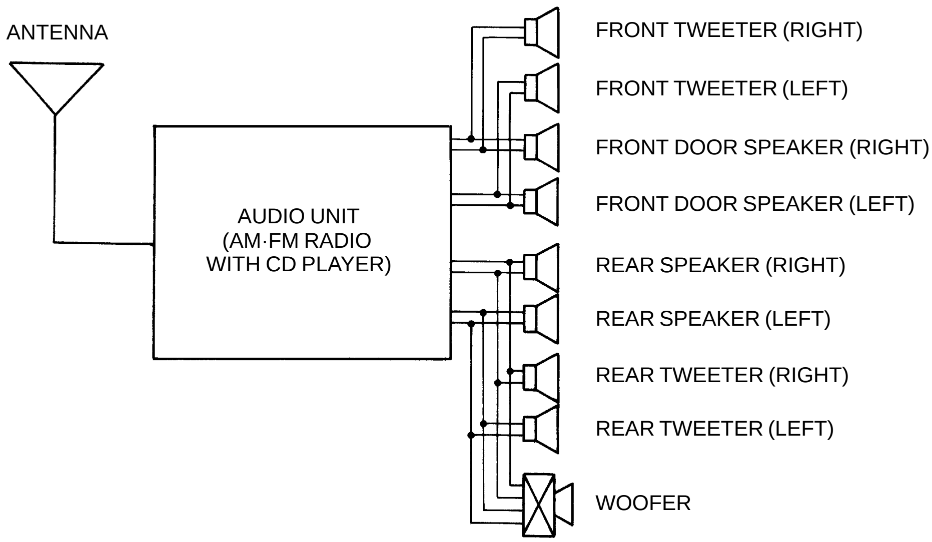
YMU920S02



YMU920SA0

ENTERTAINMENT SYSTEM DIAGRAM

YMU920S03



YMU920SA1

ENTERTAINMENT DESCRIPTION

YMU920S04

Specifications
Audio unit

Specification			AM/FM radio with CD player
Rated voltage		(V)	12
Frequency band	AM (kHz)		530—1710
	FM (MHz)		87.7—107.9
Amplifier maximum output power		(W)	25 × 4
Output impedance		(Ω)	4

Speaker

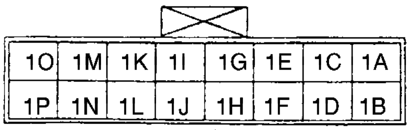
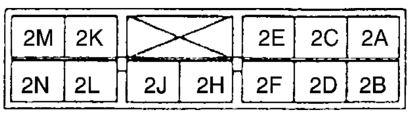
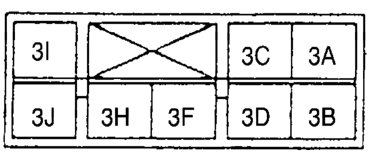
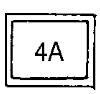
4-speaker system

Specification		Front door	Rear
Rated input	(W)	12.5	
Maximum input	(W)	25	
Impedance	(Ω)	3.4—4.6	3.4—4.2
Lowest resonance level	(Hz)	80	60
Sound pressure level	(dB)	87—93	
Size	(in)	5.5 × 7.5	6 × 9

9-speaker system

Specification		Front door (High grade)	Front tweeter	Rear (High grade)	Rear tweeter	Woofer
Rated input	(W)	12.5				
Maximum input	(W)	25				
Impedance	(Ω)	3.4—4.6	3.2—4.4	3.4—4.6	5.1—6.9	1
Lowest resonance level	(Hz)	90	—	90	—	53
Sound pressure level	(dB)	85.5—91.5	75—81	88.5	78—84	71—77
Amplifier maximum output power	(W)	—				80
Size	(in)	5.5 × 7.5	ϕ1.2	6 × 9	ϕ1.2	ϕ6.3

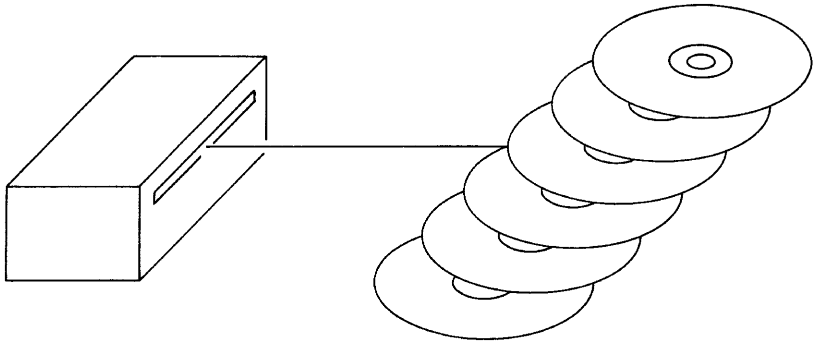
Terminal Layout and Signals
Audio unit

Terminal		Signal
		AM·FM radio with CD player
 X3U920SA2	1A	Right input (+)
	1B	Signal ground
	1C	Left input (+)
	1D	Combination control
	1E	Auxiliary control out
	1F	Auxiliary control in
	1G	Bus (–)
	1H	Bus (+)
	1I	ACC
	1J	Power ground
	1K	+B (power back up)
	1L	System mute
	1M	TNS (+)
	1N	Illumination (–)
	1O	—
	1P	—
 X3U920SA3	2A	ACC
	2B	Tel mute
	2C	+B
	2D	Antenna switch
	2E	TNS (+)
	2F	Illumination (–)
	2H	Steering switch
	2J	Steering switch
	2K	Left front speaker (+)
	2L	Left front speaker (–)
	2M	Right front speaker (+)
	2N	Right front speaker (–)
 X3U920SA4	3A	Left rear speaker (+)
	3B	Left rear speaker (–)
	3C	—
	3D	Amplifier control
	3F	Right rear speaker (+)
	3H	Right rear speaker (–)
	3I	—
	3J	—
 X3U920SA5	4A	Ground (power)

Feature

Audio unit

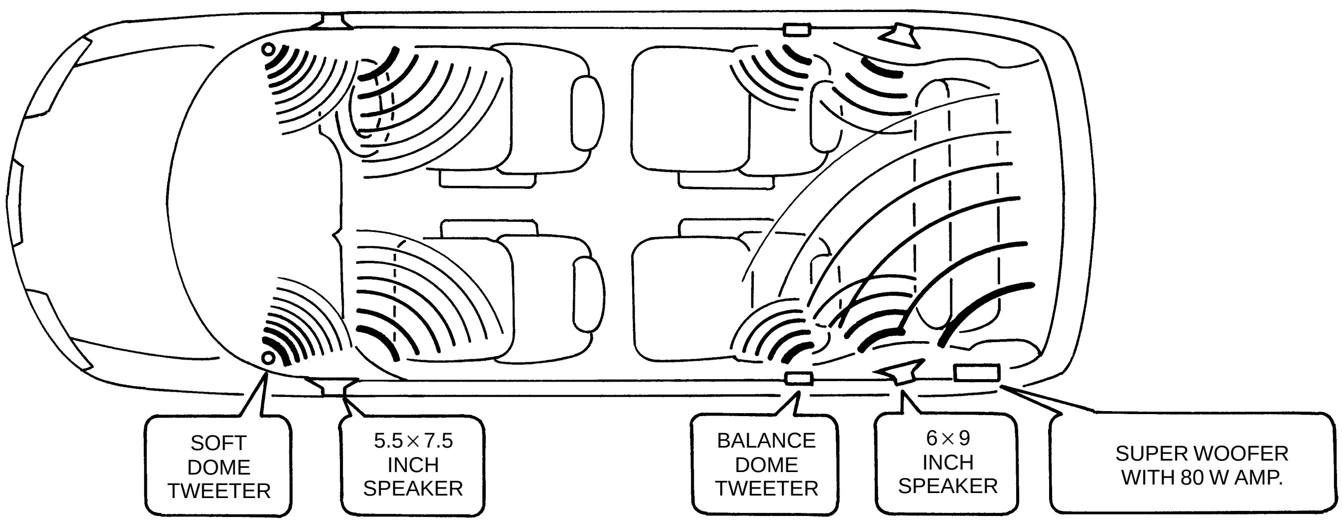
- The new AM/FM radio with CD player has a built-in CD changer that holds a maximum of six CDs.



YMU920SA2

Speaker system

- In the new 9-speaker system, the tweeters, which are placed at both the front and rear of the room, provide a clear, high frequency sound, and the woofer, which contains an amplifier with a maximum output of 80 W, generates a deep base sound for a surround sound effect.
- A soft dome front tweeter with a PPS (Polyphenylene Sulfide) diaphragm has been adopted for a wide band width and clear high frequency sound without distortion.



YMU920SA3

09–22 INSTRUMENTATION/DRIVER INFO.

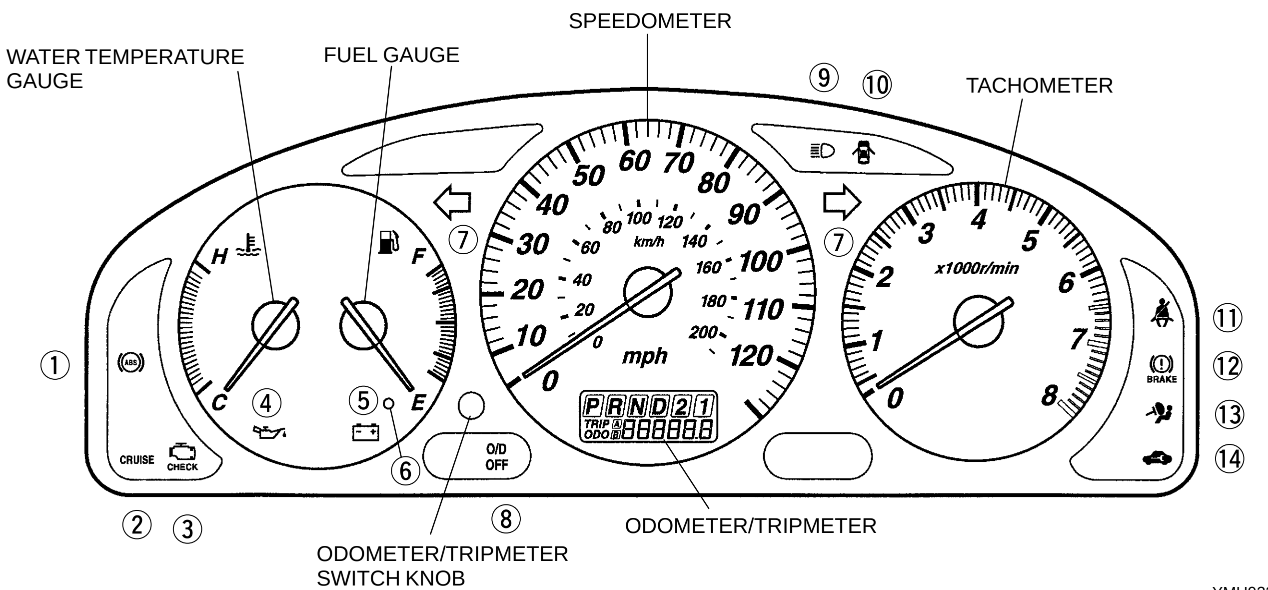
INSTRUMENT CLUSTER OUTLINE

YMU922S01

- The instrument cluster consists of a speedometer, tachometer, fuel and water temperature gauges, LCD, and warning lights and indicators.
- The operation of the instrument cluster is controlled by a built-in microcomputer.
- The instrument cluster has an input/output check mode, which is the same as the 1999MY Protegé.
- The LCD odometer/tripmeter is the same as the 1999MY Protegé.

INSTRUMENT CLUSTER STRUCTURAL VIEW

YMU922S02



YMU922SA0

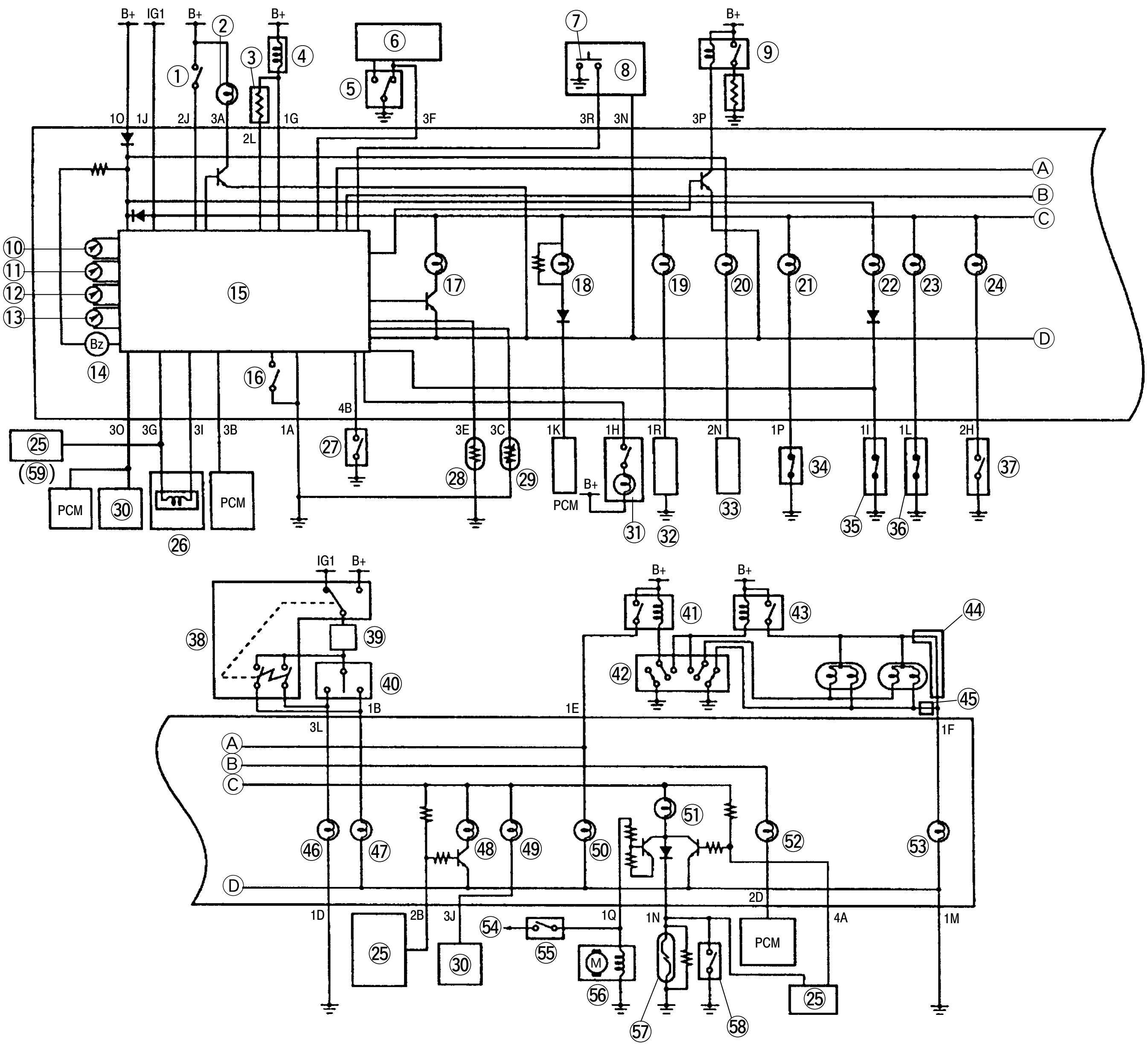
Warning and Indicator Light Layout

No.	Warning and indicator light
1	ABS warning light
2	Cruise set indicator light
3	Malfunction indicator light
4	Oil pressure warning light
5	Generator warning light
6	Fuel-level warning light
7	Turn indicator light

No.	Warning and indicator light
8	O/D OFF indicator light
9	High beam indicator light
10	Door ajar warning light
11	Seat belt warning light
12	Brake system warning light
13	Air bag system warning light
14	Security light

INSTRUMENT CLUSTER SYSTEM WIRING DIAGRAM

YMU922S03



YMU922SA3

1	Key reminder switch	15	Microcomputer
2	Ignition key illumination	16	Odometer/tripmeter switch
3	Key interlock resistor	17	Fuel-level warning light
4	Key interlock solenoid	18	Generator warning light
5	Door lock-link switch	19	Air bag system warning light
6	Door lock timer control module	20	Security light
7	Rear window defroster switch	21	Seat belt warning light
8	Front climate control unit	22	Door ajar warning light
9	Rear window defroster relay	23	Oil pressure warning light
10	Speedometer	24	O/D OFF indicator light
11	Tachometer	25	ABS HU/CM
12	Fuel gauge	26	Vehicle speedometer sensor (without ABS)
13	Water temperature gauge	27	Shift lock solenoid (P position signal)
14	Buzzer	28	Water temperature sensor

29	Fuel gauge sender unit
30	Cruise control module
31	Interior light
32	SAS control module
33	Immobilizer unit
34	Buckle switch
35	Door switch
36	Oil pressure switch
37	O/D OFF switch
38	Hazard warning switch
39	Flasher control module
40	Turn switch
41	TNS relay
42	Headlight switch
43	Headlight relay
44	With DRL

45	Without DRL
46	Turn indicator light (Left)
47	Turn indicator light (Right)
48	ABS warning light
49	Cruise set indicator light
50	Instrument cluster illumination
51	Brake system warning light
52	Malfunction indicator light
53	High beam indicator light
54	To starter switch
55	Transaxle range switch
56	Starter motor
57	Brake fluid-level sensor
58	Parking brake switch
59	With ABS

INSTRUMENT CLUSTER DESCRIPTION

YMU922S04

Specifications

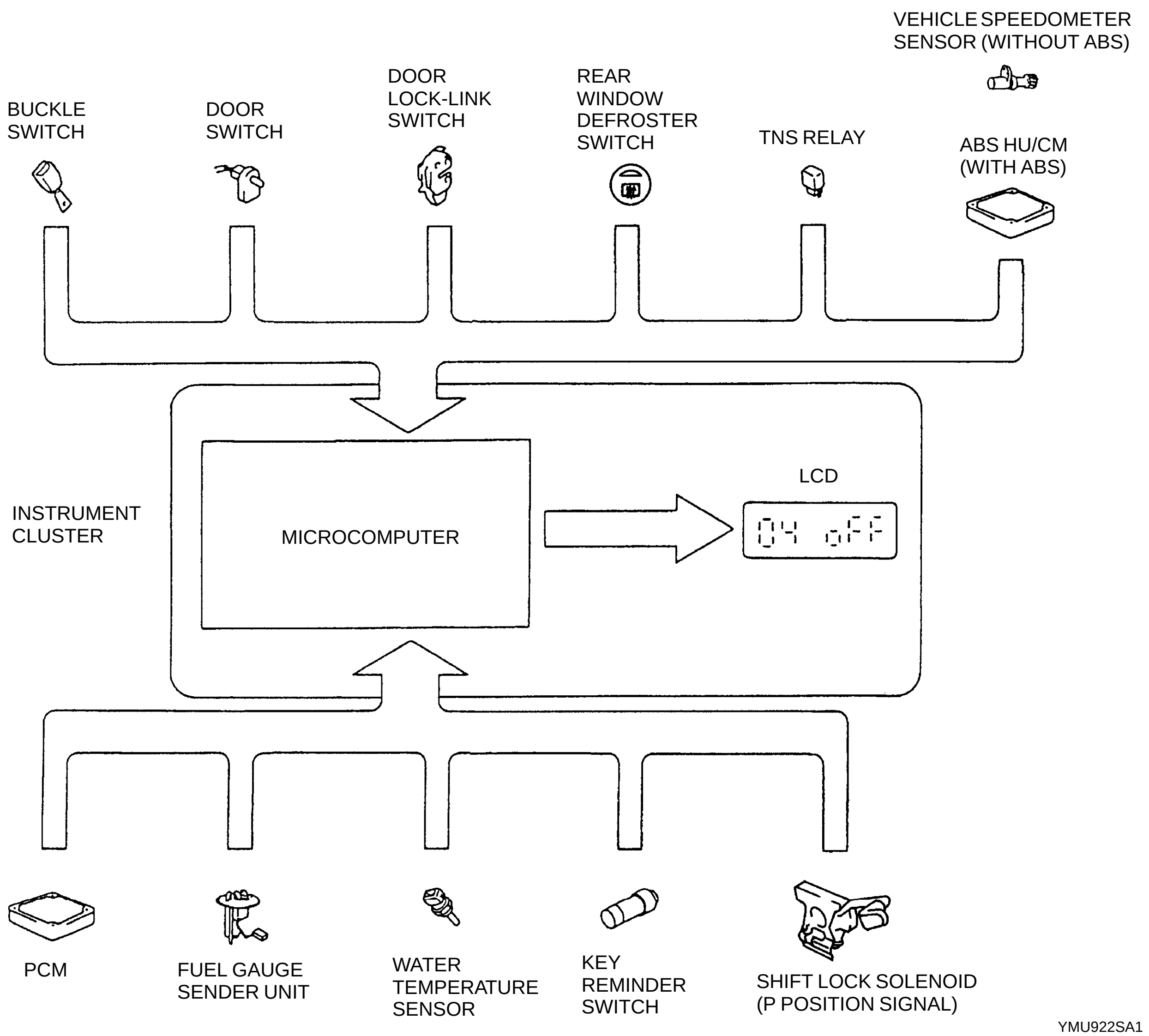
Item			Specification
Speedometer	Meter type		Cross coil type
	Indication range	Canada (km/h {MPH})	0—210 {0—130}
		Except Canada (MPH {km/h})	0—130 {0—210}
	Input signal source		With ABS: ABS HU/CM Without ABS: Vehicle speedometer sensor
	Input signal		8 pulses/one rotation of speedometer driven gear
	Output signal		4 pulses/one rotation of speedometer driven gear
	Rated voltage	(V)	DC 12
Tachometer	Meter type		Cross coil type
	Indication range	(rpm)	0—8000
	Red zone	(rpm)	6500—8000
	Input signal source		PCM
	Input signal		6 pulses/two engine rotations
	Rated voltage	(V)	DC 12
Fuel gauge	Meter type		Cross coil type (Indicator needle type)
	Rated voltage	(V)	DC 12
Water temperature gauge	Meter type		Cross coil type (Medium range stabilized type)
	Rated voltage	(V)	DC 12
Odometer	Display		Liquid crystal display
	Indication digits		6 digits
	Characteristics		1 km is added for 5096 pulses of vehicle speed input signal 1 mile is added for 8202 pulses of vehicle speed input signal
	Rated voltage	(V)	DC 12
Tripmeter	Display		Liquid crystal display
	Indication digits		4 digits
	Cancellation		Push method
	Characteristics		1 km is added for 5096 pulses of vehicle speed input signal 1 mile is added for 8202 pulses of vehicle speed input signal
	Rated voltage	(V)	DC 12

Input/Output Check Mode

- The microcomputer built into the instrument cluster detects malfunctions in the input signal or individual part.
- The input/output check mode has input circuit check and individual part check functions.
- The operating procedure of the input/output check mode is the same as the 1999MY Protegé.

Input circuit check

DTC	Part sending input signal	Remarks
01	Buckle switch	—
04	Door switch	—
05	Door lock-link switch	—
07	Rear window defroster switch	—
08	TNS relay	—
10	With ABS: ABS HU/CM Without ABS: Vehicle speedometer sensor	Parts sending vehicle speed signal have been changed.
11	PCM	Part sending engine speed signal has been changed.
22	Fuel gauge sender unit	—
24	Water temperature sensor	—
31	Key reminder switch	—
41	Shift lock solenoid (P position signal)	—



Individual part check

DTC	Simulated part sending input signal	Remarks
12	Speedometer	—
13	Tachometer	—
14	Buzzer	—
16	Fuel-level warning light	—
17	Rear window defroster indicator light	—
18	Ignition key illumination	—
20	Rear window defroster relay	—
23	Fuel gauge	—
25	Water temperature gauge	—
26	LCD	—
27	Interior light	—
42	Key interlock solenoid	—